
CAP 168

Licensing of Aerodromes

CAP 168

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Revision History

Revisions in the sixth Edition

May 2004

The opportunity has been taken as part of the remastering process to incorporate a few minor changes to the text.

Technical changes are indicated by the use of side line revision marks as shown to the left of this paragraph.

Revisions in the seventh Edition

8 May 2006

This revision incorporates the inclusion of Runway Turn Pad criteria.

Also incorporated are RETILs and the design criteria for Rapid Exit Taxiways.

Chapter 5 has been amended.

Chapter 8, Appendix 8G Medical Examinations for Aerodrome RFFS Personnel has been deleted.

A new Chapter 11, Water Aerodromes has been included.

A new Chapter 12, Heliports has been included.

The opportunity has been taken to incorporate changes to the text. Technical changes are indicated by the use of side line revision marks as shown to the left of this paragraph.

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Explanatory Note

1 Introduction

- 1.1 The CAA has made many of the documents that it publishes available electronically. Where practical, the opportunity has been taken to incorporate a clearer revised appearance to the document.
- 1.2 This is a living document and will be revised at intervals to take account of changes in regulations, feedback from industry, and recognised best practice. Contact addresses, should you have any comments concerning the content of this document or wish to obtain subsequent amendments are given on the inside cover of this publication.

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Introduction

- 1 This document is published in support of the discretionary powers relating to the grant of an aerodrome licence contained in the Air Navigation Order (ANO), and includes International Standards and Recommended Practices (SARPs) contained in Annex 14 to the Convention on International Aviation, Chicago 1944. It is the policy of the Civil Aviation Authority (CAA) to have reference to this Annex 14 when exercising the discretionary powers referred to above and in particular it will normally exercise those powers so as to ensure the effective implementation of any such international standards. Where the UK formally differs from any of the SARPs of Annex 14, these differences are recorded in the Aeronautical Information Publication (AIP).
- 2 The ANO requires that, in the United Kingdom, most flights for the public transport of passengers, and all flights for the purpose of flying instruction, take place at a licensed aerodrome, a Government aerodrome or at an aerodrome managed by the CAA. The Order also makes provision for an applicant to be granted an aerodrome licence subject to such conditions as the CAA thinks fit.
- 3 The purpose of this document is to give guidance to applicants and licensees on the procedure for the issue and continuation of or variation to an aerodrome licence issued under Article 128 of the ANO 2005, and to indicate the licensing requirements that are used for assessing a variation or an application. The document also describes the CAA's aerodrome licensing requirements relating to operational management and the planning of aerodrome development. This document represents the minimum standards necessary to meet the licensing requirement.
- 4 Prior to the grant of a licence and for continued licensing, the CAA's Inspectors will visit the aerodrome and determine the extent to which the aerodrome, its facilities and its operational procedures meet the licensing requirements. In making its assessment of an application for or continuation of a licence the CAA will adopt as flexible an approach as is consistent with the achievement and maintenance of a satisfactory level of safety. All aerodromes differ, and to allow the CAA flexibility to deal with the different situations encountered, some specifications are phrased using the word 'should'. This does not mean that compliance is optional but rather that, where insurmountable difficulties exist, the CAA may accept an alternative means of compliance, provided that an acceptable safety assurance from the applicant or licensee shows that the safety requirements will not be reduced below that intended by the requirement.
- 5 Any limiting conditions or mitigating measures, described in the safety assurance, that compensate for any increased risk will take account of the anticipated flying activity and any other non-compliances, including those documented as variations, from licensing requirements that may already exist. Thereafter, the conditions or mitigating measures, and any other non compliances, including variations, will be reviewed by the licensee and the CAA periodically, in particular when any significant changes in activity or aerodrome development is proposed.
- 6 Significant changes in the nature and the scale of flying activity at a licensed aerodrome shall be notified to the CAA as soon as is practicable and be reflected in an annual return, called a Safety Report, to the CAA. Where development work, including changes to the physical characteristics, aerodrome lighting and other visual aids is proposed, the CAA shall be consulted beforehand in accordance with the conditions of the licence and relevant legislation or both.

- 7 The CAA places emphasis on the adoption, by licensees, of safety management systems that describe the safety policy of the aerodrome licensee, and its application, and operational management, in addition to the physical design and operating standards of aerodromes. The aerodrome management will be inspected regularly by the CAA.
- 8 During an inspection the inspectors from the CAA's Aerodrome Standards Department will assess the aerodrome's compliance with requirements, audit the aerodrome's management of safety and assess the competence of those responsible for safety. The Aerodrome Manual and Safety Report are key documents in this process, as is CAP 700 Operational Safety Competencies. The inspectors will also appraise the aerodrome's current level of flying, or any anticipated change in activity against the facilities provided, in order to be satisfied that the aerodrome and the airspace, within which its visual traffic pattern is normally contained, are safe for use by aircraft. The inspectors will, as a result of their inspection, produce a report to the licensee which will list non-compliance items with agreed actions and timescales for rectification. The report will also detail other issues which may affect safety at the aerodrome.
- 9 An aerodrome licensed in accordance with aerodrome licensing requirements will normally be suitable for use by STOL aircraft; there are currently no specific criteria published for aerodromes to be used only by aircraft with a STOL capability. Proposals for the licensing of STOL or helicopter aerodromes should be discussed with the Aerodrome Standards Department, from which guidance is available.
- 10 From time to time the CAA will wish to supplement the guidance or requirements given in this publication, and this will be achieved in the form of a specific document, 'Notices to Aerodrome Licence Holders'. Where appropriate, such material will subsequently be included in this publication by amendment.
- 11 References in this publication to the Air Navigation Order, Regulations and Rules of the Air are to the Order, Regulations and Rules then in force.
- 12 An amendment service is provided for this publication, contact details are given on the inside cover of this publication.

Glossary of Terms

Accelerate – Stop Distance Available (ASDA)

The distance from the point on the surface of the aerodrome at which the aeroplane can commence its take-off run to the nearest point in the direction of take-off at which the aeroplane cannot roll over the surface of the aerodrome and be brought to rest in an emergency without the risk of accident.

Aerodrome

Any area of land or water designed, equipped, set apart or commonly used for affording facilities for the landing and departure of aircraft and includes any area or space, whether on the ground, on the roof of a building or elsewhere, which is designed, equipped or set apart for affording facilities for the landing and departure of aircraft capable of descending or climbing vertically, but shall not include any area the use of which for affording facilities for the landing and departure of aircraft has been abandoned and has not been resumed.

Aerodrome Beacon

An aeronautical beacon used to indicate the location of an aerodrome from the air.

Aerodrome Elevation

The elevation of the highest point of the landing area. This is the highest point of that part of the runway used for both landing and take-off. See also 'Landing Area'.

Aerodrome Reference Point

The aerodrome reference point is the geographical location of the aerodrome and the centre of its traffic zone where an ATZ is established.

Aerodrome Traffic Zone (ATZ)

The airspace specified in Article 156 of the ANO 2005 as being airspace in the vicinity of an aerodrome notified for the purposes of Rule 39 of the Rules of the Air Regulations.

Aeronautical Beacon

An aeronautical ground light visible continuously or intermittently to designate a particular point on the surface of the earth.

Aeronautical Ground Light

Any light specifically provided as an aid to air navigation other than a light displayed on an aircraft including lights specifically provided at an aerodrome as an aid to the movement and control of aircraft and of those vehicles which operate on the movement area.

Aeroplane

A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

Aeroplane Reference Field Length

The minimum field length required for take-off at maximum take-off weight, calculated at MSL, in standard atmosphere conditions and still air, and with zero runway slope. The precise distance will be given in the Flight Manual or equivalent data-sheets from the manufacturer.

Aircraft

Any machine that can derive support in the atmosphere from the reactions of air other than by the reactions of air against the earth's surface.

Aircraft Stand	A designated area on an aerodrome intended to be used for parking an aircraft.
Apron	A defined area on a land aerodrome provided for the stationing of aircraft for the embarkation and disembarkation of passengers, the loading and unloading of cargo, and for parking.
Balanced Field	A runway for which the Accelerate Stop Distance Available is equal to the Take-off Distance Available is considered to have a balanced field length .
Barrette	Three or more aeronautical ground lights closely spaced in a transverse line such that from a distance they appear as a short bar of light.
Baulked Landing	A landing manoeuvre that is unexpectedly discontinued.
Cleared and Graded Area (CGA)	That part of the Runway Strip cleared of all obstacles except for minor specified items and graded, intended to reduce the risk of damage to an aircraft running off the runway.
Clearway	An area at the end of the take-off run available and under the control of the aerodrome licensee, selected or prepared as a suitable area over which an aircraft may make a portion of its initial climb to a specified height.
Cloud Ceiling	In relation to an aerodrome, cloud ceiling means the vertical distance from the elevation of the aerodrome to the lowest part of any cloud visible from the aerodrome which is sufficient to obscure more than one half of the sky so visible.
Critical Area	An area of defined dimensions extending about the ground antennae of a precision instrument approach equipment within which the presence of vehicles or aircraft will cause unacceptable disturbance of the guidance signals.
Declared Distances	The distances declared by the aerodrome authority for the purpose of application of the requirement of the Air Navigation (General) Regulations in respect of aeroplanes flying for the purpose of public transport.
Frangibility	The ability of an object to retain its structural integrity and stiffness up to a specified maximum load but when subject to a load greater than specified or struck by an aircraft will break, distort or yield in such a manner as to present minimum hazard to an aircraft.
Heavier-than-air Aircraft	Any aircraft deriving its lift in flight chiefly from aerodynamic forces.
Helicopter	A heavier-than-air aircraft supported in flight by the reactions of the air on one or more power-driven rotors on substantially vertical axes.
Holding Bay	A defined area where aircraft can be held or bypassed in order to facilitate the efficient movement of aircraft.

Instrument Runway	A runway intended for the operation of aircraft using non-visual aids providing at least directional guidance in azimuth adequate for a straight-in approach.
Landing Area	That part of a movement area intended for the landing and take-off of aircraft.
Landing Distance Available (LDA)	The distance from the point on the surface of the aerodrome above which the aeroplane can commence its landing, having regard to the obstructions in its approach path, to the nearest point in the direction of landing at which the surface of the aerodrome is incapable of bearing the weight of the aeroplane under normal operating conditions or at which there is an obstacle capable of affecting the safety of the aeroplane.
Manoeuvring Area	That part of an aerodrome provided for the take-off and landing of aircraft and for the movement of aircraft on the surface, excluding the apron and any part of the aerodrome provided for the maintenance of aircraft.
Movement Area	<p>That part of an aerodrome intended for the surface movement of aircraft including the manoeuvring area, aprons and any part of the aerodrome provided for the maintenance of aircraft.</p> <p>NOTE: Manoeuvring Area and Movement Area are generic terms intended to describe the 'airside' part of an aerodrome, rather than just those pavements or surfaces on which aircraft movements take place.</p>
Non-Instrument Runway	A runway intended for the operation of aircraft using visual approach procedures.
Obstacle	All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.
Obstacle Free Zone	A volume of airspace extending upwards and outwards from an inner portion of the Runway Strip to specified upper limits which is kept clear of all obstructions except for minor specified items.
Precision Approach Runway	<p>An instrument runway intended for the operation of aircraft using precision approach aids that meet the Facility Performance requirements defined in ICAO Annex 10 appropriate to the Category of Operations. These runways are divided into three categories as follows:</p> <p>Category I (Cat I) operation</p> <p>A precision instrument approach and landing with a decision height not lower than 200 ft and with either a visibility not less than 800 m, or a runway visual range not less than 550 m.</p>

Category II (Cat II) operation

A precision instrument approach and landing with a decision height lower than 200 ft but not lower than 100 ft, and a runway visual range not less than 350 m.

Category IIIA (Cat IIIA) operation

A precision instrument approach and landing with either a decision height lower than 100 ft, or with no decision height and a runway visual range not less than 200 m.

Category IIIB (Cat IIIB) operation

A precision instrument approach and landing with either, a decision height lower than 50 ft, or with no decision height and a runway visual range less than 200 m but not less than 75 m.

Category IIIC (Cat IIIC) operation

A precision instrument approach and landing with no decision height and no runway visual range limitations.

Runway

A defined rectangular area, on a land aerodrome prepared for the landing and take-off run of aircraft along its length.

Runway End Safety Area (RESA)

An area symmetrical about the extended runway centreline and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

Runway Strip

An area of specified dimensions enclosing a runway intended to reduce the risk of damage to an aircraft running off the runway and to protect aircraft flying over it when taking-off or landing.

Runway Threshold

The beginning of that portion of the runway usable for landing.

Runway Visual Range (RVR)

The range over which the pilot of an aircraft on the centreline of a runway can see the runway surface markings or the lights delineating the runway or identifying its centreline.

Sensitive Area

An area extending beyond the Critical Area where the parking and/or movement of aircraft or vehicles will affect the guidance signal to the extent that it may be rendered unacceptable to aircraft using the signal.

Shoulder

An area adjacent to the edge of a paved surface so prepared as to provide a transition between the pavement and the adjacent surface for aircraft running off the pavement.

Stand

See Aircraft Stand.

Stopway

A defined rectangular area beyond the end of the TORA, suitably prepared and designated as an area in which an aeroplane can be safely brought to a stop in the event of an abandoned take-off.

Take-off Distance Available (TODA)	Either the distance from the point on the surface of the aerodrome at which the aeroplane can commence its take-off run to the nearest obstacle in the direction of take-off projecting above the surface of the aerodrome and capable of affecting the safety of the aeroplane, or one and one half times the take-off run available, whichever is the less.
Take-off Run Available (TORA)	The distance from the point on the surface of the aerodrome at which the aeroplane can commence its take-off run to the nearest point in the direction of take-off at which the surface of the aerodrome is incapable of bearing the weight of the aeroplane under normal operating conditions.
Taxiway	<p>A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:</p> <ul style="list-style-type: none">a) Aircraft stand taxilane. A portion of an apron designated as a taxi route intended to provide access to aircraft stands only.b) Apron taxiway. A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.c) Rapid exit taxiway. A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimising runway occupancy times.
Taxiway Strip	An area of specified dimension enclosing a taxiway and intended to protect aircraft operating on the taxiway and to reduce the risk of damage to an aircraft running off the taxiway.
Taxiway Holding Position	<p>A designated position at which taxiing aircraft and vehicles may be required to hold in order to provide adequate clearance from a runway or another taxiway.</p> <ul style="list-style-type: none">a) Runway Taxi Holding Position. A Taxi Holding Position intended to protect a runway.b) Intermediate Taxi Holding Position. A Taxi Holding Position intended to protect a priority route.
Taxiway Intersection	A junction of two or more taxiways.
Threshold	The beginning of that portion of the runway available for landing.

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Chapter 1 The Licensing Process

1 The Legal Background to Aerodrome Licensing

NOTE: In this Chapter the Air Navigation Order and references to Articles of that Order mean the Air Navigation Order 2005. Should that Order be amended or replaced, any reference to the Order or any Article of that Order shall be taken as references to the Order currently in force.

1.1 The grant of an aerodrome licence is governed by Article 128 of the Air Navigation Order the text of which is as follows:

(1) The CAA shall grant a licence in respect of any aerodrome in the United Kingdom if it is satisfied that:

- (a) the applicant is competent, having regard to his previous conduct and experience, his equipment, organisation, staffing, maintenance and other arrangements to secure that the aerodrome and the airspace within which its visual traffic pattern is normally contained are safe for use by aircraft;
- (b) the aerodrome is safe for use by aircraft, having regard in particular to the physical characteristics of the aerodrome and of its surroundings; and
- (c) the Aerodrome Manual submitted pursuant to paragraph (7) is adequate.

(2) An aerodrome licence may be granted subject to such conditions as the CAA thinks fit and shall, subject to the provisions of Article 92 of this Order, remain in force for the period specified in the licence.

(3) Without prejudice to the generality of paragraph (2), if the applicant so requests, or if the CAA considers that an aerodrome should be available for the take-off or landing of aircraft to all persons on equal terms and conditions, it may grant a licence (in this Order referred to as 'a licence for public use') which shall be subject to the condition that the aerodrome shall at all times when it is available for the take-off or landing of aircraft be so available to all persons on equal terms and conditions.

(4) The holder of an aerodrome licence granted under this Order (in this article called 'an aerodrome licence holder') shall:

- (a) furnish to any person on request information concerning the terms of the licence; and
- (b) in the case of a licence for public use, cause to be notified the times during which the aerodrome will be available for the take-off or landing of aircraft engaged on flights for the purpose of public transport of passengers or instruction in flying.

(5) The holder of an aerodrome licence granted under this Order shall not contravene or cause or permit to be contravened any condition of the aerodrome licence at any time in relation to such aircraft engaged on such flights as are specified in Article 126(2) of this Order, but the licence shall not cease to be valid by reason only of such a contravention.

(6) An aerodrome licence holder shall take all reasonable steps to secure that the aerodrome and the airspace within which its visual traffic pattern is normally contained are safe at all times for use by aircraft.

- (7) Upon making an application for an aerodrome licence the applicant shall submit to the CAA an aerodrome manual for that aerodrome.
- (8) An Aerodrome Manual required pursuant to this Article shall contain all such information and instructions as may be necessary to enable the aerodrome operating staff to perform their duties as such including, in particular, information and instructions relating to the matters specified in Schedule 13 to this Order.
- (9) Every aerodrome licence holder shall:
- (a) furnish to the CAA any amendments or additions to the Aerodrome Manual before or immediately after they come into effect;
 - (b) without prejudice to sub-paragraph (a), make such amendments or additions to the Aerodrome Manual as the CAA may require for the purpose of ensuring the safe operation of aircraft at the aerodrome or the safety of air navigation; and
 - (c) maintain the Aerodrome Manual and make such amendments as may be necessary for the purposes of keeping its contents up to date.
- (10)(a) Every aerodrome licence holder shall make available to each member of the aerodrome operating staff a copy of the Aerodrome Manual, or a copy of every part of the Aerodrome Manual which is relevant to his duties and shall ensure that each such copy is kept up to date.
- (b) Every aerodrome licence holder shall take all reasonable steps to secure that each member of the aerodrome operating staff:
- (i) is aware of the contents of every part of the Aerodrome Manual which is relevant to his duties as such; and
 - (ii) undertakes his duties as such in conformity with the relevant provisions of the Manual.
- (11) For the purposes of this article:
- (a) 'aerodrome operating staff' means all persons, whether or not the aerodrome licence holder and whether or not employed by the aerodrome licence holder, whose duties are concerned either with ensuring that the aerodrome and airspace within which its visual traffic pattern is normally contained are safe for use by aircraft, or whose duties require them to have access to the aerodrome manoeuvring area or apron;
 - (b) 'visual traffic pattern' means the aerodrome traffic zone of the aerodrome, or, in the case of an aerodrome which is not notified for the purposes of rule 39 of the Rules of the Air, the airspace which would comprise the aerodrome traffic zone of the aerodrome if it was so notified.

Schedule 13 to Article 128 of The Air Navigation Order (For Guidance on Aerodrome Manual Production Please Refer to Chapter 2)**AERODROME MANUAL**

Information and instructions relating to the following matters shall be included in the Aerodrome Manual referred to in Article 128 of this Order:

- (i) the name and status of the official in charge of day to day operation of the aerodrome together with the names and status of other senior aerodrome operating staff and instructions as to the order and circumstances in which they may be required to act as the official in charge;
- (ii) the system of aeronautical information service available;
- (iii) procedures for promulgating information concerning the aerodrome's state;
- (iv) procedures for the control of access, vehicles and work in relation to the aerodrome manoeuvring area and apron;
- (v) procedures for complying with Article 142 of this Order and for the removal of disabled aircraft;
- (vi) in the case of an aerodrome which has facilities for fuel storage, procedures for complying with Article 137 of this Order;
- (vii)
 - (aa) subject to paragraph (bb), plans to a scale of 1:2500 depicting the layout of runways, taxiways and aprons, aerodrome markings, aerodrome lighting if such lighting is provided, and the siting of any navigational aids within the runway strip;
 - (bb) in the case of copies of the Manual or extracts thereof provided or made available to a member of the aerodrome operating staff, the plans shall be of a scale reasonably appropriate for the purposes of Article 128(10) of this Order;
- (viii) in respect of an aerodrome in relation to which there is a notified instrument approach procedure, survey information sufficient to provide data for the production of aeronautical charts relating to that aerodrome;
- (ix) description, height and location of obstacles which infringe standard obstacle limitation surfaces, and whether they are lit;
- (x) data for and method of calculation of declared distances and elevations at the beginning and end of each declared distance;
- (xi) method of calculating reduced declared distances and the procedures for their promulgation;
- (xii) details of surfaces and bearing strengths of runways, taxiways and aprons;
- (xiii) the system of the management of air traffic in the airspace associated with the aerodrome, including procedures for the co-ordination of traffic with adjacent aerodromes, except any such information or procedures already published in any manual of air traffic services;
- (xiv) operational procedures for the routine and special inspection of the aerodrome manoeuvring area and aprons;
- (xv) if operations are permitted during periods of low visibility, procedures for the protection of the runways during such periods;

- (xvi) procedures for the safe integration of all aviation activities undertaken at the aerodrome;
- (xvii) procedures for the control of bird hazards;
- (xviii) procedures for the use and inspection of the aerodrome lighting system, if such a system is provided; and
- (xix) the scale of rescue, first aid and fire service facilities, the aerodrome emergency procedures and procedures to be adopted in the event of temporary depletion of the rescue and fire service facilities.

1.2 The Order and Regulations also provide for the following:

1.2.1 Aerodromes, other than Government aerodromes or aerodromes owned or managed by the CAA, must be licensed if they are used for the take-off and landing of the following aircraft:

- a) aeroplanes of which the maximum total weight authorised exceeds 2730 kg and which are flying for the purpose of the public transport of passengers or for the purpose of instruction in flying or associated flying tests for the grant of a pilot's licence or the inclusion of an aircraft rating or a night rating in a licence;
- b) aeroplanes of which the maximum total weight authorised does not exceed 2730 kg engaged on either:
 - i) scheduled journeys for the purpose of the public transport of passengers; or
 - ii) flights for the purpose of the public transport of passengers beginning and ending at the same aerodrome; or
 - iii) flights for the purpose of instruction in flying or associated flying tests for the grant of a pilot's licence or the inclusion of an aircraft rating or a night rating in a licence;
 - iv) flights for the purpose of the public transport of passengers at night;
- c) helicopters and gyroplanes engaged on such flights as are specified in subparagraphs i) and iii) above, and
- d) gliders (other than gliders being flown under arrangements made by a flying club and carrying no person other than a member of the club) which are flying for the purpose of the public transport of passengers or the purpose of instruction in flying.

1.2.2 Any 'authorised person' has the right of access to any aerodrome at all reasonable times for the purpose of inspections.

1.2.3 The CAA may, if it thinks fit, provisionally suspend or vary any licence pending enquiry into or consideration of the case, and may, on sufficient ground being shown to its satisfaction after due enquiry, revoke, suspend or vary a licence.

1.2.4 The Civil Aviation Authority Regulations provide that, where it is proposed to revoke, suspend, or vary a licence otherwise than on the application of the holder, notice of the proposal, together with the reasons for it, will be served on the holder who may within 14 days serve on the CAA a request that the case be decided by the CAA and not by any other person on its behalf.

1.2.5 Where an application for the grant or variation of an aerodrome licence is refused, or is granted in terms other than those requested by the applicant, a notice will be served stating the reasons for the decision, and the applicant may within 14 days from the date of service of the notice request that the case be reviewed by the CAA.

2 Charges

- 2.1 Details of the Civil Aviation Authority's Scheme of Charges (Aerodrome Licensing) made pursuant to Section 11 of the Civil Aviation Act 1982 may be obtained from the Aerodrome Standards Department.

3 Type of Licence

- 3.1 An applicant may be granted a Public Use aerodrome licence or an Ordinary aerodrome licence. In the case of the former the hours of availability of the aerodrome must be notified in the United Kingdom Aeronautical Information Publication (UK AIP) and the aerodrome must be available to all persons on equal terms and conditions. An Ordinary licence relates only to use of the aerodrome by the holder of the licence and persons specifically authorised by him. The holder of an Ordinary licence is not obliged to notify the hours of availability in the UK AIP but, if he does so, the aerodrome must remain open throughout the notified hours irrespective of traffic requirements. If the hours are not notified the availability of the aerodrome and its facilities can be shown in the UK AIP as 'by arrangement', but if this is the case then the protection of an Aerodrome Traffic Zone (ATZ) may not be provided.

4 Application for a Licence

- 4.1 The applicant should either be the owner of the land, or have obtained the landowner's permission for the use of the site as an aerodrome. A proposal to use land as an aerodrome may be subject to the requirements of the Town and Country Planning Acts and applicants are advised to consult the Local Planning Authority before embarking on any such project. A similar constraint will almost certainly apply to any proposals for aerodrome development. The granting of an aerodrome licence does not absolve the holder from observing other statutory requirements.
- 4.2 The initial application for an aerodrome licence must be made on form CA 651 (specimen at Appendix 1A). The completed form should be returned to the CAA together with the appropriate fee (paragraph 2.1), a map showing the aerodrome location and boundaries (preferably on a scale 1:25 000) and a copy of the Aerodrome Manual (see Chapter 2). Additionally, survey data in the form of charts, profiles, sections, evidence of pavement strengths and surface textures etc., relating to the site and its environs, must be provided by the applicant as required by the CAA.
- 4.3 An application for the variation of a licence must be made in writing, and be accompanied by the relevant survey and other information where there are any changes in the characteristics of the aerodrome or its environs.
- 4.4 A licence will normally remain in force until suspended or revoked but may be issued for a limited period. In the case of a licence for a period exceeding 12 days but not exceeding 12 months, i.e. a seasonal licence, application must be made on form CA 651 (example at Appendix 1A). In the case of a temporary licence, for a period not exceeding 12 consecutive days, application must be made on form CA 651A which is a shortened version of Appendix 1A.
- 4.5 Application forms are obtainable from the Aerodrome Standards Department and also in electronic format at www.caa.co.uk/publications.
- 4.6 Applications should be submitted in sufficient time to allow for detailed consideration and inspection of the aerodrome before the issue of a licence. The minimum notice required is 60 days from the date a completed Aerodrome Manual is accepted by the

CAA. The interval between application and grant of a licence (or a variation thereto) may depend upon matters within the control of the applicant and no undertaking can be given that the CAA will be able to reach a decision within a particular period.

- 4.7 An intending applicant should in his own interest consult the CAA before committing himself to expenditure on developing or equipping an aerodrome.

5 General Requirements for the Grant of a Licence

- 5.1 Before a licence is granted the CAA will require to be satisfied that the physical conditions on the manoeuvring area, apron and in the environs of the aerodrome are acceptable; and that the scale of equipment and facilities provided are adequate for the flying activities which are expected to take place. The criteria which will be applied in making this assessment are given in the chapters which follow. The CAA also will require to be satisfied that the applicant for the licence is able to ensure an effective safety management system and, in those activities which are related to the safe operation of the aerodrome, to provide staff who are competent and where necessary suitably qualified.
- 5.2 For these purposes the CAA's Inspectors will visit the aerodrome and determine the extent to which the aerodrome, its facilities, equipment and operational organisation meet the licensing requirements. Following the initial grant of a licence, Inspectors from the CAA's Aerodrome Standards Department will visit each aerodrome periodically as part of their audit/inspection programme. The Inspectors will assess compliance with requirements, audit the management of safety, and assess the competence of those responsible for safety. Normally prior notice will be given to the holder of the licence, but inspections may take place without such prior notice. Inspectors will be 'authorised persons' as defined in the Air Navigation Order and normally will be allocated responsibility for certain aerodromes so that a helpful continuity will develop and improve the value of contacts between them and the management of the aerodrome.

6 Conditions of Licence

- 6.1 The Air Navigation Order provides that the CAA may grant a licence 'subject to such conditions as the CAA thinks fit ...'. The standard Conditions are shown in the specimen licences at Appendix 1B 'Public Use', Appendix 1C 'Ordinary' and Appendix 1D 'Temporary'. Additional conditions may be added to a particular licence to take account of the conditions or circumstances at that aerodrome, and when appropriate this method will be considered by the CAA as a means of achieving a satisfactory level of safety by, for example, limiting the type of flying activity which may take place when one or more of the criteria cannot be met.
- 6.2 It is also a standard Condition of licences that the holder must inform the CAA of changes to data concerning the aerodrome so that appropriate promulgation of the change, and amendment to the UK AIP can be made. Guidance on the aeronautical information to be provided in respect of a licensed aerodrome, and the procedures for promulgating such information is given in Chapter 10.

7 Changes of Aerodrome Licence Holder

- 7.1 An aerodrome licence is granted to a named 'legal person' (an individual or a company or any other legally constituted authority or body – e.g. local authority) who satisfies the CAA that the criteria for licence issue have been met. Once a licence is granted

the CAA is obliged to satisfy itself that a licensee continues to meet licensing requirements. An aerodrome licence is not a saleable asset and cannot be transferred from one person to another.

- 7.2 If the identity of a licensee is to change, application for grant of a new licence should be made to the CAA by the prospective licensee. (Please note: A change in the name only of a licence holding company does not constitute a change of identity; the licensee should apply to the CAA for a variation of the licence to reflect the name change and provide a copy of the 'Certificate of Incorporation on Change of Name'.)
- 7.3 If licensed aerodrome operations are to continue during the change, the outgoing licensee must retain responsibility for the operation of the aerodrome until the grant of an aerodrome licence to the new licensee. In all cases a new aerodrome licence must be obtained from the CAA and the existing licence must be revoked by the CAA, before operations under the new licensee can begin.
- 7.4 An application for an aerodrome licence in the name of the prospective licensee should be completed and returned to the CAA together with the appropriate fee for licence issue. Documentation should be submitted in sufficient time to allow for consideration of the application by the CAA (recommended minimum is 60 days from the date a completed aerodrome manual is accepted by the CAA), and for the provision by the applicant of such further information and documentation as the CAA may require. An aerodrome manual acceptable to the CAA will be required in all cases.
- 7.5 When it is proposed to make other changes at the time of a change of licensee (for example changes to personnel in key operational posts) it is prudent to provide the CAA with as much prior notice as possible. The CAA recommends a minimum of 60 days' notice to process the change. However, the interval between application for and grant of a licence may depend on factors outside the control of the CAA (for example matters within the control of the applicant, the outgoing licensee, or other persons or organisations); therefore no undertaking can be given that the CAA will be able to reach a decision within a particular timescale or by a specific date.
- 7.6 As with any new application, grant of an aerodrome licence will be subject to the applicant satisfying the CAA on the requirements of Article 128 and Schedule 13 of the Air Navigation Order 2005; and of CAP 168 Licensing of Aerodromes. In addition to the aerodrome characteristics these requirements will include the demonstration of competence by the applicant to secure that the aerodrome and its airspace are safe for use by aircraft. In assessing an applicant's competence, matters taken into account by the CAA will include:
- a) The previous conduct and experience of the applicant.
 - b) The organisation, staffing and equipment to be provided.
 - c) The arrangements for the maintenance of the aerodrome and its facilities and equipment.
 - d) The adequacy of the aerodrome manual.
 - e) Any other arrangements made including the adequacy of safety management systems.

8 Change of Provider of an Air Traffic Service

At some licensed aerodromes the Air Traffic Services (ATS) are provided by contractors. Occasionally the contractor will change and the aerodrome licensee will wish the transition to be as seamless as possible, while maintaining high levels of safety, particularly if continuous operations are to be provided. Aerodrome licensees are reminded of their responsibilities under ANO Article 128 to secure the aerodrome and airspace especially during the change-over of providers of ATS. Licensees must be aware of the importance of the initial contract with their chosen ATS provider to ensure that the arrangements for transfer of an ATS contract to another provider is addressed. These arrangements should include processes for the implementation, at the time of transfer, of a Manual of Air Traffic Services (MATS) Part 2 acceptable to the CAA. In this respect and to ensure that there is no immediate negative impact on aerodrome operations, licensees should consider retaining ownership of the existing, approved, MATS Part 2. Further guidance on how to achieve a seamless transition from one provider of ATS to another may be found in CAP 670 ATS Safety Requirements (available on the CAA website).

Appendix 1A Application for an Aerodrome Licence

UK Civil Aviation Authority

APPLICATION FOR AN AERODROME LICENCE

GUIDANCE



General Guidance

Dear Applicant

Probably one of the first things you will notice about this application form is that it asks a lot of questions! It is important that you answer all relevant questions as fully as possible as this should help to avoid delays in processing your application. Your responses to these questions should provide the CAA with the information it needs to give proper consideration to your application.

It may be helpful to explain why this information is required. The CAA may grant a licence only if it is satisfied that both the aerodrome and the applicant meet the safety related requirements for licence issue. This will involve an inspection and assessment of the aerodrome against internationally agreed criteria appropriate to the nature and scale of operations proposed. The CAA also has to satisfy itself that the applicant is competent to provide a safe operating environment for aircraft. Many of the questions on the application form seek information relevant to that end; for example:

- 1) Sections 1 and 2 will provide information about the applicant and the aerodrome; some of these details will be included on the aerodrome licence itself.
- 2) Section 3 will provide details of key personnel with safety related responsibilities.
- 3) Section 4 will provide details on the nature, scale, and type of operations proposed.
- 4) Section 5 will provide information on the services to be provided at the aerodrome to secure the safety of its airspace.
- 5) Sections 6 and 7 will provide information on the applicant's rights to use the site as an aerodrome, and to exercise control over the activities that will take place.
- 6) Section 8 will provide information on which the licence fee will be assessed.
- 7) Section 9 deals with the Aerodrome Manual which is viewed by the CAA as a major indicator of the competency of the licensee to operate the aerodrome safely.

If you have any difficulty completing the form please do not hesitate to contact us on 01293 573283 or 573267.

Yours sincerely

Licensing Officer
Aerodrome Standards Department
Safety Regulation Group Gatwick

UK Civil Aviation Authority



APPLICATION FOR AN AERODROME LICENCE

IMPORTANT – Please complete the form in block capitals using black or dark blue ink after reading the attached guidance.

1. DETAILS OF LICENSEE (as required to be shown on the licence)

NOTES: (1) The licence holder must be a legal person. If the Licensee is a group or club and is not incorporated, the name(s) of the person(s) who holds the licence and is/are responsible for giving effect to the conditions of the licence should be stated.
(2) Where the applicant is an individual, his/her current Curriculum Vitae (CV) must be enclosed.

Full name of Licensee
 Address of Licensee

 Telephone number Fax number
 E-mail address

2. DETAILS OF AERODROME (as required to be shown on the licence)

Proposed name of Aerodrome
 Address of Aerodrome

 Telephone number Fax number
 Web site address E-mail address
 Position of proposed aerodrome with reference to nearest town
 Latitude/Longitude in WGS 84 of reference point
 Grid reference in OSGB of reference point
 Purposes for which aerodrome is to be used (e.g. Public Transport, flying training)

NOTE: This application must be accompanied by an Ordnance Survey Map, scale 1:25,000, showing by means of a broken line the exact boundaries of the proposed aerodrome. This map will be a Schedule attached to the licence.

3. KEY MANAGEMENT PERSONNEL (please enter details when applicable)

TO BE COMPLETED ONLY WHERE THE APPLICANT IS A COMPANY OR OTHER CORPORATE BODY

Board Member or person having specific responsibility for safety:

Name
 Telephone number E-mail address

Managing Director (if different from above)

Name
 Telephone number E-mail address

3. KEY MANAGEMENT PERSONNEL (continued)	
TO BE COMPLETED BY ALL APPLICANTS	
The person in Charge of day to day operation of the aerodrome: (Please enclose a current CV)	
Name	Status
Telephone number	E-mail address
The person responsible for Aerodrome Safety (if different from the person in charge above) (Please enclose a current CV)	
Name	Status
Telephone number	E-mail address
The person responsible for overseeing the day to day provision of RFF:	
Name	Status
Telephone number	E-mail address
Provider of the Air Traffic Control Service:	
Name	
Address	
.....	
.....	
The person responsible for overseeing the day to day provision of the Air Traffic Control Service:	
Name	Status
Telephone number	E-mail address
4. AERODROME ACTIVITIES	
Period for which licence is required, if less than 12 months	
Do you require a licence for Public Use or Ordinary Use as defined in Article 128 of the Air Navigation Order 2005?	
	PUBLIC <input type="checkbox"/> ORDINARY <input type="checkbox"/>
Is a licence for night use required?	YES <input type="checkbox"/> NO <input type="checkbox"/>
If the aerodrome is NOT to be licensed for night use, is it intended to display aeronautical lights?	YES <input type="checkbox"/> NO <input type="checkbox"/>
If the answer to either of the last two questions is YES , a Permission to display aeronautical lights will be required. Please provide details of proposed lighting.	
.....	
.....	
.....	
Please give details of other proposed aviation activities not requiring the use of a licensed aerodrome (for example gliding, parachuting, microlights).	
.....	
.....	
.....	
Classification of aircraft to be operated at the aerodrome (e.g. aeroplanes, helicopters, gyroplanes).	
.....	
.....	

4. AERODROME ACTIVITIES (continued)		
Type and maximum total weight authorised of the heaviest aircraft engaged on flights for the purpose of the public transport of passengers and for the instruction in flying expected to use the aerodrome, including overall length and maximum fuselage width.		
	PUBLIC TRANSPORT OF PASSENGERS	INSTRUCTION IN FLYING
TYPE		
WEIGHT (kgs)		
LENGTH		
FUSELAGE WIDTH		
Expected average number of movements per calendar month of aircraft shown above during the three busiest calendar months of the year. (One movement is one take-off or one landing.)		
	PUBLIC TRANSPORT OF PASSENGERS	INSTRUCTION IN FLYING
TYPE		
MOVEMENTS		
RFF Category to be provided.		
	AEROPLANES	HELICOPTERS

5. AERODROME SERVICES		
You should apply separately to CAA, ATSSD, Floor 2W, Aviation House, Gatwick Airport South, West Sussex RH6 0YR, for permissions and frequency allocations.		
Which of the following will be provided:		
(a) Air Traffic Control Service with licensed air traffic controllers?	YES <input type="checkbox"/>	NO <input type="checkbox"/>
(b) Aerodrome Flight Information Service?	YES <input type="checkbox"/>	NO <input type="checkbox"/>
(c) Air/Ground Service?	YES <input type="checkbox"/>	NO <input type="checkbox"/>
You should apply separately to CAA, DAP, Off-route Airspace 5, CAA House, 45–59 Kingsway, London WC2B 6TE, for an Air Traffic Zone.		
(d) Aerodrome Traffic Zone?	YES <input type="checkbox"/>	NO <input type="checkbox"/>

6. CONTROL OF THE AERODROME	
Are you the owner of the aerodrome site?	YES <input type="checkbox"/> NO <input type="checkbox"/>
IF NO – Please state:	
Details of the rights you hold over the site.	
.....	
.....	
.....	
.....	
The period for which you hold these rights:	
FROM	TO

6. CONTROL OF THE AERODROME (continued)

The name and address of the owner or the tenant whose permission has been obtained for the site to be used as an aerodrome.

.....

.....

.....

.....

Does any public or private right of way exist on or near the proposed aerodrome? YES ☐ NO ☐

If YES, would the use of the site as an aerodrome interfere with such rights? YES ☐ NO ☐

If there is a risk of interference with such rights, has any agreement been made with the holder of the rights for the use of the site as an aerodrome? YES ☐ NO ☐

If YES please give details of the agreement.

.....

.....

.....

.....

Do you have sole charge of aircraft movements at the aerodrome? YES ☐ NO ☐

If NO please give details of the nature of aircraft movements outside your control, and the person controlling such movements, and any agreements made regarding co-ordination of movements.

.....

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7. PERMISSIONS AND APPROVALS			
<p>NOTE: Before submitting this application, the authorities, as indicated below, should be consulted and, if appropriate, their approvals obtained. There may be other bodies [e.g. electrical supply re overhead wires] whom applicants should inform, in their own interests.</p>			
Please give details of Authorities consulted and approvals granted.			
Land Aerodromes, or Water Aerodromes in Inland Waters			
Local Planning Authority	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
Port and Harbour Authority	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
River Authority (Conservancy or Catchment Board)	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
Water Aerodromes in Coastal Waters			
Local Planning Authority	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
Pilotage Authority	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
Port and Harbour Authority	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
NAME AND ADDRESS OF AUTHORITY		DATES AND REFERENCE OF APPROVAL	

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The following table conforms to the CAA Scheme of Charges (Aerodrome Licensing). Please enter against the highest weight category appropriate to your aerodrome the total number of movements of aircraft in that Category flying for the purpose of public transport of passengers or instruction in flying or both which you expect to take place at the aerodrome during the busiest consecutive three months of the twelve month period starting on 1 July.

No. of movements	
CATEGORY (by weight of aircraft)	
(a) Not exceeding 2730 kg	
(b) Exceeding 2730 kg but not exceeding 6 Tonnes	
(c) Exceeding 6 Tonnes but not exceeding 35 Tonnes	
(d) Exceeding 35 Tonnes but not exceeding 140 Tonnes	
(e) Exceeding 140 Tonnes	

Is a completed Aerodrome Manual enclosed with this application? YES ☐ NO ☐

If NO please indicate below when this is likely to be submitted to the CAA.

.....

.....

.....

.....

[illegible]

11. CERTIFICATE

I hereby certify that the foregoing information is correct in every respect and no relevant information has been withheld.

I undertake to pay the CAA's charges in respect of this application.

NOTE: It is an offence to make any false representation with intent to deceive, for the purpose of procuring the grant, issue, renewal or variation of an aerodrome licence. A person found guilty of such an offence is liable to a fine on summary conviction, and to a fine, imprisonment or both on conviction on indictment.

Signature of Applicant
(or Appointed Representative)

Date

Name
(Block Capitals)

Position held

12. SUBMISSION INSTRUCTIONS

Send your completed application form together with the required supporting documentation to:

Civil Aviation Authority, Aerodrome Licensing Officer, Aerodrome Standards Department, 2W, Aviation House, Gatwick Airport South,
West Sussex RH6 0YR.

UK Civil Aviation Authority**APPLICATION FOR A TEMPORARY AERODROME LICENCE****GUIDANCE****General Guidance**

This application must be accompanied by:-

- Extract from an Ordnance Survey map scale 1:25,000 showing by means of a broken line the exact boundaries of the proposed aerodrome or heliport, and its location with regard to local roads, towns and villages.
- An Aerodrome Manual in accordance with the requirements of Schedule 13 of the ANO and the CAA's guidance material. Particular attention should be given to:
 - A description of the operational management of the aerodrome together with individually named responsibilities and accountabilities;
 - A diagrammatic representation of the site, preferably to a scale of 1:10,000 showing:-
 - All runways or FATOs and aprons
 - Their markings and designations
 - Declared distances
 - Significant obstacles (in feet agl)
 - Location of aircraft parking spots and gates with clearances, dimensions and markings
 - Location of fuelling facilities
 - Location of RFF
 - Location of air traffic control position
 - Location of windsock
 - Normal and emergency operating procedures
 - Rescue and fire fighting facilities and procedures
 - Fuelling procedures including fuel spill procedures
 - Weather minima for operations
 - Consideration for other airspace users, with any necessary letters of agreement with adjacent ATC units or arrangements with local microlight operators, hang-gliding, parachuting, gliding, private flying etc activities.

INFORMATION

- The operation of a temporary licensed aerodrome must be by prior permission (PPR) only.
- The charge for the grant of a temporary aerodrome licence including inspection of the site by the CAA is as per the CAA Scheme of Charges, Official Record Series 5. Should the site not be licensed following inspection this charge is not refundable.

UK Civil Aviation Authority**APPLICATION FOR A TEMPORARY AERODROME LICENCE**

IMPORTANT – Please complete the form in block capitals using black or dark blue ink after reading the attached guidance.

1. DETAILS OF LICENSEE (as required to be shown on the licence)

NOTE: The licence holder must be a legal person. If a group or club applying for a licence is not incorporated the name(s) of the person(s) who will hold the licence and be responsible for giving effect to the conditions of the licence should be stated.

Full name of Licensee

Address of Licensee

.....

.....

.....

Telephone number Fax number

E-mail address

2. DETAILS OF AERODROME (as required to be shown on the licence)

Proposed name of Aerodrome

Is it for use for Public Transport? YES ☐ NO ☐

IF NO - Please state purpose:

.....

.....

.....

.....

Position of proposed aerodrome with reference to nearest town

Latitude/Longitude of reference point in WGS 84

Grid reference in OSGB of reference point

Elevation

3. DETAILS OF LICENCE

Dates and times (hours of operation) for which licence is required

Is a licence for night use required? YES ☐ NO ☐

If the aerodrome is **NOT** to be licensed for night use, is it intended to display aeronautical lights? YES ☐ NO ☐

Name and status of the person in on-site operational management of the aerodrome.

.....

Types of aircraft to be operated

Largest aircraft type

Total number of expected movements on the busiest day of the licence period

Total number of aircraft expected to be within the circuit pattern on the busiest day of the licence period

AEROPLANES	HELICOPTERS	SEAPLANES

3. DETAILS OF LICENCE (continued)			
RFF Category to be provided	AEROPLANES	HELICOPTERS	
4. CONTROL OF THE AERODROME			
Are you the owner of the aerodrome site? YES <input type="checkbox"/> NO <input type="checkbox"/>			
If NO – Please state:			
Details of the rights you hold over the site.			
The period for which you hold these rights, including terminating date:		FROM	TO
The name and address of the owner or the tenant whose permission has been obtained for the site to be used as an aerodrome.			
Does any public or private right of way exist on or near the proposed aerodrome? YES <input type="checkbox"/> NO <input type="checkbox"/>			
If YES, would the use of the site as an aerodrome interfere with such rights? YES <input type="checkbox"/> NO <input type="checkbox"/>			
If there is a risk of interference with such rights, has any agreement been made with the holder of the rights for the use of the site as an aerodrome? YES <input type="checkbox"/> NO <input type="checkbox"/>			
Have any arrangements been made to control the rights of way? (Give details below) YES <input type="checkbox"/> NO <input type="checkbox"/>			
5. RESCUE AND FIRE FIGHTING SERVICES			
Name, status and contact details of the person responsible for provision of the rescue and fire fighting services where this differs from those details provided under paragraph 1.			
Name			
Status			
Telephone Number E-mail Address			
6. PERMISSIONS AND APPROVALS			
NOTE: Before submitting this application, the authorities, as indicated below, should be consulted and, if appropriate, their approvals obtained. There may be other bodies (e.g. electrical supply re overhead wires) applicants should inform, in their own interests.			
Please give details of Authorities consulted and approvals granted.			
Land Aerodromes, or Water Aerodromes in Inland Waters			
Local Planning Authority	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>
River Authority (Conservancy or Catchment Board)	YES <input type="checkbox"/>	NO <input type="checkbox"/>	N/A <input type="checkbox"/>

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10. PAYMENT METHOD

The charge must be paid in advance by cheque, failure to do so will delay your application. Cheques must be made payable to Civil Aviation Authority.

The charge for the grant of a temporary aerodrome licence including inspection of the site by the CAA is as per the CAA Scheme of Charges, Official Record Series 5.

11. CERTIFICATE

I hereby certify that the foregoing information is correct in every respect and no relevant information has been withheld.

I undertake to pay the CAA's charges in respect of this application.

NOTE: It is an offence to make any false representation with intent to deceive, for the purpose of procuring the grant, issue, renewal or variation of an aerodrome licence. A person found guilty of such an offence is liable to a fine on summary conviction, and to a fine, imprisonment or both on conviction on indictment.

Signature of Applicant
(or Appointed Representative)

Date

Name
(Block Capitals)

Position held

12. SUBMISSION INSTRUCTIONS

Send your completed application form together with the required support documentation and payment to:

Civil Aviation Authority, Aerodrome Licensing Officer, Aerodrome Standards Department, 2 West, Aviation House, Gatwick Airport South, West Sussex RH6 0YR.

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Appendix 1B Aerodrome Licence 'Public Use'

Licence No. P	
1	Name of Aerodrome
2	Position of Aerodrome (see map in Schedule 1)
3	Name and Address of Licensee

The Civil Aviation Authority (in this licence referred to as 'the CAA') in exercise of its powers under Article 128 of the Air Navigation Order hereby licences the above-named aerodrome as an aerodrome to be used as a place of take-off and landing of aircraft engaged in flights for the purpose of the public transport of passengers or for the purpose of instruction in flying, subject to the following conditions:

- 1 The aerodrome is licensed for public use and shall at all times when it is available for the take-off or landing of aircraft be so available to all persons on equal terms and conditions.
- 2 No aircraft shall take-off or land at the aerodrome unless such fire-fighting and rescue services and such medical services and equipment as are required in respect of such an aircraft in the CAA's publication CAP 168 (Licensing of Aerodromes) are provided there. Such services and equipment shall at all times when the aerodrome is available for the take-off or landing of aircraft be kept fit and ready for immediate turnout.
- 3 Changes in the physical characteristics of the aerodrome including the erection of new buildings and alterations to existing buildings or to visual aids shall not be made without prior approval of the CAA.
- 4 The licensee shall, by the quickest means available, notify the CAA of any material change in the surface of the landing area, or in the obstruction characteristics of the approach, take-off or circuit in relation to the aerodrome.
- 5 Any public right of way crossing or bordering the landing area shall be adequately sign-posted with notices warning the public of danger from aircraft.
- 6 The aerodrome is licensed for the take-off and landing of aircraft at night. Such systems of lighting appropriate to the Category of runway in use as described in the CAA's publication CAP 168 (Licensing of Aerodromes) shall be in operation at all times when aircraft are taking-off or landing at the aerodrome at night, provided that minor temporary unserviceability, not of a character likely to affect the safety of operations, shall not preclude the take-off or landing of aircraft.
- 7 The licensee shall inform the CAA of the times during which the aerodrome is to be generally available for the take-off or landing of aircraft, and of any changes in those times, and whether the aerodrome is to be available by arrangement with the licensee outside those times. The aerodrome shall be kept available for the take-off or landing of aircraft at all times when, in accordance with the information furnished by the licensee to the CAA it is notified as being generally available and shall not be used for the take-off or landing of aircraft at any other time, unless it

has been notified in accordance with such information as being available for use by arrangement with the licensee outside the times when it is generally available and is used pursuant to such arrangement.

- 8 Without prejudice to condition 1, nothing in this licence shall be taken to confer on any person the right to use the aerodrome without the consent of the licensee.
- 9 Expressions used in this licence shall have the same respective meanings as in the Air Navigation Order.
- 10 'The Air Navigation Order' in this licence means the Air Navigation Order 2005 and any reference to the Order or to any Article of the Order shall, if that Order be amended or replaced, be taken to be a reference to the Air Navigation Order for the time being in force or the corresponding Article of that Order.

This licence shall remain in force until it is varied, suspended or revoked.

Date

FOR THE CIVIL AVIATION AUTHORITY

Appendix 1C Aerodrome Licence 'Ordinary'

Licence No. <u>P</u>	
1	Name of Aerodrome
2	Position of Aerodrome (see map in Schedule 1)
3	Name and Address of Licensee

The Civil Aviation Authority (in this licence referred to as 'the CAA') in exercise of its powers under Article 128 of the Air Navigation Order hereby licences the above-named aerodrome as an aerodrome to be used as a place of take-off and landing of aircraft engaged in flights for the purpose of the public transport of passengers or for the purpose of instruction in flying, subject to the following conditions:

- 1 The aerodrome is licensed for use only by the licensee and by persons specifically authorised by him.
- 2 No aircraft shall take-off or land at the aerodrome unless such fire-fighting and rescue services and such medical services and equipment as are required in respect of such an aircraft in the CAA's publication CAP 168 (Licensing of Aerodromes) are provided there. Such services and equipment shall at all times when the aerodrome is available for the take-off or landing of aircraft be kept fit and ready for immediate turnout.
- 3 Changes in the physical characteristics of the aerodrome including the erection of new buildings and alterations to existing buildings or to visual aids shall not be made without prior approval of the CAA.
- 4 The licensee shall, by the quickest means available, notify the CAA of any material change in the surface of the landing area, or in the obstruction characteristics of the approach, take-off or circuit in relation to the aerodrome.

Night Use

- 5 The aerodrome is licensed for the take-off and landing of aircraft at night. Such systems of lighting appropriate to the Category of runway in use as described in the CAA's publication CAP 168 (Licensing of Aerodromes), shall be in operation at all times when aircraft are taking-off or landing at the aerodrome at night, provided that minor temporary unserviceability, not of a character likely to affect the safety of operations, shall not preclude the take-off or landing of aircraft.

Or

Day Use Only

- 5 The aerodrome is not licensed for the take-off or landing of aircraft at night.
- 6 Any public right of way crossing or bordering the landing area shall be adequately sign-posted with notices warning the public of danger from aircraft.

7 Expressions used in this licence shall have the same respective meanings as in the Air Navigation Order.

8 The 'Air Navigation Order' in this licence means the Air Navigation Order 2005 and any reference to the Order or to any Article of the Order shall, if that Order be amended or replaced, be taken to be a reference to the Air Navigation Order for the time being in force or the corresponding Article of that Order.

This licence shall remain in force until it is varied, suspended or revoked.

Date

FOR THE CIVIL AVIATION AUTHORITY

Appendix 1D Temporary Aerodrome Licence 'Ordinary'

Licence No. <u>I</u>	
1	Name of Aerodrome
2	Position of Aerodrome (see map in Schedule 1)
3	Name and Address of Licensee

The Civil Aviation Authority (in this licence referred to as 'the CAA') in exercise of its powers under Article 128 of the Air Navigation Order hereby licences the above-named aerodrome (on/from dates) inclusive for the take-off and landing of aircraft engaged in flights for the purpose of the public transport of passengers or for the purpose of instruction in flying, subject to the following conditions:

- 1 The aerodrome is licensed for use only by the licensee and by persons specifically authorised by him.
- 2 No aircraft shall take-off or land at the aerodrome unless such emergency services and equipment as are specified in Schedule 2 hereto are provided there. Such services and equipment shall at all times when the aerodrome is available for the take-off or landing of aircraft be kept fit and ready for immediate turn-out.
- 3 Except in an emergency no aircraft shall take-off or land at the aerodrome when any obstruction, vehicle or person is on the part of the aerodrome shown with hatching on the map at schedule 1.
- 4 Changes in the physical characteristics of the aerodrome including the erection of new buildings and alterations to existing buildings or to visual aids shall not be made without the prior approval of the CAA.
- 5 The licensee shall, by the quickest means available, notify the CAA of any material change in the surface of the landing area, or in the obstruction characteristics of the approach, take-off or circuit in relation to the aerodrome.
- 6 The aerodrome is not licensed for the take-off or landing of aircraft at night.
- 7 Expressions used in this licence shall have the same respective meanings as in the Air Navigation Order.
- 8 The 'Air Navigation Order' in this licence means the Air Navigation Order 2005 and any reference to the Order or to any Article of the Order shall, if that Order be amended or replaced, be taken to be a reference to the Air Navigation Order for the time being in force or the corresponding Article of that Order.
- 9 This licence is only valid whilst an air traffic control service, or such other air traffic service, as the CAA may have agreed in writing for the purposes of this condition, is being provided at the aerodrome.

Date

FOR THE CIVIL AVIATION AUTHORITY

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Chapter 2 The Aerodrome Manual

1 Introduction

- 1.1 Article 128 of the Air Navigation Order (ANO) governs the grant of aerodrome licences by the Civil Aviation Authority. The Article together with Schedule 13 sets out the requirements for the Aerodrome Manual within the licensing process. The CAA uses the Manual to assess the suitability of Licensees and their organisations against the safety related requirements set out in Article 128(1)(a) and (b) of the Order. The assessment is a continuous process; this is particularly relevant when changes likely to affect safety are proposed or made.
- 1.2 An application for an aerodrome licence should be accompanied by an Aerodrome Manual produced in accordance with CAP 168. Once granted a licence, the licensee is required to maintain the Manual in conformity with Chapter 2 of CAP 168, and all aerodrome operating staff must have access to the relevant parts of the Manual. The term 'operating staff' means all persons, whether or not the aerodrome licensee and whether or not employed by the aerodrome licensee, whose duties are concerned either with ensuring that the aerodrome and airspace within which its visual traffic pattern is normally contained are safe for use by aircraft, or whose duties require them to have access to the aerodrome manoeuvring area or apron. The Manual will be regarded by the CAA as the primary indication of the standards likely to be achieved by the aerodrome operator. A copy is to be lodged with the Aerodrome Standards Department.

2 Purpose and Scope of the Manual

- 2.1 An efficient management structure and a systematic approach to aerodrome operation is essential. The Manual should contain all the relevant information to describe this structure satisfactorily. It is the means by which all aerodrome operating staff are fully informed as to their duties and responsibilities with regard to safety. It should describe the aerodrome services and facilities, all operating procedures, and any restrictions on aerodrome availability.
- 2.2 Accountability for safety must start at the very top of any organisation. One of the key elements in establishing safe working practices is for all staff to understand the safety aims of the organisation, the chain of command, and their own responsibilities and accountabilities. As safety management principles are applied, the Manual should be expanded to describe clearly how the safety of operations is to be managed at all times. To a reader or user of the Manual there should never be any doubt about who is responsible, who has the authority, who has the expertise and who actually carries out the tasks described in any section.
- 2.3 The principal objective of an Aerodrome Manual should be to show how management will discharge its safety responsibilities. The Manual will set out the policy and expected standards of performance and the procedures by which they will be achieved.

3 Ownership of an Aerodrome Manual

- 3.1 The Licensee is responsible for providing the Aerodrome Manual. It should reflect the requirements and guidance material contained in Civil Aviation Publications and other documents.
- 3.2 It is the responsibility of the Licensee to be satisfied as to the appropriateness of each provision of the Manual to the particular operation, and to make amendments and additions as necessary.
- 3.3 The safety aim and objectives of the Manual and how it is to be used by employees, tenants etc. should be stated in a preface by the Licensee.
- 3.4 In this format and under the signature of the person with overall responsibility for safety in the company, the Manual demonstrates from the highest level, a commitment to the way in which safety will be managed.

4 Amendment of the Manual

- 4.1 Responsibility for maintaining the accuracy of the Manual should be clearly defined. Each copy of the Manual should be numbered and a list of holders maintained by the person responsible for the issue of amendments. In the front of each volume there should be an amendment page available for recording the amendment numbers, date of incorporation, signature of the persons amending and the page or paragraph affected.
- 4.2 Manuscript amendments are not acceptable. Changes or additions should always be the subject of an additional or replacement page on which the amended material is clearly identified.
- 4.3 Amendments to the Manual will be needed either because the document requires to be brought up to date or in response to a request by the CAA. Any amendments or additions must be furnished to the CAA by the holder of the licence before or immediately after they come into effect.

5 Form of the Manual

- 5.1 The Aerodrome Manual is a key document both for the Licensee and the CAA. Supported by the Safety Report, it is the safety assurance document for the CAA's licensing process, and a management tool for industry. The Manual is the source document describing how operational procedures and their safe management will be delivered. It should contain all such information and instructions as may be necessary to enable the aerodrome operating staff to perform their duties. This must include information and instructions relating to those matters specified in Schedule 13 to the ANO. The CAA will expect the Aerodrome Manual to be an accurate reflection of the aerodrome's visible safety management system and safety culture. It should show how the aerodrome intends to measure its performance against safety targets and objectives. An Aerodrome Manual should not just satisfy the CAA's requirements. One of the principal objectives should be to create a medium for promulgating all procedures and information relating to the safe management of the aerodrome. The reader of a Manual should be given a clear and unambiguous statement of how safety is developed, managed and maintained on the aerodrome. All safety policies, operational procedures and instructions should be contained in detail or cross-referenced to other formally accepted or recognised publications.

- 5.2 At larger aerodromes the size and complexity of operations and related procedures may dictate that these procedures could not easily be included in a single document. In such circumstances it is acceptable to identify and reference within the Manual the procedures which are not included within it. If this system is to be successful it is essential that any referenced information, documentation and procedures are subjected to exactly the same systems of consultation and promulgation as the Manual itself. For many small aerodromes the Manual can be both simple and brief as long as it covers procedures essential for satisfactory day-to-day operations. Nevertheless it is possible to adopt a common format embracing the essential elements that define a safety management system.
- 5.3 The numbering of pages and paragraphs should be orderly and systematic to facilitate reference. The standard of printing, duplication and binding should allow the Manual to be read without difficulty and ensure it remains intact and legible during normal use.

6 Contents of the Manual

- 6.1 As a general guide, the following paragraphs set out the items which should be included in the Manual, although it is recognised that the need to include all items will vary between aerodromes depending on the nature and scale of operations. It is not necessary for all operational procedures to be included in the Manual. However, when these are relevant to achievement of policy their location should be clearly referenced within the Manual.

6.1.1 Introduction

- a) Purposes of the Manual.
- b) Legal position regarding aerodrome licensing as contained in the Air Navigation Order.
- c) Distribution of the Manual.
- d) Procedures for distributing and amending the Manual and the circumstances in which amendments may be needed.
- e) Check List of Pages.
- f) Preface by Licensee.
- g) Content Page.
- h) Glossary of Terms (other than those included in CAP 168).

NOTE: This section will contain a short explanation of the general terms used in the Manual including job titles and abbreviations.

6.1.2 Technical Administration

- a) Name and address of aerodrome.
- b) Name and address of Licensee.
- c) Named Persons:
 - i) the name, status and responsibilities of the official in charge of day-to-day operation;
 - ii) the name, status and responsibility of other senior operating staff;
 - iii) instructions as to the order and circumstances in which the above named staff may be required to act as the official in charge;

iv) the name, status and responsibility of staff authorised by the CAA under Article 144 of the Air Navigation order 2005.

d) Details of the aerodrome Safety Management System (see Appendix 2C).

NOTE: This should include an organisational chart supporting the commitment to the safe operation of the aerodrome as well as simply showing the hierarchy of responsibility for safety management.

e) Safety related committees.

6.1.3 **Aerodrome Characteristics**

a) Details of the following:

i) Latitude and Longitude of the Aerodrome Reference Point in WGS 84 format;

ii) Elevations of:

- Aerodrome.
- Apron.

b) Plans to a scale of 1:2500 showing the position of the aerodrome reference point, layout of the runways, taxiways and aprons; the aerodrome markings and lighting (including PAPI, VASIS or LITAS and obstruction lighting); the siting of navigational aids within the runway strips, and their degree of frangibility. It will not be necessary for these plans or the information called for in the following subparagraphs c) to g) to accompany all copies of the Manual, but they must be appended to the Licensee's master copy and to the copy lodged with the CAA. In the case of copies or extracts provided or made available to operating staff, plans of a scale reasonably appropriate to the relevant duties of the said staff should be provided.

c) Description, height and location of obstacles which infringe the standard protection surfaces, and whether they are lighted.

d) Location, reference number and date of the survey plans from which the data at a) and b) were derived, and details of the procedures for ensuring they are maintained and updated.

e) Data for, and the method of calculation of Declared Distances and elevations at the beginning and end of each Declared Distance.

f) Method of calculating reduced Declared Distances when there are temporary objects infringing the runway strip, or the approach and take-off surfaces.

g) Details of the surfaces, dimensions, and classification or bearing strengths of runways, taxiways and aprons.

6.1.4 **Operational Procedures**

a) The system of Aeronautical Information Service available and the system that the Licensee uses to promulgate Aeronautical Information Publication (AIP) requirements.

b) Routine aerodrome inspections, including lighting inspections, and reporting including the nature and frequency of these inspections. (Chapter 3, Appendix 3F)

c) Inspecting the apron, the runways and taxiways following a report of debris on the movement area, an abandoned take-off due to engine, tyre or wheel failure, or any incident likely to result in debris being left in a hazardous position.

d) Sweeping runways, taxiways and aprons.

- e) Obtaining and disseminating meteorological information, including Runway Visual Range (RVR) and meteorological visibility and local area forecasts; (detailed specifications and procedures for RVR assessment in Category I weather conditions using human observers are given in Appendix 2A).
- f) Protection of runways during Low Visibility Procedures (LVPs) if such operations are permitted (Appendix 2B).
- g) Measurement and promulgation of water and slush depths on runways and taxiways.
- h) Measurement and/or assessment, and promulgation of runway surface friction conditions.
- i) Promulgation of information on the aerodrome operational state, temporary withdrawals of facilities, runway closures etc.
- j) The safe integration of other aviation activities such as gliding, parachuting and banner towing.
- k) Recording aircraft movements.
- l) The control of works, including trenching and agricultural activity, which may affect the safety of aircraft (Appendix 2F).
- m) The control of access to the aerodrome and its operational areas, including the location of notice boards, and the control of vehicles on the operational areas.
- n) Maintaining apron control, including marshaller's instructions.
- o) The availability of aviation fuel and its storage, handling and quality control (ANO Article 137 and CAP 748).
- p) Complying with regulatory requirements relating to accidents, incidents and Mandatory Occurrence Reporting (ANO Article 142 and Civil Aviation (Investigation of Accidents and Incidents) Regulations 1996).
- q) The removal of disabled aircraft.
- r) The aerodrome snow plan.
- s) The wildlife hazard control plan.
- t) Aerodrome Safeguarding (Chapter 4, paragraph 4.11).
- u) Runway incursion prevention (Appendix 2D).
- v) Responsibility for monitoring the third parties operating on the aerodrome (Appendix 2E).

6.1.5 **Visual Aids (Reference should be made to Chapters 6 and 7)**

- a) Responsibilities with respect to the Aerodrome Ground Lighting (AGL) system.
- b) A full description of all visual aids available on each approach, runway, taxiway and apron. This shall include AGL signs, markings and signals.
- c) Procedures for operational use and brilliancy settings of the AGL system.
- d) Standby and emergency power arrangements, including operating procedures both in LVPs and during mains failure.
- e) Procedures for routine flight inspection of approach lights, runway lights and PAPIs.
- f) The location of and responsibility for obstacle lighting on and off the aerodrome.
- g) Procedures for recording inspection and maintenance of visual aids and actions to be taken in the event of failures.

6.1.6 Rescue and Fire Fighting Services (RFFS)

- a) Policy statement of the RFF category(s) to be provided.
- b) Where the Senior Airport Fire Officer (SAFO) or designated watch officers have specific safety accountabilities these should be included in the relevant chapter of the Manual.
- c) Policy and procedures indicating how depletion of the RFFS is to be managed. This should include the extent to which operations are to be restricted, how pilots are to be notified and the maximum duration of any depletion.
- d) At aerodromes where a higher category is available by prior arrangement the Manual should clearly state the actions necessary to upgrade the facility. Where necessary this should include actions to be taken by other departments.
- e) The Licensees' objectives for each RFF category provided should be defined. This should include a brief description of:
 - amounts of media provided;
 - discharge rates;
 - number of foam producing appliances;
 - manning levels;
 - levels of supervision.

NOTE: When the objectives are higher than those set out in CAP 168, chapters 8 and 9, Licensees may also wish to indicate the minimum levels acceptable under their safety policies.

- f) Procedures for:

Monitoring the aircraft movement areas for the purpose of alerting RFF personnel.

Showing how RFF personnel are alerted throughout the range of functions (training, extraneous duties, etc.) and geographical locations from where they may be expected to respond.

Indicating how the adequacy of the response time capability throughout their functions and locations is monitored and maintained.

Indicating how RFF personnel engaged in extraneous duties are managed to ensure that response capability is not affected.

- g) Where the aerodrome provides specialist equipment such as rescue craft, emergency tenders, hose layers, appliances with aerial capability, etc., details should be included in the Manual. Procedures to be followed if these facilities are temporarily unavailable should also be included.

Where the aerodrome is reliant upon other organisations to provide equipment which is essential for ensuring safe operation of the aerodrome (perhaps water rescue), policies or letters of agreement should be included in the Manual. Where necessary contingency plans in the event of non-availability should be described.

- h) A statement describing the processes by which Licensees ensure the initial and continued competence of their RFF personnel. This should include the following:
 - realistic fuel fire training;
 - Breathing Apparatus training in heat and smoke;
 - First Aid;

- LGV driving;
 - Low Visibility Procedures CAP 168 Chapter 8 Appendix 8B;
 - CAP 168 Chapter 8 paragraph 11;
 - CAP 699 Standards for Competence of Rescue and Fire Fighting Service Personnel Employed at UK Licensed Aerodromes;
 - Health and Safety policy with regard to training of personnel in RPE and PPE.
- i) Procedures indicating how accidents within 1000 m of the threshold of each runway are to be accessed. Where other difficult environs exist the Manual should indicate how these are to be accessed.
 - j) Where Licensees expect the RFF facility to respond to domestic fires or special services, procedures for managing the impact of this upon the normal aircraft RFF response should be included.
 - k) Where Licensees expect the RFF facility to respond to aircraft accidents landside, the policy should be clearly described. This should include procedures to manage the effects on continued aircraft operations.
 - l) The availability of additional water supplies following an aircraft accident should be described. Details of the policy to be followed in the event of contractual work which requires isolation or depletion of suppliers should be included (work in progress).
 - m) Where an aerodrome accepts freight aircraft, ambulance flights or movements not required to use a licensed facility, company objectives regarding RFF category should be included.
 - n) The Licensee's arrangements for ensuring the adequacy of responses in abnormal conditions i.e. Low Visibility Procedures.
 - o) A policy statement indicating how the Licensee ensures the training and competence of First Aid personnel.
 - p) An indication of the scale of the medical equipment carried. Where medical equipment is held other than on the RFF vehicles a statement indicating its location and how it is to be transported to an incident should be included.

6.1.7 **Integrated Emergency Planning**

The Licensee's arrangements for determining and implementing plans that ensure the integrated management of response to an aircraft incident/accident. These arrangements should take account of the complexity and size of the aircraft operations.

6.1.8 **Air Traffic Services**

Details of the following:

- a) The system for the safe management of air traffic operating on the aerodrome or in the airspace associated with it.
- b) Procedures for the selection of the runway in use and the circuit direction.
- c) Procedures for noise abatement.
- d) Procedures for evaluating the suitability for use and availability of the runway(s).
- e) Procedures for alerting emergency services.

except where these are included in documentation associated with an ATSU established at the aerodrome and approved by the CAA.

6.1.9 Communications and Navaids

- a) Description of and instructions for the use of air/ground and operational ground radio communications where these are not covered in ATC or AFIS manuals.
- b) Description of and operating procedures for navigation aids.

6.1.10 Bibliography

Cross Referenced Documentation.

Appendix 2A Runway Visual Range (RVR) Assessment using Human Observers

1 Foreword

- 1.1 This Appendix sets out the CAA's specifications for establishing and operating RVR reporting systems using human observers.
- 1.2 Where Instrumented RVR is not available, RVR for the purposes of Category I operations may be assessed by human observer. However, the human observer assessment of RVR is not permitted for Category II or Category III operations.

2 Method

- 2.1 Where human observer assessment is employed, the observer counts the number of runway lights he can see from a Runway Observation Position (ROP) near the runway and this number is converted to runway visual range. An allowance is made for the differences in light intensity, background, etc., observed from the different viewing positions of the observer and the pilot. Where it is difficult to count runway lights, observations are made on a special row of runway or other lights, set up near the runway.

3 The Runway Observing Position (ROP)

3.1 Siting and Number of Runway Observing Positions

For RVR observations made in connection with Category I operations, one ROP giving an assessment of the RVR on the runway in the touchdown zone will generally be sufficient.

A ROP may be either a structure or vehicle and its location should be determined by the aerodrome operator in consultation with the CAA using the guidance material set out below. This is the position from which the RVR calibration will be made as detailed in paragraph 5.2.

3.1.1 Lateral Position

Ideally the ROP should be sited not more than 120 m laterally from the runway centreline. However, for safety reasons it must not be located:

- a) within the runway cleared and graded area,
- b) within taxiway strips,
- c) such that a profile of 1 in 10 slope originating at the runway centreline is infringed by the height of the structure or vehicle, including the observer in his observation position.

However, as an exception to b) above it is acceptable to locate the ROP on a taxiway that is inactive when measurements are being taken. Reference should be made to CAP 168 Chapter 3, paragraph 6 for details of the relevant specifications and criteria.

3.1.2 Longitudinal Position

The touchdown zone ROP should be located approximately 300 m upwind of the runway threshold. On short runways it is preferable for the ROP to be sited abeam or

downwind of the threshold so as to be able to increase the maximum reportable RVR. Care should be taken to ensure that the ROP does not constitute an obstacle infringing the relevant instrument approach surfaces specified in CAP 168.

3.1.3 **Position of ROP relative to Lights/Marker Boards**

The ROP should be sited so as to enable the lights used for assessing RVR to be clearly visible to the observer. The observer eye height should be 5 m above the runway level, this being the maximum practical height for a human observer. The most representative assessment of RVR will be made when counting lights on the opposite side of the runway to that of the ROP, but it is recognised that although this should be the aim, it will not be possible on some runways, for example on undulating runways or where there are many flush edge light fittings on the opposite side. In such cases the order of preference for the selection of lights to be used is shown in paragraph 5 below.

3.1.4 The ROP should be located so that the vehicle or structure does not obscure a pilot's view of visual aids.

3.1.5 In order to ensure that the ROP does not affect the performance of electronic navigation aids advice on the siting should be sought from the aerodrome telecommunications officer.

3.2 **Marking and Lighting**

3.2.1 Whether the ROP is a fixed structure or parked vehicle it should be marked and lighted as an obstacle as laid down in CAP 168, Chapter 4, paragraph 12.

3.2.2 In order to ensure that the observer makes his observation from the calibrated position where the ROP is a parked vehicle, the parking position should be clearly and unambiguously marked, so that the vehicle may be correctly positioned each time it is deployed.

3.3 **Equipment and Facilities**

3.3.1 **Communications**

The ROP should have direct and preferably discrete communication with ATC in order to facilitate the rapid reporting of RVR changes. It is a requirement that the report reaches the pilot within 30 seconds of an observation being made.

3.3.2 **Comfort**

The ROP, whether permanent or mobile, should have a sufficient degree of comfort so that personnel are not affected by fatigue or poor working conditions.

3.3.3 **Transparency of Glass Surfaces**

Glass surfaces through which observations are made should be kept clear of precipitation and condensation.

3.3.4 **Internal Lighting**

Sufficient light should be available for reporting and recording the observations. Lighting within the ROP should be such that the taking of observations and the visual night acclimatisation of the observer are not adversely affected.

3.3.5 **ROP Construction**

Where the ROP is a fixed structure it should be of minimum dimensions and maximum frangibility consistent with its function.

4 Lights

4.1 Selection of lights to be used for observations

The order of preference for selecting lights to be used for observations is, in descending order:

opposite side runway edge lights
opposite side special reference lights
same side runway edge lights
same side special reference lights.

The CAA will advise the aerodrome operator which lights are to be used for each runway and only that set of lights should be used for observations. Some runway edge light fittings may not be clearly visible to an observer at the side of the runway and a row of special reference lights of similar characteristics to the runway lights but beamed towards the ROP, may be needed. The intensity setting of these reference lights should be automatically set to the same intensity as the runway lights. Reference lights are to be arranged so as not to present a confusing or dangerous appearance to pilots.

4.2 Calibration of runway lights

High intensity runway lights with a beamed element, directed along the runway towards the pilot, will result in the intensity of light directed towards the ROP being less than the intensity directed towards the pilot. Consequently a calibration of the lights used will be necessary. This will be carried out by the CAA from the ROP and from the runway centreline in order to prepare a conversion table. From this table an assessment of the RVR to be experienced by the pilot can be read against the number of lights observed from the ROP. The aerodrome operator should ensure that re-calibrations are carried out by the CAA at the agreed intervals and that a new table is issued. A re-calibration is to be carried out immediately following any alterations or changes to the system, for example when lights have been re-aligned, or changes made to supply voltages, or when the ROP site has been changed. Any such change invalidates the previous conversion table and RVR reports are not to be passed until a new table is available.

4.3 Maintenance of RVR reference lights

Where special reference lights are used they should be maintained to the same standard as the corresponding runway lights so that RVR observers and pilots are viewing lights which have a comparable performance.

4.4 Inspection of lights

The lights used for RVR observations should be regularly inspected from the ROP, at the correct eye height, through binoculars in clear daylight with the lights set at maximum intensity. This visual inspection should check for subsidence, damage, misalignment, ageing of bulbs/lenses and obscuration by grass. It is recommended that this inspection is carried out at least monthly.

5 The Observer

5.1 Selection and function of the observer

The function of the observer needs no particular skill since it consists of identifying and counting lights and reporting this count to ATC. However, since assessment of RVR has a direct bearing on safety and regularity of aircraft operations, observers

should be mature and with the ability to carry out their duties conscientiously at all times. The aerodrome operator should ensure that observers understand the importance of correct RVR observations and appreciate that extra vigilance is required when fog is forming or dissipating so that changes are detected and reported as they occur.

5.2 Time on duty

Duty periods for RVR observers should be arranged so that long periods without an adequate break are avoided. Periodic visits should be made by supervisors to an active ROP to check that the correct procedures are being used and the log is being correctly maintained when this is required of the observer.

5.3 Eyesight and Hearing Requirements

5.3.1 Personnel selected for RVR observer duties should have examination performed:

- a) prior to acceptance for RVR duties;
- b) 5-yearly up to age 40, then 2-yearly to age 50, then annually thereafter;
- c) before return to duty following any sickness involving eyesight or hearing.

5.3.2 Personnel are required to have a visual acuity in each eye tested separately of not less than 6/9 measured at a distance of 6 m (20 ft) using Snellen Test Types. If correcting spectacles or contact lenses are worn, the refractive error should not exceed ± 5 dioptries of equivalent spherical error.

5.3.3 The near vision should be N5 or equivalent at a distance between 30 and 50 cm binocularly. Spectacles may be worn to achieve this standard.

5.3.4 The visual fields should be normal as tested by the confrontation method.

5.3.5 The ocular muscle balance should be normal.

5.3.6 Colour perception should be tested by Ishihara or other pseudoisochromatic colour plates. Candidates whose eyesight is shown to be defective by this means should be subjected to an approved lantern test, e.g. Giles Archer or Holmes-Wright, to demonstrate that the colours signal red, signal green and white can be readily identified. Colour perception testing should not be repeated at the periodic vision testing.

5.3.7 The observer shall have the ability to hear an average conversational voice in a quiet room using both ears at a distance of 8 ft from the examiner with his back turned to the examiner.

5.3.8 Should doubts arise on any aspect of eyesight and hearing testing or requirements, CAA Medical Department should be consulted.

6 Operating Procedures

6.1 Periods when RVR reporting is required

The ROP should be manned in accordance with an alerting procedure based on meteorological reports and forecasts which will ensure that a continuous service can be given throughout any operational period during which the meteorological visibility is reported to be 1500 m or less. Assessment and reporting may cease when meteorological visibility is greater than 1500 m and the RVR is greater than the maximum value that can be reported. At some less busy aerodromes it may be sufficient to report RVR only during those periods commencing 15 minutes prior to and during aircraft movements. However, consideration should be given to the need

for pilots intending to depart from another aerodrome to have a recent destination RVR report available to them. Under no circumstances should an RVR report be used or passed after the standing down of the observer except when that report is quoted as part of a full meteorological report which includes a time of origin.

6.2 **Reporting Procedures**

6.2.1 **Standardisation**

The UK standard for reporting RVR extends from zero to 1500 m in the following steps:

0 to 200 m in 25 m steps
200 to 800 m in 50 m steps
800 to 1500 m in 100 m steps

Where a system is unable to report the full range of RVR as outlined above, the limitations of the system should be published in the AIP at GEN 3.5.3.

6.2.2 **The count**

The number of lights that can be seen should be reported to ATC, for example 'Four lights'. The report should be read back to the observer by ATC. An immediate report is to be made whenever there is a change in the count, but if there are no changes, confirmatory reports should be made at 30 minute intervals, or when requested. Similar reports and read backs should be made if the count is converted to RVR at the ROP.

6.2.3 **Low/High RVR values**

If the RVR is so low that no lights are visible to the observer, he should report this. The RVR in these circumstances should be reported to a pilot as 'less than..... metres', the actual RVR value quoted being the equivalent of one light. If the visibility is sufficient to enable the observer to see an object at ground level at a distance greater than the light which defines the maximum reportable RVR value, a report of 'RVR greater than..... metres' should be given.

6.2.4 **Effect of light intensity on reporting**

RVR observations, including those for transmission in meteorological reports, should be made with the lights set at the intensity appropriate to the prevailing conditions. RVR should not be assessed with the lights set at an intensity for which there is no conversion table. If a pilot requests that the lights be reduced in intensity and this results in a setting for which there is no conversion table, the pilot should be advised that RVR is not available at this requested setting.

6.2.5 **Partial power failure**

At some aerodromes a partial electrical power failure can result in every second light being extinguished. If special conversion tables appropriate to these circumstances are not available the observer should double the number of lights that can be seen then subtract one. This number can then be used with the normal conversion table to establish an RVR. The record in the RVR log should be annotated accordingly.

6.3 **ATS functions**

ATS aspects of RVR are described in general terms in Part 1 of the Manual of Air Traffic Services (MATS). Air Traffic Service Units should ensure that aspects specific to their aerodromes are described in their Part 2 of MATS or Local Instructions.

6.4 Changes to procedures

RVR should be observed and reported strictly in accordance with the laid down procedures. However, where local conditions require a departure from the standard procedures the proposed change should be cleared with the CAA before operational use.

7 Operating Instructions

7.1 A comprehensive set of operating instructions should be drawn up for the aerodrome and included in the Aerodrome Manual. The instructions should state clearly who is to be responsible for the various procedures, for example, who will be required to maintain the RVR log mentioned at paragraph 8 below. It may be desirable for instructions to be issued to RVR observers in a separate document.

7.2 The minimum content of the instructions is shown at Annex A.

8 The RVR Log

8.1 At times during which RVR is being assessed, RVR and meteorological visibility values are observed or measured shall be recorded such that the reported RVR and visibility reported at any particular time can be determined. Records shall be made available to the CAA on request.

8.2 Logs and any other required records are to be collected on the termination of a period of observation and are to be kept by the unit concerned for at least twelve months from their completion, after which time they may be destroyed. Associated records (system calibration; system maintenance; observer medicals etc.) shall still be kept according to their audit requirements.

8.3 The RVR log shall include the following:

- a) Aerodrome.
- b) Date.
- c) Runway.
- d) Start and finish time for the period of observations.
- e) The time each observation is logged, expressed in UTC to the nearest minute.
- f) The actual count expressed as the number of lights observed e.g. 'Four lights', and the corresponding RVR value.

Annex A to Appendix 2A

Guidance Notes on the Contents of the Aerodrome Operations Manual Relating to RVR Observations

The following material should be included:

- a) The reason for RVR reports, with emphasis on the contribution to operational safety.
- b) The alerting procedure and meteorological conditions for manning the ROPs.
- c) The positions of the ROPs and, if applicable, which vehicle is to be used at the ROPs, the orientation of the vehicle and the precise position of the observer in relation to the vehicle, for example, sitting in the cab or on the roof.
- d) The routes to be used to reach the ROPs and details of any authorisation or clearance required.
- e) A comprehensive diagram of the runway environment is to be available at the ROP to enable the lights to be positively and individually identified.
- f) The manner in which reports are to be passed to ATS together with an instruction that reports are to be passed immediately.
- g) The method of use of the conversion table and by whom it is to be used, that is the observer or ATS.
- h) Specification of UTC as the time to be used and the need to synchronise the ROP clock or observer's watch with ATS.
- i) The action to be taken in the event of partial electrical failure extinguishing certain lights (if appropriate to the aerodrome).
- j) The method of reporting an RVR value greater than, or less than the calibrated values.
- k) An instruction to observers that they should immediately report to ATS anything they see that might affect operational safety. Examples should be given, such as unauthorised persons on the movement area, an airfield lighting fault (particularly those lights used in RVR observations), or something on an aircraft appearing to be unsafe.
- l) Responsibility and instructions for maintaining and preserving the RVR log.
- m) Arrangements for initial and renewal eye tests for observers. A reminder that spectacles or contact lenses must be worn for observation if worn for the test.
- n) The frequency of re-calibration of the RVR lights.
- o) Arrangements for inspection and cleaning of the lights.

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Appendix 2B Low Visibility Operations

1 Low Visibility Operations

- 1.1 Aircraft operations at aerodromes during reduced visibility or low cloud conditions present additional hazards to the aircraft and to other aerodrome users. As visibility reduces, the ability of air traffic service staff, pilots, vehicle drivers and other personnel to identify hazards and to take remedial action in a timely manner becomes limited. In conditions of low cloud, the time available for the pilot of an approaching aircraft to assess the aerodrome environment visually is reduced.
- 1.2 Aerodromes that wish to continue operating in poor visibility or are available for instrument approaches in conditions of low cloud are required to develop and maintain procedures to be implemented in poor weather conditions in order to safeguard the operation of aircraft. These procedures are known as Low Visibility Procedures (LVPs).
- 1.3 Aerodromes that are available to precision instrument approaches are required to develop and maintain additional procedures that ensure suitable measures are in place to protect the signal produced by the ground based radio navigation equipment.

2 Responsibilities with respect to Low Visibility Procedures

- 2.1 It is the responsibility of the aerodrome licensee to develop and maintain the LVPs used at their aerodrome.
- 2.2 Whilst ATC are responsible for advising pilots of the status of LVPs at an aerodrome, it is the responsibility of the aerodrome licensee to ensure that all measures required to protect aircraft operations in poor weather conditions are in place before advising ATC that LVPs can be declared to be in force.

3 Hazards

- 3.1 On aerodromes where the ground marking and lighting is satisfactory, ground traffic flow rates can often be sustained safely in visibilities down to 500 m. An aeroplane on the ground is most vulnerable during the landing and the take-off phases of flight, when the pilot is severely restricted in the avoiding action that he or she can take. The aircraft is likely to be badly damaged or destroyed if it collides, at high speed, with any sizeable object. As visibility deteriorates, the potential for runway incursions by aircraft, vehicles or personnel increases.
- 3.2 The risk of inadvertent runway incursion by taxiing aircraft is greatest at aerodromes with complex layouts and multiple runway access points. This risk can only be managed adequately by the application of procedures that provide the pilot with clear, unambiguous guidance on routing and holding points or ground traffic patterns.
- 3.3 The safe operation of vehicles on the movement area depends to a large degree upon drivers being adequately trained and thoroughly familiar with the aerodrome layout in all visibility conditions and by complying with procedures, signs, signals and ATC instructions. As part of their SMS, aerodrome licensees should have in place a procedure that ensures drivers permitted to operate in airside areas at times when LVPs are in force, are not only appropriately trained but also remain competent in view of the limited occasions in which these conditions occur.

- 3.4 During precision instrument approach operations, interference to the signal guiding the aircraft can cause deviation to the aircraft's flight path and can cause unnecessary go-arounds.

4 Low Visibility Procedures

- 4.1 In order that flying operations may be safely conducted at aerodromes in low visibility conditions, aerodrome licensees, in consultation with local ATS staff, should determine the movement rate that they wish to sustain and develop LVPs that will support the desired movement rate. These procedures will vary with each aerodrome and are subject to acceptance by the CAA prior to inclusion in the Aerodrome Manual and the unit Manual of Air Traffic Services Part 2 and their subsequent implementation. LVPs should take account of the factors described in the following paragraphs.
- 4.2 In order to protect aircraft operating on the ground in low visibilities, it is essential to prevent unauthorised vehicular traffic from entering the movement area. The area should, where practicable, be fenced and provided with manned controlled entry points. Where unguarded gates are provided they should be kept locked and inspected regularly to ensure that they remain secure. Where physical closure is not practicable, for example between aircraft maintenance areas and manoeuvring areas, entry points should be manned and where the opening is too wide for visual surveillance then it should be fitted with intruder detection equipment suitable for operation in a low visibility conditions. By protecting the movement area in this manner it should be possible to exclude unauthorised personnel who will not be aware of aerodrome traffic control procedures.
- 4.3 Complete protection can be expensive and is sometimes difficult to achieve, particularly on large aerodromes where taxiways cross vehicular traffic routes, and where maintenance areas compete with parking aprons for space. Where it is not practicable to secure the area in this manner recommended above the aerodrome licensee shall satisfy the CAA as to the security of the aerodrome's operations in low visibility conditions.
- 4.4 When LVPs are in force, only vehicles essential to the aerodrome operation and driven by formally tested and authorised drivers should be allowed on to the movement area. All such vehicles should be equipped with an airfield chart permanently displayed in the driver's cab clearly showing all taxiways, runways, holding points and vehicle routes marked with their appropriate designation. The chart should be accompanied by written instructions clearly detailing the action that the driver should take in the event that the vehicle should break down or that the driver should become unsure of his position on the airfield. In addition, all vehicles operating on the manoeuvring area should be equipped with R/T and the driver required to maintain contact with ATC at all times. Authorised drivers should be thoroughly briefed and familiar with the aerodrome layout including closed taxiway junctions and runway access points, the meaning of all markings, signs and aerodrome lighting, and where appropriate, standard R/T phraseology. Drivers that are restricted to certain areas of operation should be familiar with the limits of those areas, particularly if they cannot be clearly marked, for example, on the aerodrome surface. Authorised drivers should be checked periodically for competence and knowledge of local procedures. All non-essential vehicles and personnel, e.g. works contractors and maintenance parties and their equipment must be withdrawn from the manoeuvring area.
- 4.5 In order to continue unrestricted operations for as long as possible whilst weather conditions deteriorate, LVPs at many aerodromes are designed to implement most of

the ground-based measures in good time, and in certain circumstances before they are absolutely necessary. The final measures, which are wholly within the control of ATC, should be implemented only when the weather conditions demand it. However, in such cases there is potential for misunderstandings to occur as to the status of LVPs at the aerodrome. Procedures should ensure that the potential for such misunderstandings is minimised and that there is a single point from which definitive information about the current status of LVPs can be confirmed.

- 4.6 Rescue and Fire Fighting Service (RFFS) vehicles are essential to airfield operations at all times and response and deployment times are of vital concern to aerodrome licensees. Although it is unlikely that RFFS response time will be significantly affected in visibilities down to 200 m, temporary relocation of vehicles to strategic points may be necessary for a very large or complicated aerodrome. In visibilities below 200 m there is greater probability that response times will be affected. Operational procedures and training should be developed in accordance with the guidance at Chapter 8, Appendix 8B.
- 4.7 Similarly, because congregations of birds are difficult for both ATS staff or pilots to observe in poor weather conditions, bird hazard control operations should not be restricted during LVPs. Procedures should ensure that adequate time between movements is afforded to permit bird hazard control measures to be implemented. The importance of maintaining a runway inspection regime in sustained periods of LVP implementation is also highlighted. This too should be accounted for when determining the declared movement rate.
- 4.8 The risk of inadvertent runway incursion by an aircraft, or aircraft mis-routing, is increased in low visibility conditions. Wherever possible this risk should be minimised by keeping taxiway routings as simple as is practicable. This can be best achieved by restricting the available taxiway system wherever possible to a single route from the apron to the runway, with intermediate junctions closed, a clearly defined runway entry point, holding point and a separate exit taxiway and return route for landings or rejected takeoffs.

All other runway access or crossing points should be closed. This can be achieved by the use of red stop-bars or by a physical barrier using the unserviceability markers described in Chapter 7 paragraph 4.6.2. Markers used in this manner should either be retro-reflective or augmented by lights of the type described at Chapter 4 paragraphs 12.10.1 and 12.10.2. In this way the procedural control of aircraft and vehicles at complex aerodromes can be simplified. On major aerodromes where traffic is such that several routes are operated simultaneously, a Surface Movement Guidance and Control system is likely to be required in order to achieve the declared movement rate.

- 4.9 ICAO Annex 14 currently recommends the provision of Surface Movement Radar (SMR) at aerodromes where operations in RVR less than 400 m take place. However, unless the CAA has approved specific procedures, SMR is a monitoring tool only; SMR enhances existing ATC procedures and its use should **not** normally be regarded as the prime method by which collision avoidance can be effected.

5 Visibility Conditions and Associated Actions

- 5.1 The point at which LVPs should be implemented will vary from one aerodrome to another depending on local conditions and facilities available. The point at which LVPs are to be implemented must be clearly defined and should be related to a specific RVR or cloud ceiling measurement (e.g. 1000 m RVR or 300 ft cloud ceiling). Adequate consideration should be given to the time taken to implement fully all of the

measures required to protect operations in low visibility conditions. Provision should also be made for alerting airlines and other organisations with movement area access in good time of the introduction of LVPs. This is particularly important where companies exercise control over their own apron areas and maintenance facilities adjacent to the manoeuvring area.

- 5.2 It is not possible to lay down definitive rules governing the actions to be taken in order to ensure the smooth implementation of LVPs at every aerodrome. The following guidelines may be of assistance in developing robust LVPs.

6 Visibility Condition 1

- 6.1 Visibility Condition 1 is defined as visibility sufficient for the pilot to taxi and to avoid collision with other traffic on taxiways and at intersections by visual reference and for ATC personnel to exercise control over all traffic on the basis of visual surveillance.
- 6.2 No additional requirements for the protection of ground operations by aircraft are required during Visibility Condition 1.

