THE NETHERLANDS
MILITARY AVIATION REGULATIONS

CERTIFICATION SPECIFICATIONS
for Military Aerodrome Design

NLD-MAR-ADR
CS-ADR-DSN

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MILITARY AVIATION AUTHORITY
THE NETHERLANDS (MAA-NLD)

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Notes:

1. This CS-ADR-DSN part of NLD-MAR-ADR document is a derivative from the EASA CS-ADR-DSN, Issue 6, dated 29 March 2022, and is kept as close as possible to the original text. Additions, changes or deletions are applied by the MAA-NLD based only on military operational specificities. Military operational specificities are supported by specific national legislation, NATO Standardisation Agreements (STANAGs) and/or internal documents of the Netherlands Ministry of Defense. In case there are compelling budgetary or technical constraints (including capacity), (temporary) preventing implementation, the MAA-NLD and the Sector will determine together whether application of the specification is proportionate. The aim however should always be to deliver a level of safety and interoperability with civil systems that is as effective as that resulting from the application of the essential requirements set out in Annexes V this Regulation, as required through the Regulation (EU) 2018/1139

2. The following choices where made whilst creating this CS-ADR-DSN part of the NLD-MAR-ADR:

a. EASA specifications are used verbatim if the applicability is identical in the military context;

b. Specific military deviations from the EASA CS-ADR-DSN that are applicable to more than one military aerodrome are added in this CS-ADR-DSN part of the NLD-MAR-ADR;

c. Specific military deviations from the EASA CS-ADR-DSN that are applicable at one military aerodrome only, can be filled as Deviation Acceptance and Action Document (DAAD), Special Condition (SC) or Equivalent Level of Safety (ELoS).

d. EASA specifications are deleted when there is no relevance in the military (and/or civil co-use) context, as long as it has no adverse effect on the level of safety and interoperability;

3. The numbering of the paragraphs in this CS-ADR-DSN is identical to the numbering of the EASA CS-ADR-DSN, Issue 6. For military specific additions numbers are chosen that do not exist in the EASA document. If EASA text is deleted the word *Reserved* is inserted to indicate that numbering should not be used for other purposes also providing the complete picture.

4. This CS-ADR-DSN part of NLD-MAR-ADR relies on definitions laid down in NLD-MAD-1. The Forms referred to in this document are published on the MAA-NLD Intranet and Internet.

Contents

CS-ADR-DSN.A.001 Applicability

The certification specifications (CSs) and the related guidance material (GM) are applicable to military aerodromes that fall within the scope of this Regulation.

CS-ADR-DSN.A.005 Aerodrome reference code (ARC)

(+ GM)

(a) An aerodrome reference code, consisting of a code number and letter which is selected for aerodrome planning purposes, should be determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended.
(b) The aerodrome reference code numbers and letters should have the meanings assigned to them in Table A-1.
(c) The code number for element 1 should be determined from Table A-1, by selecting the code number corresponding to the highest value of the aeroplane reference field lengths of the aeroplanes for which the runway is intended. The determination of the aeroplane reference field length is solely for the selection of a code number and is not intended to influence the actual runway length provided.
(d) The code letter for element 2 should be determined from Table A-1, by selecting the code letter which corresponds to the greatest wingspan of the aeroplanes for which the facility is intended.

Code element 1	
Code number	*Aeroplane reference field length*
1	Less than 800 m
2	800 m up to but not including 1 200 m
3	1 200 m up to but not including 1 800 m
4	1 800 m and over

Code element 2	
Code letter	*Wingspan*
A	Up to but not including 15 m
B	15 m up to but not including 24 m
C	24 m up to but not including 36 m
D	36 m up to but not including 52 m
E	52 m up to but not including 65 m
F	65 m up to but not including 80 m

Table A-1

CS-ADR-DSN.B.030 Runway threshold

(+ GM)

(a) A threshold should be provided on a runway.
(b) A threshold needs not to be provided on a take-off runway.
(c) A threshold should be located at the extremity of a runway unless operational considerations justify the choice of another location.
(d) When it is necessary to displace a threshold, either permanently or temporarily, from its normal location, account should be taken of the various factors which may have a bearing on the location of the threshold.
(e) When the threshold is displaced, the threshold location should be measured at the inner edge of the threshold marking (the transverse stripe across the runway).

CS-ADR-DSN.B.035 Length of runway and declared distances

(+ GM)

(a) The length of a runway should provide declared distances adequate to meet the operational requirements for the aircraft which the runway is intended to serve.
(b) The following distances should be calculated to the nearest metre for each runway:
  (1) Take-off run available;
  (2) Take-off distance available;
  (3) Accelerate-stop distance available; and
  (4) Landing distance available.
(c) The length of the runway is measured from the start of the runway pavement or where a transverse stripe marking is provided to indicate threshold displacement, at the inner edge of the transverse stripe across the runway.

CS-ADR-DSN.B.040 Runways with stopways or clearways

(+ GM)

The length(s) of a stopway or clearway, where provided, should be of adequate distance to meet the operational requirements for the aircraft which the runway is intended to serve.

CS-ADR-DSN.B.045 Width of runways

(+ GM)

(a) The width of a runway should be not less than the appropriate dimension specified in the Table B-1.

Code number	**Outer Main Gear Wheel Span (OMGWS)**			
	Up to but not including 4.5 m	**4.5 m up to but not including 6 m**	**6 m up to but not including 9 m**	**9 m up to but not including 15 m**
1[a]	18 m	18 m	23 m	—
2[a]	23 m	23 m	30 m	—
3	30 m	30 m	30 m	45 m
4	—	—	45 m	45 m
[a] *The width of a precision approach runway should be not less than 30 m where the code number is 1 or 2.*				

Table B-1

(b) The width of the runway should be measured at the outside edge of the runway side stripe marking where provided, or the edge of the runway.

CS-ADR-DSN.B.050 Minimum distance between parallel non-instrument runways

(+ GM)

(a) Where parallel non-instrument runways are intended for simultaneous use, the minimum distance

between their centre lines should be:
(1) 210 m where the higher code number is 3 or 4;
(2) 150 m where the higher code number is 2; and
(3) 120 m where the higher code number is 1.

CS-ADR-DSN.B.055 Minimum distance between parallel instrument runways

(a) Where parallel instrument runways are intended for simultaneous use, the minimum distance between their centre lines should be:
(1) 1 035 m for independent parallel approaches;
(2) 915 m for dependent parallel approaches;
(3) 760 m for independent parallel departures; and
(4) 760 m for segregated parallel operations.
(b) Apart from provided in (a) above, for segregated parallel operations the specified minimum distance:
(1) may be decreased by 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m; and
(2) should be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft.
(c) Other combinations of minimum distances should apply taking into account ATM and operational aspects.

CS-ADR-DSN.B.060 Longitudinal slopes of runways

(a) The safety objective of limiting the longitudinal runway slope is to enable stabilized and safe use of runway by an aircraft.
(b) The slope computed by dividing the difference between the maximum and minimum elevation along the runway centre line by the runway length should not exceed:
(1) 1 % where the code number is 3 or 4; and
(2) 2 % where the code number is 1 or 2.
(c) Along no portion of a runway should the longitudinal slope exceed:
(1) 1.25 % where the code number is 4, except that for the first and last quarter of the length of the runway where the longitudinal slope should not exceed 0.8 %;
(2) 1.5 % where the code number is 3, except that for the first and last quarter of the length of a precision approach runway Category II or III where the longitudinal slope should not exceed 0.8 %; and
(3) 2 % where the code number is 1 or 2.

CS-ADR-DSN.B.065 Longitudinal slope changes on runways
(+ GM)

(a) The safety objective of limiting the longitudinal runway slope changes is to avoid damage of aircraft and to enable safe use of runway by an aircraft.
(b) Where slope changes cannot be avoided, a slope change between two consecutive slopes should not exceed:
(1) 1.5 % where the code number is 3 or 4; and
(2) 2 % where the code number is 1 or 2.
(c) The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding:
(1) 0.1 % per 30 m (minimum radius of curvature of 30 000 m) where the code number is 4;
(2) 0.2 % per 30 m (minimum radius of curvature of 15 000 m) where the code number is 3; and
(3) 0.4 % per 30 m (minimum radius of curvature of 7 500 m) where the code number is 1 or 2.

CS-ADR-DSN.B.070 Sight distance for slopes on runways
(+ GM)

(a) The safety objective of minimum runway sight distance values is to achieve the necessary visibility to enable safe use of runway by an aircraft.
(b) Where slope changes on runways cannot be avoided, they should be such that there should be an

unobstructed line of sight from:
(1) any point 3 m above a runway to all other points 3 m above the runway within a distance of at least half the length of the runway where the code letter is C, D, E, or F;
(2) any point 2 m above a runway to all other points 2 m above the runway within a distance of at least half the length of the runway where the code letter is B; and
(3) any point 1.5 m above a runway to all other points 1.5 m above the runway within a distance of at least half the length of the runway where the code letter is A.

CS-ADR-DSN.B.075 Distance between slope changes on runways

(+ GM)

Undulations or appreciable changes in slopes located close together along a runway should be avoided. The distance between the points of intersection of two successive curves should not be less than:
(a) the sum of the absolute numerical values of the corresponding slope changes multiplied by the appropriate value as follows:
(1) 30 000 m where the code number is 4;
(2) 15 000 m where the code number is 3; and
(3) 5 000 m where the code number is 1 or 2; or
(b) 45 m;
whichever is greater.

CS-ADR-DSN.B.080 Transverse slopes on runways

(a) The safety objective of runway transverse slopes is to promote the most rapid drainage of water from the runway.
(b) To promote the most rapid drainage of water, the runway surface should be cambered, except where a single crossfall from high to low in the direction of the wind most frequently associated with rain would ensure rapid drainage. The transverse slope should be:
(1) not less than 1 % and not more than 1.5 % where the code letter is C, D, E or F; and;
(2) not less than 1 % and not more than 2 % where the code letter is A or B;
except at runway or taxiway intersections where flatter slopes may be necessary.
(c) For a cambered surface, the transverse slope on each side of the centre line should be symmetrical.
(d) The transverse slope should be substantially the same throughout the length of a runway except at an intersection with another runway or a taxiway where an even transition should be provided taking account of the need for adequate drainage.

CS-ADR-DSN.B.085 Runway strength

(+ GM)

The runway should be of sufficient strength to support normal operations of the most demanding aircraft without risk of damage either to the aeroplane or the runway.

CS-ADR-DSN.B.090 Surface of runways

(a) The surface of a runway should be constructed without irregularities that would impair the runway surface friction characteristics or otherwise adversely affect the take-off or landing of an aeroplane.
(b) A paved runway should be so constructed or resurfaced as to provide surface friction characteristics at or above the minimum friction level.
(c) The average surface texture depth of a new surface should be not less than 1.0 mm.
(d) When the surface is grooved or scored, the grooves or scorings should be either perpendicular to the runway centre line or parallel to non-perpendicular transverse joints where applicable.

CS-ADR-DSN.B.095 Runway turn pads

(a) The safety objective of the runway turn pad is to facilitate a safe 180-degree turn by aeroplanes on runway ends that are not served by a taxiway or taxiway turnaround.

(b) Where the end of a runway is not served by a taxiway or a taxiway turnaround, and if required, a runway turn pad should be provided to facilitate a 180-degree turn of aeroplanes.
(c) The design of a runway turn pad should be such that when the cockpit of the most demanding aircraft for which the turn pad is intended remains over the turn pad marking, the clearance distance between any wheel of the aeroplane landing gear and the edge of the turn pad should be not less than that given by the following tabulation:

Clearance	**Outer Main Gear Wheel Span (OMGWS)**			
	Up to but not including 4.5 m	**4.5 m up to but not including 6 m**	**6 m up to but not including 9 m**	**9 m up to but not including 15 m**
	1.50 m	2.25 m	3m[a] or 4 m[b]	4 m
a if the turn pad is intended to be used by aeroplanes with a wheel base less than 18 m. b if the turn pad is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.				
Note: Wheel base means the distance from the nose gear to the geometric centre of the main gear.				

(d) The runway turn pad should be located on either the left or right side of the runway and adjoining the runway pavement at both ends of the runway and at some intermediate locations where deemed necessary.
(e) The intersection angle of the runway turn pad with the runway should not exceed 30 degrees.
(f) The nose wheel steering angle to be used in the design of the runway turn pad should not exceed 45 degrees.

CS-ADR-DSN.B.100 Slopes on runway turn pads

The longitudinal and transverse slopes on a runway turn pad should be sufficient to prevent the accumulation of water on the surface and facilitate rapid drainage of surface water. The slopes should be the same as those on the adjacent runway pavement surface.

CS-ADR-DSN.B.105 Strength of runway turn pads

The strength of a runway turn pad should be compatible with the adjoining runway which it serves, due consideration being given to the fact that the turn pad should be subjected to slow-moving traffic making hard turns and consequent higher stresses on the pavement.

CS-ADR-DSN.B.110 Surface of runway turn pads

(a) The surface of a runway turn pad should not have surface irregularities that may cause damage to an aeroplane using the turn pad.
(b) The surface of a runway turn pad should be so constructed or resurfaced as to provide surface friction characteristics at least equal to that of the adjoining runway.

CS-ADR-DSN.B.115 Width of shoulders for runway turn pads
(+ GM)

The runway turn pads should be provided with shoulders of such width as is necessary to prevent surface erosion by the jet blast of the most demanding aeroplane for which the turn pad is intended and any possible foreign object damage to the aeroplane engines.

CS-ADR-DSN.B.120 Strength of shoulders for runway turn pads

The strength of runway turn pad shoulders should be capable of withstanding the occasional passage of the most demanding aircraft it is designed to serve without inducing structural damage to the aircraft and to the supporting ground vehicles that may operate on the shoulder.

CS-ADR-DSN.B.125 Runway shoulders
(+ GM)

(a) The safety objective of a runway shoulder is that it should be so constructed as to mitigate any hazard to an aircraft running off the runway or stopway or to avoid the ingestion of loose stones or other objects by turbine engines.
(b) Runway shoulders should be provided for a runway where the code letter is D, E or F, for aeroplanes with an OMGWS from 9 m up to but not including 15 m.
(c) Runway shoulders need not be provided where the runway width is 60 m, for aeroplanes with an OMGWS from 9 m up to but not including 15 m and code letter:
    (1) D, E; or
    (2) F with two or three engines.
(d) Where the runway width is 60 m, for aeroplanes with an OMGWS from 9 m up to but not including 15 m and code letter F with four (or more) engines, only the portion of runway shoulders between the runway edge up to a distance as prescribed in paragraph (c) of CS-ADR-DSN.B.135 should be provided.

CS-ADR-DSN.B.130 Slopes on runway shoulders

(a) The safety objective of runway shoulder transverse slopes is to promote the most rapid drainage of water from the runway and runway shoulder.
(b) The surface of the paved shoulder that abuts the runway should be flush with the surface of the runway and its transverse slope should not exceed 2.5 %.

CS-ADR-DSN.B.135 Width of runway shoulders

For aeroplanes with an OMGWS from 9 m up to but not including 15 m the runway shoulders should extend symmetrically on each side of the runway so that the overall width of the runway and its shoulders is not less than:
(a) 60 m where the code letter is D or E;
(b) 60 m where the code letter is F with two- or three-engined aeroplanes; and
(c) 75 m where the code letter is F with four (or more) engined aeroplanes.

CS-ADR-DSN.B.140 Strength of runway shoulders
(+ GM)

The portion of a runway shoulder between the runway edge and a distance of 30 m from the runway centre line should be prepared or constructed so as to be capable, in the event of an aeroplane running off the runway, of supporting the aeroplane without inducing structural damage to the aeroplane and of supporting ground vehicles which may operate on the shoulder.

CS-ADR-DSN.B.145 Surface of runway shoulders
(+ GM)

(a) The surface of a runway shoulder should be prepared or constructed so as to resist erosion and prevent the ingestion of the surface material by aeroplane engines.
(b) Runway shoulders for code letter F aeroplanes should be paved to a minimum overall width of runway and shoulder of not less than 60 m.

CS-ADR-DSN.B.150 Runway strip to be provided
(+ GM)

(a) The safety objective of the runway strip is to reduce the risk of damage to an aircraft accidentally running off the runway, to protect aircraft flying over it when taking-off or landing, and to enable safe use by rescue and firefighting (RFF) vehicles.
(b) A runway and any associated stopways should be included in a strip.

CS-ADR-DSN.B.155 Length of runway strip

(a) A strip should extend before the threshold and beyond the end of the runway or stopway for a distance of at least:
  (1) 60 m where the code number is 2, 3, or 4;
  (2) 60 m where the code number is 1 and the runway is an instrument one; and
  (3) 30 m where the code number is 1 and the runway is a non-instrument one.

CS-ADR-DSN.B.160 Width of runway strip

(a) A strip including a precision approach runway should extend laterally to a distance of at least:
  (1) 140 m where the code number is 3 or 4; and
  (2) 70 m where the code number is 1 or 2;
  on each side of the centre line of the runway and its extended centre line throughout the length of the strip.
(b) A strip including a non-precision approach runway should extend laterally to a distance of at least:
  (1) 140 m where the code number is 3 or 4; and
  (2) 70 m where the code number is 1 or 2;
  on each side of the centre line of the runway and its extended centre line throughout the length of the strip.
(c) A strip including a non-instrument runway should extend on each side of the centre line of the runway and its extended centre line throughout the length of the strip, to a distance of at least:
  (1) 75 m where the code number is 3 or 4;
  (2) 40 m where the code number is 2; and
  (3) 30 m where the code number is 1.

CS-ADR-DSN.B.165 Objects on runway strips

(+ GM)

(a) An object situated on a runway strip which may endanger aeroplanes should be regarded as an obstacle and should, as far as practicable, be removed.
(b) No fixed object, other than visual aids required for air navigation or those required for aircraft safety purposes and which must be sited on the runway strip, and satisfying the relevant frangibility requirement in Chapter T, should be permitted on a runway strip:
  (1) within 77.5 m of the runway centre line of a precision approach runway Category I, II or III where the code number is 4 and the code letter is F; or
  (2) within 60 m of the runway centre line of a precision approach runway Category I, II or III where the code number is 3 or 4; or
  (3) within 45 m of the runway centre line of a precision approach runway Category I where the code number is 1 or 2.
(c) To eliminate a buried vertical surface on objects situated on a graded portion of the runway strip, a slope should be provided to minimise hazards to aeroplanes running off the runway.
(d) Fixed objects serving specific military safety purposes, which must be sited on a runway strip, are permitted, provided the risks are mitigated to a level which is 'as low as reasonably practicable'. These objects include, but are not limited to:
  (1) Local Control Bunkers (LCB)
  (2) Arrestor Gear (CS-ADR-DSN.C.237 Arrestor gear)

CS-ADR-DSN.B.175 Grading of runway strips

(+ GM)

(a) That portion of a strip of an instrument runway within a distance of at least:
  (1) 75 m where the code number is 3 or 4; and
  (2) 40 m where the code number is 1 or 2;
  from the centre line of the runway and its extended centre line should provide a graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.
(b) That portion of a strip of a non-instrument runway within a distance of at least:
  (1) 75 m where the code number is 3 or 4;

(2) 40 m where the code number is 2; and
(3) 30 m where the code number is 1;
from the centre line of the runway and its extended centre line should provide a graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

(c) The surface of that portion of a strip that abuts a runway, shoulder, or stopway should be flush with the surface of the runway, shoulder, or stopway.

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

CS-ADR-DSN.B.180 Longitudinal slopes on runway strips

(a) The safety objective of longitudinal runway strip slope is to define maximum gradient values that should not interfere with the safe use of the runway strip by an aircraft.

(b) A longitudinal slope along that portion of a strip to be graded should not exceed:
(1) 1.5 % where the code number is 4;
(2) 1.75 % where the code number is 3; and
(3) 2 % where the code number is 1 or 2.

(c) Longitudinal slope changes on that portion of a strip to be graded should be as gradual as practicable, and abrupt changes or sudden reversals of slopes should be avoided.

CS-ADR-DSN.B.185 Transverse slopes on runway strips

(+ GM)

(a) Transverse slopes on that portion of a strip to be graded should be adequate to prevent the accumulation of water on the surface but should not exceed:
(1) 2.5 % where the code number is 3 or 4; and
(2) 3 % where the code number is 1 or 2;
except that to facilitate drainage from the slope for the first 3 m outward from the runway, shoulder or stopway edge should be negative as measured in the direction away from the runway and may be as great as 4 %.

(b) The transverse slopes of any portion of a strip beyond that to be graded should not exceed an upward slope of 4 % as measured in the direction away from the runway.

CS-ADR-DSN.B.190 Strength of runway strips

(+ GM)

(a) That portion of a strip of an instrument runway within a distance of at least:
(1) 75 m where the code number is 3 or 4; and
(2) 40 m where the code number is 1 or 2;
from the centre line of the runway and its extended centre line should be prepared or constructed so as to minimise hazards arising from differences in load-bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

(b) That portion of a strip containing a non-instrument runway within a distance of at least:
(1) 75 m where the code number is 3 or 4;
(2) 40 m where the code number is 2; and
(3) 30 m where the code number is 1;
from the centre line of the runway and its extended centre line should be prepared or constructed so as to minimise hazards arising from differences in load-bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

CS-ADR-DSN.B.191 Drainage characteristics of the movement area and adjacent areas

The safety objective of the drainage systems of the movement area and adjacent areas is to minimise water depth on the surface by draining surface water off the runway in the shortest path practicable and particularly out of the area of the wheel path.

CS-ADR-DSN.B.195 Clearways

(a) The inclusion of detailed specifications for clearways below is not intended to imply that a clearway has to be provided.
(b) Location of clearways: The origin of a clearway should be at the end of the take-off run available.
(c) Length of clearways: The length of a clearway should not exceed half the length of the take-off run available.
(d) Width of clearways: A clearway should extend laterally to a distance of at least 75 m on each side of the extended centre line of the runway.
(e) Slopes on clearways: The ground in a clearway should not project above a plane having an upward slope of 1.25 %, the lower limit of this plane being a horizontal line which:
  (1) is perpendicular to the vertical plane containing the runway centre line; and
  (2) passes through a point located on the runway centre line at the end of the take-off run available.
(f) An object situated on a clearway which may endanger aeroplanes in the air should be regarded as an obstacle and should be removed.

CS-ADR-DSN.B.200 Stopways

(+ GM)

(a) The inclusion of detailed specifications for stopways below is not intended to imply that a stopway has to be provided.
(b) Width of stopways:
A stopway should have the same width as the runway with which it is associated.
(c) Slopes on stopways:
Slopes and changes in slope on a stopway, and the transition from a runway to a stopway, should comply with the specifications in CS-ADR-DSN.B.060 to CS-ADR-DSN.B.080 for the runway with which the stopway is associated except that:
  (1) the limitation in CS-ADR-DSN.B.060(c) of a 0.8 % slope for the first and last quarter of the length of a runway need not be applied to the stopway; and
  (2) at the junction of the stopway and runway and along the stopway the maximum rate of slope change may be 0.3 % per 30 m (minimum radius of curvature of 10 000 m) for a runway where the code number is 3 or 4.
(d) Strength of stopways:
A stopway should be prepared or constructed so as to be capable, in the event of an abandoned take-off, of supporting the aeroplane which the stopway is intended to serve without inducing structural damage to the aeroplane.
(e) Surface of stopways:
The surface of a paved stopway should be so constructed or resurfaced as to provide surface friction characteristics at or above those of the associated runway.

CS-ADR-DSN.B.205 Radio altimeter operating area

(a) A radio altimeter operating area should be established in the pre-threshold area of a precision approach runway Category II and III, and where practicable, in the pre-threshold area of a precision approach runway Category I.
(b) Length of the area:
A radio altimeter operating area should extend before the threshold for a distance of at least 300 m.
(c) Width of the area:
A radio altimeter operating area should extend laterally, on each side of the extended centre line of the runway, to a distance of 60 m, except that, when special circumstances so warrant, the distance may be reduced to no less than 30 m if a safety assessment indicates that such reduction would not affect the safety of operations of aircraft.

CHAPTER C - RUNWAY END SAFETY AREA

CS-ADR-DSN.C.210 Runway end safety areas (RESA)

(+ GM)

(a) The safety objective of the runway end safety area (RESA) is to minimise risks to aircraft and their occupants when an aeroplane overruns or undershoots a runway.
(b) A runway end safety area should be provided at each end of a runway strip where:
  (1) the code number is 3 or 4; and
  (2) the code number is 1 or 2 and the runway is an instrument one.
(c) Where practicable, a runway end safety area should be provided at each end of a runway strip where the code number is 1 or 2 and the runway is a non-instrument one.

CS-ADR-DSN.C.215 Dimensions of runway end safety areas

(+ GM)

(a) Length of runway end safety area
  (1) A runway end safety area should extend from the end of a runway strip to a distance of at least 90 m and, as far as practicable, extend to a distance of:
    (i) 240 m where the code number is 3 or 4 and
    (ii) 120 m where the code number is 1 or 2 and the runway is an instrument one; and
  (2) A runway end safety area should extend from the end of a runway strip, as far as practicable, to a distance of 30 m where the code number is 1 or 2 and the runway is a non-instrument one.
(b) Notwithstanding the provisions in (a) above, the length of the runway end safety area may be reduced where an arresting system is installed, based on the design specifications of the system.
(c) Width of runway end safety area
  The width of a runway end safety area should be at least twice that of the associated runway and, wherever practicable, be equal to that of the graded portion of the associated runway strip.

CS-ADR-DSN.C.220 Objects on runway end safety areas

No fixed object, other than equipment and installations required for air navigation or for aeroplane safety purposes and satisfying the relevant frangibility requirement CS-ADR-DSN.T.910, should be permitted on a runway end safety area. The detailed requirements for siting objects on a RESA are in CS-ADR-DSN.T.915.

CS-ADR-DSN.C.225 Clearing and grading of runway end safety areas

(+ GM)

A runway end safety area should provide a cleared and graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane undershooting or overrunning the runway.

CS-ADR-DSN.C.230 Slopes on runway end safety areas

(+ GM)

(a) Longitudinal slopes
  (1) The slopes of a runway end safety area should be such that no part of the runway end safety area penetrates the approach or take-off climb surface.
  (2) The longitudinal slopes of a runway end safety area should not exceed a downward slope of 5 %. Longitudinal slope changes should be as gradual as practicable, and abrupt changes or sudden reversals of slopes should be avoided.
(b) Transverse slopes
  The transverse slopes of a runway end safety area should not exceed an upward or downward slope of 5 %. Transitions between differing slopes should be as gradual as practicable.

CS-ADR-DSN.C.235 Strength of runway end safety areas
(+ GM)

A runway end safety area should have a bearing strength sufficient to serve its primary purpose.

CS-ADR-DSN.C.236 Engineered Materials Arresting System (EMAS)
(+ GM)

(a) An EMAS, provided in accordance with paragraph (b) of CS-ADR-DSN.C.215, is a type of arresting system consisting of high energy absorbing materials of specific strength, which will reliably and predictably crush under the weight of an aircraft.
(b) Location: An EMAS should be located beyond the end of the runway or stopway, if provided, at enough setback distance to avoid damage due to jet blast.
(c) General: An EMAS should:
  (1) be supported by a design method that can predict the performance of the system that is validated through laboratory or field tests;
  (2) decelerate an aircraft overrunning the runway by exerting predictable forces on the landing gear without causing major structural damage to the aircraft and avoiding injuries to its occupants;
  (3) be a passive system that requires no external means to initiate/trigger its operation to arrest an aircraft;
  (4) be constructed not to be damaged by jet blast or projected debris during normal aircraft operations;
  (5) use materials which do not generate nor worsen fire hazards to an incoming aircraft. The materials should be non-sparking, non-flammable, not promote combustion, and not emit toxic or malodorous fumes in a fire environment after installation;
  (6) be compatible with the installation of approach lighting systems, the radio altimeter operating area and with the meteorological conditions and aerodrome environment;
  (7) together with its surroundings, allow ice and snow removal and prevent water accumulation;
  (8) have enough mechanical property to avoid damage resulting from personnel walking on it for routine maintenance;
  (9) enable the access, movement, and egress of the RFFS vehicles without impeding their activities during an emergency;
  (10) be designed for repair to a usable condition (conforming to the original specifications) after an overrun or other type of physical damage, and have an established maintenance programme;
  (11) not increase the potential for damage and not cause control capabilities to an aircraft in case of an undershoot more than the risk associated with an undershoot in a RESA;
  (12) be frangible and mounted as low as possible with ramps that are provided to avoid vertical surface;
  (13) not impede crew and passenger evacuation nor hinder disabled aircraft removal procedures;
  (14) not cause visual or electromagnetic interference with any air navigation aids nor have reflecting surfaces that could cause dazzling;
  (15) not increase wildlife hazard;
  (16) not be considered to meet the definition of a stopway as provided in CS-ADR-DSN.B.200.
(d) Dimensions:
  (1) The functional length of an EMAS should be designed based on the operating conditions of the associated runway with its centre line coincidental with the extended centre line of the runway.
  (2) The functional width of an EMAS should not be less than the runway width.
(e) Arresting performance:
  (1) An EMAS should be designed to decelerate the design aircraft at an exit speed of 70 knots at both maximum take-off weight (MTOW) and 80 % maximum landing weight (MLW) without imposing loads that exceed the aircraft's design limits, causing major structural damage to the aircraft or imposing excessive forces on its occupants.
  (2) When there is insufficient space available for the design on an EMAS in accordance with paragraph (c)(4) above, an EMAS should be designed to achieve the maximum arresting performance of the critical aeroplane.
  (3) The design method for EMAS should factor in no reverse thrust of the aeroplane, using a 0.25 braking friction coefficient for the runway and length of pavement prior to the arrestor bed

(setback).

(4) The design method for the EMAS assumes no braking friction coefficient (0.00) within the EMAS arrestor bed itself, unless the minimum actual braking friction coefficient that can be achieved as an aeroplane passes through the EMAS arrestor bed material can be demonstrated.

(f) Access:

(1) Slopes or steps should be provided to allow the entrance of the RFFS vehicles from the front and sides and to facilitate crew and passenger evacuation.

(2) On both sides of an EMAS, the requirements for RESA according CS-ADR-DSN.C.210 to CS-ADR-DSN.C.235 should be applied.

(3) Service roads should be set up for maintenance and emergency access. The width of the service roads should allow access and egress of RFFS vehicles. Service roads should be graded to avoid water accumulation. The strength of the service roads pavement should be capable of supporting the passage of fully loaded RFFS vehicles.

(g) Marking:

(1) An EMAS should be provided with yellow chevrons in accordance with CS-ADR-DSN.R.865.

CS-ADR-DSN.C.237 Arrestor gear characteristics and requirements

(a) The location of the Hook type Arrestor gear should be determined by the capability of the arrestor gear and enable the aircraft to come to a complete stop latest at the threshold.

(1) When load-bearing capacity of the overrun or stopway is sufficient according CS-ADR-DSN.B.085, the pavement may be used for the runout.

(b) The asset may be fixed or mobile (deployable).

(c) Where cables are installed across the runway surface, no changes in pavement type must occur within the centre 23 m of the runway for a longitudinal distance of 60 m in either direction from the cable. Additionally, longitudinal surface deviations within this area shall not exceed 3 mm in 4 meters.

CS-ADR-DSN.D.240 Taxiways general
(+ GM)

Unless otherwise indicated, the requirements in Chapter D - Taxiways are applicable to all types of taxiways.

(a) The design of a taxiway should be such that, when the cockpit of the aeroplane for which the taxiway is intended, remains over the taxiway centre line markings, the clearance distance between the outer main wheel of the aeroplane and the edge of the taxiway should be not less than that given by the following tabulation:

	Outer Main Gear Wheel Span (OMGWS)			
	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
Clearance	1.50 m	2.25 m	3 m[a,b] or 4 m[c]	4 m
a on straight portions. b on curved portions if the taxiway is intended to be used by aeroplanes with a wheel base of less than 18 m. c on curved portions if the taxiway is intended to be used by aeroplanes with a wheel base equal to or greater than 18 m.				
Note: Wheel base means the distance from the nose gear to the geometric centre of the main gear.				

CS-ADR-DSN.D.245 Width of taxiways
(+ GM)

A straight portion of a taxiway should have a width of not less than that given by the following tabulation:

	Outer Main Gear Wheel Span (OMGWS)			
	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
Taxiway width	7.5 m	10.5 m	15 m	23 m

CS-ADR-DSN.D.250 Taxiways curves
(+ GM)

(a) Changes in direction of taxiways should be as few and small as possible. The radii of the curves should be compatible with the manoeuvring capability and normal taxiing speeds of the aeroplanes for which the taxiway is intended.

(b) The design of the curve should be such that when the cockpit of the aeroplane for which the taxiway is intended remains over the taxiway centre line markings, the clearance distance between the outer main wheels of the aeroplane and the edge of the taxiway should be not less than those specified in CS-ADR-DSN.D.240.

CS-ADR-DSN.D.255 Junction and intersection of taxiways

(a) To facilitate the movement of aeroplanes, fillets should be provided at junctions and intersections of taxiways with runways, aprons, and other taxiways.

(b) The design of the fillets should ensure that the minimum wheel clearances specified in CS-ADR-DSN.D.240 are maintained when aeroplanes are manoeuvring through the junctions or intersections.

CS-ADR-DSN.D.260 Taxiway minimum separation distance
(+ GM)

(a) The safety objective of minimum taxi separation distances is to allow safe use of taxiways and aircraft stand taxilanes to prevent possible collision with other aeroplanes operating on adjacent runways or taxiways, or collision with adjacent objects.

(b) The separation distance between the centre line of a taxiway and the centre line of a runway, the centre line of a parallel taxiway or an object should not be less than the appropriate dimension

specified in Table D-1.

	Distance between taxiway centre line and runway centre line (metres)								Taxiway centre line to taxiway centre line (metres)	Taxiway, other than aircraft stand taxilane, centre line to object (metres)	Aircraft stand taxilane centre line to aircraft stand taxilane centre line (metres)	Aircraft stand taxilane centre line to object (metres)
	Instrument runways Code number				Non-instrument runways Code number							
Code letter	1	2	3	4	1	2	3	4				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	77.5	77.5	—	—	37.5	47.5	—	—	23	15.5	19.5	12
B	82	82	152	—	42	52	87	—	32	20	28.5	16.5
C	88	88	158	158	48	58	93	93	44	26	40.5	22.5
D	—	—	166	166	—	—	101	101	63	37	59.5	33.5
E	—	—	172.5	172.5	—	—	107.5	107.5	76	43.5	72.5	40
F	—	—	180	180	—	—	115	115	91	51	87.5	47.5

Note 1: The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways.

Note 2: The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding aeroplane to permit the passing of another aeroplane on a parallel taxiway.

Table D-1. Taxiway minimum separation distances

CS-ADR-DSN.D.265 Longitudinal slopes on taxiways

(a) The safety objective of limiting the longitudinal taxiway slope is to enable stabilised safe use of taxiway by an aircraft.
(b) The longitudinal slope of a taxiway should not exceed:
(1) 1.5 % where the code letter is C, D, E, or F; and
(2) 3 % where the code letter is A or B.

CS-ADR-DSN.D.270 Longitudinal slope changes on taxiways

(a) The safety objective of limiting the longitudinal taxiway slope changes is to avoid damage of aircraft and to enable safe use of taxiway by an aircraft.
(b) Where slope changes on a taxiway cannot be avoided, the transition from one slope to another slope should be accomplished by a curved surface with a rate of change not exceeding:
(1) 1 % per 30 m (minimum radius of curvature of 3 000 m) where the code letter is C, D, E, or F; and
(2) 1 % per 25 m (minimum radius of curvature of 2 500 m) where the code letter is A or B.
(c) Where slope changes in (b)(1) and (2) are not achieved and slopes on a taxiway cannot be avoided, the transition from one slope to another slope should be accomplished by a curved surface which should allow the safe operation of all aircraft in all weather conditions.

CS-ADR-DSN.D.275 Sight distance of taxiways

(a) The safety objective of minimum taxiway sight distance values is to achieve the necessary visibility to enable safe use of taxiway by an aircraft.
(b) Where a change in slope on a taxiway cannot be avoided, the change should be such that, from any point:
(1) 3 m above the taxiway, it should be possible to see the whole surface of the taxiway for a distance of at least 300 m from that point where the code letter is C, D, E, or F;
(2) 2 m above the taxiway, it should be possible to see the whole surface of the taxiway for a distance of at least 200 m from that point where the code letter is B; and
(c) 1.5 m above the taxiway, it should be possible to see the whole surface of the taxiway for a distance of at least 150 m from that point where the code letter is A.

CS-ADR-DSN.D.280 Transverse slopes on taxiways

(a) The safety objective of taxiway transverse slopes is to promote the most rapid drainage of water from the taxiway.

(b) The transverse slopes of a taxiway should be sufficient to prevent the accumulation of water on the surface of the taxiway but should not exceed:
(1) 1.5 % where the code letter is C, D, E, or F; and
(2) 2 % where the code letter is A or B.

CS-ADR-DSN.D.285 Strength of taxiways

(+ GM)

The strength of a taxiway should be suitable for the aircraft that the taxiway is intended to serve.

CS-ADR-DSN.D.290 Surface of taxiways

(a) The surface of a taxiway should not have irregularities that cause damage to aeroplane structures.
(b) The surface of a paved taxiway should be so constructed or resurfaced as to provide suitable surface friction characteristics.

CS-ADR-DSN.D.295 Rapid exit taxiways

(a) The safety objective of rapid exit taxiway is to facilitate safe rapid exit of aeroplanes from a runway.
(b) A rapid exit taxiway should be designed with a radius of turn-off curve of at least:
(1) 550 m where the code number is 3 or 4; and
(2) 275 m where the code number is 1 or 2;
to enable under wet conditions exit speeds of:
(i) 93 km/h where the code number is 3 or 4; and
(ii) 65 km/h where the code number is 1 or 2.
(c) The radius of the fillet on the inside of the curve at a rapid exit taxiway should be sufficient to provide a widened taxiway throat in order to facilitate early recognition of the entrance and turn-off onto the taxiway.
(d) A rapid exit taxiway should include a straight distance after the turn-off curve sufficient for an exiting aircraft to come to a full stop clear of any intersecting taxiway (Figure D-1).
(e) The intersection angle of a rapid exit taxiway with the runway should not be greater than 45°, nor less than 25° and preferably should be 30°.

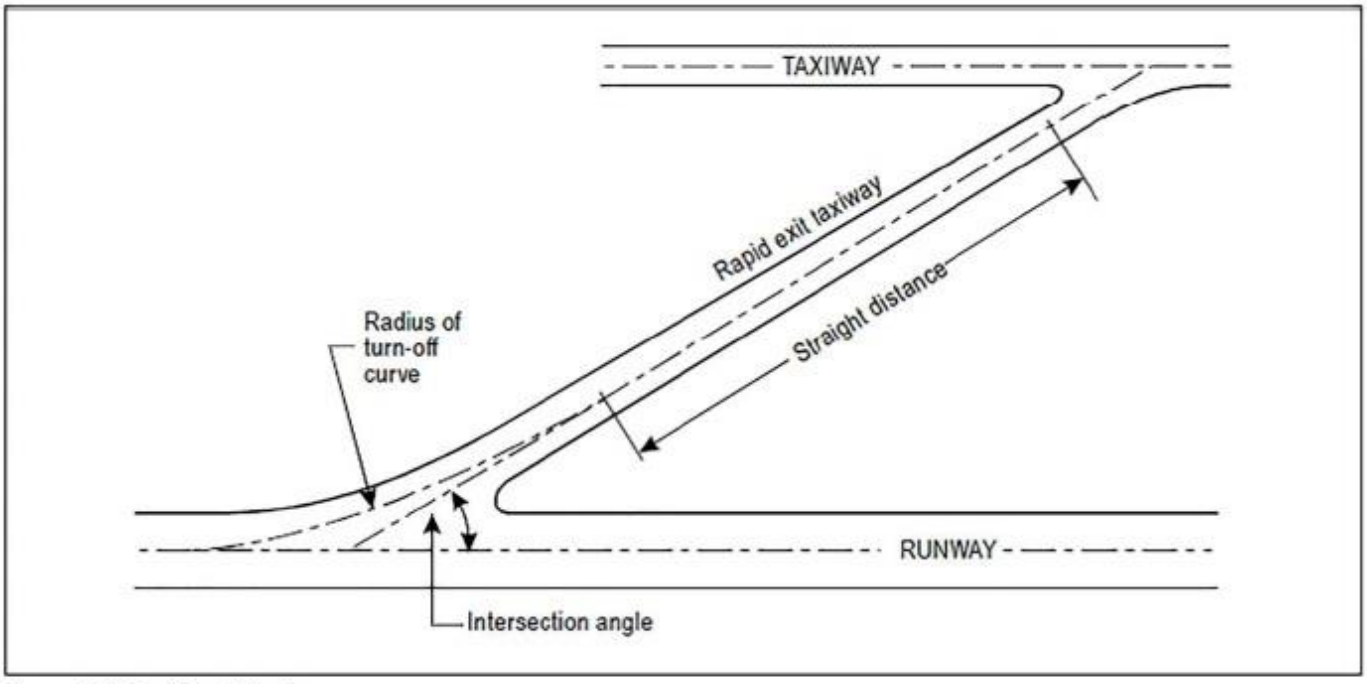

Figure D-1. Rapid exit taxiway

CS-ADR-DSN.D.300 Taxiways on bridges
(+ GM)

(a) The width of that portion of a taxiway bridge capable of supporting aeroplanes, as measured perpendicularly to the taxiway centre line, should not be less than the width of the graded area of the strip provided for that taxiway unless a proven method of lateral restraint is provided which should not be hazardous for aeroplanes for which the taxiway is intended.
(b) Access should be provided to allow rescue and firefighting vehicles to intervene in both directions within the specified response time to the largest aeroplane for which the taxiway bridge is intended.
(c) A bridge should be constructed on a straight section of the taxiway with a straight section on both ends of the bridge to facilitate the alignment of aeroplanes approaching the bridge.

CS-ADR-DSN.D.305 Taxiway shoulders

(a) Straight portions of a taxiway where the code letter is C, D, E, or F should be provided with shoulders which extend symmetrically on each side of the taxiway so that the overall width of the taxiway and its shoulders on straight portions is not less than:
  (1) 44 m where the code letter is F;
  (2) 38 m where the code letter is E;
  (3) 34 m where the code letter is D; and
  (4) 25 m where the code letter is C.
(b) On taxiway curves and on junctions or intersections where increased pavement is provided, the shoulder width should be not less than that on the adjacent straight portions of the taxiway.
(c) When a taxiway is intended to be used by turbine-engined aeroplanes, the surface of the taxiway shoulder should be prepared so as to resist erosion and the ingestion of the surface material by aeroplane engines.

CS-ADR-DSN.D.310 Taxiway Strip

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

CS-ADR-DSN.D.315 Width of taxiway strips

(a) The safety objective of the width of taxiway strips is to allow safe use of taxiways in relation to adjacent objects.
(b) A taxiway strip should extend symmetrically on each side of the centre line of the taxiway throughout the length of the taxiway to at least the distance from the centre line given in Table D-1, column (11).

CS-ADR-DSN.D.320 Objects on taxiway strips
(+ GM)

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

CS-ADR-DSN.D.325 Grading of taxiway strips

(a) The safety objective of the grading of a taxiway strip is to reduce the risk of damage to an aircraft accidentally running off the taxiway.
(b) The centre portion of a taxiway strip should provide a graded area to a distance from the centre line of the taxiway of not less than that given by the following tabulation:
  (1) 10.25 m where the OMGWS is up to but not including 4.5 m;
  (2) 11 m where the OMGWS is 4.5 m up to but not including 6 m;
  (3) 12.50 m where the OMGWS is 6 m up to but not including 9 m;
  (4) 18.50 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is D;
  (5) 19 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is E;
  (6) 22 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is F.

CS-ADR-DSN.D.330 Slopes on taxiway strips

(+ GM)

(a) The safety objective of limiting the longitudinal taxiway strip slopes and slope changes and of minimum sight distances values is to reduce the probability of damage to an aircraft accidentally running off the taxiway and to enable safe use of these areas by rescue and firefighting vehicles.
(b) The surface of the strip should be flush at the edge of the taxiway or shoulder if provided, and the graded portion should not have an upward transverse slope exceeding:
(1) 2.5 % for strips where the code letter is C, D, E, or F; and
(2) 3 % for strips of taxiways where the code letter is A or B;
the upward slope being measured with reference to the transverse slope of the adjacent taxiway surface and not the horizontal. The downward transverse slope should not exceed 5 % measured with reference to the horizontal.
(c) The transverse slopes on any portion of a taxiway strip beyond that to be graded should not exceed an upward or downward slope of 5 % as measured in the direction away from the taxiway.

CS-ADR-DSN.D.335 Holding bays, runway-holding positions, intermediate holding positions, and road-holding positions

(+ GM)

(a) Holding bay(s) or other bypasses of sufficient size and adequate construction should be provided where necessary, to make deviations in the departure sequence possible.
(b) A runway-holding position or positions should be established:
(1) on the taxiway, if the location or alignment of the taxiway is such that a taxiing aircraft or vehicle can infringe an obstacle limitation surface or ILS/MLS critical/sensitive area or interfere with the operation of radio navigation aids;
(2) on the taxiway, at the intersection of a taxiway and a runway; and
(3) at an intersection of a runway with another runway when the former runway is part of a standard taxi-route.
(c) An intermediate holding position should be established on a taxiway at any point other than a runway-holding position where it is desirable to define a specific holding limit.
(d) An emergency access road should be equipped with road-holding positions at all intersections with runways and taxiways.
(e) A road-holding position should be established at each intersection of a road with a runway.

CS-ADR-DSN.D.340 Location of holding bays, runway-holding positions, intermediate holding positions, and road-holding positions

(+ GM)

(a) The distance between a holding bay, runway-holding position established at a taxiway/runway intersection or road-holding position and the centre line of a runway should be in accordance with Table D-2 and such that a holding aircraft or vehicle should not interfere with the operation of radio navigation aids or penetrate the inner transitional surface.
(b) At elevations greater than 700 m the distance of 90 m specified in Table D-2 for a precision approach runway code number 4 should be increased as follows:
(1) up to an elevation of 2 000 m; 1 m for every 100 m in excess of 700 m;
(2) elevation in excess of 2 000 m and up to 4 000 m; 13 m plus 1.5 m for every 100 m in excess of 2 000 m; and
(3) elevation in excess of 4 000 m and up to 5 000 m; 43 m plus 2 m for every 100 m in excess of 4 000 m.
(c) The location of a runway-holding position established in accordance with CS-ADR-DSN.D.335 should be such that a holding aircraft or vehicle will not infringe the obstacle-free zone, approach surface, take-off climb surface or ILS/MLS critical/sensitive area or interfere with the operation of radio navigation aids.

Type of runway	Code number[d]			
	1	2	3	4
Non-instrument	30 m	40 m	75 m	75 m
Non-precision approach	40 m	40 m	75 m	75 m
Precision approach Category I	60 m[b]	60 m[b]	90 m[a,b]	90 m[a,b,c]
Precision approach Categories II and III	—	—	90 m[a,b]	90 m[a,b,c]
Take-off runway	30 m	40 m	75 m	75 m

a. If a holding bay, runway-holding position, or road-holding position is at a lower elevation compared to the threshold, the distance may be decreased 5 m for every metre the bay or holding position is lower than the threshold, contingent upon not infringing the inner transitional surface.

b. This distance may need to be increased to avoid interference with radio navigation aids, particularly the glide path and localiser facilities (see CS-ADR-DSN.D.340).

Note 1: The distance of 90 m for code number 3 or 4 is based on an aircraft with a tail height of 20 m, a distance from the nose to the highest part of the tail of 52.7 m and a nose height of 10 m

Note 2: The distance of 60 m for code number 2 is based on an aircraft with a tail height of 8 m, a distance from the nose to the highest part of the tail of 24.6 m and a nose height of 5.2 m holding at an angle of 45° or more with respect to the runway centre line, being clear of the obstacle-free zone.

c. Where the code letter is F, this distance should be at least 100 m.

Note: The distance of 100 m for code number 4 where the code letter is F is based on an aircraft with a tail height of 24 m, a distance from the nose to the highest part of the tail of 62.2 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centre line, being clear of the obstacle-free zone.

d. Elevation of taxiway should be taken into account for possible increase of the distances indicated in this table.

Table D-2. Minimum distance from the runway centre line to a holding bay, runway-holding position, or road- holding position

CS-ADR-DSN.E.345 General

Aprons should be provided to permit the safe loading and off-loading of passengers, cargo, or mail as well as the servicing of aircraft without interfering with the aerodrome traffic.

CS-ADR-DSN.E.345 General

(+GM)
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CS-ADR-DSN.E.355 Strength of aprons

(+GM)

Each part of an apron should be capable of withstanding the traffic of the aircraft it is intended to serve, due consideration being given to the fact that some portions of the apron should be subjected to a higher density of traffic and, as a result of slow moving or stationary aircraft, to higher stresses than a runway.

CS-ADR-DSN.E.360 Slopes on aprons

(+GM)

(a) Slopes on an apron, including those on an aircraft stand taxilane, should be sufficient to prevent accumulation of water on the surface of the apron but should be kept to the minimum required to facilitate effective drainage.
(b) On an aircraft stand the maximum slope should not exceed 1 % in any direction.

CS-ADR-DSN.E.365 Clearance distances on aircraft stands

(+GM)

(a) The safety objective of clearance distances on aircraft stands is to provide safe separation between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects.
(b) An aircraft stand should provide the following minimum clearances between an aircraft entering or exiting the stand and any adjacent building, aircraft on another stand and other objects:

Code Letter	**Clearance**
A	3 m
B	3 m
C	4.5 m
D	7.5 m
E	7.5 m
F	7.5 m

(c) The minimum clearance distance for code letters D, E and F can be reduced:
  (1) for height limited objects,
  (2) if the stand is restricted for aircraft with specific characteristics,
  (3) in the following locations (for aircraft using a taxi-in, push-back procedure only):
    (i) between the terminal (including passenger loading bridges) and the nose of an aircraft; and
    (ii) over a portion of the stand provided with azimuth guidance by a visual docking guidance system.

CHAPTER F - ISOLATED AIRCRAFT PARKING POSITION

CS-ADR-DSN.F.370 Isolated aircraft parking position

(a) The safety objective of the isolated aircraft parking position is to provide safe separation between aircraft that need isolation and other aerodrome activities.
(b) General
An isolated aircraft parking position should be designated by the aerodrome operator for parking of aircraft that needs isolation from normal aerodrome activities.
(c) Location
The isolated aircraft parking position should be located at the maximum distance practicable and in any case never less than 100 m from other parking positions, buildings, or public areas, etc.

CHAPTER G - DE-ICING/ANTI-ICING FACILITIES

CS-ADR-DSN.G.375 General

Aeroplane de-icing/anti-icing facilities should be provided at an aerodrome where icing conditions are expected to occur and such facilities are essential to local aircraft operations.

CS-ADR-DSN.G.380 Location

(+GM)

(a) De-icing/anti-icing facilities should be provided either at aircraft stands or at specified remote areas.
(b) The remote de-icing/anti-icing facilities should be located to be clear of the obstacle limitation surface, not cause interference to the radio navigation aids and be clearly visible from the air traffic control tower for clearing the treated aeroplane.

CS-ADR-DSN.G.385 Size of de-icing/anti-icing pads

(a) The safety objective of the de-icing/anti-icing pad dimensions is to allow safe positioning of aircraft for de-icing/anti-icing, including sufficient room for the safe movement of de-icing vehicles around the aircraft.
(b) The size of a de-icing/anti-icing pad should be equal to the parking area required by the most demanding aircraft in a given category with at least 3.8 m clear paved area all around the aeroplane for the movement of the de-icing/anti-icing vehicles.

CS-ADR-DSN.G.390 Slopes on de-icing/anti-icing pads

The de-icing/anti-icing pads should be provided with suitable slopes:
(a) to ensure satisfactory drainage of the area;
(b) to permit collection of all excess de-icing/anti-icing fluid running off an aeroplane; and
(c) not to hinder the movement of aircraft on or off the pad.

CS-ADR-DSN.G.395 Strength of de-icing/anti-icing pads

The de-icing/anti-icing pad should be capable of withstanding the traffic of the aircraft it is intended to serve.

CS-ADR-DSN.G.400 Clearance distances on a de-icing/anti-icing pad

(a) The safety objective of the clearance distances on a de-icing/anti-icing pad is to provide safe separation between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects.
(b) A de-icing/anti-icing pad should provide the following minimum clearances between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects:

Code Letter	Clearance
A	3.8 m
B	3.8 m
C	4.5 m
D	7.5 m
E	7.5 m
F	7.5 m

(c) If the pad layout is such as to include bypass configuration, the minimum separation distances specified in Table D-1, column (13) should be provided.
(d) Where the de-icing/anti-icing facility is located adjoining a regular taxiway, the taxiway minimum separation distance specified in Table D-1, column (11) should be provided (see Figure G-1).

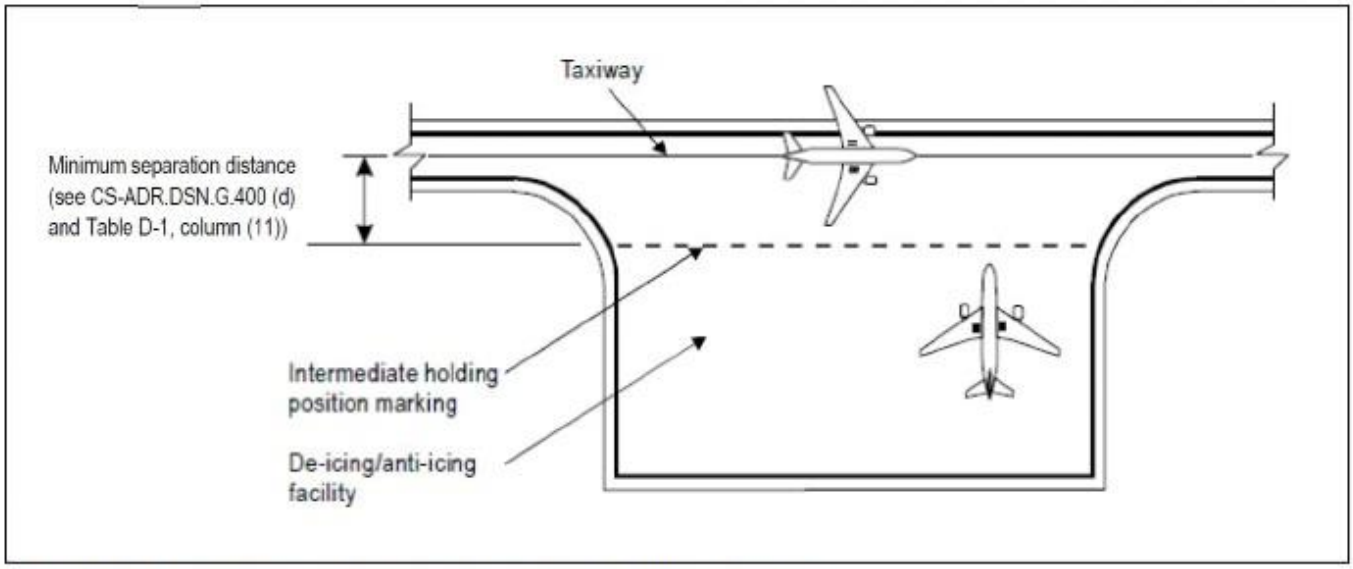

Figure G-1. Minimum separation distance on a de-icing/anti-icing facility

CHAPTER H - OBSTACLE LIMITATION SURFACES

CS-ADR-DSN.H.405 Applicability

(+GM)

Applicability: The purpose of the obstacle limitation surfaces is to define the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes to be conducted safely.

CS-ADR-DSN.H.410 Outer horizontal surface

(+GM)
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CS-ADR-DSN.H.415 Conical surface

(a) Applicability: The purpose of the conical surface is to facilitate safe visual manoeuvring in the vicinity of the aerodrome.
(b) Description: A surface sloping upwards and outwards from the periphery of the inner horizontal surface.
(c) Characteristics: The limits of the conical surface should comprise:
  (1) a lower edge coincident with the periphery of the inner horizontal surface; and
  (2) an upper edge located at a specified height above the inner horizontal surface.
(d) The slope of the conical surface should be measured in a vertical plane perpendicular to the periphery of the inner horizontal surface.

CS-ADR-DSN.H.420 Inner horizontal surface

(+GM)

(a) Applicability: The purpose of the inner horizontal surface is to protect airspace for visual manoeuvring prior to landing.
(b) Description: A surface located in a horizontal plane above an aerodrome and its environs.
(c) Characteristics: The outer limits of the inner horizontal surface are defined by a circle centred on the geometric centre of the runway, by a convex contour composed of circular arcs centred on the intersections of the extended RWY centre line with the end of the RWY strip, joined tangentially by straight lines parallel to the runway centre line, as shown in Figure H-1, or on other points established for such purpose.
(d) The height of the inner horizontal surface should be measured above an established elevation datum. The elevation datum used for the height of the inner horizontal surface should be:
  (1) the elevation of the highest point of the lowest threshold of the related runway; or
  (2) the elevation of the highest point of the highest threshold of the related runway; or
  (3) the elevation of the highest point of the runway; or
  (4) the aerodrome elevation.

CS-ADR-DSN.H.425 Approach surface

(a) Applicability: The purpose of the approach surface is to protect an aircraft during the final approach to the runway by defining the area that should be kept free from obstacles to protect an aeroplane in the final phase of the approach-to-land manoeuvre.
(b) Description: An inclined plane or combination of planes preceding the threshold.
(c) Characteristics. The limits of the approach surface should comprise:
  (1) an inner edge of specified length, horizontal and perpendicular to the extended centre line of the runway, and located at a specified distance before the threshold;
  (2) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the runway; and
  (3) an outer edge parallel to the inner edge.
  The above surfaces should be varied when lateral offset, offset or curved approaches are utilised, specifically, two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the lateral offset, offset or curved ground track.
(d) The elevation of the inner edge should be equal to the elevation of the mid-point of the threshold.

(e) The slope(s) of the approach surface should be measured in the vertical plane containing the centre line of the runway and should continue containing the centre line of any lateral offset or curved ground track.

CS-ADR-DSN.H.430 Transitional surface

(+GM)

(a) Applicability: The purpose of the transitional surface is to define the limit of the area available for buildings, other structures or natural obstructions, such as trees.
(b) Description: A complex surface along the side of the strip and part of the side of the approach surface that slopes upwards and outwards to the inner horizontal surface.
(c) Characteristics: The limits of a transitional surface should comprise:
  (1) a lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centre line; and
  (2) an upper edge located in the plane of the inner horizontal surface.
(d) The elevation of a point on the lower edge should be:
  (1) along the side of the approach surface — equal to the elevation of the approach surface at that point; and
  (2) along the strip — equal to the elevation of the nearest point on the centre line of the runway or its extension.
(e) The slope of the transitional surface should be measured in a vertical plane at right angles to the centre line of the runway.

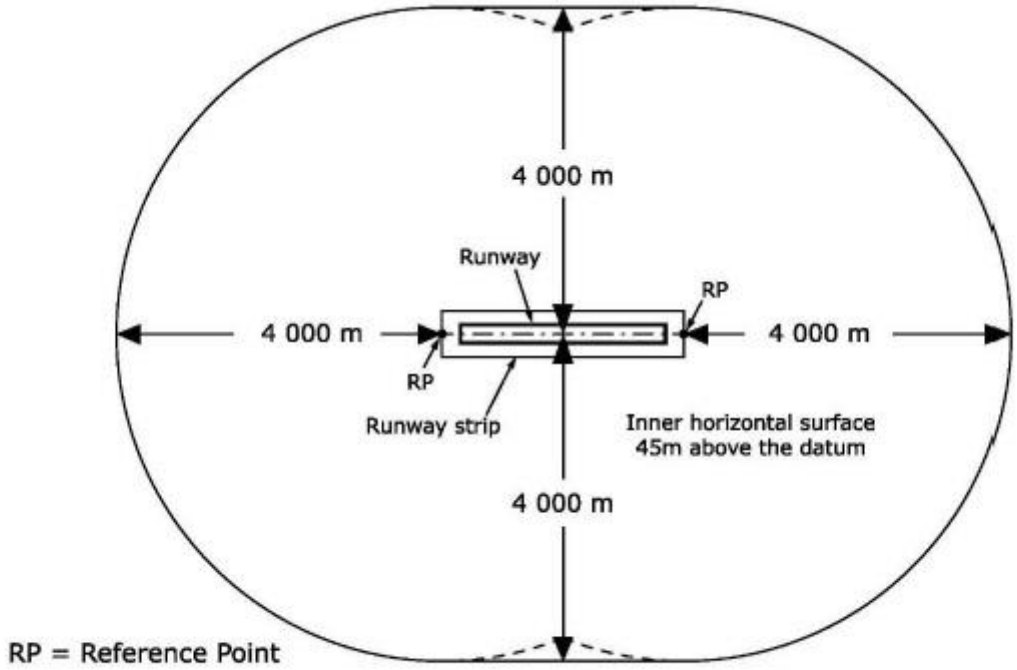


Figure H-1. Inner horizontal surface where the runway is code 4

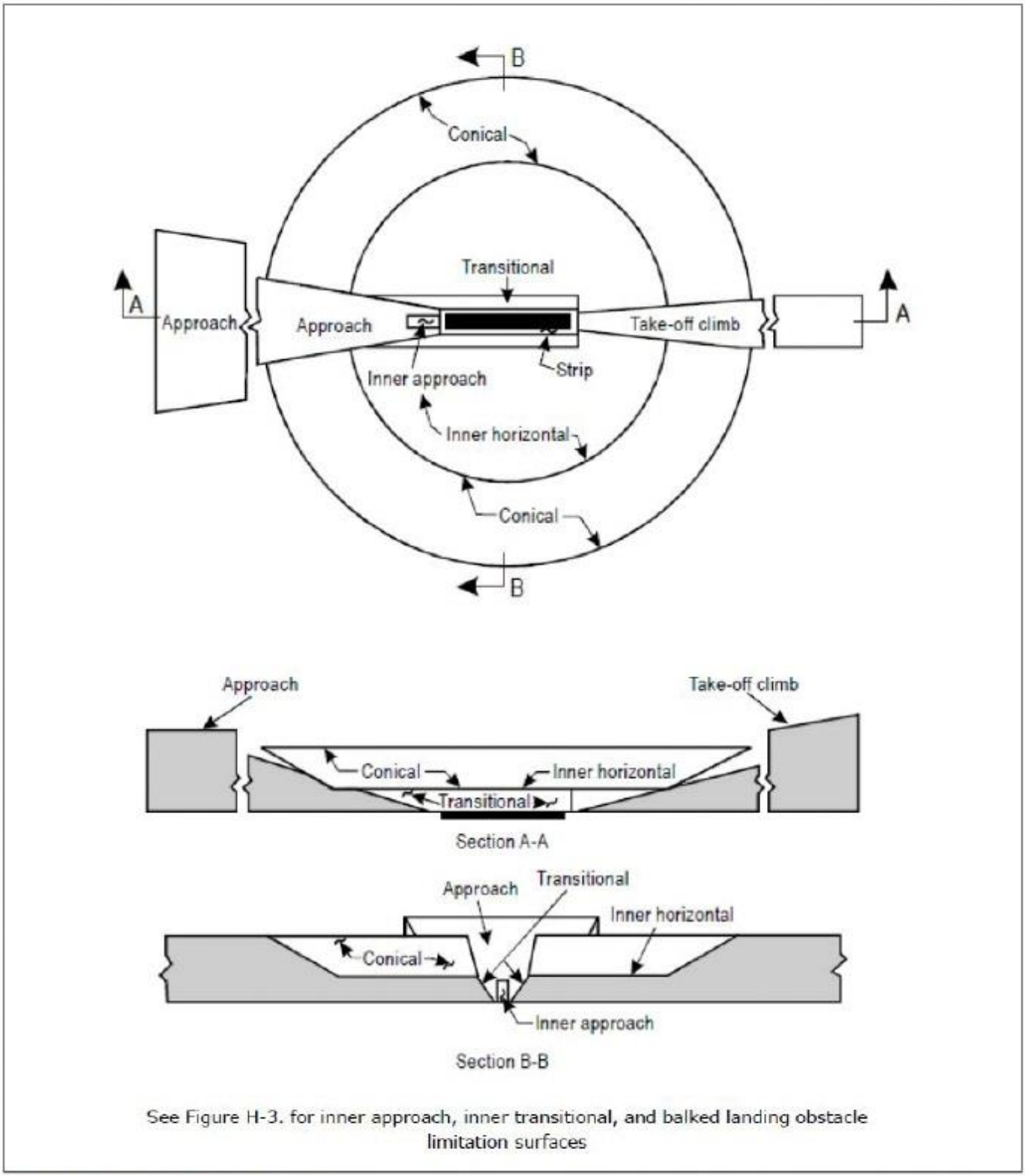


Figure H-2. Obstacle limitation surfaces

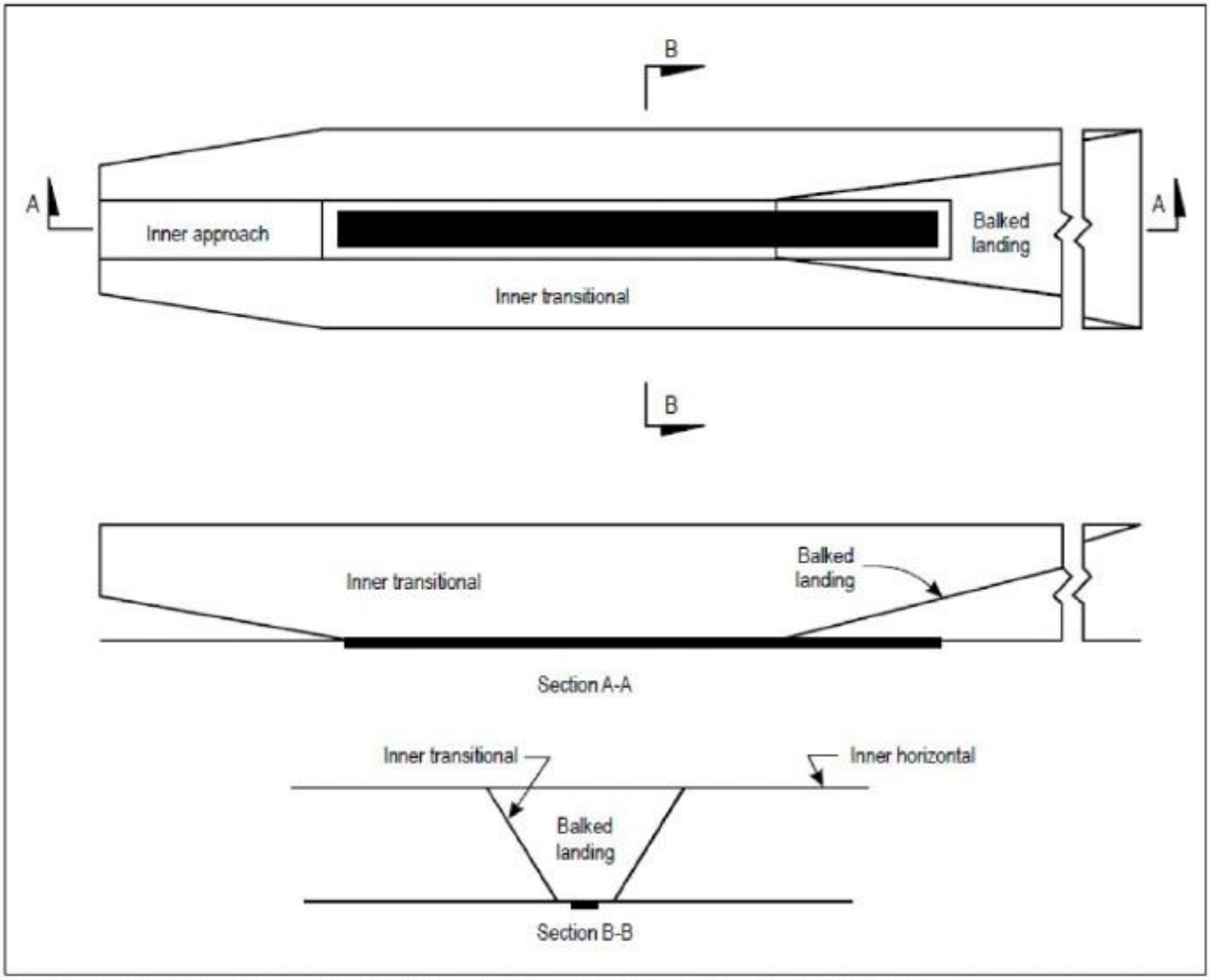


Figure H-3. Inner approach, inner transitional, and balked landing obstacle limitation surfaces

CS-ADR-DSN.H.435 Take-off climb surface

(a) Applicability: The purpose of the take-off climb surface is to protect an aircraft on take-off and during climb-out.
(b) Description: An inclined plane or other specified surface beyond the end of a runway or clearway.
(c) Characteristics: The limits of the take-off climb surface should comprise:
  (1) an inner edge horizontal and perpendicular to the centre line of the runway, and located either at a specified distance beyond the end of the runway, or at the end of the clearway when such is provided, and its length exceeds the specified distance;
  (2) two sides originating at the ends of the inner edge, diverging uniformly at a specified rate from the take-off track to a specified final width and continuing thereafter at that width for the remainder of the length of the take-off climb surface; and
  (3) an outer edge horizontal and perpendicular to the specified take-off track.
(d) The elevation of the inner edge should be equal to the highest point on the extended runway centre line between the end of the runway and the inner edge, except that when a clearway is provided, the elevation should be equal to the highest point on the ground on the centre line of the clearway.
(e) In the case of a straight take-off flight path, the slope of the take-off climb surface should be measured in the vertical plane containing the centre line of the runway.
(f) In the case of a take-off flight path involving a turn, the take-off climb surface should be a complex surface containing the horizontal normals to its centre line, and the slope of the centre line should be the same as that for a straight take-off flight path.

CS-ADR-DSN.H.440 Slewed take-off climb surface

(+GM)
Intentionally left blank

CS-ADR-DSN.H.445 Obstacle-free zone (OFZ)

(a) An OFZ is intended to protect aeroplanes from fixed and mobile obstacles during Category II and III operations when approaches are continued below decision height, and during any subsequent missed approach or balked landing with all engines operating normally. It is not intended to supplant the requirement of other surfaces or areas where these are more demanding.
(b) The OFZ is made up of the following obstacle limitation surfaces:
  (1) inner approach surface;
  (2) inner transitional surfaces; and
  (3) balked landing surface.

