Ethiopian Civil Aviation Authority
Aerodrome Safety and Standards Directorate

Visual Aids for Navigation

14

PREAMBLE

WHEREAS, it is desirable to consolidate and modernize the aviation Advisory Circular to bring them to international standards,

WHEREAS, it is important to set the Advisory Circular as to how the regulatory, administrative, technical and supervisory activities of the Authority shall be performed in the one hand and setting the duties, obligations and standards that shall be respected by operators and aviation personnel,

WHEREAS, it is necessary, to provide detailed Advisory Circular for the administration of license, certification, investigation and enforcement of aviation laws.

NOW THEREBY, The Authority under its power given by Article 92/2 of the Civil Aviation Proclamation No. 616/2008 issued the following Advisory Circular.

1. SHORT TITLE

This Advisory Circular may be cited as "Advisory Circular for Visual Aids for Navigation No. ECAA-AC-AGA006/2014"

2. REPEAL AND INAPPLICABLE LAWS

No law, directive, order or practice shall, in so far as it is inconsistent with this Advisory Circular, be applicable with respect to matters provided for by this Advisory Circular.

3. EFFECTIVE DATE

This Advisory Circular shall come into force as of November/ 2014.

Done at Addis Ababa, November, 2014

Woeenyeleh Hunegnaw (CoL)
Director General

Regulatory Statement

Visual Aids for Navigation Guidance issued pursuant to Civil Aviation proclamation number 616/2008 by the Director General of the Authority and contain instruction instructions, requirements and information pertaining Aerodrome.

This material provides guidance to aerodrome operators on the design and installation of visual Aids for Navigation at the aerodrome. Before the installation and/or application of visual Aids at the aerodrome the Authority requires the aerodrome operator to submit the design for the reviewing of its frangibility, dimension, colour, the place where they are going to apply and related standards.

These guidance shall be applied by all aerodromes operate in Ethiopia starting from the date of publication. Amendment of this guidance shall be made when necessary and will be provided to all concerned.

It is the responsibility of the operator to ensure this guidance is complied with, kept up to date and made available to all personnel responsible for operations.

Any inquiry related to ECAA Visual Aids Navigation Guidance should be addressed to:

Director, Aerodrome Safety and Standards
P.O.Box 978
Addis Ababa
Ethiopia

Chapter 01
Indicators and signaling devices

1.1 Wind direction indicator

An aerodrome can be equipped with at least one wind direction indicator. A wind direction indicator can be located so as to be visible from aircraft in flight or on the movement area and in such a way as to be free from the effects of air disturbances caused by nearby objects.

The wind direction indicator should be in the form of a truncated cone made of fabric and should have a length of not less than 3.6 m and a diameter, at the larger end, of not less than 0.9 m. It should be constructed so that it gives a clear indication of the direction of the surface wind and a general indication of the wind speed. The colour or colours should be so selected as to make the wind direction indicator clearly visible and understandable from a height of at least 300 m, having regard to background. Where practicable, a single colour, preferably white or orange, should be used.

Fig 1.1 wind direction indicator

Where a combination of two colours is required to give adequate conspicuity against changing backgrounds, they should preferably be orange and white, red and white, or black and white, and should be arranged in five alternate bands, the first and last bands being the darker colour.

The location of at least one wind direction indicator should be marked by a circular band 15 m in diameter and 1.2 m wide. The band should be centered about the wind direction indicator support and should be in a colour chosen to give adequate conspicuity, preferably white.

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

1.2 Landing direction indicator

Where provided, a landing direction indicator shall be located in a conspicuous place on the aerodrome. The landing direction indicator should be in the form of a “T”.

The shape and minimum dimensions of a landing “T” shall be as shown in Figure 1.2. The colour of the landing “T” shall be either white or orange, the choice being dependent on the colour that contrasts best with the background against which the indicator will be viewed. Where required for use at night the landing “T” shall either be illuminated or outlined by white lights.

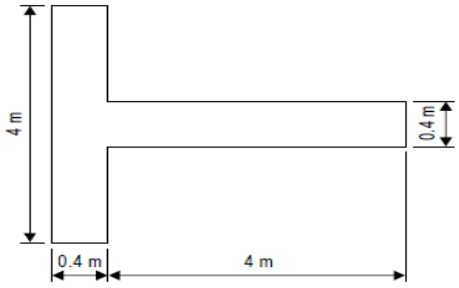


Fig 1.2 Landing direction indicator

1.3 Signaling lamp

A signaling lamp shall be provided at a controlled aerodrome in the aerodrome control tower. A signaling lamp should be capable of producing red, green and white signals, and of:

a) Being aimed manually at any target as required;

b) Giving a signal in any one colour followed by a signal in either of the two other colours; and

c) Transmitting a message in any one of the three colours by Morse code up to a speed of at least four words per minute.

Fig 1.3 signaling lamp

The beam spread should be not less than 1° or greater than 3°, with negligible light beyond 3°. When the signaling lamp is intended for use in the daytime the intensity of the coloured light should be not less than 6000 cd.

1.4 Signal panels and signal area

The inclusion of detailed specifications for a signal area in this section is not intended to imply that one has to be provided.

Fig 1.4 signal area

The signal area should be located so as to be visible for all angles of azimuth above an angle of 10° above the horizontal when viewed from a height of 300 m. The signal area shall be an even horizontal surface at least 9 m square. The colour of the signal area should be chosen to contrast with the colours of the signal panels used, and it should be surrounded by a white border not less than 0.3 m wide.

Chapter2.

Marking

2.0 General

Interruption of runway markings

At an intersection of two (or more) runways the markings of the more important runway, except for the runway side stripe marking, shall be displayed and the markings of the other runway(s) shall be interrupted. The runway side stripe marking of the more important runway may be either continued across the intersection or interrupted.

The order of importance of runways for the display of runway markings should be asfollows:

st — precision approach runway;
2nd — non-precision approach runway; and
3rd — non-instrument runway.

At an intersection of a runway and taxiway the markings of the runway shall be displayed and the markings of the taxiway interrupted, except that runway side stripe markings may be interrupted.

Colour and conspicuity

Runway markings shall be white.

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

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

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

Taxiway markings, runway turn pad markings and aircraft stand markings shall be yellow. Apron safety lines shall be of a conspicuous colour which shall contrast with that used for aircraft stand markings.

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

Note.— Guidance on reflective materials is given in the Aerodrome Design Manual *(Doc 9157), Part 4.*

2.1 Runway designation marking

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

A runway designation marking shall be located at a threshold as shown in Figure 2.1 as appropriate.

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

A runway designation marking shall consist of a two-digit number and on parallel runways shall be supplemented with a letter. On a single runway, dual parallel runways and triple parallel runways the two-digit number shall be the whole number nearest the one-tenth of the magnetic North when viewed from the direction of approach. On four or more parallel runways, one set of adjacent runways shall be numbered to the nearest one-tenth magnetic azimuth and the other set of adjacent runways numbered to the next nearest one-tenth of the magnetic azimuth. When the above rule would give a single digit number, it shall be preceded by a zero.

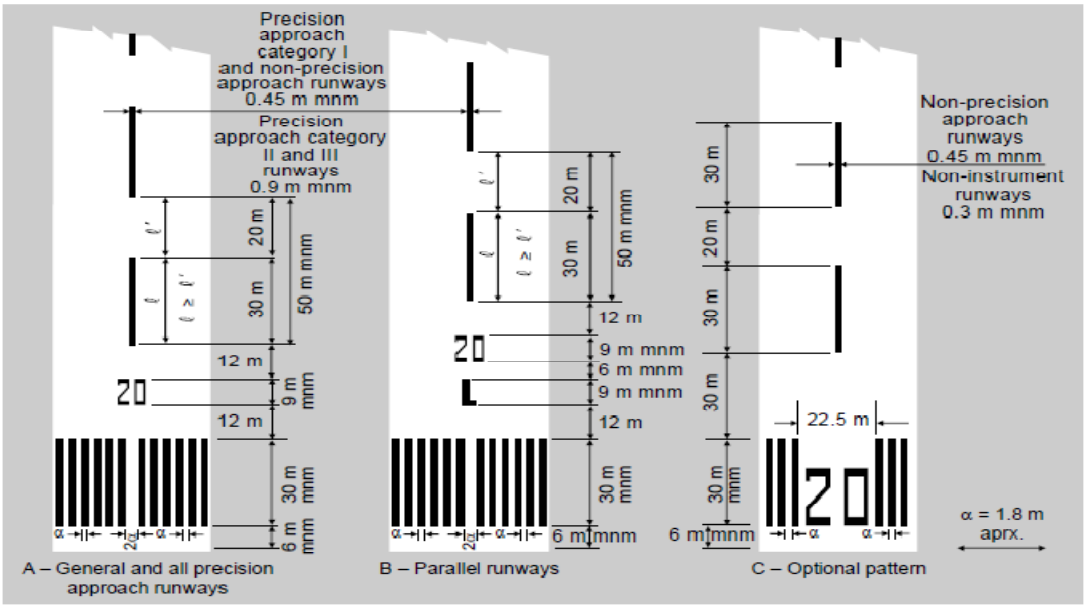


Fig 2.1 Runway designation, centre line and threshold markings

In the case of parallel runways, each runway designation number shall be supplemented by a letter as follows, in the order shown from left to right when viewed from the direction of approach:

— for two parallel runways: “L” “R”;
— for three parallel runways: “L” “C” “R”;
— for four parallel runways: “L” “R” “L” “R”;
— for five parallel runways: “L” “C” “R” “L” “R” or “L” “R” “L” “C” “R”; and
— for six parallel runways: “L” “C” “R” “L” “C” “R”.

The numbers and letters shall be in the form and proportion shown in the dimensions shall be not less than those shown in Fig 2.2, but where the numbers are incorporated in the threshold marking, larger dimensions shall be used in order to fill adequately the gap between the stripes of the threshold marking.

2.2 Runway centre line marking

A runway centre line marking shall be provided on a paved runway. A runway centre line marking shall be located along the centre line of the runway between the runways designation markings as shown in Figure 2.1.

A runway centre line marking shall consist of a line of uniformly spaced stripes and gaps. The length of a stripe plus a gap shall be not less than 50 m or more than 75 m. The length of each stripe shall be at least equal to the length of the gap or 30 m, whichever is greater.
The width of the stripes shall be not less than:
— 0.45 m on non-precision approach runways where the code number is 3 or 4, and precision approach category I runways; and
— 0.30 m on non-precision approach runways where the code number is 1 or 2, and on non-instrument runways.

2.3 Threshold marking

A threshold marking shall be provided at the threshold of a paved instrument runway, and of a paved non instrument runway where the code number is 3 or 4 and the runway is intended for use by international commercial air transport.

A threshold marking should be provided at the threshold of a paved non-instrument runway where the code number is 3 or 4 and the runway is intended for use by other than international commercial air Transport.

A threshold marking should be provided, so far as practicable, at the thresholds of an unpaved runway. The stripes of the threshold marking shall commence 6 m from the threshold

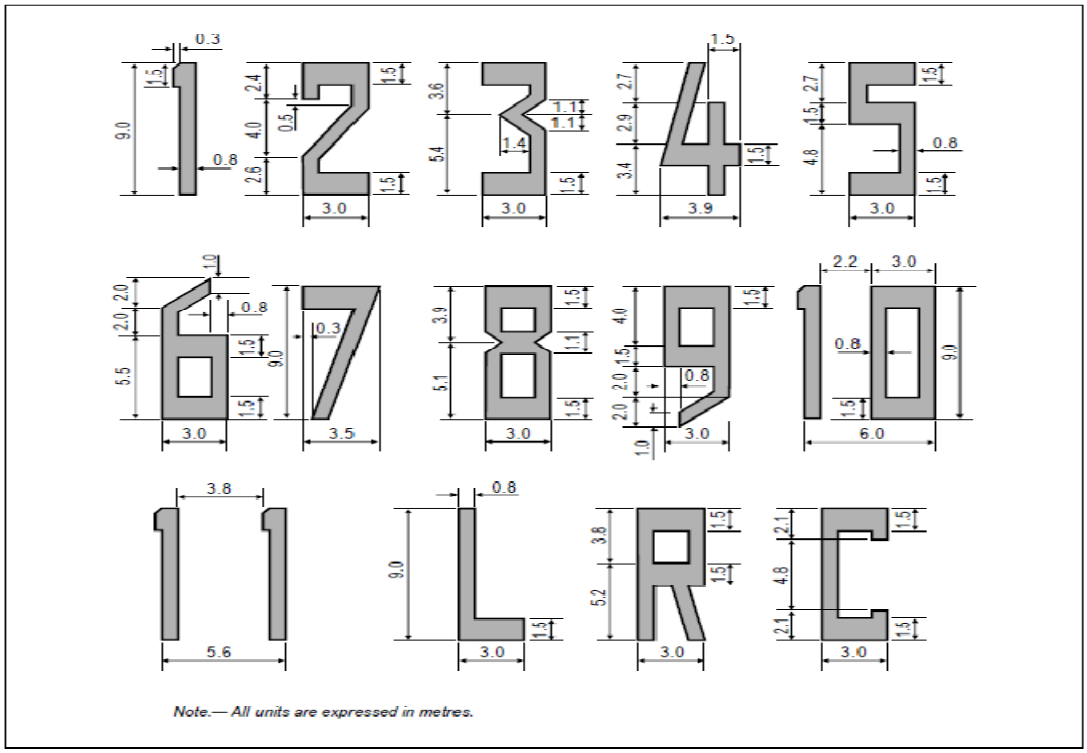


Fig 2.2

A runway threshold marking shall consist of a pattern of longitudinal stripes of uniform dimensions disposed symmetrically about the centre line of a runway as shown in **Figure 2-1** (A) and (B) for a runway width of 45 m. The number of stripes shall be in accordance with the runway width as follows:

Number of Runway width	**stripes**
18 m	**4**
23 m	**6**
30 m	**8**
45 m	**12**
60 m	**16**

Table: 2.1

The stripes shall extend laterally to within 3 m of the edge of a runway or to a distance of 27 m on either side of a runway centre line, whichever results in the smaller lateral distance. Where a runway designation marking is placed within a threshold marking there shall be a minimum of three stripes on each side of the centre line of the runway. Where a runway designation marking is placed above a threshold marking, the stripes shall be continued across the runway. The stripes shall be at least 30 m long and approximately 1.80 m wide with spacing's of approximately 1.80 m between them except that, where the stripes are continued across a runway, a double spacing shall be used to separate the two stripes nearest the centre line of the runway, and in the case

where the designation marking is included within the threshold marking this spacing shall be 22.5 m.

2.3.1 Transverse stripe

Where a threshold is displaced from the extremity of a runway or where the extremity of a runway is not square with the runway centre line; a transverse stripe as shown in Figure 2-3 (B) should be added to the threshold marking. A transverse stripe shall be not less than 1.80 m wide.

2.3.2 Arrows

Where a runway threshold is permanently displaced, arrows conforming to Figure 2-3 (B) shall be provided on the portion of the runway before the displaced threshold. When a runway threshold is temporarily displaced from the normal position, it shall be marked as shown in Figure 2-3(A) or 2-3 (B) and all markings prior to the displaced threshold shall be obscured except the runway centre line marking, which shall be converted to arrows.

Note 1. — In the case where a threshold is temporarily displaced for only a short period of time, it has been found satisfactory to use markers in the form and colour of a displaced threshold marking rather than attempting to paint this marking on the runway.

Note 2. — When the runway before a displaced threshold is unfit for the surface movement of aircraft, closed markings, as described in MOIS (11.2.1.4), are required to be provided.

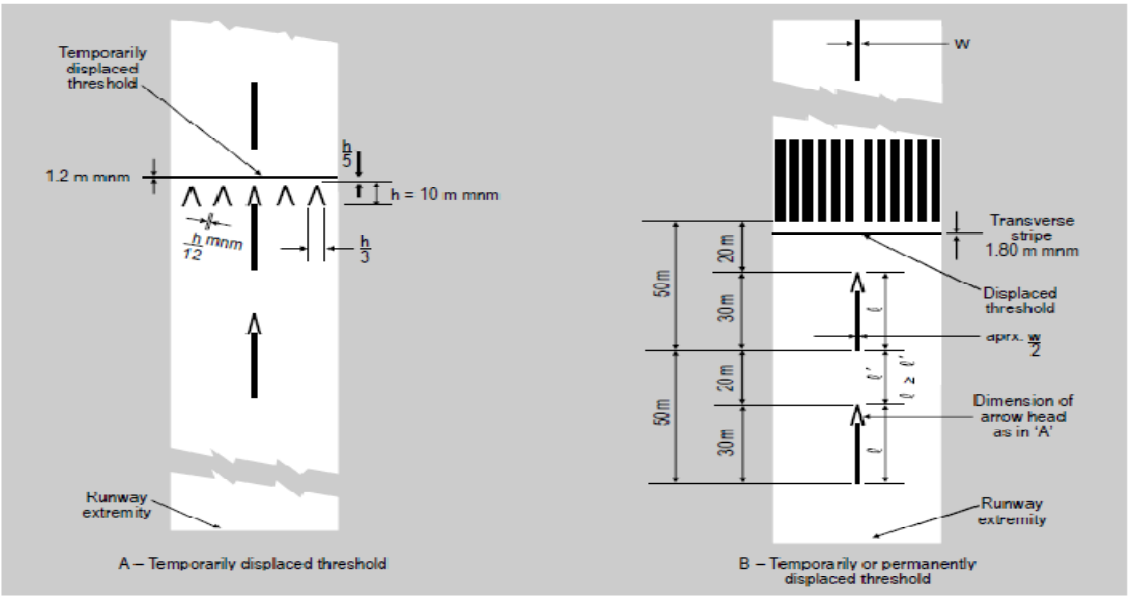


Fig 2.3 Displaced threshold markings

2.4 Aiming point marking

An aiming point marking shall be provided at each approach end of a paved instrument runway where the code number is 2, 3 or 4.An aiming point marking should be provided at each approach end of:

a) a paved non-instrument runway where the code number is 3 or 4;

b) a paved instrument runway where the code number is 1;

When additional conspicuity of the aiming point is desirable.