7 Visibility Condition 2

- 7.1 Visibility Condition 2 is defined as visibility sufficient for a pilot to taxi and to avoid collision with other traffic on taxiways and at intersections by visual reference, but insufficient for ATC personnel to exercise control over all traffic on the basis of visual surveillance.
- 7.2 Actions required in Visibility Condition 2 are dependent on the dimensions of the manoeuvring area and the position of the control tower. Procedures and visual aids will allow the pilot to determine his position and follow the required route. In the lower ranges of Visibility Condition 2, the necessary procedures might limit the movement rate unless some additional aids are available, such as Surface Movement Guidance and Control Systems, which may enable a greater movement rate to be achieved safely.
- 7.3 Adequate safeguards against runway incursions should be in place, such as limited taxi routing, surface movement radar assistance and stop-bars or physical barriers at runway access points.
- 7.4 When the visibility decreases to a value equivalent to about 1000 m RVR, and is expected to fall further, the withdrawal of vehicles and personnel involved in construction, maintenance and other non-essential activities on the manoeuvring area should normally be initiated. Routine maintenance on visual and non-visual aids should be suspended and the ILS sensitive area should be cleared of all traffic. As the RVR deteriorates to 600 m, or the cloud ceiling reduces to 200 ft, the withdrawal of non-essential vehicles and personnel from the manoeuvring area should be completed and all activities on the manoeuvring area should be brought under specific control by ATC (e.g. all activities subject to individual clearances as opposed to free-ranging).

8 Visibility Condition 3

- 8.1 Visibility Condition 3 is defined as visibility equivalent to an RVR of less than 400 m.
- 8.2 In such visibility conditions it is likely to be necessary to further restrict the operation of vehicles and persons on the manoeuvring area. Procedures developed for ATC to assist bird hazard control and the Rescue and Fire Fighting services (in case of an accident or incident) should be implemented.

9 Precision approach operations

- 9.1 As the RVR deteriorates to the minimum at which Category I approaches can be made (typically below 600 m but the exact value is determined by a variety of factors), or the cloud ceiling¹ reduces to 200 ft, the withdrawal of non-essential vehicles and personnel from the manoeuvring area should be completed.
- 9.2 In such conditions all measures designed to protect Category II and III approaches should be in place.
- 9.3 It should be noted that a pilot will expect a precision approach aid to be fully safeguarded and available for Category II or III use if LVPs are declared to be in force by ATC (see paragraph 10) at the aerodrome¹.

10 Declaration of Low Visibility Procedures in force

- 10.1 It is essential that **all** LVP measures are verified as in place before LVPs are declared to be in force by ATC. Similarly, LVPs should be declared as cancelled before the aerodrome licensee withdraws any measures. It should be remembered that aircraft established on an approach may have commenced that approach believing that LVPs are in force and that measures taken to protect the approach aid and runway remain in place until all such aircraft have completed their approach.
- 10.2 **At aerodromes that support Category II or III operations and in conditions that preclude Category I operations, under no circumstances should LVPs be declared to be in force if the appropriate safeguards for Category II or III operations are not fully in place to protect the landing aids and runway.**
- 10.3 Misunderstandings about the status of LVPs can easily arise during periods when the procedures are being introduced or withdrawn. This is particularly true at aerodromes where LVPs include a phase where preparatory actions are taken prior to the full implementation and declaration of 'LVPs in force' or where some measures may be left in place during what may be a temporary improvement in the weather conditions so that full LVPs can be re-instituted at short notice should the weather deteriorate again. Local procedures should ensure that the status of LVPs are clearly understood by all those that are involved in aerodrome operations.

11 Review of Low Visibility Procedures

- 11.1 Aerodrome authorities, in co-operation with local ATC staff and other agencies involved in LVP operations, should regularly review the effectiveness of LVPs. Any need for change should be agreed with the CAA prior to implementation and inclusion in the Aerodrome Manual and the Manual of Air Traffic Services Part 2.

1. Whilst it is normal practice to protect Category II and III approaches when the *cloud ceiling* is 200ft or below, an aerodrome may choose to implement these measures when the *cloud base* is 200ft or below in order to further reduce the risk of an aircraft having to go-around due to disturbance of the ILS signal if the cloud requires the approach to be made to Category I minima.

12 Additional information

- 12.1 Low visibility operations are discussed in greater detail in ICAO Doc 9476 Manual of Surface Movement and Guidance Control Systems Chapter 5 and examples of LVPs in use at several international airports are given in Appendix B to that Document.
- 12.2 Systems designed to enable movement rates to be sustained are discussed in ICAO Doc 9830 Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual.

13 Conversion of Reported Meteorological Visibility to RVR

- 13.1 At aerodromes where RVR measurements are not made, or in case of unserviceability of RVR measuring equipment, LVPs should include criteria for implementation and withdrawal based on the reported meteorological visibility.
- 13.2 Pilots, when converting meteorological visibility to an equivalent RVR, may apply the factors Table 2B.1 provides. This method of obtaining RVR is not intended for direct application by aerodrome authorities but is included in order to provide assistance for aerodromes at which RVR is not available.

Lighting Elements available	RVR = Reported Met Visibility	
	Day	Night
High Intensity Approach and Runway Lighting	1.5	2.0
Any type of lighting installation other than above	1.0	1.5
No lighting	1.0	—

Appendix 2C Aerodrome Safety Management System

- 1 An effective Safety Management System (SMS) forms the primary safety oversight covering the way an aerodrome manages safety. An aerodrome SMS should demonstrate an identifiable and easily audited systematic control of the management of safety at an aerodrome. It should be able to display to the aerodrome organisation and prove to the CAA that all activities result in continuous compliance with the safety requirements.
- 2 The CAA publishes advice and guidance on safety management in CAP 642, CAP 726 and CAP 728. Licensees should include or refer to the following key elements in the Aerodrome Manual:
 - a) **Safety Policy**

Effective safety policies, endorsed by senior management, set a clear direction for the organisation to follow and contribute to all aspects of business and safety performance.
 - b) **Organising**

An effective management structure and arrangements should be in place to deliver the policy. Include details of the organisational structures, including an organisation chart supporting the commitment to the safe operation of the aerodrome as well as simply showing the hierarchy of responsibility for safety management. The responsibilities and accountabilities of all individuals in respect of safety should be clearly defined.
 - c) **Planning**

From the policy statements, the organisation should define its safety management strategy. Having defined the policy statements and strategy, the procedures designed to achieve this should be clearly documented. Methods of promulgating information and ensuring competence should be included.
 - d) **Measuring Performance**

Safety performance is measured and compared to agreed safety levels and safety objectives to reveal when and where improvement is needed. Self-monitoring such as safety inspections are a part of this process.
 - e) **Auditing and Reviewing performance**

Systematic review based on data from monitoring and independent safety audits of the whole SMS. The organisation learns and applies all of the lessons, thus contributing to a continuous improvement cycle.
 - f) **Management of Change**

Assess the safety impact of any safety significant changes upon other procedures and processes, individuals and the operation and organisation as a whole. This should be done in the planning stages of any project, and updated as required.

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Appendix 2D Runway Incursion Awareness

1 Introduction

- 1.1 The UK CAA defines a runway incursion as any occurrence at an airport involving the unauthorised or unplanned presence of an aircraft, vehicle or person on the protected area of a surface designated for aircraft landings and departures.
- 1.2 Several fatal accidents have occurred, resulting in significant loss of life. Aerodrome licensees need to be aware of the potentially catastrophic hazard presented to aircraft by runway incursions and to focus on preventative measures. These include the necessity for effective low visibility procedures and runway taxiway-holding position signage to be compliant with CAP 168, which upholds the international standards.
- 1.3 Proactive measures should be taken by aerodrome licensees to reduce the likelihood of a runway incursion occurring and to raise awareness of the hazards associated with runway incursions to all aerodrome users.
- 1.4 It is rare that any incursions result from a single contributory factor; however, pilots, ATC, vehicle drivers and pedestrians may all contribute to incidents by making errors, such as:
- failure to follow a clearance or instruction;
 - failure to follow procedures;
 - issue of an incorrect clearance, instruction or procedure;
 - loss of situational awareness;
 - use of poor communication techniques;
 - poor knowledge of the aerodrome; and
 - use of inadequate or inappropriate procedures.

2 Action To Be Taken By Licensees

- 2.1 Licensees should regularly review those areas of their aerodrome Safety Management System (SMS) relevant to the prevention of runway incursions. In doing so, they should ensure that suitable measures are in place, particularly in areas of vulnerability, to minimise the risk of runway incursion. In this review, licensees should consider:
- a) to what extent aerodrome visual aids, i.e. aeronautical ground lighting, signs and markings, contribute towards reinforcing situational awareness;
 - b) whether the aerodrome's visual aids, in conjunction with ATC clearances and instructions, in the vicinity of a runway could mislead pilots and vehicle drivers;
 - c) whether the layout of any movement areas on the aerodrome could cause confusion 'hot-spots', and how such confusion could be eliminated;
 - d) whether airside driver training is sufficiently robust, reassessing vital topics such as aerodrome operations; radio communication procedures and phraseology; the use and meaning of visual aids; and familiarisation of aerodrome layout; and

- e) how runway safety is maintained during periods of 'work-in-progress', particularly when contractors who are not familiar with the aerodrome or with aerodrome operations are involved.
- 2.2 Licensees should conduct regular 'table-top' exercises attended by representatives of all relevant aerodrome functional areas, whereby runway incursion scenarios can be developed and the effectiveness of potential prevention measures may be assessed. A review of these assessments and other SMS actions may be included in the aerodrome audit process.
- 2.3 Attention is drawn to the *European Action Plan for the Reduction of Runway Incursions*¹. The Action Plan suggests certain initiatives and recommendations, including the establishment of a permanent Local Runway Safety Team (LRST), that in some cases could be taken into consideration when addressing the risk of runway incursions. It is likely that a Runway Safety Committee, or similarly named group, may perform the same role as the LRST.

1. Available for download from the EUROCONTROL website at <http://www.eurocontrol.int/eatm/agas/runwayincursions/actionplan.html>

Appendix 2E Responsibility for Monitoring Third Parties Operating within the Boundaries of Licensed Aerodromes

1 Introduction

- 1.1 The Air Navigation Order, Article 128 requires that an aerodrome be safe for the use by aircraft. As part of this aerodrome licensees have responsibility for control of those areas, including leased areas within the aerodrome boundary, that are available for aircraft movements requiring the use of a licensed aerodrome. In addition to having responsibilities for areas or services under their direct control, they have responsibilities under the aerodrome licence for areas used or operated by third parties. Examples include tenants and concessionaries under lease or other use agreements, fuel farms sited within the aerodrome boundary and operated by fuel companies, and the provision of Rescue and Fire Fighting Services where the licensee contracts this to another party.
- 1.2 If the operations of third parties give SRG cause for concern, it would have to take action with the party that it regulates, namely the licensee. Therefore, licensees have a responsibility to ensure that contractors and others operate correctly on their aerodromes. This is particularly important in areas that could affect the licensees' ability to discharge *their responsibility* for securing the safety of aircraft on their aerodromes and to demonstrate that ability to SRG's Aerodrome Standards Department.
- 1.3 The last reference to responsibilities is not meant to indicate that licensees have total responsibility; many of these areas have shared responsibilities. Common sense, as well as the finer points of aviation and other law, should prevail, in order to achieve sensible and comprehensive measures for monitoring any activity that could have a negative effect on aircraft safety. The best way to achieve this is to manage safety in a systematic way. It is accepted that aerodrome licensees, in addition to airlines and aircraft ground handling companies, all share the responsibility for aircraft safety on the aerodrome ramp or apron.

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Appendix 2F Work in Progress

1 Introduction

- 1.1 Wherever major work affecting operational areas is planned, aerodrome licensees must be satisfied that unacceptable risks generated by Works in Progress (WIP) have been identified and removed, and that procedures are provided and followed which ensure no adverse impact upon levels of safety.
- 1.2 Part of effective safety management in connection with major development or other works lies in timely and comprehensive planning, conducted in consultation with all involved parties, including ATC and users. The aims of such consultation should be the identification of all those measures necessary for the work to be undertaken safely and the early notification to all who need to know of resulting operational changes.

2 Licensing Condition

- 2.1 Aerodrome licensees are required to comply with licence conditions (and the relevant air navigation legislation) concerning changes to, or work in progress, on their aerodrome. These include:
- a) Licence Conditions
- Condition 3 – prior approval of CAA is required before any changes are made in the physical characteristics of the aerodrome.
 - Condition 4 – the licensee must notify CAA by the quickest means available of any material change in the surface of the landing area or in the obstruction characteristics of the relevant obstacle limitation surfaces.
- b) Article 128 and Schedule 13 of the Air Navigation (No 2) Order 2005
- Article 128 (6) places a direct legal obligation on the holder of an aerodrome licence to take all reasonable steps to ensure that the aerodrome and its airspace are safe at all times for use by aircraft.
 - Article 128 (8) and Schedule 13 (iii) and (iv) require that the aerodrome manual contains procedures for promulgating information concerning the aerodrome's state; and for the control of access, vehicles and work in relation to the aerodrome's manoeuvring area and aprons.

3 Procedures

- 3.1 All parties involved with:
- WIP
 - The movement of aircraft and vehicles
 - The availability of aircraft ground routes
 - The promulgation of declared distances
 - The notification and availability of navigation aids and procedures etc.
- must work to an agreed programme of works authorisation and management, if the safety of the aerodrome is to be maintained. This programme should set out clearly where responsibilities for the authorisation and implementation of any proposed change to operational facilities lies, the point at which the facilities will be withdrawn or changes and the methods by which such changes will be promulgated.

- 3.2 This programme should be formulated only after an assessment of the risks to aircraft safety had been undertaken by the aerodrome licensee in co-operation with interested parties, and appropriate mitigation measures introduced to keep risks to an acceptable level. Human factors issues should be taken into account in the risk assessment. There will be risks associated with the maintenance task itself, e.g. shift working, length of shift, time pressure etc. as well as those connected to the specific changes, e.g. possible perceptual effects induced by changes to lighting and so on.
- 3.3 Before promulgation, practical checks of proposed arrangements must be made by personnel having a comprehensive grasp of the programme and its operational implications, normally the aerodrome operations unit. Where significant changes to markings or lighting are being made, it may be necessary for the aerodrome to conduct a preliminary flight check in order to make sure that the proposals have been correctly implemented and are functioning as intended. It should also be borne in mind that changes to marking or lighting may give different perceptual effects at different times of day or in different weather conditions. Small, apparently insignificant changes can sometimes have unanticipated results.
- 3.4 Where shift working is in operation it will be necessary to ensure that each shift is properly and fully briefed. The safety management system should ensure a procedure for feedback from the parties involved and the swift implementation of corrective measures if they are necessary. Regular monitoring of contractors is essential to ensure continued safety. Operators should ensure that contractors have made support available outside normal working hours. Particular attention should be paid to the transfer of adequate information at shift or work handover. Ideally, any transfer of information should have a degree of redundancy, e.g. both verbal and written, preferably on a standard document retained for later checking and verification, if necessary.
- 3.5 Before implementation, draft operational instructions or other promulgation information should be discussed with those most directly affected, and subjected to checks to ensure that their meaning is clear to potential users.
- 3.6 Where work is already in progress aerodrome licensees should satisfy themselves that, as far as possible, the above issues are being addressed.
- 3.7 Procedures for the control of works should include any or all of the following tasks (this list is not exhaustive):
- a) Works permit procedures
 - b) Relevant safety procedures
 - c) Restrictions during low visibility conditions
 - d) R/T communications
 - e) Staff briefing
 - f) Site marking, by day or night, or in low visibility
 - g) Work on an "on-off" basis
 - h) Hot works where relevant
 - i) Airfield operating procedures during the works
 - j) Emergency procedures
 - k) Supervisory and contact information
 - l) Plans and diagrams

Chapter 3 Aerodrome Physical Characteristics

1 Introduction

- 1.1 This chapter describes the physical characteristics that are taken into account when an aerodrome is to be licensed or when developments are considered. The related safety surfaces which afford protection to aeroplanes taking-off, landing or flying in the vicinity of an aerodrome are described in Chapter 4.
- 1.2 The specifications for the individual requirements are inter-related by a two element reference code, described in paragraph 2.1 below.
- In addition, specifications will vary with the designation of a runway as an instrument runway if it is served by one or more non-visual aids to approach and landing or as a visual runway, if it is not so served.
- 1.3 The use of this system ensures that the facilities and characteristics of an aerodrome are effectively related and match the needs of the aeroplanes for which the aerodrome intends to cater.

2 Aerodrome (Runway) Reference Code

- 2.1 To determine the extent of the lateral, longitudinal, and sloping planes of the airspace and ground surfaces surrounding each runway that should be kept free of obstacles, a reference code is established from Table 3.1. This code comprises:
- a) a number determined by selecting the higher value of declared TODA or ASDA.
 - b) a letter which corresponds to the wingspan or main gear outer-wheel span, whichever is the more demanding, of the largest aircraft likely to be operating at the aerodrome.
- 2.2 The determination of a runway's reference code is for the identification of the horizontal and vertical parameters of the surfaces associated with that runway, and is not intended to influence the pavement strength. The CAA will determine the runway reference code in consultation with the aerodrome licensee.

Table 3.1 Aerodrome reference code

CODE ELEMENT ONE		Code Letter	CODE ELEMENT TWO	
Code Number	The greater of TODA or ASDA		Wing Span	Outer Main Gear Wheel Span
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1200 m up to but not including 1800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80m	14 m up to but not including 16 m

3 Runways

3.1 Introduction

- 3.1.1 A runway is a rectangular area on a land aerodrome prepared for the landing and taking-off of aeroplanes. Separate criteria apply to a runway serving as a visual runway and to a runway serving as an instrument runway. The ability to meet the criteria will determine what length of runway may be declared for what purpose. The length of runway provided is not directly determined by the Code. The aerodrome authority should declare distances for each runway direction (see paragraph 13). The declared distances are to be approved and promulgated by the CAA.

3.2 Width

- 3.2.1 Runways both paved and unpaved should have the following minimum widths:

Table 3.2 Runway widths

	Code Letter					
Code Number	A	B	C	D	E	F
1	18 m	18 m	23 m	–	–	–
2	23 m	23 m	30 m	–	–	–
3	30 m	30 m	30 m	45 m	–	–
4	–	–	45 m	45 m	45 m	60m

NOTES:

- 1 The combinations of code numbers and letter for which widths are specified have been developed for typical aeroplane characteristics.
 - 2 The width of a precision approach runway should be not less than 30 m where the code number is 1 or 2.
- 3.2.2 Where additional runway distances are required for take-off, these may be achieved by adding a starter extension to the beginning of the runway. Provided this extension is not more than 150 m in length, its width may be reduced to not less than two-thirds of the normal requirement (see paragraph 3.2.1).
- 3.2.3 It may be necessary to provide extra width at the end of a runway or starter extension to enable aeroplanes to turn around.

3.3 Longitudinal slopes

- 3.3.1 The overall longitudinal slope, calculated by dividing the difference in elevation between the runway ends by the length of the runway, should not exceed 1% (1:100) for runways where the code number is 3 or 4 and 2% (1:50) for runways where the code number is 1 or 2.
- 3.3.2 Local longitudinal slopes on runways should not exceed:
- a) 1.25% (1:80) where the code number is 4;
 - b) 1.5% (1:66) where the code number is 3;
 - c) 2.0% (1:50) where the code number is 1 or 2;
- 3.3.3 The first and last quarters of runways where the code number is 3 or 4 should not exceed a slope of 0.8% (1:125).

- 3.3.4 Longitudinal slope changes along a runway have an effect on the operation of aeroplanes which is in direct ratio to the slope change and inverse ratio to the length of transition between successive slopes. Slope changes should be minimised on new construction and wherever possible on existing runways during the course of major runway maintenance. Slope changes allowable during resurfacing are detailed at Appendix 3A, paragraph 7.
- 3.3.5 Where a slope cannot be avoided, the change between two consecutive slopes should not exceed:
- a) 1.5% where the code number is 3 or 4;
 - b) 2.0% where the code number is 1 or 2;
- 3.3.6 The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding:
- a) 0.1% per 30 m (minimum radius of curvature of 30 000 m) where the code number is 4;
 - b) 0.2% per 30 m (minimum radius of curvature of 15 000 m) where the code number is 3;
 - c) 0.4% per 30 m (minimum radius of curvature of 7500 m) where the code number is 1 or 2.

3.4 **Sight distance**

- 3.4.1 Where slope changes cannot be avoided they should be such that there will be an unobstructed line of sight from:
- a) any point 3 m above the runway to all other points 3 m above the runway within a distance of at least half the length of the runway or 1200 m whichever is the less, where the code letter is C, D, E or F;
 - b) any point 2 m above the 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;
 - c) any point 1.5 m above the 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.

3.5 **Distance between slope changes**

- 3.5.1 Undulations or appreciable changes in slopes located close together along a runway should be avoided. The distance in metres between the points of intersection of two successive slope changes should not be less than the sum of the two slope changes in absolute terms multiplied by:
- a) 300 where the code number is 4;
 - b) 150 where the code number is 3;
 - c) 50 where the code number is 1 or 2.

The minimum distance between two successive slope changes should never be less than 45 m.

Example:

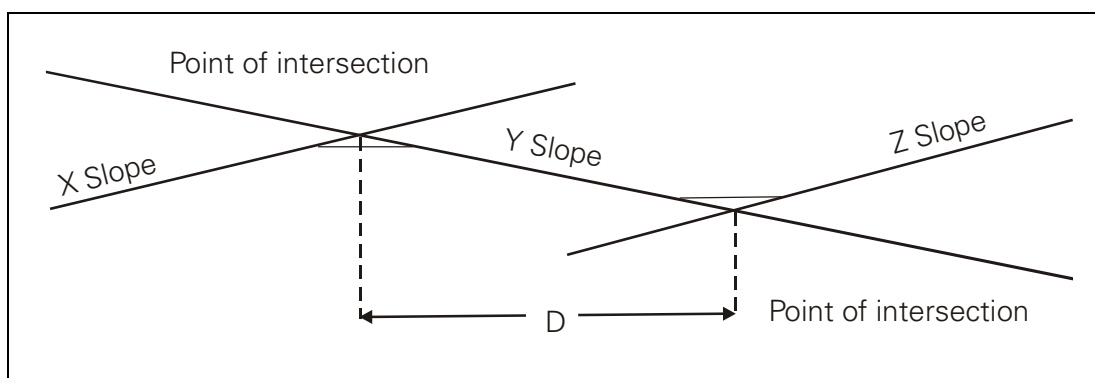


Figure 3.1

When the code number is 4 then D should be at least $300 [(X-Y) + (Y-Z)]$ m where $(X-Y)$ is the absolute numerical percentage value of $X-Y$, and $(Y-Z)$ of $Y-Z$.

Assuming $X = +1\%$
 $Y = -0.5\%$
 $Z = +0.5\%$
 Then $X-Y = 1.5\%$
 $Z-Y = 1.0\%$

D should not be less than $300 (1.5 + 1.0) \text{ m} = 750 \text{ m}$.

3.6 Transverse slopes on paved runways

- 3.6.1 Rapid drainage of water from a paved runway is assisted by a cambered surface. The surface of a new runway should be cambered. However, a single cross-fall from high to low in the direction of the wind flow most frequently associated with rain may ensure a more rapid drainage of water.
- 3.6.2 The transverse slope on either side of the crown should be symmetrical and ideally should be 1.5% (1:66) where the code letter is C, D, E or F; and 2% (1:50) where the code letter is A or B; but in any event should not exceed 1.5% or 2% as applicable, nor be less than 1% except at runway or taxiway intersections where flatter slopes may be necessary. A 1.5% slope should be provided on a straight crossfall. In the case of a cambered runway when a transverse slope of only 1% exists it is recommended that the surface of that runway be of a Porous Friction Course (PFC) or grooved finish.

3.7 Runway shoulders

- 3.7.1 Strong crosswinds may result in significant deviation from the runway centreline. With some large aircraft the wing-mounted engines may overhang the runway edge and there is then a risk of jet blast eroding the surface adjacent to the runway. This can cause dust and the possible ingestion of debris by the engines.
- 3.7.2 To overcome the potential problems indicated in paragraph 3.7.1, runway shoulders should be provided for runways where the code letter is D or E, except that this is not necessary where the runway width is 60 m or more. Runway shoulders should be provided for a runway where the code letter is F.

- 3.7.3 Runway shoulders should extend symmetrically on both sides of the runway so that the overall width of runway plus shoulders is not less than 60 m where the code letter is D or E, and 75 m where the code letter is F.
- 3.7.4 The surface of the shoulder that abuts the runway should be flush with the runway surface, and its transverse slope should not exceed 2.5% (1:40).
- 3.7.5 Runway shoulders should be so prepared as to be capable of supporting the aeroplanes using the runway without causing structural damage to those aeroplanes. They should also be capable of supporting vehicles such as firefighting appliances. In some cases, whilst the bearing strength of the natural ground may be sufficient, special preparation may be necessary to avoid erosion or the ingestion of debris into aircraft engines.

3.8 Runway turn pads

- 3.8.1 Where the end of a runway is not served by a taxiway or a taxiway turnaround a runway turn pad should be provided, if necessary, to facilitate a 180° turn of aeroplanes.
- 3.8.2 Such areas may also be useful if provided along a runway to reduce taxiing time and distance for aeroplanes that may not require the full length of the runway.
- 3.8.3 The runway turn pad may be located on either the left or the right side of the runway and adjoining the runway pavement at both ends of the runway, and at some intermediate locations where deemed necessary. However, the initiation of the turn would be facilitated by locating the turn pad on the left side of the runway, since the left hand seat is the normal position of the pilot-in-command.
- 3.8.4 Where the use of runway turn pads is deemed necessary they should have the characteristics below:
- 3.8.5 The intersection angle of the runway turn pad should not exceed 30° and the nose wheel steering angle to be used should not exceed 45°.
- 3.8.6 The design of a runway turn pad should be such that, with the cockpit of the most critical aeroplane for which the turn pad is intended over the turn pad marking, the minimum distance between the outer edge of the main wheels of the aeroplane and the edge of the turn pad should be:
 - a) 4.5 m where the code letter is D, E, F or C and the turn pad is intended to be used by aeroplanes with a wheelbase of 18 m or greater;
 - b) 3 m where the code letter is C and the turn pad is intended to be used by aeroplanes with a wheelbase of less than 18 m;
 - c) 2.25 m where the code letter is B;
 - d) 1.5 m where the code letter is A; or
 - e) where severe weather conditions and resultant lowering of surface friction characteristics prevail, a larger wheel-to-edge clearance of 6 m should be provided where the code letter is E or F.
- 3.8.7 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 surface.
- 3.8.8 The strength of a runway turn pad should be at least equal to that of the adjoining runway which it serves, due consideration being given to the fact that the turn pad will be subjected to slow-moving traffic making hard turns and consequent higher

stresses on the pavement. Where a turn pad is provided with flexible pavement, the surface would need to be capable of withstanding the horizontal shear forces exerted by the main landing gear during turning manoeuvres.

- 3.8.9 The surface of a runway turn pad should not have surface irregularities that may cause damage to an aeroplane using the turn pad and should be so constructed as to provide good friction characteristics for aeroplanes using the facility when the surface is wet.
- 3.8.10 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. As a minimum the width of the shoulders would need to cover the outer engine of the most demanding aeroplane and thus may be wider than the associated runway shoulders.
- 3.8.11 The strength of the runway turn pad shoulders should be capable of withstanding the occasional passage of the aeroplane it is designed to serve without inducing structural damage to the aeroplane and to the supporting ground vehicles that may operate on the shoulder.
- 3.8.12 The characteristics of runway turn pad lights are detailed in Chapter 6, paragraph 5.10 and runway turn pad markings in Chapter 7, paragraph 4.4.

4 Runway Strips

4.1 Introduction

- 4.1.1 A runway strip is an area enclosing a runway and any associated stopway. Its purpose is to:
 - a) reduce the risk of damage to an aeroplane running off the runway by providing a graded area which meets specified longitudinal and transverse slopes, and bearing strength requirements, and
 - b) protect aeroplanes flying over it during landing, bailed landing or take-off by providing an area which is cleared of obstacles except permitted aids to air navigation.
- 4.1.2 Ideally the whole of a runway strip should be clear of obstacles but in practice it is recognised that the strip facilitates the installation of visual, surface movement, radio and radar aids, and some of these cannot perform their function if they are sited outside the runway strip. Equipment essential to an approach, landing or bailed landing is permitted within the runway strip subject to the conditions detailed in paragraph 6.
- 4.1.3 Drainage channels, catchpits and other essential design features at aerodromes should not constitute hazards to aeroplanes. Whenever possible, items which are not required to be at ground level should be buried to a depth of not less than 0.45 m. Within the graded area of the runway strip constructions such as plinths, runway ends, paved taxiway edges, etc. should be dealthalised, that is, so constructed as to avoid presenting a buried vertical face to aircraft wheels in soft ground conditions in any direction from which an aircraft is likely to approach. To eliminate a buried vertical surface, a slope should be provided which extends from the top of the construction to not less than 0.3 m below ground level. The slope should be no greater than 1:10.
- 4.1.4 Agricultural crops other than long grass should not be grown within the runway strip since they would either conflict with the requirements of paragraph 4.1.1a), provide a bird-attractive environment or be a fire hazard. See paragraph 11.3.3.

- 4.1.5 The total area within the runway strip should be capable of supporting unrestricted access for emergency service vehicles.

4.2 Length

- 4.2.1 A runway strip should extend beyond each end of a runway and of any associated stopway for a distance of at least 60 m where the code number is 2, 3 or 4, and where the code number is 1 and the runway is an instrument runway. When the code number is 1 and the runway is a visual runway the distance should be 30 m.
- 4.2.2 When a starter extension is provided (paragraph 3.2.2) the runway strip before the starter extension need only provide for wing overhang plus a safety margin of 7.5 m or 20% of wingspan, whichever is the greater. This distance may need to be increased for other factors, e.g. blast (see Figure 3.2).

4.3 Width

- 4.3.1 The runway strip which encloses a visual runway should extend each side of the centreline and extended centreline of the runway and any associated stopway for a distance of at least:
- a) 75 m where the code number is 3 or 4;
 - b) 40 m where the code number is 2;
 - c) 30 m where the code number is 1.
- 4.3.2 Where there is a visual runway of substantially more than the minimum width, the overall width of the runway strip should be increased to provide a distance measured from each edge to the runway, of at least:
- a) 28 m where the code number is 2;
 - b) 21 m where the code number is 1.
- 4.3.3 The runway strip which encloses an instrument runway should extend each side of the centreline and extended centreline of the runway from 60 m before threshold to 60 m beyond the end of the declared landing distance for a distance of at least:
- a) 150 m where the code number is 3 or 4;
 - b) 75 m where the code number is 1 or 2.
- Except that when the highest value of TODA or ASDA falls in the bottom third of code number 3 the width for a non-precision approach runway strip may be reduced to not less than 105 m either side of the centreline and extended centreline of the runway.
- 4.3.4 When the threshold or end of landing distance do not coincide with the ends of a runway, the runway strip enclosing the runway and any associated stopway should extend to the lengths specified in paragraph 4.2.1 at the widths specified in paragraph 4.3.1, based on the threshold, end of landing distance or end of stopway as appropriate.
- 4.3.5 Near the start of its take-off run an aeroplane will be moving slowly consequently the runway strip width up to the beginning of a starter extension may be reduced to provide a distance from each edge of the extension for wing overhang plus 7.5 m or 20% of wingspan of the largest aeroplane, whichever is the greater.

Thereafter the width of the runway strip should increase at a splay of not less than 20% each side in the direction of take-off until the full visual strip width is achieved relevant to the runway code number (see Figure 3.2).

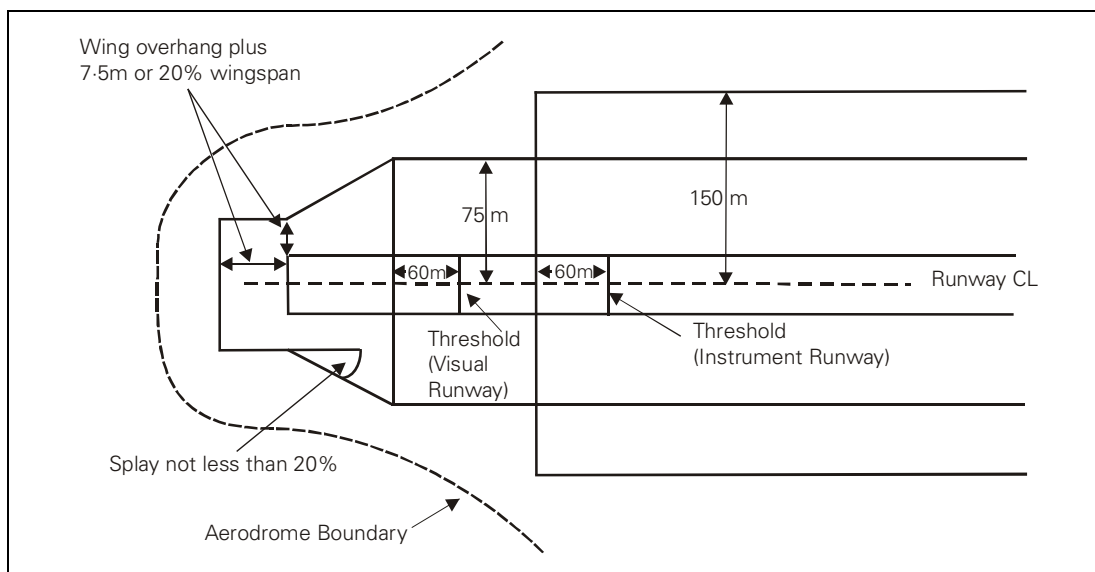


Figure 3.2

4.4 Cleared and Graded Area (CGA)

- 4.4.1 The runway strip which encloses a precision instrument runway where the code number is 3 or 4 should be cleared of obstacles and graded for a distance of at least 105 m each side of the centreline from the threshold continuing to the end of LDA. Subject to a satisfactory safety assessment (see paragraph 5.3), this distance may be reduced to not less than 75 m each side of the centreline and extended centreline at each strip end, continuing at this width for the first 150 m of runway available for landing in each direction, then increasing uniformly to 105 m from centreline by 300 m (see Figure 3.3).

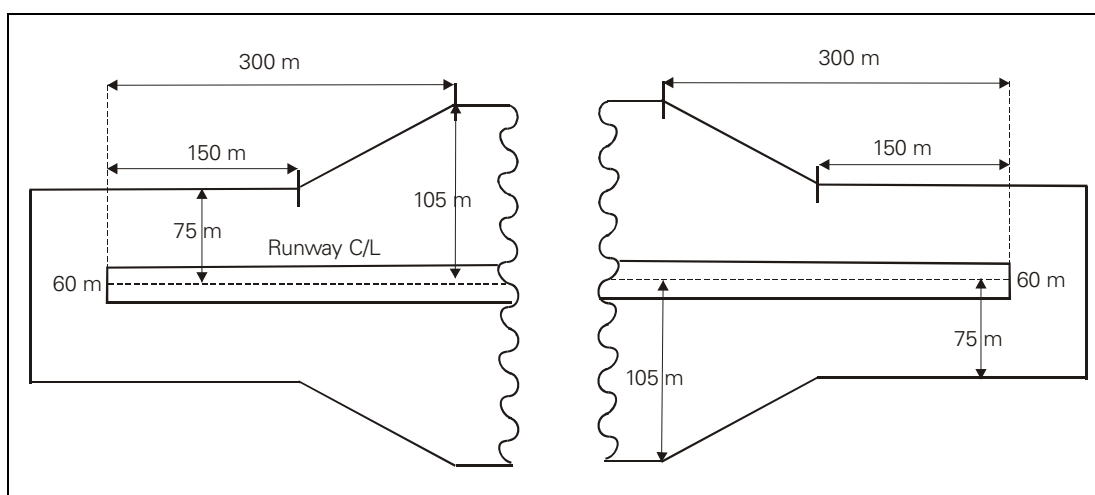


Figure 3.3

- 4.4.2 The runway strip which encloses a precision approach runway where the code number is 1 or 2 should be cleared of obstacles and graded for a distance of at least 45 m each side of the centreline and extended centreline.

4.4.3 The runway strip which encloses a visual, or a non-precision approach runway, should be cleared of obstacles and graded on each side of the centreline and extended centreline of the runway and any associated stopway for a distance of at least:

- a) 75 m where the code number is 3 or 4;
- b) 40 m where the code number is 2;
- c) 30 m where the code number is 1.

4.4.4 Where the runway is more than 10% greater than the minimum width, the runway strip should be cleared and graded throughout its length for a distance from each side of the runway of at least:

- a) 60 m where the code is 3;
- b) 28 m where the code is 2;
- c) 21 m where the code is 1.

4.4.5 Guidance on temporary obstacles within runway strips is at Appendix 3B.

4.5 **Bearing strength**

4.5.1 The runway strip should be flush with the runway, runway shoulder and stopway along their common edges. That part which is required to be graded should be so prepared as to be capable of supporting any aeroplane at maximum certificated weight that the runway is intended to serve, without the aeroplane suffering significant damage. The area before the runway threshold should be prepared against blast erosion to at least 30 m, in order to protect a landing aircraft from the exposed edge.

4.5.2 The bearing strength may decrease gradually in a transverse direction away from the runway to assist arresting an aeroplane but rapid transverse changes in bearing strength should be avoided.

4.6 **Longitudinal slopes**

4.6.1 The longitudinal slope along any portion of a runway strip which is required to be graded should not exceed:

- a) 1.5% (1:66) where the code number is 4;
- b) 1.75% (1:57) where the code number is 3;
- c) 2.0% (1:50) where the code number is 1 or 2;

4.6.2 Longitudinal slope changes on that portion of a strip to be graded should be gradual. Abrupt changes of slope should be removed.

4.7 **Transverse slopes**

4.7.1 The transverse slopes on that portion of the runway strip to be graded should avoid the accumulation of water but should not exceed:

- a) 2.5% (1:40) where the code number is 3 or 4;
- b) 3.0% (1:33) where the code number is 1 or 2;

except that to facilitate drainage, the transverse slope for the first 3 m outwards from the edge of the runway, runway shoulder or stopway should be negative as measured in the direction away from the runway but should not exceed 5% (1:20).

4.7.2 The transverse slopes on those portions of the runway strip outside the area to be graded should not exceed an upward slope of 5% (1:20) measured in the direction away from the runway.

5 Runway End Safety Areas (RESA)

- 5.1 RESAs are intended to minimise risks to aircraft and their occupants when an aeroplane overruns or undershoots a runway. These areas should be provided at each end of the runway strip enclosing all runways where the code number is 3 or 4, and instrument runways where the code number is 1 or 2. RESAs should be considered for visual runways where the code number is 1 or 2, particularly where there are movements by jet aircraft not using public transport performance factors, or a high proportion of runway-limited movements at the higher weights.
- 5.2 The length of RESA needed for a specific runway will depend on a number of variables, such as the type and level of aircraft activity, and local conditions. The minimum requirement is 90 m for all code 3 and 4 runways, and code 1 and 2 instrument runways. The RESA width should be that of the associated cleared and graded area, with a minimum of twice runway width, symmetrically disposed about the extended centreline of the runway.
- 5.3 Licensees should not assume that the minimum distance of RESA will necessarily be sufficient, particularly where there have been changes to the environment on or around the aerodrome, or to the type or level of traffic; it is recommended that RESAs extend to at least 240 m for code 3 and 4, and up to at least 120 m for code 1 and 2 instrument runways, wherever practicable and reasonable. Therefore, as part of their system for the management of safety, licensees should review and determine on an annual basis the RESA distance required for individual circumstance, taking into account in their risk assessments factors such as:
- a) the nature and location of any hazard beyond the runway end;
 - b) the type of aircraft and level of traffic at the aerodrome, and actual or proposed changes to either;
 - c) aerodrome overrun history;
 - d) overrun causal factors;
 - e) friction and drainage characteristics of the runway;
 - f) navigation aids available;
 - g) scope for procedural risk mitigation measures; and
 - h) the net overall effect on safety of any proposed changes, including reduction of Declared Distances.

Further guidance from the CAA is available for licensees on the issues surrounding risks from aeroplanes overrunning aerodrome runways, and the process of undertaking risk assessments.

If a RESA beyond the 90 m minimum is deemed necessary but there are physical constraints to achieving the desired distance, Declared Distances should be reduced unless other mitigation measures can be demonstrated to achieve an equivalent safety result for the same set of operational circumstances. Mitigation measures that may be acceptable, singly or in combination, as alternatives to the reduction of Declared Distances, include:

- a) improving runway surfaces and/or the means of recording and indicating rectification action, particularly for contaminated runway states – know your runways and their condition and characteristics in precipitation;

- b) ensuring that accurate and up-to-date information on weather, the runway state and characteristics is notified and passed to flight crews in a timely way, particularly when flight crews need to make operational adjustments;
- c) improving the aerodrome management's knowledge, recording, prediction and dissemination of wind data, including wind shear, and any other relevant weather information, particularly when it is a significant feature of an aerodrome's weather pattern;
- d) minimising the obstruction environment in the area beyond the RESA;
- e) upgrading visual and instrument landing aids to improve the accuracy of aeroplane delivery at the correct landing position on runways (including the provision of Instrument Landing Systems);
- f) formulating, in consultation with aeroplane operators, adverse weather and any other relevant aerodrome operating procedures or restrictions, and promulgating such information appropriately;
- g) installing suitably positioned and designed arrester beds, to supplement the RESA where appropriate; minimum requirement, taking account of other risks that they may introduce; and
- h) publishing the RESA provision in the AIP.

The above list is not in any particular order, is not exhaustive and should complement other action by aeroplane operators and licensees, working in co-operation to reduce overrun risks.

- 5.4 The surface of a runway end safety area need not be prepared to the same standard as that of the graded area of the associated runway strip. It should enhance the deceleration of aeroplanes in the event of an overrun, but it should not:
 - a) hinder the movement of rescue and firefighting vehicles, the effectiveness of the rescue and firefighting provision; or
 - b) endanger aircraft in the event of an aeroplane undershooting or overrunning.
- 5.5 Should soft ground arrester beds be considered the licensee needs to be aware of the risks to aircraft and possible increase in Rescue and Firefighting provision that their establishment may introduce. Soft ground arrester beds are not intended to replace RESA and, therefore, should not be located within the minimum RESA distance.
- 5.6 The overall longitudinal slope in a runway end safety area should not exceed a downslope of 5% (1:20), and should be such that no part of the safety area penetrates the approach or take-off climb surfaces. Where the ground in a runway end safety area exceeds a downslope of 5% (1:20), it may be acceptable in the case of an overrun RESA to increase the length of the area beyond that considered to be adequate for the particular circumstances in order to compensate for steeper slopes, up to a maximum of 10% (1:10) gradient.
- 5.7 Transverse slopes should not exceed 5% (1:20).
- 5.8 Slope changes and transitions between slopes should be gradual: abrupt changes of slope or a slope reversal should be removed.
- 5.9 Aids to navigation, which because of their function must be placed within a runway end safety area to meet air navigation requirements, should be constructed and sited to reduce the potential hazards to a minimum and consequential risks to an acceptable level.

6 The Siting of Aids to Navigation within Runway Strips

- 6.1 Any aids to air navigation to be sited within a runway strip should be made as light and as frangible as design and function will permit. In this context a frangible object is one which retains its structural integrity and stiffness up to a desired maximum load, but when subjected to a greater load than desired will break, distort or yield in such a manner as to present the minimum hazard to an aeroplane.
- 6.2 The height of any object which is permitted within a runway strip should be kept to the minimum for the particular site and function of the equipment.
- 6.3 Objects which are unlikely to aggravate the consequences of a ground swing may be located within the cleared and graded area provided they are frangible, not more than 0.9 m above local ground level, and not closer than 15 m from the edge of the runway. All other permitted objects are to be sited outside this area, and should be so positioned that they do not penetrate a limiting surface sloping upward and outward from the runway centreline at a slope of 1:10.
- 6.4 The limiting surface at 1:10 referred to in paragraph 6.3. above extends beyond the edge of the runway strip, until either it intersects the inclined plane of the transitional surface rising outwards from the edge of the strip, or until it meets the plane of the inner horizontal surface, and continues at that height until it reaches the point where the transitional surface meets the inner horizontal surface.

7 Taxiways

- 7.1 Taxiways should be provided when they are necessary for the safe and orderly movement of aircraft on the ground, or when it is necessary for aircraft to follow a certain path to avoid protected areas or surfaces. When the end of a paved runway is not wide enough to allow an aeroplane to turn around, either the runway should be widened or an entrance/exit taxiway provided at the runway end.
- 7.2 **Width**
- 7.2.1 The width of a taxiway should be such that with the cockpit of the most critical aeroplane for which the taxiway is intended over the centreline, the minimum distance between the outer edge of the main wheels of the aeroplane and the edge of the pavement should be:
- a) 4.5 m where the code letter is D, E, F or C and the taxiway is intended to be used by aeroplanes with a wheelbase of 18 m or greater;
 - b) 3 m where the code letter is C and the taxiway is intended to be used by aeroplanes with a wheelbase less than 18 m;
 - c) 2.25 m where the code letter is B;
 - d) 1.5 m where the code letter is A.
- 7.2.2 While the changes in direction of taxiways should be as few as possible, where curves are necessary they should be compatible with the manoeuvring capability at normal taxiing speed of the most critical aeroplane for which the taxiway is intended. To provide the clearance distances in paragraph 7.2.1 it may be necessary to widen taxiways on the inside of curves, the amount of widening depending on the wheelbase and track of the critical aeroplane and the radius of curvature of the taxiway centreline. The design of the curve should be such that the intent of paragraph 7.2.1. is met at all points on the curve.

7.2.3 A straight portion of a taxiway should have a width of not less than:

- a) 25 m where the code letter is F;
- b) 23 m where the code letter is E, or D and the taxiway is intended to be used by aeroplanes with an outer main gear wheel span of 9 m or more;
- c) 18 m where the code letter is D and the taxiway is intended to be used by aeroplanes with a main gear wheel span of less than 9 m; or
- d) 18 m where the code letter is C and the taxiway is intended to be used by aeroplanes with a wheelbase of 18 m or greater;
- e) 15 m where the code letter is C and the taxiway is intended to be used by aeroplanes with a wheelbase of less than 18 m;
- f) 10.5 m where the code letter is B;
- g) 7.5 m where the code letter is A.

7.3 Longitudinal slopes and slope changes

7.3.1 The longitudinal slopes of taxiways should be kept to a minimum to avoid tracking or handling problems. The longitudinal slopes should not exceed:

- a) 1.5% (1:66) where the code letter is C, D, E or F;
- b) 3.0% (1:33) where the code letter is A or B.

7.3.2 Where longitudinal slope changes on a taxiway cannot be avoided, the transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding:

- a) 1% per 30 m where the code letter is C, D, E or F;
- b) 1% per 25 m where the code letter is A or B.

7.4 Sight distance

7.4.1 Where a change in slope on a taxiway cannot be avoided the change should be such that from any point:

- a) 3 m above the taxiway it will be possible to see the 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;
- b) 2 m above the taxiway it will be possible to see the surface of the taxiway for a distance of at least 200 m where the code letter is B;
- c) 1.5 m above the taxiway it will be possible to see the surface of the taxiway for a distance of at least 150 m where the code letter is A.

7.5 Transverse slopes

7.5.1 The transverse slope of a taxiway should be sufficient to prevent the accumulation of water but should not exceed:

- a) 1.5% (1:66) where the code letter is C, D, E or F;
- b) 2.0% (1:50) where the code letter is A or B.

7.6 Taxiway strips

7.6.1 A taxiway should be enclosed by a strip providing an area clear of objects which may endanger taxiing aeroplanes and to reduce the risk of damage to an aircraft running off the taxiway. The strip should extend on each side of the taxiway centreline throughout the length of the taxiway for a distance of:

- a) 57.5 m where the code letter is F;

- b) 47.5 m where the code letter is E;
 - c) 42.5 m where the code letter is D;
 - d) 28.5 m where the code letter is C;
 - e) 19.5 m where the code letter is B;
 - f) 13.5 m where the code letter is A.
- 7.6.2 The central portion of the taxiway strip should provide a graded area to a distance from the centreline of the taxiway of at least:
- a) 30 m where the code letter is F;
 - b) 22 m where the code letter is E;
 - c) 19 m where the code letter is D;
 - d) 12.5 m where the code letter is B or C;
 - e) 11 m where the code letter is A.
- 7.6.3 On taxiway curves, junctions and intersections where extra pavement is provided a corresponding increase should be made in the width of the taxiway strip and graded area.
- 7.6.4 The taxiway graded area should be flush with the taxiway along their common edges and should be maintained free from holes, ditches and debris that could damage an aeroplane or its engines. Special preparation of the graded area such as surfacing will help to avoid erosion by overhanging engines.
- 7.6.5 The transverse slope on the graded area of a taxiway strip, taken in conjunction with the transverse slope on the adjacent taxiway should not be such as to cause a hazard to aircraft and should not exceed an upward slope of:
- a) 2.5% (1:40) where the code letter is C, D, E or F;
 - b) 3.0% (1:33) where the code letter is A or B
- measured relative to the transverse slope on the adjacent taxiway.
- 7.6.6 The downward transverse slope of the graded portion of a taxiway strip should not exceed 5% (1:20) measured relative to the horizontal.
- 7.6.7 The transverse slope of a taxiway strip beyond that part to be graded should not exceed an upward slope of 5% (1:20) measured in the direction away from the taxiway and relative to the horizontal.
- 7.7 **Taxiway holding bays and holding positions**
- 7.7.1 A taxiway holding position or holding bay is not to be located closer to the runway centreline than the edge of the relative cleared and graded area of the runway. On precision approach runways this distance may need to be increased to avoid:
- a) interference with radio aids;
 - b) penetration of the Obstacle Free Zone by a holding aeroplane; or
 - c) a holding aeroplane being accountable in the calculation of Obstacle Clearance Altitude/Height (OCA/H).

Table 3.3 Minimum distance from runway centreline to holding bay or taxi holding position

Type of Runway	Code Number			
	1	2	3	4
Visual	30 m	40 m	75 m	75 m
Instrument and Take-off	30 m	40 m	75 m	75 m
Precision Approach Category I	60 m	60 m	90 m	90 m
Category II			107.5 m	107.5 m
Category III			137 m	137 m

NOTES:

- 1 The distance of 60 m for code number 1 and 2 is based on an aeroplane 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 centreline, being clear of the obstacle free zone.
- 2 The distance of 90 m for code number 3 and 4 is based on an aeroplane with a tail height of 20 m, a distance from the nose to the highest part of the tail of 52.7 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centreline being clear of the obstacle free zone and not accountable for the calculation of OCA/H.
- 3 Where holding positions set to the distances above would fall within the ILS sensitive areas, the distances should be increased accordingly.
- 4 Holding positions must be located outside the CGA (see paragraph 4.4). Note particularly when the hold is not near a runway end.
- 5 For a precision approach runway, code numbers 3 and 4, the category 1 distance of 90 m should be increased to 107.5 m when the code letter is F.

7.8 Taxiway separation distances

- 7.8.1 The minimum distance between a taxiway and other aerodrome features should be as listed in Table 3.4 if operational restrictions are to be avoided.
- 7.8.2 At aerodromes where these separation distances are not achieved operational restrictions may include a limitation on the size of aeroplane using a particular taxiway, or the sterilisation of a taxiway when the runway is in use.

Table 3.4 Taxiway minimum separation distances

Code Letter	Distance between taxiway centreline and runway centreline								Taxiway centreline to taxiway centreline	Taxiway and apron taxiway centreline to object (Note 1)	Aircraft stand taxi-lane centreline to object (Note 1)
	Instrument Runway Code Number				Visual Runway Code Number						
	1	2	3	4	1	2	3	4			
1	2				3				4	5	6
A	82.5	82.5			37.5	47.5			21	13.5	12
B	87	87			42	52			31.5	19.5	16.5
C			168				93		46.5	28.5	24.5
D			176	176			101	101	68.5	42.5	36
E				182.5				107.5	80	47.5	42.5
F				190				115	97.5	57.5	50.5

NOTE: These distances may have to be increased on taxiway curves to accommodate the wing sweep of the critical aeroplane.

7.8.3 Objects essential to the use of a taxiway system which require to be sited closer than shown in Table 3.4, column 5 should be kept at such a distance from the edge and at such a height, allowing for taxiway and strip transverse slopes, that the most critical aeroplane cannot strike them whilst keeping all wheels on the taxiway. Restrictions may be placed on the types of aeroplane which may use a particular taxiway if an object exceeds 36 cm above the taxiway level within the following distances of the edge of the taxiway:

- a) 22 m where the code letter is F;
- b) 18 m where the code letter is D or E;
- c) 11 m where the code letter is C;
- d) 7.5 m where the code letter is A or B.

7.8.4 Between the distances in paragraph 7.8.3 and those in column 5 of Table 3.4, objects should not exceed 1.5 m in height above taxiway level.

7.8.5 Acceptance of temporary obstacles near a taxiway will depend on the types of aeroplane using the taxiway. Clearance between an aeroplane wing tip and the temporary obstacle should be not less than 20% of aeroplane wingspan when the aeroplane is in the centre of the taxiway.

7.9 Rapid Exit Taxiways

7.9.1 Where rapid exit taxiways are provided they should have the specifications detailed in paragraphs 7.9.2 to 7.9.6.

7.9.2 Rapid exit taxiways should be designed with a radius of turn-off curve of at least:

- a) 550 m where the code number is 3 or 4;
 - b) 275m where the code number is 1 or 2;
- to enable exit speeds under wet conditions of:
- c) 93 km/h where the code number is 3 or 4;
 - d) 65 km/h where the code number is 1 or 2.

- 7.9.3 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.
- 7.9.4 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 an intersecting taxiway.
- 7.9.5 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°.
- 7.9.6 The locations of rapid exit taxiways along a runway and their speed criteria, along with other guidance on the provision and design of rapid exit taxiways is given in the ICAO Aerodrome Design Manual, Part 2.
- 7.10 **Taxiways on bridges**
- 7.10.1 Where taxiways on bridges are provided, the width of that portion of a taxiway bridge capable of supporting aircraft should be at least the width of the graded area of the taxiway strip, unless a proven method of lateral restraint is provided which is not hazardous to aircraft.
- 7.10.2 Access should be provided to allow rescue and fire fighting vehicles to intervene in both directions within the specified response time to the largest aircraft for which the taxiway is intended. If aircraft engines overhang the bridge structure, protection of adjacent areas below the bridge from engine blast should be taken into consideration.
- 7.10.3 A taxiway bridge should be constructed on a straight section of taxiway, with a straight section at both ends of the bridge, to facilitate the alignment of aircraft approaching the bridge.

8 Stopways

8.1 Introduction

- 8.1.1 A stopway is an area on the ground beyond the end of the take-off run available (TORA) which is prepared and designated as a suitable area in which an aeroplane can be stopped in the event of an abandoned take-off. TORA plus Stopway makes up the Accelerate – Stop Distance Available (ASDA) (previously Emergency Distance (ED)).
- 8.1.2 A stopway is regarded as being provided for infrequent use and it need not have the same bearing or wearing qualities as the runway with which it is associated. In some cases the natural surfaces will be adequate while in others some land drainage, ground grading or consolidation or even light paving may be required.
- 8.1.3 A stopway may be an economical substitute for what would otherwise have to be provided as paved runway to meet the take-off field length requirements of some aeroplanes, but when comparable field lengths are required in each direction, a stopway will be required at each end. This will require the availability of a longer overall runway strip than would result from extending the runway to meet the take-off field length requirements. The relative difficulties and costs of providing the extra length of runway strip for stopways, or of extending the runway will normally be the decisive factors in deciding which course to follow.

8.2 Bearing strength

- 8.2.1 The load-bearing qualities should be sufficient to support the aeroplanes it is intended to serve without causing structural damage to the aeroplanes.
- 8.2.2 A stopway should be so prepared or constructed as to allow unimpeded passage by rescue and fire-fighting vehicles.

8.3 **Width**

- 8.3.1 A stopway should have the same width as its associated runway.

8.4 **Slopes**

- 8.4.1 Slopes and slope changes on a stopway, and the transition from runway to stopway, should meet the requirements for the associated runway, except that the limitation of a 0.8% slope for the first and last quarters of a runway where the code number is 3 or 4 (paragraph 3.3.3) need not be applied. The rate of change of slope on a stopway should not exceed 0.3% per 30 m where the code number is 3 or 4, or 0.5% per 30 m where the code number is 1 or 2.

9 **Clearways**

9.1 **Introduction**

- 9.1.1 A clearway is an area which may be provided beyond the end of the Take-Off Run Available (TORA) which is free from objects which may cause a hazard to aeroplanes in flight. In conjunction with the runway it provides an area over which an aeroplane can safely transit from lift-off to the required screen height. In certain circumstances it may be an alternative to an increase in runway length (see Appendix 3C).
- 9.1.2 A clearway need not have bearing strength and may be land or water. It may extend outside the aerodrome boundary only if the aerodrome authority establishes such control that will ensure that the clearway will be kept free from obstacles or that the clearway plane will not be infringed.

9.2 **Width**

- 9.2.1 The width of clearway at the end of TORA should be not less than the width of the runway strip for a relevant visual runway. The width should expand linearly in the direction of take-off so that at the end of the Take-Off Distance Available (TODA) it equals the width at origin of the area within which obstacles are to be accounted for in the calculation of Regulated Take-Off Weight. This width is taken to be 180 m where the code number is 3 or 4 and 150 m where it is 1 or 2.

9.3 **Length**

- 9.3.1 The length of a clearway will be the least of either the distance to the first upstanding obstacle, excluding lightweight, frangible objects of 0.9 m or less in height, or the distance resulting from the application of the criteria in the following paragraphs, subject to an overall limit of 50% of the TORA.

9.4 **Types of clearway**

9.4.1 **Normal clearway**

- 9.4.1.1 The characteristics of a normal clearway follow from its function, which is to provide an area over which an aeroplane is able to complete its initial climb to the Flight Manual specified height above ground level, or above the object that limits clearway. Minor surface irregularities are permitted including isolated depressions such as ditches running across the clearway. The surface will not require special preparation, but abrupt upward changes of slope are undesirable.
- 9.4.1.2 The length of a normal clearway cannot exceed whichever is the least of either the distance to the first upstanding obstacle (excluding lightweight, frangibly-mounted objects not exceeding 0.9 m above local ground level), or the distance to the point where the ground in the clearway projects above the slopes detailed in paragraph 9.4.1.4.

- 9.4.1.3 Within the area either side of the extended centreline of the runway and having the same width as the runway, the slopes, slope changes and transition from runway to clearway should conform to the requirements of the associated runway.
- 9.4.1.4 Over the remainder of the clearway no part of the ground along any line parallel to the runway centreline should project above a longitudinal slope measured from the surface of the ground at the start of clearway on the line in question, and having an upward slope of:
- 1.25% (1:80) where the code number is 3 or 4;
 - 2% (1:50) where the code number is 1 or 2.

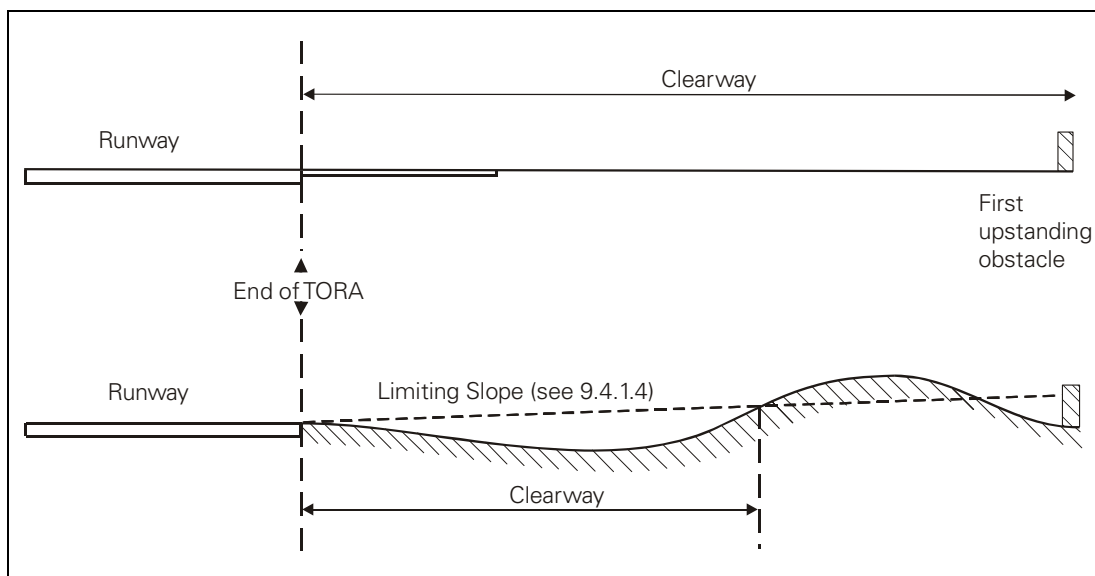


Figure 3.4

9.4.2 Horizontal plane clearway

- 9.4.2.1 Except as provided in paragraph 9.4.2.2, if the ground in the clearway falls at a longitudinal gradient exceeding:
- 1.25% (1:80) for runways where the code number is 3 or 4; or
 - 2.0% (1:50) for runways where the code number is 1 or 2;

clearway may be declared on the basis of a horizontal plane commencing at runway level at the end of TORA and extending to the first upstanding obstacle, providing that the ground profile is never more than 9 m below the horizontal plane. Lightweight, frangible or frangibly-mounted objects are permitted to infringe the horizontal plane by not more than 0.9 m without affecting the declaration of clearway.

The elevation at the end of clearway for all gradients of clearway at or less than 1.25% for codes 3 and 4 and 2.0% for codes 1 and 2 is to be taken as actual ground level at the end of the clearway (i.e. origin of the TOCS). Should the length of the clearway

and the gradient combined create a drop of more than 9 m from a horizontal profile taken from the origin of the clearway then paragraph 9.4.2.2 would apply, in principle.

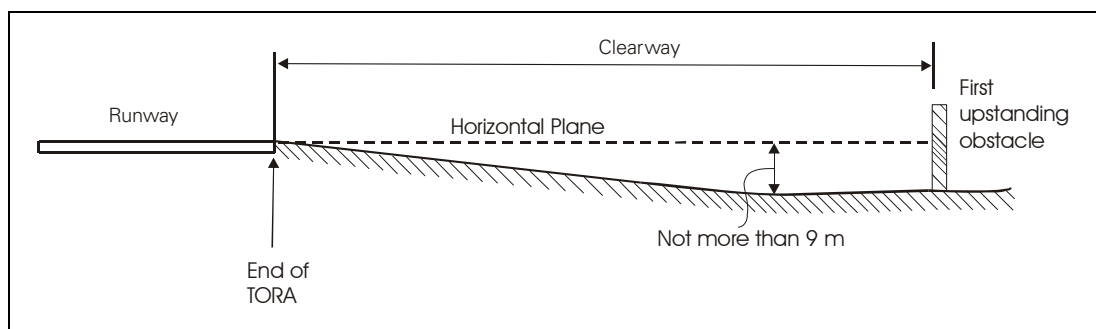


Figure 3.5

- 9.4.2.2 When the ground in the clearway falls to more than 9 m below the horizontal plane described in paragraph 9.4.2.1, the length of clearway will not exceed the distance at which the appropriate Take-Off Climb Surface (TOCS) projected downwards from the top of the first upstanding obstacle (other than non-accountable lightweight, frangible objects) intersects the horizontal plane. If the first upstanding obstacle is beyond a distance equal to one half TORA, it need not be taken into account for the calculation of clearway.

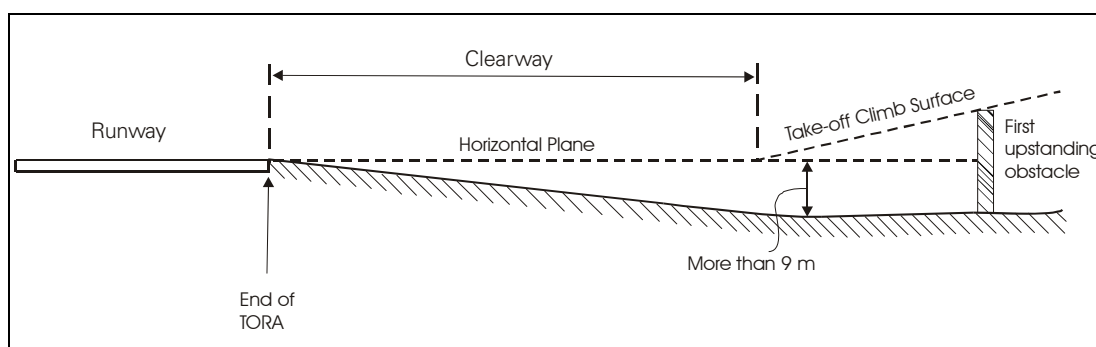


Figure 3.6

- 9.4.2.3 Horizontal Plane Clearway (HPC) calculated by one of the methods described in paragraphs 9.4.2.1 and 9.4.2.2 may be additional to normal clearway subject to an overall maximum clearway length of one half of TORA. When HPC is combined with normal clearway the origin of the horizontal plane will be ground level at the end of the normal clearway.

9.4.3 Runway Continued Plane Clearway

- 9.4.3.1 If the last part of the runway where the code number is 3 or 4 in the direction of take-off has a downward slope over a distance exceeding 300 m or 15% of TORA if this is greater, and the ground in the clearway falls more than 9 m below the elevation of the end of TORA, the clearway plane is a continuation of the last downhill part of the runway or of the mean overall downhill slope of TORA if this is steeper. For clearway to be calculated by this method the down-sloping clearway plane cannot be penetrated by any obstacle for a distance of 610 m measured from the end of TORA.

Beyond this point clearway is calculated on the basis of a horizontal plane subject to the limits on distance specified in paragraph 9.4.2.2.

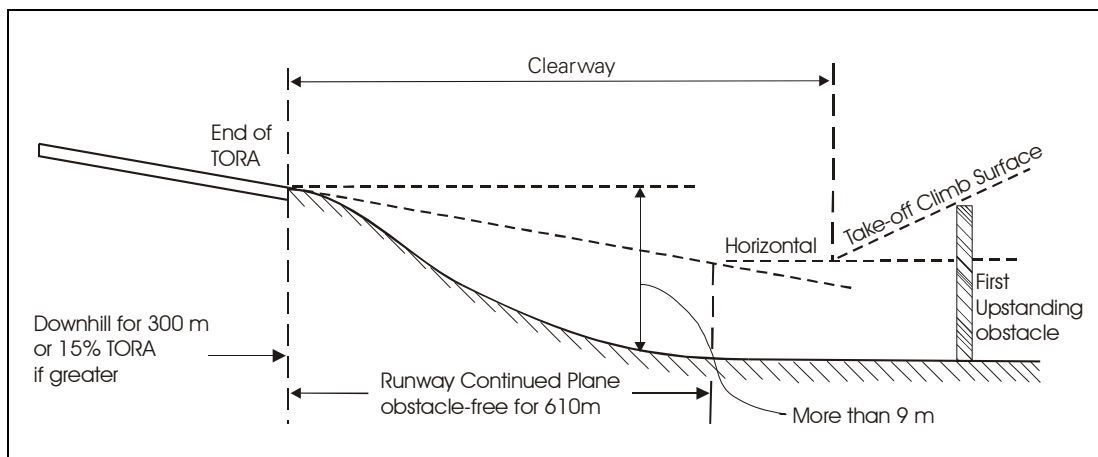


Figure 3.7

- 9.4.3.2 Runway Continued Plane Clearway (RCPC) requires both the last part of the runway to slope downhill for the minimum distances specified in paragraph 9.4.3.1 and the ground to fall more than 9 m below the elevation of the end of TORA. If the ground in the clearway falls to less than 9 m below the elevation of the end of TORA the aeroplane can be considered to be in ground effect and clearway may be declared under the terms of paragraph 9.4.2.1.

9.5 Calculation of the slope of Take-Off Distance Available

- 9.5.1 When any type of clearway is declared the elevation of the runway at the start of TORA and the elevation of the far end of the clearway or clearway plane, as appropriate, are to be promulgated for calculating the overall slope of TODA.

10 Aprons and Stands

10.1 Introduction

- 10.1.1 An apron is a defined area on a land aerodrome which is intended to accommodate aircraft for the purpose of loading or unloading passengers, mail or cargo, refuelling, parking or maintenance.
- 10.1.2 An apron may be divided into stands in order to facilitate the safe parking and movement of aircraft and people.
- 10.1.3 Separate aprons for long term parking or maintenance may be necessary to reduce congestion in the main terminal area.
- 10.1.4 When an aerodrome is used extensively by helicopters which have skid undercarriages and are therefore obliged to hover-taxi between the apron and the operating areas, provision of a discrete helicopter apron is recommended.

10.2 Size

- 10.2.1 There should be room enough on the apron to provide for the number and types of aircraft expected to use it with adequate safety margins from obstructions including parked aircraft. The design of the apron should aim at facilitating the movement of aircraft and avoiding difficult manoeuvres which might require undesirable use of excessive amounts of engine thrust, or impose abnormal stress on tyres.

10.2.2 The dimensions of the apron should be such that the minimum clearance between a manoeuvring aircraft and any obstruction is 20% of wingspan.

10.2.3 For nose-in push-back stands this safety clearance may be reduced to 4.5 m where a suitably managed guidance system, acceptable to the CAA, is available.

10.3 Slopes

10.3.1 Slopes on an aircraft stand should not exceed 1% in any direction.

10.3.2 Aprons or stands should not slope down towards the terminal buildings. Where such slopes are unavoidable special measures should be taken to reduce the fire hazard resulting from fuel spillage.

11 Aerodrome Surface Conditions

11.1 Introduction

11.1.1 In conjunction with the specifications for longitudinal and transverse slopes of runways, taxiways and strips, the type of construction and surface characteristics of the runway itself are probably the most important factors in maintaining safe aircraft operations and in alleviating the operational effect of surface contaminants. In particular, aircraft operations can be affected adversely when the movement area has a low surface friction or is contaminated by ice, snow, slush, water, mud, oil or rubber deposits.

11.1.2 The aim should be to provide in the first instance a runway surface that is clean and has a uniform longitudinal profile and friction levels that will give satisfactory braking action in wet conditions. These issues should be addressed at the time of the design of runways, pavements or subsequent resurfacing. Thereafter it is important to ensure that the surface qualities do not deteriorate below an acceptable level by undertaking periodic inspection and maintenance. Details of the minimum requirement for periodic monitoring of airfield pavements are given in Appendix 3F. Advice on airfield pavement design and maintenance is given in Appendix 3A.

11.1.3 When the surface is affected by winter contaminants, the procedure in Appendix 3D should be followed.

11.1.4 In wet conditions the runway surface state should be reported to pilots as 'Damp', 'Wet', 'Water Patches' or 'Flooded' as laid down by the CAA in the Manual of Air Traffic Services.

11.2 Paved surfaces

11.2.1 Runways

11.2.1.1 It has been found that, after an initial period, the wet friction characteristics of a runway surface generally remain relatively constant and deteriorate only slowly over a period of time, depending on frequency of use. However, the friction level of a wet runway and thus the braking action available can vary significantly over a short period depending on the actual depth of water on the runway and the characteristics of the surfacing materials. Although there is no meaningful operational benefit to be derived from continually measuring the friction level of a runway in wet conditions, it is essential to monitor the friction level on a regular basis.

11.2.1.2 The surface of a new runway or a newly resurfaced runway should be designed and constructed to enable good braking action to be achieved by aeroplanes in wet runway conditions. When a new runway is built or an existing runway resurfaced, the wet surface friction characteristics shall be assessed in order to classify the friction level.

Thereafter, the runway should be subject to periodic assessment in order to ensure that the friction level does not fall below an acceptable level. The procedures for runway surface friction assessment along with the friction criteria are given in CAP 683.

- 11.2.1.3 The surface of a new runway or a resurfaced runway should be designed and constructed without irregularities or surface characteristics which would adversely affect the directional control, braking efficiency of anti-skid systems or ride characteristics of an aeroplane. Therefore in addition to complying with the slope criteria of paragraphs 3.3 to 3.6 and friction criteria in CAP 683, the finished surface should be checked for such irregularities. In particular the surface should be such that when a 3 m straight edge is placed anywhere in any direction across the surface there is no deviation greater than 3 mm between the bottom of the straight edge and the surface of the pavement other than when the straight edge crosses the crown of a camber or a drainage channel.
- 11.2.1.4 Day-to-day operations of aeroplanes may lead to deformation of pavement layers or differential settlement of the pavement foundation, either of which will result in an increase in surface irregularity. Apart from increasing the possibility of control or braking difficulties, a greater depth of standing water can result which may initiate aquaplaning and, if sufficiently deep can lead to engine water ingestion. Runway surfaces should be maintained so that standing water is avoided and no pool of water deeper than 13 mm can form or be retained on any part of the runway declared as available for take-off or landing. (The significant water depth for engine water ingestion for aeroplanes certified to the requirements of Performance Group A is 13 mm.)
- 11.2.1.5 Brief technical details of various runway surfaces which have been shown to provide the required good wet runway braking action are described in Appendix 3A, together with criteria for 'feathering' during runway resurfacing.

11.2.2 **Taxiways and Aprons**

- 11.2.2.1 The surface of taxiways and aprons should have adequate draining characteristics and should provide good braking action for aeroplanes using them. The surface of a taxiway should not have irregularities that could cause damage to aircraft.

11.2.3 **Stopway**

- 11.2.3.1 The surface of a paved stopway should have friction characteristics not substantially less than those of the associated runway and above the Minimum Friction Level stated in CAP 683. It should be kept free from debris and loose material which could damage aeroplanes (see Appendix 3E).

11.2.4 **Movement area cleanliness**

- 11.2.4.1 The surface of the movement area should be inspected at least twice on each day the aerodrome is available for operations, and adequate measures taken to ensure its cleanliness (see Appendix 3F).
- 11.2.4.2 The surfaces should be kept free from loose stones, chippings, grit and other debris which might damage an aeroplane or its engines (see Appendix 3E).
- 11.2.4.3 Contaminants such as mud, oil and rubber deposits lead to a deterioration in the friction value of a surface which could adversely affect aircraft and ground vehicles. The contaminants should be removed as completely as possible particularly from apron stands.

11.2.5 Winter conditions

- 11.2.5.1 To allow aircraft movements to take place, snow, slush and ice should be removed from as much of the movement area as is required for safe operations (see Appendix 3G). When snow banks remain at the edge of a cleared section of the movement area they should not exceed the profiles given in Figures 3.8 and 3.9.
- 11.2.5.2 Aerodromes and airports listed as either a 'Regular' or an 'Alternate' in the current edition of ICAO Air Navigation Plan – European Region are required to draw up a snow plan in accordance with the national Snow Plan (see Appendix 3D). Other aerodromes can be included in the National Snow Plan on request to the CAA.

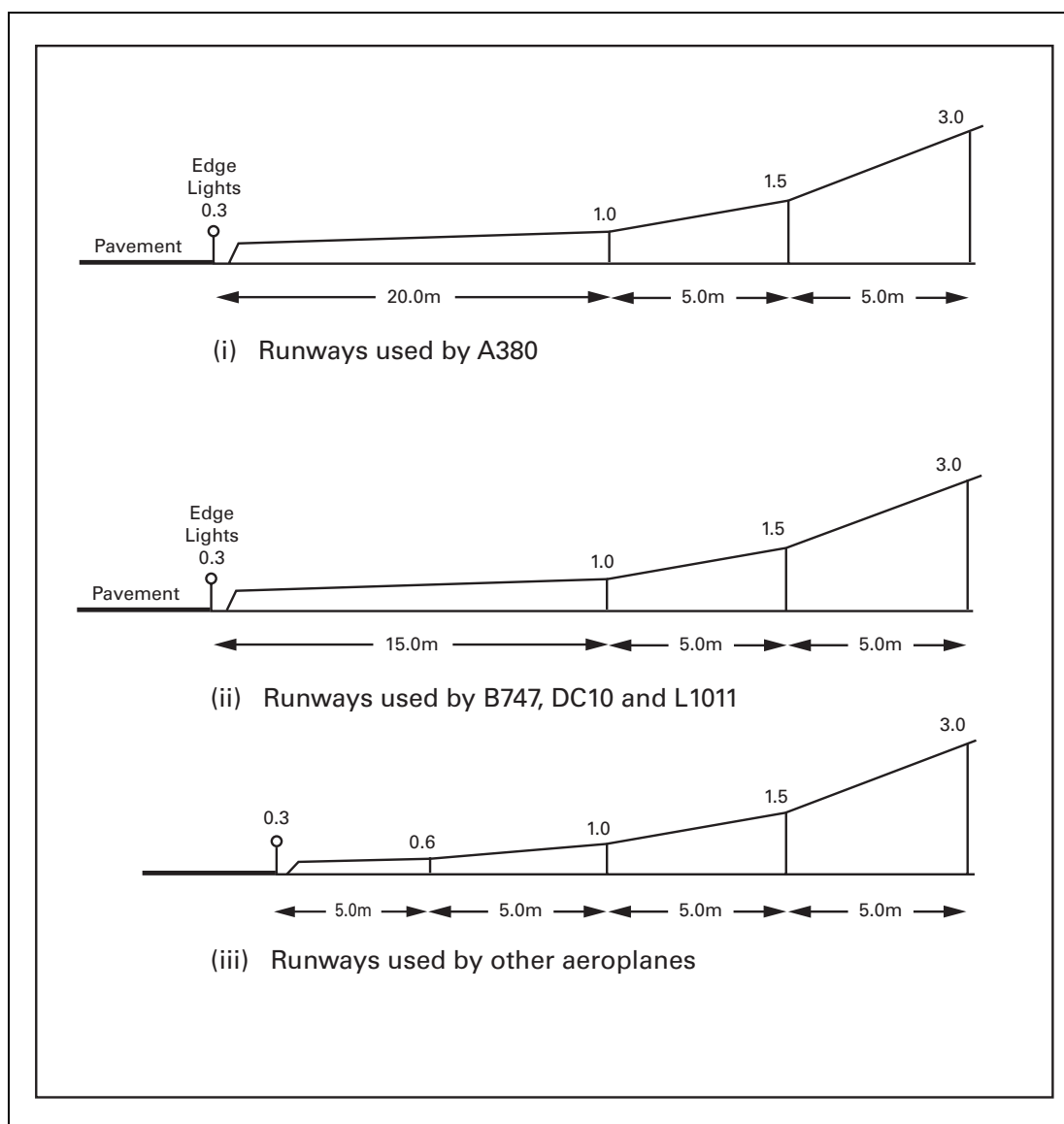


Figure 3.8 Acceptable profile of snowbanks showing maximum height in metres

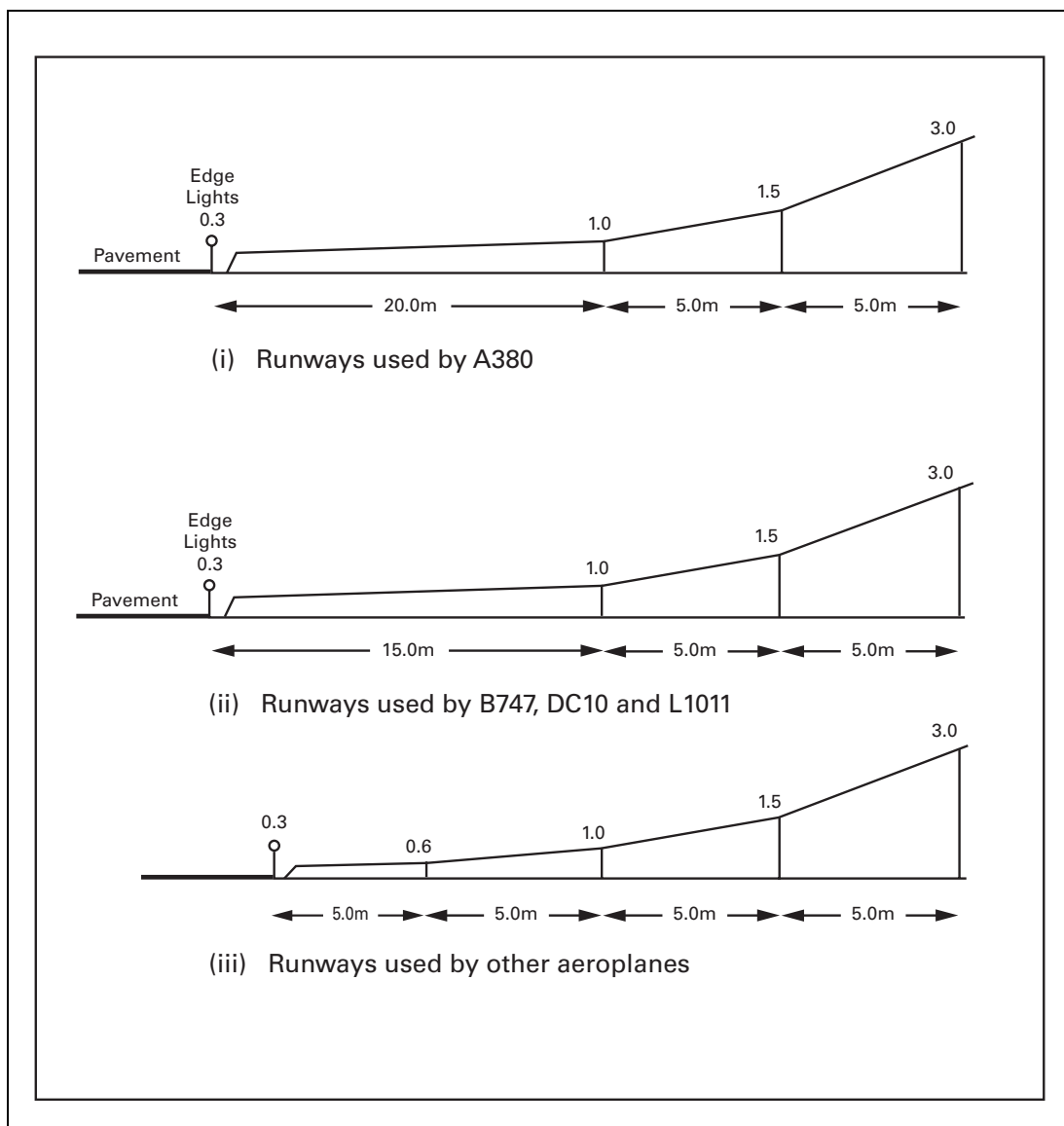


Figure 3.9 Acceptable profile of fully cleared snowbanks showing maximum height in metres

11.3 Unpaved surfaces

11.3.1 Runways

11.3.1.1 Natural surfaces of unpaved runways should be prepared or treated to remove irregularities which might adversely affect the directional control, braking or riding characteristics of an aeroplane. There should be no irregularities which would allow the collection of surface water or the discontinuity of bearing strength in wet conditions.

11.3.1.2 A simple method of assessing the evenness of a natural surface is to drive over it in a Land Rover or similar vehicle at 30 mph. If the surface is acceptably even, this test should be accomplished without discomfort to the vehicle occupants.

11.3.2 Stopways

11.3.2.1 An unpaved stopway should be prepared or constructed so that the braking action is not substantially less than that of the associated runway.

11.3.2.2 An unpaved stopway should be made resistant to erosion where it abuts a paved surface, and so prepared or treated as to minimise the hazard to an aeroplane running onto the stopway.

11.3.3 Length of grass

11.3.3.1 Within the manoeuvring area on a grass aerodrome the length of grass should not exceed the limits described in CAP 680, Bird Control on Aerodromes.

11.3.3.2 Grass may be grown in line with the Long Grass Maintenance regime as described in CAP 680 within RESAs, unpaved stopways and the graded area of runway and taxiway strips. To ensure adequate visibility of installed lights and signs, grass in their immediate vicinity should be closely mown. No more grass than is necessary should be closely mown.

11.3.4 Movement area cleanliness

11.3.4.1 The surface of the movement area should be inspected at least once on each day the aerodrome is available for operations, and adequate measures taken to ensure its cleanliness.

11.3.4.2 The surface should be kept free from loose stones, chippings, grit and other debris which might damage an aeroplane or its engines (see Appendix 3E).

12 Movement Area Bearing Strength

12.1 Pavement forming part of the movement area needs to be of sufficient strength to allow aircraft to operate without risk of damage either to the pavement or to the aircraft. Pavements subject to overload conditions will deteriorate at an increasing rate depending upon the degree of overload. To control this it is necessary to classify both pavement and aircraft under a system whereby the load bearing capacity of the pavement and the loads imposed by the aircraft can be compared. The method used in the UK is the Aircraft Classification Number – Pavement Classification Number (ACN/PCN) method.

12.2 Operational requirements

12.2.1 All pavements forming part of the movement area should be of adequate bearing strength for the types of aircraft expected to use the aerodrome.

12.2.2 All pavements should be regularly examined by a suitably qualified person. For further details see Appendix 3F. Any pavements which have been subjected to overload conditions should be closely monitored by suitably qualified staff for a period of several weeks or until it is clear that no rapid deterioration of the pavement has been triggered.

12.3 Reporting pavement bearing strength

12.3.1 The ACN/PCN method has been developed by ICAO as an international method of reporting the bearing strength of pavements which leaves States the option to use national methods for design and evaluation. Accordingly, the UK will continue to use criteria developed from the Load Classification Group (LCG) system for pavement design and evaluation but the results will be converted into units of the ACN/PCN method.

12.3.2 The ACN/PCN method of classifying the bearing strength of pavements differs from the LCG method in that emphasis is shifted from direct evaluation of the pavement itself to the load imposed on the pavement by the aircraft. In this respect, the load rating of the aircraft is most significantly affected by the sub-grade support strength

of the pavement. ACNs are therefore numbers giving a relative load rating of the aircraft on pavements for certain specified sub-grade strengths. ACN values for most aeroplanes have been calculated by ICAO and are published in Aeronautical Information Publications. The PCN is also a number which represents the load bearing strength of the pavement in terms of the highest ACN which can be accepted on the pavement for unrestricted use.

- 12.3.3 In order to calculate a PCN using the current UK criteria for design and evaluation, the normal method is to identify the aircraft which has the highest Load Classification Number (LCN) which can be accepted on the pavement for unrestricted use. This aircraft is designated as the critical aircraft for the pavement. To convert to the ACN/PCN method, the ACN of the critical aircraft is notified as the PCN. This PCN value indicates that aircraft with ACNs appropriate to the pavement type and specified sub-grade that are equal to or less than the reported PCN can use the pavement without restriction.
- 12.3.4 As an alternative, a PCN can be identified and reported without a technical evaluation of the pavement by means of an assessment of the results of aircraft using the pavement. Providing the type and sub-grade support strength of the pavement are known, the ACN of the most critical aircraft successfully using the pavement can be reported as the PCN.
- 12.3.5 A PCN is reported in a five-part format. Apart from the numerical value, notification is also required of the pavement type (rigid or flexible) and the sub-grade support category. Additionally, provision is made for the aerodrome authority to limit the maximum allowable tyre pressure. A final indication is whether the assessment has been made by a technical evaluation or from past experience of aircraft using the pavement.
- 12.4 **Overload operations**
- 12.4.1 Individual aerodrome authorities are free to decide their own criteria for permitting overload operations as long as pavements remain safe for use by aircraft. The PCN value does include a safety factor so that a 10% increase of ACN over PCN is generally acceptable for pavements that are well consolidated and in good condition.
- 12.5 **Unpaved surfaces**
- 12.5.1 The bearing strength of unpaved surfaces cannot usefully be classified. The basic material, its degree of compaction, the quality of the sub-grade, and the drainage characteristics are examples of factors that can cause considerable daily variation in bearing strength.
- 12.5.2 After prolonged rain the condition of an unpaved surface may become such that either further use by aircraft would result in serious damage to the surface or due to the difficulty of assessing bearing strength the surface can no longer be considered suitable for take-off and landing. Where such conditions are likely to occur a close watch should be kept on the surface and if in the judgement of the aerodrome operator such action appears necessary use of the aerodrome should be restricted or the aerodrome closed altogether.
- 12.6 **Published details**
- 12.6.1 Details of individual aerodrome ACN or PCN values are published in the Part 3 of the UK AIP.
- 12.7 **The use of block pavers on aerodrome movement areas**
- 12.7.1 It is recommended that pavers should normally only be used to surface the following categories of aircraft pavements:

- a) Aircraft stands.
 - b) Low speed taxiways not subject to significant jet blast or propeller wash.
 - c) Aircraft maintenance areas not subject to significant jet blast or propeller wash.
 - d) Helicopter pads.
- 12.7.2 Block pavers should normally not be used to surface the following categories of aircraft pavements:
- a) Runways.
 - b) Areas where aircraft engines are run at high thrust values.
 - c) High speed taxiways.
- 12.7.3 Should aerodrome management wish to depart from these recommendations, they should first discuss this with their Aerodrome Inspector.

13 Declared Distances

- 13.1 Aerodrome declared distances constitute the relevant distances for the application of the weight and performance requirements of the Air Navigation (General) Regulations in respect of aeroplanes flying for the purpose of public transport. The distances are illustrated in Figure 3.10 and are:
- a) Take-Off Run Available (TORA). This is the length of runway available and suitable for the ground run of an aeroplane taking-off.
 - b) Accelerate Stop Distance Available (ASDA) This is the length of TORA plus the length of any associated stopway.
 - c) Take-Off Distance Available (TODA). This is the length of TORA plus the length of any associated clearway.
 - d) Landing Distance Available (LDA). This is the length of runway available and suitable for the ground landing run of an aeroplane.
- The significance and application of the runway/stopway/clearway concept in relation to aircraft performance is given in Appendix 3C.

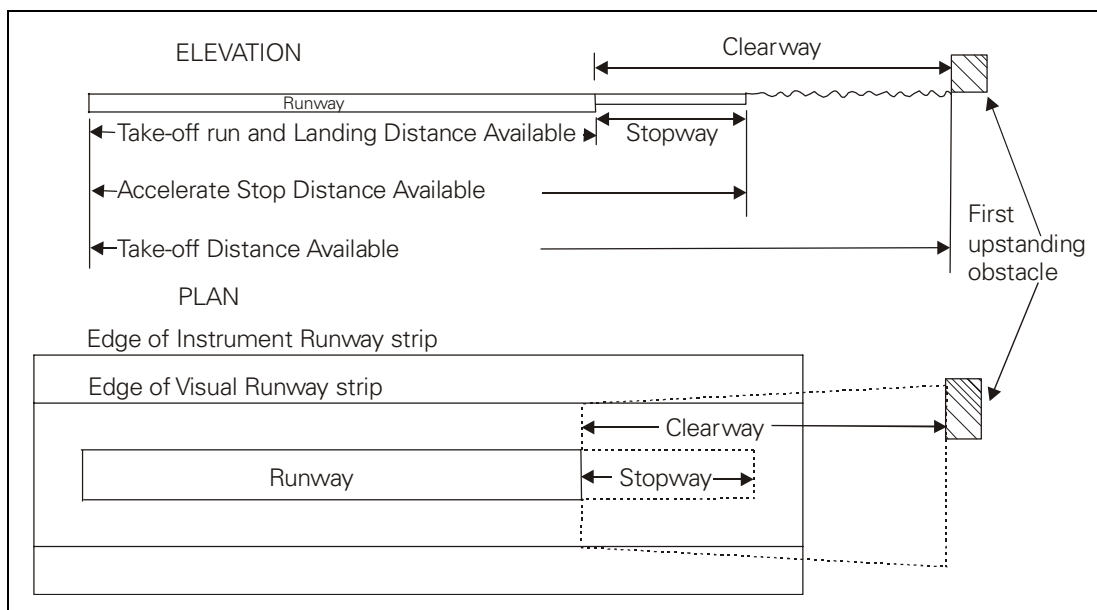


Figure 3.10

- 13.2 The TORA, ASDA, TODA and LDA should be measured for each paved and unpaved runway direction. For this purpose unpaved runways are to be marked. The distances are measured along the centreline of the runway and of any associated stopway and clearway, and should be declared by publication in the UK AIP or in a NOTAM. Declared distances may be reduced as outlined in Appendix 3B. They may only be increased with the prior agreement of the Aerodrome Standards Department.
- 13.3 The intended use of a runway or part thereof for take-off or for landing using either visual or instrument approach procedures will determine the criteria to be applied in measuring the distances which may be declared. Alternatively the ability to meet the criteria will decide what length of runway may be declared for what purpose. For example, a runway strip should extend beyond the end of a runway or stopway where the code number is 3 or 4 for a distance of 60 m (paragraph 4.2.1) at an overall width of 150 m (paragraph 4.3.1). However, such a runway should also have a runway end safety area extending beyond the end of the strip (paragraph 5.1) for a distance of at least 90 m at a minimum width of twice that of the associated runway (paragraph 5.2). The end of the declared TORA, ASDA and LDA should be adjusted so that the runway end safety area is provided as well as the required strip length and width. If the particular runway is served by an instrument approach procedure, the strip width to be applied when determining LDA will differ from that required for TORA and ASDA (paragraphs 4.3.2 and 4.3.3). Examples of the application of the various criteria are illustrated in Figures 3.11, 3.12 and 3.13.
- 13.4 **Threshold displacement**
- The threshold is the start of that part of a runway that is declared as available for landing. When the individual requirements for strip width and length, and runway end safety area are met (paragraphs 4 and 5 refer but also see paragraph 1.3) the threshold will normally be located at the start of the runway. However, it may be necessary to account for any of these physical characteristics or an obstacle which cannot be removed and extends above the approach surface (see Chapter 4) by displacement of the threshold from the runway end. The amount by which the threshold is displaced will vary with the individual circumstances of each situation, regard being given to:

- a) The nature, type and level of traffic.
- b) Whether the runway is an instrument runway or a visual runway, and if it is an instrument runway whether it is a precision approach runway or non-precision approach runway.
- c) The position of any obstacle that either affects the RESA or infringes the approach surface, in relation to the threshold and extended centreline of the runway.
- d) The amount by which the obstacle penetrates the approach surface, and its significance in the calculation of the obstacle clearance height.
- e) The angle of the glidepath or nominal glidepath for an instrument approach procedure and the calculated obstacle clearance height.
- f) The limiting visibility and cloudbase conditions under which the runway will be used.

