## MEMORANDUM CIRCULAR NO.: 013-17

**TO : ALL CONCERNED**

**FROM : ACTING DIRECTOR GENERAL**

**SUBJECT : AMENDMENT TO PHILIPPINE MANUAL OF STANDARDS FOR AERODROMES INCORPORATING AMENDMENT 13 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 13
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. 13 to the Philippine Manual of Standards for Aerodromes.

**ORIGINAL REGULATION:**

**MANUAL OF STANDARDS FOR AERODROMES**

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**CHAPTER 1 - General provisions.**

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**Section 1.4: Definitions**

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

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

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

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**CHAPTER 5 - Aerodrome Information for AIP**

**6. Aerodrome physical characteristics**

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**Section 6.3 Runway strip**

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6.3.8.1 The surface of a runway strip that abuts a runway, shoulder or stopway shall be flush with the surface of the runway, shoulder or stopway.

6.3.8.2 Effective drainage in the graded area must be provided to avoid water ponding. Open drains must not be constructed in the graded portion of a runway strip.

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.

6.3.8.4 These standards for the surface of runway strips apply equally for runway strips at aerodromes intended for small aeroplanes set out in Chapter 13.

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**Section 6.7: Taxiways**

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**6.7.1 Taxiway Width**

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**6.7.2 Taxiway Edge Clearance**

6.7.2.1 The width of any section of a taxiway must be such that, with the nose wheel of the aircraft remaining on the taxiway, the clearance between the outer main gear wheels and the edge of the taxiway, at any point, must not be less than the distance determined using Table 6.3-2.

| **Code letter** | **Minimum clearance** |
|---|---|
| A | 1.5 m |
| B | 2.25 m |
| C | 4.5 m* |
| D, E or F | 4.5 m |
| * If the turning area or curve is only intended to serve aircraft with a wheelbase of less than 18 m, the minimum clearance is 3.0 m. | |

**Table 6.3-2: Minimum clearance between outer main gear wheels and edge of taxiway**

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**6.7.1 Taxiway Width**

6.7.1.1 The width of a straight section of a taxiway must not be less than the width determined using Table 6.3-1.

| Code letter | Minimum taxiway width (straight sections) |
|---|---|
| A | 7.5 m |
| B | 10.5 m |
| C | 18 m a |
| D | 23 m b |
| E | 23 m |
| F | 25 m |

| |
|---|
| If the taxiway is only intended to serve aircraft with a wheelbase of lessthan 18 m, the width may be reduced to 15 m.<br>If the taxiway is only intended to serve aircraft with an outer main gear span of less than 9 m, the width may be reduced to 18 m. |

**Table 6.3-1: Minimum width for straight section of taxiway**

| | Distance between taxiway centre line and runway centre line (metres) | | | | | | | | Taxiway centre line to taxiway centre line (metres) | Taxiway, other than aircraft stand taxilane, centre line to object (metres) | Aircraft stand taxilane centre line to aircraft stand taxilane centre line (metres) | Aircraft stand taxilane centre line to object (metres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instrument runways Code number | | | | Non-instrument runways Code number | | | | | | | |
| Code letter | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| A | 82.5 | 82.5 | - | - | 37.5 | 47.5 | - | - | 23 | 15.5 | 19.5 | 12 |
| B | 87 | 87 | - | - | 42 | 52 | - | - | 32 | 20 | 28.5 | 16.5 |
| C | - | - | 168 | - | - | - | 93 | - | 44 | 26 | 40.5 | 22.5 |
| D | - | - | 176 | 176 | - | - | 101 | 101 | 63 | 37 | 59.5 | 33.5 |
| E | - | - | - | 182.5 | - | - | - | 107.5 | 76 | 43.5 | 72.5 | 40 |
| F | - | - | - | 190 | - | - | - | 115 | 91 | 51 | 87.5 | 47.5 |

**Table 6.4-5: Taxiway minimum separation distance**

*Note: - 1. The separation distances are based on the concept of the wing of the aeroplane, centered on the parallel taxiway, remaining clear of the runway strip of standard width.*

*Note: - 2. The taxiway centreline to runway centreline separation distances have been determined using the maximum runway strip width required for the particular category and code of runway.*

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**6.7.15 Objects on Taxiway Strip**

6.7.15.1 A taxiway strip must be free of fixed objects other than visual or navigational aids used for the guidance of aircraft or vehicles.

6.7.15.2 Visual aids located within a taxiway strip must be sited at such a height that they cannot be struck by propellers, engine pods and wings of aircraft using the taxiway.

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**Section 6.9: Aprons**

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***9.6.2 Precision approach Category I lighting system***

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9.6.2.7 If the centerline consists of barrettes, each barrette should be supplemented by a capacitor discharge light, except where such lighting is considered unnecessary by CAAP taking into account the characteristics of the system and the nature of the meteorological conditions.

9.6.2.8 Each capacitor discharge light shall flash twice a second in sequence beginning with the outermost light and progressing to the innermost light. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights in the approach lighting system.

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### 9.6.3 Precision Approach Category II and III Lighting System

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9.6.3.17 If the centerline beyond 300 m from the threshold consists of barrettes, each barrette beyond 300 m should be supplemented by a capacitor discharge light, except where such lighting is considered unnecessary by CAAP taking into account the characteristics of the system and the nature of the meteorological conditions.

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15.15.7.5 Where an aeronautical study indicates that an existing object extending above an obstacle protection surface could adversely affect the safety of operations of helicopters one or more of the following measures shall be taken to:

(a) suitably raise the approach slope of the system;

(b) reduce the azimuth spread of the system so that the object is outside the confines of the beam;

(c) displace the axis of the system and its associated obstacle protection surface by no more than 5 degrees;

(d) suitably displace the final approach and take-off area; and

(e) install a visual alignment guidance system specified in 5.3.4.

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| SURFACE AND DIMENSIONS | NON-INSTRUMENT FATO | NON-PRECISION FATO |
|---|---|---|
| Length of inner edge | Width of safety area | Width of safety area |
| Distance from end of FATO | 3 m minimum | 60 m |
| Divergence | 10% | 15% |
| Total length | 2 500 m | 2 500 m |
| Slope | PAPI Aa - 0.57° | Aa - 0.57° |
| | HAPI Ab - 0.65° | Ab - 0.65° |
| | APAPI Aa - 0.9° | Aa - 0.9' |
| As indicated in *Annex 14, Volume 1, Figure 5-13*, The angle of the upper boundary of the "below slope" signal. | | |

**Table 5 - 7. Dimensions and slopes of the obstacle protection surface**

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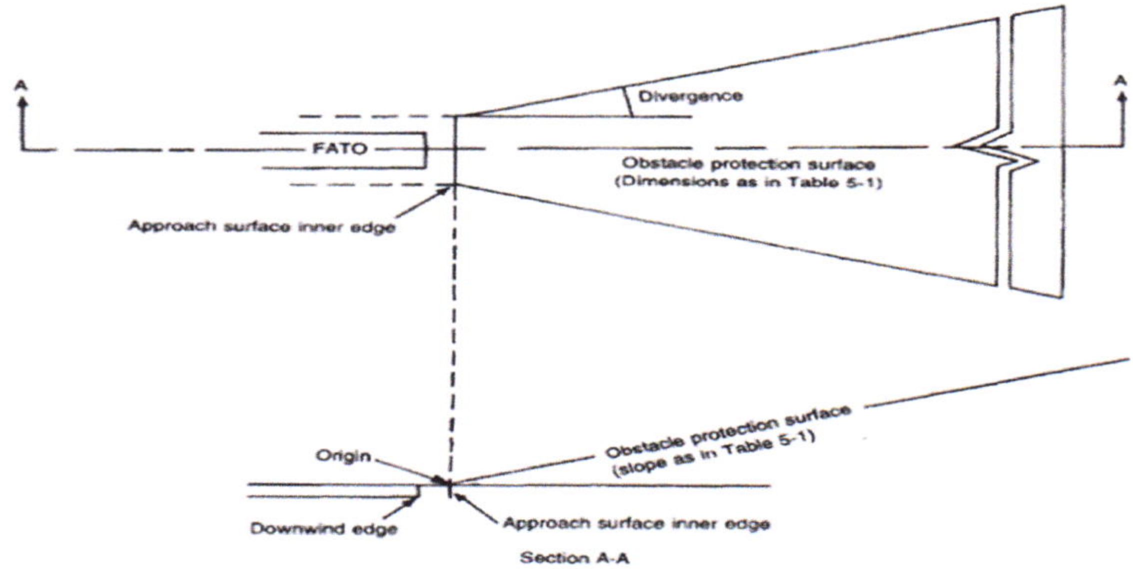


**Figure 5-31. Obstacle protection surface for visual approach slope indicator systems**

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**10.2.5 Cleanliness of the movement area.**

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10.2.5.1 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.

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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.

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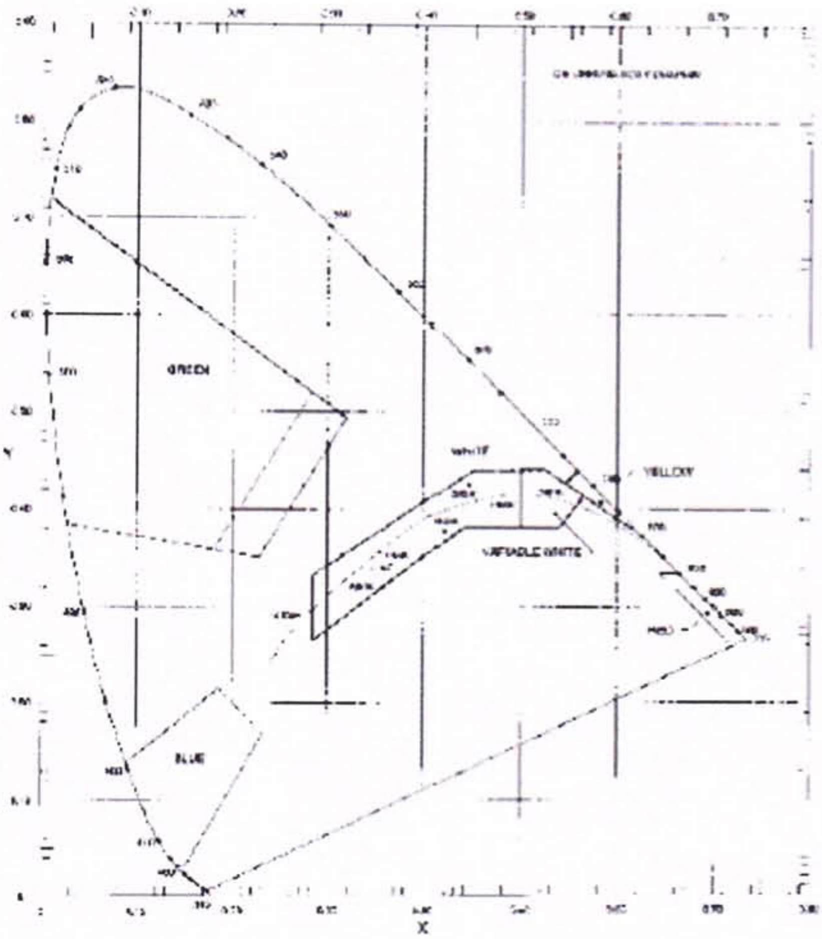



Figure 9.2-1: Colours for aeronautical ground lights

**Figure 9.2-1: Colours for aeronautical ground lights**

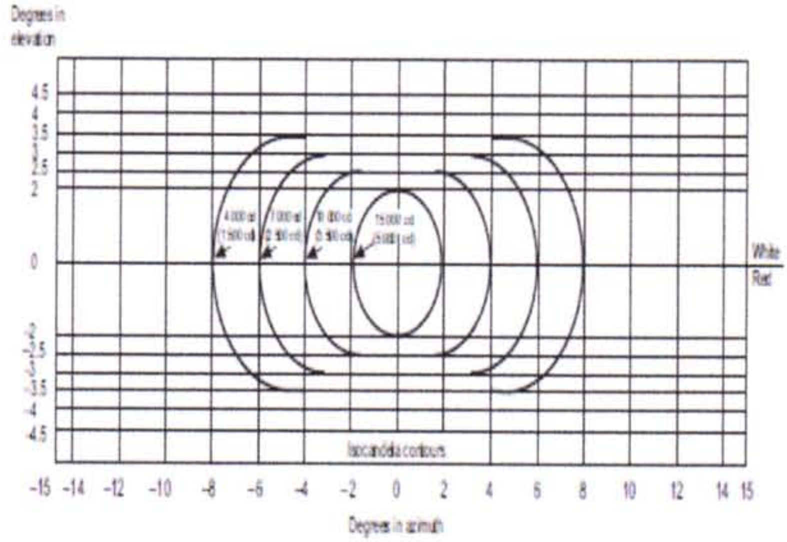
*Notes:*

*1. Lights on curves to have light beam toed-in 15.75° with respect to the tangent of the curve.*

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

**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 where large offsets can occur and for low-intensity runway guard lights, Configuration B**

**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. These curves are for minimum intensities in red light.*

*2. The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.*

**Figure 9.8-4: Light intensity distribution of PAPI**

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**8.5.25 Designation characters for taxi and apron markings**