The aiming point marking shall commence no closer to the threshold than the distance indicated in the appropriate column of Table 2-2, except that, on a runway equipped with a visual approach slope indicator system, the beginning of the marking shall be coincident with the visual approach slope origin.

An aiming point marking shall consist of two conspicuous stripes. The dimensions of the stripes and the lateral spacing between their inner sides shall be in accordance with the provisions of the appropriate column of Table 2-2. Where a touchdown zone marking is provided, the lateral spacing between the markings shall be the same as that of the touchdown zone marking.

2.5 Touchdown zone marking

A touchdown zone marking shall be provided in the touchdown zone of a paved precision approach runway where the code number is 2, 3 or 4.

A touchdown zone marking should be provided in the touchdown zone of a paved non-precision approach or non-instrument runway where the code number is 3 or 4 and additional conspicuity of the touchdown zone is desirable.

Table 2.2 Location and dimensions of aiming point marking

Location and dimensions (1)	Landing distance available: Less than 800 m (2)	800 m up to but not including 1 200 m (3)	1 200 m up to but not including 2 400 m (4)	2 400 m and above (5)
Distance from threshold to beginning of marking	150 m	250 m	300 m	400 m
Length of stripe[a]	30–45 m	30–45 m	45–60 m	45–60 m
Width of stripe	4 m	6 m	6–10 m[b]	6–10 m[b]
Lateral spacing between inner sides of stripes	6 m[c]	9 m[c]	18–22.5 m	18–22.5 m

a. The greater dimensions of the specified ranges are intended to be used where increased conspicuity is required.
b. The lateral spacing may be varied within these limits to minimize the contamination of the marking by rubber deposits.

Location and characteristics

A touchdown zone marking shall consist of pairs of rectangular markings symmetrically disposed about the Runway centre line with the number of such pairs related to the landing distance available and, where the marking is to be displayed at both the approach directions of a runway, the distance between the thresholds, as shown in table 2.3:

Landing distance available or the distance between thresholds	*Pair(s) of markings*
less than 900 m	1
900 m up to but not including 1 200 m	2
1 200 m up to but not including 1 500 m	3
1 500 m up to but not including 2 400 m	4
2 400 m or more	6

Table 2.3

A touchdown zone marking shall conform to either of the two patterns shown in Figure Fig 2.4 for the pattern shown in Fig 2.4 (A), the markings shall be not less than 22.5 m long and 3 m wide. For the pattern shown in Fig 2.4 (B), each stripe of each marking shall be not less than

22.5 m long and 1.8 m wide with spacing of 1.5 m between adjacent stripes. The lateral spacing between the inner sides of the rectangles shall be equal to that of the aiming point marking where provided.

Where an aiming point marking is not provided, the lateral spacing between the inner sides of the rectangles shall correspond to the lateral spacing specified for the aiming point marking. The pairs of markings shall be provided at longitudinal spacing's of 150 m beginning from the threshold, except that pairs of touchdown zone markings coincident with or located within 50 m of an aiming point marking shall be deleted from the pattern.

On a non-precision approach runway where the code number is 2, an additional pair of touchdown zone marking stripes should be provided 150 m beyond the beginning of the aiming point marking.

2.6 Runway side stripe marking

A runway side stripe marking shall be provided between the thresholds of a paved runway where there is a lack of contrast between the runway edges and the shoulders or the surrounding terrain.

A runway side stripe marking should be provided on a precision approach runway irrespective of the contrast between the runway edges and the shoulders or the surrounding terrain. A runway side stripe marking should consist of two stripes, one placed along each edge of the runway with the outer edge of each stripe approximately on the edge of the runway, except that, where the runway is greater than 60 m in width, the stripes should be located 30 m from the runway centre line.

Where a runway turn pad is provided, the runway side stripe marking should be continued between the runway and the runway turn pad

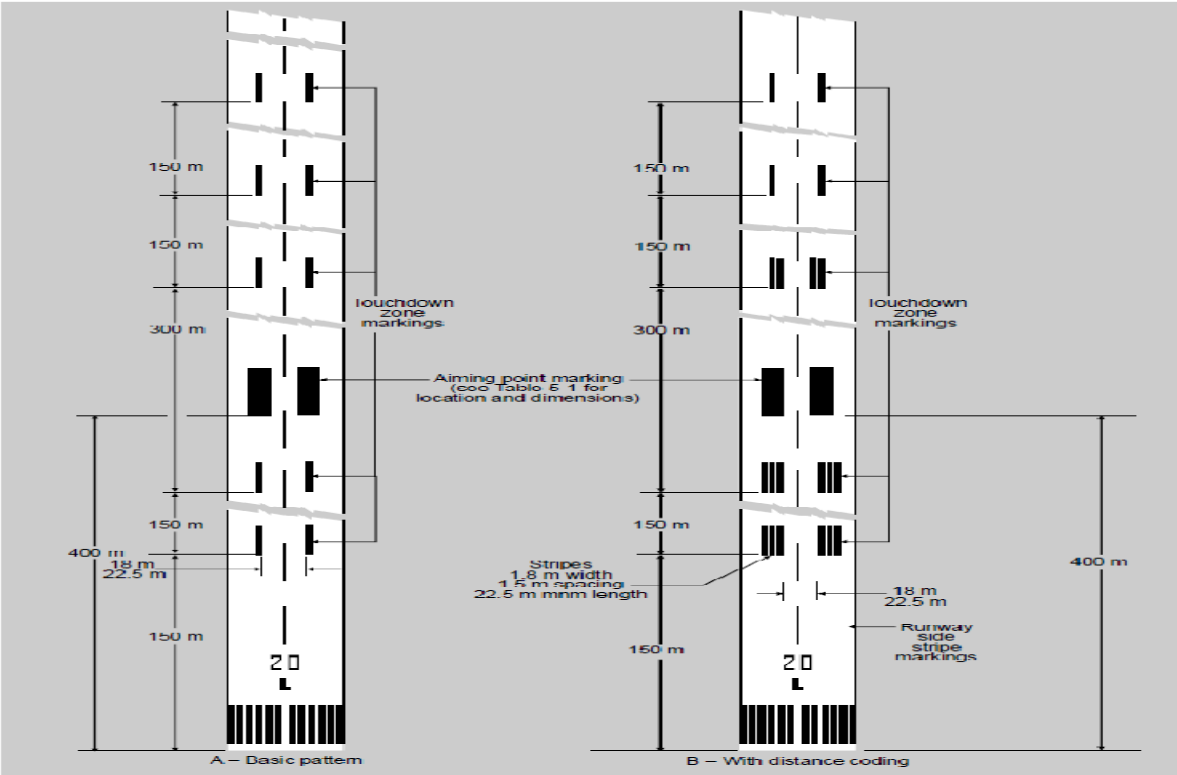


Fig 2.4 Aiming point and touchdown zone markings (Illustrated for a runway with a length of 2 400 m or more)

A runway side stripe should have an overall width of at least 0.9 m on runways 30 m or more in width and at least 0.45 m on narrower runways.

2.7 Taxiway centre line marking

Taxiway centre line marking shall be provided on a paved taxiway and apron where the code number is 3 or 4 in such a way as to provide continuous guidance between the runway center line and aircraft stands. Taxiway centre line marking shall be provided on a paved runway when the runway is part of a standard Taxi-route and:

a) There is no runway centre line marking; or

b) Where the taxiway centre line is not coincident with the runway centre line.

Where it is necessary to denote the proximity of a runway-holding position, enhanced taxiway centre line marking should be provided.

Note. — The provision of enhanced taxiway centre line marking may form part of runway incursion prevention measures.

Where provided, enhanced taxiway centre line marking shall be installed at all taxiway/runway intersections at that aerodrome.

On a straight section of a taxiway the taxiway centre line marking should be located along the taxiway centre line. On a taxiway curve the marking should continue from the straight portion of the taxiway at a constant distance from the outside edge of the curve.

At an intersection of a taxiway with a runway where the taxiway serves as an exit from the Runway, the taxiway centre line marking should be curved into the runway centre line marking.

The taxiway centre line marking should be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the code number is 3 or 4, and for a distance of at least 30 m where the code number is 1 or 2.

A taxiway centre line marking shall be at least 15 cm in width and continuous in length except where it intersects with a runway-holding position marking or an intermediate holding position marking as shown in Figure 2.5.

Enhanced taxiway centre line marking shall be as shown in Figure 2.6.

Where taxiway centre line marking is provided on a runway in accordance with the marking should be located on the centre line of the designated taxiway.

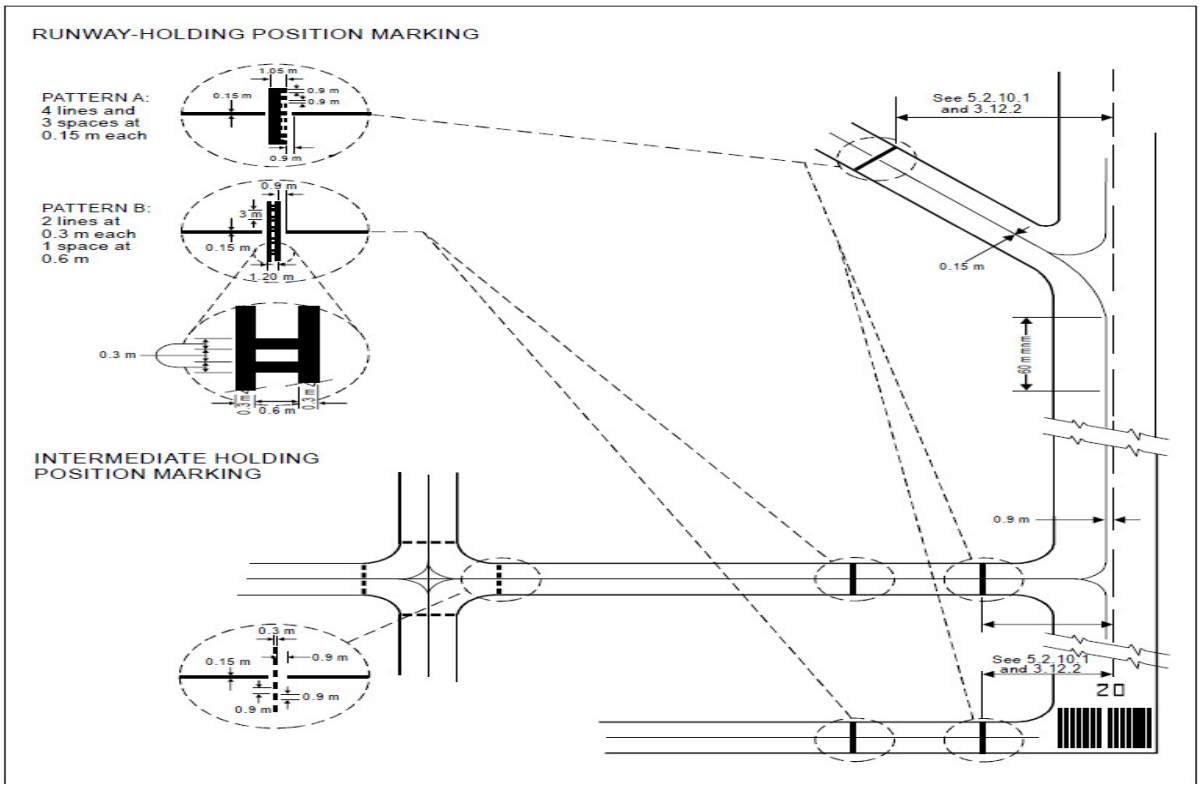


Fig 2.5 Taxiway markings

2.8 Runway turns pad marking

Where a runway turn pad is provided, a runway turn pad marking shall be provided for continuous guidance to enable an airplane to complete a 180-degree turn and align with the runway centre line.

The runway turn pad marking should be curved from the runway centre line into the turn Pad. The radius of the curve should be compatible with the maneuvering capability and normal taxiing speeds of the airplanes for which the runway turn pad is intended. The intersection angle of the runway turn pad marking with the runway centre line should not be greater than 30 degrees.

The runway turn pad marking should be extended parallel to the runway centre line marking for a distance of at least 60 m beyond the point of tangency where the code number is 3 or 4, and for a distance of at least 30 m where the code number is 1 or 2.

A runway turn pad marking should guide the airplane in such a way as to allow a straight portion of taxiing before the point where a 180-degree turn is to be made. The straight portion of the runway turn pad marking should be parallel to the outer edge of the runway turn pad.

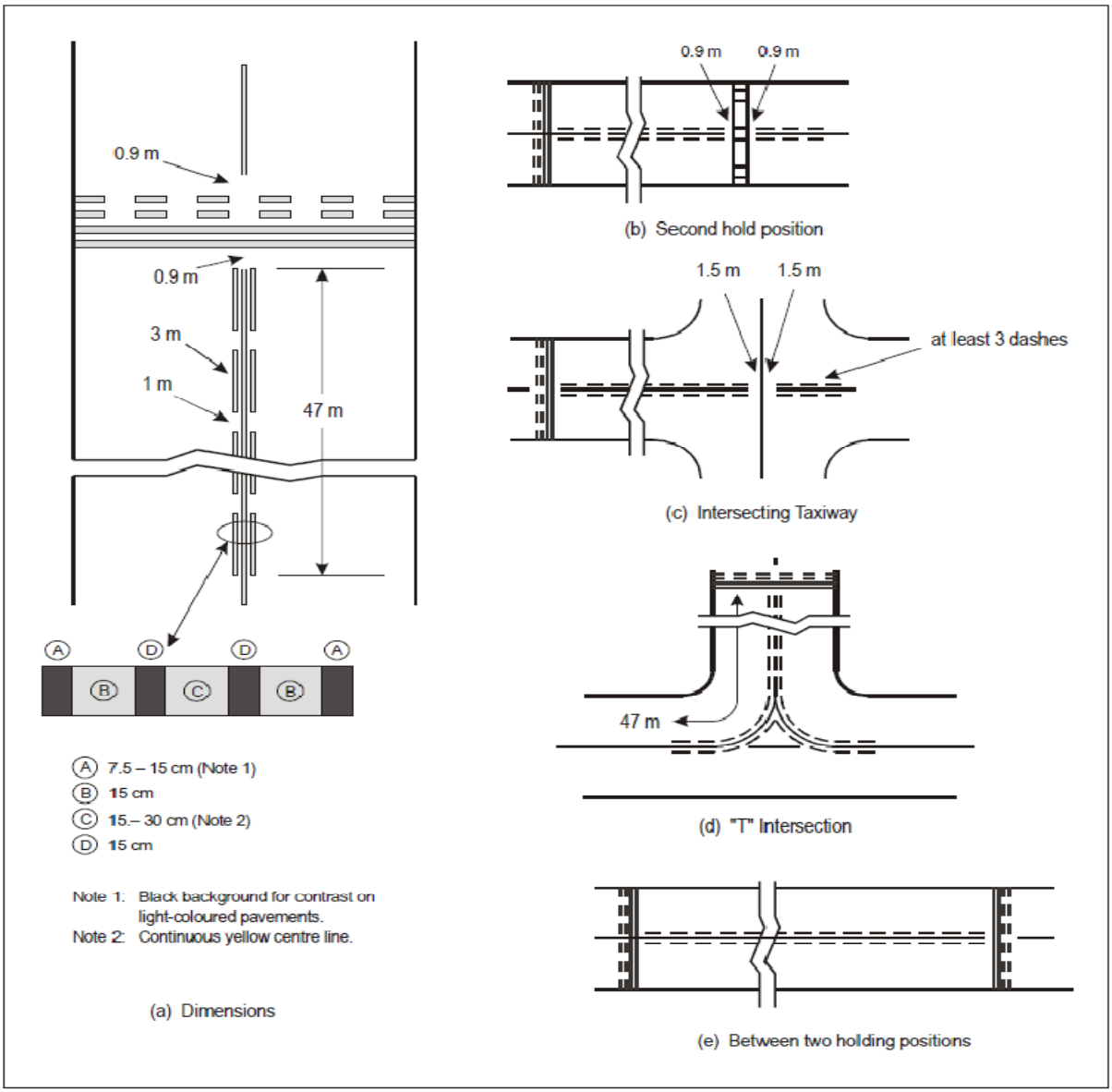


Fig 2.6 Enhanced taxiway center line marking

The design of the curve allowing the aeroplane to negotiate a 180-degree turn should be based on a nose wheel steering angle not exceeding 45 degrees. The design of the turn pad marking should be such that, when the cockpit of the aeroplane remains over the runway turn pad marking, the clearance distance between any wheel of the aeroplane landing gear and the edge of the runway turn pad should be not less than those specified in MOIS Section 7.2.3.6.