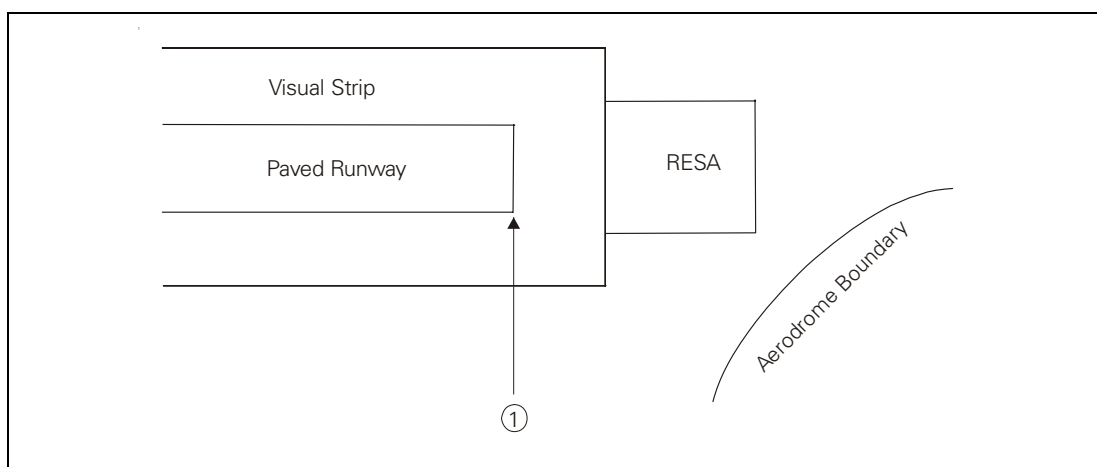


Figure 3.11

- 1 would be the end of TORA and ASDA (no stopway), and the end of LDA for a visual runway. It would be the start of TORA, ASDA and TODA in the reciprocal direction, and also LDA unless the threshold were displaced because of obstacles in the approach area.

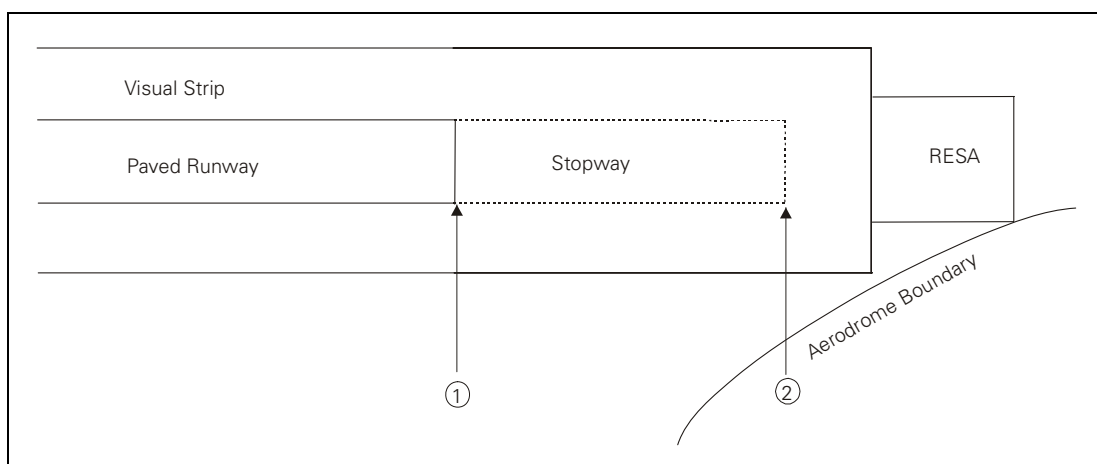


Figure 3.12

Here, in Figure 3.12, the runway depicted in Figure 3.11 has been supplemented by the provision of stopway.

- 1 would be the end of TORA and LDA for a visual runway. It would be the start of TORA, ASDA and TODA in the reciprocal direction, and also the start of LDA unless the threshold were displaced because of obstacles in the approach area.

- 2 would be the end of ASDA, limited by the RESA short of the aerodrome boundary not by the strip width.

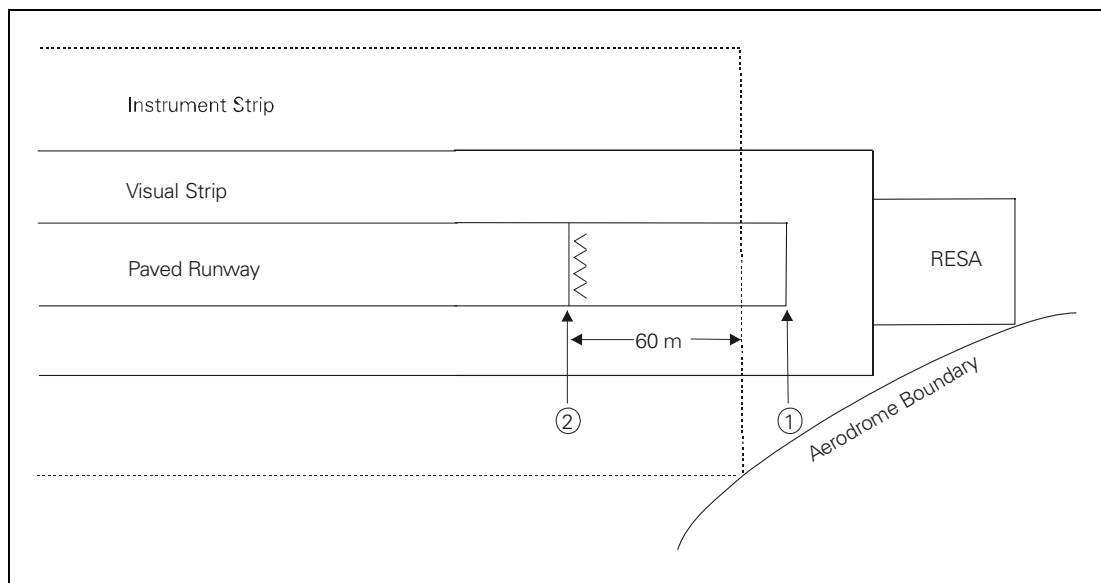


Figure 3.13

The runway of Figures 3.11 and 3.12 has been extended by paving the declared stopway of Figure 3.12 to full runway strength.

- 1 would be the end of TORA and LDA for a visual runway. It would be the start of TORA, ASDA and TODA in the reciprocal direction, also LDA unless the threshold were displaced because of obstacles in the approach area.
- 2 would be the end of LDA for an instrument runway, the provision of the required instrument strip becoming the limiting factor, and the start of LDA in the reciprocal direction, subject to the availability of an acceptable obstacle free approach surface.

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Appendix 3A Runway Surfaces – Technical Details

1 Introduction

- 1.1 It is essential to ensure that a runway surface is sufficiently well constructed and maintained to stand up to the particular demands of aircraft take-off and landing operations. The principal requirements of a new or resurfaced runway may be summarised as follows:
- a) Provide a surface friction level at or above the Design Objective Level defined in CAP 683.
 - b) Provide an average texture depth of not less than 1 mm.
 - c) Provide a hard durable surface that will not generate loose materials or contaminants.
 - d) Provide good rideability.
 - e) Provide good surface water drainage.
 - f) Avoid excessive tyre wear.
 - g) Avoid damage to the surface by aircraft manoeuvring.
 - h) Provide a stable surface that will not be damaged or removed by jet engine exhaust efflux.
 - i) Provide a suitable Pavement Classification Number (PCN) for aircraft operations.
 - j) Provide an acceptable design life.
 - k) Meet the geometric criteria defined in Chapter 3.
- 1.2 Brief details are given below of runway surfaces which have normally been found to provide good friction performance.

2 Porous Friction Course

- 2.1 Porous friction course is open-graded macadam laid to a uniform thickness of typically 20 mm with a high void ratio making it pervious. This allows the free penetration of surface water to the underlying layer which must be a densely graded impervious bituminous surfacing shaped to ensure drainage to the sides of the runway.
- 2.2 Porous friction course has good riding qualities, due to the close tolerances to which it is laid. Ice formation is retarded on a porous friction course and the thawing of both snow and ice is accelerated. In addition reverted rubber tends to crumble from, rather than stick to, the surface of the friction course.
- 2.3 It should be noted that due to the use of a relatively soft bitumen binder this can lead to softening of the surface during the first summer after laying. It is also important that the pavement joints are sufficiently porous to allow cross flow of water.

3 New Concrete Runways

3.1 Coarse directional texturing by wire broom or comb

- 3.1.1 This surface texturing is formed in the plastic concrete by drawing a wire broom or purpose made comb transversely across the surface of the plastic concrete surface at right angles to the runway centreline. During the laying of the concrete regular measurements of texture depth are made on the coarse textured slabs.

3.2 Grooving

- 3.2.1 The transverse grooving of hardened concrete is undertaken by a specialised machine to saw a groove in the surface of the concrete at regular intervals, in a similar pattern to that on new asphalt runways.

4 New Asphalt Runways

4.1 General

- 4.1.1 New or resurfaced runways with an asphalt surface normally do not provide adequate friction levels for aircraft operations immediately after the new surface has been placed. This is because it takes some period of time for the surface film of oils to be removed by traffic and weathering so as to expose the micro texture of the aggregate. In these circumstances it is generally necessary to treat the surface by either the application of a coarse textured slurry seal, grooving or the addition of a porous friction course.

4.2 Coarse textured slurry seal

- 4.2.1 This method involves the application of a coarse textured bitumen emulsion slurry seal with a graded crush rock aggregate from 3.35 mm down, however, care must be taken to ensure good adhesion of the slurry seal to the new asphalt.

4.3 Grooving

- 4.3.1 The dense asphalt wearing course is grooved transversely by a machine incorporating diamond saw blades. Grooves are typically 3 mm wide by 3 mm deep at a minimum spacing of 25 mm.

4.4 Porous Friction Course – see paragraph 2.

5 Existing Concrete Runways – Grooving

- 5.1 Provided the concrete is sound grooving treatment wears well. However, when the concrete is old, and the surface seal is broken, exposing the aggregate, some deterioration of the concrete may then occur.
- 5.2 The concrete is grooved transversely using a cutting drum incorporating typically fifty 3 mm wide equally-spaced circular segmented diamond saw blades per 300 mm width of drum. Grooves are typically 3 mm wide by 3 mm deep at a spacing of 6 mm.

6 Existing Asphalt Runways

- 6.1 **Coarse textured slurry seal** – see paragraph 4.2
- 6.2 **Grooving** – see paragraph 4.3
- 6.3 **Porous friction course** – see paragraph 2.

7 Runway Ramping During Resurfacing

- 7.1 In order that operations may continue between periods of runway resurfacing or maintenance, the new surface and temporary ramps should be constructed across the full width of the runway. Before operations recommence, after a period of runway closure, the surface should be inspected to ensure that temporary ramps have been constructed as follows:
- a) The gradient of temporary ramps should not be steeper than 1:100 where the depth of overlay is not greater than 50 mm otherwise the gradient shall not be steeper than 1:200.
 - b) The depth of ramp should not exceed 100 mm.
 - c) The minimum spacing between successive ramps should be 150 m.
 - d) All ramps should be constructed so as to remain stable and durable under aircraft operations.
 - e) Wherever possible ramps should be constructed with regard to the prevailing landing and take-off direction. It is undesirable that an aircraft encounters an up gradient during take-off or landing, particularly in the touch down zone.

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Appendix 3B Temporary Obstacles within Runway Strips

- 1 It is the responsibility of the aerodrome authority to notify pilots of the existence of all temporary obstacles within a runway strip either through the medium of Air Traffic Control or by NOTAM. The following paragraphs give guidance on the operational implications of temporary obstacles within runway strips and the limitations which should govern the continued use of the runway.
- 2 A runway should be withdrawn from service or its length and declared distances restricted if there is an obstacle which cannot be removed within the area which is to be cleared and graded.
- 3 The amended distances declared as available will have regard for the differences in the area to be cleared for an instrument runway compared with a take-off runway. Thus with an obstacle say 80 m laterally from the runway centreline it may be feasible to reduce the landing distance available on an instrument runway but leave the take-off field lengths unchanged. Alternatively the instrument procedure might be withdrawn. When the landing distance for an instrument runway is amended the CAA shall be consulted in order to determine whether consequential amendments are necessary to the instrument approach procedure.
- 4 Declared distances have a statutory application and it is important that amendments are promulgated as they arise. The CAA may require to verify amended distances. The revised distances must be included in a NOTAM issued to advise pilots of temporary aerodrome conditions. It cannot be assumed that inbound pilots will have had access to the NOTAM and therefore the information should also be passed by R/T.
- 5 When there is a temporary obstacle within the runway strip but outside the area to be cleared and graded, the continued use of the runway may be permitted subject to the pilots being notified of the obstacle. Every effort should be made to remove the obstacle as soon as possible.
- 6 Temporary ditches or depressions are acceptable on only one side of the runway within the graded area at any given time. They should not exceed a surface area of 10 square metres or exceptionally for narrow trenches a surface area of 30 square metres. There should be no earth banks or equipment above the original ground level of the area.

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Appendix 3C The Use of Runway, Stopway and Clearway – Performance Aspects

- 1 The decision to provide stopway or clearway as an alternative to an increased length of runway will depend on the physical characteristics of the site, and the performance requirements of the aeroplane expected to use the runway. Take-off performance is normally the critical factor, but landing requirements are occasionally over-riding.

2 Rules on the Amount of Stopway or Clearway which may be Used Vary According to the Aircraft Performance Group Classification

- 2.1 Aeroplanes classified in Performance Group 'A'
- 2.1.1 Broadly speaking Group 'A' aeroplanes are those of a maximum total weight authorised exceeding 5700 kg, certified after 1951. The Weight and Performance requirements of the Air Navigation (General) Regulations for such aeroplanes require an aerodrome large enough to ensure that taking account of ambient conditions, i.e. runway slope, surface wind, temperature, aerodrome pressure and altitude, the aeroplane can either be brought to rest or complete the take-off safely in the event of one engine failing during take-off. For the purpose of these notes it has been assumed that the lengths provided at an aerodrome are just adequate for the aeroplane at its proposed operating weight. Under these circumstances there is for each take-off a speed, called the Decision Speed, at which, if engine failure occurs, the aeroplane may be stopped within the emergency distance available or continue a take-off with equal safety. If an engine fails below this speed the take-off must be abandoned, whilst above it the take-off must be continued. A very long take-off run and take-off distance would be required to enable a take-off to be continued when an engine fails below the decision speed because the reduced power available would result in a reduction in acceleration. There would be no difficulty in stopping in the emergency distance available provided action was taken immediately; therefore, in these circumstances, the correct course of action would be to abandon the take-off. On the other hand, if an engine fails in the latter stages of the take-off, the aeroplane will have already attained sufficient speed to continue the take-off safely in the remaining distance available, but because of its high speed would have insufficient distance in which to stop.
- 2.1.2 The decision speed is not a unique value for each aeroplane, but can be selected by the pilot within certain limits to suit the field lengths available at the aerodrome. For example, when the take-off distance available is long and the emergency distance available is short, a low decision speed may be chosen. As emergency distance increases or take-off distance decreases, so the decision speed may be increased. A variety of combinations of emergency distance and take-off distance can accommodate a particular aeroplane at a particular weight. Each combination requires its particular length of take-off run which must consist of runway alone.
- 2.1.3 The most familiar case is where the take-off distance available is equal to the emergency distance available, this is referred to as the balanced field length. When only runway is available, these distances will always be equal to the runway length. It is not essential that a balanced field length should consist of runway alone. Where it does not consist of runway alone the take-off run required will be less than the emergency distance required as the balanced field length is then provided as runway plus stopway. If stopway is to be used and the runway is level, and can be used for

take-off in both directions as is normally the case, an equal length of stopway would need to be provided at each end. The saving in runway is, therefore, bought at the cost of greater total strip length. If the runway is not level, or take-offs with a tail wind are acceptable, varying lengths of stopway will be required.

- 2.1.4 A decision speed other than that associated with the balanced field length conditions is selected when emergency and take-off distances are unequal. Normally, only lower values are of interest, since higher speeds will always increase the requirement for stopway although reducing take-off distance requirements. By using lower decision speeds, the emergency distance required will be reduced, i.e. less stopway required. However, additional clearway will be needed to provide for the increase in the take-off distance required. Exceptionally, the use of higher speeds would be an advantage when obstacles in the take-off area make it necessary to reduce to a minimum the take-off distance required.
- 2.1.5 At some aerodromes it may be expedient to provide both stopway and clearway. Where the nature of the ground is such that stopway can be economically provided, there will be little gain in the substitution of clearway, since this will result in a greater total field length requirement. Where stopway cannot be economically provided and only runway and clearway are practicable the take-off run available and emergency distance available will equal the runway length, whilst clearway will constitute the remainder of the take-off distance available.
- 2.1.6 If field length requirements at a particular aerodrome are critical for an aeroplane in Group 'A', the minimum runway, stopway and/or clearway lengths which can be used may be determined from Flight Manual performance data, as follows:
- a) If stopway is economically possible, the emergency distance lengths to be provided are preferably those for the balanced field length. The runway length is the take-off run required or the landing distance required, whichever is the greater. If the take-off distance/emergency distance required is greater than the runway length so determined, the excess may be provided as stopway, usually at each end of the runway (see Chapter 3, paragraph 8).
 - b) If stopway is not to be provided, the runway length required will be the greater of the landing distance required and the emergency distance required corresponding to the lowest usable value of the decision speed. The lowest practical value is the speed at which the emergency distance required and take-off run required are equal, unless the minimum of the permissible range of decision speeds is higher. The difference between the take-off distance required and the runway length may be provided as clearway, usually at each end of the runway; and
 - c) Where the physical limitations of the site make it necessary to provide both stopway and clearway, the lengths required may be determined from Flight Manual data using an appropriate decision speed.
- 2.1.7 The rules given above may be complicated by three factors not so far considered in detail. First there is, generally, a lower limit to the range of decision speeds which can be chosen; in certain circumstances this limit will be above the decision speed corresponding to the balanced field length. When this occurs there is no choice of decision speed; the emergency distance required is greater than the take-off distance required and will determine the length of stopway which needs to be provided. The provision of clearway does not arise if the decision speed cannot be reduced.
- 2.1.8 The second factor normally concerns only turbine-engined aeroplanes. With piston-engined aeroplanes, the engine-out take-off distance required has always been so much greater than the average all-engines take-off distance required, that a large margin was available for any likely variation in all-engines take-off performance.

However, with turbine-engined aeroplanes this is not necessarily true, and variations in the performance of the aeroplane can occur, on those occasions when the power to weight ratio is high, which will make the factored all-engines take-off distance required greater than the average distance required for an engine-out take-off.

- 2.1.9 The remaining factor is the restriction on the upper limit of the decision speed which is imposed because of the danger of burning out wheel brakes. This brake kinetic energy limitation speed may be less than that for the decision speed corresponding to the balanced field length.

2.2 Other aeroplanes

- 2.2.1 Aeroplanes, other than those in Performance Group 'A', are not permitted to take advantage of clearway. If they are in groups 'C' or 'D', take-off distance required must not exceed emergency distance available, i.e. runway or runway plus stopway. For aeroplanes which have no performance group classification, the take-off distance required must not exceed the runway length and must also be less than 75% of the runway plus stopway for twin-engined aeroplanes, and 85% for four-engined aeroplanes. Generally, only aeroplanes with a maximum weight less than 5700 kg are certified in groups 'C' and 'D', while aeroplanes having no group classifications are the older piston-engined aeroplanes certificated not later than the early post-war years.

3 General

- 3.1 The paragraphs above give some guidance on how the proportions of runway, stopway and clearway may be determined to meet the needs of a particular aeroplane. For general planning purposes, in the case of aeroplanes other than Group 'A', the runway length to be provided may be about 85% of the full requirement, the remaining 15% being stopway. As a somewhat arbitrary guide for Group 'A' aeroplanes some 20% of the take-off distance required may be provided as clearway – the total length in each direction being some 5% greater than the balanced field length required. In either case the remarks at the end of paragraph 2.1.3 apply, and the ultimate runway length selected must take account of the landing distance requirements since this may, on occasions, be more limiting.

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Appendix 3D National Snow Plan including Procedures for Dealing with Winter Contamination of Aerodrome Surfaces

1 Introduction

- 1.1 The presence of winter contaminants (ice, snow, slush and associated standing water) on aerodrome surface areas frequently results in hazardous conditions which in turn contribute to aircraft accidents and incidents. Reduced traffic volumes, resulting in flight delays, diversions and cancellations, can be expected at affected aerodromes and the aerodrome management approach to the control and clearance of these contaminants will largely determine the extent to which the effects can be minimised.
- 1.2 The following paragraphs describe the procedures, equipment and techniques that should be employed for the clearance of winter contaminants from pavements at aerodromes available to public transport operations. The methods used for the measurement and reporting of aerodrome surface conditions in accordance with internationally agreed procedures are described, as are procedures for aerodromes participating in the United Kingdom Snow Plan.
- 1.3 It is the responsibility of the aerodrome licensee to ensure that all parts of the movement area that are in use, including taxiways, have adequate surface friction levels such that they may be used safely by aircraft. If, for any reason, the surface friction level is inadequate, the movement area should be withdrawn from operational use.
- 1.4 Aerodrome licensees should regularly assess the current procedures for monitoring surface conditions and the reporting and treatment of the manoeuvring areas that are contaminated, particularly during winter conditions when surface contamination by ice or wet snow is likely. Additionally, aerodrome operators should review their winter and cold weather operating procedures, and ensure that they are promulgated to the relevant operations staff.
- 1.5 Using their experience and knowledge of the aerodrome, licensees should identify areas that are susceptible to surface contamination, paying particular attention to gradients and curves. When the threat of contamination exists, it may be appropriate to closely monitor these areas and to arrange localised snow/ice clearance activity as necessary.

2 Responsibility for Planning and Implementation

- 2.1 The clearance of winter contaminants from pavements and the measurement and reporting of surface conditions are the responsibility of the aerodrome authority. Prior to the onset of winter conditions, the aerodrome authority should prepare a plan to effect efficient clearance and measurement procedures intended to ensure maximum availability of the aerodrome. The plan should be formulated in co-operation with ATS and the aerodrome users. Arrangements should be made to ensure that the plan can be implemented as soon as meteorological forecasts indicate the likelihood of surface contamination. The first priority should be to clear operational runways and other essential parts of the movement area. Provision for measurement and reporting procedures will also be necessary. Subsequently, the surfaces cleared should be maintained as free from contaminant as is reasonably practicable.

3 Clearance Techniques

- 3.1 Whenever possible, the full length and width of runways should be cleared completely. Mechanical snow clearing equipment; blowers, sweepers, ploughs and rotary brushes should form the main part of the snow clearance equipment used at most large aerodromes. As far as practicable, clearance techniques employed should prevent the build-up of snow banks. Where this is unavoidable, every effort should be made to restrict snow banks to such a height and distance apart as to ensure safe manoeuvring of the most critical aircraft, in this context, normally using the aerodrome (see Chapter 3 paragraph 11.2.5).
- 3.2 Slush and associated standing water should be cleared whilst it is forming. Clearance may have to be repeated at intervals and some interruption of operations may be inevitable.
- 3.3 Chemicals used for clearing or preventing the formation of ice should be fit for the purpose, non-toxic and should have no detrimental effects on aircraft, aerodrome surfaces, or the friction value of aerodrome pavements. Salt is a particularly corrosive chemical and should be employed only where its use is essential to the prevention of contaminant build up around edge drains.

4 Operational Priorities for the Treatment and Clearance of Movement Areas

- 4.1 Aerodrome licensees should ensure that all parts of the movement area that are in use have adequate surface friction levels, especially during winter operations.
- 4.2 Where contamination exists, licensees should determine the level of treatment and clearance needed and the order of priority in which it should take place. The order of priority will depend upon many factors; however, it should be a general policy to treat and clear in the following order:
- a) runway(s) in use, including rapid exits and starter strips;
 - b) all runway holding areas, taxiways and aprons that are to be used;
 - c) all other areas and roads.

5 Assessment and Notification of Runway Surface and Allied Conditions

5.1 General

- 5.1.1 The aerodrome authority or ATS, according to local organisation, should assess and report runway surface conditions. Information on runway conditions should be notified by SNOWTAM, OPMET RUNWAY STATE MESSAGE (where applicable) or by RTF on request.
- 5.1.2 Until a satisfactory method has been found to determine accurately and quickly the density of a contaminant on a runway, the nature of the surface covering shall be described using the following categories based on subjective assessment by the personnel making the inspection:
- a) Ice – water in its solid state, it takes many forms including sheet ice, hoar frost and rime (assumed specific gravity 0.92).
 - b) Dry snow – a condition where snow can be blown loose, or if compacted by hand, will fall apart again upon release (assumed specific gravity less than 0.35).

- c) Compacted snow – snow which has been compressed into a solid mass that resists further compression and will hold together or break up into chunks if picked up (assumed specific gravity 0.35 to 0.50).
- d) Wet snow – a composition which, if compacted by hand, will stick together and tend to, or does form a snowball (assumed specific gravity greater than 0.5).
- e) Slush – a water saturated snow which, with a heel and toe slap down action with the foot against the ground, will be displaced with a splatter (assumed specific gravity 0.50 to 0.80).
- f) Associated standing water – standing water produced as a result of melting contaminant in which there are no visible traces of slush or ice crystals (assumed specific gravity 1.0).

5.2 **Depth of Snow or Slush**

- 5.2.1 A standard depth gauge should be used to measure the depth of snow, slush or associated standing water on runways. Readings should be taken at approximately 300 m intervals between 5 and 10 m on each side of the centre line, avoiding the effects of rutting. Depth information shall be given in millimetres representing the mean of readings obtained for each third of the total runway length.

5.3 **Snow Banks**

- 5.3.1 The height of snow banks and their distance apart shall be reported as soon as a situation arises that these affect safe manoeuvring by the most critical aircraft, in this context, normally using the aerodrome. Details of acceptable snow bank profiles for certain large aircraft are given at paragraph 11.2.5 of Chapter 3.

5.4 **Runways Affected by Compacted Snow and Ice**

- 5.4.1 On runways affected by compacted snow or ice, a braking action assessment should be made by use of either of the following methods:
 - a) Continuous Friction Measuring Equipment (CFME) operated in accordance with the manufacturers' instructions.
 - b) Brake Testing Decelerometer – An assessment is made of the coefficient of friction using a brake testing decelerometer fitted in a car, van or light truck, the brakes being applied at 25–30 mph ensuring that the vehicle wheels are momentarily locked. A standard procedure should be followed to ensure uniformity in technique.
- 5.4.2 The methods described above are limited to use on ice (gritted or un-gritted) and compacted snow. They are likely to produce misleading readings in slush or uncompacted snow.
- 5.4.3 Braking action tests where appropriate should be made over the usable length of the runway at approximately 3 m each side of the centre line and in such a manner as to produce mean values for each third of the length available. Assessment of stopway braking action where applicable should also be made.

- 5.4.4 The results of braking action testing on compacted snow or ice should be interpreted by reference to the Snow and Ice Table below.

Table 3D.1 Snow and Ice Table

Friction Number	Estimated Braking Action	Opmet Snowtam Code
.40 and above	Good	95
.39 – .36	Medium/Good	94
.35 – .30	Medium	93
.29 – .26	Medium/Poor	92
.25 and below	Poor	91
If, for any reason, the reading is considered unreliable		99

- 5.4.5 It is important to remember that the braking action assessment obtained from the Snow and Ice Table is only a rough indication of the relative slipperiness of a contaminated runway. The description 'Good' is used in the comparative sense – good for an icy surface – and is intended to indicate that aircraft generally, but not specifically, should not experience undue directional control or braking difficulties, but clearly a surface affected by ice and/or snow is not as good as a clean dry or even a wet runway. The description 'Good' must not be used for braking action on untreated ice but may be used, where appropriate, when ice has been gritted. 'Poor' will almost invariably mean that conditions are extremely slippery, and probably acceptable if at all, only to aircraft needing to use little or no braking or steering. Where 'Poor' braking assessment exists, landings should only be attempted if the Landing Distance Available exceeds the Landing Distance Required on a 'very slippery' or icy runway as given in the aircraft Flight Manual. The intermediate values of 'Medium/Good', and 'Medium/Poor' have been included only to try to amplify the description when conditions are found to be medium. The procedure is insufficiently refined to be able to discriminate accurately in the narrow numerical bands as set out in the table.
- 5.4.6 In exceptional circumstances, grit, to an internationally accepted specification (defined at Appendix 3G) may be used to increase the friction value of manoeuvring areas affected by ice or snow. The specification of grit has been selected as providing the best compromise between improving the coefficient of friction and presenting the least hazard to aircraft. However, the risk of ingestion into jet engines or of damage to the control surfaces of propeller driven aircraft, particularly where reverse thrust is used, cannot be entirely discounted and its use should be agreed with operators beforehand. Grit should be left on the surface only for so long as the ice or snow persists.

5.5 Runways Affected by Slush

- 5.5.1 Aircraft operations on runways affected by slush can be particularly hazardous and every effort should be made to clear the surface, as far as is reasonably practicable, of all slush contaminant prior to an aircraft movement. However, the practical difficulties of ensuring that a runway is totally slush free are significant and success will depend heavily on the prevailing meteorological conditions, the resources and time available. In such conditions, up to date runway condition reports will be required by flight crews. However, because of the effects of drag, runway friction measuring machines operated in slush can produce misleading readings. In addition, because of the variable quality of the contaminant, no satisfactory method of assessing braking action in slush exists. Where a runway has been assessed to be clear of all

contaminant, friction tests shall be conducted in order to establish that friction levels have returned to those normally associated with a wet runway as determined by routine Runway Friction Monitoring. Where contaminant remains, runway condition reports shall not contain readings taken directly from friction measuring machines or braking action reports derived from use of the Snow and Ice Table.

- 5.5.2 Aquaplaning conditions should be assumed to exist whenever depths of water or slush exceeding approximately 3 mm affect a significant portion of the available runway.

6 Notification Procedures

- 6.1 The SNOWTAM provides a standard report which includes an assessment of each third of the runway. Whilst appropriate conditions prevail, participating authorities should issue SNOWTAMs as follows:
- a) A new (not revised) SNOWTAM whenever there is a significant change in conditions.
 - b) The maximum validity of a SNOWTAM shall not exceed 24 hours.
- 6.2 Guidance on the completion of the SNOWTAM (form CA 1272) (see Chapter 10) is promulgated regularly in Aeronautical Information Circulars. Information on the distribution of SNOWTAM and the division of the aerodromes into distribution lists is to be published annually as an Aeronautical Information Circular before the onset of winter.
- 6.3 For as long as conditions warrant, runway surface conditions should be reported by those aerodromes contributing to the OPMET Broadcast system of disseminating information, every half hour in the following format:
- runway designator, type, extent and depth of deposit; and braking action.
- The report is included as an eight digit code at the end of routine aerodrome meteorological reports (METARs) – see AIP GEN 3–5.
- 6.4 RTF reports to pilots should provide a description of the available runway length and width along with an assessment of the prevailing conditions i.e. ice, snow or slush, together with the time of the measurement.
- 6.5 If the aerodrome is closed through snow a further signal in addition to the SNOWTAM must be sent to EGGNYNYX for NOTAM action.

7 Aerodrome Snow Plan

The contents of an aerodrome Snow Plan should include instructions and information covering the following areas:

7.1 Preparation

- a) Consultation with air operators, training, communications, equipment, servicing.
- b) Allocation of responsibilities.
- c) Equipment to be used.
- d) Alerting and call-out system.
- e) The use of approved chemicals – see Appendix 3G.

7.2 **Clearance, removal and improvement of braking action**

- a) Methods, techniques. The magnitude of effort and types of equipment will depend on local authorities.
- b) Priorities for clearing specific parts of movement area.
- c) The use of grit to improve braking action and subsequent sweeping.

7.3 **Measurement/assessment of the aerodrome state**

- a) Braking action. Assessment by an approved measuring device.
- b) Degradation of acceleration on take-off due to precipitation drag. Assessment by a description of the type and depth of the deposit.
- c) Snowbanks, location, height and distance apart.

7.4 **Dissemination of information**

Information on the clearance methods and priorities should be published in the individual aerodrome entry or AD 2.7. Any changes to this information should be notified to AIS in writing to the address given in Chapter 10, paragraph 4.

Appendix 3E Aerodrome Movement Areas – Clearance of Foreign Objects and Debris (FOD)

1 General

- 1.1 It is important in the interests of safety and economy to keep runways, taxiways and aprons clear of loose stones or other objects and debris that could cause damage to aircraft or engines, or impair the operation of aircraft systems. Turbine engines are extremely susceptible to damage as a result of foreign object ingestion. Propellers, aircraft skin and tyres have all been damaged as a result of loose stones or debris becoming dislodged by jet blast, slipstream or tyre action. Serious accidents have resulted from tyres being punctured by a metal object on a runway. Grit used on icy runways has led to control surface jamming and wet tar ingestion has led to engine failure. At all times, debris on the movement area of an aerodrome is a potential hazard to aircraft safety. An aborted take-off brought about by an engine failure or a wheel/tyre failure is particularly likely to result in debris being left on the runway.
- 1.2 Apart from the safety aspect, unscheduled replacement of parts or components damaged by debris will result in economic penalties for an aircraft operator. Damage to tyres resulting from contact with sharp objects, untreated joints or deteriorating pavement edges are responsible for reduced tyre life. The cleanliness of the surface of the movement area should be a matter of continuous concern and attention to an aerodrome authority.
- 1.3 FOD typically falls into two main categories:
- a) That on the runway consists largely of aircraft parts, typically small metal panels or metallic honeycomb structures, and tools, torches and equipment, including wheel chocks.
 - b) That on the taxiways and aprons is usually associated with vehicles and smaller items associated with passenger baggage, catering and cargo handling equipment or is from adjacent Works in Progress.
- 1.4 All personnel involved in operations on the aerodrome movement area, maintenance hangars and aircraft turnrounds have equal responsibility to ensure that their particular operation does not give rise to FOD. Likewise, every member of staff should act when they detect FOD, either by removing it, should that be safe so to do, or reporting it immediately to the appropriate authority. Above all, FOD should be prevented.
- 1.5 Aerodrome and aircraft operators, maintenance and ground handling organisations should include FOD prevention in their induction, and continuation training programmes, for all airside, maintenance and hangar staff. Specific procedures for the elimination of the risk of FOD should be implemented and working practices that pose a high risk of providing FOD should be reviewed.
- 1.6 Closer co-operation between Aerodrome Licensees, aircraft operators and their service partners should be fostered. The topic of FOD should be a standing agenda item for all aerodrome users committee meetings and internal safety meetings.
- 1.7 No proprietary system has yet been proven to be fully effective in the detection and identification of FOD on runways. However, whilst future developments of such systems should not be discounted, the use of advanced technology should only supplement current methods of inspection.

- 1.8 Aerodrome Licensees should regularly review their FOD policy and assure themselves that it remains effective. They should also ensure that any third party operation on the aerodrome can demonstrate a satisfactory level of FOD awareness and that their working procedures do not increase the likelihood of FOD.

2 Pavement Surfaces

- 2.1 Particular care is needed in the maintenance of the surfaces of manoeuvring areas especially where the pavement shows any signs of deterioration or damage. All joint sealants, crack repairs, patching and maintenance works should be stable and permanent even under the influence of aircraft movements, slipstream or jet efflux.
- 2.2 Pavements should be adequately sealed and joints properly filled to permit effective sweeping without forming a trap for debris. Runway and taxiway shoulders should also be adequately sealed and care exercised to minimise the risk of ingestion into turbine engines of vegetation, grass cuttings, and debris that can result from erosion of the surface by overhanging turbine engines. It is possible for stones to be thrown onto runways and taxiways during grass cutting or other work on areas adjacent to paved surfaces, and the potential hazard to aircraft that this presents should be minimised by frequent inspections during such activities, sweeping as necessary.
- 2.3 Newly surfaced areas can also be sources of hazard from engine ingestion. These areas should not be used by aircraft until the material is no longer susceptible to being picked up by the aircraft wheels or spattered on any part of the aircraft.

3 Grit and Spoil

- 3.1 Sand used to clean fuel and oil spillage from aprons is a potential cause of turbine engine and propeller damage and should be removed immediately after use.
- 3.2 Where construction is in progress on aerodromes, authorities should if practicable prohibit use of the movement area by contractors' vehicles or at least minimise such use by restricting them to marked lanes, particularly when the vehicles are engaged in transporting the types of load from which spillage frequently occurs, e.g. building waste, gravel and fill. Earth and stones adhering to the wheels of such vehicles can also become dislodged and subsequently create a hazard to aircraft using the same areas. Where building construction is in close proximity to the movement area, it is important that some form of screening be provided to prevent sand and small stones being blown onto the movement area by high winds or jet blast. Following the completion of construction the contractor should be required to remove all debris from the surrounding areas and not leave piles of dirt, or rubble, on the aerodrome surface.

4 Packages and Wrappings

- 4.1 The widespread use of polythene bags and sheets on aprons is another potential source of damage to engines through ingestion. Suitably covered receptacles for such litter should be provided in sufficient numbers by aerodrome authorities. Similar receptacles should also be provided on all vehicles which use the movement areas on a routine basis.
- 4.2 Cargo areas are particularly liable to contamination from loose strappings, nails, wire, paper and wood etc from crates, or containers discarded in the course of handling in addition to the polythene sheets mentioned above.

5 Inspection and Standards of Cleanliness

- 5.1 For details of inspection procedures see Appendix 3F.
- 5.2 Aerodrome authorities should impress the need for apron cleanliness upon those in control of such staff as airline ground handlers, aircraft caterers, fuel suppliers, cleaners and freight agents who have access to the movement area in the course of their duties.
- 5.3 Analysis of any debris on the movement area should be undertaken to determine its origin, and the frequency of cleaning operations increased in those areas where contamination is highest. Remedial measures should be taken with those responsible.

6 Aircraft Debris

- 6.1 Flight crews are expected to report at once to ATS any incident during take-off or landing which might result in a part of the aircraft's structure becoming detached and left behind on runways or taxiways. Ground engineering staff should also be asked to collaborate by reporting to ATS minor damage to aircraft which may have left debris on runways. Failure to make these reports to ATS could mean that debris remains on the runway for longer than would otherwise be the case, and thus, particularly at night, constitute an avoidable hazard to other aircraft taking-off and landing.
- 6.2 Whenever debris is reported on the movement area, whenever a take-off is abandoned due to engine, tyre or wheel failure, or whenever an incident occurs that is likely to result in debris being left in a hazardous position, the runway, taxiway or apron as appropriate should be inspected and any debris removed before any other aircraft is allowed to use it.

7 Equipment for the Removal of Debris

- 7.1 Guidance on suitable equipment for providing clean aerodrome pavement is given in the ICAO Airport Services Manual Part 2.

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Appendix 3F Aerodrome Pavement Maintenance and Inspection Procedures

1 Introduction

- 1.1 Aerodrome pavements to runways, taxiways and aprons are critical to the safe, efficient and economic operation of an aerodrome. As such they represent a significant capital investment that must be preserved in a suitable condition for the particular demands of aircraft operations.
- 1.2 Aerodrome pavements are complex structural systems and their performance depends on a large number of variables relating to the unique mix of aircraft operations, pavement materials and environmental conditions at each aerodrome. As with all aerodrome assets the most effective means of preserving these pavements in a suitable condition is to implement appropriate inspection and maintenance procedures.
- 1.3 Aerodrome licensees should be aware of the importance of timely and disciplined core runway inspections and have suitable procedures to ensure that such inspections are undertaken effectively. Regular inspections should be planned so as to ensure that an appropriate level of vigilance is maintained at all times. These will also improve the level of understanding of the changes under local conditions and allow for maintenance activities to be proactive. The inspections should address the following related items:
 - a) Inspection of the runway surface condition, including water drainage characteristics;
 - b) FOD detection and removal;
 - c) Aeronautical ground lighting fittings within the pavement including the structural integrity of the fittings;
 - d) Signage, markings and other visual aids;
 - e) Cleared and graded areas;
 - f) Wildlife control and the removal of remains.
- 1.4 A runway inspection involves the deliberate entry of an active runway. It is therefore essential that any hazards associated with this activity are identified and addressed so that each agency with an inspection duty has a clear understanding of what is involved and how the task is carried out safely.
- 1.5 All personnel with a task that involves entering a runway should clearly understand their responsibilities and the identified hazards. This training should be recorded and a system of review should be established so that new hazards can be identified and new training needs satisfied.
- 1.6 The aerodrome licensee should ensure that the development and use of runway inspection procedures are addressed in the safety management system employed at the aerodrome.

2 Documentation

- 2.1 All aerodrome inspections, maintenance activities and matters arising from such should be formally documented by the aerodrome licensee and records maintained for future reference.
- 2.2 Each inspection should include a reporting mechanism to ensure that appropriate action is taken. Reports should include details of the task(s); any remedial action(s) necessary or taken; should identify the person/agency responsible for undertaking the task and/or further action; and should identify the timescale by which it should be completed.

3 Daily Inspections

- 3.1 All aerodrome pavements within the movement area should be inspected by aerodrome operations staff at least twice a day, although this may be increased dependent upon the movement rate and duration of operations, but they should be spread over the main times of operational activity.
- 3.2 Inspections planned to take place during the hours of darkness may need to be done in a different manner from those undertaken during the daytime, with consideration being given to the presence of vehicles, people, lighting etc. The inspection should check the current suitability for aerodrome operations and the presence of FOD. Inspections may be undertaken from a vehicle travelling at a speed suitable to the task.

4 Weekly Inspections

- 4.1 All aerodrome pavements within the movement area should be inspected in more detail at least once a week.
- 4.2 The inspection should check the integrity of the aerodrome pavements and should give particular attention to those areas subject to high loads such as departure taxiways, thresholds and high speed operations. High levels of jet blast are known to be a cause for concern. Inspections should be undertaken preferably on foot but may be made from a slow moving vehicle.

5 Annual Inspections

- 5.1 All pavements within the movement area should be subject to inspection by a professional qualified engineer at least once a year. Inspections should be undertaken on foot and should cover the whole of the movement area or a statistically significant sample.

6 Optional Inspections

- 6.1 Specific additional on-runway inspections, for example: bird hazard control or FOD detection, might be undertaken by a single vehicle and should be carried out at an appropriate speed for effective monitoring.
- 6.2 Off-runway observations may be taken from various vantage points, such as the edge of the clear and graded area, holding points, taxiways or tracks. Observations should be carried out from a stationary vehicle, with binoculars. These types of inspections may only be possible during daylight hours and, if utilised, should be integrated with the core 'on-runway' inspections.

- 6.3 Daily runway lighting checks are normally undertaken in order to identify unserviceable lamps and possible failures of light fittings. It might be possible to incorporate inspections of particular areas of the runway at the same time. These inspections will need to integrate with the other on-runway inspections and be flexible in timing to cater for the variability of the onset of night.
- 6.4 Runway walking inspections can provide a more thorough examination of the runway. The number of full walking inspections planned for each year will depend upon the age and use of the runway surface, and the level of operations undertaken at each aerodrome. Suitable opportunities for this type of inspection may include during and after periods of maintenance, when engineering staff are working on the runway.
- 6.5 A runway inspection should be conducted in the vicinity of the working area after completion of the works to ensure that tools, machinery and other forms of FOD are not present. This is particularly important after works at night where there is a greater risk of the misplacement of work items.

7 Detailed Pavement Inspection and Evaluation

- 7.1 The inspection procedures described in paragraphs 3-6 above address the functional condition of the surface of the aerodrome pavement but do not consider the structural condition of the pavement construction as a whole. In order to monitor the change in the condition of aerodrome pavements over time it is recommended that aerodrome authorities establish a formal index to define pavement condition.
- 7.2 The pavement structure has a limited operational life that will be related in part to the declared Pavement Classification Number (PCN). The ACN/PCN method is described in Section 12, Chapter 3. The aerodrome should review declared PCN values in the light of the functional condition.
- 7.3 A detailed pavement inspection of functional condition should normally be undertaken every 2-4 years and a detailed pavement structural evaluation every 5-10 years. However, the frequency will depend on the age, condition and usage of each area.

The regular inspection and evaluation of aerodrome pavements can be the first step in establishing a formal management system that will provide significant advantages to aerodromes by improving the ability to predict, plan and budget for future maintenance work. A number of computerised systems are available.

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Appendix 3G Care of Pavements during Winter Conditions – Improving Surface Friction by Removal of Contaminants

(See also ICAO Airport Services Manual Part 2 'Pavement Surface Conditions')

1 Chemical Methods

- 1.1 Many chemicals that might be used to improve the friction coefficient of a movement area contaminated with ice, snow, slush or associated water are corrosive and harmful to aircraft components. It is, therefore, essential to confirm before using any chemical for this purpose that it has been tested and found harmless to aircraft, components and light fittings and that it is acceptable ecologically.
- 1.2 Chemicals are best used as anti-icers. They may be in pellet or liquid form but neither is universally satisfactory. Liquids used on a bare pavement can cause a loss of traction; and the pellet form is unsuitable for use on a porous friction course as it results in an uneven spread of anti-icing liquid and pockets of water in the surface layer.
- 1.3 When chemicals are used as de-icers the result can be an icy surface covered by melt water, one of the most slippery of surfaces. This can be avoided by using pellet chemicals on a dry icy surface to loosen the ice which should then be removed mechanically.
- 1.4 Following the severe winter of 1978–79 considerable frost and ice damage was experienced, mainly to concrete pavements which had hitherto been satisfactory for a number of years. Investigations revealed a link between the use of liquid chemicals for pavement de-icing and the damage reported. Concrete when hardened contains a series of pores or voids which, depending upon the local weather conditions, may be partially or completely filled with water. This water, if it freezes, expands by approximately 9% but is usually safely accommodated by adjacent voids or by relief to the surface. The slower the rate of refrigeration the more safely this process can evolve. If the refrigeration rate is fast, or the surface is already frozen there is a risk of damage to the pavement.
- 1.5 If ice forms on the concrete before a de-icing chemical is applied, it is quite probable that there will be water-filled voids below the surface. The de-icer is subjected to very rapid cooling and the latent heat required to melt the ice is quickly drawn from the nearest available source, which in this case is the pavement. The more concentrated the chemical the more rapid is the refrigeration of the concrete, and the water in the voids may be turned to ice. If the resultant expansion cannot be relieved safely, the concrete surface will be damaged.
- 1.6 To reduce the risk of damage, the concrete used in modern pavements is air-entrained. Minute air bubbles are dispersed through the matrix and tend to act as cushions to absorb expansion. This process does not make the surface completely damage proof, so even comparatively new concrete pavements should be treated with care.
- 1.7 It is always better to apply chemicals in advance to prevent ice forming. In the event that this cannot be done the minimum amount of chemical should be used so as to reduce the risk of damage, even if it takes a little longer to remove the ice. As a guide, the maximum rate of spread for undiluted fluids should be 0.35 fluid ozs per square

yard, equivalent to 1 kilo per 75 square metres. Records should be kept to determine the actual rate of spread achieved.

- 1.8 Whilst the above recommendations are for concrete pavements, bituminous surfaces should also be treated cautiously, especially if they are old. Though surfaces which are in good condition will not be liable to disruption, with age the thermoplastic binder can become brittle and porous, making the pavement vulnerable. Often, a new bituminous surface is laid over an old surface which contained extensive reflective cracks. As time passes, these cracks tend to widen and the cracking is propagated upwards through the new surface and continued frosts aggravate the condition.

2 Mechanical Methods

- 2.1 Mechanical methods of clearance should commence as soon as the snow begins to accumulate on the surface. The machinery employed will depend upon the type of snow, whether wet or dry, and the direction and strength of the wind. Normally, runway sweepers should be used first and for as long as they remain effective. Snow ploughs and blowers should supplement the sweepers only when the sweeper cannot efficiently remove the accumulation. The use of vehicles with chains, high speed snow drags and underbody metal scrapers should be forbidden.

3 Sand/Grit

- 3.1 Engine turbines will suffer erosion damage if even the finest grain sand is ingested. For this reason, sand should only be used on runways as a last resort. However, if it is necessary to use sand or grit to increase friction on the movement area it needs to be carefully selected and the supply should be rigidly controlled to ensure that the material meets the specification at paragraph 3.3 below and is free from soluble salts. Loads containing oversized particles should be rejected, as should any flint-type material.
- 3.2 Normally runways should be swept clean of grit as soon as ice has melted but if they are gritted because of the imminent return of freezing conditions, pilots should be warned of the presence of 'dry' grit on the runway. It is particularly important to clear away any slush that is contaminated by grit. Such a combination thrown up by the wheels increases the risk of damage by ingestion.
- 3.3 Sand/grit should have an aggregate crushing value of less than 20 when tested in accordance with British Standards BS 812, 1973, Part 3 and be of the following sizes:

Metric	BS 410 Sieve	US	% By Weight Passing
3 mm	1/8 inch	No. 6	100
1 mm	No. 14	No. 16	0 – 20
0.25 mm	No. 52	No. 50	0

The use of limestone chippings is not recommended as they do not provide good runway friction qualities and are wasteful in providing a high percentage of fines.

4 Porous Friction Course

- 4.1 A porous friction course presents a specific problem because of the nature of its construction. If water should be present in the pores of the friction course when freezing takes place damage may be caused by expansion of the water within the pores or ice protrusions may form on the surface of the runway as water is forced back onto the surface. To prevent these two possibilities the principle of anti-icing should be followed using liquid chemicals to provide an even distribution of anti-icing fluid to infiltrate the whole structure.

5 Ice Detectors

- 5.1 Ice detectors can provide an accurate assessment of surface conditions and lead to the efficient and cost effective use of anti-icing or de-icing materials.

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Chapter 4 The Assessment and Treatment of Obstacles

1 Introduction

- 1.1 The effective utilisation of an aerodrome may be considerably influenced by natural features and man-made constructions inside and outside its boundary. These may result in limitations on the distance available for take-off and landing and on the range of meteorological conditions in which take-off and landing can be undertaken. For these reasons certain areas of the local airspace must be regarded as integral parts of the aerodrome environment. The degree of freedom from obstacles in these areas is as important in the granting and retention of an aerodrome licence as the more obvious physical requirements of the runways and their associated runway strips, and is determined by survey in accordance with CAP 232 – Aerodrome Survey Requirements.
- 1.2 The method of assessing the significance of any existing or proposed object within the aerodrome boundary or in the vicinity of the aerodrome is to establish defined obstacle limitation surfaces particular to a runway and its intended use. The purpose of this chapter is to define these obstacle limitation surfaces and their characteristics and describe the action to be taken in respect of objects which infringe them. These surfaces are illustrated at Figure 4.11. In ideal circumstances all the surfaces will be free from obstacles but when a surface is infringed, any safety measures required by the CAA will have regard to:
- a) the nature of the obstacle and its location relative to the surface origin, to the extended centreline of the runway or normal approach and departure paths and to existing obstructions;
 - b) the amount by which the surface is infringed;
 - c) the gradient presented by the obstacle to the surface origin;
 - d) the type of air traffic at the aerodrome; and
 - e) the instrument approach procedures published for the aerodrome.
- 1.3 Safety measures could be as follows:
- a) promulgation in the UK AIP of appropriate information;
 - b) marking and/or lighting of the obstacle;
 - c) variation of the runway distances declared as available;
 - d) limitation of the use of the runway to visual approaches only;
 - e) restrictions on the type of traffic.
- 1.4 In addition to the requirements described in this chapter it may be necessary to call for other restrictions to development on and in the vicinity of the aerodrome in order to protect the performance of visual and electronic aids to navigation and to ensure that such development does not adversely affect instrument approach procedures and the associated obstacle clearance limits. Details of these restrictions, which are distinct from aerodrome licensing requirements, may be obtained from Aerodrome Standards Department or Air Traffic Standards Department.
- 1.5 Particular attention should also be given to the security of the movement area and access denied to unauthorised persons and/or vehicles.
- 1.6 Paragraphs 2 to 8 illustrate how to determine what constitutes an obstacle. Paragraphs 9 onwards relate to the treatment of obstacles.

OBSTACLE LIMITATION SURFACES

2 The Take-off Climb Surface

- 2.1 A take-off climb surface is an inclined plane located beyond the end of the take-off run available or the end of the clearway where one is provided.
- 2.2 A take-off climb surface is established for each runway direction intended to be used for take-off.
- 2.3 The limits of a take-off climb surface comprise:
- a) an inner edge of specified length, perpendicular to the extended centreline of the runway, at the end of the clearway, when such is provided, but in no case less than:
 - i) a distance of 60 m measured horizontally in the direction of take-off beyond the end of the declared take-off run available, where the code number is 2, 3 or 4; or
 - ii) a distance of 30 m measured horizontally in the direction of take-off beyond the end of the declared take-off run available where the code number is 1.
 - b) two sides originating at the ends of the inner edge, diverging uniformly at a specified rate from the vertical projection of the take-off flight path to a specified final width and continuing thereafter at that width for the remainder (if any) of the length of the take-off climb area;
 - c) an outer edge parallel to the inner edge.
- 2.4 The dimensions of the take-off climb surface are specified in Table 4.1 and illustrated in Figures 4.1 to 4.4. A reduced length may be adopted where this length would be consistent with procedures for the control of departing aeroplanes.
- 2.5 The elevation of the inner edge is equal to that of the end of the clearway, or clearway plane, on the extended centreline of the runway. Where a clearway is not provided, the elevation is that of the point of intersection of the centreline of the runway and the inner edge.
- 2.6 In the case of a straight take-off flight path the slope of the take-off climb surface is measured in the vertical plane containing the extended centreline of the runway. The slope should not be steeper than is specified in Table 4.1. Where no object reaches the 2% (1:50) surface slope specified for runways where the code number is 3 or 4 the slope should be reduced until it touches the first immovable object or reaches 1.6% (1:62.5), whichever is the steeper. If the slope is reduced, the length of the surface should be increased to afford protection on the climb to a height of 1000 ft.
- 2.7 In the case of a take-off flight path involving a turn, the take-off climb surface is a complex surface such that the normal at any point on the flight path centreline is a horizontal line at the same height above surface origin as would have resulted from the application of a straight flight path. The edge of a TOCS may be slewed in the direction of a turn away from the extended runway centreline up to a maximum of 15° splay. The portion of TOCS encompassing the new departure track should be the same shape and dimensions as the original TOCS measured relative to the new departure track. The opposite edge of the TOCS should remain unchanged unless there is another turning departure towards that side also, in which case, the edge may be slewed in that direction too.
- 2.8 Where a runway is 10% or more than the minimum width, the length of the inner edge of the take-off climb surface is extended so that it is not less than the

appropriate strip width. The initial part of the surface is formed by sides drawn from the strip edges parallel to the extended centreline until they intersect the diverging sides of the normal take-off climb surface (see Figure 4.4).

Table 4.1 Dimensions and slopes of take-off climb surfaces

Code number	3 or 4	2	1
Length of inner edge	180 m	¹ 80 m	² 60 m
Distance of inner edge from end of take-off run ³	60 m	60 m	30 m
Divergence (each side)	12.5%	10%	10%
Final width	1200 m ⁴ 1800 m	580 m	380 m
Length	15000 m	2500 m	1600 m
Slope	2% (1:50)	4% (1:25)	5% (1:20)

1. Where clearway is provided the length of the inner edge should be 150 m.
2. Where clearway is provided the length of the inner edge should be 150 m.
3. Where clearway is provided the inner edge is at the end of the clearway.
4. When the intended track includes changes of heading greater than 15°, the final width of the take-off climb surface for runways where the code number is 3 or 4 is increased to 1800 m.

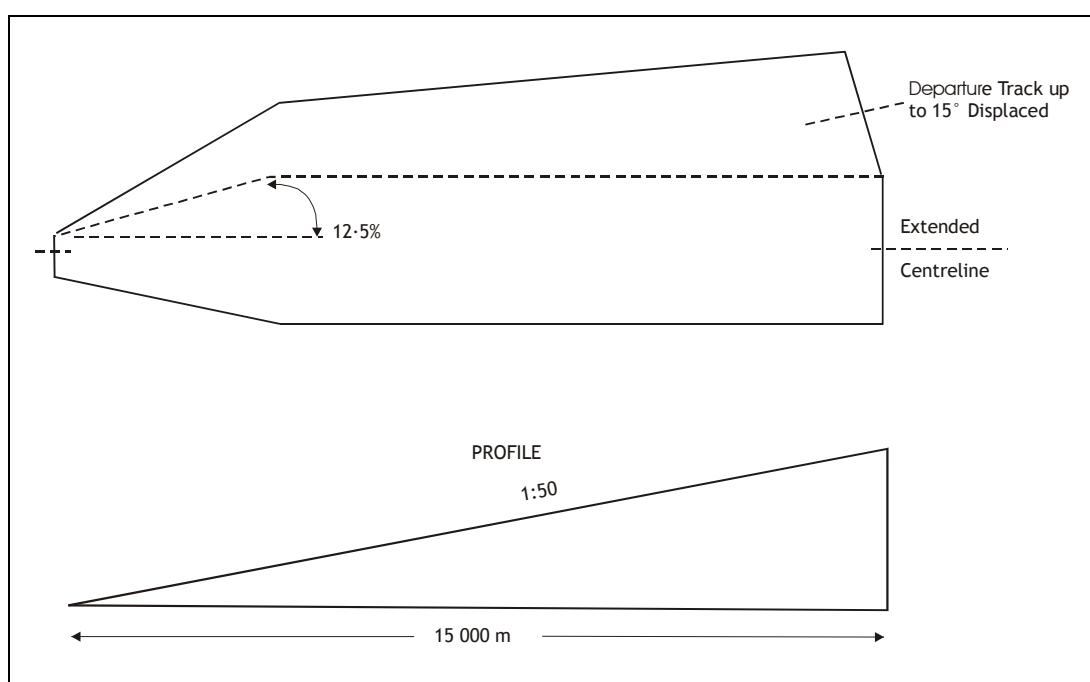


Figure 4.1 Take-off climb surface associated with a runway where the code number is 3 or 4, also showing slewed TOCS

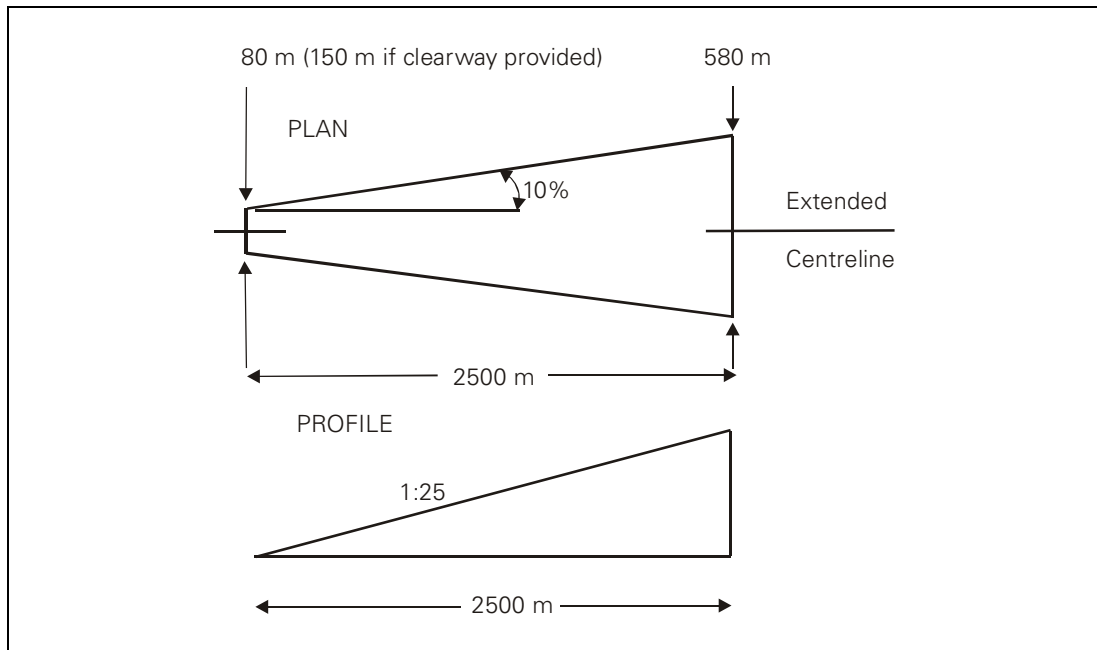


Figure 4.2 Take-off climb surface associated with a runway where the code number is 2

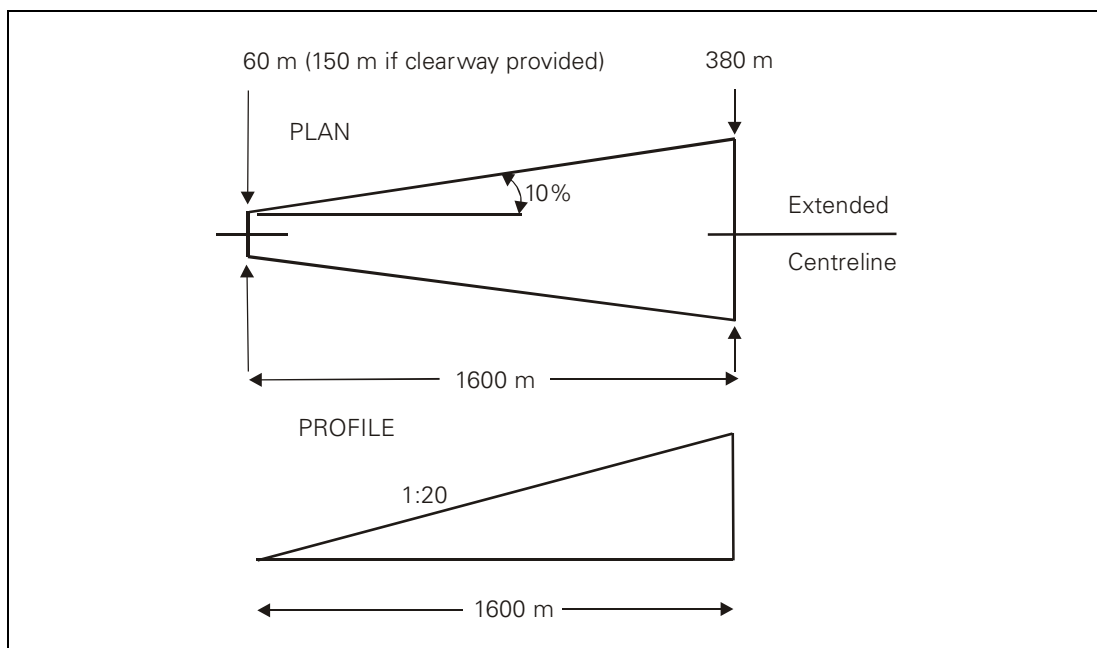


Figure 4.3 Take-off climb surface associated with a runway where the code number is 1

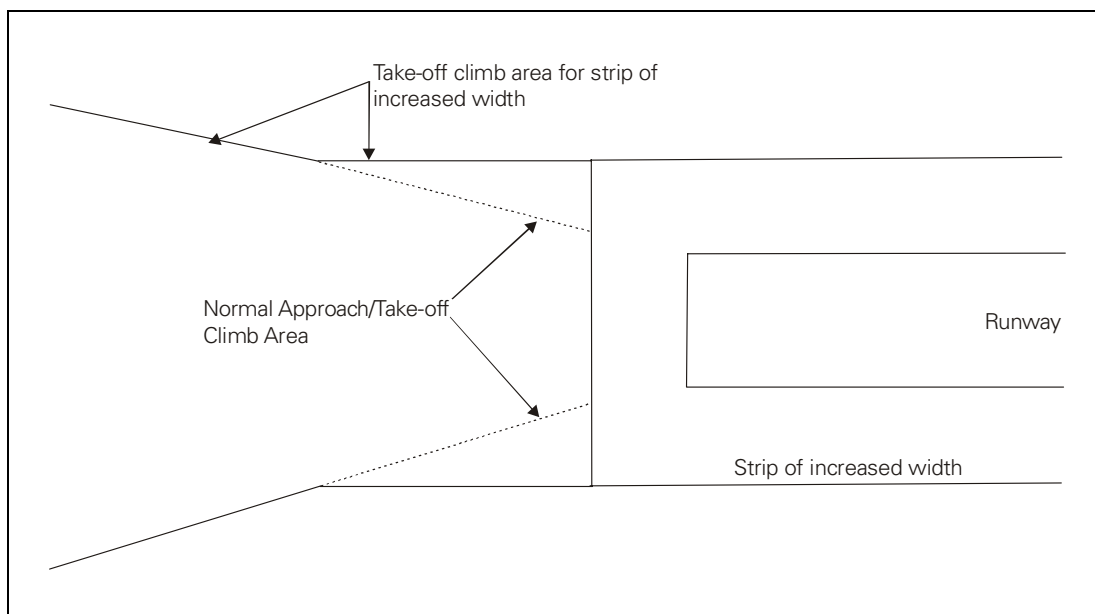


Figure 4.4 Approach/take-off climb surface associated with a runway of substantially more than minimum width

3 The Approach Surface

- 3.1 An approach surface is an inclined plane or combination of planes preceding the threshold.
- 3.2 An approach surface is established for each runway direction intended to be used for the landing of aircraft.
- 3.3 The limits of the approach surface comprise:
 - a) a horizontal inner edge of specified length perpendicular to the centreline of the runway located at a distance of 60 m before the landing threshold, except in the case of visual runways where the code number is 1 where the distance is 30 m;
 - b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from a line drawn parallel to the extended centreline of the runway;
 - c) an outer edge parallel to the inner edge.
- 3.4 The dimensions and slope of the approach surface are specified in Table 4.2 and illustrated in Figures 4.5 to 4.10.
- 3.5 The elevation of the inner edge is equal to the elevation of the mid-point of the landing threshold.
- 3.6 The slope of the approach surface is measured in the vertical plane containing the centreline of the runway. An approach surface for an instrument runway is horizontal beyond the point at which it intersects a horizontal plane 150 m above the threshold elevation.
- 3.7 Where there is a runway of 10% or more than the minimum width, the length of the inner edge of the approach surface is extended so that it is not less than the appropriate strip width. The initial part of the surface is formed by sides drawn from the strip edges parallel to the extended centreline until they intersect the diverging sides of the normal approach surface. This principle is illustrated at Figure 4.4.

Table 4.2 Approach surface slopes and dimensions

	Precision Instrument Approach Runways		Non-Precision Instrument Approach Runways		Visual Runways			
	Code Number		Code Number		Code Number			
	3 or 4	1 or 2	3 or 4	1 or 2	4	3	2	1
Length of inner edge ¹	300 m	150 m	300 m	150 m	150 m	150 m	80 m	60 m
Distance before threshold	60 m	60 m	60 m	60 m	60 m	60 m	60 m	30 m
Divergence each side	15%	15%	15%	15%	10%	10%	10%	10%
Length of first section	3000 m	3000 m	3000 m	4500 m	3000 m	3000 m	2500 m	1600 m
Slope of first section ²	2% (1:50)	2.5% (1:40)	2% (1:50)	3.33% (1:30)	2.5% (1:40)	3.33% (1:30)	4% (1:25)	5% (1:20)
Length of second section	3600 m	2500 m	3600 m					
Slope of second section	2.5% (1:40)	3% (1:33.3)	2.5% (1:40)					
Length of horizontal section	8400 m	9500 m	8400 m					

1. The length of the inner edge may be reduced to 210 m for a runway where the Aeroplane Reference Field Length of the critical aeroplane falls into the lower third of code number 3, and where, in the opinion of the CAA, such a reduction is compatible with the use made of the runway.
2. The slopes of an approach surface may be increased, at the discretion of the CAA, when glidepaths of steeper than 3° are used.

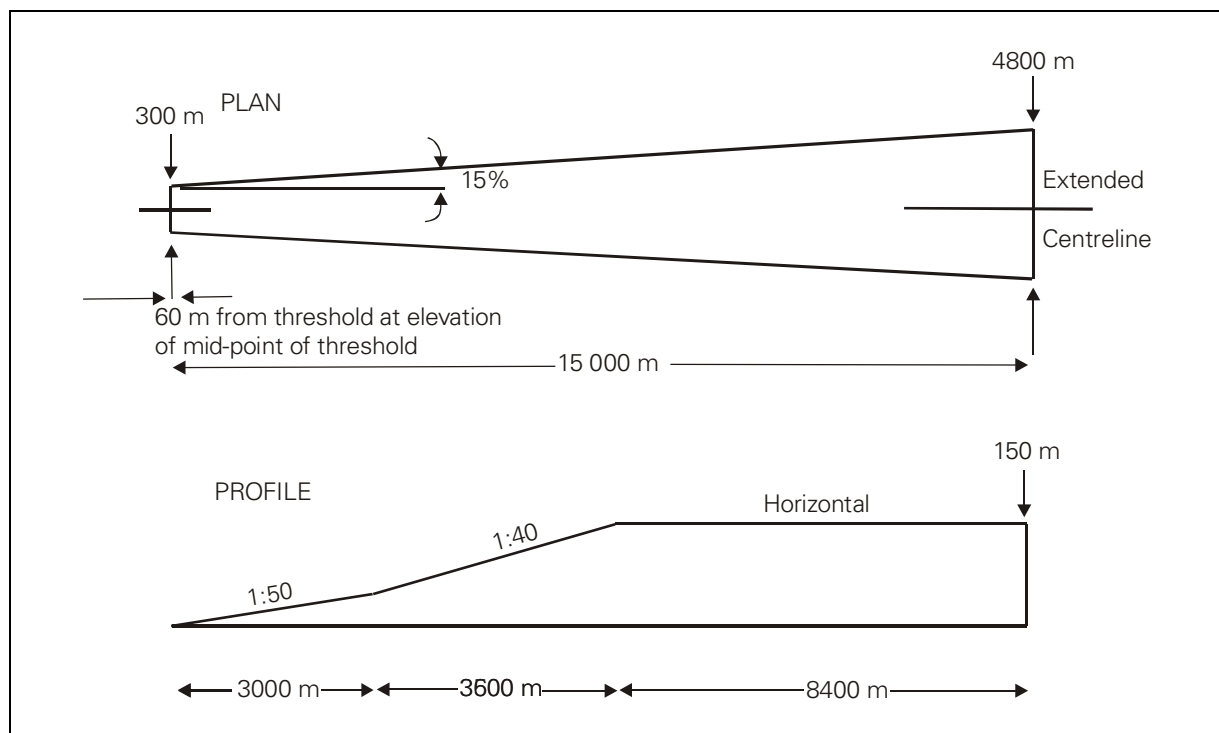


Figure 4.5 Approach surface associated with an instrument runway where the code number is 3 or 4

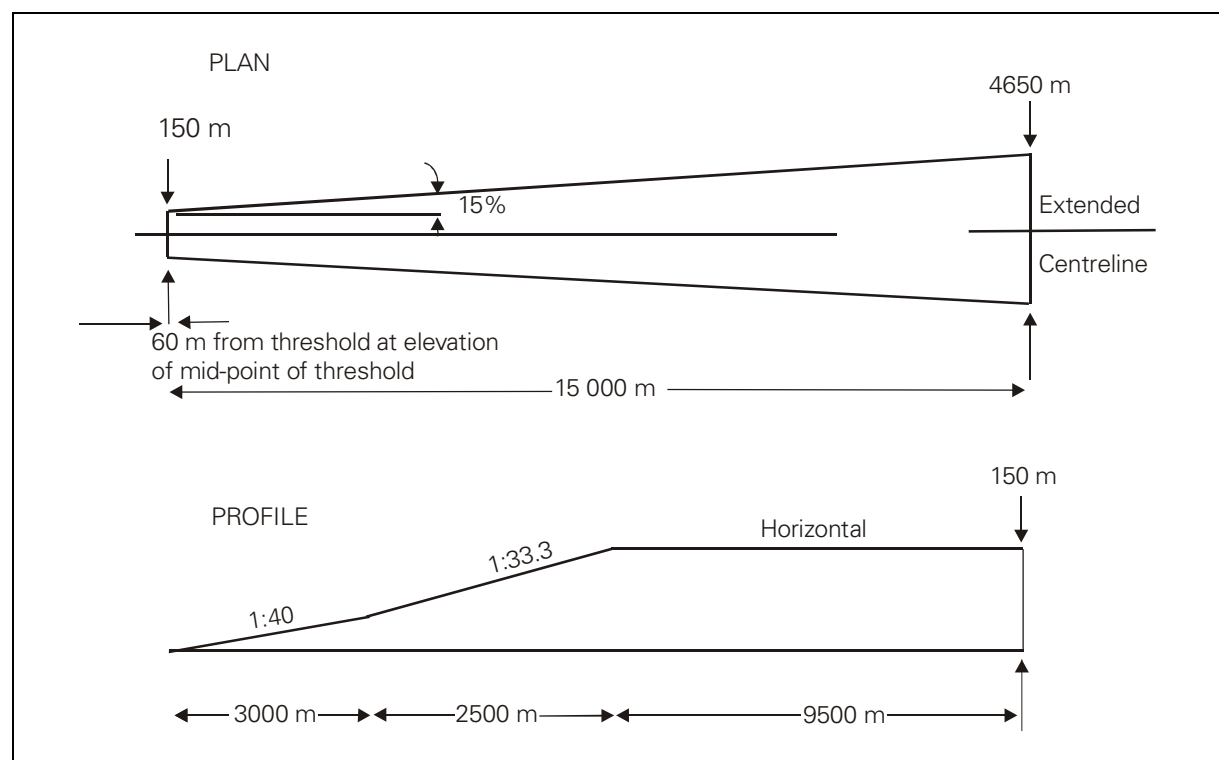


Figure 4.6 Precision approach where the code number is 1 or 2

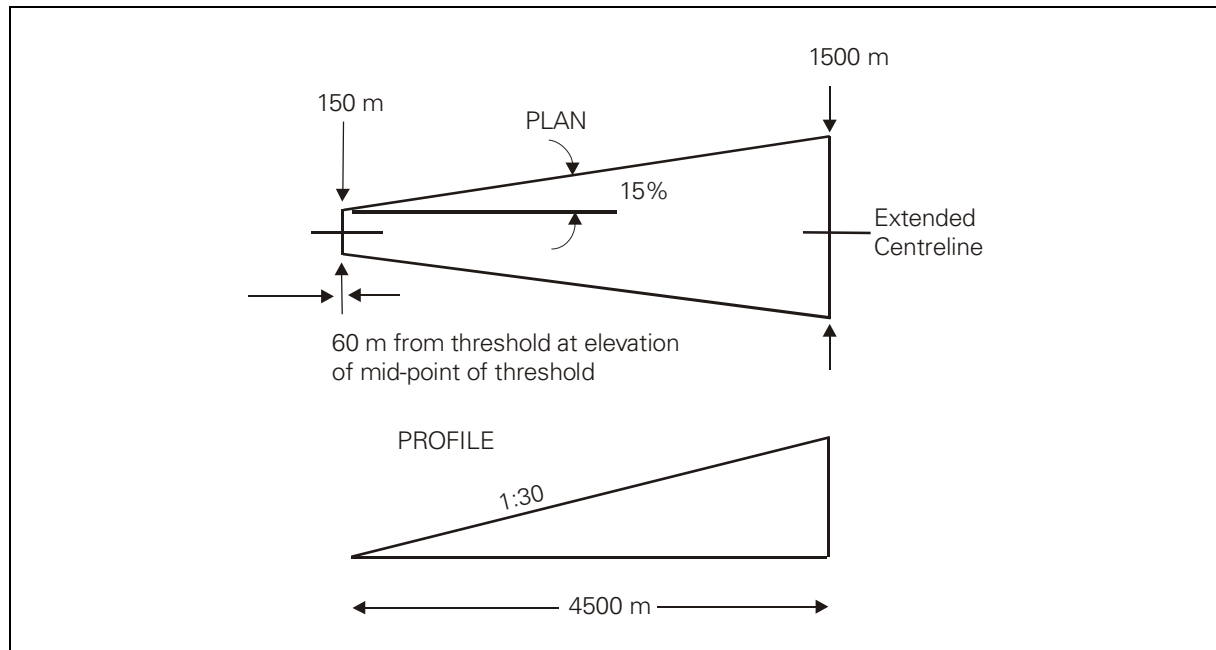


Figure 4.7 Non-precision approach where the code number is 1 or 2

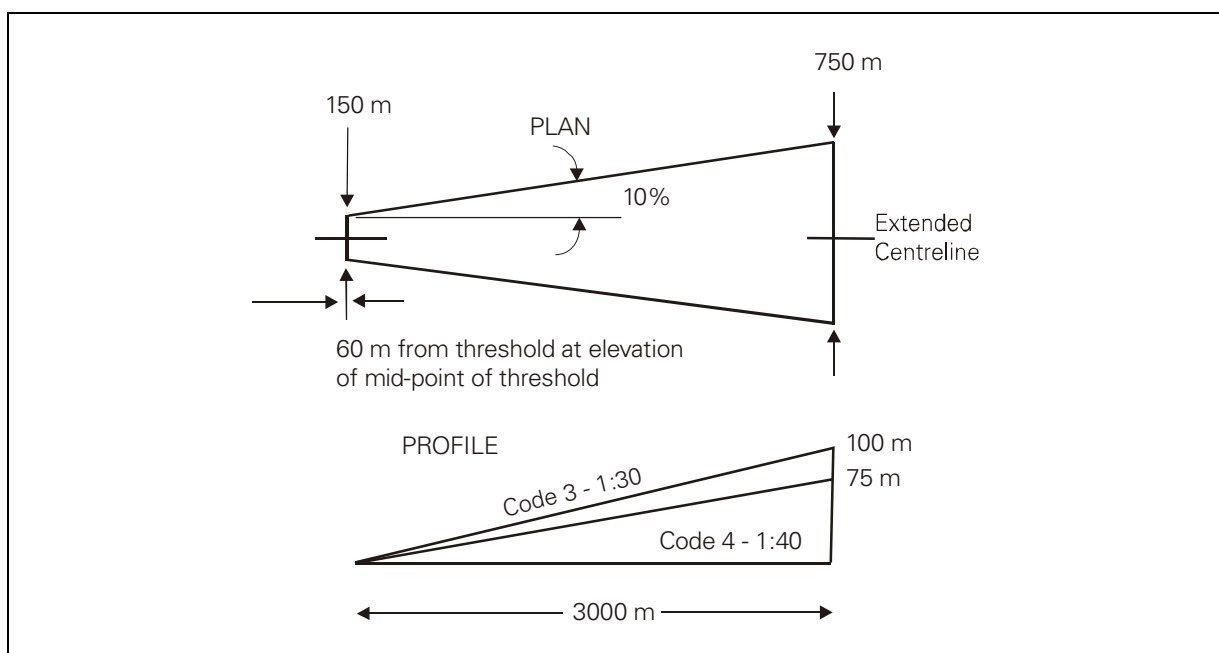


Figure 4.8 Approach surface associated with a visual runway where the code number is 3 or 4

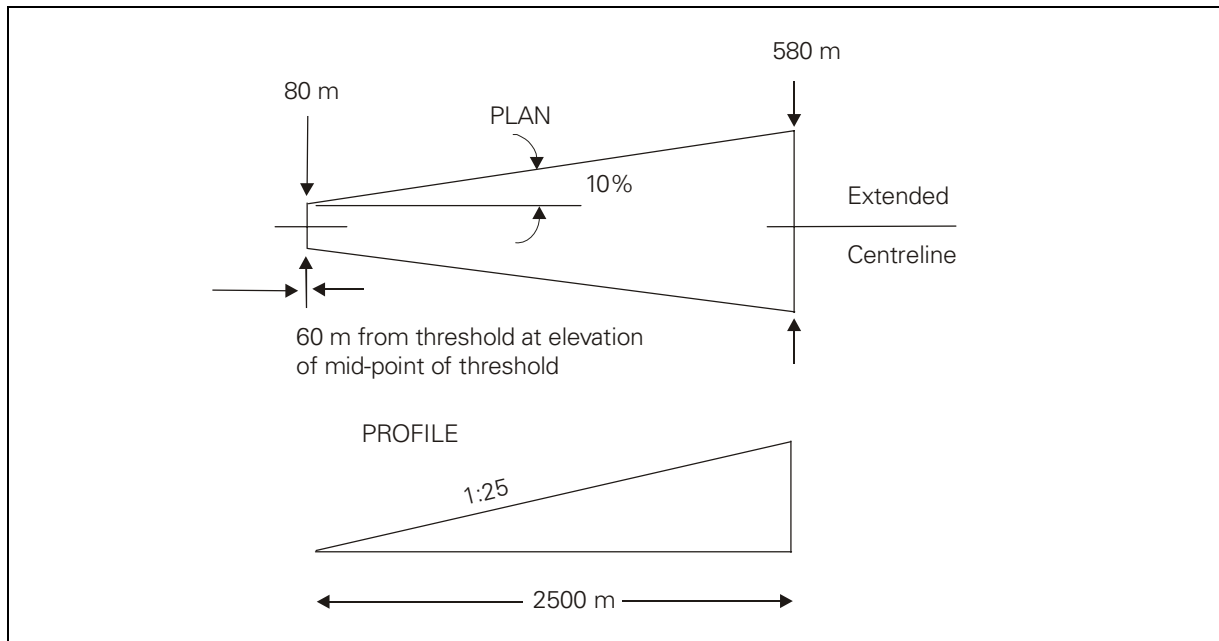


Figure 4.9 Approach surface associated with a visual runway where the code number is 2

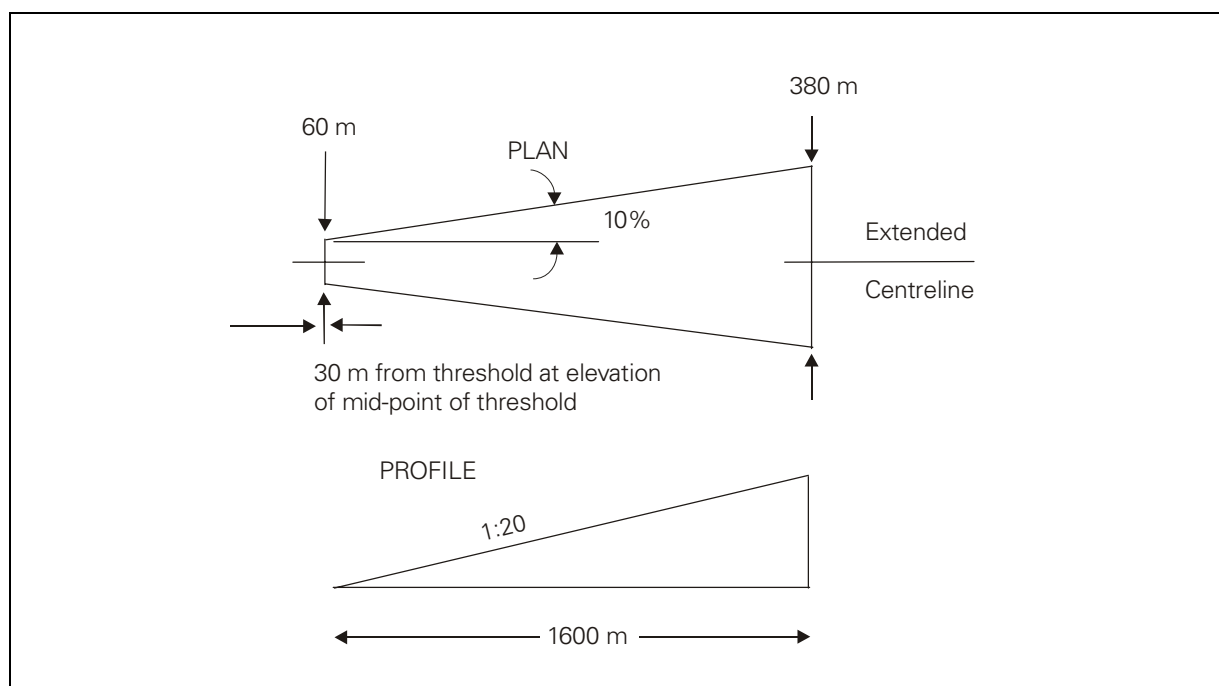


Figure 4.10 Approach surface associated with a visual runway where the code number is 1

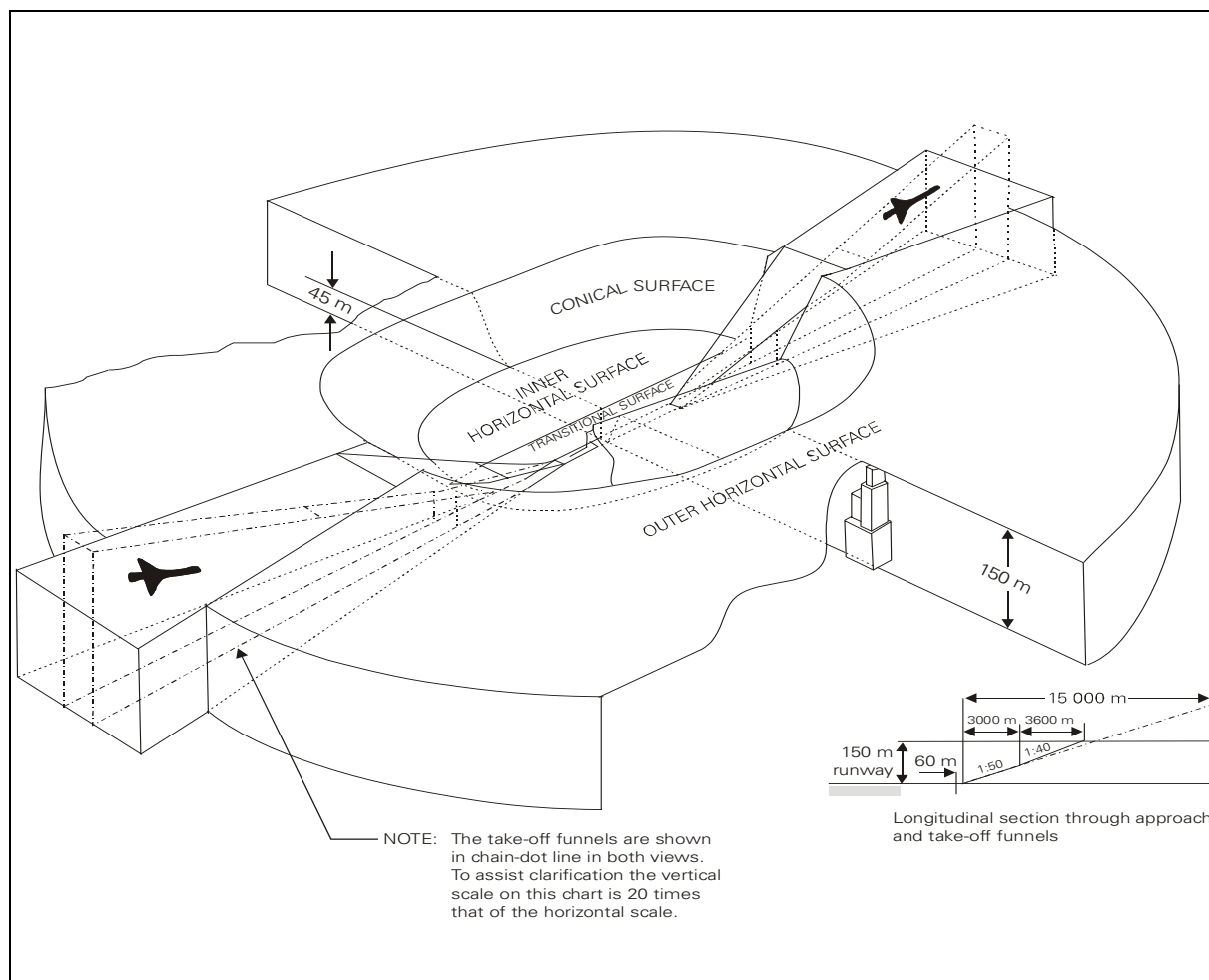


Figure 4.11 Obstacle limitation surfaces for an instrument runway where the main runway is 1800 m or more in length

4 The Transitional Surface

- 4.1 A transitional surface is a complex surface sloping up to the inner horizontal surface from the side of the runway strip and from part of the side of the approach surface.
- 4.2 Transitional surfaces are established for every runway intended to be used for landing.
- 4.3 The slope of the transitional surface is measured in the vertical plane above the horizontal, and normal to, the centreline of each runway. Where the runway code is 1 or 2 and has a visual or non-precision instrument approach, the slope is 20% (1:5). For all other runways the slope is 14.3% (1:7).
- 4.4 The elevation of any point on the lower edge of the surface is:
 - a) along the side of the approach surface, equal to the elevation of the approach surface at that point;
 - b) along the strip, equal to the elevation of the centreline of the runway opposite that point.
- 4.5 The outer limit of a transitional surface is determined by its intersection with the plane of the inner horizontal surface.

- 4.6 An obstacle may be sited in a position that would cause it to infringe the transitional surface only if:
- a) it is an aid to navigation,
 - b) the entire structure complies with the frangibility requirements of obstacles sited within runway strips (Chapter 3 paragraph 6.1 refers), and
 - c) it does not penetrate a surface sloping upward and outward from the centreline of the runway at a slope of 1:10. The elevation of the lower edge of this 1:10 slope is that of the runway centreline at a point where a line drawn to the obstacle is normal to the centreline. The elevation of the upper edge is where the 1:10 surface:
 - i) meets the transitional surface, or where no such intersection occurs,
 - ii) is equal to the elevation of the inner horizontal surface, and continues at this height until it meets the point where the transitional surface intercepts the inner horizontal surface.

5 The Inner Horizontal Surface

- 5.1 An inner horizontal surface is a horizontal plane located above an aerodrome and its vicinity. It represents the level above which consideration needs to be given to the control of new obstacles and the removal or marking of existing obstacles to ensure safe visual manoeuvring of aeroplanes in the vicinity of the aerodrome.
- 5.2 An inner horizontal surface is established for every aerodrome.
- 5.3 The inner horizontal surface is contained in a horizontal plane located 45 m above the elevation of the lowest runway threshold existing or proposed for the aerodrome.
- 5.4 The limits of the inner horizontal surface are established as follows:
- 5.4.1 Where the main runway is 1800 m or more in length circles of radius 4000 m are described centred on the strip ends of the runway. These circles are joined by common tangents parallel to the runway centreline to form a racetrack pattern. The boundary of this pattern is the boundary of the inner horizontal surface.
 - 5.4.2 Where a main runway is less than 1800 m in length the inner horizontal surface is circular and is centred on the mid-point of the runway. The radius is 4000 m except in the case of visual runways where the code number is 1 or 2. For these runways the radii are 2000 m and 2500 m respectively.
 - 5.4.3 Where an end of a subsidiary runway more than 1800 m long is less than 3000 m from any point on the periphery of the surface constructed in accordance with paragraph 5.4.1 or 5.4.2 the dimensions of the surface are modified. A circle of radius 3000 m is described centred on the strip end of the subsidiary runway and this is joined by common tangents to the pattern already established.
- 5.5 Where the inner horizontal surface is at any point lower than an approach surface or take-off climb surface the inner horizontal surface is the obstacle limitation surface at that point.

6 The Conical Surface

- 6.1 A conical surface is a surface sloping upwards and outwards from the periphery of the inner horizontal surface. It represents the level above which consideration needs to be given to the control of new obstructions and the removal or marking of existing obstructions so as to ensure safe visual manoeuvring in the vicinity of an aerodrome.

- 6.2 A conical surface is established for every aerodrome.
- 6.3 The slope of the conical surface measured in the vertical plane above the horizontal is 5% (1:20).
- 6.4 The outer limits of the conical surface are contained in a horizontal plane located 105 m above the inner horizontal surface except where the code number of a visual runway is 2 or 1. In these cases the plane is located 55 m above the inner horizontal surface where the code number is 2 and 35 m above the inner horizontal surface where the code number is 1.

7 The Outer Horizontal Surface

- 7.1 An outer horizontal surface is a specified portion of a horizontal plane around an aerodrome beyond the limits of the conical surface. It represents the level above which consideration needs to be given to the control of new obstacles in order to facilitate practicable and efficient instrument approach procedures, and together with the conical and inner horizontal surfaces to ensure safe visual manoeuvring in the vicinity of an aerodrome.
- 7.2 An outer horizontal surface is established for every aerodrome where the main runway is 1100 m or more in length.
- 7.3 The outer horizontal surface extends from the periphery of the conical surface to a minimum radius of 15 000 m from the aerodrome reference point when the main runway is 1860 m or more in length and to a minimum radius of 10 000 m where the main runway is 1100 m or more but less than 1860 m in length.