CS-ADR-DSN.H.450 Inner approach surface

(a) Applicability: The purpose of the inner approach surface is to protect final precision approaches.
(b) Description: A rectangular portion of the approach surface immediately preceding the threshold.
(c) Characteristics: The limits of the inner approach surface should comprise:
  (1) an inner edge coincident with the location of the inner edge of the approach surface but of its own specified length;
  (2) two sides originating at the ends of the inner edge and extending parallel to the vertical plane containing the centre line of the runway; and
  (3) an outer edge parallel to the inner edge.

CS-ADR-DSN.H.455 Inner transitional surface

(+GM)

(a) Applicability: The purpose of the inner transitional surface is to protect aeroplanes during precision approaches and balked landing.
(b) Description: A surface similar to the transitional surface but closer to the runway.
(c) Characteristics: The limits of an inner transitional surface should comprise:
  (1) a lower edge beginning at the end of the inner approach surface and extending down the side of the inner approach surface to the inner edge of that surface, from there along the strip parallel to the runway centre line to the inner edge of the balked landing surface, and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and
  (2) an upper edge located in the plane of the inner horizontal surface.
(d) The elevation of a point on the lower edge should be:
  (1) along the side of the inner approach surface and balked landing surface — equal to the elevation of the particular surface at that point; and
  (2) along the strip — equal to the elevation of the nearest point on the centre line of the runway or its extension.
(e) The slope of the inner transitional surface should be measured in a vertical plane at right angles to the centre line of the runway.

CS-ADR-DSN.H.460 Balked landing surface

(a) Applicability: The purpose of the balked landing surface is to protect balked landing.
(b) Description: An inclined plane located at a specified distance after the threshold, extending between the inner transitional surfaces.
(c) Characteristics: The limits of the balked landing surface should comprise:
  (1) an inner edge horizontal and perpendicular to the centre line of the runway and located at a specified distance after the threshold;
  (2) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centre line of the runway; and
  (3) an outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.

(d) The elevation of the inner edge should be equal to the elevation of the runway centre line at the location of the inner edge.
(e) The slope of the balked landing surface should be measured in the vertical plane containing the centre line of the runway.

CS-ADR-DSN.J.465 General

(+GM)

Obstacle limitation requirements should be distinguished between:
(a) non-instrument runways;
(b) non-precision approach runways;
(c) precision approach runways; and
(d) runways meant for take-off.

CS-ADR-DSN.J.470 Non-instrument runways

(+GM)

(a) The following obstacle limitation surfaces should be established for a non-instrument runway:
  (1) conical surface;
  (2) inner horizontal surface;
  (3) approach surface; and
  (4) transitional surfaces.
(b) The heights and slopes of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table J-1.
(c) New objects or extensions of existing objects should not be permitted above an approach or transitional surface except when the new object or extension would be shielded by an existing immovable object.
(d) New objects or extensions of existing objects should not be permitted above the conical surface or inner horizontal surface except when the object would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.
(e) Existing objects above any of the conical surface, inner horizontal surface, approach surface and transitional surfaces should, as far as practicable, be removed except when the object is shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.
(f) In considering proposed construction, account should be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.

CS-ADR-DSN.J.475 Non-precision approach runways

(+GM)

(a) The following obstacle limitation surfaces should be established for a non-precision approach runway:
  (1) conical surface;
  (2) inner horizontal surface;
  (3) approach surface; and
  (4) transitional surfaces.
(b) The heights and slopes of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table J-1, except in the case of the horizontal section of the approach surface (see paragraph (c) below).
(c) The approach surface should be horizontal beyond the point at which the 2.5 % slope intersects:
  (1) a horizontal plane 150 m above the threshold elevation; or
  (2) the horizontal plane passing through the top of any object that governs the obstacle clearance altitude/height (OCA/H);
  whichever is the higher.
(d) New objects or extensions of existing objects should not be permitted above an approach surface within 3 000 m of the inner edge or above a transitional surface except when the new object or extension would be shielded by an existing immovable object.
(e) New objects or extensions of existing objects should not be permitted above the approach surface beyond 3 000 m from the inner edge, the conical surface or inner horizontal surface except when

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

(f) Existing objects above any of the surfaces required by paragraph (a) should as far as practicable be removed except when the object would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

CS-ADR-DSN.J.480 Precision approach runways

(+GM)

(a) The following obstacle limitation surfaces should be established for a precision approach runway Category I:
  (1) conical surface;
  (2) inner horizontal surface;
  (3) approach surface; and
  (4) transitional surfaces.

(b) The following obstacle limitation surfaces should be established for a precision approach runway Category II or III:
  (1) conical surface;
  (2) inner horizontal surface;
  (3) approach surface and inner approach surface;
  (4) transitional surfaces and inner transitional surfaces; and
  (5) balked landing surface.

(c) The heights and slopes of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table J-1, except in the case of the horizontal section of the approach surface in paragraph (d) below.

(d) The approach surface should be horizontal beyond the point at which the 2.5 % slope intersects:
  (1) a horizontal plane 150 m above the threshold elevation; or
  (2) the horizontal plane passing through the top of any object that governs the obstacle clearance limit;
  whichever is the higher.

(e) Fixed objects should not be permitted above the inner approach surface, the inner transitional surface or the balked landing surface, except for frangible objects which because of their function should be located on the strip. Mobile objects should not be permitted above these surfaces during the use of the runway for landing.

(f) New objects or extensions of existing objects should not be permitted above an approach surface or a transitional surface except when the new object or extension would be shielded by an existing immovable object.

(g) New objects or extensions of existing objects should not be permitted above the conical surface and the inner horizontal surface except when an object would be shielded by an existing immovable object, or if after a safety assessment , it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

(h) Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface should, as far as practicable, be removed except when an object would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

APPROACH RUNWAYS										
RUNWAY CLASSIFICATION										
Surface and dimensions[a]	Non-instrument Code number				Non-precision approach Code number			Precision approach category		
								I Code number		II or III Code number
	1	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5 %	5 %	5 %	5 %	5 %	5 %	5 %	5 %	5 %	5 %
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
INNER APPROACH										
Width	-	-	-	-	-	-	-	90 m	120 m[e]	120 m[e]
Distance from threshold	-	-	-	-	-	-	-	60 m	60 m	60 m
Length	-	-	-	-	-	-	-	900 m	900 m	900 m
Slope	-	-	-	-	-	-	-	2.5 %	2 %	2 %

APPROACH RUNWAYS RUNWAY CLASSIFICATION										
Surface and dimensions[a]	Non-instrument Code number				Non-precision approach Code number			Precision approach category		
								I Code number		II or III Code number
	1	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
APPROACH										
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side	10 %	10 %	10 %	10 %	15 %	15 %	15 %	15 %	15 %	15 %
First section										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5 %	4 %	3.33 %	2.5 %	3.33 %	2 %	2 %	2.5 %	2 %	2 %
Second section										

Length	-	-	-	-	-	3 600 m[b]	3 600 m[b]	12 000 m	3 600 m[b]	3 600 m[b]
Slope	-	-	-	-	-	2.5 %	2.5 %	3 %	2.5 %	2.5 %
Horizontal section										
Length	-	-	-	-	-	8 400 m[b]	8 400 m[b]	-	8 400 m[b]	8 400 m[b]
Total length	-	-	-	-	-	15000m	15000m	15 000 m	15 000 m	15 000 m
TRANSITIONAL										
Slope	20 %	20 %	14.3 %	14.3 %	20 %	14.3 %	14.3 %	14.3 %	14.3 %	14.3 %
INNER TRANSITIONAL										
Slope	-	-	-	-	-	-	-	40 %	33.3 %	33.3 %
BALKED LANDING SURFACE										
Length of inner edge	-	-	-	-	-	-	-	90 m	120 m[e]	120 m[e]
Distance from threshold	-	-	-	-	-	-	-	c	1 800 m[d]	1 800 m[d]
Divergence (each side)	-	-	-	-	-	-	-	10 %	10 %	10 %
Slope	-	-	-	-	-	-	-	4 %	3.33 %	3.33 %

Surface and dimensions[a]	APPROACH RUNWAYS RUNWAY CLASSIFICATION Non-instrument Code number				Non-precision approach Code number			Precision approach category I Code number		Precision approach category II or III Code number
	1	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

a. All dimensions are measured horizontally unless specified otherwise.

b. Variable length (CS-ADR-DSN.J.475(c) or CS MAR-ADR-DSN.J480(d)

c. Distance to the end of strip.

d. Or end of runway whichever is less.

e. Where the code letter is F (Code element 2 of Table A-1), the width is increased to 140 m.

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

CS-ADR-DSN.J.485 Runways meant for take-off
(+GM)

(a) The safety objective of the take-off climb surface slopes and dimensions is to allow safe take-off operations by defining the limits above which new obstacles should not be permitted unless shielded by an existing immoveable object.
(b) A take-off climb surface should be established for a runway meant for take-off.
(c) The dimensions of the surface should be not less than the dimensions specified in Table J-2, except that a lesser length may be adopted for the take-off climb surface where such lesser length would be consistent with procedural measures adopted to govern the outward flight of aeroplanes.
(d) New objects or extensions of existing objects should not be permitted above a take-off climb surface except when the new object or extension would be shielded by an existing immovable object.
(e) Existing objects that extend above a take-off climb surface should as far as practicable be removed except when an object is shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

RUNWAYS MEANT FOR TAKE-OFF			
Surface and dimensions[a]	Code number		
	1	2	3 or 4
(1)	(2)	(3)	(4)
TAKE-OFF CLIMB			
Length of inner edge	60[e] m	80[e] m	180 m
Distance from runway end[b]	30 m	60 m	60 m
Divergence (each side)	10 %	10 %	12.5 %
Final width	380 m	580 m	1 200 m 1 800 m[c]
Length	1 600 m	2 500 m	15 000 m
Slope	5 %	4 %	2 %[d]
All dimensions are measured horizontally unless specified otherwise.			
The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.			
1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.			
See GM1 MAR-ADR-DSN.J.485 (a) and (e).			
Where clearway is provided the length of the inner edge should be 150 m.			

Table J-2. Dimensions and slopes of obstacle limitation surfaces — Runways meant for take-off

CS-ADR-DSN.J.486 Other objects
(+GM)

(a) Objects which do not project through the approach surface but which would nevertheless adversely affect the optimum siting or performance of visual or non-visual aids should, as far as practicable, be removed.
(b) Anything which may, after a safety assessment, endanger aeroplanes on the movement area or in the air within the limits of the inner horizontal and conical surfaces should be regarded as an obstacle and should be removed in so far as practicable.

CS-ADR-DSN.J.487 Objects outside the obstacle limitation surfaces

(+GM)

(a) Applicability: The specifications in paragraph (b) below apply only to the area under control of the aerodrome operator.

(b) In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a safety assessment indicates that they do not constitute a hazard to aeroplanes.

CS-ADR-DSN.K.490 Wind direction indicator

(+GM)

(a) An aerodrome should be equipped with a sufficient number of wind direction indicators in order to provide wind information to the pilot during approach and take-off.

(b) Location:
Each wind direction indicator should be located so that at least one wind direction indicator is visible from aircraft in flight, during approach or on the movement area before take-off, and in such a way as to be free from the effects of air disturbances caused by nearby objects.

(c) Characteristics:
(1) Each 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.
(2) 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.
(3) 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:
i) where practicable, a single colour should be used; and
ii) 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.

(d) Night conditions:
Provision should be made for illuminating a sufficient number of wind indicators at an aerodrome intended for use at night.

CS-ADR-DSN.K.495 Landing direction indicator

(a) Location: Where provided, a landing direction indicator should be located in a conspicuous place on the aerodrome.

(b) Characteristics:
(1) The landing direction indicator should be in the form of a 'T'.
(2) The shape and minimum dimensions of a landing 'T' should be as shown in Figure K-1.
(3) The colour of the landing 'T' should be either white or orange, the choice being dependent on the colour that contrasts best with the background against which the indicator should be viewed.
(4) Where used at night, the landing 'T' should either be illuminated or outlined by white lights.

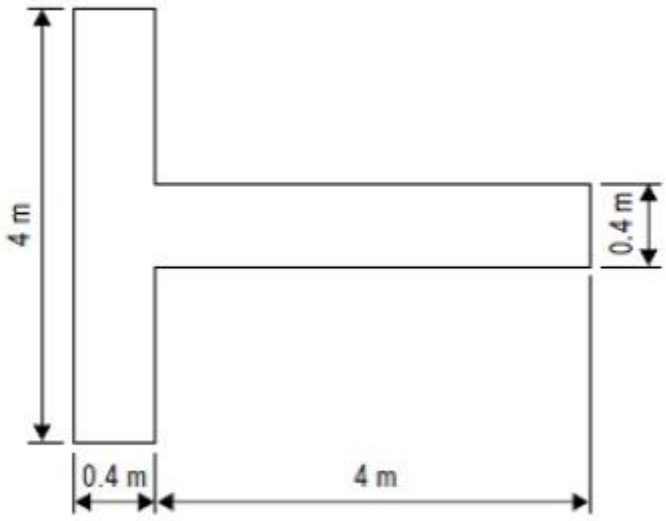


Figure K-1. Landing direction indicator

CS-ADR-DSN.K.500 Signalling lamp

(+GM)

(a) A signalling lamp should be provided at a controlled aerodrome in the aerodrome control tower.
(b) Characteristics:
  (1) A signalling lamp should be capable of producing red, green and white signals, and of:
    i) being aimed manually at any target as required; and
    ii) giving a signal in any one colour followed by a signal in either of the two other colours.
  (2) The beam spread should be not less than 1° or greater than 3°, with negligible light beyond 3°. When the signalling lamp is intended for use in the daytime, the intensity of the coloured light should be not less than 6 000 cd.

CS-ADR-DSN.L.520 General — Colour and conspicuity

(+GM)

Markings should be of a conspicuous colour and contrast with the surface on which they are laid.

(a) Runway markings should be white.

(b) Markings for taxiways, runway turn pads, and aircraft stands should be yellow.

(c) Apron safety lines should be of a conspicuous colour which should contrast with that used for aircraft stand markings.

(d) When it is operationally necessary to apply temporary runway or taxiway markings, those markings should comply with the relevant CS.

CS-ADR-DSN.L.525 Runway designation marking

(a) Applicability: A runway designation marking should be provided at the thresholds of a runway.

(b) Location and positioning: A runway designation marking should be located at a threshold as shown in Figure L-1 as appropriate.

(c) Characteristics:

(1) A runway designation marking should consist of a two-digit number and on parallel runways should be supplemented with a letter.

i) On a single runway, dual parallel runways and triple parallel runways, the two-digit number should be the whole number nearest the one-tenth of the magnetic North when viewed from the direction of approach.

ii) On four or more parallel runways, one set of adjacent runways should 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.

iii) When a runway designation marking consists of a single digit number, it should be preceded by a zero.

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

i) for two parallel runways: 'L' 'R';

ii) for three parallel runways: 'L' 'C' 'R';

iii) for four parallel runways: 'L' 'R' 'L' 'R';

iv) for five parallel runways: 'L' 'C' 'R' 'L' 'R' or 'L' 'R' 'L' 'C' 'R'; and

v) for six parallel runways: 'L' 'C' 'R' 'L' 'C' 'R'.

(3) The numbers and letters should be in the form and proportion shown in Figure L-2. The dimensions should be not less than those shown in Figure L-2. Where the numbers are incorporated in the threshold marking, larger dimensions should be used in order to fill adequately the gap between the stripes of the threshold marking.

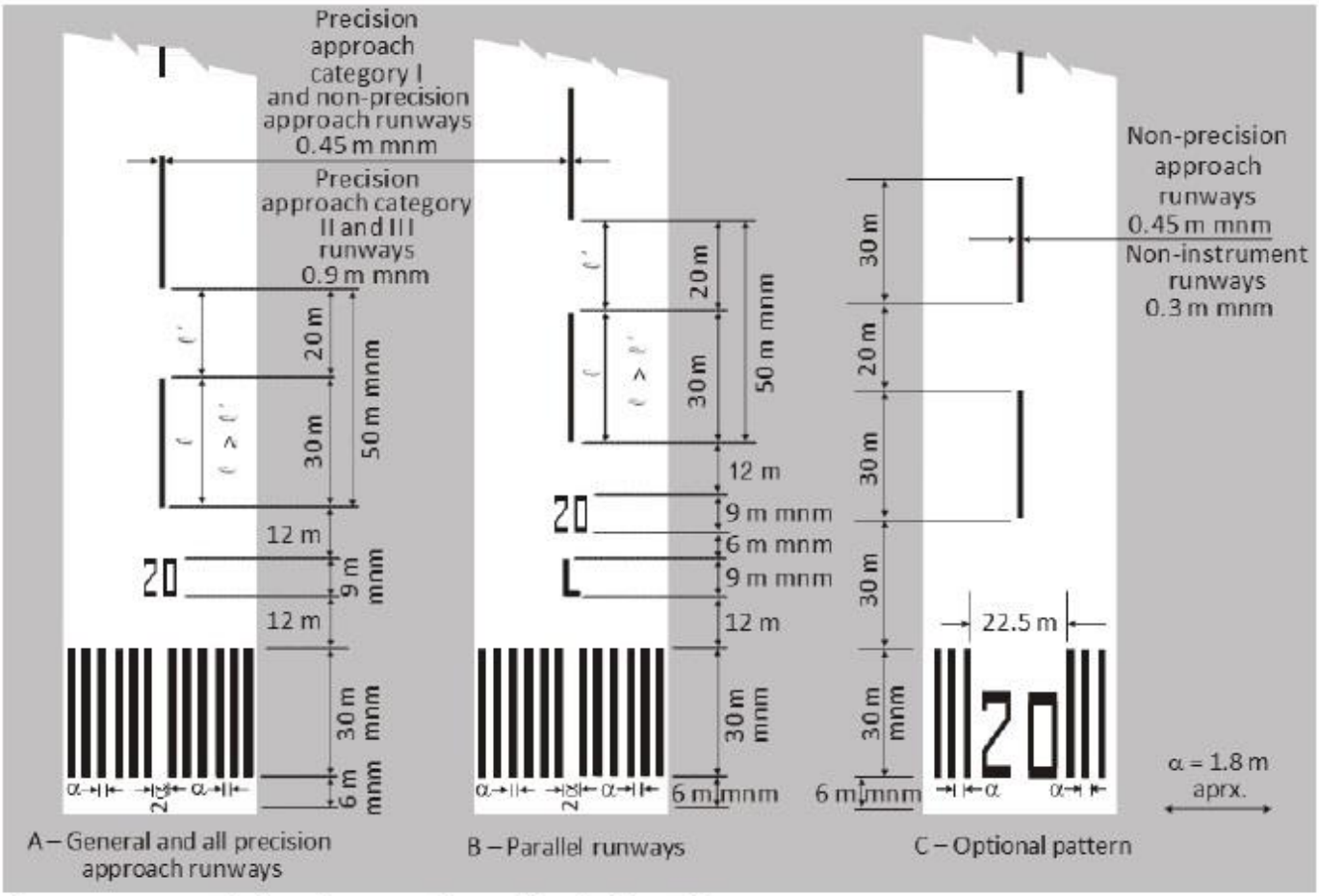


Figure L-1. Runway designation, centre line and threshold markings

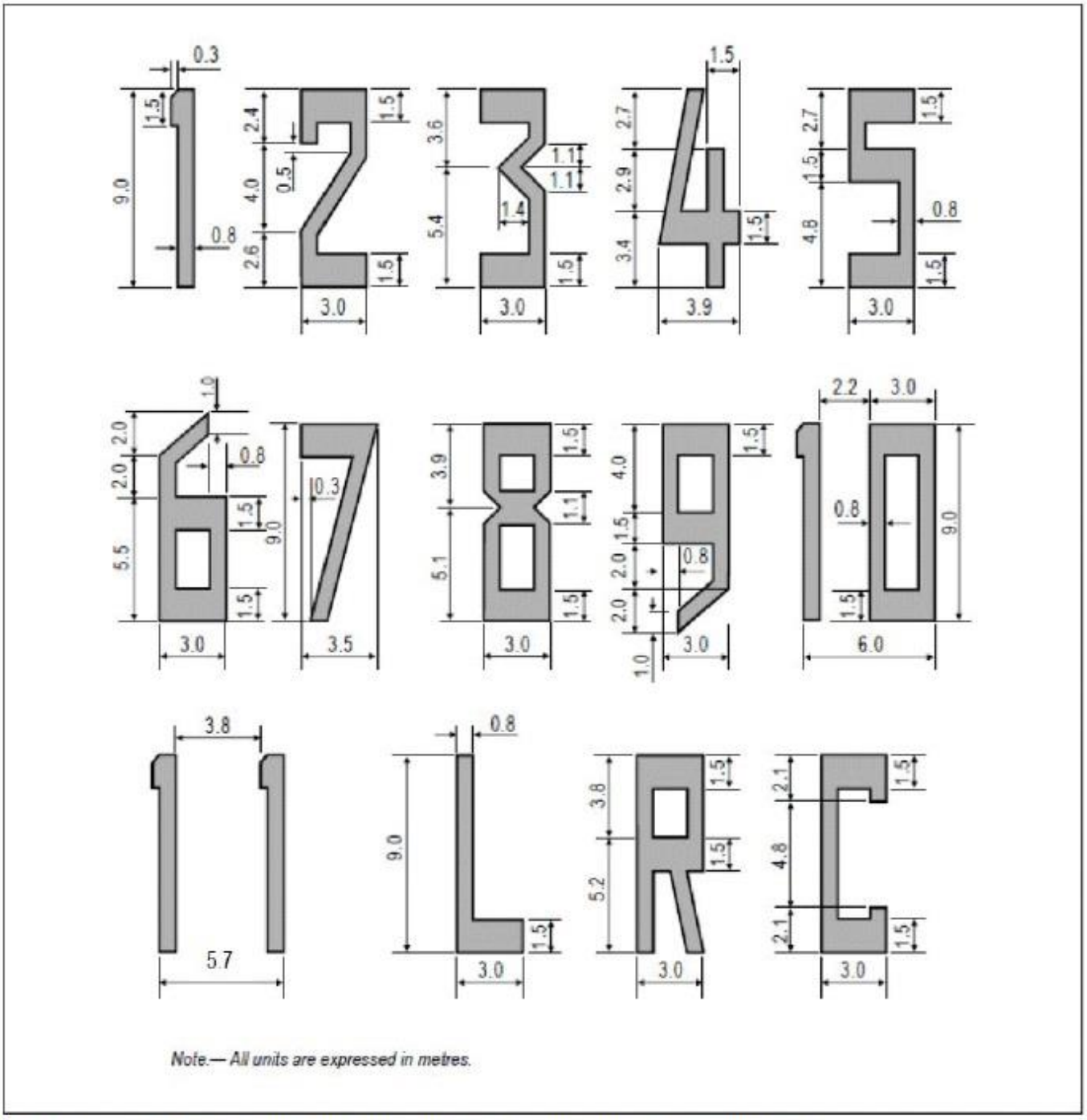


Figure L-2. Form and proportions of numbers and letters for runway designation markings

CS-ADR-DSN.L.530 Runway centre line marking

(+GM)

(a) Applicability: A runway centre line marking should be provided on a paved runway.

(b) Location: A runway centre line marking should be located along the centre line of the runway between the runway designation marking as shown in Figure L-1, except when interrupted as given in CS-ADR-DSN.L.560.

(c) Characteristics:

(1) A runway centre line marking should consist of a line of uniformly spaced stripes and gaps. The length of a stripe plus a gap should be not less than 50 m or more than 75 m. The length of each stripe should be at least equal to the length of the gap or 30 m, whichever is greater.

(2) The width of the stripes should be not less than:

(i) 0.90 m on precision approach Category II and III runways;

(ii) 0.45 m on non-precision approach runways where the code number is 3 or 4, and precision approach Category I runways; and
(iii) 0.30 m on non-precision approach runways where the code number is 1 or 2, and on non-instrument runways.

CS-ADR-DSN.L.535 Threshold marking

(a) Applicability: A threshold marking should be provided at the threshold of a runway.
(b) Characteristics:
(1) The stripes of the threshold marking should commence 6 m from the threshold.
(2) A runway threshold marking should consist of a pattern of longitudinal stripes of uniform dimensions disposed symmetrically about the centre line of a runway as shown in Figure L-1(A) and L-1(B) for a runway width of 45 m. The number of stripes should be in accordance with the runway width as follows:

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

except that on non-precision approach and non-instrument runways 45 m or greater in width, they may be as shown in Figure L-1(C).
(3) The stripes should 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.
(4) Where a runway designation marking is placed within a threshold marking, there should be a minimum of three stripes on each side of the centre line of the runway.
(5) Where a runway designation marking is placed above a threshold marking, the stripes should be continued across the runway. The stripes should be at least 30 m long and approximately 1.80 m wide with spacing's of approximately 1.80 m between them. Where the stripes are continued across a runway, a double spacing should 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 should be 22.5 m.
(c) Displaced threshold:
(1) 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 L-3(B) should be added to the threshold marking.
(2) A transverse stripe should be not less than 1.80 m wide.
(3) Where a runway threshold is permanently displaced, arrows conforming to Figure L-3(B) should be provided on the portion of the runway before the displaced threshold.
(4) When a runway threshold is temporarily displaced from the normal position, it should be marked as shown in Figure L-3(A) or L-3(B), and all markings prior to the displaced threshold should be obscured except the runway centre line marking which should be converted to arrows.

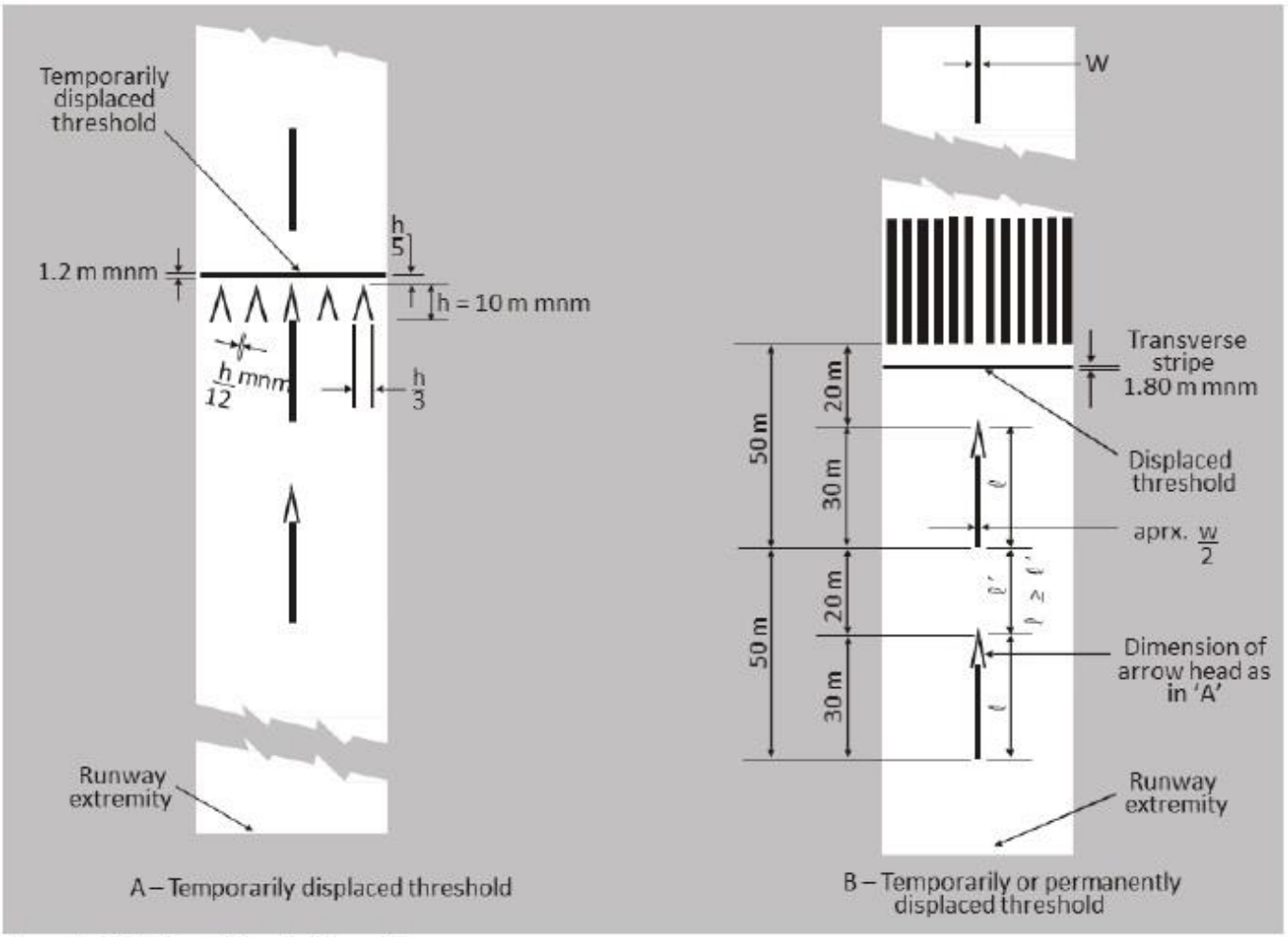


Figure L-3. Displaced threshold markings

CS-ADR-DSN.L.540 Aiming point marking

(+GM)

(a) Applicability:

(1) An aiming point marking should be provided at each approach end of an instrument runway where the code number is 2, 3, or 4.

(2) An aiming point marking should be provided when additional conspicuity of the aiming point is required at each approach end of:

(i) a non-instrument runway where the code number is 3 or 4,

(ii) an instrument runway where the code number is 1.

(b) Characteristics. The aiming point marking should commence no closer to the threshold than the distance indicated in the appropriate column of Table L-1, except that, on a runway equipped with a PAPI system, the beginning of the marking should be coincident with the visual approach slope origin.

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

a Where a PAPI system is provided for the runway, the beginning of the marking should be coincident with the visual approach slope origin.

b Where greater dimensions of the specified ranges are intended to be used where increased conspicuity is required.

c Where lateral spacing may be varied within these limits to minimise the contamination of the marking by rubber deposits.

d These figures were deduced by reference to the outer main gear wheel span which is element 2 of the aerodrome reference code

Table L-1. Location and dimensions of aiming point marking

(c) An aiming point marking should consist of two conspicuous stripes. The dimensions of the stripes and the lateral spacing between their inner sides should be in accordance with the provisions of the appropriate column of Table L-1.

CS-ADR-DSN.L.545 Touchdown zone marking

(+GM)

(a) Applicability:
(1) A touchdown zone marking should be provided in the touchdown zone of a paved precision approach runway where the code number is 2, 3, or 4.
(2) 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.

(b) Location: A touchdown zone marking should consist of pairs of rectangular markings symmetrically disposed about the runway centre line with the number of such pairs related to the landing distance available and, where the marking is to be displayed at both the approach directions of a runway, the distance between the thresholds, as follows:

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

(c) Characteristics:
(1) A touchdown zone marking should conform to the patterns shown in Figure L-4. For the pattern shown in Figure L-4(A), the markings should be not less than 22.5 m long and 3 m wide. For the pattern shown in Figure L-4(B), each stripe of each marking should be not less than 22.5 m long and 1.8 m wide with spacing of 1.5 m between adjacent stripes.

(2) The lateral spacing between the inner sides of the rectangles should 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 should correspond to the lateral spacing specified for the aiming point marking in Table L-1 (columns (2), (3), (4), or (5), as appropriate). The pairs of markings should be provided at longitudinal spacings of 150 m beginning from the threshold, except that pairs of touchdown zone markings coincident with or located within 50 m of an aiming point marking should be deleted from the pattern.

(3) 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.

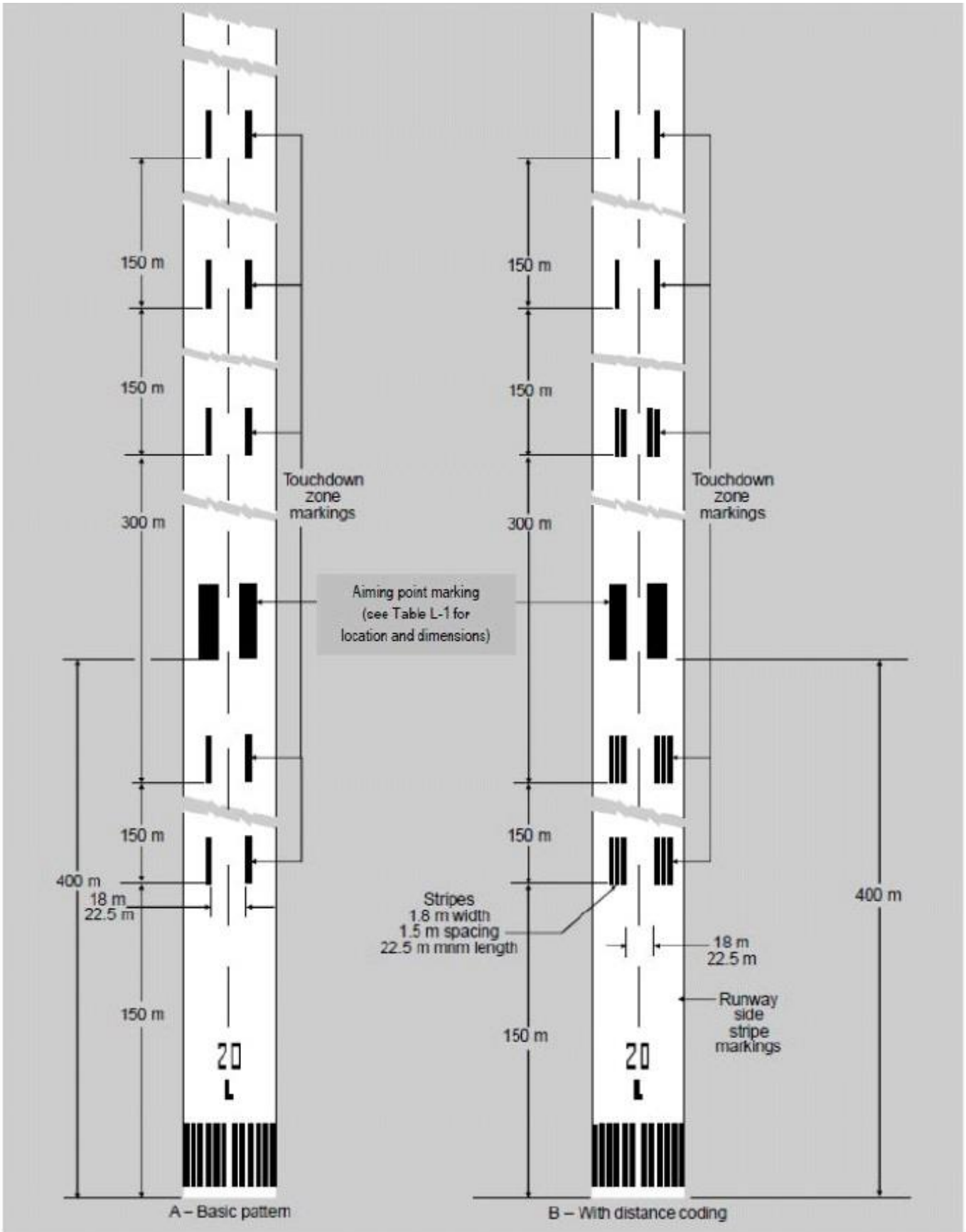


Figure L-4. Aiming point and touchdown zone markings (illustrated for a runway with a length of 2 400 m or more)

CS-ADR-DSN.L.550 Runway side stripe marking

(+GM)

(a) Applicability:
  (1) A runway side stripe marking should be provided between the thresholds of a runway where there is a lack of contrast between the runway edges and the shoulders or the surrounding terrain.
  (2) 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.

(b) Location and characteristics:
  (1) 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.
  (2) Where a runway turn pad is provided, the runway side stripe marking should be continued between the runway and the runway turn pad.
  (3) 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.

CS-ADR-DSN.L.555 Taxiway centre line marking

(+GM)

(a) Applicability:
  (1) Taxiway centre line marking should be provided on a taxiway, de-icing/anti-icing facility and apron in such a way as to provide continuous guidance between the runway centre line and aircraft stands.
  (2) Taxiway centre line marking should be provided on a runway when the runway is part of a standard taxi-route and where the taxiway centre line is not coincident with the runway centre line.

(b) Characteristics:
  (1) On a straight section of a taxiway, the taxiway centre line marking should be located along the taxiway centre line.
  (2) 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.
  (3) 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 as shown in Figure L-5. 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.
  (4) Where taxiway centre line marking is provided in accordance with (a)(2) above, the marking should be located on the centre line of the designated taxiway.
  (5) A taxiway centre line marking should 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 L-5. Taxiway markings (shown with basic runway markings).

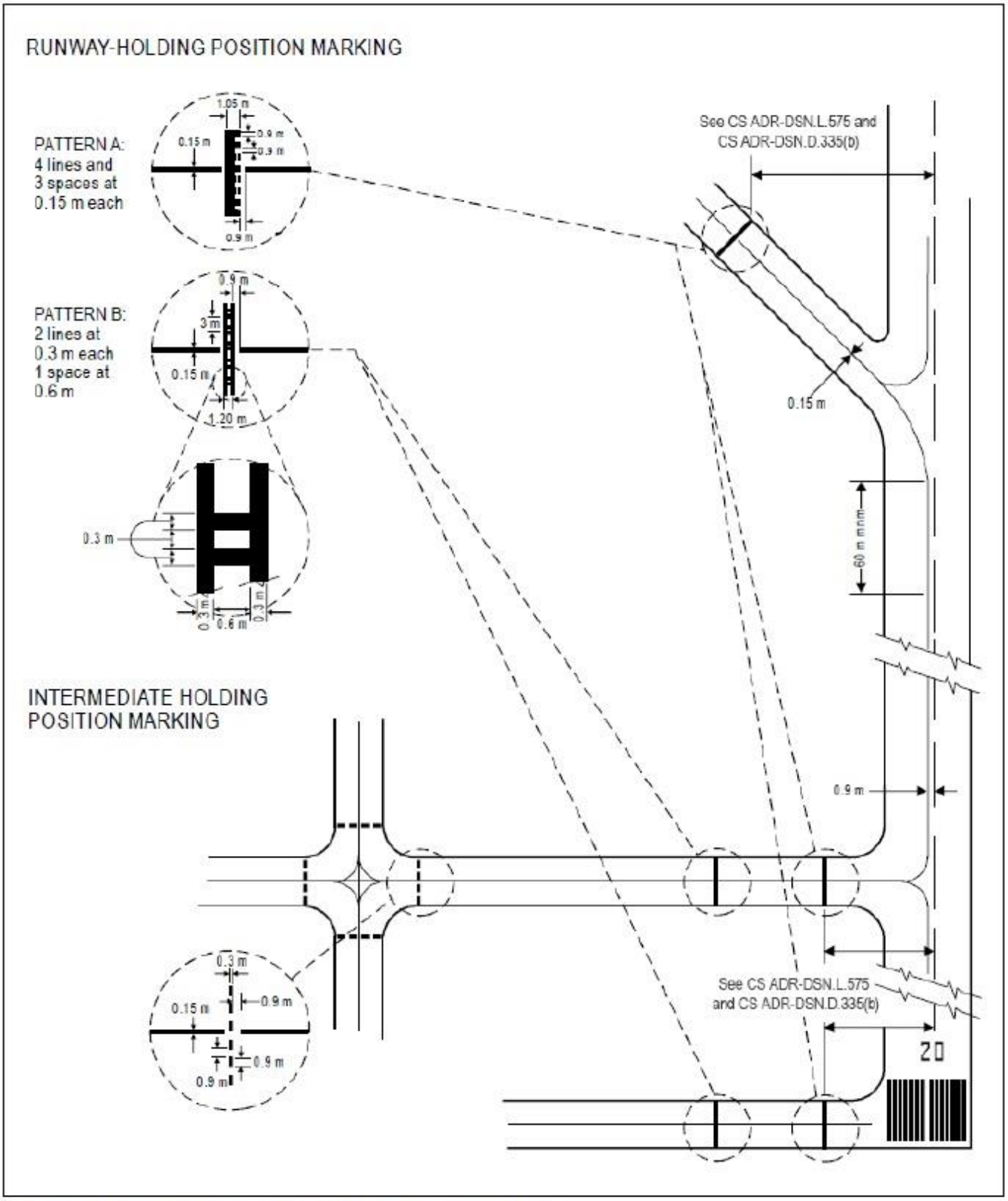


Figure L-5. Taxiway markings (shown with basic runway markings)

CS-ADR-DSN.L.560 Interruption of runway markings

(+GM)

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

either continued across the intersection or interrupted.

(b) The order of importance of runways for the display of runway markings should be as follows:
(1) precision approach runway;
(2) non-precision approach runway; and
(3) non-instrument runway.

(c) At an intersection of a runway and taxiway the markings of the runway should be displayed and the markings of the taxiway interrupted, except that runway side stripe markings should be either continued across the intersection or interrupted.

CS-ADR-DSN.L.565 Runway turn pad marking

(+GM)

(a) Applicability: Where a runway turn pad is provided, a runway turn pad marking should be provided for continuous guidance to enable an aeroplane to complete a 180-degree turn and align with the runway centre line.

(b) Characteristics:
(1) 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 manoeuvring capability and normal taxiing speeds of the aeroplanes for which the runway turn pad is intended.
(2) The intersection angle of the runway turn pad marking with the runway centre line should not be greater than 30 degrees.
(3) 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.
(4) A runway turn pad marking should guide the aeroplane in such a way as to allow a straight portion of taxiing before the point where a 180-degree turn is to be made. The straight portion of the runway turn pad marking should be parallel to the outer edge of the runway turn pad.
(5) 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.
(6) 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 CS-ADR-DSN.B.095(c).
(7) A runway turn pad marking should be at least 15 cm in width and continuous in length.

CS-ADR-DSN.L.570 Enhanced taxiway centre line marking

(+GM)

(a) Where provided, an enhanced taxiway centre line marking should be installed at each taxiway/runway intersection where it is necessary to denote the proximity of a runway-holding position.

(b) Characteristics:
(1) Enhanced taxiway centre line marking should be as shown in Figure L-6. An enhanced taxiway centre line marking should extend from the runway-holding position Pattern A (as defined in Figure L-5) to a distance of up to 47 m in the direction of travel away from the runway (see Figure L-6(a)).
(2) If the enhanced taxiway centre line marking intersects another runway-holding position marking, such as for a precision approach Category II or III runway, that is located within 47 m of the first runway-holding position marking, the enhanced taxiway centre line marking should be interrupted 0.9 m prior to and after the intersected runway-holding position marking. The enhanced taxiway centre line marking should continue beyond the intersected runway-holding position marking for at least three dashed line segments or 47 m from start to finish, whichever is greater (see Figure L-6(b)).
(3) If the enhanced taxiway centre line marking continues through a taxiway/taxiway intersection that is located within 47 m of the runway-holding position marking, the enhanced taxiway centre line marking should be interrupted 1.5 m prior to and after the point where the intersected taxiway centre line crosses the enhanced taxiway centre line. The enhanced taxiway centre line marking should continue beyond the taxiway/taxiway intersection for at least three dashed line segments or 47 m from start to finish, whichever is greater (see Figure

L-6(c)).

(4) Where two taxiway centre lines converge at or before the runway-holding position marking, the inner dashed line should not be less than 3 m in length (see Figure L-6(d)).

(5) Where there are two opposing runway-holding position markings and the distance between the markings is less than 94 m, the enhanced taxiway centre line markings should extend over this entire distance. The enhanced taxiway centre line markings should not extend beyond either runway-holding position marking (see Figure L-6(e)).

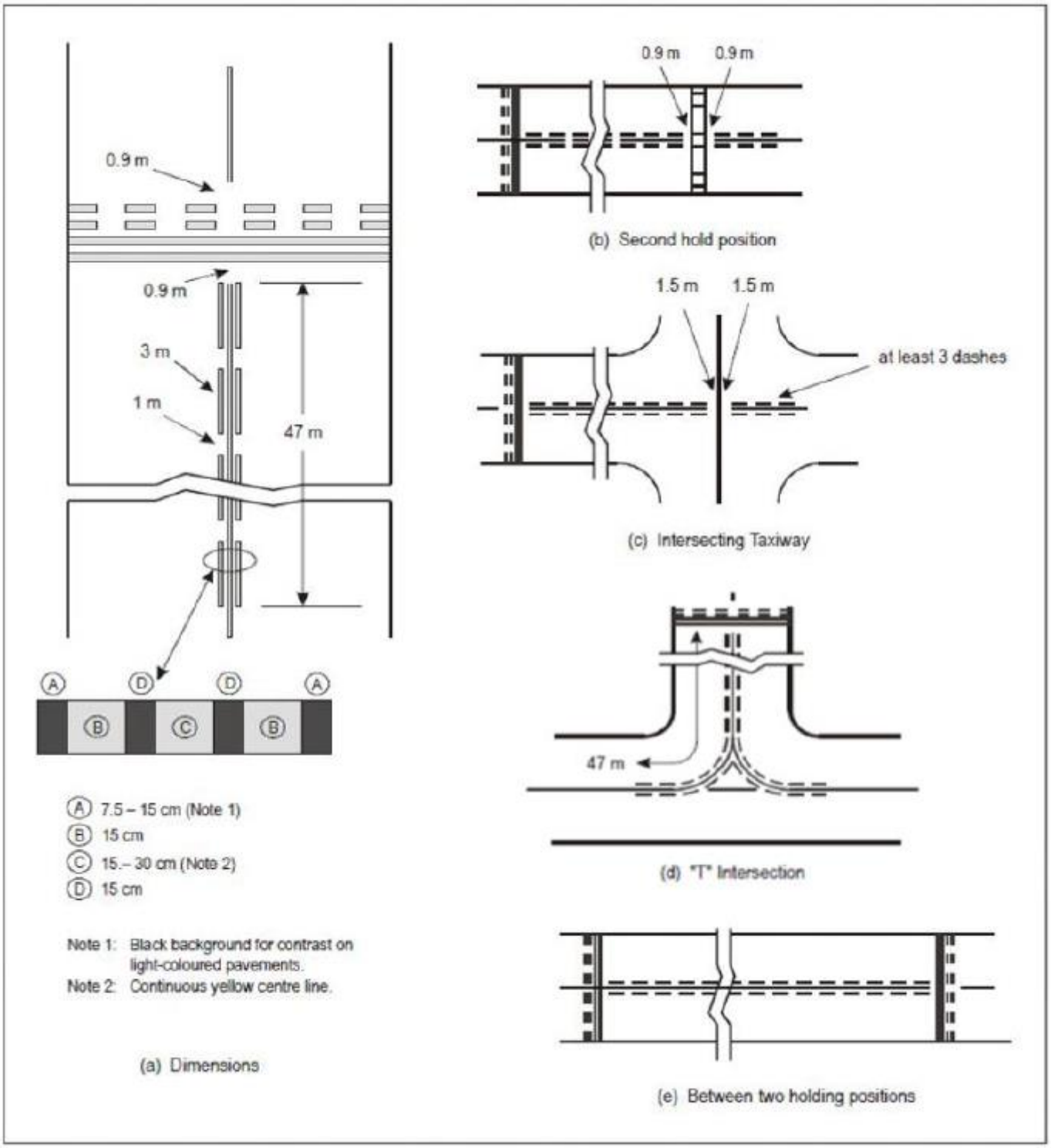


Figure L-6. Enhanced taxiway centre line marking

CS-ADR-DSN.L.575 Runway-holding position marking

(+GM)

A runway-holding position marking should be displayed along a runway-holding position.

(a) Characteristics:

(1) At an intersection of a taxiway and a non-instrument, non-precision approach or take-off runway, the runway-holding position marking should be as shown in Figure L-5, pattern A.

(2) Where a single runway-holding position is provided at an intersection of a taxiway and a precision approach Category I, II or III runway, the runway-holding position marking should be as shown in Figure L-5, pattern A.

(3) Where two or three runway-holding positions are provided at such an intersection, the runway-holding position marking closer (closest) to the runway should be as shown in Figure L-5, pattern A, and the markings farther from the runway should be as shown in Figure L-5, pattern B.

(4) The runway-holding position marking displayed at a runway-holding position established in accordance with CS-ADR-DSN.D.335(b)(1) should be as shown in Figure L-5, pattern A.

(5) Where increased conspicuity of the runway-holding position is required, the runway-holding position marking should be as shown in Figure L-7, pattern A or pattern B, as appropriate.

(6) Where a pattern B runway-holding position marking is located on an area where it would exceed 60 m in length, a mandatory instruction marking containing the term 'CAT II' or 'CAT III' as appropriate should be marked on the surface at the ends of the runway-holding position marking and at equal intervals of 45 m maximum between successive marks. The letters should be not less than 1.8 m high and should be placed not more than 0.9 m on the holding side of the runway holding position marking.

(7) The runway-holding position marking displayed at a runway/runway intersection should be perpendicular to the centre line of the runway forming part of the standard taxi-route. The pattern of the marking should be as shown in Figure L-7, pattern A.

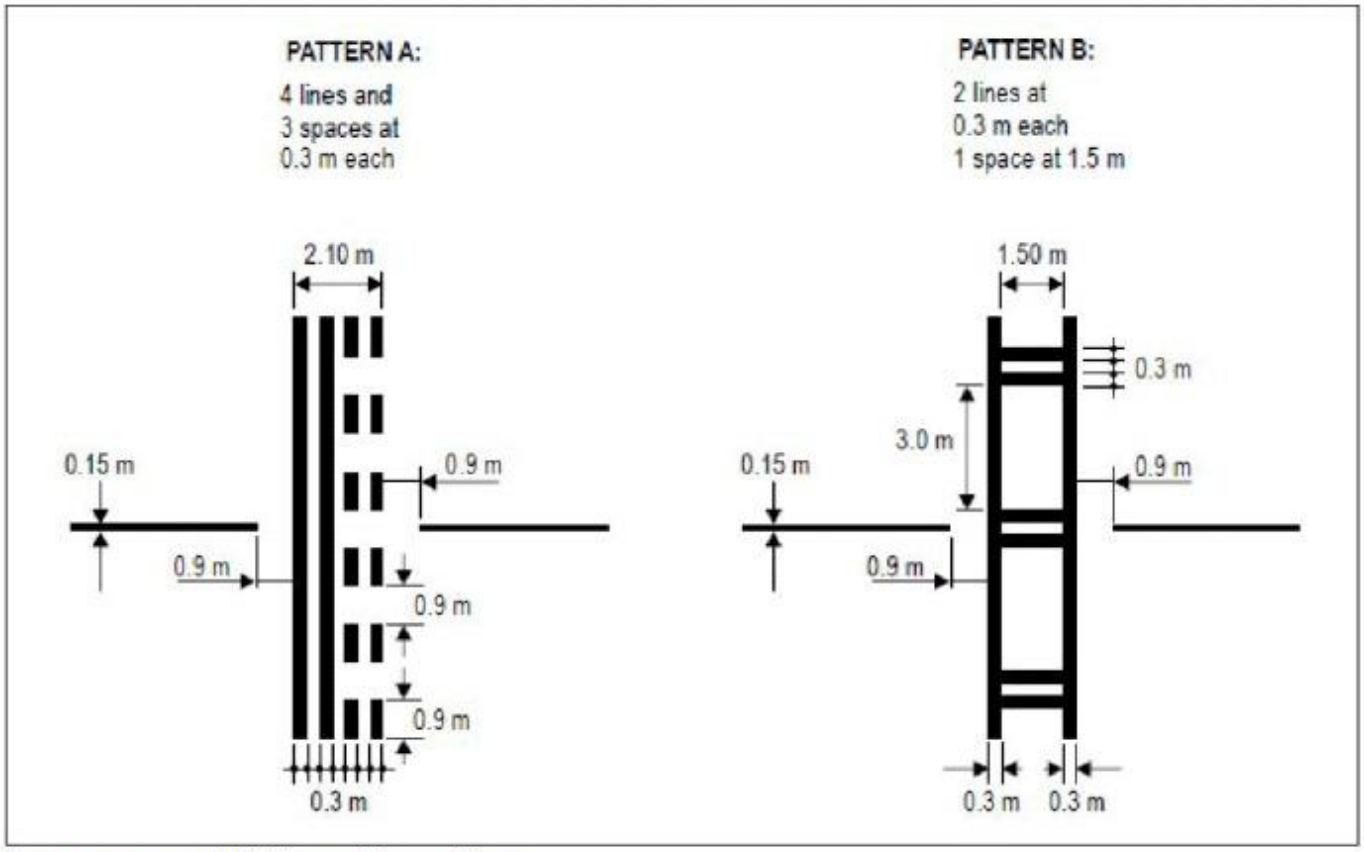


Figure L-7. Runway-holding position markings

CS-ADR-DSN.L.580 Intermediate holding position marking

(a) Applicability:
  (1) An intermediate holding position marking should be displayed along an intermediate holding position.
  (2) An intermediate holding position marking should be displayed at the exit boundary of a remote de-icing/anti-icing facility adjoining a taxiway.
(b) Location:
  (1) Where an intermediate holding position marking is displayed at an intersection of two taxiways, it should be located across the taxiway at sufficient distance from the near edge of the intersecting taxiway to ensure safe clearance between taxiing aircraft. It should be coincident with a stop bar or intermediate holding position lights where provided.
  (2) The distance between an intermediate holding position marking at the exit boundary of a remote de-icing/anti-icing facility and the centre line of the adjoining taxiway should not be less than the dimension specified in the table below.

Code letter	Distance (metres)
A	15.5
B	20
C	26
D	37
E	43.5
F	51

(c) Characteristics: An intermediate holding position marking should consist of a single broken line as shown in Figure L-5.

CS-ADR-DSN.L.590 Aircraft stand marking

(+GM)

(a) Applicability: Aircraft stand markings should be provided for designated parking positions on an apron and on a de-icing/anti-icing facility.
(b) General characteristics: 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.
(c) Aircraft stand identification:
  (1) An 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.
  (2) Identification of the aircraft for which each set of markings is intended, should be added to the stand identification where two sets of aircraft stand markings are superimposed on each other in order to permit more flexible use of the apron and safety would be impaired if the wrong marking was followed.
(d) Lead-in, turning, and lead-out lines:
  (1) Lead-in, turning, and lead-out lines should, as far as practicable, 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.
  (2) 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.
  (3) Where it is intended that an aircraft proceeds 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.
(e) Alignment bar: 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.
(f) Turn bar and stop line:
  (1) 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.

(2) 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.
(3) If more than one turn bar and/or stop line is required, they should be designated for the appropriate aircraft types.

CS-ADR-DSN.L.595 Apron safety lines
(+GM)

(a) Applicability: Apron safety lines should be provided on an apron as required by the parking configurations and ground facilities.
(b) Location: Apron safety lines should be located so as to define the areas intended for use by ground vehicles and other aircraft servicing equipment to provide safe separation from aircraft.
(c) Characteristics:
(1) 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.
(2) Apron safety lines should be of a conspicuous colour which should contrast with that used for aircraft stand markings.
(3) An apron safety line should be continuous in length and at least 10 cm in width.

CS-ADR-DSN.L.597 Apron service road marking
(+GM)

(a) Applicability: The limits of an apron service road, should be defined by apron service road markings.
(b) Location: Apron service road markings should define the areas intended for use by ground vehicles and other aircraft servicing equipment to provide safe separation from aircraft.
(c) Characteristics:
(1) Apron service road markings should be white.
(2) Apron service road markings should be continuous in length on the edges, continuous or broken in the middle, as appropriate, and at least 10 cm in width.
(3) When an apron service road crosses a taxiway or aircraft stand taxilane, the apron service road edge marking should be laterally dashed along the crossing. The stripes should be 1.0 m in length, and their width should be equal to the width of the continuous part of the marking.
(d) Apron service road markings should be discontinued when they intersect with other markings on an apron. The interrupted gap should be not more than 1 m on each side from the edge of the interested marking.

CS-ADR-DSN.L.600 Road-holding position marking
(+GM)

(a) Applicability: A road-holding position marking should be provided at all road entrances or intersections to a runway or a taxiway.
(b) Location:
(1) The road-holding position marking should be located across the road at the holding position.
(2) Where a road intersects a taxiway, a road-holding position marking should be located across the road at the appropriate distance to ensure vehicles remain clear of the taxiway strip.
(c) Characteristics:
(1) The road-holding position marking should be in accordance with the local road traffic regulations.
(2) The road-holding position marking at the intersection of a road with a taxiway should be in accordance with the local traffic regulations for a yield right-of-way or mandatory stop.

CS-ADR-DSN.L.605 Mandatory instruction marking
(+GM)

(a) Applicability:
(1) Where a mandatory instruction sign in accordance with CS-ADR-DSN.N.780 is not installed, a mandatory instruction marking should be provided on the surface of the pavement.

(2) 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.

(b) Location:

(1) The mandatory instruction marking on taxiways, where the code letter is A, B, C, or D, should 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 L-9(A). The distance between the nearest edge of the marking and the runway-holding position marking or the taxiway centre line marking should be not less than 1 m.

(2) The mandatory instruction marking on taxiways where the code letter is E or F, should be located on the both sides of the taxiway centre line marking and on the holding side of the runway-holding position marking as shown in Figure L-9(B). The distance between the nearest edge of the marking and the runway-holding position marking, or the taxiway centre line marking should be not less than 1 m.

(c) Characteristics:

(1) A mandatory instruction marking should consist of an inscription in white on a red background. Except for a no-entry marking, the inscription should provide information identical to that of the associated mandatory instruction sign.

(2) A no-entry marking should consist of an inscription in white reading NO ENTRY on a red background.

(3) Where there is insufficient contrast between the marking and the pavement surface, the mandatory instruction marking should include an appropriate border, preferably white or black.

(4) The character height should be 4 m for inscriptions where the code letter is C, D, E, or F, and at least 2 m where the code letter is A or B. The inscription should be in the form and proportions shown in Figures L-10A to L-10D.

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

(6) The spacing of characters for mandatory instruction marking should be obtained by first determining the equivalent elevated sign character height and then proportioning from the spacing values given in Table N-3.

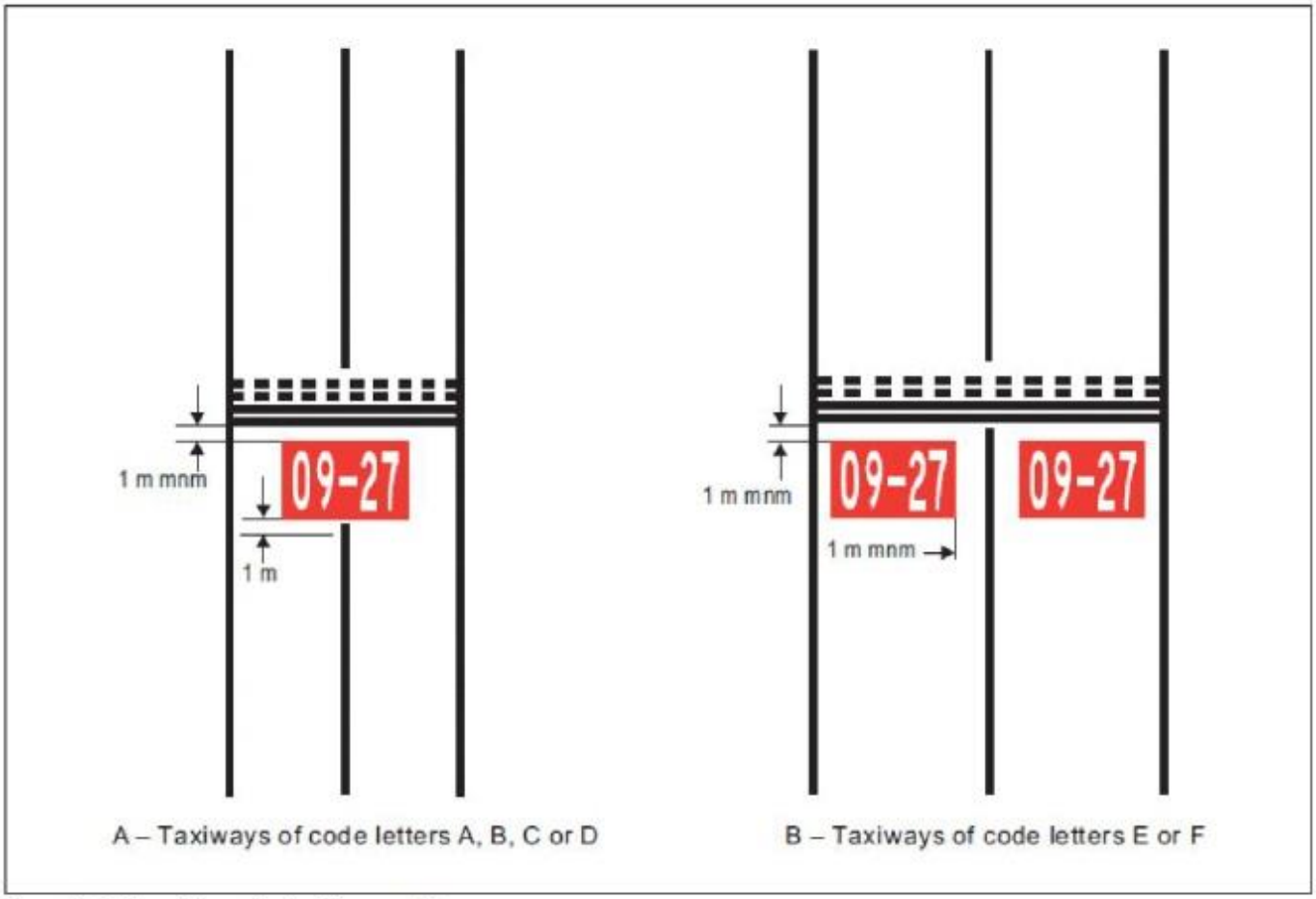


Figure L-9. Mandatory instruction marking

CS-ADR-DSN.L.610 Information marking

(+GM)

(a) Applicability: Where an information sign in accordance with CS-ADR-DSN.N.785 is not installed, an information marking should be displayed on the surface of the pavement.

(b) Characteristics:

(1) An information marking should consist of:

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

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

(2) Where there is insufficient contrast between the marking background and the pavement surface, the marking should include:

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

(ii) a yellow border where the inscriptions are in yellow.

(3) The character height, spacing, and the form and proportions of the inscription should be as for mandatory instruction markings.

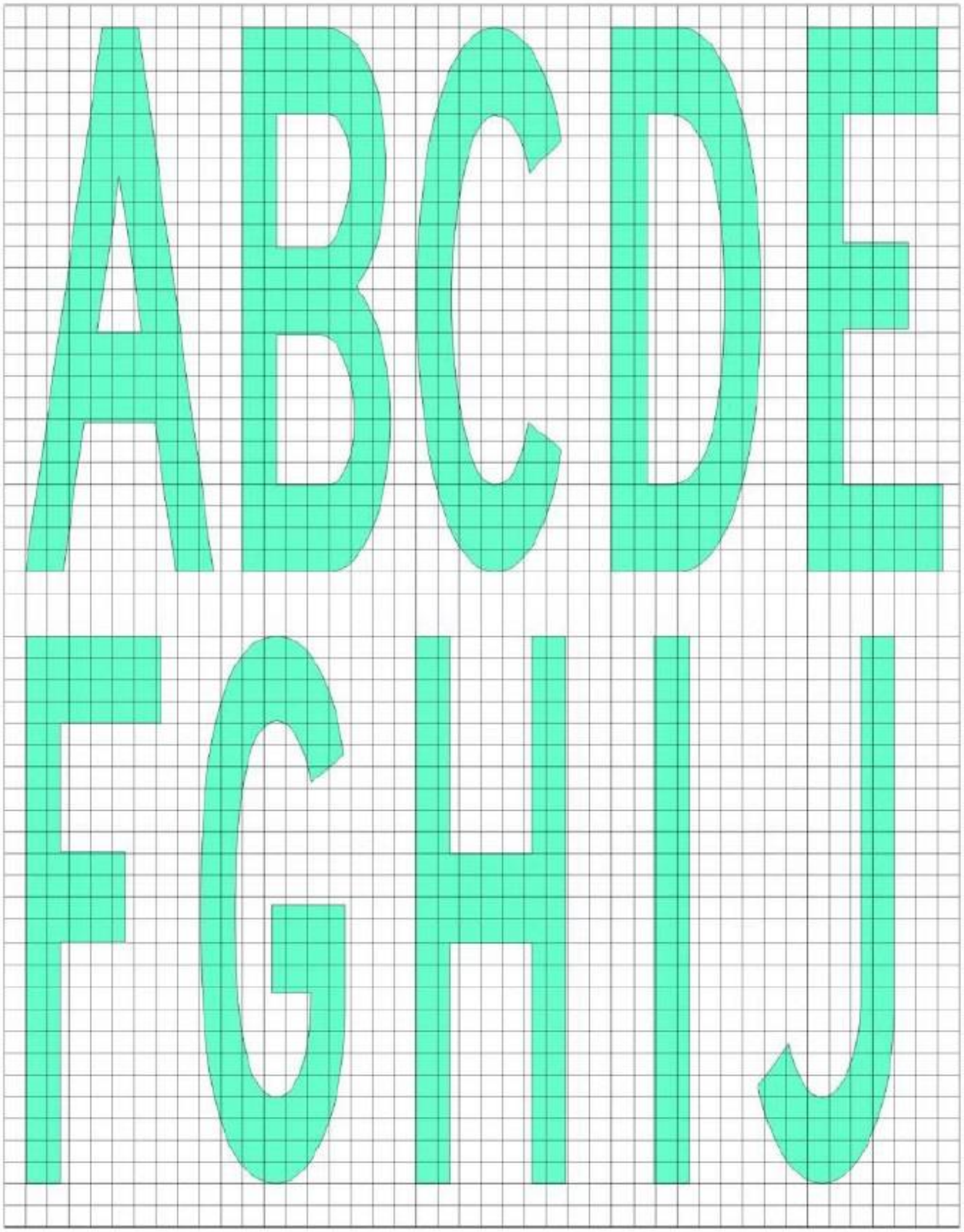


Figure L-10A. Mandatory instruction marking inscription form and proportions

Figure L-10B. Mandatory instruction marking inscription form and proportions

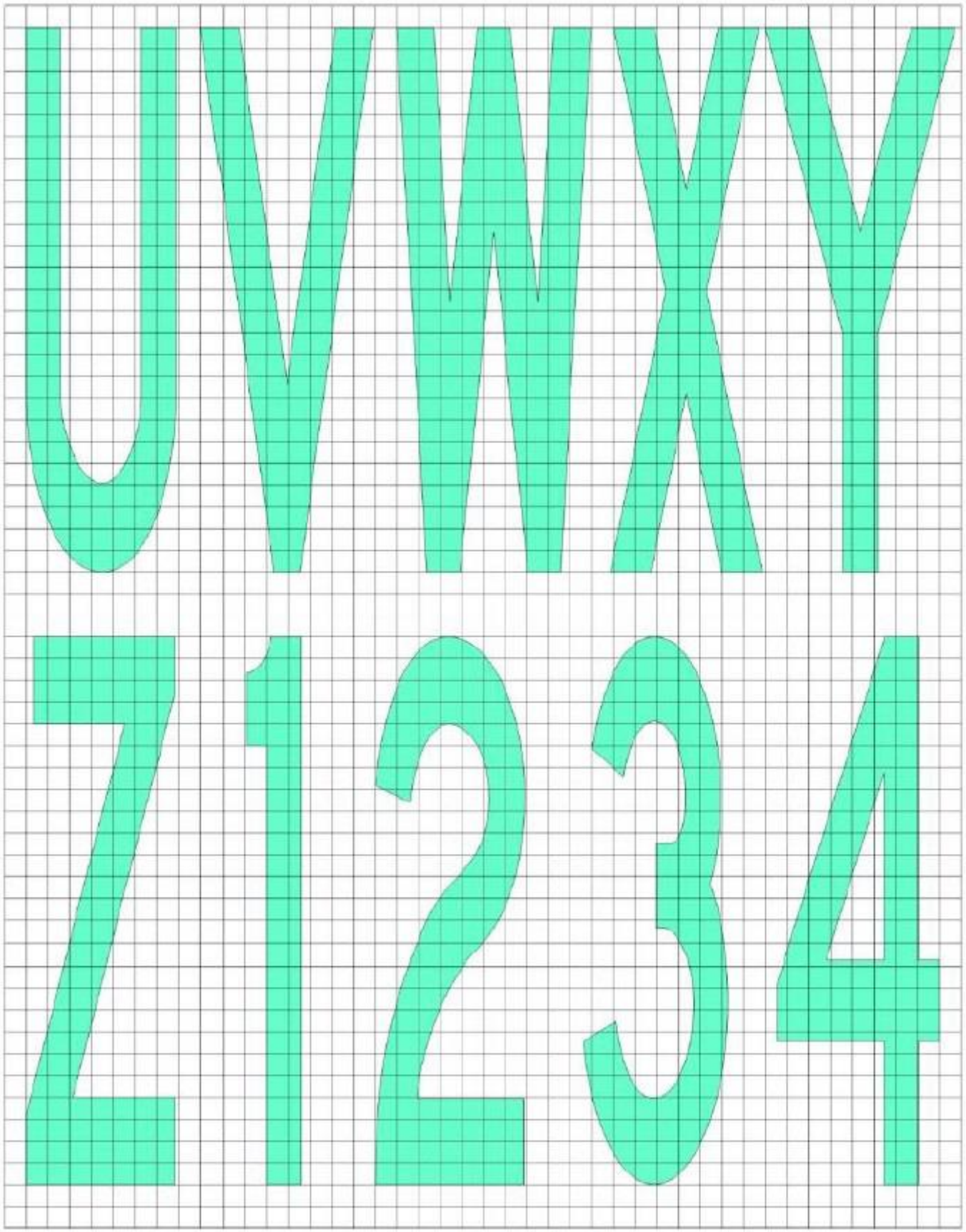


Figure L-10C. Mandatory instruction marking inscription form and proportions

Figure L-10D. Mandatory instruction marking inscription form and proportions

CS-ADR-DSN.L.611 Aircraft Arresting System Markings

(a) Aircraft Arresting System Markings (Permissive). When an aircraft arresting system cable is installed on an operational runway surface, its location may be marked by a series of discs painted on the runway along the line of the pendant cable. The discs should be 3 m (10 feet) in diameter and should be spaced at 7.5 m (25 feet) between centres. They should be arranged in two groups symmetrically disposed about the runway centreline. The centre of the innermost discs in each group should be 3.75 m (12.5 feet) from the runway centreline. The number of discs required will be determined by the width of the runway or by the distance between the side stripes, if present. The colour of the discs should be aviation surface yellow. If the pavement is equipped with a sacrificial pad beneath the cable, the discs may be divided at the equator for the width of the sacrificial pad.

(b) Aircraft arresting system location signs or pavement markings shall not be provided for systems located in overruns. Such markings could cause a pilot to engage a unidirectional system from the wrong direction.