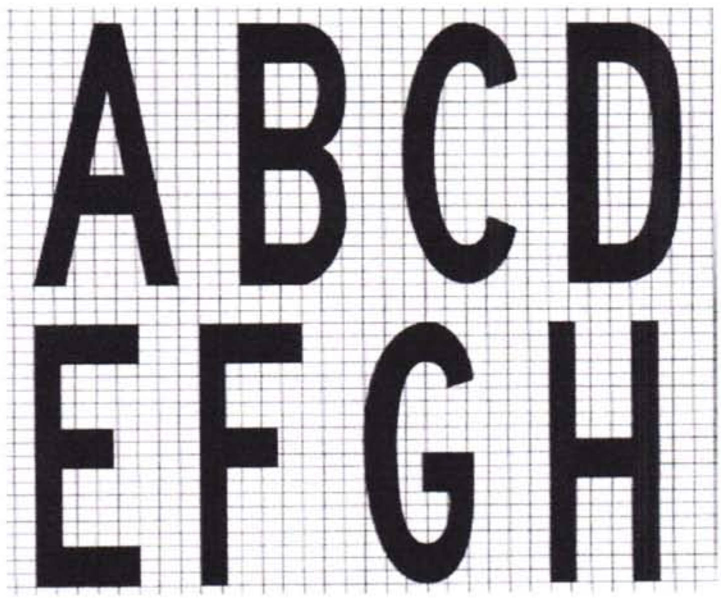



**Figure 8.5-19: Letters and numbers used in designations for taxiway and apron markings**

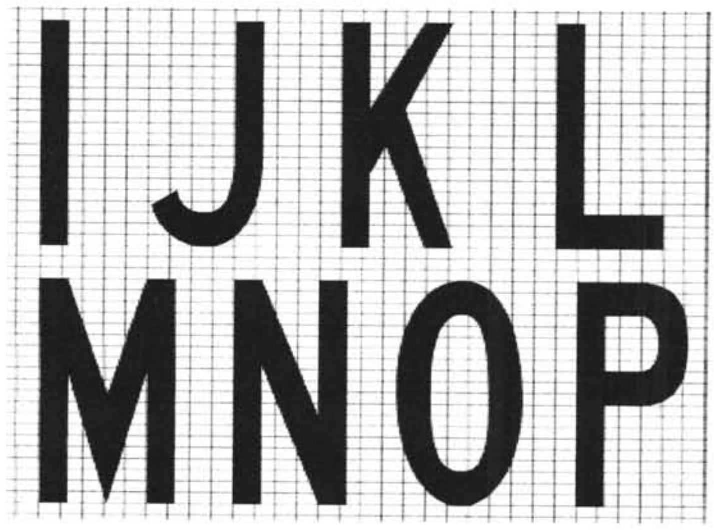



**Figure 8.5-20: Letters and numbers used in designations for taxiway and apron markings**


**Figure 8.5-21: Letters and numbers used in designations for taxiway and apron markings**

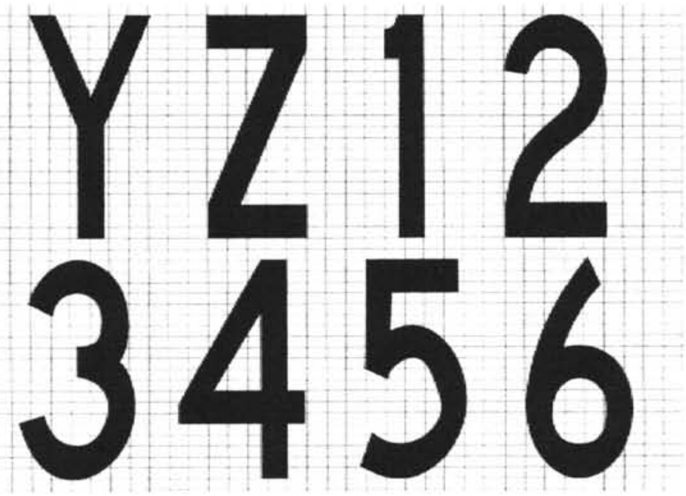



**Figure 8.5-22: Letters and numbers used in designations for taxiway and apron markings**

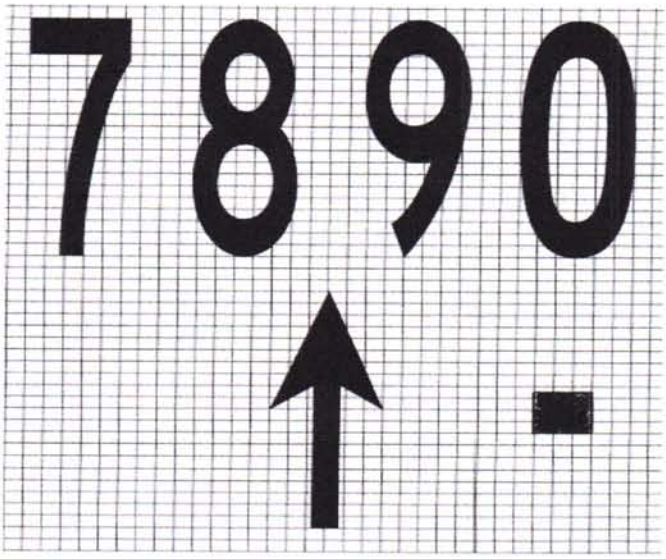
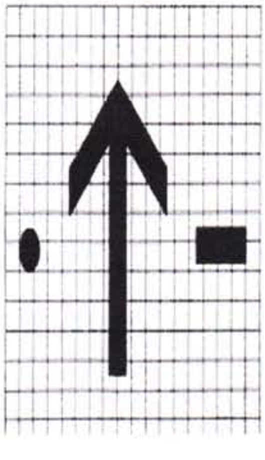
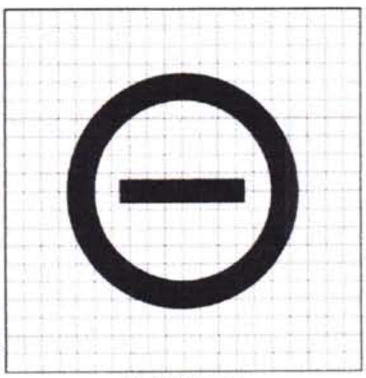



**Figure 8.5-23: Letters and numbers used in designations for taxiway and apron markings**



*Note 1.— The arrow stroke width, diameter of the dot, and both width and length of the dash shall be proportioned to the character stroke widths.*

*Note 2.— The dimensions of the arrow shall remain constant for a particular sign size, regardless of orientation.*



NO ENTRY sign

**Figure 8.6-6: Form and proportion of letters, numbers and symbols used on Movement Area Guidance Signs**

| a) Letter to letter code number | | | |
|---|---|---|---|
| Preceding Letter | Following Letter | | |
| | B, D, E, F, H, I, K, L, M, N, P, R, U | C, G, O, Q, S, X, Z | A, J, T, V, W, Y |
| | Code number | | |
| A | 2 | 2 | 4 |
| B | 1 | 2 | 2 |
| C | 2 | 2 | 3 |
| D | 1 | 2 | 2 |
| E | 2 | 2 | 3 |
| F | 2 | 2 | 3 |
| G | 1 | 2 | 2 |
| H | 1 | 1 | 2 |
| I | 1 | 1 | 2 |
| J | 1 | 1 | 2 |
| K | 2 | 2 | 3 |
| L | 2 | 2 | 4 |
| M | 1 | 1 | 2 |
| N | 1 | 1 | 2 |
| O | 1 | 2 | 2 |
| P | 1 | 2 | 2 |
| Q | 1 | 2 | 2 |
| R | 1 | 2 | 2 |
| S | 1 | 2 | 2 |
| T | 2 | 2 | 4 |
| U | 1 | 1 | 2 |
| V | 2 | 2 | 4 |
| W | 2 | 2 | 4 |
| X | 2 | 2 | 3 |
| Y | 2 | 2 | 4 |
| Z | 2 | 2 | 3 |

| b) Numeral to numeral code number | | | |
|---|---|---|---|
| Preceding Numeral | Following number | | |
| | 1, 5 | 2, 3, 6, 8, 9, 0 | 4, 7 |
| | Code number | | |
| 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 |
| 3 | 1 | 2 | 2 |
| 4 | 2 | 2 | 4 |
| 5 | 1 | 2 | 2 |
| 6 | 1 | 2 | 2 |
| 7 | 2 | 2 | 4 |
| 8 | 1 | 2 | 2 |
| 9 | 1 | 2 | 2 |
| 0 | 1 | 2 | 2 |

| c) Space between characters | | | |
|---|---|---|---|
| Code No. | Letter Height (mm) | | |
| | 200 | 300 | 400 |
| | Space (mm) | | |
| 1 | 48 | 71 | 96 |
| 2 | 38 | 57 | 76 |
| 3 | 25 | 38 | 50 |
| 4 | 13 | 19 | 26 |

| d) Width of letter | | | |
|---|---|---|---|
| Letter | Letter height (mm) | | |
| | 200 | 300 | 400 |
| | Width (mm) | | |
| A | 170 | 255 | 340 |
| B | 137 | 205 | 274 |
| C | 137 | 205 | 274 |
| D | 137 | 205 | 274 |
| E | 124 | 186 | 248 |
| F | 124 | 186 | 248 |
| G | 137 | 205 | 274 |
| H | 137 | 205 | 274 |
| I | 32 | 48 | 64 |
| J | 127 | 190 | 254 |
| K | 140 | 210 | 280 |
| L | 124 | 186 | 248 |
| M | 157 | 236 | 314 |
| N | 137 | 205 | 274 |
| O | 143 | 214 | 286 |
| P | 137 | 205 | 274 |
| Q | 143 | 214 | 286 |
| R | 137 | 205 | 274 |
| S | 137 | 205 | 274 |
| T | 124 | 186 | 248 |
| U | 137 | 205 | 274 |
| V | 152 | 229 | 304 |
| W | 178 | 267 | 356 |
| X | 137 | 205 | 274 |
| Y | 171 | 257 | 342 |
| Z | 137 | 205 | 274 |

| e) Width of numeral | | | |
|---|---|---|---|
| Letter | Numeral height (mm) | | |
| | 200 | 300 | 400 |
| | Width (mm) | | |
| 1 | 50 | 74 | 98 |
| 2 | 137 | 205 | 274 |
| 3 | 137 | 205 | 274 |
| 4 | 149 | 224 | 298 |
| 5 | 137 | 205 | 274 |
| 6 | 137 | 205 | 274 |
| 7 | 137 | 205 | 274 |
| 8 | 137 | 205 | 274 |
| 9 | 137 | 205 | 274 |
| 0 | 143 | 214 | 286 |

**INSTRUCTIONS**

1. To determine the proper SPACE between letters or numerals, obtain the code number from table a or b and enter table c for that code number to the desired letter or numeral height.
2. The space between words or groups of characters forming an abbreviation or symbol should be equal to 0.5 to 0.75 of the height of the characters used except that where an arrow is located with a single character such as 'A →', the space may be reduced to not less than one quarter of the character of the height in order to provide a good visual balance.
3. Where the numeral follows a letter or vice versa use Code 1.
4. Where a hyphen, dot, or diagonal stroke follows a character or vice versa use Code 1.

| a) Letter to letter code number | | | |
|---|---|---|---|
| Preceding Letter | Following Letter | | |
| | B, D, E, F, H, I, K, L, M, N, P, R, U | C, G, O, Q, S, X, Z | A, J, T, V, W, Y |
| | Code number | | |
| A | 2 | 2 | 4 |
| B | 1 | 2 | 2 |
| C | 2 | 2 | 3 |
| D | 1 | 2 | 2 |
| E | 2 | 2 | 3 |
| F | 2 | 2 | 3 |
| G | 1 | 2 | 2 |
| H | 1 | 1 | 2 |
| I | 1 | 1 | 2 |
| J | 1 | 1 | 2 |
| K | 2 | 2 | 3 |
| L | 2 | 2 | 4 |
| M | 1 | 1 | 2 |
| N | 1 | 1 | 2 |
| O | 1 | 2 | 2 |
| P | 1 | 2 | 2 |
| Q | 1 | 2 | 2 |
| R | 1 | 2 | 2 |
| S | 1 | 2 | 2 |
| T | 2 | 2 | 4 |
| U | 1 | 1 | 2 |
| V | 2 | 2 | 4 |
| W | 2 | 2 | 4 |
| X | 2 | 2 | 3 |
| Y | 2 | 2 | 4 |
| Z | 2 | 2 | 3 |

| b) Numeral to numeral code number | | | |
|---|---|---|---|
| Preceding Numeral | Following number | | |
| | 1, 5 | 2, 3, 6, 8, 9, 0 | 4, 7 |
| | Code number | | |
| 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 |
| 3 | 1 | 2 | 2 |
| 4 | 2 | 2 | 4 |
| 5 | 1 | 2 | 2 |
| 6 | 1 | 2 | 2 |
| 7 | 2 | 2 | 4 |
| 8 | 1 | 2 | 2 |
| 9 | 1 | 2 | 2 |
| 0 | 1 | 2 | 2 |

| c) Space between characters | | | |
|---|---|---|---|
| Code No. | Letter Height (mm) | | |
| | 200 | 300 | 400 |
| | Space (mm) | | |
| 1 | 48 | 71 | 96 |
| 2 | 38 | 57 | 76 |
| 3 | 25 | 38 | 50 |
| 4 | 13 | 19 | 26 |

| d) Width of letter | | | |
|---|---|---|---|
| Letter | Letter height (mm) | | |
| | 200 | 300 | 400 |
| | Width (mm) | | |
| A | 170 | 255 | 340 |
| B | 137 | 205 | 274 |
| C | 137 | 205 | 274 |
| D | 137 | 205 | 274 |
| E | 124 | 186 | 248 |
| F | 124 | 186 | 248 |
| G | 137 | 205 | 274 |
| H | 137 | 205 | 274 |
| I | 32 | 48 | 64 |
| J | 127 | 190 | 254 |
| K | 140 | 210 | 280 |
| L | 124 | 186 | 248 |
| M | 157 | 236 | 314 |
| N | 137 | 205 | 274 |
| O | 143 | 214 | 286 |
| P | 137 | 205 | 274 |
| Q | 143 | 214 | 286 |
| R | 137 | 205 | 274 |
| S | 137 | 205 | 274 |
| T | 124 | 186 | 248 |
| U | 137 | 205 | 274 |
| V | 152 | 229 | 304 |
| W | 178 | 267 | 356 |
| X | 137 | 205 | 274 |
| Y | 171 | 257 | 342 |
| Z | 137 | 205 | 274 |

| e) Width of numeral | | | |
|---|---|---|---|
| Letter | Numeral height (mm) | | |
| | 200 | 300 | 400 |
| | Width (mm) | | |
| 1 | 50 | 74 | 98 |
| 2 | 137 | 205 | 274 |
| 3 | 137 | 205 | 274 |
| 4 | 149 | 224 | 298 |
| 5 | 137 | 205 | 274 |
| 6 | 137 | 205 | 274 |
| 7 | 137 | 205 | 274 |
| 8 | 137 | 205 | 274 |
| 9 | 137 | 205 | 274 |
| 0 | 143 | 214 | 286 |

INSTRUCTIONS

1. To determine the proper SPACE between letters or numerals, obtain the code number from table a or b and enter table c for that code number to the desired letter or numeral height.
2. The space between words or groups of characters forming an abbreviation or symbol should be equal to 0.5 to 0.75 of the height of the characters used except that where an arrow is located with a single character such as 'A →', the space may be reduced to not less than one quarter of the character of the height in order to provide a good visual balance.
3. Where the numeral follows a letter or vice versa use Code 1.
4. Where a hyphen, dot, or diagonal stroke follows a character or vice versa use Code 1.

**Table A5.1-1 - Latitude and longitude**

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## ATTACHMENT A: SUPPLEMENTARY GUIDANCE MATERIAL TO MOS

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### 4. Runway surface evenness

4.1. In adopting tolerances for runway surface irregularities, the following standard of construction is achievable for short distances of 3 m and conforms to good engineering practice:

Except across the crown of a camber or across drainage channels, the finished surface of the wearing course is to be of such regularity that, when tested with a 3 m straight-edge placed anywhere in any direction on the surface, there is no deviation greater than 3 mm between the bottom of the straight-edge and the surface of the pavement anywhere along the straight-edge.

4.2. Caution shall also be exercised when inserting runway lights or drainage grilles in runway surfaces to ensure that adequate smoothness of the surface is maintained.

4.3 The operation of aircraft and differential settlement of surface foundations will eventually lead to increases in surface irregularities. Small deviations in the above tolerances will not seriously hamper aircraft operations. In general, isolated irregularities of the order of 2.5 cm to 3 cm over a 45 m distance are tolerable. Although maximum acceptable deviations vary with the type and speed of an aircraft, the limits of acceptable surface irregularities can be estimated to a reasonable extent. The following table describes maximum and temporarily acceptable limits. If the maximum limits are exceeded, corrective action should be undertaken as soon as reasonably practicable to improve the ride quality. If the temporarily acceptable limits are exceeded, the portions of the runway that exhibit such roughness should have corrective measures taken immediately if aircraft operations are to be continued.

| | Minimum acceptable length of irregularity (m) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Surface irregularity | 3 | 6 | 9 | 12 | 15 | 20 | 30 | 45 | 60 |
| Maximum surface irregularity height (or depth) (cm) | 3 | 3.5 | 4 | 5 | 5.5 | 6 | 6.5 | 8 | 10 |
| Temporary acceptable surface irregularity height (or depth) (cm) | 3.5 | 5.5 | 6.5 | 7.5 | 8 | 9 | 11 | 13 | 15 |

**Table A-1: Minimum acceptable length of surface irregularity (m)**

Note that "surface irregularity" is defined herein to mean isolated surface elevation deviations that do not lie along a uniform slope through any given section of a runway. For the purposes of this concern, a "section of a runway" is defined herein to mean a segment of a runway throughout which a continuing general uphill, downhill or flat slope is prevalent. The length of this section is generally between 30 and 60 metres, and can be greater, depending on the longitudinal profile and the condition of the pavement.