8 The Obstacle Free Zone (OFZ)

- 8.1 An OFZ is intended to protect aeroplanes from fixed and mobile obstacles during Category I, II or III operations when approaches are continued below decision height and during any subsequent missed approach or baulked landing with all engines operating normally. It is not intended to supplant the requirement of other surfaces or areas where these are more demanding.
- 8.2 The limits of the OFZ where the code number is 3 or 4 are described below and illustrated at Figure 4.12. It is designed to protect an aeroplane with a wingspan of up to 60 m which has descended below a height of 100 ft, and has been correctly aligned with the runway at that height by visual reference to the runway or approach lighting. The length of runway enclosed is based on an assumption that a go-around is initiated not later than the end of the touchdown zone and that a further 900 m distance is sufficient for the pilot to make any necessary changes of the aircraft configuration and to achieve a positive rate of climb of at least 3.33% with a deviation from track contained within a 10% splay either side of centreline. When an aeroplane's wingspan is greater than 60 m or its performance is worse than the basis used in defining the surfaces, the OFZ will need to be redesigned or operations for the particular aeroplane restricted. Conversely a narrower OFZ may be acceptable if the wingspan of the aeroplanes at a particular aerodrome are limited to less than 60 m.
- 8.3 The limits of the OFZ where the code number is 1 or 2 are described in paragraph 8.6 below, and illustrated in Figure 4.13. The rationale is similar to that detailed in paragraph 8.2 above except that the maximum wingspan is reduced to 30 m, the rate of climb on missed approach increased to 4%, and the origin of the baulked landing surface is at the upwind end of the runway strip.

- 8.4 An OFZ is established for each precision approach Category II or III runway and shall be maintained during operations conforming to those categories. An OFZ should be established for precision approach Category I runways, and should be maintained during operations conforming to this category.
- 8.5 The limits of the OFZ where the code number is 3 or 4 comprise:
- a) A portion of the instrument approach surface commencing at its inner edge at a width of 60 m on each side of the extended centreline of the runway and extending at this width for a distance of 1500 m away from the direction of landing, and with an outer edge parallel to the inner edge. This distance shall increase to 77.5 m for code F runways.
 - b) A portion of the runway strip extending to 60 m on each side of the runway centreline from a distance of 60 m before threshold to a distance of 1800 m beyond threshold. This distance shall increase to 77.5 m for code F runways.
 - c) A baulked landing surface with:
 - i) an inner edge coincident with the upwind edge of the area described at b) above, with an elevation of the centreline of the runway at that point;
 - ii) two sides originating at the outer extremities of the inner edge and diverging uniformly at 10% each side from the extended centreline of the runway;
 - iii) an outer edge parallel to the inner edge and located in the plane of the Inner Horizontal Surface;
 - iv) a slope of 3.33% (1:30) measured in the vertical plane containing the centreline of the runway.
 - d) Side surfaces which slope upwards at 33.3% (1:3) measured in a vertical plane normal to the centreline of the runway:
 - i) from the sides of that portion of the approach surface described at paragraph 8.5 a) to a height equal to the plane of Inner Horizontal Surface, with the elevation of any point on the lower edge equal to the elevation of the approach surface at that point;
 - ii) from the sides of the area described at paragraph 8.5 b) to a height equal to the plane of Inner Horizontal Surface, with the elevation of any point along the lower edge equal to the elevation of the centreline of the runway opposite that point;
 - iii) from the sides of the baulked landing surface described at paragraph 8.5 c) to a height equal to the plane of Inner Horizontal surface with the elevation of any point on the lower edge equal to the elevation of the baulked landing surface at that point.
- 8.6 The limits of the OFZ where the code number is 1 or 2 comprise:
- a) A portion of the instrument approach surface commencing at its inner edge at width of 45 m on each side of the runway centreline and extending at this width for a distance of 1500 m away from the direction of landing, and with an outer edge parallel to the inner edge.
 - b) A portion of the runway strip extending to 45 m on each side of the runway centreline from a distance of 60 m before threshold to a distance of 60 m beyond the end of the landing distance available.
 - c) A baulked landing surface with:

- i) an inner edge coincident with the upwind edge of the area described at paragraph 8.6 b) above, with an elevation equal to that of the centreline of the runway at that point;
 - ii) two sides originating at the outer extremities of the inner edge and diverging uniformly at 10% each side from the extended centreline of the runway;
 - iii) an outer edge parallel to the inner edge and located in the plane of the inner horizontal surface;
 - iv) a slope of 4% (1:25) measured in the vertical plane containing the centreline of the runway.
- d) Side surfaces which slope upwards at 40% (1:2.5) in a vertical plane perpendicular to the centreline of the runway:
- i) from the sides of that portion of the approach surfaces described in paragraph 8.6 a) to a height equal to that of the plane of Inner Horizontal surface, with the elevation of any point on the lower edge equal to the elevation of the approach surface at that point;
 - ii) from the sides of the area described at paragraph 8.6 b) to a height equal to that of the plane of Inner Horizontal surface, with the elevation of any point along the lower edge equal to the elevation of the centreline of the runway opposite that point;
 - iii) from the sides of the baulked landing surface described at paragraph 8.6 c) to a height equal to that of the plane of Inner Horizontal surface with the elevation of any point on the lower edge equal to the elevation of the baulked landing surface at that point.

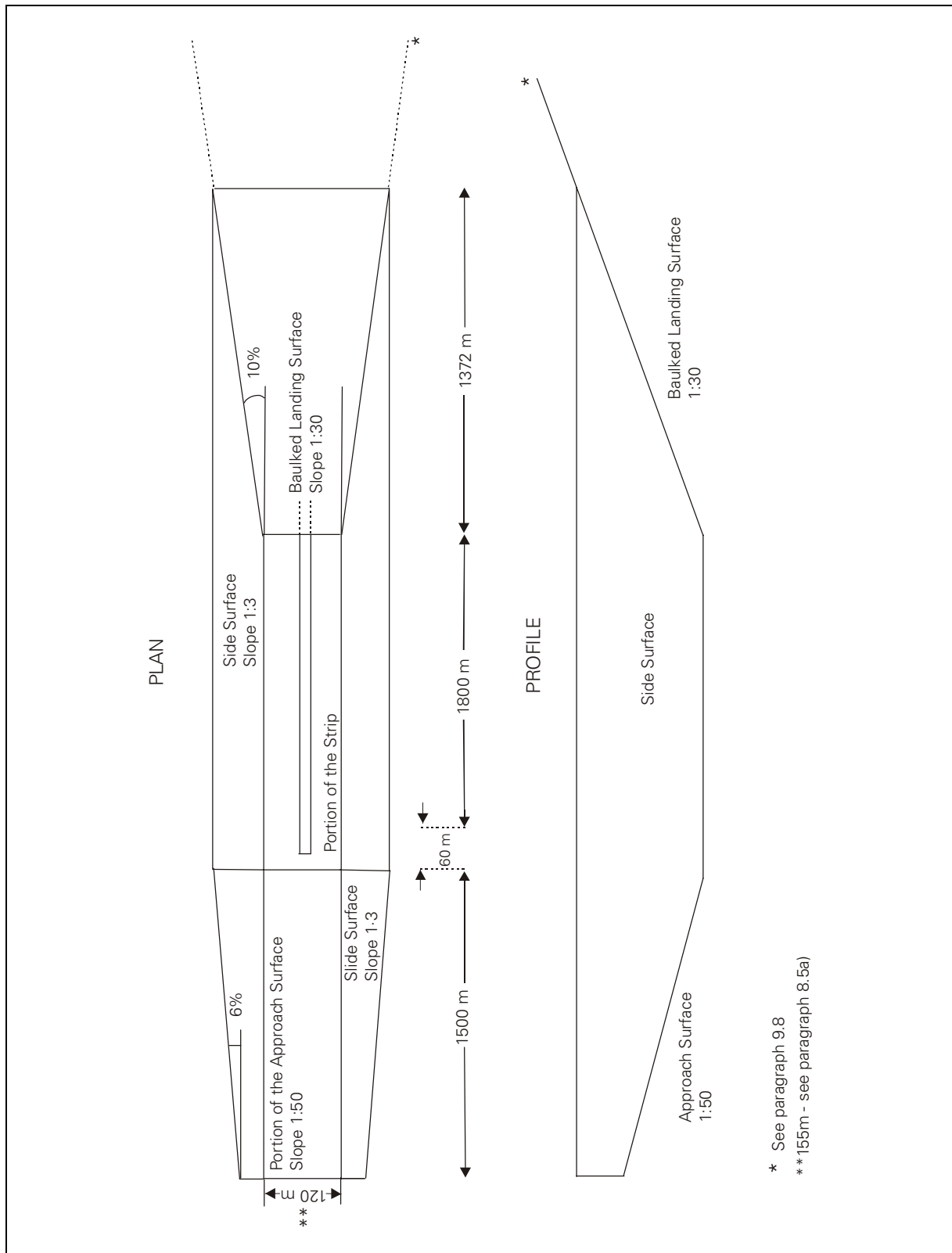


Figure 4.12 Obstacle Free Zone for Category I, II and III operations where the code number is 3 or 4 (not to scale)

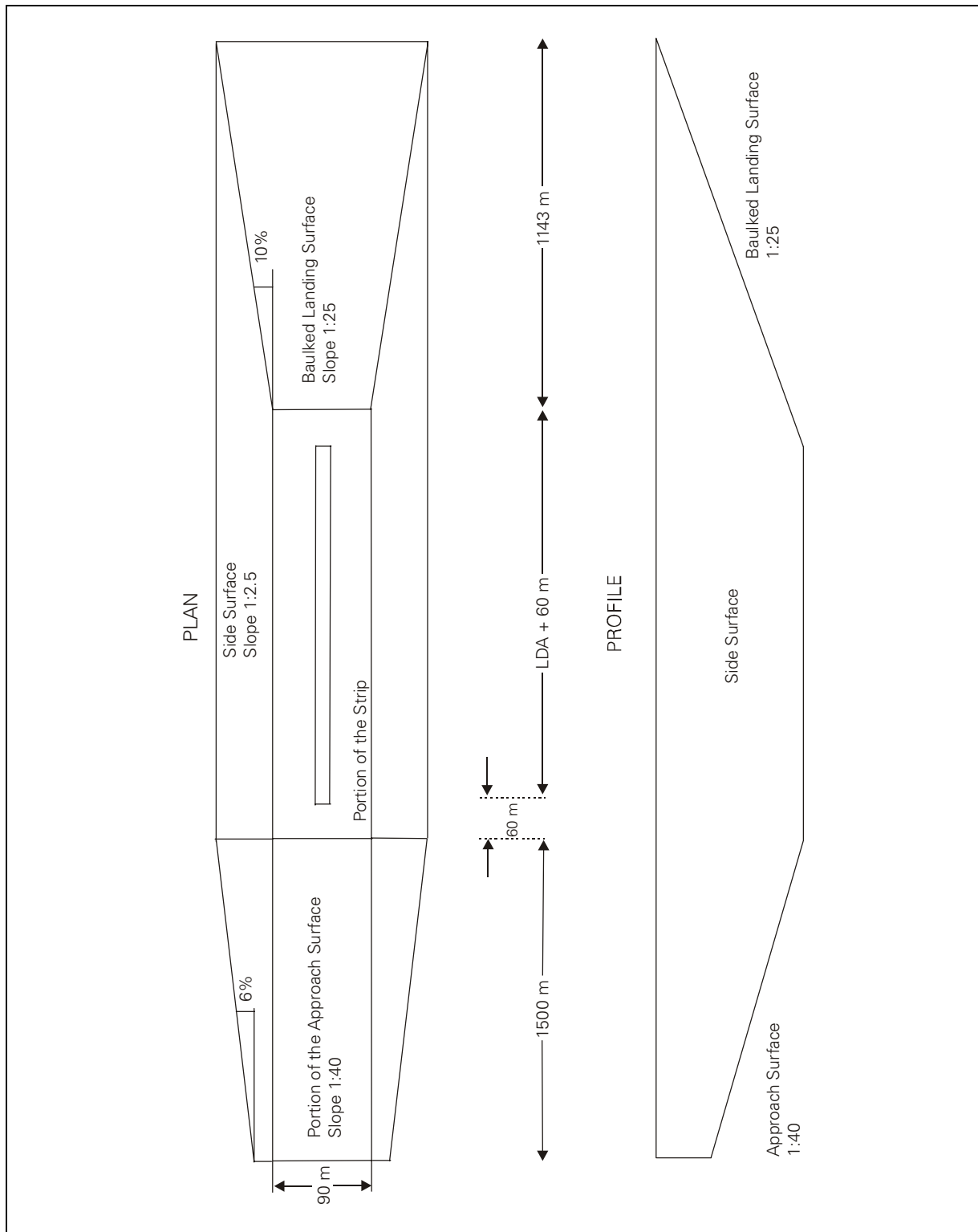


Figure 4.13 Obstacle Free Zone for Category I operations where the code number is 1 or 2 (not to scale)

9 Restriction and Removal of Obstacles

- 9.1 New objects or additions to existing objects should not extend above an approach surface, above a transitional surface or above a take-off climb surface, except when in the opinion of the CAA the new object or addition would be shielded by an existing immovable object.
- 9.2 New objects or additions to existing objects should not extend above an inner horizontal surface, a conical surface or an outer horizontal surface, except when in the opinion of the CAA the object would be shielded by an existing immovable object or it is determined that the object would not adversely affect the safety or significantly affect the regularity of aircraft operations.
- 9.3 Existing objects above an approach surface, transitional surface, take-off climb surface, inner horizontal surface or conical surface should as far as practicable be removed, except when in the opinion of the CAA the object is shielded by an existing immovable object.
- 9.4 Objects which do not penetrate an approach surface to a new runway or a proposed runway extension but which would nevertheless adversely affect the optimum performance of visual or non-visual aids should be removed.
- 9.5 Anything which may, in the opinion of the CAA endanger aircraft on the movement area must be removed.
- 9.6 Except for those objects or vehicles on essential aerodrome duties which because of their function must be positioned within the runway strip (but outside the cleared and graded area) to meet air navigation requirements, any object or vehicle situated on a runway strip which may endanger aircraft must be removed.
- 9.7 No object whether fixed or mobile is to be permitted to penetrate the OFZ during the use of a runway for landing in Category I, II or III operational conditions, except essential visual aids which are frangibly mounted.
- 9.8 No object whether fixed or mobile is to be permitted to penetrate the baulked landing surface of an OFZ established for Category II or III operations, see paragraph 8.5 c) ii) and iv). Where this surface intercepts the Basic ILS missed approach obstacle clearance surface, the latter becomes limiting. The Basic ILS missed approach surface is a 2.5% (1:40) slope commencing 900 m after the landing threshold, at the same elevation as the threshold.
- 9.9 Confirmation that the extended OFZ baulked landing surface is obstacle free up to the height where it intersects with the Category I ILS missed approach surface will normally be necessary only when the OFZ is initially established. Thereafter the normal safeguarding procedures as well as observance of the conditions of the aerodrome licence will ensure that either the extended OFZ missed approach surface will remain obstacle free or that proposed constructions which might infringe the surface are referred to the CAA for consideration.
- 9.10 Objects which would endanger aircraft in the air are not permitted in a clearway. Essential aids to navigation, providing they are frangible and do not exceed 0.9 m above ground level or the clearway plane, as appropriate, are acceptable.
- 9.11 Objects which would endanger aircraft on the ground are not permitted in a stopway or runway end safety area. When it is essential for approach light fittings to be situated in a stopway, they must be frangible and not exceed 0.46 m in height.
- 9.12 Where there are transverse or longitudinal slopes on a strip or clearway the inner edge of a take-off climb surface or an approach surface may lie partly or wholly below

the level of the ground in the strip or clearway. It is not necessary that the strip or clearway should, in such cases, be graded to conform with the inner edge of the take-off climb or approach surface.

- 9.13 Because of the difficulty of recognition special restrictions must be applied to elevated wires and their supports. Where no other object penetrates a given obstacle limitation surface, overhead wires and their supports should not penetrate a surface passing through the top of the highest existing object and parallel to the established surface for a distance of 1500 m from the runway threshold. The shielding criteria at paragraph 10 do not apply to the shielding of overhead wires.

10 Shielding of Obstacles

- 10.1 The principle of shielding is employed when a substantial and permanent object or natural terrain already penetrates an obstacle limitation surface. When it is considered that such an obstacle is permanent, objects of equal or lesser height around it may at the CAA's discretion be permitted to penetrate the surface.
- 10.2 Acceptance by the CAA of obstacle limitation surface penetrations using the shielding principle will always be subject to close scrutiny of the operational implications. Existing obstacles will be regarded as shields only when there is no prospect of their removal or destruction.
- 10.3 An object, building, structure or terrain which is accepted as a shielding obstacle and which penetrates an approach or take-off climb surface will create two shielding planes (see Figure 4.14). The first plane is horizontal at the elevation of the top of the obstacle, and extends from the obstacle in the direction away from the runway. The second plane extends from the top of the shielding obstacle, towards the runway with a negative slope of 10%. The width of these planes will be the width of the obstacle (measured in the plane normal to the extended centreline of the runway) at the obstacle, decreasing with sides parallel to the sides of the relevant protecting surface (see Figure 4.15), until the point where these projected lines converge, or intersect the take-off climb surface or the approach surface. Thus either the profile or plan view may take the form of a truncated triangle (see Figures 4.14 and 4.15). Where the take-off climb surface and the approach surface are not coincident it may be necessary to adopt a different angle of convergence, between the two surfaces.

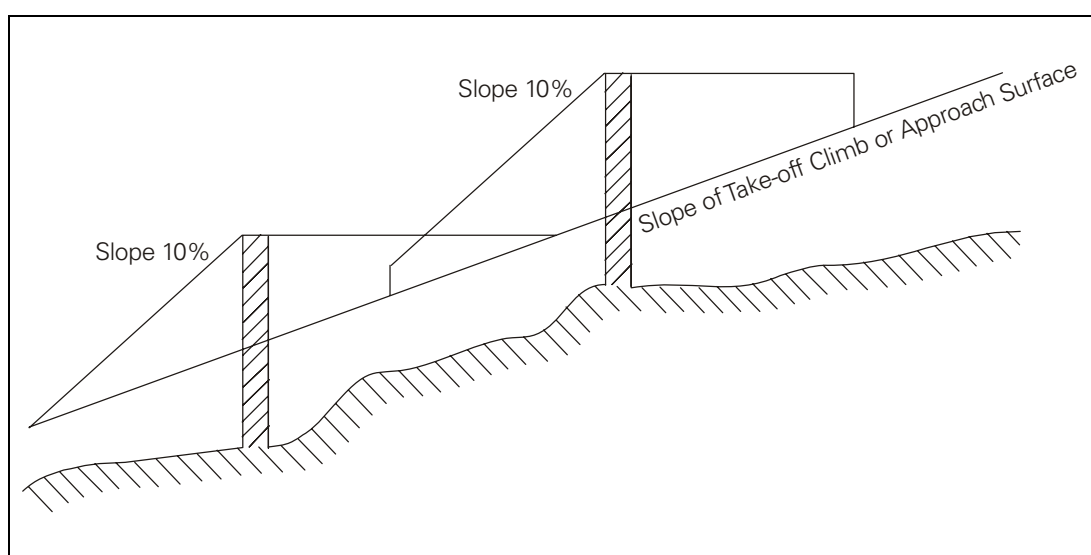
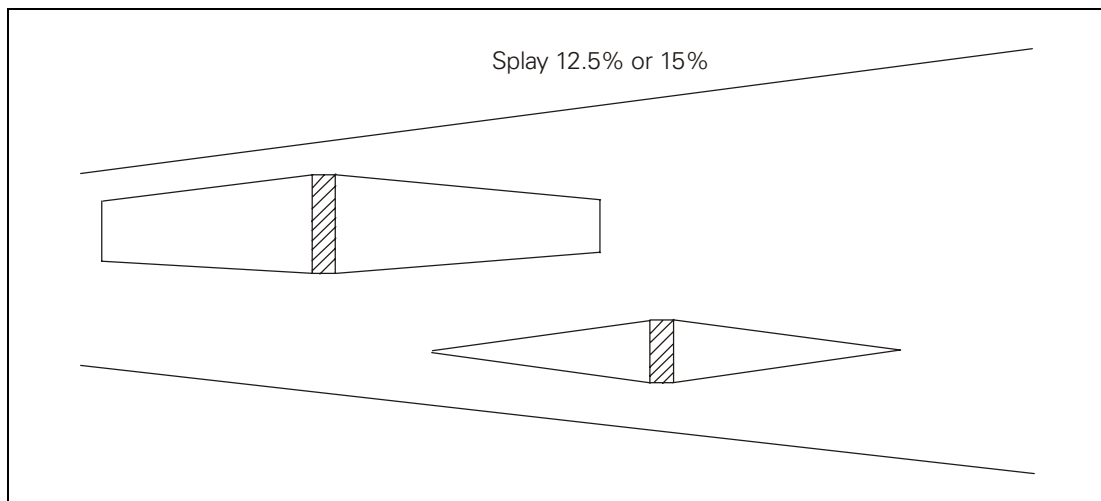
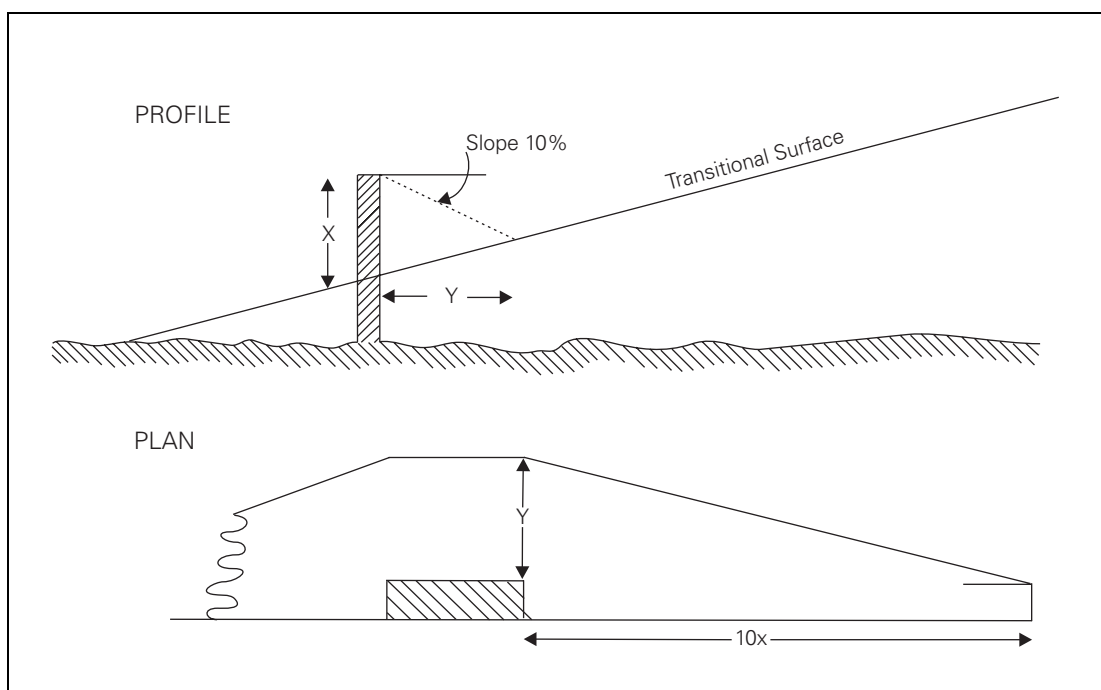


Figure 4.14

**Figure 4.15**

- 10.4 A permanent obstacle which penetrates a transitional surface may be regarded as shielding any other obstacles which lie beneath a negative slope of 10% extending from the top of the obstacle except that no obstacle can be considered as shielded that is situated closer to the runway than the shielding obstacle (see Figure 4.16).

**Figure 4.16**

11 Aerodrome Safeguarding

- 11.1 Detailed guidance is incorporated in a separate Civil Aviation Publication, CAP 738 Safeguarding of Aerodromes.
- 11.2 Aerodrome Licensees should take all reasonable steps to ensure that, through safeguarding, the aerodrome and its airspace are safe at all times for use by aircraft.

To enable this, procedures should be established to manage the safeguarding process. Details of the following should be included in the Aerodrome Manual:

- a) Accountability with regard to safeguarding and a system for recording consultations, including a method for seeking advice on issues of OLS infringements and, if officially safeguarded, call-in procedures.
- b) Procedures for notifying planning authorities of objections.
- c) Procedures for consulting the aerodrome's air traffic control (ATC) provider to ensure development has no electromagnetic/line of sight issues, either temporary or permanent.
- d) Procedures for assessing and monitoring the wildlife hazard risk.
- e) Procedures for evaluating potential impacts on instrument approach procedures.
- f) Procedures for promulgating infringements in the UK Aeronautical Information Publication (AIP), if appropriate.

- 11.3 It is recognised that the need to include all items will vary between aerodromes depending on the nature and scale of operations.

12 Marking and Lighting of Obstacles and Unserviceable Surface Areas

12.1 General

The following paragraphs contain details of the requirements for the marking and lighting of obstacles on and near aerodromes and for the standards applicable to en route obstacles. The latter is provided for the information of licensees and to assist them should they be consulted, or their advice sought, on the lighting and marking of obstacles in the vicinity of the aerodromes but beyond the obstacle limitation surface boundaries.

- 12.1.1 The responsibility for marking and lighting obstacles on or near aerodromes must be determined between the aerodrome licensee and the owners of the structures. The CAA is not concerned with the allocation of responsibility but may withhold, suspend, vary or withdraw a licence if the following requirements for lighting and/or marking are not met.
- 12.1.2 Licensees are responsible for ensuring that all obstacles on the movement area are lighted and/or marked as required, irrespective of ownership.
- 12.1.3 All objects which extend to a height of 150 m or more above ground elevation are regarded as obstacles and shall be lit in accordance with ANO Article 133. Other objects of a lesser height may be assessed as hazards to aviation and also treated as obstacles. They should be marked and/or lighted as detailed in the following paragraphs.

12.2 Objects to be marked or lighted

- 12.2.1 Indicating the presence of obstacles by marking or lighting is intended to reduce the hazards to aircraft operating at low level or moving on the surface.
- 12.2.2 Objects which, in accordance with paragraph 12.1.3 are deemed by the CAA to be en-route obstacles should be marked and/or lighted.
- 12.2.3 Objects which in accordance with paragraphs 9.1 to 9.4 of this Chapter are deemed by the CAA to be aerodrome obstacles should, if not removed, be marked and if the aerodrome is used at night, lighted except that:

- a) obstacles that are sufficiently conspicuous by their shape, size or colour need not be marked;
 - b) objects which technically are aerodrome obstacles but which are deemed to be shielded by other obstacles (see paragraph 10) need not be marked or lighted;
 - c) immovable obstacles or terrain which extensively obstruct an aerodrome circuit area need not be marked or lighted providing appropriate terrain avoidance procedures have been established;
 - d) an obstacle which the CAA considers to be of no operational significance need not be marked or lighted.
- 12.2.4 Vehicles and other mobile objects, excluding aircraft, on the movement area of an aerodrome are obstacles and should be marked and, if the vehicles and aerodrome are used at night or in conditions of low visibility, be lighted. Aerodrome licensees may exempt aircraft servicing equipment and vehicles used only on aprons from this provision provided that they are adequately conspicuous.
- 12.2.5 Elevated aeronautical ground lights on aerodromes should be made conspicuous by day by a suitable form of marking.
- 12.3 Marking of Obstacles**
- 12.3.1 Fixed obstacles that are sufficiently conspicuous by their shape, size or colour need not be otherwise marked.
- 12.3.2 Fixed obstacles that require marking should be conspicuously coloured. If this is not practicable, markers or flags should be displayed on or above them.
- 12.3.3 No fixed obstacle need be marked if it is lit.
- 12.3.4 A fixed obstacle 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 directions. The pattern should consist of rectangles with sides of not less than 1.5 m and not greater than 3 m.
- 12.3.5 A fixed obstacle should be coloured to show alternating contrasting bands if:
- a) it has essentially unbroken surfaces and has one dimension, horizontal or vertical, greater than 1.5 m, and the other dimension, horizontal or vertical, less than 4.5 m; or
 - b) it is of skeletal type with either a vertical or horizontal dimension greater than 1.5 m.
- The bands should be perpendicular to the longest dimension and have a width the dimensions of which are in accordance with Table 4.3 (see Figure 4.17).

- 12.3.6 A fixed obstacle should be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m.

Table 4.3 Marking band widths

Longest Dimension			
Greater than	Not exceeding	Band Width	
1.5 m	210 m	1/7 of longest dimension)	or 30 m whichever is less
210 m	270 m	1/9 of longest dimension)	
270 m	330 m	1/11 of longest dimension)	
330 m	390 m	1/13 of longest dimension)	
390 m	450 m	1/15 of longest dimension)	
450 m	510 m	1/17 of longest dimension)	
510 m	570 m	1/19 of longest dimension)	
570 m	630 m	1/21 of longest dimension)	

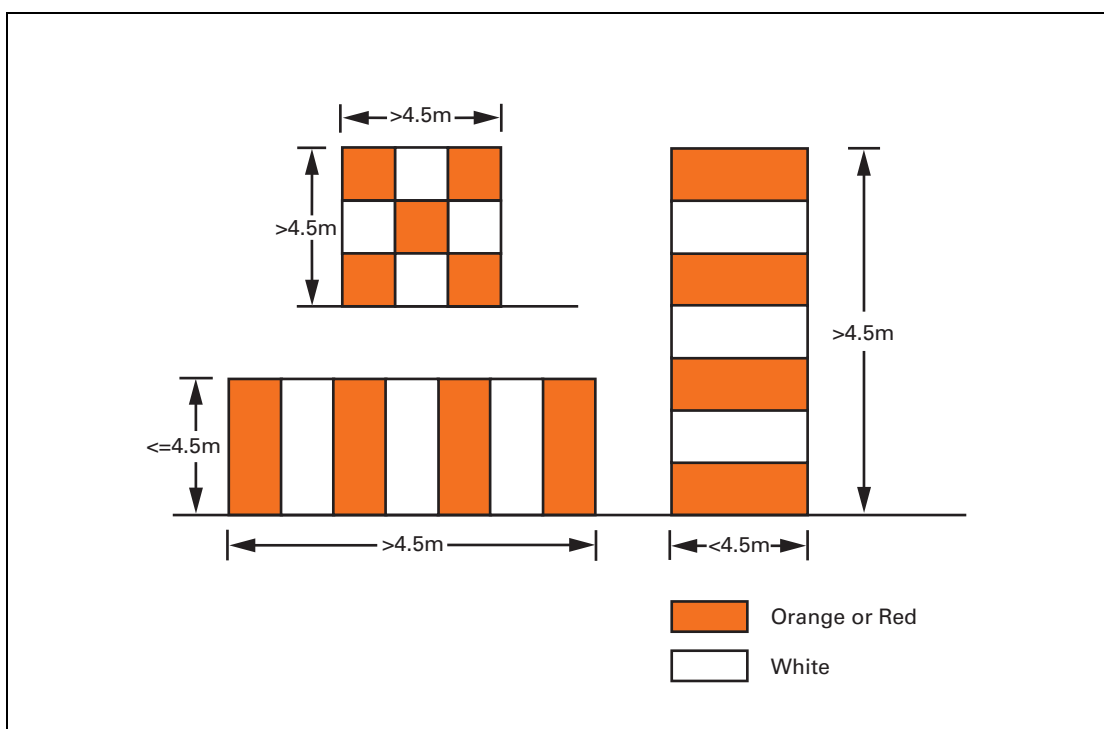


Figure 4.17(a) Basic marking patterns

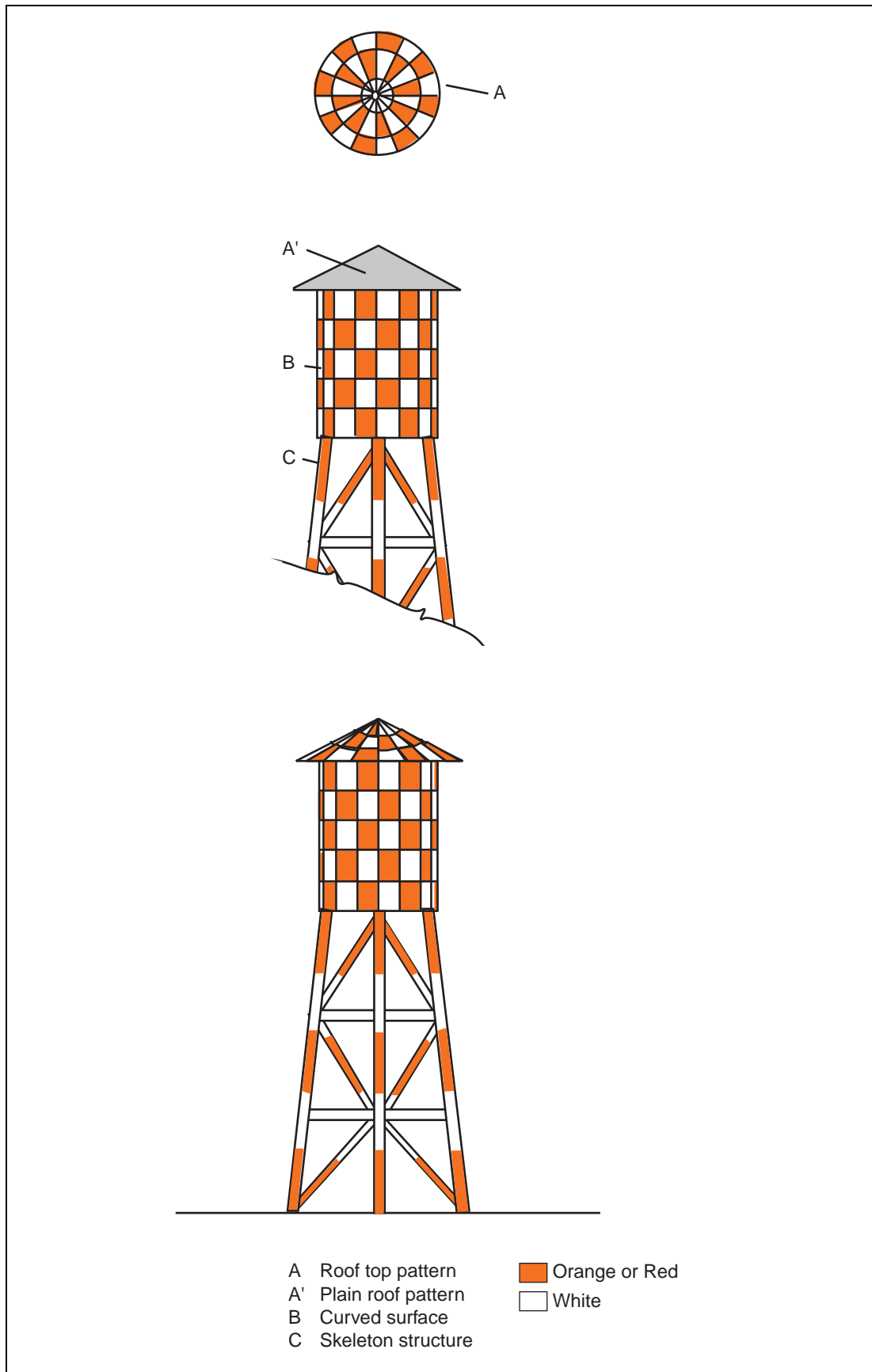


Figure 4.17(b) Marking of tall structures

12.3.7 All mobile obstacles that require marking should be conspicuously coloured or carry markers or flags (see also paragraph 12.4.2).

12.3.8 En route obstacles are not normally marked but may be marked in accordance with the preceding sub-paragraphs if local authorities so wish.

12.4 **Colouring**

12.4.1 The colours used for marking fixed obstacles should contrast with the background against which they will be seen. Where practicable orange and white or red and white should be used for chequers and bands and red or orange used for small objects as defined at 12.3.6. The chequers/bands on the extremities of the obstacle should be of the darker colour. (See Figure 4.17.)

12.4.2 When mobile obstacles are marked by colour, a single distinctive conspicuous colour should be used.

12.5 **Use of Markers**

12.5.1 Markers displayed on or adjacent to obstacles should be located in conspicuous positions so as to retain the general definition of the object without increasing the hazard it presents. The markers should be coloured either orange and white or red and white to contrast with the background.

12.6 **Use of Flags**

12.6.1 Flags used to mark obstacles, including temporary obstacles to taxiing aircraft, should be displayed around, on top of, or along the highest edge of an object, but must not increase the hazard presented by the object they mark. Flags should be displayed at least every 15 m and:

- a) For fixed obstacles, flags should be not less than 0.6 m square and be orange in colour or a combination of two triangular sections, one orange or red and the other white, in order to give the maximum contrast. (See diagram at Chapter 7, paragraph 4.6.3.)
- b) For mobile obstacles, flags should be not less than 0.9 m square, consisting of a chequered pattern of squares in the manner illustrated in Figure 4.17 and having sides not less than 0.3 m. The chequers should be coloured orange and white, or red and white except where such colours merge with the background.

12.7 **Marking of unserviceable surface areas**

12.7.1 Markers as described in paragraph 4.6 of Chapter 7 should be used to delineate an unserviceable portion of the paved movement area. Unfit areas on paved taxiways and runways should be marked with white crosses as in paragraph 4.6.1 of Chapter 7. When the portion is sufficiently small as to be by-passed safely by aircraft, flags or traffic cones may be used to outline its limits.

12.7.2 Marker boards alternating with flags or cones as described in paragraph 4.6.3 of Chapter 7, should be used to delineate an unserviceable portion of a grass aerodrome.

12.8 **Lighting of obstacles**

12.8.1

- a) Low intensity steady red obstacle lights should be used on obstacles less than 45 m high, except that medium intensity steady red lights should be used to light such obstacles as an elongated structure, an obstacle in the outer area of the approach or high ground adjacent to the aerodrome circuit. There are two types of low intensity obstacle lights for fixed obstacles: Group A and Group B (see Table 6A.1).

- i) Low intensity Group A lights should be used for obstacles on the movement area where Group B lights may cause dazzle.
- ii) Low intensity Group B lights should be used away from the movement area or in areas on the movement area with high levels of background illuminance.
- b) Medium intensity red steady obstacle lights should be used on obstacles between 45 m and less than 150 m in height.
- c) Medium intensity steady red obstacle lights should be used to indicate the presence of:
 - i) an obstacle if its height is 150 m or more; or
 - ii) a tower supporting overhead wires, cables etc. of any height where an aeronautical study indicates such lights to be essential for recognition of the presence of the obstacle.

However, where an aeronautical study conducted by the Directorate of Airspace Policy of the CAA concludes that greater conspicuity of the obstacle through the use of a higher specification light is required, the use of a high intensity flashing white obstacle light will be considered by the CAA.

- d) The combination of white and red obstacle lights should not be used at the same time to light an obstacle.

12.9 **Location of obstacle lights (Figure 4.18)**

12.9.1 **The Top Light**

- a) Except in the case of a chimney or other similar structure, one or more lights should be located at the top of the obstacle. The lights should be so arranged as to indicate the highest points or edges of the obstacle relative to the obstacle limitation surface. If two or more edges are of the same height, the edge nearest the flight path should be lighted. On facing sides of groups of obstacles, lights may be omitted with the approval of the CAA, and the group treated as one solid obstacle.
- b) In the case of a chimney or other similar structure, the top light should be placed between 1.5 m and 3.0 m below the top in order to reduce the effects of discolouration or corrosion from the exhaust fumes.
- c) In the case of a guyed tower or antenna where it is not possible to locate an obstacle light on the top because of the weight of equipment involved, such a light should be located at the highest practicable point acceptable to the CAA.

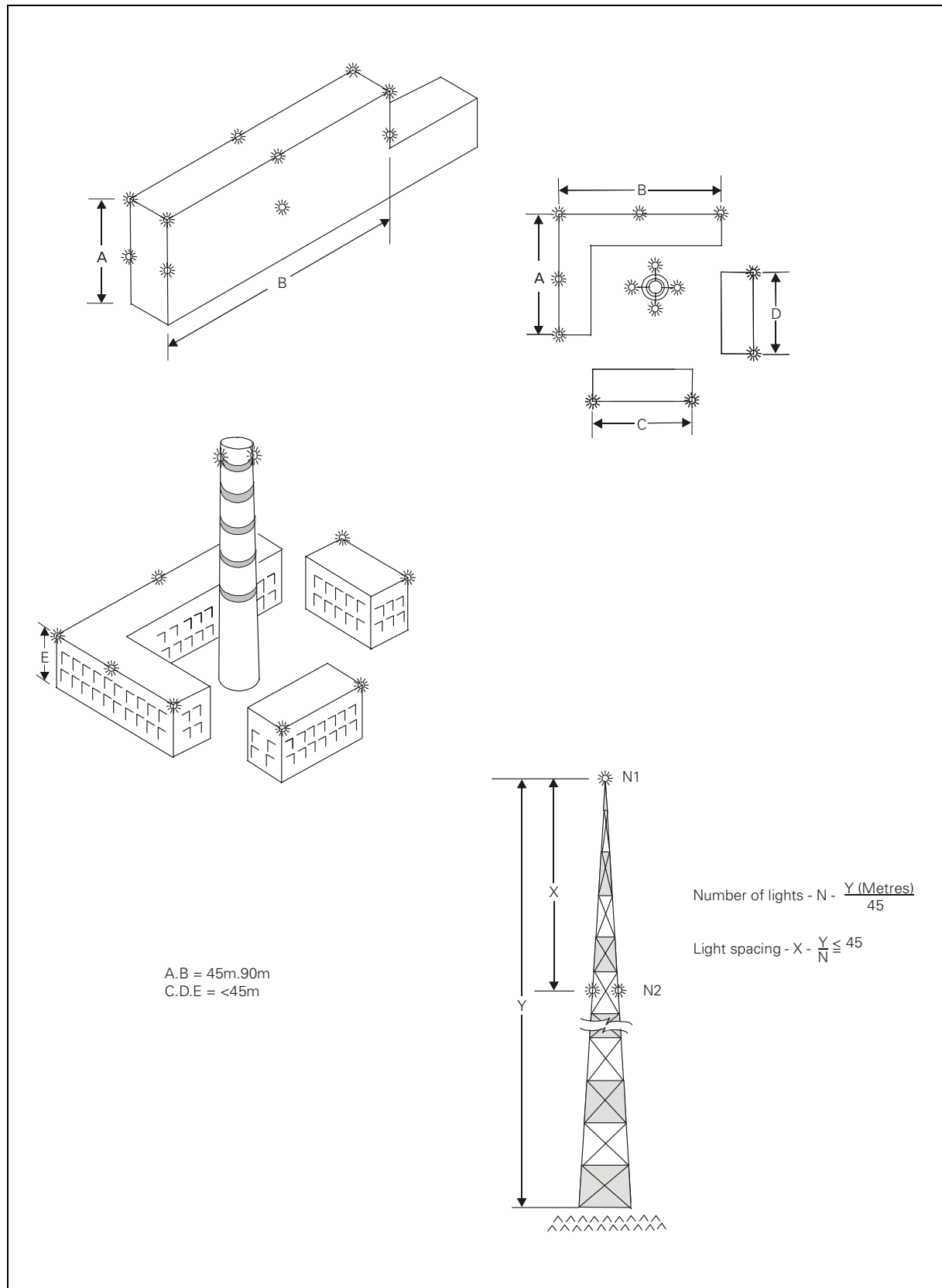


Figure 4.18 Lighting of Objects

12.9.2 Intermediate lights

Where the top of an obstacle is more than 45 m above the level of the surrounding ground, additional lights should be provided at intermediate levels. These additional lights should be spaced as equally as practicable between the top light and ground level as follows:

- a) When low or medium intensity obstacle lights are used the spacing should not exceed 52 m.
- b) Where deemed necessary by an aeronautical study, the spacing of high intensity flashing white obstacle lights on an obstacle other than a tower supporting overhead cables or wires should not exceed 105 m.
- c) Where obstacle lights are used on a tower supporting overhead wires or cables (Figure 4.19) they should be located at three levels:
 - i) on the top of the tower;
 - ii) on the tower at the lowest level of the catenary of the wires or cables; and
 - iii) at approximately mid-way between these two levels.
- d) At each level the lights should be arranged to give full cover in azimuth.

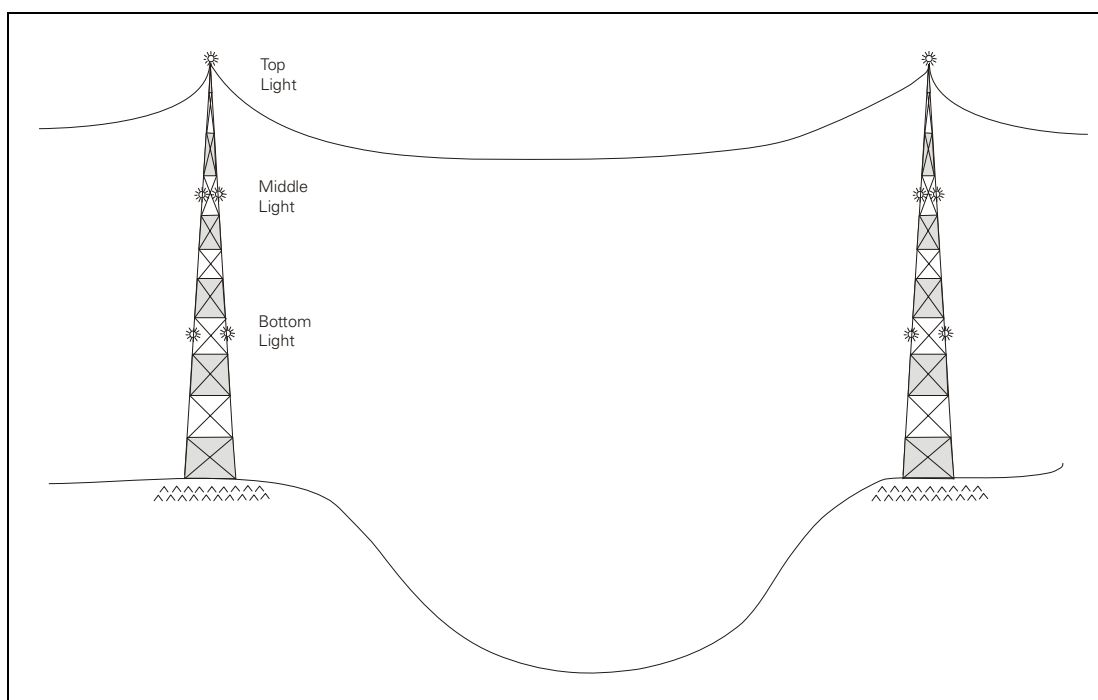


Figure 4.19 Example of Intermediate Lighting

12.10 Lighting of Unserviceable Parts of the Movement Area

12.10.1 Unserviceable parts of the movement area of an aerodrome used at night should be lit as follows:

- a) to delineate unsafe areas lights should be spaced at intervals of not more than 7.5 m;
- b) to close off unserviceable sections of runways or taxiways, lights should be spaced at intervals of not more than 3 m.

NOTE: The normal runway and taxiway lighting within the unserviceable area should be suppressed.

- 12.10.2 A light used to mark unserviceable parts of the movement area should consist of a steady red light of sufficient intensity to ensure conspicuity, considering adjacent lights and the general level of illumination against which it would normally be viewed. It should have a minimum intensity of not less than 10 cd.

12.11 **Lighting of Vehicles**

- 12.11.1 The responsibility for marking and lighting vehicles used on the movement area must be determined between the licensee and the operators of the vehicles. Licensees are responsible for ensuring that vehicles on the movement area are lighted and/or marked as required, irrespective of ownership.
- 12.11.2 The specification for yellow flashing vehicle obstacle lights is given in Chapter 6, Appendix A, Table 6A.1. Strobe lighting is unacceptable. Obstacle lights for 'Follow-me' vehicles only shall have characteristics described in Figure 6A.19.
- 12.11.3 The lights specified should be fitted at the highest point of the prime mover vehicle. The highest point of trailers should be fitted with steady red lights of not less than 10 cd.
- 12.11.4 Obstacle lights on vehicles should be switched on whenever the vehicles are within the movement area; however the number of vehicles displaying flashing lights should be restricted to the operational minimum.
- 12.11.5 Aerodrome ambulances, fire and rescue appliances should, in addition, carry blue flashing lights for use whilst carrying out emergency duties.
- 12.11.6 In conditions where emergency vehicles not normally based at an aerodrome are called upon for assistance, flashing blue lights, where fitted, should be operated within the movement area.

12.12 **Light characteristics (see Chapter 6, Appendix A, Table 6A.1)**

12.12.1 **Low intensity obstacle lights**

On fixed obstacles, low intensity lights should be steady red and omni-directional.

12.12.2 **Medium intensity obstacle lights**

Medium intensity obstacle lights should be steady red light.

12.12.3 **High intensity obstacle lights**

High intensity obstacle lights should be flashing white lights.

12.13 **Replacement of lamps**

Unserviceable lamps should be replaced as soon as possible and in any event within 24 hours. Periodic replacement of all lamps is advisable – the active life being deemed to be 80% of the rated lamp life. Where such preventive maintenance cannot be arranged, tungsten lamps may be underrun on voltage down to a minimum of 90% of rated voltage, provided that the specified output can be met. This procedure should increase lamp life to about 400% of the rated lamp life. When this procedure is used, preventive replacement should be carried out after the increased interval. The requirements for periodic change of lamps may, however, be varied or waived where fittings having acceptable performance and proved life are used.

NOTE: NOTAM action should be taken to promulgate unserviceabilities.

12.14 **Periods of illumination of obstacle lighting**

- 12.14.1 High intensity flashing white obstacle lights should be lighted at all times throughout the day and night.
- 12.14.2 Steady red medium and low intensity obstacle lights should be lighted:

- a) On and adjacent to an aerodrome from 30 minutes before sunset to 30 minutes after sunrise during the hours of availability notified in the UK AIP or by NOTAM.
- b) On en route obstacles from 30 minutes before sunset to 30 minutes after sunrise.
- c) Should switching present problems, these lights may remain lighted continuously.

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Chapter 5 Aerodrome Bird Control

1 Introduction

- 1.1 Birds, especially in flocks, have the potential to cause damage to airframes and engines, especially turbine engines, and therefore their presence on an aerodrome and its immediate flight paths should be deterred. All reasonable measures should be taken to address those features on the aerodrome that may attract birds, control the existence of birds on the aerodrome, and, where practicable, in the vicinity of the aerodrome to prevent bird flightlines across the aerodrome and its approach and departure routes.
- 1.2 Guidance on current best practice for all aspects of bird control is detailed in CAP 680 Aerodrome Bird Control.

2 Bird Control Management

- 2.1 A Bird Control Management Plan should be developed to:
 - a) assess the potential birdstrike risk;
 - b) reduce bird infestation on the aerodrome as much as practicable;
 - c) implement a safeguarding system to identify, and, where possible, address existing and planned developments within 13 km of the aerodrome that may have the potential to increase the birdstrike risk;
 - d) monitor and assess birdstrike events; and
 - e) strive to improve the effectiveness of the plan.
- 2.2 Details of, or reference to, the Bird Control Management Plan should be included in the Aerodrome Manual.

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Chapter 6 Aeronautical Ground Lighting

1 Basic Licensing Requirements

1.1 General Information

- 1.1.1 Aeronautical Ground Lighting (AGL) provides flightcrew with location, orientation and alignment information in adverse visibility conditions and at night. Table 6.1 outlines the minimum prescribed scales of AGL needed in order to satisfy the aerodrome licensing requirement in respect of low visibility and night operations; it also highlights those elements of AGL equipment considered by the CAA to be operationally desirable for a particular operation. The type of lighting is specified according to the runway approach category and take-off (T/O) minima. Where the prescribed scale cannot be provided for an instrument runway there may be a consequential penalty on operational minima. The components, listed in Table 6.1, are described in the succeeding paragraphs in the order in which they will be seen by a pilot approaching an aerodrome. The characteristics of the lights and their overall height limits, are detailed in Appendix 6A.
- 1.1.2 AGL for precision approach runways should be high intensity so that it is usable by day and night. Low intensity may be used for other runways, but high intensity lighting is strongly recommended for non-precision approaches and should be provided where there are public transport passenger jet operations.

Table 6.1 Aeronautical Ground Lighting - Minimum Licensing Requirements

	Day or Night Operations					Night Only Operations			Notes	Text Ref
	App Cat II & III	T/O RVR <400	App Cat I	T/O RVR 400–800	App N/P	T/O RVR 800 - 1200	App Visual	T/O >1200		
Equipment	Scale L1		Scale L2		Scale L3		Scale L4			
Aerodrome Beacon	O	-	R	-	R	-	R	-		Para 2
Approach										Para 3
HI C/L 5-bars	R	-	R	-	-	-	-	-		
Supplementary	R	-	-	-	-	-	-	-		
Simple	-	-	-	-	R	-	O	-	1	
Sequenced strobe	-	-	-	-	-	-	-	-		
Approach Slope										Para 4
PAPI	R	-	R	-	O	-	-	-	2	
HI APAPI	-	-	-	-	R	-	O	-	2	
LI APAPI	-	-	-	-	-	-	R	-	2, 4	
Runway										Paras 1.1.2 and 5
HI edge, threshold, end	R	R	R	R	R	O	-	-		
LI edge, threshold, end	-	-	-	-	-	R	R	R	3, 4	
HI C/L	R	R	O	O	-	-	-	-		
Touchdown zone	R	-	O	-	-	-	-	-		
Stopway	R	R	R	R	R	R	R	R		
Taxiway										
Centreline	R	R	O	O	-	-	-	-		Para 6
Edge	-	-	R	R	R	R	O	O	4, 5	
Illuminated Signs	R	R	R	R	R	R	O	O		
Stop bars	R	R	R	R	-	-	-	-		
Runway Guard	R	R	R	R	R	R	-	-		
Obstacle	R	R	R	R	R	R	R	R	6	Chap 4 Para 12
Alternate Input Power Supply	R	R	R	R	O	O	O	O		Para 10
Illuminated Wind Sleeve	R	R	R	R	R	R	R	R		Para 1.1.3

R = Required, O = Operationally desirable, C/L = Centreline, HI = High Intensity, LI = Low Intensity, NP = Non Precision, App = Approach

NOTES:

- May not be required where aerodrome used by day only and high intensity runway edge lighting installed or when used at night in good visibility or when sufficient guidance is provided by other visual aids. Where at an aerodrome licensed for night use the direction of approach is not evident from the configuration of the approach and runway lighting, an illuminated white landing T as described in Chapter 7 paragraph 2.4 should be provided either in the signals square or adjacent to the runway.

- 2 At aerodromes used by day only, by public transport aeroplanes carrying passengers on scheduled journeys or by public transport aeroplanes exceeding 5700 kg MTWA carrying passengers on other than scheduled journeys, the runway most frequently used, whether paved or unpaved, should be equipped with visual approach slope guidance. All runways used for public transport passenger jet operations should be equipped with PAPI.
 - 3 Electric runway edge lighting should be provided for all operations by public transport aeroplanes carrying passengers on scheduled journeys or by public transport aeroplanes exceeding 5700 kg MTWA carrying passengers on other than scheduled journeys. Paraffin flares may be used for runway edge lighting in Scale L4 for other operations.
 - 4 Low intensity systems are suitable only for night time use.
 - 5 Not normally required where HI C/L provided. Chapter 6 paragraph 6.1.2 refers.
 - 6 Runway Guard Lights are required for take-off in RVR < 1200 m day or night.
- 1.1.3 At least one illuminated wind sleeve conforming to the requirements of Chapter 7 paragraph 2.3, should be provided where scheduled public transport operations take place at night.
- 1.1.4 A luminous intensity control system is required for all high intensity lighting (see paragraph 9). It will also be needed in most cases for low intensity APAPI.
- 1.1.5 These requirements are derived from the Standards and Recommended Practices detailed in ICAO Annex 14 and are intended to cater for the full range of operations that might reasonably be expected at a particular aerodrome. They should not be confused with the minimum requirements for specific aeroplane operations as described in other documents such as JAR-OPS and CAP 360.
- 1.1.6 Any proposed modification to an AGL system or any work that requires the approval of the CAA (under the terms of the Aerodrome Licence) should be notified to the Aerodrome Standards Department. Details of the procedure that should be followed for such work is contained in CAP 655 – Aeronautical Ground Lighting, the Procedure for meeting Statutory Requirements.
- 1.1.7 Additional information on the purpose and significance of AGL may be found in the Visual Aids Handbook, CAP 637.
- 1.2 **Periods of display of Aeronautical Ground Lighting**
- 1.2.1 Aeronautical ground lighting should be displayed at least 15 minutes before the estimated time of arrival of any aircraft and until at least 15 minutes after the actual time of departure of any aircraft as follows:
- By day: High intensity systems, where installed on the runway to be used, whenever the visibility is less than 5 km and/or the cloud base is less than 700 ft.
- By night: Irrespective of weather conditions.
- 1.2.2 Aerodrome beacons and obstacle lighting should be displayed at night whenever the aerodrome is available for use.
- 1.3 **Dangerous and confusing lights**
- 1.3.1 The Air Navigation Order provides that a person shall not exhibit in the UK any light which is liable to endanger aircraft taking-off or landing or which is liable to be mistaken for an aeronautical light.
- 1.3.2 A light may endanger aircraft when:
- a) the intensity causes glare in the direction of an approaching aircraft;

- b) the colour (e.g. advertising signs) causes it to be mistaken for an aeronautical light;
- c) viewed from the air, lights make a pattern (e.g. a row of street lights) similar to an approach or runway lighting pattern;
- d) the overall amount of illumination near the approach to a runway detracts from the effectiveness of the AGL, particularly in poor visibility.

1.3.3 Lasers are a source of special concern because even brief exposure to the light from such devices can cause temporary blindness. Guidance on the use of lasers with regard to aviation safety has been produced by the CAA and is contained in CAP 736 Guide for the Operation of Lasers, Searchlights and Fireworks in United Kingdom Airspace.

1.3.4 The Licensee should ensure that arrangements exist whereby Local Planning Authorities may receive appropriate advice about the lighting implications of Planning Applications before such Applications are determined.

Particular attention should be paid to lights in the following areas:

a) **For instrument approach runways**

A rectangular area 750 m on each side of the centreline and extended centreline of the runway extending to a distance of 4500 m before the threshold.

b) **For non-instrument runways**

An area 220 m wide equally disposed about the centreline of the runway and increasing in width along the extended centreline from 220 m at the threshold to 950 m wide at a distance of 3000 m from the threshold.

1.4 **AGL for Helicopter Night Landing Training**

1.4.1 Where helicopter night landing training is conducted at an aerodrome, a 6 light proportional T (see Figure 6.0) may be provided. The lights of the proportional T should be omni-directional, white and useable from a distance of 4 nm.

1.4.2 When positioned on an aerodrome with a fixed wing runway also in use, the proportional T should be sited so as to permit safe parallel approaches, to avoid obstructions and to minimise noise nuisance.

1.4.3 If provided, a proportional T must be notified to the CAA and included in the Permission to display AGL. Procedures for the use of the proportional T should be included in the Aerodrome Manual.

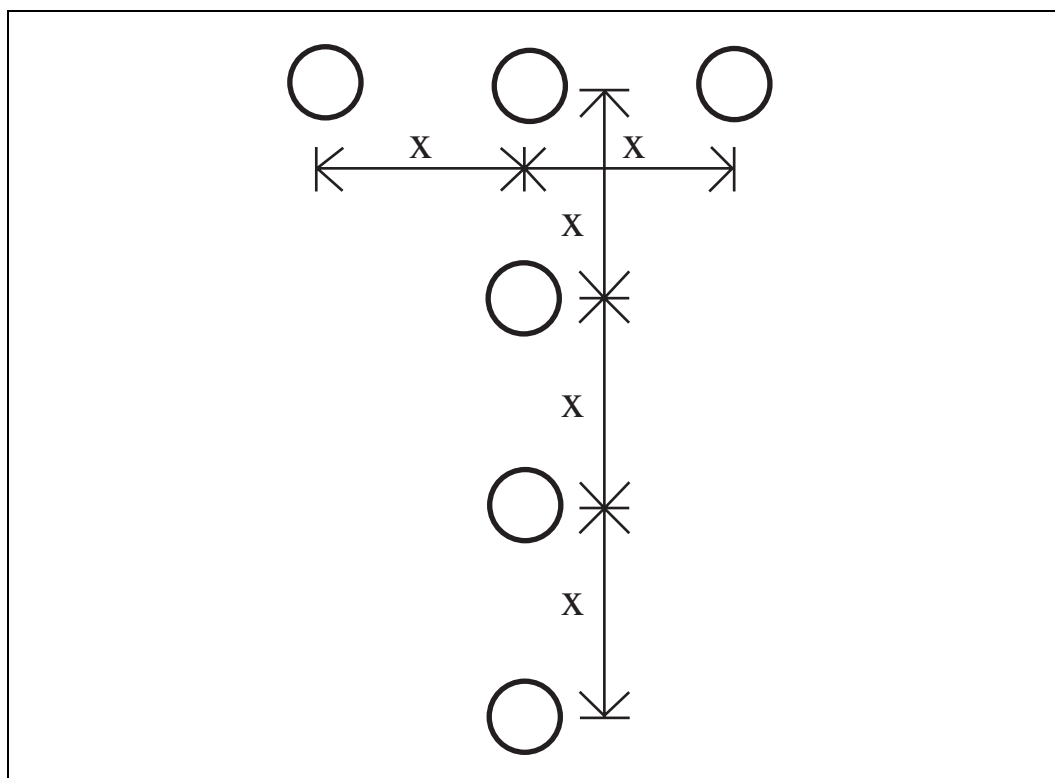


Figure 6.0 Proportional T

NOTE: It is recommended that the dimension x should be 10 m.

2 Aerodrome Beacon

- 2.1 An Aerodrome Beacon is intended to assist pilots in locating and/or identifying an aerodrome at night and should be provided at all aerodromes licensed for night operations except where the CAA considers such provision unnecessary.
- 2.2 Exemption from the requirement at paragraph 2.1 above will be assessed according to the type of operations conducted at the aerodrome, the conspicuity of the AGL pattern in relation to background lighting patterns and levels, and the availability of other aids with which to locate the aerodrome at night. As a general principle, an Aerodrome Beacon is required at an aerodrome where visual approaches are conducted at night or where night flying training is carried out. However, at major aerodromes located in a Control Zone where aircraft are positioned using radio navigation aids and ATC procedures are in force, the requirement may be waived if the CAA is satisfied that there can be no possibility of confusion with other aerodromes nearby.
- 2.3 The characteristics of Aerodrome Beacons are described at Appendix 6A paragraph 2; there are two main categories as follows:
 - a) **Identification Beacon** – An Identification Beacon is intended for use where aerodromes in the same vicinity operate at night and confusion could arise as to the identity of the airfield in question. The beacon flashes a two letter morse code symbol in green identifying the airfield.
 - b) **Location Beacon** – A Location Beacon is intended for use at aerodromes where the local terrain or the pattern and level of background lighting is such that it might

be difficult for a pilot to identify the AGL pattern when outside the circuit area but where no other airfield operates in the same vicinity at night. There are two types of Location Beacon.

- i) Location Beacon Pattern 'A' – a beacon flashing alternately green and white. A Pattern 'A' Location Beacon is intended for use in those geographic areas where high background light levels persist (such as urban areas).
- ii) Location Beacon Pattern 'B' – a white flashing light. A Pattern 'B' Location Beacon is intended for use in those geographic areas where low background light levels are found.

2.4 The type of Aerodrome Beacon and any associated morse code symbol to be provided at an aerodrome will be determined by the CAA. However, where a requirement for an Aerodrome Location Beacon is determined, the Aerodrome may provide instead, an Aerodrome Identification Beacon.

2.5 An Aerodrome Beacon should be situated on a part of the aerodrome where the level of local background lighting is low and so that it is visible from all directions of approach. The site chosen should be such that the beacon will not cause a hazard by impairing the vision of flight and ground crews engaged in carrying out their duties nor cause any interference with other visual or radio aids.

3 Approach Lighting and Circling Guidance Lights

3.1 Approach lighting provides alignment, roll guidance and limited distance-to-go information for the visual completion of an instrument approach. Circling guidance lights provide orientation with the runway for traffic outside the approach area, e.g. in the aerodrome circuit.

3.2 High intensity coded centreline and crossbar approach lighting system

3.2.1 The standard approach lighting system consists of a 900 m coded line of white lights, on the extended centreline of the runway, and five crossbars at 150 m intervals. The bars decrease in width towards the runway threshold, lines through the outer lights of the bars converging to meet the runway centreline 300 m upwind from threshold. The illustration at Figure 6.1 shows the plan view for precision approach operations. Vertical setting angles are contained in Table 6A.2 and the associated Notes, and in Figure 6A.1.

3.2.2 Terrain or other constraints may limit the length or type of approach lighting that can be installed to less than that specified. In such circumstances a lesser length is acceptable but will normally incur a penalty on aerodrome operating minima. Whatever length is installed should be appropriate to the approach procedure and specified pattern.

3.2.3 Approach lighting for newly equipped precision approach runways should have the characteristics specified in Figure 6A.1. The light performance requirements to adapt existing Category II lighting for Category III operations are given in Table 6A.2.

3.2.4 Five stages of luminous intensity are required for this type of approach lighting (see paragraph 9).

3.3 Supplementary approach lighting

3.3.1 Supplementary approach lighting required for Category II and III operations consists of:

- two additional white lights on each side of the centreline light forming barrettes along the inner 300 m of the approach centreline, the lights in each barrette being spaced 1.2 m apart; and
- red side row barrettes of four lights spaced 1.5 m apart on each side of each centreline barrette over the inner 270 m of the approach lighting system. The lateral gauge of the barrettes should be equal to that of the Touchdown Zone (TDZ) lighting as described in paragraph 5.8.1. The pattern is illustrated in Figure 6.2 and the light characteristics are specified in Figure 6A.2.

3.3.2 Three stages of luminous intensity are required for this part of the system (see paragraph 9).

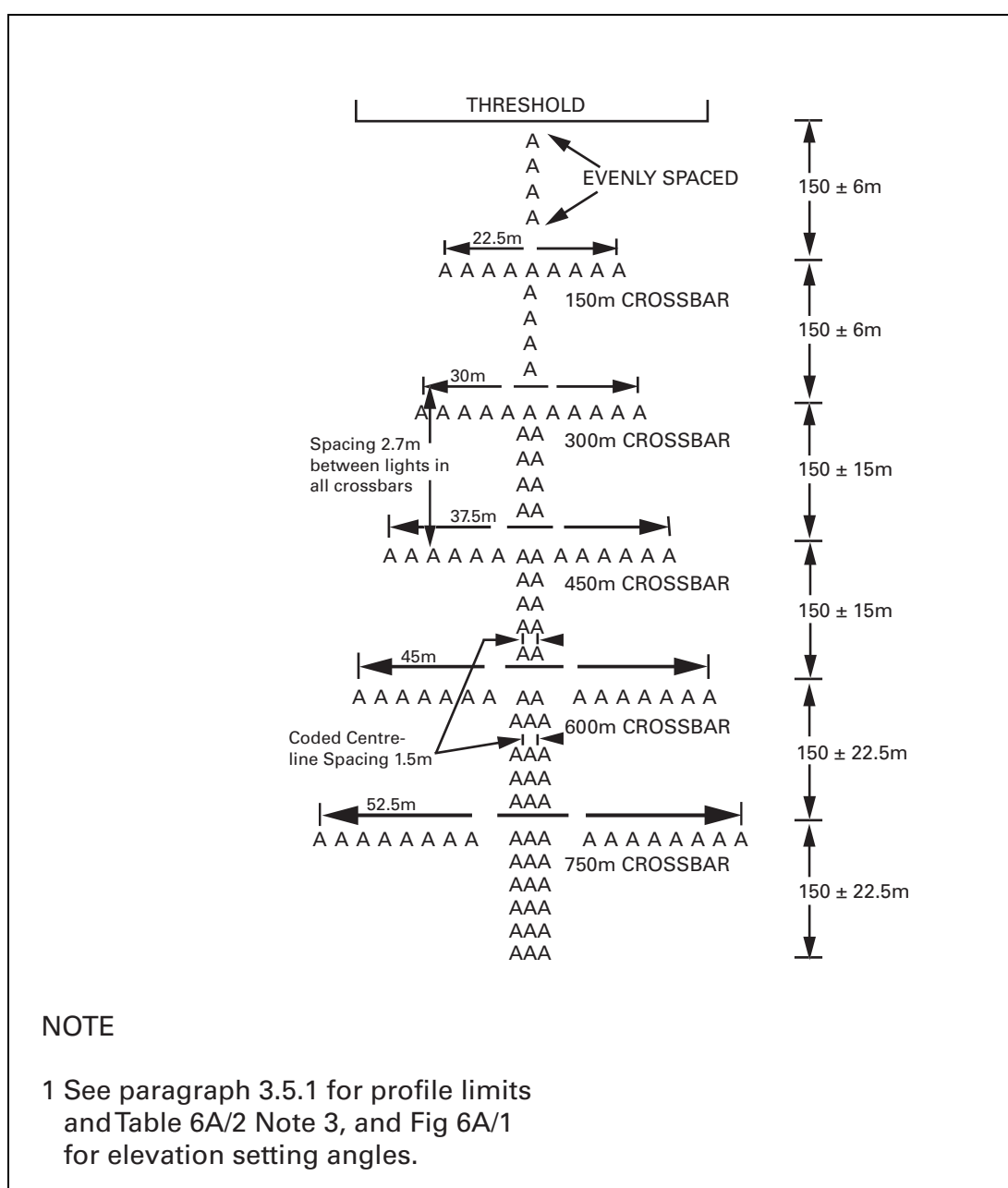


Figure 6.1 High intensity coded centreline and crossbar approach lighting system

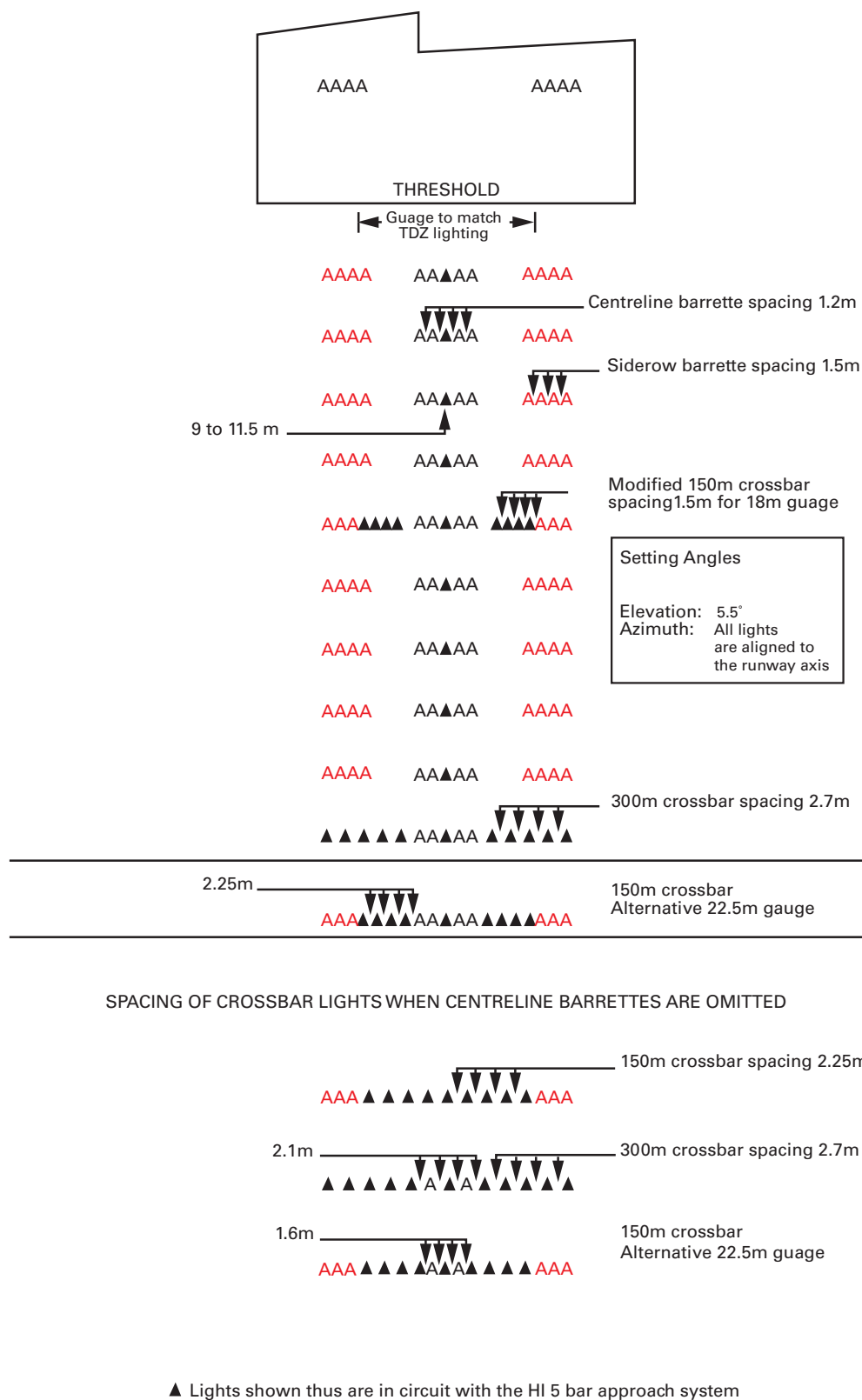


Figure 6.2 Supplementary approach lighting system

3.4 Simple approach lighting system

- 3.4.1 The system consists of a row of lights, white for high intensity and red for low intensity, on the extended centreline of the runway at 60 m intervals for a distance of at least 420 m from the runway threshold, with a crossbar 30 m in width at 300 m from the threshold. The pattern is illustrated in Figure 6.3 and the light performance requirements are given in Figure 6A.1 for HI lights and Table 6A.1 for LI lights.

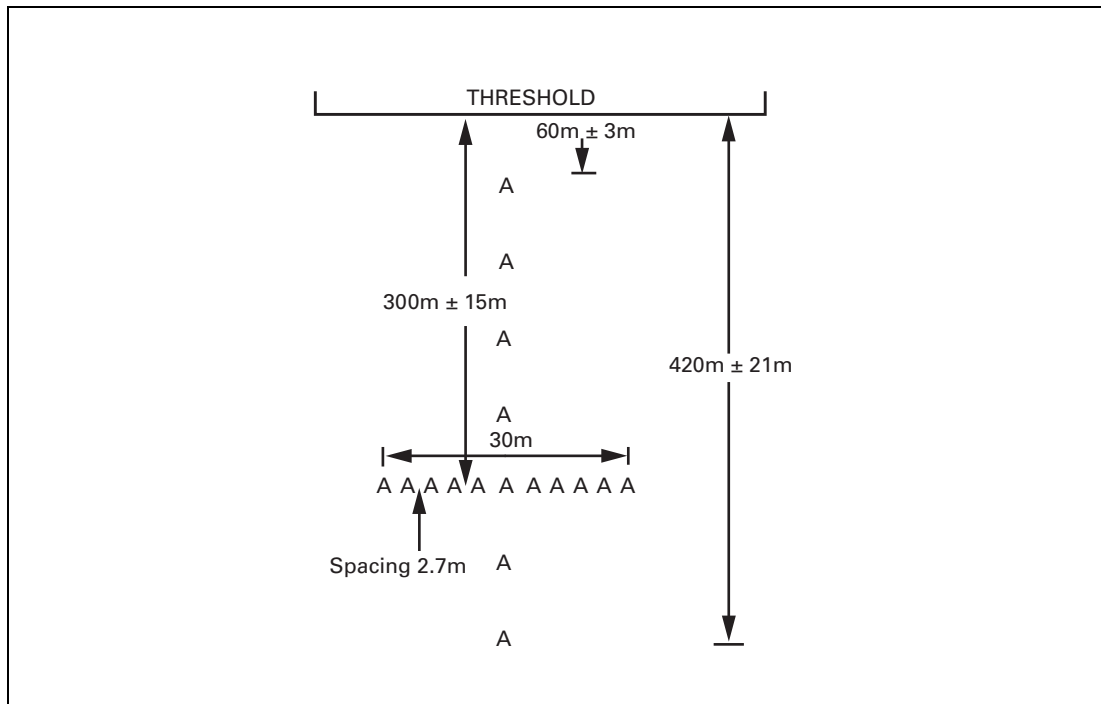


Figure 6.3 Simple approach lighting system

- 3.4.2 A high intensity system should have five stages of luminous intensity (see paragraph 9).
- 3.4.3 Sequenced capacitor discharge (strobe) approach lighting is an alternative means of providing simple approach and circling guidance lighting. This system should consist of seven omnidirectional strobe lights, five of them located on the extended runway centreline and the other two at the runway threshold as shown in Figure 6.4. The light performance requirements are given in Table 6A.1.

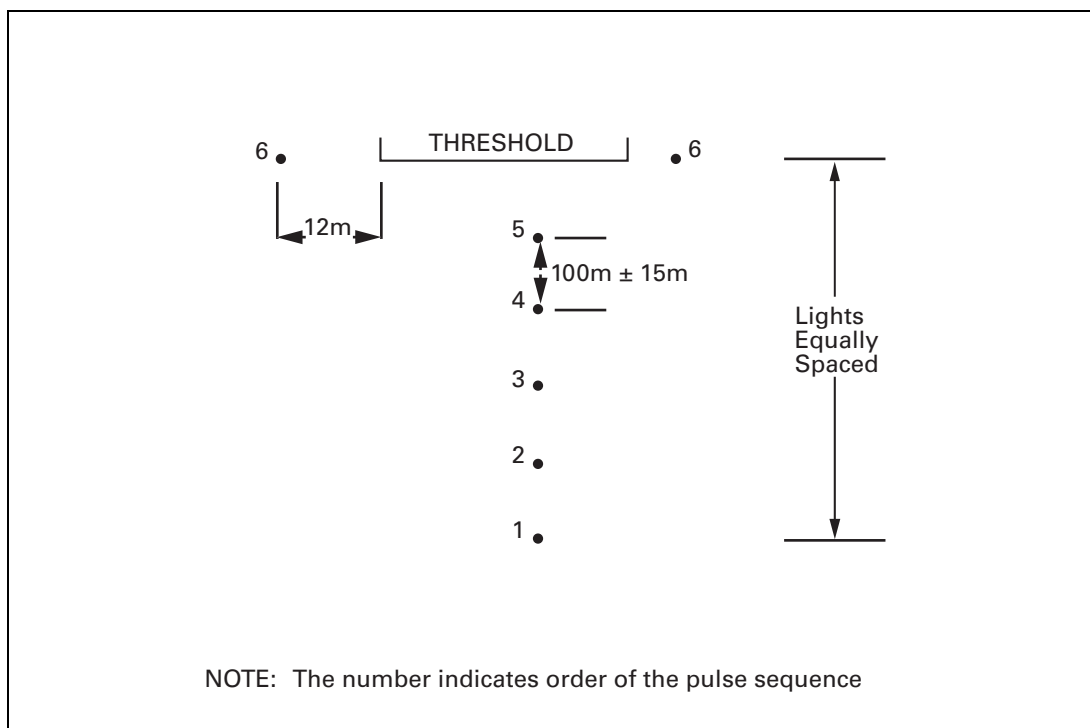


Figure 6.4 Sequenced strobe approach lighting

3.4.4 The objective is to provide a continuous ripple along the length of the extended centreline. The duration of each discharge should not exceed 200 milliseconds and the next discharge in sequence should commence within 1.2 second of the initiation of the previous discharge. Adjustment to the discharge duration and trigger rate should be made in order to achieve the optimum ripple effect without any breaks.

3.4.5 The strobe approach lights shall be independently switched from the rest of the AGL.

3.5 Approach lighting profile and obstacle protection

3.5.1 Ideally, all the approach lights should lie in a horizontal plane at the same level as the runway threshold. However, this is seldom achievable because of terrain undulations or obstacles in the approach area. The profile of the centreline lights should not exceed the limits shown at Figure 6.5. The lateral gradient of the lights in each crossbar should not be greater than 1:80 with the mid-point in the plane of the centreline lights. Excessive gradients may cause misleading perspective and height cues, and changes of gradient within the length of the system may result in an uneven sequence of the lights when seen from the approach. To keep these effects to a minimum successive changes in profile gradients should be as few as possible and not exceed 1:60.

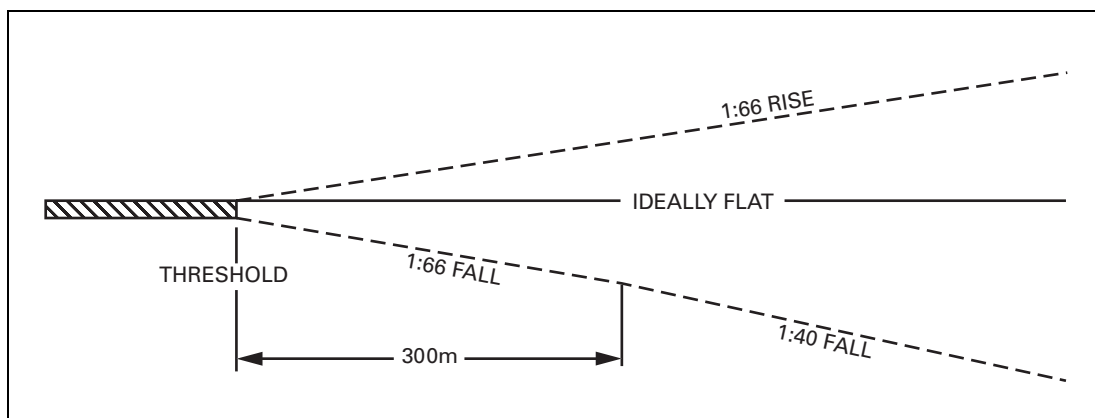


Figure 6.5 Approach light centreline profile limits

- 3.5.2 An approach light plane is established to ensure that objects do not obscure or distort the lighting pattern observed from an aircraft on the approach. The plane, or more commonly a series of planes, contains the lights comprising the system and extends from the threshold to 1.5 times the length of the installation at a width of 120 m equally disposed about the extended centreline of the runway. Beyond the outer end of the approach lights the gradient of the plane contains the threshold and the outermost lights.

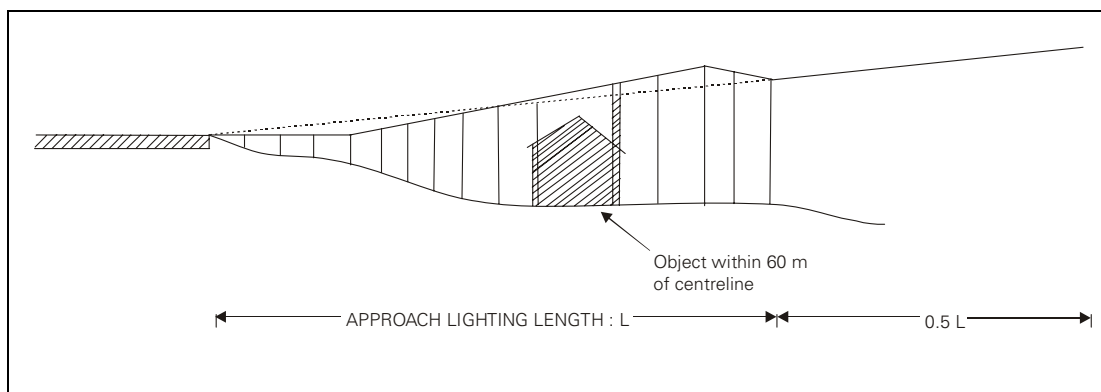


Figure 6.6 Approach light plane

3.6 Circling guidance lighting

- 3.6.1 Circling guidance lighting should be provided where visual approaches to the aerodrome or flying training takes place at night. It should also be provided in special circumstances; e.g. where obstacles affect visual manoeuvring, in which case high intensity lighting may be specified if a daylight capability is necessary. The omnidirectional component of runway edge lights will normally provide sufficient orientation to a pilot flying in the aerodrome circuit (see paragraph 5.4.2). If the presence of such a component is insufficiently conspicuous, guidance should be provided by any of the following systems:

- separate lights adjacent to the runway;
- omnidirectional red low intensity approach lights;
- omnidirectional white sequenced strobe approach lighting; or
- runway alignment beacons, flashing white or red on the runway extended centreline.

4 Approach Slope Indicators

4.1 General

- 4.1.1 Approach slope indicators provide flightcrew with information on the achieved approach angle, as well as giving clearance over approach obstacles.
- 4.1.2 The basic system is the Precision Approach Path Indicator (PAPI). In certain circumstances (see Table 6.1), less than the full system may be provided. These abbreviated systems are prefixed 'A'. The units are normally installed on the left hand side of the runway, viewed from the approach, a right hand installation is permitted if it is not practicable to position them on the left or if a second set is required. Details of the installation criteria for (A)PAPI and its required setting angles, are given in Appendix 6B.

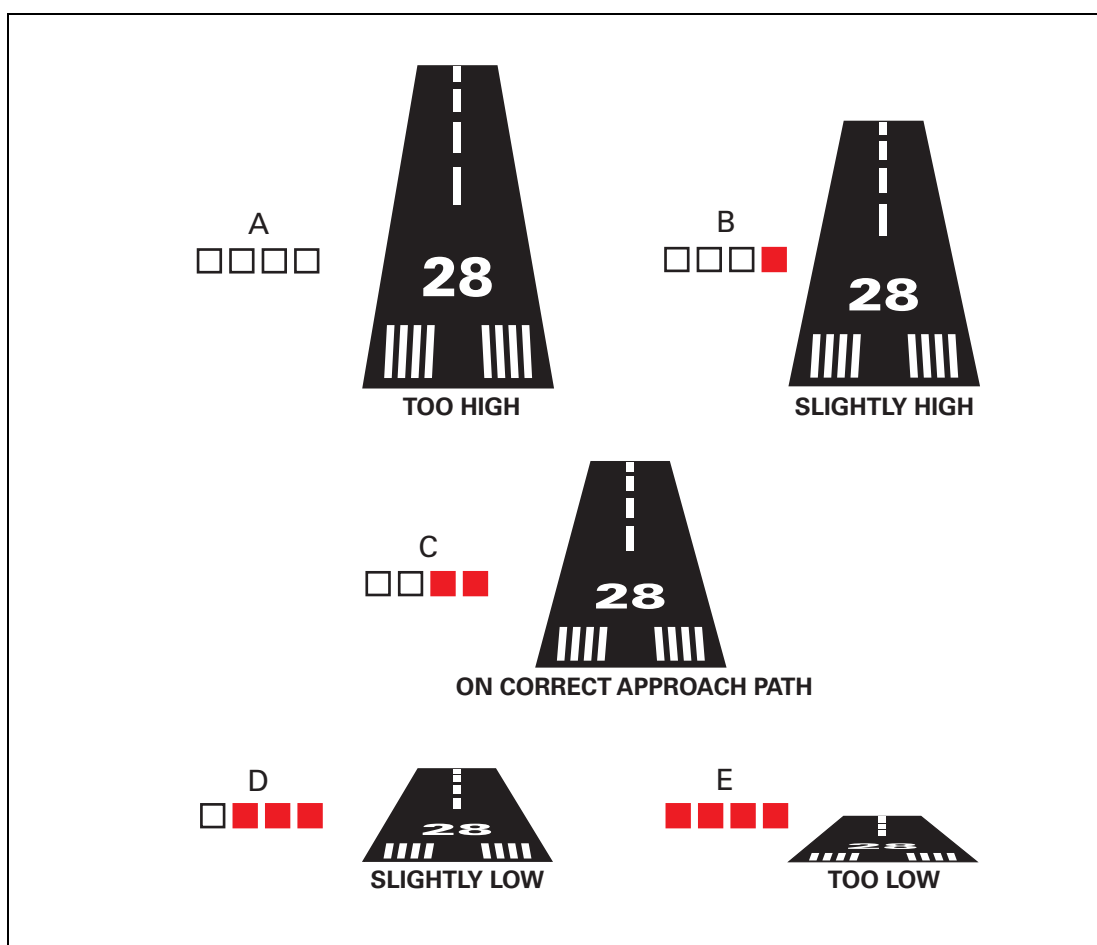


Figure 6.7 Typical PAPI System

- 4.1.3 The units direct a beam of light, red in the lower half and white in the upper, towards the approach. They are set at different elevation angles so as to give a combination of red and white for an on-slope signal, all-red if the aircraft is too low, and all-white if it is too high (see Figure 6.7). A transition zone will be perceived between the red and white sectors of each unit. PAPI units have a perceived transition of approximately three minutes of arc and are known as sharp transition units.
- 4.1.4 The siting and elevation settings of approach slope indicators installed on runways served by ILS should be such that the visual approach slope conforms as closely as possible to the ILS glidepath.

- 4.1.5 Systems required for day and night use should consist of high intensity units with a luminous intensity control.
- 4.1.6 The CAA should be consulted before any approach slope indicator is installed or repositioned. The following information should be provided:
- a) the number and type of units, their proposed location and angular settings;
 - b) any difference in elevation between the runway threshold and the proposed sites of the individual units, enabling siting adjustments to be made for any longitudinal or transverse slope, see Figure 6B.2; and
 - c) either a survey of the obstacle clearance surface shown at Figures 6B.1 or 6B.3, as appropriate, or other evidence that the surface is not infringed by any object.

4.2 **Precision Approach Path Indicator (PAPI)**

- 4.2.1 PAPI consists of four sharp transition units located as a wingbar, preferably on the left side of the runway. If roll guidance is required and is not provided by other visual means, four units should be positioned on each side of the runway so that the wingbars appear opposite each other. Siting data are contained in Appendix 6B, together with information on elevation setting angles.
- 4.2.2 Each unit provides discrete information. Two factors important to the reliability of the system are therefore the number of lamps per unit and the knowledge that the lamps are working when required. Units should have two or more lamps, and the lamps may if convenient, be interleaved. In this case the interleaving should be between lamps and not luminaires (see paragraph 13.3.1). PAPI installations should be equipped with a monitoring system which will detect lamp failure so that flightcrew may be advised and the failure investigated and remedied without delay.
- 4.2.3 Lenses must be kept clean to produce a usable signal. In certain meteorological conditions condensation may form on either side of the lenses when the units are not in use. This will degrade and distort the signal to an unacceptable extent for some time after the system is switched on. The problem can be overcome either by running the lamps at very low power while the unit is not in use, or by operating low powered heaters fitted to the units. Where neither of these provisions is made, the units should be selected to full luminous intensity for at least 15 minutes, or such other period recommended by the units' manufacturer, before they are required for use. More detailed guidance is at paragraph 12.4.1.

4.3 **APAPI**

- 4.3.1 APAPI consists of two sharp transition units located as a wingbar, preferably on the left side of the runway. A high intensity system should be used for Scale L3. That for Scale L4 may be high or low intensity. Low intensity units are of limited use by day, having a range of about 3 km. Each unit should have at least two lamps. Siting data and information on setting angles are contained in Appendix 6B.
- 4.3.2 APAPI systems are not suitable for approach paths in excess of 4 degrees in elevation and for public transport passenger jet operations (see Table 6.1).

4.4 **Luminous intensity control requirements for approach slope indicators**

- 4.4.1 PAPI, and high intensity APAPI should have at least five luminous intensity stages: 100%, 30%, 10%, 3% and 1%.
- 4.4.2 An additional 80% stage may be added to conserve lamp life if the manufacturer so advises. An 80% setting is normally adequate for daylight use except when approaches are made towards a low sun.

4.4.3 A luminous intensity control is not essential for low intensity systems, but at least two stages (100% and 30%) are desirable since the units are often considerably brighter than the runway edge lights. This applies particularly to PAPI/APAPI at low intensity where a further 10% stage is advisable in most cases.

4.4.4 Luminous intensity control is described more fully at paragraph 9.

4.5 **Unserviceability of (A)PAPI systems**

4.5.1 PAPI and APAPI installations should be withdrawn from service if one unit is found to be unserviceable, except where installations are on both sides of the runway, in which case only the affected side should be withdrawn. However when PAPI is installed for scales L3 and L4 and either of the outside units become unserviceable, the two central units may be used temporarily as an APAPI without altering the setting angles. See paragraph 12.4.2.

5 **Runway and Stopway Lighting**

5.1 Runway threshold, end and edge lighting are intended to define the usable extent of the runway – not the declared distances. For low visibility operations centreline lighting is added in order to provide alignment and some distance-to-go information by colour coding; touchdown zone lighting is added in order to improve texture and perspective and to give flightcrew an indication of the area within which a baulked landing must be initiated if it is to be contained within the OFZ. Stopway lights delineate the stopway. The cabling for these lights should be buried.

5.2 The characteristics of the lights, including height limits, are detailed at Appendix 6A, and layouts are shown at Figures 6.8 and 6.9. Setting angles are given in Table 6A.1, Table 6A.2, Note 3 and Figures 6A.3 to 6A.10.

5.3 High intensity lights should have five luminous intensity stages (see paragraph 9). Low intensity lighting needs only one setting.

5.4 **Runway edge lighting**

5.4.1 Runway edge lights consist of two parallel rows of lights equidistant from the runway centreline. They should be located along the edges of the area declared for use as the runway. A licensee seeking a variation to this requirement will need the approval of the CAA; this should be sought before proceeding with any planning or other work.

5.4.2 On runways of up to 50 m in width, the longitudinal spacing of the lights should be 60 m \pm 6 m. Where the width of the runway exceeds 50 m, a closer longitudinal spacing as determined by the CAA may be required dependent upon the nature of operations and other visual aids serving the runway. The lights on opposite sides of the runway should be on lines at right angles to the centreline, as shown at Figure 6.8. Where uni or bidirectional light units are used at aerodromes and visual approaches to the airfield or flying training take place at night, an omnidirectional light should be provided at each alternate position in order to provide circling guidance (ref paragraph 3.6.1).

5.4.3 Runway edge lights should be white except in the following instances:

- a) On a precision approach runway without centreline lighting, yellow lights should be installed on the upwind 600 m or one third of the lighted runway length available, whichever is the less. This section is known as the yellow caution zone, and gives visual warning of approaching the runway end.
- b) Where a threshold is displaced, the lights between the beginning of the runway and the displaced threshold should show red in the approach direction.