CS-ADR-DSN.M.615 General

(+GM)

(a) Elevated approach lights:
  (1) Elevated approach lights and their supporting structures should be frangible except that, in that portion of the approach lighting system beyond 300 m from the threshold:
    i) where the height of a supporting structure exceeds 12 m, the frangibility requirement should apply to the top 12 m only; and
    ii) where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding objects should be frangible.
  (2) When an approach light fixture or supporting structure is not in itself sufficiently conspicuous, it should be suitably marked.

(b) Elevated lights:
Elevated runway, stopway, and taxiway lights should be frangible. Their height should be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

(c) Surface lights:
  (1) Light fixtures inset in the surface of runways, stopways, taxiways, and aprons 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 lights themselves.
  (2) 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.

(d) Light intensity and control:
  (1) The intensity of runway lighting should 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.
  (2) Where a high-intensity lighting system is provided, a suitable intensity control should be incorporated to allow for adjustment of the light intensity to meet the prevailing conditions. Separate intensity controls or other suitable methods should be provided to ensure that the following systems when installed, can be operated at compatible intensities:
    i) approach lighting system;
    ii) runway edge lights;
    iii) runway threshold lights;
    iv) runway end lights;
    v) runway centre line lights;
    vi) runway touchdown zone lights; and
    vii) taxiway centre line lights.
  (3) On the perimeter of and within the ellipse defining the main beam in CS-ADR-DSN.U.940, the maximum light intensity value should not be greater than three times the minimum light intensity value measured in accordance with CS-ADR-DSN.U.940.
    i) On the perimeter of and within the rectangle defining the main beam in CS-ADR-DSN.U.940, the maximum light intensity value should not be greater than three times the minimum light intensity value measured in accordance with CS-ADR-DSN.U.940.

CS-ADR-DSN.M.625 Approach lighting systems

(+GM)

(a) The safety objective of the approach lighting system is to provide alignment and roll guidance, and limited distance-to-go information to enable safe approach to a runway.

(b) Non-instrument runway
Applicability: Where physically practicable, a simple approach lighting system as specified in CS-ADR-DSN.M.626 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.

(c) Non-precision approach runway
Applicability: Where physically practicable, a simple approach lighting system specified in CS-ADR-DSN.M.626 should 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.

(d) Precision approach runway Category I
Applicability: Where physically practicable, a precision approach Category I lighting system as specified in CS-ADR-DSN.M.630 should be provided to serve a precision approach runway Category I.

(e) Precision approach runway Categories II and III
Applicability: A precision approach Category II and III lighting system as specified in CS-ADR-DSN.M.635 should be provided to serve a precision approach runway Category II or III.

CS-ADR-DSN.M.626 Simple approach lighting systems

(a) Location and composition:
(1) A simple approach lighting system should 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 (see Figure M-1).
(2) The certification specifications provide for the basic characteristics for simple approach lighting systems. For certain aspects of these systems, some latitude is permitted; for example, in the spacing between centre line lights and crossbar.

(b) Crossbar lights:
(1) The lights forming the crossbar should be as close as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights.
(2) The lights of the crossbar should 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 should be kept to a minimum to meet local requirements, and each should not exceed 6 m.
(3) Spacing 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 firefighting vehicles.

(c) Centre line lights:
(1) The lights forming the centre line should 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.
(2) The innermost light should 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.
(3) The system should lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
(i) no object other than an ILS or MLS azimuth antenna should protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
(ii) no light other than a light located within the central part of a crossbar or a centre line barrette, excluding their extremities, should be screened from an approaching aircraft.
Any ILS or MLS azimuth antenna protruding through the plane of the lights should be treated as an obstacle, and marked and lighted accordingly as specified in the requirements for obstacle marking and lighting.

(d) Characteristics:
(1) The lights of a simple approach lighting system should be fixed lights and the colour of the lights should be such as to ensure that the system is readily distinguishable from other aeronautical ground lights, and from extraneous lighting if present, but should be preferably fixed lights showing variable white. Each centre line light should consist of either:
(i) a single source; or
(ii) a barrette at least 3 m in length.

(e) Barrettes of 4 m in length should be so designed if it is anticipated that the simple approach lighting system should be developed into a precision approach lighting system.

(f) 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.

(g) 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.

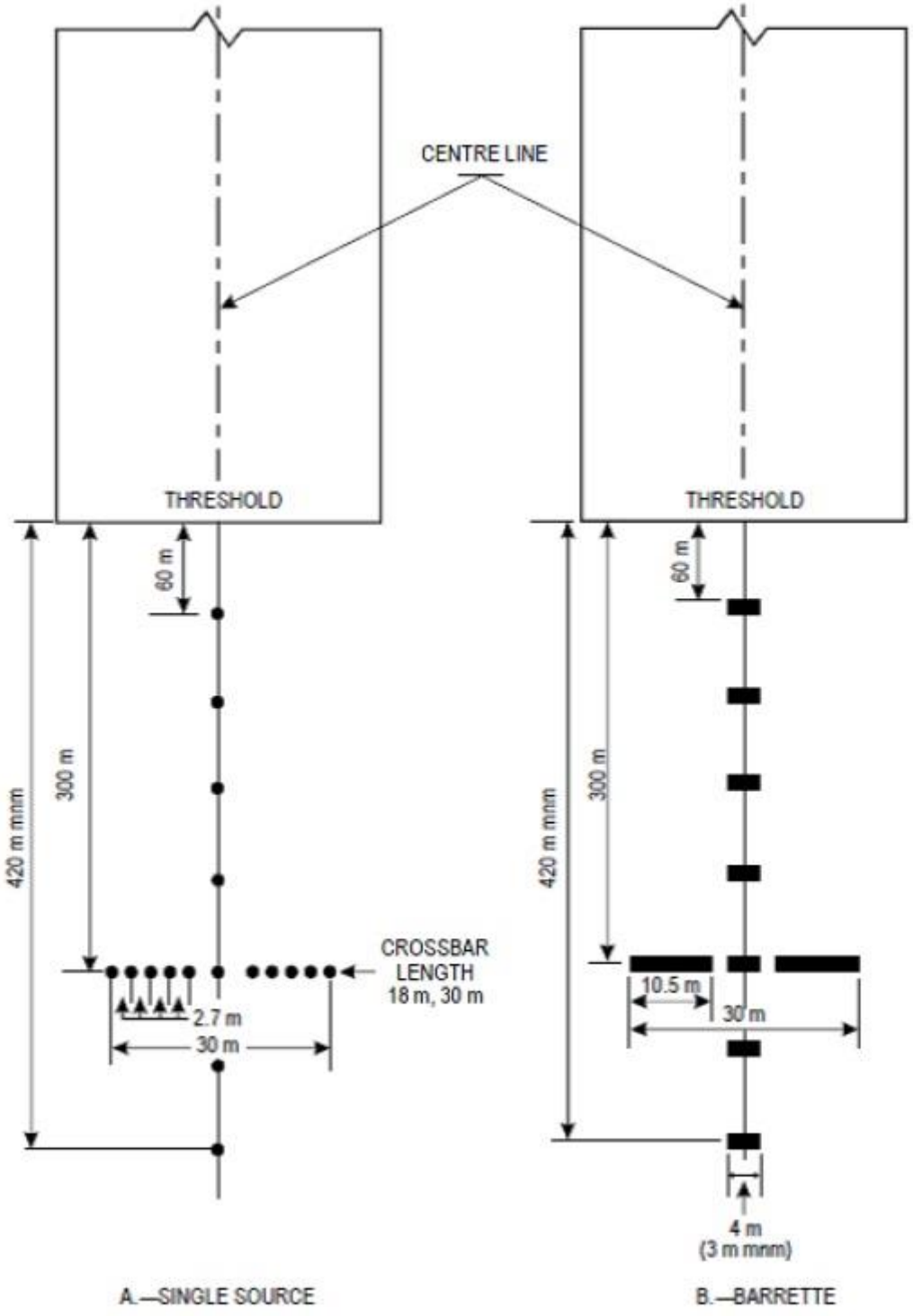


Figure M-1. Simple approach lighting systems

CS-ADR-DSN.M.630 Precision approach Category I lighting system

(+GM)

(a) The safety objective of the approach lighting system is to provide alignment and roll guidance, and limited distance-to-go information to enable safe approach to a runway.

(b) Location and composition

(1) General: A precision approach Category I lighting system should 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 (see Figure M-2).

(2) Crossbar lights: The lights forming the crossbar should be as close 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 should be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps should be kept to a minimum to meet local requirements and each should not exceed 6 m.

(3) Centre line lights: The lights forming the centre line should be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold.

(4) The system should lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

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

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

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

(c) Characteristics:

(1) The centre line and crossbar lights of a precision approach Category I lighting system should be fixed lights showing variable white. Each centre line light position should consist of either:

(i) 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

(ii) a barrette.

(2) Where the serviceability level of the approach lights specified as a maintenance objective in MAR-ADR.OPS.C.015 can be demonstrated, each centre line light position should consist of either:

(i) a single light source; or

(ii) a barrette.

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

(3) If the centre line consists of lights as described in paragraph (c)(1)(i) or (c)(2)(i) above, additional crossbars of lights to the crossbar provided at 300 m from the threshold should be provided at 150 m, 450 m, 600 m and 750 m from the threshold. The lights forming each crossbar should 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 should be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps should be kept to a minimum to meet local requirements and each should not exceed 6 m.

(4) Where the additional crossbars are incorporated in the system, the outer ends of the crossbars should 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 upwind from threshold.

(5) The characteristics of lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-5. The chromaticity of lights should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

(6) If the centre line consists of barrettes as described in paragraph (c)(1)(ii) or (c)(2)(ii) above, each barrette should be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system, and the nature of the meteorological conditions.

(7) Each flashing light, as described in paragraph (c)(6), should 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 should be such that these lights can be operated independently of the other lights of the approach lighting system.

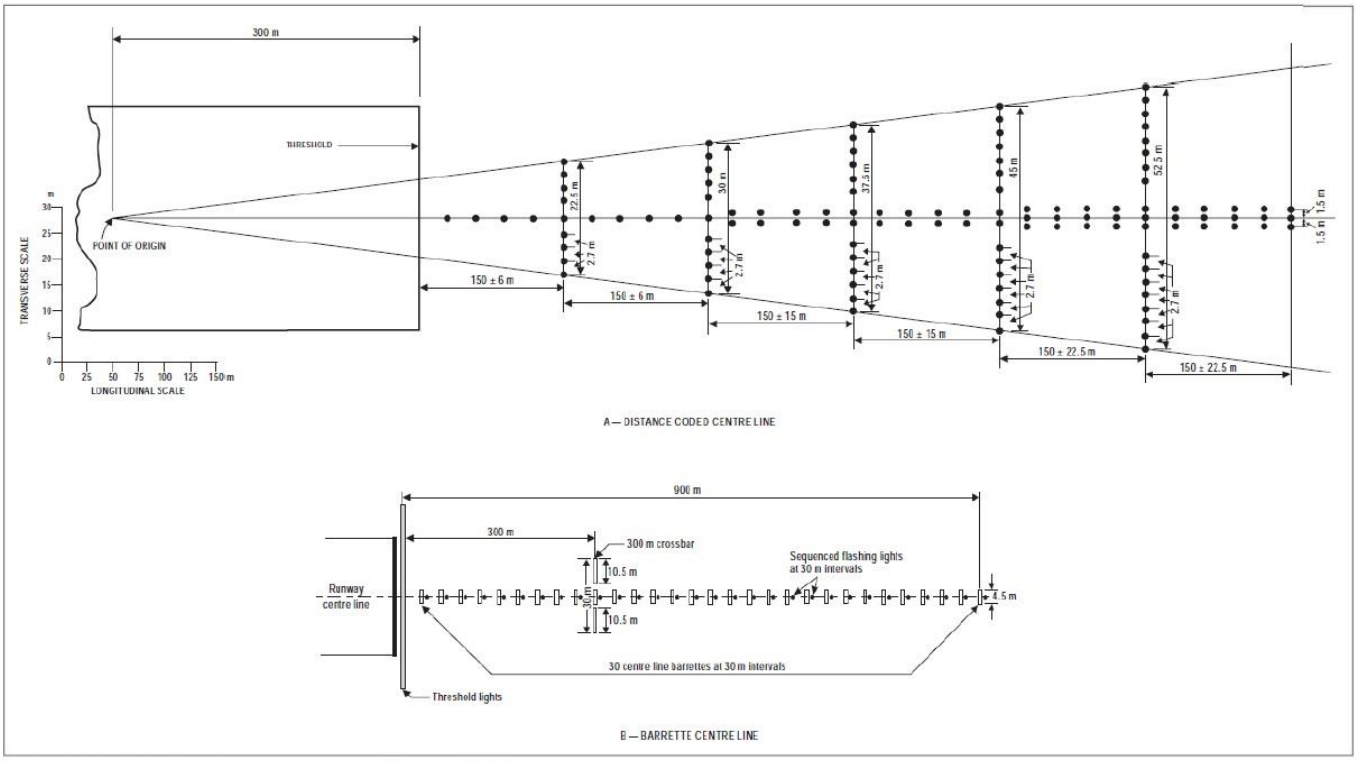


Figure M-2. Precision approach Category I lighting systems

CS-ADR-DSN.M.635 Precision approach Category II and III lighting system

(+GM)

(a) Location and composition:

(1) The approach lighting system should consist of a row of lights on the extended centre line of the runway, extending, wherever possible, over a distance of 900 m from the runway threshold. In addition, the system should have two side rows of lights, extending 270 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure M-3A. Where the serviceability level of the approach lights specified as maintenance objectives in MAR-ADR.OPS.C.015 can be demonstrated, the system may have two side rows of lights extending 240 m from the threshold, and two crossbars, one at 150 m, and one at 300 m from the threshold, all as shown in Figure M-3B.

(2) The lights forming the centre line should be placed at longitudinal intervals of 30 m with the innermost lights located 30 m from the threshold.

(3) The lights forming the side rows should be placed on each side of the centre line, at a longitudinal spacing equal to that of the centre line lights and with the first light located 30 m from the threshold. Where the serviceability level of the approach lights specified as maintenance objectives can be demonstrated, lights forming the side rows may be placed on each side of the centre line, at a longitudinal spacing of 60 m with the first light located 60 m from the threshold. The lateral spacing (or gauge) between the innermost lights of the side rows should be not less than 18 m nor more than 22.5 m, and preferably 18 m, but in any event should be equal to that of the touchdown zone lights.

(4) The crossbar provided at 150 m from the threshold should fill in the gaps between the centre line and side row lights.

(5) The crossbar provided at 300 m from the threshold should extend on both sides of the centre line lights to a distance of 15 m from the centre line.

(6) If the centre line beyond a distance of 300 m from the threshold consists of lights as described in paragraphs (b)(2)(ii) and (b)(3)(ii) below, additional crossbars of lights should be provided at 450 m, 600 m and 750 m from the threshold. Where such additional crossbars are incorporated in the system, the outer ends of these crossbars should lie on two straight lines that either are parallel to the centre line or converge to meet the runway centre line 300 m from the threshold.

(7) The system should lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
  (i) no object other than an ILS or MLS azimuth antenna should protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
  (ii) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) should be screened from an approaching aircraft.
  (iii) Any ILS or MLS azimuth antenna protruding through the plane of the lights should be treated as an obstacle and marked and lighted accordingly.

(b) Characteristics:
(1) The centre line of a precision approach Category II and III lighting system for the first 300 m from the threshold should consist of barrettes showing variable white, except that where the threshold is displaced 300 m or more, the centre line may consist of single light sources showing variable white. Where the serviceability level of the approach lights specified in MAR-ADR.OPS.C.015 can be demonstrated, the centre line of a precision approach Category II and III lighting system for the first 300 m from the threshold may consist of:
  (i) barrettes where the centre line beyond 300 m from the threshold consists of barrettes as described in paragraph (b)(3)(i) below; or
  (ii) alternate single light sources and barrettes, where the centre line beyond 300 m from the threshold consists of single light sources as described in paragraph (b)(3)(ii) below, with the innermost single light source located 30 m and the innermost barrette located 60 m from the threshold; or
  (iii) single light sources where the threshold is displaced 300 m or more;
  all of which should show variable white.
(2) Beyond 300 m from the threshold each centre line light position should consist of either:
  (i) a barrette as used on the inner 300 m; or
  (ii) two light sources in the central 300 m of the centre line, and three light sources in the outer 300 m of the centre line;
  all of which should show variable white.
(3) Where the serviceability level of the approach lights in MAR-ADR.OPS.C.015 as maintenance objectives can be demonstrated beyond 300 m from the threshold, each centre line light position may consist of either:
  (i) a barrette; or
  (ii) a single light source;
  all of which should show variable white.
(4) The barrettes should be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights should be uniformly spaced at intervals of not more than 1.5 m.
(5) If the centre line beyond 300 m from the threshold consists of barrettes as described in paragraphs (b)(2)(i) and (b)(3)(i), each barrette beyond 300 m should be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.
(6) Each flashing light should 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 should be such that these lights can be operated independently of the other lights of the approach lighting system.
(7) The side row should consist of barrettes showing red. The length of a side row barrette and the spacing of its lights should be equal to those of the touchdown zone light barrettes.
(8) The lights forming the crossbars should be fixed lights showing variable white. The lights should be uniformly spaced at intervals of not more than 2.7 m.
(9) The intensity of the red lights should be compatible with the intensity of the white lights.
(10) The characteristics of lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figures U-5 or U-6, as appropriate.
(11) The chromaticity of lights should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

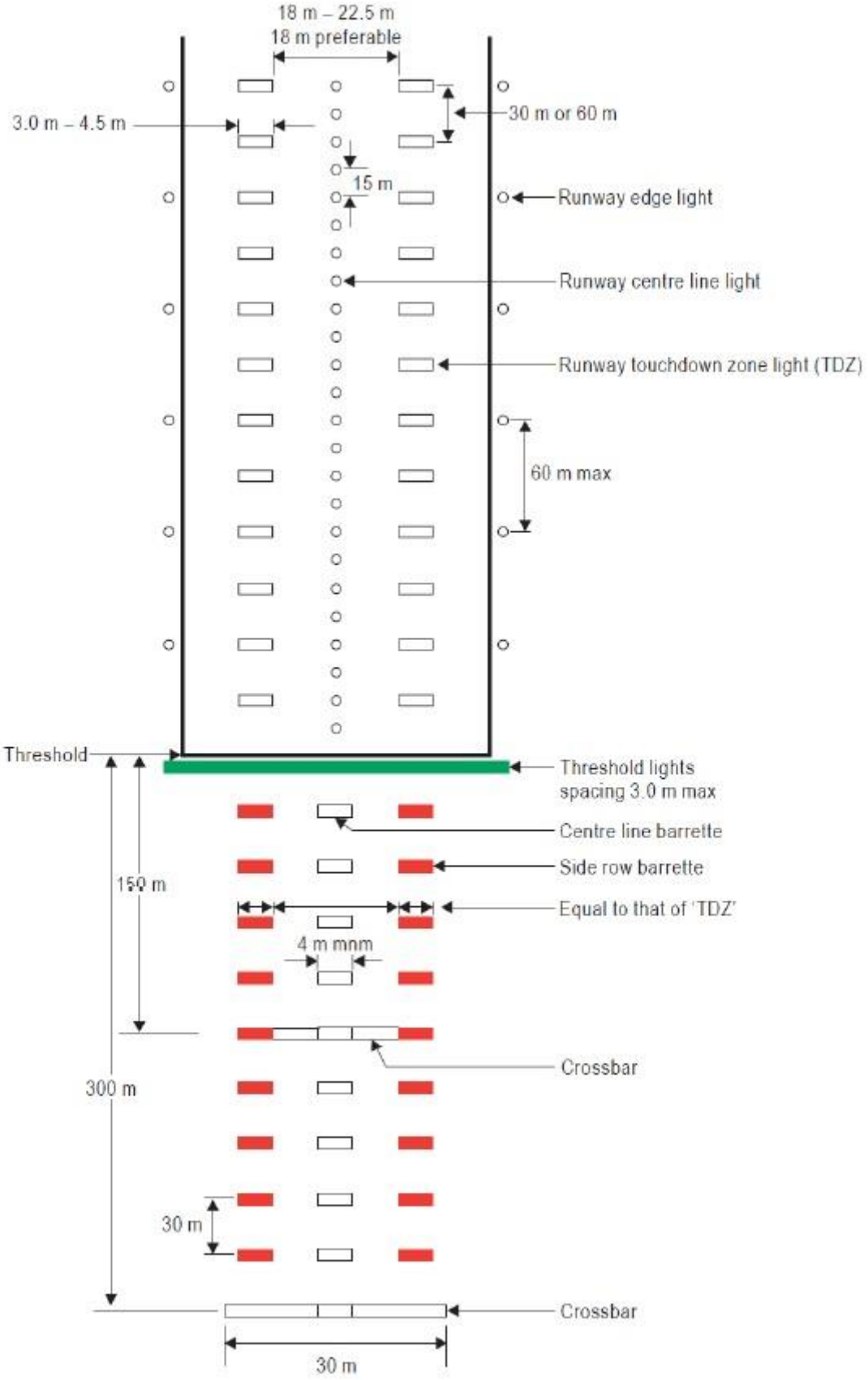


Figure M-3A. Inner 300 m approach and runway lighting for precision approach runways, Categories II and III

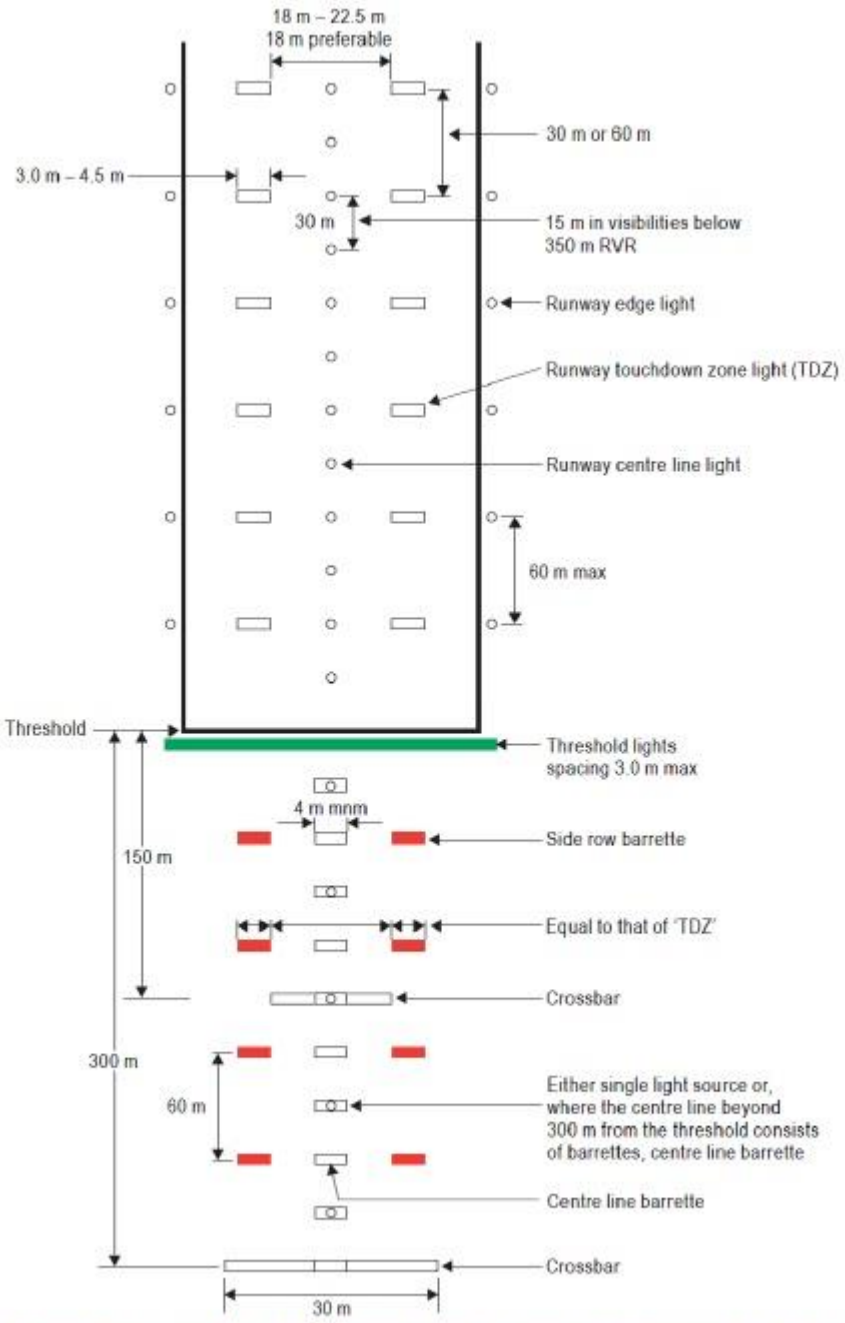


Figure M-3B. Inner 300 m approach and runway lighting for precision approach runways, Categories II and III, where the serviceability levels of the lights specified as maintenance objectives in ADR.OPS.C.015(b)(1) to (3) can be demonstrated.

CS-ADR-DSN.M.640 Visual approach slope indicator systems

(+GM)

The safety objective of visual approach slope indicators is to provide information on the approach angle necessary to maintain a safe height over obstacles and threshold.

(a) A visual approach slope indicator system should be provided to serve the approach to a runway where one or more of the following conditions exist:
  (1) the runway is used by turbojet or other aeroplanes with similar approach guidance requirements;
  (2) the pilot of any type of aeroplane may have difficulty in judging the approach due to:
    (i) inadequate visual guidance such as is experienced during an approach over water or featureless terrain by day or in the absence of sufficient extraneous lights in the approach area by night; or
    (ii) misleading information such as is produced by deceptive surrounding terrain or runway slopes.

(3) 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;
(4) physical conditions at either end of the runway present a serious hazard in the event of an aeroplane undershooting or overrunning the runway; and
(5) terrain or prevalent meteorological conditions are such that the aeroplane may be subjected to unusual turbulence during approach.

(b) The standard visual approach slope indicator systems should consist of PAPI and APAPI systems conforming to the specifications, as prescribed in CS-ADR-DSN.M.645 to CS-ADR-DSN.M.655.

(c) PAPI should be provided where the code number is 3 or 4 when one or more of the conditions specified in paragraph (a) above exist.

(d) PAPI or APAPI should be provided where the code number is 1 or 2 when one or more of the conditions specified in paragraph (a) above exist.

CS-ADR-DSN.M.645 Precision approach path indicator and Abbreviated precision approach path indicator (PAPI and APAPI)

(a) A PAPI or APAPI should be in accordance with the specifications provided in paragraphs CS-ADR-DSN.M.645 to CS-ADR-DSN.M.655.

(b) Definition and positioning:
(1) The PAPI system should consist of a wing bar of four sharp transition multi-lamp (or paired single lamp) units equally spaced. The APAPI system should consist of a wing bar of two sharp transition multi-lamp (or paired single lamp) units. The PAPI and APAPI system should be located on the left side of the runway unless it is physically impracticable to do so. Where a
(2) 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 for PAPI or APAPI.
(3) The wing bar of a PAPI should be constructed and arranged in such a manner that a pilot making an approach should:
(i) 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;
(ii) 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
(iii) 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.
(4) The wing bar of an APAPI should be constructed and arranged in such a manner that a pilot making an approach should:
(i) 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;
(ii) when above the approach slope, see both the units as white; and
(iii) when below the approach slope, see both the units as red.
(5) The light units should be located as in the basic configuration illustrated in Figure M-4, subject to the installation tolerances given below. The units forming a wing bar should be mounted so as to appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units should be mounted as low as possible and should be frangible.

(c) Characteristics:
(1) The system should be suitable for both day and night operations.
(2) Colour:
(i) The colour transition from red to white in the vertical plane should 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´.
(ii) At full intensity, the chromaticity of lights units should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate, and the red light should have a Y coordinate not exceeding 0.320.
(3) Intensity:
(i) The light intensity distribution of the light units should be as shown in CS-ADR-DSN.U.940, Figure U-26.

(ii) Suitable intensity control should be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

(4) Light orientation: Each light unit should be capable of adjustment in elevation so that the lower limit of the white part of the beam may be fixed at any desired angle of elevation between 1°30´and at least 4°30´above the horizontal.

(5) Other characteristics: The light units should be so designed that deposits of condensation, snow, ice, dirt, or other contaminants, on optically transmitting or reflecting surfaces should interfere to the least possible extent with the light signals and should not affect the contrast between the red and white signals and the elevation of the transition sector.

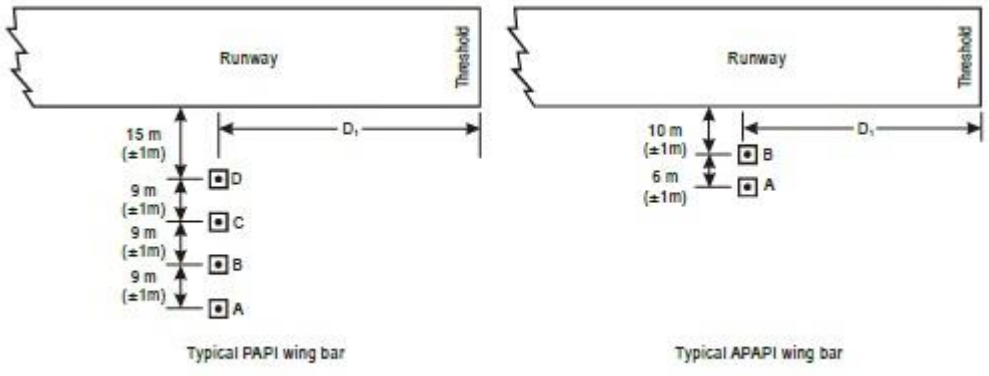


Figure M-4. Siting of PAPI and APAPI

INSTALLATION TOLERANCES

a) Where a PAPI or APAPI is installed on a runway not equipped with an ILS or MLS, the distance D1 should be calculated to ensure that the lowest height at which a pilot will see a correct approach path indication (Figure M-5, angle B for a PAPI and angle A for an APAPI) provides the wheel clearance over the threshold specified in Table M-1 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 D1 should 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 should 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 should be such that in no case will the wheel clearance over the threshold be lower than that specified in column (3) of Table M-1.

Note: See CS-ADR-DSN.L.540 for specifications on aiming point marking. Further guidance on the harmonisation of PAPI, ILS and/or

c) If a wheel clearance, greater than that specified in a) above is required for specific aircraft, this can be achieved by increasing D1.

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

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

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

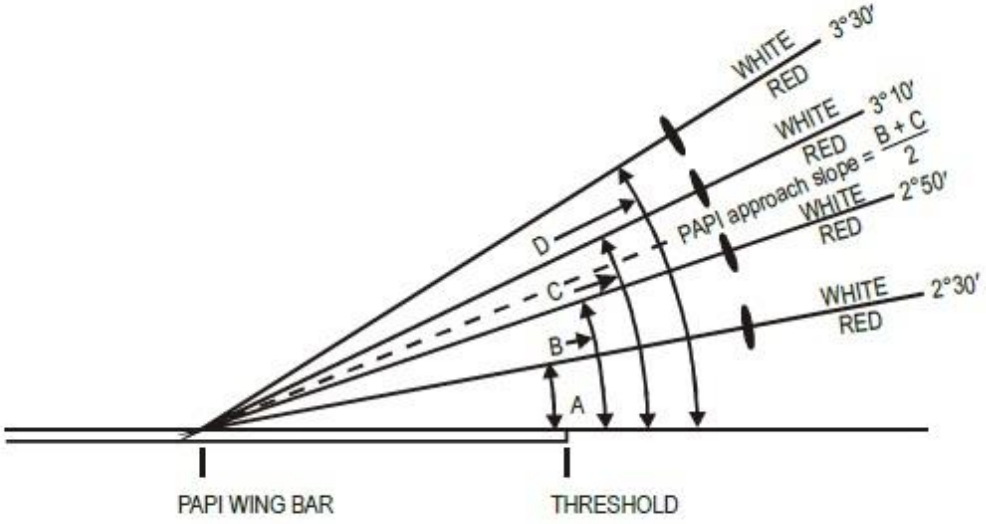
Note: Reducing the spacing between light units results in a reduction in usable range of the system.

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 should be located 15 m (±1 m) from the runway edge.

CS-ADR-DSN.M.650 Approach slope and elevation setting of light units for PAPI and APAPI

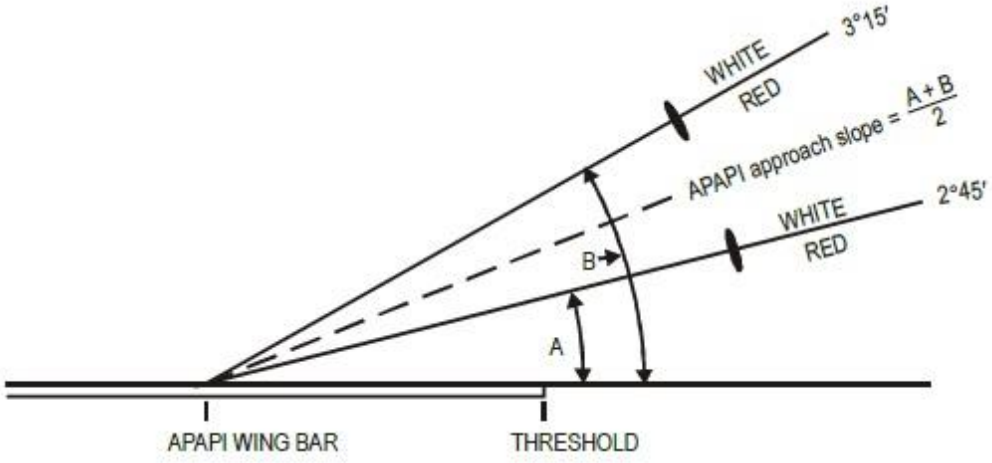
(a) Approach slope:
  (1) The approach slope as defined in Figure M-5, should be so designed to be appropriate for use by the aeroplanes in the approach.
  (2) When the runway is equipped with an ILS and/or MLS, the siting and the angle of elevation of the light units should be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.

(b) Elevation setting of light units
  (1) The angle of elevation settings of the light units in a PAPI wing bar should be such that, during an approach, the pilot of an aeroplane observing a signal of one white and three reds should clear all objects in the approach area by a safe margin (see Table M-1).
  (2) The angle of elevation settings of the light units in an APAPI wing bar should be such that, during an approach, the pilot of an aeroplane observing the lowest on-slope signal, i.e. one white and one red, should clear all objects in the approach area by a safe margin (see Table M-1).
  (3) The azimuth spread of the light beam should 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 a safety assessment indicates that the object could adversely affect the safety of operations. The extent of the restriction should be such that the object remains outside the confines of the light beam.
  (4) Where wing bars are installed on each side of the runway to provide roll guidance, corresponding units should be set at the same angle so that the signals of each wing bar change symmetrically at the same time.



The height of the pilot's eye above the aircraft's ILS glide path/MLS antenna varies with the type of aeroplane and approach attitude. Harmonization of the PAPI signal and ILS glide path and/or MLS minimum glide path to a point closer to the threshold may be achieved by increasing the on-course sector from 20′ to 30′. The setting angles for a 3° glide slope would then be 2°25′, 2°45′, 3°15′ and 3°35′.

A — 3° PAPI ILLUSTRATED



B — 3° APAPI ILLUSTRATED

Figure M-5. Light beams and angle of elevation setting of PAPI and APAPI

CS-ADR-DSN.M.655 Obstacle protection surface for PAPI and APAPI

(+GM)

(a) Applicability:

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

(b) Characteristics:
The characteristics of the obstacle protection surface, i.e. origin, divergence, length, and slope should correspond to those specified in the relevant column of Table M-2 and in Figure M-6.

(c) New objects or extensions of existing objects should not be permitted above an obstacle protection surface except when the new object or extension would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety of operations of aeroplanes.

(d) Where a safety assessment 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 should be taken:
(1) remove the object;
(2) suitably raise the approach slope of the system;
(3) reduce the azimuth spread of the system so that the object is outside the confines of the beam;
(4) displace the axis of the system and its associated obstacle protection surface by no more than 5°;
(5) suitably displace the threshold; and
(6) where (5) is found to be impracticable, suitably displace the system upwind of the threshold such that the object no longer penetrates the obstacle protection surface.

	Runway type/code number							
	Non-instrument				**Instrument**			
	Code number				**Code number**			
Surface dimensions	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Length of inner edge	60 m	80 m	150 m	150 m	150 m	150 m	300 m	300 m
Distance from the visual approach slope indicator system[2]	D_1+30 m	D_1+60 m	D_1+60 m	D_1+60 m	D_1+60 m	D_1+60 m	D_1+60 m	D_1+60 m
Divergence (each side)	10 %	10 %	10 %	10 %	15 %	15 %	15 %	15 %
Total length	7 500 m	7 500 m	15 000 m	15 000 m	7 500 m	7 500 m	15 000 m	15 000 m
Slope								
a) PAPI[1]	—	A–0.57°	A–0.57°	A–0.57°	A–0.57°	A–0.57°	A–0.57°	A–0.57°
b) APAPI[1]	A–0.9°	A–0.9°	–	–	A–0.9°	A–0.9°	–	–
1 Angles as indicated in Figure M-5. 2 D1 is the distance of the visual approach slope indicator system from threshold prior to any displacement to remedy object penetration of the obstacle protection surface (refer to Figure M-4). The start of the obstacle protection surface is fixed to the visual approach slope indicator system location, such that displacement of the PAPI results in an equal displacement of the start of the obstacle protection surface.								

Table M-2. Dimensions and slopes of the obstacle protection surface

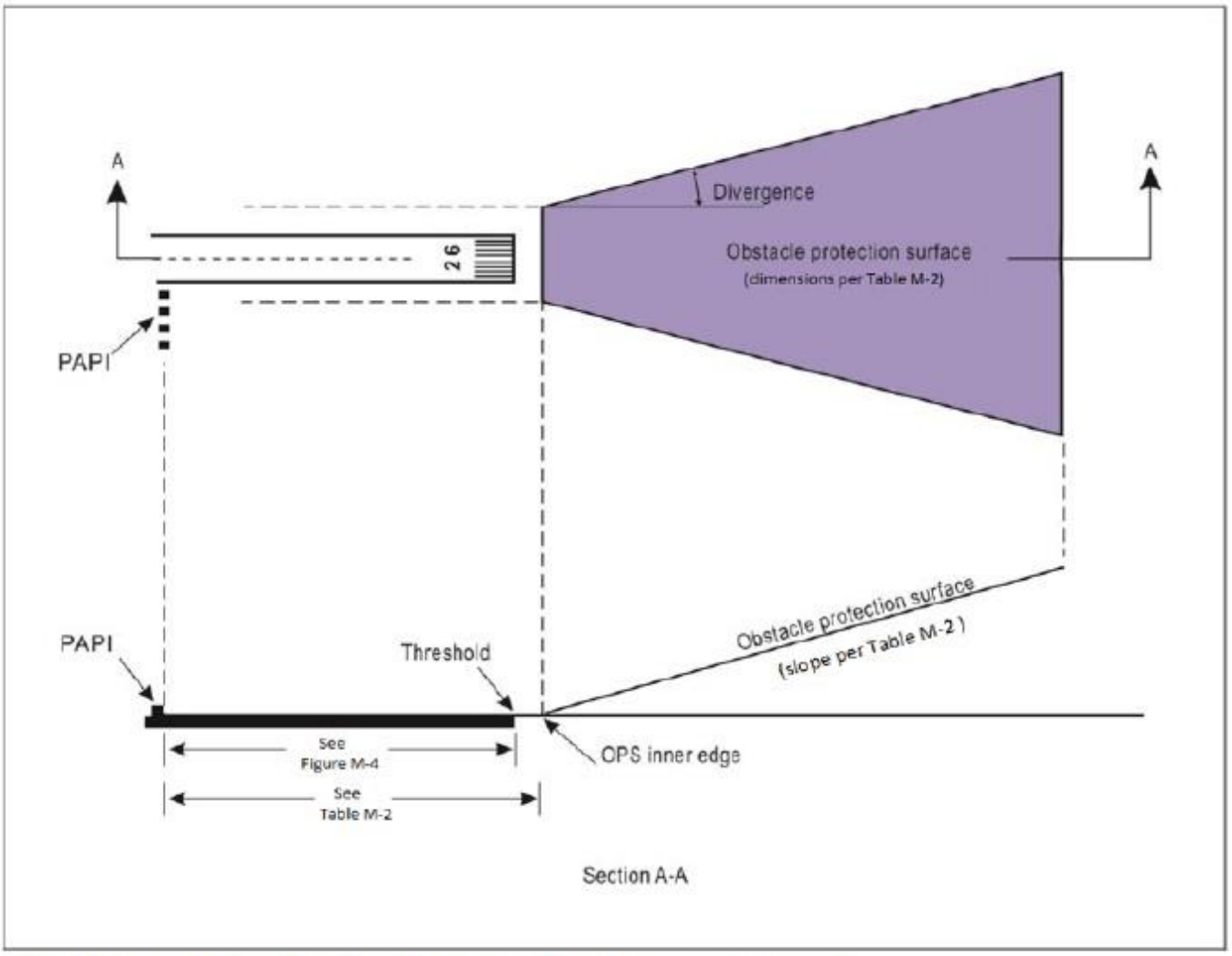


Figure M-6. Obstacle protection surface for visual approach slope indicator systems

CS-ADR-DSN.M.675 Runway edge lights

(a) Applicability:

(1) Runway edge lights should be provided for a runway intended for use at night or for a precision approach runway intended for use by day or night.

(2) 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.

(b) Location and positioning:

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

(2) Runway edge lights should 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.

(3) 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.

(4) The lights should 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 should 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.

(c) Characteristics:

(1) Runway edge lights should be fixed lights showing variable white, except that:

(i) in the case of a displaced threshold, the lights between the beginning of the runway and the displaced threshold should show red in the approach direction; and
(ii) 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, should show yellow.

(2) The runway edge lights should 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 should show at all angles in azimuth.

(d) In all angles of azimuth, as prescribed in paragraph (c)(2) above, runway edge lights should 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 should 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.

(e) Runway edge lights characteristics on a precision approach runway should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-13 or Figure U-14, as appropriate.

(f) The chromaticity of lights should be in accordance with the specifications in CS-ADR-DSN.U.930 and in Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.680 Runway threshold and wing bar lights

(a) Applicability of runway threshold: Runway threshold lights should be provided for a runway equipped with runway edge lights, except on a non-instrument or non-precision approach runway where the threshold is displaced and wing bar lights are provided.

(b) Location and positioning of runway threshold:

(1) When a threshold is at the extremity of a runway, the threshold lights should be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any case, not more than 3 m outside the extremity.

(2) When a threshold is displaced from the extremity of a runway, threshold lights should be placed in a row at right angles to the runway axis at the displaced threshold.

(3) Threshold lighting should consist of:
(i) on a non-instrument or non-precision approach runway, at least six lights;
(ii) on a precision approach runway Category I, at least the number of lights that would be required if the lights were uniformly spaced at intervals of 3 m between the rows of runway edge lights; and
(iii) on a precision approach runway Category II or III, lights uniformly spaced between the rows of runway edge lights at intervals of not more than 3 m.

(4) The lights prescribed in paragraphs (b)(3)(i) and (b)(3)(ii) above should be either:
(i) equally spaced between the rows of runway edge lights, or
(ii) symmetrically disposed about the runway centre line in two groups, with the lights uniformly spaced in each group and with a gap between the groups equal to the gauge of the touchdown zone marking or lighting, where such is provided, or otherwise not more than half the distance between the rows of runway edge lights.

(c) Applicability of wing bar lights:

(1) Wing bar lights should be provided on a precision approach runway when additional conspicuity is considered desirable.

(2) Wing bar lights should be provided on a non-instrument or non-precision approach runway where the threshold is displaced and runway threshold lights are required, but are not provided.

(d) Location and positioning of wing bar lights: Wing bar lights should be symmetrically disposed about the runway centre line at the threshold in two groups, i.e. wing bars. Each wing bar should be formed by at least five lights extending at least 10 m outward from, and at right angles to, the line of the runway edge lights, with the innermost light of each wing bar in the line of the runway edge lights.

(e) Characteristics of runway threshold and wing bar lights:

(1) Runway threshold and wing bar lights should be fixed unidirectional lights showing green in the direction of approach to the runway. The intensity and beam spread of the lights should be adequate for the conditions of visibility and ambient light in which use of the runway is intended.

(2) Runway threshold lights on a precision approach runway should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-7.
(3) Threshold wing bar lights on a precision approach runway should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-8.
(4) The chromaticity of lights should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.685 Runway end lights

(+GM)

(a) Applicability: Runway end lights should be provided for a runway equipped with runway edge lights.
(b) Location and positioning:
(1) Runway end lights should 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.
(2) Runway end lighting should consist of at least six lights. The lights should be either:
(i) equally spaced between the rows of runway edge lights; or
(ii) 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.
(3) For a precision approach runway Category III, the spacing between runway end lights, except between the two innermost lights if a gap is used, should not exceed 6 m.
(c) Characteristics of runway end lights:
(1) Runway end lights should be fixed unidirectional lights showing red in the direction of the runway. The intensity and beam spread of the lights should be adequate for the conditions of visibility and ambient light in which use of the runway is intended.
(2) Runway end lights characteristics on a precision approach runway should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-12.
(3) Runway end lights on a precision approach runway should be in accordance with the chromaticity specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.
(d) Where an arrestor system is installed and runway centre line lighting is not provided, a fixed light unit showing green shall be installed in the centre line position of the runway end lights and directed towards the runway to act as an aiming point for the pilot. The photometric characteristics of the light units shall be similar to those of the runway end lighting system.

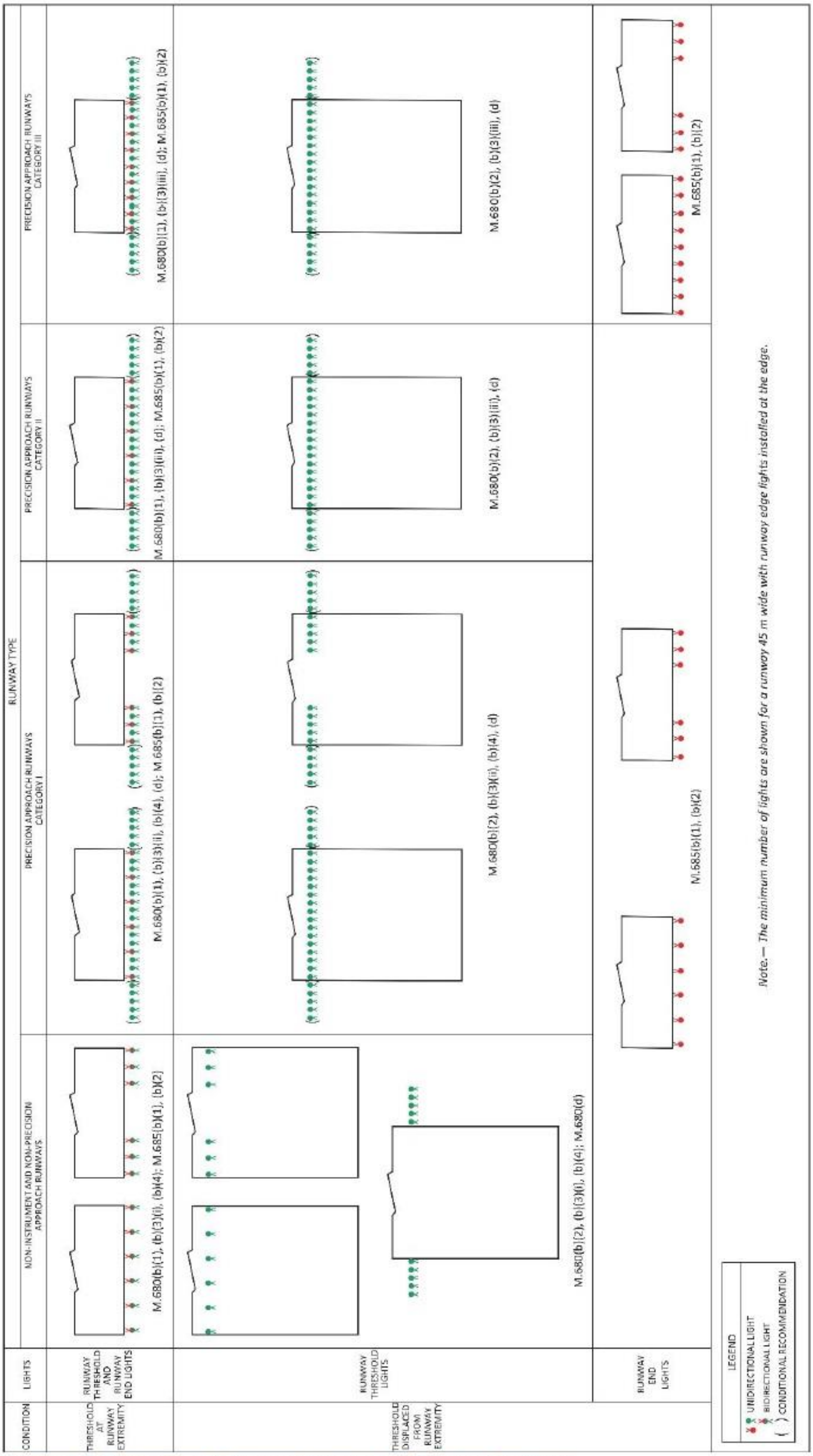


Figure M-7. Arrangement of runway threshold and runway end lights

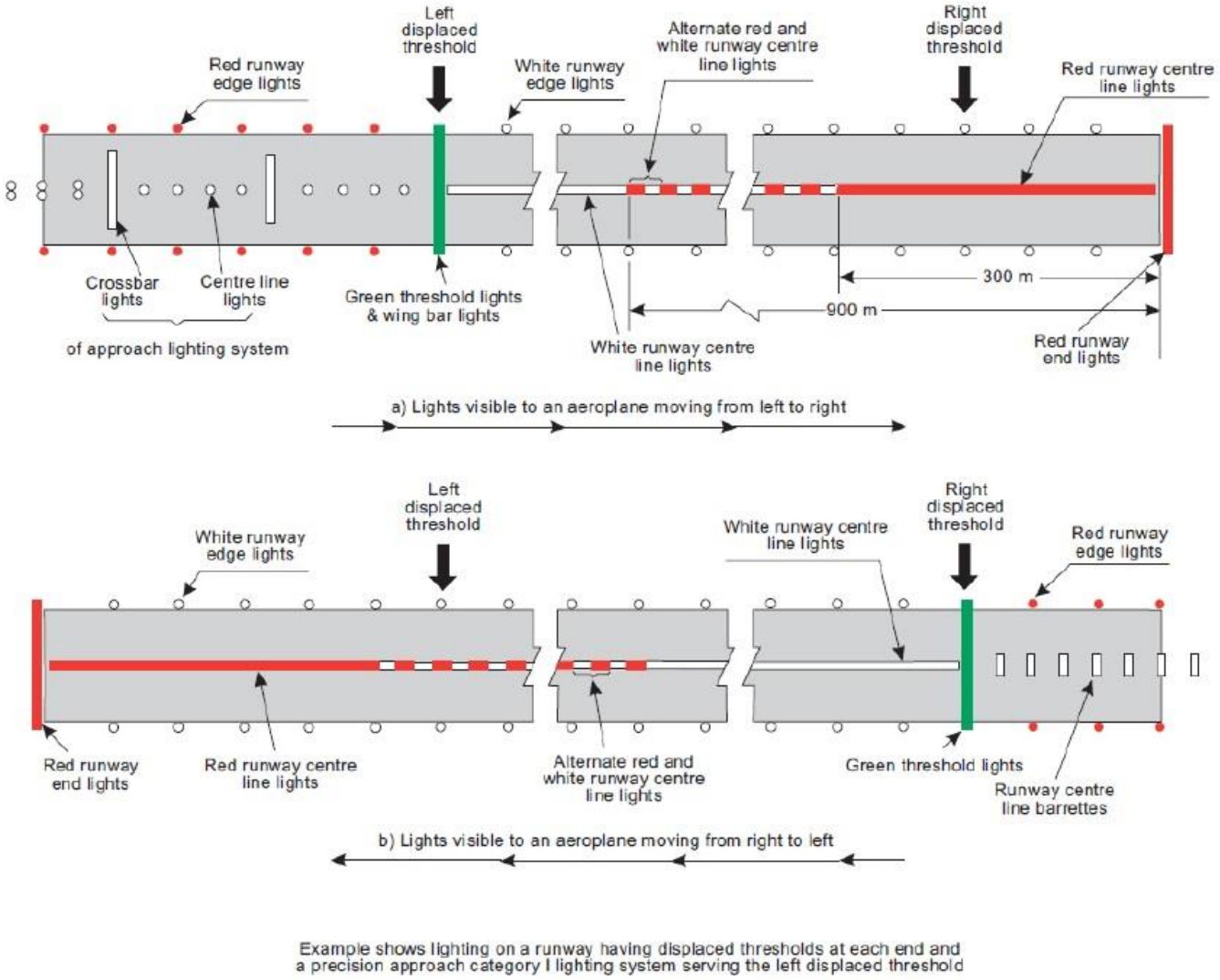


Figure M-8. Example of approach and runway lighting for runway with displaced thresholds

CS-ADR-DSN.M.690 Runway centre line lights

(a) The safety objective of runway centre line lights is to facilitate safe take-off and landing.
(b) Applicability:
  (1) Runway centre line lights should be provided on a precision approach runway Category II or III.
  (2) Runway centre line lights should be provided on a runway intended to be used for take-off with an operating minimum below an RVR of the order of 400 m.
(c) Location: Runway centre line lights should be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of the runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line. The lights should be located from the threshold to the end at longitudinal spacing of approximately 15 m. Where the serviceability level of the runway centre line lights specified as maintenance objectives in MAR-ADR.OPS.C.015(b)(1) to (b)(3) can be demonstrated, and the runway is intended for use in runway visual range conditions of 350 m or greater, the longitudinal spacing may be approximately 30 m.
(d) Characteristics:
  (1) Runway centre line lights should be fixed lights showing variable white from the threshold to the point 900 m from the runway end; alternate red and variable white from 900 m to 300 m from the runway end; and red from 300 m to the runway end, except that for runways less than 1 800 m in length, the alternate red and variable white lights should extend from the midpoint of the runway usable for landing to 300 m from the runway end.

(2) Runway centre line lights characteristics should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-10 or Figure U-11, as appropriate.
(3) Runway centre line lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

(e) Centre line guidance for take-off from the beginning of a runway to a displaced threshold should be provided by:
(1) an approach lighting system if its characteristics and intensity settings afford the guidance required during take-off, and it does not dazzle the pilot of an aircraft taking off; or
(2) runway centre line lights; or
(3) barrettes of at least 3 m length, and spaced at uniform intervals of 30 m, as shown in Figure M-8, designed so that their photometric characteristics and intensity setting afford the guidance required during take-off without dazzling the pilot of an aircraft taking off.

Where necessary, provision should be made to extinguish those centre line lights, as prescribed in paragraph (2) above or reset the intensity of the approach lighting system or barrettes when the runway is being used for landing. In no case should only the single source runway centre line lights show from the beginning of the runway to a displaced threshold when the runway is being used for landing.

CS-ADR-DSN.M.695 Runway touchdown zone lights

(+GM)

(a) Applicability: Touchdown zone lights should be provided in the touchdown zone of a precision approach runway Category II or III.
(b) Location and positioning:
(1) Touchdown zone lights should extend from the threshold for a longitudinal distance of 900 m, except that, on runways less than 1 800 m in length, the system should be shortened so that it does not extend beyond the midpoint of the runway.
(2) The pattern should be formed by pairs of barrettes symmetrically located about the runway centre line. The lateral spacing between the innermost lights of a pair of barrettes should be equal to the lateral spacing selected for the touchdown zone marking. The longitudinal spacing between pairs of barrettes should be either 30 m or 60 m.
(c) Characteristics:
(1) A barrette should be composed of at least three lights with spacing between the lights of not more than 1.5 m.
(2) A barrette should be not less than 3 m or more than 4.5 m in length.
(3) Touchdown zone lights should be fixed unidirectional lights showing variable white.
(4) Touchdown zone lights characteristics should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-9.
(5) Touchdown zone lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.700 Rapid exit taxiway indicator lights (RETILs)

(+GM)

(a) Applicability:
(1) The inclusion of specifications for RETILs is not intended to imply that RETILs have to be provided at an aerodrome.
(2) Where installed, the purpose of RETILs is to provide pilots with distance-to-go information to the nearest rapid exit taxiway on the runway, to enhance situational awareness in low visibility conditions and enable pilots to apply braking action for more efficient roll-out and runway exit speeds.
(b) Location:
(1) RETILs should be located on the runway on the same side of the runway centre line as the associated rapid exit taxiway. The lights should be located 2 m apart and the light nearest to the runway centre line should be displaced 2 m from the runway centre line.
(2) Where more than one rapid exit taxiway exists on a runway, the set of RETILs for each exit should not overlap when displayed.
(c) Characteristics:

(1) RETILs are fixed lights and comprise a set of yellow unidirectional lights installed in the runway adjacent to the centre line. The lights are positioned in a 3-2-1 sequence at 100 m intervals prior to the point of tangency of the rapid exit taxiway centre line.
(2) RETILs should be supplied with power on a separate circuit to other runway lighting so that they may be used when other lighting is switched off.
(3) RETILs' characteristics should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-10 or U-11, as appropriate.
(4) RETILs' chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.705 Stopway lights

(a) Applicability: Stopway lights should be provided for a stopway intended for use at night, or in runway visual range conditions less than a value of 800 m.
(b) Location:
(1) Stopway lights should be placed along the full length of the stopway and should be in two parallel rows that are equidistant from the centre line and coincident with the rows of the runway edge lights. The spacing between the lights should be in accordance with CS-ADR-DSN.M.675(b)(4). Stopway lights placed along the edge of the stopway should consist of at least one pair of lights.
(2) At least four uni-directional stopway lights equally spaced across the width of the stopway should be provided across the end of a stopway on a line at right angles to the stopway axis as near to the end of the stopway as possible and, in any case, not more than 3 m outside the end.
(c) Characteristics:
(1) Stopway lights should be fixed unidirectional lights showing red in the direction of the runway.
(2) Stopway lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.710 Taxiway centre line lights

(+GM)

(a) The safety objective of taxiway centre line lights is to provide guidance for the safe taxi of aircraft as described in paragraph (b).
Applicability:
(1) Taxiway centre line lights should be provided on an exit taxiway, taxiway, de-icing/anti-icing facility, and apron intended for use in runway visual range conditions less than a value of 350 m in such a manner as to provide continuous guidance between the runway centre line and aircraft stands, except that these lights need not be provided where the traffic density is light and taxiway edge lights, and centre line marking provide adequate guidance.
(2) Taxiway centre line lights should be provided on a taxiway intended for use at night in runway visual range conditions of 350 m or greater, and particularly on complex taxiway intersections and exit taxiways, except that these lights need not be provided where taxiway edge lights, and centre line marking provide adequate guidance.
(3) Taxiway centre line lights should be provided on an exit taxiway, taxiway, de-icing/anti icing facility, and apron in all visibility conditions where specified as components of an advanced surface movement guidance and control system in such a manner as to provide continuous guidance between the runway centre line and aircraft stands.
(4) Taxiway centre line lights should be provided on a runway forming part of a standard taxi-route and intended for taxiing in runway visual range conditions less than a value of 350 m, except that these lights need not be provided where the traffic density is light and taxiway edge lights, and centre line marking provide adequate guidance.
(5) Taxiway centre line lights should be provided in all visibility conditions on a runway forming part of a standard taxi-route where specified as components of an advanced surface movement guidance and control system.
(6) Where a runway forming part of a standard taxi route is provided with runway lighting and taxiway lighting, the lighting systems should be interlocked to preclude the possibility of simultaneous operation of both forms of lighting.
(7) Specific military operational considerations may affect the (non-)need for taxiway center line

lights.

(b) Characteristics:

(1) Except as provided for in paragraph (c)(3) below, taxiway centre line lights on a taxiway other than an exit taxiway and on a runway forming part of a standard taxi-route should be fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on, or in the vicinity of the taxiway.

(2) Taxiway centre line lights on an exit taxiway should be fixed lights. Alternate taxiway centre line lights should show green and yellow from their beginning near the runway centre line to the perimeter of the ILS/MLS critical/sensitive area, or the lower edge of the inner transitional surface, whichever is farthest from the runway; and thereafter all lights should show green, as shown in Figure M-10. The first light in the exit centre line should always show green and the light nearest to the perimeter should always show yellow.

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

(i) their end point near the runway centre line; or

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

(4) Taxiway centre line lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-16, U-17, or U-18, as appropriate, for taxiways intended for use in runway visual range conditions of less than a value of 350 m; Figure U-19 or Figure U-20, as appropriate, for other taxiways.

(5) Where higher intensities are required, from an operational point of view, taxiway centre line lights on rapid exit taxiways intended for use in runway visual range conditions less than a value of 350 m should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-16. The number of levels of brilliancy settings for these lights should be the same as that for the runway centre line lights.

(6) Where taxiway centre line lights are specified as components of an advanced surface movement guidance and control system and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, taxiway centre line lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-21, U-22, or U-23, as appropriate.

(7) High intensity centre line lights should only be used in case of an absolute necessity and following a specific study.

(8) Taxiway centre line lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

(c) Location and positioning:

(1) Taxiway centre line lights should normally be located on the taxiway centre line marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking, as shown in Figure M-9.

(2) Taxiway centre line lights on taxiways, runways, rapid exit taxiways or on other exit taxiways should be positioned in accordance with CS-ADR-DSN.M.715.

CS-ADR-DSN.M.715 Taxiway centre line lights on taxiways, runways, rapid exit taxiways, or on other exit taxiways

(a) The safety objective of taxiway centre line lights is to provide guidance for the safe taxi of aircraft as described in paragraph (b).

(b) Taxiway centre line lights on taxiways:

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

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

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

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

(3) On a taxiway curve the spacing of taxiway centre line lights should be as specified in the Table M-3.

RVR	Radius of taxiway curve	Taxiway centre line lights spacing on taxiway curves
< 350 m	< 400 m	Not greater than7.5 m. This spacing should extend for 60 m before and after the curve.
	> 400 m	Not greater than 15 m
> 350 m	< 400 m	Not greater than 7.5 m
	401 m to 899 m	Not greater than 15 m
	> 900 m	Not greater than 30 m

Table M-3. Taxiway centre line lights spacing on taxiway curves

(c) Taxiway centre line lights on rapid exit taxiways:
(1) Taxiway centre line lights on a rapid exit taxiway should commence at a point at least 60 m before the beginning of the taxiway centre line curve, and continue beyond the end of the curve to a point on the centre line of the taxiway where an aeroplane can be expected to reach normal taxiing speed, as shown in Figure M-10. The lights on that portion parallel to the runway centre line should always be at least 60 cm from any row of runway centre line lights, as shown in Figure M-9.
(2) The lights should be spaced at longitudinal intervals of not more than 15 m. Where runway centre line lights are not provided, a greater interval not exceeding 30 m may be used.
(d) Taxiway centre line lights on other exit taxiways:
(1) Taxiway centre line lights on exit taxiways other than rapid exit taxiways should commence at the point where the taxiway centre line marking begins to curve from the runway centre line, and follow the curved taxiway centre line marking at least to the point where the marking leaves the runway. The first light should be at least 60 cm from any row of runway centre line lights, as shown in Figure M-9.
(2) The lights should be spaced at longitudinal intervals of not more than 7.5 m.
(e) Taxiway centre line lights on runways: Taxiway centre line lights on a runway forming part of a standard taxi-route, and intended for taxiing in runway visual range conditions less than a value of 350 m should be spaced at longitudinal intervals not exceeding 15 m.

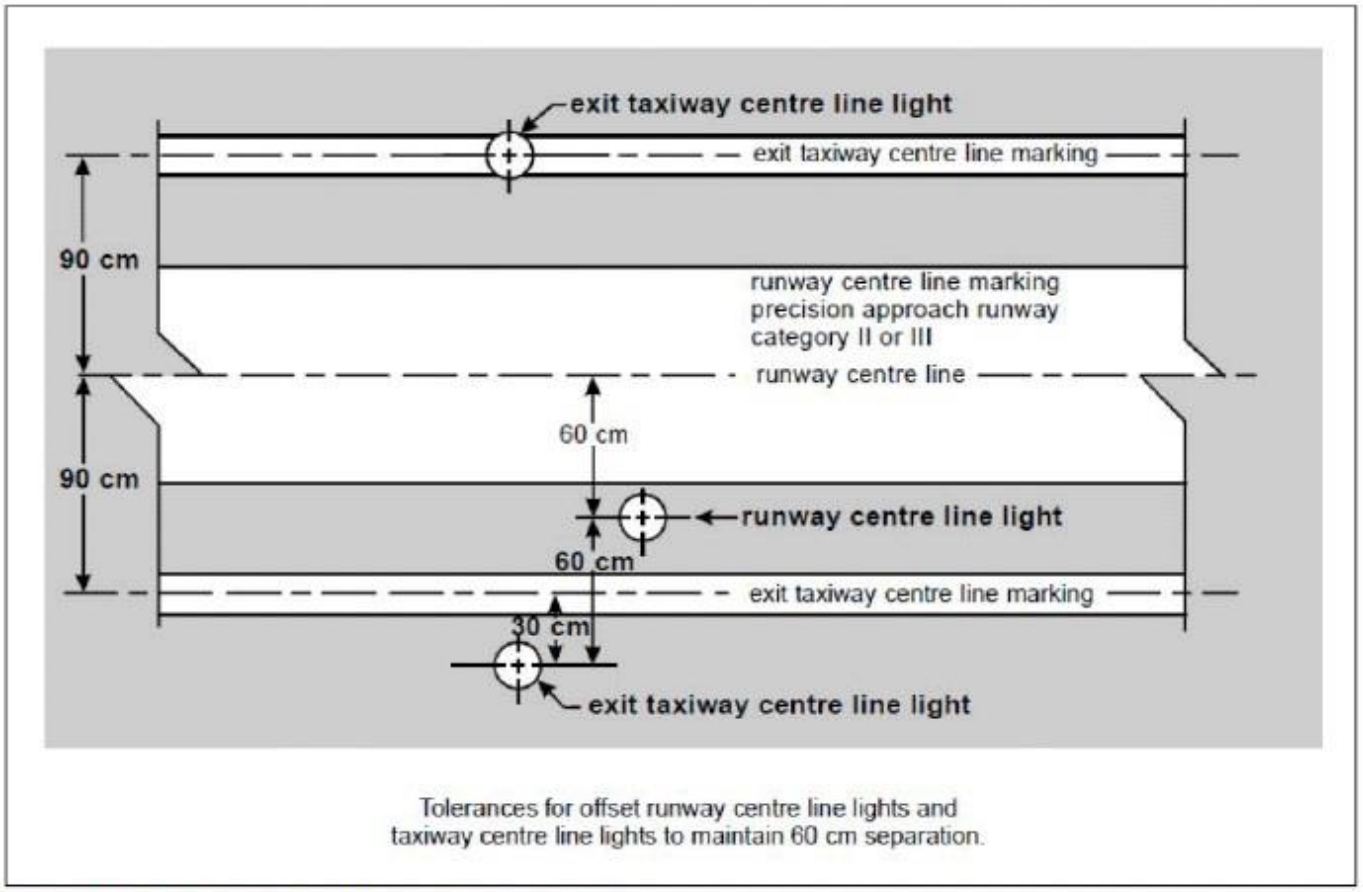


Figure M-9. Offset runway and taxiway centre line lights

(f) Positioning of taxiway centre line lights on taxiway:
The spacing on a particular section of taxiway centre line lighting (straight or curved section) should be such that a clear indication of the taxiway centre line is provided, particularly on a curved section.

(g) Taxiway centre line lights on straight sections of taxiways: Larger intervals not exceeding 60 m may be used where, because of the prevailing meteorological conditions, adequate guidance is provided by such spacing.