4.4 Table 10.15-3 illustrates a comparison of the surface roughness criteria with those developed by the United States Federal Aviation Administration

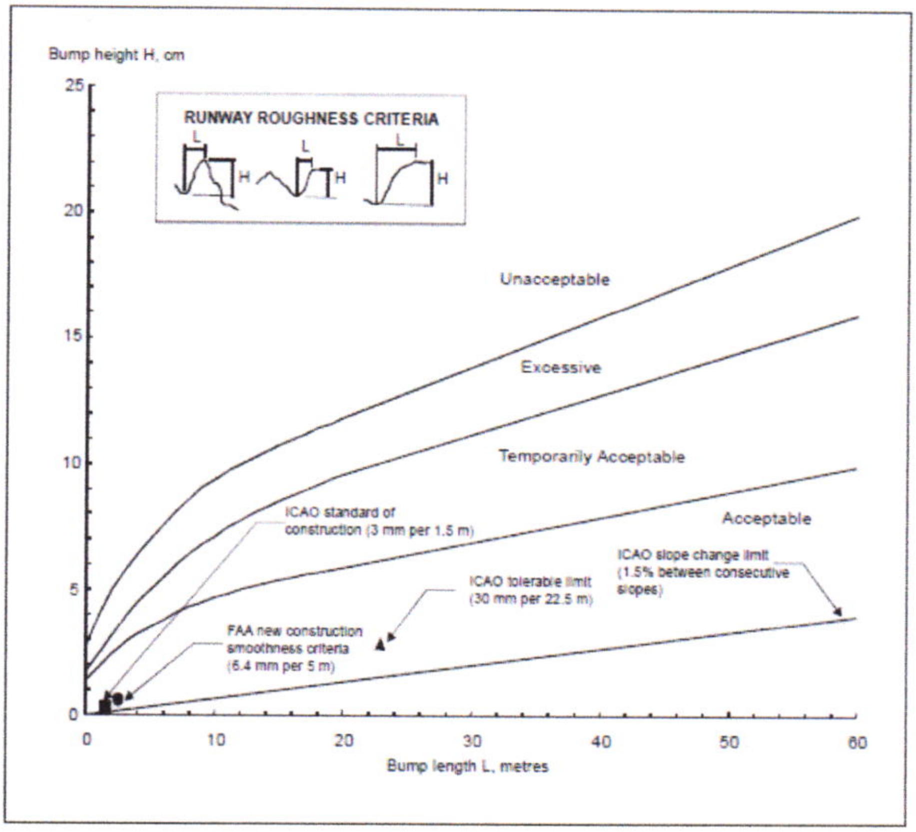


**Figure A-2. Comparison of roughness criteria**

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**Section 1.4: Definitions**

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

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

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

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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 Annex 15 and PANS-ATM (Doc 4444).*

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— 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.*

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 at least once where the code number is 1 or 2 and at least twice where the code number is 3 or 4.

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

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

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

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

i. DAMP — the surface shows a change of colour due to moisture.

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

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

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

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

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

*Note.— Guidance on conducting a runway surface friction characteristics evaluation programme that includes determining and expressing the minimum friction level is provided in MOS Attachment A Section 3.*

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**Section 10.15 Aerodrome Maintenance**

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**10.15.1 Pavement Cleanliness**

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10.15.1.2 All paved runway, taxiway and apron surfaces must be kept clear of objects or debris that may cause damage to aircraft structures or engines, or impair the operation of aircraft systems 10.2.1

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.

6.2.9.7 Determination of surface friction characteristics for construction and maintenance purposes

**MOS ATT A Section 3:Determination of surface friction characteristics for construction and maintenance purposes**

*Note:- The guidance in this section deals with the functional measurement of friction-related aspects related to runway construction and maintenance. Excluded in this section is the operational, as opposed to functional, measurement of friction for contaminated runways. However, the devices used for functional measurement could also be used for operational measurement, but in the latter case, the figures given in Airport Services Manual (Doc 9137), Part 2, Table 3-1 are not relevant.*

3.1 The surface friction characteristics of a paved runway should be:

a) assessed to verify the surface friction characteristics of new or resurfaced paved runways (Section 6.2.9.5); and

b) assessed periodically in order to determine the slipperiness of paved runways (Section 10.15.2.3).

3.2 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.

3.3 Friction tests of existing surface conditions are taken periodically in order to avoid falling below the minimum friction level 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.

3.4 Friction measurements of existing, new or resurfaced runways are made with a continuous friction measuring device provided with a smooth tread tire. The device should use self-wetting features to allow measurements of the surface friction characteristics to be made at a water depth of 1 mm.

3.5 When it is suspected that the surface friction characteristics of a runway may be reduced because of poor drainage, owing to inadequate slopes or depressions, then an additional measurement is made, but this time under natural conditions representative of a local rain. This measurement differs from the previous one in that water depths in the poorly cleared areas are normally greater in a local rain condition. The measurement results are thus more apt to identify problem areas having low friction values that could induce aquaplaning than the previous test. If circumstances do not permit measurements to be conducted during natural conditions representative of a rain, then this condition may be simulated. (See section 8.)

3.6 When conducting friction tests using a self-wetting continuous friction measuring device, it is important to note that, unlike compacted snow and ice conditions, in which there is very limited variation of the friction coefficient with speed, a wet runway produces a drop in friction with an increase in speed. However, as the speed increases, the rate at which the friction is reduced becomes less. Among the factors affecting the friction coefficient between the tire and the runway surface, texture is particularly important. If the runway has a good macro-texture allowing the water to escape beneath the tire, then the friction value will be less affected by speed. Conversely, a low macro-texture surface will produce a larger drop in friction with increase in speed.

3.7 Annex 14, Volume I, requires States to specify a minimum friction level below which corrective maintenance action should be taken. As criteria for surface friction characteristics of new or resurfaced runway surfaces and its maintenance planning, the State can establish a maintenance planning level below which appropriate corrective maintenance action should be initiated to improve the friction. The Airport Services Manual (Doc 9137), Part 2, provides guidance on establishing maintenance planning and minimum friction levels for runway surfaces in use.

Note 1.— The objective of 10.2.3 MOS Att. A 3.4, MOS 10.15.2.3, MOS 10.15.2.7 (c) and MOS 10.15.2.6 to 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.

Note 2.— Guidance for the determination of the required frequency is provided in the Airport Services Manual (Doc 9137), Part 2, Appendix 5

**AMENDED REGULATION:**

**MANUAL OF STANDARDS FOR AERODROMES**

...

**AMENDMENT 13A**

**CHAPTER 1. Introduction**

...

**Section 1.4 Definition of Terms**

...

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

**Arresting System.** A system designed to decelerate an aeroplane overrunning the runway

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

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

...

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

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**CHAPTER 5 - Aerodrome Information for AIP**

...

**CHAPTER 6. Aerodrome physical characteristics**

...

**Section 6.3 Runway strip**

...

**6.3.9 Objects on runway strips**

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

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6.3.9.4 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.*

. . .

6.3.8.1 The surface of a runway strip that abuts a runway, shoulder or stopway shall be flush with the surface of the runway, shoulder or stopway.

6.3.8.2 Effective drainage in the graded area must be provided to avoid water ponding. Open drains must not be constructed in the graded portion of a runway strip.

6.3.8.3 The portion of a strip to at least 30 m before the start of a runway 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.*

6.3.8.4 Where the areas in 6.3.8.3 have paved surfaces, they shall be able to withstand the occasional passage of the critical aeroplane for runway pavement design.

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6.3.7.2 The transverse slopes of any portion of a strip beyond that to be graded shall not exceed an upward slope of 5 per cent as measured in the direction away from the runway.

*Note: - 1. Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a runway strip and would be placed as far as practicable from the runway.*

*Note: - 2. The aerodrome RFF procedure would need to take into account the location of open-air water conveyances within the non-graded portion of a runway strip.*

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**Section 6.7 Taxiways**

Taxiways shall be provided to permit the safe and expeditious surface movement of aircraft.

*Note: - 1. Unless otherwise indicated the requirements in this section are applicable to all types of taxiways.*

*Note:- 2. See MOS Attachment A, Section 9 for specific taxiway design guidance which may assist in the prevention of runway incursions when developing a new taxiway or improving existing ones with a known runway incursion safety risk*

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*Note: - 3. Guidance on layout of taxiways is given in the Aerodrome Design Manual (Doc 9157), Part 2.*

Sufficient entrance and exit taxiways for a runway shall be provided to expedite the movement of aeroplanes to and from the runway and provision of rapid exit taxiways considered when traffic volumes are high.

### 6.7.1 Taxiway Width

### 6.7.2 Taxiway Edge Clearance

6.7.2.1 The design of a taxiway shall be such that, when the cockpit of the aeroplane for which the taxiway is intended remains over the taxiway centerline markings, the clearance distance between the outer main wheel of the aeroplane and the edge of the taxiway shall be not less than the distance determined using Table 6.7-2.

| Code letter | Minimum clearance |
|---|---|
| **A** | 1.5 m |
| **B** | 2.25 m |
| **C** | *3 m on straight portion;* |
| *3 m on curved portions if the taxiway is intended to be used aeroplanes with a wheel base less than 18 m* | |
| *4.5 m on curved portions if the taxiway is intended to be used bay aeroplanes with a wheel base less than 18 m;* | |
| **D, E or F** | 4.5 m |

**Table 6.7-2: Minimum clearance between outer main gear wheels and edge of taxiway**

*Note: - 1. Wheel base means the distance from the nose gear to the geometric center of the main gear.*

*Note: - 2. Where the code letter is F and the traffic density is high, a wheel-to-edge clearance greater*

*Note: - 3. This provision applies to taxiways first put into service on or after 20 November 2008.*

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### 6.7.1 Taxiway Width

6.7.1.1 The width of a straight section of a taxiway must not be less than the width determined using Table 6.7-1.

| Code letter | Minimum taxiway width (straight sections) |
|---|---|
| **A** | 7.5 m |
| **B** | 10.5 m |
| **C** | 15m |
| **D** | *18 m if the taxiway is intended to be used by aeroplanes with an outer main gear wheel span of less than 9 m;* |
| | *23 m if the taxiway is intended to be used by aeroplanes with an outer main gear wheel span equal to or greater than 9 m.* |
| **E** | 23 m |
| **F** | 25 m |

**Table 6.7-1: Minimum width for straight section of taxiway**

*Note: - Guidance on width of taxiways is given in the Aerodrome Design Manual (Doc9157), Part 2.*

| Code letter | Distance between taxiway centre line and runway centre line (metres) | | | | | | | | Taxiway centre line to taxiway centre line (metres) | Taxiway, other than aircraft stand taxilane, centre line to object (metres) | Aircraft stand taxilane centre line to aircraft stand taxilane centre line (metres) | Aircraft stand taxilane centre line to object (metres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instrument runways Code number | | | | Non-instrument runways Code number | | | | | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
| A | 82.5 | 82.5 | - | - | 37.5 | 47.5 | - | - | 23 | 15.5 | 19.5 | 12 |
| B | 87 | 87 | - | - | 42 | 52 | - | - | 32 | 20 | 28.5 | 16.5 |
| C | - | - | 168 | - | - | - | 93 | - | 44 | 26 | 40.5 | 22.5 |
| D | - | - | 176 | 176 | - | - | 101 | 101 | 63 | 37 | 59.5 | 33.5 |
| E | - | - | - | 182.5 | - | - | - | 107.5 | 76 | 43.5 | 72.5 | 40 |
| F | - | - | - | 190 | - | - | - | 115 | 91 | 51 | 87.5 | 47.5 |

**Table 6.7-5: Taxiway minimum separation distances**

*Note: - 1 The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways. The basis for development of these distances is given in the Aerodrome Design Manual (Doc 9157), Part 2.*

*Note: - 2. The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding aeroplane to permit the passing of another aeroplane on a parallel taxiway. See the Aerodrome Design Manual (Doc 9157), Part 2.*

. . .

**6.7.16 Objects on Taxiway Strip**

*Note: - See MOS 11.1.1.1 for information regarding general siting requirements of equipment and installations on taxiway strips.*

6.7.16.1 The taxiway strip must provide an area clear of objects which may endanger taxiing aeroplanes.

*Note: - 1. Consideration will have to be given to the location and design of drains on a taxiway strip to prevent damage to an aeroplane accidentally running off a taxiway. Suitably designed drain covers may be required. For further guidance, see the Aerodrome Design Manual (Doc 9157), Part 2.*

*Note: - 2. Where open-air or covered storm water conveyances are installed, consideration will have to be given to ensure that their structure do not extend above the surrounding ground so as not to be considered an obstacle. See also Note 1 MOS 6.7.15.3.*

*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.*

6.7.16.2 A taxiway strip must be free of fixed objects other than visual or navigational aids used for the guidance of aircraft or vehicles.

6.7.16.3 Visual aids located within a taxiway strip must be sited at such a height that they cannot be struck by propellers, engine pods and wings of aircraft using the taxiway.

. . .

6.7.15.3 The transverse slopes on any portion of a taxiway strip beyond that to be graded shall not exceed an upward or downward slope of 5.0% as measured in the direction away from the taxiway.

*Note: - 1. Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a taxiway strip and would be placed as far as practicable from the taxiway.*

*Note: - 2. The aerodrome RFF procedure would need to take into account the location of open-air storm water conveyances within the non-graded portion of a taxiway strip.*

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**Section 6.9 Aprons**

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**6.9.2 Clearance distances on aircraft stands**

6.9.2.1 An aircraft stand shall be provided the following minimum clearances between an aircraft entering or exiting the stand and any adjacent building, aircraft on another stand and other objects using Table 6.9-1.

| Code letter for aircraft | From centre line of aircraft pa | From wing tip of aircraft on aircraft parking position to object |
|---|---|---|
| A | 12.0 m | 3.0 m |
| B | 16.5 m | 3.0 m |
| C | 24.5 m | 4.5 m |
| D | 36.0 m | 7.5 m |
| E | 42.5 m | 7.5 m* |
| F | 50.5 m | 7.5 m* |
| * The minimum separation distance is 10 metres if free moving parking is used. | | |

**Table 6.9-1: Aircraft parking positions – Minimum separation distance**

6.9.2.2 Subject to Paragraph 6.9.2.3, an aircraft on an aircraft parking position must be cleared from any object, other than an aerobridge, by a distance not less than that determined using Table 6.9-1.

6.9.2.3 Paragraph 6.9.2.2 does not apply to a Code D, E or F aircraft if a visual docking guidance system allows a reduced clear distance.

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

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

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

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

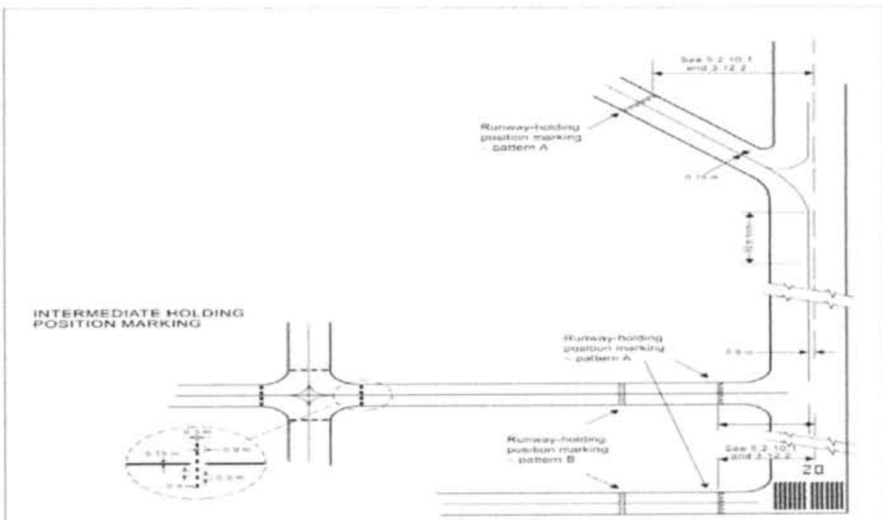


**Figure 8.4-2: Taxiway Marking**

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### 8.4.3 Runway holding position markings

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8.4.3.10 The runway-holding position marking displayed at a runway-holding position established in accordance with MOS 6.8.2.3 shall be as shown in Figure 8.4-2, Pattern A.

. . .

8.4.3.2 Until 26 November 2026, the dimensions of runway-holding position markings shall be as shown in Figure 8.4-3, pattern A1 (or A2) or pattern B1 (or B2), as appropriate.

. . .

8.4.3.11 Where increased conspicuity of the runway-holding position is required, the dimensions of runway-holding position marking shall be as shown in Figure 8.4-4, pattern A2 or pattern B2, as appropriate.

*Note: - An increased conspicuity of the runway-holding position can be required, notably to avoid incursion risks.*

. . .