- c) One or two omnidirectional blue lights may replace or supplement the edge lights to indicate an exit taxiway.

5.4.4 Scale L4 lighting may comprise fixed or portable lights. The location of portable lights should be marked permanently. The power for electric edge lights should be provided preferably by mains or locally-generated electricity, but battery powered lights are acceptable provided that the battery lives are adequate for the duration of night flying operations. Gooseneck paraffin flares are acceptable as edge lights subject to the proviso of Table 6.1, Note 3, but electric lighting should be used in such a pattern for the threshold and runway end.

5.5 **Runway threshold and runway end lights**

5.5.1 Runway threshold lights are green and indicate the start of the available landing distance. Runway end lights are red and delineate the extremity of the runway that is available for manoeuvring – not the declared distances. The characteristics of these lights are detailed in Appendix 6A.

5.5.2 Figure 6.9 shows the layouts permitted according to circumstances.

5.5.3 Threshold wingbars should be provided for Scales L1 and L2, and for other Scales where the threshold is displaced. They are recommended for Scale L3 and L4 in the interests of added conspicuity.

5.5.4 Threshold lights should have luminous intensity compatible with that of the runway edge lights (see paragraph 9).

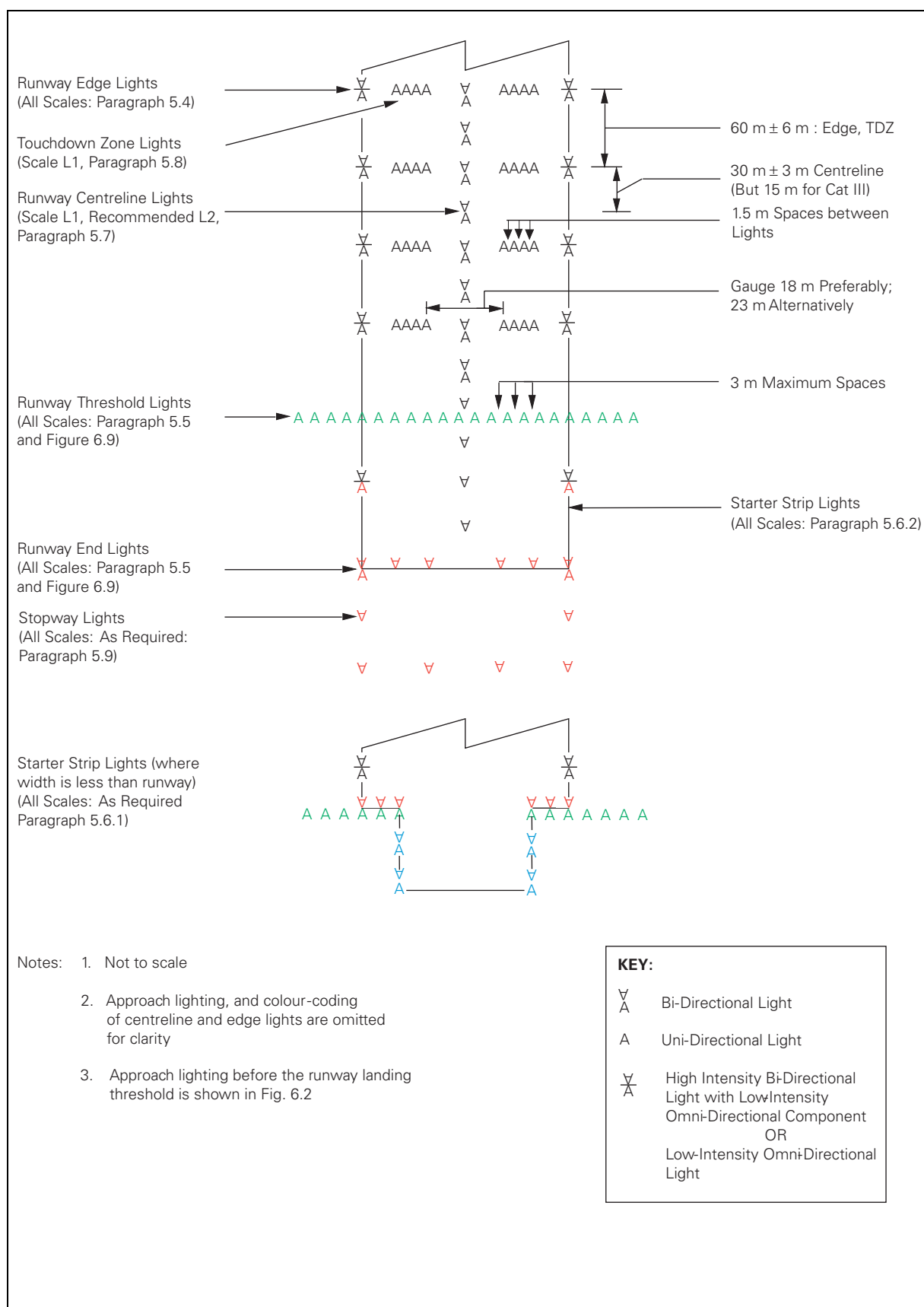


Figure 6.8 Runway lighting

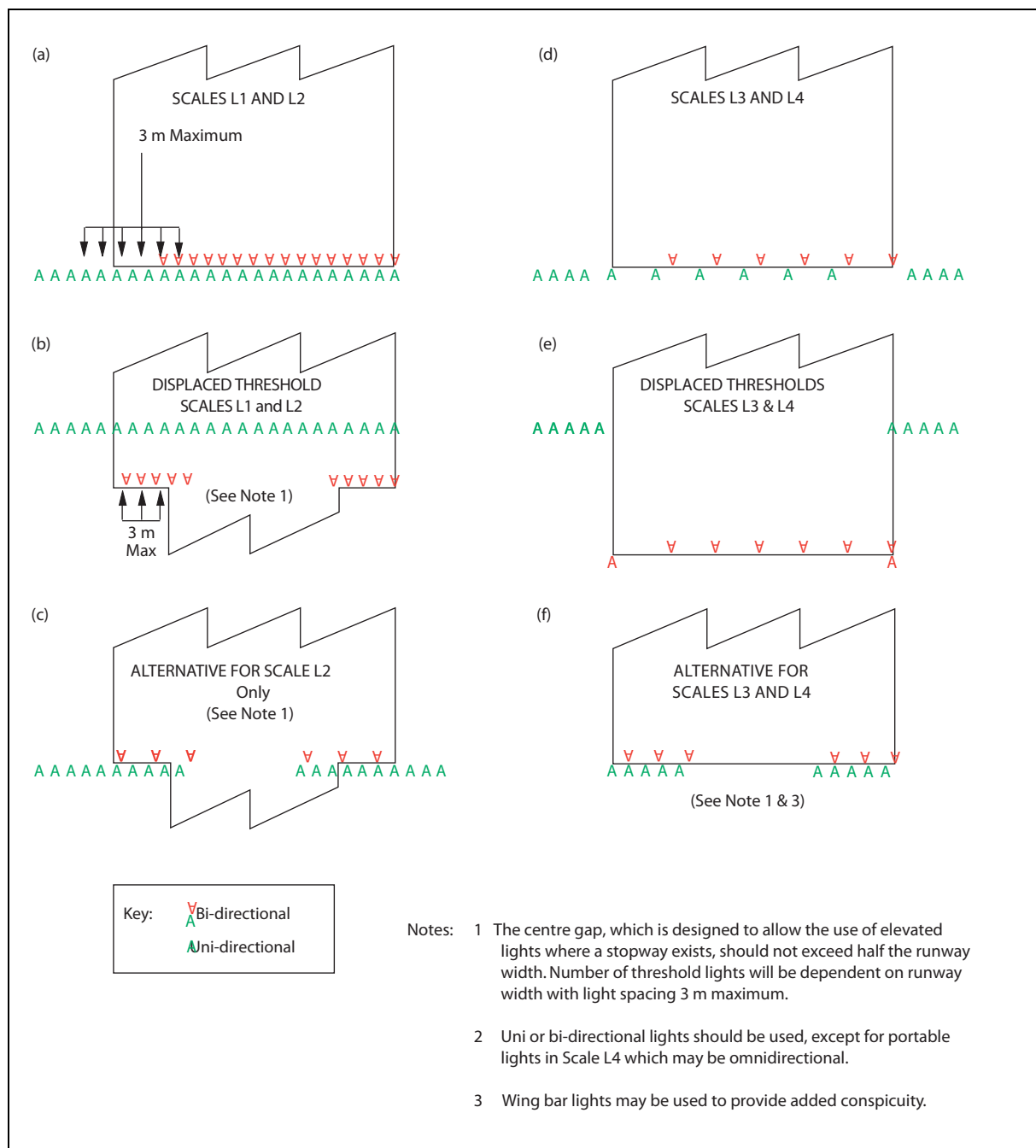


Figure 6.9 Runway threshold and runway end lighting

5.6 Starter Extension Lighting

- 5.6.1 A starter extension which is narrower than its associated runway should have blue edge lighting as described in paragraph 6.1.1.
- 5.6.2 A starter extension of the same width as its associated runway should have edge lighting showing red on approach and white in the opposite direction with longitudinal spacing as for the runway edge lights.

5.7 Runway centreline lights

- 5.7.1 White runway centreline lights are required for take-off in RVR below 400 m and for Precision Approach Runways Category II and III. They extend to 900 m from the upwind runway end, then the following 600 m should be alternate white and red

lights, and the final 300 m all red lights. The circuits for the white and red lights should be arranged so as to preserve the colour coding in the event of a circuit failure. The spacing between centreline lights should be 30 m except that for Category III operations and for take-off in RVR below 400 m the spacing should be 15 m. The layout of runway centreline lights is illustrated at Figure 6.8.

- 5.7.2 For Category II operations centreline lights with characteristics meeting the requirements in Table 6A.2 should be set to give maximum luminous intensity at 3° above the horizontal. For Category III operations using adapted Category II lighting, the first 900 m of runway centreline lights should be set at 5.5° with the remainder at the normal 3°. Newly constructed or re-equipped runways for Category III operations should have centreline lighting with the characteristics specified in Figure 6A.6 or 6A.7 as appropriate.

5.8 Touchdown zone lights (TDZ)

- 5.8.1 Touchdown zone barrettes symmetrically disposed either side of the runway centreline should extend from the threshold for a distance of 900 m or to the midpoint of the runway, whichever is less. Each barrette has four white lights spaced not more than 1.5 m apart, the innermost lights being not less than 9 m nor more than 11.5 m either side of the centreline. The longitudinal spacing between barrettes should be 60 m \pm 6 m. The lateral gauge of the barrettes should be equal to that of the Supplementary Approach lighting red side row barrettes described at paragraph 3.3.1 b). The layout of the touchdown zone lights is illustrated in Figure 6.8.
- 5.8.2 A setting angle of 3° should be used for Category II operations. For Category III operations using Category II lighting, the TDZ lights should be set to give their maximum luminous intensity at 5.5° above the horizontal. Newly constructed or re-equipped runways for Category III operations, should have TDZ lighting with the characteristics specified in Figure 6A.5.

5.9 Rapid Exit Taxiway Indicator Lights

- 5.9.1 The purpose of rapid exit taxiway indicator lights (RETILs) is to provide pilots with distance to go information to the nearest rapid exit taxiway on the runway, to enhance situational awareness in low visibility conditions and enable pilots to apply braking action for more efficient roll-out and runway exit speeds. It is essential that pilots operating at aerodromes with runways displaying RETILs be familiar with the purpose of these lights.
- 5.9.2 RETILs may be considered for all runways, but their use is enhanced on runways used in RVR less than 400 m and/or where the traffic density is heavy.
- 5.9.3 RETILs should be located on the runway on the same side of the runway centreline as the associated rapid exit taxiway, in the configuration shown in Fig 6.10. In each set the lights should be located 2 m apart and the light nearest the runway centreline shall be displaced 2 m from the runway centreline.
- 5.9.4 Where more than one rapid exit taxiway exists on a runway, the set of RETILs for each exit should not overlap when displayed.
- 5.9.5 RETILs shall be fixed unidirectional yellow lights, aligned so as to be visible to the pilot of a landing aeroplane in the direction of approach to the runway, and in accordance with the specifications given in Figure 6A.7.
- 5.9.6 RETILs should not be displayed in the event of any lamp failure or other failure that prevents the display of the light pattern depicted in Figure 6.10 in full.

- 5.9.7 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.

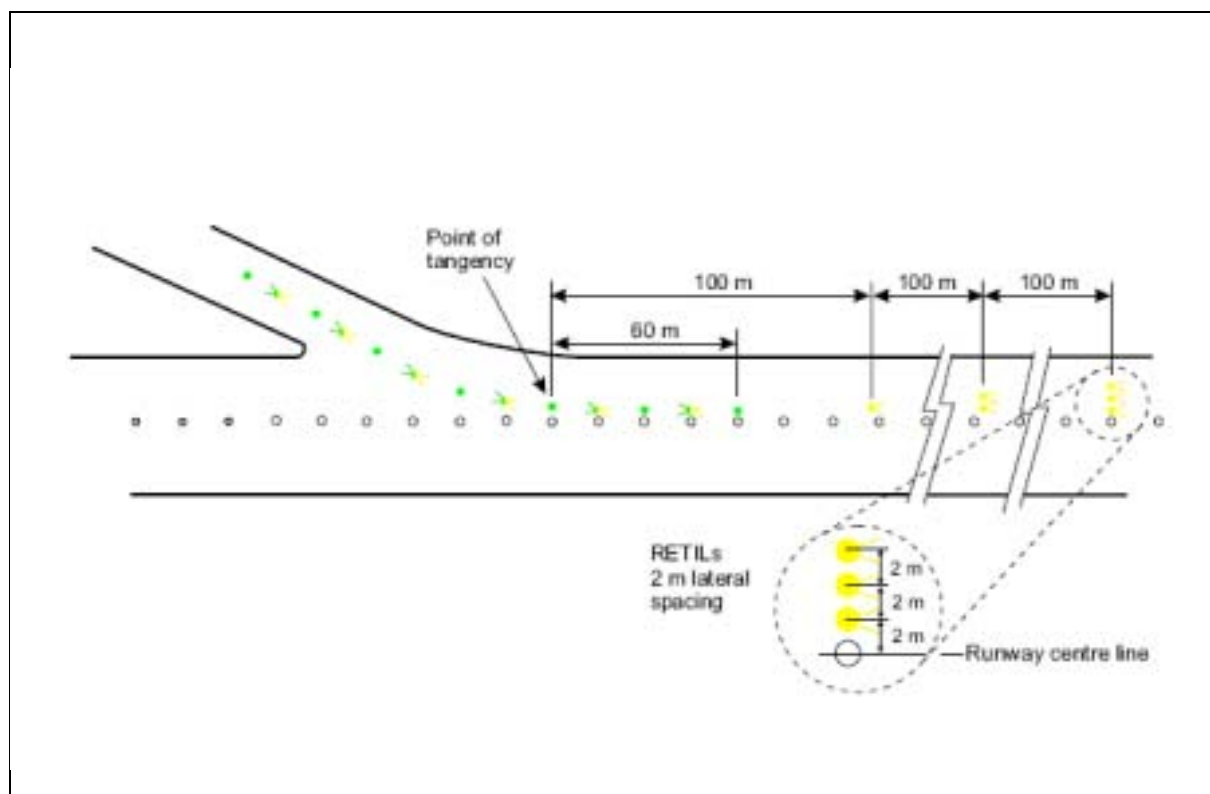


Figure 6.10 Rapid Exit Taxiway Indicator Lights

5.10 Runway Turn Pad Lighting

- 5.10.1 Runway turn pad lights should be provided for continuous guidance on a runway turn pad intended for use at night and in RVR conditions less than 400 m, to enable an aeroplane to complete a 180° turn and align with the runway centreline.
- 5.10.2 Runway turn pad lights should normally be located on the runway turn pad marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.
- 5.10.3 Runway turn pad lights on a straight section of the turn pad marking should be spaced at intervals of not more than 15 m, whilst the spacing for lights on the curved sections of the turn pad should not exceed 7.5 m.
- 5.10.4 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 turn pad. The characteristics of runway turn pad lights are given in Figures 6A.12, 6A.13 and 6A.14.
- 5.10.5 Taxiway edge lights on a runway turn pad should be placed at uniform longitudinal intervals not exceeding 30 m.

5.11 Stopway lights

- 5.11.1 The end of any stopway associated with a runway used at night should be marked with four unidirectional red lights equally spaced across the width of the stopway. The edges of the stopway should be marked by pairs of similar red lights at a uniform spacing not exceeding 60 m. The layout is illustrated in Figure 6.8.

6 Taxiway Lighting

6.1 Taxiway edge lighting

- 6.1.1 Blue lighting is used to indicate the edge of a taxiway and should be installed on paved taxiways where centreline lighting is not provided. However, retroreflective edge markers may be used instead of edge lights for Scale L4 (see paragraph 6.8). The lights should be placed in pairs one on each side of the taxiway on lines at right angles to the centre line except at junctions. The spacing of the lights on straight sections and curves of radius 150 m or greater serving runways with Scale L2 lighting should not exceed 30 m. On taxiways serving runways with Scale L3 and L4 lighting, the spacing should not exceed 60 m but should preferably be no greater than 45 m. On curves of radius less than 150 m, the lights should be located on radii passing through points on the taxiway centreline spaced at one fifth the radius of the curve of the centreline. On small fillets less than 15 m radius at the taxiway edge a minimum spacing of 3 m should be used.
- 6.1.2 Taxiway edge lighting may be used to augment centreline lighting where aircraft are required to negotiate difficult curves.
- 6.1.3 The edges of turning and holding areas should be marked with blue lights, in accordance with the specifications given in paragraph 6.1.1.
- 6.1.4 The characteristics of elevated taxiway edge lights are given at Table 6A.1.

6.2 Taxiway centreline lighting

- 6.2.1 Green taxiway centreline lights are used to provide centreline guidance on taxiways and aprons and when entering or vacating a runway. The characteristics of centreline lights required for day/night use in RVR's of less than 400 m are given at Figures 6A.12 to 6A.14. A three stage luminance intensity control should be provided (see paragraph 9). Low intensity centreline lights are suitable for night use only and are not intended to support operations in RVR's of less than 400 m; their characteristics are given in Figures 6A.15 and 6A.16. Where occasional take-off movements take place in RVR's less than 400 m, taxiway edge lighting supplemented by centreline marking may exceptionally be approved by the CAA.
- 6.2.2 The effectiveness of taxiway centreline lights is dependent upon the slant visibility from the cockpit, the distance between successive lights and their luminous intensity. Therefore, the light spacing should be designed to correspond with the minimum RVR in which operations are intended as given in Table 6.2:

Table 6.2 Taxiway Centreline Light Spacing

Taxiway	Minimum RVR	
	<200 m	≥200 m
Straight	15 m	30 m
Curved	7.5 m	15 m

NOTE: Spacing may be reduced by up to 10% to facilitate pavement design.

For operations in RVR less than 200 m the reduced spacing for curved sections should extend 60 m before the start and 60 m beyond the end of the curves; for operations in RVR of 200 m or greater this distance is reduced to 30 m.

- 6.2.3 On runways equipped with ILS, taxiway centreline lights located within the ILS critical/sensitive area or the OFZ should be colour coded to show alternate green/yellow in both directions. The colour coding should commence with a green light close to the runway centreline and end with a yellow light at the perimeter of the ILS critical/sensitive area or the lower edge of the side surface of the OFZ, whichever is the farther from the runway. At rapid exit taxiways the lead-off lights should commence adjacent to the runway centreline at least 60 m before the intersection with the exit taxiway curvature. At all other taxiway/runway intersections the lead-off lights should commence at least 30 m before the intersection. The section of lighting running parallel to the runway centreline should be offset transversely by 75 cms \pm 15 cms.

6.3 **Stop-bars**

- 6.3.1 Stop-bars are intended to help protect the runway against inadvertent incursions. A stop-bar consists of a single row of flush or semi flush inset lights installed laterally across a taxiway showing red towards the intended direction of approach.
- 6.3.2 Stop-bars should be provided at all Runway Taxi-Holding Positions and Intermediate Taxi-Holding Positions intended for use in RVR conditions less than 800 m unless procedures have been agreed with the CAA to limit the number of aircraft either on the manoeuvring area or on final approach within 5 nm to one at any given time.
- 6.3.3 Stop-bars installed at taxiway/runway intersection should be unidirectional and show red towards the direction of approach to the runway. Stop-bars installed at Intermediate Taxi-Holding Positions may be bi-directional where the holding position is intended for use in each direction. Stop-bars installed at Runway Taxi-Holding Positions and Intermediate Taxi-Holding Positions should be independently switchable; all other stop-bars protecting the runway as described in Appendix 2B should be permanently illuminated during Low Visibility Operations.
- 6.3.4 An independently switchable stop-bar should consist of a stop-bar interlocked with a section of taxiway centreline lead-on lighting beyond the stop-bar. The section of interlocked taxiway centreline lead-on lighting should, wherever practicable, be at least 90 m in length. The interlock should be designed to meet the requirements at paragraph 12.3.1.
- 6.3.5 The light fittings making up a stop-bar shall be spaced equally across the taxiway in a line at right angles to the taxiway centreline at intervals of no greater than 3 m. They should be positioned co-incident with any associated taxiway holding position marking so as not to obscure or interfere with the integrity of the marking. The outer lights of the stop-bar should be located on the edges of the taxiway. However, at holding positions where a flightcrew's view of the stop-bar might be obscured, the stop-bar should be extended beyond the edge of the taxiway by the addition of four omni-directional elevated lights, two placed on each side of the taxiway along the stop-bar axis at intervals equal to the spacing of other lights making up the stop-bar. Stop-bars installed at taxiway/runway intersections not used in Low Visibility Operations in order to protect the runway against inadvertent incursions should be located no closer to the runway than the distances laid down at Chapter 3 Table 3.3.
- 6.3.6 The characteristics of lights, including elevated side lights used in stop-bars are given in Figures 6A.12 to 6A.16.

6.4 **Taxiway guidance and control systems**

- 6.4.1 At aerodromes where operations take place in RVR less than 400 m or where ground movement requirements are complex, a taxiway guidance and control system should be installed, except where aircraft movements are limited in accordance with the

procedure outlined at paragraph 6.3.2. The system should operate by selective switching of the taxiway centreline lights so that individual sections or routes are illuminated, each terminating at a lighted stop-bar.

6.5 **Runway Guard Lights**

- 6.5.1 Runway Guard Lights are a visual aid intended to caution flightcrews or vehicle drivers that they are about to enter an active runway. Runway Guard Lights should be provided on all taxiways/runway intersections associated with a runway intended for use in RVR less than 1200 m. The system consists of two units, one located on each side of the taxiway at the distance given in paragraph 6.5.2. Each unit comprises a pair of alternately illuminating yellow lamps which operate at between 30 and 60 cycles per minute, with periods of light illumination and suppression equal and opposite in each case. The lights should be in operation whenever the RVR is less than 1200 m and be switched independently of any stop-bar lights.
- 6.5.2 Runway Guard Lights should not exceed 36 cms in height. They should be located on each side of the taxiway as close as possible to the pavement edge and adjacent to the visual runway holding point, normally the Runway Taxi-Holding Position closest to the runway.

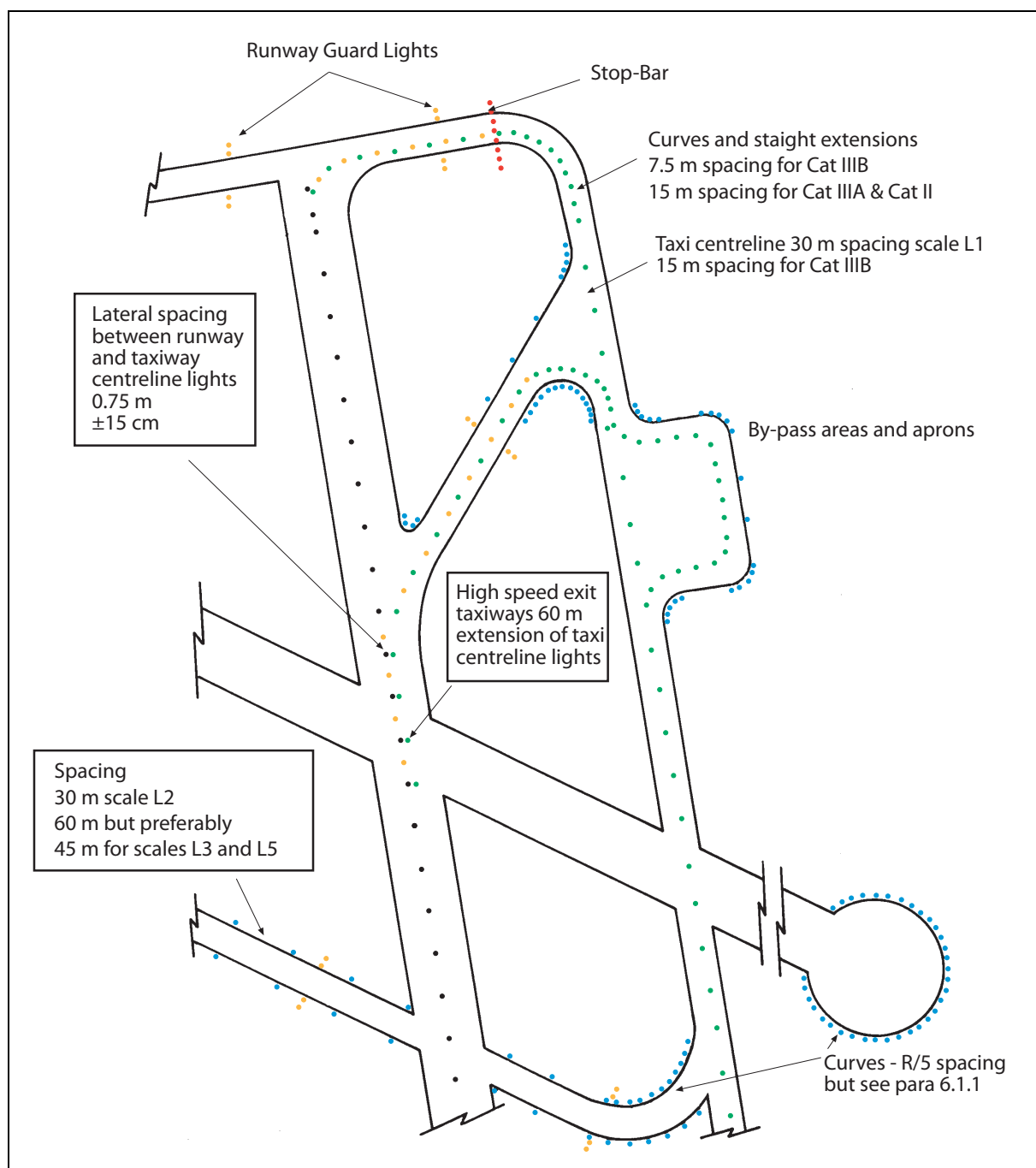


Figure 6.11 Taxiway lighting

- 6.5.3 Where runway guard lights are operated in good visibility conditions at night, the luminous intensity may be reduced to 30% but the signal characteristics specified in paragraph 6.5.1 must be retained.
- 6.5.4 On wide throat taxiways used in low visibility conditions when enhanced conspicuity of the taxiway/runway intersection is required, an alternative form of runway guard light may be used. This consists of a row of inset lights spaced at 3 m intervals across the taxiway at the distance from the runway centreline specified in paragraph 6.5.2 above. The lights should have the characteristics described at paragraph 6.5.1 above but adjacent lights should be alternately illuminated and alternate lights should be illuminated in unison. This alternative form of Runway Guard Light should not be co-located with a stop-bar.

6.6 Road-holding Position Lights

- 6.6.1 Road-holding position lights should be provided at the intersection of all roads with runways and taxiways used in visibility less than 1200 m except apron taxiways where the road is provided with the appropriate road markings and signs detailed in Chapter 7. The lights should be located 1.5 m from the edge of the left side of the road and adjacent to the road holding position marking and sign described in Chapter 7.
- 6.6.2 The road-holding position light should consist of either:
- a) a red/green traffic light where a controlled crossing exists, or
 - b) a flashing amber light or an amber light system meeting the characteristics of Runway Guard Lights at a point where caution should be exercised.
- 6.6.3 Road-holding position lights should always be accompanied by a road-holding position sign such as that illustrated at Figure 7.37 and, where appropriate, an instruction or cautionary notice.

6.7 Signs

- 6.7.1 The requirements for the lighting of signs are detailed at Chapter 7.

6.8 Retroflective Taxiway Edge Markers and Centreline Studs

- 6.8.1 Retroflective edge markers or centreline studs either together or separately may be used instead of taxiway edge lights for Scale L4 and, if agreed by the CAA, on other taxiways that are used infrequently. Edge markers should not exceed 36 cm in height. Centreline studs should not exceed 2.5 cm in height.
- 6.8.2 Edge markers should have a minimum viewing area of 150 sq cms and be blue in colour; centreline studs should be green, and have a minimum viewing area of 20 sq cms.

6.9 Unpaved taxiway routes

- 6.9.1 If taxiing is confined to specific routes but the taxiway is not paved, the routes should be either edged with blue portable lights spaced not more than 60 m apart and laid out as for normal taxiway edge lighting, or marked with taxiway edge markers, spaced not more than 30 m apart. At the discretion of the CAA, apron flood-lighting may be accepted as sufficient illumination of taxiways in the vicinity of the apron.

6.10 Aerodromes without specific taxiway routes

- 6.10.1 Where specific taxiway routes are not provided on grass aerodromes, the lighting requirement may be met by white lights marking the boundary of the manoeuvring area. The lights should be spaced not more than 90 m apart and emit a minimum of 10 candelas.

7 Apron Lighting and Visual Docking Guidance Systems

7.1 Apron lighting

- 7.1.1 The edges of aprons should be marked with blue lights in accordance with the specifications given in paragraph 6.1.1. Retroflective edge markers may be used in place of blue edge lights where the CAA is satisfied that safety will not be compromised.
- 7.1.2 Apron floodlights should be located so as to provide adequate illumination on all apron areas, with a minimum of glare to pilots of aircraft in flight and on the ground,

aerodrome and apron controllers, and personnel on the apron. The arrangement and aiming of floodlights should be such that an aircraft stand receives light from two or more directions to minimize shadows.

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

7.1.3 The average illuminance should be at least the following:

Aircraft stand:

Horizontal illuminance 20 lux with a uniformity ratio (average to minimum) of not more than 4 to 1; and

Vertical illuminance 20 lux at a height of 2 m above the apron in relevant directions.

Other apron areas:

Horizontal illuminance 50 per cent of the average illuminance on the aircraft stands with a uniformity ratio (average to minimum) of not more than 4 to 1.

7.2 **Visual docking guidance systems (VDGS)**

7.2.1 A VDGS providing both azimuth and stopping guidance should be installed when it is necessary to indicate by a visual aid, the precise positioning of an aircraft on a stand.

7.2.2 Where all aircraft parking positions on an apron are provided with VDGS, and the CAA is satisfied that safety will not be compromised, the requirements of paragraph 7.1.1 may be waived.

7.2.3 A description of VDGS in common use in the UK is given in CAP 637.

7.2.4 VDGS should meet the requirements specified in ICAO Annex 14. Aerodromes should replace existing VDGS with ICAO compliant systems as soon as practicable, and when refurbishment or development of stands is undertaken.

8 Obstacle Lighting

8.1 Details of this lighting are given in Chapter 4, paragraph 12.

9 Control of AGL Luminous Intensity

9.1 AGL incorporating high intensity lights may be used in varying visibility and ambient lighting conditions. In certain conditions inset supplementary approach lighting at displaced thresholds and touchdown zone lighting at higher luminous intensity settings can cause unacceptable levels of glare to flightcrew lining up for take-off. The final choice of AGL luminous intensity setting rests with the flightcrew; therefore, except for obstacle lighting the luminous intensity of AGL that has an output of more than 150 candelas directed towards an approaching aircraft should be individually and independently controllable in accordance with the luminous intensity stages detailed in Table 6.3.

Table 6.3 Luminous intensity control stages

Lighting	Stages	
	Minimum	Recommended
High intensity approach and runway systems, PAPI and High intensity APAPI, except for supplementary approach lighting in Scale L1	100%, 30%, 10%, 3%, 1% (see Note 1)	Additionally 0.3%
Supplementary approach	100%, 30%, 10%	
Taxiway centreline and stop bars	100%, 30% Additionally 10% for HI	
Low intensity systems and taxiway edge exceeding 5 candelas output	–	100%, 30% (see Note 2)

NOTES:

- 1 Unless the manufacturer recommends otherwise, an 80% PAPI and 30% APAPI luminous intensity may be used to increase lamp life.
- 2 An additional 10% setting for low intensity (A)PAPI is also advisable.

9.2 Typical luminous intensity settings

- 9.2.1 It is essential that the various services that make up the AGL present a well balanced and even pattern to flightcrew; hence the provision of an additional ability to select pre-set combinations of luminous intensity settings with one switch may be of benefit. Table 6.4 details typical combinations of AGL luminous intensity settings. The luminous intensity settings outlined at Table 6.4 provide guidance on the typical settings required for various ambient light and weather conditions; however local operating requirements may dictate variations to the settings noted.
- 9.2.2 A luminous intensity control is not essential for low intensity systems, but at least two stages (100% and 30%) are desirable. An additional 10% stage is advisable for low intensity PAPI/APAPI systems.
- 9.2.3 The luminous intensity stages not only attempt to provide the most appropriate settings according to ambient light and visibility conditions but also take into account the different light outputs for each type of AGL. The optimum overall pattern for approach and runway lighting should be in the order of a 2:1 balance, which is reflected in the average light output requirements in candela of the lights (see Appendix 6A). It is therefore essential that the light output and alignment of every light is correct in order to achieve the optimum overall lighting pattern.

Table 6.4 Typical AGL Luminous Intensity Settings

	DAYLIGHT						DARKNESS				
	TWILIGHT										
Weather Conditions	A	B	C	D	A	B	A	B	C (Note 1)	D (Note 1)	Weather Conditions
High Intensity approach lighting	–	100%	100%	100%	10%	30%	1%	3%	10%	30%	A: Vis > 5000 m and cloud ceiling (cc) > 700 ft
Supplementary approach lighting	–	–	100%	100%	–	–	–	–	10%	30%	
Low intensity approach and runway lighting	–	–	–	–	–	–	100% (Note 2)	100%	–	–	
High intensity runway lighting:											
a) edge, threshold and end	–	100%	100%	100%	10%	30%	1%	3%	10%	30%	B: Vis 1500 m - 5000m or cc 200 – 700 ft
b) centreline	–	–	100%	100%	10%	30%	1%	3%	10%	30%	
c) TDZ	–	–	100%	100%	10%	30%	1% (Note 6)	3% (Note 6)	10%	30%	
HI Taxiway centreline and stop-bars	100% (Note 3)	100% (Note 3)	100%	100%	10%	30%	10%	10%	10%	30%	C: Vis 800 m – 1499 m or cc < 200 ft
LI Taxiway centreline and stop-bars	100% (Note 3)	100% (Note 3)	100%	100%	10%	30%	30%	30%	100%	100%	
Taxiway edge (Note 4)	–	–	100%	100%	10%	30%	30%	30%	30%	30%	D: RVR < 800 m
PAPI or APAPI	100% (Note 5)	100%	100%	100%	10%	30%	1%	3%	10%	30%	

Table 6.4 Cont'd**NOTES:**

- 1 Change setting at 600 m RVR when visibility is deteriorating and at 800 m RVR when visibility is improving. When the runway edge luminous intensity is set to less than 10% the IRVR system is unable to provide a reading. When the observed visibility deteriorates to less than 1500 m the runway edge lights should be set to 10% or greater.
 - 2 Low intensity may be used at 30% if conditions warrant; low intensity and high intensity may be used together or independently; high intensity should be at 3% except that where there is little or no extraneous lighting, it may be operated at 1% or 0.3% if available and conditions warrant.
 - 3 When used for taxiway guidance/control (stop-bars) system purposes, otherwise not required.
 - 4 Settings other than 100% should be used as indicated when available.
 - 5 80% may be used if available.
 - 6 Where required.
 - 7 Where Taxi Guidance Signs capable of being illuminated are installed, they should be lit at night and whenever the weather conditions are C or D during the day.
- 9.2.4 An IRVR system will not display a reading if the runway edge lighting luminous intensity is set to less than 10%; therefore when the observed visibility deteriorates to less than 1500 m the runway and approach lighting luminous intensity should be set to a minimum of 10%.
- 9.3 **Luminous intensity balance considerations for coloured lighting**
- 9.3.1 Colour filters reduce the light output. The best balance between coloured and white lights may be obtained by either of the following means:
- a) Separate electrical AGL circuits with luminous intensity controls for the different elements so that the green threshold and red runway end lighting may be selected at one or two steps higher than the white edge lighting.
 - b) Higher output lights or the use of increased wattage lamps in the existing lights for the coloured lighting. With this method the whole system can remain on a common AGL circuit, but care has to be exercised in order to ensure that the increased heat generated by higher wattage lamps does not damage the colour filters or aircraft tyres.

10 Alternate Input Power Supply for AGL Systems

- 10.1 At least one alternate input supply should be provided for Scales L1, L2 including internally lit mandatory signs where appropriate, and is recommended for other scales. Table 6.5 details the maximum time interval to be achieved between failure of the normal source of supply and the restoration of individual services (Maximum Switchover Time) when in the associated visibility conditions. A Maximum Switchover Time of one second can be achieved by automatic changeover either:
- a) between two incoming supplies and a closed ring system, or
 - b) between a diesel generating set supplying the load with reversion to the normal supply on failure of the generating set.

Maximum Switchover Time is the time required for the actual intensity of a light measured in a given direction to fall from 50% and recover to 50% during a power supply changeover, when the light is being operated at intensities of 25% or above.

- 10.2 Where the power supply to an aerodrome is provided by two separate grid sources, one of them may be considered as an alternate input power supply if common failure modes in addition to that expected with a grid and standby generator design do not exist and the simultaneous loss of both supplies can be shown to be only a remote possibility.
- 10.3 If no alternate power supply is available the aerodrome authorities should notify the effect by NOTAM. The NOTAM action should be taken by only one source on the aerodrome. ATS should notify flightcrew on initial RTF contact and by ATIS when possible. Flightcrews can then be expected to follow the appropriate instructions in their operations manual. There is no need to withdraw a system from service or to downgrade it arbitrarily unless the failed power source is not recovered within two hours.
- 10.4 If the unavailability of an alternate power supply exceeds a period of two hours, approaches should be restricted to non-precision status and take-offs limited to visual ranges greater than 400 m.
- 10.5 Refer to paragraph 12.5 for details of the routine checks that should be carried out on AGL input power supplies.
- 10.6 Where there is no alternate power supply to support lighting to Scale L3 and L4, portable emergency lighting should be available in sufficient numbers for the minimum runway lighting pattern to be provided in the event of an AGL input power failure.
- 10.7 Aerodrome authorities should put in place procedures that will ensure that emergency lighting provided in accordance with paragraph 10.6 will be in operation within 15 minutes of any loss of the input power supply.

Table 6.5 Alternate Power Supply – Maximum Switchover Time

Runway	Aids requiring power	Maximum Switchover Time
Precision approach Categories II and III (Scale L1)	Approach lighting	1 second
	Runway edge	15 seconds
	Runway threshold and end	1 second
	Runway centreline	1 second
	Runway touchdown zone	1 second
	All stop-bars for Category III	1 second
	Runway guard lights	1 second
	Category II stop-bars at taxi holding positions	1 second
	Other stop-bars	15 seconds
	Essential taxiway, mandatory signs	15 seconds
	Obstacle	15 seconds
	PAPI	15 seconds
Precision approach Category I (Scale L2)	Approach lighting	15 seconds
	Runway edge	15 seconds
	Runway threshold and end	15 seconds
	Essential taxiway lights and mandatory signs	15 seconds
	Obstacle	15 seconds
	PAPI	15 seconds
Non-precision approach (Scale L3)	Approach lighting	15 seconds
	Runway edge	15 seconds
	Runway threshold and end	15 seconds
	Obstacle	15 seconds
	PAPI and APAPI	15 seconds
Take-off runway intended for use in runway visual range conditions less than 800 m	Runway edge	15 seconds ¹
	Runway end	1 second
	Runway centreline (where fitted)	1 second
	All stop-bars	1 second
	Essential taxiway	15 seconds
	Obstacle	15 seconds

1. 1 second where no runway centreline lighting provided and when threshold and end lighting are on same circuit as edge lighting.

11 Control and Monitoring of Aeronautical Ground Lighting

11.1 General Requirements

- 11.1.1 At the majority of aerodromes the AGL should be controlled remotely from an Air Traffic Control (ATC) Visual Control Room (VCR). In such case, a remote monitoring

facility should also be provided in the VCR where an adequate assessment of the serviceability of the AGL cannot be made by other means.

- 11.1.2 In the absence of a VCR and/or remote control facilities, the AGL should be switched directly from its power source (in most cases the constant current regulator (CCR)). The AGL should be verified as operationally serviceable by means of a visual inspection and/or indications from the AGL equipment. Where operationally significant, this information should be notified immediately to the AGL operator and, where necessary, flightcrew.
- 11.1.3 The control of an AGL system from beyond the boundary of a licensed aerodrome will only be approved by the CAA for the sole use of the emergency services. Where this type of control is desired, an operational requirement proposed by the aerodrome authority and supported by the emergency services involved should be submitted in the first instance to the CAA.
- 11.1.4 When in use, the operational status of the AGL system should be continuously monitored. An appropriate means of detecting an AGL system failure or fault and other serviceability information should be provided. The AGL system serviceability information should be provided to the AGL operator in a simple but accurate and concise way, so that if necessary the user may pass a report to flightcrew. The report should enable flightcrew to determine whether the AGL meets their current operational flight requirements or not (see paragraph 11.3.5).
- 11.1.5 The design of the control and monitoring system should be kept as simple as possible. It should be ergonomically sound, easy to operate, simple to understand, unambiguous and it should be configured so as to prevent accidental mis-selection of the AGL. The remote control and monitoring facilities provided for ATC use shall be approved by the CAA under Article 100 of the ANO. Further guidance on the manner in which serviceability information may be presented in remote control facilities in ATC VCRs can be found in CAP 670, ATS Safety Requirements.
- 11.1.6 The complexity of the AGL control and monitoring system will depend upon the operational requirements of the aerodrome concerned. In many cases, the control facilities can be simple, requiring only hardwired switches and relays to meet the functional requirements of the AGL system. However, aerodromes with increasingly more complex taxiway routing systems and heavy volumes of traffic find that programmable electronic systems provide the capability and flexibility needed. Moreover, the gradual reduction in cost of programmable electronic systems may permit a better overall system to be installed to cater for routine maintenance and future modifications. The procedure for the approval of AGL systems by the CAA is contained in CAP 655, Aeronautical Ground Lighting.
- 11.1.7 The AGL control and monitoring system should:
- a) be suitable for the aerodrome, and be adaptable to changes in an aerodrome's physical characteristics (layout, installations, etc.) or operational procedures;
 - b) be inspired by safety in such a way that allows for the redundancy of equipment or elements which are critical for fail safe design;
 - c) have a high dependability;
 - d) be capable of communicating with other related systems, as required.
- 11.1.8 Where software is used for the purpose of control or monitoring of the AGL the following aspects shall be addressed:
- a) through analysis of the potential hazards introduced by the software to perform system functions, target safety integrity levels shall be specified for each software

function. The chosen software design and build tools, and operating system shall be shown to be appropriate for the production of the software to achieve the target safety integrity levels;

- b) known hazardous software states shall be either removed or mitigated by the total system design; and
- c) documented evidence shall be produced to demonstrate accomplishment of the target safety integrity levels.

The requirements for software in safety-related ATS systems are contained in CAP 670, ATS Safety Requirements.

11.1.9 Commercial-off-the-shelf (COTS) systems may provide a cost and time-effective solution for the design of a part or even the whole AGL system. COTS includes all types of software and electronic or electrical processing equipment and may also be applied to luminaires and other hardware. The following conditions in addition to paragraph 11.1.8 shall be satisfied where a COTS product is being considered for AGL safety related applications:

- a) the scope of the design specification for the COTS product shall include the purpose for which it is intended to be used;
- b) the COTS product shall be designed, manufactured and tested to an appropriate standard or to a level consistent with the safety related aspects of its application;
- c) the functionality of the COTS product shall conform to the applicable safety requirements;
- d) any changes or user-defined modifications to the COTS product shall be made under a suitable configuration change control system;
- e) proof of a) to d) above can be provided and submitted to the CAA.

11.2 **Control Equipment**

11.2.1 The control equipment should:

- a) provide a clear layout with efficient ergonomics to support simple and safe handling;
- b) facilitate the switching on or off of the AGL;
- c) facilitate the switching of the luminous intensity setting of the AGL (see paragraph 9);
- d) facilitate alarm handling (visual and audible);
- e) if necessary for complex aerodrome layouts, provide programmable inputs (for example taxiway routing).

11.2.2 Where an operational requirement exists for the simultaneous selection of AGL for more than one runway, the potential hazards of incorrect selection should be identified and, where appropriate, suitable interlocks and alert/warning devices should be provided.

11.2.3 Where stop-bars and associated runway lead-on/off lighting are installed, a separate selector panel and associated monitoring display should be incorporated into the Air Controller's position in order to provide for the operational control of these services. However, where the Air Controller has direct and ready access to the main AGL control panel, the CAA may approve the operational control of these services from the main panel.

11.3 **Monitoring Equipment**

- 11.3.1 The task of the monitoring function is to indicate the actual operational state of the AGL system and to detect a failure of the control and monitoring system itself.

The monitoring equipment should:

- a) provide information concerning the operational status of the AGL system and should display it at all times. The information required is determined by the provisions of paragraph 11.4 but would typically include the following:
 - i) AGL on or off
 - ii) AGL performance, e.g. luminous intensity correct or within tolerance and lamp failure;
- b) notify the existence of an alarm by appropriate visual and aural means.

- 11.3.2 Where used, a hard-wired mimic display panel should depict the individual systems and layout of the AGL by way of a representative lighted display corresponding in pattern colour and orientation to the systems installed on the aerodrome. The detail of pattern and layout of the mimic display should reflect the complexity of the AGL installations and should be capable of providing timely information to ATC staff on the status of each circuit of those systems and of any associated taxiway guidance system. The selection of any AGL (or part thereof) should illuminate the corresponding display on the mimic panel only when the selected service is activated and verified as serviceable.

- 11.3.3 The requirements of paragraph 11.3.2 should also be applied to the use of a visual display unit for the control and/or monitoring of the AGL, including touch-screen devices. The software aspects are outlined at paragraphs 11.1.8 and 11.1.9.

- 11.3.4 An audio-visual alarm should be provided in order to draw the attention of the AGL operator to any disparity between the AGL selection and the corresponding verification, whenever a selected AGL fails, fails to activate or fails to meet the requirements set out in Tables 6.6 and paragraph 12.2.1. The audio alarm should be capable of being temporarily suppressed whilst the visual indication of the fault should remain on both the control panel and monitoring display panel, where these are separately located, until the fault is cleared. Subsequent failures should reactivate the audio alarm even when the fault has not been cleared fully. The aspects to consider for a monitoring display are:

- a) if the indicator is on, the AGL is on and serviceable;
- b) if the indicator is off, the AGL is off;
- c) if the indicator is active (i.e. flashing) and accompanied by an audible alert, the AGL serviceability state has changed.

- 11.3.5 In order to align with the requirements of JAR-OPS the reporting to flightcrew of the serviceability of the AGL, the AGL operator needs to be able to state whether the AGL is in one of the following states: serviceable, downgraded, or failed. Therefore, where a new system is installed or significant modification is carried out on an existing system, the AGL control and monitoring system should be capable of determining and indicating which of the aforementioned states applies. For existing AGL control and monitoring systems, a method of reporting such states should be implemented. Using existing indications and a look-up table is one method that may be suitable. The status of the AGL will probably differ according to visibility conditions and other factors; therefore the status report (or look-up table) should reflect these factors. Further guidance on the assessment of AGL serviceability and the presentation of this information is provided in CAP 670, ATS Safety Requirements.

- 11.3.6 Consideration should be given to the provision of an intermediate warning level that indicates a degradation of performance of the AGL and the likelihood of further degradation to alarm level. In the event of a warning level being achieved, action may be taken to prevent an alarm state being reached.
- 11.3.7 Verification of AGL performance should be derived from a device that is designed to monitor the true status of the services selected. Any such device should be proved to be satisfactory to the CAA. For constant current series circuits, an acceptable means of providing verification of luminous intensity is the detection of the true root mean square (RMS) current within the primary series circuit. Table 6.6 indicates the logarithmic current values and tolerances for serviceable AGL using such a device. This type of verification does not however provide an assurance that the AGL meets the photometric requirements outlined at Appendix 6A. Therefore, the integrity of this verification method should be augmented by the adoption of a maintenance regime that incorporates the measurement of the photometric characteristics of the AGL while in service (see paragraph 12.2.2).
- 11.3.8 Technical serviceability information about the AGL system other than that required to meet the requirement of paragraph 11.1.4 need not be displayed or trigger alerts at ATC or other operational positions.
- 11.3.9 All operationally significant events, alarms or failures should be recorded and retained for at least 30 days. The content of a hard copy record may be restricted to error and principal switching messages if no circumstances occurred that might require an investigation into the AGL system integrity, condition or state during the period. However, magnetic, optical or electronic storage should contain all monitored data.
- 11.4 **AGL Fault Conditions**
- 11.4.1 An AGL system fault exists if:
- a) there is a difference between a requested status and the actual status of the AGL,
or
 - b) a malfunction of a significant component or function is detected, or
 - c) the result of a measurement is not within the specified tolerance.

Table 6.6 AGL Luminous Intensity RMS Current Limits

Luminous Intensity		Current	(amps)	Range	Current	(amps)	Range	Current	(amps)	Range
Setting %	Tolerance %	6.6	+	-	12.0	+	-	20	+	-
100	±9	6.6	6.7	6.4	12.0	12.18	11.64	20	20.4	19.62
80	±9	6.34	6.36	6.2	11.52	11.56	11.27	19.21	19.28	18.78
30	±20	5.35	5.76	5.26	9.72	10.47	9.56	16.21	17.45	15.90
10	±40	4.55	4.80	4.20	8.28	8.73	7.64	13.79	14.54	12.72
3	±40	3.89	4.05	3.70	7.08	7.36	6.72	11.79	12.27	11.21
1	±40	3.37	3.58	3.26	6.12	6.51	5.92	10.20	10.85	9.87
0.3	±40	2.90	3.18	2.76	5.28	5.78	5.01	8.79	9.64	8.36
0.1	±40	2.57	2.65	2.39	4.68	4.82	4.34	7.79	8.03	7.24
0	-	0	0	0	0	0	0	0	0	0

NOTE: The specifications contained in this table have been derived through consultation with equipment manufacturers.

- 11.4.2 Unserviceable light fittings should not be permitted to alter the basic pattern of the AGL system, which should always give adequate guidance. For AGL in use in RVR less than 400 m, no two adjacent light fittings should be unserviceable.
- 11.4.3 Where a stop-bar fails to function in the manner described at paragraph 6.3.3 and is required for use, the stop-bar and the associated section of taxiway should be withdrawn from service until the fault is rectified.
- 11.4.4 In the event of a failure that disables the control equipment the AGL should assume a predetermined fail-safe condition. Reversion should normally be to the last set selection where that is a safe condition.
- 11.4.5 In the event of restoration following a system or power failure, the AGL should be restored to the same status as that which prevailed before the failure or to a safe preset condition and there should be no loss of logging facilities.

12 Maintenance of AGL Systems

12.1 General

- 12.1.1 The Electricity at Work Regulations 1989 encompass all work carried out on AGL and other electrical installations in and around aerodromes. As these are a Statutory Instrument, compliance with them is mandatory. The equipment and system shall be shown to be electrically safe by means of demonstrated compliance with recognised standards and Approvals and shall comply with all Health and Safety and personal safety requirements in this respect. This includes the compliance with the Low Voltage Directive 72/23/EEC where applicable.
- 12.1.2 A maintenance policy should be produced and followed that addresses the safety of personnel engaged in the maintenance of AGL constant current series circuits. The maintenance policy should address the following aspects:
 - a) the organisation, roles and responsibilities;
 - b) the maintenance philosophy, that includes and takes account of:
 - i) the maintenance objectives;
 - ii) the operational requirements;
 - iii) the maintenance resources.
 - c) a maintenance schedule and procedures, which include:
 - i) planned, controlled, conditional and corrective maintenance programmes;
 - ii) post-maintenance activities;
 - iii) the modification or upgrading of equipment.
 - d) specific safety procedures;
 - e) the management of records and documentation;
 - f) the provision of spares, tools and test equipment;
 - g) inspections.
- 12.1.3 The maintenance of AGL equipment should consider the objectives of aerodrome operations and address the impact on such operations whilst maintenance activities are being carried out. In addition, during periods of maintenance, or equipment failure, it may be necessary to operate AGL circuits on local control at the remote Power Centres, thus removing control from ATC whilst the work is being carried out. A

procedure for local operation should be agreed with ATC before local switching of AGL circuits commences. A record of all maintenance operations should be kept including periods when local operation of a circuit or power centre is under the control of maintenance staff. A log book should be provided at each Power Centre for this purpose and retained for at least three years after the date of the last entry. All log books together with installation drawings and operating and maintenance manuals should be available for examination during licensing inspections.

- 12.1.4 By assessing the performance of each light on a regular basis and targeting maintenance on the under-performing light, the overall performance of the installation can be considerably improved. Targeting work on those lights that are under-performing ensures that maximum benefit can be obtained from maintenance activity thereby minimising wastage and enabling maintenance expenditure to be optimised.
- 12.1.5 The conventional AGL maintenance strategies of block change or change on failure, have been shown to be inadequate with many of the lamps failing to meet the required standard either immediately or shortly after the maintenance activity (see paragraph 12.3.8). Lamps and associated equipment do not age at a uniform rate and consequently only limited benefit is achieved from a routine block change. On the other hand, if the performance of individual lights is allowed to decay until lamp failure occurs, then each light will be operating below the required standard for a substantial percentage of its life. Both strategies result in the possibility of entering LVPs with the installation operating below the required serviceability levels. Routine and regular targeted maintenance procedures are essential if this scenario is to be avoided.
- 12.1.6 The performance of lights can change rapidly, especially at large aerodromes with high movement rates. Therefore, it is important to assess performance accurately on a regular basis and act upon the information collected. The frequency with which such assessments should be undertaken is dependant upon the type and age of the installation, maintenance policy adopted, movement rates and prevailing weather conditions. Typically, a weekly survey, with associated maintenance, has been found to be adequate for a major aerodrome.
- 12.1.7 Changing the light fitting will not always ensure the required performance is achieved since the luminous intensity of the beam is dependent on the total electrical and optical system. The importance of maintaining the primary series circuit current is only a single factor in the system and additional work may be required at specific locations, for instance a faulty transformer or a slightly dirty lens can reduce output by up to 50%. A single application of de-icing fluid to a runway can reduce the light output of centreline lights by up to 70%.

12.2 **Maintenance Objectives**

- 12.2.1 The maintenance of AGL should have as its objective, that during any period of operations all AGL equipment is serviceable but that, in any event, the serviceability levels detailed in Table 6.7 should be regarded as the absolute minimum for the operation intended.

Table 6.7 Minimum Percentage of Serviceable Light Fittings

AGL	Landing		T/O	
	CAT I	CAT II/III	RVR <800m	RVR ≥800m
App beyond 450 m	85%	85%	–	–
App inner 450	85%	95%	–	–
Rwy threshold	85%	95%	–	–
Rwy end	85%	85%	85%	75%
Rwy edge	85%	95%	95%	85%
Rwy C/L where fitted	85%	95%	95%	85%
TDZ where fitted	85%	90%	–	–

- 12.2.2 The objectives contained in Table 6.7 specifically target precision approach runways and operations in low visibility. For precision approach runways the CAA expects the aerodrome authority to provide evidence that the performance of the associated AGL meets the requirements for all weather operations, which include Table 6.7. One method of providing such evidence is to carry out regular measurements of the photometric performance (i.e. the luminous intensity, beam coverage and alignment) of the AGL when in service.

12.3 Maintenance practices

- 12.3.1 Persons should be protected against dangers that may arise from contact with live parts of the installation. Only limited protection against overcurrent and open circuit can be provided therefore no work should be undertaken on live AGL constant current series circuits unless adequate provisions are made to ensure the safety of personnel.
- 12.3.2 Approach and runway lighting patterns are designed for viewing from the air. At ground level the pattern may appear to be perfect, but small errors in the setting of lights may present a ragged and apparently incomplete pattern to flightcrew. If local circumstances permit, maintenance staff should be given the opportunity to view the AGL from the air.
- 12.3.3 The overall performance of AGL can be dramatically improved and maintained with the introduction of an adequate cleaning regime. The nature of their general location makes inset fittings particularly susceptible to the presence of dirt, dust, moisture and the effects of heavy loads. Staining of the glassware and rubber deposits can considerably reduce the light output of these lights and reductions of the order of 50% are not uncommon. The periodicity of AGL cleaning will depend upon environmental and operating conditions but typically AGL on runways that are subjected to a heavy traffic density should be cleaned at least once per week, other AGL should be cleaned at least once every two weeks.
- 12.3.4 A routine ground inspection of all AGL systems where practicable should be made daily or before use as appropriate and any defects remedied as soon as practicable. All deficiencies and associated remedial action should be logged and the system should again be inspected before use after remedial action.

- 12.3.5 As an aid to maintenance it is recommended that each AGL location be marked with an identification number where practicable, large enough to be legible from a passing vehicle (e.g. 27/A/14 refers to light fitting No 14 of circuit A on runway 27) as follows:
- a) Lights in paved areas – Numbers painted with white road paint adjacent to the light fitting.
 - b) Lights in grassed areas – Numbers painted on the light fitting.
 - c) Pole or mast mounted lights – Numbers painted on plates attached to the poles or masts.
- 12.3.6 An up-to-date set of drawings showing the AGL layout, light fitting location numbers and cable routing, along with operating and maintenance manuals containing adequate information for the safe operation and maintenance of the AGL system should be provided at all appropriate sites.
- 12.3.7 Where AGL and equipment is installed on private land, rights of access should be maintained in order that regular maintenance may be carried out.
- 12.3.8 If the process detailed in paragraph 12.2.2 is carried out on a regular and adequate basis, individual lamp conformance can be assessed and therefore a lamp could be changed or cleaned on an individual basis and only when necessary. Where it is not possible to perform this level of maintenance, AGL lamps should be replaced in groups as part of a planned change programme based on the length of operating time or an observed deterioration. Lamps should be changed after 90% of nominal life at maximum luminous intensity (operating time at other luminous intensity levels being ignored). Any observed deterioration of an AGL pattern should be promptly corrected. The replacement of AGL lamps only on failure should be a last resort.
- 12.3.9 The insulation value of a primary series circuit may decrease by a very significant amount before any operational effect on the AGL is noticed; however in this case there would be a much greater risk of harm to maintenance or installation persons. Therefore, a device should be provided to measure the insulation value of the primary series circuit with an error of not greater than 10%. The measurement should be performed as part of the routine maintenance or by using an automatic facility. Where an automatic measurement facility is provided the measurement shall be done at a rate of not less than once per hour. Remedial action should be taken where the insulation between primary and secondary series circuits and between primary series circuit and earth falls below 30 M Ω . The insulation properties of secondary series circuit cables should be checked on a regular basis and when an insulation failure is suspected. The resistance between secondary series circuit and earth should be not less than 5 M Ω .
- 12.3.10 Adequate spares should be held on site in order to support the complete AGL system maintenance procedures. An appropriate parts control system should be instigated in order to ensure that the correct parts are available and used when replacements are carried out. Components such as lenses may appear to be identical but may have substantially different photometric performance.
- 12.3.11 Licensees should adopt maintenance practices to minimise the potential for intergranular corrosion of aluminium alloy light fittings. Corrosion may be initiated by the use of high alkaline property cleaning fluids, which may damage or destroy the passivated layer protecting the fitting from corrosion.
- 12.3.12 To minimise future cracking of aluminium alloy light fittings due to intergranular corrosion, licensees should prevent the contact of fluids with a high acidic or alkaline property (PH less than 4 to greater than 8.5) with aluminium alloy parts of AGL fittings. Licensees should address the potential for corrosion where there is an essential

operational need to use a fluid with a high acidic or alkaline property in the vicinity of AGL and a suitable alternative with a more neutral solution cannot be found.

12.3.13 Mechanical loading may affect the structural integrity of AGL fixtures and fittings whilst in service, and may also exacerbate the effects of corrosion. Accordingly:

- a) Staff should look for the effects of poor installation with, especially with regard to debris entrapment between fitting, seating ring and base, and rectify as necessary.
- b) Replacement components should, where possible, form a part of a bespoke or homogenous assembly, and attention should be paid to the compatibility and suitability of materials.
- c) Seating rings should be designed and constructed to the same tolerances as the AGL fitting. If signs of wear exist, the stud location and load transfer surfaces should be jig-checked and discarded if found to be out of tolerance.

12.3.14 The maintenance procedures detailed in this paragraph should be adopted as a minimum requirement. Additional maintenance may be needed following extreme weather conditions, where high incidence of vandalism occurs or following agricultural work within the area bounded by the approach system. A competent engineer should assess the AGL maintenance requirements and augment the minimum requirements in scope and frequency where necessary. The minimum maintenance procedures are as follows:

- a) **Daily:** A visual inspection of the AGL should be undertaken. Unserviceabilities should be recorded and appropriate remedial action taken.
- b) **6 monthly:** Check and take remedial action as required to ensure that:
 - i) The alignment of all elevated lights is within tolerance. If hinged masts are used with alignment carried out at ground level, the checking procedure should include the mast settings when reinstated.
 - ii) Primary series circuit current levels at all luminous intensity settings comply with the levels and tolerances given in Table 6.6. Actual values and the type and serial number of the test instrument used should be noted in the maintenance log. It is desirable that a percentage of secondary series circuit currents should be checked.
 - iii) All AGL control and monitoring facilities are serviceable.
 - iv) All earth connections are satisfactory (see paragraph 13.2.3).
 - v) The insulation resistance of all primary series circuits is satisfactory (see paragraph 12.3.9).
- c) **At regular intervals:** On specific installations, maintenance in accordance with the manufacturer's recommendations should be carried out and remedial action taken where required. Photometric checks, if appropriate, should be carried out in accordance with traffic density and AGL performance (see paragraph 12.2.2).

NOTES:

- 1 Additional alignment checks to elevated lights should be carried out after severe storms, heavy snowfalls and after work that could have affected light alignment has been carried out in their vicinity.
- 2 Wood poles supporting approach lights should be inspected and tested before climbing. They are now considered to be an obsolescent mounting method and lighter, frangible, hinged masts are preferred.

12.3.15 All maintenance activities should be recorded in a suitable log. Maintenance and flight check records should be retained for at least three years at the aerodrome for use by maintenance staff and for examination during licensing inspections.

12.3.16 All test equipment, alignment devices and protective clothing should be calibrated/checked or replaced at intervals recommended by the manufacturer and the results recorded in the maintenance log.

12.4 **Photometric Requirements**

12.4.1 The maintenance objectives for AGL are detailed in Paragraph 12.2.1 and Table 6.7. The objectives are specified in terms of the maximum number of unserviceable lights at any one time. A light should be deemed unserviceable if its average luminous intensity is, for any reason, less than 50% of the average luminous intensity specified in the relevant isocandela diagram at Appendix 6A, or the brightest part of the beam is not within the specified main beam area.

12.4.2 AGL maintenance should be focused on assuring maximum availability of lights that are of the correct intensity and alignment. The most effective means to determine this is through photometric measurement and visual assessment

12.4.3 It should be the aim for AGL to meet or exceed the average luminous intensities specified in the isocandela diagrams. Where this is not possible the aerodrome licensee should establish and maintain the best AGL photometric performance achievable, taking into consideration the following factors:

- a) The design performance of the lights when new;
- b) The aerodrome traffic type and density; and
- c) The prevailing weather conditions (including whether anti-icing or de-icing procedures are used).

12.4.4 With the use of photometric measurement within a robust maintenance programme, it should be possible to achieve and maintain a demonstrable performance level of at least 70% of the specified minimum. Where movement rates are high and aircraft types heavy, even if this level cannot be continuously achieved, AGL maintained in this way should display a significantly improved, balanced pattern of lights, which is of value to pilots.

12.5 **Checking of (A)PAPI systems**

12.5.1 (A)PAPI serviceability gives rise to additional considerations as moisture or dirt on the lenses will diffuse the beam and can result in a white signal being emitted at all angles of elevation. To prevent this potentially hazardous situation from occurring additional measures should be adopted as follows:

- a) On a daily basis, particular attention should be paid to the following items with respect to (A)PAPI systems:
 - i) All lamps are serviceable and evenly illuminated;
 - ii) There is no apparent damage to units;
 - iii) The change from red to white is coincident for all elements of a unit;
 - iv) The heating facilities are functioning correctly;
 - v) All lenses are clean.
- b) The vertical alignment of each (A)PAPI unit should be checked once every week to a tolerance of ± 1 minute of arc and should be verified by inspection with a suitable instrument and flight check at least twice every year. Clinometers are intended to

be used for a quick check that the installation has not been disturbed and should not be used for alignment adjustments. Small alignment errors can be observed according to the time of day, weather and other environmental conditions and will normally require no adjustment; however, where a significant difference is noted (probably on only one unit, a consistent error on all units usually indicates a clinometer calibration error) the unit may be adjusted using a clinometer but must be checked using a suitable instrument and flight checked as soon as possible. Clinometers should be calibrated annually or as recommended by the manufacturer or when an error is suspected.

- c) At weekly intervals the (A)PAPI system should be inspected internally and cleaned, lenses should be polished and anti-misting fluid applied if appropriate.
- d) High intensity units that have no permanently-on lens heaters should be operated for 15 minutes at maximum luminous intensity or as recommended by manufacturers in order to disperse moisture. In low intensity units moisture clearance by this method takes much longer and it is more practical to inspect the units. Operational procedures should allow for moisture dispersal or removal before use.
- e) Some units are supplied with integral lens heaters. These should be run continuously if there is any possibility of condensation occurring. Alternatively, high intensity lamp units may be operated continuously at low luminous intensity (typically a primary series circuit current level of 1.5A RMS is set) when not in operational use; such units are ready for immediate use. Routine daily checks should include serviceability of the permanent heat system.
- f) Units without permanently-on lens heaters cannot be guaranteed free from moisture at switch-on, so allowances should be made for such warm-up period as the unit manufacturer recommends.

12.5.2 The integrity of (A)PAPI systems is of the utmost importance, and a unit should be considered unserviceable if:

- a) it has less than half of its originally specified minimum average luminous intensity; or
- b) it has an elevation setting error exceeding ± 1 minute of arc; or
- c) its physical condition, on inspection, is in question, e.g. if a filter glass is cracked.

12.6 **Checking of AGL system input power supply**

- 12.6.1 A check of an alternate input power supply to the AGL system (where provided) operating under full load should be made at least once each month. Where the alternate input power supply is provided by independent generators, they should be run for at least 15 minutes under full load when carrying out this check.
- 12.6.2 Where automatic switch-over is provided for the AGL system input power supplies, a check of the switching system should be made in addition to those checks contained in paragraph 12.6.1 in order to ensure that the switchover times required at Table 6.5 can be met.
- 12.6.3 A log should be kept detailing each check undertaken. Switchover times and generator running times should be noted along with any action taken to ensure that the requirements are met.

12.7 **AGL Flight Checks**

- 12.7.1 All approach and runway AGL on an instrument runway shall be flight checked in accordance with Appendix 6C at least once every six months.
- 12.7.2 All approach and runway AGL on runways other than those applicable in paragraph 12.6.1 shall be flight checked in accordance with Appendix 6C at least once every 12 months.
- 12.7.3 An (A)PAPI system shall be flight checked in accordance with Appendix 6D at least once every six months.
- 12.7.4 Commissioning flight checks of new AGL installations, including A(PAPI), shall be conducted by the CAA prior to their operational use (see CAP 655 Chapter 1 paragraph 9). Permission for another organisation or persons to conduct an AGL commissioning flight check, as proposed by the aerodrome, may be granted at the discretion of the CAA.
- 12.7.5 Routine AGL flight checks shall be conducted by competent persons, holding appropriate flight crew qualifications.

13 **Installation of AGL Systems**

13.1 **General**

- 13.1.1 An AGL system should normally comprise a single control and monitoring equipment and several constant current series circuits. The following elements make up a typical constant current series circuit (see Figure 6.11):
 - a) a constant current regulator (CCR);
 - b) a primary series circuit, which includes:
 - i) primary cable
 - ii) AGL series transformer(s) (may be known as isolating transformer)
 - c) a secondary series circuit, which includes:
 - i) secondary cables
 - ii) the light fitting or other devices.

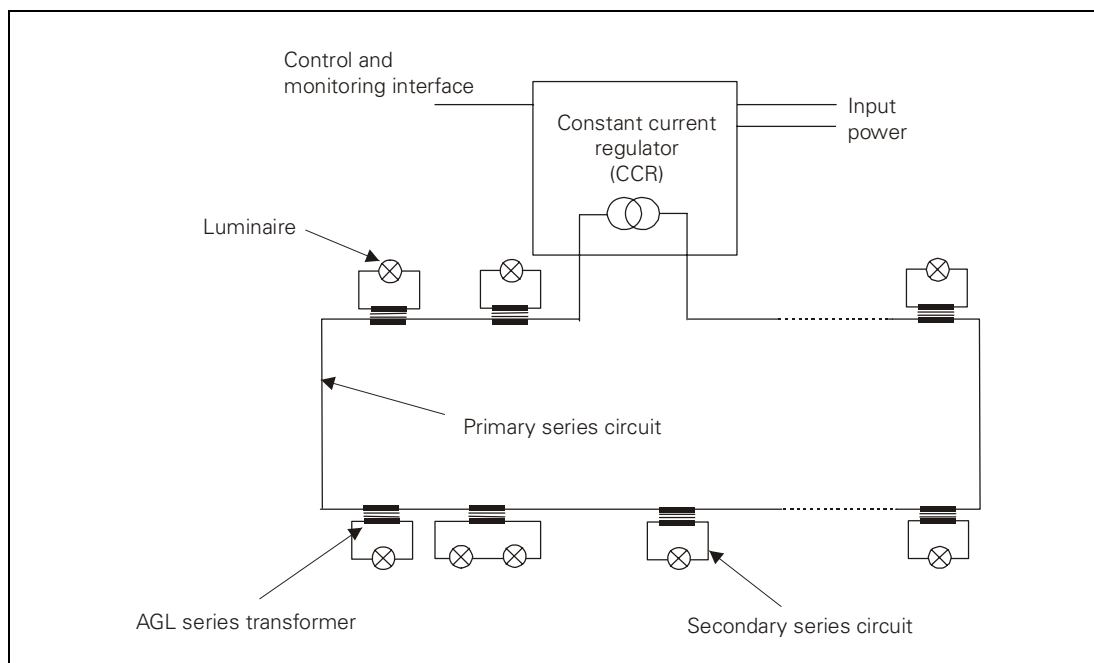


Figure 6.12 Typical AGL constant current series circuit

- 13.1.2 Approval requirements associated with the design and installation of AGL are contained in CAP 655.
- 13.1.3 Where an electrical installation is of a low-voltage type (e.g. the control and monitoring equipment) – but **excluding** the secondary series circuits – the current BS 7671 requirements should be applied. However, BS 7671 is not wholly appropriate for the electrical installation of the constant current series circuit therefore special consideration should be given to this type of installation to ensure the correct operation of the equipment and the safety of personnel involved in the installation, operation and maintenance of the AGL system.
- 13.1.4 Parallel circuits should be used only when there are few fittings in the circuit and accurate luminous intensity balance is not critical, e.g. a short taxiway or blue edge lighting of a paved area.
- 13.2 **Earthing**
- 13.2.1 The equipment in the control and distribution centres should be bonded to earth in accordance with BS 7671.
- 13.2.2 Primary series circuits shall not be earthed and all attempts to work on these circuits when live shall be prevented. In an ideal installation it should be unnecessary to earth the secondary series circuits, however the installation environment, repairs and wear and tear do not provide an assurance that the installation is ideal. On the other hand, if earthing of the secondary series circuits is provided, there is no guarantee of the safety of personnel who happen to come into direct or indirect contact with a live circuit. Certain equipment failure modes (e.g. double earth faults and isolating transformer primary-secondary shorts) could present a potentially hazardous situation for maintenance personnel even if the equipment is apparently earthed. Therefore, whether or not it is the practice to earth the secondary series circuit, care shall be taken to ensure that adequate protection from electric shock is provided (see paragraph 12.3.1).

- 13.2.3 Where provided, earth connections should be measured to be no greater than 6 ohms in order to provide protection from electric shock.
- 13.2.4 Where shielded cable is used in a constant current series circuit (for EMC purposes), the shield should be continuous throughout the loop and earthed at the ends of the primary series circuit within the CCR. Cable shields also provide some protection against insulation deterioration due to high voltage stress and it is recommended that the shield be earthed at every practicable point.
- 13.2.5 Where a counterpoise is provided (for protection against lightning) it may be used as an earth source for AGL installations if no suitable alternative exists and it meets the requirement of paragraph 13.2.3. Care should be taken to ensure that in the event of a lightning strike the connection of equipment to a counterpoise will not cause unacceptable damage to the AGL.

13.3 **Interleaving of AGL electrical circuits**

- 13.3.1 The configuration of the electrical circuits (constant current series circuits) that make up the AGL system should be designed so that a failure of a single circuit will not cause a total lack of guidance. One means of providing a continuity of service is to incorporate interleaving techniques where alternate lamps (or as necessary to provide the required guidance information) are controlled by different CCRs. However the minimum requirement is as follows:
- a) Two separate interleaved circuits for each of the following systems:
 - i) Approach lighting on precision approach runways.
 - ii) Supplementary approach lighting.
 - iii) HI Runway edge, Threshold and End lighting. See Note 1 below and Note 1 of Table 6.5.
 - iv) HI Runway centreline lighting.
 - v) Touchdown zone lighting.
 - vi) For each stop-bar (sub paragraph c, d & e below refer).
 - vii) HI taxiway centreline lighting (including runway lead-on and lead-off lighting but excluding systems with route switching or block control where the failure of a lighting circuit would not present a flightcrew with a hazardous situation in low visibility)

NOTES:

- 1 Threshold lighting should be on independent interleaved circuits.
 - 2 Where technically desirable, threshold and end lighting may be served by the same circuits as runway centreline lighting provided that any operational penalty suffered as a result of loss of use of the runway at night where both centreline circuits fail, is acceptable to the aerodrome operator.
- b) One separate circuit for each of the following systems:
- i) HI simple approach lighting.
 - ii) Approach lighting on non-precision approach runways.
 - iii) LI runway edge, threshold and end lighting.
 - iv) PAPI or APAPI but see paragraph 4.2.2.
 - v) Taxiway and apron edge lighting.

- c) Stop-bars and associated taxiway lead-on lighting should be on separate circuits so that a loss of one of these facilities will not affect the serviceability of the other. In addition the stop-bar and lead-on lighting circuits should be interlocked so that the stop-bar and lead-on lighting cannot be illuminated simultaneously. Verification of the stop-bar and lead-on lighting selection should be provided. However, the design of the interlocked stop-bar and lead-on lighting should be such that a failure of the stop-bar circuit cannot cause the lead-on lighting to illuminate.
 - d) Where stop-bars and taxiway centreline lighting are interlocked to provide block switching and verification of the stop-bar selection is provided, stop-bars at Intermediate Taxi-Holding Positions need not be interleaved.
 - e) Stop-bars at runway holding points should consist of two separate interleaved circuits. Other stop-bars should be interleaved where no taxiway centreline lighting is provided.
 - f) Runway guard lights may be served by the taxiway lighting circuits other than those for stop-bars provided that the requirements of paragraph 6.5.1 and 6.5.3 are met. Verification that the runway guard lights are operating is required.
- 13.3.2 Where interleaved circuits are provided, alternate lights should normally be connected to the same circuit. However, care must be taken in the design of interleaved circuits to ensure that in the event of the failure of one or more circuits, a recognisable pattern and any colour coding is retained.
- 13.3.3 Interleaved circuits may be provided for the services listed in paragraph 13.3.1b) in order to increase integrity or to overcome a technical difficulty. However, approach slope indicator installations should be limited to two circuits per runway end.
- 13.3.4 Where a runway is used also as a taxiway and both taxiway and runway lighting are provided, the lighting circuits shall be interlocked in order to prevent the selection of both systems simultaneously.
- 13.3.5 The interleaving criterion is still applicable where individual or addressable AGL switching is installed.
- 13.4 **Electromagnetic compatibility (EMC)**
- 13.4.1 The AGL system and its components shall conform to the EMC Directive 89/336EEC. It shall not cause radiated or conducted electromagnetic interference to other systems such as information technology equipment (ITE), or radio navigational aids that may be located on or near the aerodrome, or that may use the same power supply. All equipment included in the electrical installations shall have immunity to electromagnetic phenomena and electromagnetic fields such as from radio transmitters, transients on power lines, atmospheric discharges etc.
- 13.4.2 An aerodrome movement area is generally considered an uncontrollable electromagnetic environment. EMC levels (emission and immunity limits) should be assessed in order to ensure that existing or expected disturbance levels will not increase when new equipment is installed and that such equipment is sufficiently immune. Shielded cables in the constant current series circuits are recommended in order to achieve EMC.
- 13.5 **Constant current regulators (CCRs)**
- 13.5.1 In order to provide the AGL operational luminous intensity, the CCR should have a range of output current steps in accordance with Table 6.6. The CCR should maintain the required constant current output regardless of variations of the AGL constant current series circuit load and be capable of a luminous intensity change without interruption of the output current.

- 13.5.2 The calculated AGL constant current series circuit load should not exceed the CCR rating. The CCR shall be matched to the constant current series circuit load by selection of the appropriate output load tap (if available) to provide the required power efficiency and power.
- 13.5.3 Independent input and output disconnecting devices should be provided that remove any power to the CCR and to the primary series circuit. An appropriate method of preventing the re-energising of the CCR or primary series circuit should be provided. The design features of this requirement should consider the following safety aspects:
- a) assurance of no voltage or current in the CCR or primary series circuit
 - b) mechanical disablement (e.g. key switch mechanisms, padlocks etc.)
 - c) an indication of the disconnection.
- 13.5.4 The CCR output disconnecting device should short the input of the primary series circuit. As an extra precaution against induced currents in the primary series circuit the conductors may be earthed. The disconnected output terminals of the CCR may also be shorted together and earthed.
- 13.5.5 The CCR should incorporate output open circuit protection that disconnects the power to the primary series circuit in the event of an open circuit occurring. The protection device should not operate during normal switching operations.

Warning: This requirement will not prevent the electric shock hazard that exists when a live circuit is intentionally disconnected.

- 13.5.6 The CCR should incorporate overcurrent protection that disconnects the power to the primary series circuit in the event of an overcurrent occurring in order to prevent damage to equipment.
- 13.5.7 It should be possible to reset the protective devices locally, but only after the cause of the operation of the protective device has been identified and any fault is cleared. Remote setting of protective devices shall not be provided for.

13.6 Installation of AGL cables

- 13.6.1 The installation of an AGL constant current series circuit involves the laying of cables in operational areas of an aerodrome. The cables should be directly buried in the earth, laid in pre-installed ducts or conduits, or, for secondary cables, laid in saw cuts. It is considered best practice to bury cables to a depth of at least 30 cm and to separate cables of different circuits by sufficient margin in order to eliminate possible EMC problems. Cables that cannot be hidden and are exposed, especially those that are not within the confines of the aerodrome, should be armoured or protected by conduit.
- 13.6.2 Cables should not be directly buried under paved areas, roadways, rail tracks, or ditches. In these areas the cable should be installed in concrete-encased ducts or in suitable strength conduit at a minimum depth of 45 cm below the finished grade.
- 13.6.3 All cables installed shall be tested for continuity. Any faults indicated by these tests shall be located and repaired before any further testing is performed. The insulation of all control cables shall be measured using a suitable instrument designed to apply a d.c. or ultra low frequency (0.1 Hz) voltage of at least 1000 V. Where voltage with respect to earth is less than 150 V the resistance shall be 100 k Ω or greater; where the voltage with respect to earth is between 150–300 V the resistance shall be 200 k Ω or greater; and where the voltage with respect to earth is greater than 300 V but less than 600 V the resistance shall be 400 k Ω or greater. Where provided, earth and bonding connections shall be tested and verified as correct.

- 13.6.4 The primary series circuit shall be subjected to a high-voltage insulation test (dielectric strength test). The primary series circuit shall withstand a d.c. test voltage of 1.5 times the maximum circuit rating applied between the primary series circuit and earth for at least 5 minutes. The maximum circuit rating should include the insulation rating of the cables, connectors and AGL series transformers. The CCR and lightning arrestors should not be connected when carrying out the test. Wherever possible, these tests should be performed when the ground is thoroughly wet, since tests may pass during dry weather but fail after a heavy rainfall. An air gap of at least 100 mm should exist between bare conductors and earth. The insulation at each end of the cable and the cable sheath for a distance of at least 300 mm from the end of the cable should be clean and dry.
- 13.6.5 The insulation leakage current in microamperes for each complete primary series circuit shall be measured at the same time as the high-voltage tests and shall not exceed a calculated value based on the following basis.
- a) $2\mu\text{A}$ for each AGL series transformer
 - b) $1\mu\text{A}$ for each 100 m of cable (this value includes allowances for a nominal number of connectors and splices).
- A temperature compensation factor should be incorporated in the calculation. The values given above are for an ambient temperature of 20°C . For an increase in temperature of 10°C , the leakage current will double. If the leakage current exceeds the value calculated, the circuit shall be sectionalised and the tests repeated for each section. Defective elements shall be located and repaired, or replaced until the entire circuit meets the required criteria. Ambient temperature and weather conditions shall be recorded at the time of each test.
- 13.6.6 Cable should not be installed if:
- a) it has been kinked
 - b) the shield (if fitted) has been damaged
 - c) the surface of the sheath or jacket has been damaged so that the insulation properties have been degraded
 - d) it shows signs of cross-sectional distortion.
- 13.6.7 Where accessible, including at each cable end, joint or connection, all cables should be labelled with an appropriate, indelible and secure identification mark.

Appendix 6A Aeronautical Ground Lighting Characteristics

1 General

1.1 The characteristics of low intensity AGL and of en-route obstacle lighting can be found at Table 6A.1. The requirements for the upgrade of existing systems to Category III Standard are at Table 6A.2. Figures 6A.1 to 6A.18 show the photometric characteristics and beam coverage of high intensity AGL that all newly installed lights should display.

1.2 A light is considered to have failed if its average luminous intensity is, for any reason, less than half of the minimum average luminance intensity specified in the relevant isocandela diagrams of this Appendix. Where more than one light is used in a unit, the unit is considered to have failed if its light output is similarly reduced.

Only AGL conforming to the specified colours should be displayed to flightcrew and vehicle drivers (see paragraph 5 for colour specifications and a means of verification).

The importance of adequate maintenance cannot be over-emphasised. The average intensity should never fall below 50% of the value shown in the figures and it should be the aim of Licensees to maintain a level of light exceeding the specified minimum intensities.

1.3 Construction and height of lighting fittings

1.3.1 All AGL fittings should be of such construction and height that their presence does not endanger aircraft.

1.3.2 Elevated fittings should be of lightweight construction and frangible, and if mounted on supports these should also be frangible. Where approach lights are mounted on high supports, the top 4–6 m should be made frangible. The following provision shall apply:

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:

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

1.3.3 Within the manoeuvring area, elevated fittings should be conspicuous.

1.3.4 Elevated light fittings should not exceed 36 cm in height above the adjacent pavement level. In stopways and clearways used for routine manoeuvring (e.g. as entry or exit taxiways) the lights should be flush with the pavement. Otherwise, the fittings in these areas should not exceed the following dimensions:

- a) 0.46 m above ground level in stopways;
- b) 0.9 m above local ground level in clearways.

1.3.5 Inset fittings should be capable of bearing the loads imposed by any aircraft normally using the aerodrome when landing, taking-off or taxiing. The contours and

temperature of the top surface of the light fitting should not cause damage to aircraft undercarriage components especially tyres.

- 1.3.6 The projection of an inset fitting above the surrounding surface should not exceed:
- a) 1.6 cm within 7.5 m either side of the runway centreline except that inset approach lights in this area and taxiway lights crossing a runway or leading to a runway centreline may project 2.5 cm.
 - b) 1.9 cm between 7.5 m from the runway centreline to 3 m from the runway edge except that inset approach lights in these areas may project 3.2 cm and taxiway lights crossing or leading to a runway centreline may project 2.5 cm.
 - c) 3.8 cm within 6 m of the runway end or within 3 m of the runway edge.
 - d) 3.2 cm for displaced threshold lights.
 - e) 2.5 cm in taxiway surfaces.
- 1.3.7 Inset fittings should be secured in the surface so as to prevent accidental extraction. It is particularly important that stable mountings are provided so that the beam spread angles are maintained within the tolerances detailed in the appropriate table.

2 Aerodrome Beacons

- 2.1 Aerodrome Beacons should be omni-directional and have a minimum effective flash luminous intensity equivalent to not less than 2000 cd in white. The light distribution of the beam should be such that it is clearly visible from 10 km between 1° and 45° above the horizon on a clear night. The flash rate should be fixed as follows:
- a) Coded beacons – 6 to 8 words per minute.
 - b) Non-coded beacons – 20 to 30 flashes per minute.

NOTE: At locations where a high level of ambient background lighting persists, it may be necessary to increase the effective flash luminous intensity in order to meet the above parameters.

3 Instrument Runways and Associated Taxiways

- 3.1 Figures 6A.1 to 6A.18 of this Appendix give the characteristics of lighting to be used for new installations. Table 6A.2 gives the minimum characteristics of lights in existing systems if they are to be made acceptable for Category III operations. When practicable it is recommended that lights with the characteristics detailed in Table 6A.2 be replaced by lights with characteristics shown in Figures 6A.1 to 6A.10.
- 3.2 Figures 6A.12 to 6A.16 give details of characteristics for taxiway centreline and stop-bar lights.

Table 6A.1 Characteristics of obstacle lights and low intensity aeronautical ground lights

Lighting System (Purpose of the light fitting)		Colour	Beam Coverage (Degrees) Average		Minimum Setting Intensity (Candelas)	Elevation Projection Angle (Degrees)	Remarks
			Horizontal	Vertical			
1		2	3	4	5	6	7
1	Low intensity Approach	Red	Omni-directional	+5 to +8 0 to +15	200 50	–	
2	Low intensity Runway Edge	White	Omni-directional	± 4	200	4.0	Elevated fittings
3	Low intensity Runway Edge (battery)	White	Omni-directional	± 4 to ±8 +8 to +8	50 10	4.0	Portable elevated fittings
4	Low intensity threshold	Green	Omni-directional	± 4	100	4.0	Elevated fittings
5	Low intensity threshold (battery)	Green	Omni-directional	± 4	40	4.0	Portable elevated fittings
6	Low intensity runway end	Red	Omni-directional	± 4	100	4.0	Elevated fittings
7	Low intensity runway end (battery)	Red	Omni-directional	± 4	18	4.0	Portable elevated fittings
8	Taxiway edge	Blue	Omni-directional	1 to 6	4	3.5	
9	Stopway	Red	± 6.5	0 to +15	100	-	
10	Runway guard lights	Yellow	Uni-directional ± 15	0 to +15	200	-	30 to 60 cycles per minute with periods of light suppression and illumination equal and opposite in each case
11	Low Intensity obstacle (Group A)	Red	Omni-directional	0 to +30	10	-	Steady

Table 6A.1 Characteristics of obstacle lights and low intensity aeronautical ground lights

Lighting System (Purpose of the light fitting)		Colour	Beam Coverage (Degrees) Average		Minimum Setting Intensity (Candelas)	Elevation Projection Angle (Degrees)	Remarks
			Horizontal	Vertical			
1		2	3	4	5	6	7
12	Low Intensity obstacle (Group B)	Red	Omni-directional	+5 to +8 0 to +15	200 50	-	Steady
13	Vehicle obstacle	Yellow	360°	±10° (see Note 1)	40	-	Flash Rate 60 to 90 per minute. Maximum intensity not to exceed 400 Cd.
14	Medium intensity obstacle	Red	Omni-directional	± 4°	2000 ±20%	-	Steady
15	High intensity obstacle	White	120	3	200 000 day 20 000 dusk 2000 night	0	40 flashes per minute (see Notes 2 and 3)
16	Simple Sequenced approach	White	Omni-directional	0 to + 15	5000	-	Elevated fittings. Flash Sequence 1 per second per unit.

NOTES:

- 1 The coverage requirement for 'Follow Me' vehicles only is illustrated in Figure 6A.19.
- 2 Where an intermediate high intensity obstacle light is fitted, the angle should be 3° for a light less than 92 m agl, 2° for a light between 92 m and 122 m agl, and 1° for a light between 122 m and 151 m.
- 3 If more than one light is fitted, the lights should flash simultaneously.
- 4 Lights should flash sequentially if indicating overhead wires or cables.

Table 6A.2 Minimum characteristics of lights in existing systems to make them acceptable for Category III operations

Light	Colour	Minimum beam Coverage (deg) (Note 1)		Ratio of Average Intensity	Minimum Average Intensity in Specified Colours Cd x 10 ³ (Note 2)	Angular settings (deg) (Note 3)			
						Category I and II		Category I, II and III	
		Horizontal	Vertical			Elevation	Toe-in	Elevation	Toe-in
1	2	3	4	5	6	7	8	9	10
Approach centreline and crossbars	White	20	8	2	20	6 to 4.5 (Note 3)	0	9 to 6 (Note 3)	0
Approach side row	Red	15	7	0.5	5	5.5	0	6	0
Threshold	Green	11	5.5	1	10	3.5	0	6	0
Threshold wing bars	Green	15	7	1	10	3.5	0	6	0
Touchdown zone	White	9	5	0.5	5	3	1.5	5.5 to 3 (Note 3)	1.5
Runway centreline 30 m spacing	White/Red	9	5	0.5	5 (Note 7)	3	0		
Runway centreline 15 m spacing	White/Red	9	5	0.25 to 0.5 (Note 4)	2.5 (Notes 4&7)	3	0	5.5 to 3 (Note 3)	0
Runway end	Red	11	5.5	0.25 to 0.5	2.5	2.75	0	3	0
Runway edge	White	11	5.5	1	10	2.75	2	5.5 to 3 (Note 3)	2

NOTES:

- 1 Throughout the beam coverages the luminous intensity at maximum output should not be less than half the average luminous intensity and should not exceed the average luminous intensity by more than 50%.
- 2 Within the beam coverages specified in Columns 3 and 4.

3 Setting angles based upon beam coverages given in Columns 3 and 4 are as follows:

Column 7	Threshold to 315 m	=	4.5°
	316 m to 475 m	=	5.0°
	476 m to 640 m	=	5.5°
	Beyond 640 m	=	6.0°

Column 9 Where lights have a vertical beam spread equal to or exceeding 8° the angular setting of approach centreline and crossbars should be:

Threshold to 315 m	=	6.0°
316 m to 475 m	=	7.0°
476 m to 640 m	=	8.0°
Beyond 640 m	=	9.0°
Runway centreline, touchdown zone and runway edge		
First 900 m of lights	=	5.5°
Remaining lights	=	3.0°

- 4 A luminous intensity of 5 kilocandelas, intensity ratio 0.5, should be used for Category III operations.
- 5 Alignment tolerances have not been included in the beam spread angles given in Columns 3 and 4.
- 6 Where inset lights are used instead of elevated lights, e.g. on a runway with a displaced threshold, the luminous intensity requirements can be met by installing multiple fittings of lower intensity at each position.
- 7 Values given are for white light.
- 8 Beam coverages quoted are for the extremities of an ellipse.