Note. For ease of maneuvering, consideration may be given to providing a larger wheel-to-edge clearance for codes E and F aeroplanes.

A runway turn pad marking shall be at least 15 cm in width and continuous in length.

2.9 Runway-holding position marking

A runway-holding position marking shall be displayed along a runway-holding position. At an intersection of a taxiway and a non-instrument, non-precision approach or take-off runway, the runway-holding position marking shall be as shown in Figure 2.5, pattern A. Where a single runway-holding position is provided at an intersection of a taxiway and a precision approach category I runway, the runway-holding position marking shall be as shown in Figure 2.5, pattern A. Where two or three runway-holding positions are provided at such an intersection, the runway-holding position marking closer (closest) to the runway shall be as shown in Figure 2.5, pattern A and the markings farther from the runway shall be as shown in Figure 2.5, pattern B.

The runway-holding position marking displayed at a runway-holding position established in accordance with shall be as shown in Figure 2.5 pattern A.

Where increased conspicuity of the runway-holding position is required, the runway-holding position marking should be as shown in Figure 2.7, pattern A or pattern B, as appropriate.

The runway-holding position marking displayed at a runway/runway intersection shall be perpendicular to the centre line of the runway forming part of the standard taxi-route. The pattern of the marking shall be as shown in Figure 2.5, pattern A.

2.10 Intermediate holding position marking

An intermediate holding position marking should be displayed along an intermediate Holding position. An intermediate holding position marking should be displayed at the exit boundary of adjoining a taxiway.

Where an intermediate holding position marking is displayed at an intersection of two paved taxiways, it shall be located across the taxiway at sufficient distance from the near edge of the intersecting taxiway to ensure safe clearance between taxiing aircraft.

An intermediate holding position marking shall consist of a single broken line as shown in Figure 2.5.

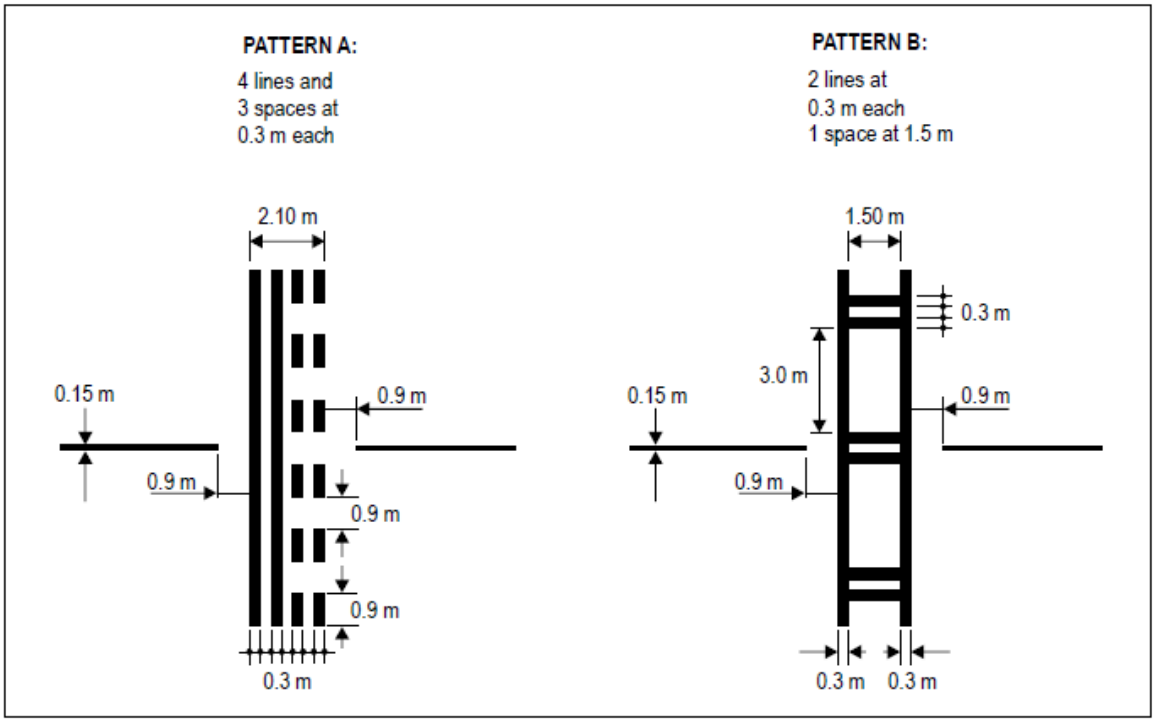


Fig 2.7 Runway-holding position markings

2.11 VOR aerodrome checkpoint marking

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

Location of a VOR aerodrome checkpoint marking shall be centered on the spot at which an aircraft is to be parked to receive the correct VOR signal.

A VOR aerodrome checkpoint marking shall consist of a circle 6 m in diameter and have a line width of 15 cm (see Figure 2.8 (A)). When it is preferable for an aircraft to be aligned in a specific direction, a line should be provided that passes through the centre of the circle on the desired azimuth. The line should extend 6 m outside the circle in the desired direction of heading and terminate in an arrowhead. The width of the line should be 15 cm (see Figure 2.8 (B)).

A VOR aerodrome checkpoint marking should preferably be white in colour but should differ from the colour used for the taxiway markings.

Note. — To provide contrast, markings may be bordered with black.

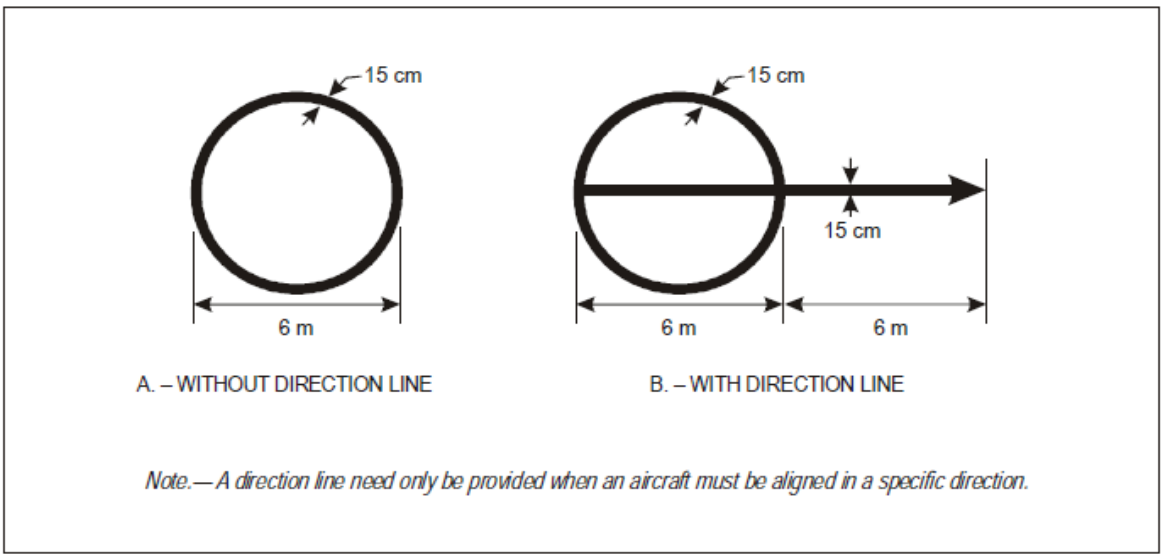


Fig 2.8 VOR aerodrome checkpoint marking

2.12 Aircraft stand marking

Aircraft stand markings should be provided for designated parking positions on a paved apron. Aircraft stand markings on a paved apron should be located so as to provide, when the nose wheel follows the stand marking.

Aircraft stand markings should include such elements as stand identification, lead-in line, turn bar, turning line, alignment bar, stop line and lead-out line, as are required by the parking configuration and to complement other parking aids.

Aircraft stand identification (letter and/or number) should be included in the lead-in line a short distance after the beginning of the lead-in line. The height of the identification should be adequate to be readable from the cockpit of aircraft using the stand.

Where two sets of aircraft stand markings are superimposed on each other in order to permit more flexible use of the apron and it is difficult to identify which stand marking should be followed, or safety would be impaired if the wrong marking was followed, then identification of the aircraft for which each set of markings is intended should be added to the stand identification.

Note. — Example: 2A-B747, 2B-F28.

Lead-in, turning and lead-out lines should normally be continuous in length and have a width of not less than 15 cm. Where one or more sets of stand markings are superimposed on a stand

marking, the lines should be continuous for the most demanding aircraft and broken for other aircraft.

The curved portions of lead-in, turning and lead-out lines should have radii appropriate to the most demanding aircraft type for which the markings are intended.

Where it is intended that an aircraft precede in one direction only, arrows pointing in the direction to be followed should be added as part of the lead-in and lead-out lines. A turn bar should be located at right angles to the lead-in line, abeam the left pilot position at the point of initiation of any intended turn. It should have a length and width of not less than 6 m and 15 cm, respectively, and include an arrowhead to indicate the direction of turn.

Note. — The distances to be maintained between the turn bar and the lead-in line may vary according to different aircraft types, taking into account the pilot's field of view.

If more than one turn bar and/or stop line is required, they should be coded. An alignment bar should be placed so as to be coincident with the extended centre line of the aircraft in the specified parking position and visible to the pilot during the final part of the parking manoeuvre. It should have a width of not less than 15 cm.

A stop line should be located at right angles to the alignment bar, abeam the left pilot position at the intended point of stop. It should have a length and width of not less than 6 m and 15 cm, respectively.

Note.— The distances to be maintained between the stop line and the lead-in line may vary according to different aircraft types, taking into account the pilot's field of view.

2.13 Apron safety lines

Apron safety lines should be provided on a paved apron as required by the parking configurations and ground facilities. Apron safety lines shall be located so as to define the areas intended for use by ground vehicles and other aircraft servicing equipment, etc., to provide safe separation from aircraft. Apron safety lines should include such elements as wing tip clearance lines and service road boundary lines as required by the parking configurations and ground facilities. An apron safety line should be continuous in length and at least 10 cm in width

2.14 Road-holding position marking

A road-holding position marking shall be provided at all road entrances to a runway. The road-holding position marking shall be located across the road at the holding position. The road-holding position marking shall be in accordance with the local road traffic regulations.

2.15 Mandatory instruction marking

Where it is impracticable to install a mandatory instruction sign in accordance with MOIS 9.2.4 a mandatory instruction marking shall be provided on the surface of the pavement. Where operationally required, such as on taxiways exceeding 60 m in width, or to assist in the prevention of a runway incursion, a mandatory instruction sign should be supplemented by a mandatory instruction marking.

The mandatory instruction marking on taxiways where the code letter is A, B, C or D shall be located across the taxiway equally placed about the taxiway centre line and on the holding side of the runway-holding position marking as shown in Figure 2.9 (A). The distance between the nearest edge of the marking and the runway-holding position marking or the taxiway centre line marking shall be not less than 1 m.

The mandatory instruction marking on taxiways where the code letter is E or F shall be located on both sides of the taxiway centre line marking and on the holding side of the runway-holding position marking as shown in Figure 2.9 (B).

The distance between the nearest edge of the marking and the runway-holding position marking or the taxiway centre line marking shall be not less than 1 m. Except where operationally required, a mandatory instruction marking should not be located on a runway.

A mandatory instruction marking shall consist of an inscription in white on a red background. Except for a NO ENTRY marking, the inscription shall provide information identical to that of the associated mandatory instruction sign.

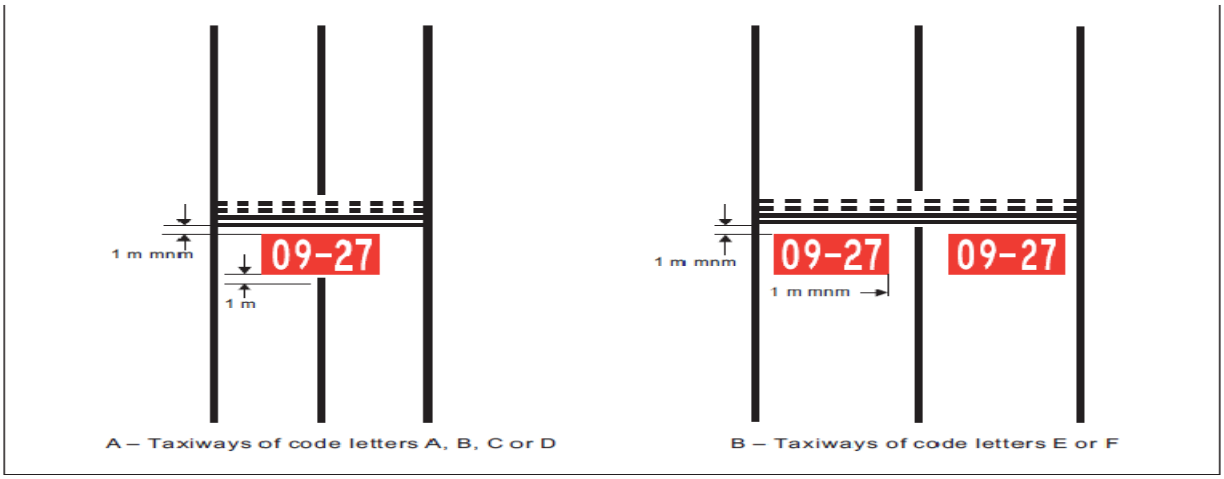


Fig 2.9 Mandatory instruction marking

2.16 A NO ENTRY marking

It consists of an inscription in white reading NO ENTRY on a red background. Where there is insufficient contrast between the marking and the pavement surface, the mandatory instruction marking shall include an appropriate border, preferably white or black. The character height should be 4 m for inscriptions where the code letter is C, D, E or F, and 2 m where the code letter is A or B.

The inscriptions should be in the form and proportions shown in the background should be rectangular and extend a minimum of 0.5 m laterally and vertically beyond the extremities of the inscription.

2.17 Information marking

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

Where operationally required information sign should be supplemented by information marking. An information (location/direction) marking should be displayed prior to and following complex taxiway intersections and where operational experience has indicated the addition of a taxiway location marking could assist flight crew ground navigation.

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

The information marking should be displayed across the surface of the taxiway or apron where necessary and positioned so as to be legible from the cockpit of an approaching aircraft.

An information marking consist of:

a) an inscription in yellow upon a black background, when it replaces or supplements a location sign; and

b) an inscription in black upon a yellow background, when it replaces or supplements a direction or destination sign.

Where there is insufficient contrast between the marking background and the pavement surface, the marking shall include:

a) a black border where the inscriptions are in black; and

b) a yellow border where the inscriptions are in yellow.

The character height should be 4 m.

Chapter 3
Signage

Signs can be provided to convey a mandatory instruction, information on a specific location or destination on a movement area or to provide other information to meet national requirements of MOIS section 13.2.8.

A variable message sign should be provided where:

a) The instruction or information displayed on the sign is relevant only during a certain period of time; and/or
b) There is a need for variable predetermined information to be displayed on the sign to meet the national requirements MOIS 13.2.8

Signs shall be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and the engine pods of jet aircraft. The installed height of the sign shall not exceed the dimension shown in the appropriate column of table 3:1.

Signs shall be rectangular, as shown in Figures 3.1 and 3.2 with the longer side horizontal. The only signs on the movement area utilizing red shall be mandatory instruction signs. The inscriptions on a sign shall be in accordance with the provisions MOIS (manual of implementing standard) 9.2.4.

Signs shall be illuminated in accordance with the provisions of ICAO Annex 14 Vol. I Appendix 4 when intended for use:

a) In runway visual range conditions less than a value of 800 m; or
b) At night in association with instrument runways; or
c) At night in association with non-instrument runways where the code number is 3 or 4.