8.4.3.5 The runway-holding position marking displayed at a runway/runway intersection shall be perpendicular to the centerline of the runway forming part of the standard taxi-route. The pattern of the marking shall be as shown in Figure 8.4-4, pattern A2.

. . .

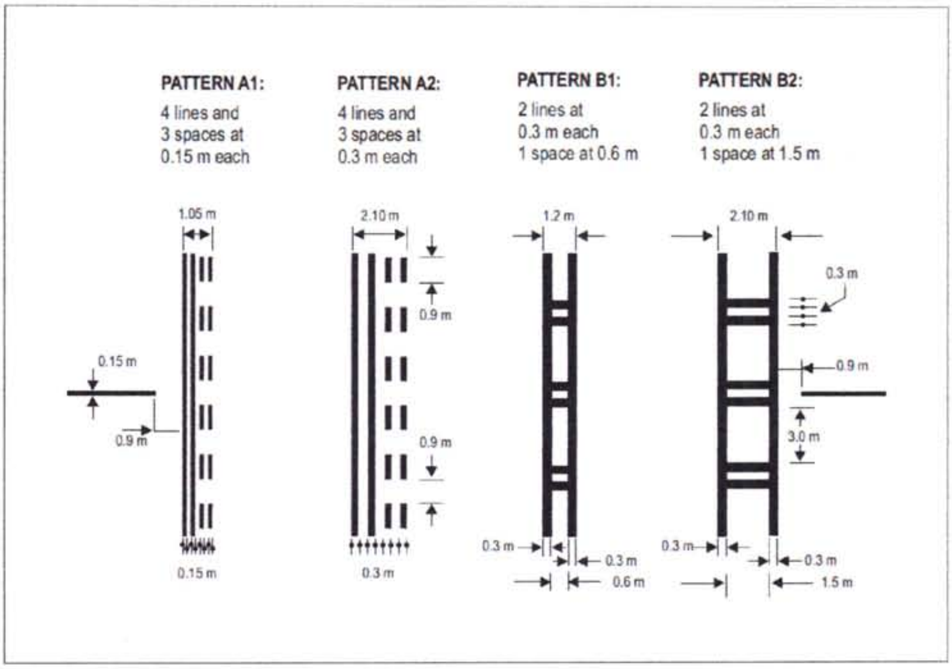


**Figure 8.4-4: Runway-holding position markings**

*Note: - Patterns A1 and B1 are no longer valid after 2026.*

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### 9.6.2 Precision approach Category I lighting system

. . .

9.6.2.8 If the centerline consists of barrettes as described in MOS 9.6.2.12 (b) and 9.6.2.13 (b), each barrette shall be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.

9.6.2.9 Each flashing light as described in 9.6.2.8 shall flash twice a second in sequence beginning with the outermost light and progressing to the innermost light. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights in the approach lighting system.

. . .

### 9.6.3 Precision Approach Category II and III Lighting System

. . .

9.6.3.15 If the centerline beyond 300 m from the threshold consists of barrettes as described in 9.6.3.12 (a) or 9.6.3.13 (a), each barrette beyond 300 m shall be supplemented by a flashing light, except where such lighting is considered unnecessary by CAAP taking into account the characteristics of the system and the nature of the meteorological conditions.

. . .

9.8.1.6 PAPI, T-VASIS or AT-VASIS shall be provided where the code number is 3 or 4 when one or more of the conditions specified in MOS 9.8.1.2 exist.

9.8.1.7 As of 1 January 2020, the use of T-VASIS and AT-VASIS as standard visual approach slope indicator systems shall be discontinued.

. . .

9.8.2.5 Where an aeronautical study indicates that an existing object extending above an obstacle protection surface (OPS) can adversely affect the safety of operations of aeroplanes, one or more of the following measures shall be taken:

(a) remove the object;

(b) suitably raise the approach slope of the system;

(c) reduce the azimuth spread of the system so that the object is outside the confines of the beam;

(d) displace the axis of the system and its associated obstacle protection surface by no more than 5°;

(e) suitably displace the system upwind of the threshold such that the object no longer penetrates the OPS.

*Note: - 1. Guidance on this issue is contained in the Aerodrome Design Manual (Doc 9157), Part 4.*

*Note: - 2. The displacement of the system upwind of the threshold reduces the operational landing distance.*

| | Runway type/code number | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Non-instrument Code number | | | | Instrument Code number | | | |
| Surface dimensions | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Length of inner edge | 60 m | 80 m[a] | 150 m | 150 m | 150 m | 150 m | 300 m | 300 m |
| Distance from the visual approach slope indicator system[e] | $D_1$+30 m | $D_1$+60 m | $D_1$+60 m | $D_1$+60 m | $D_1$+60 m | $D_1$+60 m | $D_1$+60 m | $D_1$+60 m |
| Divergence (each side) | 10% | 10% | 10% | 10% | 15% | 15% | 15% | 15% |
| Total length | 7 500 m | 7 500 m[b] | 15 000 m | 15 000 m | 7 500 m | 7 500 m[b] | 15 000 m | 15 000 m |
| *Slope* | | | | | | | | |
| a) T-VASIS and AT-VASIS | –[c] | 1.9° | 1.9° | 1.9° | – | 1.9° | 1.9° | 1.9° |
| b) PAPI[d] | – | A–0.57° | A–0.57° | A–0.57° | A–0.57° | A–0.57° | A–0.57° | A–0.57° |
| c) APAPI[d] | A–0.9° | A–0.9° | – | – | A–0.9° | A–0.9° | – | – |

a. This length is to be increased to 150 m for a T-VASIS or AT-VASIS.
b. This length is to be increased to 15 000 m for a T-VASIS or AT-VASIS.
c. No slope has been specified if a system is unlikely to be used on runway type/code number indicated.
d. Angles as indicated in MOS Figure 9.8-5.
e. D1 is the distance of the visual approach slope indicator system from threshold prior to any displacement to remedy object penetration of the OPS (refer to MOS Figure 9.8-3). The start of the OPS is fixed to the visual approach slope indicator system location, such that displacement of the PAPI results in an equal displacement of the start of the OPS. See MOS 9.8.2.5 ( e).

f. **Table 9.8-1: Dimensions and slopes of the obstacle protection surface**

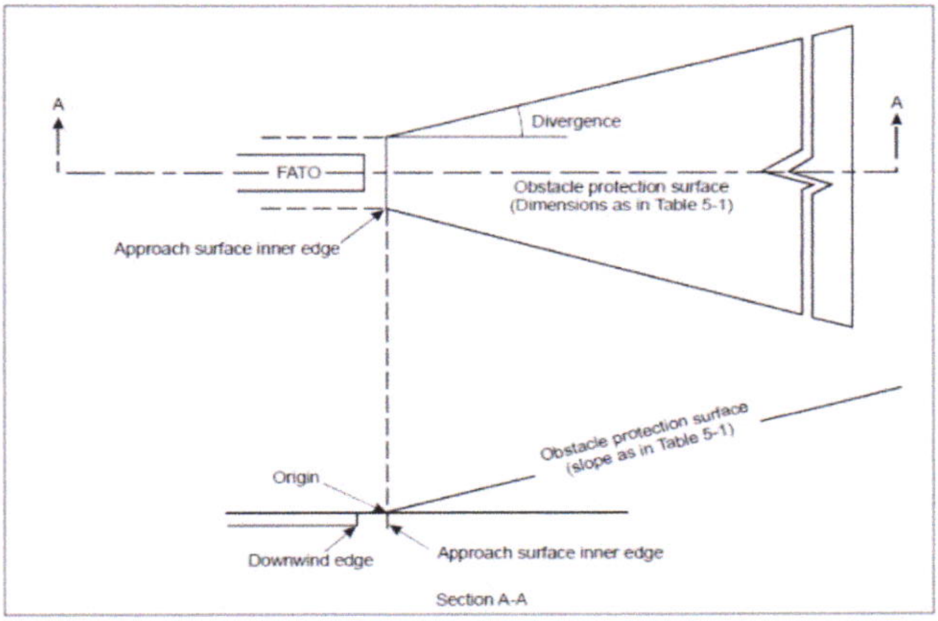


**Figure 15-33 Obstacle protection surface for visual approach slope indicator systems**

9.11.1.5 The flashing lights and the steady burning lights shall be white.

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**9.11.2 Runway status lights**

*Note: - Runway status lights (RWSL) is a type of autonomous runway incursion warning system (ARIWS). The two basic visual components of RWSL are runway entrance lights (RELs) and take-off hold lights (THLs). Either may be installed by itself, but the two components are designed to be complementary to each other.*

9.11.2.1 Where provided, RELs shall be offset 0.6 m from the taxiway centerline on the opposite side to the taxiway centerline lights and begin 0.6 m before the runway-holding position extending to the edge of the runway. An additional single light shall be placed on the runway 0.6 m from the runway centerline and aligned with the last two taxiway RELs.

*Note: - Where two or more runway-holding positions are provided, the runway-holding position referred is that closest to the runway.*

9.11.2.2 RELs shall consist of at least five light units and shall be spaced at a minimum of 3.8 m and a maximum of 15.2 m longitudinally, depending upon the taxiway length involved, except for a single light installed near the runway centerline.

9.11.2.3 Where provided, THLs shall be offset 1.8 m on each side of the runway centerline lights and extend, in pairs, starting at a point 115 m from the beginning of the runway and, thereafter, every 30 m for at least 450 m.

*Note: - Additional THLs may be similarly provided at the starting point of the take-off roll.*

9.11.2.4 Where provided, RELs shall consist of a single line of fixed in pavement lights showing red in the direction of aircraft approaching the runway.

9.11.2.5 RELs shall illuminate as an array at each taxiway/runway intersection where they are installed less than 2 seconds after the system determines a warning is needed.

9.11.2.6 Intensity and beam spread of RELs shall be in accordance with the specifications of MOS Figure 9.13-3: and Figure 9.13-5.

*Note: - Consideration for reduced beam width may be required for some REL lights at acute angled runway/taxiway intersections to ensure the RELs are not visible to aircraft on the runway.*

9.11.2.7 Where provided, THLs shall consist of two rows of fixed in pavement lights showing red facing the aircraft taking off.

9.11.2.8 THLs shall illuminate as an array on the runway less than 2 seconds after the system determines a warning is needed.

9.11.2.9 Intensity and beam spread of THLs shall be in accordance with the specifications of MOS Figure 9.10-5 and 9.10-6.

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

...

8.6.7 Mandatory instruction signs

*Note: - See Figure 8.6-14 for pictorial representation of mandatory instruction signs and Figure 8.6-11 for examples of locating signs or sign positions at taxiway/runway intersections*

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8.6.7.13 The inscription on a runway designation sign shall consist of the runway designations of the intersecting runway properly oriented with respect to the viewing position of the sign, except that a runway designation sign installed in the vicinity of a runway extremity may show the runway designation of the concerned runway extremity only.

8.6.7.14 The inscription on a category I, II, III or joint II/III holding position sign shall consist of the runway designator followed by CAT I, CAT II, CAT III or CAT II/III, as appropriate.

8.6.7.15 The inscription on a NO ENTRY sign shall be in accordance with MOS Figure 8.6-14.

8.6.7.16 The inscription on a runway-holding position sign at a runway-holding position established in accordance with MOS 8.6.2.3 shall consist of the taxiway designation and a number.

8.6.7.17 Where installed, the inscriptions/symbol shall be used as shown in Figure 8.6-14.

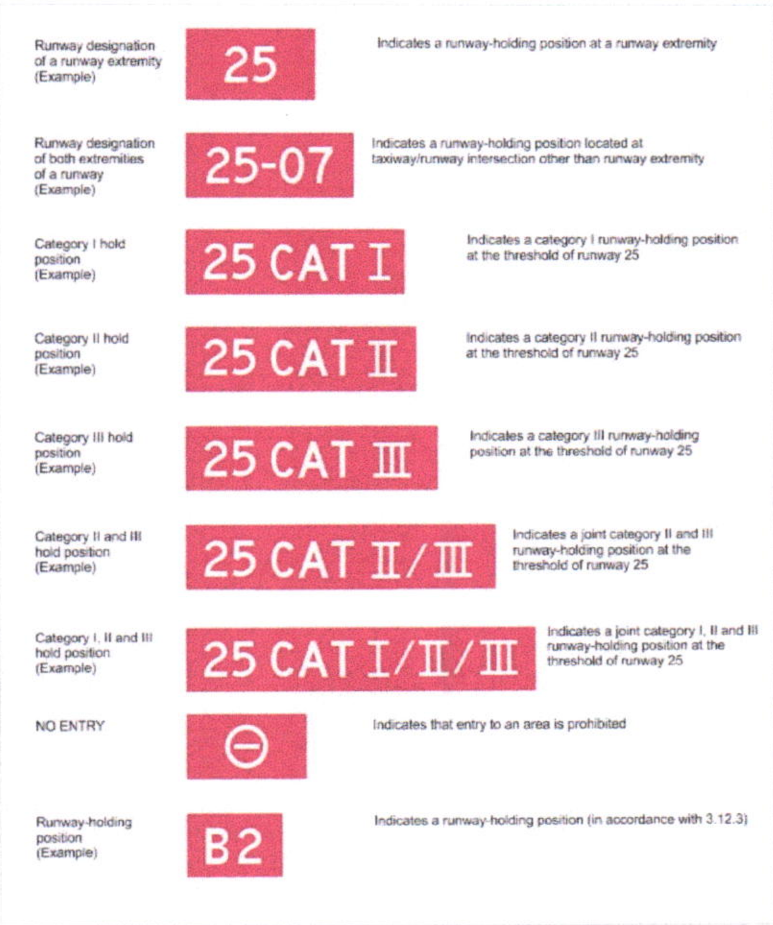



**Figure 8.6-14 Mandatory instruction signs**

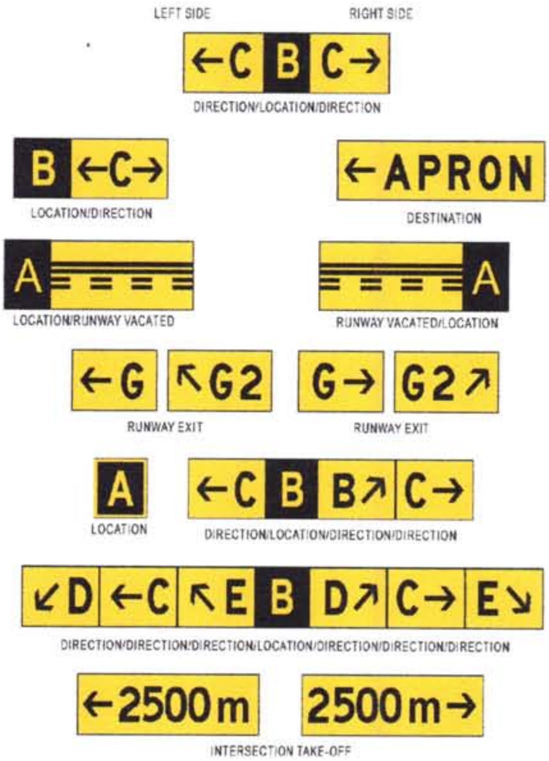
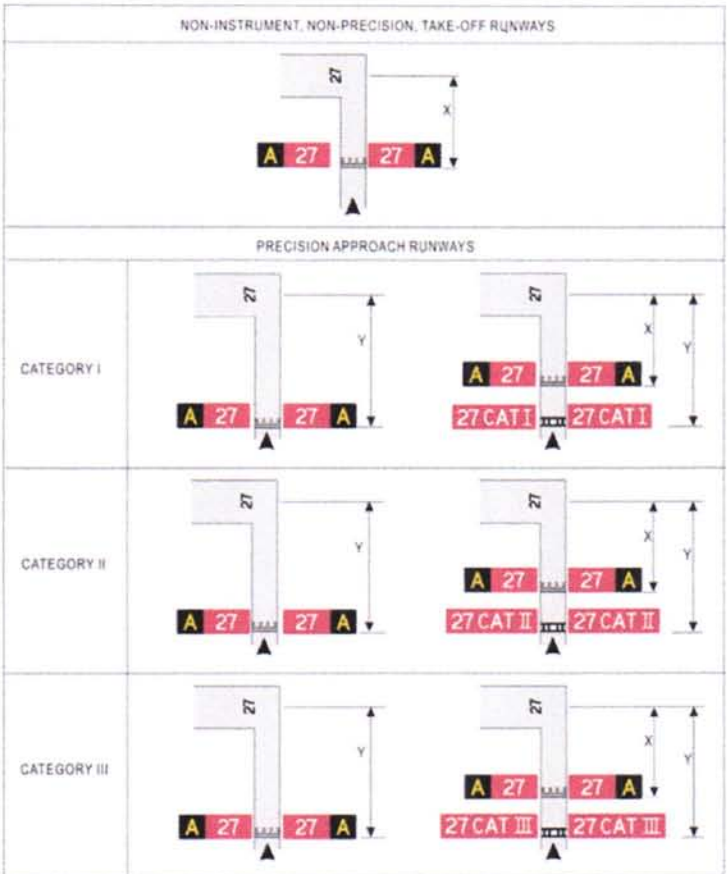



Figure 8.6-15 Information signs



*Note.— Distance X is established in accordance with Table 6.5-1 Distance Y is established at the edge of the ILS/MLS critical/sensitive area.*

**Figure 8.6-11 : Category I, II, III runway-holding position sign**

### 8.6.14 Information Signs

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8.6.16.3 At a taxiway intersection, information signs shall be located prior to the intersection and in line with intermediate holding position marking. Where there is no intermediate holding position marking, the signs shall be installed at least 60 m from the centerline of the intersecting taxiway where the code number is 3 or 4, and at least 40 m where the code number is 1 or 2.