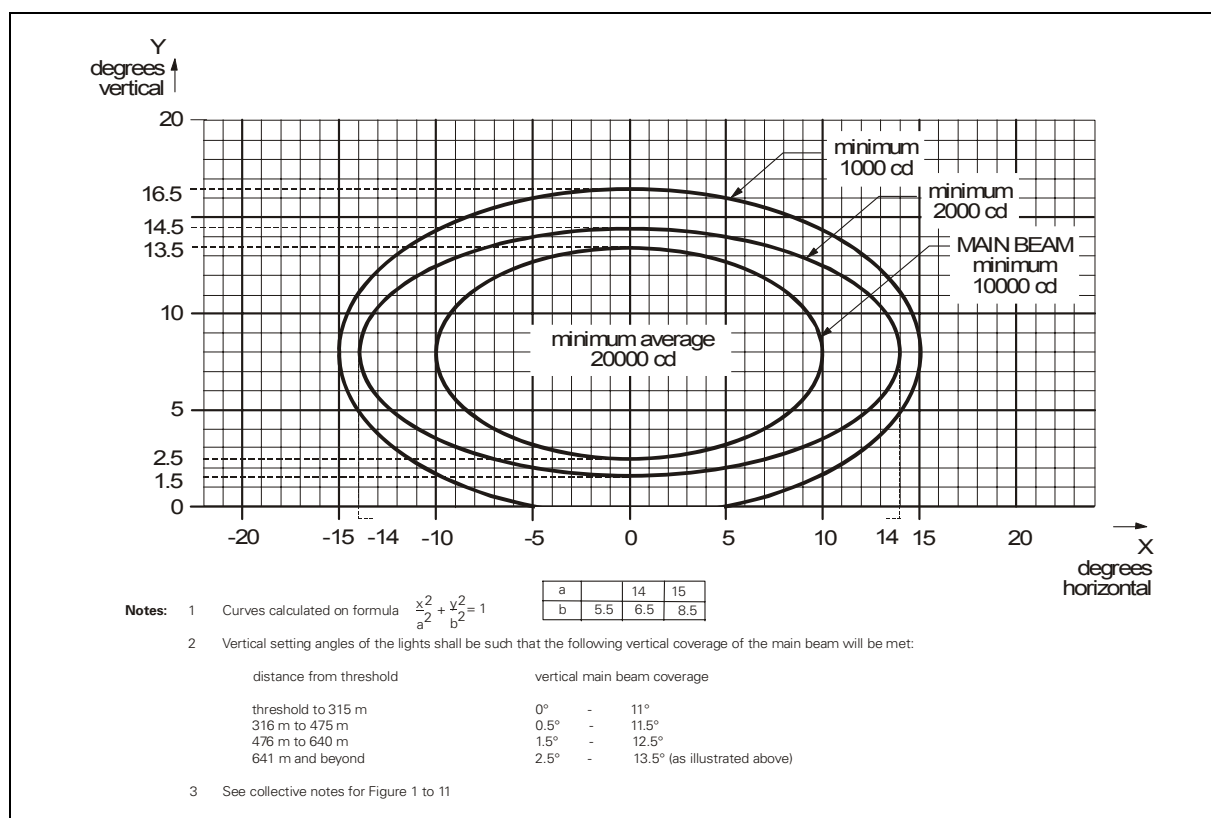


Figure 6A.1 Isocandela Diagram for Approach Centre Line Light and Crossbars (White Light)

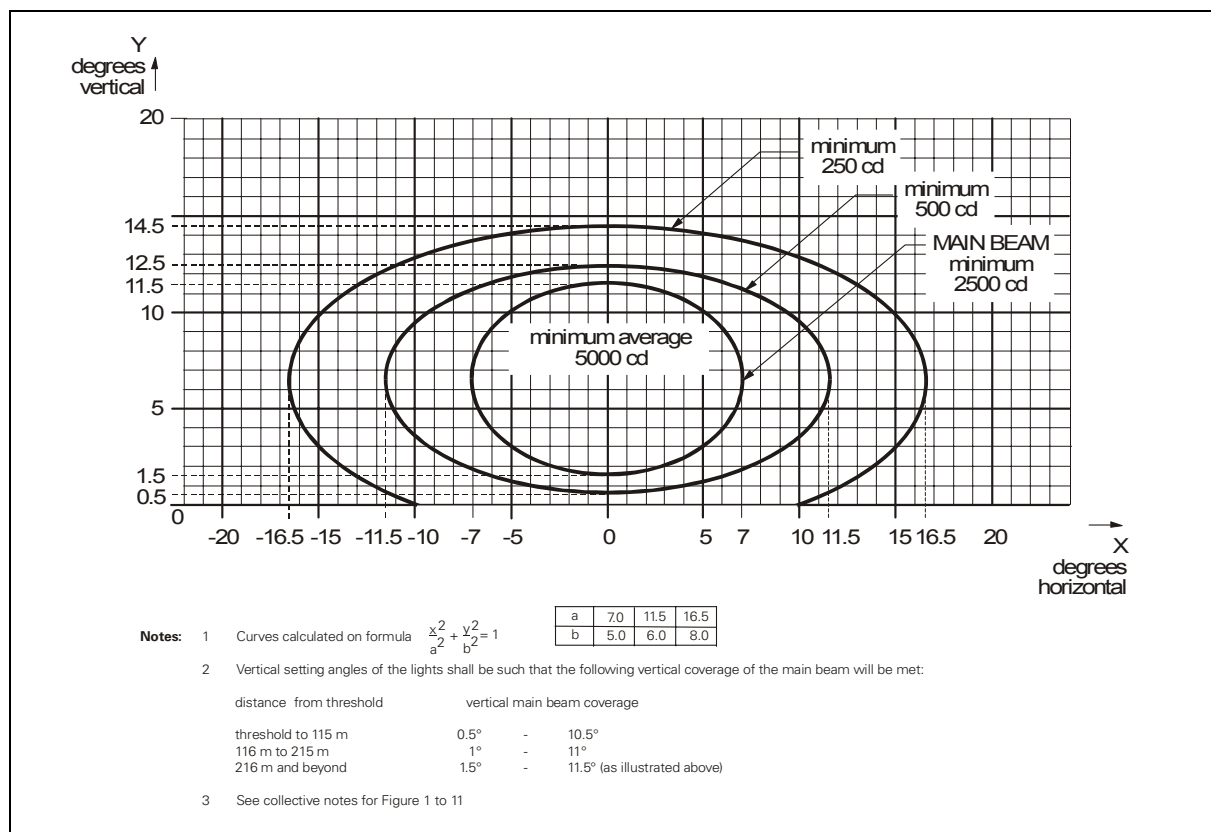


Figure 6A.2 Isocandela Diagram for Approach Side Row Light (Red Light)

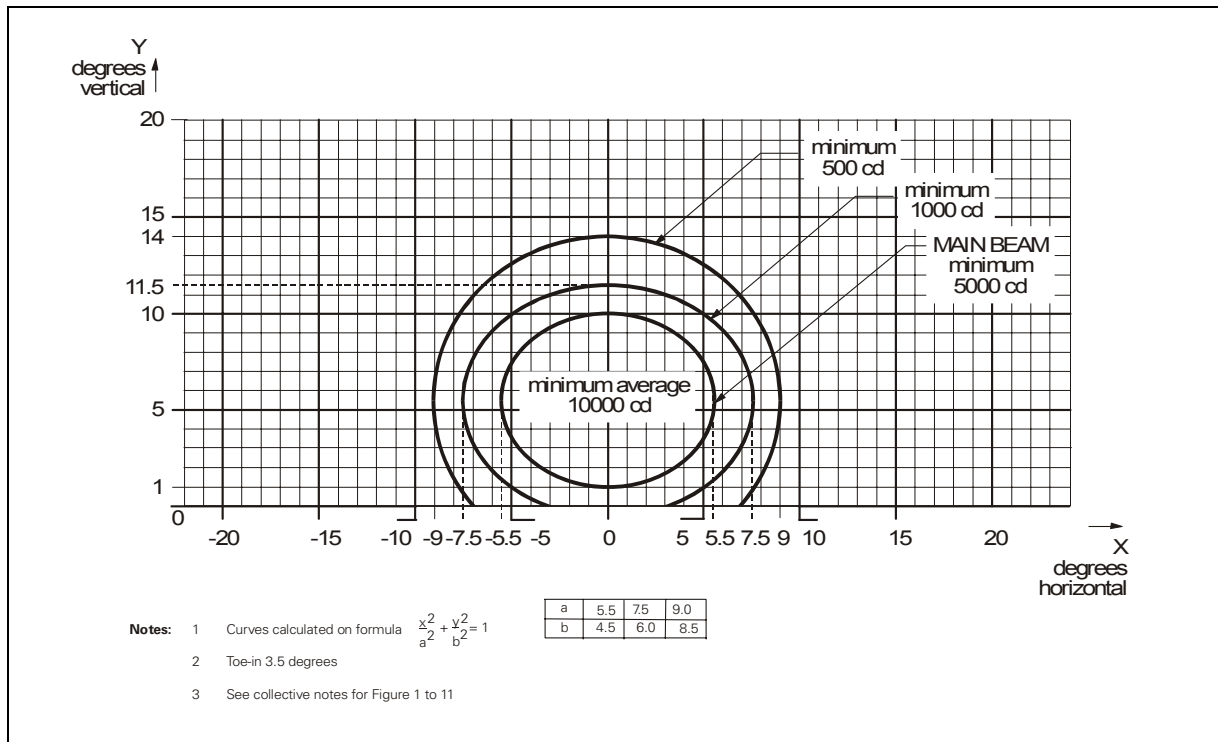


Figure 6A.3 Isocandela Diagram for Threshold Light (Green Light)

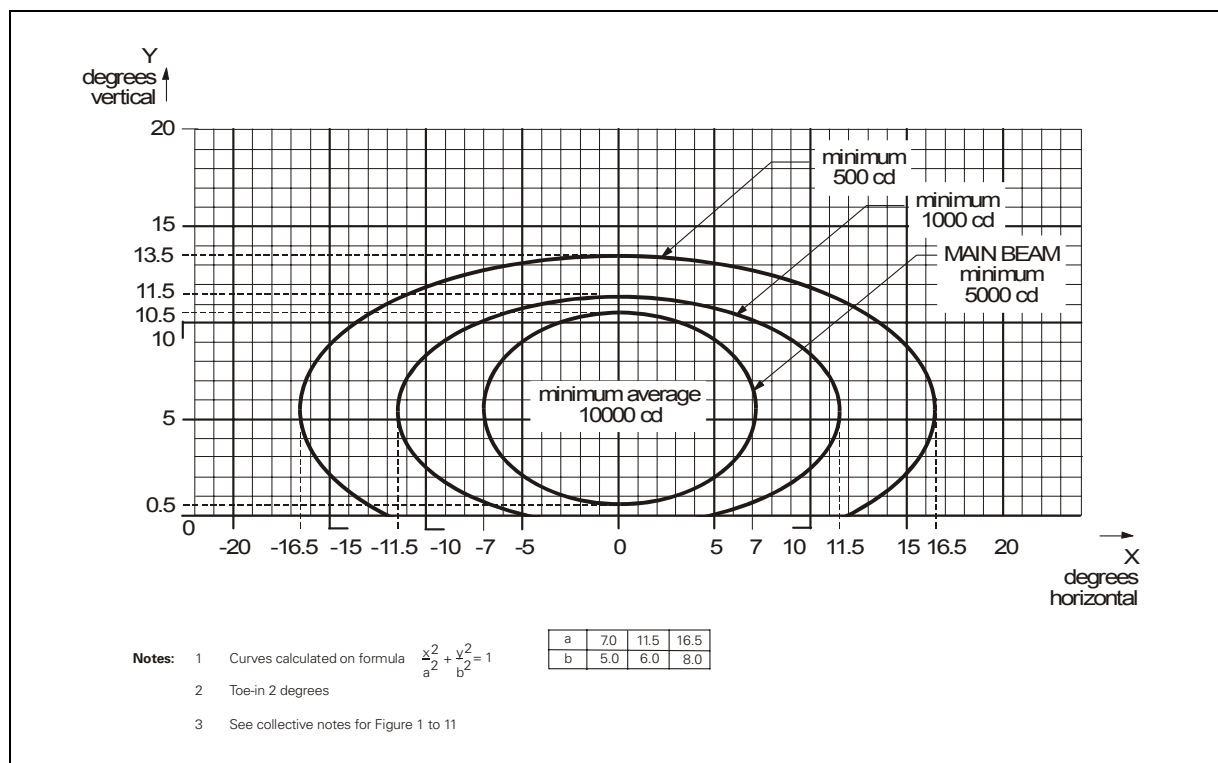


Figure 6A.4 Isocandela Diagram for Threshold Wing Bar Light (Green Light)

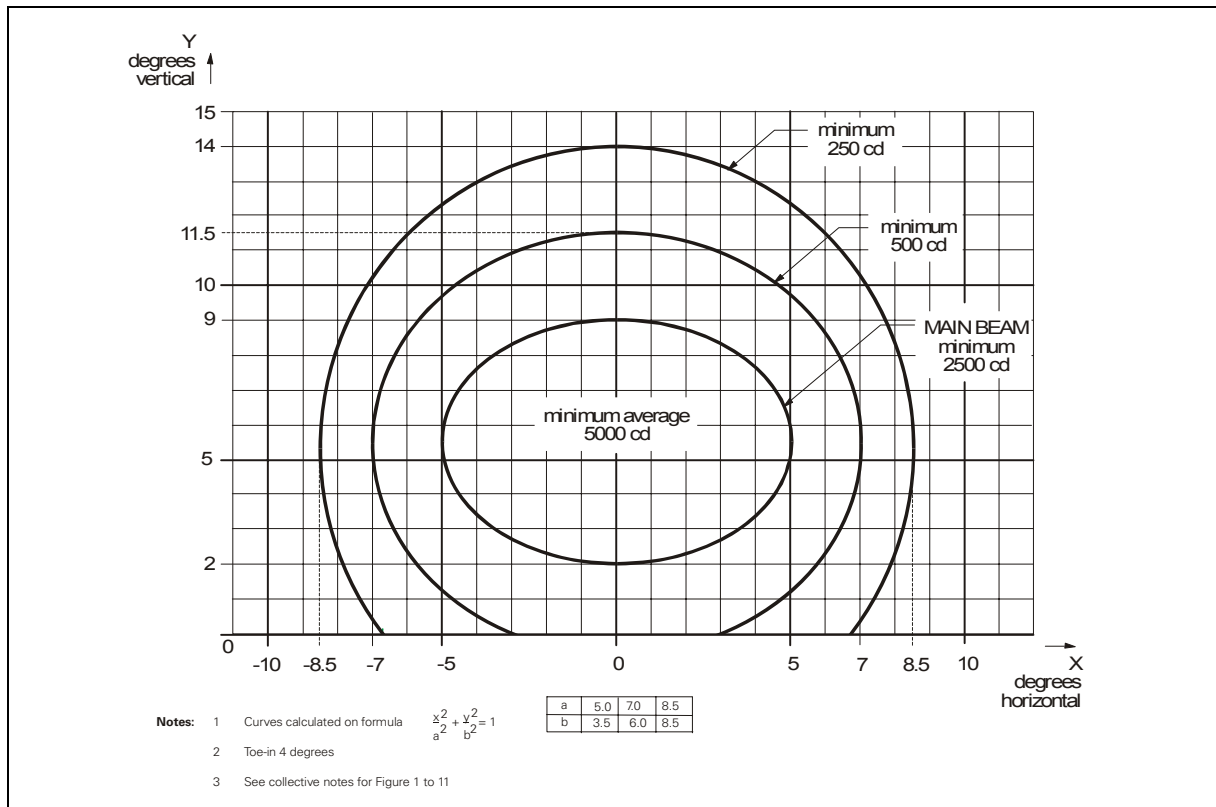


Figure 6A.5 Isocandela Diagram for Touchdown Zone Light (White Light)

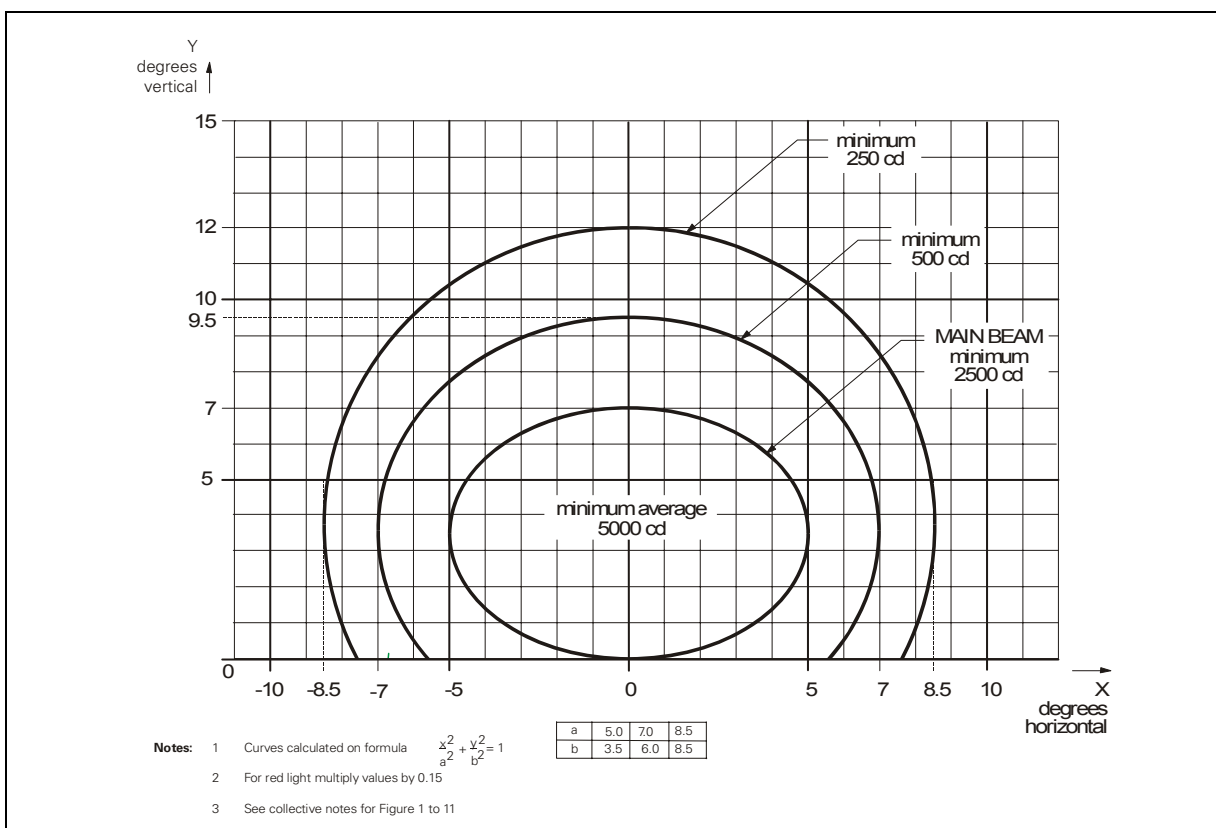


Figure 6A.6 Isocandela Diagram for Runway Centre Line Light with 30 m Longitudinal Spacing (White Light)

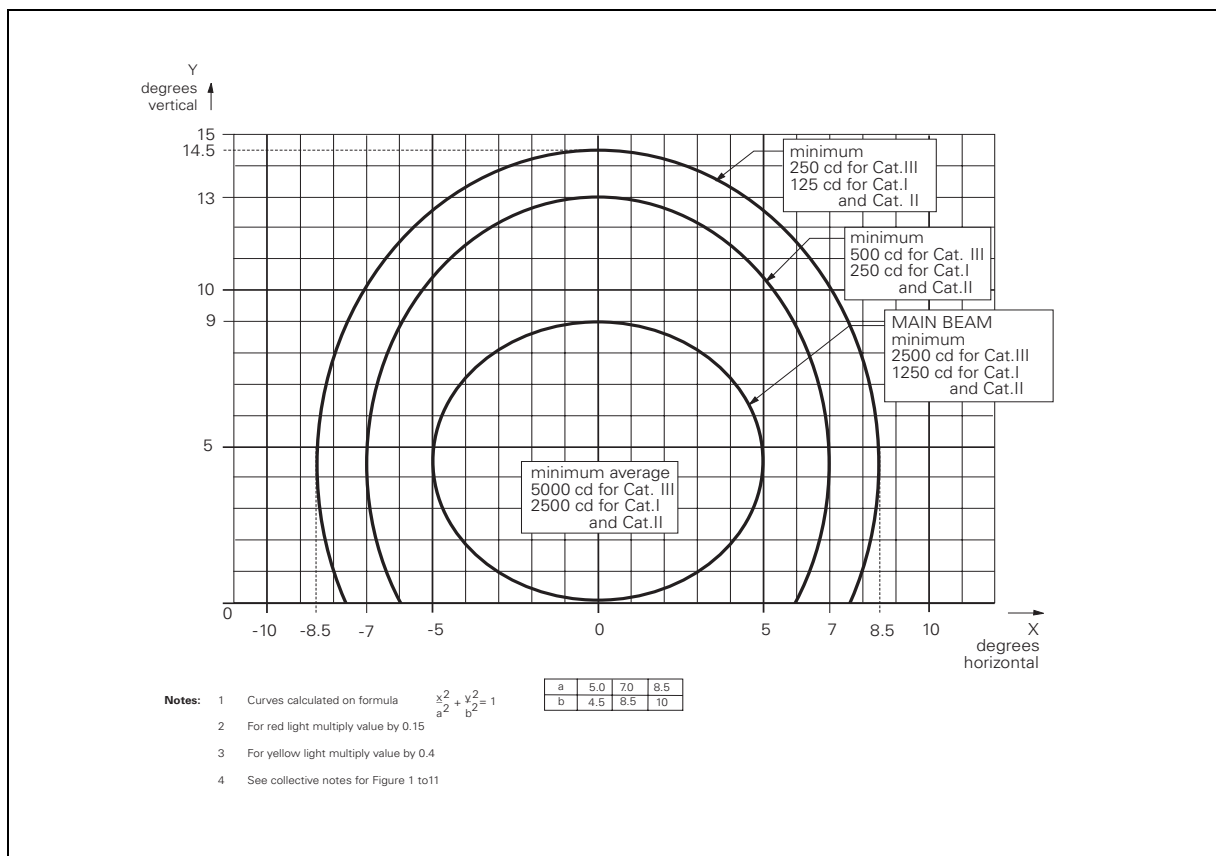


Figure 6A.7 Isocandela Diagram for Runway Centre Line Light with 15 m Longitudinal Spacing (White Light)

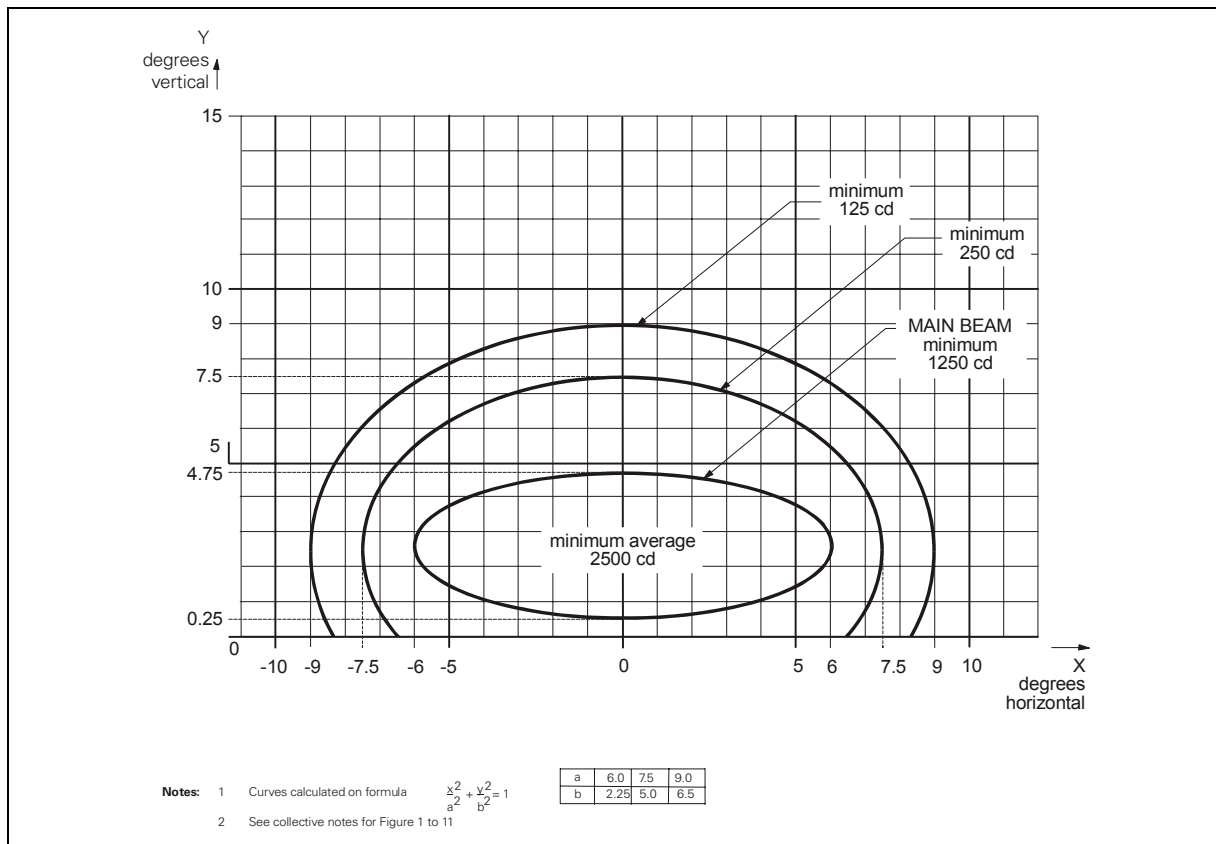


Figure 6A.8 Isocandela Diagram for Runway End Light (Red Light)

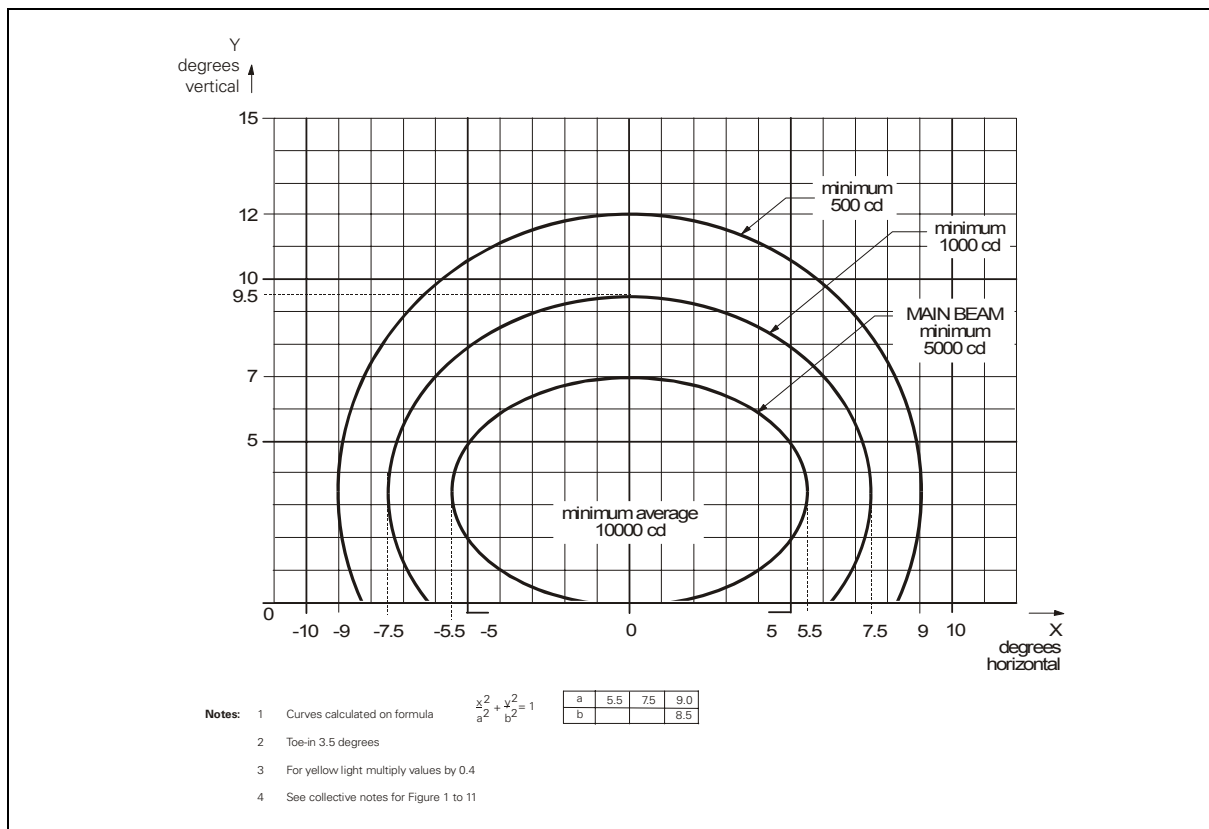


Figure 6A.9 Isocandela Diagram for Runway Edge Light where width of Runway is 45 m (White Light)

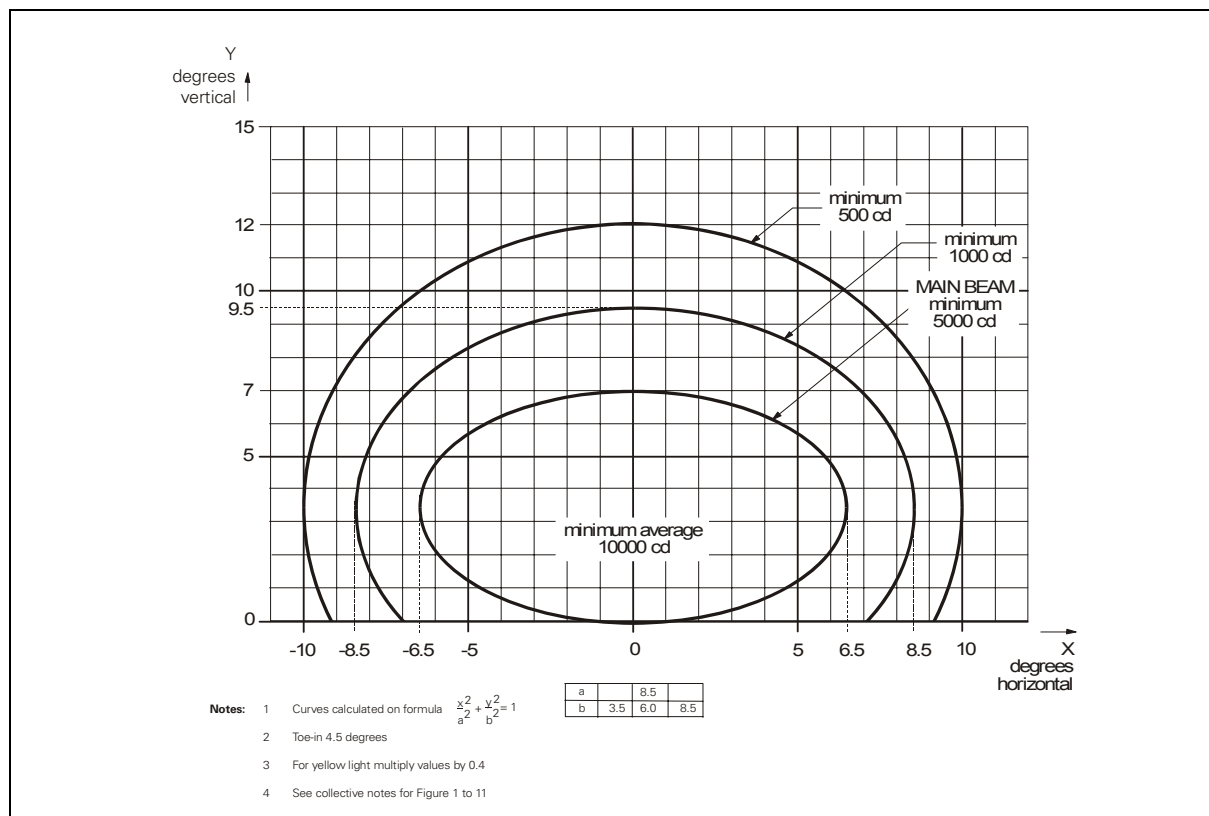


Figure 6A.10 Isocandela Diagram for Runway Edge Light where width of Runway is 60 m (White Light)

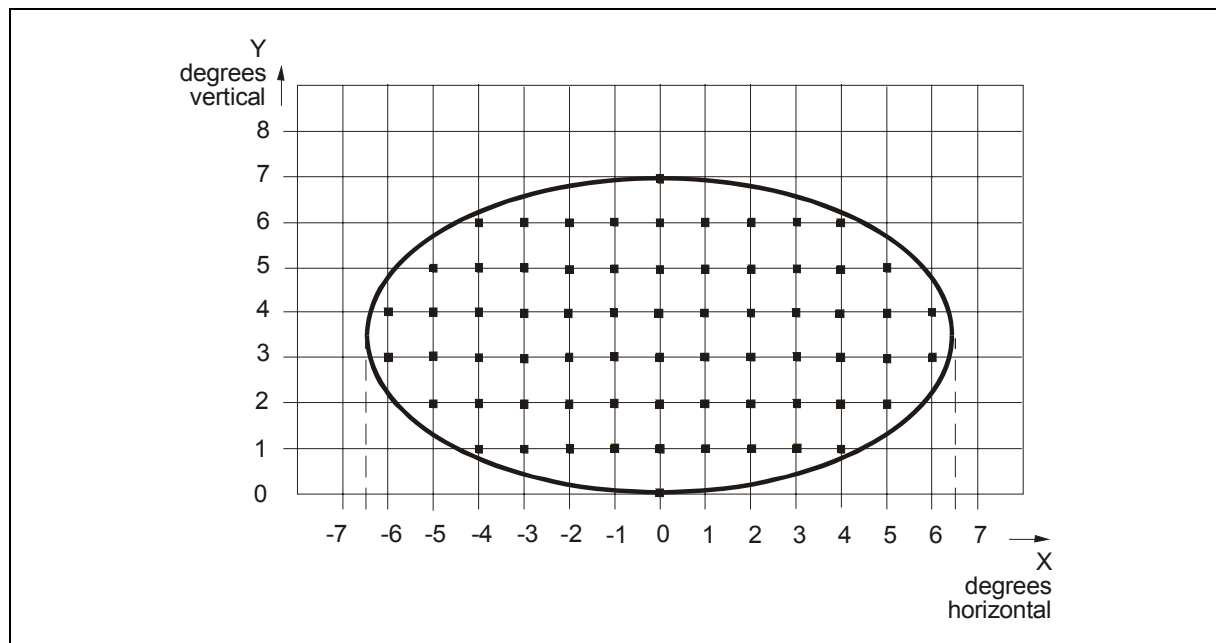


Figure 6A.11 Grid Points to be used for the Calculation of Average Intensity of Approach and Runway Lights

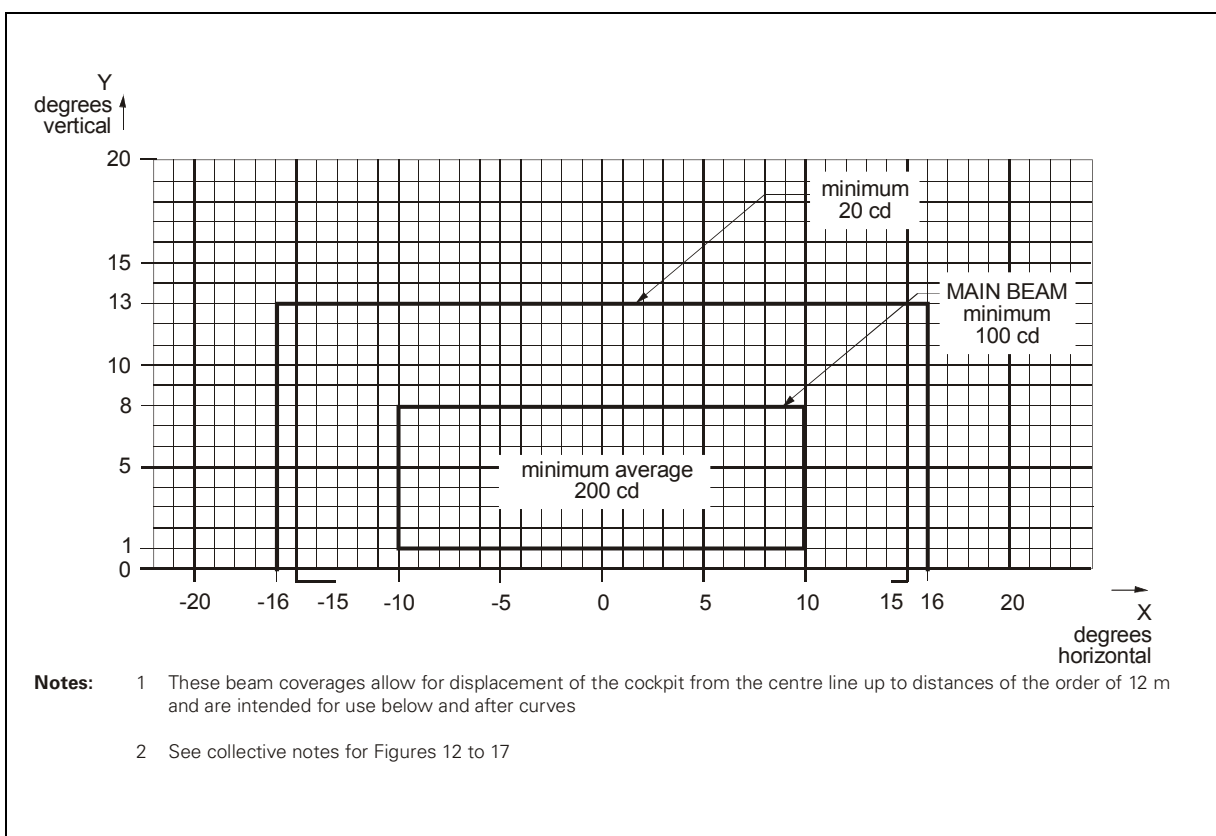


Figure 6A.12 Isocandela Diagram for Taxiway Centre Line (15 m Spacing), Turn Pad Lights and Stop-Bar Lights in Straight Sections Intended for use in Runway Visual Range Conditions of less than a value of the order of 400 m where large offsets can occur

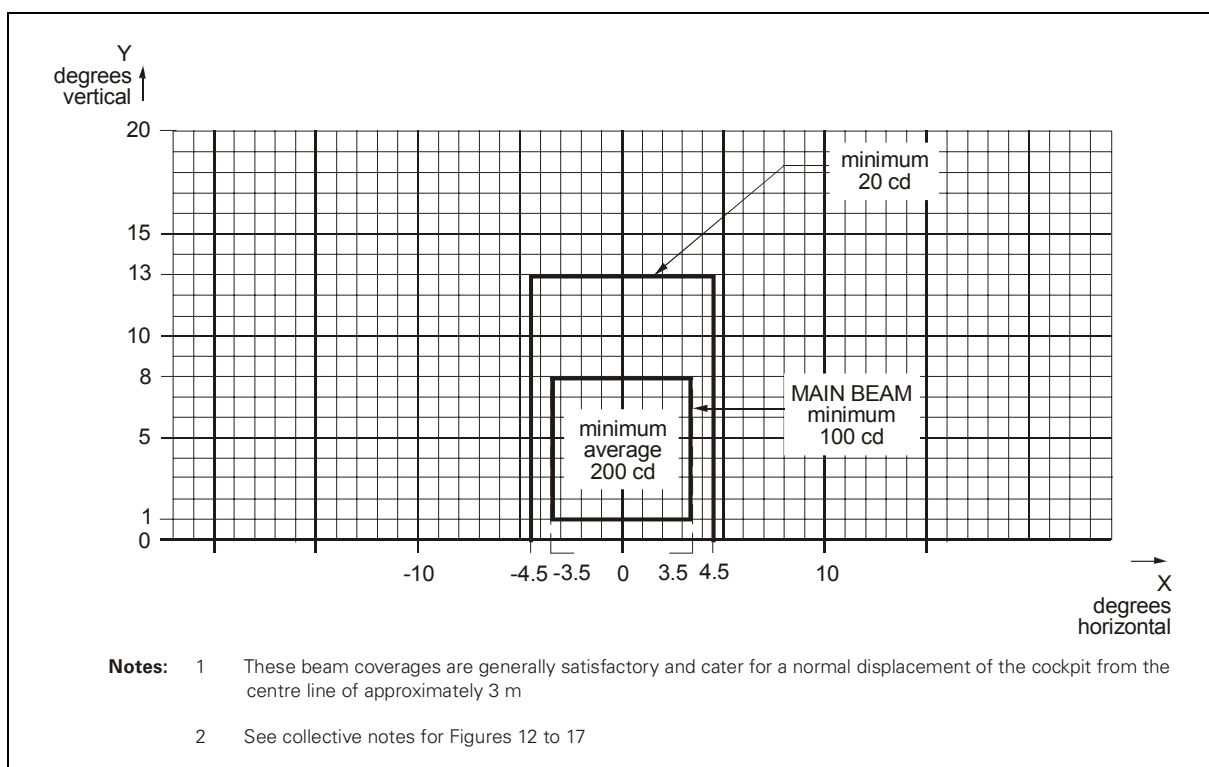


Figure 6A.13 Isocandela Diagram for Taxiway Centre Line (15 m Spacing), Turn Pad Lights and Stop-Bar Lights in Straight Sections Intended for use in Runway Visual Range Conditions of less than a value of the order of 400 m

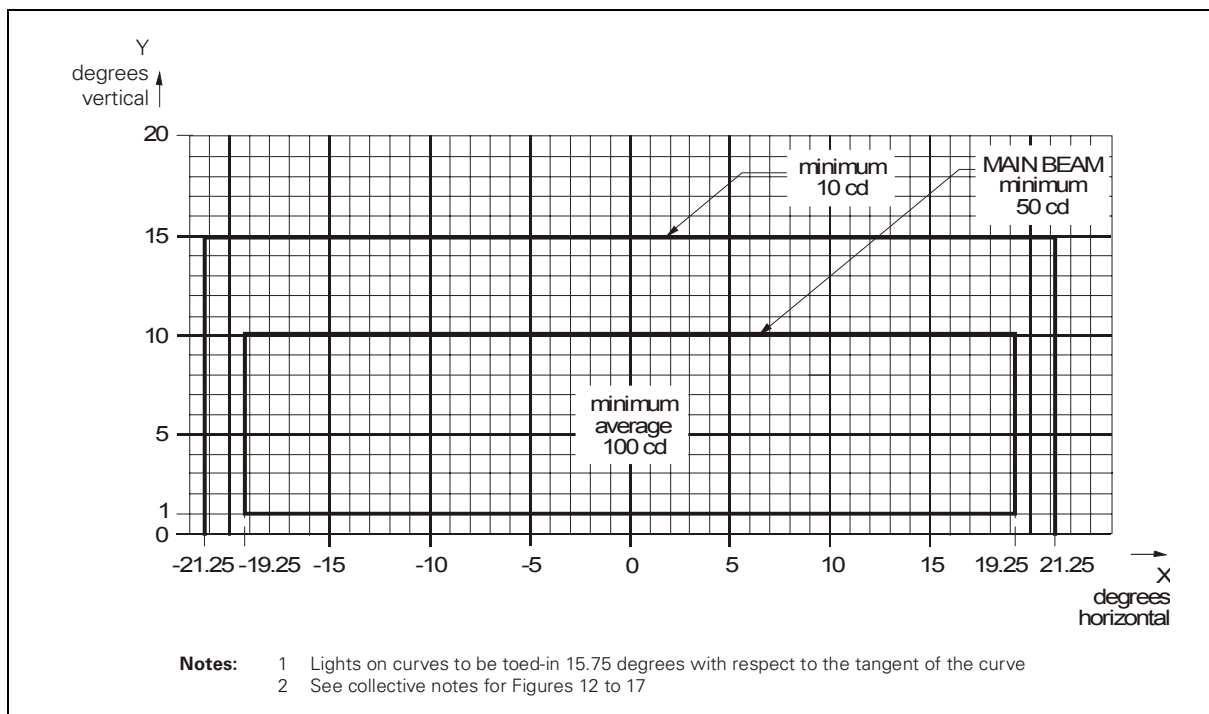


Figure 6A.14 Isocandela Diagram for Taxiway Centre Line (7.5 m Spacing), Turn Pad Lights and Stop-Bar Lights in Curved Sections Intended for use in Runway Visual Range Conditions of less than a value of the order of 400 m

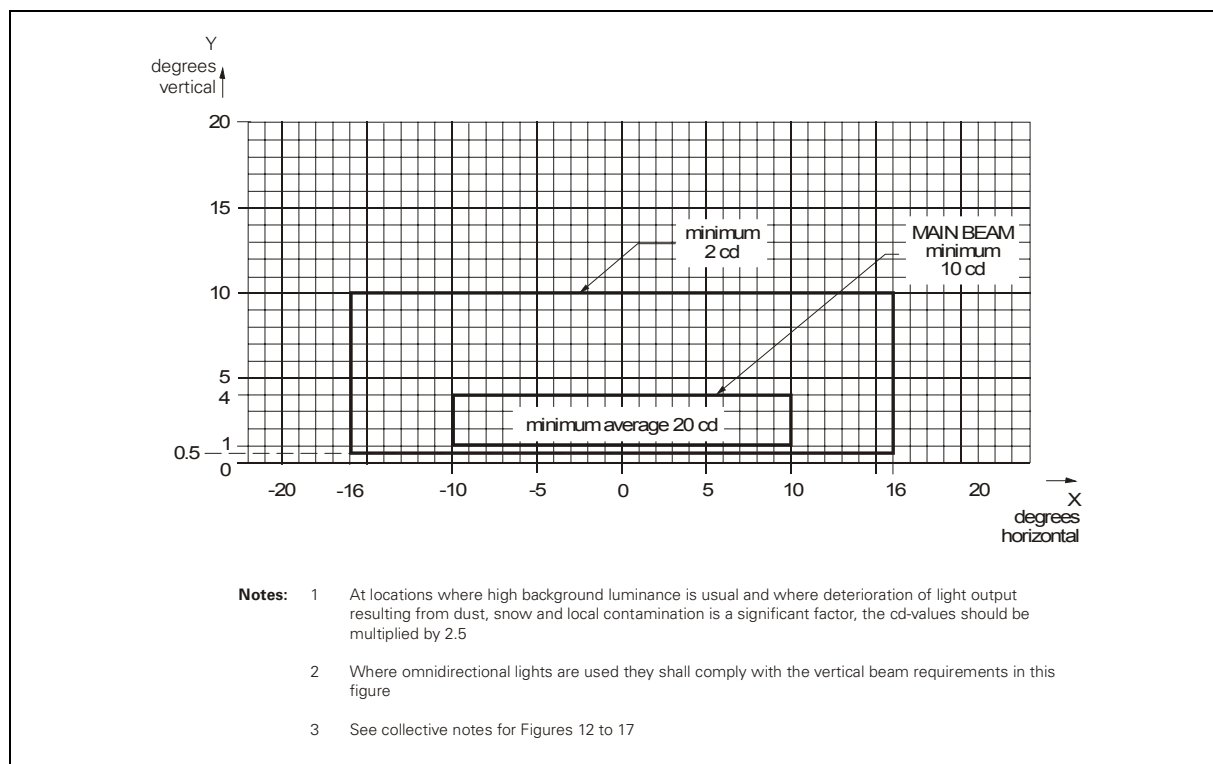


Figure 6A.15 Isocandela Diagram for Taxiway Centre Line (30 m, 60 m Spacing) and Stop-Bar Lights in Straight Sections Intended for use in Runway Visual Range Conditions of the order of 400 m or greater

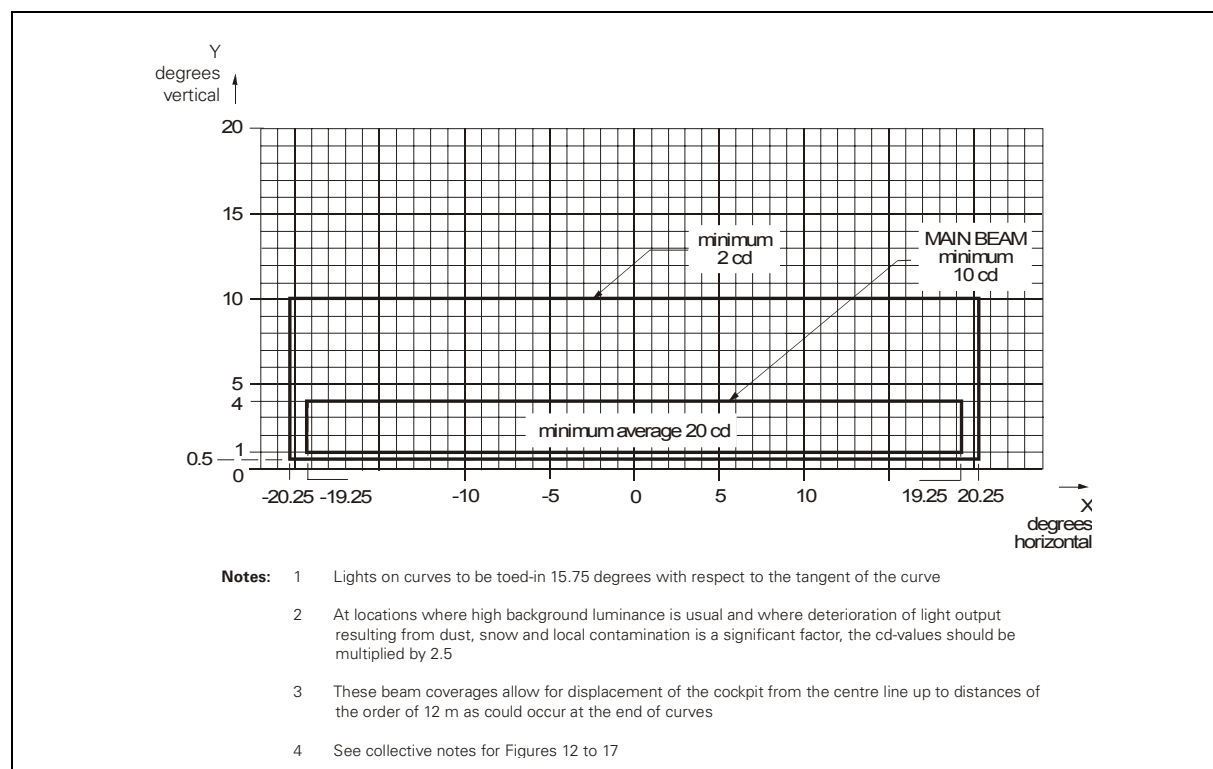


Figure 6A.16 Isocandela Diagram for Taxiway Centre Line (7.5 m, 10 m, 30 m Spacing) and Stop-Bar Lights in Curved Sections Intended for use in Runway Visual Range Conditions of the order of 400 m or greater

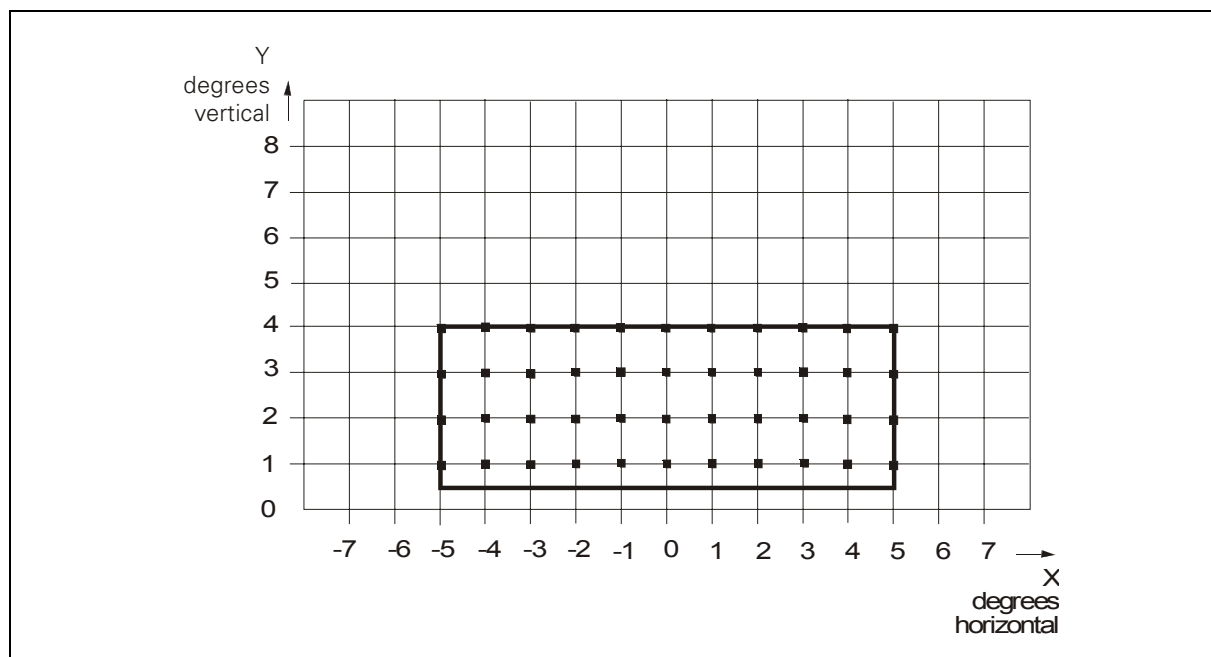


Figure 6A.17 Grid Points to be used for the Calculation of Average Intensity of Taxiway Centre Line and Stop-Bar Lights

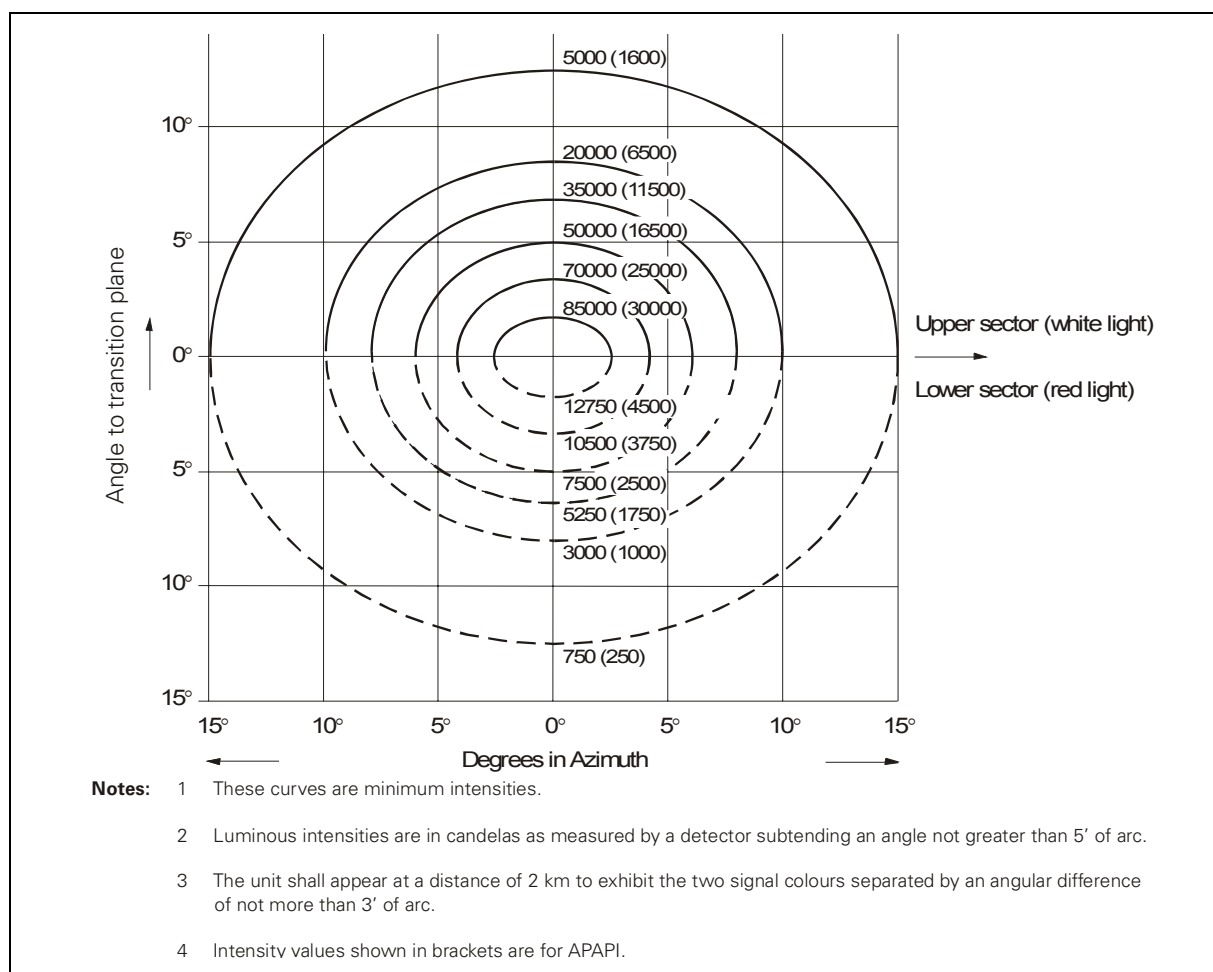


Figure 6A.18 Light Intensity Distribution of PAPI and APAPI

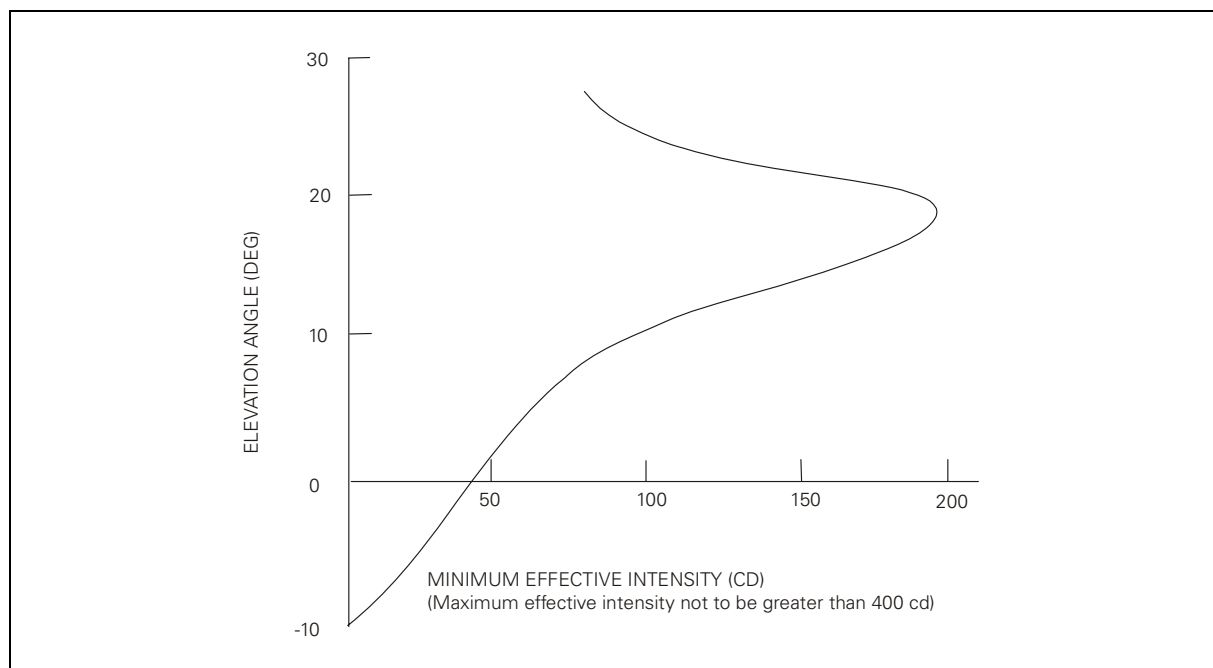


Figure 6A.19 Follow Me Vehicle Obstacle Light

4 Photometric Characteristics

4.1 Collective notes for Figures 6A.1 to 6A.11

- 4.1.1 The ellipses in each figure are symmetrical about the common vertical and horizontal axis.
- 4.1.2 On the perimeter of and within the ellipse defining the main beam in Figures 6A.1 to 6A.10 the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with paragraph 4.1.3.
- 4.1.3 Figures 1 to 20 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure 6A.11 and using the intensity values measured 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.
- 4.1.4 No deviations are acceptable in the main beam pattern when the lighting fixture is properly aimed. The light unit shall be installed so that the main beam is aligned within ± 1.2 degree of the specified requirement.
- 4.1.5 Average intensity ratio. The ratio between the average intensity within the ellipse defining the main beam of a typical new light and the average light intensity of the main beam of a new runway edge light shall be as follows:

Approach centreline and crossbars	Figure 6A.1	1.5 – 2.0
Approach side row	Figure 6A.2	1.5 – 1.0
Threshold	Figure 6A.3	1.0 – 1.5
Threshold wing bar	Figure 6A.4	1.0 – 1.5
Touchdown zone	Figure 6A.5	0.5 – 1.0

Runway centreline (longitudinal spacing 30 m)	Figure 6A.6	0.5 – 1.0 (white light)
Runway centreline (longitudinal spacing 15 m)	Figure 6A.7	0.5 – 1.0 for Cat III (white light) 0.25 – 0.5 for Cat I, II (white light)
Runway end	Figure 6A.8	0.25 – 0.5
Runway edge (45 m runway width)	Figure 6A.9	1.0 (white light)
Runway edge (60 m runway width)	Figure 6A.10	1.0 (white light)

4.1.6 The beam coverages in the figures provide the necessary guidance for approaches down to an RVR of 150 m and take-offs down to an RVR of 100 m.

4.2 **Collective notes for Figures 6A.12 to 6A.17**

4.2.1 Figures 6A.12 to 6A.16 show candela values in green and yellow for taxiway centreline lights and red for stop-bar lights.

4.2.2 On the perimeter of and within the rectangle defining the main beam in Figures 6A.12 to 6A.16 the maximum light intensity value shall not be greater than three times the minimum light intensity value measured in accordance with paragraph 4.2.3.

4.2.3 Figures 6A.12 to 6A.16 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure 6A.17 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.

4.2.4 No deviations are acceptable in the main beam when the lighting fixture is properly aimed.

4.2.5 Horizontal angles are measured with respect to the vertical plane through the taxiway centreline except on curves where they are measured with respect to the tangent to the curve.

4.2.6 Vertical angles are measured from the longitudinal slope of the taxiway surface.

4.2.7 The light unit shall be installed so that the main beam is aligned within $\pm 1/2$ degree of the specified requirement.

5 **Colour Requirements for AGL**

5.1 **General**

5.1.1 The colour of light signals is an important characteristic of the guidance provided by the AGL. It is incumbent upon Aerodrome Licensees to ensure that wherever a light signal depends on colour to provide essential information, the lighting equipment employed displays no misleading signals within the equipment beamspread or at any angle within the intended viewing segment.

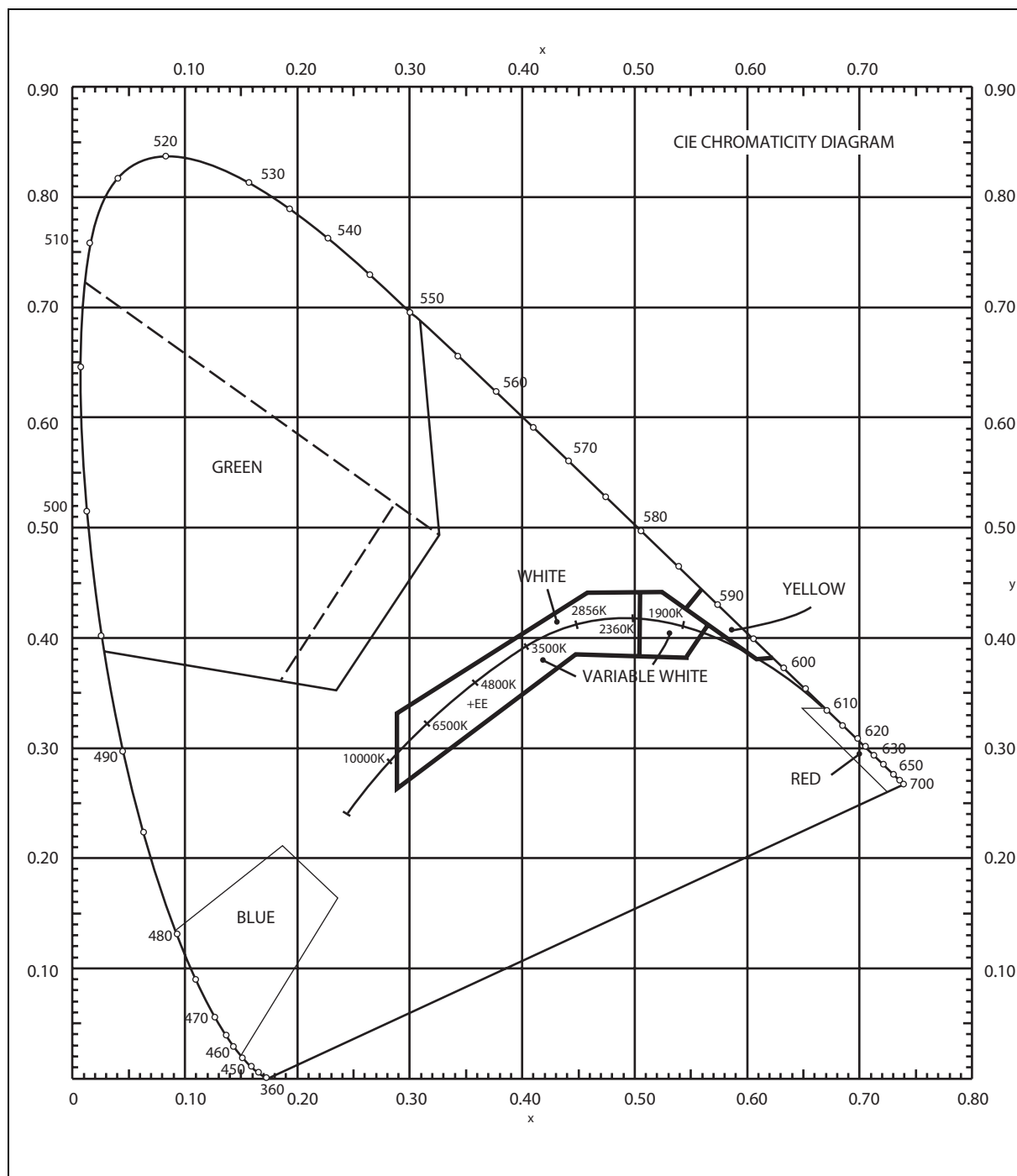


Figure 6A.20 Colours for aeronautical ground lights

- 5.1.2 The colour change associated with light fittings employing dichroic filters, when measured in the high intensity part of the beam, is generally still within the appropriate colour specification. However, depending on the layout of an aerodrome, it is possible for flightcrew or a vehicle driver to see incorrect colour signals when viewing a light signal from large offset angles. An example of the problem occurs where a stop-bar is installed on a wide taxiway leading onto a runway in such a manner that it is intended that the stop-bar should be seen when approached at an acute angle. In such situations it is possible for the stop-bar to display yellow rather than red light.

- 5.1.3 The colour of AGL should be verified by the manufacturer as being within the boundaries of Figure 6A.20 by measurement at five points within the area bounded by the innermost isocandela curve (isocandela diagrams 6A.1 to 6A.18 refer), with operation at rated current or voltage as follows:-
- 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);
 - 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;
 - a measurement of colour co-ordinates for the outermost isocandela curve should be made by the manufacturer and recorded for review and judgement of acceptability by the aerodrome authority;
 - where lights may be viewed and used by flightcrew from directions beyond that of the indicated isocandela curve (e.g. stop-bars at wide taxi-holding positions), the aerodrome authority should make a visual assessment of the actual application and, if necessary, require a check of colour shift at angular ranges beyond the outermost isocandela curve; and
 - the signal colours for (A)PAPI and AGL having a colour transition sector should be measured at points, as indicated above, except that the colour areas shall be treated separately and no point shall be within 0.5 degrees of the transition sector.

5.2 Chromaticities

- 5.2.1 The chromaticities of AGL shall be within the following boundaries:

CIE Equations (see Figure 6A.20)

- Red

Purple boundary	$y = 0.980 - x$
Yellow boundary	$y = 0.335$
- Yellow

Red boundary	$y = 0.382$
White boundary	$y = 0.790 - 0.667x$
Green boundary	$y = x - 0.120$
- Green

Yellow boundary	$x = 0.360 - 0.080y$
White boundary	$x = 0.650y$
Blue boundary	$y = 0.390 - 0.171x$
- Blue

Green boundary	$y = 0.805x + 0.065$
White boundary	$y = 0.400 - x$
Purple boundary	$x = 0.600y + 0.133$

e) White

Yellow boundary	$x = 0.500$
Blue boundary	$x = 0.285$
Green boundary	$y = 0.440$
and	$y = 0.150 + 0.640x$
Purple boundary	$y = 0.050 + 0.750x$
and	$y = 0.382$

f) Variable white

Yellow boundary	$x = 0.255 + 0.750y$
and	$x = 1.185 - 1.500y$
Blue boundary	$x = 0.285$
Green boundary	$y = 0.440$
and	$y = 0.150 + 0.640x$
Purple boundary	$y = 0.050 + 0.750x$
and	$y = 0.382$

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

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

5.2.3 Where increased certainty of recognition is more important than maximum visual range, green signals should be within the following boundaries:

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

5.3 Discrimination between lights

- 5.3.1 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.
- 5.3.2 If there is a requirement to discriminate yellow from green and/or white, as for example on exit taxiway centre line lights the y co-ordinates of the yellow light should not exceed a value of 0.40.

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

5.3.3 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:

- a) the x co-ordinate of the yellow is at least 0.050 greater than the x co-ordinate of the white; and
- b) the disposition of the lights will be such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

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Appendix 6B PAPI: Siting and Setting Angles

1 Layout and Elevation Setting Angles

- 1.1 The PAPI system comprises a four-unit wing bar normally located in a line at right angles to the runway. The unit nearest the runway is set higher than the required approach angle, with progressive reductions in the setting of the units further outboard. The arrangement of the units is shown at Figure 6B.1, together with the standard differential setting angles. Each unit should contain 3 light projectors.
- 1.2 The difference between the setting angles is normally 20 minutes of arc. This value may be varied where PAPI is used in conjunction with ILS (see paragraph 2.4.3 below) and where approach angles are steeper than 4° (see paragraph 5 below).

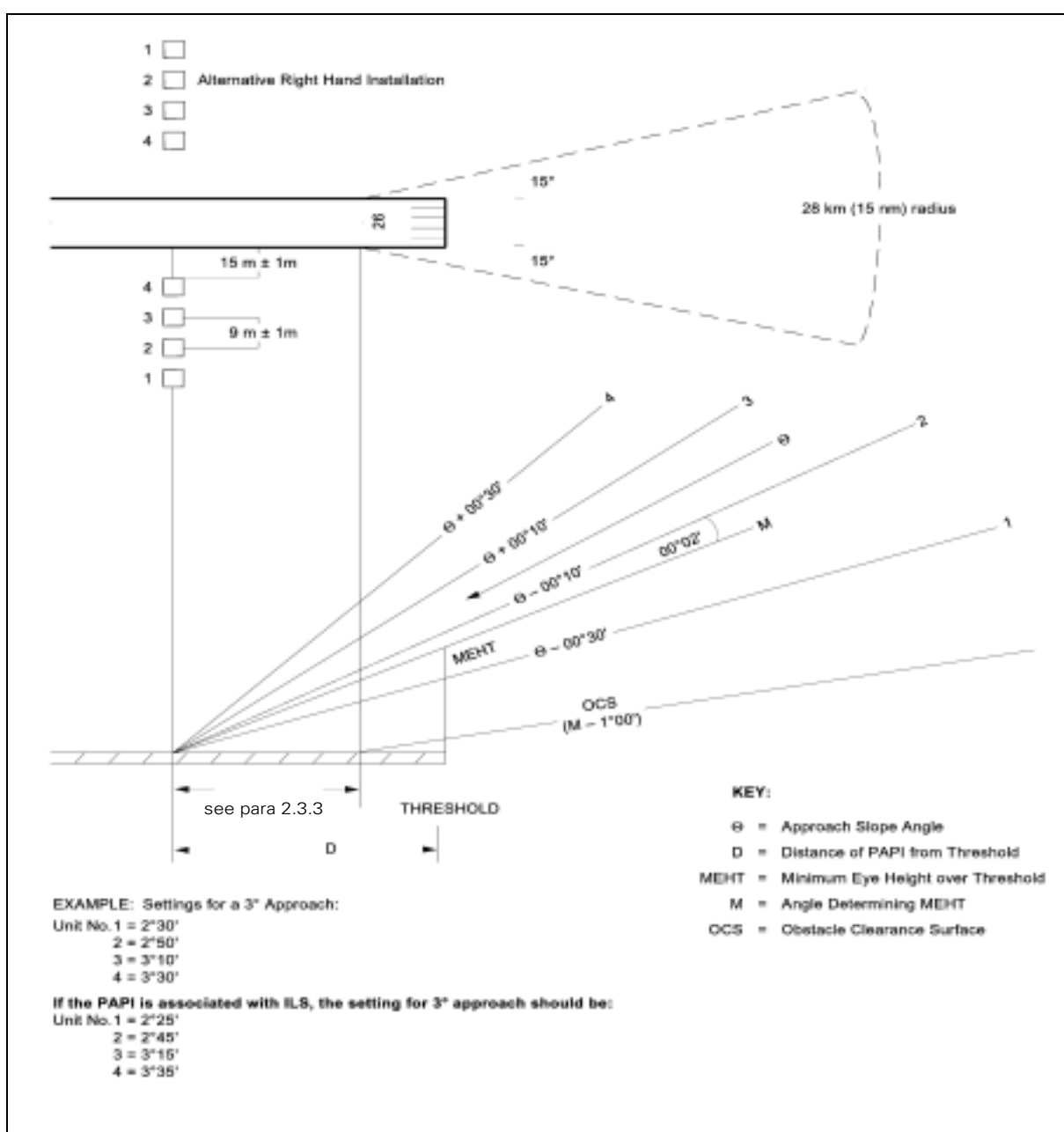


Figure 6B.1 PAPI: General arrangement

2 Distance from Threshold

2.1 The distance of PAPI from the runway threshold will depend upon the following:

- a) the need to provide adequate wheel clearance over threshold of a visual or non-precision approach runway for all types of aircraft for which the runway is intended, having due regard to the length of runway available for stopping the aircraft;
- b) obstacle clearance considerations;
- c) the operational requirement that PAPI be compatible with the instrument glidepath down to the minimum possible range and height for the types of aircraft for which the runway is intended; and
- d) any difference in elevation between the PAPI units and the runway threshold.

NOTE: The CAA should be consulted on the application of these variables in each case. With regard to d) above, it is recommended that the procedure described at paragraph 2.5.1 d) is adopted for ease of checking.

2.2 Wheel clearance and Minimum Eye Height over Threshold (MEHT)

2.2.1 Wheel clearance over threshold should take account of the eye-to-wheel height of the most demanding aircraft when it is at the lowest possible on-slope signal from the PAPI. The MEHT will be agreed in consultation with the CAA.

2.2.2 The angle which establishes the MEHT is two minutes of arc less than the setting angle of the unit defining the lower on-slope boundary (see Figure 6B.1). Where a runway is not equipped with ILS, MEHT should provide the wheel clearances specified in Table 6B.1. The MEHT is the combination of the eye-to-wheel height and the wheel clearance.

Table 6B.1 Wheel clearance over threshold for PAPI and APAPI

Eye-to-wheel height of aeroplane in the approach configuration Note 1	Desired wheel clearance Notes 2, 3 (metres)	Minimum wheel clearance Note 4 (metres)
(1)	(2)	(3)
up to but not including 3 m	6	3 (Note 5)
3 m up to but not including 5 m	9	4
5 m up to but not including 8 m	9	5
8 m up to but not including 14 m	9	6

NOTES:

- 1 In selecting the eye-to-wheel height group, only aeroplanes meant to use the system on a regular basis shall be considered. The most demanding amongst such aeroplanes shall determine the eye-to-wheel height group.
- 2 Where practicable the desired wheel clearances shown in column (2) shall be provided.
- 3 The wheel clearances in column (2) may be reduced to no less than those in column (3) where an aeronautical study indicates that such reduced wheel clearances are acceptable.
- 4 When a reduced wheel clearance is provided at a displaced threshold it shall be ensured that the corresponding desired wheel clearance specified in column (2) will be available

when an aeroplane at the top end of the eye-to-wheel group chosen overflies the extremity of the runway.

- 5 This wheel clearance may be reduced to 1.5 m on runways used mainly by lightweight non turbo-jet aeroplanes.

2.3 Obstacle clearance considerations

- 2.3.1 The nominal approach angle should be such that flightcrew of an aeroplane receiving the lowest on-slope signal will clear all obstacles in the approach area by a safe margin. To achieve this an Obstacle Clearance Surface (OCS) is established which should not be penetrated by any object.
- 2.3.2 The OCS for PAPI is a plane 1° below the angle of the lower boundary of the on-slope signal. Figure 6B.1 shows that for a normal approach angle of 3° the OCS will be $2^\circ 48' - 1^\circ = 1^\circ 48'$. The surface extends to 15° either side of the runway edge out to a distance of 28 km (15 nm).
- 2.3.3 The OCS originates at the same level as the units but at the following distances downwind of them:
 - a) 90 m where the LDA is 1200 m or greater;
 - b) 60 m where the LDA is 800–1199 m;
 - c) 30 m where the LDA is less than 800 m.

2.4 Compatibility of PAPI with ILS

- 2.4.1 PAPI should be sited so that its on-slope signal conforms as closely as possible with that of the ILS glidepath. The variables that need to be considered are fluctuations of the ILS glidepath and the different eye-to-aerial height of various types of aeroplane.
- 2.4.2 An ILS glidepath has a tolerance of ± 0.075 of the nominal glidepath angle for a Category I or II system and of ± 0.04 for a Category III. For a nominal 3° glideslope the tolerances are ± 13.5 and ± 7.2 minutes of arc respectively. The standard PAPI settings define a glideslope within 10 minutes of arc and can therefore show a variation from a nominal ILS glideslope that is operating within its tolerances.
- 2.4.3 Flightcrew's eye-to-aerial height varies considerably with aeroplane type and will affect the minimum range to which PAPI and ILS harmonisation is achieved. In order to allow for the full range of public transport aircraft, harmonisation is enhanced by widening the on-slope sector from 20 minutes to 30 minutes of arc. As mentioned in paragraph 2.4.2 above, the ILS glidepath angle may vary, so it is desirable to check the calibrated ILS GP angle against the PAPI settings and to change the latter if necessary. Such changes should be referred to the CAA for approval before they are implemented.

2.5 Procedure for establishing the distance of the PAPI wing bar from the runway threshold

- 2.5.1 When the required approach angle and associated unit setting angles have been determined, the parameters outlined at paragraph 2.1 are applied as follows:
 - a) In order to provide the appropriate wheel clearance over the threshold of a visual or non-precision approach runway, the distance of PAPI from the threshold is established by adding the approach configuration eye-to-wheel height of the most demanding aeroplane using the runway to the required threshold wheel clearance and dividing the result by the tangent of angle M in Figure 6B.1 or 6B.3 as appropriate.
 - b) Where ILS is installed (see paragraph 2.4) the PAPI should be sited upwind of the effective ILS glidepath origin by a distance that is dependent upon the range of

eye-to-aerial heights of the aeroplanes using the runway. For a 3° approach angle and no difference in elevation between the ILS and PAPI signal origins the distances are as follows:

- i) All aeroplanes including B747 67 m
 - ii) All aeroplanes excluding B747 35 m
 - iii) All aeroplanes excluding B747 and A300 26 m
- c) The OCS origin is determined in accordance with the requirements of paragraph 2.3.3 above and the surface (see Figures 6B.1 for PAPI and 6B.3 for APAPI) examined in order to confirm the absence of infringements. If the surface is penetrated but the offending object cannot be removed, the vertical extent of the infringement is divided by the tangent of the OCS angle, and the PAPI relocated that much further from the threshold. Alternatively, where a prescribed approach angle is not critical, it may be increased by the angular extent of the infringement. In some circumstances a combined displacement and angular increase may be the best solution.
- d) A height difference between threshold and unit lens centres exceeding 0.3 m will require a siting adjustment as follows:
- i) In Figure 6B.2 the uncorrected visual aiming point is shown as the distance D₁ from the threshold. The nominal siting of PAPI would be on a line at right angles to the runway centreline at this distance, the units being P₁, P₂, P₃ and P₄.
 - ii) The height difference between the threshold T_h, and the lens centre of the highest of the units (P_n) at the nominal sites P₁ to P₄ is determined. The following formula will determine the revised distance from threshold D₂:

$$D_1 + (T_h - P_n) \cot \emptyset = D_2$$

where \emptyset is the setting angle of the unit at site P₂, less 2 minutes of arc (cot \emptyset can be taken as 20 for a 3° approach).

- iii) The highest unit level at distance D₂, (P_c) is compared with P_n. If the difference is 0.3 m or more, the final siting, D₃, is determined as follows:

$$D_2 + (P_n - P_c) \cot \emptyset = D_3.$$

- iv) The MEHT resulting from the level of unit P₂ at D₃ is checked to ensure that it achieves the original target.

2.5.2 Further guidance is contained in the ICAO Aerodrome Design Manual Part 4 Visual Aids (Doc 9157 – AN/901).

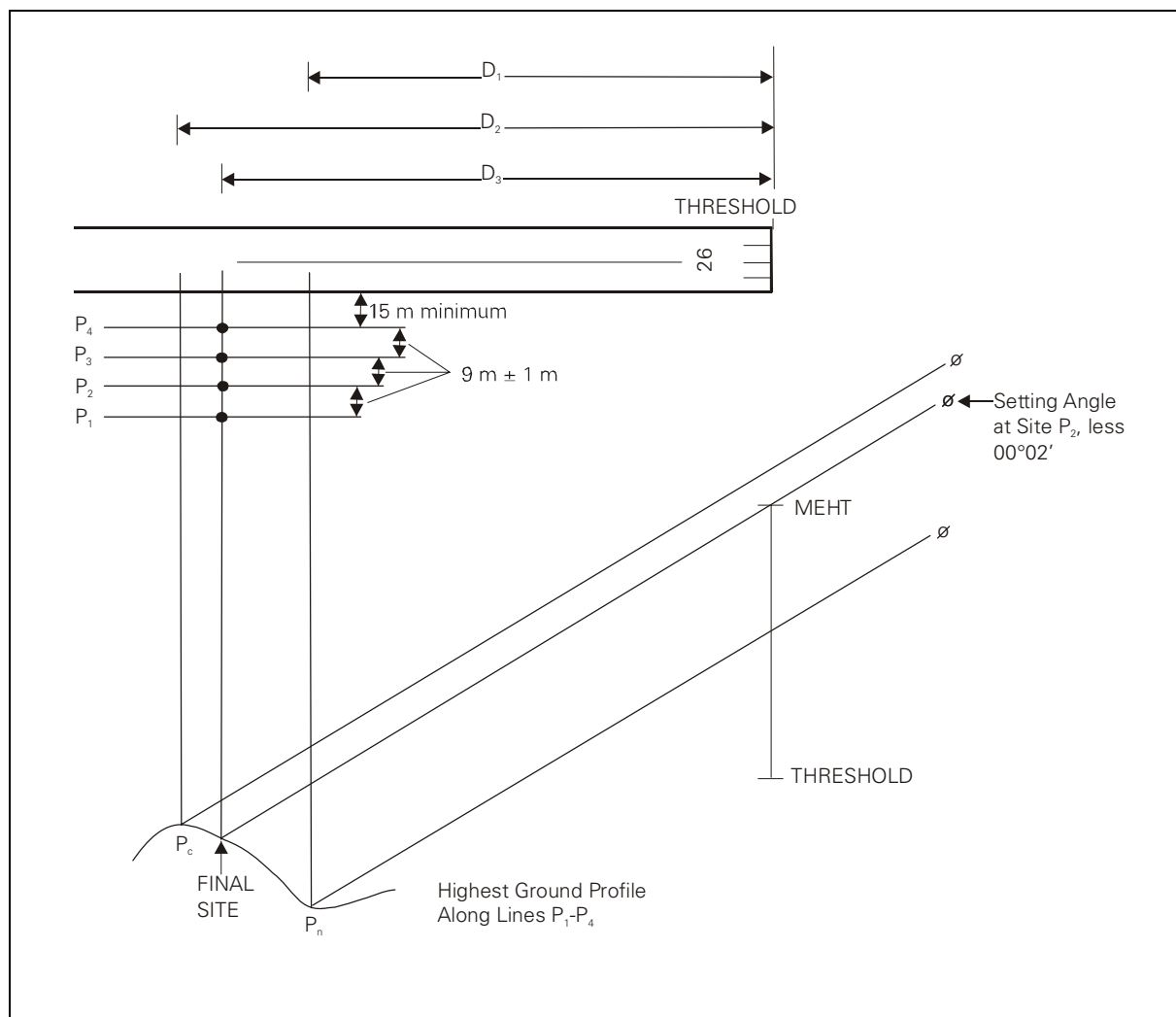


Figure 6B.2 PAPI siting – principle of compensation for different ground heights

3 Installation

- 3.1 PAPI units should be mounted as close to ground level as practicable but overall height should never exceed 0.9 m. The units of a wing bar should all lie in the same horizontal plane, but where crossfalls make this impracticable within the 0.9 m constraint, the height difference between adjacent units should preferably not exceed 5 cm. Where even this tolerance cannot be achieved, a maximum gradient of 1.25% across the bar can be accepted provided that it is uniform.
- 3.2 The spacing between units (see Figure 6B.1) will normally be $9\text{ m} \pm 1\text{ m}$, except that a spacing of not less than 6 m between units may be used with agreement of the CAA where there is insufficient strip width to accommodate all four units at 9 m spacing.
- 3.3 The inner edge of the unit nearest the runway should be $15\text{ m} \pm 1\text{ m}$ from the runway edge. Units should not be closer than 14 m to any taxiway, apron, or another runway.
- 3.4 Firm stable bases are essential for PAPI units, and concrete should be used. Bases should be either depressed below ground level and covered with a suitable infill or flush fitted. The edges of bases should be constructed in the manner prescribed at Chapter 3 paragraph 4.1.3.

4 Initial Checking of Elevation Angles

- 4.1 Setting angles are checked using a theodolite or equivalent device. Errors in excess of 1 minute of arc should be corrected.
- 4.2 After installation, angular errors caused by settling of the bases may occur. Therefore, the angles should initially be checked daily using a clinometer or equivalent device and, if necessary, adjusted using a theodolite. The interval between checks may be extended progressively to once a week as greater stability becomes evident. However, special checks should be made in the event of heavy frost or rain or a significant change of weather such as the end of a drought, since angular variations are possible at such times. For elevation angle checks after installation see paragraph 12.4.1.

5 Variations of PAPI Differential Settings with Increasing Approach Angle

- 5.1 As approach angles steepen, wider differential settings are needed between units in order to facilitate approach slope capture and flyability.
- 5.2 Those differential settings that have been found to be satisfactory are:

Approach angle	Differential setting angle
2° – 4°	00°20' (except for ILS, see paragraph 2.4.3)
4° – 7°	00°30'
over 7°	01°00'

6 APAPI

- 6.1 The calculations for the siting and the setting criteria of APAPI are the same as for PAPI, with the following exceptions:
- Two units are used normally spaced 6 m apart, the inner unit at least 10 m from the runway edge. (See Figure 6B.3 for siting adjustments.)
 - The differential setting between the units is 0°30' i.e., the approach angle $\phi \pm 15'$.
 - The MEHT datum angle M is 0°02' below the setting angle of unit No. 1.
 - The OCS is 1° below the angle M, and for low intensity units extends only to 10 km.

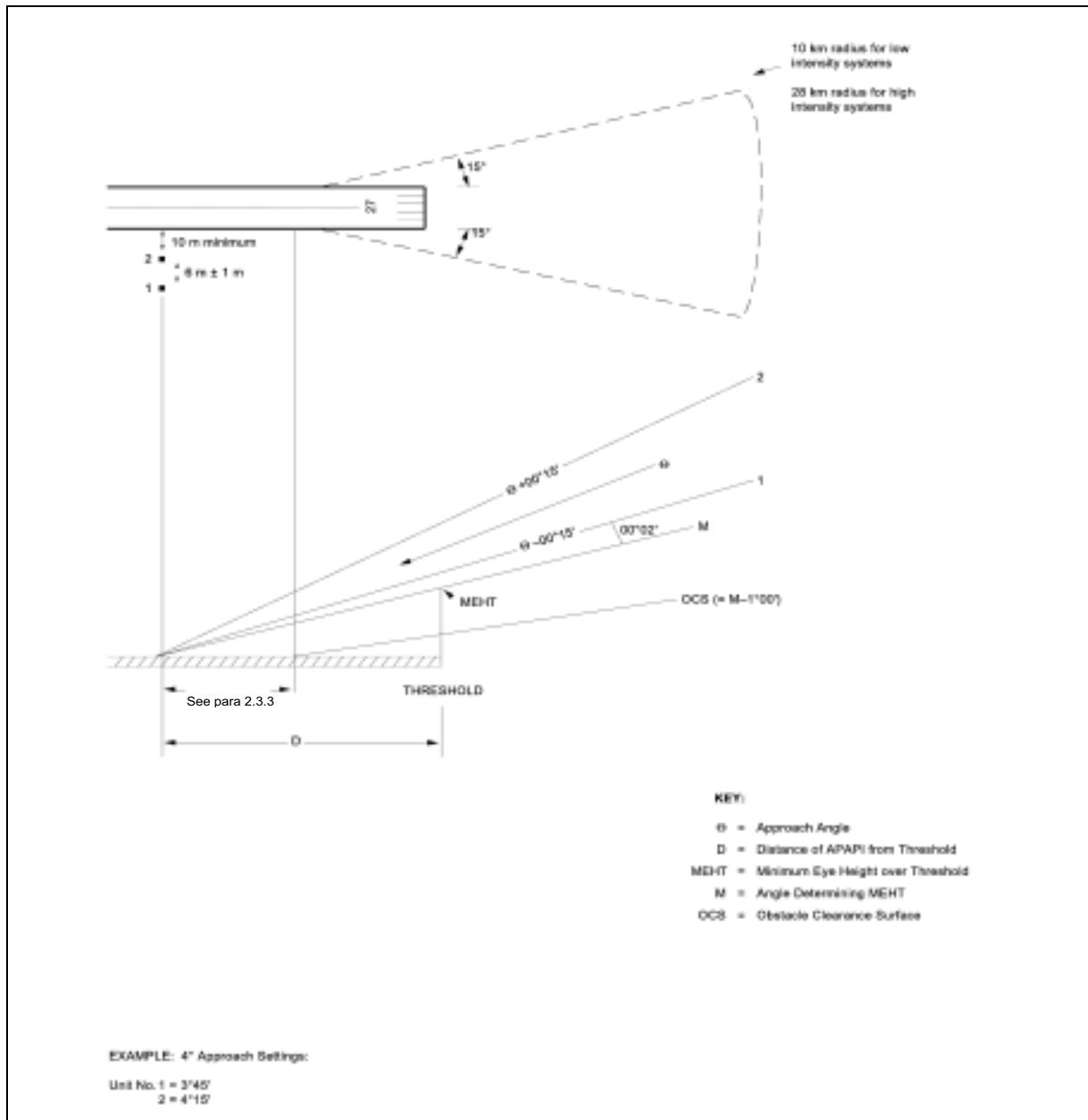


Figure 6B.3 APAPI general arrangement

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Appendix 6C Procedure for the Routine Flight Inspection of Approach and Runway Lights

NOTES:

- 1 For simplicity in presentation this procedure is written as a series of steps, but with flight experience it should be possible to combine some of them and complete an inspection with fewer approaches.
- 2 These checks should not be carried out in weather conditions worse than cloud ceiling 1500 ft and visibility 10 km.
- 3 Form CA 1560 is provided for the recording of the flight check. An electronic copy is available on request.

Approach Lighting Pattern

- Check 1** Carry out a normal approach from the final approach fix (FAF) or at least 5 nm starting with all approach lights at the maximum luminous intensity setting. Check that a uniform pattern is presented to an aircraft on the normal approach path. Flight variations should be made about the approach path. Small variations in elevation and azimuth should not produce any noticeable change in the intensity of the lights. Large variations will produce a progressive reduction in intensity as the aircraft leaves the area of primary cover of the lights. These changes in intensity should be similar for all lights. Ragged changes are normally caused by incorrect setting angles of individual units, and a note of these should be made for subsequent checking on the ground.
- Check 2** During the approach call for progressive reductions in luminous intensity down to the minimum setting. Check that all lights respond correctly and simultaneously to the setting changes. With all approach lights set at a suitable luminous intensity setting (the lowest at which the individual lights are discernible is normally best) check that all the individual lights are illuminated. Note and record all outages and misalignments.

Supplementary Approach Lights (When Installed)

- Check 3** Repeat Checks 1 and 2 above for supplementary approach lighting.
- Check 4** Repeat with approach and supplementary approach lighting combined.

Runway Edge, Threshold and End Lights

- Check 5** With edge, threshold and end lights at maximum luminous intensity, check that a uniform pattern is presented to an aircraft taking-off, landing and going around. Check that there is a progressive and even reduction in the intensity of the lights as the aircraft leaves their area of primary cover.

Check 6 From the downwind leg check that all omnidirectional runway lights are visible and that they clearly define the runway edges.

Check 7 During a normal approach, initially with the runway lights at maximum intensity, call for progressive reductions in the light intensities down to the minimum setting. Check that all lights respond correctly and simultaneously to the setting changes. At a low luminous intensity setting, carry out a low go-around and check for any light outages or misalignments.

Runway Centreline Lights

Check 8 Repeat Checks 5 and 7 above for the runway centreline lights.

Touchdown Zone Lights

Check 9 Repeat Checks 5 and 7 above for touchdown zone lights.

Complete Check of Approach and Runway Lighting

Check 10 With all approach and runway lights set at the luminous intensity levels appropriate to the conditions prevailing (see Table 6.4) carry out a normal approach. Check that a balanced lighting system is presented to flightcrew. Call for luminous intensity adjustments appropriate to other conditions and check that the intensity balance is maintained. Check that the colour of the AGL corresponds to that expected.

Check visibility of illuminated wind sleeve and landing T where installed.