Table 3:1Location distances for taxiing guidance signs including runway exit signs

Sign height (mm)				Perpendicular distance from defined taxiway pavement edge to near side of sign	Perpendicular distance from defined runway pavement edge to near side of sign
Code number	Legend	Face (min.)	Installed (max.)		
1 or 2	200	400	700	5–11 m	3–10 m
1 or 2	300	600	900	5–11 m	3–10 m
3 or 4	300	600	900	11–21 m	8–15 m
3 or 4	400	800	1 100	11–21 m	8–15 m

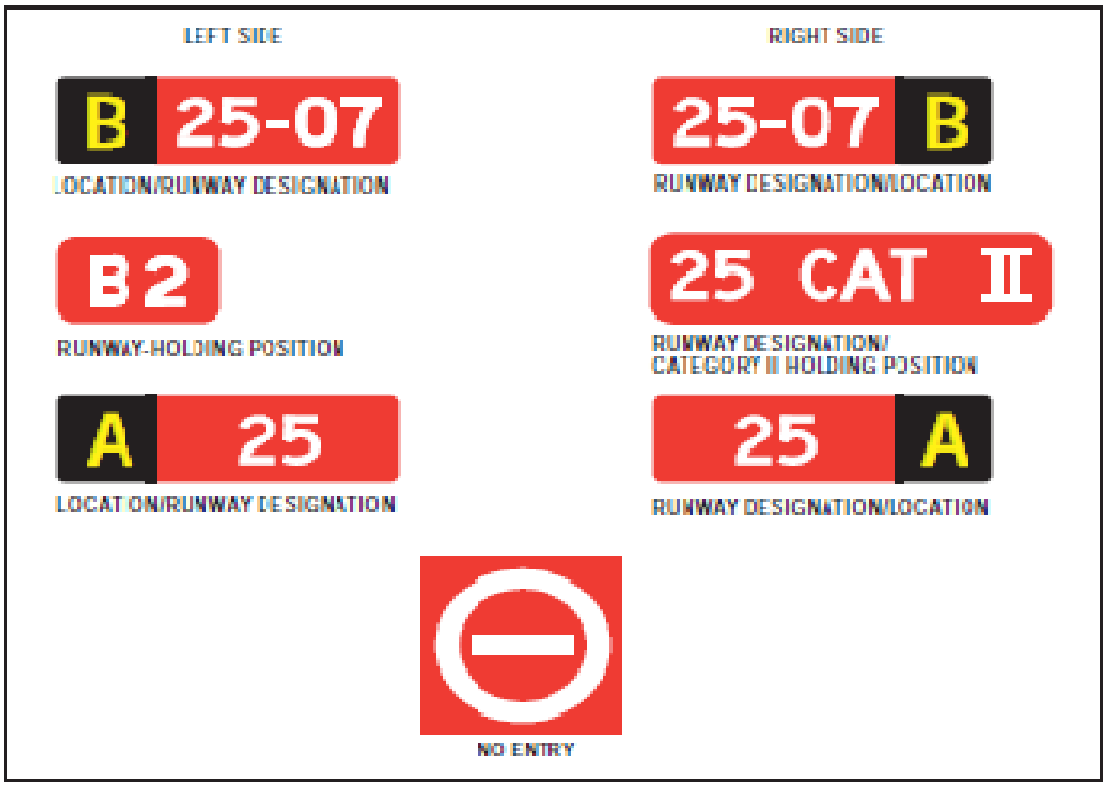


Fig 3.1 Mandatory instruction signs

Signs shall be retro reflective and/or illuminated in accordance with the provisions of MOIS 9.2.4 when intended for use at night in association with non-instrument runways where the code number is 1 or 2. A variable message sign shall show a blank face when not in use. In case of failure, a variable message sign shall not provide information that could lead to unsafe action from a pilot or a vehicle driver. The time interval to change from one message to another on a variable message sign should be as short as practicable and should not exceed 5 seconds.

3.1 Mandatory instruction signs

A mandatory instruction sign shall be provided to identify a location beyond which an aircraft taxiing or vehicle shall not proceed unless authorized by the aerodrome control tower.

Mandatory instruction signs shall include runway designation signs, category I holding position signs, runway-holding position signs, road-holding position signs and NO ENTRY signs for specifications on road-holding position signs.

A pattern “A” runway-holding position marking shall be supplemented at a taxiway/runway intersection or a runway/runway intersection with a runway designation sign.

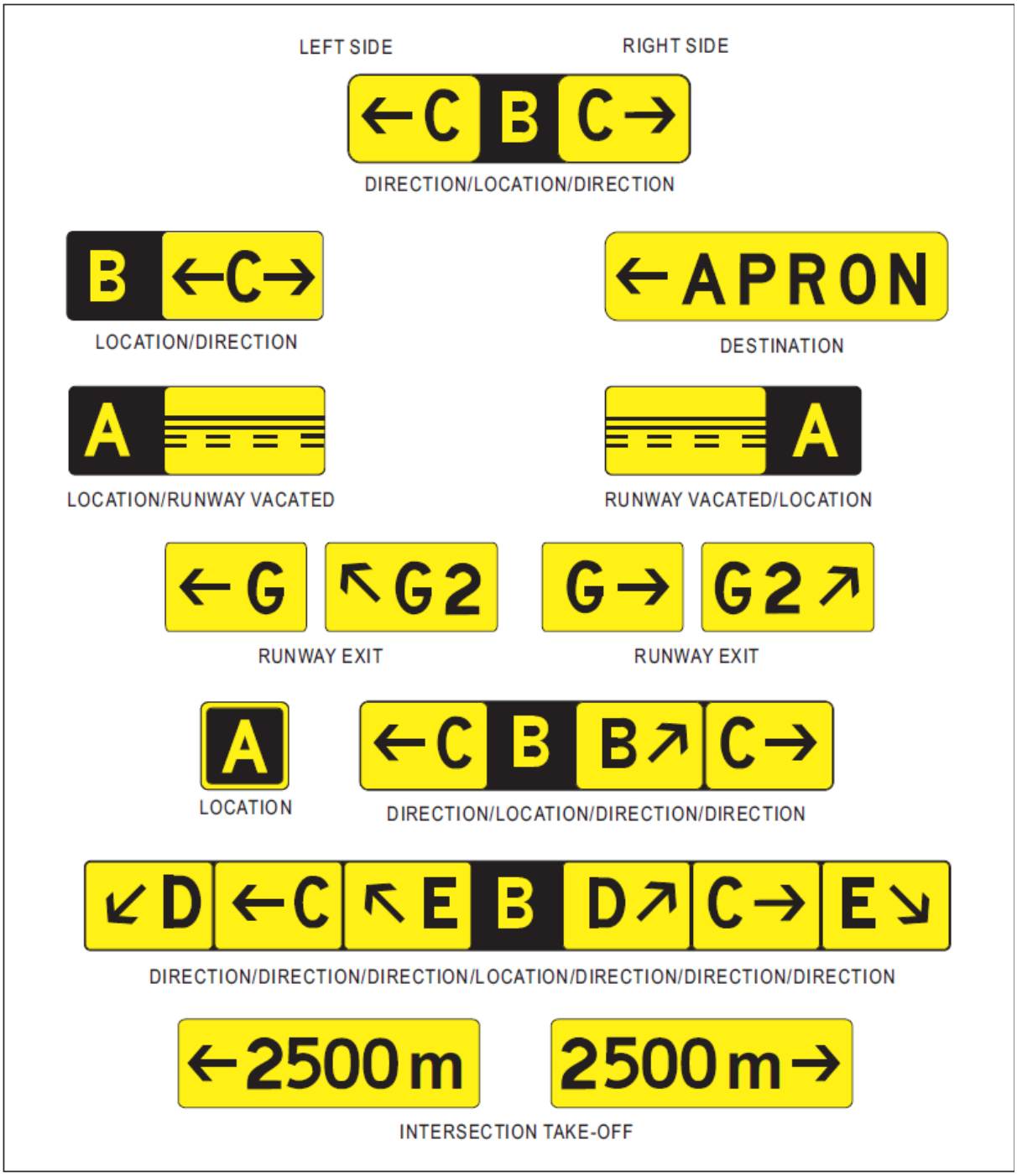


Fig 3.2 Information signs

A pattern “B” runway-holding position marking shall be supplemented with a category I holding position sign.

A pattern “A” runway-holding position marking at a runway-holding position established in accordance with MOIS 9.2.4 shall be supplemented with a runway-holding position sign.

A runway designation sign at a taxiway/runway intersection should be supplemented with a location sign in the outboard (farthest from the taxiway) position, as appropriate.

A NO ENTRY sign shall be provided when entry into an area is prohibited.

Location

A runway designation sign at a taxiway/runway intersection or a runway/runway intersection shall be located on each side of the runway-holding position marking facing the direction of approach to the runway.

A category I holding position sign shall be located on each side of the runway-holding position marking facing the direction of the approach to the critical area.

A NO ENTRY sign shall be located at the beginning of the area to which entrance is prohibited on each side of the taxiway as viewed by the pilot.

A runway-holding position sign shall be located on each side of the runway-holding position established in accordance with MOIS 7.2.12.3, facing the approach to the obstacle limitation surface or ILS/MLS critical sensitive area as appropriate.

Note.— Distance X is established in accordance with Table 3-1. Distance Y is established at the edge of the ILS critical/sensitive area.

A mandatory instruction sign shall consist of an inscription in white on a red background. Where, owing to environmental or other factors, the conspicuity of the inscription on a mandatory instruction sign needs to be enhanced, the outside edge of the white inscription should be supplemented by a black outline measuring 10 mm in width for runway code numbers 1 and 2, and 20 mm in width for runway code numbers 3 and 4.

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.

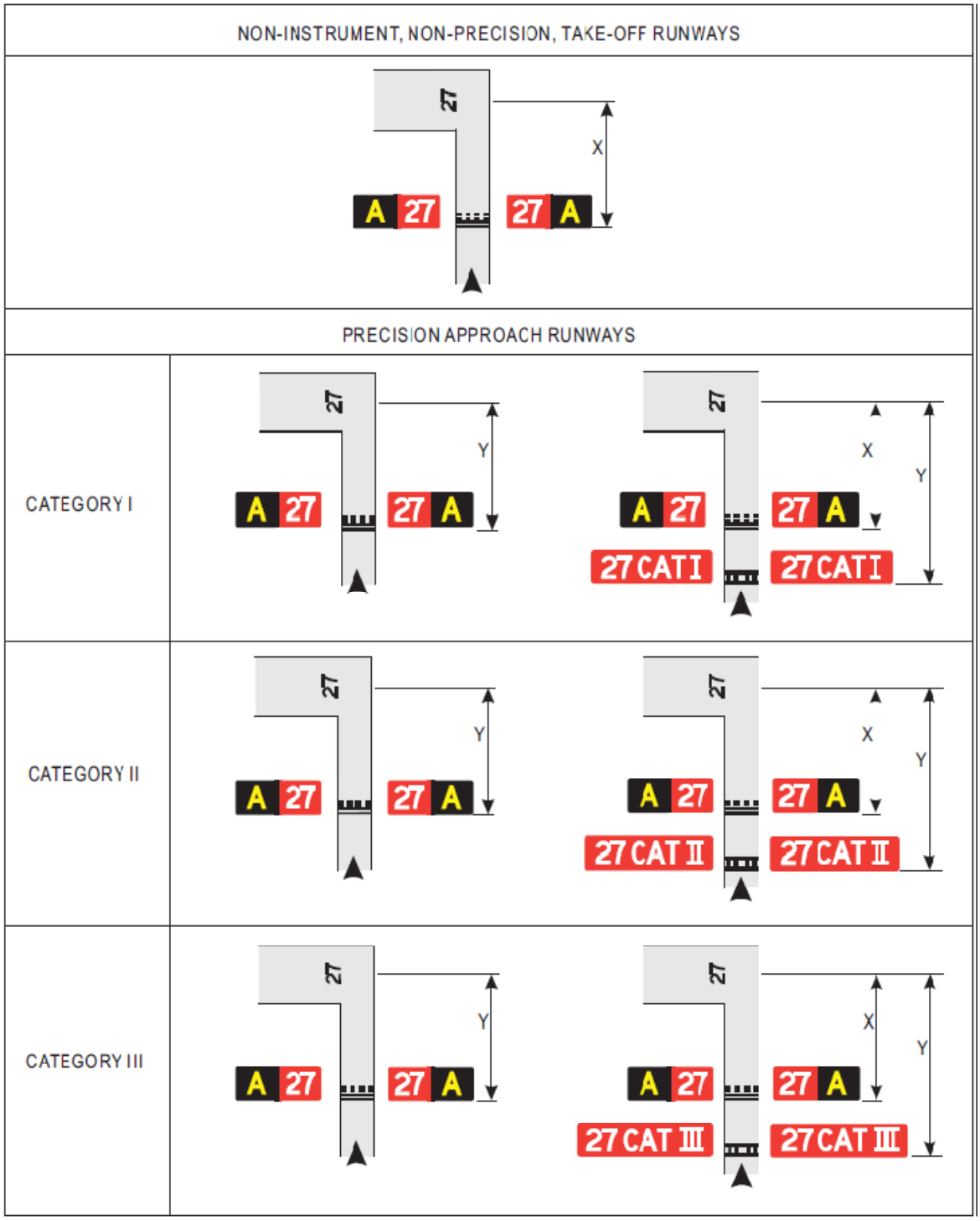


Fig 3.3 Examples of sign positions at taxiway/runway intersections

The inscription on a category I holding position sign shall consist of the runway designator followed by CAT I as appropriate. The inscription on a NO ENTRY sign shall be in accordance with Figure 3.1. The inscription on a runway-holding position sign at a runway-holding position

established in accordance with MOIS 7.2.12.3 shall consist of the taxiway designation and a number.

Where appropriate, the following inscriptions/symbol shall be used

Inscription/symbol	Use
Runway designation of a runway extremity OR	To indicate a runway-holding position at a runway extremity
Runway designations of both Extremities of a runway	To indicate a runway-holding position located at other taxiway/runway intersections or Runway/runway intersections
25 CAT I (Example)	To indicate a category I runway- holding Position at the threshold of runway 25
NO ENTRY Symbol B2 (Example)	To indicate that entry to an area is prohibited To indicate a runway-holding position established in accordance with paragraph 7.2.12.3 of this manual

Table 3:2

3.2 Information signs

An information sign shall be provided where there is an operational need to identify by a sign, a specific location, or routing (direction or destination) information.

Information signs shall include: direction signs, location signs, destination signs, runway exit signs, runway vacated signs and intersection take-off signs. A runway exit sign shall be provided where there is an operational need to identify a runway exit.

A runway vacated sign shall be provided where the exit taxiway is not provided with taxiway centre line lights and there is a need to indicate to a pilot leaving a runway the perimeter of the ILS/MLS critical/sensitive area or the lower edge of the inner transitional surface, whichever is farther from the runway centre line.

An intersection take-off sign should be provided when there is an operational need to indicate the remaining take-off run available (TORA) for intersection take-offs. Where necessary, a destination sign should be provided to indicate the direction to a specific destination on the aerodrome, such as cargo area, general aviation, etc.

A combined location and direction sign can be provided when it is intended to indicate routing information prior to a taxiway intersection. A direction sign can be provided when there is an operational need to identify the designation and direction of taxiways at an intersection.

A location sign should be provided at an intermediate holding position. A location sign can be provided in conjunction with a runway designation sign except at a runway/runway intersection. A location sign can be provided in conjunction with a direction sign, except that it may be omitted where an aeronautical study indicates that it is not needed. Where necessary, a location sign should be provided to identify taxiways exiting an apron or taxiways beyond an intersection. Where a taxiway ends at an intersection such as a ‘‘T’’ and it is necessary to identify this, a barricade, direction sign and/or other appropriate visual aid should be used. Wherever practicable, INFORMATION SIGN is located on the left-hand side of the taxiway in accordance with MOIS 9.2.4.

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

Note. — A location sign installed beyond a taxiway intersection may be installed on either side of a taxiway.

A runway exit sign can be located on the same side of the runway as the exit is located (i.e. left or right) and positioned in accordance with Table 3-1. A runway exit sign can be located prior to the runway exit point in line with a position at least 60 m prior to the point of tangency where the code number is 3 or 4, and at least 30 m where the code number is 1 or 2.

A runway vacated sign can be located at least on one side of the taxiway. The distance between the sign and the centre line of a runway shall be not less than the greater of the following:

a) The distance between the centre line of the runway and the perimeter of the ILS critical/sensitive area; or
b) The distance between the centre line of the runway and the lower edge of the inner transitional surface.

Where provided in conjunction with a runway vacated sign, the taxiway location sign can be positioned outboard of the runway vacated sign. An intersection take-off sign can be located at the left-hand side of the entry taxiway. The distance between the sign and the centre line of the runway can be not less than 60 m where the code number is 3 or 4, and not less than 45 m where the code number is 1 or 2.

A taxiway location sign installed in conjunction with a runway designation sign can be positioned outboard of the runway designation sign. A destination sign should not normally be collocated with a location or direction sign. An information sign other than a location sign shall not be collocated with a mandatory instruction sign.

A direction sign, barricade and/or other appropriate visual aid used to identify a ‘‘T’’ intersection should be located on the opposite side of the intersection facing the taxiway. An information sign other than a location sign shall consist of an inscription in black on a yellow background. A location sign shall consist of an inscription in yellow on a black background and where it is a stand-alone sign shall have a yellow border.