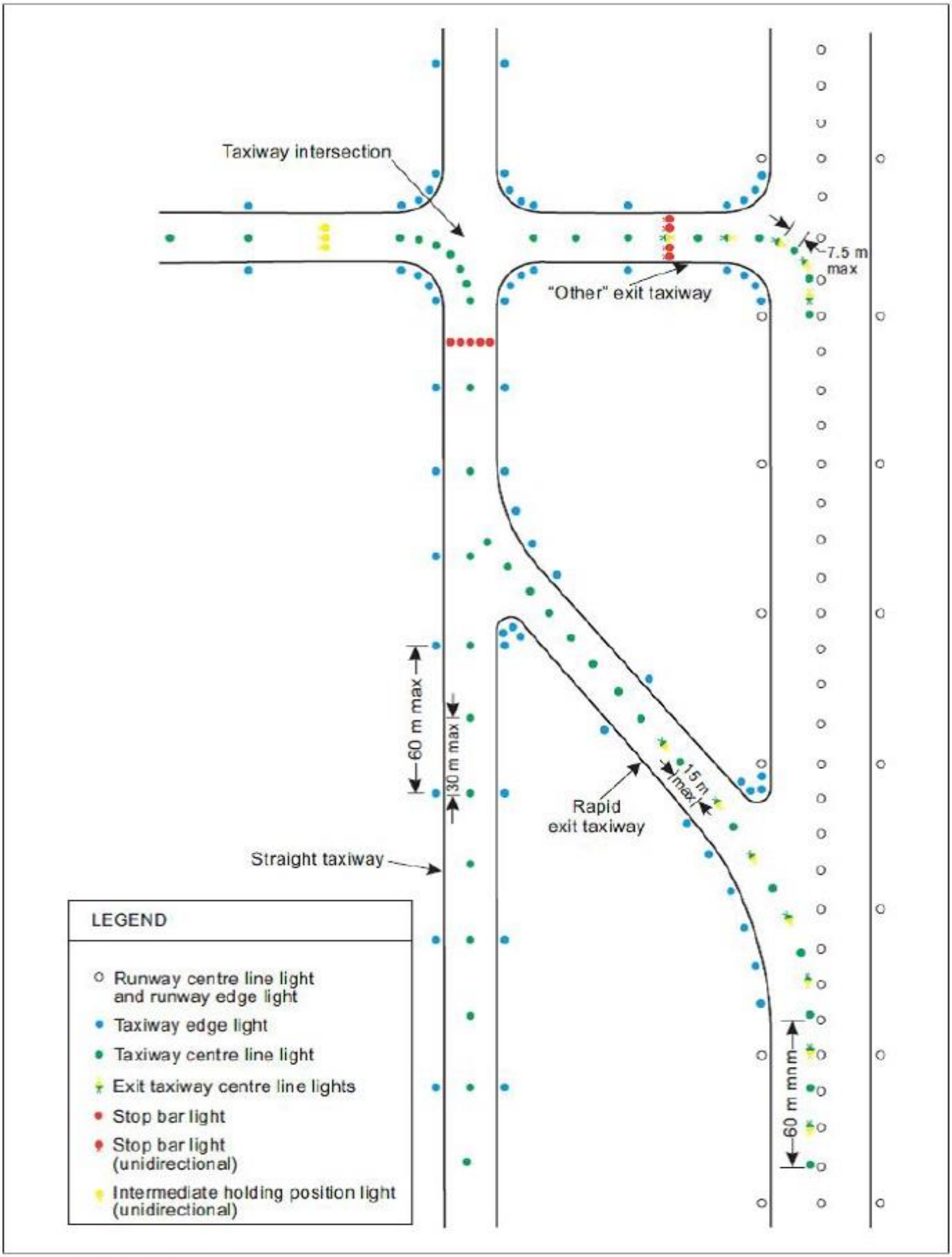


Figure M-10. Taxiway lighting

CS-ADR-DSN.M.720 Taxiway edge lights

(a) Applicability:
  (1) Taxiway edge lights should be provided at the edges of a runway turn pad, holding bay, de-icing/anti-icing facility, apron, etc. intended for use at night, and on a taxiway not provided with taxiway centre line lights and intended for use at night, except that taxiway edge lights need not be provided where, considering the nature of the operations, adequate guidance can be achieved by surface illumination or other means.
  (2) Taxiway edge lights should 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.
(b) Location and positioning:
  (1) 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.
  (2) Taxiway edge lights on a holding bay, de-icing/anti-icing facility, apron, etc. should be spaced at uniform longitudinal intervals of not more than 60 m.
  (3) Taxiway edge lights on a runway turn pad should be spaced at uniform longitudinal intervals of not more than 30 m.
  (4) The lights should be located as near as practicable to the edges of the taxiway, runway turn pad, holding bay, de-icing/anti-icing facility, apron or runway, etc., or outside the edges at a distance of not more than 3 m.
(c) Characteristics:
  (1) Taxiway edge lights should be fixed lights showing blue.
  (2) The lights should 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 should 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.
  (3) The intensity of taxiway edge lights should be at least 2 cd from 0° to 6° vertical, and 0.2 cd at any vertical angles between 6° and 75°.
  (4) Taxiway edge lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.725 Runway turn pad lights

(a) The safety objective of runway turn pad lights is to provide additional guidance on a runway turn pad to enable an aeroplane to complete a safe 180-degree turn, and align with the runway centre line.
(b) Applicability:
  (1) Runway turn pad lights should be provided for continuous guidance on a runway turn pad intended for use in runway visual range conditions less than a value of 350 m to enable an aeroplane to complete a 180-degree turn, and align with the runway centre line.
  (2) Runway turn pad lights should be provided on a runway turn pad intended for use at night, except that these lights need not be provided where taxiway edge lights and runway turn pad marking provide adequate guidance.
(c) Location:
  (1) Runway turn pad lights should normally be located on the runway turn pad marking, except that they should be offset by not more than 30 cm where it is not practicable to locate them on the marking.
  (2) Runway turn pad lights on a straight section of the runway turn pad marking should be spaced at longitudinal intervals of not more than 15 m.
  (3) Runway turn pad lights on a curved section of the runway turn pad marking should not exceed a spacing of 7.5 m.
(d) Characteristics:
  (1) Runway turn pad lights should be unidirectional fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on or approaching the runway turn pad.
  (2) Runway turn pad lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-17 or Figure U-18, as appropriate.

(3) Runway turn pad lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.730 Stop bars

(+GM)

(a) Applicability:
(1) A stop bar should be provided at every runway-holding position serving a runway when it is intended that the runway should be used in runway visual range conditions less than a value of 550 m, except where:
(i) appropriate aids and procedures are available to assist in preventing inadvertent incursions of traffic onto the runway; or
(ii) operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:
(A) aircraft on the manoeuvring area to one at a time; and
(B) vehicles on the manoeuvring area to the essential minimum.
(2) Where there is more than one stop bar associated with a taxiway/runway intersection, only one should be illuminated at any given time.
(3) A stop bar should be provided at an intermediate holding position when it is desired to supplement markings with lights, and to provide traffic control by visual means.
(b) Location: Stop bars should be located across the taxiway at the point where it is desired that traffic stop.
(c) Characteristics:
(1) Stop bars should consist of lights spaced at uniform intervals of not more than 3 m across the taxiway, showing red in the intended direction(s) of approach to the intersection or runway-holding position.
(2) Stop bars installed at a runway-holding position should be unidirectional, and should show red in the direction of approach to the runway.
(3) The intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figures U-16 to U-20, as appropriate.
(4) Where stop bars are specified as components of an advanced surface movement guidance and control system, and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figures U-21, U-22 or U-23, as appropriate.
(5) Where a wide beam fixture is required, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-21 or Figure U-23, as appropriate.
(6) The lighting circuit should be designed so that:
(i) stop bars located across entrance taxiways are selectively switchable;
(ii) stop bars located across taxiways intended to be used only as exit taxiways are switchable selectively or in groups;
(iii) when a stop bar is illuminated, any taxiway centre line lights installed beyond the stop bar should be extinguished for a distance of at least 90 m; and
(iv) stop bars are interlocked with the taxiway centre line lights so that when the centre line lights beyond the stop bar are illuminated, the stop bar is extinguished and vice versa.
(7) Stop bar lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.735 Intermediate holding position lights

(a) Applicability:
(1) Except where a stop bar has been installed, intermediate holding position lights should be provided at an intermediate holding position intended for use in runway visual range conditions less than a value of 350 m.
(2) Intermediate holding position lights should be provided at an intermediate holding position where there is no need for stop-and-go signals as provided by a stop bar.
(b) Location: Intermediate holding position lights should be located along the intermediate holding

position marking at a distance of 0.3 m prior to the marking.

(c) Characteristics of intermediate holding position lights:

(1) Intermediate holding position lights should consist of three fixed unidirectional lights showing yellow in the direction of approach to the intermediate holding position with a light distribution similar to taxiway centre line lights if provided.

(2) The lights should be disposed symmetrically about and at right angle to the taxiway centre line, with individual lights spaced 1.5 m apart.

(3) Intermediate holding position lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and in Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.M.745 Runway guard lights

(+GM)

(a) The safety objective of the runway guard lights is to warn pilots and drivers of vehicles, when operating on taxiways, that they are about to enter a runway. There are two standard configurations of runway guard lights as illustrated in Figure M-12.

(b) Applicability:

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

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

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

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

(3) Configuration B runway guard lights should not be collocated with a stop bar.

(4) Where more than one runway-holding position exists at a runway/taxiway intersection, only the set of runway guard lights associated with the operational runway-holding position should be illuminated.

(c) Location:

(1) Runway guard lights, Configuration A should be located at each side of the taxiway within the area delimited by the inner and the outer edges of the runway holding position marking.

(2) Runway guard lights, Configuration B, should be located across the taxiway within the area delimited by the inner and the outer edges of the runway holding position marking.

(d) Characteristics:

(1) Runway guard lights, Configuration A, should consist of two pairs of yellow lights.

(2) Runway guard lights, Configuration B, should consist of yellow lights spaced at intervals of 3 m across the taxiway.

(3) The light beam should be unidirectional and should show yellow in the direction of approach to the runway-holding position.

(4) The intensity in yellow light and beam spreads of lights of Configuration A should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-27.

(5) 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 CS-ADR-DSN.U.940, Figure U-28.

(6) Where runway guard lights are specified as components of an advanced surface movement guidance and control system where higher light intensities are required, the intensity in yellow light and beam spreads of lights of Configuration A should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-28.

(7) The intensity in yellow light and beam spreads of lights of Configuration B should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-28.

(8) Where runway guard lights are intended for use during the day, the intensity in yellow light and beam spreads of lights of Configuration B should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-24.

(9) Where runway guard lights are specified as components of an advanced surface movement guidance and control system where higher light intensities are required, the intensity in yellow light and beam spreads of lights of Configuration B should be in accordance with the specifications in CS-ADR-DSN.U.940, Figure U-24.

(10) The lights in each unit of Configuration A should be illuminated alternately.
(11) For Configuration B, adjacent lights should be alternately illuminated and alternative lights should be illuminated in unison.
(12) The lights should be illuminated between 30 and 60 cycles per minute and the light suppression and illumination periods should be equal and opposite in each light.
(13) Runway guard lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

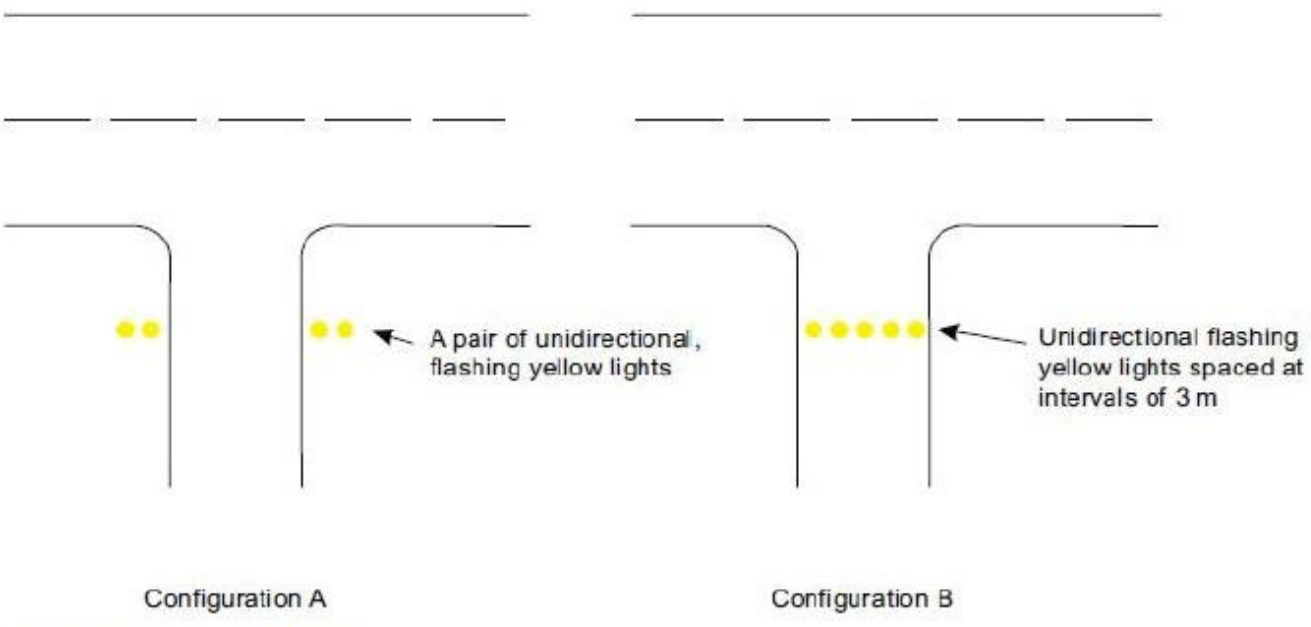


Figure M-12. Runway guard lights

CS-ADR-DSN.M.750 Apron floodlighting

(a) The purpose of apron floodlighting is to facilitate safe operations on an apron, on a de-icing/anti-icing facility, and on a designated isolated aircraft parking position intended to be used at night.
(b) Applicability: Apron floodlighting should be provided on an apron, as necessary on a de-icing/anti-icing facility, and on a designated isolated aircraft parking position intended to be used at night. Aprons primarily used for recreational flying need not be illuminated. Apron flood lighting may not be provided on aprons used for military operations based on operational considerations.
(c) Location: 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 minimise shadows.
(d) Characteristics:
  (1) The spectral distribution of apron floodlights should be such that the colours used for aircraft marking connected with routine servicing, and for surface and obstacle marking, can be correctly identified.
  (2) The average illuminance should be at least the following:
    (i) Aircraft stand:
      (A) horizontal illuminance — 20 lux with a uniformity ratio (average to minimum) of not more than 4 to 1; and
      (B) vertical illuminance — 20 lux at a height of 2 m above the apron in relevant directions.
    (ii) Other apron areas: horizontal illuminance — 50 % of the average illuminance on the aircraft stands with a uniformity ratio (average to minimum) of not more than 4 to 1.

CS-ADR-DSN.M.765 Aircraft stand manoeuvring guidance lights

(a) Applicability: Aircraft stand manoeuvring guidance lights should be provided to facilitate the positioning of an aircraft on an aircraft stand on a paved apron, or on a de-icing/anti-icing facility intended for use in poor visibility conditions unless adequate guidance is provided by other means.
(b) Location: Aircraft stand manoeuvring guidance lights should be collocated with the aircraft stand markings.
(c) Characteristics:
  (1) Aircraft stand manoeuvring guidance lights, other than those indicating a stop position, should be fixed yellow lights, visible throughout the segments within which they are intended to provide guidance.
  (2) The lights used to delineate lead-in, turning, and lead-out lines should be spaced at intervals of not more than 7.5 m on curves and 15 m on straight sections.
  (3) The lights indicating a stop position should be fixed, unidirectional lights showing red.
  (4) The intensity of the lights should be adequate for the condition of visibility and ambient light in which the use of the aircraft stand is intended.
  (5) The lighting circuit should be designed so that the lights may be switched on to indicate that an aircraft stand is to be used, and switched off to indicate that it is not to be used.

CS-ADR-DSN.M.770 Road-holding position light

(a) Applicability: A road-holding position light should be provided at each road-holding position serving a runway when it is intended that the runway should be used in runway visual range conditions less than a value of 550 m.
(b) Location: A road-holding position light should be located adjacent to the holding position marking 1.5 m (±0.5 m) from one edge of the road, i.e. left or right as appropriate to the local road traffic regulations.
(c) Characteristics:
  (1) The road-holding position light should comprise:
    (i) a controllable red (stop)/green (go) traffic light; or
    (ii) a flashing-red light
  (2) Provisions for control of the lights in paragraph (1)(i) above should be installed in the positions for the air traffic services.
  (3) The road-holding position light beam should be unidirectional and aligned so as to be visible to the driver of a vehicle approaching the holding position.
  (4) The intensity of the light beam should be adequate for the conditions of visibility and ambient light in which the use of the holding position is intended but should not dazzle the driver.
  (5) The flash frequency of the flashing red light should be between 30 and 60 flashes per minute.

CS-ADR-DSN.M.771 No-entry bar

(+GM)

(a) Applicability: A no-entry bar should be provided across a taxiway which is intended to be used as an exit only taxiway. The purpose of a no-entry bar is to assist in preventing inadvertent access of traffic to that taxiway.
(b) Location:
  (1) A no-entry bar should be located across the taxiway at the end of an exit only taxiway where it is desired to prevent traffic from entering the taxiway in the wrong direction.
  (2) A no-entry bar should be collocated with a no-entry sign and/or a no-entry marking.
(c) Characteristics:
  (1) A no-entry bar should consist of unidirectional lights spaced at uniform intervals of no more than 3 m showing red in the intended direction(s) of approach to the runway.
  (2) Taxiway centre line lights installed beyond the no-entry bar, looking in the direction of the runway, should not be visible when viewed from the taxiway.
  (3) The intensity in red light and beam spreads of no-entry bar lights should be in accordance with the specifications in CS-ADR-DSN.U.940, Figures U-16 to U-20, as appropriate.
  (4) No-entry bar lights chromaticity should be in accordance with the specifications in CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate.

CS-ADR-DSN.N.775 General

(+GM)

(a) Signs should be either fixed message signs or variable message signs.
(b) Applicability:
  (1) Signs should be provided to convey a mandatory instruction, information on a specific location, or destination on a movement area or to provide other information necessary for the implementation of surface movement guidance and control system (SMGCS) at an aerodrome.
  (2) A variable message sign should be provided where:
    (i) the instruction or information displayed on the sign is relevant only during a certain period of time; and/or
    (ii) there is a need for variable predetermined information to be displayed on the sign to meet the requirements of the implementation of surface movement guidance and control system (SMGCS) at an aerodrome.
(c) Characteristics:
  (1) Signs should be frangible. Those located near a runway or taxiway should be sufficiently low to preserve clearance for propellers and the engine pods of jet aircraft. The installed height of the sign should not exceed the dimension shown in the appropriate column of Table N-1.
  (2) Signs should be rectangular, as shown in Figures N-4 and N-6 with the longer side horizontal.
  (3) The only signs on the movement area utilising red should be mandatory instruction signs.
  (4) Signs should be illuminated when intended for use:
    (i) in runway visual range conditions less than a value of 800 m; or
    (ii) at night in association with instrument runways; or
    (iii) at night in association with non-instrument runways where the code number is 3 or 4.
  (5) Signs should be retroreflective and/or illuminated when intended for use at night in association with non-instrument runways where the code number is 1 or 2.
  (6) Where variable pre-determined information is required, a variable sign should be provided.
    (i) A variable message sign should show a blank face when not in use.
    (ii) In case of failure, a variable message sign should not provide information that could lead to unsafe action from a pilot or a vehicle driver.
    (iii) 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.
  (7) The taxiing guidance signs should be in accordance with the specifications of paragraphs (c)(8) to (c)(22).
  (8) The location distance for taxiing guidance signs including runway exit signs should conform to Table N-1.

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
Runway 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

Table N-1. Location distances for taxiing guidance signs including runway exit signs

  (9) Inscription heights should conform to the Table N-2.

Runway code number	Minimum character height		
	Mandatory instruction sign	Information sign	
		Runway exit and runway vacated signs	Other signs
1 or 2	300 mm	300 mm	200 mm

3 or 4	400 mm	400 mm	300 mm

Table N-2. Minimum character height

(10) Where a taxiway location sign is installed in conjunction with a runway designation sign (see CS-ADR-DSN.N.785(b)(9)), the character size should be that specified for mandatory instruction signs.

(11) The dimensions should be as follows for:

(i) Arrow dimensions:

Legend height	**Stroke**
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

(ii) Stroke:

Legend height	**Stroke**
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

(12) Sign luminance should be as follows:

(i) Where operations are conducted in runway visual range conditions less than a value of 800 m, average sign luminance should be at least:

Red	30 cd/m2
Yellow	150 cd/m2
White	300 cd/m2

(ii) Where operations are conducted in accordance with CS-ADR-DSN.N.775(c)(4)(ii) and (c)(5), average sign luminance should be at least:

Red	10 cd/m2
Yellow	50 cd/m2
White	100 cd/m2

Note: In runway visual range conditions less than a value of 400 m, there will be some degradation in the performance of signs.

(13) The luminance ratio between red and white elements of a mandatory instruction sign should be between 1:5 and 1:10.

(14) The average luminance of the sign is calculated by establishing grid points as shown in Figure N-1, and using the luminance values measured at all grid points located within the rectangle representing the sign.

(15) The average value is the arithmetic average of the luminance values measured at all considered grid points.

(16) The ratio between luminance values of adjacent grid points should not exceed 1.5:1. For areas on the sign face where the grid spacing is 7.5 cm, the ratio between luminance values of adjacent grid points should not exceed 1.25:1. The ratio between the maximum and minimum luminance value over the whole sign face should not exceed 5:1.

(17) The forms of characters, i.e. letters, numbers, arrows, and symbols should conform to those shown in Figures N-2A to N-2H. The width of characters and the space between individual characters should be determined as indicated in Table N-3.

(18) The face height of signs should be as follows:

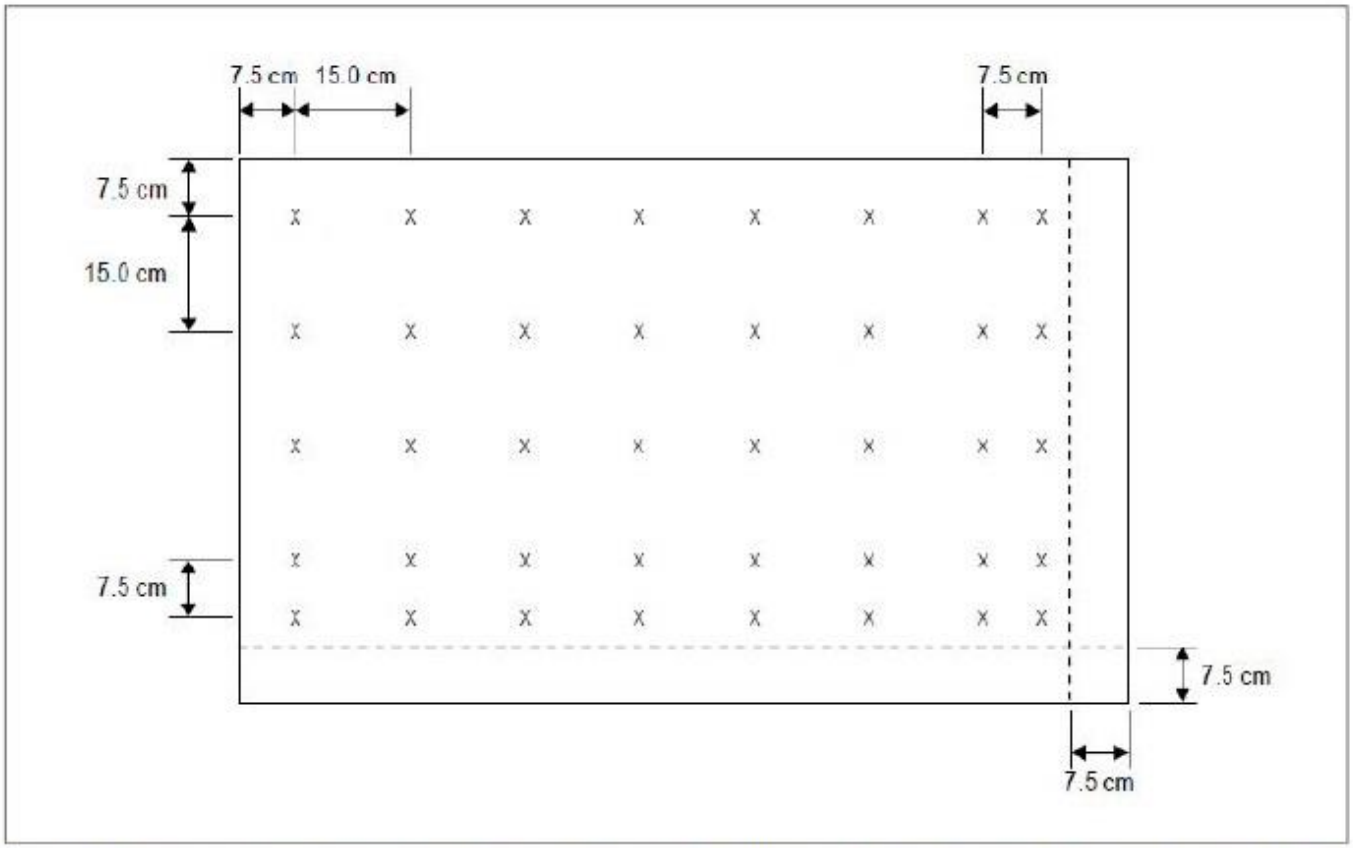
Legend height	**Face height (min)**
200 mm	400 mm
300 mm	600 mm
400 mm	800 mm

(19) The face width of signs should be determined using Figure N-3 except that, where a mandatory instruction sign is provided on one side of a taxiway only, the face width should not be less than:
   (i) 1.94 m where the code number is 3 or 4; and
   (ii) 1.46 m where the code number is 1 or 2.

(20) Borders:
   (i) The black vertical delineator between adjacent direction signs should have a width of approximately 0.7 of the stroke width.
   (ii) The yellow border on a stand-alone location sign should be approximately 0.5 stroke width.

(21) The colours of signs should be in accordance with the appropriate specifications in CHAPTER U — Colours for aeronautical ground lights, markings, signs and panels.

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



Note 1: The average luminance of a sign is calculated by establishing grid points on a sign face showing typical inscriptions and a background of the appropriate colour (red for mandatory instruction signs and yellow for direction and destination signs) as follows:

(a) Starting at the top left corner of the sign face, establish a reference grid point at 7.5 cm from the left edge and the top of the sign face.

(b) Create a grid of 15 cm spacing horizontally and vertically from the reference grid point. Grid points within 7.5 cm of the edge of the sign face should be excluded.

(c) Where the last point in a row/column of grid points is located between 22.5 cm and 15 cm from the edge of the sign face (but not inclusive), an additional point should be added 7.5 cm from this point.

(d) Where a grid point falls on the boundary of a character and the background, the grid point should be slightly shifted to be completely outside the character.

Note 2: Additional grid points may be required to ensure that each character includes at least five evenly spaced grid points.

Note 3: Where one unit includes two types of signs, a separate grid should be established for each type.

Figure N-1. Grid points for calculating average luminance of a sign

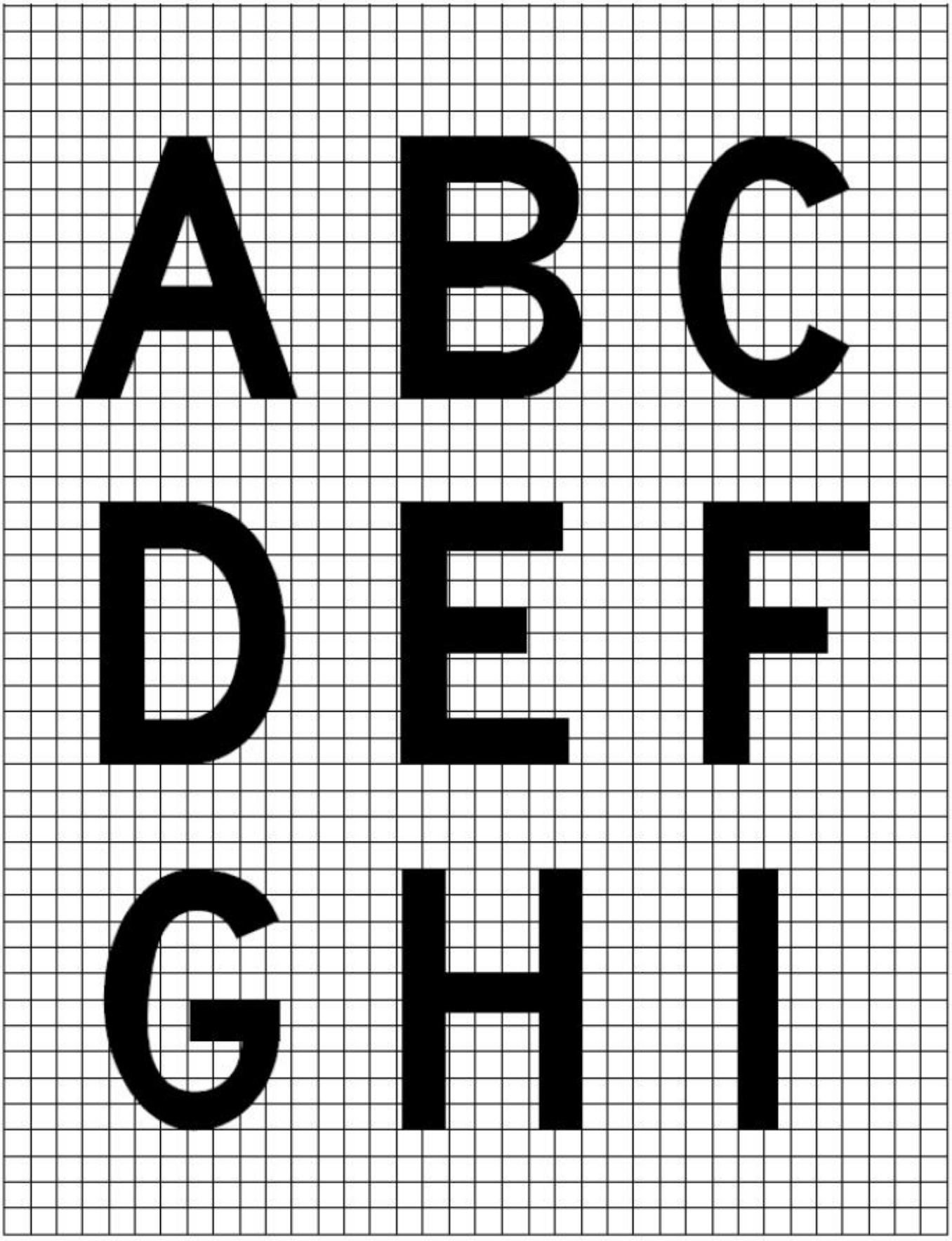


Figure N-2A. Forms of characters for signs

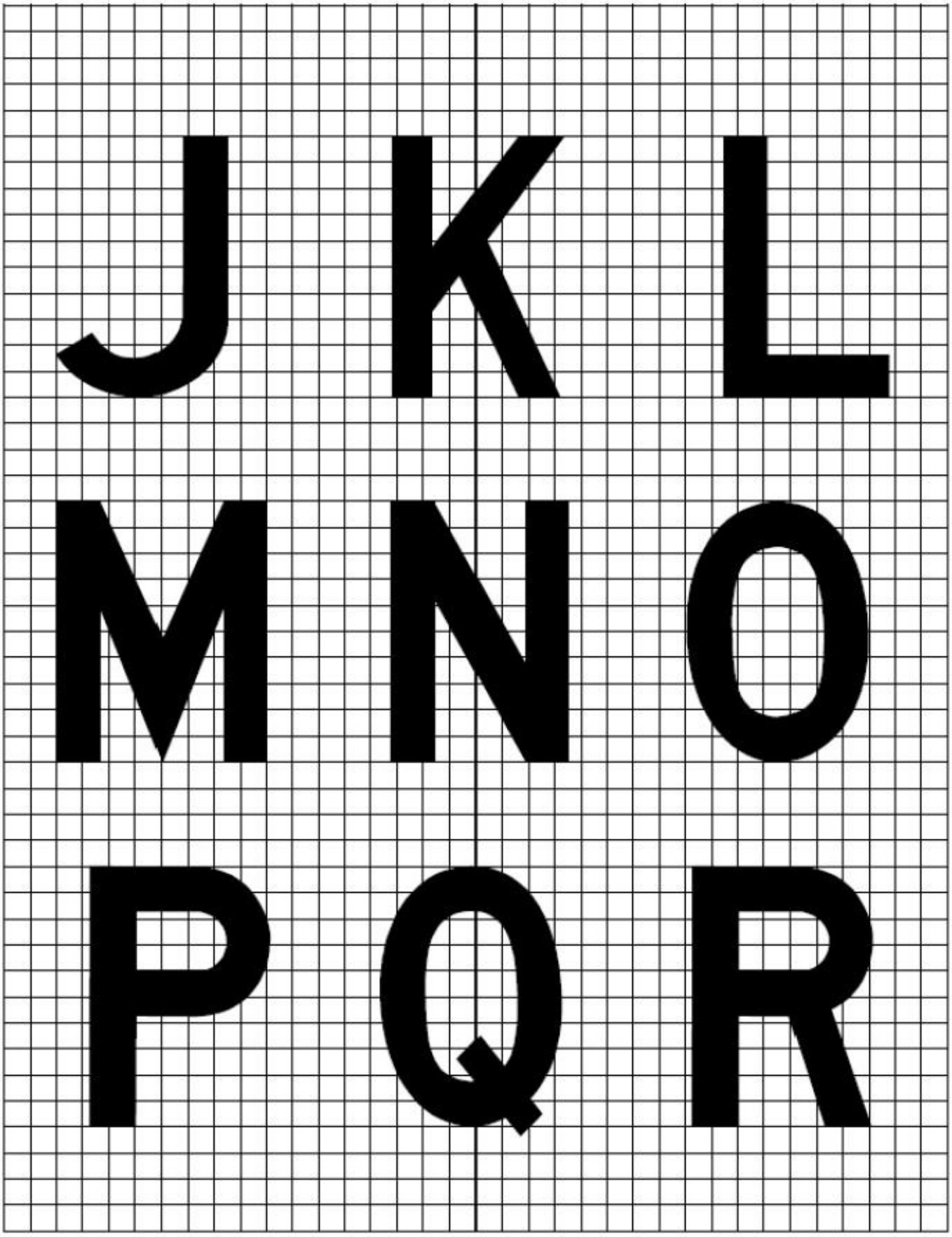


Figure N-2B. Forms of characters for signs

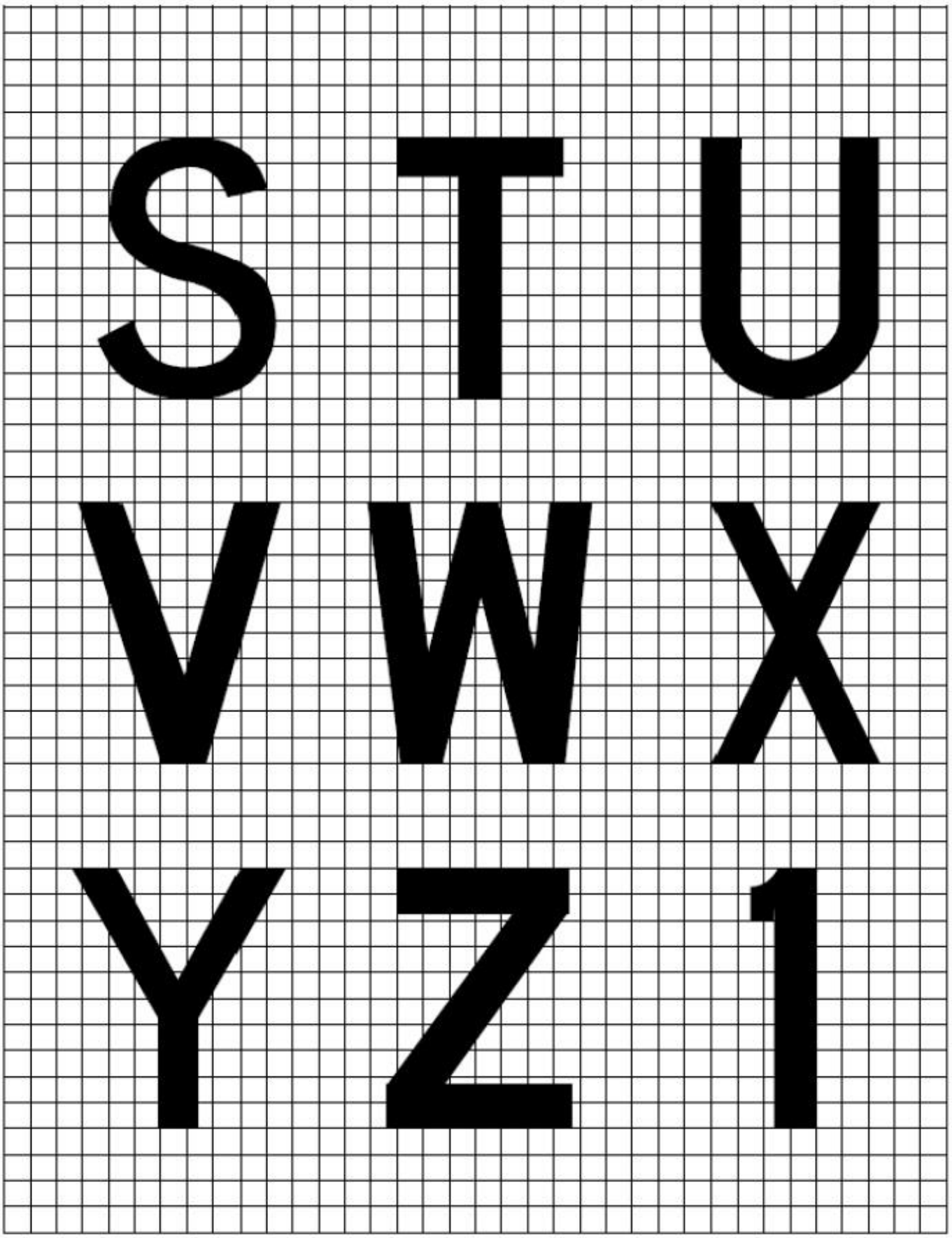


Figure N-2C. Forms of characters for signs

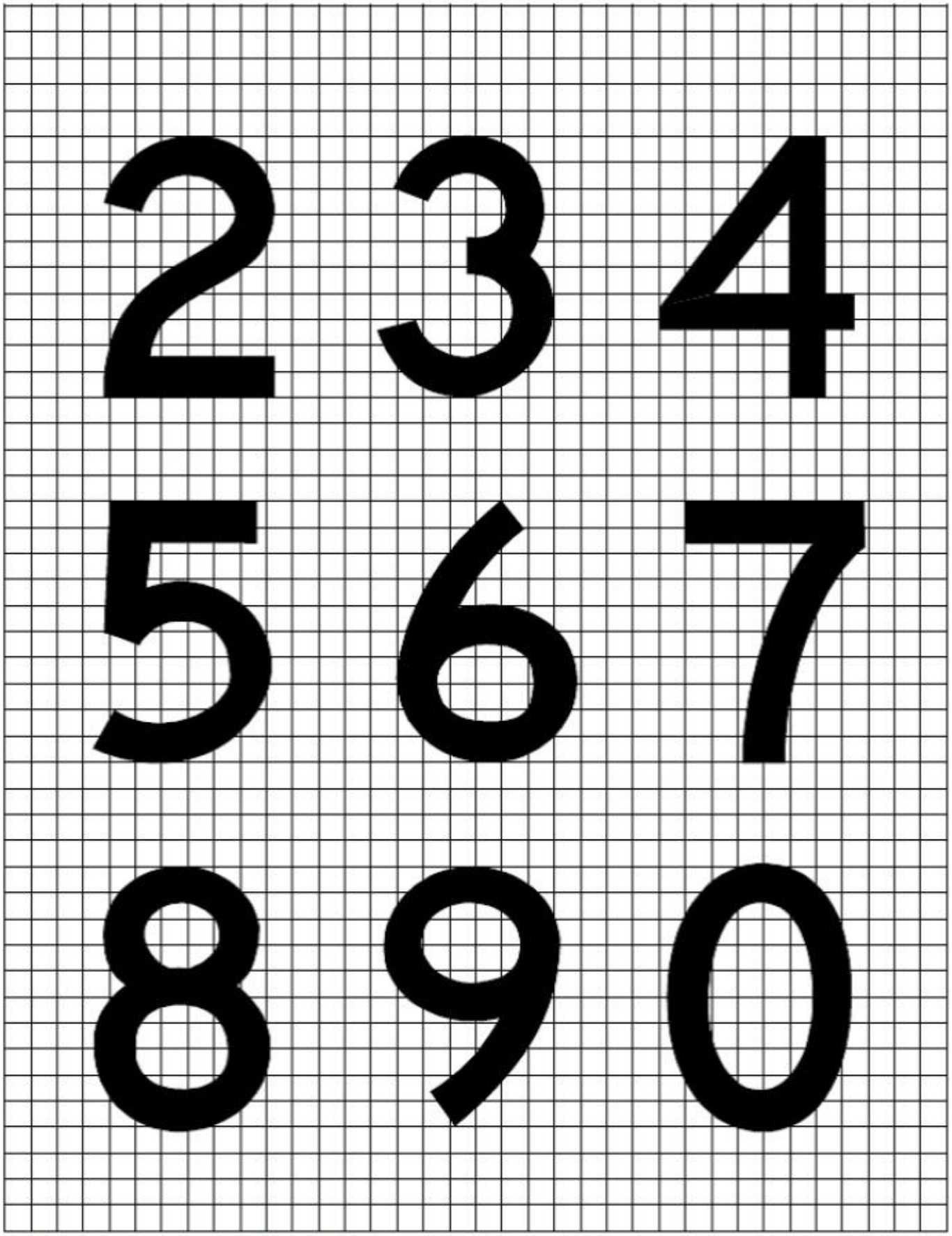


Figure N-2D. Forms of characters for signs

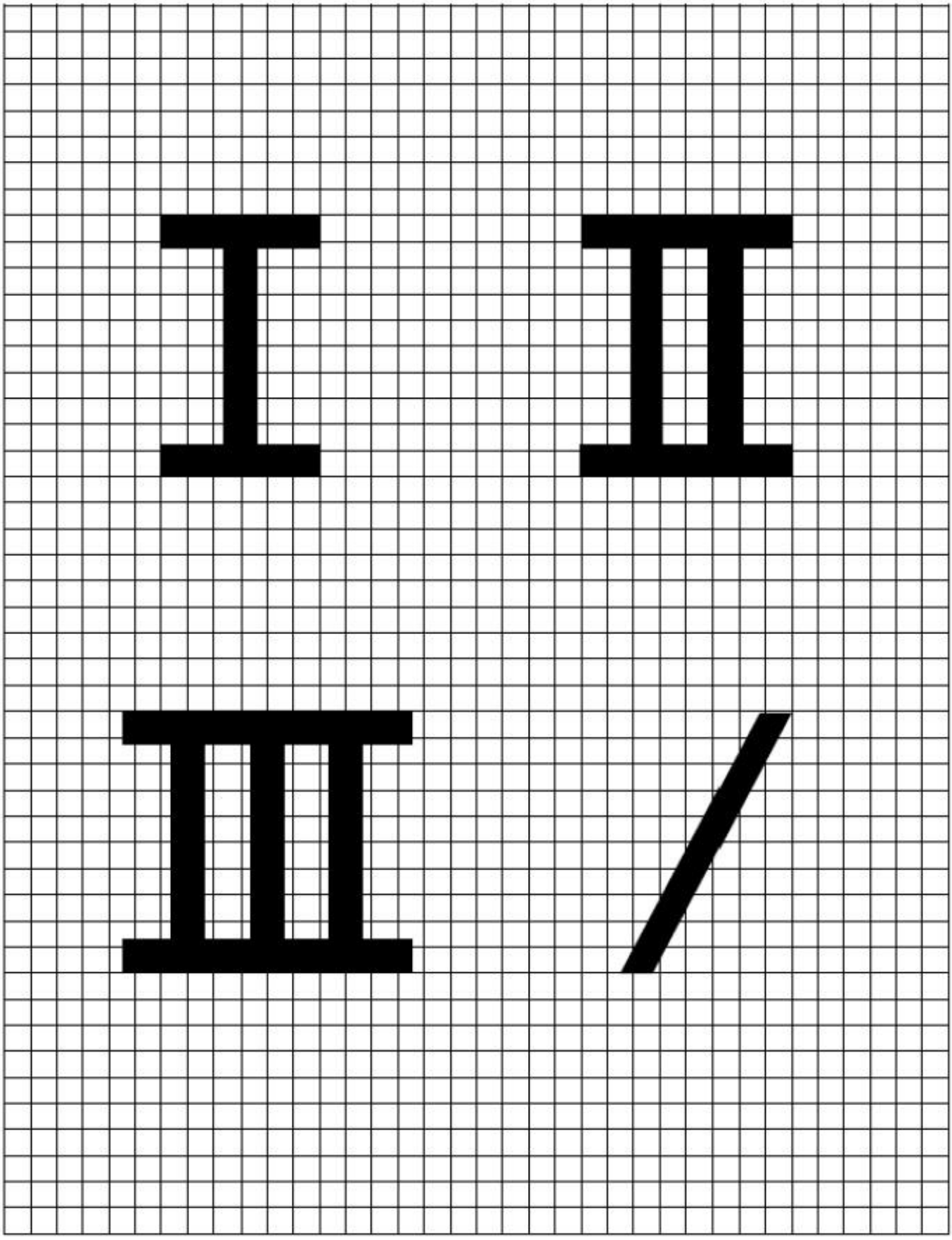


Figure N-2E. Forms of characters for signs

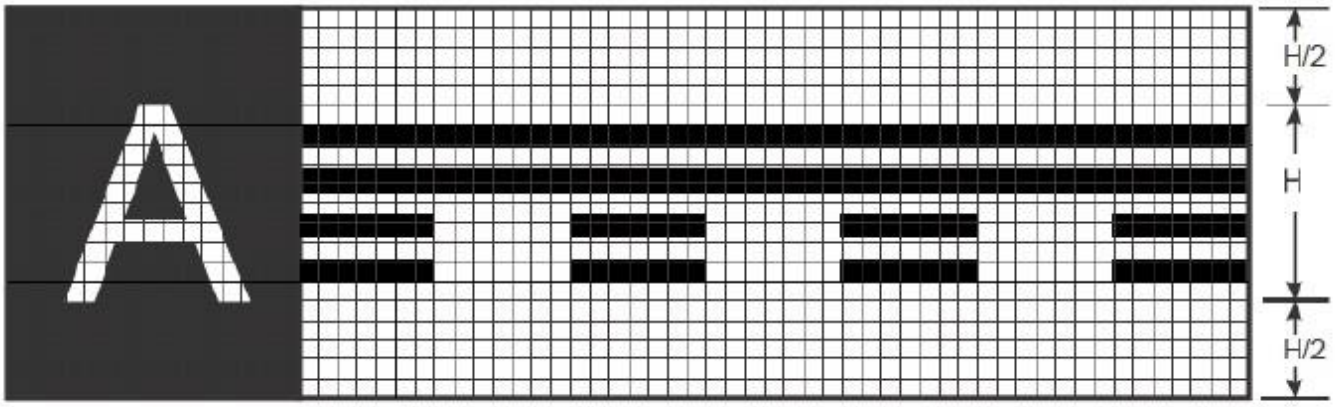


Figure N-2F. Runway vacated sign with typical location sign

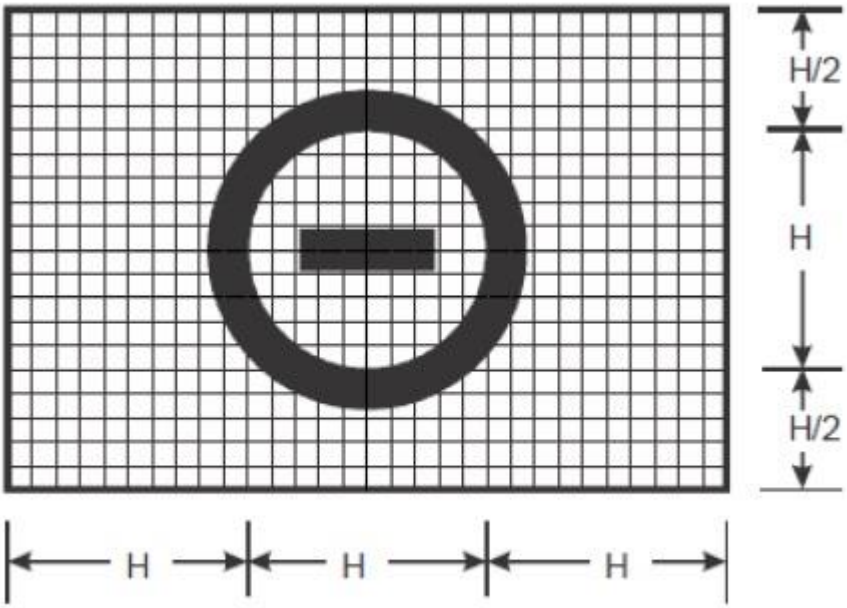


Figure N-2G. No entry sign

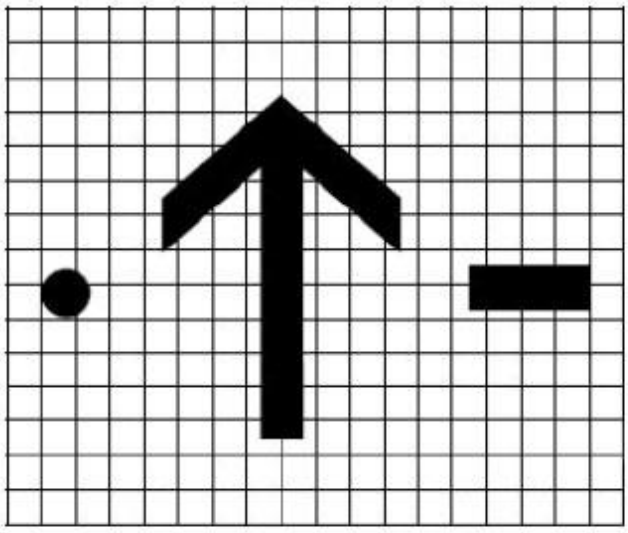


Figure N-2H. Forms of characters for signs

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

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

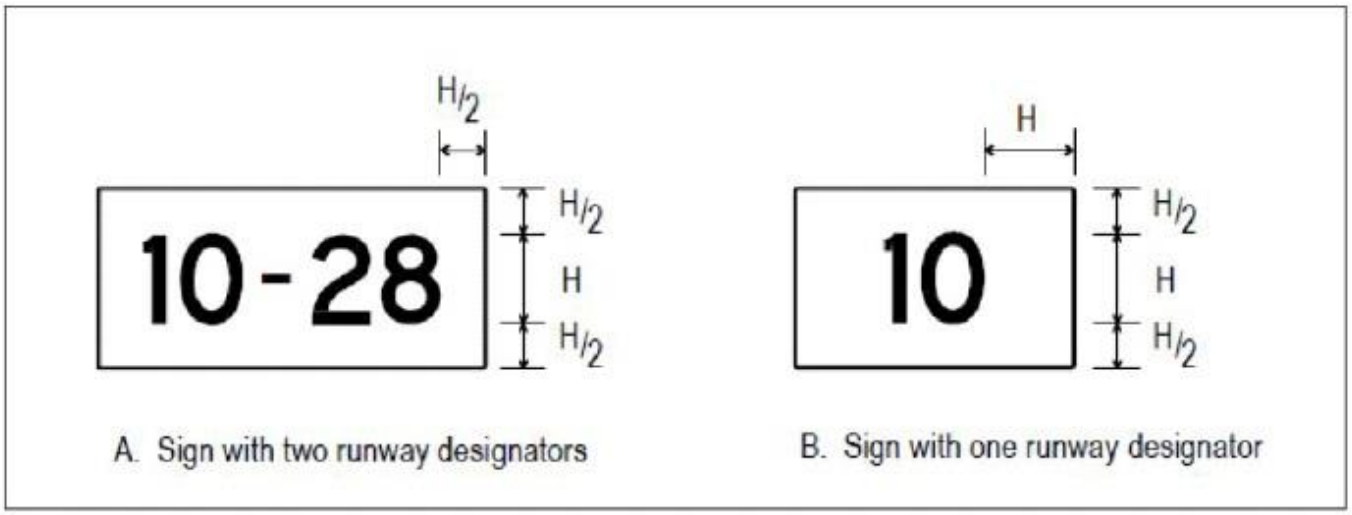


Figure N-3. Sign dimensions

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

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

5	1	2	2
6	1	2	2
7	2	2	4
8	1	2	2
9	1	2	2
0	1	2	2

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

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

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

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

Table N-3. Letter and numeral width and space between letters or numerals

CS-ADR-DSN.N.780 Mandatory instruction signs

(a) Applicability:
- (1) A mandatory instruction sign should be provided to identify a location beyond which an aircraft taxiing or vehicle should not proceed unless authorised by the aerodrome control tower.
- (2) Mandatory instruction signs should include runway designation signs, Category I, II, or III holding position signs, runway-holding position signs, road-holding position signs, and no-entry signs.
- (3) A pattern 'A' runway-holding position marking should be supplemented at a taxiway/runway intersection or a runway/runway intersection with a runway designation sign.
- (4) A pattern 'B' runway-holding position marking should be supplemented with a Category I, II, or III holding position sign.
- (5) A pattern 'A' runway-holding position marking at a runway-holding position should be supplemented with a runway-holding position sign.
- (6) 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.
- (7) A road-holding position sign should be provided at all road entrances to a runway and may also be provided at road entrances to taxiways.
- (8) A no-entry sign should be provided when entry into an area is prohibited.

(b) Location:
- (1) A runway designation sign at a taxiway/runway intersection or a runway/runway intersection should be located on each side of the runway-holding position marking facing the direction of approach to the runway.
- (2) A Category I, II, or III holding position sign should be located on each side of the runway-holding position marking facing the direction of the approach to the critical area.
- (3) A no-entry sign should be located at the beginning of the area to which entrance is prohibited on each side of the taxiway as viewed by the pilot.
- (4) A runway-holding position sign should be located on each side of the runway-holding position facing the approach to the obstacle limitation surface or ILS/MLS critical/sensitive area as appropriate.

(c) Characteristics:
- (1) A mandatory instruction sign should 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.
- (2) The inscription on a runway designation sign should 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.
- (3) The inscription on a Category I, II, III, joint II/III or joint I/II/III holding position sign should consist of the runway designator followed by CAT I, CAT II, CAT III, CAT II/III or CAT I/II/III, as appropriate.
- (4) The inscription on a NO ENTRY sign should be in accordance with Figure N-4.
- (5) The inscription on a runway-holding position sign at a runway-holding position should consist of the taxiway designation and a number.

(d) Where installed, the inscriptions/symbol of Figure N-4 should be used:

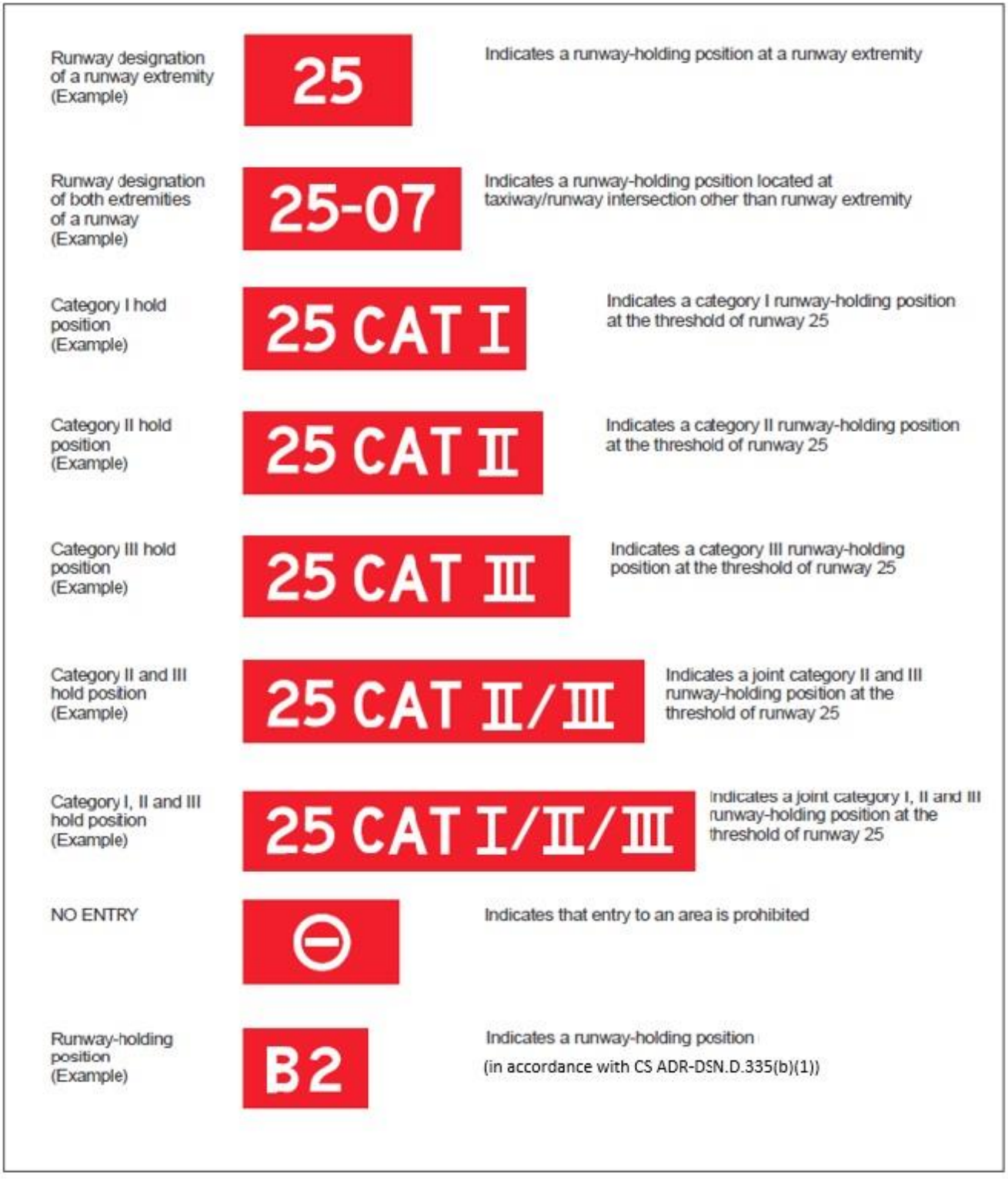
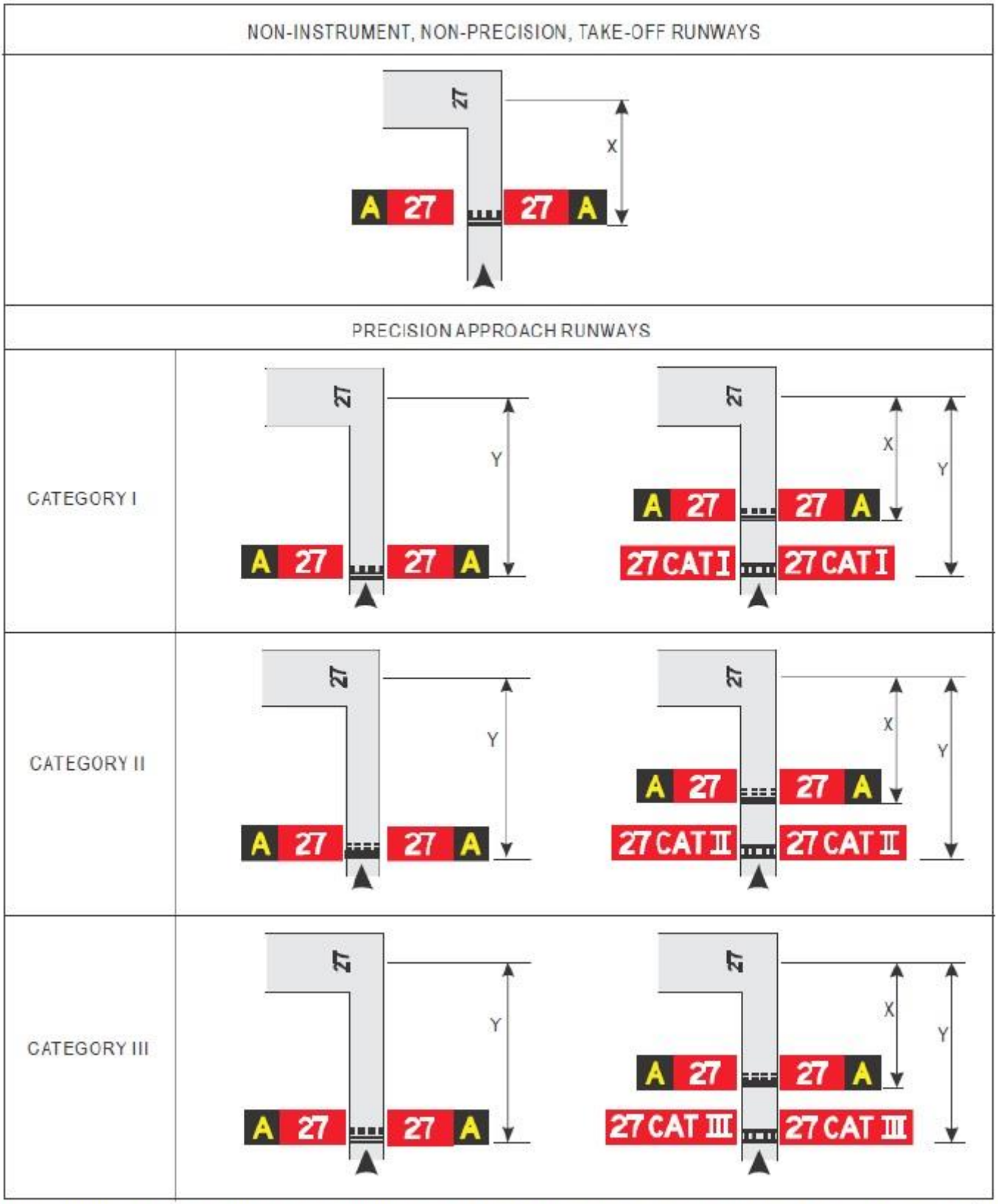


Figure N-4. Mandatory instruction signs



Note: Distance X is established in accordance with Table D-2. Distance Y is established at the edge of ILS/ML critical/sensitive area

Figure N-5. Positions of signs at taxiway/runway intersections

CS-ADR-DSN.N.785 Information signs

(+GM)

(a) Applicability:

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

(2) Information signs should include: direction signs, location signs, destination signs, runway exit signs, runway vacated signs, and intersection take-off signs.

(3) A runway exit sign should be provided where there is an operational need to identify a runway exit.

(4) A runway vacated sign should 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.

(5) At runways where intersection take-offs are conducted, an intersection take-off sign should be provided to indicate the remaining take-off run available (TORA) for such take-offs.

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

(7) A combined location and direction sign should be provided when it is intended to indicate routing information prior to a taxiway intersection.

(8) A direction sign should be provided when there is an operational need to identify the designation and direction of taxiways at an intersection.

(9) A location sign should be provided at an intermediate holding position.

(10) A location sign should be provided in conjunction with a runway designation sign except at a runway/runway intersection.

(11) A location sign should be provided in conjunction with a direction sign, except that it may be omitted where a safety assessment indicates that it is not needed.

(12) Where necessary, a location sign should be provided to identify taxiways exiting an apron or taxiways beyond an intersection.

(13) Where a taxiway ends at an intersection such as a 'T' and it is necessary to identify this, a barricade, direction sign, and/or other appropriate visual aid should be used.

(b) Location:

(1) Except as specified in paragraph (b)(3) below, information signs should wherever practicable, be located on the left-hand side of the taxiway in accordance with Table N-1.

(2) At a taxiway intersection, information signs should be located prior to the intersection and in line with the intermediate holding position marking. Where there is no intermediate holding position marking, the signs should 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.

(3) A runway exit sign should 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 N-1.

(4) A runway exit sign should be located prior to the runway exit point in line with a position at least 60 m prior to the point of tangency where the code number is 3 or 4, and at least 30 m where the code number is 1 or 2.

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

(i) the distance between the centre line of the runway and the perimeter of the ILS/MLS critical/sensitive area; or

(ii) the distance between the centre line of the runway and the lower edge of the inner transitional surface.

(6) Where provided in conjunction with a runway vacated sign, the taxiway location sign should be positioned outboard of the runway vacated sign.

(7) An intersection take-off sign should be located at the left-hand side of the entry taxiway. The distance between the sign and the centre line of the runway should 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.

(8) A taxiway location sign installed in conjunction with a runway designation sign should be positioned outboard of the runway designation sign.

(9) A destination sign should not normally be collocated with a location or direction sign.

(10) An information sign other than a location sign should not be collocated with a mandatory instruction sign.

(c) Characteristics:

(1) An information sign other than a location sign should consist of an inscription in black on a yellow background.

(2) A location sign should consist of an inscription in yellow on a black background and where it is a stand-alone sign, should have a yellow border.

(3) The inscription on a runway exit sign should consist of the designator of the exit taxiway and an arrow indicating the direction to follow.

(4) The inscription on a runway vacated sign should depict the pattern A runway-holding position marking as shown in Figure N-6.

(5) The inscription on an intersection take-off sign should consist of a numerical message indicating the remaining take-off run available in metres, plus an arrow, appropriately located and oriented, indicating the direction of the take-off as shown in Figure N-6.

(6) The inscription on a destination sign should comprise an alpha, alphanumerical or numerical message identifying the destination, plus an arrow indicating the direction to proceed as shown in Figure N-6.

(7) The inscription on a direction sign should comprise an alpha or alphanumerical message identifying the taxiway(s) , plus an arrow or arrows appropriately oriented as shown in Figure N-6.

(8) The inscription on a location sign should comprise the designation of the location taxiway, runway, or other pavement the aircraft is on or is entering, and should not contain arrows.

(9) Where 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 progressive number.

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

(i) 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;

(ii) 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;

(iii) 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

(iv) adjacent direction signs should be delineated by a vertical black line as shown in Figure N-6.

(11) A taxiway should be identified by a designator that is only used once on an aerodrome and comprising a single letter, two letters, or a combination of a letter or letters followed by a number.

(12) When designating taxiways:

(i) the letters I, O, or X should not be used, to avoid confusion with the numerals 1, 0, and the closed marking.

(ii) the use of words such as 'inner' and 'outer' should be avoided wherever possible.

(13) The use of numbers alone on the manoeuvring area should be reserved for the designation of runways.

(14) Apron stand designators should not be the same as taxiway designators.

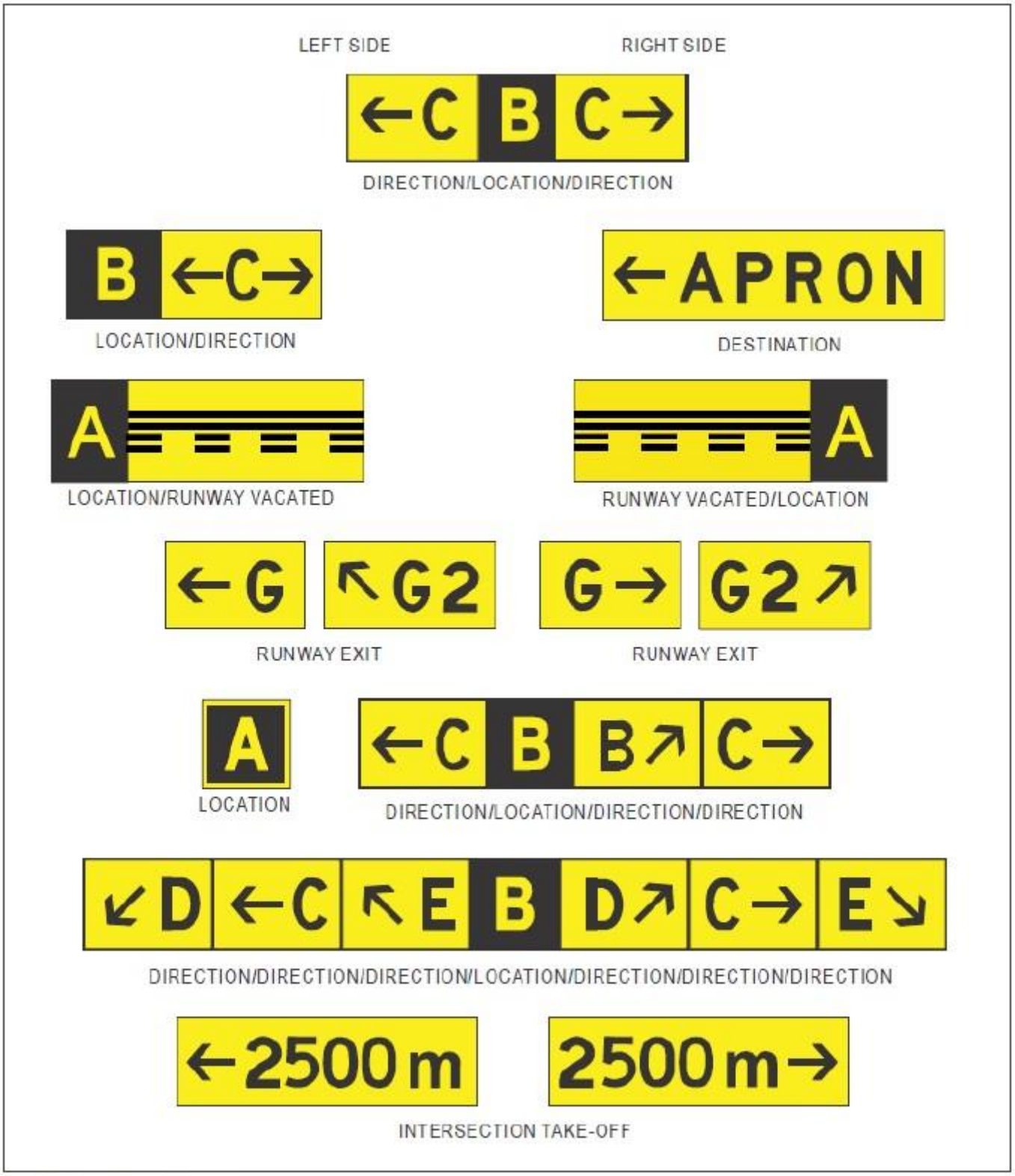


Figure N-6. Information signs

CS-ADR-DSN.N.791 TACAN aerodrome checkpoint sign

When a TACAN aerodrome check-point is established, it should be indicated by a TACAN aerodrome check-point marking and sign.

(a) Location: A TACAN aerodrome check-point sign should be located as near as possible to the check-point and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the TACAN aerodrome check-point marking.

(b) Characteristics:

A TACAN aerodrome check-point sign should consist of an inscription in black on a yellow background.

CS-ADR-DSN.N.795 Aircraft stand identification signs

(a) Applicability: An aircraft stand identification marking should be supplemented with an aircraft stand identification sign where feasible.
(b) Location: 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.
(c) Characteristics: An aircraft stand identification sign should consist of an inscription in black on a yellow background.

CS-ADR-DSN.N.800 Road-holding position sign

(a) Applicability: A road-holding position sign should be provided at all road entrances to a runway.
(b) Location: The road-holding position sign should be located 1.5 m from one edge of the road (left or right as appropriate to the local road traffic regulations) at the holding position.
(c) Where a road intersects a taxiway, a suitable sign may be located adjacent to the roadway/taxiway intersection marking 1.5 m from one edge of the road, i.e. left or right as appropriate to the local road traffic regulations.
(d) Characteristics:
  (1) A road-holding position sign at an intersection of a road with a runway should consist of an inscription in white on a red background.
  (2) The inscription on a road-holding position sign should be in the national language, be in conformity with the local road traffic regulations, and include the following:
    (i) a requirement to stop; and
    (ii) where appropriate:
      (A) a requirement to obtain ATC clearance; and
      (B) location designator.
  (3) A road-holding position sign intended for night use should be retroreflective or illuminated.
  (4) A road-holding position sign at the intersection of a road with a taxiway should be in accordance with the local road traffic regulations for a yield right of way sign or a stop sign.

CS-ADR-DSN.N.801 Runway distance signs

Vertical runway distance markers shall be placed on the left side of a runway on a line parallel to and normally equidistant from the centreline of the runway. The markers are to indicate the distance for both directions of operation.
(a) The markers shall indicate the runway distance remaining in thousands of feet (the last three digits being omitted). Where the length of the runway (Declared TORA) is other than a multiple of 300m (1,000 ft), half the odd length shall be used at each end of the runway, for determining the actual position of the markers.
(b) The distance from the edge of the usable runway shall not be less than 15m (50 ft) nor greater than 23m (75 ft). Markers, which would normally be at a runway or taxiway intersection, may be omitted. However, they may be sited not more than 30m (100 ft) further along the line if this makes it possible to avoid omitting them altogether. The corresponding markers shall remain opposite to each other.