Obstacle Lights

Check 11 Check obstacle lighting on or in the immediate vicinity of the aerodrome for outages.

Location/identification Beacon

Check 12 Check that the beacon is clearly discernible at a range appropriate to the conditions, and that the coding/flash rate is correct.

Dangerous/confusing Lights

Check 13 Check for dangerous or confusing lights.

CIVIL AVIATION AUTHORITY

Aeronautical Ground Lighting Flight Inspection Report (Simple)

(This form is to be completed during or immediately after the flight)

Aerodrome _____ Runway _____

PAPI	Transition	APAPI
<input type="checkbox"/> W	<input type="checkbox"/> W	<input type="checkbox"/> W
<input type="checkbox"/> W	<input type="checkbox"/> W	<input type="checkbox"/> W
<input type="checkbox"/> W	<input type="checkbox"/> R	<input type="checkbox"/> R
<input type="checkbox"/> W	<input type="checkbox"/> R	<input type="checkbox"/> R
<input type="checkbox"/> R	<input type="checkbox"/> R	<input type="checkbox"/> R

Range (FAF) _____ nm

Intensity Changes

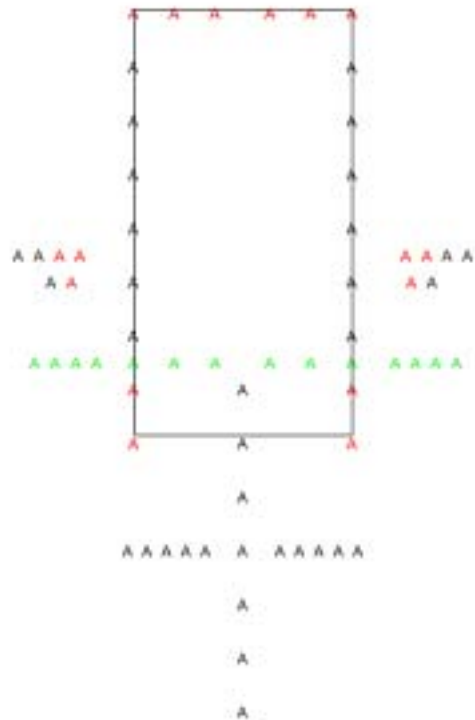
<input type="checkbox"/>	100%
<input type="checkbox"/>	80%
<input type="checkbox"/>	30%
<input type="checkbox"/>	10%
<input type="checkbox"/>	3%
<input type="checkbox"/>	1%
<input type="checkbox"/>	OFF

Continuous Assessment

	Low	On-slope	High
Intensity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alignment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall Assessment

- ☐ Approach/Runway Balance
- ☐ Circling Guidance
- ☐ Approach
- ☐ Strobe
- ☐ Threshold
- ☐ Runway Edge
- ☐ Stop-end
- ☐ Windsleeves
- ☐ Beacon
- ☐ Obstacle



Inspected by _____ Date _____

CA 1508 E (Part 1)
170400

CIVIL AVIATION AUTHORITY

Aeronautical Ground Lighting Flight Inspection Report (CAT I)

(This form is to be completed during or immediately after the fight)

Aerodrome _____ Runway _____

PAPI Transition	ILS Correlation
1	0.99
2	0.99
3	0.99
4	0.99
5	0.99
6	0.99
7	0.99
8	0.99
9	0.99
10	0.99
11	0.99
12	0.99
13	0.99
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92	0.99
93	0.99
94	0.99
95	0.99
96	0.99
97	0.99
98	0.99
99	0.99
100	0.99

	W	W	W	W	
	W	W	W	R	
	W	W	R	R	
	W	R	R	R	
	R	R	R	R	

Range (FAF) _____ nm

Intensity Changes

	100%
	80%
	30%
	10%
	3%
	1%
	OFF

Continuous Assessment

	Low	On-slope	High
Intensity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alignment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall Assessment

- ☐ Approach/Runway Balance
- ☐ Circling Guidance
- ☐ Approach
- ☐ Threshold
- ☐ Runway Centreline
- ☐ Runway Edge
- ☐ Runway Centreline Coding
- ☐ Stop-end
- ☐ Windscreens
- ☐ Beacon
- ☐ Obstacle

Inspected by _____ Date _____

CIVIL AVIATION AUTHORITY									
Aeronautical Ground Lighting Flight Inspection Report (CAT II/III) <small>(This form is to be completed during or immediately after the flight)</small>									
Aerodrome _____					Runway _____				
PAPI Transition		ILS Correlation							
□	W	W	W	W	□				
□	W	W	W	R	□				
□	W	W	R	R	□				
□	W	R	R	R	□				
□	R	R	R	R	□				
Range (FAF) _____ nm									
Intensity Changes									
□	100%								
□	80%								
□	30%								
□	10%								
□	3%								
□	1%								
□	OFF								
Continuous Assessment									
	Low	On-slope	High						
Intensity	□	□	□						
Alignment	□	□	□						
Overall Assessment									
□	Approach/Runway Balance								
□	Circling Guidance								
□	Approach								
□	Supplementary								
□	Threshold								
□	Touchdown Zone (TDZ)								
□	Runway Centreline								
□	Runway Edge								
□	Runway Centreline Coding								
□	Stop-end								
□	Windscreens								
□	Beacon								
□	Obstacle								
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Inspected by _____ Date _____ </div> </div> <div style="width: 50%; text-align: center;"> </div> </div>									

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Appendix 6D Procedure for the Flight Inspection of PAPI and APAPI

NOTES:

- 1 High intensity units may be checked by day at intensities of 30% or higher. Checks should be completed at dusk or night for lower intensities and for low intensity units. However care must be exercised when checking obstacle clearances when at night.
- 2 These checks should not be carried out in weather conditions worse than cloud ceiling 1500 ft and visibility 10 km.

Effective Range

- Check 1** At a range of approximately 7.5–9 km and height about 1500 ft QFE check the effective range. In daylight the difference between the red and white lights should be clearly discernible at a minimum of 7.5 km in good visibility.

Colour Changes

- Check 2** Commence an approach from 7.5 km flying level at 1000 ft QFE and check that the units are evenly illuminated and that signal changes from red to white are sharp. Check also that the colour change sequence is even. Where PAPI is on both sides of the runway check that the colour change of corresponding opposite units is coincident.

NOTE: In reduced visibility it may be necessary to carry out this check at closer range in which case the height will have to be reduced. The minimum practicable height is 500 ft.

- Check 3** Commence an approach from about 5 km and acquire an on-slope signal. Continue the approach, descend until 4 reds (or 2 reds in the case of APAPI) are just visible. Then climb until 4 whites (or 2 whites) are visible. Return to on-slope and continue to a point close to the threshold. The colour changes should be consistent with change in height and permit easy correction of approach height and angle.

Luminous Intensity Settings

- Check 4** Make a normal approach from approximately 7.5 km starting at about 1000 ft QFE. Maintain an 'on-slope' indication and during the approach call for progressive reductions in intensity of the units. Check that all units change intensity correctly and simultaneously.

Compatibility with Non-visual AIDS

Check 5 Where an instrument glidepath is available carry out an instrument approach maintaining the glidepath, or in the case of a radar approach, following ATC instructions. Check that the PAPI indicates 'on-slope' from a range of 7.5 km to close in to the threshold.

The ILS glidepath should be near the lower limit of the PAPI 'on-slope' signal if an aeroplane with a small eye-to-aerial height is used.

The person inspecting the system should carry a diagram of the installation to facilitate recording any observed deficiencies.

Obstacle Check

Check 6 Fly sufficiently low from 7.5 km so as to be just within the all-red indication and check that there is clearance from obstacles throughout the horizontal coverage of the beam.

FLIGHT CHECK: PAPI/APAPI**Aerodrome:.....**

Runway designation				Date	GMT	Day/Dusk/Night				
Effective range (km)				Time		Weather				
Colour change: Red-to-White (Level run 1000 ft QFE from 7.5 km)				Aircraft Registration:		W/V				
Intensity balance of individual units (and of Left and Right sides if applicable)				Captain		Visibility Cloud Turbulence				
Intensity check	100%			NOTES: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> L 1 2 3 4 0 0 0 0 </div> <div style="border: 1px solid black; width: 100px; height: 100px; margin: 0 auto;"></div> <div style="text-align: center;"> R 4 3 2 1 0 0 0 0 </div> </div>						
	80%									
	30%									
	10%									
	3%									
	1%									
	< 1%									
Integration with non-visual aids				1	1					
Synchronisation L–R (if applicable)				2	2					
Obstacle clearance				3	3					
Fitting type				4	4					
				Inspected by:						

CA1560 E
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Chapter 7 Aerodrome Signals, Signs and Markings

1 Introduction

- 1.1 Aerodrome signals, signs and markings provide guidance and information to pilots and assist them in complying with the Rules of the Air Regulations 1991 (the Rules). All signals, signs and markings should be repainted, cleaned or replaced as soon as their conspicuity is degraded.
- 1.2 Colour specifications for paints can be found in British Standard Specification 381C – 'Colours for Specific Purposes'. The individual specifications are 356 Golden Yellow, 557 Light Orange and 537 Signal Red. Colour specifications for signs and surface markings are given at Figures 20 and 21; those for reflective materials are prescribed in BS873 Part 6 or its successor.
- 1.3 Licensed aerodromes should meet the requirements for signals, signs and markings described in this Chapter. Such signals as are prescribed by the Rules are marked with an asterisk (*) in the following paragraphs, and they are allowed a dimensional tolerance of 10%.
- 1.4 Any marshalling service provided should comply with Rule 48 of the Rules.

2 Signals

- 2.1 An aerodrome should display at least one wind sleeve and the signals described in these paragraphs, as appropriate, except that a landing T, signals area, or signals on a signals mast, need not be displayed at an aerodrome which is available only to radio-equipped aircraft at which an ATC or Flight Information Service is available. An aerodrome used extensively by non-radio-equipped aircraft should display the name of the aerodrome in letters at least 3 m high.
- 2.2 Where appropriate, an aerodrome should have a signal lamp capable of producing white, red and green lights, to make the signals specified in Rule 47 of the Rules. Pyrotechnic lights or flares should also be available for the same purpose.
- 2.3 **Wind sleeves**
- 2.3.1 At least one wind sleeve of the following dimensions should be provided at an aerodrome:

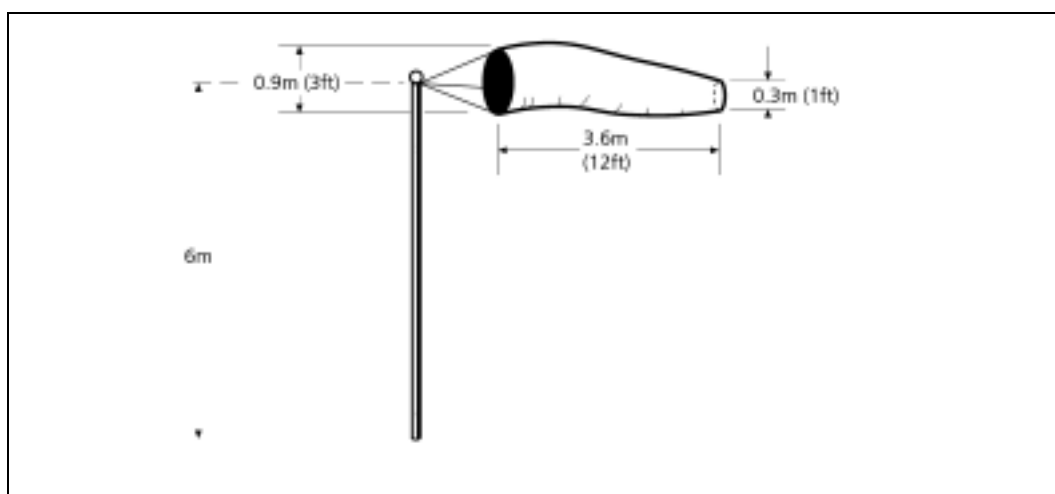


Figure 7.1 Wind sleeve dimensions

- 2.3.2 Wind sleeves should be coloured so as to give maximum contrast with their background. At aerodromes which accept non-radio aircraft, the location of at least one wind sleeve should be emphasised by a white circular band 7.5 m in diameter and 0.6 m wide around the base of the mast.
- 2.3.3 Wind sleeves should be so positioned on the aerodrome as to be visible from the approaches to all runways and be free from the effects of any disturbances caused by nearby objects. They should be sited so that at least one sleeve is visible from each take-off position and so that they meet the requirements of Chapter 3 paragraph 6.3 of this publication.
- 2.3.4 .least one wind sleeve conforming to the requirements of paragraph 2.3.3 above should be illuminated in the manner prescribed at Appendix 7D paragraph 1b).
- 2.3.5 The usefulness of any visual aid is determined largely by its size, conspicuity and location. Given conditions of good atmospheric visibility, the maximum distance at which the information available from an illuminated wind sleeve of the type described at Appendix 7D can be usefully interpreted is 1 km. Thus, in order that a pilot may make use of this information whilst on approach, the wind sleeve should be sited no farther from the runway threshold than 600 m. Obstacle criteria excluded, the ideal location is 300 m along the runway from the threshold and laterally displaced at 80 m from the runway centreline. This means, in effect, that only those aerodromes where the thresholds are less than 1200 m apart can meet the minimum requirement with a single unit. Most Code 3 and 4 aerodromes will require two or more units suitably sited in order to provide the best possible coverage.
- 2.3.6 The final choice of unit numbers and location will depend on a variety of factors which will vary from aerodrome to aerodrome. However, account should be taken of the following points when deciding on the most appropriate site:
- Outside the Cleared and Graded Area of the runways and taxiways and beneath the 1:10 obstacle surface
 - Clear of the OFZ and ILS critical/sensitive areas where appropriate
 - Preferably not more than 200 m lateral displacement from the runway edge
 - Preferably between 300 m and 600 m from the runway threshold measured along the runway
 - An area with low background levels of illumination
 - Visible from the approach and take-off positions of all runways used for public transport operations
 - Free from the effects of air disturbance caused by nearby objects

2.4 **Signals Area**

- 2.4* When required, the signals specified below should be displayed in a signals area. This area should be a square with internal sides measuring 12 m, bordered by a white strip 30 cm wide and should be visible from the air from all directions. Where appropriate the Signals Area should be illuminated at night. (See Note 1 to Table 6.1.)

- 2.4.1* A white landing T as shown in Figure 7.2 signifies that aeroplanes and gliders taking-off or landing shall do so in a direction parallel with the shaft of the T and towards the cross arm, unless otherwise authorised by the appropriate air traffic control unit.

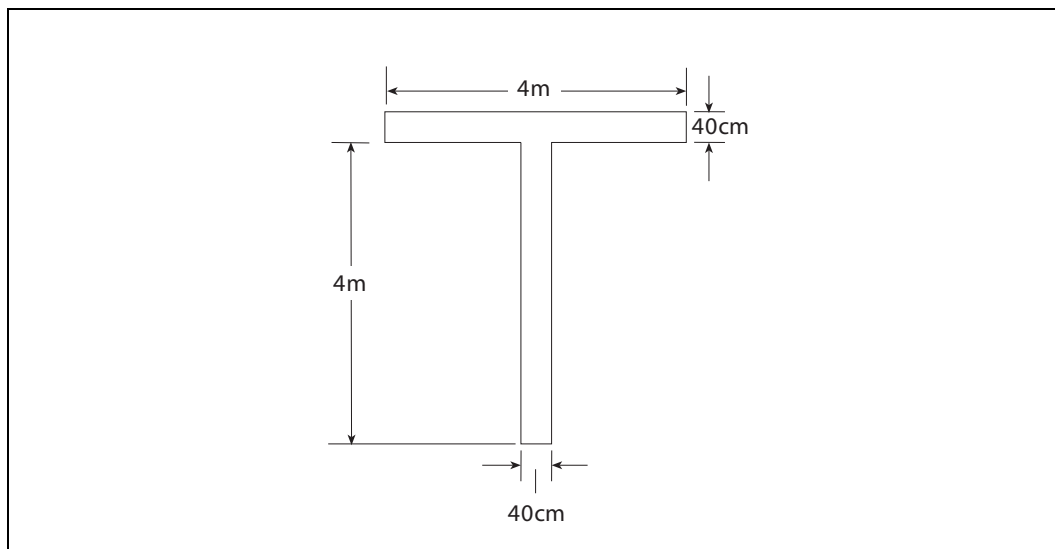


Figure 7.2 Landing Direction

- 2.4.2* A white disc as shown in Figure 7.3 of 60 cm diameter displayed alongside the cross arm of the T in line with the shaft of the T signifies that the direction of landing and take-off do not necessarily coincide.

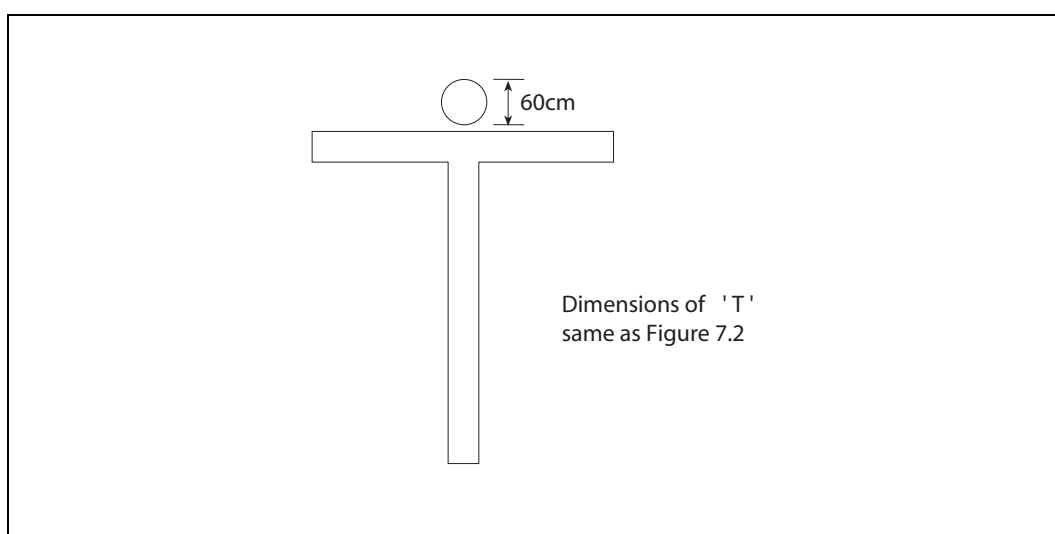


Figure 7.3 Landing/Take-off Direction

- 2.4.3* A red and yellow striped arrow as shown in Figure 7.4 the shaft of which is at least 1 m wide placed along the whole or not less than a total of 11 m of two adjacent sides of the signals area and pointing in a clockwise direction signifies that a right-hand circuit is in force.

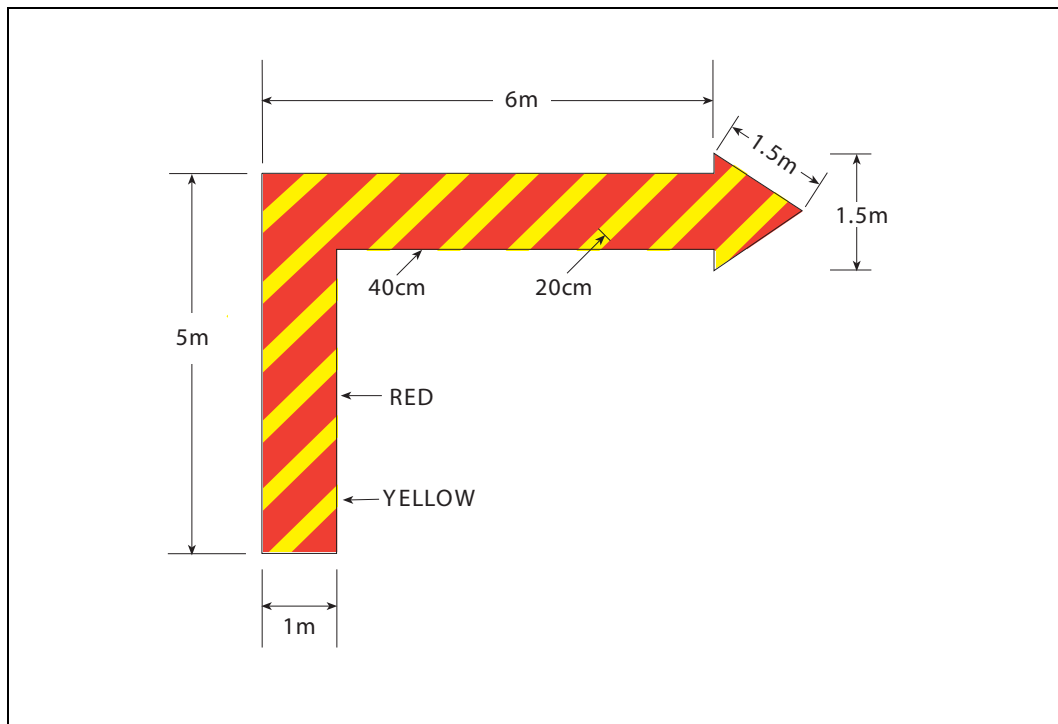


Figure 7.4 Right-Hand Circuit

- 2.4.4* A red panel of 3 m square when displayed in conjunction with yellow diagonal stripes has the following meaning:
- a yellow diagonal stripe at least 50 cm wide as shown in Figure 7.5 signifies that the state of the manoeuvring area is poor and pilots must exercise special care when landing.

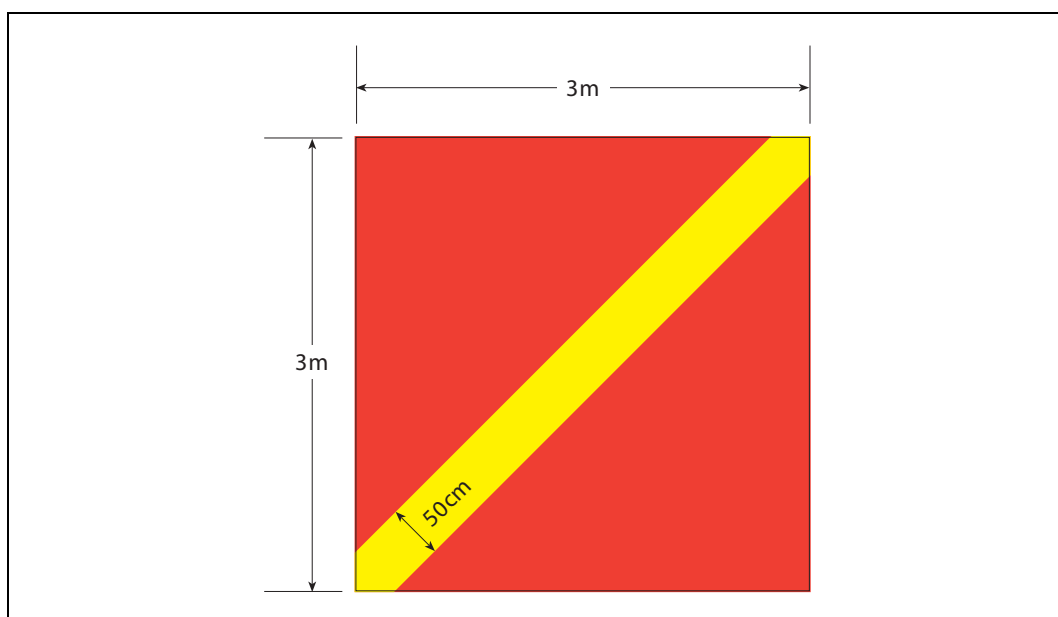


Figure 7.5 State of Manoeuvring Area

- b) yellow stripes at least 50 cm wide along each diagonal as shown in Figure 7.6 signify that the aerodrome is unsafe for the movement of aircraft and that landing is prohibited.

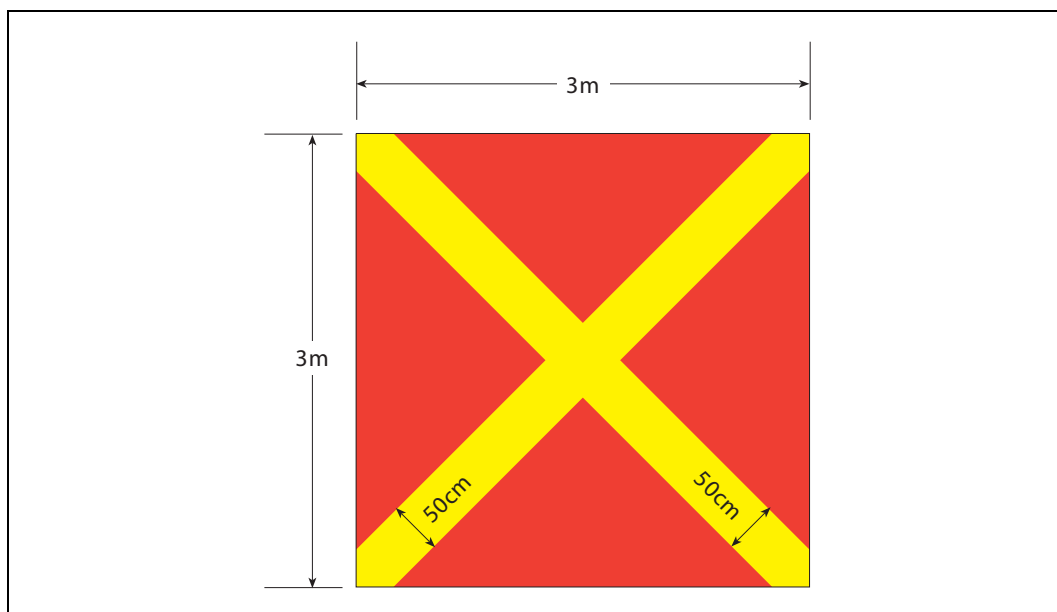


Figure 7.6 Aerodrome Unsafe

- 2.4.5* A white dumb-bell as shown at Figure 7.7 signifies that movements of aeroplanes and gliders on the ground shall be confined to paved, metalled or similar hard surfaces.

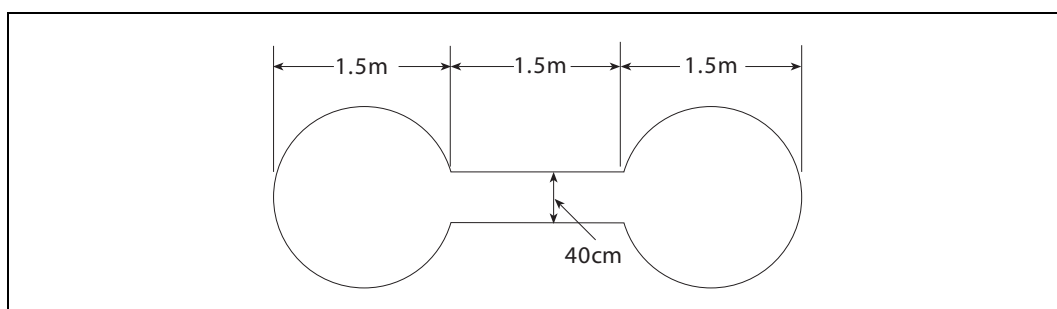


Figure 7.7 Restricted Ground Movement

- 2.4.6* A black stripe as shown at Figure 7.8 of 60 cm width, placed across each disc of the dumb-bell at right angles to its shaft signifies that aeroplanes and gliders taking-off or landing shall do so on a runway but that movement on the ground is not confined to paved, metalled or similar hard surfaces.

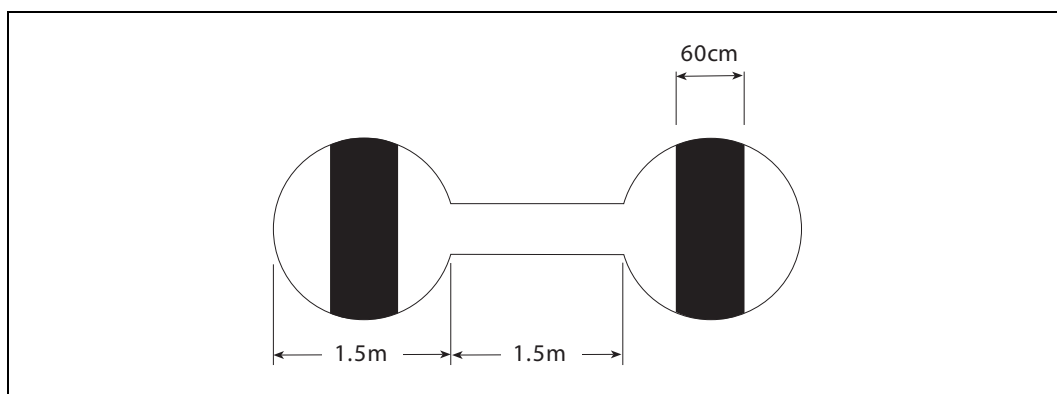


Figure 7.8 Unrestricted Ground Movement

- 2.4.7* A red letter L as shown in Figure 7.9 displayed on the dumb-bell signifies that light aircraft are permitted to take-off and land either on a runway or on the area designated by the marking specified in paragraph 4.7.3.

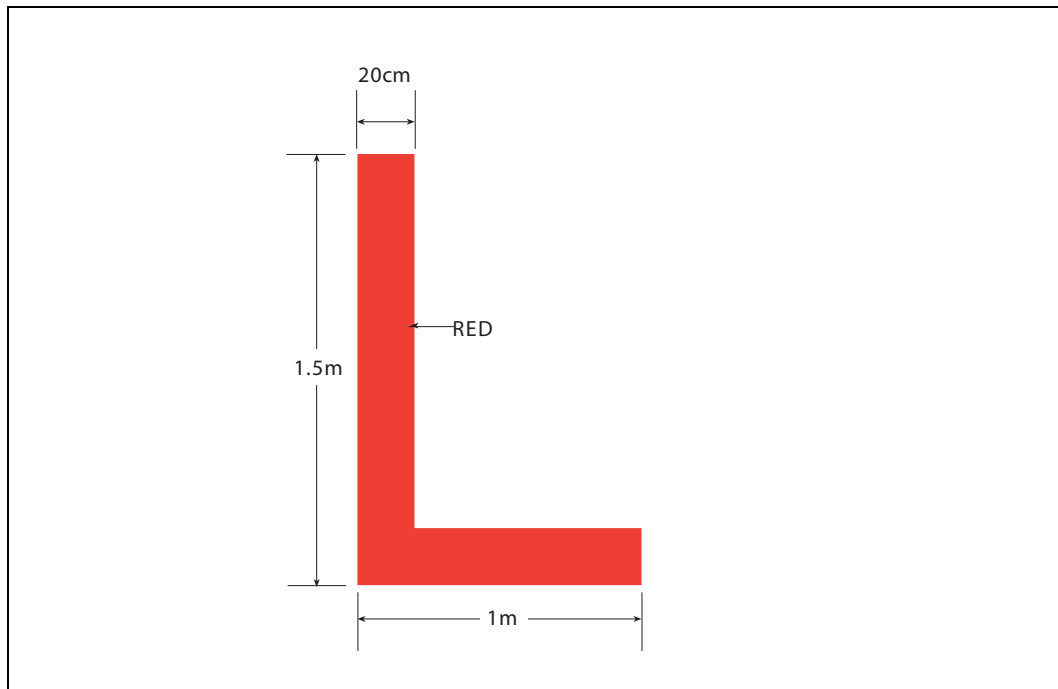


Figure 7.9 Designated Light Aircraft Operating Area

- 2.4.8* A white letter H as shown in Figure 7.10 signifies that helicopters shall take-off and land only within the area designated by the marking specified in paragraph 4.7.2.

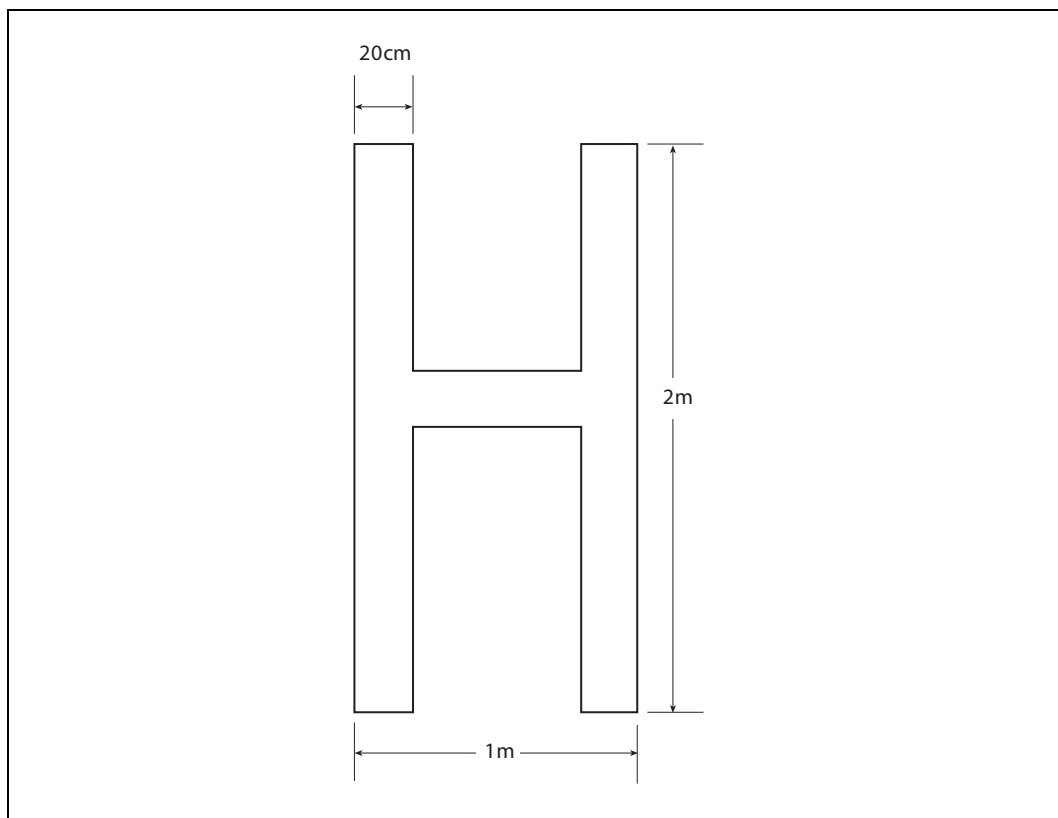


Figure 7.10 Helicopter Landing Area

- 2.4.9* A white double cross as shown at Figure 7.11 signifies that glider flying is in progress.

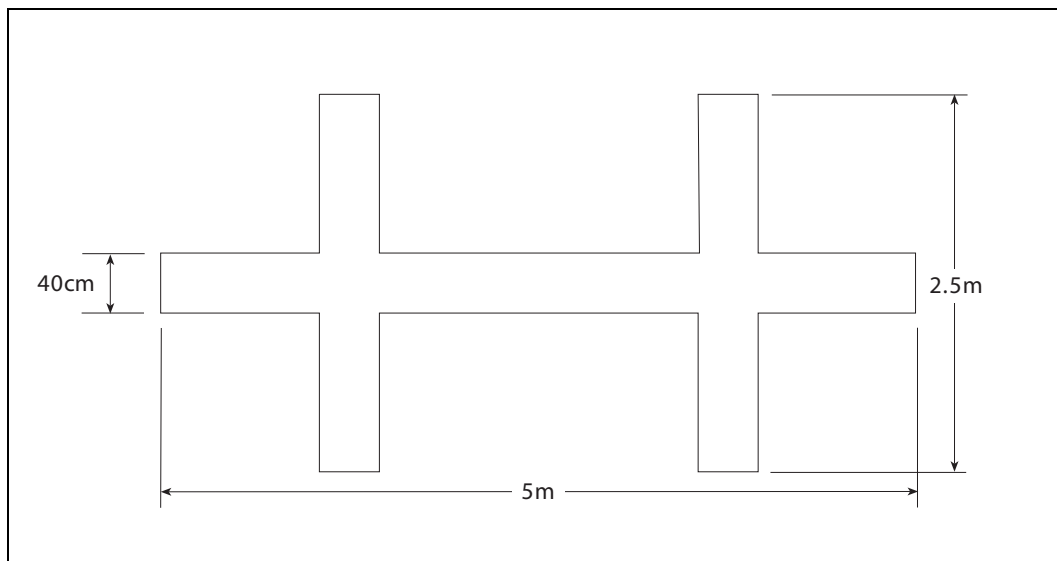


Figure 7.11 Glider Flying in Progress

2.5 Signals visible from the ground

- 2.5.1* A black letter C against a yellow background as shown at Figure 7.12 indicates the place at which a pilot can report to the air traffic control unit or to the person in charge of the aerodrome.

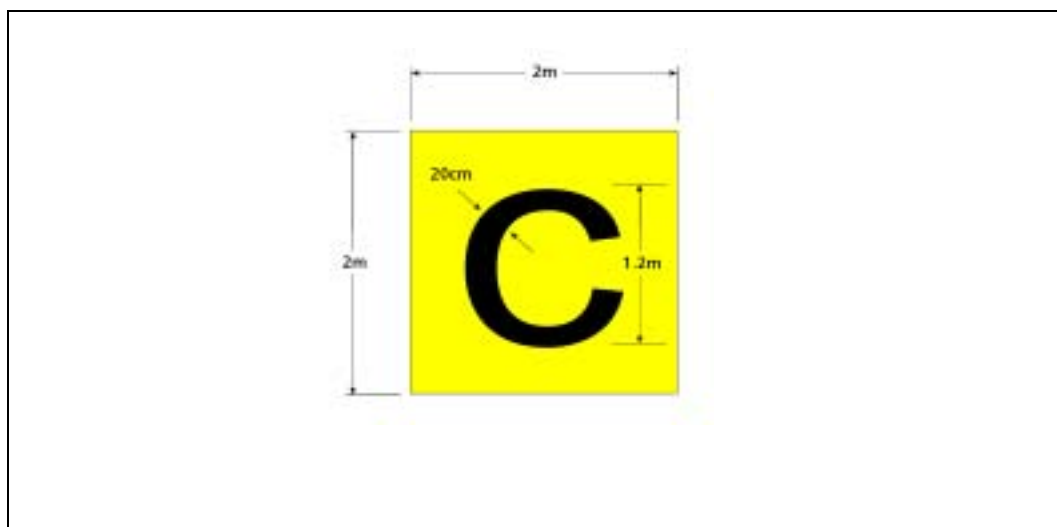


Figure 7.12 Reporting Point

- 2.5.2* Black arabic numerals in two-figure groups and, where parallel runways are provided the letter or letters L (left), LC (left centre), RC (right centre) and R (right), placed against a yellow background, indicate the direction for take-off or the runway in use.
- 2.5.3* A checkered flag or board 1.2 m by 90 cm containing 12 equal squares, 4 horizontally and 3 vertically, coloured red and yellow alternately, signifies that aircraft may move on the manoeuvring area and apron only in accordance with the permission of the air traffic control unit at the aerodrome.
- 2.5.4* A black ball 60 cm in diameter suspended from a mast signifies that the directions of take-off and landing are not necessarily the same.

- 2.5.5* Two red balls each 60 cm in diameter, disposed vertically one above the other, 60 cm apart and suspended from a mast, signify that glider flying is in progress at the aerodrome.
- 2.5.6* A rectangular green flag of not less than 60 cm side flown from a mast indicates that a right-hand circuit is in force.

3 Taxi Guidance Signs

Taxi Guidance Signs are divided into two categories, namely Mandatory Signs and Information Signs.

Variable message signs as specified in Annex 14 Volume 1 paragraph 5.4 are not currently permitted in the UK.

3.1 Mandatory Signs

- 3.1.1 The following Mandatory Signs should be provided on the manoeuvring area of an aerodrome in order to identify by a sign any location beyond which an aircraft or vehicle should not proceed unless authorised by ATC. Mandatory Signs display white characters on a red background. Except for the provisions of paragraph 3.1.3.3 below, Mandatory Signs should not be accompanied by Information Signs.

- 3.1.2 Internally lit mandatory signs should be provided with an alternative power source in accordance with the requirements of Chapter 6 paragraph 10.

3.1.3 Runway Taxi-Holding Position Signs

- 3.1.3.1 Runway Taxi-Holding Position Signs identify the designated Taxi-Holding Position (as determined in accordance with Chapter 3 paragraph 7.7) associated with a particular runway and consist of the runway designation in white on a red background as illustrated at Figure 7.13. Figure 7.14 illustrates some typical Runway Taxi-Holding Position Sign layouts. The number of signs required at each Runway Taxi-Holding Position is prescribed at paragraph 3.8.2.
- 3.1.3.2 Where the runway is equipped with ILS, the Runway Taxi-Holding Position should be established at the edge of the critical/sensitive area in order to protect the ILS when in use. The signs associated with ILS Runway Taxi-Holding Positions should be annotated CAT I, CAT II, CAT III, CAT II/III or CAT I/II/III as appropriate as illustrated in Figure 7.13 b), c), d) and e) except that where the Visual Runway Taxi-Holding Position and the CAT I Runway Taxi-Holding Position are co-located, the CAT I annotation is not used (see Figure 7.13 a)). Where the ILS Runway Taxi-Holding Position is at such a distance from the runway that it would hinder the expeditious flow of traffic in VMC, a Visual Runway Taxi-Holding Position should also be established closer to the runway as illustrated in Figure 7.14 e), f) and g).
- 3.1.3.3 Where a runway is served by more than one taxiway, the Runway Taxi-Holding Position Sign should be accompanied by a Taxiway Location Sign (described at paragraph 3.2.1.3) in order to assist in identifying the holding position, as illustrated at Figure 7.14 b), c) and d). The Taxiway Location Sign should be positioned outboard of the Runway Taxi-Holding Position Sign.
- 3.1.3.4 Where a runway is served by more than one Runway Taxi-Holding Position located on the same taxiway, the Runway Taxi-Holding Positions should be numbered in a logical manner such as illustrated in Figure 7.14 e), f), g) and h) and identified in the manner described at paragraph 3.1.3.3 above, using the type of Location Sign described at paragraph 3.2.1.5 and illustrated at Figure 7.16 a) ii).
- 3.1.3.5 At aerodromes where no ATC service is provided, Visual Runway Taxi-Holding Position Signs should be used to identify the position where aircraft and vehicles are required to stop and hold when conceding right of way prior to entering or crossing a runway.


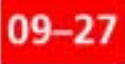











(a) Visual Runway Taxi-Holding Position Sign – denotes the Visual Taxi-Holding Position and also the ILS CAT I Holding Position where the Visual and CAT I holding positions are co-located.	(i)	
	(ii)	
(b) CAT I Runway Taxi-Holding Position Sign – denotes the ILS CAT I Taxi-Holding Position only where a Visual Taxi-Holding Position is established closer to the runway in order to expedite traffic flow.	(i)	
	(ii)	
(c) CAT II Runway Taxi-Holding Position Sign – marks the ILS CAT II Taxi-Holding Position – a visual Taxi-Holding Position may be established closer to the runway where it is necessary to expedite traffic flow.	(i)	
	(ii)	
(d) CAT III Runway Taxi-Holding Position Sign – marks the ILS CAT III Taxi-Holding Position – a CAT II Taxi-Holding Position and a Visual Taxi-Holding Position may be established closer to the runway where it is necessary to expedite traffic flow.	(i)	
	(ii)	
(e) Combined Runway Taxi-Holding Position Sign – marks the Taxi-Holding Position where the ILS Taxi-Holding Positions are co-incident. A Visual Taxi-Holding Position Sign may be established closer to the runway when it is necessary to expedite traffic flow.	(i)	
	(ii)	 
(f) Intermediate Taxi-Holding Position Sign – marks a holding position established to protect a priority route.		
(g) No Entry Sign		
Note: <ol style="list-style-type: none"> 1 The signs at (i) should be used where the taxiway is in the vicinity of one extremity of a runway and the taxiway normally serves only the runway direction concerned. The signs at (ii) should be used where the taxiway normally serves both runway directions. 2 Where a runway Taxi-Holding Position serves more than one runway, the sign layout at Fig 7.18 should be used. 3 Sign dimensions are given in Appendix 7A. 		

Figure 7.13 Examples of Mandatory Signs for Aircraft Surface Movements

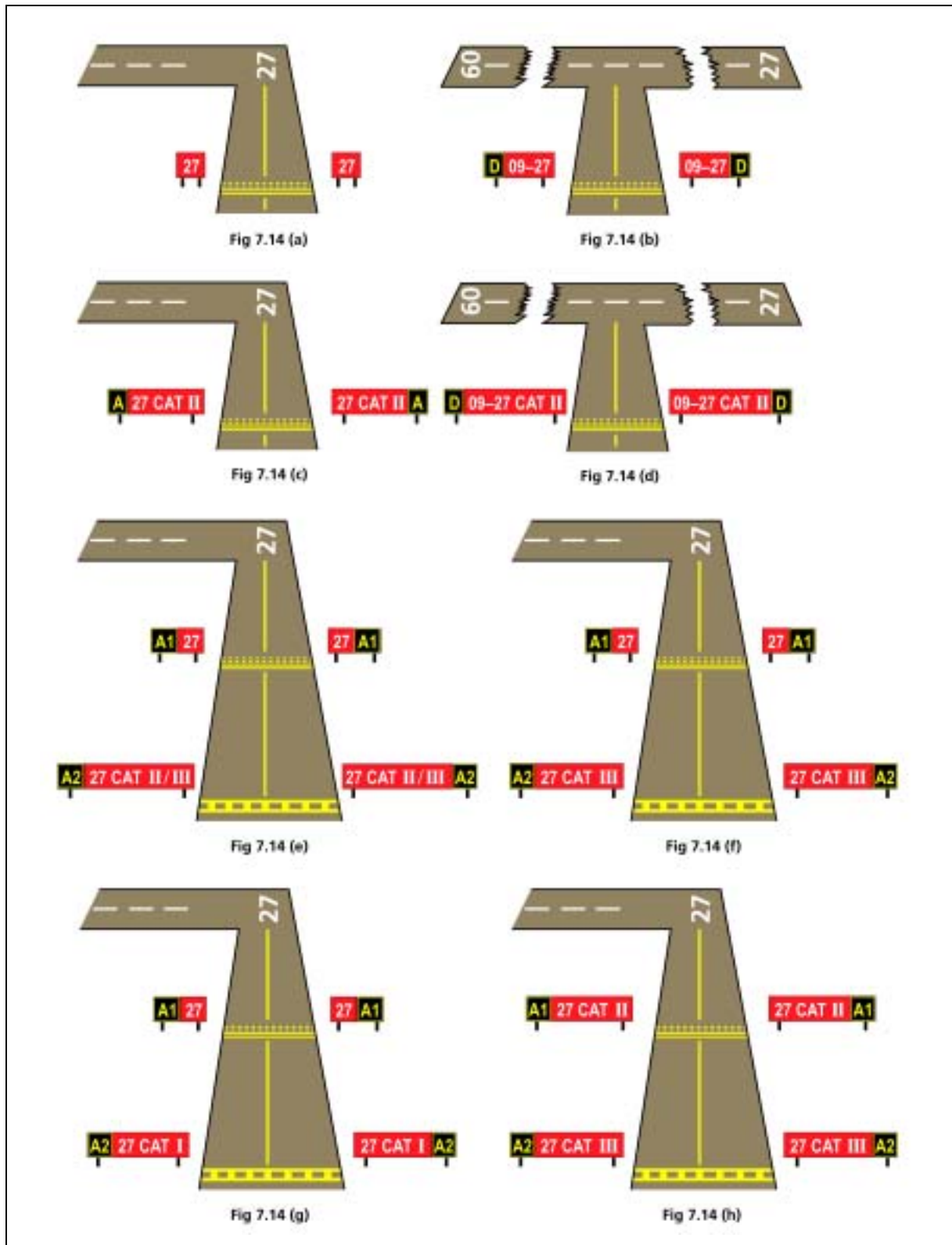


Figure 7.14 Typical Runway Taxi-Holding Position Signs and Associated Taxiway Marking

The diagrams illustrate typical signs associated with various Runway Taxi-holding positions on Taxiway 'A' leading to the threshold of Runway 27 and on Taxiway 'D' leading to an intermediate taxiway entrance to Runway 09-27.

NOTE: The signs at intermediate taxiway entrances as shown at Figure b) and d) above are handed to show a left turn is required to reach the threshold of Rwy 09 and a right turn to reach the threshold of Rwy 27.

3.1.4 Intermediate Taxi-Holding Position Signs

Where it is considered necessary to locate taxi-holding positions other than at runway/taxiway intersections – for example at taxiway/taxiway intersections in order to protect a priority route – the holding position should be identified by a single sign located wherever practicable on the left side of the taxiway. The sign consists of a combination of the letter designating the taxiway and a number identifying the hold position e.g. A1, A2, B2 etc. in white on a red background. An example of an Intermediate Taxi-Holding Position Sign is shown at Figure 7.13 f).

3.1.5 No Entry Signs

Where part of an aerodrome is restricted to one way traffic or is withdrawn from use, No Entry Signs, as illustrated at Figure 7.13 g), should be located on both sides of the mouth of the area showing in the direction from which entry is prohibited.

3.2 Information Signs

The following Information Signs should be provided **where there is an operational need** to provide additional guidance to pilots manoeuvring aircraft on the ground.

3.2.1 Taxiway Location Signs

3.2.1.1 Taxiway Location Signs should be used to identify individual taxiways.

3.2.1.2 All in-use taxiways should be designated by a letter of the alphabet – Alpha, Bravo, Charlie, etc. – however, the letters Oscar, India and X-ray are not used. As far as possible the allocation of designation letters should follow a logical pattern eliminating the possibility for confusion. Where there are more taxiways than letters of the alphabet, double letters should be used to designate short taxiway stubs between a runway and parallel taxiway or between a taxiway and adjacent apron. An example of a taxiway layout is shown at Figure 7.15.

3.2.1.3 Taxiway Location Signs bear the taxiway designation letter in yellow on a black background surrounded by a yellow border, as illustrated at Figure 7.16 a)i).

3.2.1.4 Taxiway Location Signs should be positioned at the approach to a taxiway intersection. At a complicated intersection, Taxiway Location Signs should also be located at each exit from the intersection in order to provide confirmation that the correct route is being followed. They may also be placed at intermediate positions along a very long taxiway. Examples of the layout of Taxiway Location Signs at different types of intersection are shown at Figure 7.17.

3.2.1.5 Where a Taxiway Location Sign is co-located with a Runway Taxi-Holding Position Sign, as described at paragraph 3.1.3.4, the character identifying the taxiway should be accompanied by an arabic numeral as illustrated at Figures 7.14 e), f), g) and h) and 7.16 a) ii) in order to identify individual Taxi-Holding Positions.

3.2.2 Taxiway Ending Sign

Where a taxiway ends at an intersection other than an intersection with a runway, a yellow diagonal marker is overlaid on the appropriate Taxiway Location Sign as shown in Figure 7.16 g).

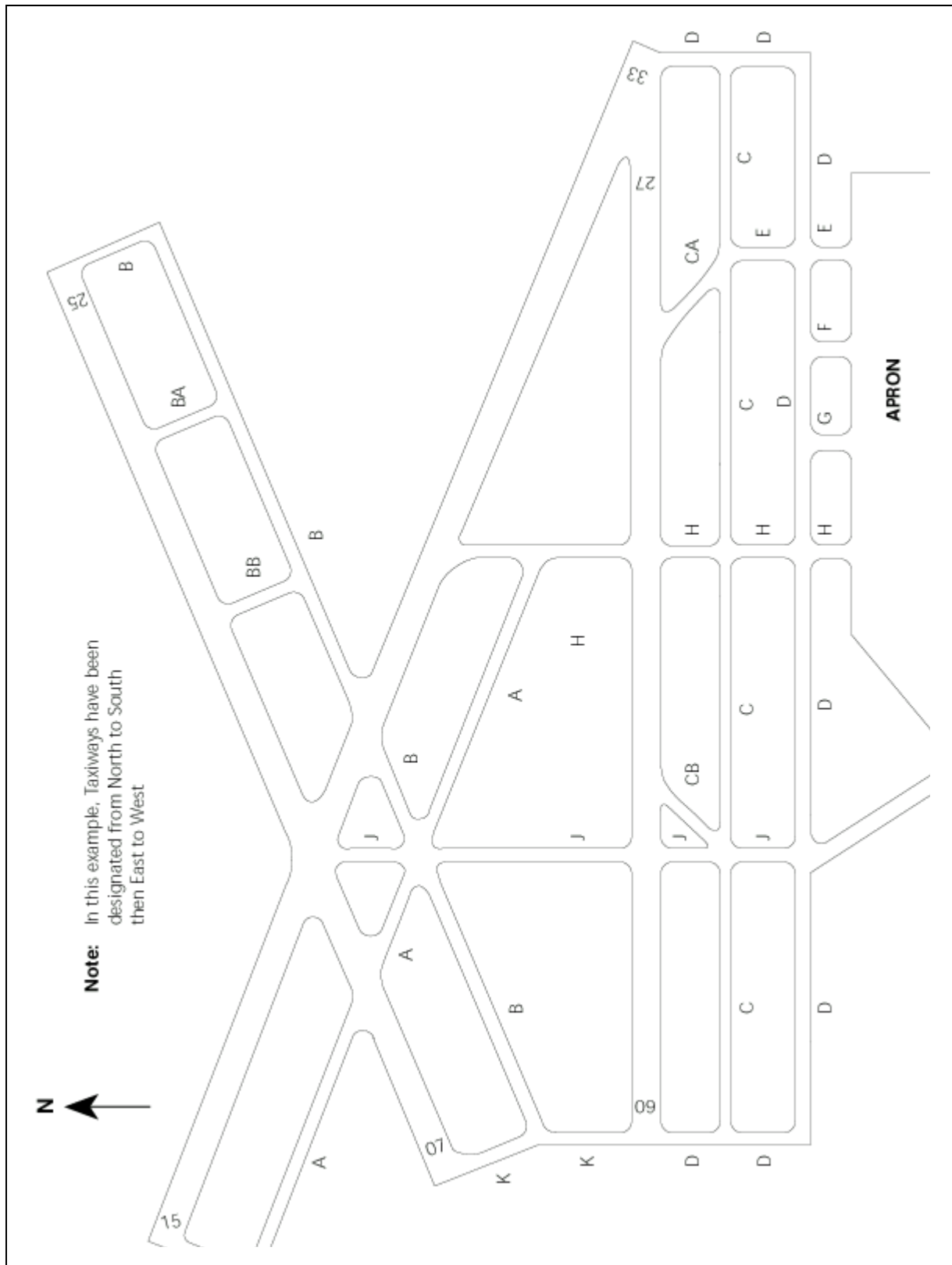


Figure 7.15 Example: Designating Taxiways



Figure 7.16 Examples of Information Signs

3.2.3 Runway Location Sign

Where runways intersect and the possibility of confusion could arise, Runway Location Signs should be placed at the edge of a runway as shown in Figure 7.18. These signs stand independently of other signs and bear the runway designation in yellow on a black background surrounded by a yellow border as shown at Figure 7.16 b).

3.2.4 Runway Vacated Sign

Where it is considered necessary for pilots to report runway vacated, a Taxiway Location Sign as illustrated at Figure 7.16 a) should be used to indicate to the pilot the position at which the report should be made. The sign would normally be located on the reverse side of ILS Runway Taxi-Holding Position Sign or at the edge of the cleared and graded area for visual runways, and correspond in designation with the Taxiway Location Sign identifying the Runway Taxi-Holding Position.

3.2.5 Direction Signs

Direction Signs located at the approach to a taxiway intersection indicate the direction of taxiways leading out of that intersection. These signs bear the letter designating each taxiway leading out of the intersection along with an arrow oriented to illustrate the direction and degree of the turn. The designation letter and the arrow are black on a yellow background as shown at Figure 7.16 c). Direction Signs should be accompanied by a Taxiway Location Sign. However, an individual direction sign may be located adjacent to a runway edge in order to indicate a particular runway exit point. Examples of the layout of signs at taxiway intersections are shown at Figure 7.17.

3.2.6 Destination Signs

Destination Signs such as those illustrated at Figure 7.16 d), e) and f) should be used where it is determined that the combination of location and direction signs would not provide adequate guidance to a destination. Destination Signs should not be accompanied by Location or Direction Signs. Common abbreviations used for inbound destinations are:

APRON	general parking, servicing and loading areas
GEN AV	general aviation
STANDS	aircraft stands
FUEL	areas where aircraft are fuelled or serviced
TERM	gate positions at which aircraft are loaded or unloaded
CIVIL	areas set aside for civil aircraft
MIL	areas set aside for military aircraft
PAX	areas set aside for passenger handling
CARGO	areas set aside for cargo handling
INTL	areas set aside for handling international flights
HELI	helicopter parking

3.3 Character Size, Spacing and Style

- 3.3.1 The character size to be used for letters and numbers is determined by the type of operation that the sign is intended to support and is prescribed at Table 7.1. Where a Taxiway Location Sign is located jointly with a Mandatory Sign, as described at paragraph 3.1.3.3 the character size shall be that of the Mandatory Sign and where an

Information Sign contains 10 or more characters, 20 cm characters may be used in the manner illustrated at Appendix 7A, Figure 7A.9.

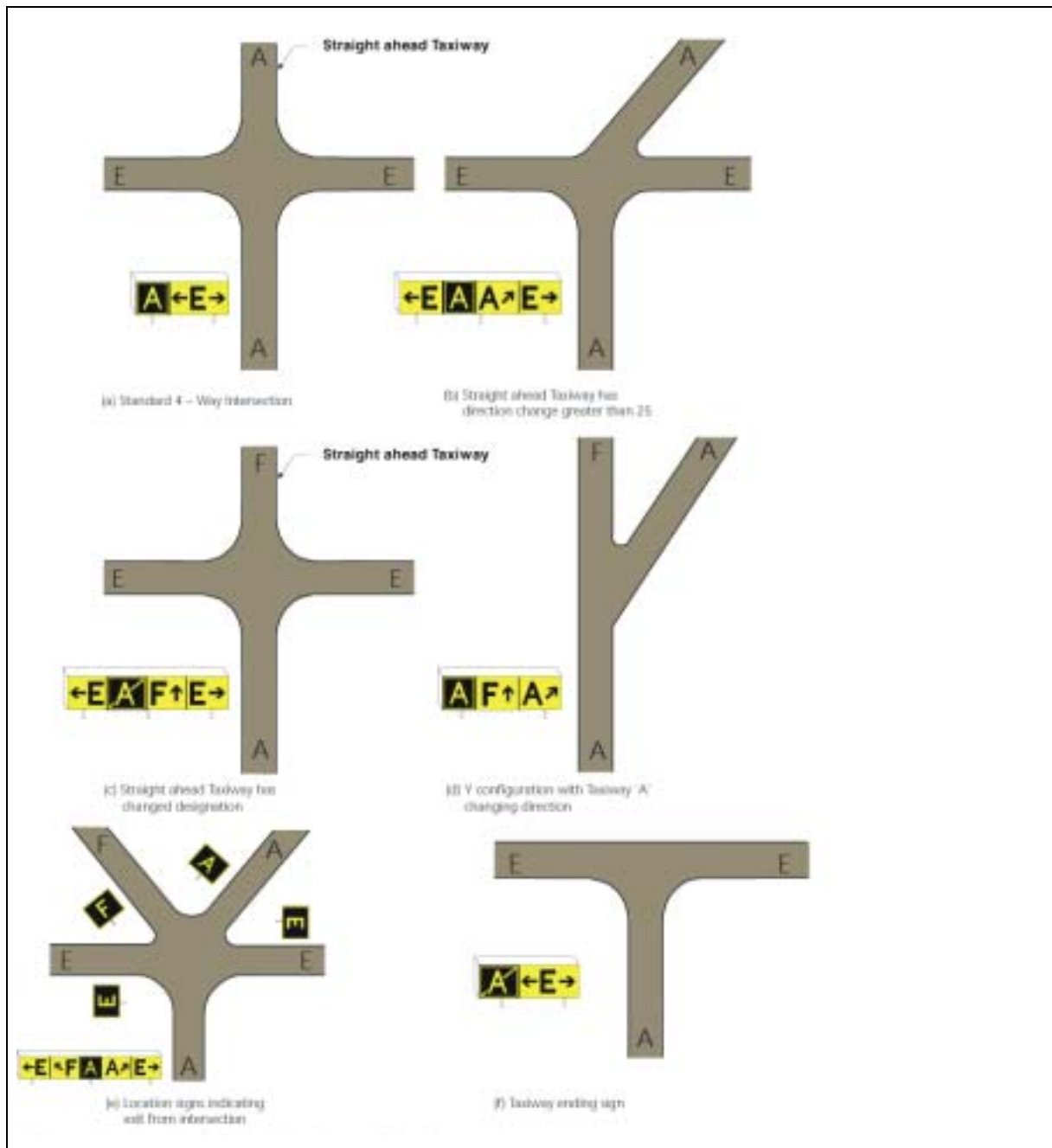


Figure 7.17 Examples of Taxi guidance signs at Taxiway intersections

NOTES:

- 1 Signs are laid out as shown above, i.e. from left to right in a clockwise manner. Left turn signs are on the left of the Taxiway Location Sign, Right turn signs on the right, except in situations corresponding to a) and f) above where the double arrow direction sign is inboard of the taxiway location sign. Adjacent signs are separated by a black vertical delineator.
- 2 Double arrow direction signs are used only at simple intersections such as those illustrated at Figure a) and f) above.

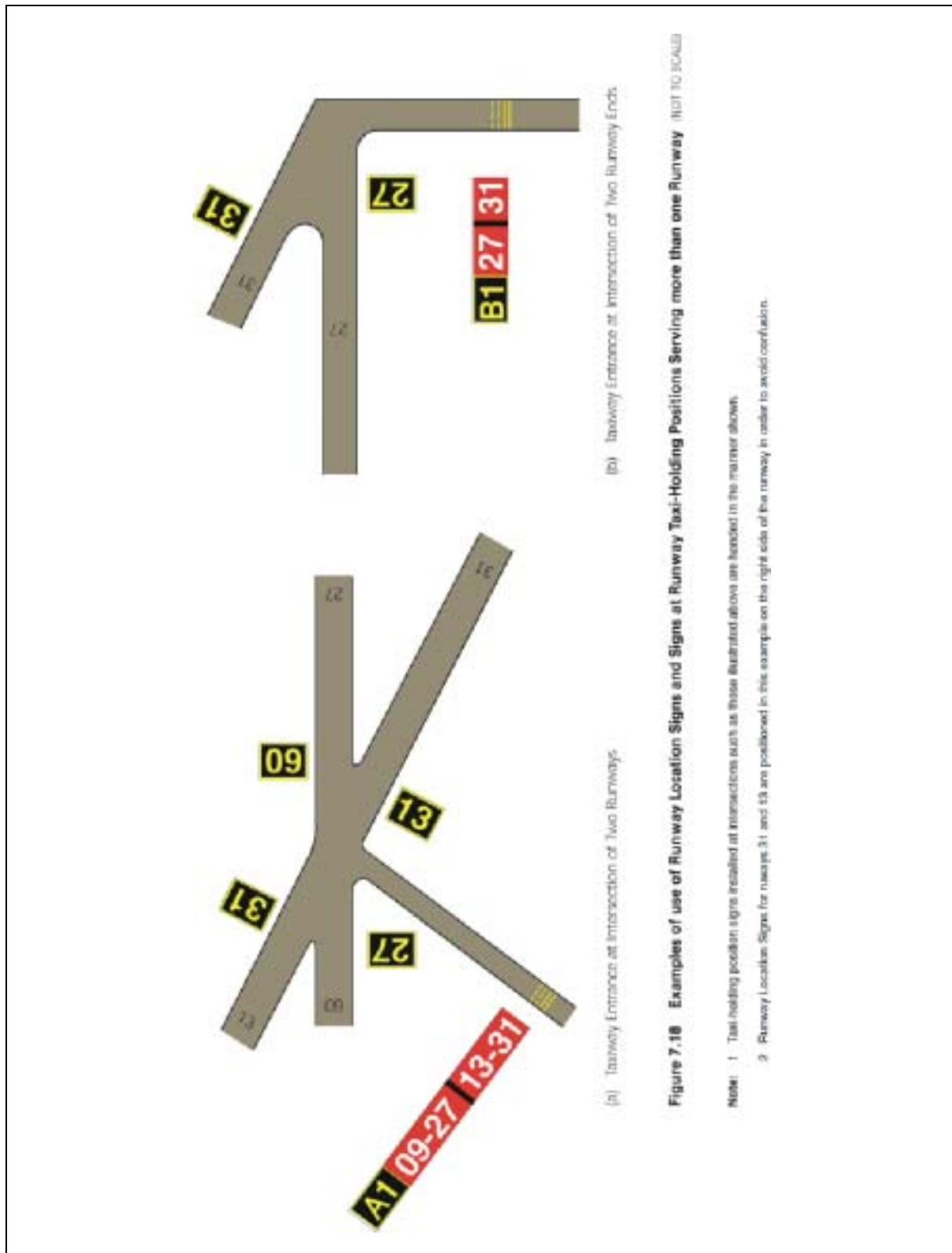


Figure 7.18 Examples of use of Runway Location Signs and Signs at Runway Taxi-Holding Positions Serving more than one Runway

Table 7.1 Signs Character Size

Operations conducted in RVR of	Character Size			
	Mandatory Signs		Information Signs	
	Height cm	Stroke Width cm	Height cm	Stroke Width cm
800 m or more	30	4.8	20	3.2
< 800 m	40	6.4	30	4.8

3.3.2 The character size to be used for other characters is as follows:

- a) DOTS Where a dot is employed on a sign such as that illustrated in Figure 7.16 e), the diameter of the dot shall be equal to the stroke width of the other characters employed, as illustrated in Appendix 7A, Figure 7A.6.
- b) HYPHENS Where a hyphen is employed on a sign such as that illustrated at Figure 7.13 a), b), c), d) and e) it shall have the same stroke width as the other characters employed but the length shall be equal to $\frac{1}{3}$ of the height of the other characters, as illustrated in Appendix 7A, Figure 7A.6.
- c) ARROWS Where an arrow is employed on a direction or destination sign, it shall have the same stroke width and height of the other characters employed. The style and proportions of the arrow shall conform to the detail in Appendix 7A, Figure 7A.6.
- d) DIAGONAL LINES
 - i) Where diagonal lines are used to separate symbols such as CAT II/III they shall be of the same stroke width and height as other characters used. Overall size and proportions are shown at Appendix 7A, Figure 7A.6.
 - ii) Where diagonal lines are used on Taxiway Ending Signs, as illustrated at Figure 7.16 g), the stroke width of the diagonal shall be equal to $\frac{3}{4}$ of the stroke width of the character. The size of the break between the diagonal and the character should be approximately $\frac{1}{2}$ the character stroke width.

3.3.3 The space between individual characters making up a sign shall be determined as outlined at Appendix 7A Table 7A-1.

3.3.4 The style and proportions of characters used shall be those given at Appendix 7A. Roman numerals as illustrated at Appendix 7A, Figure 7A.6 shall be used on Category I, II and III signs.

3.4 Face Size

The face size of Taxi Guidance Signs shall conform to the proportions and layout as illustrated at Appendix 7A, Figure 7A.1.

3.5 Borders and Delineators

3.5.1 Signs having a black background shall be provided with a yellow border, as shown in Figure 7.16 a), b) and g), equal in width to one half of the character stroke employed. Otherwise no provision is made for borders. The yellow border shall be included in the overall dimensions of the face size described at paragraph 3.4.

3.5.2 Where signs of the same background colour are joined together (or where a sign with a yellow border adjoins a sign with a yellow background) the signs shall be separated

by a black vertical delineator as illustrated in Figures 7.17 and 7.18. The black vertical delineator separating adjoining signs shall have a width of three quarters of the width of the character stroke employed, but shall not reduce the overall visible face size.

3.6 Illumination of Signs

- 3.6.1 The minimum levels of average luminance for lit signs used in support of operations conducted in RVR less than 800 m day or night are listed at Table 7.2. Facility should be provided to increase these levels by a factor of up to 2 where a sign is located in an area where the background luminance at night exceeds 200 cd/sq m. The method of calculating average sign luminance is described at paragraph 3.7.6.
- 3.6.2 All signs (including yellow borders required by paragraph 3.5.1) used in support of operations in RVR less than 800 m day or night should be internally lit, except that where only departures take place in such conditions or where aircraft movements are restricted to one at a time in the manner prescribed in Chapter 6 paragraph 6.3.2, signs may be externally lit in the manner prescribed in paragraph 3.6.3 a) below.
- 3.6.3 Signs used in support of operations in RVR of 800 m or greater at night should be illuminated as follows:
- a) Where operations are conducted in RVR 800–1500 m at night, signs may be either internally or externally lit. Where signs are externally lit they should be provided with a dedicated source of light which conforms to the following requirements.
 - i) Only white light shall be used and the light source shall be shielded so as to avoid dazzle or glare to pilots using adjacent areas.
 - ii) The light source shall be so positioned that it provides an even distribution of light over the whole sign face without any unwanted reflection of the light source.
 - iii) The light source, including any shielding and support equipment shall be so positioned that no part of the face of the sign is obscured from the view of those for whom the sign is intended.
 - b) Where operations are conducted at night but only when the visibility is 1500 m or greater, signs need not be provided with a dedicated source of light provided that the sign face is manufactured from materials that conform to the colour code prescribed in this section for Taxi-Guidance Signs and have photometric qualities equal to or better than those prescribed at BS873 Part 6 Table 1. The chromaticity co-ordinates for such materials are prescribed at BS873 Part 6 Table 4.

Table 7.2 Minimum Average Sign Luminance
(Signs used in support of operation RVR less than 800 m)

Colour	Luminance cd/m ²
Red	30
Yellow	150
White	300

NOTES:

- 1 The method of calculating average sign luminance is described at Figure 7.19. The Red luminance value should be between 10% and 20% of that of the White.
- 2 The average luminance level should not exceed three times the minimum average.

- 3.6.4 The colour specification for signs is prescribed at Figure 7.20 (internally lit) and Figure 7.21 (externally lit).
- 3.6.5 All lighted signs shall be equipped with a suitable disconnect plug so designed as to ensure that in the event that the sign is torn from its base, the power source is safely isolated.
- 3.6.6 Power for the illumination of internally-lit signs may be provided from adjacent constant current series circuits if the required electrical capacity is available. This type of installation may provide the selection of different luminous intensity settings; however care must be taken to ensure that the signs are lit at all required times of operation. In this case, the luminous intensity settings should correspond to that of taxiway centreline and stop-bars as indicated in Chapter 6 Tables 6.3 and 6.4. Care should also be taken to ensure that the constant current power supply is not adversely affected by the additional (and electrically different) load created by signage and that the illumination requirements are met.

3.7 **Construction**

- 3.7.1 Taxi Guidance Signs shall be frangible but nevertheless capable of withstanding wind loads of up to 60 m/sec (a suitable means of test is described at BS 3224 Part 1 paragraph 5.3.2) without sustaining damage. Where a sign or series of co-located signs is so constructed that part of the supporting or retaining structure appears as a frame surrounding the face, the size of the sign should be adjusted where necessary in order to ensure that the frame does not cover any part of the face and that the requirements of paragraph 3.4 are met. Signs constructed in this manner should not display a frame to the face of the sign greater than 4.5 cm in width; the colour of this frame should be black.
- 3.7.2 Where a number of signs are co-located, for example at a taxiway intersection or at a taxi-holding position, the signs should be secured in a single common structure with black vertical delineators outlining the extent of each sign as described at paragraph 3.5.2.
- 3.7.3 Where individual signs are made up of adjoining single character plates held together in a common frame, care must be taken to ensure that the method of construction does not lead to degradation of legibility at night either by light leakage between adjacent plates or by blanking caused by the location of frame members designed to hold the plates in place. Upright members designed to secure single character plates on the same sign should, where visible on the sign face, display the same colour as the sign background. Signs constructed in this manner must conform to the character spacing requirements at paragraph 3.3.3.
- 3.7.4 Except where signs are mounted back to back, the rear of a sign constructed in the form of a box should comply with the requirements at Chapter 4 paragraphs 12.3 and 12.4.1 for marking fixed obstacles. Normally a single conspicuous colour, preferably orange or yellow will suffice.
- 3.7.5 Sign faces should be made of materials that can withstand sustained temperatures within the range –40 to +55 degrees Celsius, relative humidity from 10 to 90% and altitudes of up to 2000 m without detriment to performance or durability. The material chosen should not be capable of reflecting external light to the extent that the readability of the sign is adversely affected.
- 3.7.6 In order to determine conformance with the requirements of paragraph 3.6, the average luminance of a sign should be calculated in the following manner:
 - a) Starting at the top left corner of the sign face establish a reference grid point at 7.5 cm from both the left edge and the top of the sign face.

- b) Construct a grid pattern as illustrated in Figure 7.19 based on the reference grid point established at paragraph a) above, ensuring that the rows of grid points are correctly aligned parallel to both the top and left edge of the sign face. Where the edge of the sign is between 22.5 cm and 15 cm away from the last grid point, add a further row and/or column 7.5 cm away from the edge of the 15 cm grid.
 - c) Measure the luminance levels at each grid point established in paragraphs a) and b) above, ensuring that the area used for each individual measurement does not exceed that prescribed by a circle of diameter 3 cm centred on the grid point.
 - d) For Mandatory Signs and Taxiway Location Signs, the luminance value of the character should be measured at a minimum of 5 well-spaced points within each character and these values used to compute the average luminance for white or yellow characters.
 - e) In calculating average luminance and inspecting for uniformity the luminance value measured on any character should be deleted from the calculation. Grid points within 7.5 cm of the edge of the sign should be excluded from the calculation. The ratio between points 7.5 cm apart should not exceed 1.25 to 1. In order to achieve uniformity of signal, the luminance value should not exceed a ratio of 1.5 to 1 between adjacent grid points and 5 to 1 between the maximum and minimum values over the whole face.
 - f) Measurements made for compliance with the sign colour specifications should be made at the same grid points and over the same areas as specified at paragraphs a), b) and c) above.
 - g) Where a curved-faced sign is submitted for evaluation the surface should be assumed to be flat and the grid formatted in the same manner described above.
- 3.7.7 Throughout the test, the intended lamp type and power supply shall be used. Where different lamp types are available, each option shall be tested. Similarly, where different power supply options are available, the sign shall be tested with each power supply type. The provision of power for the test shall take into consideration the power factor and loading that may be typically encountered at an aerodrome installation. Any combination of lamp and power supply type for a sign that fails to conform to the illumination requirements shall be reported to the CAA and not be used at a licensed aerodrome.
- 3.7.8 Where two or more modules are housed in a single sign box, each module should be evaluated as a separate sign face. The ratio between the average luminance level of modules of the same colour and type should not exceed 1.5 to 1.
- 3.8 **Siting**
- 3.8.1 Taxi Guidance Signs should be sited so as to comply with the criteria laid down at Chapter 3 paragraphs 6.3, 7.8.3 and 7.8.4. They should normally be positioned at right angles to the runway or taxiway centreline but may be toed-in where appropriate in order to provide for maximum legibility e.g. where signs are located on or close to a bend in the taxiway.
- 3.8.2 Runway Taxi-Holding Position Signs installed in support of operations in RVR less than 1500 m should be sited on both sides of the taxiway as illustrated in Figure 7.14. Where a runway is used only in visibility conditions of 1500 m or greater the Runway Taxi-Holding Position may be identified by a single Runway Taxi-Holding Position Sign located wherever practicable on the left side of the taxiway.

- 3.8.3 Mandatory Signs should be located in line with the surface marking used to define the associated Holding Position described at paragraphs 4.5.2 and 4.5.3 to this Chapter.

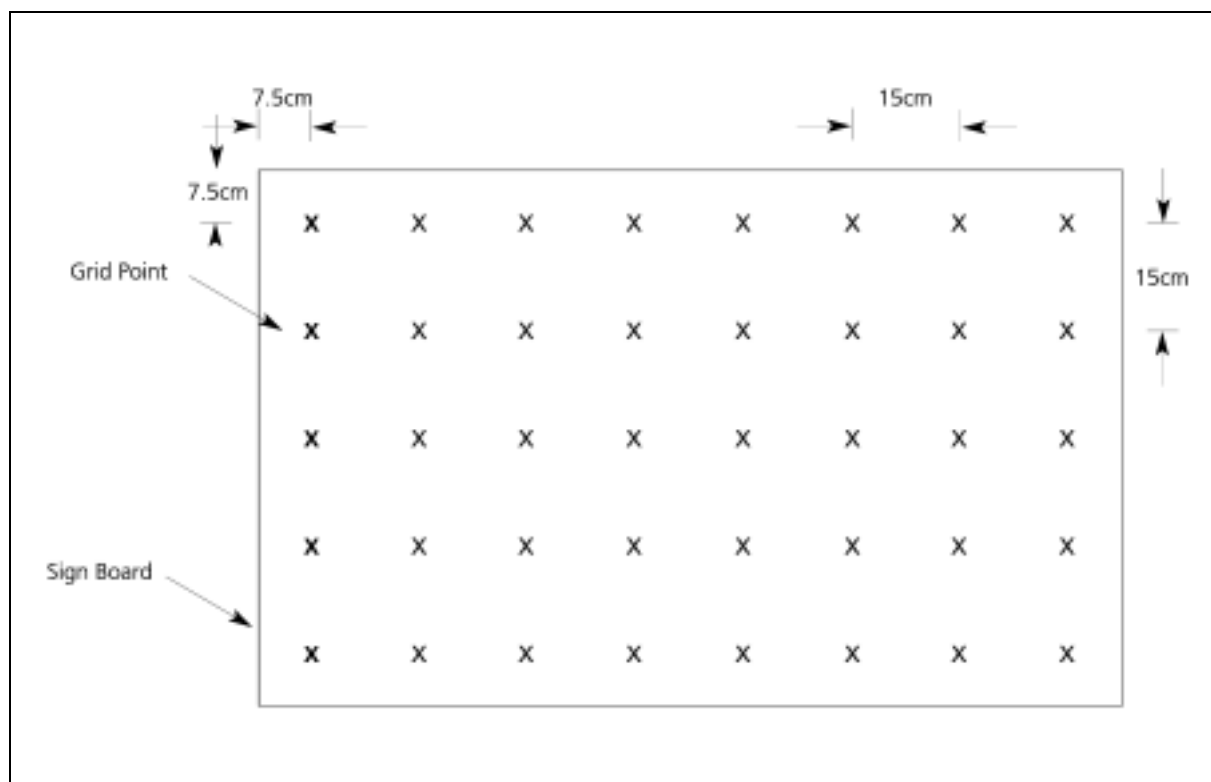


Figure 7.19 Means of Calculating Average Luminance of a Sign

- 3.8.4 Information Signs should be located, whenever practicable on the left side of a taxiway or runway and so positioned as to give adequate time for a pilot to make use of the information provided.

4 Markings

4.1 General

- 4.1.1 Markings provide perspective information, alignment guidance, location, and runway and threshold identification.
- 4.1.2 Markings shall be white for runways and yellow for taxiways. Black outlining (at least 15 cm in width) should be provided where there is insufficient background contrast. Colour specification for paved surface markings are detailed at Figure 7.21.
- 4.1.3 All markings on paved runways should have friction values not less than the friction assessment Minimum Friction Level for the surrounding runway. Markings on aprons and taxiways should be made with materials having similar wet friction qualities to those of the surrounding paved surfaces.

4.2 Markings on paved runways

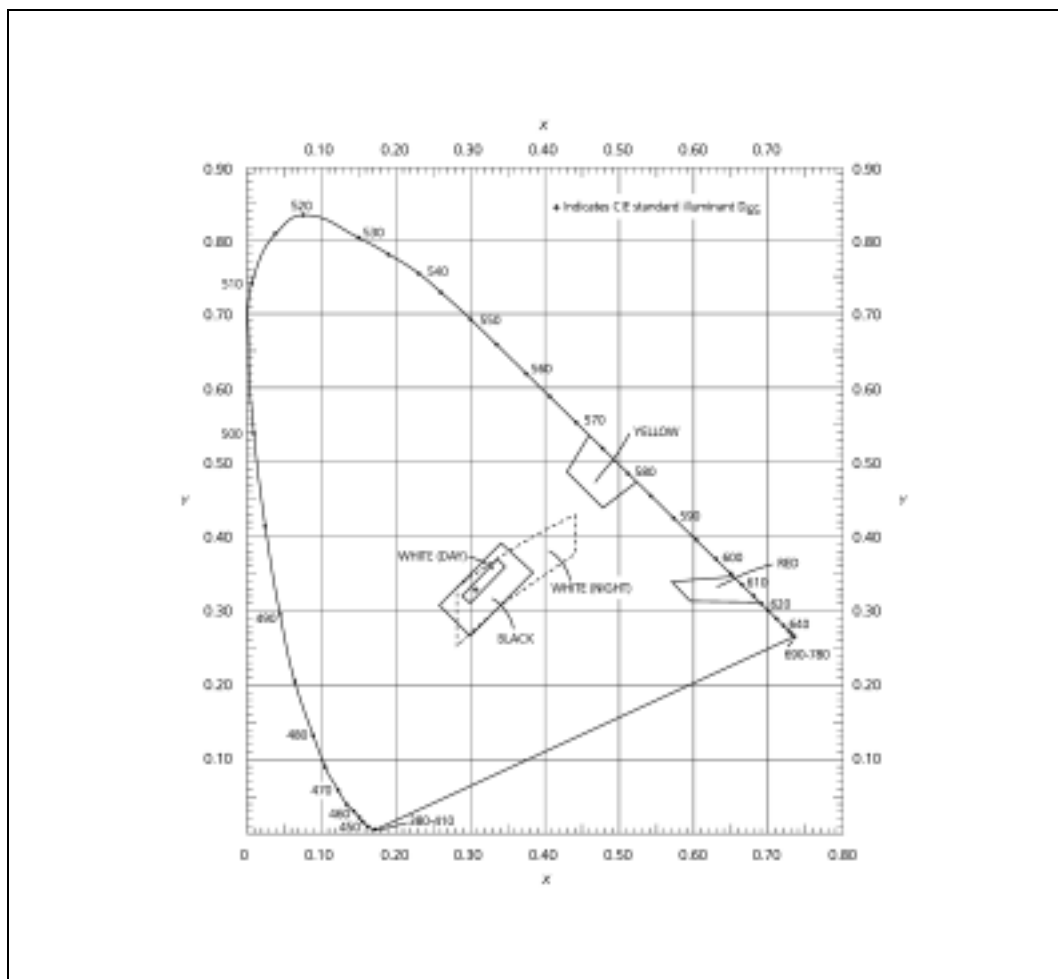
- 4.2.1 Centreline marking should be provided on all paved runways and consists of lines 30 m apart throughout the length of the runway. At runway intersections, the marking of the major runway should be continued and that of the subsidiary runway should be interrupted. The dimensions of the marking are shown at Table 7.3.

Table 7.3 Runway Centreline and Threshold Markings – Dimensions

RWY C/L MARKING				THRESHOLD MARKING								
Rwy Width m	Length of and distance between each mark m	Width m		Number of stripes		Length of stripes m W	Width of and distance between stripes m X		Width of Centre Gap m Y		Character ht m Z	
		P	NP	P	NP		P	NP	P	NP	P	NP
45	30	0.9	0.45	12	6	30	1.8	1.8	3.6	22.5	15	15
30	30	0.9	0.45	8	6	30	1.8	0.9	3.6	20.0	15	12
23	30	0.45	0.3	6	6	24	1.8	0.6	3.6	16.0	12	9
18	30	0.45	0.3	4	4	24	1.8	0.3	3.6	15.0	12	9

P = Precision Approach Runway

NP = Non-Precision Approach Runway

**Figure 7.20** Colours of Transilluminated (internally illuminated) Signs and Panels

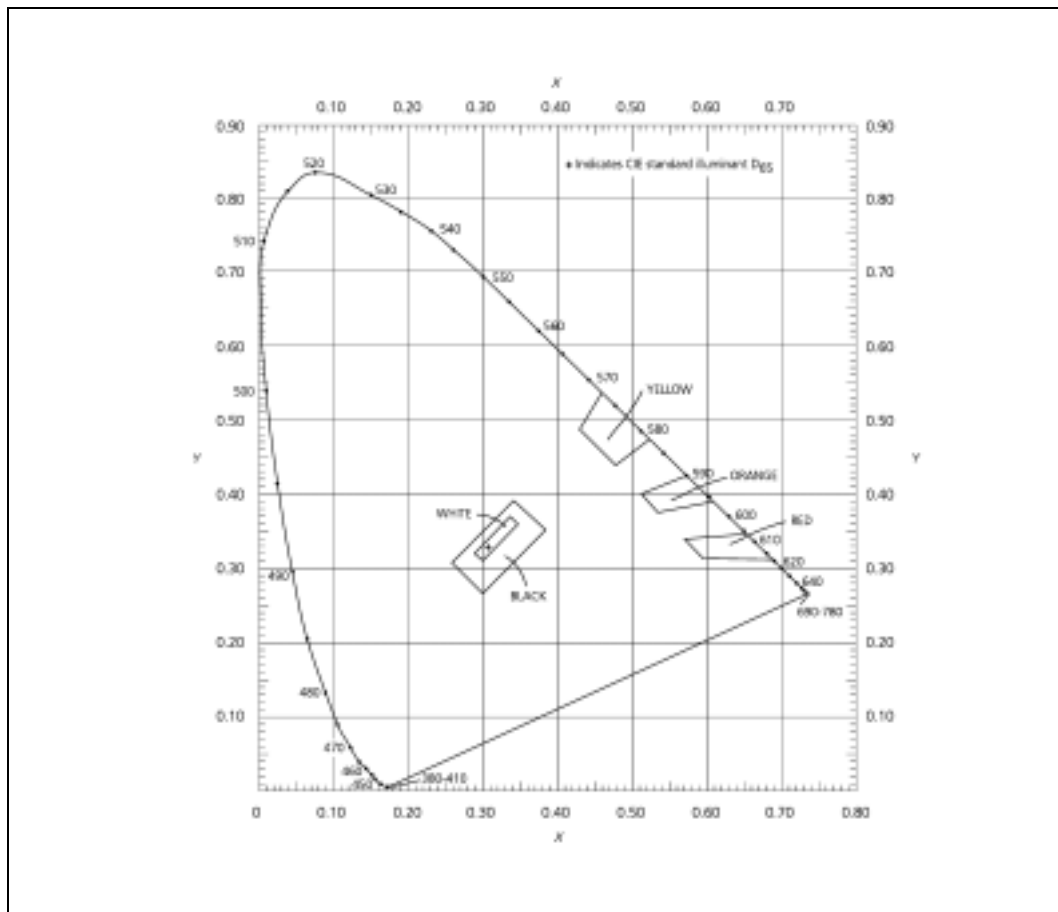


Figure 7.21 Colours for Surface Markings and Externally lit Signs

- 4.2.2 Runway edge markings should be provided on all precision approach runways and also on those other paved runways where there is insufficient contrast between the runway and the shoulders. Edge marking should also be provided where the declared or available runway width is less than the apparent total width e.g. the central 30 m of a 45 m runway and where runway edge lighting lies outside the declared width of the runway, see Chapter 6 paragraph 5.4.1. Runway edge marking should consist of two parallel lines, one placed along each edge of the runway with the outer edge of each line marking the declared edge of the runway. The lines should be 0.9 m wide where the runway is 30 m or more in width and 0.45 m wide on narrower runways. Edge markings should be interrupted at runway intersections. Where edge lights are located along the extremity of the declared runway width, the edge marking may be located inboard of the edge lights in order to avoid painting light fittings.
- 4.2.3 A runway designator comprising a two-figure group showing the magnetic heading to the nearest whole ten degrees, should be located at each threshold. In the case of parallel runways, a white letter (L – Left or R – Right) is added to the designator. The dimensions and patterns are shown at Appendix 7B, Figures 7B.1 and 7B.2. Examples of layout are shown at Figure 7.22.
- 4.2.4 Runway threshold markings should be provided according to the status of the runway, as shown at Figure 7.22. The dimensions of threshold markings are given in Table 7.3.
- 4.2.5 Aiming Point (AP) and Touchdown Zone (TDZ) markings conforming to those illustrated at Figure 7.23 and located at the positions detailed in Figure 7.24 should be provided on all precision approach runways and on those other runways where additional conspicuity of the touchdown zone is desirable. An Aiming Point marking

should be provided on paved visual runways where there is no visual approach slope guidance.

- 4.2.6 A temporarily displaced threshold should be marked as illustrated in Figure 7.22.
- 4.2.7 Where a starter extension does not extend to the full length of the available pavement, an alternative form of pre-threshold marking, as illustrated in Fig. 7.22 e) may be used.

4.3 **Markings on unpaved runways**

- 4.3.1 Where aircraft performance considerations necessitate the notification of field lengths for a grass aerodrome, the boundaries of unpaved runways and stopways should be delineated by runway edge markers visible from an aircraft on the approach at a range of at least 2 km. Delineation should be effected by either of the following methods:
 - a) white, flat, rectangular markers flush with the surface, 3 m long, 1 m wide and spaced at intervals not exceeding 90 m, or
 - b) frangible markers single-coloured to contrast with their background and firmly secured to the surface spaced at intervals not exceeding 90 m; the height of the markers should not exceed 36 cm.
- 4.3.2 Where frangible markers are used to delineate the boundaries of unpaved runway, or other areas within the runway clear and graded area, whether temporary or otherwise, such markers should be lightweight. Whilst ballast may be required to ensure stability of the markers, aerodrome operators should ensure that the units should retain their frangibility, taking into account the types of aircraft that commonly use the runway.