The inscription on a runway exit sign shall consist of the designator of the exit taxiway and an arrow indicating the direction to follow. The inscription on a runway vacated sign can depict the pattern A runway-holding position marking as shown in Figure 3.2.

The inscription on an intersection take-off sign shall consist of a numerical message indicating the remaining take-off run available in meters plus an arrow, appropriately located and oriented, indicating the direction of the take-off as shown in Figure 3.2.

The inscription on a destination sign can comprise an alpha, alphanumerical or numerical message identifying the destination plus an arrow indicating the direction to proceed as shown in fig 3.2.The inscription on a direction sign can comprise an alpha or alphanumerical message identifying the taxiway(s) plus an arrow or arrows appropriately oriented as shown in Figure 3.2

The inscription on a location sign can comprise the designation of the location taxiway, runway or other pavement the aircraft is on or is entering and shall not contain arrows. Where it is necessary to identify each of a series of intermediate holding positions on the same taxiway, the location sign should consist of the taxiway designation and a number.

Where a location sign and direction signs are used in combination:

a) all direction signs related to left turns should be placed on the left side of the location sign, and all direction signs related to right turns should be placed on the right side of the location sign, except that where the junction consists of one intersecting taxiway, the location sign may alternatively be placed on the left-hand side;
b) The direction signs should be placed such that the direction of the arrows departs increasingly from the vertical with increasing deviation of the corresponding taxiway;
c) An appropriate direction sign should be placed next to the location sign where the direction of the location taxiway changes significantly beyond the intersection; and
d) Adjacent direction signs should be delineated by a vertical black line as shown in Figure 3.2.

A taxiway should be identified by a designator comprising a letter, letters or a combination of a letter or letters followed by a number. When designating taxiways, the use of the letters I, O or X and the use of words such as inner and outer should be avoided wherever possible to avoid confusion with the numerals 1, 0 and closed marking. The use of numbers alone on the manoeuvring area should be reserved for the designation of runways.

3.3 VOR aerodrome checkpoint sign

When a VOR aerodrome checkpoint is established, it shall be indicated by a VOR aerodrome checkpoint marking and sign. A VOR aerodrome checkpoint sign should be located as near as possible to the checkpoint and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the VOR aerodrome checkpoint marking.

A VOR aerodrome checkpoint sign should consist of an inscription in black on a yellow background. The inscriptions on a VOR checkpoint sign should be in accordance with one of the Alternatives shown in Figure 3.4 in which VOR is an abbreviation identifying this as a VOR checkpoint; 116.3 is an example of the radio frequency of the VOR concerned; 147° is an example of the VOR bearing, to the nearest degree, which should be indicated at the VOR checkpoint; and 4.3 NM is an example of the distance in nautical miles to a DME collocated with the VOR concerned.

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

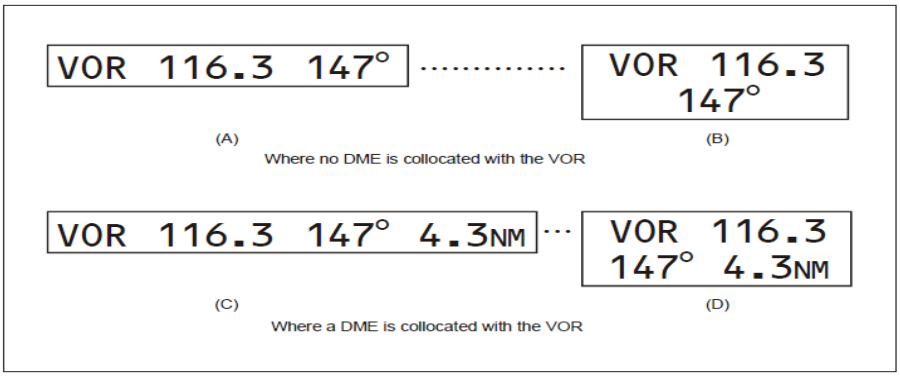


Fig 3.4 VOR aerodrome checkpoint sign

3.4 Aerodrome identification sign

An aerodrome identification sign should be provided at an aerodrome where there is insufficient alternative means of visual identification.
The aerodrome identification sign should be placed on the aerodrome so as to be legible, in so far as is practicable, at all angles above the horizontal.

The aerodrome identification sign should consist of the name of the aerodrome. The colour selected for the sign should give adequate conspicuity when viewed against its background. The characters should have a height of not less than 3 m.

3.5 Aircraft stand identification signs

An aircraft stand identification marking should be supplemented with an aircraft stand identification sign where feasible.

An aircraft stand identification sign should be located so as to be clearly visible from the cockpit of an aircraft prior to entering the aircraft stand. An aircraft stand identification sign should consist of an inscription in black on a yellow background.

3.6 Road-holding position sign

A road-holding position sign shall be provided at all road entrances to a runway. The road-holding position sign shall be located 1.5 m from one edge of the road (left or right as appropriate to the local traffic regulations) at the holding position. A road-holding position sign shall consist of an inscription in white on a red background.

- ❖ The inscription on a road-holding position sign shall be in the national language, be in conformity with the local traffic regulations and include the following:

a) A requirement to stop; and
b) Where appropriate:
    1) A requirement to obtain ATC clearance; and
    2) Location designator.

A road-holding position sign intended for night use shall be retro reflective or illuminated.

Chapter4.
Markers

Markers should be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft. Anchors or chains, to prevent markers which have broken from their mounting from blowing away, are sometimes used.

4.1 Unpaved runway edge markers

Markers should be provided when the extent of an unpaved runway is not clearly indicated by the appearance of its surface compared with that of the surrounding ground. Where runway lights are provided, the markers should be incorporated in the light fixtures. Where there are no lights, markers of flat rectangular or conical shape should be placed so as to delimit the runway clearly. The flat rectangular markers should have a minimum size of 1 m by 3 m and should be placed with their long dimension parallel to the runway centre line. The conical markers should have a height not exceeding 50 cm.

4.2 Stop way edge markers

Stop way edge markers should be provided when the extent of a stop way is not clearly indicated by its appearance compared with that of the surrounding ground. The stop way edge markers should be sufficiently different from any runway edge markers used to ensure that the two types of markers cannot be confused. Markers consisting of small vertical boards camouflaged on the reverse side, as viewed from the runway, have proved operationally acceptable.

4.3 Taxiway edge markers

Taxiway edge markers should be provided on a taxiway where the code number is 1 or 2 and taxiway centre line or edge lights or taxiway centre line markers are not provided. Taxiway edge markers should be installed at least at the same locations as would the taxiway edge lights had they been used. A taxiway edge marker should be retro reflective blue. The marked surface as viewed by the pilot should be a rectangle and should have a minimum viewing area of 150 cm2. Taxiway edge markers should be frangible. Their height should be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

4.4 Taxiway centre line markers

Taxiway centre line markers should be provided on a taxiway where the code number is 1 or 2 and taxiway centre line or edge lights or taxiway edge markers are not provided. Taxiway centre

line markers should be provided on a taxiway where the code number is 3 or 4 and taxiway centre line lights are not provided if there is a need to improve the guidance provided by the taxiway centre line marking. Taxiway centre line markers should be installed at least at the same location as would taxiway centre line lights had they been used. Taxiway centre line markers should normally be located on the taxiway centre line marking except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.

A taxiway centre line marker should be retro reflective green. The marked surface as viewed by the pilot should be a rectangle and should have a minimum viewing area of 20 cm2.

Taxiway centre line markers should be so designed and fitted as to withstand being run over by the wheels of an aircraft without damage either to the aircraft or to the markers themselves.

4.5 Unpaved taxiway edge markers

Where the extent of an unpaved taxiway is not clearly indicated by its appearance compared with that of the surrounding ground, markers should be provided. Where taxiway lights are provided, the markers should be incorporated in the light fixtures. Where there are no lights, markers of conical shape should be placed so as to delimit the taxiway clearly.

4.6 Boundary markers

Boundary markers should be provided at an aerodrome where the landing area has no runway. Boundary markers shall be spaced along the boundary of the landing area at intervals of not more than 200 m, or approximately 90 m, if the conical type is used with a marker at any corner. Boundary markers should be of a form similar to that shown in Figure 4.1, or in the form of a cone not less than 50 cm high and not less than 75 cm in diameter at the base. The markers should be colored to contrast with the background against which they will be seen. A single colour, orange or red, or two contrasting colours, orange and white or alternatively red and white, should be used, except where such colours merge with the background.

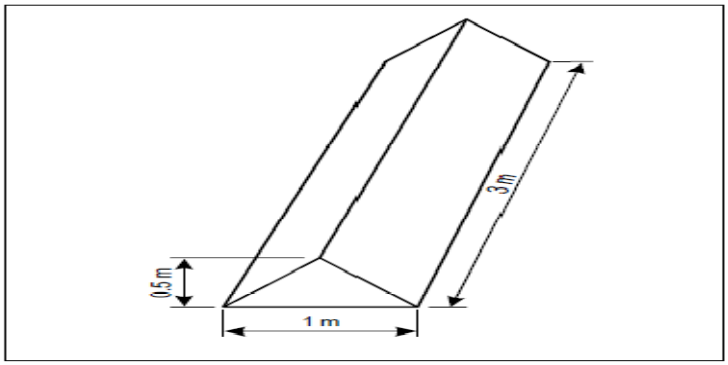


Fig. 4.1 Boundary markers

Chapter 5

5.1 Visual docking guidance system

A visual docking guidance system shall be provided when it is intended to indicate, by a visual aid, the precise positioning of an aircraft on an aircraft stand and other alternative means, such as marshallers, are not practicable.

Note.— The factors to be considered in evaluating the need for a visual docking guidance system are in particular: the number and type(s) of aircraft using the aircraft stand, weather conditions, space available on the apron and the precision required for manoeuvring into the parking position due to aircraft servicing installation, passenger loading bridges, etc.

The system can provide both azimuth and stopping guidance. The azimuth guidance unit and the stopping position indicator shall be adequate for use in all weather, visibility, background lighting and pavement conditions for which the system is intended, both by day and night, but shall not dazzle the pilot.

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

The azimuth guidance unit and the stopping position indicator shall be of a design such that:

a) A clear indication of malfunction of either or both is available to the pilot; and
b) They can be turned off.

The azimuth guidance unit and the stopping position indicator shall be located in such a way that there is continuity of guidance between the aircraft stand markings, the aircraft stand manoeuvring guidance lights, if present, and the visual docking guidance system. The accuracy of the system shall be adequate for the type of loading bridge and fixed aircraft servicing installations with which it is to be used.

The system should be usable by all types of aircraft for which the aircraft stand is intended, preferably without selective operation.

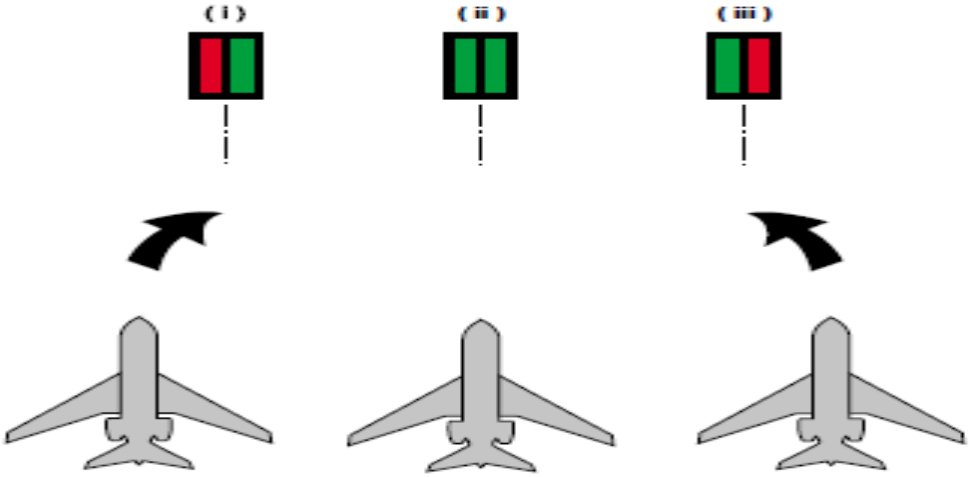
If selective operation is required to prepare the system for use by a particular type of aircraft, then the system shall provide an identification of the selected aircraft type to both the pilot and the system operator as a means of ensuring that the system has been set properly.

Azimuth guidance unit

The azimuth guidance unit shall be located on or close to the extension of the stand centre line ahead of the aircraft so that its signals are visible from the cockpit of an aircraft throughout the docking manoeuvre and aligned for use at least by the pilot occupying the left seat.

The azimuth guidance unit should be aligned for use by the pilots occupying both the left and right seats. The azimuth guidance unit shall provide unambiguous left/right guidance which enables the pilot to acquire and maintain the lead-in line without over-controlling.

When azimuth guidance is indicated by colour change, green shall be used to identify the centre line and red for deviations from the centre line.



Stopping position indicator

The stopping position indicator shall be located in conjunction with, or sufficiently close to, the azimuth guidance unit so that a pilot can observe both the azimuth and stop signals without turning the head.

The stopping position indicator shall be usable at least by the pilot occupying the left seat. The stopping position indicator should be usable by the pilots occupying both the left and right seats. The stopping position information provided by the indicator for a particular aircraft type shall account for the anticipated range of variations in pilot eye height and/or viewing angle.

The stopping position indicator shall show the stopping position for the aircraft for which guidance is being provided and shall provide closing rate information to enable the pilot to gradually decelerate the aircraft to a full stop at the intended stopping position.

The stopping position indicator should provide closing rate information over a distance of at least 10 m. When stopping guidance is indicated by colour change, green shall be used to show that the aircraft can proceed and red to show that the stop point has been reached ,except that for a short distance prior to the stop point a third colour may be used to warn that the stopping point is close.

5.2 Advanced visual docking guidance system

Note 1 — Advanced visual docking guidance systems (A-VDGS) include those systems that, in addition to basic and passive azimuth and stop position information, provide pilots with active (usually sensor-based) guidance information, such as aircraft type indication (in accordance with ICAO Document 8643), distance-to-go information and closing speed. Docking guidance information is usually provided on a single display unit.

Note 2 — An A-VDGS may provide docking guidance information in three stages: the acquisition of the aircraft by the system, the azimuth alignment of the aircraft, and the stopping position information.

An A-VDGS should be provided where it is operationally desirable to confirm the correct aircraft type for which guidance is being provided, and/or to indicate the stand centre line in use, where more than one is provided for.

The A-VDGS shall be suitable for use by all types of aircraft for which the aircraft stand is intended. The A-VDGS shall only be used in conditions in which its operational performance is specified.

Note 1.— The use of the A-VDGS in conditions such as weather, visibility, and background lighting both by day and night would need to be specified.

Note 2.— Care is required in both the design and on-site installation of the system to ensure that glare, reflection of sunlight, or other light in the vicinity, does not degrade the clarity and conspicuity of the visual cues provided by the system.

docking guidance information provided by an A-VDGS shall not conflict with that provided by a conventional visual docking guidance system on an aircraft stand if both types are provided and are in operational use. A method of indicating that the A-VDGS is not in operational use or unserviceable, shall be provided.

Location

The A-VDGS shall be located such that unobstructed and unambiguous guidance is provided to the person responsible for, and persons assisting, the docking of the aircraft throughout the docking manoeuvre.

Note.— Usually the pilot-in-command is responsible for the docking of the aircraft. However, in some circumstances, another person could be responsible and this person may be the driver of a vehicle that is towing the aircraft.

Characteristics

The A-VDGS shall provide, at minimum, the following guidance information at the appropriate stage of the docking manoeuvre:

a) an emergency stop indication;
b) the aircraft type and model for which the guidance is provided;
c) an indication of the lateral displacement of the aircraft relative to the stand centre line;
d) the direction of azimuth correction needed to correct a displacement from the stand centre line;
e) an indication of the distance to the stop position;
f) an indication when the aircraft has reached the correct stopping position; and
g) a warning indication if the aircraft goes beyond the appropriate stop position.

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

Note.— See the Aerodrome Design Manual, Part 4, for an indication of the maximum aircraft speeds relative to distance to the stopping position.

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

The information on displacement of the aircraft relative to the stand centre line and distance to the stopping position, when displayed, should be provided with the accuracy specified in Table 5.2.1

Table 5.2.1 Recommended displacement accuracy

Guidance information	max. deviation at stop position (stop area)	max. deviation at 9 m from stop position	max. deviation at 15 m from stop position	max. deviation at 25 m from stop position
Azimuth	±250 mm	±340 mm	±400 mm	±500 mm
Distance	±500 mm	±1000 mm	±1300 mm	Not specified

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

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

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

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

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

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

Throughout the docking manoeuvre, an appropriate means shall be provided on the AVDGS to indicate the need to bring the aircraft to an immediate halt. In such an event, which includes a failure of the A-VDGS, no other information shall be displayed.

Provision to initiate an immediate halt to the docking procedure shall be made available to personnel responsible for the operational safety of the stand.