...

### 6.1 Specifications for obstacle lights

**Table 6.1-1. Characteristics of obstacle lights**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Light Type | Color | Signal type/ (flash rate) | Peak intensity (cd) at given Background Luminance (b) | | | Light Distribution Table |
| | | | Day (Above 500 cd/m2) | Twilight (50-500 cd/m2) | Night (Below 50 cd/m2) | |
| Low-intensity, Type A (fixed obstacle) | Red | Fixed | N/A | N/A | 10 | Table 6.1-2 |
| Low-intensity, Type B (fixed obstacle) | Red | Fixed | N/A | N/A | 32 | Table 6.1-2 |
| Low-intensity, Type C (mobile obstacle) | Yellow/Blue (a) | Flashing (60-90 fpm) | N/A | 40 | 40 | Table 6.1-2 |
| Low-intensity, Type D (follow-me vehicle) | Yellow | Flashing (60-90 fpm) | N/A | 200 | 200 | Table 6.1-2 |
| Low-intensity, Type E | Red | Flashing (c) | N/A | N/A | 32 | Table 6.1-2 (Type B) |
| Medium-intensity, Type A | White | Flashing (20-60 fpm) | 20000 | 20000 | 2000 | Table 6.1-3 |
| Medium-intensity, Type B | Red | Flashing (20-60 fpm) | N/A | N/A | 2000 | Table 6.1-3 |
| Medium-intensity, Type C | Red | Fixed | N/A | N/A | 2000 | Table 6.1-3 |
| High-intensity, Type A | White | Flashing (40-60 fpm) | 200000 | 20000 | 2000 | Table 6.1-3 |
| High-intensity, Type B | White | Flashing (40-60 fpm) | 100000 | 20000 | 2000 | Table 6.1-3 |

(a) 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.

(b) For flashing lights, effective intensity as determined in accordance with the Aerodrome Design Manual (Doc 9157), Part 4.

(c) For wind turbine application, to flash at the same rate as the lighting on the nacelle.

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.*

**Markings**

(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.

**Lighting**

(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 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:

i. for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle shall be provided;

ii. for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate shall be provided in case of failure of the operating light. The lights shall be installed to assure that the output of either light is not blocked by the other; and

iii. in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, shall be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights maybe used.

*Note: - The above MOS 8.10.3.5(c)(v) does not address wind turbines of more than 315 m of overall height. For such wind turbines, additional marking and lighting may be required as determined by an aeronautical study.*

(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.

| 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**

...

**Section 10.20 Autonomous runway incursion warning system**

*Note: - 1. The inclusion of detailed specifications for an autonomous runway incursion warning system (ARIWS) in this section is not intended to imply that an ARIWS has to be provided at an aerodrome.*

*Note: - 2. The implementation of an ARIWS is a complex issue deserving careful consideration by aerodrome operators, air traffic services and States, and in coordination with the aircraft operators.*

*Note: - 3. MOS Attachment A, Section 8, provides a description of an ARIWS and information on its use.*

10.20.1.1 Where an ARIWS is installed at an aerodrome:

(a) it shall provide autonomous detection of a potential incursion or of the occupancy of an active runway and a direct warning to a flight crew or vehicle operator;

(b) it shall function and be controlled independently of any other visual system on the aerodrome;

(c) its visual aid components, i.e. lights, shall be designed to conform with the relevant specifications in MOS 9.18.4.1; and

(d) failure of part or all of it shall not interfere with normal aerodrome operations. To this end, provision shall be made to allow the ATC unit to partially or entirely shut down the system.

*Note: - 1. An ARIWS may be installed in conjunction with enhanced taxiway centerline markings, stop bars or runway guard lights.*

*Note: - 2. It is intended that the system(s) be operational under all weather conditions, including low visibility.*

*Note: - 3. An ARIWS may share common sensory components of an SMGCS or A-SMGCS, however, it operates independently of either system.*

10.20.1.2 Where an ARIWS is installed at an aerodrome, information on its characteristics and status shall be provided to the appropriate aeronautical information services for promulgation in the AIP with the description of the aerodrome surface movement guidance and control system and markings as specified in Annex 15, Appendix 1, AD 2.9.

*10.15.2 Pavements*

...

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

*Note: - 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).*

...

**Section 9.2 Colors 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 colors 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 color not be greatly modified by selective* *atmospheric attenuations and that the observer's color vision be adequate. There is also a risk of confusion of color 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.*

9.2.2 Chromaticities for lights having filament-type light sources

9.2.2.1 The chromaticities of aeronautical ground lights with filament-type light sources shall 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 $y = 0.360 - 0.080y$
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 y = 0.790-0.667x |
| Blue boundary | x = 0.285 |
| Green boundary | y = 0.440 and y = 0.150 + 0.640x |
| Purple boundary | y = 0.050 + 0.750x and y = 0.382 |

*Note: - Guidance on chromaticity changes resulting from the effect of temperature on filtering elements is given in the Aerodrome Design Manual (Doc 9157), Part 4.*

9.2.2.2 Where dimming is not required, or where observers with defective color vision must be able to determine the color of the light, green signals shall be within the following boundaries:

| | |
|---|---|
| Yellow boundary | y = 0.726 – 0.726x |
| White boundary | x = 0.650y |
| Blue boundary | y = 0.390 – 0.171x |

*Note: - Where the color signal is to be seen from long range, it has been the practice to use colors within the boundaries of MOS 5.1.2.2.*

9.2.2.3 Where increased certainty of recognition from white, is more important than maximum visual range, green signals shall be within the following boundaries:

| | |
|---|---|
| Yellow boundary | y = 0.726 – 0.726x |
| White boundary | x = 0.625y – 0.041 |
| Blue boundary | y = 0.390 – 0.171x |

9.2.3 Discrimination between colored lights having filament-type sources

9.2.3.1 If there is a requirement to discriminate yellow and white from each other, they must be displayed in close proximity of time or space as, for example, by being flashed successively from the same beacon.

9.2.3.2 If there is a requirement to discriminate yellow from green or white, as for example, with exit taxiway centerline lights, the 'y' co-ordinate of the yellow light must not exceed a value of 0.40.

*Note: - The limits of white have been based on the assumption that they will be used in situations in which the characteristics (color, temperature) of the light source will be substantially constant.*

9.2.3.3 The color variable white is intended to be used only for lights that are to be varied in intensity, e.g. to avoid dazzling. If these lights are to be discriminated from yellow lights, the lights must be designed and operated so that:

(a) the 'x' co-ordinate of the yellow is at least 0.050 greater than the 'x' co-ordinate of the white; and

(b) the disposition of the lights is such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

9.2.4 Chromaticities for lights having a solid state light source

9.2.4.1 The chromaticities of aeronautical ground lights with solid state light sources, e.g. LEDs, shall be within the following boundaries:

CIE Equations (see Figure 9.2-1b):

(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 = 0.387 |
| White boundary | y = 0.980-x |
| Green boundary | y = 0.727x+0.054 |

(c) Green (also refer to MOS 9.8.4.7 and 9.8.4.8)

| | |
|---|---|
| Yellow boundary | x = 0.310 |
| White boundary | x = 0.625y – 0.041 |
| Blue boundary | y = 0.400 |

(d) Blue

| | |
|---|---|
| Green boundary | y = 0.1.141x – 0.0377 |
| White boundary | x = 0.400 - y |
| Purple boundary | x = 0.134 + 0.590y |

(e) White

| | |
|---|---|
| Yellow boundary | x = 0.440 |
| Blue boundary | x = 0.320 |
| Green boundary | y = 0.1.50 + 0.643x |
| Purple boundary | y = 0.050 + 0.757x |

(f) Variable white

The boundaries of variable white for solid state light sources are those of (e) White above

9.2.4.2 Where observers with defective color vision must be able to determine the color of the light, green signals shall be within the following boundaries:

| | |
|---|---|
| Yellow boundary | y = 0.726 – 0.726x |
| White boundary | x = 0.625y– 0.041 |
| Blue boundary | y = 0.400 |

9.2.4.3 In order to avoid a large variation of shades of green, if colors within the boundaries below are selected, colors within the boundaries of MOS 9.2.4.2 shall not be used.

| | |
|---|---|
| Yellow boundary | x = 0.310 |

White boundary x = 0.625y – 0.041
Blue boundary y = 0.726 - 0.726x

9.2.5 Color measurement for filament-type and solid state-type light sources

9.2.5.1 The color of aeronautical ground lights shall be verified as being within the boundaries specified in Figure 9.2-1a or 9.2-1b, as appropriate, by measurement at five points within the area limited by the innermost isocandela curve (isocandela diagrams in Chapter 9, collective notes to figures), with operation at rated current or voltage. In the case of elliptical or circular isocandela curves, the color measurements shall be taken at the center and at the horizontal and vertical limits. In the case of rectangular isocandela curves, the color measurements shall be taken at the center and the limits of the diagonals (corners). In addition, the color of the light shall be checked at the outermost isocandela curve to ensure that there is no color shift that might cause signal confusion to the pilot.

*Note: - 1. For the outermost isocandela curve, a measurement of color coordinates should be made and recorded for review and judgement of acceptability by the State.*

*Note: - 2. Certain light units may have application so that they may be viewed and used by pilots from directions beyond that of the outermost isocandela curve (e.g. stop bar lights at significantly wide runway-holding positions). In such instances, the State should assess the actual application and if necessary require a check of color shift at angular ranges beyond the outermost curve.*

9.2.5.2 In the case of visual approach slope indicator systems and other light units having a color transition sector, the color shall be measured at points in accordance with MOS 9.2.5.1, except that the color areas shall be treated separately and no point shall be within 0.5 degrees of the transition sector

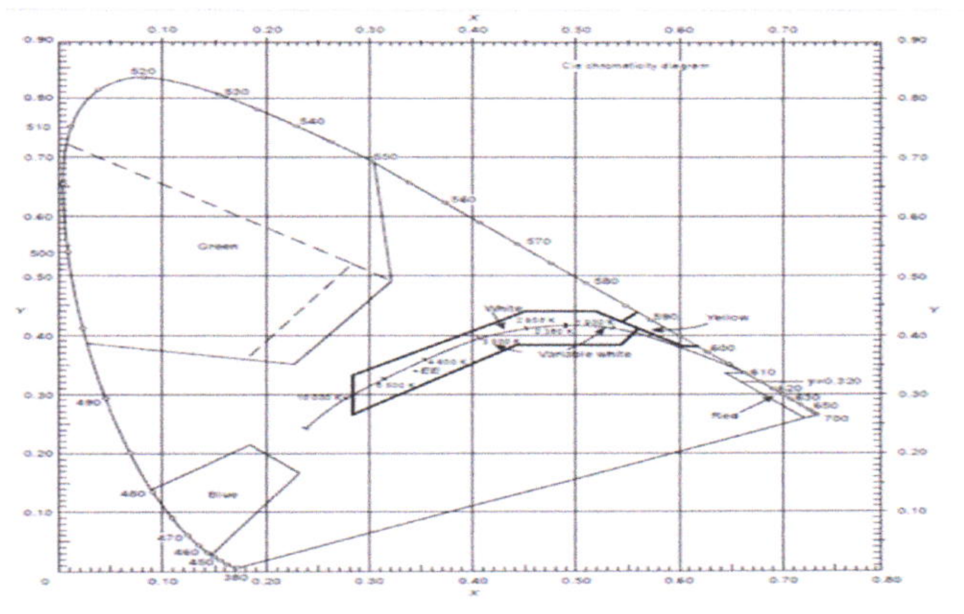


**Figure 9.2-1a: Colors for aeronautical ground lights (filament-type lamps)**

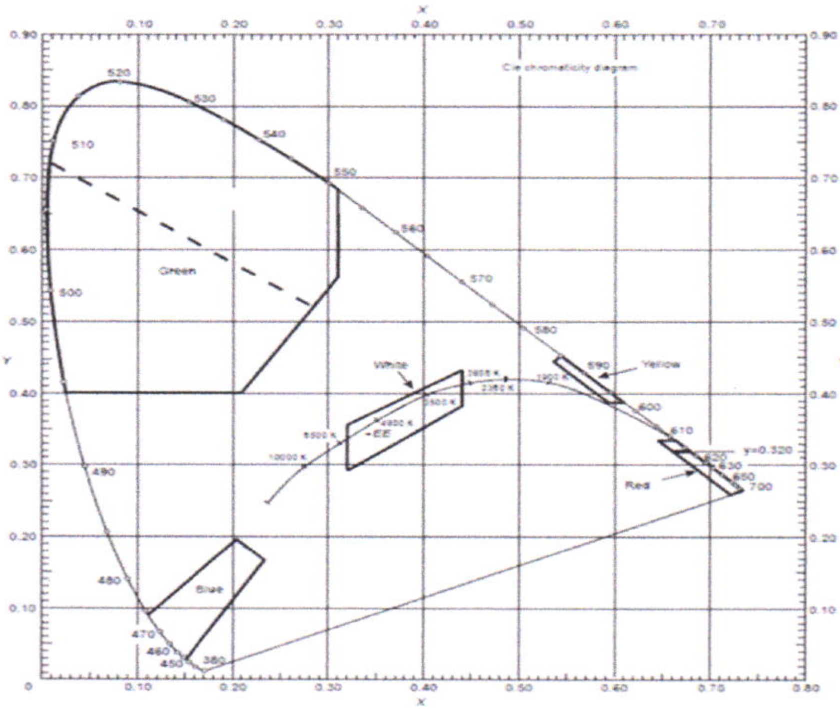

Figure 9.2-1b: Colors for aeronautical ground lights (solid state lighting)

*Notes:*

1. *Lights on curves to have light beam toed-in 15.75° with respect to the tangent of the curve. This does not apply to runway entrance lights (RELs).*

2. *Increased intensities for RELs shall be twice the specified intensities, i.e. minimum 20 cd, main beam minimum 100 cd and minimum average 200 cd.*

3. *See collective notes at Paragraph 9.13.1 for these isocandela diagrams.*

**Figure 9.13-3: Isocandela diagram for taxiway centerline (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 9.13-5: Isocandela diagram for taxiway centerline (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**