CS-ADR-DSN.N.803 Arrestor system signs

(a) The position of all runway arrestor systems shall be indicated in the direction of use by vertical illuminated arrestor system signs.
  (1) Signs shall be placed left of the runway adjacent to the cable and normally equidistant from the centre line of the runway. The distance from the edge of the usable runway shall not be less than 15m (50 ft) nor greater than 23m (75 ft).
  (2) The signs shall be light and frangible and show a yellow disc 1.0m (3.25 ft) diameter, on a black border not less than 100mm wide.
  (3) A sign containing the word 'HOOK' may be placed to indicate the location on which the hook should be selected by air crew. When placed, the sign should be placed left of the runway,

maximum 609m (2000ft) before the arrestor gear.

CS-ADR-DSN.P.805 General

Markers should be frangible. Those located near a runway or taxiway should be sufficiently low to preserve clearance for propellers, and for the engine pods of jet aircraft.

CS-ADR-DSN.P.810 Unpaved runway edge markers

(a) Applicability: 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.
(b) Characteristics:
  (1) 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.
  (2) 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 0.50 m.

CS-ADR-DSN.P.815 Stopway edge markers

(a) Applicability: Stopway edge markers should be provided when the extent of a stopway is not clearly indicated by its appearance compared with that of the surrounding ground.
(b) Characteristics: The stopway edge markers should be sufficiently different from any runway edge markers used to ensure that the two types of markers cannot be confused.

CS-ADR-DSN.P.820 Edge markers for snow-covered runways

(+GM)

(a) Applicability: Edge markers for snow-covered runways should be used to indicate the usable limits of a snow-covered runway when the limits are not otherwise indicated.
(b) Location: Edge markers for snow-covered runways should be placed along the sides of the runway at intervals of not more than 100 m, and should be located symmetrically about the runway centre line at such a distance from the centre line that there is adequate clearance for wing tips and powerplants. Sufficient markers should be placed across the threshold and end of the runway.

CS-ADR-DSN.P.825 Taxiway edge markers

(+GM)

(a) Applicability: Taxiway edge markers should be provided on a taxiway where taxiway centre line or edge lights or taxiway centre line markers are not provided.
(b) Location: Taxiway edge markers should be installed at least at the same locations as would the taxiway edge lights, had they been used.
(c) Characteristics:
  (1) A taxiway edge marker should be retroreflective blue.
  (2) The marked surface as viewed by the pilot should be a rectangle and should have a minimum viewing area of 150 cm2.
  (3) 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.

CS-ADR-DSN.P.830 Taxiway centre line markers

(a) Applicability:
  (1) Taxiway centre line markers should be provided on a taxiway where taxiway centre line or edge lights or taxiway edge markers are not provided.
  (2) Taxiway centre line markers should be provided on a taxiway where taxiway centre line lights are not provided if there is a need to improve the guidance provided by the taxiway centre line marking.
(b) Location

(1) Taxiway centre line markers should be installed at least at the same location as would taxiway centre line lights had they been used.
(2) Taxiway centre line markers should be located on the taxiway centre line marking except that they may be offset by not more than 0.3 m where it is not practicable to locate them on the marking.

(c) Characteristics:
(1) A taxiway centre line marker should be retroreflective green.
(2) The marked surface as viewed by the pilot should be a rectangle, and should have a minimum viewing area of 20 cm2.
(3) 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.

CS-ADR-DSN.P.835 Unpaved taxiway edge markers

(a) Applicability: 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.

(b) Characteristics:
(1) Where taxiway lights are provided, the markers should be incorporated in the light fixtures.
(2) Where there are no lights, suitable markers should be placed so as to clearly delineate the taxiway.

CHAPTER Q - VISUAL AIDS FOR DENOTING OBSTACLES

CS-ADR-DSN.Q.840 Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces

(+GM)

(a) Applicability: The specifications for objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces apply only to the area under control of the aerodrome operator.
(b) Elevated aeronautical ground lights within the movement area should be marked so as to be conspicuous by day. Obstacle lights should not be installed on elevated ground lights or signs in the movement area.
(c) All obstacles within the distance specified in Table D-1, column (11), (12) or (13), from the centre line of a taxiway, an apron taxiway or aircraft stand taxilane should be marked and, if the taxiway, apron taxiway or aircraft stand taxilane is used at night, lighted.
(d) A fixed obstacle that extends above a take-off climb, approach or transitional surface within 3 000 m of the inner edge of the take-off climb or approach surface should be marked and if the runway is used at night, lighted, except that:
  (1) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;
  (2) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m;
  (3) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient; and
  (4) the lighting may be omitted where the obstacle is a lighthouse and an safety assessment indicates the lighthouse light to be sufficient.
(e) A fixed object, other than an obstacle, adjacent to a take-off climb, approach or transitional surface should be marked and, if the runway is used at night, lighted, if such marking and lighting is considered necessary to ensure its avoidance, except that the marking may be omitted when:
  (1) the object is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m; or
  (2) the object is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient.
(f) A fixed obstacle that extends above a horizontal surface should be marked and if the aerodrome is used at night, lighted, except that:
  (1) such marking and lighting may be omitted when:
    (i) the obstacle is shielded by another fixed obstacle; or
    (ii) for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or
    (iii) an safety assessment shows the obstacle is not of operational significance.
  (2) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m;
  (3) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient; and
  (4) the lighting may be omitted where the obstacle is a lighthouse and a safety assessment indicates the lighthouse light to be sufficient.
(g) A fixed object that extends above an obstacle protection surface should be marked and, if the runway is used at night, lighted, except that such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle.

CS-ADR-DSN.Q.841 Objects to be marked and/or lighted outside the lateral boundaries of the obstacle limitation surfaces

(+GM)

(a) Applicability: The specifications for objects to be marked and/or lighted outside the lateral boundaries of the obstacle limitation surfaces apply only to the area under control of the aerodrome operator.

(b) Obstacles in accordance with CS-ADR-DSN.J.487 should be marked and lighted, except that the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day.
(c) When considered as an obstacle, other objects outside the obstacle limitation surfaces should be marked and/or lighted.

CS-ADR-DSN.Q.845 Marking of fixed objects

(+GM)

(a) General: All fixed objects to be marked should, whenever practicable, be coloured but if this is not practicable, markers or flags should be displayed on or above them, except those objects that are sufficiently conspicuous by their shape, size, or colour need not be otherwise marked.
(b) Marking by colour
  (1) An object should be coloured to show a chequered pattern if it has essentially unbroken surfaces, and its projection on any vertical plane equals or exceeds 4.5 m in both dimensions. The pattern should consist of rectangles of not less than 1.5 m and not more than 3 m on a side, the corners being of the darker colour. The colours of the pattern should contrast with each other and with the background against which they should be seen.
  (2) An object should be coloured to show alternating contrasting bands if:
    (i) it has essentially unbroken surfaces, and has one dimension, horizontal or vertical, greater than 1.5 m, and the other dimension, horizontal or vertical, less than 4.5 m; or
    (ii) it is of skeletal type with either a vertical or a horizontal dimension greater than 1.5 m.
  (3) The bands should be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less. The colours of the bands should contrast with the background against which they should be seen. Orange and white should be used, except where such colours are not conspicuous when viewed against the background. The bands on the extremities of the object should be of the darker colour (see Figures Q-1 and Q-2). The dimensions of the marking band widths are shown in Table Q-4.
  (4) An object should be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red should be used, except where such colours merge with the background.
(c) Marking by flags
  (1) Flags used to mark fixed objects should be displayed around, on top of, or around the highest edge of the object. When flags are used to mark extensive objects or groups of closely spaced objects, they should be displayed at least every 15 m. Flags should not increase the hazard presented by the object they mark.
  (2) Flags used to mark fixed objects should not be less than 0.6 m on each side.
  (3) Flags used to mark fixed objects should be orange in colour or a combination of two triangular sections, one orange and the other white, or one red and the other white. Except where such colours merge with the background, other conspicuous colours should be used.
(d) Marking by markers
  (1) Markers displayed on or adjacent to objects should be located in conspicuous positions so as to retain the general definition of the object and should be recognisable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The shape of markers should be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they should be such that the hazard presented by the object they mark is not increased.
  (2) A marker should be of one colour. When more than one markers are installed, white and red, or white and orange markers should be displayed alternately. The colour selected should contrast with the background against which it should be seen.

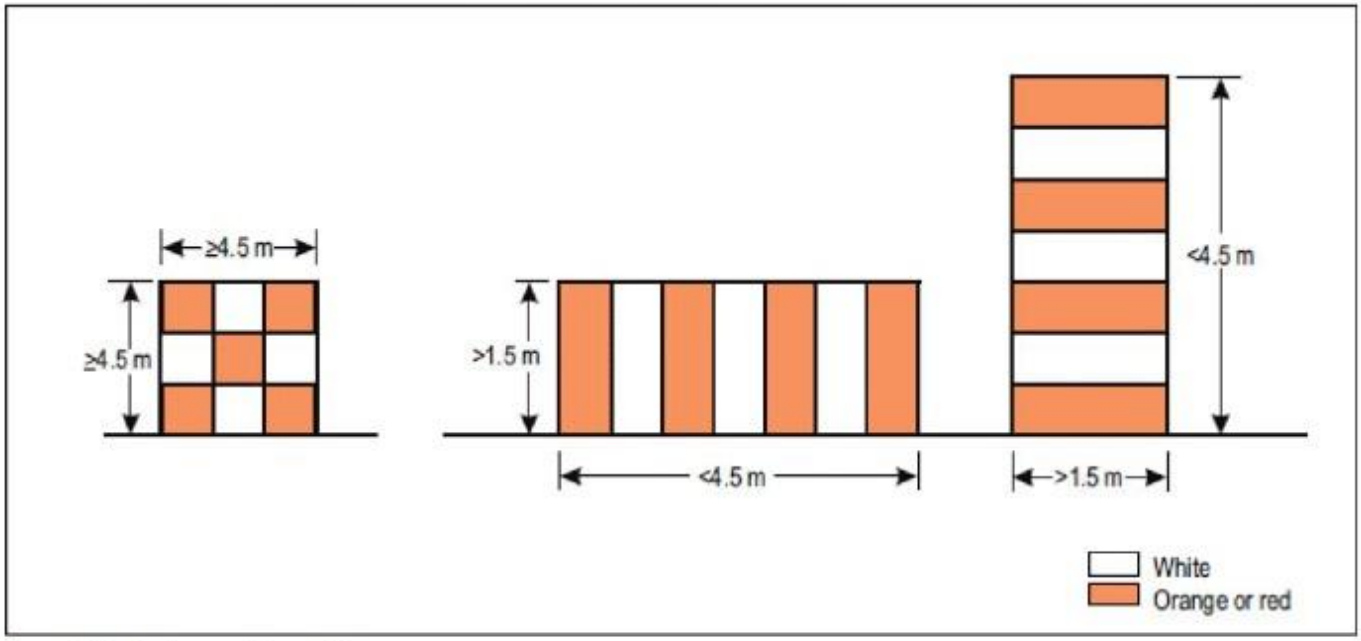


Figure Q-1. Basic marking patterns

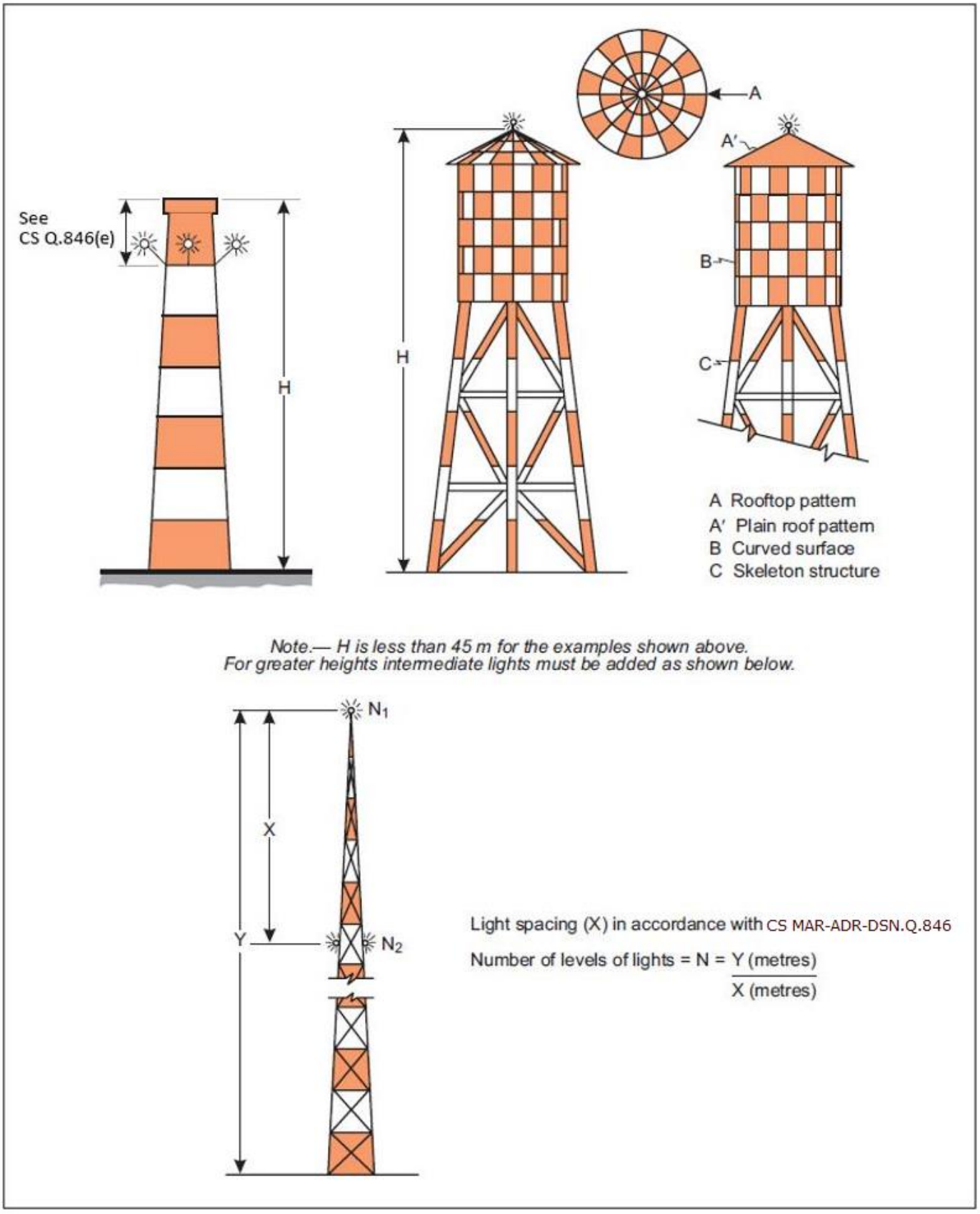


Figure Q-2. Examples of marking and lighting of tall structures

CS-ADR-DSN.Q.846 Lighting of fixed objects

(+GM)

(a) The presence of objects which should be lighted, as specified in CS-ADR-DSN.Q.840 and CS-ADR-DSN.Q.841 should be indicated by low-, medium- or high-intensity obstacle lights, or a combination of such lights.
(b) Low-intensity obstacle lights, Types A, B, C and D, medium-intensity obstacle lights, Types A, B and C and high-intensity obstacle lights Types A and B, should be in accordance with the specifications in Table Q-1, CS-ADR-DSN.U.930 and Figure U-1A or U-1B, as appropriate..
(c) The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked should be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object or by an adjacent object, additional lights should be provided on that adjacent object, or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.
(d) In case of an object to be lighted one or more low-, medium- or high-intensity obstacle lights should be located as close as practicable to the top of the object.
(e) In the case of chimney or other structure of like function, the top lights should be placed sufficiently below the top so as to minimise contamination by smoke, etc. (see Figure Q-2).
(f) In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance such as a rod or an antenna greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance, such a light should be located at the highest practicable point, and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.
(g) In the case of an extensive object or of a group of closely spaced objects to be lighted that are:
    (1) Penetrating a horizontal obstacle limitation surface (OLS) or located outside an OLS, the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to OLS or above the ground, and so as to indicate the general definition and the extent of the objects; and
    (2) Penetrating a sloping OLS, the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to the OLS, and so as to indicate the general definition and the extent of the objects. If two or more edges are of the same height, the edge nearest the landing area should be marked.
(h) When the obstacle limitation surface concerned is sloping and the highest point above the obstacle limitation surface is not the highest point of the object, additional obstacle lights should be placed on the highest point of the object.
(i) Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and
    (1) Low-intensity lights are used, they should be spaced at longitudinal intervals not exceeding 45 m.
    (2) Medium-intensity lights are used, they should be spaced at longitudinal intervals not exceeding 900 m.
(j) High-intensity obstacle lights, Type A, and medium-intensity obstacle lights, Types A and B, located on an object should flash simultaneously.
(k) The installation setting angles for high-intensity obstacle lights, Type A, should be in accordance with Table Q-5.

CS-ADR-DSN.Q.847 Lighting of fixed objects with a height less than 45 m above ground level

(+GM)

(a) Low-intensity obstacle lights, Type A or B, should be used where the object is a less extensive one and its height above the surrounding ground is less than 45 m.
(b) Where the use of low-intensity obstacle lights, Type A or B, would be inadequate, or an early special warning is required, then medium- or high-intensity obstacle lights should be used.
(c) Low-intensity obstacle lights, Type B, should be used either alone or in combination with medium-intensity obstacle lights, Type B, in accordance with subparagraph (d), below.
(d) Medium-intensity obstacle lights, Type A, B, or C, should be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, should be used alone, whereas medium-

intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.

CS-ADR-DSN.Q.848 Lighting of fixed objects with a height 45 m to a height less than 150 m above ground level

(+GM)

(a) Medium-intensity obstacle lights, Type A, B, or C, should be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, should be used alone, whereas medium-intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.
(b) Where an object is indicated by medium-intensity obstacle lights, Type A, and the top of the object is more than 105 m above the level of the surrounding ground, or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings as appropriate, with the spacing not exceeding 105 m.
(c) Where an object is indicated by medium-intensity obstacle lights, Type B, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels. These additional intermediate lights should be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and should be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings as appropriate, with the spacing not exceeding 52 m.
(d) Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.
(e) Where high-intensity obstacle lights, Type A, are used, they should be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in paragraph CS-ADR-DSN.Q.846(d), except that where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

CS-ADR-DSN.Q.849 Lighting of fixed objects with a height 150 m or more above ground level

(+GM)

(a) High-intensity obstacle lights, Type A, should be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and a safety assessment indicates such lights to be essential for the recognition of the object by day.
(b) Where high-intensity obstacle lights, Type A, are used, they should be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in CS-ADR-DSN.Q.846(d), except where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.
(c) Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.
(d) Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights should be provided at intermediate levels. These additional intermediate lights should be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.
(e) Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as

equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

CS-ADR-DSN.Q.851 Marking and lighting of wind turbines

(+GM)

(a) Applicability: When considered as an obstacle a wind turbine should be marked and/or lighted.
(b) Marking: The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, or if after a safety assessment, it is determined that other colour will improve safety.
(c) Lighting:
  (1) Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation should be in accordance with paragraph (c)(2)(v) below, or as determined by a safety assessment.
  (2) When lighting is deemed necessary in the case of a wind farm (i.e. a group of two or more wind turbines), the wind farm should be regarded as an extensive object and lights should be installed:
    (i) to identify the perimeter of the wind farm;
    (ii) respecting the maximum spacing, in accordance with CS-ADR-DSN.Q.846(i), between the lights along the perimeter, or if after a safety assessment, it is determined that a greater spacing can be used;
    (iii) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;
    (iv) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and
    (v) at locations prescribed in (i), (ii) and (iv):
      (A) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium intensity lighting on the nacelle;
      (B) for wind turbines from 150 m to 315 m in overall height, in addition to the medium intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light; the lights should be installed to assure that the output of either light is not blocked by the other;
      (C) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low intensity Type E lights, as specified in CS-ADR-DSN.Q.846(c), that are configured to flash at the same rate as the light on the nacelle; low-intensity Type A or B lights may be used if an safety assessment shows that low intensity Type E lights are not suitable.
  (3) The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

CS-ADR-DSN.Q.852 Marking and lighting of overhead wires, cables, supporting towers, etc.

(+GM)

(a) Marking: The wires, cables, etc. to be marked should be equipped with markers; the supporting tower should be coloured.
(b) Marking by colours: The supporting towers of overhead wires, cables, etc. that require marking should be marked in accordance with CS-ADR-DSN.Q.845(b), except that the marking of the supporting towers may be omitted when they are lighted by high-intensity obstacle lights by day.
(c) Marking by markers:
  (1) Markers displayed on or adjacent to objects should be located in conspicuous positions so as to retain the general definition of the object and should be recognisable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The shape of markers should be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they should be such that the hazard presented by the object they mark is not increased.
  (2) A marker displayed on an overhead wire, cable, etc., should be spherical and have a diameter of not less than 60 cm.

(3) The spacing between two consecutive markers, or between a marker and a supporting tower, should be appropriate to the diameter of the marker. The spacing should normally not exceed:
(i) 30 m where the marker diameter is 60 cm, increasing progressively with increase of the marker diameter to:
(ii) 35 m where the marker diameter is 80 cm; and
(iii) further progressive increases to a maximum of 40 m where the marker diameter is of at least 130 cm.

(d) Where multiple wires, cables, etc., are involved, a marker should be located not lower than the level of the highest wire at the point marked.
(1) A marker should be of one colour. When installed, white and red, or white and orange, markers should be displayed alternately. The colour selected should contrast with the background against which it should be seen.
(2) When it has been determined that an overhead wire, cable, etc., needs to be marked but it is not practicable to install markers on the wire, cable, etc., then high-intensity obstacle lights, Type B, should be provided on their supporting towers.

(e) Lighting:
(1) High-intensity obstacle lights, Type B, should be used to indicate the presence of the tower supporting overhead wires, cables, etc. where:
(i) a safety assessment indicates such light to be essential for the recognition of the presence of wires, cables, etc.; or
(ii) it has not been found practicable to install marker on the wires, cables, etc.
(2) Where high-intensity obstacle lights, Type B, are used, they should be located at three levels:
(i) at the top of the tower;
(ii) at the lowest level of the catenary of the wires or cables; and
(iii) at approximately midway between these two levels.
(3) High-intensity obstacle lights, Type B, indicating the presence of a tower supporting overhead wires, cables, etc., should flash sequentially; first the middle light, second the top light, and last the bottom light. The intervals between flashes of the lights should approximate the following ratios:

Flash interval between	Ratio of cycle time
Middle and top light	1/13
Top and bottom light	2/13
Bottom and middle light	10/13

(4) The installation setting angles for high-intensity obstacle lights, Types B, should be in accordance with Table Q-5.

(1) Light type	(2) Colour	(3) Signal type/ (Flash Rate)	(4) Peak intensity (cd) at given Background Luminance Day (Above 500 cd/m2)	(5) Twilight (50-500 cd/m2)	(6) Night (Below 50 cd/m2)	(7) Light Distribution Table
Low-intensity Type A (fixed obstacle)	Red	Fixed	N/A	N/A	10	Table Q-2
Low-intensity Type B (fixed obstacle)	Red	Fixed	N/A	N/A	32	Table Q-2
Low-intensity Type C (mobile obstacle)	Yellow/ Blue (a)	Flashing (60-90 fpm)	N/A	40	40	Table Q-2
Low-intensity Type D (follow-me vehicle)	Yellow	Flashing (60-90 fpm)	N/A	200	200	Table Q-2
Low-intensity, Type E	Red	Flashing (c)	N/A	N/A	32	Table Q-2 (Type
Medium-intensity Type A	White	Flashing (20-60 fpm)	20 000	20 000	2 000	Table Q-3
Medium-intensity Type B	Red	Flashing (20-60 fpm)	N/A	N/A	2 000	Table Q-3
Medium-intensity Type C	Red	Fixed	N/A	N/A	2 000	Table Q-3

High-intensity Type A	White	Flashing (40-60 fpm)	200 000	20 000	2 000	Table Q-3
High-intensity Type B	White	Flashing (40-60 fpm)	100 000	20 000	2 000	Table Q-3

(a) CS-ADR-DSN.Q.850(b)

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

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

Table Q-1. Characteristics of obstacle lights

Benchmark intensity	Minimum requirements Vertical elevation angle (b)			Vertical beam spread (c)		Recommendations Vertical elevation angle (b)			Vertical beam spread (c)	
	0°		-1°			0°	-1°	-10°		
	Minimum average intensity (a)	Minimum intensity (a)	Minimum intensity (a)	Minimum beam spread	Intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum beam spread	Intensity (a)
200 000	200 000	150 000	75 000	3°	75 000	250 000	112 500	7 500	7°	75 000
100 000	100 000	75 000	37 500	3°	37 500	125 000	56 250	3 750	7°	37 500
20 000	20 000	15 000	7 500	3°	7 500	25 000	11 250	750	N/A	N/A
2 000	2 000	1 500	750	3°	750	2 500	1 125	75	N/A	N/A

Note: This table does not include recommended horizontal beam spreads. CS-ADR-DSN.Q.846(c) requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

(a) 360° horizontal. All intensities are expressed in Candela. For flashing lights, the intensity is read into effective intensity, as determined in accordance with ICAO Doc 9157, Aerodrome Design Manual, Part 4, Visual Aids.

(b) Elevation vertical angles are referenced to the horizontal when the light unit is levelled.

(c) Beam spread is defined as the angle between the horizontal plan and the directions for which the intensity exceeds that mentioned in the 'intensity' column.

Note: an extended beam spread may be necessary under specific configuration and justified by a safety assessment.

Table Q-2. Light distribution for low-intensity obstacle lights

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

Table Q-4. Marking band widths

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

Table Q-5. Installation setting angles for high-intensity obstacle lights

CS-ADR-DSN.R.855 Closed runways and taxiways, or parts thereof

(a) Applicability:
A closed marking should be displayed on a runway, or taxiway, or portion thereof which is permanently closed to the use of all aircraft.
(b) Location of closed markings: On a runway, a closed marking should be placed at each end of the runway, or portion thereof, declared closed, and additional markings should be so placed that the maximum interval between markings does not exceed 300 m. On a taxiway a closed marking should be placed at least at each end of the taxiway or portion thereof closed.
(c) Characteristics of closed markings: The closed marking should be of the form and proportions as detailed in Figure R-1, Illustration (a), when displayed on a runway, and should be of the form and proportions as detailed in Figure R-1, Illustration (b), when displayed on a taxiway. The marking should be white when displayed on a runway and should be yellow when displayed on a taxiway.
(d) When a runway, or taxiway, or portion thereof is permanently closed, all normal runway and taxiway markings should be physically removed.
(e) In addition to closed markings, when the runway, or taxiway, or portion thereof closed is intercepted by a usable runway or taxiway which is used at night, unserviceability lights should be placed across the entrance to the closed area at intervals not exceeding 3 m (see CS-ADR-DSN.R.870(c)(2)).

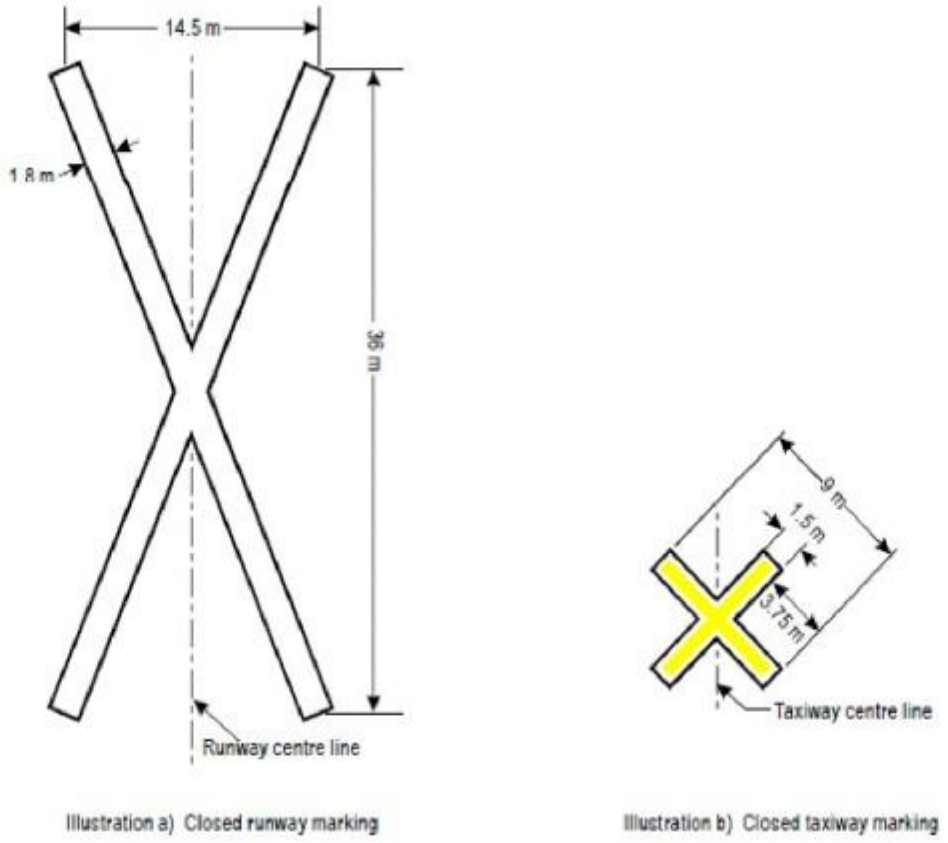


Figure R-1. Runway and taxiway closed markings

CS-ADR-DSN.R.860 Non-load-bearing surfaces

(+GM)

(a) Shoulders for taxiways, runway turn pads, holding bays and aprons, and other non-load-bearing surfaces which cannot readily be distinguished from load-bearing surfaces and which, if used by aircraft, might result in damage to the aircraft, should have the boundary between such areas and the load-bearing surface marked by a taxi side stripe marking.
(b) A taxi side stripe marking should consist of a pair of solid lines, each 15 cm wide and spaced 15

cm apart, and the same colour as the taxiway centre line marking.

CS-ADR-DSN.R.865 Pre-threshold area

(+GM)

(a) Applicability of Pre-threshold area: When the surface before a threshold is paved and exceeds 60 m in length, and is not suitable for normal use by aircraft, the entire length before the threshold should be marked with a chevron marking.
(b) Location: A chevron marking should point in the direction of the runway and be placed as shown in Figure R-2.
(c) Characteristics: A chevron marking should be of conspicuous colour and contrast with the colour used for the runway markings; it should preferably be yellow and should have an overall width of at least 0.9 m.

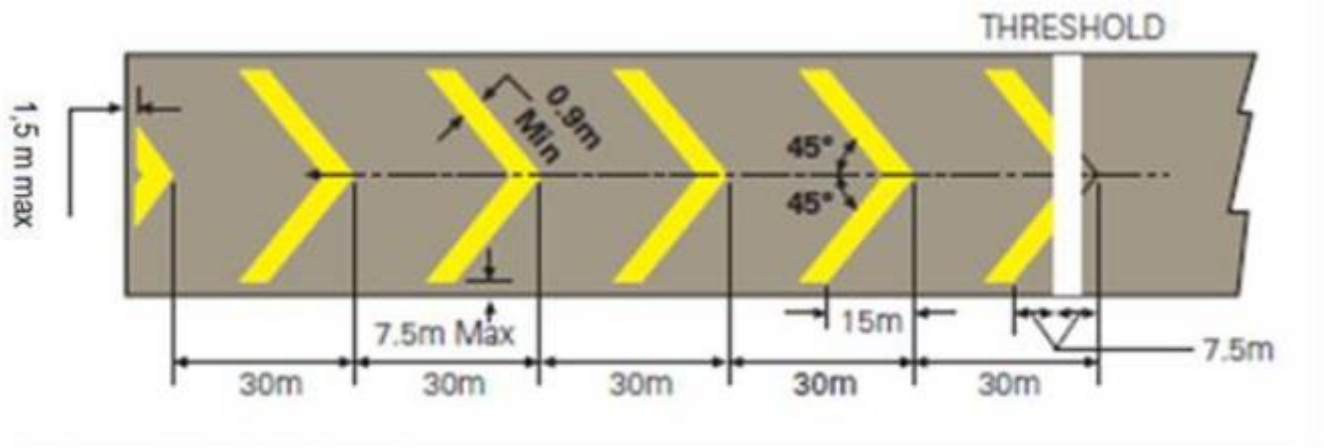


Figure R-2. Pre-threshold area marking

CS-ADR-DSN.R.870 Unserviceable areas

(+GM)

(a) Applicability of unserviceability markers and lights:
Unserviceability markers should be displayed wherever any portion of a taxiway, apron, or holding bay is declared unfit for the movement of aircraft but it is still possible for aircraft to bypass the area safely. On a movement area used at night, unserviceability lights should be used.
(b) Location: Unserviceability markers and lights should be placed at intervals sufficiently close so as to delineate the unserviceable area.
(c) Characteristics:
(1) Unserviceability markers should consist of conspicuous upstanding devices such as flags, cones, or marker boards.
(2) An unserviceability light should consist of a red fixed light. The light should have intensity sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general level of illumination against which it would normally be viewed. In no case should the intensity be less than 10 cd of red light.
(3) An unserviceability cone should be at least 0.5 m in height and red, orange, or yellow, or any one of these colours in combination with white.
(4) An unserviceability flag should be at least 0.5 m square and red, orange, or yellow, or any one of these colours in combination with white.
(5) An unserviceability marker board should be at least 0.5 m in height and 0.9 m in length, with alternate red and white, or orange and white vertical stripes.

CS-ADR-DSN.S.875 Electrical power supply systems for air navigation facilities

(+GM)

(a) Adequate primary power supply should be available at aerodromes for the safe functioning of air navigation facilities.
(b) The design and provision of electrical power systems for aerodrome visual and radio navigation aids should be such that an equipment failure should not leave the pilot with inadequate visual and non-visual guidance, or misleading information.
(c) Electric power supply connections to those facilities for which secondary power is required should be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.
(d) The time interval between failure of the primary source of power and the complete restoration of the services required by CS-ADR-DSN.S.880(d) should be as short as practicable, except that for visual aids associated with non-precision, precision approach, or take-off runways the requirements of Table S-1 for maximum switch-over times should apply.

CS-ADR-DSN.S.880 Electrical power supply systems

(+GM)

(a) For a precision approach runway, a secondary power supply capable of meeting the requirements of Table S-1 for the appropriate category of precision approach runway should be provided. Electric power supply connections to those facilities for which secondary power is required should be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.
(b) For a runway meant for take-off in runway visual range conditions less than a value of 800 m, a secondary power supply capable of meeting the relevant requirements of Table S-1 should be provided.
(c) At an aerodrome where the primary runway is a non-precision approach runway, a secondary power supply capable of meeting the requirements of Table S-1 should be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway.
(d) The following aerodrome facilities should be provided with a secondary power supply capable of supplying power when there is a failure of the primary power supply:
  (1) the signalling lamp and the minimum lighting necessary to enable air traffic services personnel to carry out their duties;
  (2) obstacle lights which are essential to ensure the safe operation of aircraft;
  (3) approach, runway and taxiway lighting as specified in CS-ADR-DSN.M.625 to CS-ADR-DSN.M.745;
  (4) meteorological equipment;
  (5) essential equipment and facilities for the parking position if provided, in accordance with CS-ADR-DSN.M.750(a) and CS-ADR-DSN.M.755(a); and
  (6) illumination of apron areas over which passengers may walk.

Runway	**Lighting aids requiring power**	**Maximum switch-over time**
Non-instrument	Visual approach slope indicators[a] Runway edge[b] Runway threshold[b] Runway end[b] Obstacle[a] Stopway end Stopway edge	See CS-ADR-DSN.S.875(d) and CS-ADR-DSN.S.880(d)
Non-precision approach	Approach lighting system Visual approach slope indicators[a, d] Runway edged Runway threshold[d] Runway end[d] Obstacle[a]	15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds

	Stopway end Stopway edge	15 seconds 15 seconds
Precision approach Category I	Approach lighting system Runway edged Visual approach slope indicators[a, d] Runway threshold[d] Runway end Essential taxiway[a] Obstacle[a] Stopway end Stopway edge	15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds
Precision approach Category II/III	Inner 300 m of the approach lighting system Other parts of the approach lighting system Obstacle[a] Runway edge Runway threshold Runway end Runway centre line Runway touchdown zone Runway guard lights All stop bars Essential taxiway Stopway end Stopway edge	1 second 15 seconds 15 seconds 15 seconds 1 second 1 second 1 second 1 second 15 seconds 1 second 15 seconds 1 second 15 seconds
Runway meant for take-off in runway visual range conditions less than a value of 800 m	Runway edge Runway end Runway centre line All stop bars Essential taxiway[a] Obstacle[a] Stopway end Stopway edge	15 seconds[c] 1 second 1 second 1 second 15 seconds 15 seconds 1 second 15 seconds
a. Supplied with secondary power when their operation is essential to the safety of flight operation. b. The use of emergency lighting should be in accordance with any procedures established. c. One second where no runway centre line lights are provided. d. One second where approaches are over hazardous or precipitous terrain.		

Table S-1. Secondary power supply requirements (see CS-ADR-DSN.S.875(d))

CS-ADR-DSN.S.885 System design

(a) For a runway meant for use in runway visual range conditions less than a value of 550 m, the electrical systems for the power supply, lighting, and control of the lighting systems included in Table S-1 should be so designed that an equipment failure should not leave the pilot with inadequate visual guidance or misleading information.
(b) Where the secondary power supply of an aerodrome is provided by the use of duplicate feeders, such supplies should be physically and electrically separate so as to ensure the required level of availability and independence.
(c) Where a runway forming part of a standard taxi-route is provided with runway lighting and taxiway lighting, the lighting systems should be interlocked to preclude the possibility of simultaneous operation of both forms of lighting.

CS-ADR-DSN.S.890 Monitoring

(a) A system of monitoring should be employed to indicate the operational status of the lighting systems.
(b) Where lighting systems are used for aircraft control purposes, such systems should be monitored automatically so as to provide an indication of any fault which may affect the control functions. This information should be automatically relayed to the air traffic service unit.

(c) Where a change in the operational status of lights has occurred, an indication should be provided within two seconds for a stop bar at a runway-holding position and within five seconds for all other types of visual aids.
(d) For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table S-1 should be monitored automatically so as to provide an indication when the serviceability level of any element falls below a minimum serviceability level specified in MAR-ADR.OPS.C.015 (b)(1) to (b)(7). This information should be automatically relayed to the maintenance crew.
(e) For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table S-1 should be monitored automatically to provide an indication when the serviceability level of any element falls below a minimum level, below which operations should not continue. This information should be automatically relayed to the air traffic services unit and displayed in a prominent position.

CS-ADR-DSN.T.900 Emergency access and service roads

(+GM)

Emergency access roads and service roads should be equipped with a road-holding position, in accordance with CS-ADR-DSN.L.600, CS-ADR-DSN.M.770 and CS-ADR-DSN.N.800, as appropriate, at all intersections with runway and taxiways.

CS-ADR-DSN.T.905 Fire stations

(a) All rescue and firefighting vehicles should normally be housed in a fire station. Satellite fire stations should be provided whenever the response time cannot be achieved from a single fire station.
(b) The fire station should be located so that the access for rescue and firefighting vehicles into the runway area is direct and clear, requiring a minimum number of turns.
(c) The fire station, and any satellite fire stations, should be located outside taxiway and runway strips, and not infringe obstacle limitation surfaces.

CS-ADR-DSN.T.910 Equipment frangibility requirements

(+GM)

Equipment and structures should be so designed to meet the appropriate frangibility characteristics, when required.

CS-ADR-DSN.T.915 Siting of equipment and installations on operational areas

(+GM)

(a) Equipment and installations should be sited as far away from the runway and taxiway centre lines as practicable.
(b) Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation endangering an aircraft should be located:
(1) on a runway strip, a runway end safety area, a taxiway strip, or within the following distances:

Code Letter	**Distance between taxiway, other than aircraft stand taxilane, centre line to object (metres)**
A	15.5
B	20
C	26
D	37
E	43.5
F	51

if it would endanger an aircraft, or
(2) on a clearway if it would endanger an aircraft in the air.
(c) Any equipment or installation required for air navigation or for aircraft safety purposes which should be located:
(1) on that portion of a runway strip within:
(i) 75 m of the runway centre line where the code number is 3 or 4; or
(ii) 45 m of the runway centre line where the code number is 1 or 2; or
(2) on a runway end safety area, a taxiway strip, or within the distances specified in Table D-1; or
(3) on a clearway and which would endanger an aircraft in the air;
should be frangible and mounted as low as possible.
(d) Unless its function requires it to be there for air navigation or for aircraft safety purposes, or if after a safety assessment, it is determined that it would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes, no equipment or installation should be located within 240 m from the end of the strip and within:
(1) 60 m of the extended centre line where the code number is 3 or 4; or
(2) 45 m of the extended centre line where the code number is 1 or 2;

of a precision approach runway Category I, II or III.

(e) Any equipment or installation required for air navigation or for aircraft safety purposes which should be located on or near a strip of a precision approach runway Category I, II, or III and which:
   (1) is situated within 240 m from the end of the strip and within:
      (i) 60 m of the extended runway centre line where the code number is 3 or 4; or
      (ii) 45 m of the extended runway centre line where the code number is 1 or 2; or
   (2) penetrates the inner approach surface, the inner transitional surface, or the balked landing surface;
   should be frangible and mounted as low as possible.

(f) Any equipment or installation required for air navigation or for aircraft safety purposes that is an obstacle of operational significance in accordance with CS-ADR-DSN.J.470(d), CS-ADR-DSN.J.475(e), CS-ADR-DSN.J.480(g), or CS-ADR-DSN.J.485(e) should be frangible and mounted as low as possible.

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

CS-ADR-DSN.T.920 Fencing

(+GM)

(a) The safety objective of fencing is to prevent animals or unauthorised persons that could be a safety risk to aircraft operations, to enter the aerodrome.

(b) Fencing should be sited as far away from the runway and taxiway centre lines as practicable.

(c) Suitable means of protection such as fence or other suitable barrier should be provided on an aerodrome to prevent the entrance to the aerodrome:
   (1) by non-flying animals large enough to be a hazard to aircraft; and/or
   (2) by an unauthorised person.
   This includes the barring of sewers, ducts, tunnels, etc. where necessary to prevent access.

(d) Suitable means of protection should be provided to deter the inadvertent or premeditated access of unauthorised persons into ground installations and facilities essential for the safety of civil aviation located off the aerodrome.

CS-ADR-DSN.T.921 Autonomous runway incursion warning system (ARIWS)

(+GM)

(a) Applicability: The inclusion of detailed specifications for an ARIWS is not intended to imply that an ARIWS has to be provided at an aerodrome.

(b) Characteristics: Where an ARIWS is installed at an aerodrome:
   (1) It should provide autonomous detection of a potential incursion or of the occupancy of an active runway and a direct warning to a flight crew or vehicle operator;
   (2) It should function and be controlled independently of any other visual system on the aerodrome;
   (3) Its visual aid components, i.e. lights, should be designed to conform with the relevant specifications in Chapter M; and
   (4) Failure of the ARIWS or part of it should not interfere with normal aerodrome operations. To this end, provision should be made to allow air traffic services (ATS) unit to partially or entirely shut down the system.

(c) Where an ARIWS is installed at an aerodrome, information on its characteristics and status should be provided to the appropriate aeronautical information services (AIS) for promulgation in the aeronautical information publication (AIP) with the description of the aerodrome surface movement guidance and control system and markings.

CS-ADR-DSN.U.925 General

(+GM)

(a) The specifications in this Chapter define the chromaticity limits of colours to be used for aeronautical ground lights, markings, signs, and panels. The specifications are in accord with the specifications in the International Commission on Illumination (CIE), except for the colour orange in Figure U-2.
(b) The chromaticity is expressed in terms of the standard observer and coordinate system adopted by the International Commission on Illumination (CIE).
(c) The chromaticity for solid state lighting (e.g. LEDs) is based upon the boundaries given in Standard S 004/E-2001 of the International Commission on Illumination (CIE), except for the blue boundary of white.

CS-ADR-DSN.U.930 Colours for aeronautical ground lights

(a) The chromaticity of aeronautical ground lights with filament-type light sources should be within the following boundaries:
CIE Equations (see Figure U-1A):
(1) Red
Purple boundary $y = 0.980 - x$
Yellow boundary $y = 0.335$
Note: see CS-ADR-DSN.M.645(c)(2)(i)
(2) Yellow
Red boundary $y = 0.382$
White boundary $y = 0.790 - 0.667x$
Green boundary $y = x - 0.120$
(3) Green
Yellow boundary $x = 0.360 - 0.080y$
White boundary $x = 0.650y$
Blue boundary $y = 0.390 - 0.171x$
(4) Blue
Green boundary $y = 0.805x + 0.065$
White boundary $y = 0.400 - x$
Purple boundary $x = 0.600y + 0.133$
(5) White
Yellow boundary $x = 0.500$
Blue boundary $x = 0.285$
Green boundary $y = 0.440$ and $y = 0.150 + 0.640x$
Purple boundary $y = 0.050 + 0.750x$ and $y = 0.382$
(6) Variable white
Yellow boundary $x = 0.255 + 0.750y$ and $y = 0.790 - 0.667x$
Blue boundary $x = 0.285$
Green boundary $y = 0.440$ and $y = 0.150 + 0.640x$
Purple boundary $y = 0.050 + 0.750x$ and $y = 0.382$
(b) Where increased certainty of recognition from white is more important than maximum visual range, green signals should be within the following boundaries:
(1) Yellow boundary $y = 0.726 - 0.726x$
(2) White boundary $x = 0.625y - 0.041$
(3) Blue boundary $y = 0.390 - 0.171x$
(c) Discrimination between lights having filament-type sources:
(1) If there is a requirement to discriminate yellow and white from each other, they should be displayed in close proximity of time or space as, for example, by being flashed successively from the same beacon.
(2) If there is a requirement to discriminate yellow from green and/or white, as for example on exit taxiway centre line lights, the y coordinates of the yellow light should not exceed a value of 0.40. The limits of white have been based on the assumption that they should be used in

situations in which the characteristics (colour temperature) of the light source should be substantially constant.

(3) The colour variable white is intended to be used only for lights that are to be varied in intensity, e.g. to avoid dazzling. If this colour is to be discriminated from yellow, the lights should be so designed and operated that:

(i) the x coordinate of the yellow is at least 0.050 greater than the x coordinate of the white; and

(ii) the disposition of the lights should be such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

(d) The chromaticity of aeronautical ground lights with solid state light sources, e.g. LEDs, should be within the following boundaries:

CIE Equations (see Figure U-1B):

(1) Red

Purple boundary y = 0.980 – x

Yellow boundary y = 0.335;

Yellow boundary y = 0.320.

Note: see CS-ADR-DSN.M.645(c)(2)(i)

(2) Yellow

Red boundary y = 0.387

White boundary x = 0.980 – x

Green boundary y = 0.727x+0.054

(3) Green (refer also to GM1 MAR-ADR-DSN.U.930(d) and (e))

Yellow boundary x = 0.310

White boundary x = 0.625y – 0.041

Blue boundary y = 0.400

(4) Blue

Green boundary y = 1.141x – 0.037

White boundary x = 0.400 – y

Purple boundary x = 0.134 + 0.590y

(5) White

Yellow boundary x = 0.440

Blue boundary x = 0.320

Green boundary y = 0.150 + 0.643x

Purple boundary y = 0.050 + 0.757x

(6) Variable white

The boundaries of variable white for solid state light sources are those specified in CS-ADR-DSN.U.930(d)(5) above.

(e) Colour measurement for filament-type and solid state light sources:

(1) The colour of aeronautical ground lights should be verified as being within the boundaries specified in Figure U-1A or U-1B, as appropriate, by measurement at five points within the area limited by the innermost isocandela curve in the isocandela diagrams in CS-ADR DSN.U.940, with operation at rated current or voltage. In the case of elliptical or circular isocandela curves, the colour measurements should be taken at the centre and at the horizontal and vertical limits. In the case of rectangular isocandela curves, the colour measurements should be taken at the centre and the limits of the diagonals (corners). In addition, the colour of the light should be checked at the outermost isocandela curve to ensure that there is no colour shift that might cause signal confusion to the pilot.

(2) In the case of visual approach slope indicators and other light units having a colour transition sector, the colour should be measured at points in accordance with paragraph CS-ADR-DSN.U.930(e)(1) above, except that the colour areas should be treated separately and no point should be within 0.5 degrees of the transition sector.

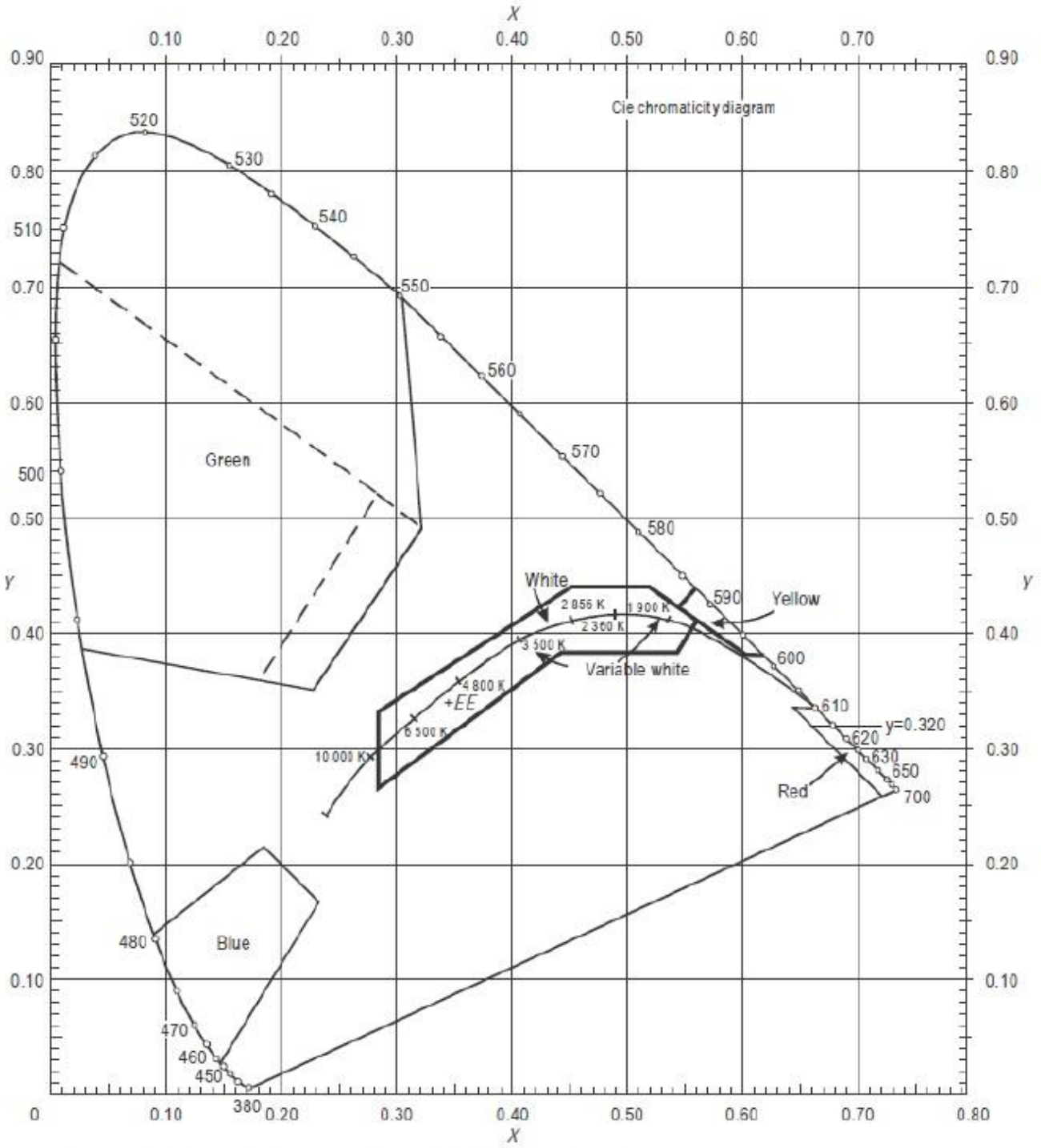


Figure U-1A. Colours for aeronautical ground lights (filament-type lamps)

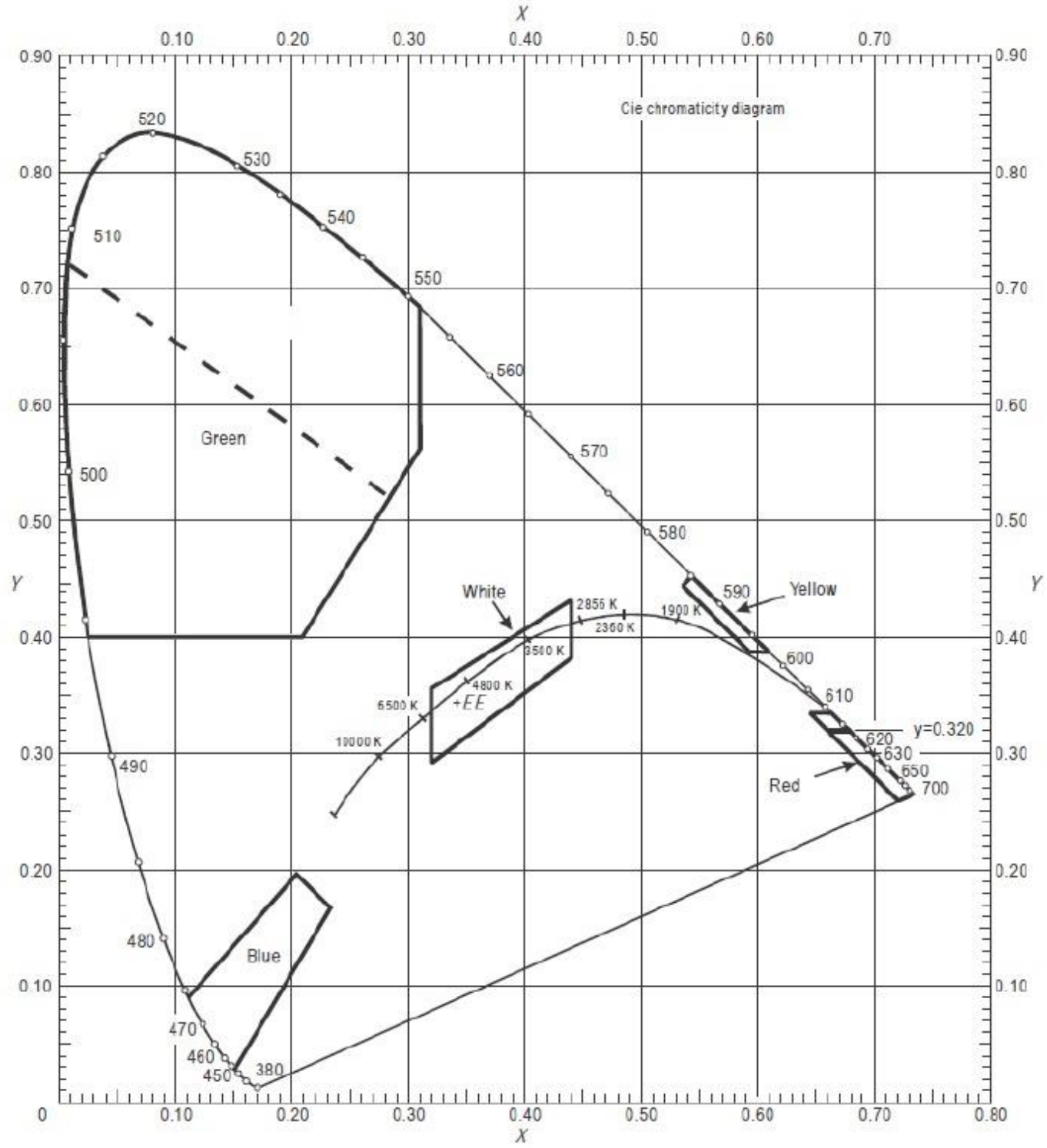


Figure U-1B. Colours for aeronautical ground lights (solid state lighting)

CS-ADR-DSN.U.935 Colours for markings, signs and panels

(a) The specifications in surface colours given below apply only to freshly coloured surfaces. Colours used for markings, signs, and panels usually change with time and, therefore, require renewal.

(b) The specifications in paragraph (f) below for internally illuminated panels are interim in nature and are based on the CIE specifications for internally illuminated signs. It is intended that these specifications should be reviewed and updated as and when CIE develops specifications for internally illuminated panels.

(c) The chromaticities and luminance factors of ordinary colours, colours of retroreflective materials,

and colours of internally illuminated signs and panels should be determined under the following standard conditions:
(1) angle of illumination: 45°;
(2) direction of view: perpendicular to surface; and
(3) illuminant: CIE standard illuminant D65.

(d) The chromaticity and luminance factors of ordinary colours for markings and externally illuminated signs and panels should be within the following boundaries when determined under standard conditions.
CIE Equations (see Figure U-2):
(1) Red

Purple boundary	$y = 0.345 - 0.051x$
White boundary	$y = 0.910 - x$
Orange boundary	$y = 0.314 + 0.047x$
Luminance factor	$\beta = 0.07$ (minimum)

(2) Orange

Red boundary	$y = 0.285 + 0.100x$
White boundary	$y = 0.940 - x$
Yellow boundary	$y = 0.250 + 0.220x$
Luminance factor	$\beta = 0.20$ (minimum)

(3) Yellow

Orange boundary	$y = 0.108 + 0.707x$
White boundary	$y = 0.910 - x$
Green boundary	$y = 1.35x - 0.093$
Luminance factor	$\beta = 0.45$ (minimum)

(4) White

Purple boundary	$y = 0.010 + x$
Blue boundary	$y = 0.610 - x$
Green boundary	$y = 0.030 + x$
Yellow boundary	$y = 0.710 - x$
Luminance factor	$\beta = 0.75$ (minimum)

(5) Black

Purple boundary	$y = x - 0.030$
Blue boundary	$y = 0.570 - x$
Green boundary	$y = 0.050 + x$
Yellow boundary	$y = 0.740 - x$
Luminance factor	$\beta = 0.03$ (maximum)

(6) Yellowish green

Green boundary	$y = 1.317x + 0.4$
White boundary	$y = 0.910 - x$
Yellow boundary	$y = 0.867x + 0.4$

(7) Green

Yellow boundary	$x = 0.313$
White boundary	$y = 0.243 + 0.670x$
Blue boundary	$y = 0.493 - 0.524x$
Luminance factor	$\beta = 0.10$ (minimum)

The small separation between surface red and surface orange is not sufficient to ensure the distinction of these colours when seen separately.

(e) The chromaticity and luminance factors of colours of retroreflective materials for markings, signs, and panels should be within the following boundaries when determined under standard conditions.
CIE Equations (see Figure U-3):
(1) Red

Purple boundary	$y = 0.345 - 0.051x$
White boundary	$y = 0.910 - x$
Orange boundary	$y = 0.314 + 0.047x$
Luminance factor	$\beta = 0.03$ (minimum)

(2) Orange

Red boundary	$y = 0.265 + 0.205x$
White boundary	$y = 0.910 - x$
Yellow boundary	$y = 0.207 + 0.390x$

Luminance factor	β = 0.14 (minimum)
(3) Yellow	
Orange boundary	y = 0.160 + 0.540x
White boundary	y = 0.910 – x
Green boundary	y = 1.35x – 0.093
Luminance factor	β = 0.16 (minimum)
(4) White	
Purple boundary	y = x
Blue boundary	y = 0.610 – x
Green boundary	y = 0.040 + x
Yellow boundary	y = 0.710 – x
Luminance factor	β = 0.27 (minimum)
(5) Blue	
Green boundary	y = 0.118 + 0.675x
White boundary	y = 0.370 – x
Purple boundary	y = 1.65x – 0.187
Luminance factor	β = 0.01 (minimum)
(6) Green	
Yellow boundary	y = 0.711 – 1.22x
White boundary	y = 0.243 + 0.670x
Blue boundary	y = 0.405 – 0.243x
Luminance factor	β = 0.03 (minimum)

(f) The chromaticity and luminance factors of colours for luminescent or internally illuminated signs and panels should be within the following boundaries when determined under standard conditions. CIE Equations (see Figure U-4):

(1) Red		
Purple boundary	y = 0.345 – 0.051x	
White boundary	y = 0.910 – x	
Orange boundary	y = 0.314 + 0.047x	
Luminance factor (day condition)	β = 0.07 (minimum)	
Relative luminance to white (night condition)	5 % (minimum)	20 % (max)
(2) Yellow		
Orange boundary	y = 0.108 + 0.707x	
White boundary	y = 0.910 – x	
Green boundary	y = 1.35x – 0.093	
Luminance factor (day condition)	β = 0.45 (minimum)	
Relative luminance to white (night condition)	30 % (minimum)	80 % (max)
(3) White		
Purple boundary	y = 0.010 + x	
Blue boundary	y = 0.610 – x	
Green boundary	y = 0.030 + x	
Yellow boundary	y = 0.710 – x	
Luminance factor (day condition)	β = 0.75 (minimum)	
Relative luminance to white (night conditions)	100 %	
(4) Black		
Purple boundary	y = x – 0.030	
Blue boundary	y = 0.570 – x	
Green boundary	y = 0.050 + x	
Yellow boundary	y = 0.740 – x	
Luminance factor (day condition)	β = 0.03 (max)	
Relative luminance to white (night condition)	0 % (minimum)	2 % (maximum)

(5) Green

Yellow boundary	x = 0.313	
White boundary	y = 0.243 + 0.670x	
Blue boundary	y = 0.493 – 0.524x	
Luminance factor (day conditions)	β = 0.10 minimum	
Relative luminance to white (night conditions)	5 % (minimum)	30 % (maximum)

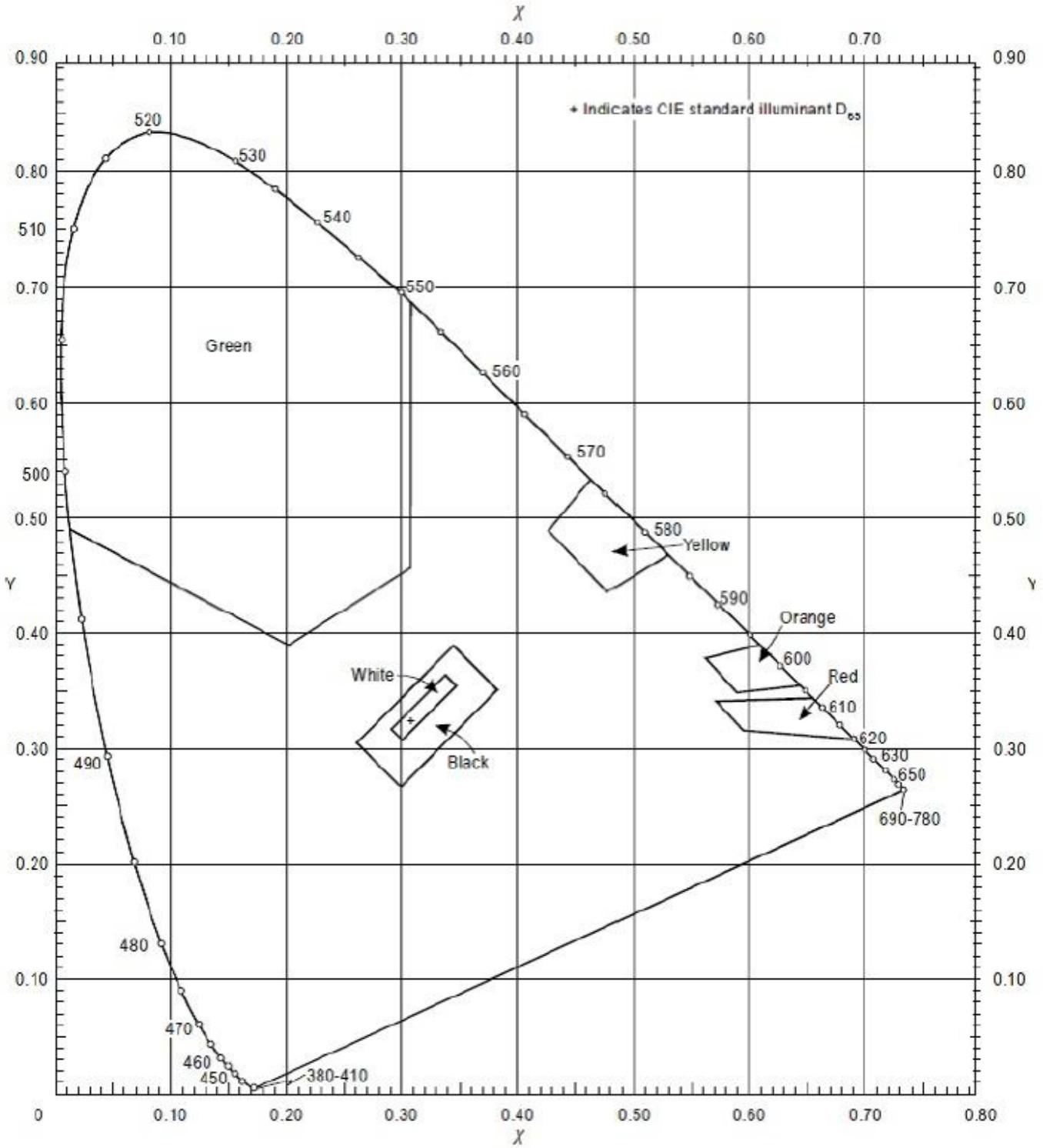


Figure U-2. Ordinary colours for markings and externally illuminated signs and panels

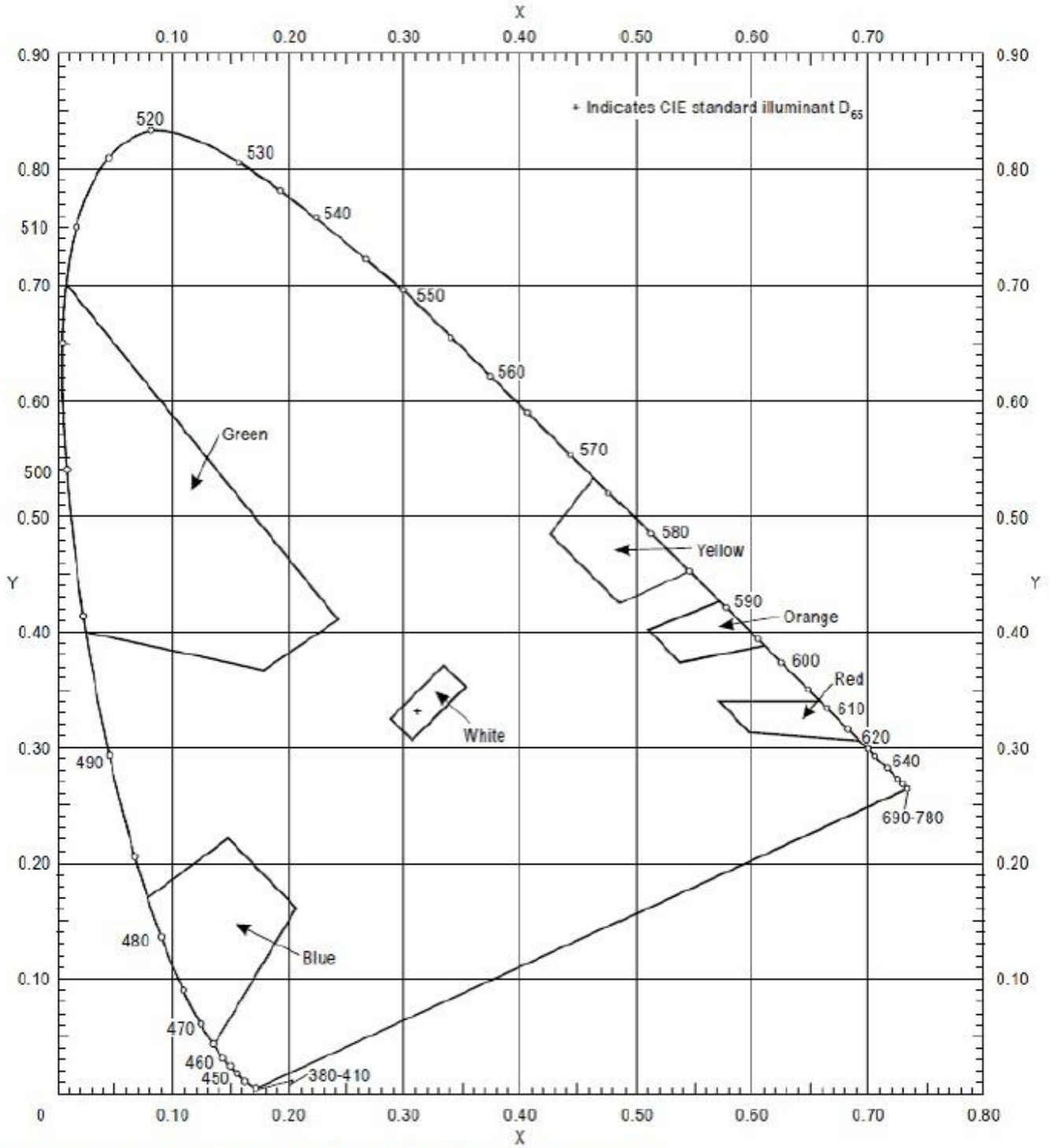


Figure U-3. Colours of retroreflective materials for markings, signs and panels

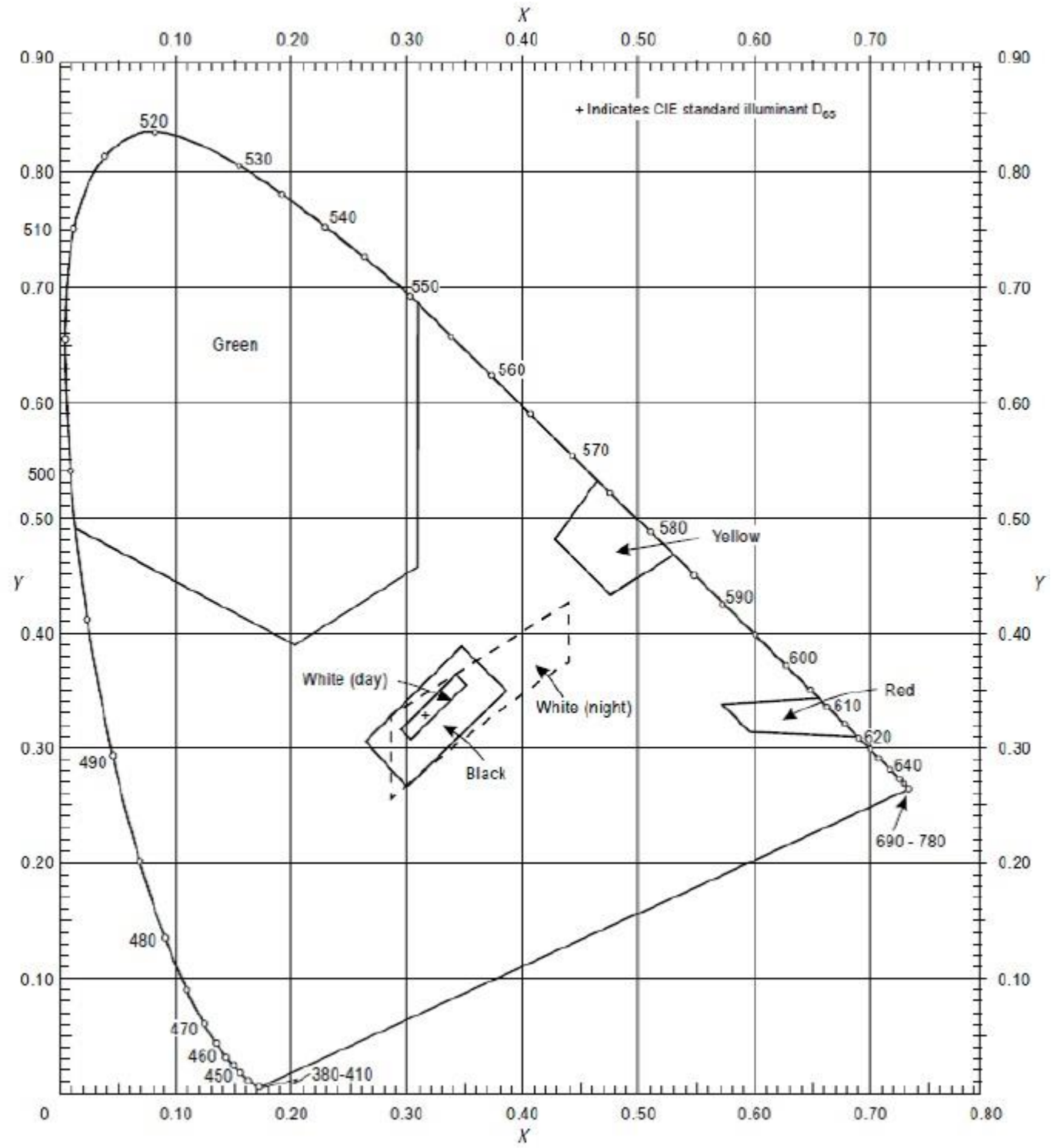


Figure U-4. Colours of luminescent or internally illuminated signs and panels

CS-ADR-DSN.U.940 Aeronautical ground light characteristics

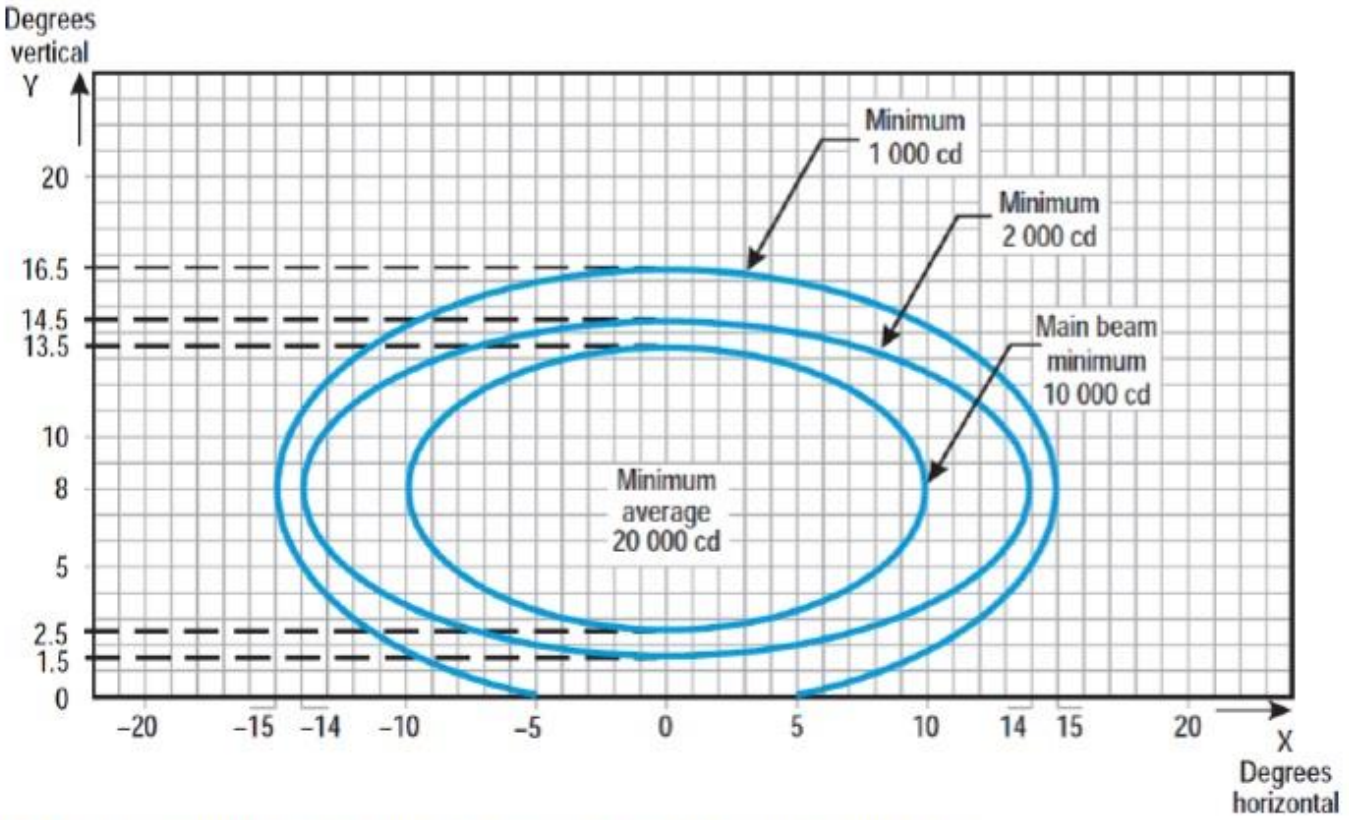


Figure U-5. Isocandela diagram for approach centre line light and crossbars (white light)

Notes:

(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	10	14	15
b	5.5	6.5	8.5

(b) Vertical setting angles of the lights should be such that the following vertical coverage of the main beam should be met:

distance from threshold	**vertical main beam coverage**
threshold to 315 m	0° - 11°
316 m to 475 m	0.5° - 11.5°
476 m to 640 m	1.5° - 12.5°
641 m and beyond	2.5° -13.5° (as illustrated above)

(c) Lights in crossbars beyond 22.5 m from the centre line should be toed-in 2 degrees. All other lights should be aligned parallel to the centre line of the runway.