The word “STOP” in red characters should be displayed when an immediate cessation of the docking manoeuvre is required

Chapter 6

Obstacle Lighting and Markings

1. General

1.1 Obstacles to air navigation are divided into two groups, namely Aerodrome Obstacles and En-route Obstacles. The following paragraphs outline the methods of marking and lighting obstacles in order that they may be readily identified.

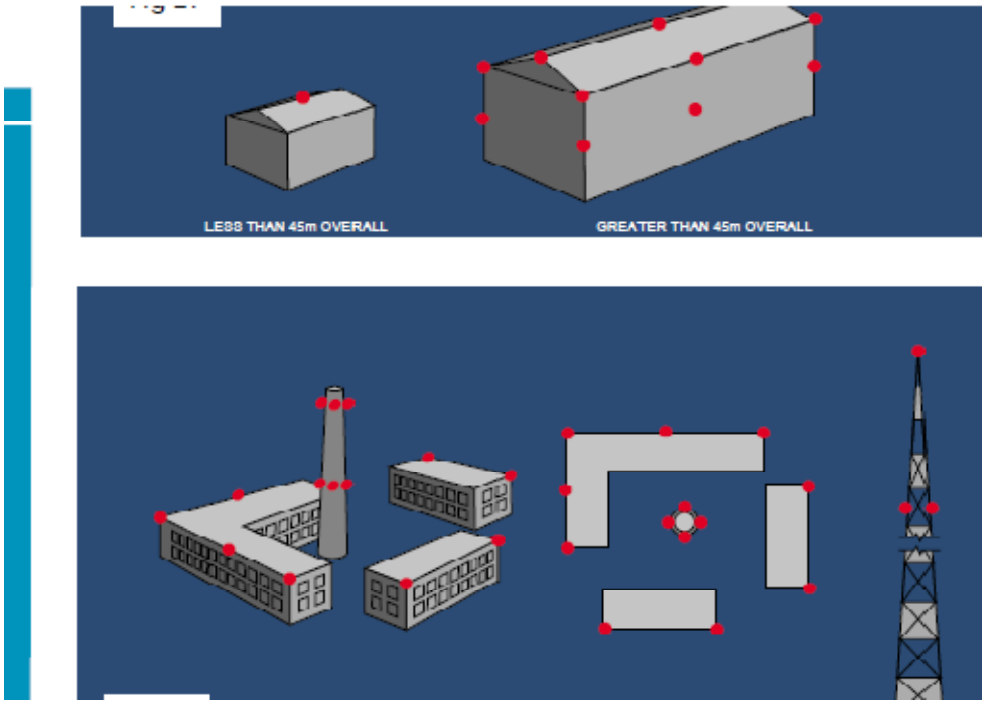
2. Aerodrome Obstacles

2.1 An aerodrome obstacle is one that is located on an area intended for the surface movement of an aircraft or that extends above a defined surface intended to protect aircraft in flight or exceeds 150 m height above ground, within a radius of up to 15 km of the aerodrome

2.2 All objects that are considered to be obstacles to aircraft in flight or maneuvering on the ground are normally lit at night and, where the obstacle is insufficiently conspicuous by day, marked in contrasting colours. Surface obstructions and areas of bad ground on aerodrome movement areas are marked by the use of coloured markers or flags. The methods of marking and lighting of aerodrome obstacles are described on Manual of Implementing standards (MOIS) chapter 10 and Advisory Circular ECAA-AC-AGA-015/2014.

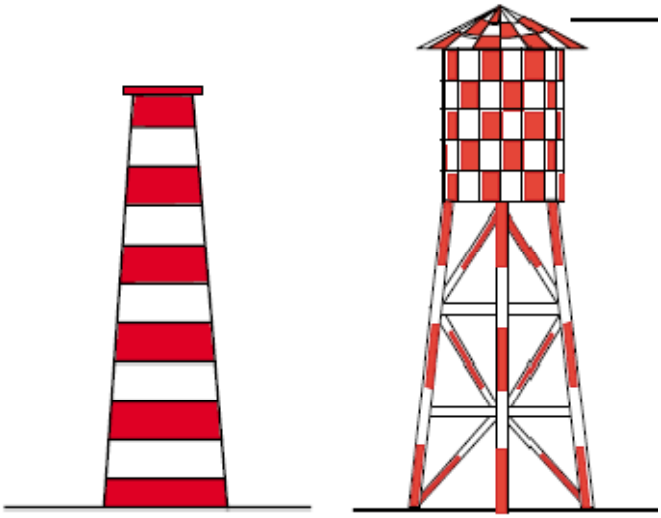
2.3 Lighting

2.3.1 Fixed obstacles of 45 m or less in height, width and length are normally lit by a single steady red light placed at the highest practicable point; those obstacles of greater size are normally provided with additional red lights in order to outline the extent of the obstruction. Surface obstructions and unserviceable parts of the movement area are normally delineated by portable red lights. Mobile obstacles such as vehicles and equipment frequently employed on the movement area normally display a yellow flashing light except that emergency service vehicles responding to an incident display flashing blue lights.



2.4 Marking

2.4.1 Where fixed obstacles are insufficiently conspicuous by day, they are normally marked either by alternating bands or by a chequered pattern of red or orange.



Chapter 7

Lighting

7.1 General

Lights which may endanger the safety of aircraft

A non-aeronautical ground light near an aerodrome which might endanger the safety of aircraft shall be extinguished, screened or otherwise modified so as to eliminate the source of danger.

Lights which may cause confusion

A non-aeronautical ground light which, by reason of its intensity, configuration or colour, might prevent, or cause confusion in, the clear interpretation of aeronautical ground lights should be extinguished, screened or otherwise modified so as to eliminate such a possibility. In particular, attention should be directed to a non-aeronautical ground light visible from the air within the areas described hereunder:

a) Instrument runway — code number 4: within the areas before the threshold and beyond the end of the runway extending at least 4500 m in length from the threshold and runway end and 750 m either side of the extended runway centre line in width.
b) Instrument runway — code number 2 or 3: as in a), except that the length should be at least 3000 m.
c) Instrument runway — code number 1; and non-instrument runway: within the approach area.

Light fixtures and supporting structures

Note — See the ICAO Aerodrome Design Manual, Part 6 for guidance on frangibility of light fixtures and supporting structures.

Elevated approach lights

Elevated approach lights and their supporting structures shall be frangible except that, in that portion of the approach lighting system beyond 300 m from the threshold:

a) where the height of a supporting structure exceeds 12 m, the frangibility requirement shall apply to the top 12 m only; and
b) Where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding objects shall be frangible.

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

Elevated lights

Elevated runway, stop way and taxiway lights shall be frangible. Their height shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

Surface lights

Light fixtures inset in the surface of runways, stop ways, taxiways and aprons shall be so designed and fitted as to withstand being run over by the wheels of an aircraft without damage either to the aircraft or to the lights themselves.

The temperature produced by conduction or radiation at the interface between an installed inset light and an aircraft tire should not exceed 160°C during a 10-minute period of exposure.

Note — Guidance on measuring the temperature of inset lights is given in the ICAO Aerodrome Design Manual, Part 4.

Light intensity and control

Note — In dusk or poor visibility conditions by day, lighting can be more effective than marking. For lights to be effective in such conditions or in poor visibility by night, they must be of adequate intensity. To obtain the required intensity, it will usually be necessary to make the light directional, in which case the arcs over which the light shows will have to be adequate and so orientated as to meet the operational requirements. The runway lighting system will have to be considered as a whole, to ensure that the relative light intensities are suitably matched to the same end. (See ICAO Annex 14 Vol. I, Attachment A, Section 14, and the ICAO Aerodrome Design Manual, Part 4)

The intensity of runway lighting shall be adequate for the minimum conditions of visibility and ambient light in which use of the runway is intended, and compatible with that of the nearest section of the approach lighting system when provided.

Note — While the lights of an approach lighting system may be of higher intensity than the runway lighting, it is good practice to avoid abrupt changes in intensity as these could give a pilot a false impression that the visibility is changing during approach.

Where a high-intensity lighting system is provided, a suitable intensity control shall be incorporated to allow for adjustment of the light intensity to meet the prevailing conditions. Separate intensity controls or other suitable methods shall be provided to ensure that the following systems, when installed, can be operated at compatible intensities:

— approach lighting system;
— runway edge lights;
— runway threshold lights; and
— runway end lights;

On the perimeter of and within the ellipse de firefrrning the main beam in ICAO Annex 14 Vol. I, Appendix 2, Figures A2-1 to A2-10, the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with ICAO Annex 14 Vol. I, Appendix 2, collective notes for Figures A2-1 to A2- 11, Note 2.

On the perimeter of and within the rectangle defining the main beam in ICAO Annex 14 Vol. I, Appendix 2, Figures A2-12 to A2-20, the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with ICAO Annex 14 Vol. I, Appendix 2, collective notes for Figures A2-12 to A2-21, Note 2.

7.2 Emergency lighting

At an aerodrome provided with runway lighting and without a secondary power supply, Sufficient emergency lights should be conveniently available for installation on at least the primary runway in the event of failure of the normal lighting system.

Note.— Emergency lighting may also be useful to mark obstacles or delineate taxiways and apron areas.

When installed on a runway the emergency lights should, as a minimum, conform to the configuration required for a non-instrument runway. The colour of the emergency lights should conform to the colour requirements for runway lighting, except that, where the provision of coloured lights at the threshold and the runway end is not practicable, all lights may be variable white or as close to variable white as practicable.

7.3 Aeronautical beacons

Where operationally necessary an aerodrome beacon or an identification beacon shall be provided at each aerodrome intended for use at night. The operational requirement shall be determined having regard to the requirements of the air traffic using the aerodrome, the conspicuity of the aerodrome features in relation to its surroundings and the installation of other visual and non-visual aids useful in locating the aerodrome.

7.3.1 Aerodrome beacon

An aerodrome beacon shall be provided at an aerodrome intended for use at night if one or more of the following conditions exist:

a) aircraft navigate predominantly by visual means;
b) reduced visibilities are frequent; or
c) it is difficult to locate the aerodrome from the air due to surrounding lights or terrain.

The aerodrome beacon shall be located on or adjacent to the aerodrome in an area of low ambient background lighting.

The location of the beacon should be such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land.

The aerodrome beacon shall show either coloured flashes alternating with white flashes, or white flashes only. The frequency of total flashes shall be from 20 to 30 per minute. Where used, the coloured flashes emitted by beacons at land aerodromes shall be green, and coloured flashes emitted by beacons at water aerodromes shall be yellow. In the case of a combined water and land aerodrome, coloured flashes, if used, shall have the colour characteristics of whichever section of the aerodrome is designated as the principal facility.

The light from the beacon shall show at all angles of azimuth. The vertical light distribution shall extend upwards from an elevation of not more than 1° to an elevation determined by the ECAA to be sufficient to provide guidance at the maximum elevation at which the beacon is intended to be used, and the effective intensity of the flash shall be not less than 2 000 cd.

Note.— At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.

7.3.2 Identification beacon

An identification beacon shall be provided at an aerodrome which is intended for use at night and cannot be easily identified from the air by other means.

The identification beacon shall be located on the aerodrome in an area of low ambient background lighting. The location of the beacon should be such that the beacon is not shielded by objects in significant directions and does not dazzle a pilot approaching to land.

An identification beacon at a land aerodrome shall show at all angles of azimuth. The vertical light distribution shall extend upwards from an elevation of not more than 1° to an elevation determined by the ECAA to be sufficient to provide guidance at the maximum elevation at which the beacon is intended to be used, and the effective intensity of the flash shall be not less than 2 000 cd.

Note.— At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.

An identification beacon shall show flashing-green at a land aerodrome and flashing-yellow at a water aerodrome. The identification characters shall be transmitted in the International Morse Code.

The speed of transmission should be between six and eight words per minute, the corresponding range of duration of the Morse dots being from 0.15 to 0.2 seconds per dot.

7.4 Approach lighting systems

- **Non-instrument runway**

Where physically practicable, a simple approach lighting system as specified in MOIS chapter 5 section 5.3.4.2 to 5.3.4.9 should be provided to serve a non-instrument runway where the code number is 3 or 4 and intended for use at night, except when the runway is used only in conditions of good visibility and sufficient guidance is provided by other visual aids.

Note. — A simple approach lighting system can also provide visual guidance by day.

- **Non-precision approach runway**

Where physically practicable, a simple approach lighting system as specified in MOIS chapter 5 section 5.3.4.2 to 5.3.4.9 shall be provided to serve a non-precision approach runway, except when the runway is used only in conditions of good visibility or sufficient guidance is provided by other visual aids.

Note.— It is advisable to give consideration to the installation of a precision approach category I lighting system or to the addition of a runway lead-in lighting system.

- **Precision approach runway category I**

Where physically practicable, a precision approach category I lighting system shall be provided to serve a precision approach runway category I.

- **Simple approach lighting system**

A simple approach lighting system shall consist of a row of lights on the extended centre line of the runway extending, whenever possible, over a distance of not less than 420 m from the threshold with a row of lights forming a crossbar 18 m or 30 m in length at a distance of 300 m from the threshold.

The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that, when a crossbar of 30 m is used, gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

Note 1. — Spacing's for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire fighting vehicles.

Note 2. — See ICAO Annex 14 Vol. I Attachment A, Section 11, for guidance on installation tolerances.

The lights forming the centre line shall be placed at longitudinal intervals of 60 m, except that, when it is desired to improve the guidance, an interval of 30 m may be used. The innermost light shall be located either 60 m or 30 m from the threshold, depending on the longitudinal interval selected for the centre line lights.

If it is not physically possible to provide a centre line extending for a distance of 420 m from the threshold, it should be extended to 300 m so as to include the crossbar. If this is not possible, the centre line lights should be extended as far as practicable, and each centre line light should then consist of a barrette at least 3 m in length. Subject to the approach system having a crossbar at 300 m from the threshold, an additional crossbar may be provided at 150 m from the threshold.

The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

The lights of a simple approach lighting system shall be fixed lights and the colour of the lights shall be such as to ensure that the system is readily distinguishable from other aeronautical ground lights, and from extraneous lighting if present. Each centre line light shall consist of either:

a) a single source; or
b) a barrette at least 3 m in length.

Note 1.— When the barrette as in b) is composed of lights approximating to point sources, a spacing of 1.5 m between adjacent lights in the barrette has been found satisfactory.

Note 2.— It may be advisable to use barrettes 4 m in length if it is anticipated that the simple approach lighting system will be developed into a precision approach lighting system.

Note 3.— At locations where identification of the simple approach lighting system is difficult at night due to surrounding lights, sequence flashing lights installed in the outer portion of the system may resolve this problem.

Where provided for a non-instrument runway, the lights should show at all angles in azimuth necessary to a pilot on base leg and final approach. The intensity of the lights should be adequate for all conditions of visibility and ambient light for which the system has been provided.

Where provided for a non-precision approach runway, the lights should show at all angles in azimuth necessary to the pilot of an aircraft which on final approach does not deviate by an abnormal amount from the path defined by the non-visual aid. The lights should be designed to provide guidance during both day and night in the most adverse conditions of visibility and ambient light for which it is intended that the system should remain usable.

- **Precision approach category I lighting system**

A precision approach category I lighting system shall consist of a row of lights on the extended centre line of the runway extending, wherever possible, over a distance of 900 m from the runway threshold with a row of lights forming a crossbar 30 m in length at a distance of 300 m from the runway threshold.

Note. — The installation of an approach lighting system of less than 900 m in length may result in operational limitations on the use of the runway. See ICAO Annex 14 vol. I Attachment A, Section 11.

The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

Note 1.— Spacing's for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire fighting vehicles.

Note 2.— See ICAO Annex 14 Vol. I Attachment A, Section 11, for guidance on installation tolerances.

The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold.

The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and

b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

The centre line and crossbar lights of a precision approach category I lighting system shall be fixed lights showing variable white. Each centre line light position shall consist of either:

a) a single light source in the innermost 300 m of the centre line, two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of the centre line to provide distance information; or

b) a barrette.

The serviceability level of the approach lights can be demonstrated, each centre line light position may consist of either:

a) a single light source; or

b) a barrette.

The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.

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

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

If the centre line consists of lights as described above, additional crossbars of lights to the crossbar provided at 300 m from the threshold shall be provided at 150 m, 450 m, 600 m and 750 m from the threshold. The lights forming each crossbar shall be as nearly as practicable in a

horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.
Note.— See Attachment A, Section 12, for detailed configuration.

Where the additional crossbars are incorporated in the system, the outer ends of the crossbars shall lie on two straight lines that either are parallel to the line of the centre line lights or converge to meet the runway centre line 300 m from threshold.

Note.— The flight path envelopes used in the design of these lights are given in Attachment A, Figure A-6.