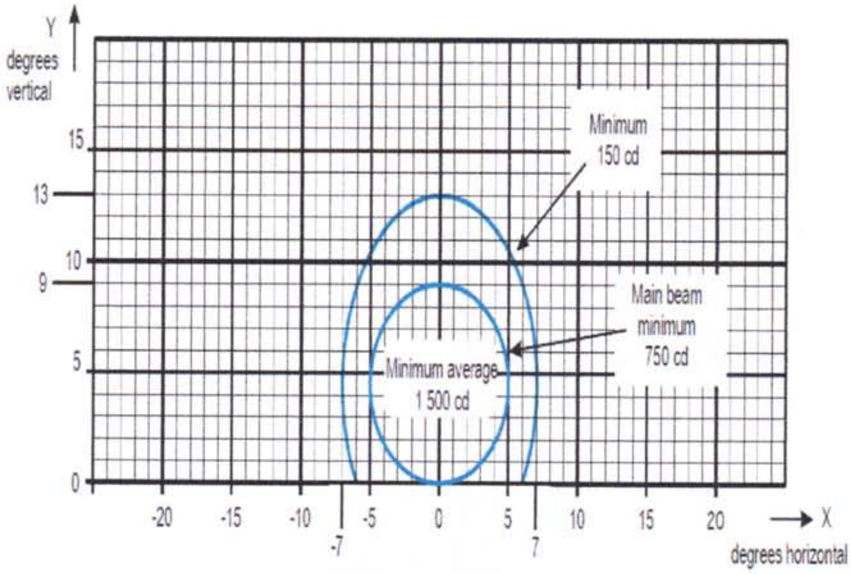


**Figure 9.13-13. Isocandela diagram for take-off and hold lights (THL) (red light)**

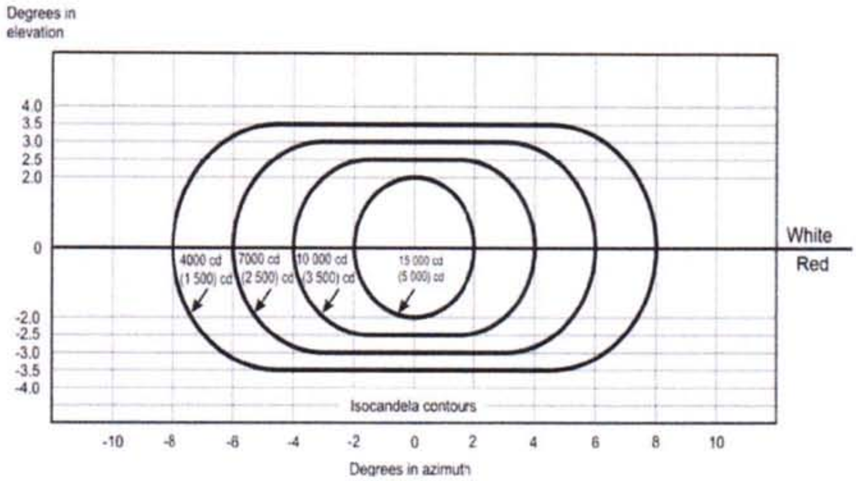


**Figure 9.8-4: Light intensity distribution of PAPI and APAPI**

*Notes:*

*1. These curves are for minimum intensities in red light.*

*2. The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.*

*3. The intensity values shown in brackets are for APAPI.*

**Figure 9.8-4: Light intensity distribution of PAPI and APAPI**

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**8.5.25 Designation characters for taxi and apron markings**

*Note: - 1. See MOS 8.5.34 and 8.5.35, for specifications on the application, location and characteristics of mandatory instruction markings and information markings.*

*Note: - 2 The form and proportions of the letters, numbers and symbols of mandatory instruction markings and information markings must be on a grid.*

...

**Figure 8.5-22: Letters and numbers used in designations for taxiway and apron markings**

*Note 3: - The mandatory instruction markings and information markings on pavements are formed as if shadowed (i.e., stretched) from the characters of an equivalent elevated sign by a factor of 2.5 as shown in the figure below. The shadowing, however, only affects the vertical dimension. Therefore, the spacing of characters for pavement marking is obtained by first determining the equivalent elevated sign character height and then proportioning from the spacing values given in Figure 8.6-7.*

*For example, in the case of the runway designator "10" which is to have a height of 4 000 mm (Hps), the equivalent elevated sign character height is 4 000/2.5=1 600 mm (Hes). Figure 8.6-7 (b) indicates numeral to numeral code 1 and from Table A4-1(c) Figure 8.6-7 (c). this code has a dimension of 96 mm, for a character height of 400 mm. The pavement marking spacing for "10" is then (1 600/400)*96=384 mm.*

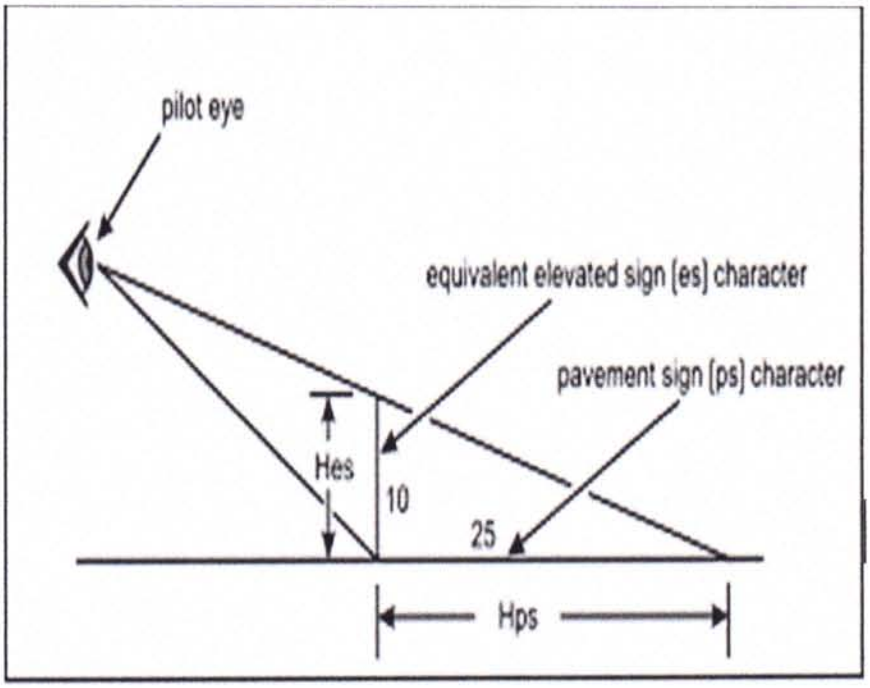



**Figure 8.5-23: Mandatory Instruction and Information Markings**


**Figure 8.5-19: Letters and numbers used in designations for taxiway and apron markings**


**Figure 8.5-20: Letters and numbers used in designations for taxiway and apron**

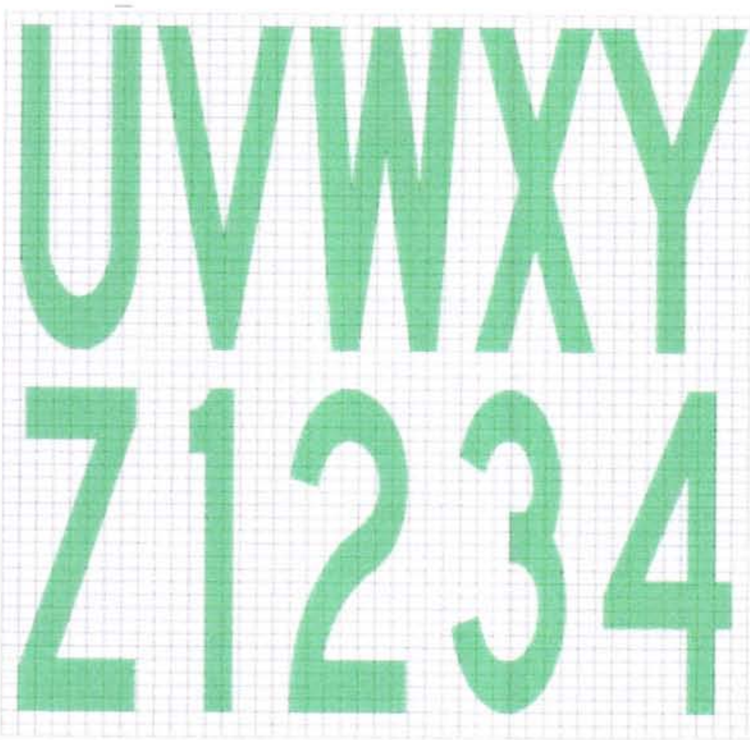


**Figure 8.5-21: Letters and numbers used in designations for taxiway and apron markings**

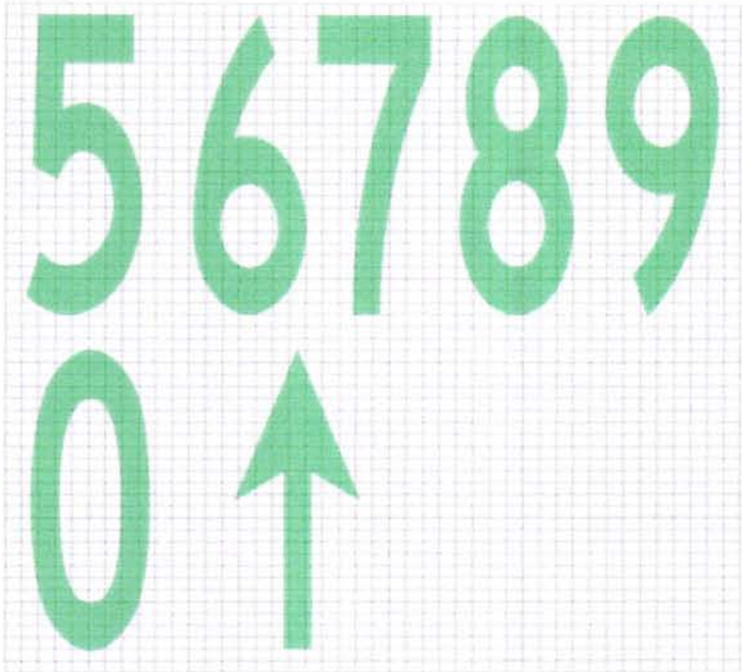


**Figure 8.5-22: Letters and numbers used in designations for taxiway and apron markings**

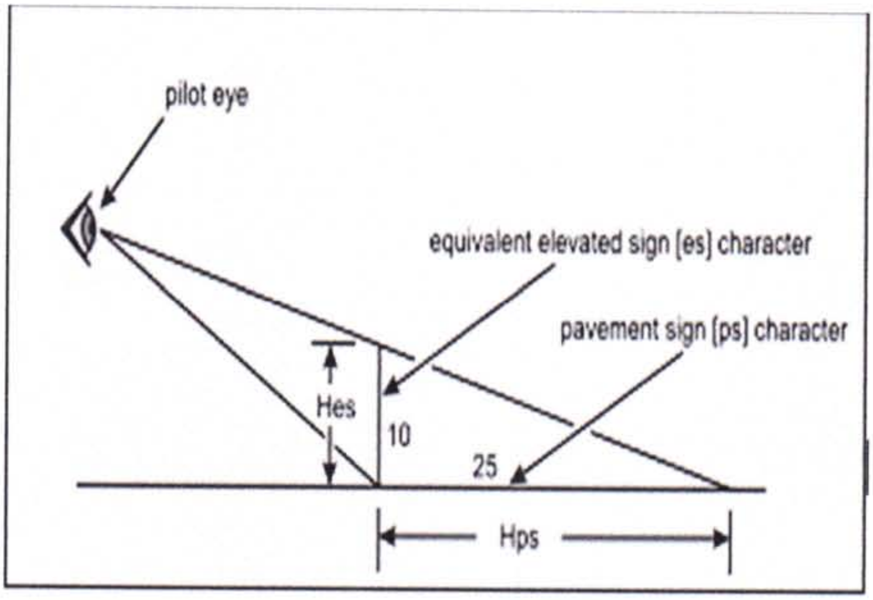
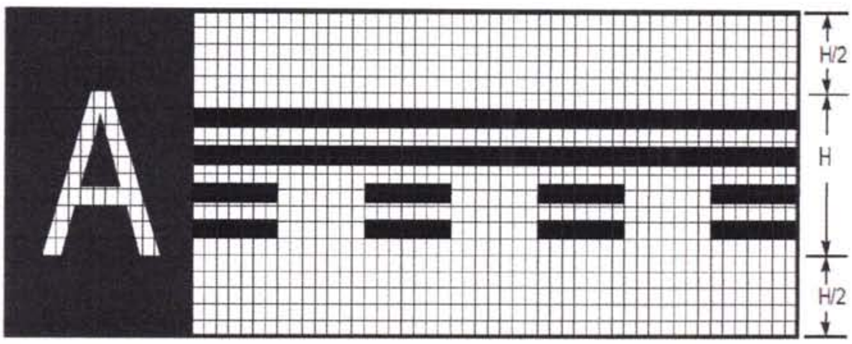
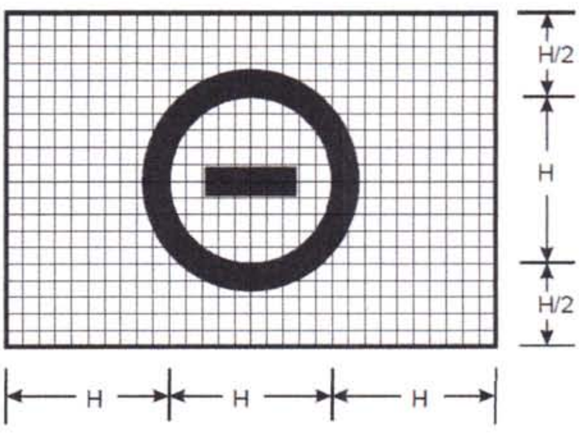



**Figure 8.5-23: Renamed as Mandatory Instruction and Information Markings on Pavements**




**Runway vacated sign (with typical location sign)**




**NO ENTRY sign**

## Figure 8.6-6: Runway vacated and NO ENTRY signs

a) Letter to letter code number

| Preceding Letter | Following Letter | | |
|---|---|---|---|
| | B, D, E, F, H, I, K, L, M, N, P, R, U | C, G, O, Q, S, X, Z | A, J, T, V, W, Y |
| | Code number | | |
| A | 2 | 2 | 4 |
| B | 1 | 2 | 2 |
| C | 2 | 2 | 3 |
| D | 1 | 2 | 2 |
| E | 2 | 2 | 3 |
| F | 2 | 2 | 3 |
| G | 1 | 2 | 2 |
| H | 1 | 1 | 2 |
| I | 1 | 1 | 2 |
| J | 1 | 1 | 2 |
| K | 2 | 2 | 3 |
| L | 2 | 2 | 4 |
| M | 1 | 1 | 2 |
| N | 1 | 1 | 2 |
| O | 1 | 2 | 2 |
| P | 1 | 2 | 2 |
| Q | 1 | 2 | 2 |
| R | 1 | 2 | 2 |
| S | 1 | 2 | 2 |
| T | 2 | 2 | 4 |
| U | 1 | 1 | 2 |
| V | 2 | 2 | 4 |
| W | 2 | 2 | 4 |
| X | 2 | 2 | 3 |
| Y | 2 | 2 | 4 |
| Z | 2 | 2 | 3 |

d) Width of letter

| Letter | Letter height (mm) | | |
|---|---|---|---|
| | 200 | 300 | 400 |
| | Width (mm) | | |
| A | 170 | 255 | 340 |
| B | 137 | 205 | 274 |
| C | 137 | 205 | 274 |
| D | 137 | 205 | 274 |
| E | 124 | 186 | 248 |
| F | 124 | 186 | 248 |
| G | 137 | 205 | 274 |
| H | 137 | 205 | 274 |
| I | 32 | 48 | 64 |
| J | 127 | 190 | 254 |
| K | 140 | 210 | 280 |
| L | 124 | 186 | 248 |
| M | 157 | 236 | 314 |
| N | 137 | 205 | 274 |
| O | 143 | 214 | 286 |
| P | 137 | 205 | 274 |
| Q | 143 | 214 | 286 |
| R | 137 | 205 | 274 |
| S | 137 | 205 | 274 |
| T | 124 | 186 | 248 |
| U | 137 | 205 | 274 |
| V | 152 | 229 | 304 |
| W | 178 | 267 | 356 |
| X | 137 | 205 | 274 |
| Y | 171 | 257 | 342 |
| Z | 137 | 205 | 274 |

b) Numeral to numeral code number

| Preceding Numeral | Following number | | |
|---|---|---|---|
| | 1, 5 | 2, 3, 6, 8, 9, 0 | 4, 7 |
| | Code number | | |
| 1 | 1 | 1 | 2 |
| 2 | 1 | 2 | 2 |
| 3 | 1 | 2 | 2 |
| 4 | 2 | 2 | 4 |
| 5 | 1 | 2 | 2 |
| 6 | 1 | 2 | 2 |
| 7 | 2 | 2 | 4 |
| 8 | 1 | 2 | 2 |
| 9 | 1 | 2 | 2 |
| 0 | 1 | 2 | 2 |

e) Width of numeral

| Numeral | Numeral height (mm) | | |
|---|---|---|---|
| | 200 | 300 | 400 |
| | Width (mm) | | |
| 1 | 50 | 74 | 98 |
| 2 | 137 | 205 | 274 |
| 3 | 137 | 205 | 274 |
| 4 | 149 | 224 | 298 |
| 5 | 137 | 205 | 274 |
| 6 | 137 | 205 | 274 |
| 7 | 137 | 205 | 274 |
| 8 | 137 | 205 | 274 |
| 9 | 137 | 205 | 274 |
| 0 | 143 | 214 | 286 |

c) Space between characters

| Code No. | Character height (mm) | | |
|---|---|---|---|
| | 200 | 300 | 400 |
| | Space (mm) | | |
| 1 | 48 | 71 | 96 |
| 2 | 38 | 57 | 76 |
| 3 | 25 | 38 | 50 |
| 4 | 13 | 19 | 26 |