(d) See collective notes for Figures U-5 to U-15.

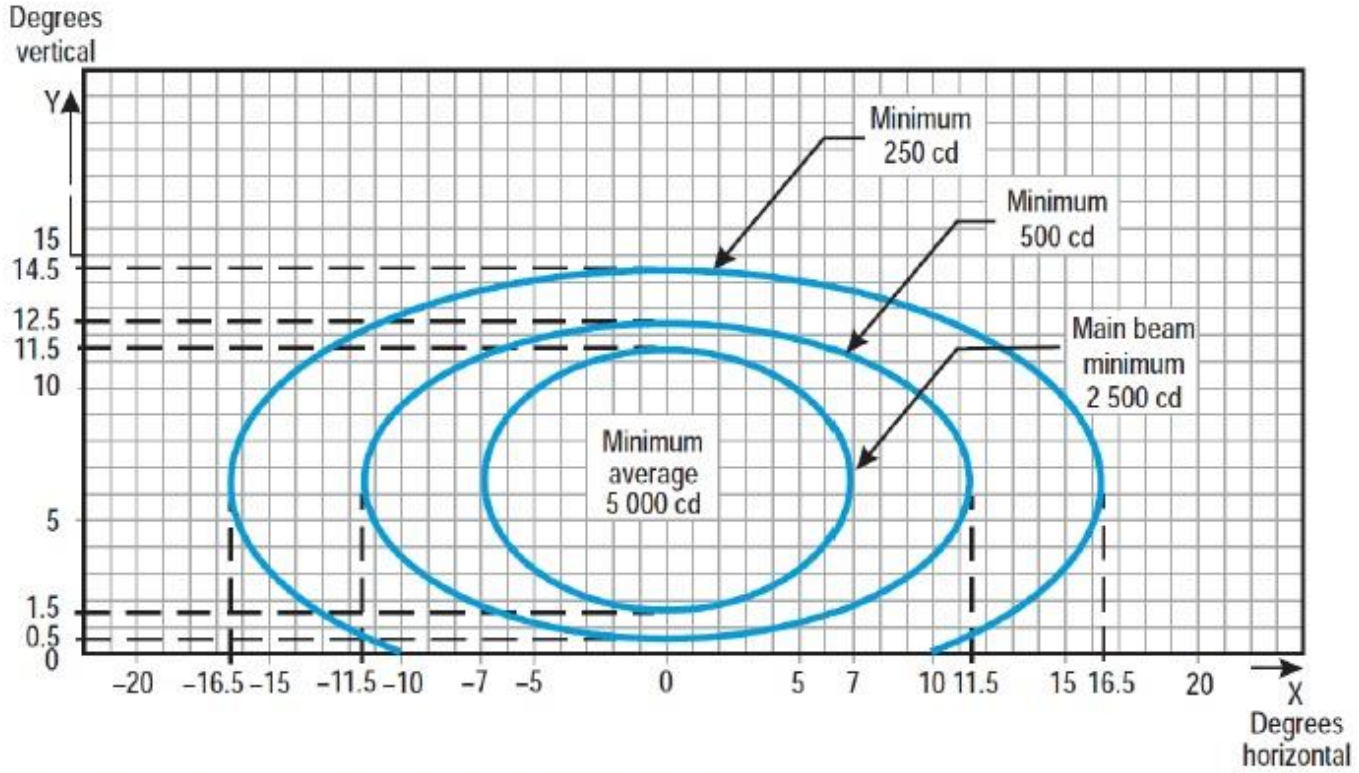


Figure U-6. Isocandela diagram for approach side row light (red light)

Notes:

(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	7.0	11.5	16.5
b	5.0	6.0	8.0

(b) Toe-in 2 degrees

(c) Vertical setting angles of the lights should be such that the following vertical coverage of the main beam should be met:

distance from threshold	**vertical main beam coverage**
threshold to 115 m	0.5° - 10.5°
116 m to 215 m	1° - 11°
216 m and beyond	1.5° - 11.5° (as illustrated above)

(a) See collective notes for Figures U-5 to U-15.

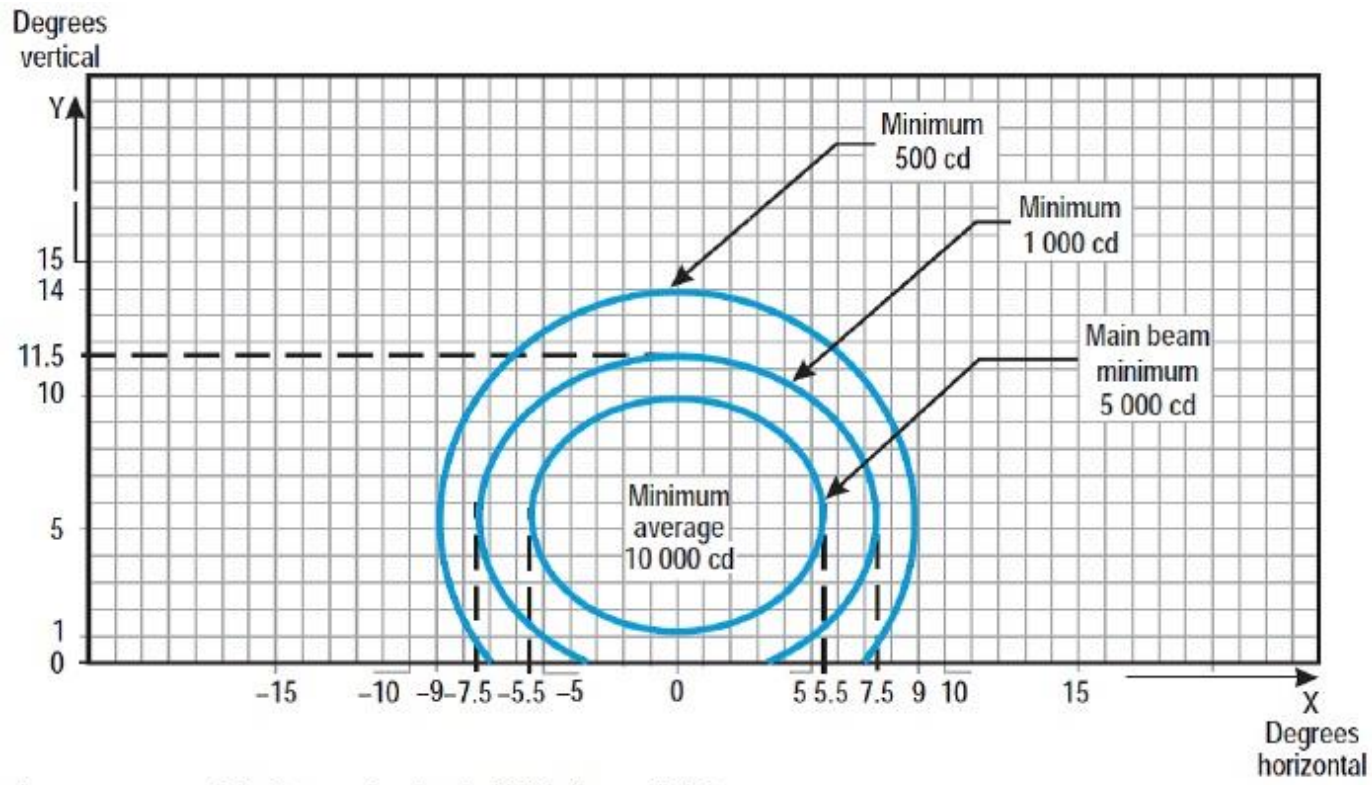


Figure U-7. Isocandela diagram for threshold light (green light)

Notes:
(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.5	7.5	9.0
b	4.5	6.0	8.5

(b) Toe-in 3.5 degrees
(c) See collective notes for Figures U-5 to U-15.

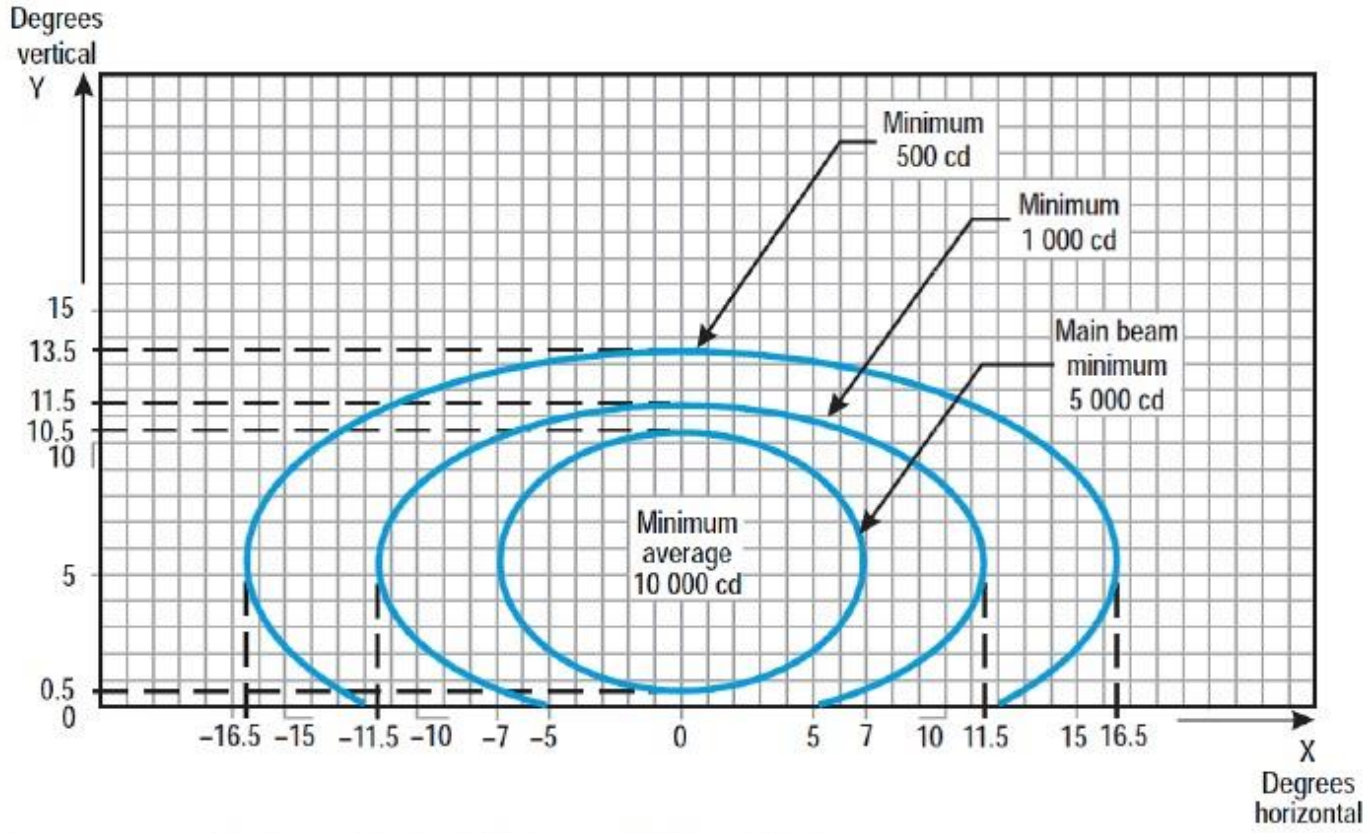


Figure U-8. Isocandela diagram for threshold wing bar light (green light)

Notes:
(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	7.0	11.5	16.5
b	5.0	6.0	8.0

(b) Toe-in 2 degrees
(c) See collective notes for Figures U-5 to U-15.

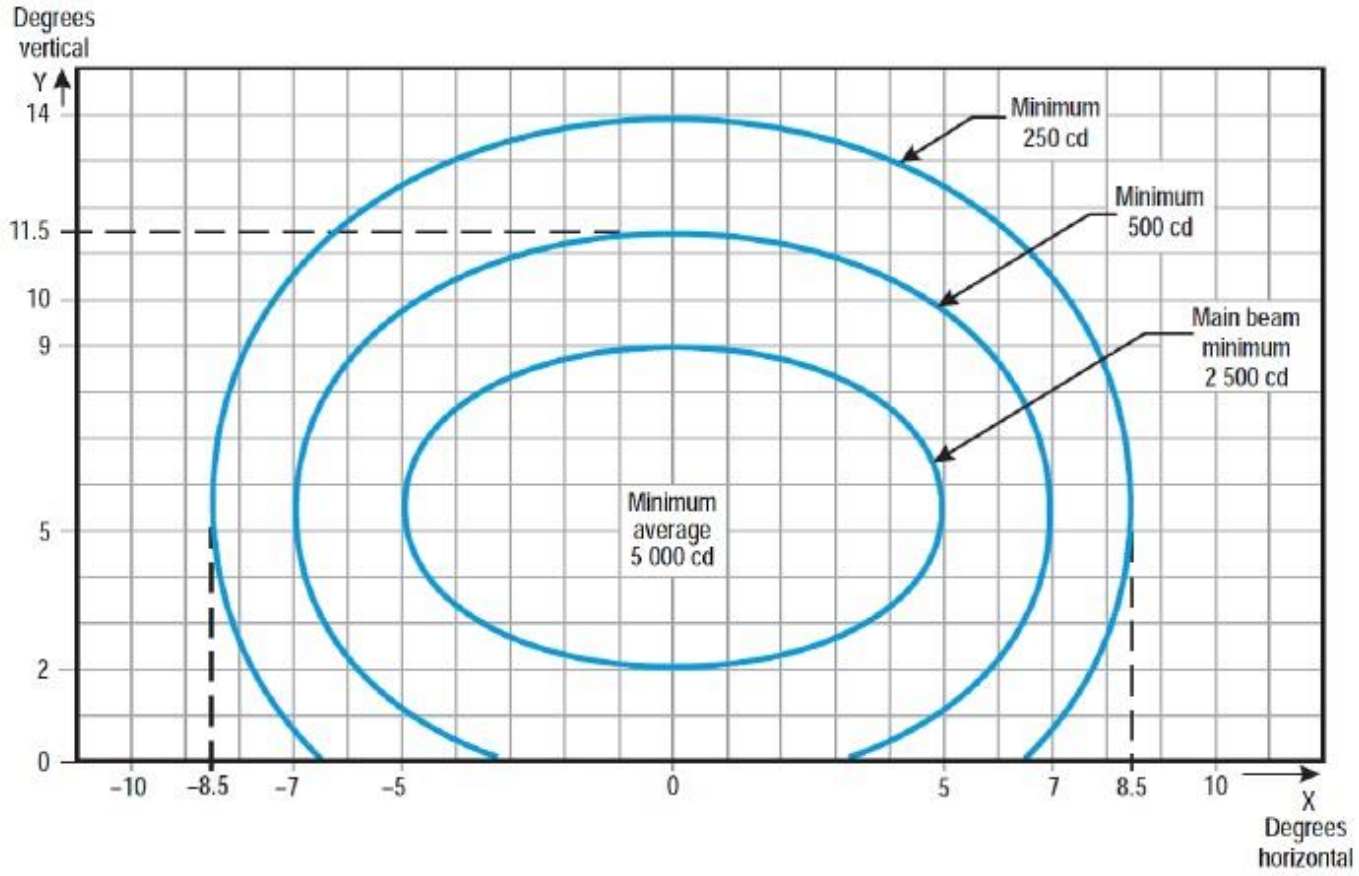


Figure U-9. Isocandela diagram for touchdown zone light (white light)

Notes:
(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.0	7.0	8.5
b	3.5	6.0	8.5

(b) Toe-in 4 degrees
(c) See collective notes for Figures U-5 to U-15.

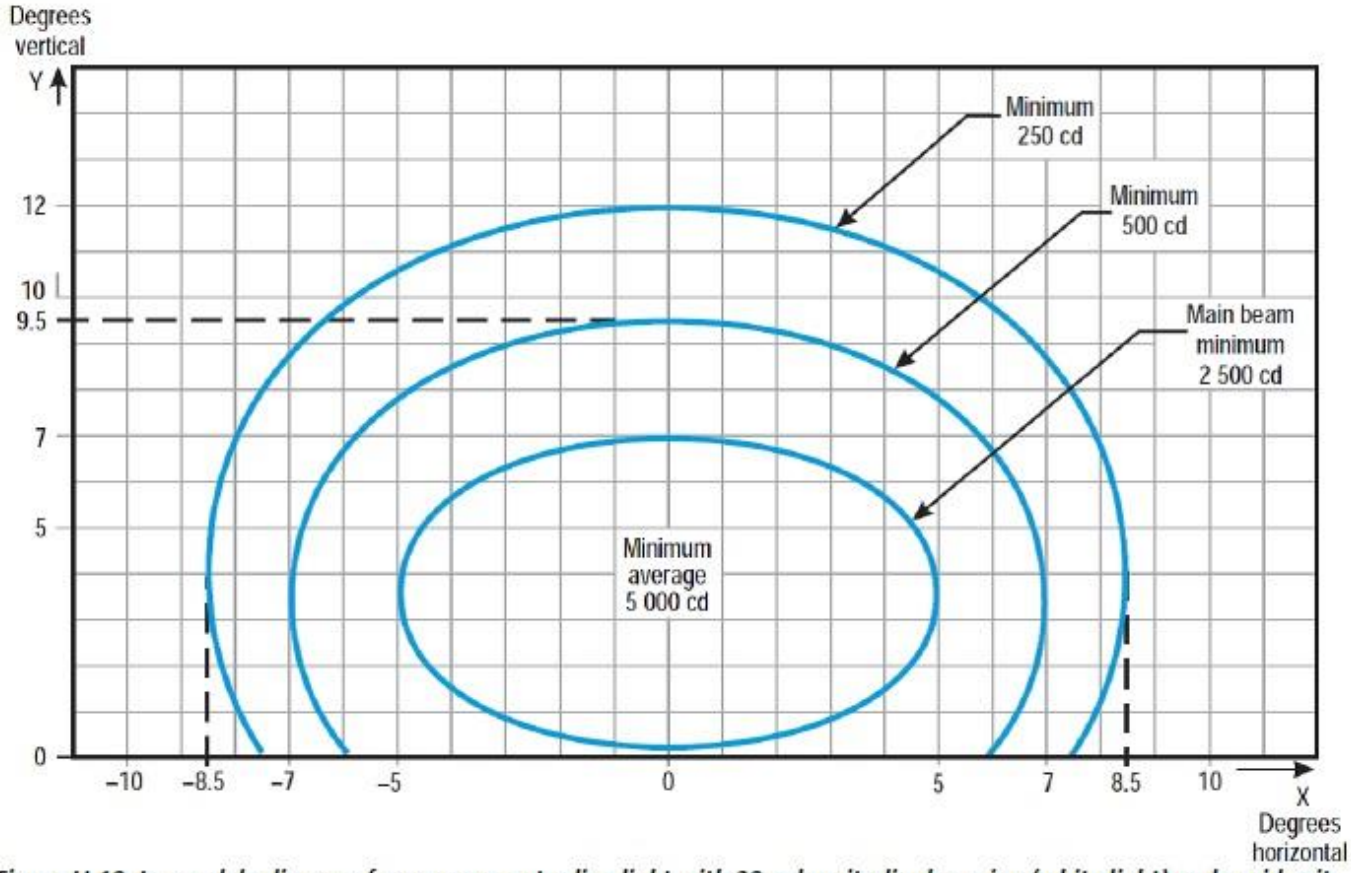


Figure U-10. Isocandela diagram for runway centre line light with 30 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)

Notes:

(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.0	7.0	8.5
b	3.5	6.0	8.5

(b) For red light, multiply values by 0.15.

(c) For yellow light, multiply values by 0.40.

(d) See collective notes for Figures U-5 to U-15.

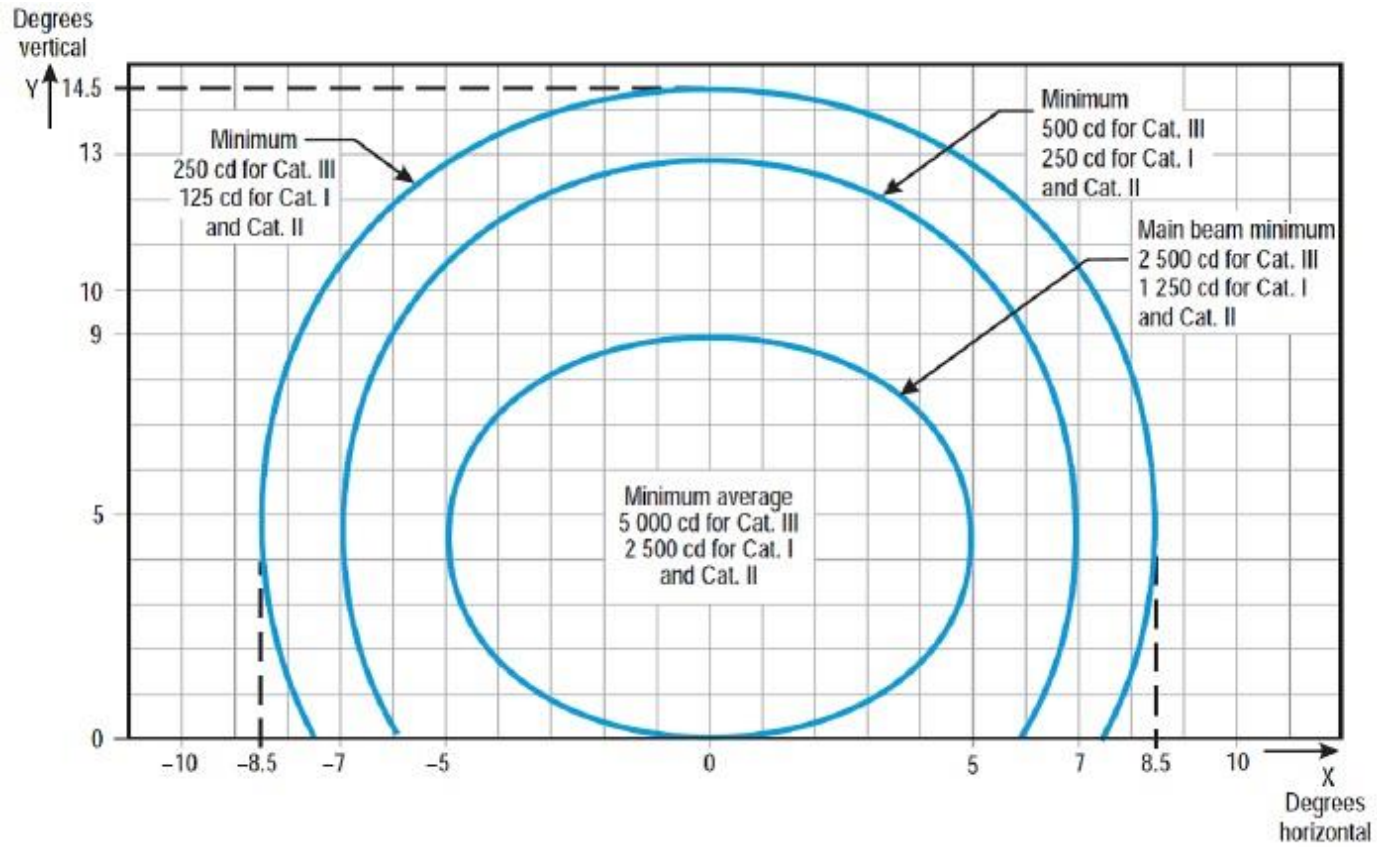


Figure U-11. Isocandela diagram for runway centre line light with 15 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)

Notes:
(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.0	7.0	8.5
b	3.5	6.0	8.5

(b) For red light, multiply values by 0.15.
(c) For yellow light, multiply values by 0.40.
(d) See collective notes for Figures U-5 to U-15.

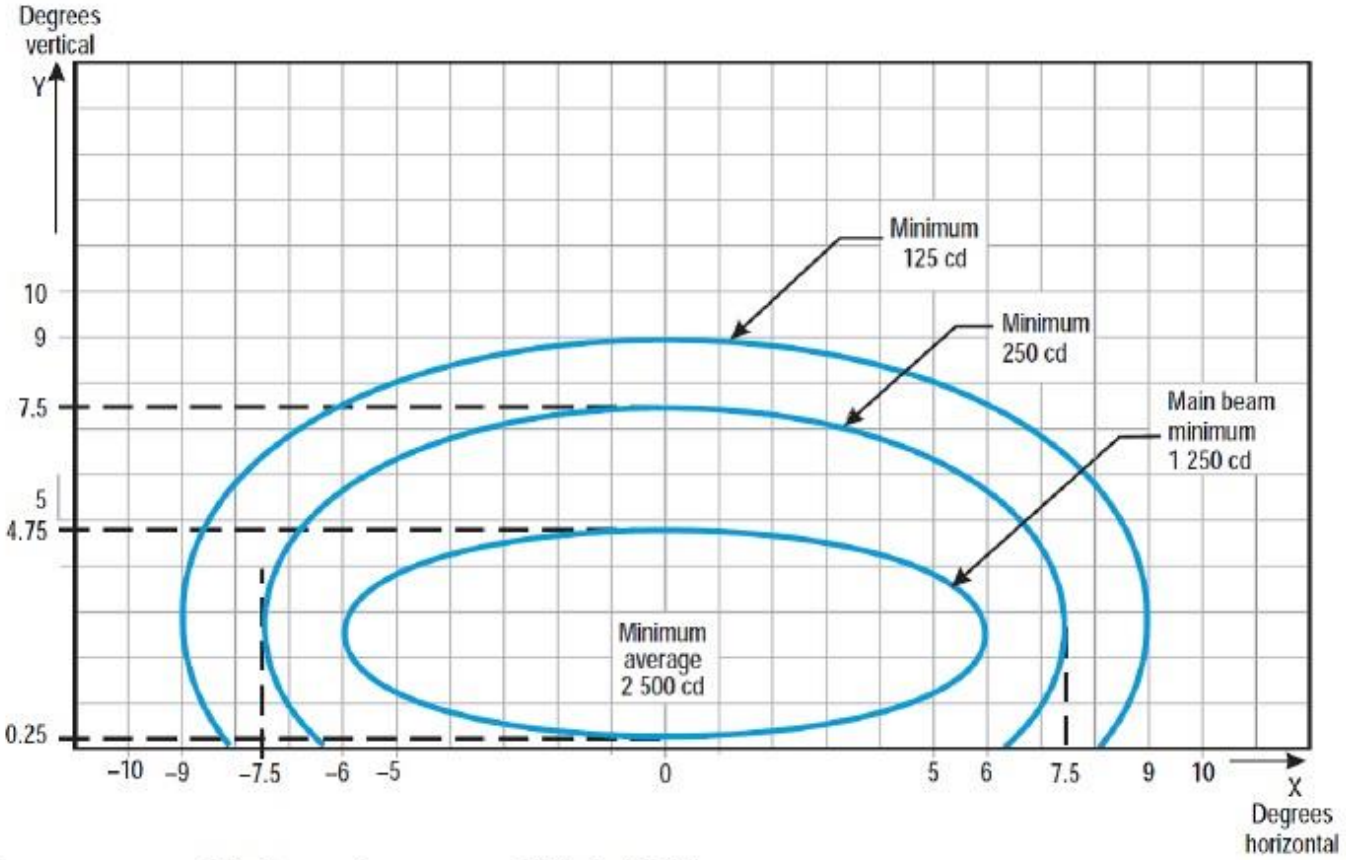


Figure U-12. Isocandela diagram for runway end light (red light)

Notes:

(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	6.0	7.5	9.0
b	2.25	5.0	6.5

(b) See collective notes for Figures U-5 to U-15.

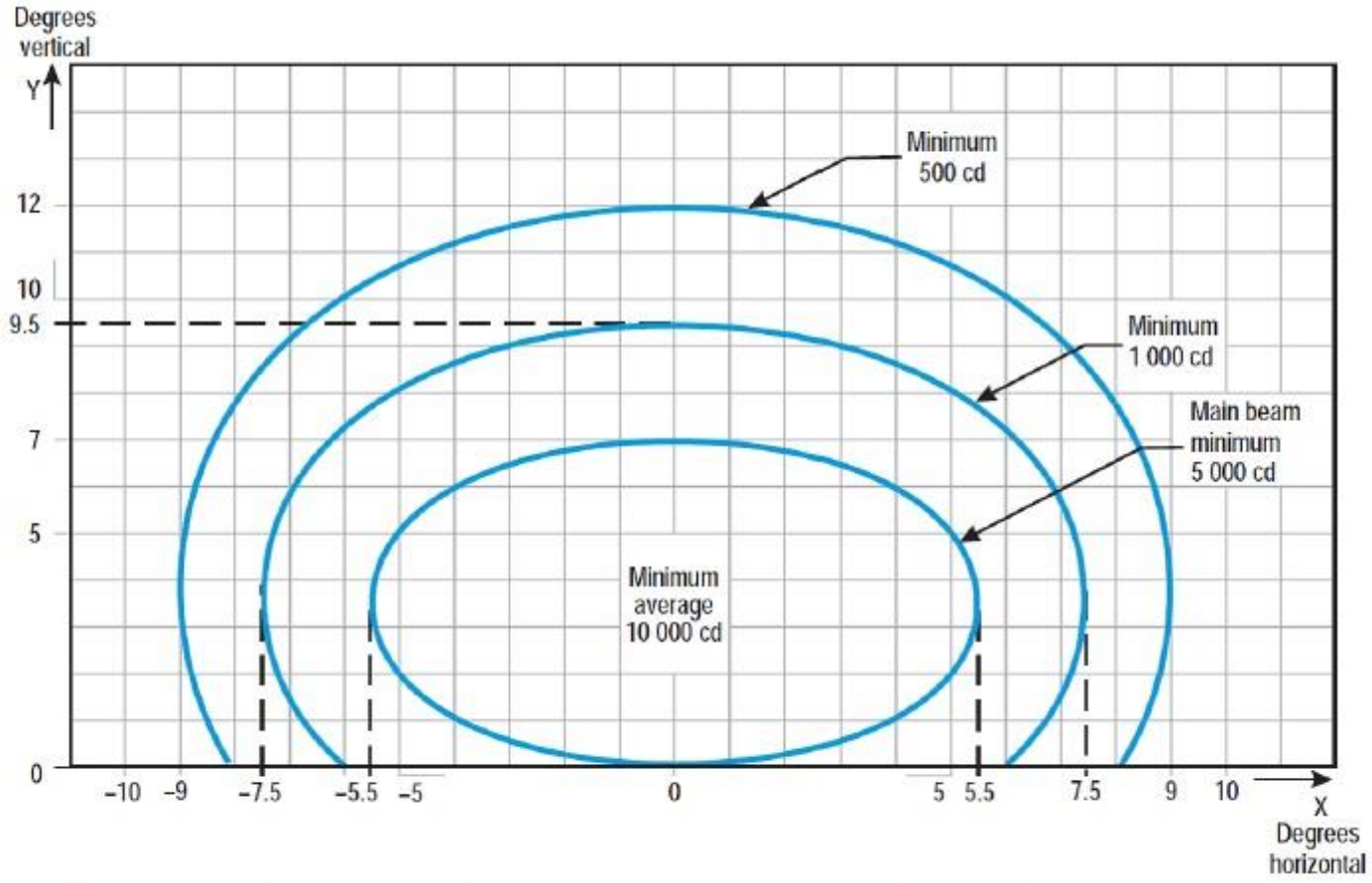


Figure U-13. Isocandela diagram for runway edge light where width of runway is 45 m (white light)

Notes:
(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.5	7.5	9.0
b	3.5	6.0	8.5

(b) Toe-in 3.5 degrees
(c) For red light, multiply values by 0.15.
(d) For yellow light, multiply values by 0.40.
(e) See collective notes for Figures U-5 to U-15.

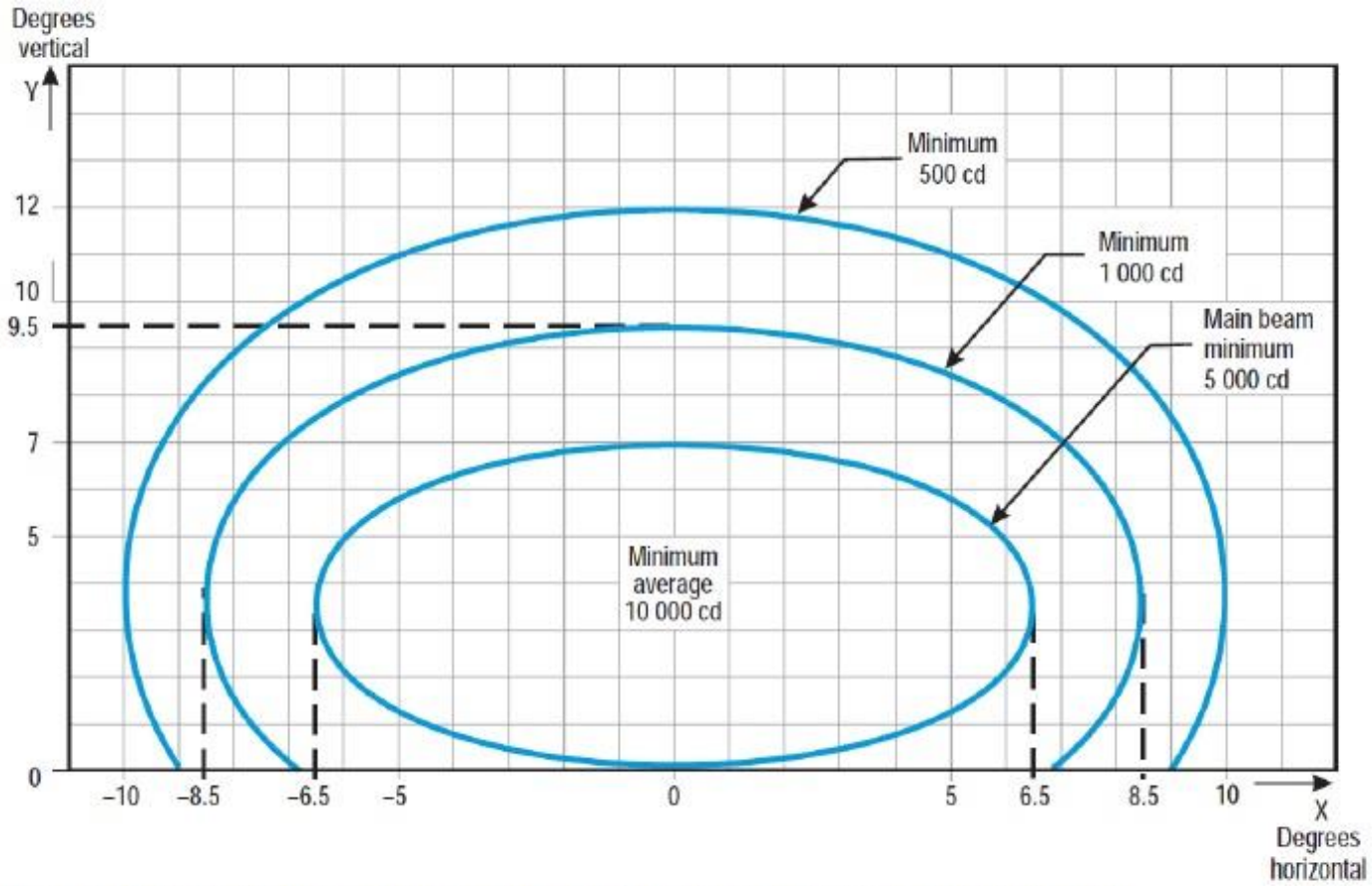


Figure U-14. Isocandela diagram for runway edge light where width of runway is 60 m (white light)

Notes:

(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	6.5	8.5	10.0
b	3.5	6.0	8.5

(b) Toe-in 4.5 degrees

(c) For red light, multiply values by 0.15.

(d) For yellow light, multiply values by 0.40.

(e) See collective notes for Figures U-5 to U-15.

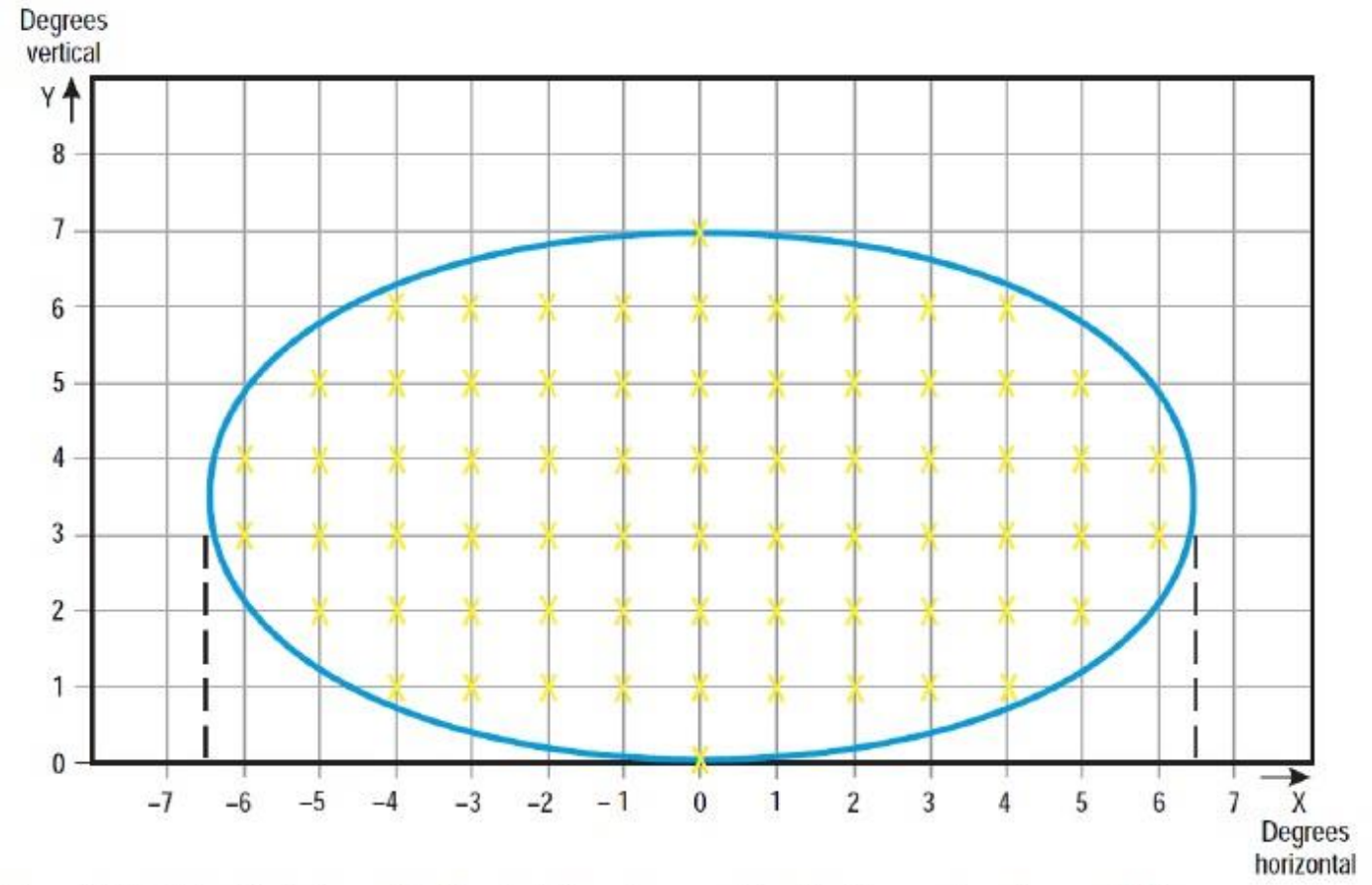


Figure U-15. Grid points to be used for the calculation of average intensity of approach and runway lights

Collective notes to Figures U-5 to U-15

(a) The ellipses in each Figure are symmetrical about the common vertical and horizontal axes.
(b) Figures U-5 to U-14 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure U-15 and using the intensity value measures at all grid points located within and on the perimeter of the ellipse representing the main beam. The average value is the arithmetic average of light intensities measured at all considered grid points.
(c) No deviations are acceptable in the main beam pattern when the lighting fixture is properly aimed.
(d) Average intensity ratio. The ratio between the average intensity within the ellipse defining the main beam of a typical new light and the average light intensity of the main beam of a new runway edge light should be as follows:

Figure U-5	Approach centre line and crossbars	1.5 to 2.0	(white light)
Figure U-6	Approach side row	0.5 to 1.0	(red light)
Figure U-7	Threshold	1.0 to 1.5	(green light)
Figure U-8	Threshold wing bar	1.0 to 1.5	(green light)
Figure U-9	Touchdown zone	0.5 to 1.0	(white light)
Figure U-10	Runway centre line (longitudinal spacing 30 m)	0.5 to 1.0	(white light)
Figure U-11	Runway centre line (longitudinal spacing 15 m)	0.5 to 1.0 for CAT III	(white light)
		0.25 to 0.5 for CAT I, II	(white light)
Figure U-12	Runway end	0.25 to 0.5	(red light)
Figure U-13	Runway edge (45 m runway width)	1.0	(white light)

Figure U-14	Runway edge (60 m runway width)	1.0	(white light)

(e) The beam coverages in the Figures provide the necessary guidance for approaches down to an RVR of the order of 150 m and take-offs down to an RVR of the order of 100 m.
(f) Horizontal angles are measured with respect to the vertical plane through the runway centre line. For lights other than centre line lights, the direction towards the runway centre line is considered positive. Vertical angles are measured with respect to the horizontal plane.
(g) Where, for approach centre line lights and crossbars and for approach side row lights, inset lights are used in lieu of elevated lights, e.g. on a runway with a displaced threshold, the intensity requirements can be met by installing two or three fittings (lower intensity) at each position.
(h) The importance of adequate maintenance cannot be overemphasised. The average intensity should never fall to a value less than 50 % of the value shown in the Figures, and it should be the aim of aerodrome operator to maintain a level of light output close to the specified minimum average intensity.
(i) The light unit should be installed so that the main beam is aligned within one-half degree of the specified.

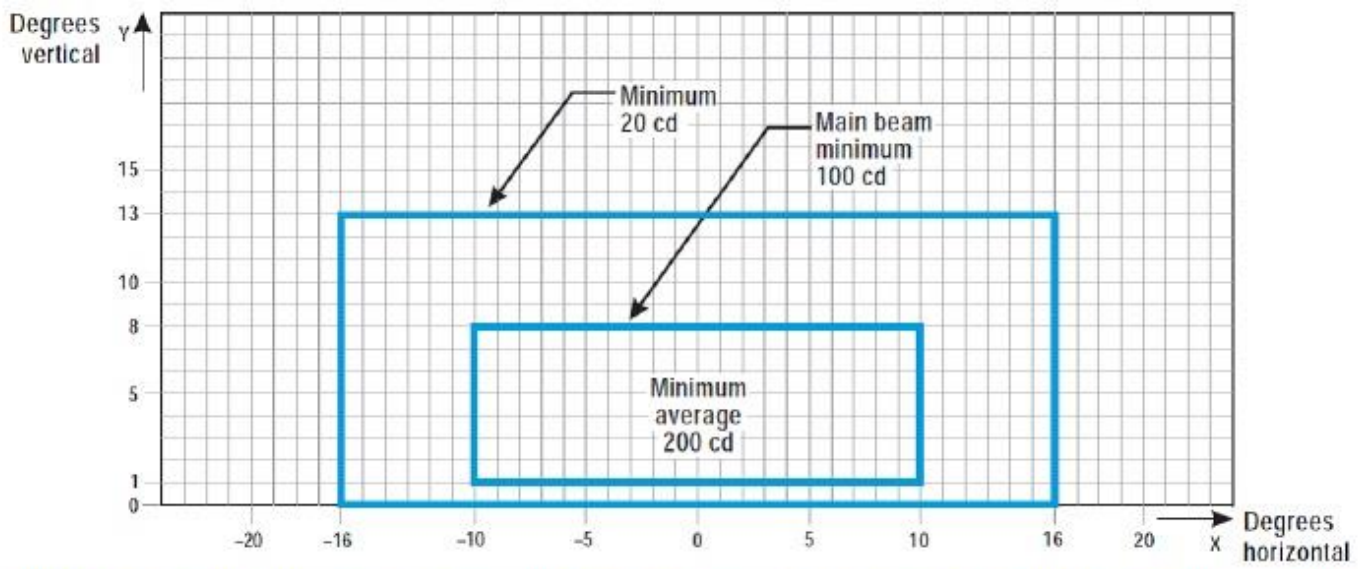


Figure U-16. Isocandela diagram for taxiway centre line (15 m spacing), RELs, no-entry bar, and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m where large offsets can occur and for low-intensity runway guard lights, Configuration B

Notes:
(a) These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.
(b) See collective notes for Figures U-16 to U-25.
(c) Increased intensities for enhanced rapid exit taxiway centre line lights are four times the respective intensities in the figure (i.e. 800 cd for minimum average main beam).

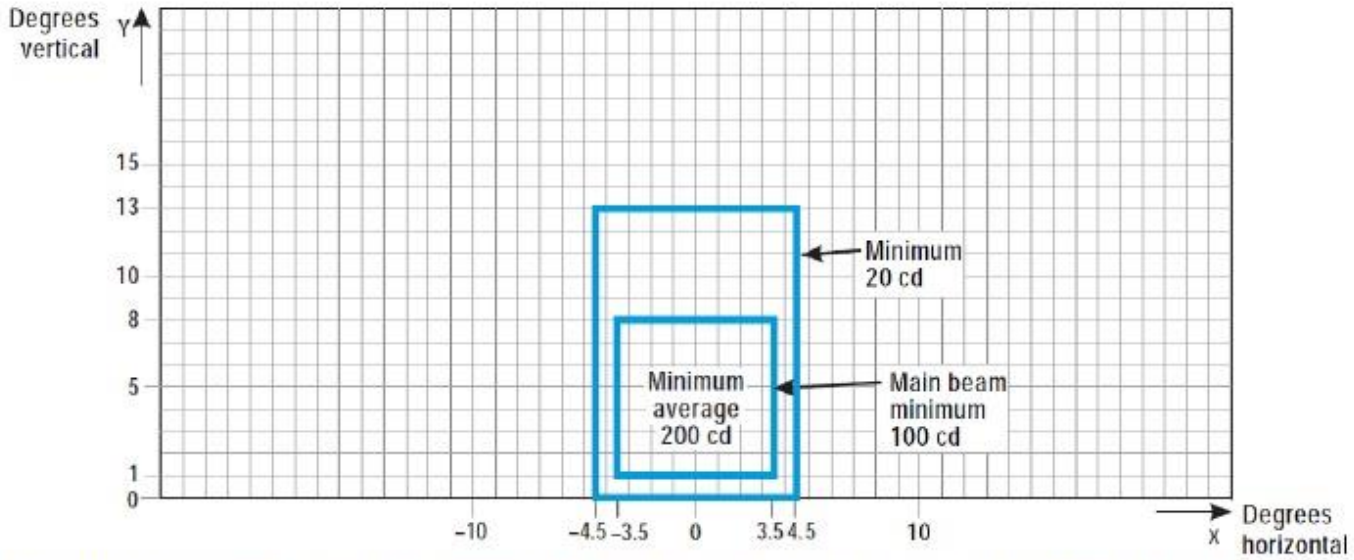


Figure U-17. Isocandela diagram for taxiway centre line (15 m spacing), no-entry bar, and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m

Notes:
(a) These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit from the centre line of approximately 3 m.
(b) See collective notes for Figures U-16 to U-25.

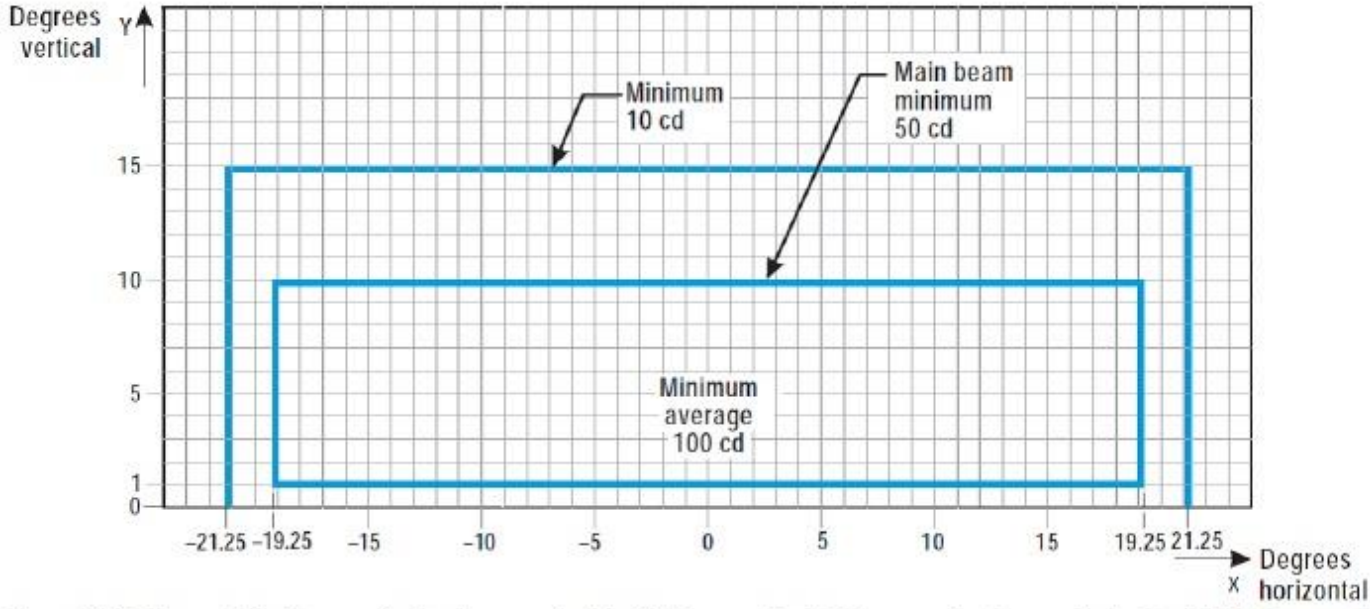


Figure U-18. Isocandela diagram for taxiway centre line (7.5 m spacing), RELs, no-entry bar, and stop bar lights in curved sections intended for use in runway visual range conditions of less than a value of 350 m

Notes:
(a) Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve. This does not apply to RELs.
(b) Where provided, increased intensities for RELs should be twice the specified intensities, i.e. minimum 20 cd, main beam minimum 100 cd, and minimum average 200 cd.
(c) See collective notes for Figures U-16 to U-25.

Notes:
(a) At locations where high background luminance is usual, and where deterioration of light output resulting from dust, snow, and local contamination is a significant factor, the cd-values should be multiplied by 2.5.
(b) Where omnidirectional lights are used they should comply with the vertical beam requirements in this Figure.

(c) See collective notes for Figures U-16 to U-25.

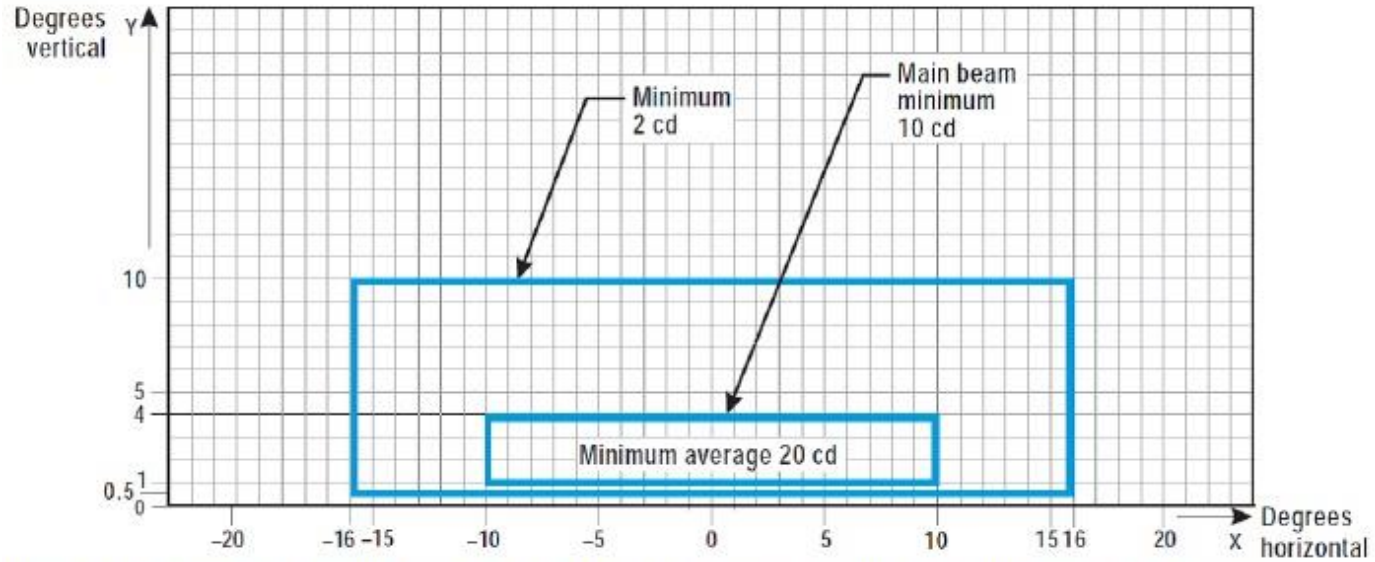


Figure U-19. Isocandela diagram for taxiway centre line (30 m, 60 m spacing), no-entry bar, and stop bar lights in straight sections intended for use in runway visual range conditions of 350 m or greater

Notes:

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

(b) Where omnidirectional lights are used they should comply with the vertical beam requirements in this Figure.

(c) See collective notes for Figures U-16 to U-25.

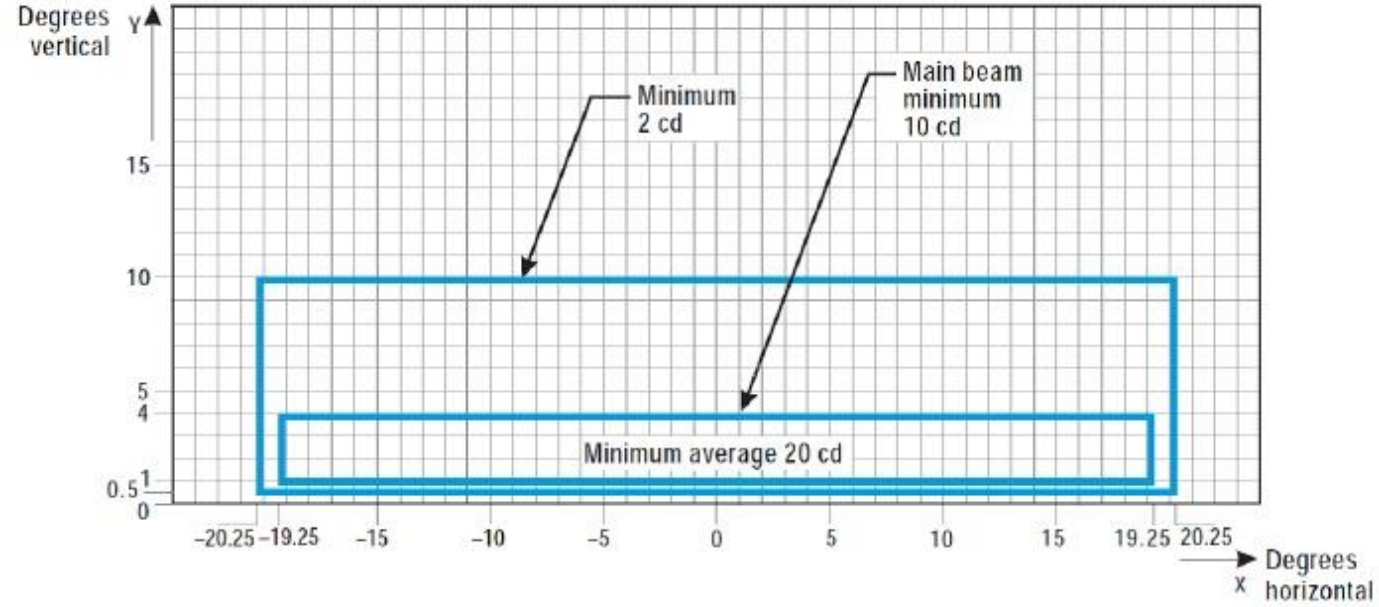


Figure U-20. Isocandela diagram for taxiway centre line (7.5 m, 15 m, 30 m spacing), no-entry bar, and stop bar lights in curved sections intended for use in runway visual range conditions of 350 m or greater

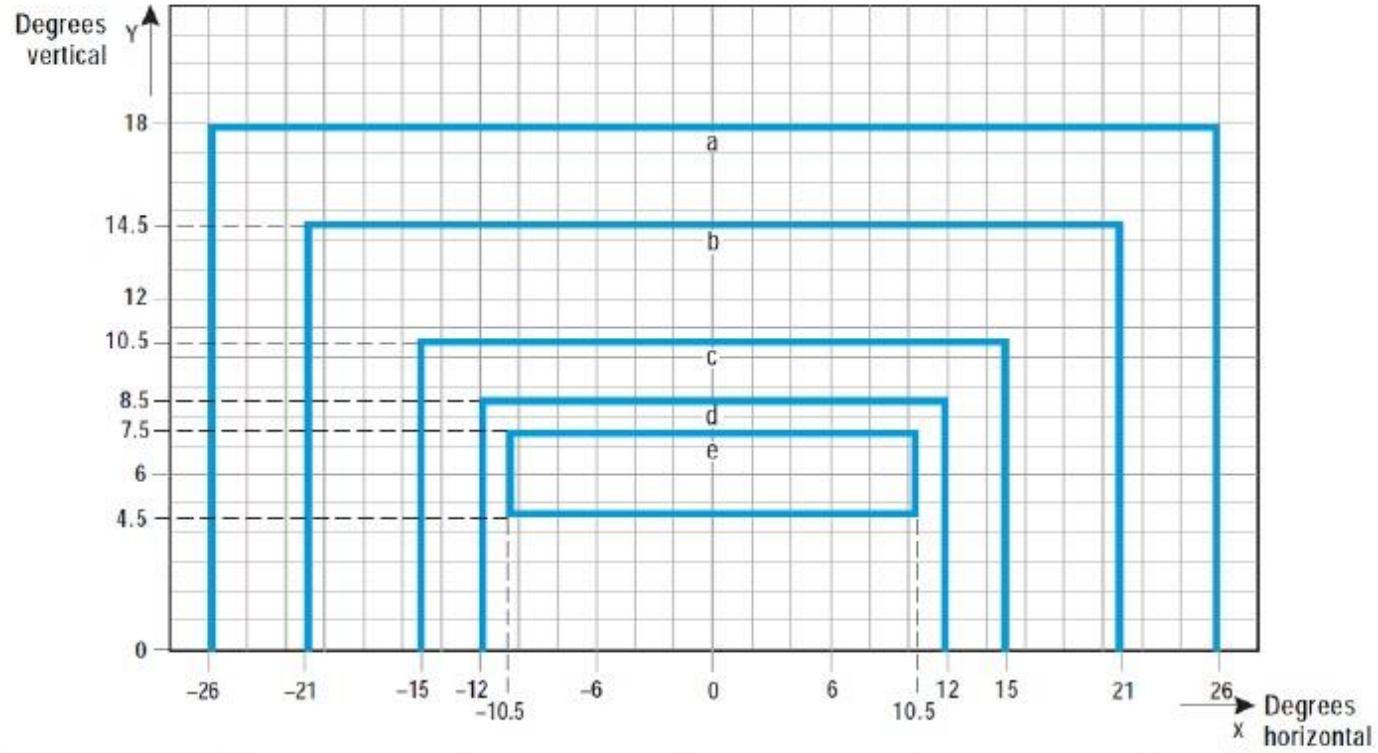
Notes:

(a) Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve.

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

(c) These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m as could occur at the end of curves.

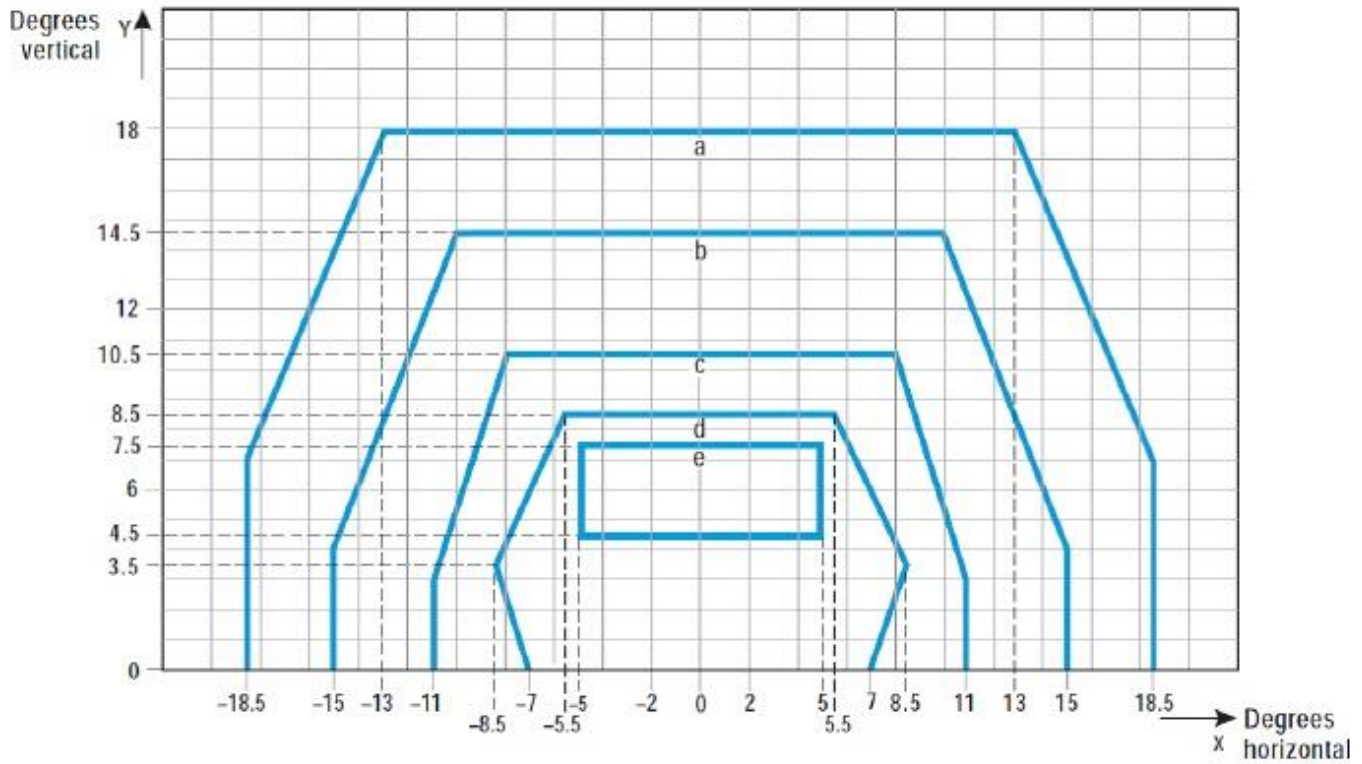
(d) See collective notes for Figures U-16 to U-25.



Curve	a	b	c	d	e
Intensity (cd)	8	20	100	450	1800

Figure U-21. Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar, and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required and where large offsets can occur.

Notes:
(a) These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit corresponding to the outer main gear wheel on the taxiway edge.
(b) See collective notes for Figures U-16 to U-25.