7.5 Visual approach slope indicator systems

A visual approach slope indicator system shall be provided to serve the approach to a runway whether or not the runway is served by other visual approach aids or by non-visual aids, where one or more of the following conditions exist:

a) the runway is used by turbojet or other aeroplanes with similar approach guidance requirements;

b) the pilot of any type of aeroplane may have difficulty in judging the approach due to:

1) Inadequate visual guidance such as is experienced during an approach over water or featureless terrain by day or in the absence of sufficient extraneous lights in the approach area by night; or

2) Misleading information such as is produced by deceptive surrounding terrain or runway slopes;

c) the presence of objects in the approach area may involve serious hazard if an aeroplane descends below the normal approach path, particularly if there are no non-visual or other visual aids to give warning of such objects;

d) physical conditions at either end of the runway present a serious hazard in the event of an aeroplane undershooting or overrunning the runway; and

e) terrain or prevalent meteorological conditions are such that the aeroplane may be subjected to unusual turbulence during approach.

The standard visual approach slope indicator system shall consist of PAPI and APAPI.

❖ PAPI and APAPI

The PAPI system shall consist of a wing bar of 4 sharp transition multi-lamp (or paired single lamp) units equally spaced. The system shall be located on the left side of the runway unless it is physically impracticable to do so.

Note.— Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.

The APAPI system shall consist of a wing bar of 2 sharp transition multi-lamp (or paired single lamp) units. The system shall be located on the left side of the runway unless it is physically impracticable to do so.

Note.— Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.

The wing bar of a PAPI shall be constructed and arranged in such a manner that a pilot making an approach will:

a) when on or close to the approach slope, see the two units nearest the runway as red and the two units farthest from the runway as white;
b) when above the approach slope, see the one unit nearest the runway as red and the three units farthest from the runway as white; and when further above the approach slope, see all the units as white; and
c) when below the approach slope, see the three units nearest the runway as red and the unit farthest from the runway as white; and when further below the approach slope, see all the units as red.

The wing bar of an APAPI shall be constructed and arranged in such a manner that a pilot making an approach will:

a) when on or close to the approach slope, see the unit nearer the runway as red and the unit farther from the runway as white;
b) when above the approach slope, see both the units as white; and
c) when below the approach slope, see both the units as red.

❖ Sitting

The light units shall be located as in the basic configuration illustrated in Figure 7.1, subject to the installation tolerances given therein. The units forming a wing bar shall be mounted so as to

appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.

- **Characteristics of the light units**

The system shall be suitable for both day and night operations. The colour transition from red to white in the vertical plane shall be such as to appear to an observer, at a distance of not less than 300 m, to occur within a vertical angle of not more than 3′. At full intensity the red light shall have a Y coordinate not exceeding 0.320. The light intensity distribution of the light units shall be as shown in ICAO Annex 14 Vol. I Appendix 2, Figure A2-23.

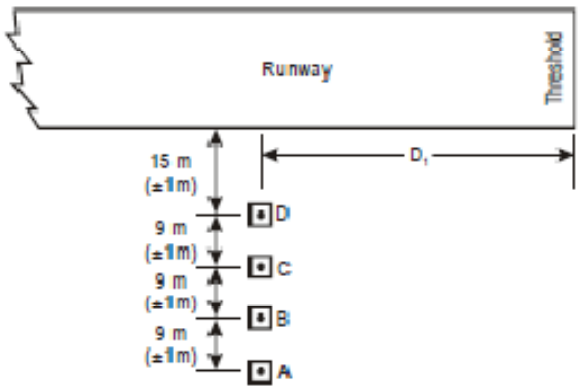
Note.— See the Aerodrome Design Manual (Doc 9157), Part 4, for additional guidance on the characteristics of light unit Suitable intensity control shall be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

Each light unit shall be capable of adjustment in elevation so that the lower limit of the white part of the beam may be fixed at any desired angle of elevation between 1°30′ and at least 4°30′ above the horizontal.

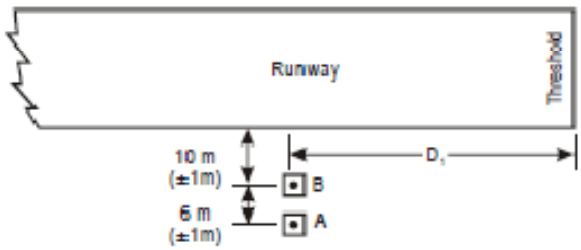
The light units shall be so designed that deposits of condensation, snow, ice, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall not affect the contrast between the red and white signals and the elevation of the transition sector.

- **Approach slope and elevation setting of light units**

The approach slope as defined in Figure 7.2 shall be appropriate for use by the aeroplanes using the approach. When the runway is equipped with an ILS and/or MLS, the sitting and the angle of elevation of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.



Typical PAPI wing bar



Typical APAPI wing bar

INSTALLATION TOLERANCES

a) Where a PAPI or APAPI is installed on a runway not equipped with an ILS or MLS, the distance D_1 shall be calculated to ensure that the lowest height at which a pilot will see a correct approach path indication (Figure 5-20, angle B for a PAPI and angle A for an APAPI) provides the wheel clearance over the threshold specified in Table 5-2 for the most demanding amongst aeroplanes regularly using the runway.

b) Where a PAPI or APAPI is installed on a runway equipped with an ILS and/or MLS, the distance D_1 shall be calculated to provide the optimum compatibility between the visual and non-visual aids for the range of eye-to-antenna heights of the aeroplanes regularly using the runway. The distance shall be equal to that between the threshold and the effective origin of the ILS glide path or MLS minimum glide path, as appropriate, plus a correction factor for the variation of eye-to-antenna heights of the aeroplanes concerned. The correction factor is obtained by multiplying the average eye-to-antenna height of those aeroplanes by the cotangent of the approach angle. However, the distance shall be such that in no case will the wheel clearance over the threshold be lower than that specified in column (3) of Table 5-2.

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

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

d) Distance D_1 shall be adjusted to compensate for differences in elevation between the lens centres of the light units and the threshold.

e) To ensure that units are mounted as low as possible and to allow for any transverse slope, small height adjustments of up to 5 cm between units are acceptable. A lateral gradient not greater that 1.25 per cent can be accepted provided it is uniformly applied across the units.

f) A spacing of 6 m (±1 m) between PAPI units should be used on code numbers 1 and 2. In such an event, the inner PAPI unit shall be located not less than 10 m (±1 m) from the runway edge.

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

g) The lateral spacing between APAPI units may be increased to 9 m (±1 m) if greater range is required or later conversion to a full PAPI is anticipated. In the latter case, the inner APAPI unit shall be located 15 m (±1 m) from the runway edge.

Fig. 7.1 sitting of PAPI and APAPI

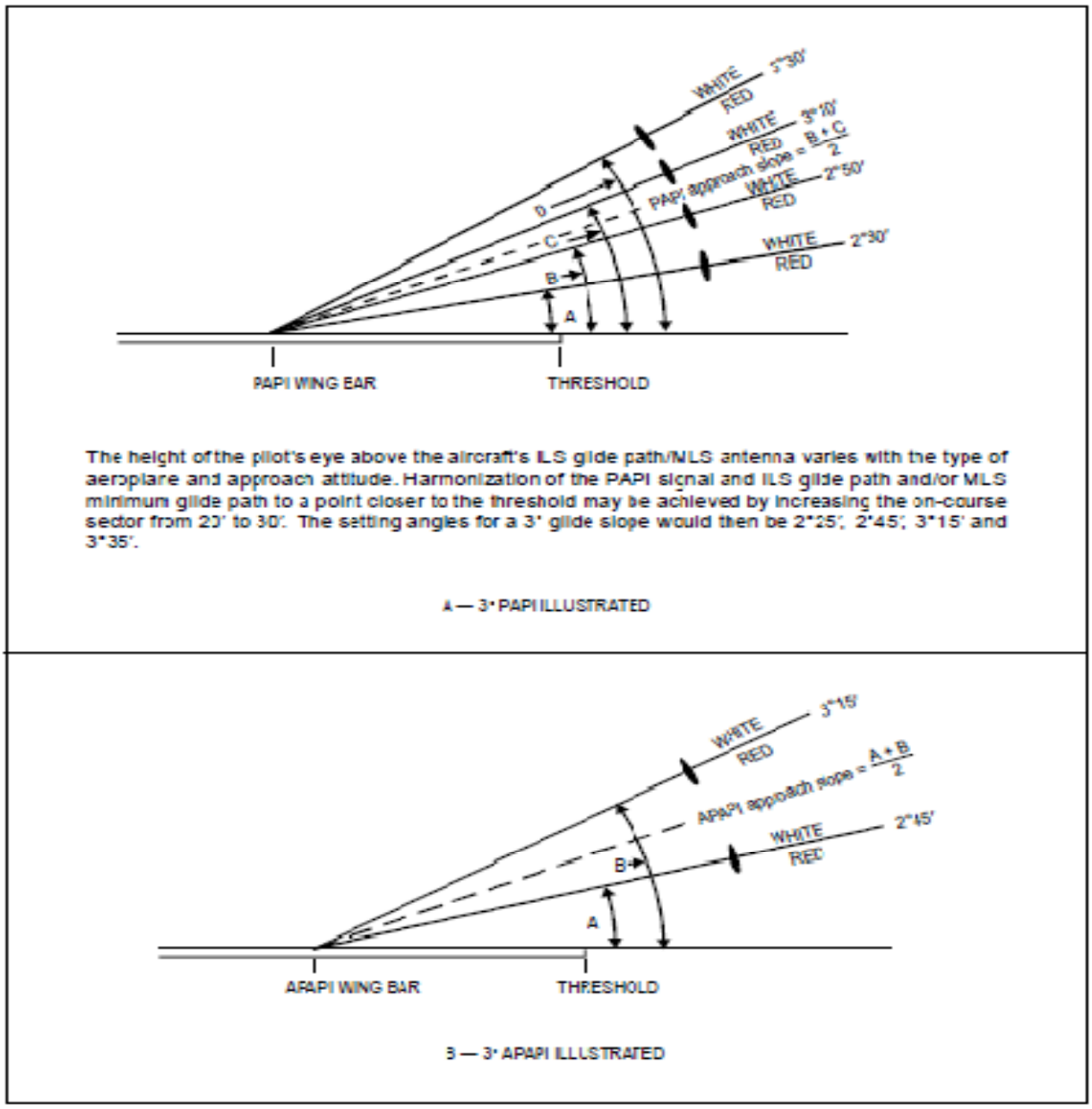


Fig.7.2 Light beams and angle of elevation setting of PAPI and APAPI

The angle of elevation settings of the light units in a PAPI wing bar shall be such that, during an approach, the pilot of an aeroplane observing a signal of one white and three reds will clear all objects in the approach area by a safe margin

The angle of elevation settings of the light units in an APAPI wing bar shall be such that, during an approach, the pilot of an aeroplane observing the lowest on slope signal, i.e. one white and one red will clear all objects in the approach area by a safe margin.

The azimuth spread of the light beam shall be suitably restricted where an object located outside the obstacle protection surface of the PAPI or APAPI system, but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and an aeronautical study indicates that the object could adversely affect the safety of operations. The extent of the restriction shall be such that the object remains outside the confines of the light beam.

Where wing bars are installed on each side of the runway to provide roll guidance, corresponding units shall be set at the same angle so that the signals of each wing bar change symmetrically at the same time.

- **Obstacle protection surface**

Note. — The following specifications apply to PAPI and APAPI. An obstacle protection surface shall be established when it is intended to provide a visual approach slope indicator system.

The characteristics of the obstacle protection surface, i.e. origin, divergence, length and slope, shall correspond to those specified in the relevant column of Table 7.2 and in Figure 7.3.

New objects or extensions of existing objects shall not be permitted above an obstacle protection surface except when, in the opinion of the ECAA, the new object or extension would be shielded by an existing immovable object.

Existing objects above an obstacle protection surface shall be removed except when, in the opinion of the ECAA, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety of operations of aeroplanes.

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

a) suitably raise the approach slope of the system;

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

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

d) suitably displace the threshold; and

e) where d) is found to be impracticable, suitably displace the system upwind of the threshold to provide an increase in threshold crossing height equal to the height of the object penetration.

Eye-to-wheel height of aeroplane in the approach configuration[a]	Desired wheel clearance (metres)[b,c]	Minimum wheel clearance (metres)[d]
(1)	(2)	(3)
up to but not including 3 m	6	3[e]
3 m up to but not including 5 m	9	4
5 m up to but not including 8 m	9	5
8 m up to but not including 14 m	9	6

a. In selecting the eye-to-wheel height group, only aeroplanes meant to use the system on a regular basis shall be considered. The most demanding amongst such aeroplanes shall determine the eye-to-wheel height group.
b. Where practicable the desired wheel clearances shown in column (2) shall be provided.
c. The wheel clearances in column (2) may be reduced to no less than those in column (3) where an aeronautical study indicates that such reduced wheel clearances are acceptable.
d. When a reduced wheel clearance is provided at a displaced threshold it shall be ensured that the corresponding desired wheel clearance specified in column (2) will be available when an aeroplane at the top end of the eye-to-wheel height group chosen overflies the extremity of the runway.
e. This wheel clearance maybe reduced to 1.5 m on runways used mainly by light-weight non-turbojet aeroplanes.

Table 7.1

	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 threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%
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 Figure 5-20.

Table 7.2

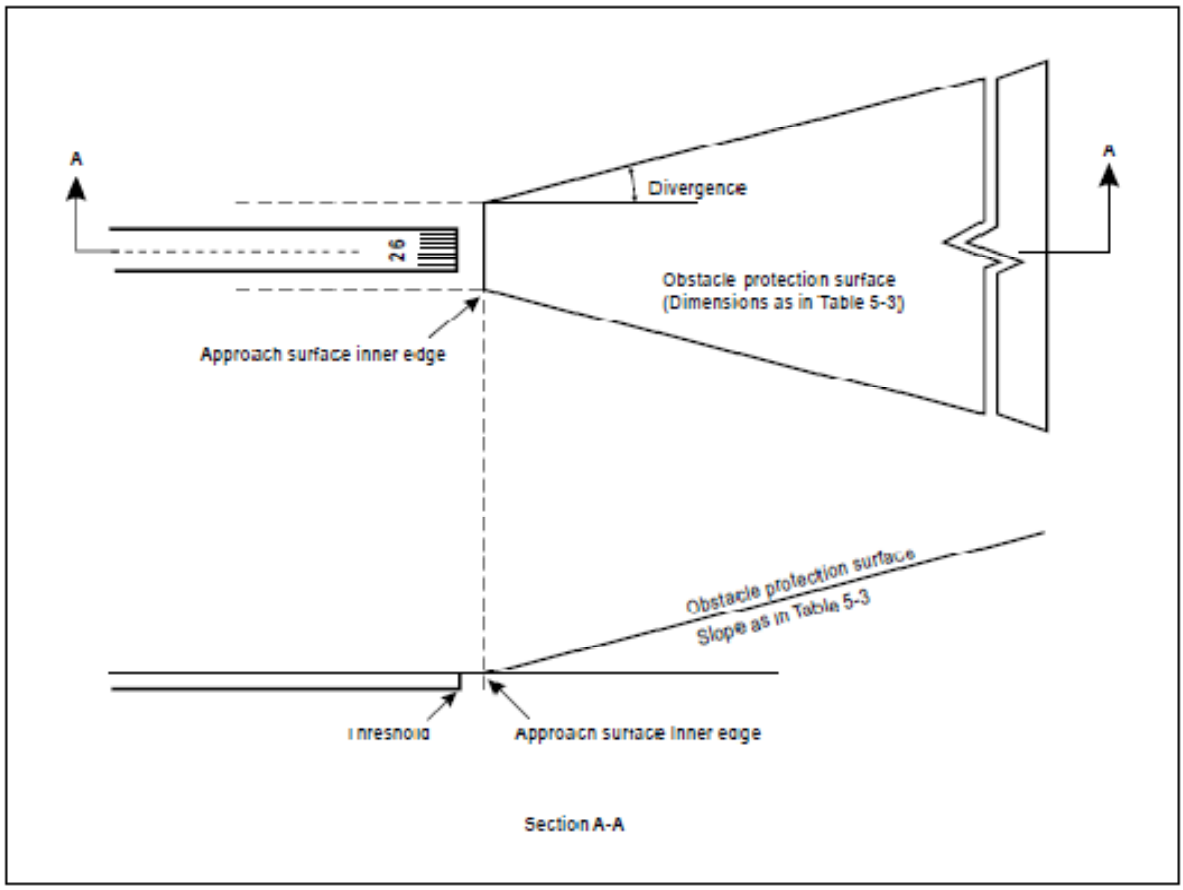


Fig 7.3

7.6 Circling guidance lights

Circling guidance lights should be provided when existing approach and runway lighting systems do not satisfactorily permit identification of the runway and/or approach area to a circling aircraft in the conditions for which it is intended the runway be used for circling approaches.

Location

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

a) join the downwind leg or align and adjust the aircraft's track to the runway at a required distance from it and to distinguish the threshold in passing; and
b) keep in sight the runway threshold and/or other features which will make it possible to judge the turn on to base leg and final approach, taking into account the guidance provided by other visual aids.