INSTRUCTIONS

1. To determine the proper SPACE between letters or numerals, obtain the code number from table a) or b) and enter table c) for that code number to the desired letter or numeral height.
2. The space between words or groups of characters forming an abbreviation or symbol should be equal to 0.5 to 0.75 of the height of the characters used except that where an arrow is located with a single character such as 'A →', the space may be reduced to not less than one quarter of the height of the character in order to provide a good visual balance.
3. Where the numeral follows a letter or vice versa use, Code 1.
4. Where a hyphen, dot, or diagonal stroke follows a character or vice versa use Code 1.
5. For the intersection take-off sign, the height of the lower case "m" is 0.75 of the height of the preceding "0" (zero) and spaced from the preceding "0" at code 1 for the character height of the numerals.

. . .

## Appendix 7: Aeronautical Data Quality Requirements

| Latitude and longitude | Accuracy<br>Data type | Integrity<br>Classification |
|---|---|---|
| Heliport reference point | 30 m<br>surveyed/calculated | routine |
| Navaids located at the heliport | 3 m<br>surveyed | essential |
| Obstacles in Area 3 | 0.5 m<br>surveyed | essential |
| Obstacles in Area 2 (the part within the heliport boundary) | 5 m<br>surveyed | essential |
| Geometric centre of TLOF or FATO thresholds | 1 m<br>surveyed | critical |
| Helicopter ground taxiway centre line points and helicopter air taxiway points | 0.5 m<br>surveyed/calculated | essential |
| Helicopter ground taxiway intersection marking line | 0.5 m<br>surveyed | essential |
| Ground exit guidance line | 0.5 m<br>surveyed | essential |
| Apron boundaries (polygon) | 1 m<br>surveyed | routine |
| De-icing/anti-icing facility (polygon) | 1 m<br>surveyed | routine |
| Helicopter standpoints/INS checkpoints | 0.5 m<br>surveyed | routine |

**Table A5.1-1 - Latitude and longitude**

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## ATTACHMENT A: SUPPLEMENTARY GUIDANCE MATERIAL TO MOS

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### 4. Runway surface evenness

4.1. In adopting tolerances for runway surface irregularities, the following standard of construction is achievable for short distances of 3 m and conforms to good engineering practice:

Except across the crown of a camber or across drainage channels, the finished surface of the wearing course is to be of such regularity that, when tested with a 3 m straight-edge placed anywhere in any direction on the surface, there is no deviation greater than 3 mm between the bottom of the straight-edge and the surface of the pavement anywhere along the straight-edge.

4.2. Caution shall also be exercised when inserting runway lights or drainage grilles in runway surfaces to ensure that adequate smoothness of the surface is maintained.

4.3. The operation of aircraft and differential settlement of surface foundations will eventually lead to increases in surface irregularities. Small deviations in the above tolerances will not seriously hamper aircraft operations. In general, isolated irregularities of the order of 2.5 cm to 3 cm over a 45 m distance are acceptable, as shown in MOS Figure A-2. Although maximum acceptable deviations vary with the type and speed of an aircraft, the limits of acceptable surface irregularities can be estimated to a reasonable extent. The following table describes acceptable, tolerable and excessive limits:

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a) if the surface irregularities exceed the heights defined by the acceptable limit curve but are less than the heights defined by the tolerable limit curve, at the specified minimum acceptable length, herein noted by the tolerable region, then maintenance action shall be planned. The runway must remain in service. This region is the start of possible passenger and pilot discomfort;

b) if the surface irregularities exceed the heights defined by the tolerable limit curve, but are less than the heights defined by the excessive limit curve, at the specified minimum acceptable length, herein noted by the excessive region, then maintenance corrective action is mandatory to restore the condition to the acceptable region. The runway must remain in service but be repaired within a reasonable period. This region can lead to the risk of possible aircraft structural damage due to a single event or fatigue failure over time; and

c) if the surface irregularities exceed the heights defined by the excessive limit curve, at the specified minimum acceptable length, herein noted by the unacceptable region, then the area of the runway where the roughness has been identified warrants closure. Repairs must be made to restore the condition to within the acceptable limit region and the aircraft operators must be advised accordingly. This region runs the extreme risk of a structural failure and must be addressed immediately.

| Surface Irregularity | Length of irregularity (m) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 6 | 9 | 12 | 15 | 20 | 30 | 45 | 60 |
| Acceptable surface irregularity height (cm) | 2.9 | 3.8 | 4.5 | 5 | 5.4 | 5.9 | 6.5 | 8.5 | 10 |
| Tolerable surface (cm) | 3.9 | 5.5 | 6.8 | 7.8 | 8.6 | 9.6 | 11 | 13.6 | 16 |
| Excessive surface irregularity height (cm) | 5.8 | 7.6 | 9.1 | 10 | 10.8 | 11.9 | 13.9 | 17 | 20 |

Note that "surface irregularity" is defined herein to mean isolated surface elevation deviations that do not lie along a uniform slope through any given section of a runway. For the purposes of this concern, a "section of a runway" is defined herein to mean a segment of a runway throughout which a continuing general uphill, downhill or flat slope is prevalent. The length of this section is generally between 30 and 60 meters, and can be greater, depending on the longitudinal profile and the condition of the pavement.

The maximum tolerable step type bump, such as that which could exist between adjacent slabs, is simply the bump height corresponding to zero bump length at the upper end of the tolerable region of the roughness criteria of Table 10.15-3. The bump height at this location is 1.75 cm.

4.4. MOS Figure A-2 illustrates a comparison of the surface roughness criteria with those developed by the United States Federal Aviation Administration. Further guidance regarding temporary slopes for overlay works on operational runways can be found in Aerodrome Design Manual, Part 3 — Pavements (Doc 9157).

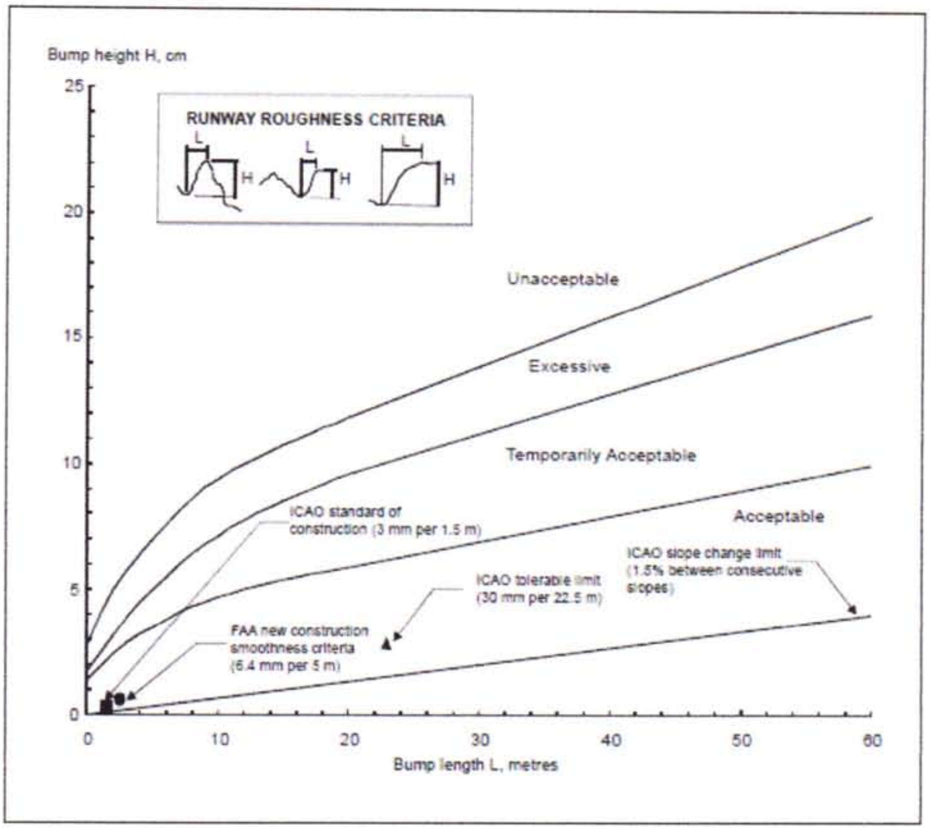


**Figure A-2. Comparison of roughness criteria**

*Note: - Note.— These criteria address single event roughness, not long wavelength harmonic effects nor the effect of repetitive surface undulations.*

4.5 Deformation of the runway with time may also increase the possibility of the formation of water pools. Pools as shallow as approximately 3 mm in depth, particularly if they are located where they are likely to be encountered at high speed by landing aeroplanes, can induce aquaplaning, which can then be sustained on a wet runway by a much shallower depth of water. Improved guidance regarding the significant length and depth of pools relative to aquaplaning is the subject of further research.

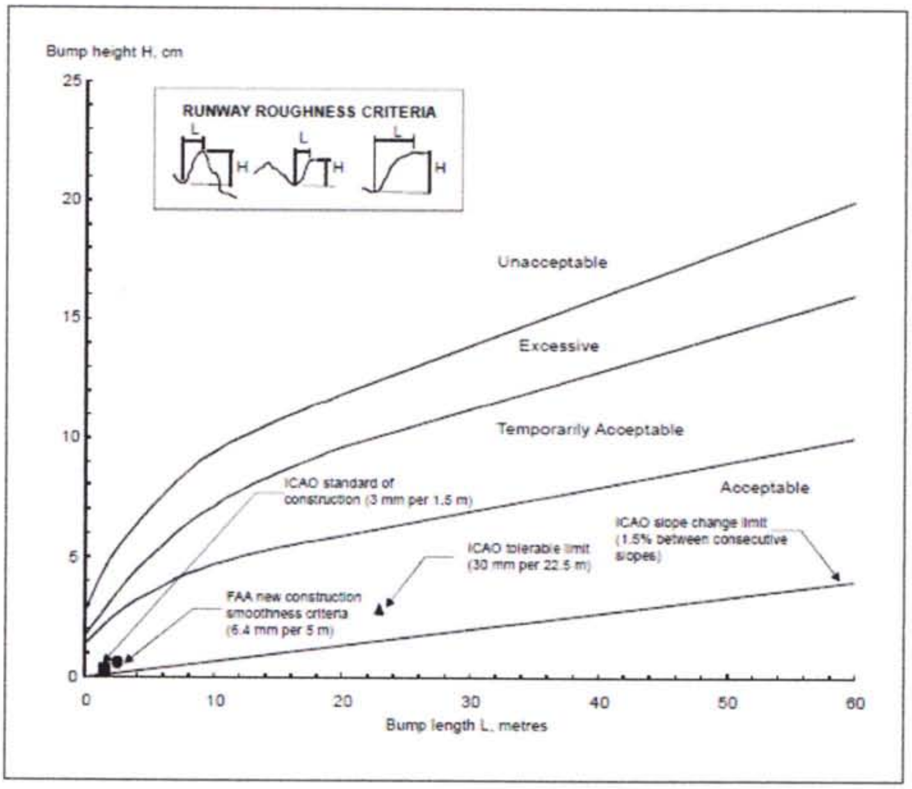


**Figure A-2. Comparison of roughness criteria**

*Note.— These criteria address single event roughness, not long wavelength harmonic effects nor the effect of repetitive surface undulations.*

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## 8. Autonomous runway incursion warning system (ARIWS)

These autonomous systems are generally quite complex in design and operation and, as such deserve careful consideration by all levels of the industry, from the regulating authority to the end user. This guidance is offered to provide a more clear description of the system(s) and offer some suggested actions required in order to properly implement these system(s) at an aerodrome in any province in the Philippines.

The Manual on the Prevention of Runway Incursion (Doc 9870) presents different approaches for the prevention of runway incursion.

### 8.1. General description

8.1.1. The operation of an ARIWS is based upon a surveillance system which monitors the actual situation on a runway and automatically returns this information to warning lights at the runway (take-off) thresholds and entrances. When an aircraft is departing from a runway (rolling) or arriving at a runway (short final), red warning lights at the entrances will illuminate, indicating that it is unsafe to enter or cross the runway. When an aircraft is aligned on the runway for take-off and another aircraft or vehicle enters or crosses the runway, red warning lights will illuminate at the threshold area, indicating that it is unsafe to start the take-off roll.

8.1.2. In general, an ARIWS consists of an independent surveillance system (primary radar, multi-lateration, specialized cameras, dedicated radar, etc.) and a warning system in the form of extra airfield lighting systems connected through a processor which generates alerts independent from ATC directly to the flight crews and vehicle operators.

8.1.3. An ARIWS does not require circuit interleaving, secondary power supply or operational connection to other visual aid systems.

8.1.4. In practice, not every entrance or threshold needs to be equipped with warning lights. Each aerodrome will have to assess its needs individually depending on the characteristics of the aerodrome. There are several systems developed offering the same or similar functionality.

## 8.2. Flight crew actions

8.2.1. It is of critical importance that flight crews understand the warning being transmitted by the ARIWS system. Warnings are provided in near real-time, directly to the flight crew because there is no time for "relay" types of communications. In other words, a conflict warning generated to ATS which must then interpret the warning, evaluate the situation and communicate to the aircraft in question, will result in several seconds being taken up where each second is critical in the ability to stop the aircraft safely, and prevent a potential collision. Pilots are presented with a globally consistent signal which means "STOP IMMEDIATELY" and must be taught to react accordingly. Likewise, pilots receiving an ATS clearance to take-off or cross a runway, and seeing the red light array, must STOP and advise ATS that they aborted/stopped because of the red lights. Again, the criticality of the timeline involved is so tight that there is no room for misinterpretation of the signal. It is of utmost importance that the visual signal be consistent around the world.

8.2.2. It must also be stressed that the extinguishing of the red lights does not, in itself, indicate a clearance to proceed. That clearance is still required from air traffic control. The absence of red warning lights only means that potential conflicts have not been detected.

8.2.3. In the event that a system becomes unserviceable, one of two things will occur. If the system fails in the extinguished condition, then no procedural changes need to be accomplished. The only thing that will happen is the loss of the automatic, independent warning system. Both ATS operations and flight crew procedures (in response to ATS clearances) will remain unchanged.