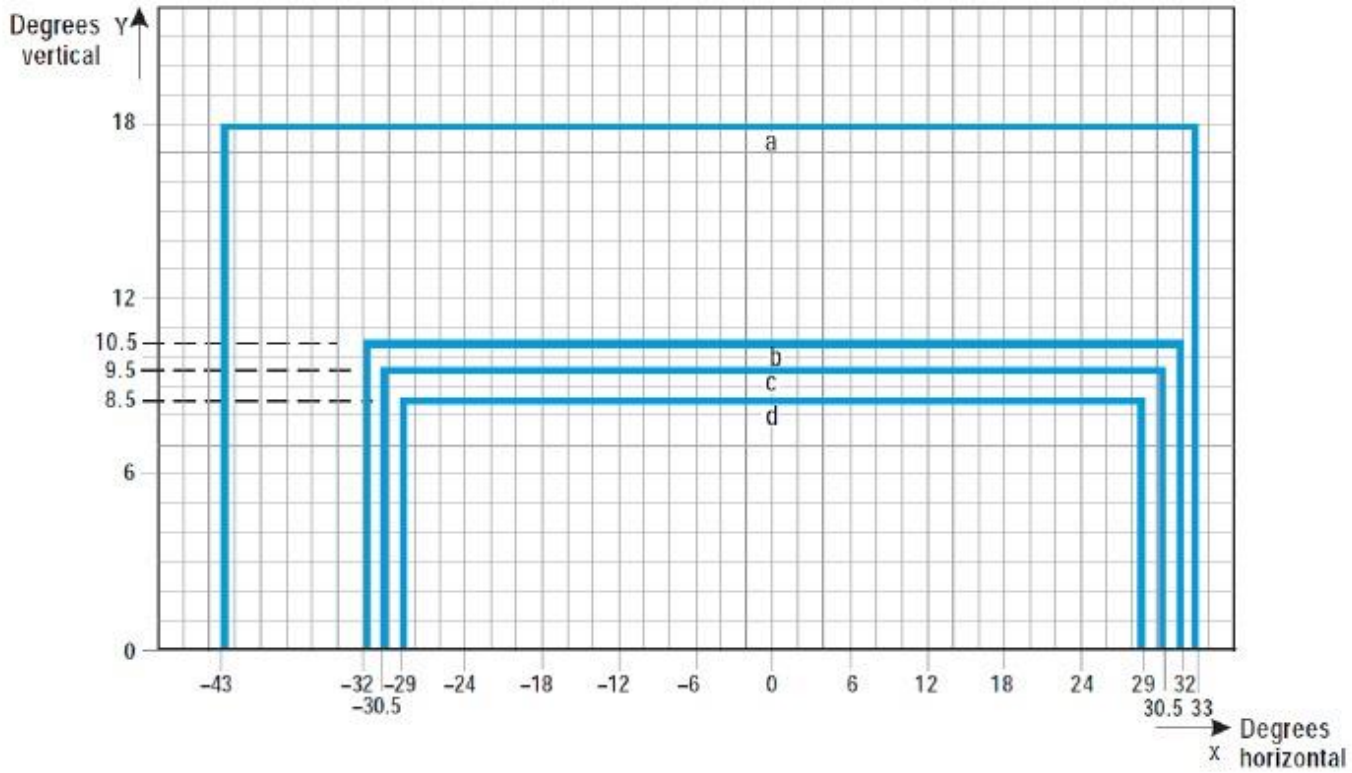
Curve	a	b	c	d	e
Intensity (cd)	8	20	100	450	1800

Figure U-22. Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar, and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required

Notes:

(a) These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit corresponding to the outer main gear wheel on the taxiway edge.

(b) See collective notes for Figures U-16 to U-25.



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

Figure U-23. Isocandela diagram for high-intensity taxiway centre line (7.5 m spacing), no-entry bar, and stop bar lights in curved sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required

Notes:
(a) Lights on curves to be toed-in 17 degrees with respect to the tangent of the curve.
(b) See collective notes for Figures U-16 to U-25.

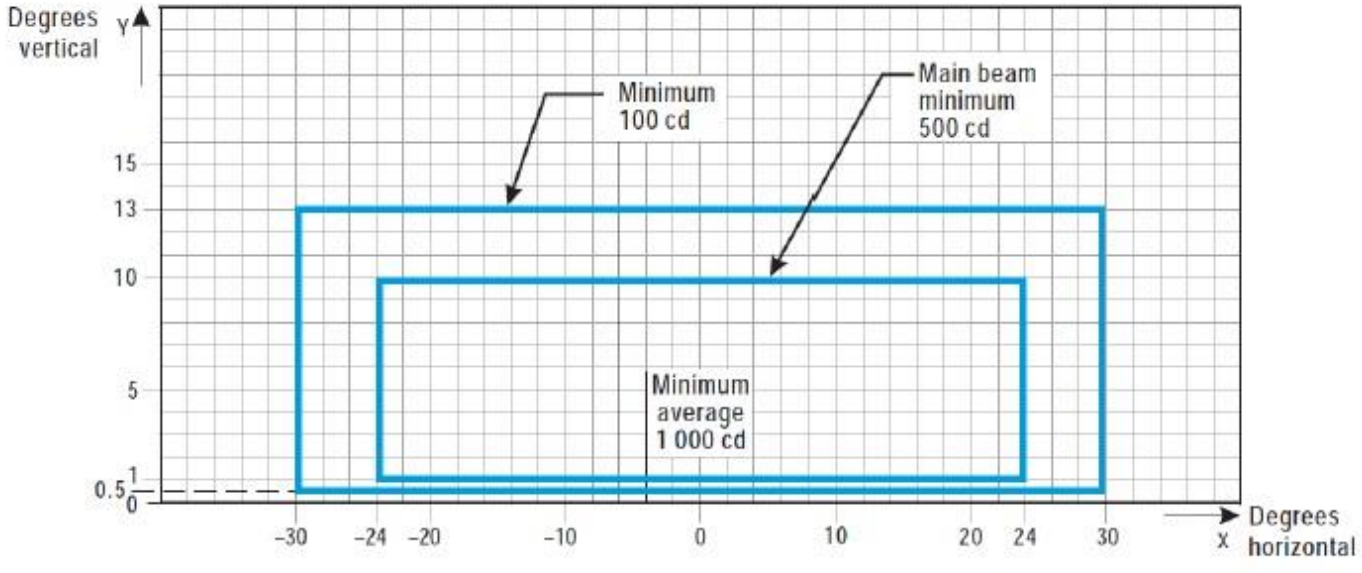


Figure U-24. Isocandela diagram for high-intensity runway guard lights, Configuration B

Notes:

(a) Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.
(b) See collective notes for Figures U-16 to U-25.

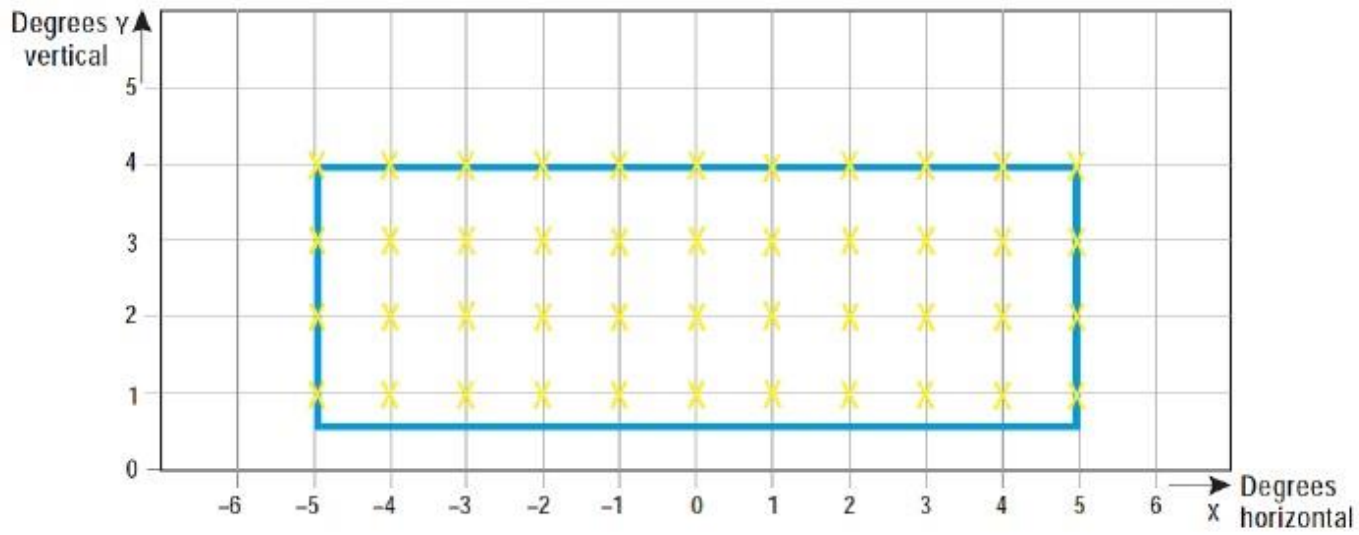


Figure U-25. Grid points to be used for calculation of average intensity of taxiway centre line and stop bar lights

Collective notes to Figures U-16 to U-25:

(a) The intensities specified in Figures U-16 to U-24 are in green and yellow light for taxiway centre line lights, yellow light for runway guard lights, and red light for stop bar lights.
(b) Figures U-16 to U-24 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure U-25, and using the intensity values measured at all grid points located within and on the perimeter of the rectangle representing the main beam. The average value is the arithmetic average of the light intensities measured at all considered grid points.
(c) No deviations are acceptable in the main beam or in the innermost beam as applicable, when the lighting fixture is properly aimed.
(d) Horizontal angles are measured with respect to the vertical plane through the taxiway centre line, except on curves where they are measured with respect to the tangent to the curve.
(e) Vertical angles are measured from the longitudinal slope of the taxiway surface.
(f) The importance of adequate maintenance cannot be overemphasised. The intensity, either average where applicable or as specified on the corresponding isocandela curves, should never fall to a value less than 50 % of the value shown in the figures, and it should be the aim of aerodrome operator to maintain a level of light output close to the specified minimum average intensity.
(g) The light unit should be installed so that the main beam or the innermost beam as applicable, is aligned within one-half degree of the specified requirement.

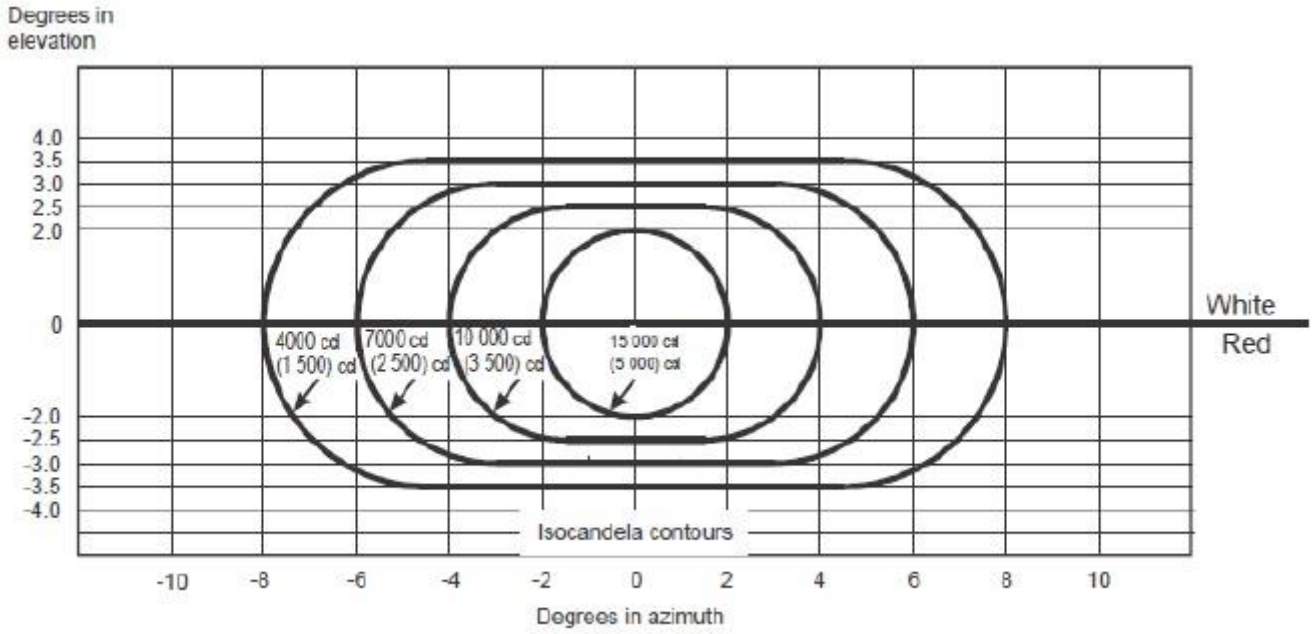


Figure U-26. Light intensity distribution of PAPI and APAPI

Notes:
(a) These curves are for minimum intensities in red light.
(b) The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.
(c) The intensity values shown in brackets are for APAPI.

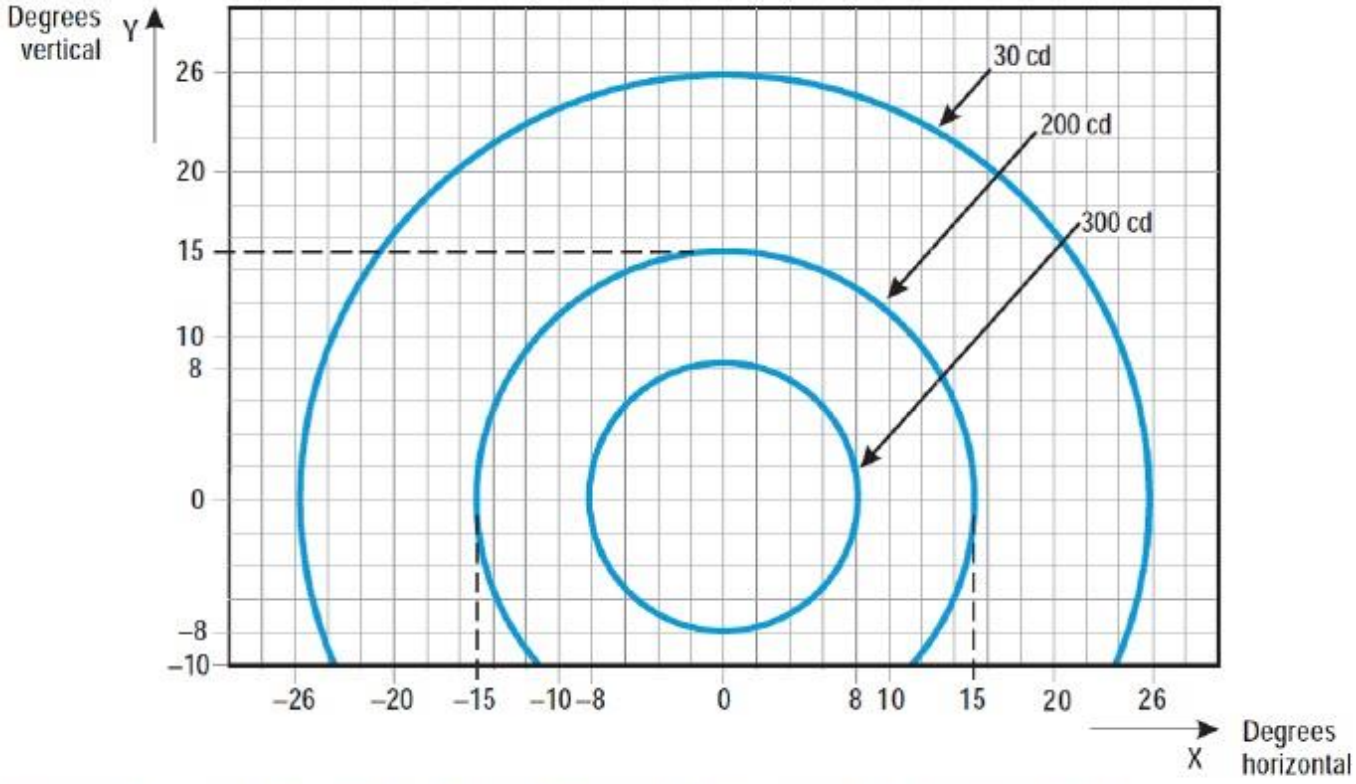


Figure U-27. Isocandela diagram for each light in low-intensity runway guard lights, Configuration A

Notes:
(a) Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.
(b) The intensities specified are in yellow light.

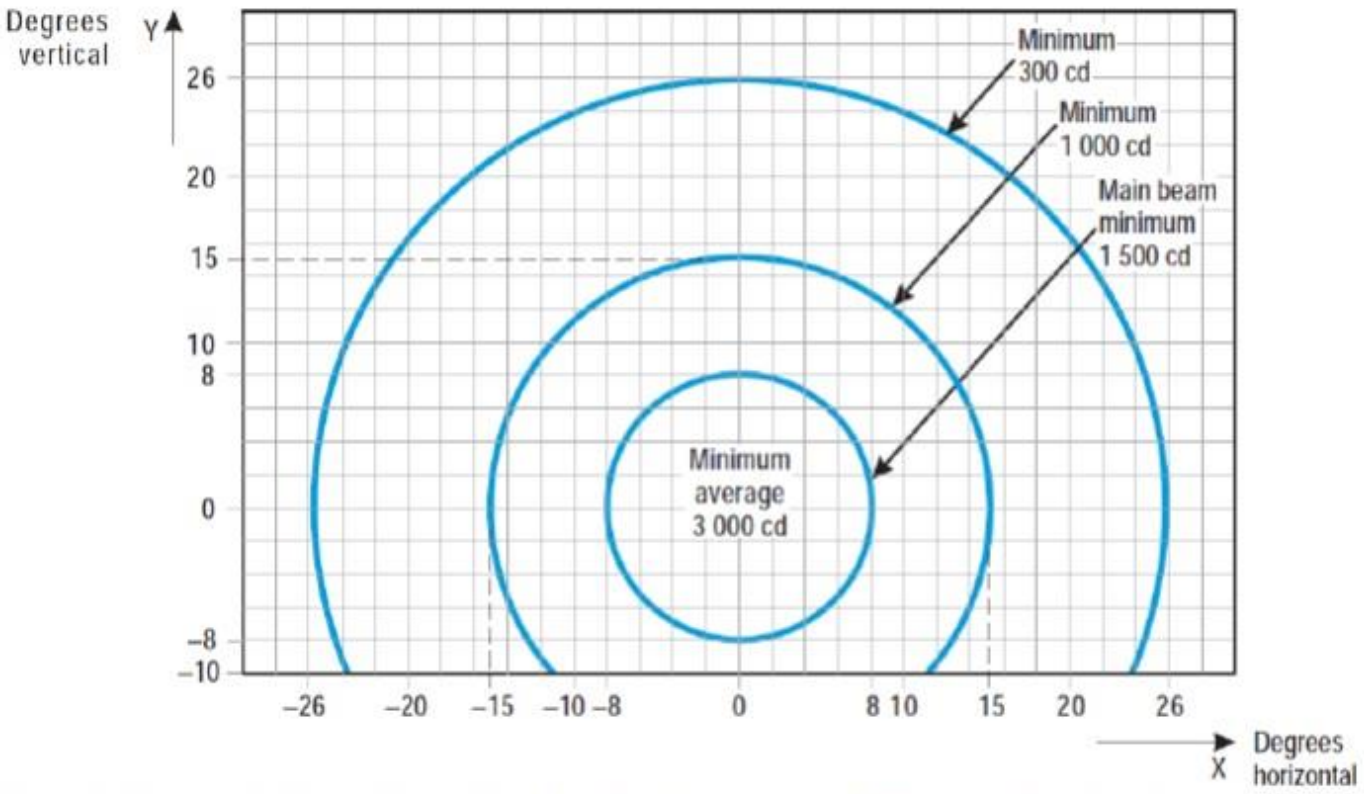


Figure U-28. Isocandela diagram for each light in high-intensity runway guard lights, Configuration A

Notes:
(a) Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.
(b) The intensities specified are in yellow light.

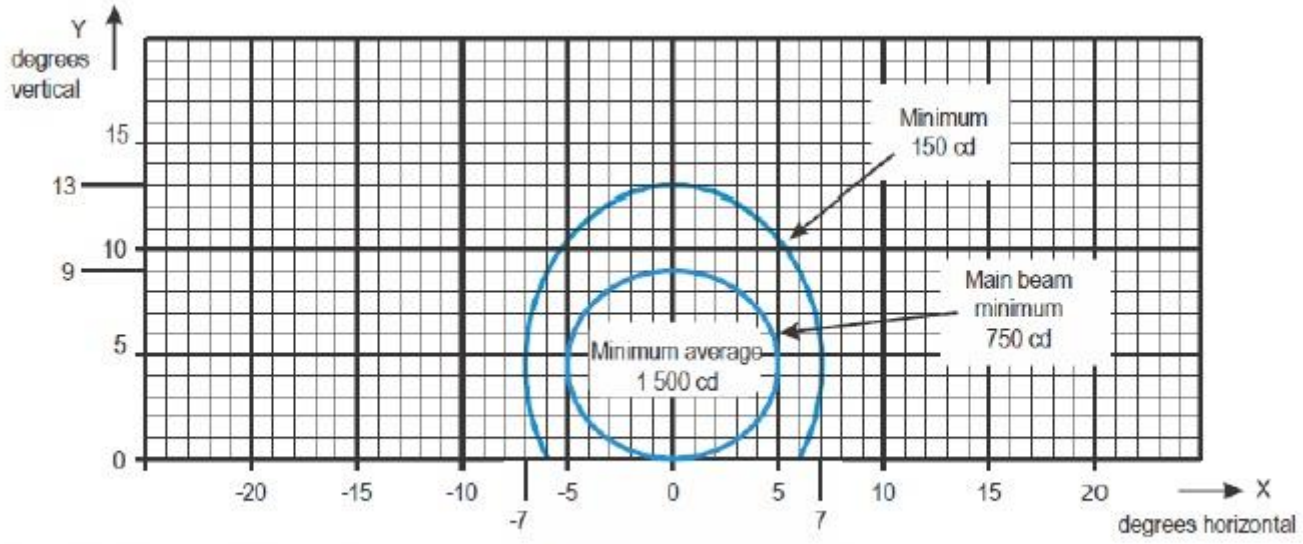


Figure U-29. Isocandela diagram for take-off and hold lights (THL) (red light)

Notes:
(a) Curves calculated on formula

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

a	5.0	7.0
b	4.5	8.5

(b) See collective notes for Figures U-5 to U-15 and Figure U-29.

CERTIFICATION SPECIFICATIONS FOR HELIPORT DESIGN

CHAPTER A — GENERAL

CS-HPT-DSN.A.010 Applicability

(a) The certification specifications (CSs) and the related guidance material (GM) (CS-MAR-HPT-DSN) are applicable to the design of surface-level VFR heliports or parts thereof located at aerodromes that fall under the scope of this Regulation.
(b) Where relevant, the CSs and GM for aerodrome design (CS-MAR-ADR-DSN) apply to the aerodrome areas and infrastructure used by helicopters.
(c) Unless otherwise specified, the specifications for a colour referred to within CS-MAR-HPT-DSN should be those contained in CS-MAR-ADR-DSN.
(d) This regulation does not apply to specific military (training) locations used by helicopters. Where possible the regulation should be met, however (training) locations such as confined, dummydeck, slopes etc. may deviate from this regulation to meet the specific (training) requirements. A safety assessment and approval by MAA-NLD are required to allow operations.

CS-HPT-DSN.A.020 Definitions

(+GM)

For the purpose of this Regulation the generic definitions in NLD-MAD-1 apply.

CS-HPT-DSN.A.030 Criteria for military helipads

(+GM)

Military helipads provide a location suitable for the use of military rotary wing aircraft at maximum weight to land and take-off or hover. In case helipads are intended for specific use by military helicopters, specific military requirements shall apply. If such helipads are used by civil helicopters, limitations may apply based on helicopter characteristics and use.
(a) Military helipad dimensions: Standard size is 30×30 m. Minimum size for VFR limited use is 15×15 m.

CHAPTER B — HELICOPTER OPERATING AREAS

CS-HPT-DSN.B.100 Final approach and take-off areas (FATOs)

(+GM)

(a) Applicability: A heliport should be provided with at least one final approach and take-off area (FATO).
(b) Location: A FATO in proximity to other infrastructure and objects should be located so as to minimise:
  (1) the influence of the surrounding environment, including structure-induced turbulence;
  (2) the influence of, and on, the surrounding traffic, including wake turbulence, where simultaneous aircraft operations are intended.
(c) Characteristics:
  (1) A FATO should be obstacle-free; however, when collocated with the touchdown and lift-off area (TLOF), TLOF arrays of segmented point source lighting (ASPSL) or luminescent panels (LPs) with a height not more than 5 cm can be provided for the installation of visual aids.
  (2) Where a FATO is intended to be used by helicopters operated in performance class 1, its dimensions should be as prescribed in the helicopter (aircraft) flight manual (HFM) except that, in the absence of width specifications, the width should be not less than the greatest overall dimension (D) of the largest helicopter the FATO is intended to serve.
  (3) Where a FATO is intended to be used by helicopters operated in performance class 2 or 3, its dimensions should be of sufficient size and shape to contain an area within which a circle can be drawn of diameter not less than:
    (i) 1 D of the largest helicopter when the maximum take-off mass (MTOM) of helicopters the FATO is intended to serve is more than 3 175 kg;
    (ii) 0.83 D of the largest helicopter when the MTOM of helicopters the FATO is intended to serve is 3 175 kg or less.
  (4) The surface of the FATO should:
    (i) be resistant to the effects of rotor downwash;
    (ii) be free of irregularities that would adversely affect the take-off or landing of helicopters;
    (iii) have bearing strength sufficient to accommodate a rejected take-off by helicopters operated in performance class 1;
    (iv) provide ground effect;
    (v) have a mean slope in any direction which should not exceed 3 per cent; and
    (vi) provide rapid drainage.
  (5) No portion of a FATO should have a local slope exceeding:
    (i) 5 per cent where the heliport is intended to be used by helicopters operated in performance class 1;
    (ii) 7 per cent where the heliport is intended to be used by helicopters operated in performance class 2 or 3.

CS-HPT-DSN.B.110 Helicopter clearways

(+GM)

(a) Applicability: When provided, a helicopter clearway should be located beyond the end of the FATO.
(b) Characteristics:
  (1) The width of a helicopter clearway should not be less than that of the associated safety area (see Figure B-1).
  (2) The ground in a helicopter clearway should not project above a plane having an upward slope of 3 per cent, commencing at the periphery of the FATO.
  (3) An object situated in a helicopter clearway, which may endanger helicopters in the air, should be regarded as an obstacle and should be removed.

CS-HPT-DSN.B.120 Touchdown and lift-off areas (TLOFs)

(+GM)

(a) General:
  (1) At least one TLOF should be provided at a heliport.
  (2) One TLOF should be located within the FATO or one or more TLOFs should be collocated with

helicopter stands.

(b) Characteristics:

(1) A TLOF should be of sufficient size to contain a circle of diameter of at least 0.83 D of the largest helicopter the area is intended to serve.

(2) Where the TLOF is within the FATO, the TLOF should be dynamic load-bearing.

(3) Where a TLOF is collocated with a helicopter stand, the TLOF should be static load-bearing and be capable of withstanding the traffic of the helicopters that the area is intended to serve.

(4) Slopes on a TLOF should be sufficient to prevent accumulation of water on the surface of the area and should not exceed 2 per cent in any direction.

(5) Where a TLOF is located within a FATO which can contain a circle of diameter more than 1 D, the centre of the TLOF should be located not less than 0.5 D from the edge of the FATO.

CS-HPT-DSN.B.130 Safety areas

(+GM)

(a) General: A FATO should be surrounded by a safety area which need not be solid.

(b) Characteristics:

(1) A safety area surrounding a FATO should extend outwards from the periphery of the FATO for a distance of at least 3 m or 0.25 D, whichever is greater, of the largest helicopter the FATO is intended to serve and:

(i) each external side of the safety area should be at least 2 D where the FATO is quadrilateral (see Figure B-1); or

(ii) the outer diameter of the safety area should be at least 2 D where the FATO is circular.

(2) The surface of the safety area should be treated to prevent flying debris caused by rotor downwash.

(3) When solid, the surface of the safety area abutting the FATO should be continuous with the FATO.

(4) When solid, the surface of a safety area should not project above a plane having an upward slope of 4 per cent, commencing at the periphery of the FATO.

(5) From the outer edge of the safety area to a distance of 10 m there should be a protected side slope rising at 45 degrees.

(6) The protected side slope should not be penetrated by obstacles, except that when obstacles are located to one side of the FATO only, they may be permitted to penetrate the side slope surface.

(7) No mobile object should be permitted on a safety area during helicopter operations.

(8) No fixed object should be permitted above the plane of the FATO on a safety area, except for frangible objects which, because of their function, must be located on the area.

(9) Objects whose function requires them to be located on the safety area should not:

(i) if located at a distance of less than 0.75 D from the centre of the FATO, penetrate a plane at a height of 5 cm above the plane of the FATO; and

(ii) if located at a distance of 0.75 D or more from the centre of the FATO, penetrate a plane originating at a height of 25 cm above the plane of the FATO and sloping upwards and outwards at a gradient of 5 per cent.

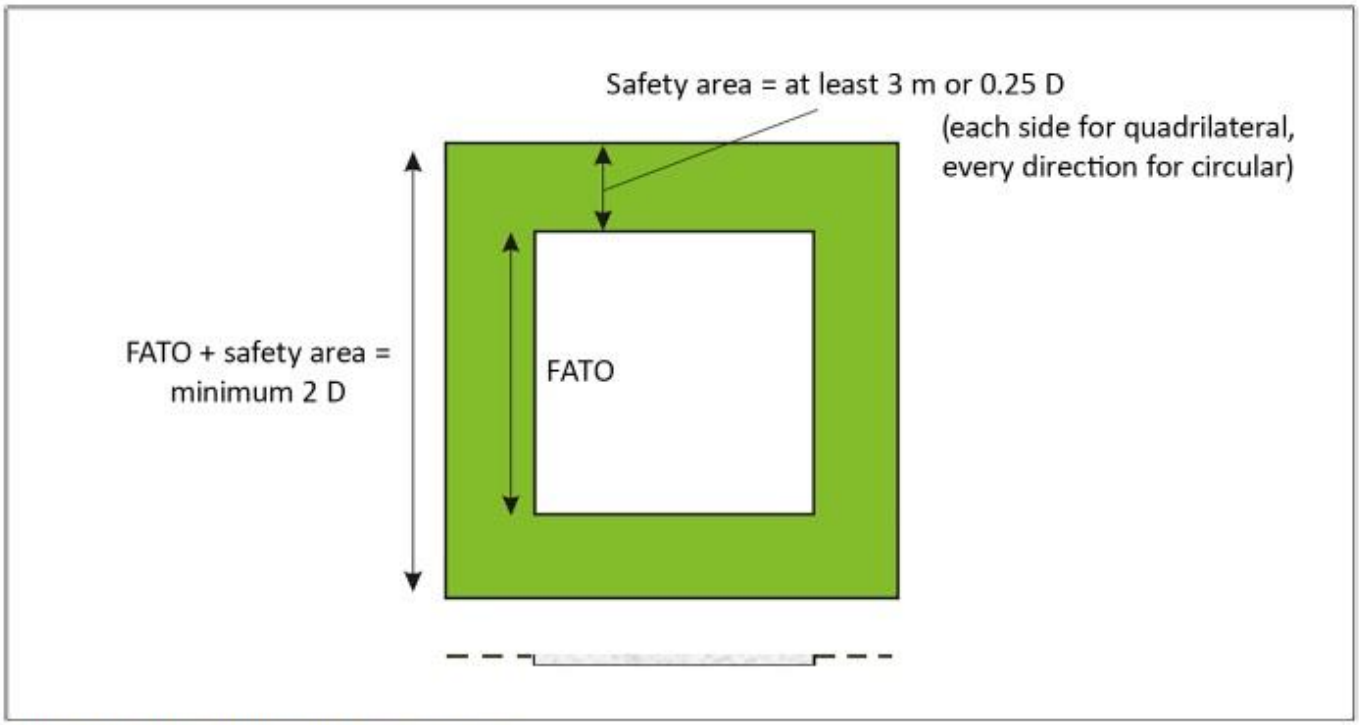


Figure B-1. FATO and associated safety area

CHAPTER C - HELICOPTER TAXIWAYS AND TAXI-ROUTES

CS-HPT-DSN.C.200 Helicopter ground taxiways and helicopter ground taxi-routes (+GM)

(a) General: A helicopter ground taxiway should be designed to permit the surface movement of a wheeled helicopter under its own power.

(b) Characteristics:

(1) The width of a helicopter ground taxiway should not be less than 1.5 times the largest width of the undercarriage (UCW) of the helicopters the helicopter ground taxiway is intended to serve (see Figure C-1).

(2) The longitudinal slope of a helicopter ground taxiway should not exceed 3 per cent.

(3) A helicopter ground taxiway should be static load-bearing and capable of withstanding the traffic of the helicopters the helicopter ground taxiway is intended to serve.

(4) A helicopter ground taxiway should be centred on a helicopter ground taxi-route.

(5) A helicopter ground taxi-route should extend symmetrically on each side of the centre line for at least 0.75 times the largest overall width of the helicopters it is intended to serve.

(6) No fixed object should be permitted above the surface on a helicopter ground taxi-route, except for frangible objects, which, because of their function, must be located there.

(7) No mobile object should be permitted on a ground taxi-route during helicopter movements.

(8) Objects whose function requires them to be located on a helicopter ground taxi-route should not:

(i) be located at a distance of less than 50 cm from the edge of the helicopter ground taxiway; and

(ii) penetrate a plane originating at a height of 25 cm above the plane of the helicopter ground taxiway, at a distance of 50 cm from the edge of the helicopter ground taxiway and sloping upwards and outwards at a gradient of 5 per cent.

(9) The helicopter ground taxiway and the helicopter ground taxi-route should provide rapid drainage but the transverse slope of a helicopter ground taxiway should not exceed 2 per cent.

(10) The surface of a helicopter ground taxi-route should be resistant to the effect of rotor downwash.

(11) For simultaneous operations, the helicopter ground taxi-routes should not overlap.

(c) NATO standard RWA taxiway width is 12m. This generic requirement may be replaced by the above specified values based on specific helicopter characteristics.

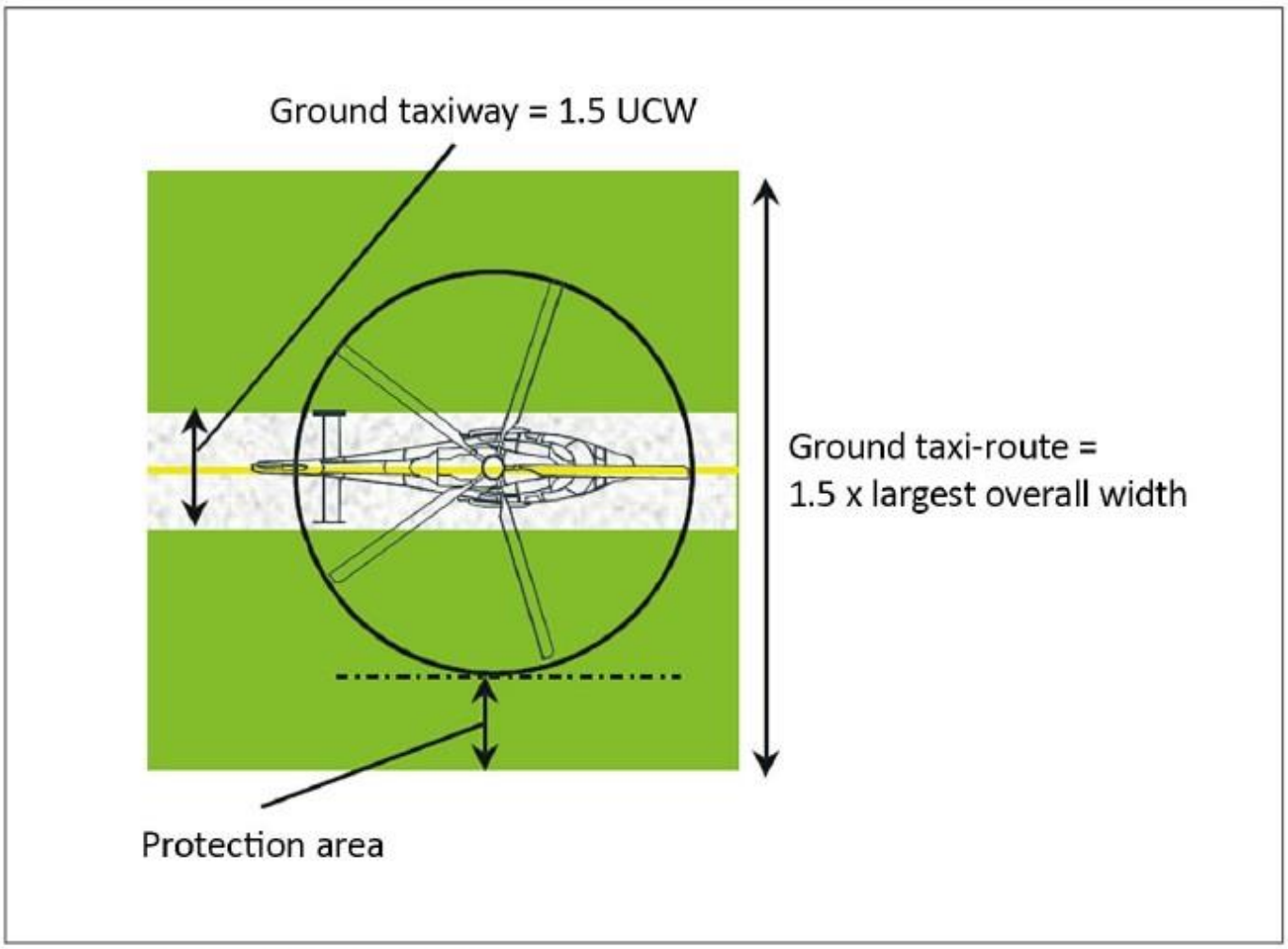


Figure C-1. Helicopter ground taxi-route/taxiway

CS-HPT-DSN.C.210 Helicopter air taxiways and helicopter air taxi-routes

(+GM)

(a) General: A helicopter air taxiway should be designed so as to permit the movement of a helicopter above the surface at a height normally associated with ground effect and at ground speed less than 37 km/h (20 kt).

(b) Characteristics:

(1) The width of a helicopter air taxiway should be at least two times the largest width of the undercarriage (UCW) of the helicopters that the helicopter air taxiway is intended to serve (see Figure C-2).

(2) The surface of a helicopter air taxiway should be static load-bearing.

(3) The slopes of the surface of a helicopter air taxiway should not exceed the slope landing limitations of the helicopters the helicopter air taxiway is intended to serve.

(4) The transverse slope of a helicopter air taxiway should not exceed 10 per cent.

(5) The longitudinal slope of a helicopter air taxiway should not exceed 7 per cent.

(6) A helicopter air taxiway should be centred on a helicopter air taxi-route.

(7) A helicopter air taxi-route should extend symmetrically on each side of the centre line for a distance at least equal to the largest overall width of the helicopters it is intended to serve.

(8) No fixed object should be permitted above the surface on an air taxi-route, except for frangible objects, which, because of their function, must be located there.

(9) No mobile object should be permitted on an air taxi-route during helicopter movements.

(10) Objects above ground level whose function requires them to be located on a helicopter air taxi route should not:

(i) be located at a distance of less than 1 m from the edge of the helicopter air taxiway, or at a distance of less than 0.5 times the largest overall width of the helicopter for which the helicopter air taxi-route is designed from the centre line of the helicopter air taxiway,

whichever is greater; and

(ii) penetrate a plane originating at a height of 25 cm above the plane of the helicopter air taxiway, and sloping upwards and outwards at a gradient of 5 per cent, at a distance of 1 m from the edge of the helicopter air taxiway, or at a distance of 0.5 times the largest overall width of the helicopter for which the helicopter air taxi-route is designed from the centreline of the helicopter air taxiway, whichever is lower.

(11) The surface of a helicopter air taxi-route should be resistant to the effect of rotor downwash.

(12) The surface of a helicopter air taxi-route should provide ground effect.

(13) For simultaneous operations, the helicopter air taxi-routes should not overlap.

(c) NATO standard RWA taxiway width is 12m. This generic requirement may be replaced by the above specified values based on specific helicopter characteristics.

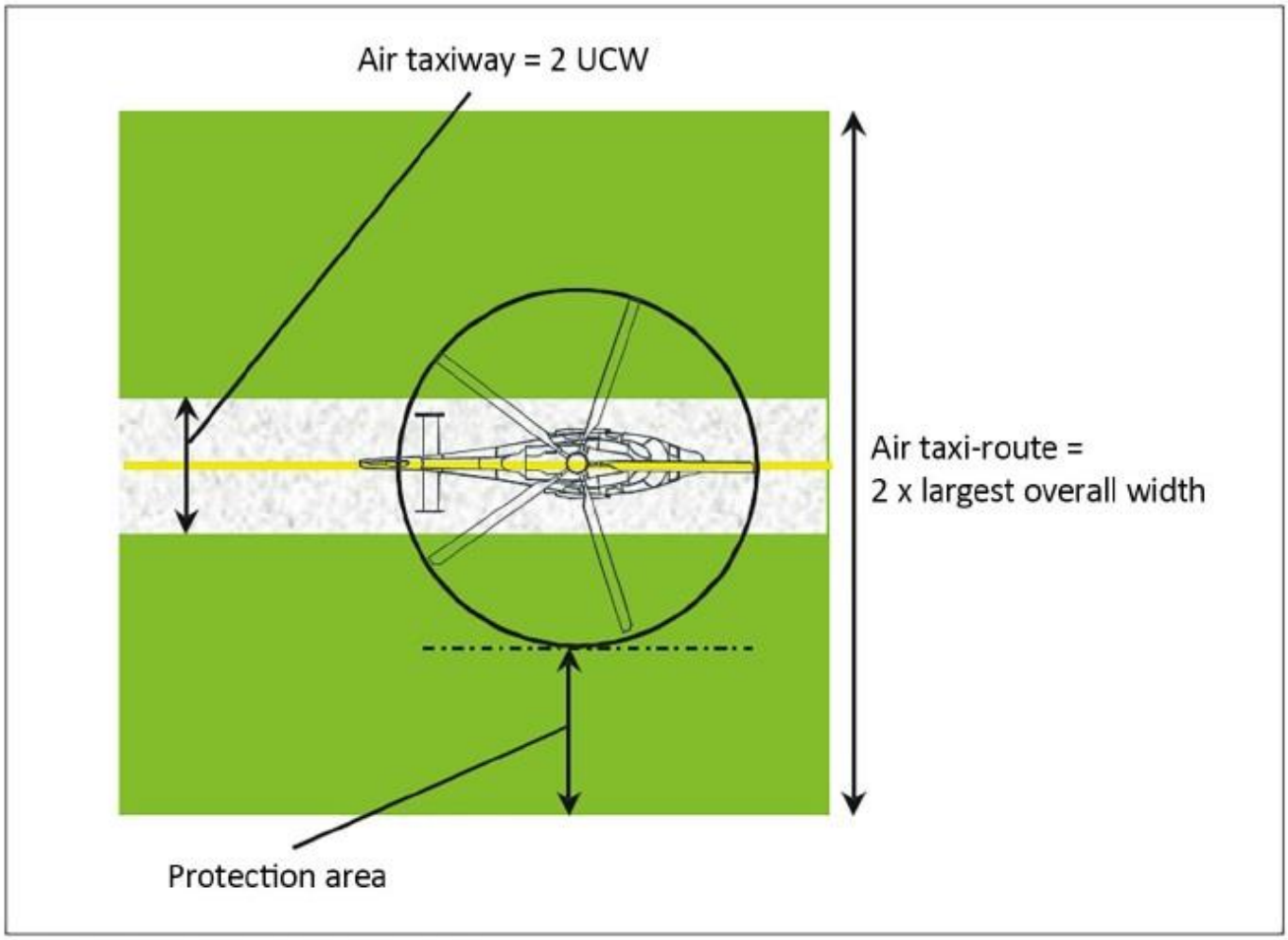


Figure C-2. Helicopter air taxi-route/taxiway

CS-HPT-DSN.D.300 Helicopter stands

(+GM)

(a) Characteristics:

(1) When a TLOF is collocated with a helicopter stand, the protection area of the stand should not overlap the protection area of any other helicopter stand or associated taxi route.

(2) A helicopter stand should provide rapid drainage.

(3) The slope of a helicopter stand in any direction should not exceed 2 per cent.

(4) When used by helicopters turning in a hover, a helicopter stand should be of sufficient size to contain a circle of diameter of at least 1.2 D of the largest helicopter the stand is intended to serve (see Figure D-1).

(5) Where a helicopter stand is intended to be used for taxi-through and where the helicopter using the stand is not required to turn, the minimum width of the stand and associated protection area should be that of the taxi-route.

(6) Where a helicopter stand is intended to be used for turning, the minimum overall dimension of the stand and protection area should not be less than 2 D.

(7) Where a helicopter stand is intended to be used for turning, the helicopter stand should be surrounded by a protection area which extends for a distance of 0.4 D from the edge of the helicopter stand.

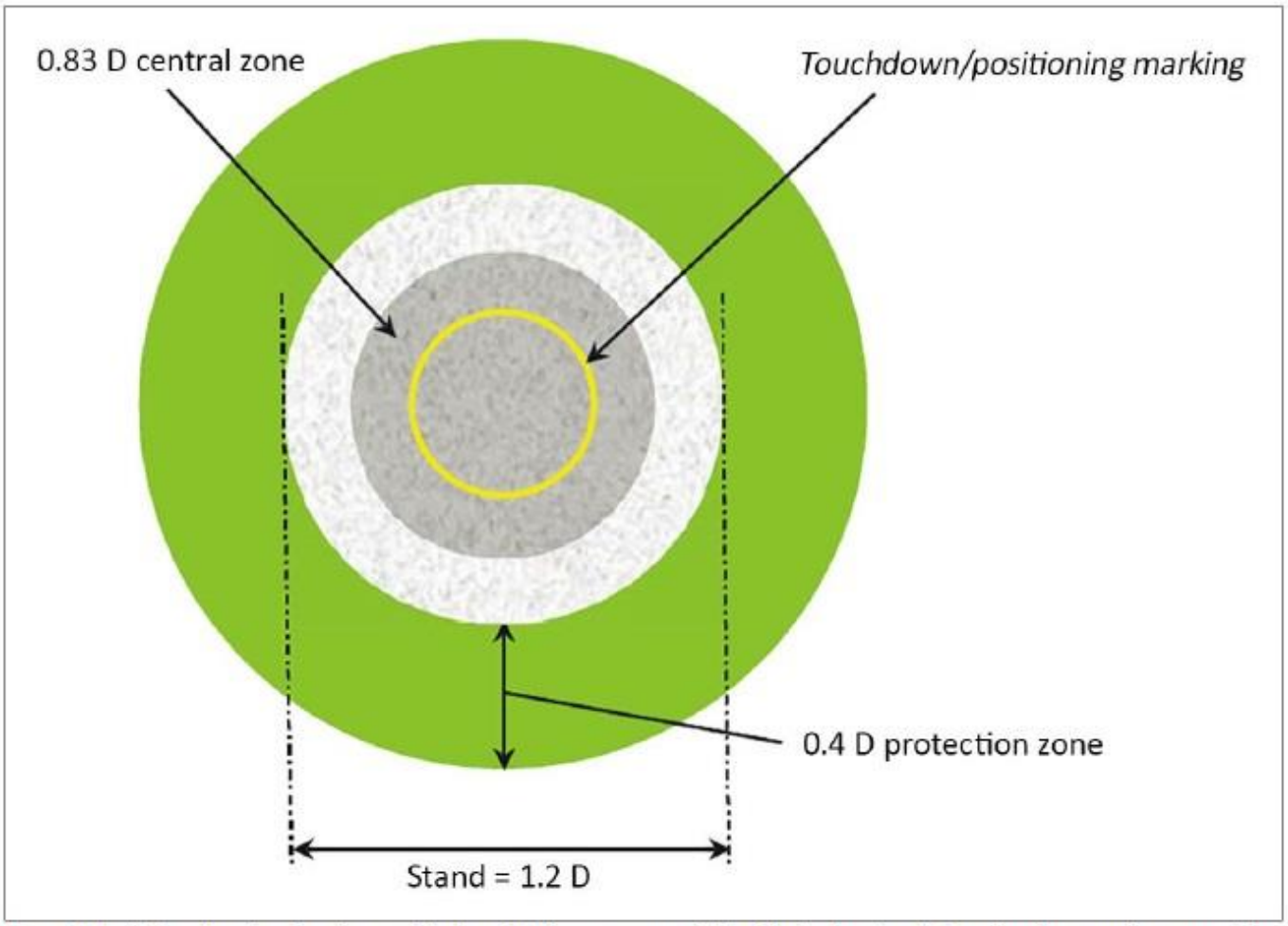


Figure D-1. Helicopter stand and associated protection area permitting the helicopter to turn in a hover when operating

(8) For simultaneous operations, the protection areas of helicopter stands and their associated taxi-routes should not overlap (see Figure D-2).

(9) A helicopter stand and the associated protection area intended to be used for air taxiing should provide ground effect.

(10) No fixed object should be permitted above the surface of the ground on a helicopter stand, except for tie-down points with a height of less than 5 cm, which can be accommodated if needed.
(11) No fixed object should be permitted above the surface of the ground in the protection area around a helicopter stand except for frangible objects which, because of their function, must be located there.
(12) No mobile object should be permitted on a helicopter stand and the associated protection area during helicopter movements.
(13) Objects whose function requires them to be located in the protection area at a distance of less than 0.75 D from the centre of the helicopter stand, should not exceed 5 cm in height.
(14) Objects whose function requires them to be located in the protection area should not:
(i) if located at a distance of less than 0.75 D from the centre of the helicopter stand, penetrate a plane at a height of 5 cm above the plane of the central zone; and
(ii) if located at a distance of 0.75 D or more from the centre of the helicopter stand, penetrate a plane at a height of 25 cm above the plane of the central zone and sloping upwards and outwards at a gradient of 5 per cent.
(15) The central zone of a helicopter stand should be capable of withstanding the traffic of helicopters it is intended to serve and have a static load-bearing area:
(i) of diameter not less than 0.83 D of the largest helicopter it is intended to serve; or
(ii) for a helicopter stand intended to be used for taxi-through, and where the helicopter using the stand is not required to turn, the same width as the helicopter ground taxiway.

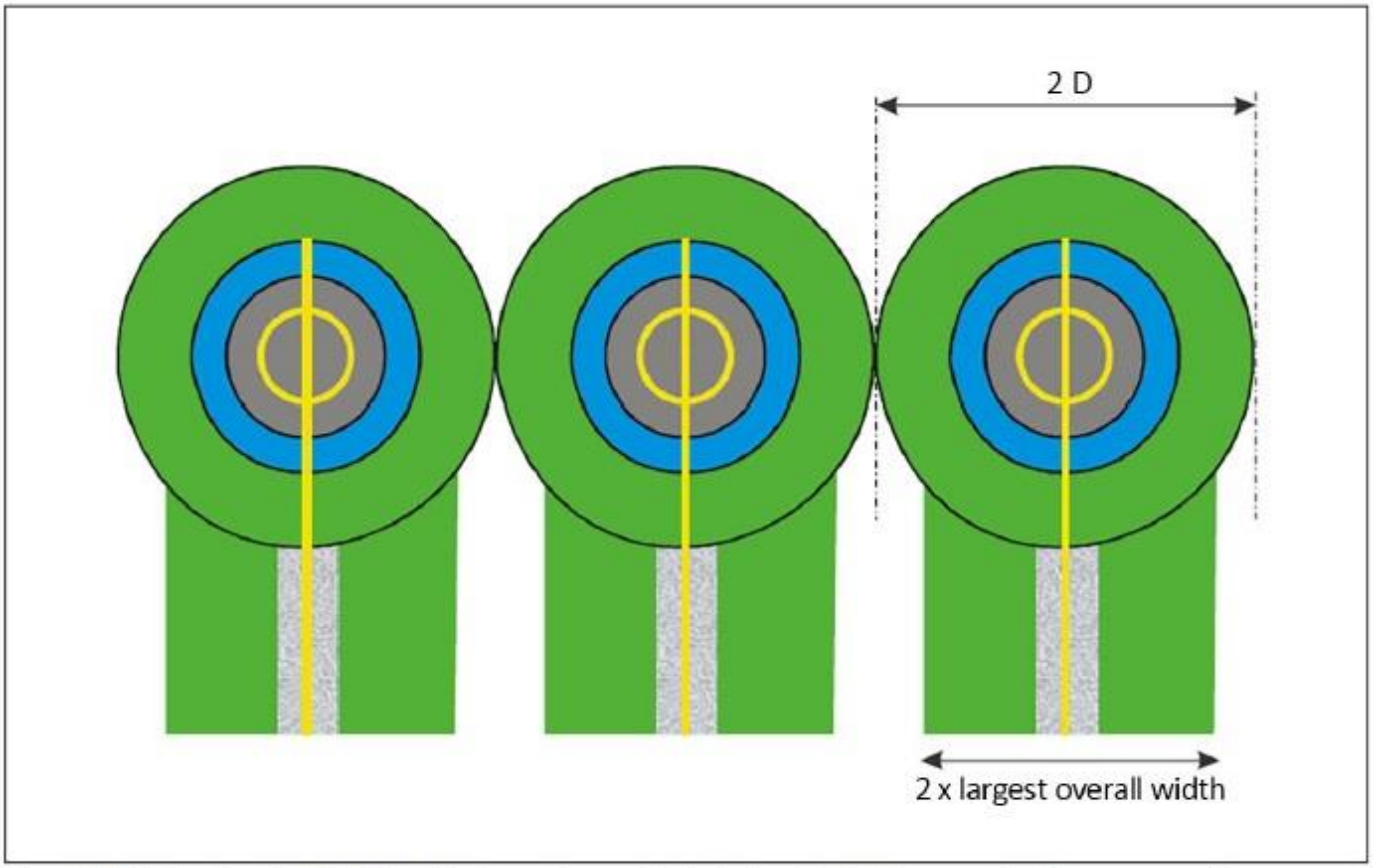


Figure D-2. Helicopter stands designed for hover turns with air taxi-routes/taxiways — simultaneous operations

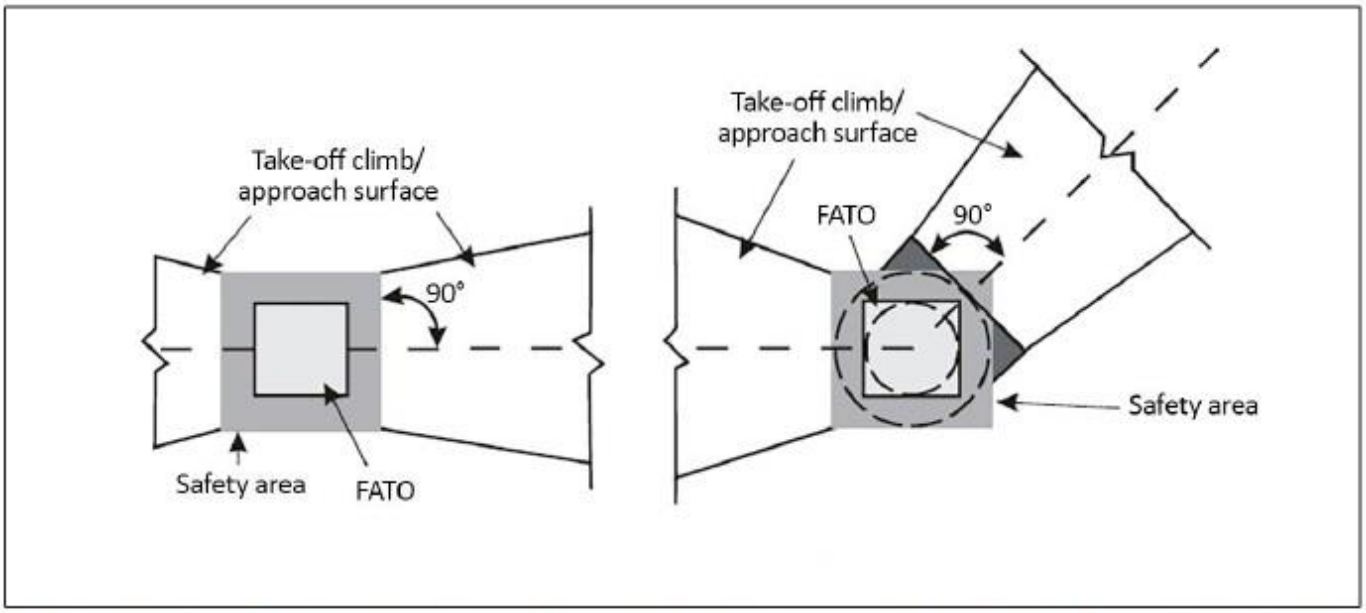
CS-HPT-DSN.E.400 Applicability

The purpose of the obstacle limitation surfaces is to define the airspace around heliports so as to permit intended helicopter operations to be conducted safely.

CS-HPT-DSN.E.410 Approach surface

(+GM)

(a) Applicability: The purpose of an approach surface is to protect a helicopter during the final approach to the FATO by defining an area that should be kept free from obstacles to protect a helicopter in the final phase of the approach to land manoeuvre.
(b) Description: An inclined plane or a combination of planes or, when a turn is involved, a complex surface sloping upwards from the end of the safety area and centred on a line passing through the centre of the FATO (see Figures E-1, E-2, E-3 and E-4 and Table E-1).
(c) Characteristics:
  (1) The limits of an approach surface should comprise:
    (i) an inner edge horizontal and equal in length to the minimum specified width/diameter of the FATO plus the safety area, perpendicular to the centre line of the approach surface and located at the outer edge of the safety area;
    (ii) two side edges originating at the ends of the inner edge diverging uniformly at a specified rate from the vertical plane containing the centre line of the FATO; and
    (iii) an outer edge horizontal and perpendicular to the centre line of the approach surface and at a specified height of 152 m (500 ft) above the elevation of the FATO.
  (2) The elevation of the inner edge should be the elevation of the FATO at the point on the inner edge that is intersected by the centre line of the approach surface. For heliports intended to be used by helicopters operated in performance class 1, the inclined plane may be raised directly above the FATO.
  (3) The slope(s) of the approach surface should be measured in the vertical plane containing the centre line of the surface.
  (4) In the case of an approach surface involving a turn, the surface should be a complex surface containing the horizontal normals to its centre line and the slope of the centre line should be the same as that for a straight approach surface (see Figure E-3).
  (5) In the case of an approach surface involving a turn, the surface should not contain more than one curved portion.
  (6) Where a curved portion of an approach surface is provided, the sum of the radius of the arc defining the centre line of the approach surface and the length of the straight portion originating at the inner edge should not be less than 575 m.
  (7) Any variation in the direction of the centre line of an approach surface should be designed so as not to necessitate a turn radius less than 270 m.



Note 1 - Dark grey shaded area requires the same characteristics as the safety area

Note 2 - Angle between take-off climb/ approaches surfaces from centreline to centreline depicted for illustration purposes only

Note 3 - Offset take-off climb/approach surface rotated around centre point of FATO

Figure E-1. Obstacle limitation surfaces — Take-off climb and approach surface

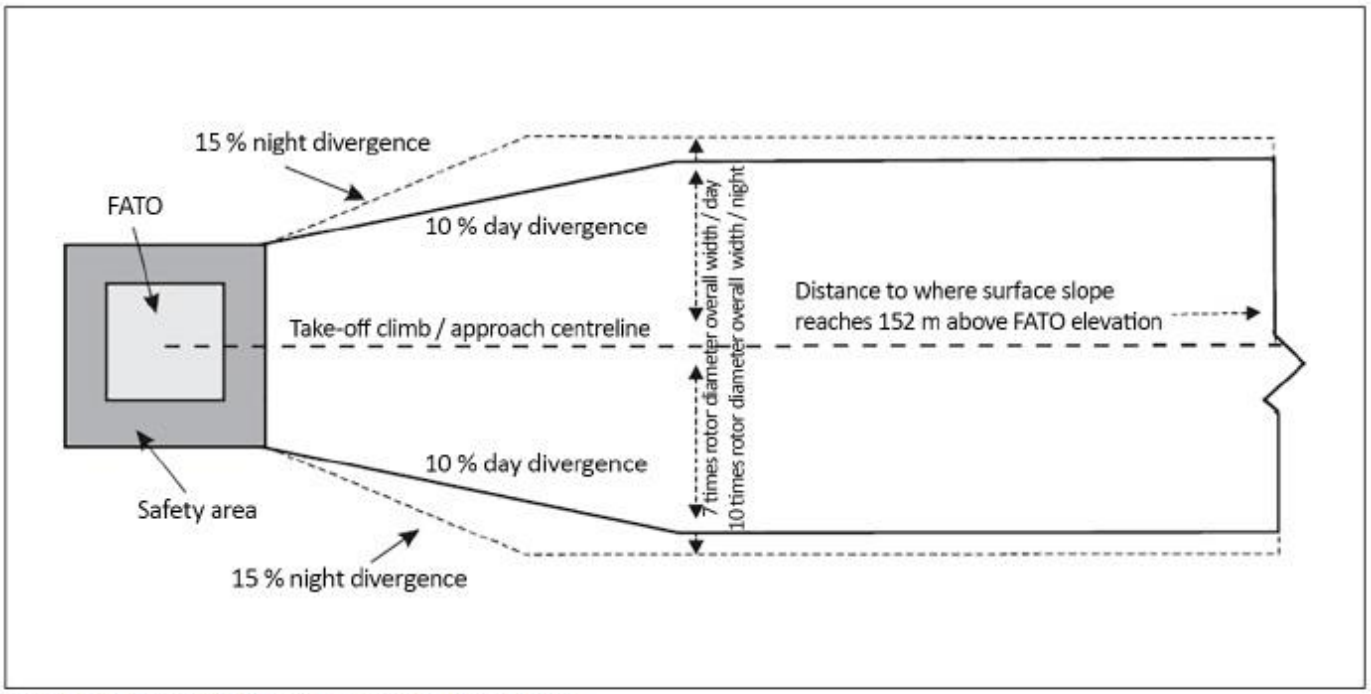
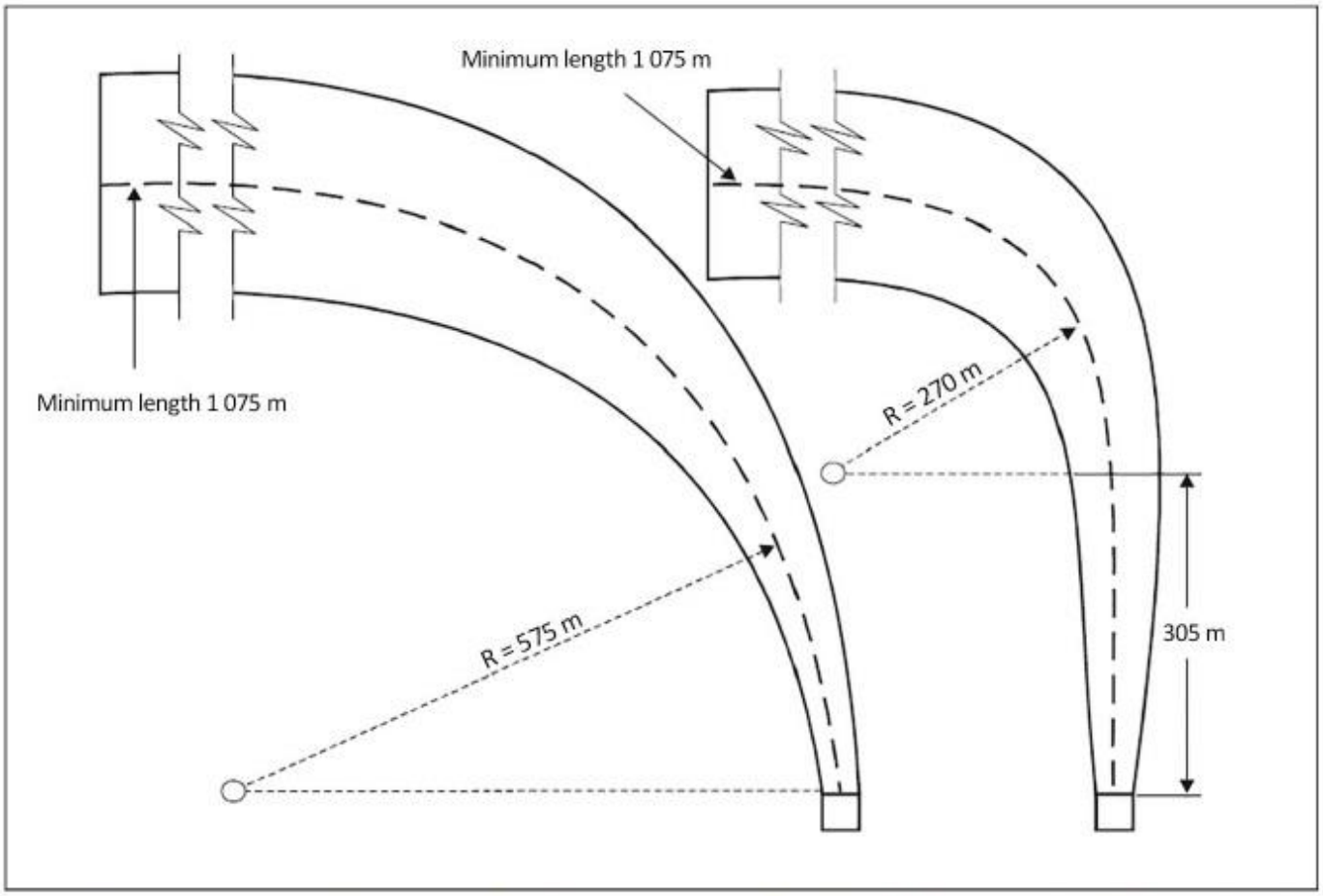


Figure E-2. Take-off climb/approach surface width



Note 1 - Any combination of curve and straight portion may be established using the following formula: S+R ≥ 575 m and R ≥ 270 m where S = 305 m, where S is the length of the straight portion and R is the radius of turn. Note any combination ≥ 575 m will work.

Note 2 - The minimum length of the centre line of the curve and straight portion is 1 075 m but may be longer depending upon the slope used. See table E-1 for longer lengths.

Note 3 - Helicopter take-off performance is reduced in a curve and as such a straight portion along the take-off climb surface prior to the start of the curve should be considered to allow for acceleration.

Figure E-3. Curved approach and take-off climb surface for all FATOs

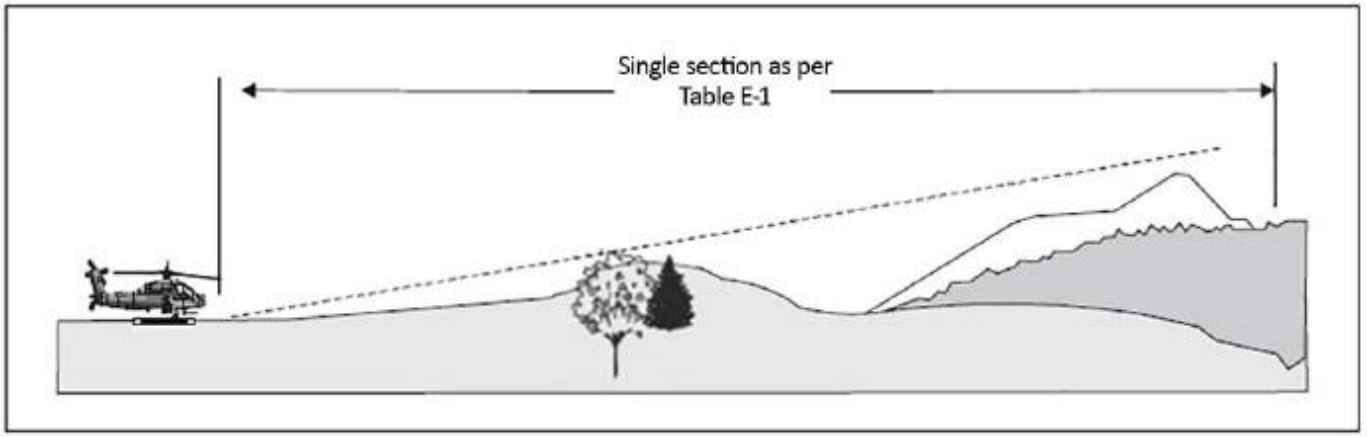
SURFACE AND DIMENSIONS	SLOPE DESIGN CATEGORIES		
	A	B	C
APPROACH AND TAKE-OFF CLIMB SURFACE:			
Length of inner edge	Width of safety area	Width of safety area	Width of safety area
Location of inner edge	Safety area boundary (Clearway boundary if provided)	Safety area boundary	Safety area boundary
Divergence: (1st and 2nd section)			
Day use only	10 %	10 %	10 %
Night use	15 %	15 %	15 %
First section:			
Length	3 386 m	245 m	1 220 m
Slope	4.5 % (1:22.2)	8 % (1:12.5)	12.5 % (1:8)
Outer width	(b)	N/A	(b)
Second section:			
Length	N/A	830 m	N/A
Slope	N/A	16 % (1:6.25)	N/A
Outer width	N/A	(b)	N/A
Total length from inner edge (a)	3 386 m	1 075 m	1 220 m

(a) The approach and take-off climb surface lengths of 3 386 m, 1 075 m and 1 220 m associated with the respective slopes, bring the helicopter to 152 m (500 ft) above FATO elevation.

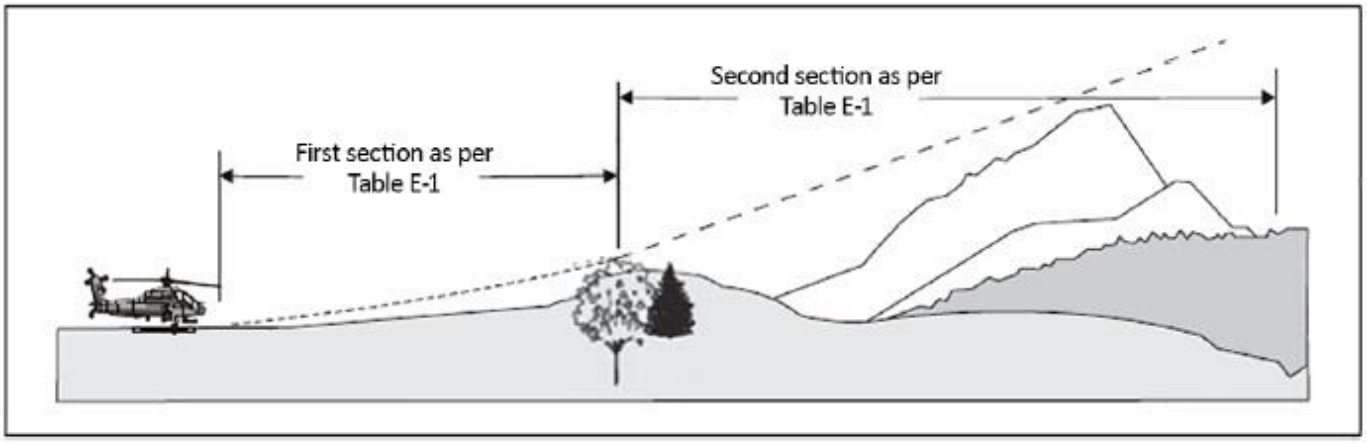
(b) 7 rotor diameters overall width for day operations or 10 rotor diameters overall width for night operations.