Circling guidance lights should consist of:

a) lights indicating the extended centre line of the runway and/or parts of any approach lighting system; or

b) lights indicating the position of the runway threshold; or

c) lights indicating the direction or location of the runway;

or a combination of such lights as is appropriate to the runway under consideration.

Circling guidance lights should be fixed or flashing lights of an intensity and beam spread adequate for the conditions of visibility and ambient light in which it is intended to make visual circling approaches. The flashing lights should be white, and the steady lights either white or gaseous discharge lights. The lights should be designed and be installed in such a manner that they will not dazzle or confuse a pilot when approaching to land, taking off or taxiing.

7.7 Runway lead-in lighting systems

A runway lead-in lighting system should be provided where it is desired to provide visual Guidance along a specific approach path, for reasons such as avoiding hazardous terrain or for purposes of noise abatement.

A runway lead-in lighting system should consist of groups of lights positioned so as to define the desired approach path and so that one group may be sighted from the preceding group. The interval between adjacent groups should not exceed approximately 1 600 m.

Note. — Runway lead-in lighting systems may be curved, straight or a combination thereof.

A runway lead-in lighting system should extend from a point as determined by the ECAA, up to a point where the approach lighting system, if provided, or the runway or the runway lighting system is in view.

Each group of lights of a runway lead-in lighting system should consist of at least three Flashing lights in a linear or cluster configuration. The system may be augmented by steady burning lights where such lights would assist in identifying the system.

The flashing lights should be white, and the steady burning lights gaseous discharge lights. Where practicable, the flashing lights in each group should flash in sequence towards the runway.

7.8 Runway threshold identification lights

Runway threshold identification lights should be installed:

a) at the threshold of a non-precision approach runway when additional threshold conspicuity is necessary or where it is not practicable to provide other approach lighting aids; and

b) where a runway threshold is permanently displaced from the runway extremity or temporarily displaced from the normal position and additional threshold conspicuity is necessary.

Runway threshold identification lights shall be located symmetrically about the runway centre line, in line with the threshold and approximately 10 m outside each line of runway edge lights.

Runway threshold identification lights should be flashing white lights with a flash frequency between 60 and 120 per minute. The lights shall be visible only in the direction of approach to the runway.

7.9 Runway edge lights

Runway edge lights shall be provided for a runway intended for use at night or for a precision approach runway intended for use by day or night.

Runway edge lights should be provided on a runway intended for take-off with an operating minimum below an RVR of the order of 800 m by day.

Runway edge lights shall be placed along the full length of the runway and shall be in two parallel rows equidistant from the centre line.

Runway edge lights shall be placed along the edges of the area declared for use as the runway or outside the edges of the area at a distance of not more than 3 m.

Where the width of the area which could be declared as runway exceeds 60 m, the distance between the rows of lights should be determined taking into account the nature of the operations, the light distribution characteristics of the runway edge lights, and other visual aids serving the runway.

The lights shall be uniformly spaced in rows at intervals of not more than 60 m for an instrument runway, and at intervals of not more than 100 m for a non-instrument runway. The lights on opposite sides of the runway axis shall be on lines at right angles to that axis. At intersections of

runways, lights may be spaced irregularly or omitted, provided that adequate guidance remains available to the pilot.

Runway edge lights shall be fixed lights showing variable white, except that:

a) in the case of a displaced threshold, the lights between the beginning of the runway and the displaced threshold shall show red in the approach direction; and

b) a section of the lights 600 m or one-third of the runway length, whichever is the less, at the remote end of the runway from the end at which the take-off run is started, may show yellow.

The runway edge lights shall show at all angles in azimuth necessary to provide guidance to a pilot landing or taking off in either direction. When the runway edge lights are intended to provide circling guidance, they shall show at all angles in azimuth

In all angles of azimuth required in MOIS 9.2.3.9.8, runway edge lights shall show at angles up to 15° above the horizontal with intensity adequate for the conditions of visibility and ambient light in which use of the runway for take-off or landing is intended. In any case, the intensity shall be at least 50 cd except that at an aerodrome without extraneous lighting, the intensity of the lights may be reduced to not less than 25 cd to avoid dazzling the pilot.

7.10 Runway end lights

Runway end lights shall be provided for a runway equipped with runway edge lights.

Note.— When the threshold is at the runway extremity, fittings serving as threshold lights may be used as runway end lights.

Runway end lights shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3 m outside the end.

Runway end lighting should consist of at least six lights. The lights should be either:

a) Equally spaced between the rows of runway edge lights; or

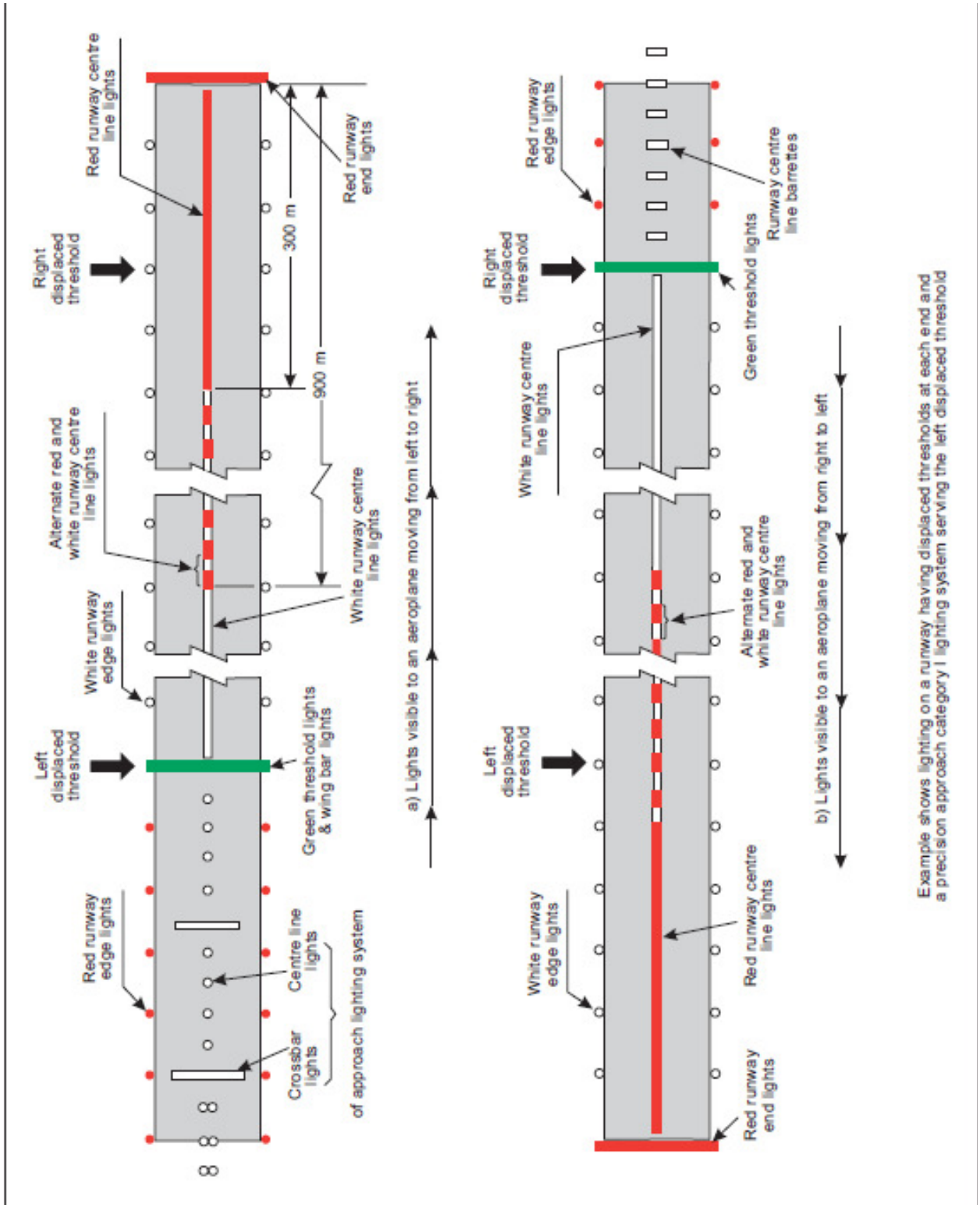
b) Symmetrically disposed about the runway centre line in two groups with the lights uniformly spaced in each group and with a gap between the groups of not more than half the distance between the rows of runway edge lights.

7.11 Stop way lights

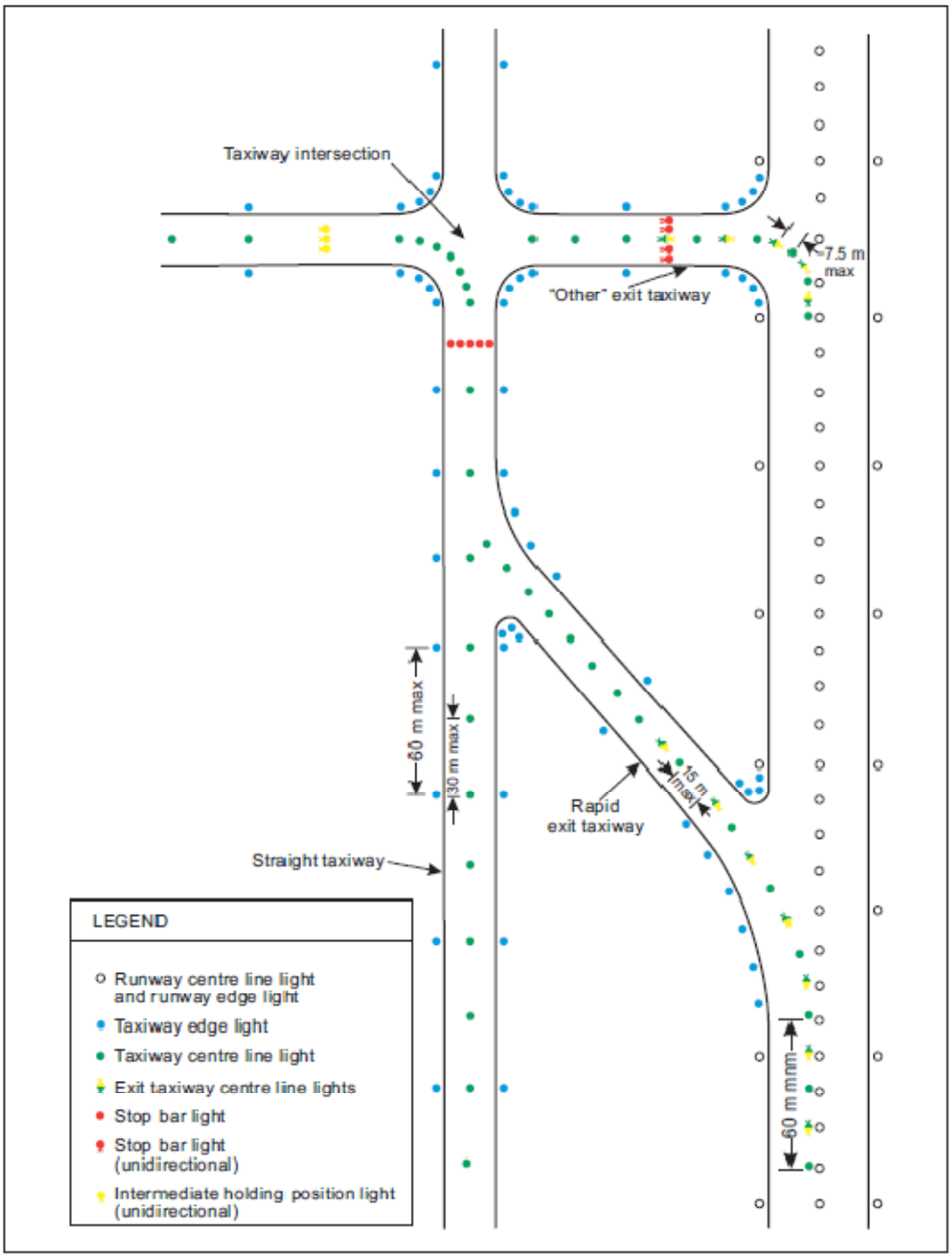
Stop way lights shall be provided for a stop way intended for use at night. Stop way lights shall be placed along the full length of the stop way and shall be in two parallel rows that are

equidistant from the centre line and coincident with the rows of the runway edge lights. Stop way lights shall also be provided across the end of a stop way on a line at right angles to the stop way axis as near to the end of the stop way as possible and, in any Case, not more than 3 m outside the end.

Stop way lights shall be fixed unidirectional lights showing red in the direction of the runway.



Example of approach and runway lighting for runway with displaced thresholds



Taxiway lighting

7.12 Taxiway edge lights

Taxiway edge lights shall be provided at the edges of a runway turn pad, taxiway edge, holding bay, apron, etc., intended for use at night and on a taxiway not provided with taxiway centre line lights and intended for use at night, except that taxiway edge lights need not be provided where, considering the nature of the operations, adequate guidance can be achieved by surface illumination or other means.

Taxiway edge lights shall be provided on a runway forming part of a standard taxi-route and intended for taxiing at night where the runway is not provided with taxiway centre line lights.

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

Taxiway edge lights on a holding bay, apron, etc., should be spaced at uniform longitudinal intervals of not more than 60 m.

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

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

Taxiway edge lights shall be fixed lights showing blue. The lights shall show up to at least 75° above the horizontal and at all angles in azimuth necessary to provide guidance to a pilot taxiing in either direction. At an intersection, exit or curve the lights shall be shielded as far as practicable so that they cannot be seen in angles of azimuth in which they may be confused with other lights.

The intensity of taxiway edge lights shall be at least 2 cd from 0° to 6° vertical, and 0.2 cd at any vertical angles between 6° and 75°.

7.13 Run Way Guad Light

Runway guard lights, Configuration A, shall be provided at each taxiway/runway intersection associated with a runway intended for use in:

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

b) runway visual range conditions of values between 550 m and 1 200 m where the traffic density is heavy.

Runway guard lights, Configuration A, should be provided at each taxiway/runway intersection associated with a runway intended for use in:

a) runway visual range conditions of values less than a value of 550 m where a stop bar is installed; and

b) runway visual range conditions of values between 550 m and 1 200 m where the traffic density is medium or light.

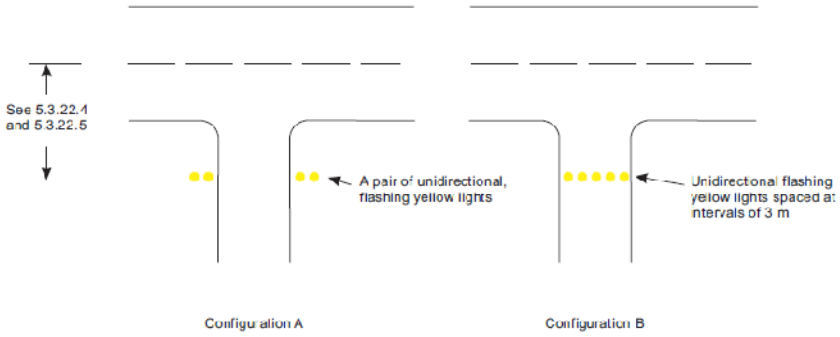
Runway guard lights, Configuration A or Configuration B or both, should be provided at each taxiway/runway intersection where enhanced conspicuity of the taxiway/runway intersection is needed, such as on a wide-throat taxiway, except that Configuration B should not be collocated with a stop bar.

Runway guard lights, Configuration A, shall consist of two pairs of yellow lights. Where there is a need to enhance the contrast between the on and off state of runway guard lights, Configuration A, intended for use during the day, a visor of sufficient size to prevent sunlight from entering the lens without interfering with the function of the fixture should be located above each lamp.

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

Runway guard lights, Configuration B, shall consist of yellow lights spaced at intervals of 3 m across the taxiway. The light beam shall be unidirectional and aligned so as to be visible to the pilot of an aeroplane taxiing to the holding position.

Where runway guard lights are intended for use during the day, the intensity in yellow light and beam spreads of lights of Configuration A should be in accordance with the specifications in MOIS.



Runway guard light

7.14 Apron floodlighting

Apron floodlighting should be provided on an apron, and on a designated isolated aircraft parking position intended to be used at night.

Apron floodlights should be located so as to provide adequate illumination on all apron Service areas, with a minimum of glare to pilots of aircraft in flight and on the ground, aerodrome and apron controllers, and personnel on the apron. The arrangement and aiming of floodlights should be such that an aircraft stand receives light from two or more directions to minimize shadows.

The spectral distribution of apron floodlights shall be such that the colours used for aircraft marking connected with routine servicing, and for surface and obstacle marking, can be correctly identified.

The average luminance should be at least the following:

Aircraft stand:
— Horizontal luminance — 20 lux with a uniformity ratio (average to minimum) of not more than 4 to 1; and
— Vertical luminance — 20 lux at a height of 2 m above the apron in relevant directions.
Other apron areas:
— Horizontal luminance — 50 per cent of the average luminance on the aircraft stands with a uniformity ratio (average to minimum) of not more than 4 to 1.