8.2.4. Procedures shall be developed to address the circumstance where the system fails in the illuminated condition. It will be up to the ATS and/or aerodrome operator to establish those procedures depending on their own circumstances. It must be remembered that flight crews are instructed to "STOP" at all red lights. If the affected portion of the system, or the entire system is shut off, the situation is reverted to the extinguished scenario described in 8.2.3 above.

## 8.3. Aerodromes

8.3.1. An ARIWS does not have to be provided at all aerodromes. An aerodrome considering the installation of such a system may wish to assess its needs individually, depending on traffic levels, aerodrome geometry, ground taxi patterns, etc. Local user groups such as the Local Runway Safety Team (LRST) can be of assistance in this process. Also, not every runway or taxiway needs to be equipped with the lighting array(s), and not every installation requires a comprehensive ground surveillance system to feed information to the conflict detection computer.

8.3.2. Although there might be local specific requirements, some basic system requirements are applicable to all ARIWS:

(a) the control system and energy power supply of the system must be independent from any other system in use at the aerodrome, especially the other parts of the lighting system;

(b) the system must operate independently from ATS communications;

(c) the system must provide a globally accepted visual signal that is consistent and instantly understood by crews; and

(d) local procedures shall be developed in the case of malfunction or failure of a portion of, or the entire system

### 8.4. Air traffic services

8.4.1. The ARIWS is designed to be complementary to normal ATS functions, providing warnings to flight crews and vehicle operators when some conflict has been unintentionally created or missed during normal aerodrome operations. The ARIWS will provide a direct warning when, for example, ground control or tower (local) control has provided a clearance to hold short of a runway but the flight crew or vehicle operator has "missed" the hold short portion of their clearance and tower has issued a take-off or landing clearance to that same runway, and the non-read back by the flight crew or vehicle operator was missed by air traffic control.

8.4.2. In the case where a clearance has been issued and a crew reports a non-compliance due to "red lights", or aborting because of "red lights", then it is imperative that the controller assess the situation and provide additional instructions as necessary. It may well be that the system has generated a false warning or that the potential incursion no longer exists; however, it may also be a valid warning. In any case, additional instructions and/or a new clearance need to be provided. In a case where the system has failed, then procedures will need to be put into place as described in 8.2.3 and 8.2.4 above. In no case shall illumination of the ARIWS be dismissed without confirmation that, in fact, there is no conflict. It is worth noting that there have been numerous incidents avoided at aerodromes with such systems installed. It is also worth noting that there have been false warnings as well, usually as a result of the calibration of the warning software, but in any case, a confirmation of the potential conflict existence or non-existence must be done.

8.4.3. While many installations may have a visual or audio warning available to ATS personnel, it is in no way intended that ATS personnel be required to actively monitor the system. Such warnings may assist ATS personnel in quickly assessing the conflict in the event of a warning and help them to provide appropriate further instructions, but the ARIWS should not play an active part in the normal functioning of any ATS facility.

8.4.4. Each aerodrome where the system is installed will develop procedures depending upon their unique situation. Again, it must be stressed that under no circumstances should pilots or operators be instructed to "cross the red lights". As indicated previously, the use of local runway safety teams can greatly assist in this development process.

## 8.5. Promulgation of information

8.5.1. Information on the characteristics and status of an ARIWS at an aerodrome are promulgated in the Philippine AIP, Section AD 2.9 and its status updated as necessary through NOTAM or ATIS in compliance with MOS 5.1.5.1.

8.5.2. Aircraft operators are to ensure that flight crews documentation include procedures regarding ARIWS and appropriate guidance information, in compliance with Annex 6, Part I.

8.5.3. Aerodromes must provide additional sources of guidance on operations and procedures for their personnel, aircraft operators, ATS and third parties personnel who will deal with an ARIWS.

9.1. Good aerodrome design practices can reduce the potential for runway incursions while maintaining operating efficiency and capacity. The following taxiway design guidance must be considered to be part of a runway incursion prevention programme as a means to ensure that runway incursion aspects are addressed during the design phase for new runways and taxiways. Within this focused guidance, the prime considerations are to limit the number of aircraft or vehicles entering or crossing a runway, provide pilots with enhanced unobstructed views of the entire runway, and correct taxiways identified as hot spots as far as possible.

9.2. The centerline of an entrance taxiway shall be perpendicular to the runway centerline, where possible. This design principle provides pilots with an unobstructed view of the entire runway, in both directions, to confirm that the runway and approach are clear of conflicting traffic before proceeding towards the runway. Where the taxiway angle is such that a clear unobstructed view, in both directions, is not possible, consideration shall be given to providing a perpendicular portion of the taxiway immediately adjacent to the runway to allow for a full visual scan by the pilots prior to entering or crossing a runway.

9.3. For taxiways intersecting with runways, avoid designing taxiways wider than recommended in the MOS. This design principle offers improved recognition of the location of the runway holding position and the accompanying sign, marking, and lighting visual cues.

9.4. Existing taxiways wider than recommended in the MOS, can be rectified by painting taxi side stripe markings to the recommended width. As far as practicable, it is preferable to redesign such locations properly rather than to repaint such locations.

9.5. Multi-taxiway entrances to a runway shall be parallel to each other and shall be distinctly separated by an unpaved area. This design principle allows each runway holding location an earthen area for the proper placement of accompanying sign, marking, and lighting visual cues at each runway holding position. Moreover, the design principle eliminates the needless costs of building unusable pavement and as well as the costs for painting taxiway edge markings to indicate such unusable pavement. In general, excess paved areas at runway holding positions reduce the effectiveness of sign, marking, and lighting visual cues.

9.6. Build taxiways that cross a runway as a single straight taxiway. Avoid dividing the taxiway into two after crossing the runway. This design principle avoids constructing "Y-shaped" taxiways known to present risk of runway incursions.

9.7. If possible, avoid building taxiways that enter at the mid-runway location. This design principle helps to reduce the collision risks at the most hazardous locations (high energy location) because normally departing aircraft have too much energy to stop, but not enough speed to take-off, before colliding with another errant aircraft or vehicle.

9.8. Provide clear separation of pavement between a rapid exit taxiway and other non-rapid taxiways entering or crossing a runway. This design principle avoids two taxiways from overlapping each other to create an excessive paved area that will confuse pilots entering a runway.

9.9. Avoid the placement of different pavement materials (asphalt and cement concrete) at or near the vicinity of the runway holding position, as far as practicable. This design principle avoids creating visual confusion as to the actual location of the runway holding position.

9.10. Perimeter taxiways. Many aerodromes have more than one runway, notably paired parallel runways (two runways on one side of the terminal), which creates a difficult problem in that either on arrival or departure an aircraft is required to cross a runway. Under such a configuration, the safety objective here is to avoid or at least keep to a minimum the number of runway crossings. This safety objective may be achieved by constructing a "perimeter taxiway". A perimeter taxiway is a taxi route that goes around the end of a runway, enabling arrival aircraft (when landings are on outer runway of a pair) to get to the terminal or departure aircraft (when departures are on outer runway of a pair) to get to the runway without either crossing a runway, or conflicting with a departing or approaching aircraft.

9.11. A perimeter taxiway will be designed according to the following criteria:

9.11.1. Sufficient space is required between the landing threshold and the taxiway centerline where it crosses under the approach path, to enable the critical taxiing aircraft to pass under the approach without penetrating any approach surface.

9.11.2. The jet blast impact of aircraft taking off shall be considered in consultation with aircraft manufacturers; the extent of take-off thrust shall be evaluated when determining the location of a perimeter taxiway.

9.11.3. The requirement for a runway end safety area, as well as possible interference with landing systems and other navigation aids shall also be taken into account. For example, in the case of an Instrument Landing System, the perimeter taxiway shall be located behind the localizer antenna, not between the localizer antenna and the runway, due to the potential for severe Instrument Landing System disturbance, noting that this is harder to achieve as the distance between the localizer and the runway increases.

9.11.4. Human factors issues shall also be taken into account. Appropriate measures shall be put in place to assist pilots to distinguish between aircraft that are crossing the runway and those that are safely on a perimeter taxiway.

## 10. Aerodrome mapping data

10.1. Introduction

MOS 5.1.2.2 and 5.1.2.3, contain provisions related to the provision of aerodrome mapping data. The aerodrome mapping data features are collected and made available to the aeronautical information services for aerodromes designated by CAAP with consideration of the intended applications. These applications are closely tied to an identified need and operational use where the application of the data will provide a safety benefit or can be used as mitigation to a safety concern.

## 10.2. Applications

10.2.1. Aerodrome mapping data include aerodrome geographic information that support applications which improve the user's situational awareness or supplement surface navigation, thereby increasing safety margins and operational efficiency. With appropriate data element accuracy, these data sets support collaborative decision making, common situational awareness, and aerodrome guidance applications. The data sets are intended to be used in the following air navigation applications:

a) on-board positioning and route awareness including moving maps with own aircraft position, surface guidance and navigation;
b) traffic awareness including surveillance and runway incursion detection and alerting (such as respectively in A-SMGCS levels 1 and 2);
c) ground positioning and route awareness including situational displays with aircraft and vehicles position and taxi route, surface guidance and navigation (such as A-SMGCS levels 3 and 4);
d) facilitation of aerodrome-related aeronautical information, including NOTAMs;
e) resource and aerodrome facility management; and
f) aeronautical chart production.

10.2.2. The data may also be used in other applications such as training / flight simulators and on-board or ground enhanced vision systems (EVS), synthetic vision systems (SVS) and combined vision systems (CVS).

## 10.3. Determination of aerodromes to be considered for collection of aerodrome mapping data features.

10.3.1. In order to determine which aerodromes must make use of applications requiring the collection of aerodrome mapping data features, the following aerodrome characteristics must be considered:

- safety risks at the aerodrome ;
- visibility conditions ;
- aerodrome layout ; and
- traffic density.

*Note: - Further guidance on aerodrome mapping data can be found in Doc 9137, Airport Services Manual, Part 8 — Airport Operational Service.*

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**AMENDMENT 13B**

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## Section 1.4 Definition of Terms

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

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

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

*Note: - The purpose of the runway condition code is to permit an operational aeroplane performance calculation by the flight crew. Procedures for the determination of the runway condition code are described in the PANS-Aerodromes (Doc 9981).*

**Runway condition report (RCR).** A comprehensive standardized report relating to runway surface conditions and its effect on the aeroplane landing and take-off performance.

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

*Note: - 1. The runway surface conditions used in the runway condition report establish the performance requirements between the aerodrome operator, aeroplane manufacturer and aeroplane operator.*

*Note: - 2. Aircraft de-icing chemicals and other contaminants are also reported but are not included in the list of runway surface condition descriptors because their effect on runway surface friction characteristics and the runway condition code cannot be evaluated in a standardized manner.*

*Note: - 3. Procedures on determining runway surface conditions are available in the PANS-Aerodromes (Doc 9981).*

*a) Dry runway. A runway is considered dry if its surface is free of visible moisture and not contaminated within the area intended to be used.*

*b) Wet runway. The runway surface is covered by any visible dampness or water up to and including 3 mm deep within the intended area of use.*

*c) Slippery wet runway. A wet runway where the surface friction characteristics of a significant portion of the runway has been determined to be degraded.*

*d) Contaminated runway. A runway is contaminated when a significant portion of the runway surface area (whether in isolated areas or not) within the length and width being used is covered by one or more of the substances listed in the runway surface condition descriptors.*

*Note: - Procedures on determination of contaminant coverage on runway is available in the PANS-Aerodromes (Doc 9981).*

*e) Element on the surface of the runway:*

*Note: - The description for standing water below, is used solely in the context of the runway condition report and are not intended to supersede or replace any existing WMO definitions.*

*f) Standing water. Water of depth greater than 3 mm.*

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

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**Runway visual range (RVR).** The range over which the pilot of an aircraft on the centerline of the runway can see the runway surface markings or the lights delineating the runway or identifying its centerline.

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

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

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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. PCARs 8.7, Attachment B 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 fulfil the requirements to achieve the desired level of safety for aeroplane operations prescribed by PCAR Part 8 and PCAR Part 5 and to provide the information fulfilling the syntax requirements for dissemination specified in MOS Attachment A, Section 3.6, MOS-ATS 11.2.2.2.1 and Annex 15.*

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.*

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### 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.*

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

*Note: - See MOS Attachment A Section 20.*

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

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

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

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### 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.*

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**Section 10.15 Aerodrome Maintenance**

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**10.15.2 Pavements**

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10.15.2.2 The surface of a runway shall be maintained in a condition such as to prevent formation of harmful irregularities.

*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 CAAP.

*Note 1: - 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 2: - 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 purposes shall be periodically measured with a continuous friction measuring device using self-wetting features and documented. The frequency of these measurements shall be sufficient to determine the trend of the surface friction characteristics of the runway.

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

*Note: - 2. The objective of MOS 10.15.2.3 to 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.*

10.15.2.5 When runway surface friction measurements are made for maintenance purposes using a self-wetting continuous friction measuring device, the performance of the device shall meet the standard set or agreed by CAAP.

10.15.2.6 Personnel measuring runway surface friction required in 10.15.2.5 shall be trained to fulfil their duties.

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-engined aeroplanes, the surface of the taxiway shoulders shall be maintained so as to be free of any loose stones or other objects that could be ingested by the aeroplane engines.

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

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### 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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10.15.3.2 Chemicals which may have harmful effects on aircraft or pavements, or chemicals which may have toxic effects on the aerodrome environment, shall not be used.

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## ATTACHMENT A: SUPPLEMENTARY GUIDANCE MATERIAL TO MOS

### MOS ATT A Section 3:

### 3. Runway condition report for reporting runway surface condition

3.1 On a global level, movement areas are exposed to a multitude of climatic conditions and consequently a significant difference in the condition to be reported. The runway condition report (RCR) describes a basic methodology applicable for all these climatic variations and is structured in such a way that States can adjust them to the climatic conditions applicable for that State or region.

3.2 The concept of the RCR is premised on:

a) an agreed set of criteria used in a consistent manner for runway surface condition assessment, aeroplane (performance) certification and operational performance calculation;

b) a unique runway condition code (RWYCC) linking the agreed set of criteria with the aircraft landing and take-off performance table, and related to the braking action experienced and eventually reported by flight crews;

c) reporting of contaminant type and depth that is relevant to take-off performance;

d) a standardized common terminology and phraseology for the description of runway surface conditions that can be used by aerodrome operator inspection personnel, air traffic controllers, aircraft operators and flight crew; and

e) globally-harmonized procedures for the establishment of the RWYCC with a built-in flexibility to allow for local variations to match the specific weather, infrastructure and other particular conditions.

3.3 These harmonized procedures are reflected in a runway condition assessment matrix (RCAM) which correlates the RWYCC, the agreed set of criteria and the aircraft braking action which the flight crew should expect for each value of the RWYCC.

3.4 Procedures which relate to the use of the RCAM are provided in the PANS-Aerodromes (Doc 9981).

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

3.6 This is further amplified by the need for providing the assessed information in the proper format for dissemination, which requires insight into the limitations set by the syntax for dissemination. This in turn restricts the wording of plain text remarks that can be provided.

3.7 It is important to follow standard procedures when providing assessed information on the runway surface conditions to ensure that safety is not compromised when aeroplanes use wet or contaminated runways. Personnel should be trained in the relevant fields of competence and their competence verified in a manner required by the State to ensure confidence in their assessments.

3.8 The training syllabus may include initial and periodic recurrent training in the following areas:

a) aerodrome familiarization, including aerodrome markings, signs and lighting;

b) aerodrome procedures as described in the aerodrome manual;

c) aerodrome emergency plan;

d) Notice to Airmen (NOTAM) initiation procedures;

e) completion of/ initiation procedures for RCR;

f) aerodrome driving rules;

g) air traffic control procedures on the movement area;

h) radiotelephone operating procedures;

i) phraseology used in aerodrome control, including the ICAO spelling alphabet;

j) aerodrome inspection procedures and techniques;

k) type of runway contaminants and reporting;

l) assessment and reporting of runway surface friction characteristics;

m) use of runway friction measurement device;

n) calibration and maintenance of runway friction measurement device;

o) awareness of uncertainties related to l) and m); and

p) low visibility procedures.

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**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**