Note:
The slope design categories depicted above represent minimum design slope angles and not operational slopes. Slope category 'A' generally corresponds with helicopters operated in performance class 1; slope category 'B' generally corresponds with helicopters operated in performance class 3; and slope category 'C' generally corresponds with helicopters operated in performance class 2.

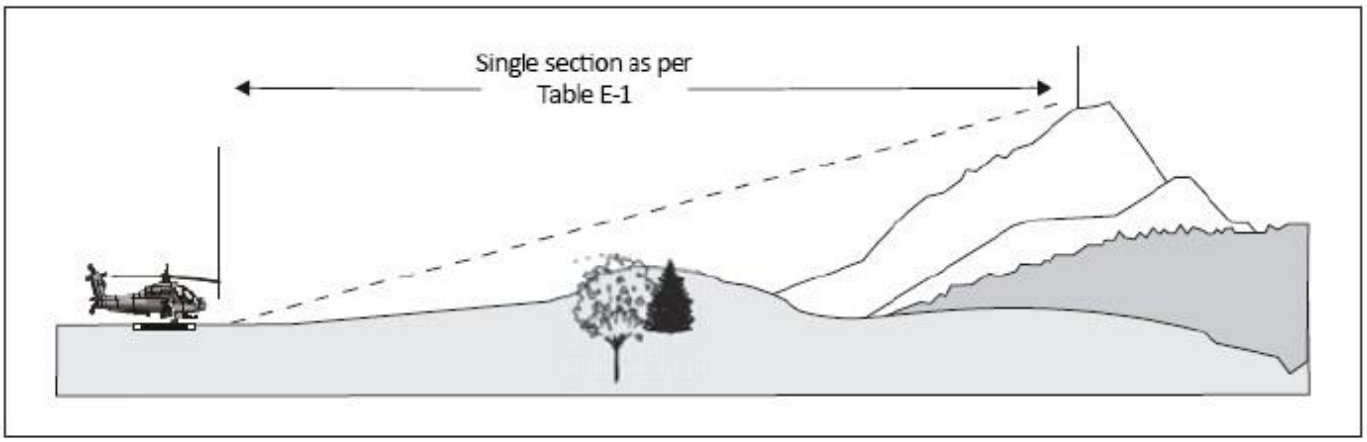
Table E-1. Dimensions and slopes of obstacle limitation surfaces for all visual FATOs



a) Approach and take-off climb surfaces – "A" slope profile – 4.5 % design



b) Approach and take-off climb surfaces – "B" slope profile – 8 % and 16 % design



c) Approach and take-off climb surfaces – "C" slope profile – 12.5 % design

Figure E-4. Approach and take-off climb surfaces with different slope design categories

CS-HPT-DSN.E.420 Take-off climb surface

(+GM)

(a) Applicability: The purpose of the take-off climb surface is to protect a helicopter on take-off and during climb-out.

(b) Description: An inclined plane, a combination of planes or, when a turn is involved, a complex

surface sloping upwards from the end of the safety area and centred on a line passing through the centre of the FATO (see Figures E-1, E-2, E-3, and E-4, and Table E-1).

(c) Characteristics:

(1) The limits of a take-off climb surface should comprise:

(i) an inner edge horizontal and equal in length to the minimum specified width/diameter of the FATO plus the safety area, perpendicular to the centre line of the take-off climb surface and located at the outer edge of the safety area;

(ii) two side edges originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centre line of the FATO; and

(iii) an outer edge horizontal and perpendicular to the centre line of the take-off climb surface and at a specified height of 152 m (500 ft) above the elevation of the FATO.

(2) The elevation of the inner edge should be the elevation of the FATO at the point on the inner edge that is intersected by the centre line of the take-off climb surface. For heliports intended to be used by helicopters operated in performance class 1, the inclined plane may be raised directly above the FATO.

(3) Where a clearway is provided the elevation of the inner edge of the take-off climb surface should be located at the outer edge of the clearway at the highest point on the ground based on the centre line of the clearway.

(4) In the case of a straight take-off climb surface, the slope should be measured in the vertical plane containing the centre line of the surface.

(5) In the case of a take-off climb surface involving a turn, the surface should be a complex surface containing the horizontal normals to its centre line and the slope of the centre line should be the same as that for a straight take-off climb surface (see Figure E-3).

(6) In the case of a take-off climb surface involving a turn, the surface should not contain more than one curved portion.

(7) Where a curved portion of a take-off climb surface is provided, the sum of the radius of the arc defining the centre line of the take-off climb surface and the length of the straight portion originating at the inner edge should not be less than 575 m.

(8) Any variation in the direction of the centre line of a take-off climb surface should be designed so as not to necessitate a turn of radius less than 270 m.

CS-HPT-DSN.E.430 Obstacle limitation requirements

(a) General: The following obstacle limitation surfaces should be established for a FATO:

(1) take-off climb surface; and

(2) approach surface.

(b) Characteristics:

(1) The slopes of the obstacle limitation surfaces should not be greater than, and their other dimensions not less than, those specified in Table E-1 and should be located as shown in Figures E-1, E-2 and E-4.

(2) Where a heliport visual approach slope indicator is installed, additional obstacle protection surfaces should be provided, as specified in CS-HPT-DSN.F.660, which can be more demanding than the obstacle limitation surfaces prescribed in Table E-1.

(3) For heliports that have an approach/take-off climb surface with a 4.5 per cent slope design, objects can be permitted to penetrate the obstacle limitation surface, if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of helicopters.

(4) New objects or extensions of existing objects should not be permitted above the approach or take-off climb surfaces except when shielded by an existing immovable object or when after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of helicopters.

(5) Existing objects above the approach and take off climb surfaces should, as far as practicable, be removed except when the object is shielded by an existing immovable object or when after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of helicopters.

(6) When only a single approach and take-off climb surface is provided, a safety assessment should be undertaken considering as a minimum, the following factors:

(i) the area/terrain over which the flight is being conducted;

(ii) the obstacle environment surrounding the heliport;

(iii) the performance and operating limitations of helicopters intending to use the heliport; and
(iv) the local meteorological conditions including the prevailing winds.

CS-HPT-DSN.F.500 General

(+GM)

(a) When a FATO has similar characteristics to a runway, the applicable CSs are provided in the paragraphs below entitled 'runway-type FATO'.
(b) For all other types of FATO, the applicable CSs are provided in the paragraphs below entitled 'All FATOs except runway-type FATOs'.
(c) When NVG/NVS are used during helicopter operations, deviations from the requirements for visual aids (lighting systems) can be approved by MAA-NLD.

CS-HPT-DSN.F.510 Wind direction indicators

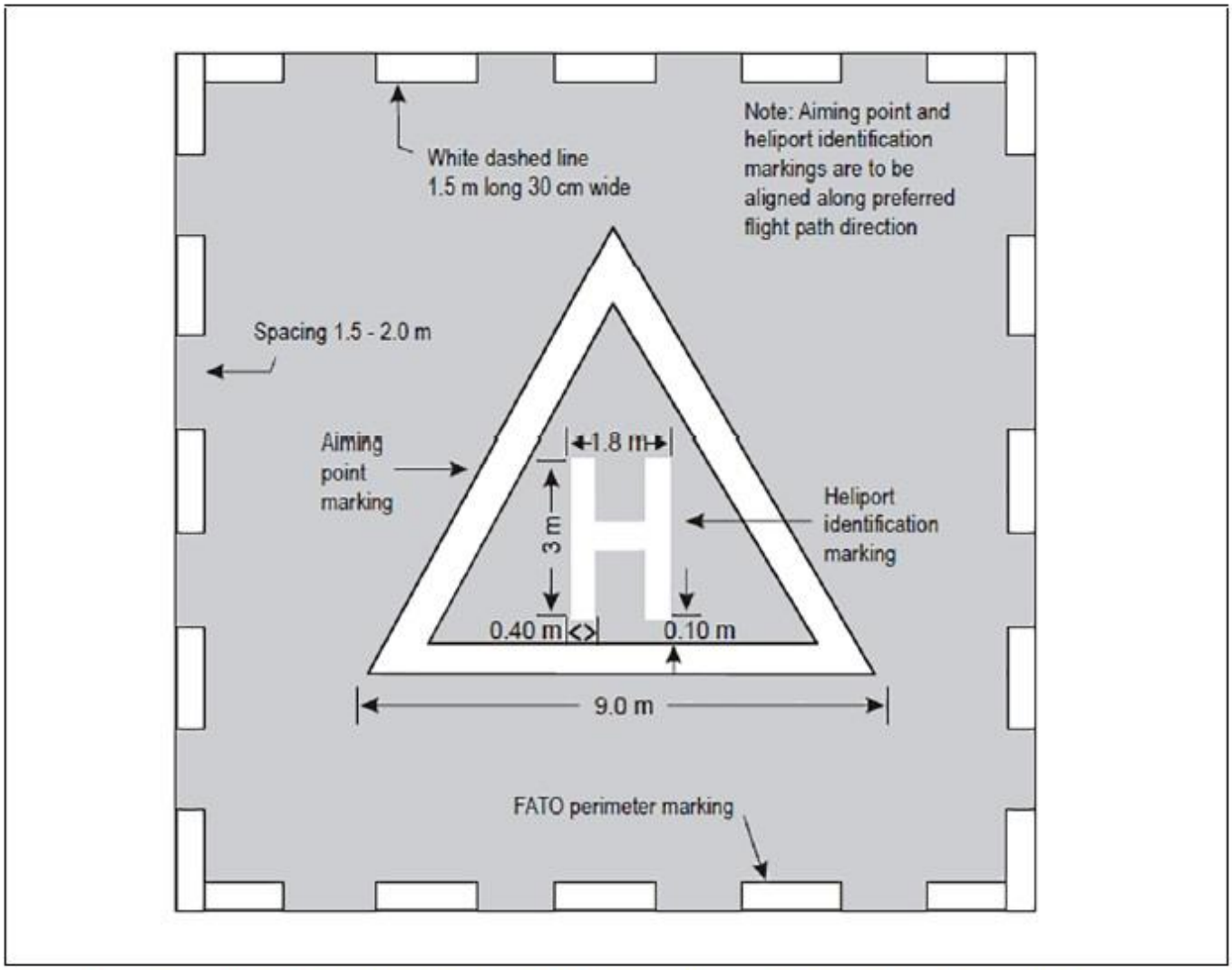
(+GM)

Applicability: A heliport should be equipped with at least one wind direction indicator.

CS-HPT-DSN.F.520 Heliport identification marking

(+GM)

(a) Applicability: Heliport identification markings should be provided at a heliport.
(b) Location:
    (1) For runway-type FATOs:
        A heliport identification marking should be located in the FATO and when used in conjunction with FATO designation markings, should be displayed at each end of the FATO (see Figure F-2).
    (2) For all FATOs except runway-type FATOs:
        (i) A heliport identification marking should be located at or near the centre of the FATO (see Figure F-1).
        (ii) On a FATO which contains a TLOF, a heliport identification marking should be located in the FATO so that the position of it coincides with the centre of the TLOF.
(c) Characteristics:
    (1) A heliport identification marking should consist of a letter 'H', white in colour. The dimensions of the 'H' marking should be no less than those shown in Figure F-3.
    (2) Where the 'H' marking is used for a runway-type FATO, its dimensions should be increased by a factor of 3 (see Figures F-2 and F-3).
    (3) A heliport identification marking should be oriented with the cross arm of the 'H' at right angles to the preferred final approach direction.



Note: The aiming point, heliport identification and FATO perimeter markings are white and may be edged with a 10 cm black border to improve contrast

Figure F-1. Combined heliport identification, aiming point and FATO perimeter marking

Figure F-2. FATO designation marking and heliport identification marking for a runway-type FATO

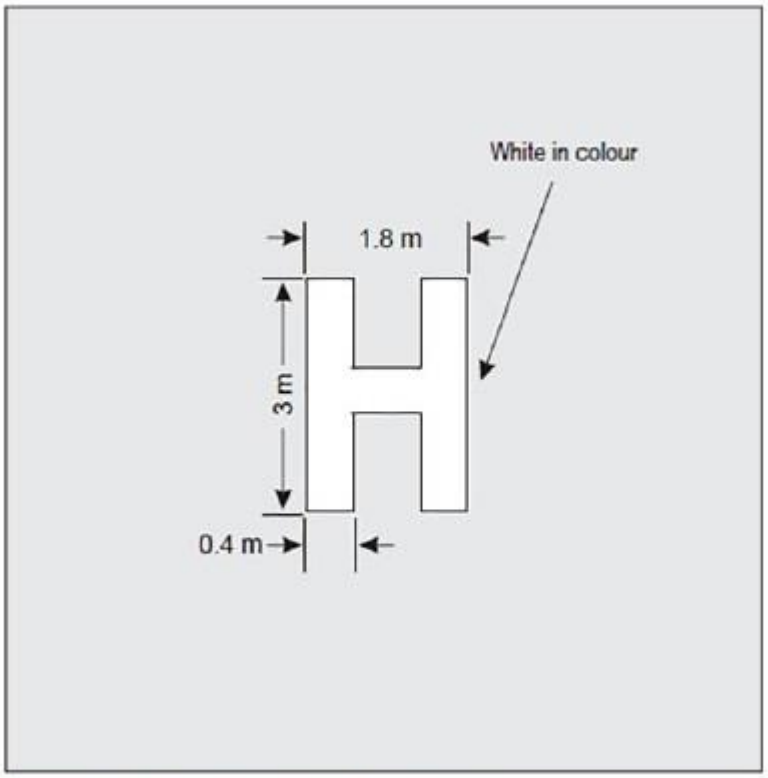


Figure F-3. Heliport identification marking

CS-HPT-DSN.F.530 Final approach and take-off area perimeter marking or markers

(+GM)

(a) Applicability: FATO perimeter marking or markers should be provided where the extent of the FATO is not self-evident.
(b) Location: The FATO perimeter marking or markers should be located on the edge of the FATO.
(c) Characteristics:
  (1) For runway-type FATOs:
    (i) The perimeter of the FATO should be defined with markings or markers spaced at equal intervals of not more than 50 m with at least three markings or markers on each side including a marking or marker at each corner.
    (ii) A FATO perimeter marking should be a rectangular stripe with a length of 9 m or one-fifth of the side of the FATO which it defines and a width of 1 m.
    (iii) FATO perimeter markings should be white.
    (iv) FATO perimeter markers should be of a colour (or colours) that contrasts (contrast) effectively against the operating background.
(d) For all FATOs except runway-type FATOs:
    (i) For an unpaved FATO, the perimeter should be defined with flush in-ground markers. The FATO perimeter markers should be 30 cm in width, 1.5 m in length, and with end-to-end spacing of not less than 1.5 m and not more than 2 m. The corners of a square or rectangular FATO should be defined.
    (ii) For a paved FATO, the perimeter should be defined with a dashed line. The FATO perimeter marking segments should be 30 cm in width, 1.5 m in length, and with end-to-end spacing of not less than 1.5 m and not more than 2 m. The corners of the square or rectangular FATO should be defined.
    (iii) FATO perimeter markings and flush in-ground markers should be white.

CS-HPT-DSN.F.540 Final approach and take-off area designation marking

(+GM)

(a) Applicability: A FATO designation marking should be provided on a runway-type FATO at a heliport where it is necessary to designate the FATO to the pilot.

(b) Location: Where provided, a FATO designation marking should be located at the beginning of the runway-type FATO (see Figure F-2).
(c) Characteristics: A FATO designation marking should consist of a two-digit number. The two-digit number should be the whole number nearest the one-tenth of the magnetic North when viewed from the direction of approach. When the above rule would give a single digit number, it should be preceded by a zero (see Figure F-2).

CS-HPT-DSN.F.550 Aiming point marking

(+GM)

(a) The safety objective of an aiming point marking is to provide a visual cue indicating to the pilot the preferred approach/departure direction, to the point to which the helicopter approaches to hover before positioning to a stand where a touchdown should be made, and that the surface of the FATO is not intended for touchdown.
(b) Location: Where provided, the aiming point marking should be located within the FATO (see Figure F-1).
(c) Characteristics:
    (i) The aiming point marking should be an equilateral triangle with a minimum side length of 9.0 metres, with the bisector of one of the angles aligned with the preferred approach direction.
    (ii) The marking should consist of continuous white lines, 1.0 m in width (see Figures F-1 and F-12).

CS-HPT-DSN.F.560 Touchdown and lift-off area perimeter marking

(+GM)

(a) The safety objective of the touchdown and lift-off area perimeter marking is to provide to the pilot a clear indication of a TLOF.
(b) Applicability: When the perimeter of the TLOF is not self-evident, a TLOF perimeter marking should be displayed on a TLOF located in a FATO.
(c) Location: Where provided, the TLOF perimeter marking should be located along the edge of the TLOF.
(d) Characteristics: A TLOF perimeter marking should consist of a continuous white line with a width of at least 30 cm.

CS-HPT-DSN.F.570 Touchdown/positioning marking

(a) Applicability:
    (1) A touchdown/positioning marking should be provided where it is necessary for a helicopter to touch down and/or be accurately positioned.
    (2) A touchdown/positioning marking should be provided on a helicopter stand designed for turning.
(b) Location:
    (1) A touchdown/positioning marking should be located so that when the pilot's seat is over the marking, the whole of the undercarriage should be within the TLOF and all parts of the helicopter should be clear of any obstacle by a safe margin.
    (2) On a heliport, the centre of the touchdown/positioning marking should be located at the centre of the TLOF, except the centre of the touchdown/positioning marking may be offset away from the centre of the TLOF where a safety assessment indicates such offsetting to be necessary, and providing that a marking that is so offset would not adversely affect safety.
    (3) For a helicopter stand designed for hover turning, the touchdown/positioning marking should be located in the centre of the central zone (see Figure D-1).
(c) Characteristics:
    (1) A touchdown/positioning marking should be a yellow circle and have a line width of at least 0.5 m.
    (2) The inner diameter of the touchdown/positioning marking should be 0.5 D of the largest helicopter the TLOF and/or the helicopter stand is intended to serve.

CS-HPT-DSN.F.580 Heliport name marking
(+GM)

(a) Applicability: A heliport name marking should be provided at a heliport where there is insufficient alternative means of visual identification.
(b) Characteristics: A heliport name marking should consist of the name or the alphanumeric designator of the heliport as used in radio (R/T) communications.

CS-HPT-DSN.F.590 Helicopter ground taxiway markings and markers
(+GM)

(a) Applicability:
  (1) The specifications for runway-holding position markings defined in CS-ADR-DSN.L.575 and for intermediate holding position marking defined in CS-ADR-DSN.L.580 are equally applicable to taxiways intended for ground taxiing of helicopters.
  (2) The centre line of a helicopter ground taxiway should be identified with a marking.
  (3) The edges of a helicopter ground taxiway, if not self-evident, should be identified with markers or markings.
(b) Location:
  (1) Helicopter ground taxiway markings should be along the centre line, and, if provided, along the edges of a helicopter ground taxiway.
  (2) Helicopter ground taxiway edge markers should be located at a distance of 0.5 m to 3 m beyond the edge of the helicopter ground taxiway.
  (3) Where provided, helicopter ground taxiway edge markers should be spaced at intervals of not more than 15 m on each side of straight sections and 7.5 m on each side of curved sections with a minimum of four equally spaced markers per section.
(c) Characteristics:
  (1) A helicopter ground taxiway centre line marking should be a continuous yellow line 15 cm in width.
  (2) Helicopter ground taxiway edge markings should be a continuous double yellow line, each 15 cm in width, and spaced 15 cm apart (nearest edge to nearest edge).
  (3) A helicopter ground taxiway edge marker should not exceed the height of a plane originating at a height of 25 cm above the plane of the helicopter ground taxiway, at a distance of 0.5 m from the edge of the helicopter ground taxiway and sloping upwards and outwards at a gradient of 5 per cent to a distance of 3 m beyond the edge of the helicopter ground taxiway.
  (4) Helicopter ground taxiway edge markers should be frangible to the wheeled undercarriage of helicopters.
  (5) A helicopter ground taxiway edge marker should be blue.
  (6) If the helicopter ground taxiway is to be used at night, the edge markers should be internally illuminated or retro-reflective.

CS-HPT-DSN.F.600 Helicopter air taxiway markings and markers
(+GM)

(a) Applicability:
  (1) The specifications for runway-holding position markings defined in CS-ADR-DSN.L.575 and intermediate holding position marking defined in CS-ADR-DSN.L.580 are equally applicable to taxiways intended for air taxiing of helicopters.
  (2) The centre line of a helicopter air taxiway or, if not self-evident, the edges of a helicopter air taxiway, should be identified with markers or markings.
(b) Location:
  (1) A helicopter air taxiway centre line marking or flush in-ground centre line marker should be located along the centre line of the helicopter air taxiway.
  (2) Helicopter air taxiway edge markings should be located along the edges of a helicopter air taxiway.
  (3) Helicopter air taxiway edge markers should be located at a distance of 1 m to 3 m beyond the edge of the helicopter air taxiway.
(c) Characteristics:
  (1) A helicopter air taxiway centre line should be marked with a continuous yellow line 15 cm in

width, when on a paved surface.

(2) The edges of a helicopter air taxiway, when on a paved surface, should be marked with continuous double yellow lines each 15 cm in width, and spaced 15 cm apart (nearest edge to nearest edge).

(3) Where a helicopter air taxiway is located on an unpaved surface and painted markings of a helicopter air taxiway centre line cannot be provided, it should be marked with flush in-ground 15 cm wide and approximately 1.5 m in length yellow markers, spaced at intervals of not more than 30 m on straight sections and not more than 15 m on curves, with a minimum of four equally spaced markers per section.

(4) Helicopter air taxiway edge markers, where provided, should be spaced at intervals of not more than 30 m on each side of straight sections and not more than 15 m on each side of curves, with a minimum of four equally spaced markers per section.

(5) Helicopter air taxiway edge markers should be frangible.

(6) Helicopter air taxiway edge markers should not penetrate a plane originating at a height of 25 cm above the plane of the helicopter air taxiway, at a distance of 1 m from the edge of the helicopter air taxiway and sloping upwards and outwards at a gradient of 5 per cent to a distance of 3 m beyond the edge of the helicopter air taxiway.

(7) A helicopter air taxiway edge marker should be of a colour (or colours) that contrasts (contrast) effectively against the operating background. The red colour should not be used for markers.

(8) If the helicopter air taxiway is to be used at night, helicopter air taxiway edge markers should be either internally illuminated or retro-reflective.

CS-HPT-DSN.F.610 Helicopter stand markings

(+GM)

(a) Applicability:

(1) A helicopter stand perimeter marking should be provided on a helicopter stand designed for turning. If a helicopter stand perimeter marking is not practicable, a central zone perimeter marking should be provided instead if the perimeter of the central zone is not self-evident.

(2) For a helicopter stand that is intended to be used for taxi-through and which does not allow a helicopter to turn, a stop line should be provided.

(3) Alignment lines and lead-in/lead-out lines should be provided on a helicopter stand (see Figures F-4 and F-5).

(b) Location:

(1) A helicopter stand perimeter marking on a helicopter stand designed for turning or, a central zone perimeter marking, should be concentric with the central zone of the stand.

(2) For a helicopter stand that is intended to be used for taxi-through and which does not allow the helicopter to turn, a stop line should be located on the helicopter ground taxiway axis at right angles to the centre line.

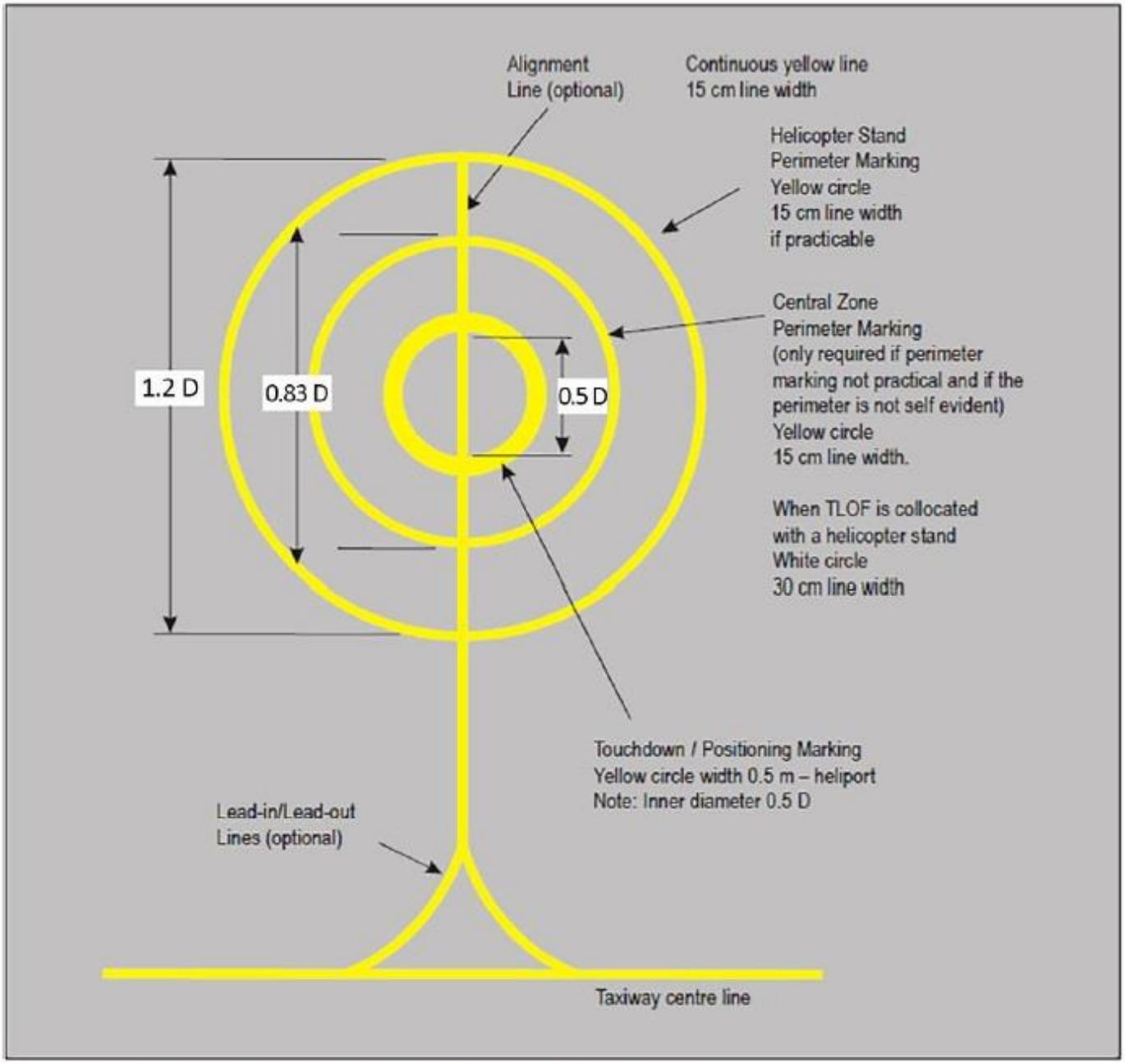


Figure F-4. Helicopter stand markings at a stand designated for hover turning

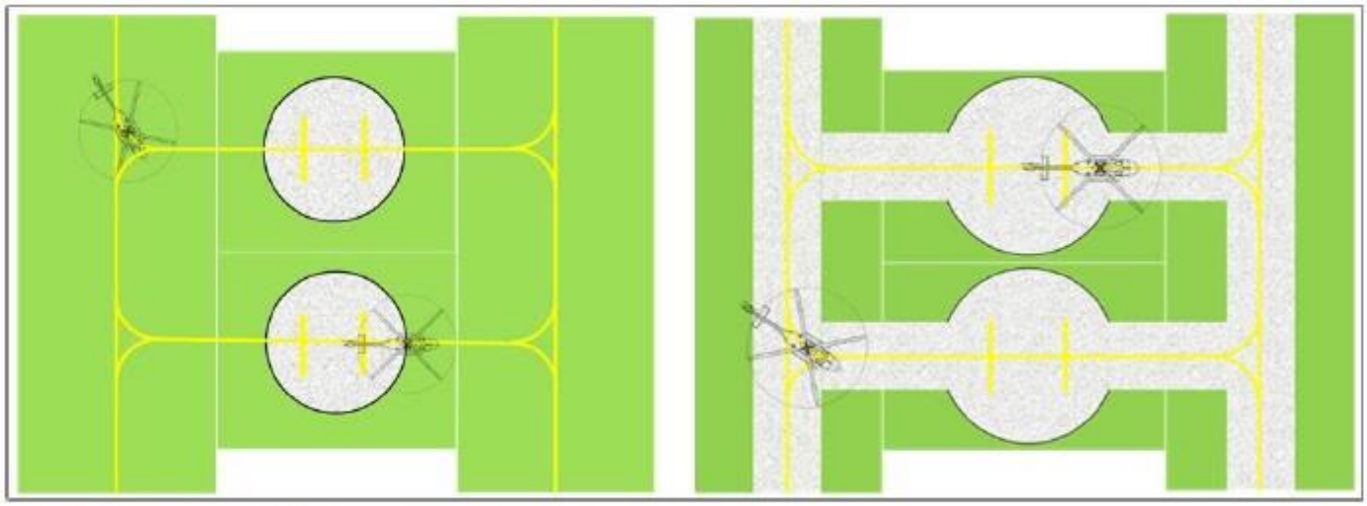


Figure F-5. Taxi through helicopter stand markings

(c) Characteristics:
(1) A helicopter stand perimeter marking should be a yellow circle and have a line width of 15 cm.
(2) A central zone perimeter marking should be a yellow circle and have a line width of 15 cm, except when the TLOF is collocated with a helicopter stand, in which case the characteristics of the TLOF perimeter markings should apply.
(3) For a helicopter stand that is intended to be used for taxi-through and which does not allow the helicopter to turn, the yellow stop line should not be less than the width of the helicopter ground taxiway and should have a line thickness of 50 cm.
(4) Alignment lines and lead-in/lead-out lines should be continuous yellow lines and should have a width of 15 cm.
(5) Curved portions of alignment lines and lead-in/lead-out lines should have radii appropriate to the most demanding helicopter type the helicopter stand is intended to serve.
(6) Stand identification markings should be marked in a contrasting colour so as to be easily readable.
(7) Where it is intended that helicopters proceed in one direction only, arrows indicating the direction to be followed may be added as part of the alignment lines.

CS-HPT-DSN.F.620 Flight path alignment guidance marking

(a) Applicability: Where provided at a heliport, a flight path alignment guidance marking (or markings) should indicate the available approach and/or departure path direction(s).
(b) Location: The flight path alignment guidance marking should be located in a straight line along the direction of approach and/or departure path on one or more of the TLOF, FATO, safety area or any suitable surface in the immediate vicinity of the FATO or the safety area.
(c) Characteristics:
(1) A flight path alignment guidance marking should consist of one or more arrows marked on the TLOF, FATO and/or safety area surface, as shown in Figure F-6. The stroke of the arrow(s) should be 50 cm in width and at least 3 m in length. When combined with a flight path alignment guidance lighting system, it should take the form shown in Figure F-6, which includes the scheme for marking the 'heads of the arrows', which are always of the same size, regardless of the stroke length.
(2) In the case of a flight path limited to a single approach direction or a single departure direction, the arrow marking may be unidirectional. In the case of a heliport with only a single approach/departure path available, one bidirectional arrow is marked.
(3) The markings should be in a colour, preferably white, which provides good contrast against the background colour of the surface on which they are marked.

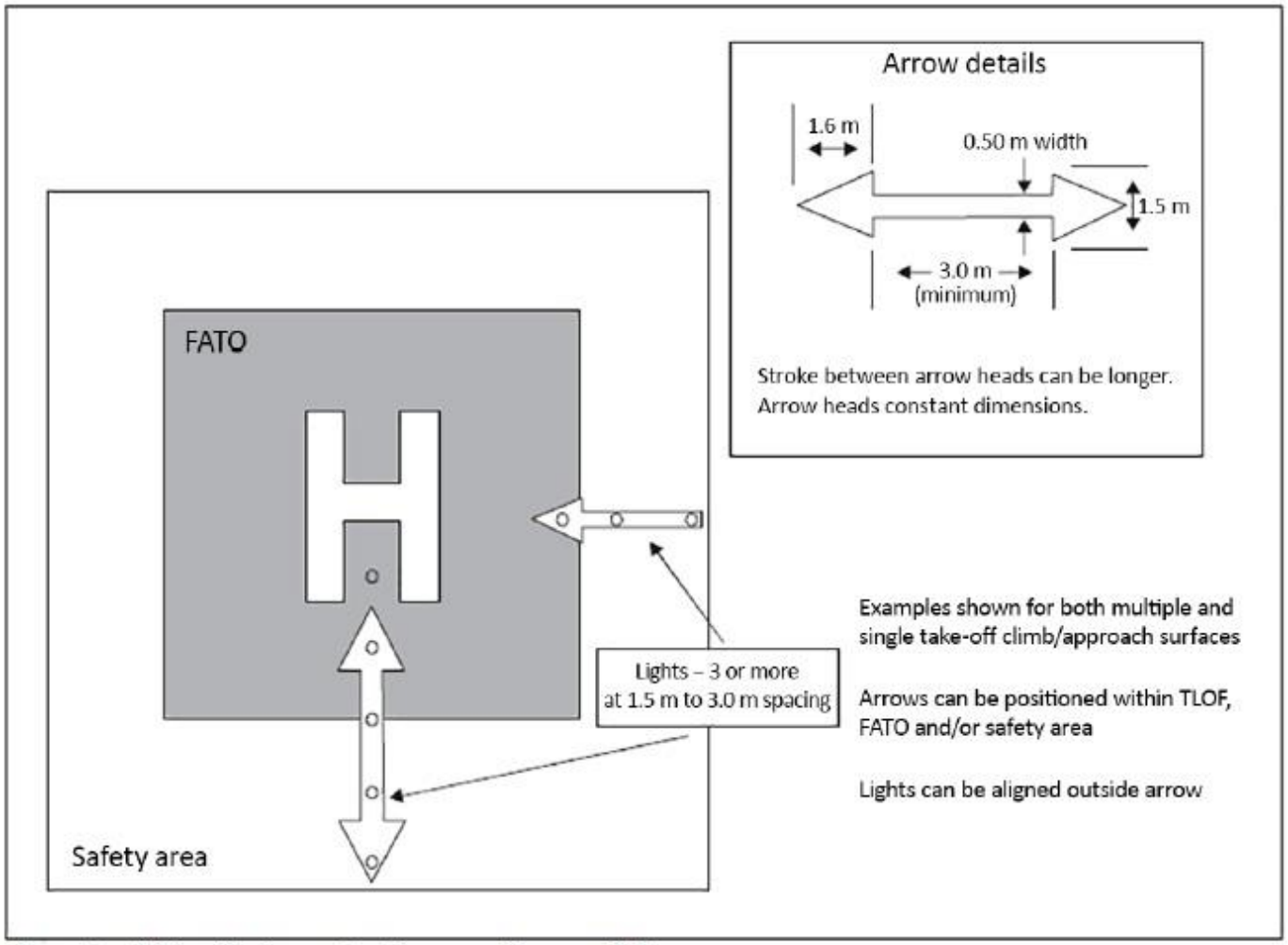


Figure F-6. Flight path alignment guidance markings and lights

CS-HPT-DSN.F.630 Approach lighting system

(+GM)

(a) Applicability: Where provided at a heliport, an approach lighting system should indicate a preferred approach direction.

(b) Location: The approach lighting system should be located in a straight line along the preferred direction of approach.

(c) Characteristics:

(1) An approach lighting system should consist of a row of three lights spaced uniformly at 30 m intervals and of a crossbar 18 m in length at a distance of 90 m from the perimeter of the FATO as shown in Figure F-7. The lights forming the crossbar should be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights, and spaced at 4.5 m intervals.

(2) Where there is a need to make the final approach course more conspicuous, additional lights spaced uniformly at 30 m intervals should be added beyond the crossbar. The lights beyond the crossbar may be steady or sequenced flashing, depending upon the environment.

(3) The steady lights should be omnidirectional white lights.

(4) Sequenced flashing lights should be omnidirectional white lights.

(5) The flashing lights should have a flash frequency of one per second and their light distribution should be as shown in Figure F-9, Illustration 2. The flash sequence should commence from the outermost light and progress towards the crossbar.

(6) A suitable brilliancy control should be incorporated to allow for adjustment of light intensity to meet the prevailing conditions.

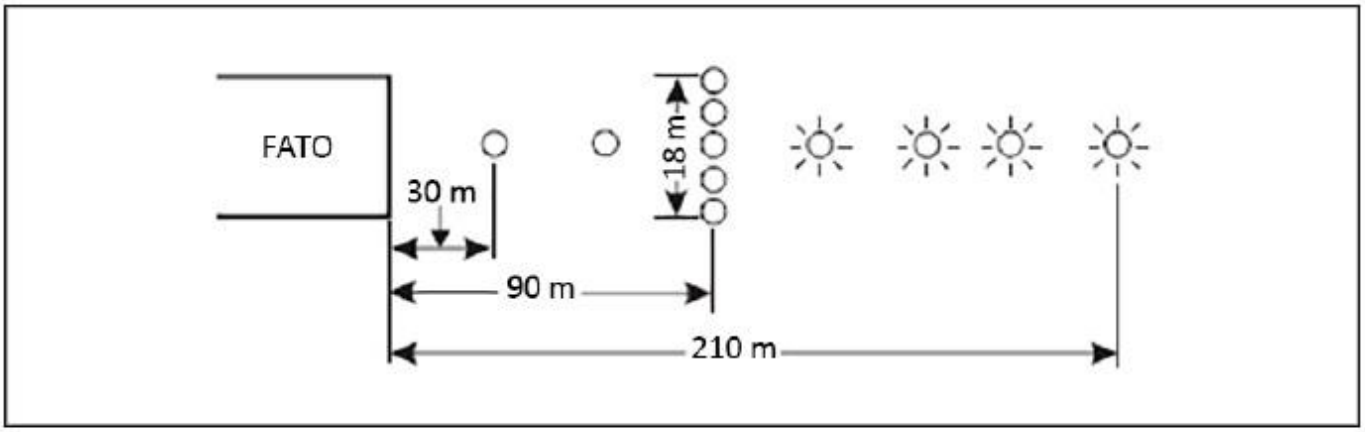


Figure F-7. Approach lighting system

CS-HPT-DSN.F.640 Flight path alignment guidance lighting system

(+GM)

(a) Applicability: Where provided at a heliport, a flight path alignment guidance lighting system (or systems) should indicate the available approach and/or departure path direction(s).

(b) Location:

(1) The flight path alignment guidance lighting system should be in a straight line along the direction(s) of approach and/or departure path on one or more of the TLOF, FATO, safety area or any suitable surface in the immediate vicinity of the FATO, TLOF or safety area.

(2) If combined with a flight path alignment guidance marking, then as far as is practicable, the lights should be located inside the 'arrow' markings.

(c) Characteristics:

(1) A flight path alignment guidance lighting system should consist of a row of three or more lights spaced uniformly over a total minimum distance of 6 m. Intervals between lights should not be less than 1.5 m and should not exceed 3 m.

(2) Where space permits, there should be 5 lights. The number of lights and the spacing between these lights may be adjusted to reflect the space available.

(3) If more than one flight path alignment system is used to indicate the available approach and/or departure path direction(s), the characteristics for each system are typically kept the same (see Figure F-6).

(4) The lights should be steady omnidirectional inset white lights.

(5) The distribution of the lights should be as indicated in Figure F-9, Illustration 5.

(6) A suitable control should be incorporated to allow for adjustment of light intensity to meet the prevailing conditions and to balance the flight path alignment guidance lighting system with other heliport lights and general lighting that may be present around the heliport.

CS-HPT-DSN.F.650 Visual alignment guidance system

(+GM)

(a) Applicability: Where provided at a heliport, a visual alignment guidance system should provide guidance to the pilot during the approach to a heliport.

(b) Location:

(1) The visual alignment guidance system should be located such that a helicopter is guided along the prescribed track towards the FATO.

(2) The system should be located at the downwind edge of the FATO and aligned along the preferred approach direction.

(3) The light units should be frangible and mounted as low as possible.

(4) Where the lights of the system need to be seen as discrete sources, light units should be located such that at the extremes of system coverage, the angle subtended between the units as seen by the pilot should not be less than 3 minutes of arc.

(5) The angles subtended between the light units of the system and other units of comparable or greater intensities should also be not less than 3 minutes of arc.

(6) The requirements of paragraphs (4) and (5) above can be met for lights on a line normal to

the line of sight if the light units are separated by 1 m for every kilometre of viewing range.

(c) Signal format:
  (1) The signal format of the alignment guidance system should include a minimum of three discrete signal sectors providing 'offset to the right', 'on track' and 'offset to the left' signals.
  (2) The divergence of the 'on track' sector of the system should be 1° as shown in Figure F-8.
  (3) The signal format should be such that there is no possibility of confusion between the system and any associated visual approach slope indicator or other visual aids.
  (4) The system should avoid the use of the same coding as any associated visual approach slope indicator.
  (5) The signal format should be such that the system is unique and conspicuous in all operational environments.
  (6) The system should not significantly increase the pilot workload.

(d) Light distribution:
  (1) The usable coverage of the visual alignment guidance system should be equal to or better than that of the visual approach slope indicator system with which it is associated.
  (2) A suitable intensity control should be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

(e) Approach track and azimuth setting:
  (1) A visual alignment guidance system should be capable of adjustment in azimuth to within ± 5 minutes of arc of the desired approach path.
  (2) The angle of the azimuth guidance system should be such that during an approach, the pilot of a helicopter at the boundary of the 'on track' signal would clear all objects in the approach area by a safe margin.
  (3) The characteristics of the obstacle protection surface specified in CS-HPT-DSN.F.660(h)(2), Table F-1 and Figure F-10 should equally apply to the system.

(f) Characteristics of the visual alignment guidance system:
  (1) In the event of a failure of any component affecting the signal format, the system should be automatically switched off.
  (2) The light units should be so designed that deposits of condensation, ice, dirt, etc. on optically transmitting or reflecting surfaces would interfere to the least possible extent with the light signal and should not cause spurious or false signals to be generated.

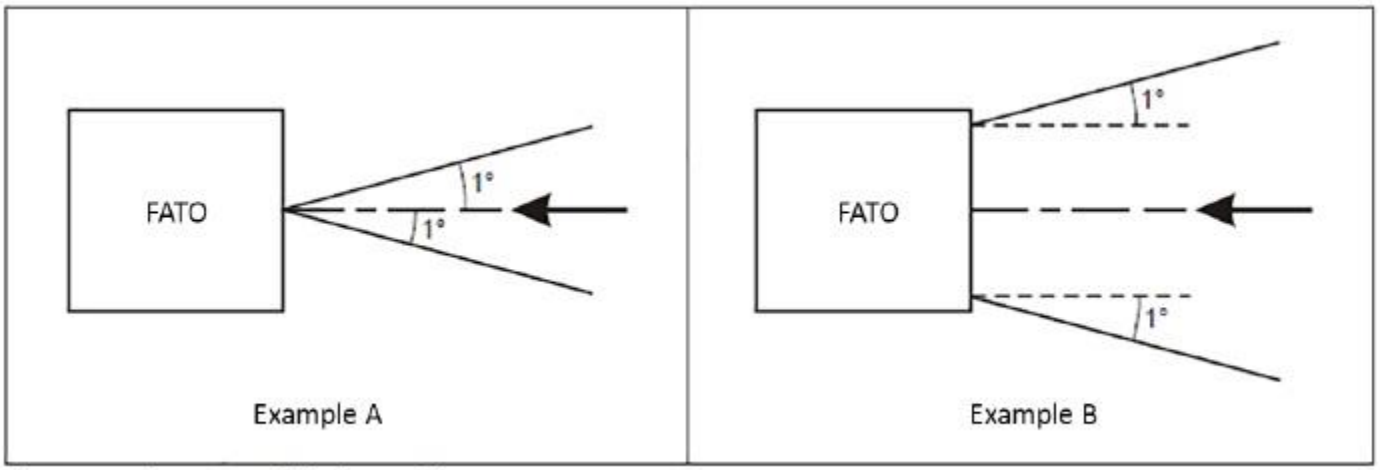


Figure F-8. Divergence of the 'on track' sector

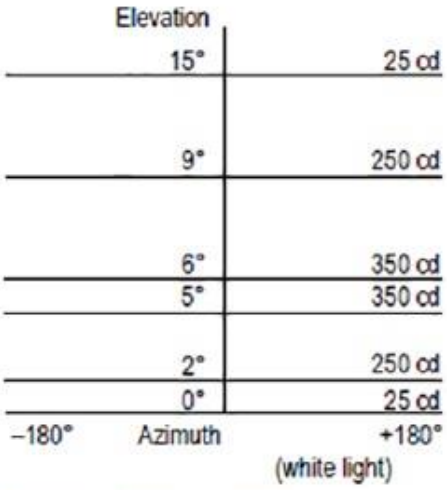
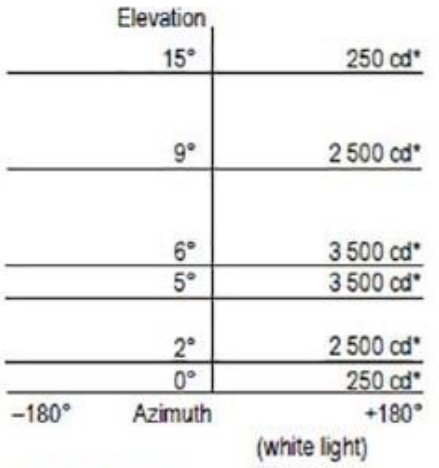


Illustration 1 – Approach light steady burning



* Effective intensity

Illustration 2 – Approach light flashing

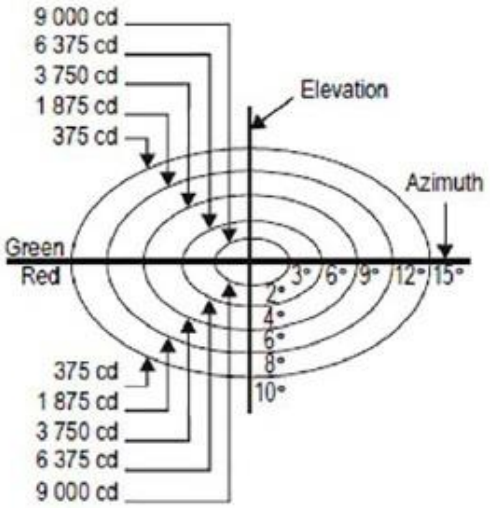


Illustration 3 – HAPI system

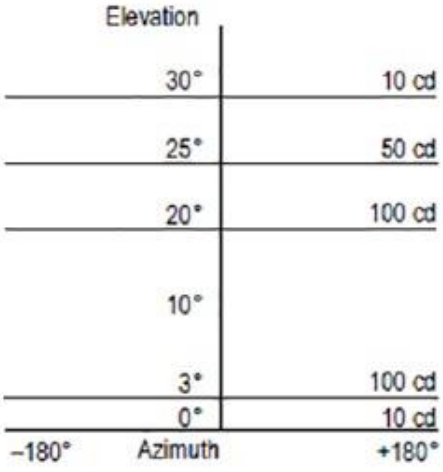
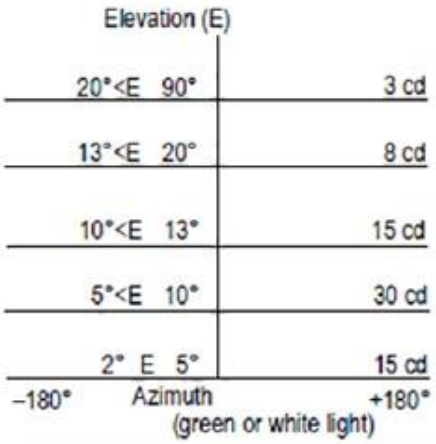


Illustration 4 – Final approach and take-off lights and aiming point lights



Note – Additional values may be required in the case of installations requiring identification by means of the lights at an elevation of less than two degrees.

Illustration 5 – TLOF perimeter lights and flight path alignment guidance lighting system

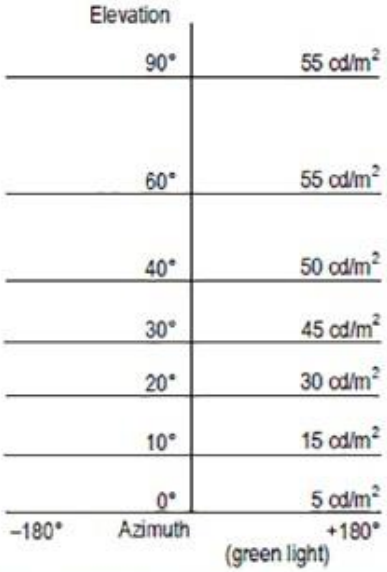


Illustration 6 – Touchdown and lift-off area luminescent panels

(1) ***Figure F-9. Isocandela diagrams***

SURFACE AND DIMENSIONS	FATO	
Length of inner edge	Width of safety area	
Distance from end of FATO	3 m minimum	
Divergence	10 %	
Total length	2 500 m	
Slope	PAPI	A[a] – 0.57°
	HAPI	A[b] – 0.65°
	APAPI	A[a] – 0.9°

a. As indicated in CS ADR-DSN.M.645, Figure M-4.
b. The angle of the upper boundary of the 'below slope' signal.

Table F-1. Dimensions and slopes of the obstacle protection surface for heliport visual approach indicator system

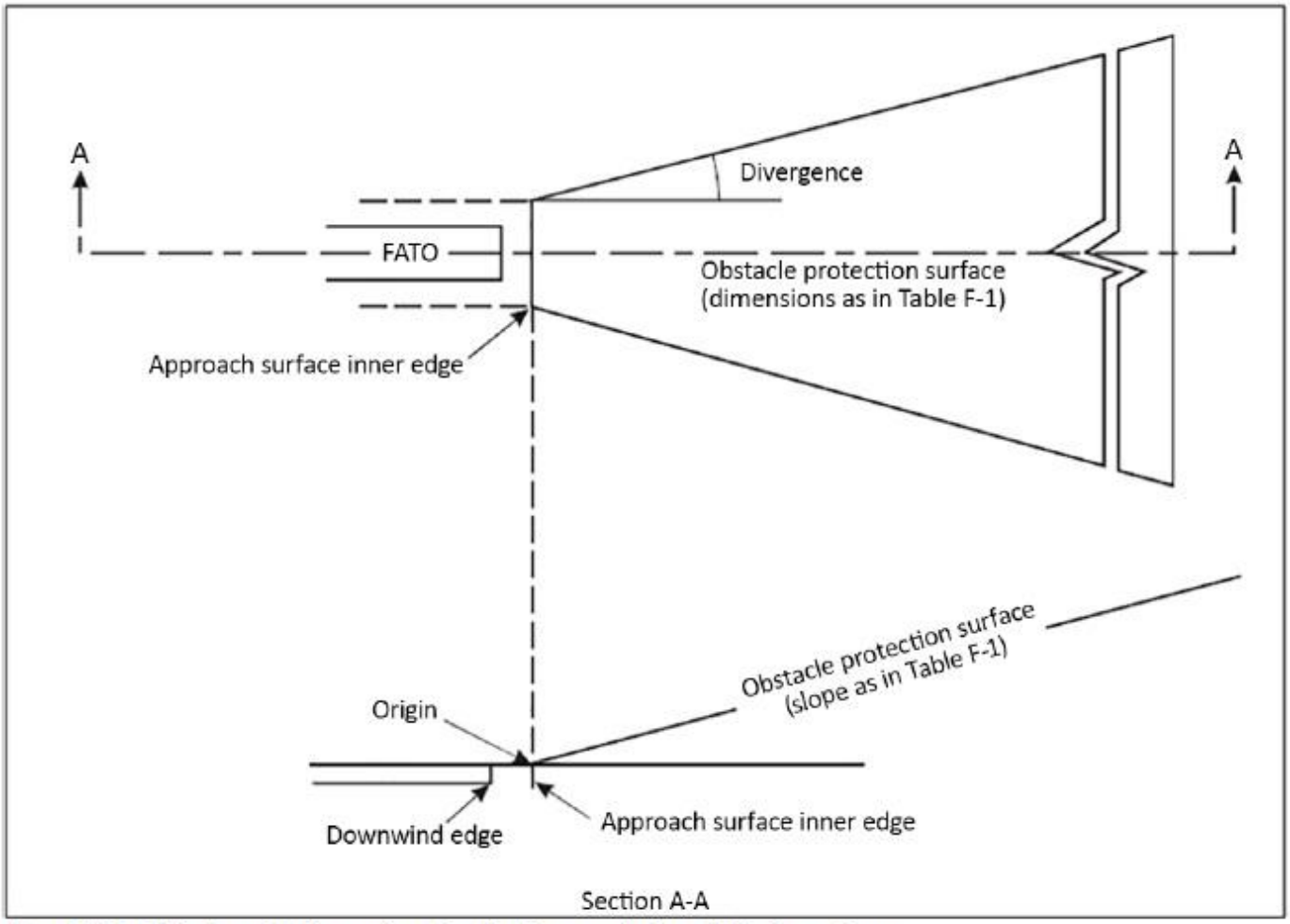


Figure F-10. Obstacle protection surface for visual approach slope indicator systems

CS-HPT-DSN.F.660 Visual approach slope indicator

(+GM)

(a) Applicability: Where provided at a heliport, a visual slope indicator system should provide information on the approach angle necessary to maintain a safe height over obstacles on the approach to a heliport.

(b) The standard visual approach slope indicator systems for helicopter operations should consist of the following:

(1) PAPI (precision approach path indicator) and APAPI (abbreviated precision approach path indicator) systems conforming to the specifications contained in CS-ADR-DSN.M.645 and CS-

ADR-DSN.M.650, except that the angular size of the on-slope sector of the systems should be increased to 45 minutes of arc; or

(2) HAPI (helicopter approach path indicator) system conforming to the specifications in paragraphs (d) to (g) below.

(c) Location:

(1) A visual approach slope indicator should be located such that a helicopter is guided to the desired position within the FATO and so as to avoid dazzling the pilot during final approach and landing.

(2) The light unit(s) should be mounted as low as possible.

(d) Characteristics of the HAPI signal format:

(1) The signal format of the HAPI should include four discrete signal sectors, providing an 'above slope', an 'on slope', a 'slightly below' and a 'below slope' signal.

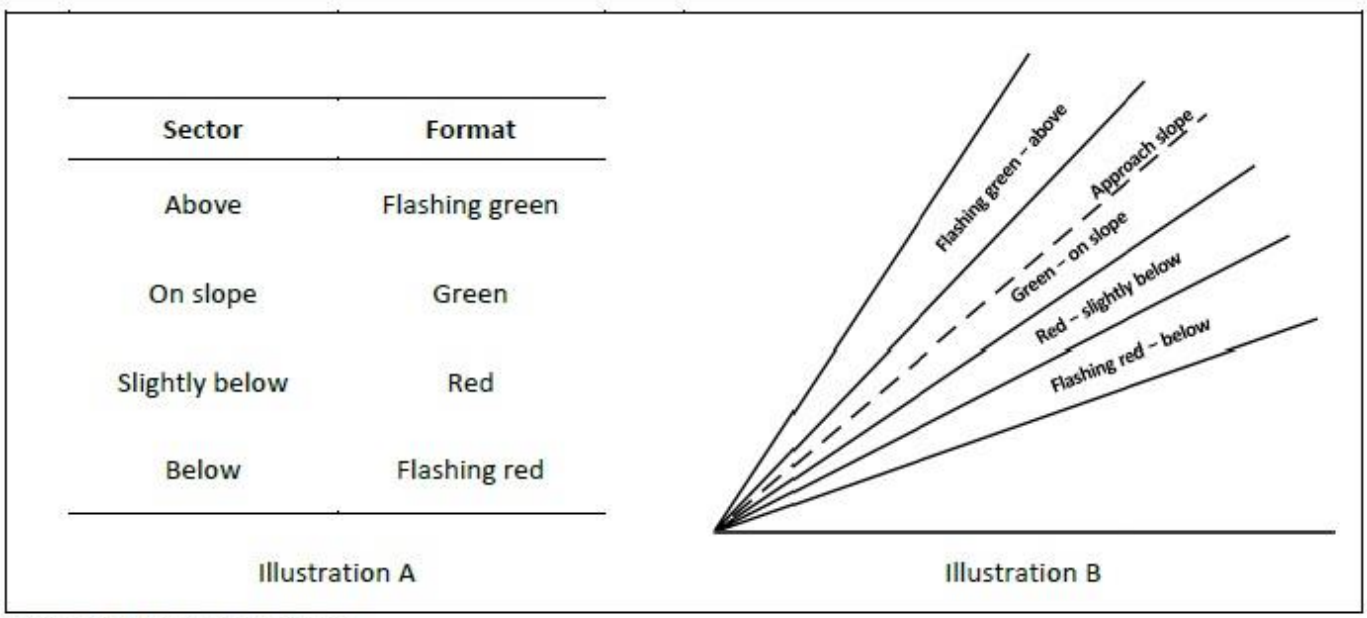
(2) The signal format of the HAPI should be as shown in Figure F-11, Illustrations A and B.

(3) The signal repetition rate of the flashing sector of the HAPI should be at least 2 Hz.

(4) The on-to-off ratio of pulsing signals of the HAPI should be 1 to 1, and the modulation depth should be at least 80 per cent.

(5) The angular size of the 'on-slope' sector of the HAPI should be 45 minutes of arc.

(6) The angular size of the 'slightly below' sector of the HAPI should be 15 minutes of arc.



Sector	Format
Above	Flashing green
On slope	Green
Slightly below	Red
Below	Flashing red

Illustration A

Illustration B

Figure F-11. HAPI signal format

(e) Light distribution:

(1) The light intensity distribution of the HAPI in red and green colours should be as shown in Figure F-9, Illustration 3.

(2) The colour transition of the HAPI in the vertical plane should 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 three minutes of arc.

(3) The transmission factor of a red or green filter should be not less than 15 per cent at the maximum intensity setting.

(4) At full intensity, the red light of the HAPI should have a Y-coordinate not exceeding 0.320, and the green light should be within the boundaries specified in CS-ADR-DSN.U.930(b).

(5) A suitable intensity control should be provided so as to allow adjustment to meet the prevailing conditions and to avoid dazzling the pilot during approach and landing.

(f) Approach slope and elevation setting:

(1) A HAPI system should be capable of adjustment in elevation at any desired angle between 1 degree and 12 degrees above the horizontal with an accuracy of ± 5 minutes of arc.

(2) The angle of elevation setting of a HAPI should be such that during an approach, the pilot of a helicopter observing the upper boundary of the 'below slope' signal would clear all objects in the approach area by a safe margin.

(g) Characteristics of the light unit:

(1) The system should be so designed that:
(i) in the event the vertical misalignment of a unit exceeds ± 0.5 degrees (± 30 minutes), the system should switch off automatically; and
(ii) if the flashing mechanism fails, no light is emitted in the failed flashing sector(s).
(2) The light unit of the HAPI should be so designed that deposits of condensation, ice, dirt, etc. on optically transmitting or reflecting surfaces would interfere to the least possible extent with the light signal and should not cause spurious or false signals to be generated.

(h) Obstacle protection surface (applicable to PAPI, APAPI and HAPI):
(1) An obstacle protection surface should be established when it is intended to provide a visual approach slope indicator system.
(2) The characteristics of the obstacle protection surface, i.e. origin, divergence, length and slope, should correspond to those specified in the relevant column of Table F-1 and in Figure F-10.
(3) New objects or extensions of existing objects should not be permitted above an obstacle protection surface except when the new object or extension would be shielded by an existing immovable object.
(4) Existing objects above an obstacle protection surface should be removed except when the object is shielded by an existing immovable object, or when after a safety assessment, it is determined that the object would not adversely affect the safety of operations of helicopters.
(5) Where a safety assessment indicates that an existing object extending above an obstacle protection surface could adversely affect the safety of operations of helicopters, one or more of the following measures should be taken:
(i) suitably raise the approach slope of the system;
(ii) reduce the azimuth spread of the system so that the object is outside the confines of the beam;
(iii) displace the axis of the system and its associated obstacle protection surface by no more than 5 degrees;
(iv) suitably displace the FATO; and
(v) install a visual alignment guidance system.

CS-HPT-DSN.F.670 Final approach and take-off area lighting systems

(a) Applicability: FATO lights should be provided where a FATO is established at a heliport intended for use at night. They can be omitted where the FATO and the TLOF are nearly coincidental and the TLOF lights are provided, or the extent of the FATO is self-evident.
(b) Location: FATO lights should be placed along the edges of the FATO. The lights should be uniformly spaced as follows:
(1) for an area in the form of a square or rectangle, at intervals of not more than 50 m with a minimum of four lights on each side including a light at each corner; and
(2) for any other shaped area, including a circular area, at intervals of not more than 5 m with a minimum of ten lights.
(c) Characteristics:
(1) FATO lights should be fixed omnidirectional lights showing white. Where the intensity of the lights is to be varied, the lights should show variable white.
(2) The light distribution of FATO lights should be as shown in Figure F-9, Illustration 4.
(3) The lights should not exceed a height of 25 cm and should be inset when a light extending above the surface would endanger helicopter operations.
(4) Where a FATO is not meant for lift-off or touchdown, the lights should not exceed a height of 25 cm above ground or snow level.

CS-HPT-DSN.F.680 Aiming point lights

(a) Applicability: Aiming point lights should be provided where an aiming point marking is provided at a heliport intended for use at night.
(b) Location: Aiming point lights should be collocated with the aiming point marking.
(c) Characteristics:
(1) Aiming point lights should form a pattern of at least six omnidirectional white lights (see Figure F-12).
(2) The lights should be inset when a light extending above the surface could endanger helicopter operations.

(3) The light distribution of aiming point lights should be as shown in Figure F-9, Illustration 4.

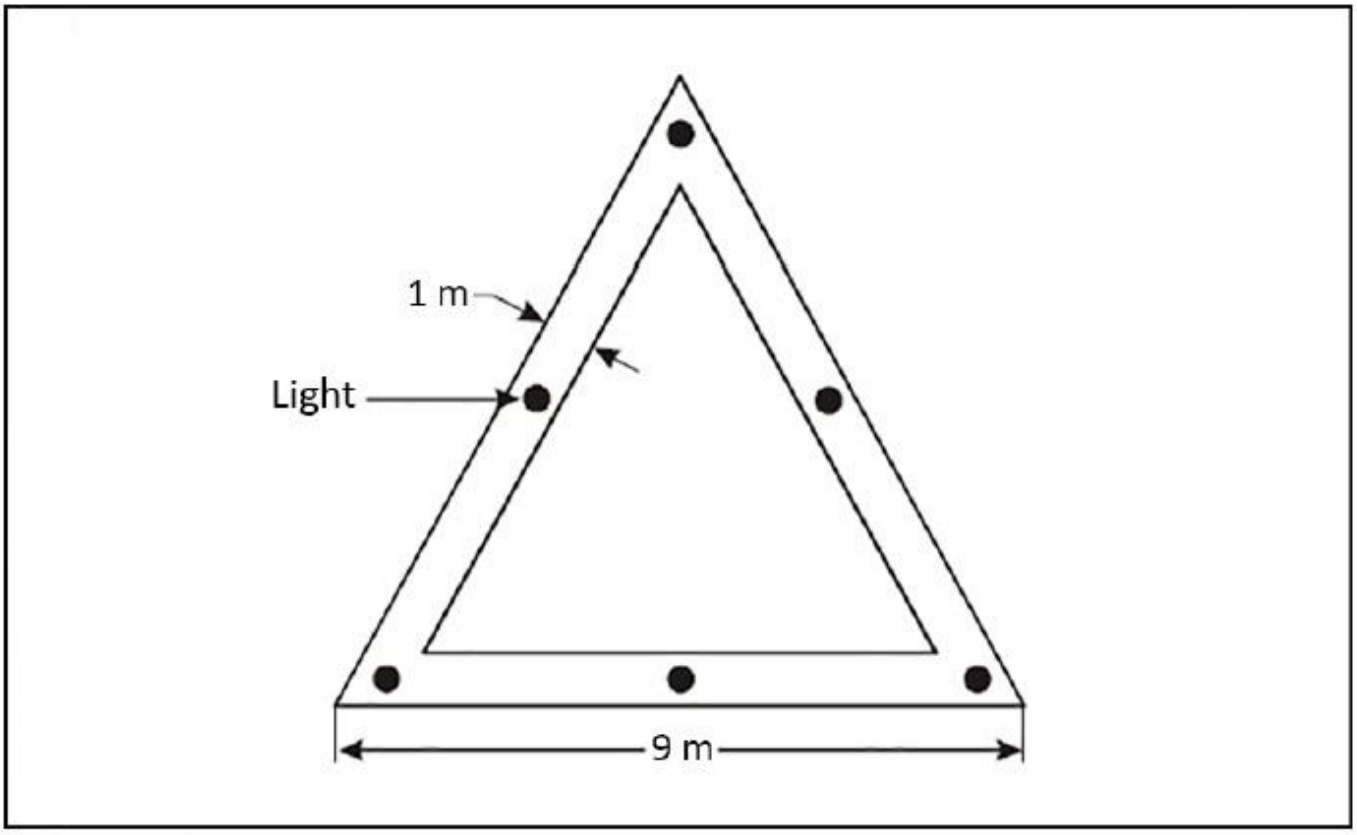


Figure F-12. Aiming point marking and lighting

CS-HPT-DSN.F.690 Touchdown and lift-off area lighting system

(+GM)

(a) Applicability:

(1) A TLOF lighting system should be provided at a heliport intended for use at night.

(2) The TLOF lighting system for a heliport should consist of one or more of the following:

(i) perimeter lights; or

(ii) floodlighting; or

(iii) ASPSL or LP lighting to identify the TLOF when (i) and (ii) are not practicable and FATO lights are available.

(b) Location:

(1) TLOF perimeter lights should be placed along the edge of the area designated for use as the TLOF or within a distance of 1.5 m from the edge.

(2) Where the TLOF is a circle, the lights should be:

(i) located on straight lines in a pattern which should provide information to pilots on drift displacement; or

(ii) evenly spaced around the perimeter of the TLOF at the appropriate intervals, sufficient to present the pattern, TLOF ASPSL and/or LPs to identify the touchdown marking and/or floodlighting should be provided for use at night when enhanced surface texture cues are required. except that over a sector of 45 degrees, the lights should be spaced at half spacing.

(3) TLOF perimeter lights should be uniformly spaced at intervals of not more than 5 m.

(4) Where TLOF perimeter lights are located on straight lines, there should be a minimum number of four lights on each side, including a light at each corner.

(5) For a circular TLOF, where lights are installed in accordance with paragraph (2)(ii) above, there should be a minimum of fourteen lights.

(6) Where ASPSL or LPs are provided to identify the TLOF, which is not a circle, they should be placed along the marking designating the edge of the TLOF.

(7) Where ASPL or LPs are provided to identify the TLOF, which is a circle, they should be located on straight lines circumscribing the area.
(8) The minimum number of LPs on a TLOF should be nine.
(9) The total length of LPs in a pattern should not be less than 50 per cent of the length of the pattern.
(10) There should be an odd number of LPs with a minimum number of three panels on each side of the TLOF, including a panel at each corner.
(11) LPs should be uniformly spaced with a distance between adjacent panel ends of not more than 5 m on each side of the TLOF.
(12) TLOF floodlights should be located so as to avoid glare to pilots in flight or to personnel working on the area.
(13) The arrangement and aiming of floodlights should be such that shadows are kept to a minimum.

(c) Characteristics:
(1) The TLOF perimeter lights should be fixed omnidirectional lights showing green.
(2) ASPSL or LPs should emit green light when used to define the perimeter of the TLOF.
(3) The chromaticity and luminance of colours of LPs should be in accordance with the specifications in CS-ADR-DSN.U.935.
(4) An LP should have a minimum width of 6 cm. The panel housing should be the same colour as the marking it defines.
(5) The perimeter lights should not exceed a height of 25 cm and should be inset when a light extending above the surface could endanger helicopter operations.
(6) When located within the safety area of a heliport, the TLOF floodlights should not exceed a height of 25 cm.
(7) The LPs should not extend above the surface by more than 2.5 cm.
(8) The light distribution of the perimeter lights should be as shown in Figure F-9, Illustration 5.
(9) The light distribution of the LPs should be as shown in Figure F-9, Illustration 6.
(10) The spectral distribution of TLOF area floodlights should be such that the surface and obstacle marking can be correctly identified.
(11) The average horizontal illuminance of the floodlighting should be at least 10 lux, with a uniformity ratio (average to minimum) of not more than 8:1 measured on the surface of the TLOF.
(12) The lighting used to identify the touchdown marking should comprise a segmented circle of omnidirectional ASPSL strips showing yellow. The segments should consist of ASPSL strips, and the total length of the ASPSL strips should not be less than 50 per cent of the circumference of the circle.
(13) If utilised, the heliport identification marking lighting should be omnidirectional showing green.

CS-HPT-DSN.F.700 Taxiway lights

The specifications of CS-ADR-DSN.M.710, CS-ADR-DSN.M.715 and CS-ADR-DSN.M.720 are applicable to taxiways intended for ground taxiing of helicopters.

CS-HPT-DSN.F.710 Visual aids for denoting obstacles

(+GM)

Obstacles should be marked and lit in accordance with CS-ADR-DSN.Q.840, CS-ADR-DSN.Q.845 and CS-ADR-DSN.Q.850.

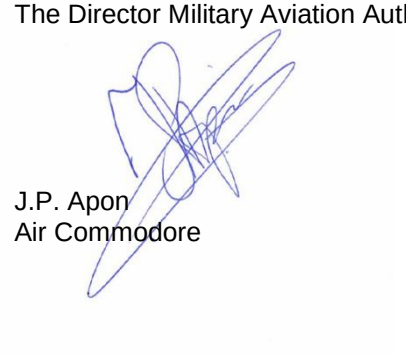
FINAL CLAUSES

This Certification Specifications for Military Aerodrome Design as part of the Military Aviation Regulation, NLD-MAR-ADR is known as NLD-MAR-ADR CS-ADR-DSN.

This Certification Specifications for Military Aerodrome Design as part of the Military Aviation Regulation, NLD-MAR-ADR shall enter into force on January 10th, 2024 and will be published on the MAA-NLD internet/intranet.

The Hague, 10 January 2024

The Director Military Aviation Authority – the Netherlands,



J.P. Apon
Air Commodore