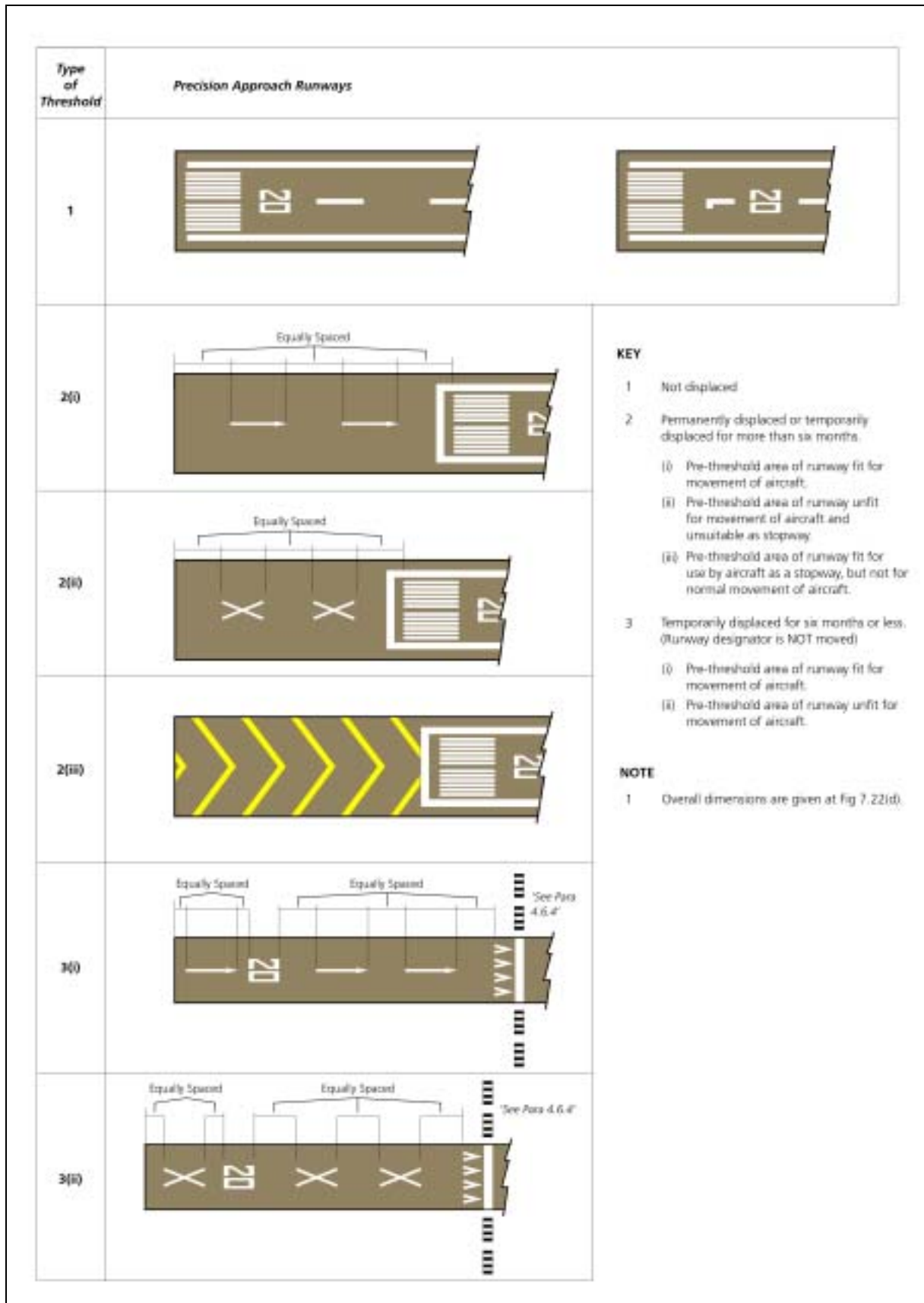


Figure 7.22(a) Paved Runway Threshold Markings

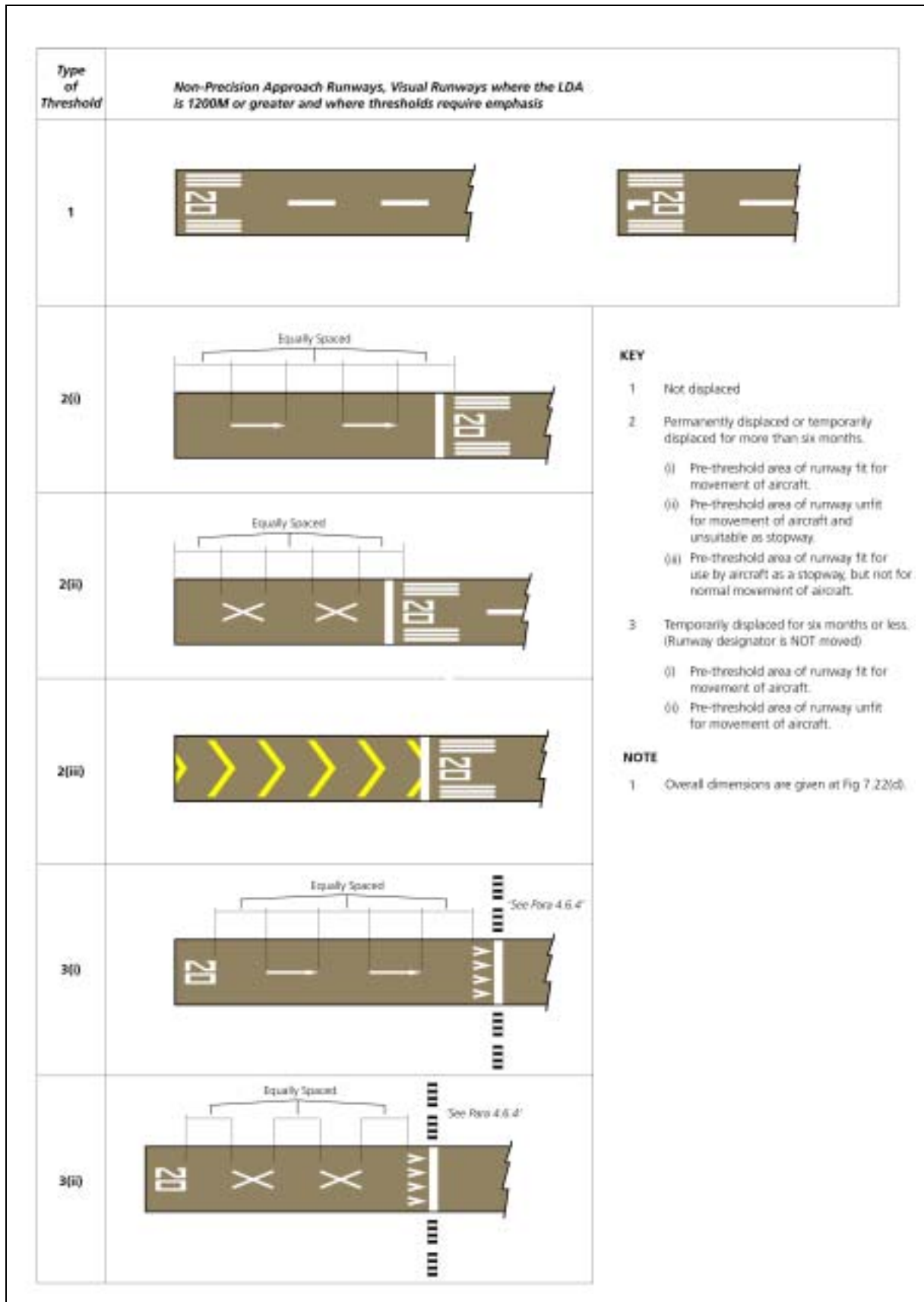


Figure 7.22(b) Paved Runway Threshold Markings

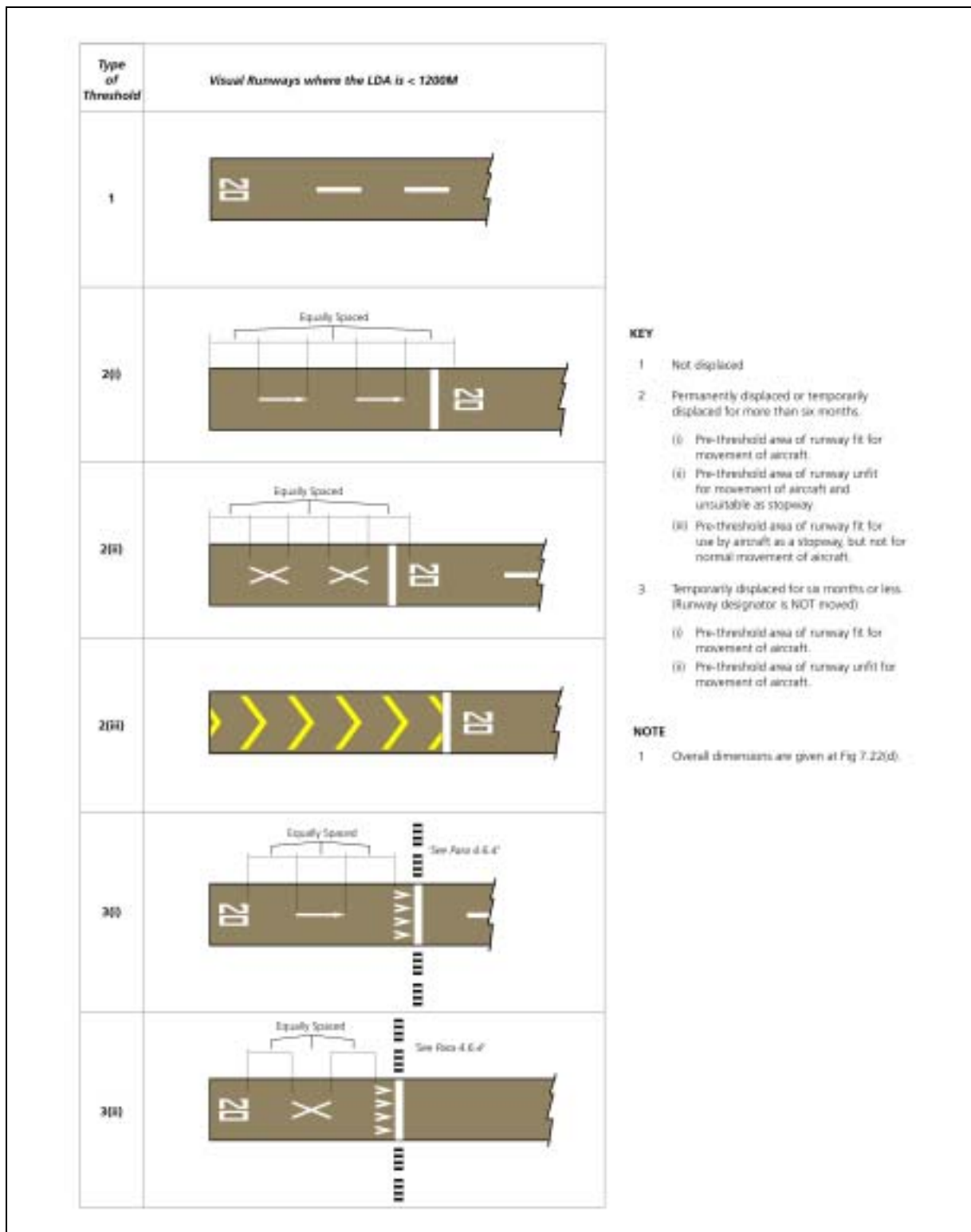


Figure 7.22(c) Paved Runway Threshold Markings

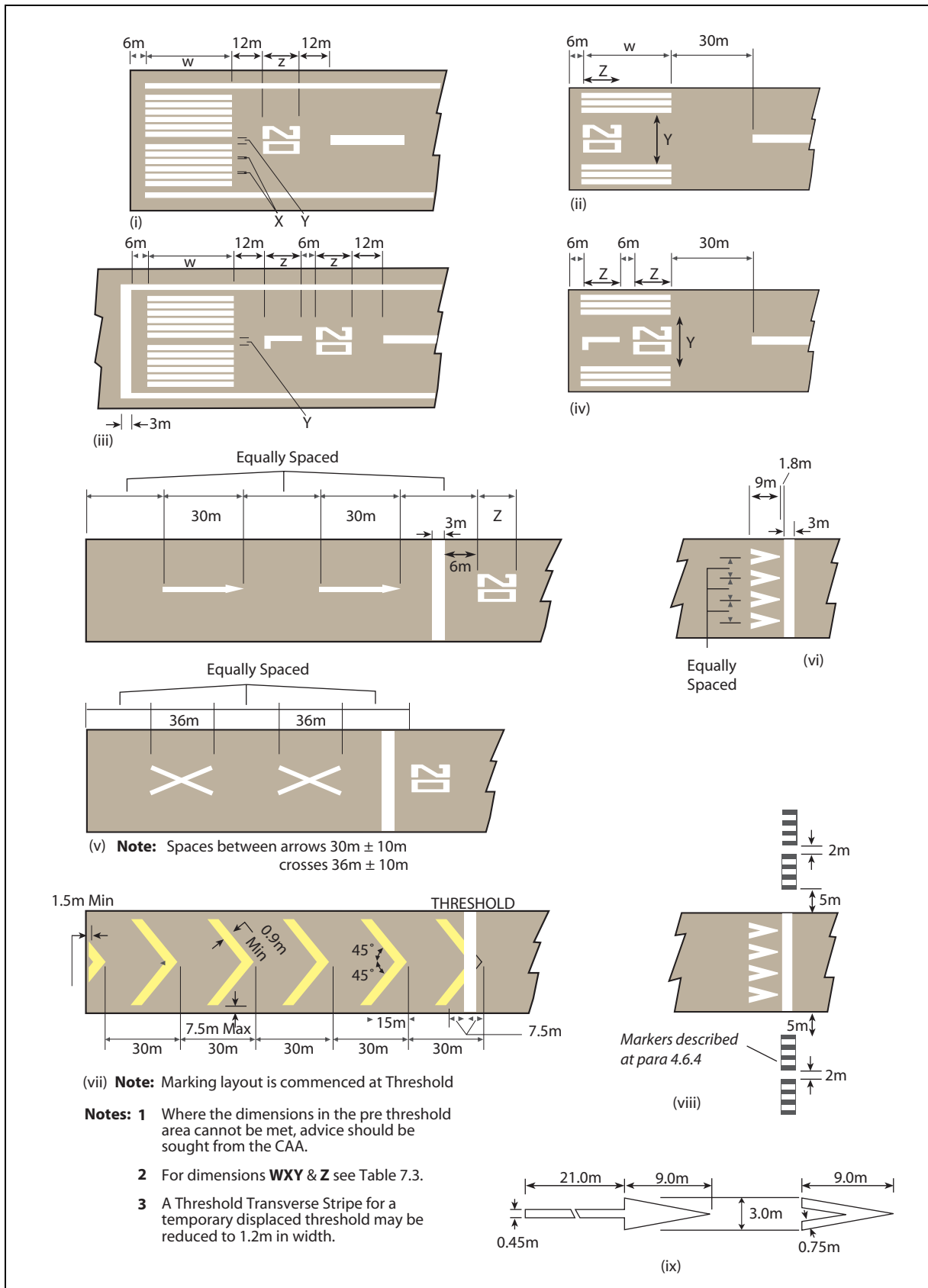


Figure 7.22(d) Threshold Markings Dimensions

- 4.3.3 Runway edge markers should be arranged in pairs on opposite sides of and equidistant from the centreline.
- 4.3.4 The corners of an unpaved runway or stopway should be indicated by additional markings placed at right angles to and adjoining the appropriate longitudinal markers.
- 4.3.5 The threshold of an unpaved runway should be marked with a designator showing the magnetic heading to the nearest whole ten degrees. Spacing and dimensions are given at Appendix 7B, Table 7B.1. Elevated markers used to indicate a displaced threshold should be located as wing bars as illustrated at Figure 7.22 and Figure 7.31.

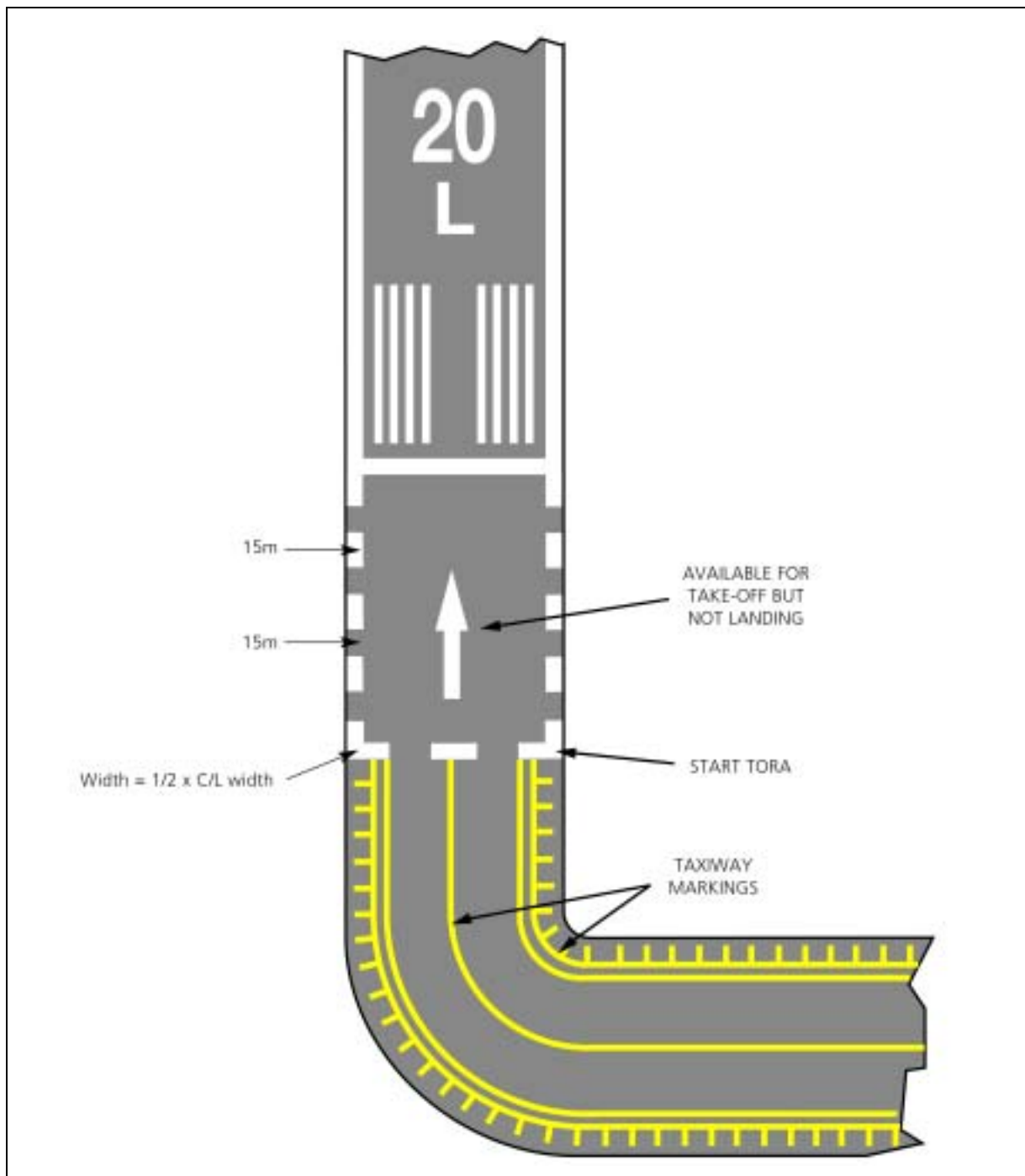


Figure 7.22(e) Alternative Pre-Threshold Markings

- 4.3.6 A temporarily displaced threshold should be marked in the manner illustrated at Figure 7.22. However, the chevrons and displacement arrows may be omitted.
- 4.3.7 An unpaved runway should be provided with centreline marking (see paragraph 4.2.1), if the runway edge marking is not easily seen during take-off or landing.
- 4.3.8 Where landings and take-offs are not confined to marked runways and the aerodrome boundary is not readily apparent, boundary markers, as defined in paragraph 4.7.1, should be provided.

4.4 Runway turn pad markings

- 4.4.1 Where a runway turn pad is provided, a runway turn pad marking should be provided for continuous guidance to enable an aircraft to complete a 180° turn and align with the runway centreline.
- 4.4.2 A runway turn pad marking should be at least 15 cm in width and continuous in length. The marking should be curved from the runway centreline into the turn pad. The radius of the curve should be compatible with the manoeuvring compatibility and normal taxiing speeds of the aircraft for which the runway turn pad is intended. The intersection angle of the turn pad marking with the runway centreline should not be greater than 30°.
- 4.4.3 The runway turn pad marking should extend parallel to the runway centreline marking for at least 60 m beyond the point of tangency where the code number is 3 or 4, and for at least 30 m where the code number is 1 or 2.
- 4.4.4 The runway turn pad marking should guide the aircraft in such a way as to allow a straight portion of taxiing before the point where the 180° turn is to be made. The straight portion of the turn pad making should be parallel to the outer edge of the runway turn pad.
- 4.4.5 The design of the curve allowing an aircraft to negotiate a 180° turn should be based on a nose-wheel steering angle not exceeding 45°. The design should be such that, when the cockpit of the aircraft remains over the runway turn pad marking, the clearance distance between any wheel of the aircraft landing gear and the edge of the runway turn pad should be not less than specified in Chapter 3, 7.2.1.
- 4.4.6 Where a runway turn pad is provided, the runway side stripe marking should be continued between the runway and the runway turn pad.

4.5 Day markers for snow-covered runways

- 4.5.1 Type 'C' markers as illustrated at Figure 7.30 should be used to indicate the threshold, end and usable width of a snow-covered runway. The spacing of markers along the sides of the runway should be at intervals of not more than 100 m. Markers may not be needed where elevated runway edge lighting is installed. Where necessary the threshold should additionally be marked with Runway Threshold Marker Boards described at paragraph 4.7.4, positioned as illustrated in Figure 7.22 d).

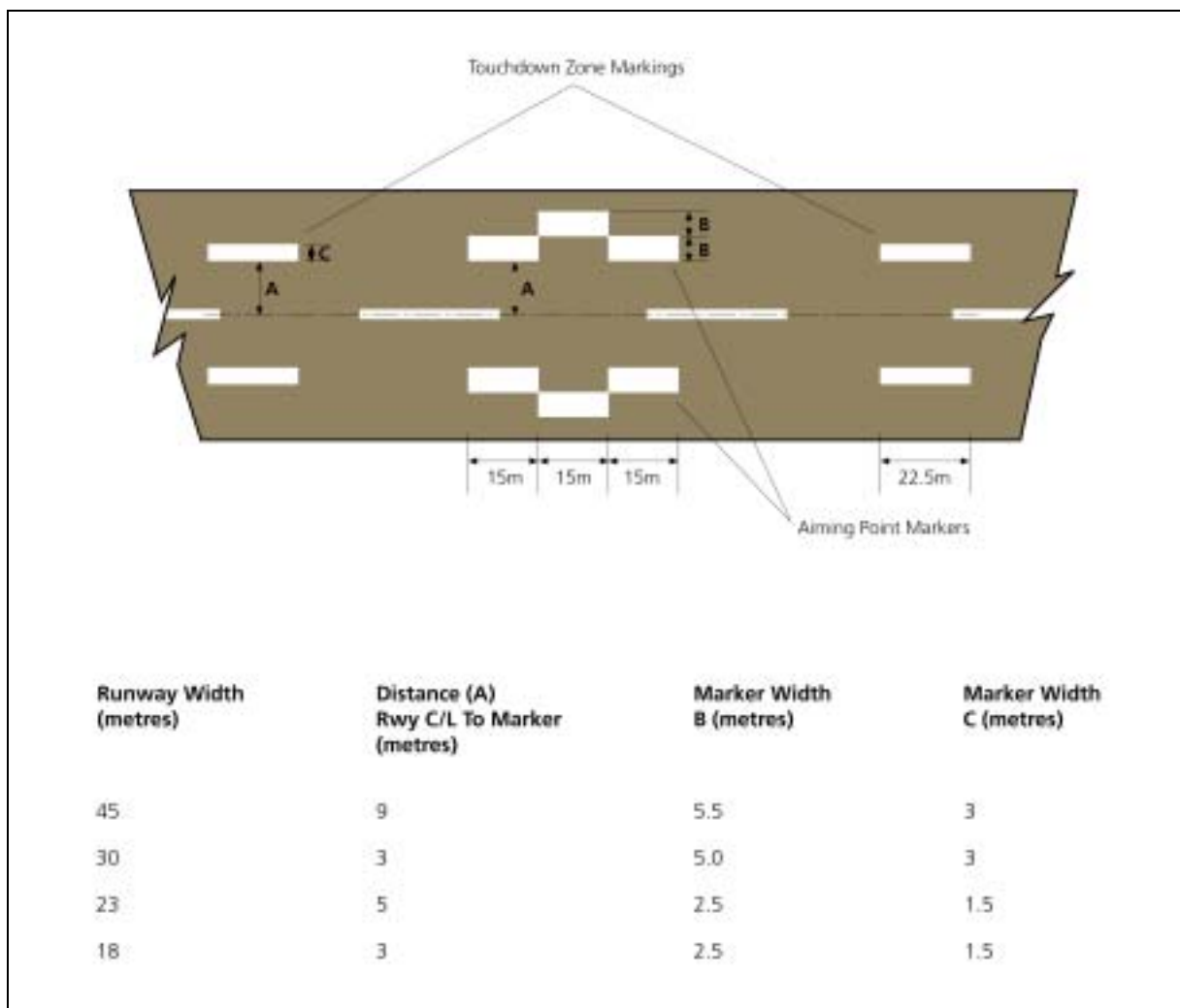


Figure 7.23 Aiming Point and Touchdown Zone Markings – Dimensions

NOTE: For runways in excess of 45m, contact Aerodrome Standards Department.

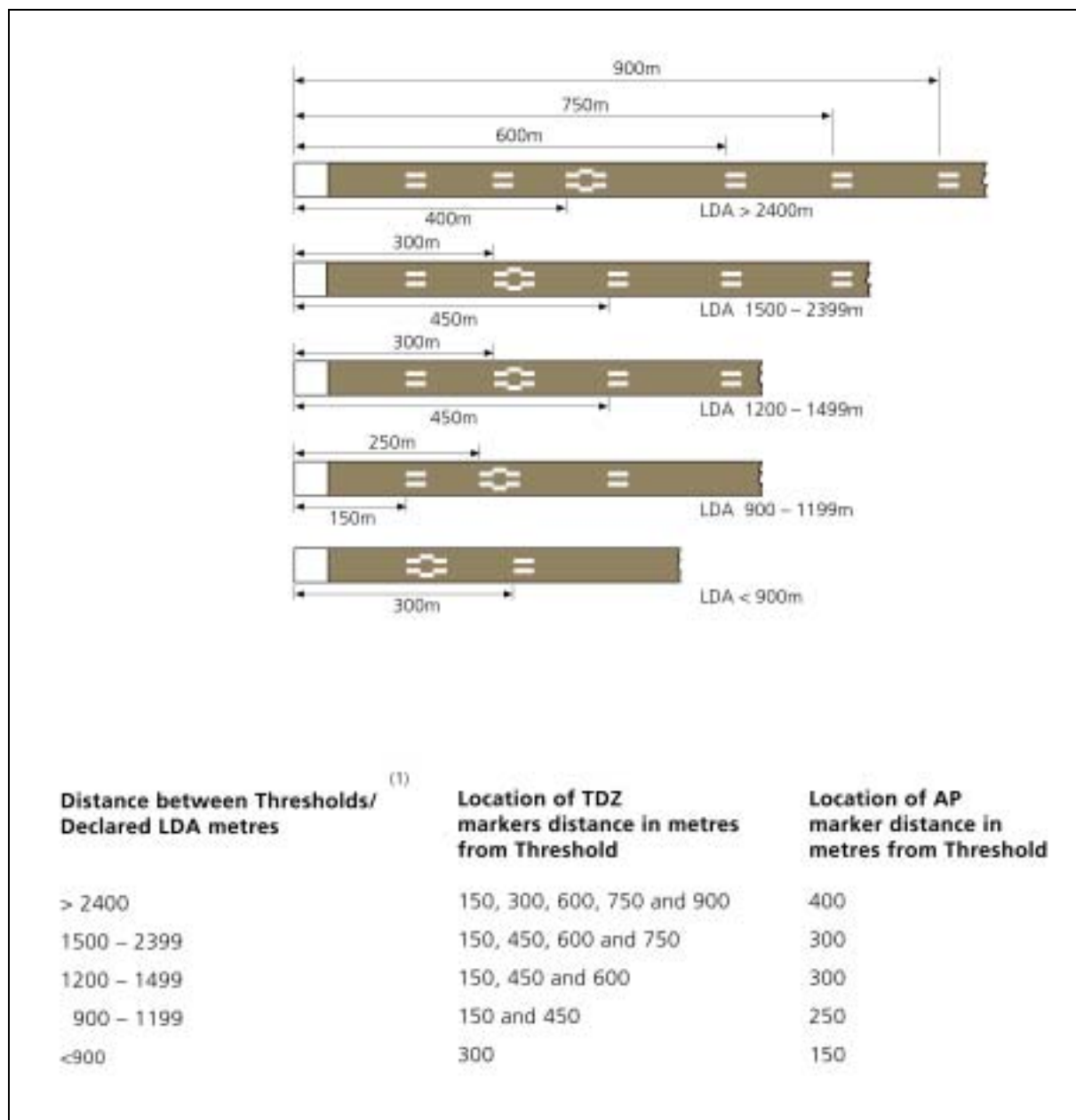


Figure 7.24 Paved Runways – Location of Touchdown Zone and Aiming Point Markers

NOTES:

- 1 Where the runway is served by an instrument approach at both ends, use distance between thresholds to determine the location of the TDZ markings. The distance between the last TDZ marks serving each landing direction should be not less than 300 m.
- 2 Where PAPI is provided, the beginning of the Aiming Point Markers shall be co-incident with the PAPI approach slope origin. However, if the difference in distance between the PAPI location and that depicted in the applicable diagram above will not, as agreed mutually with the CAA, result in a significant reduction in safety, it is acceptable to leave existing AP markers in their present position.

4.6 Taxiway markings

- 4.6.1 The centreline of paved taxiways serving precision approach runways and other taxiways where the route is difficult to follow should be marked by a continuous yellow line 0.15 m wide. Where the taxiway leads onto or off the runway, the yellow line should be curved into the nearside of and 0.75 m \pm 0.15 m from the runway centreline, except at the runway threshold where the yellow line should be discontinued at the edge of the runway in the manner illustrated at Figure 7.27. When a taxiway crosses a runway, the centreline may be continued across the runway, interrupted as necessary for the runway markings. At taxiway intersections the taxiway centrelines should be intersected in the manner illustrated at Figure 7.26.
- 4.6.2* Runway Taxi-Holding Positions should be established in accordance with the requirements of Chapter 3 paragraph 7.7 on each taxiway serving a runway. On each taxiway the Runway Taxi-Holding Position closest to the runway should be marked as shown in Figure 7.25 Pattern 'A'. Other Runway Taxi-Holding Positions where provided on the same taxiway but farther from the runway should be marked as shown at Figure 7.25 Pattern 'B'.

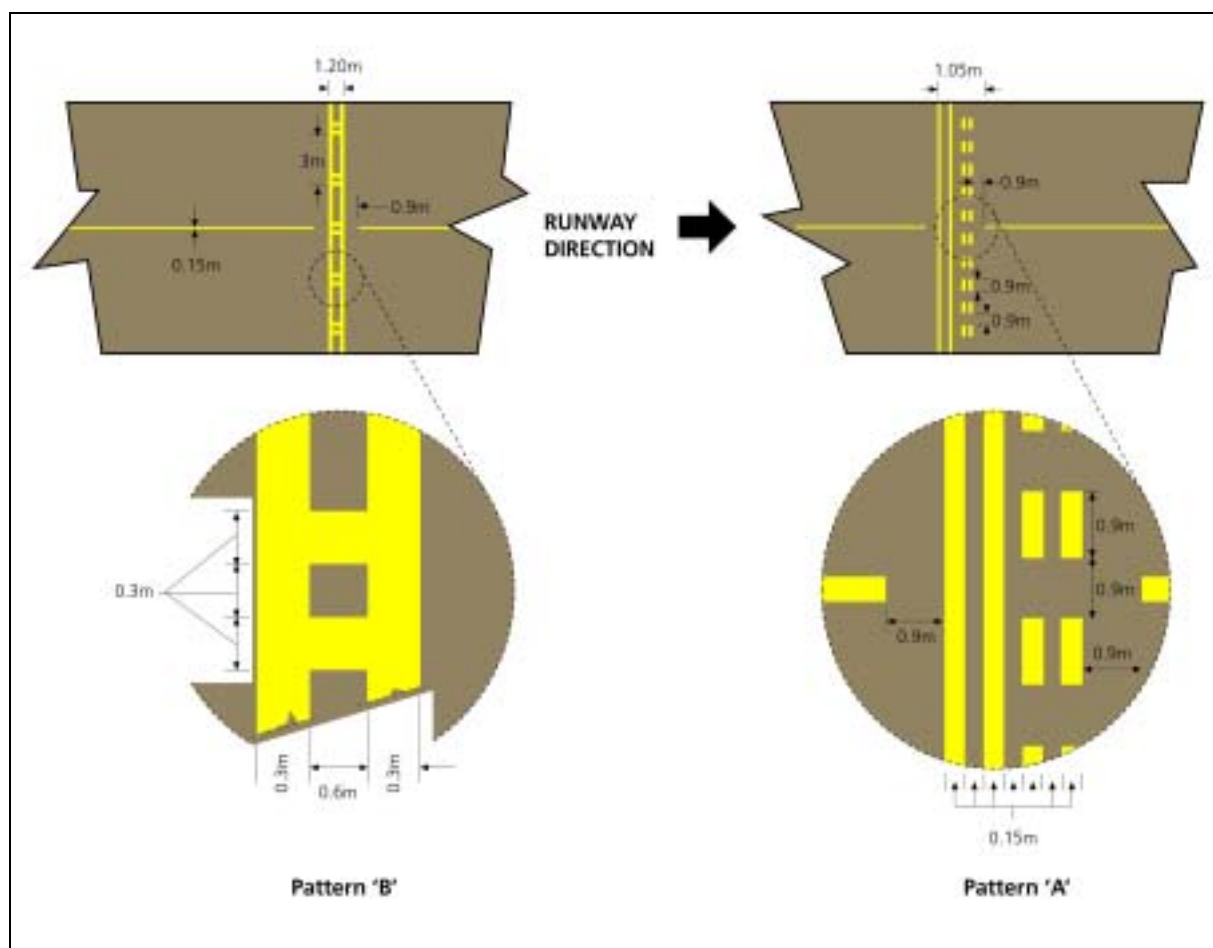


Figure 7.25 Runway Taxi-Holding Position Marks

NOTES:

- 1 The Runway Taxi-Holding Position marking should be positioned at right angles to the taxiway centreline marking.
- 2 No part of the Runway Taxi-Holding Position marking should be closer to the runway than the appropriate distance as determined by use of Table 3.3.

- 4.6.3 Intermediate Taxi-Holding Position markings as illustrated in Figure 7.26 should be displayed wherever it is intended to locate an Intermediate Taxi-Holding Position.
- 4.6.4 Where it is necessary to define the outer edges of a taxiway, e.g. where a paved taxiway shoulder has a bearing strength less than that of the main taxiway or where a taxiway lies adjacent to a paved area not intended for use as a taxiway, the outer edges of the taxiway should be marked as illustrated in Figure 7.27. The mark should be so positioned that the inner edge of the mark represents the outer edge of the taxiway.

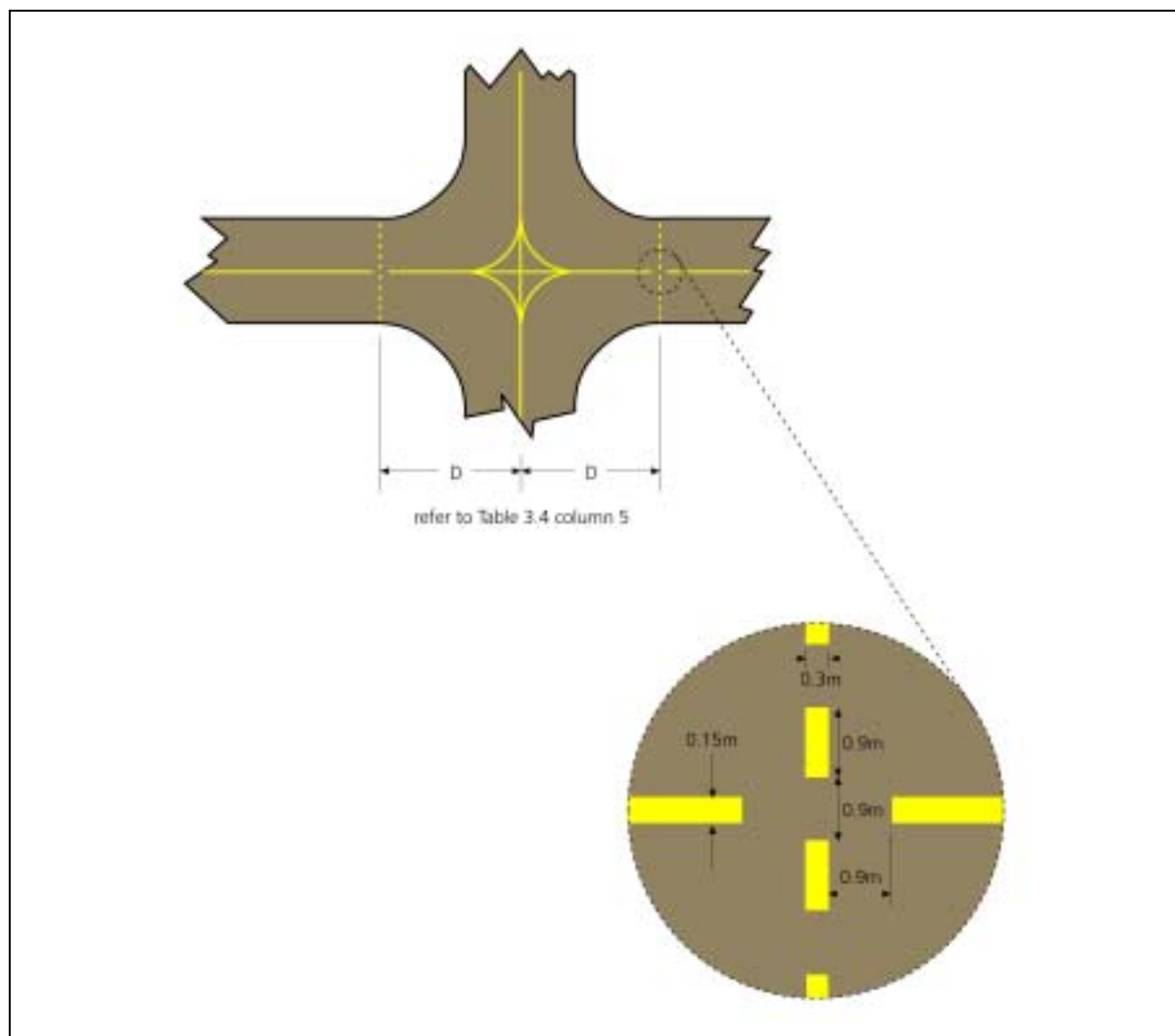


Figure 7.26 Intermediate Taxi-Holding Position Marking

NOTE: An Intermediate Taxi-Holding Position Marking should be placed at right angles to the taxiway centreline and in such a position so as to ensure that the minimum separation distances outlined in column 5 to Table 3.4 are achieved.

- 4.6.5 On taxiways or aprons where it is impracticable to install an information sign, the information should be displayed in the form of a marking on the pavement positioned as to be legible from the cockpit of an approaching aircraft. The markings should conform to the illustrations at Appendix 7C.

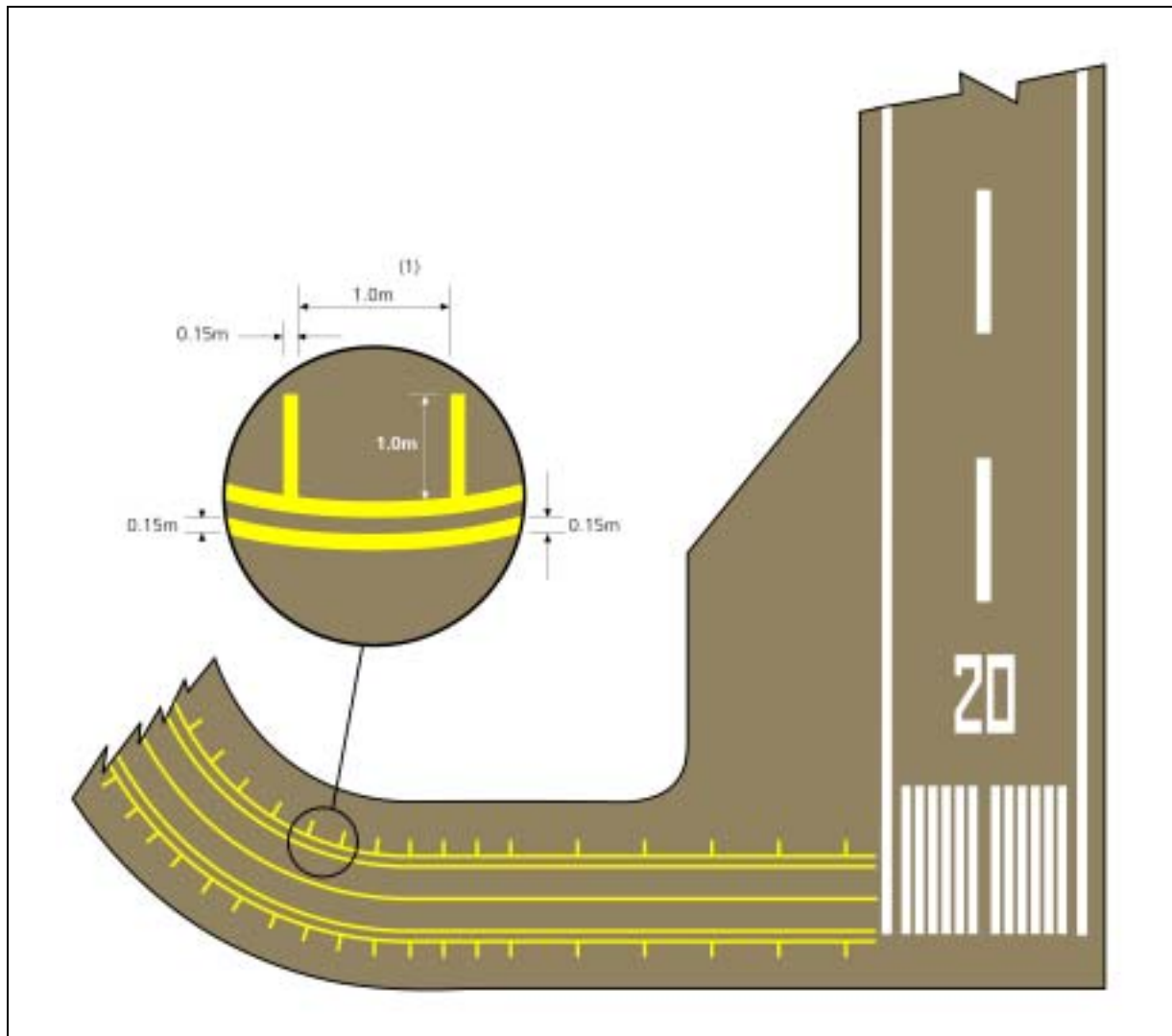


Figure 7.27 Taxiway Edge Marking

NOTE: On straight sections of taxiway this distance may be increased to 2 m.

4.7 Markings of unfit areas

- 4.7.1 One or more cross as illustrated at Figure 7.28 should be used to mark runways or taxiways declared as unfit for the movement of aircraft. The crosses should be spaced at intervals of not more than 300 m except where they form part of the marking for a displaced runway threshold when the spacing at Figure 7.22 d) v) applies.

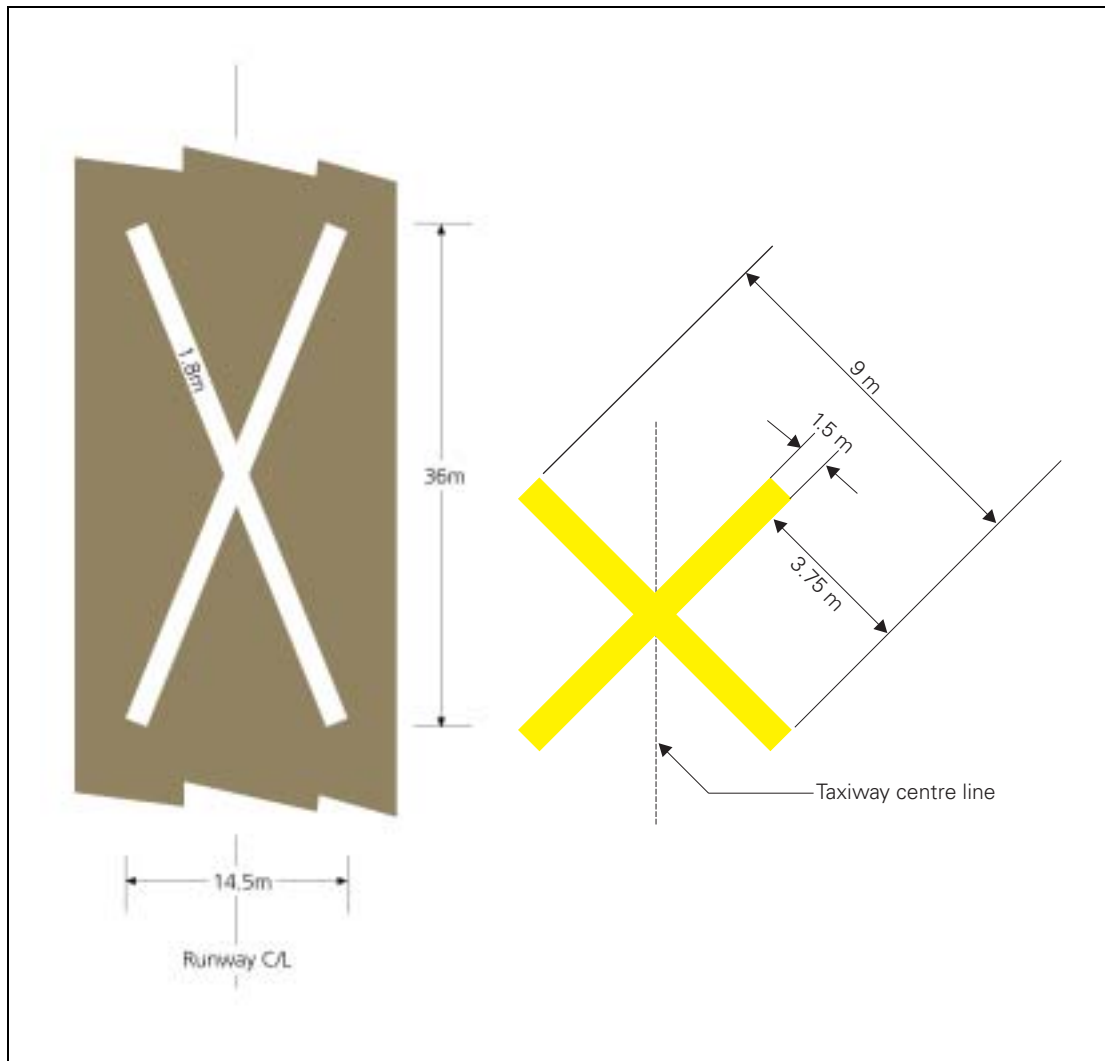


Figure 7.28 Closed Runway and Taxiway Markings

- 4.7.2* Type 'A' ground markers as illustrated in Figure 7.29, spaced not more than 15 m apart, signify the boundary of that part of a paved runway, taxiway or apron unfit for the movement of aircraft.

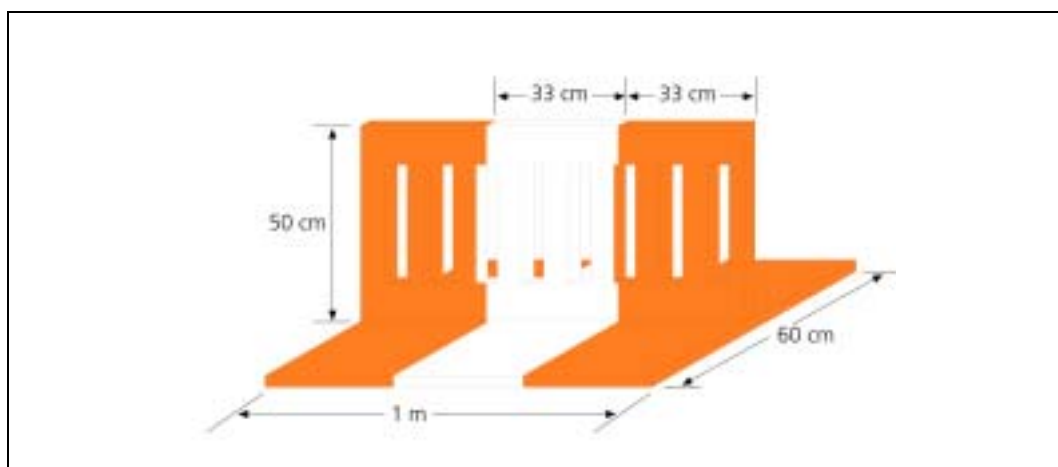


Figure 7.29 Bad Ground Marker Type 'A'

- 4.7.3* Areas on unpaved manoeuvring areas that are unfit for the movement of aircraft should be marked by one or more crosses as specified in Figure 7.28 and bounded by Ground Markers Type 'B' alternating with Type 'C' illustrated at Figure 7.30. The Type 'C' marker should also be used to mark the usable portion of a snow covered runway as described at paragraph 4.4 and should be located where runway edge lighting would normally be expected. The distance between successive Type 'C' markers therefore should not exceed 60 m.
- 4.7.4 Alternatively, cones may be used to denote such areas. Cones should be at least 0.5 m in height and red, orange or yellow, or any of these colours in combination with white. Whilst ballast may be required to ensure stability, aerodrome operators should ensure that cones retain their frangibility.

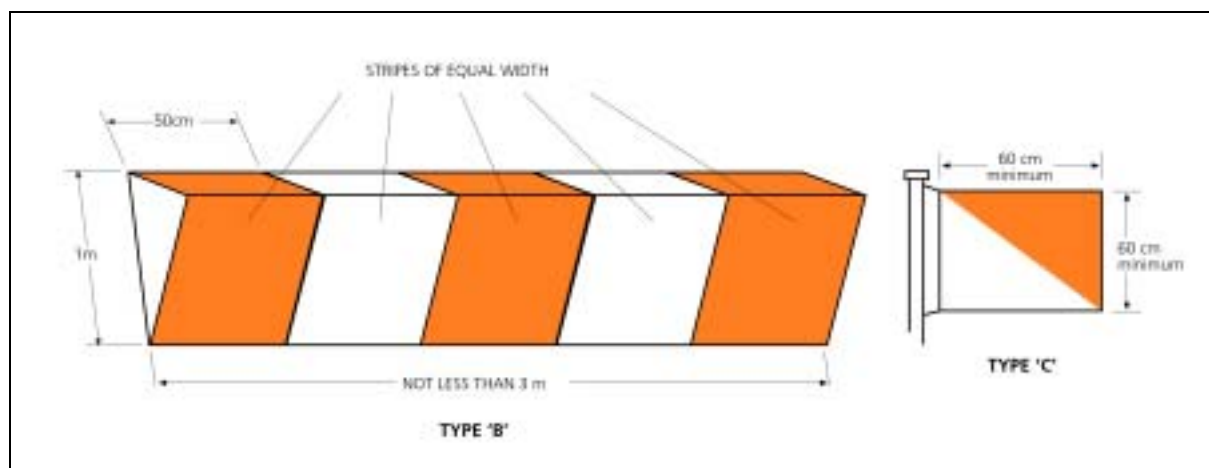


Figure 7.30 Bad Ground Markers Types 'B' and 'C'

- 4.7.5 Where a runway threshold is temporarily displaced, or where a threshold is insufficiently conspicuous (e.g. snow covered runway) the threshold should be marked with the boards illustrated at Figure 7.31 (in addition to the pavement markings), positioned in accordance with the illustrations at Figure 7.22.

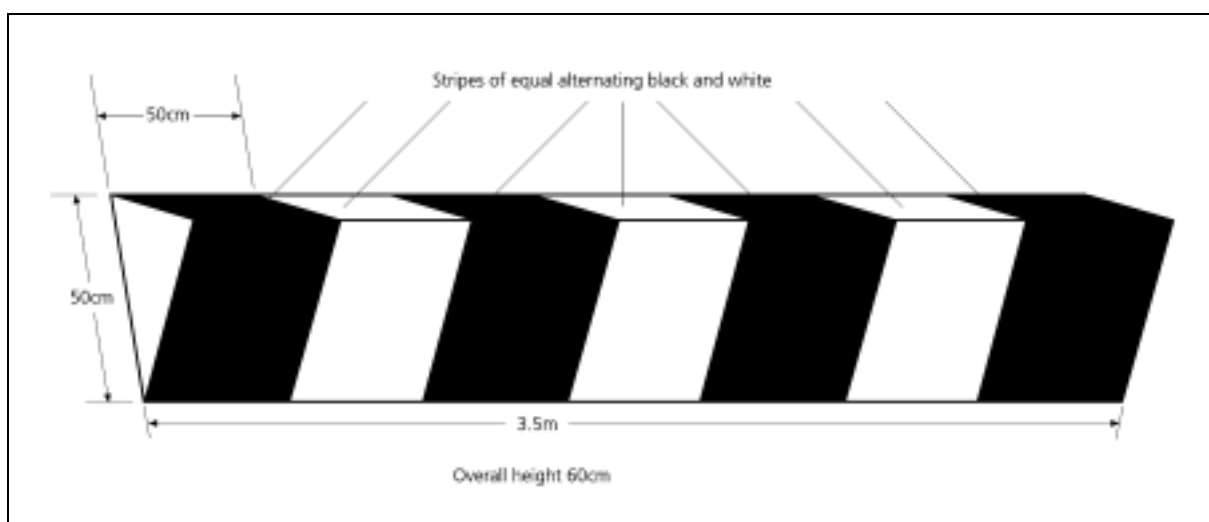


Figure 7.31 Runway Threshold Marker Board

- 4.7.6 When a runway or taxiway, or portion thereof, is permanently closed, all normal runway and taxiway markings should be obliterated.

4.8 Other markers

- 4.8.1* An aerodrome boundary that is insufficiently conspicuous should be delineated by orange and white striped markers either as illustrated in Figure 7.32 or as specified in paragraph 4.7.3. Spacing should not exceed 45 m.

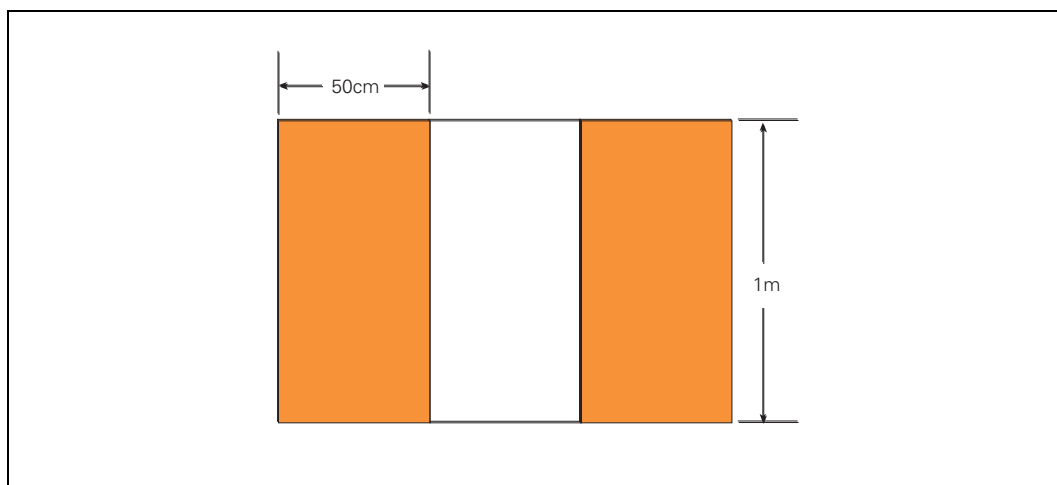


Figure 7.32 Aerodrome Boundary Marker

- 4.8.2* A white letter H as illustrated in Figure 7.33 indicates a part of the manoeuvring area to be used only for the take-off and landing of helicopters.

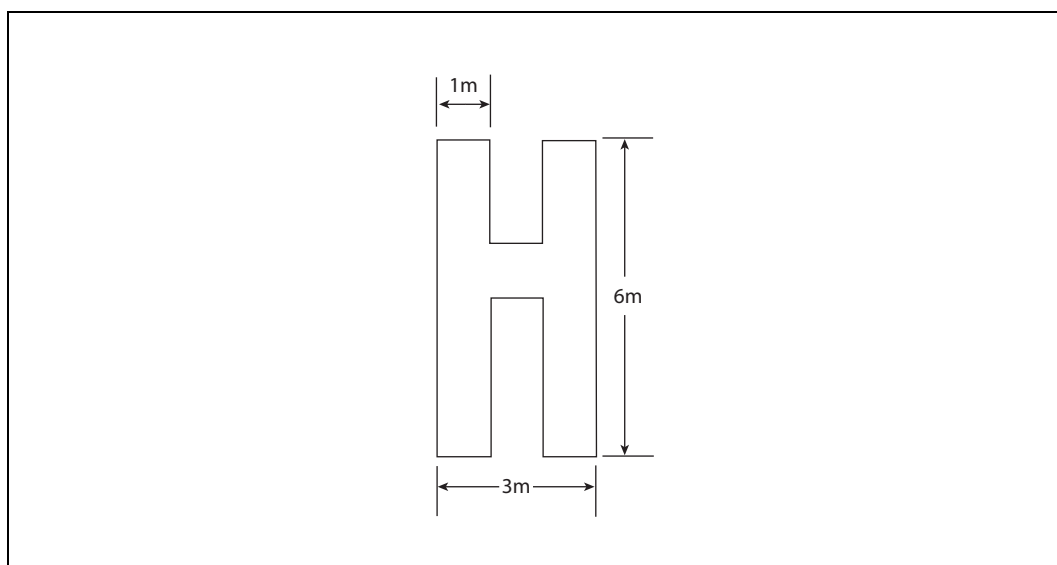


Figure 7.33 Helicopter Landing Area Mark

- 4.8.3* A white letter L as illustrated in Figure 7.34 indicates a part of the manoeuvring area to be used only for the take-off and landing of light aircraft.

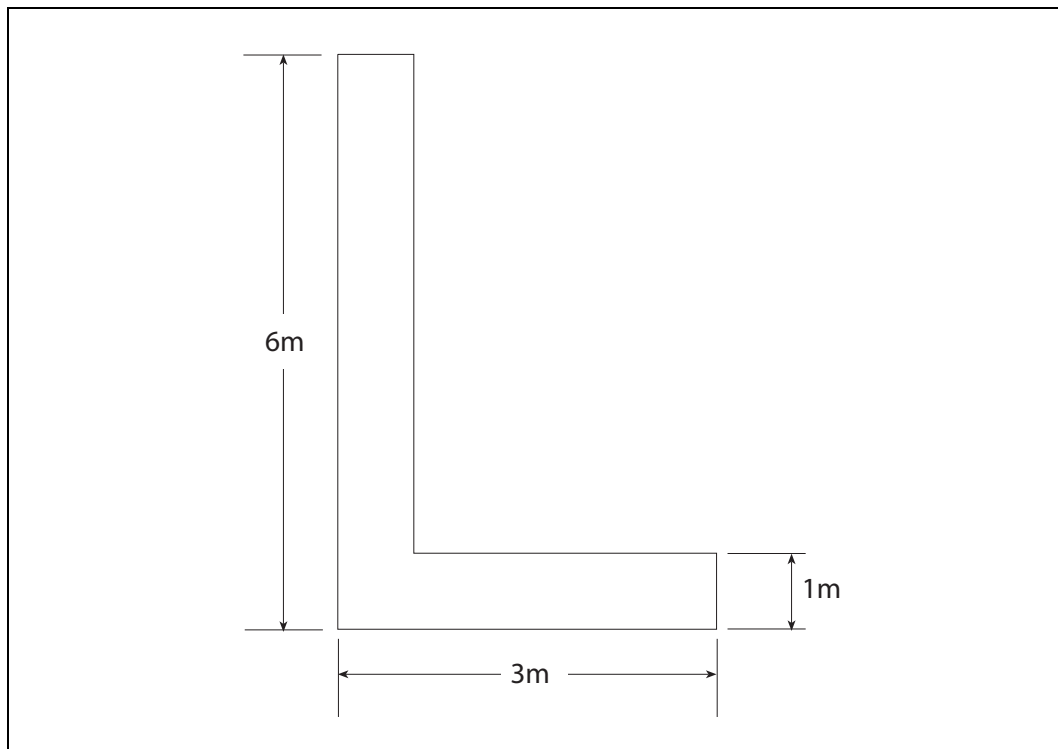


Figure 7.34 Light Aircraft Landing/Take-off Area Mark

- 4.8.4* A yellow cross of dimensions illustrated in Figure 7.35 indicates that tow ropes and similar articles towed by aircraft are to be dropped only in the area in which the cross is placed.

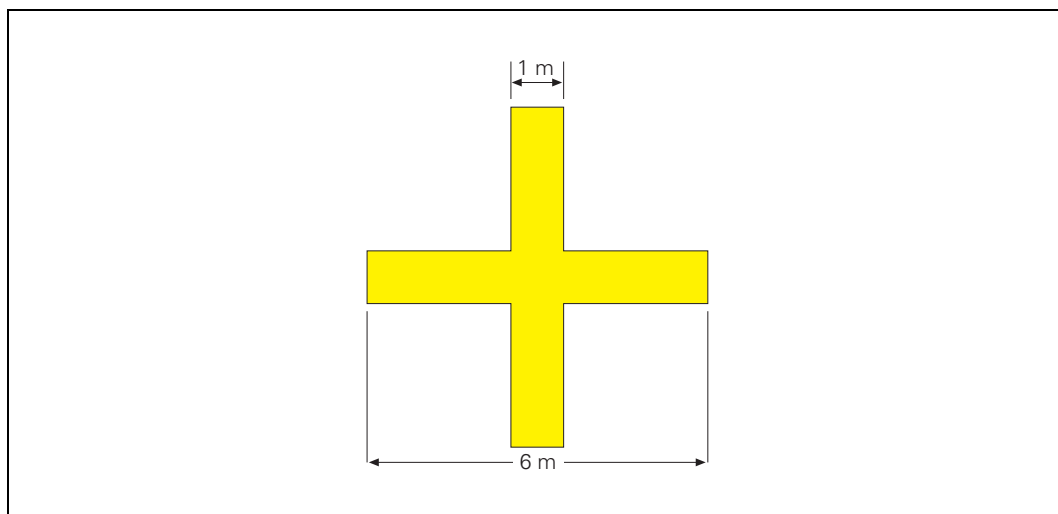


Figure 7.35 Yellow Cross

- 4.8.5* A white double cross as illustrated at Figure 7.36 indicates an area to be used only for the taking-off and landing of gliders.

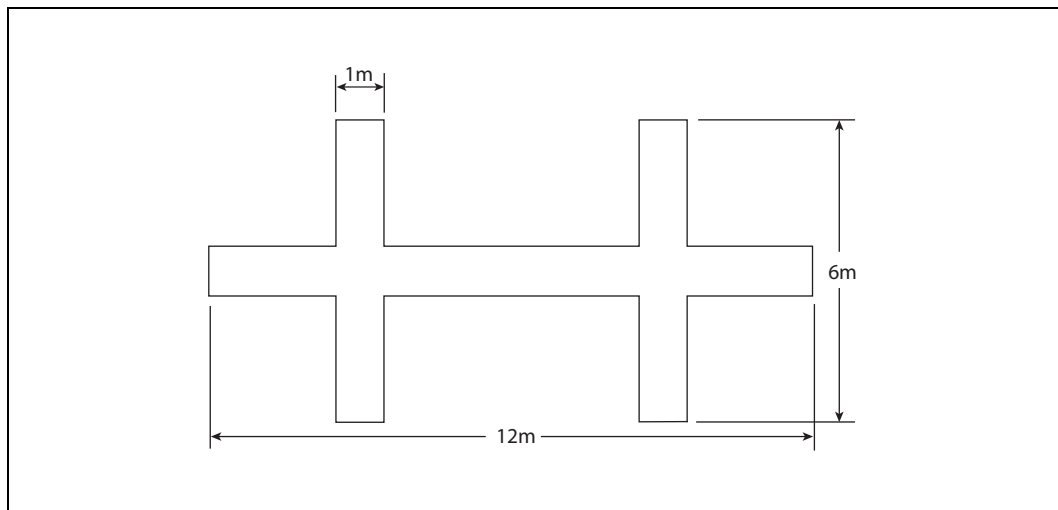


Figure 7.36 White Double Cross – Dimensions

- 4.8.6* A white landing T as specified in paragraph 2.4.1 or 2.4.2, placed at the left hand side of the runway when viewed from the direction of landing indicates the runway to be used.

5 Road Signs and Markings

- 5.1 Road signs and markings used on aerodrome movement areas should conform wherever possible with the Traffic Signs Regulations and General Directions 2002 SI 1997/2400 and the 'Zebra', 'Pelican' and 'Puffin' Pedestrian Crossing Regulations and General Directions 1997 SI 1997/2400 (as amended by SI 1998/901) as appropriate.

5.2 Road-Holding Position Sign

- 5.2.1 Whenever a route intended for vehicular traffic use intersects a taxiway or a runway, a Road-Holding Position Sign should be located not closer to the appropriate taxiway or runway than the distances notified in Chapter 3 paragraphs 7.7 and 7.8 and 1.5 m from the defined edge of the vehicular traffic route.
- 5.2.2 The Road-Holding Position Sign should combine a standard road traffic 'STOP' sign with, where appropriate, an instruction on how the driver of a vehicle should proceed. Examples of Road-Holding Position Signs are illustrated at Figure 7.37.

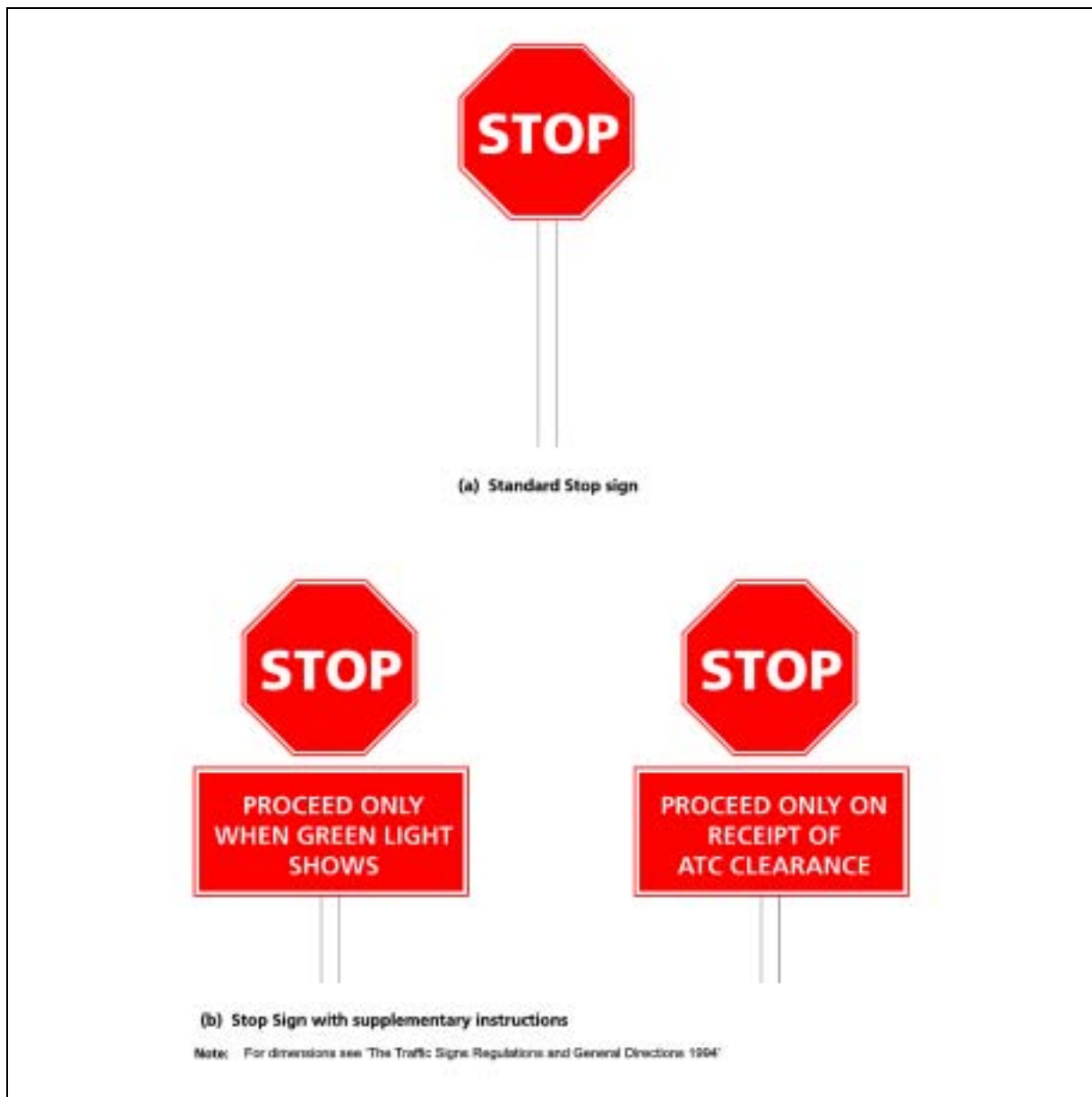


Figure 7.37 Road Holding Position Signs (NOT TO SCALE)

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Appendix 7A Taxi Guidance Signs Style and Proportion of Characters, Sign Layout and Face Size

- 1 This Appendix details the style and proportions of the characters to be employed on and the layout and face size of Taxi Guidance signs.
- 2 The characters are shown at Appendix 7A; Figures 7A.2 to 7A.6 for a 50 mm letter height. The characters may be enlarged to the desired letter height by any conventional enlarging process and the letters will remain in the proper proportion. However, any errors and inconsistencies in the space and character stroke width introduced as a result of enlargement will have to be corrected to reflect the requirements of Tables 7.1 and 7A-1. A 5 mm grid has been superimposed on the letters to facilitate the enlarging process. For example, to obtain 300 mm letter height, enlarge the grid squares to 30 mm.
- 3 A set of spacing tables is provided at Table 7A-1. These tables give the letter and numeral width by direct reading for several standard letter heights. In addition, the dimension for space between any combination of letters or numerals may be obtained through a two-step process described in the table. This space is the distance measured horizontally between the extreme right edge of the preceding letter and the extreme left edge of the following letter. No part of these letters may extend into this space.
- 4 The width of a word or name may be readily determined by adding the sum of the letter widths to the sum of the spaces between letters.
- 5 All characters having an arc at the top or bottom are extended slightly above or below the grid lines. This is in accord with accepted practice for rounded letters.
- 6 Sign face size shall be determined in the manner shown below.

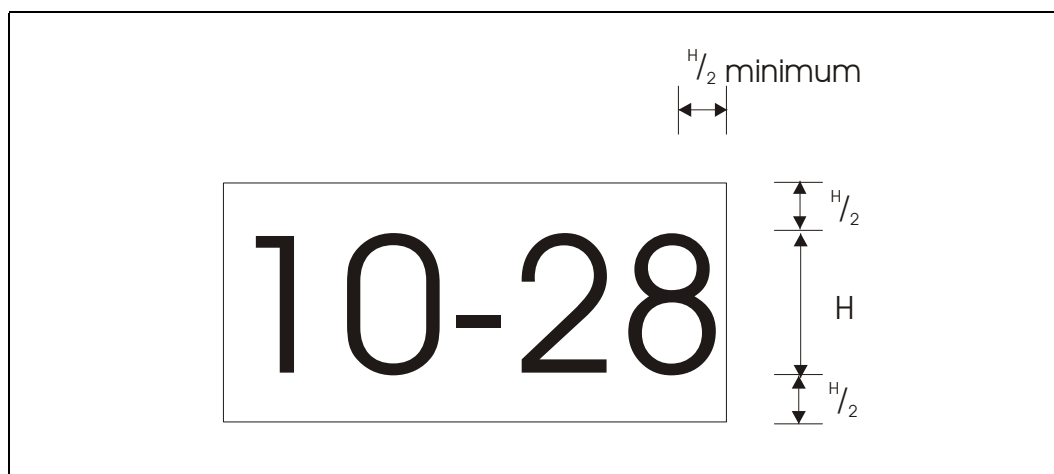


Figure 7A.1

Examples of sign layout and face size proportions are given at Figures 7A.7 to 7A.10.

NOTES:

- 1 Vertical dimensions may be **increased** by up to $H/10$ in order to accommodate construction tolerances.
- 2 Horizontal dimensions are a minimum. $H/2$ may be increased in order to allow flexibility in manufacture of a range of standard frames and enclosures.

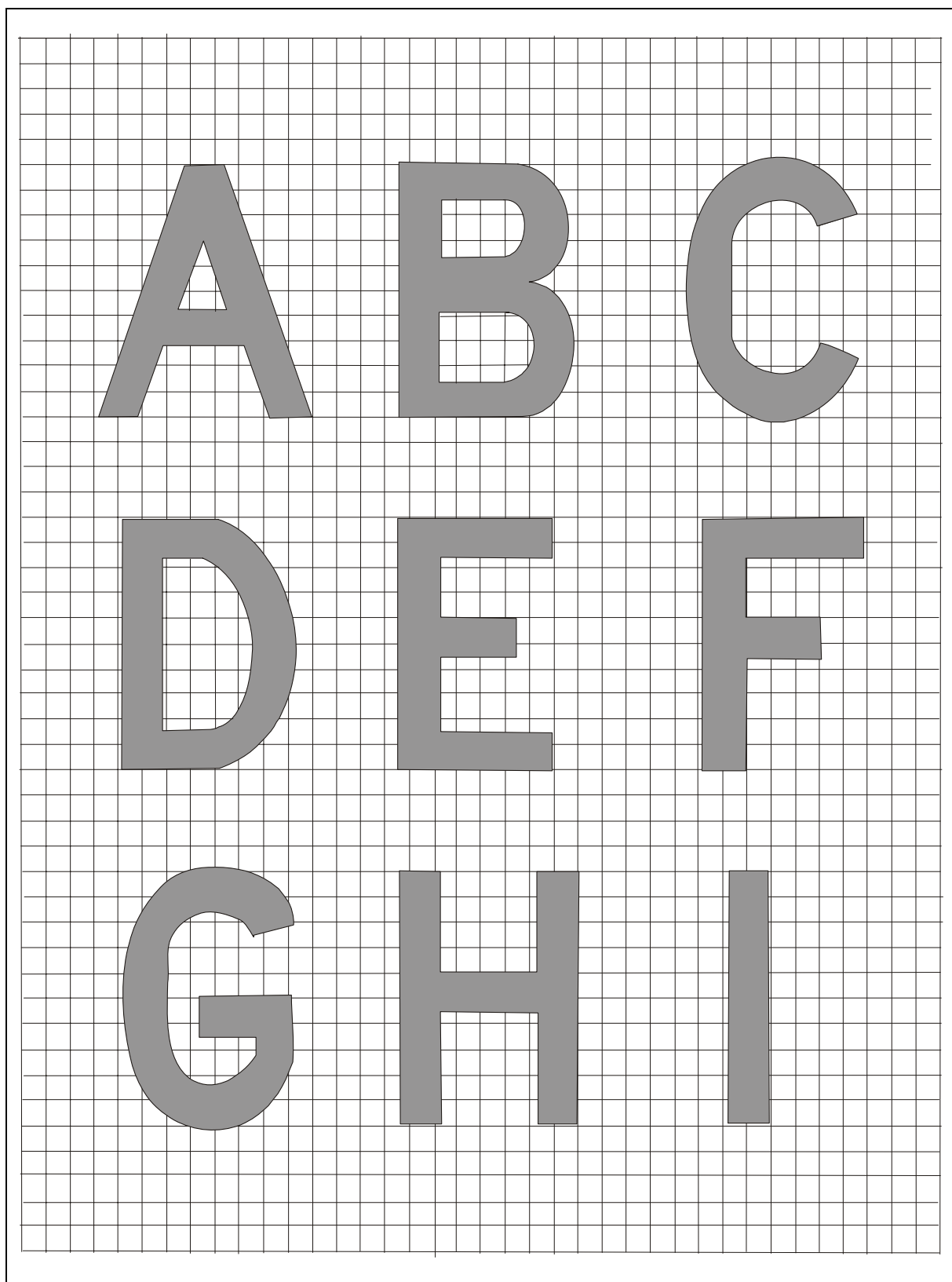


Figure 7A.2 Sign Characters Proportions and Style

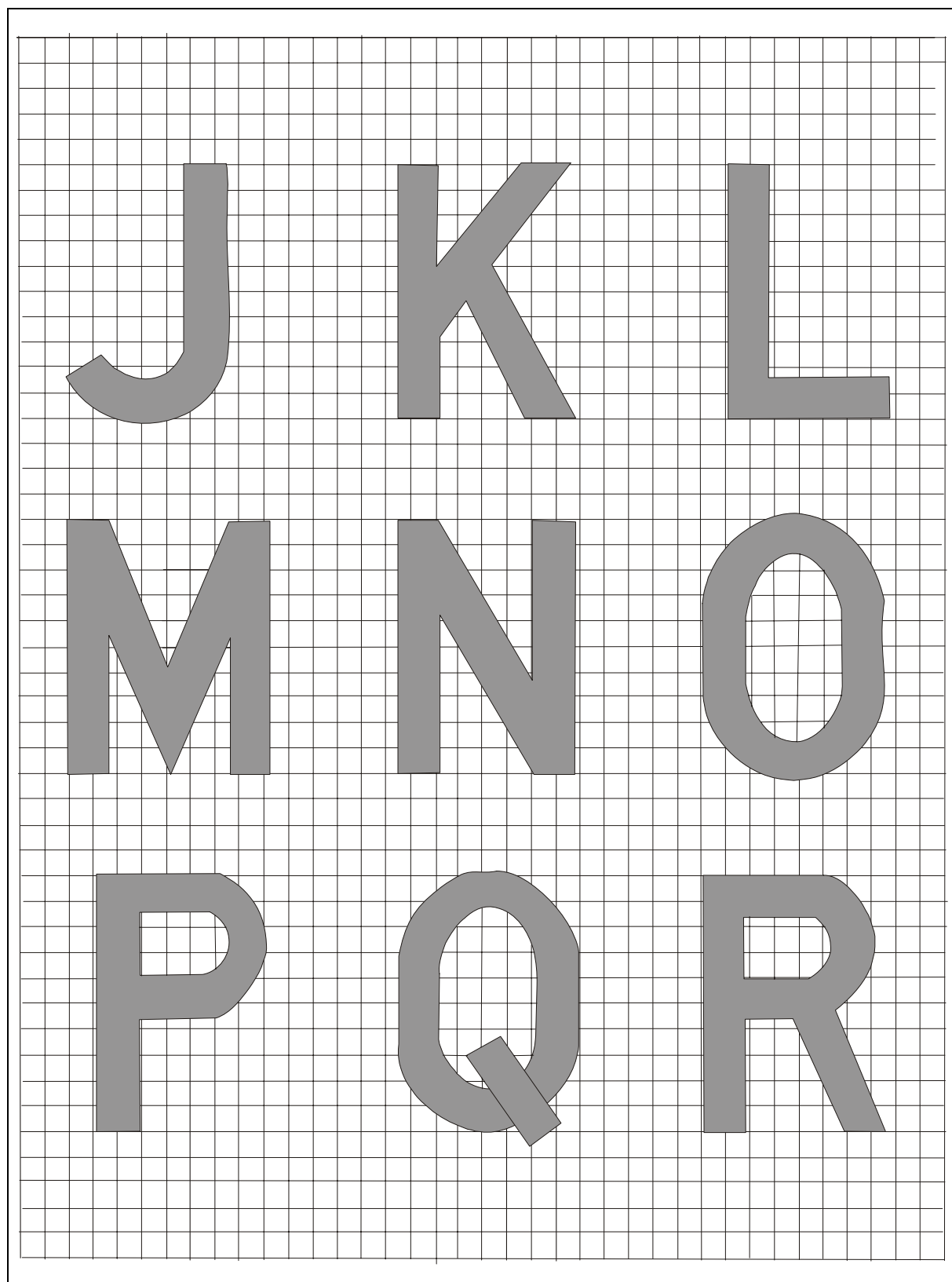


Figure 7A.3 Sign Characters Proportions and Style

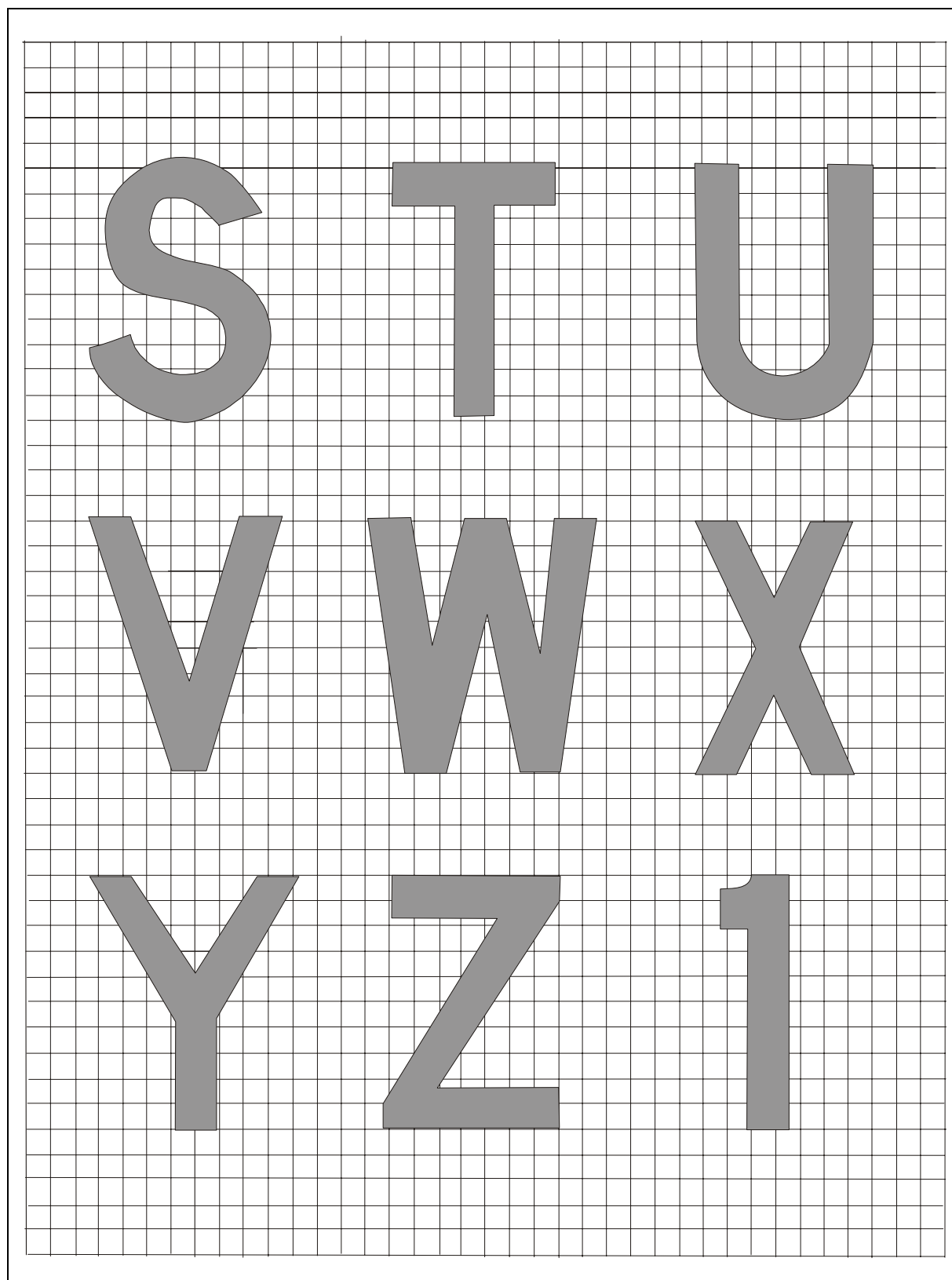


Figure 7A.4 Sign Characters Proportions and Style

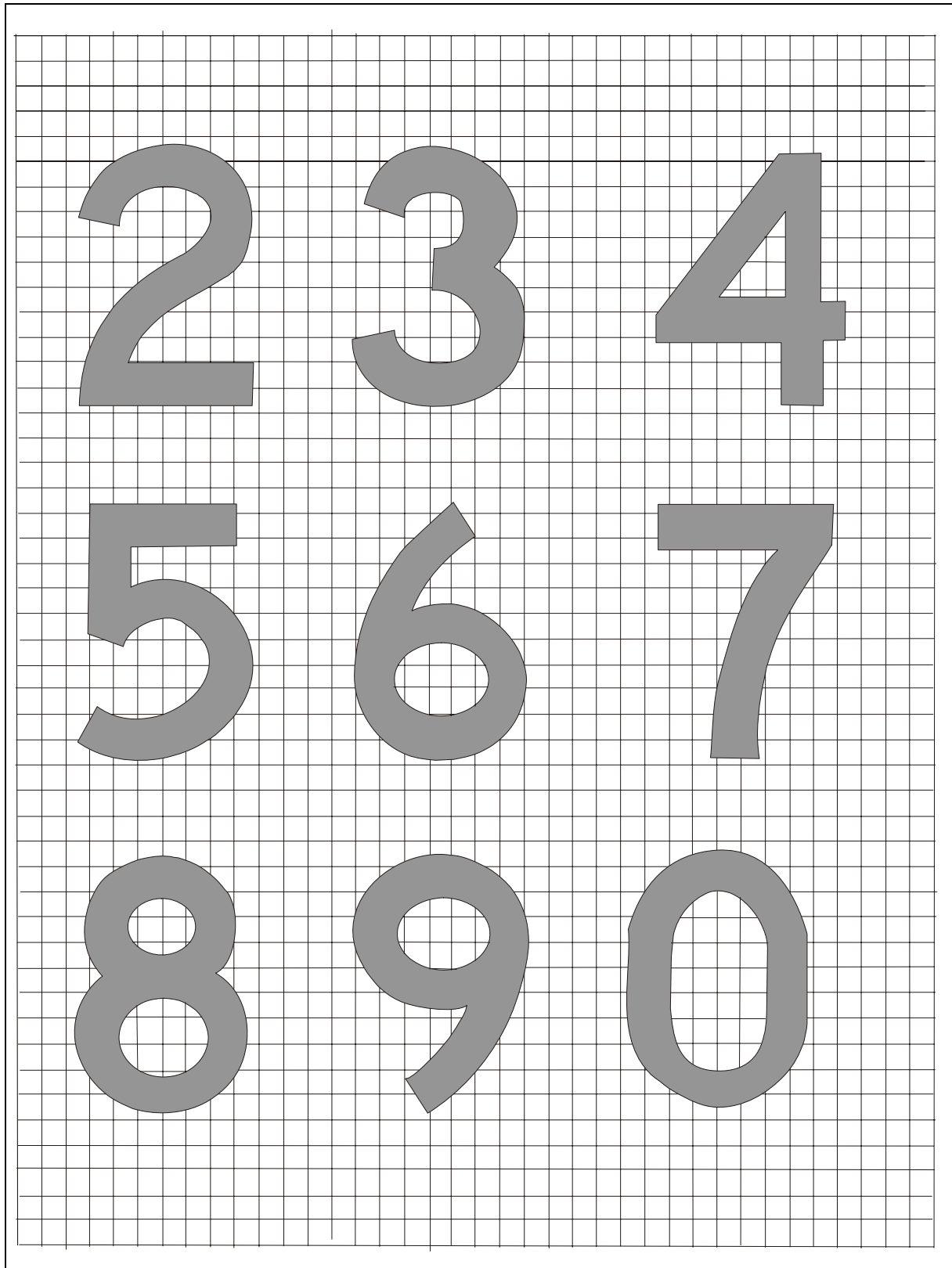


Figure 7A.5 Sign Characters Proportions and Style

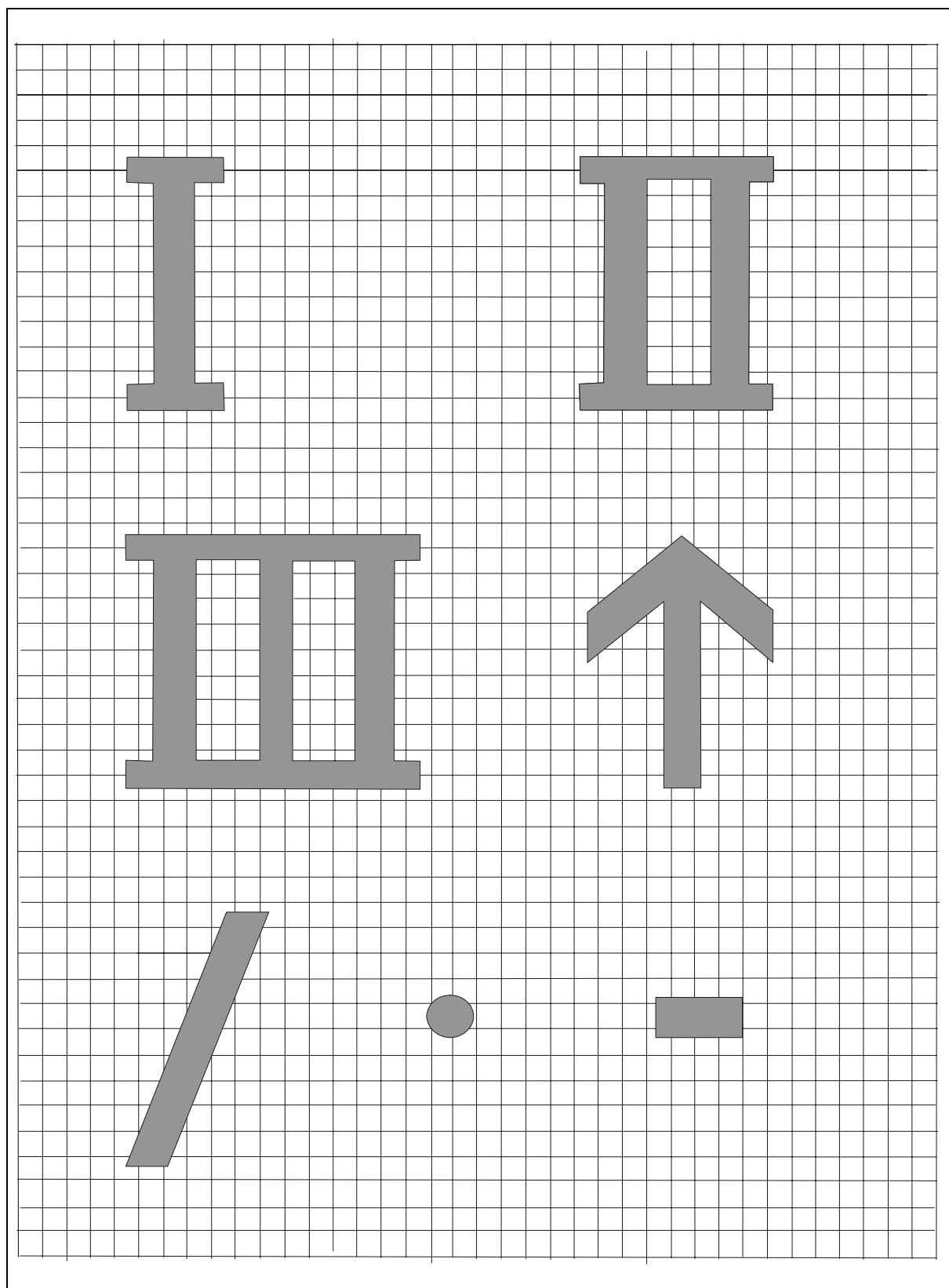


Figure 7A.6 Sign Characters Proportions and Style

Table 7A.1(a) Letter and Numeral Widths and Space Between Letters or Numerals

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

Table 7A.1(b) Letter and Numeral Widths and Space Between Letters or Numerals

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

Table 7A.1(c) Letter and Numeral Widths and Space Between Letters or Numerals

SPACE BETWEEN CHARACTERS			
CODE NO.	Letter Height (mm)		
	200	300	400
	SPACE (mm)		
1	48	71	96
2	38	57	76
3	25	38	50
4	13	19	26

Table 7A.1(d) Letter and Numeral Widths and Space Between Letters or Numerals

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

Table 7A.1(e) Letter and Numeral Widths and Space Between Letters or Numerals

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 half of the height of the characters used except that where an arrow is located with a single character such as 'A→', the space may be reduced to not less than one quarter of the character height in order to provide a good visual balance.
- 3 Where a 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.

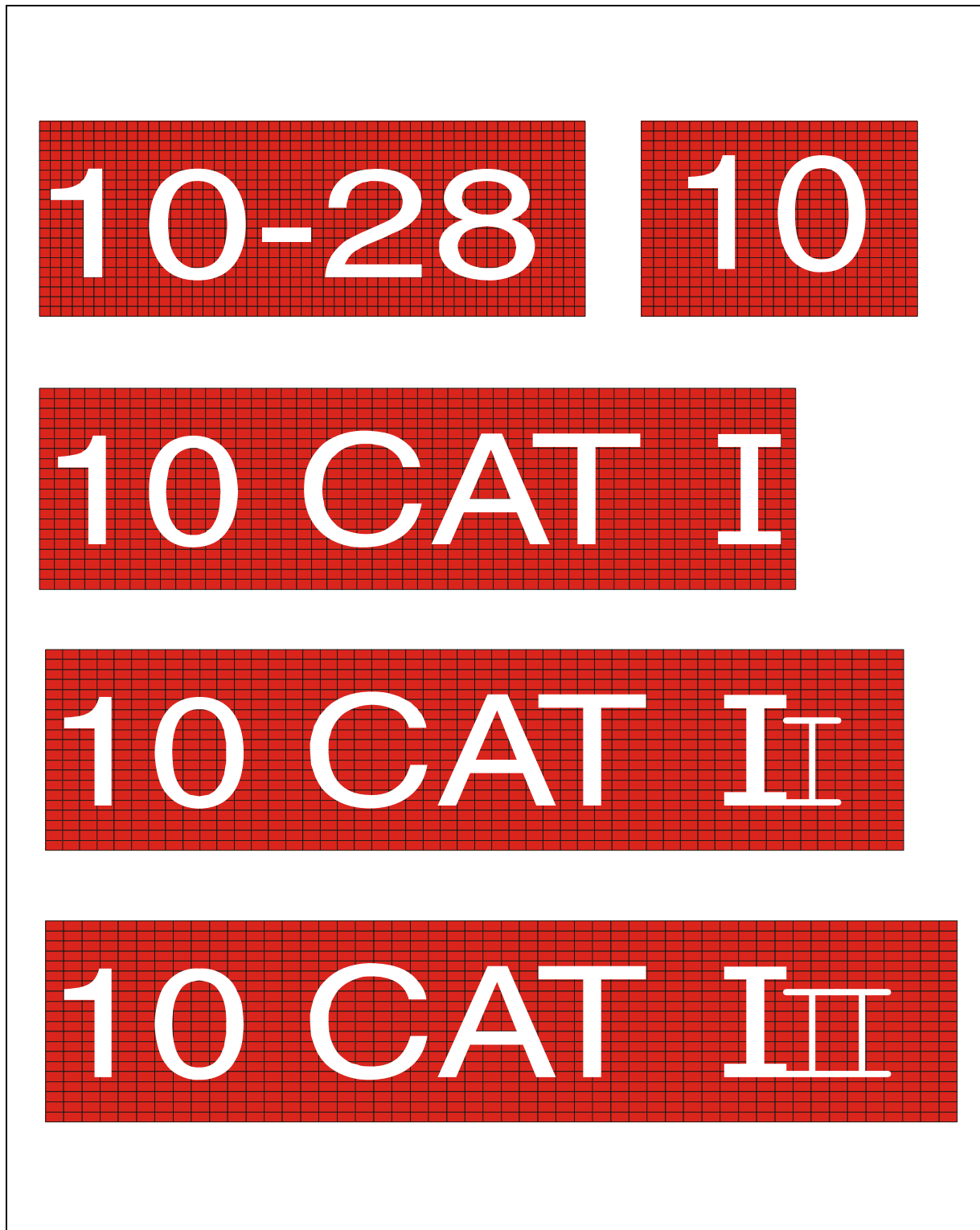


Figure 7A.7 Sign Face Size Proportions and Layout

NOTES:

- 1 The grid is shown only for the purpose of illustrating Sign Face and Character Proportions and should not show on a completed Sign Face.
- 2 For correct spacing between characters/symbols refer to Table 7A.1.

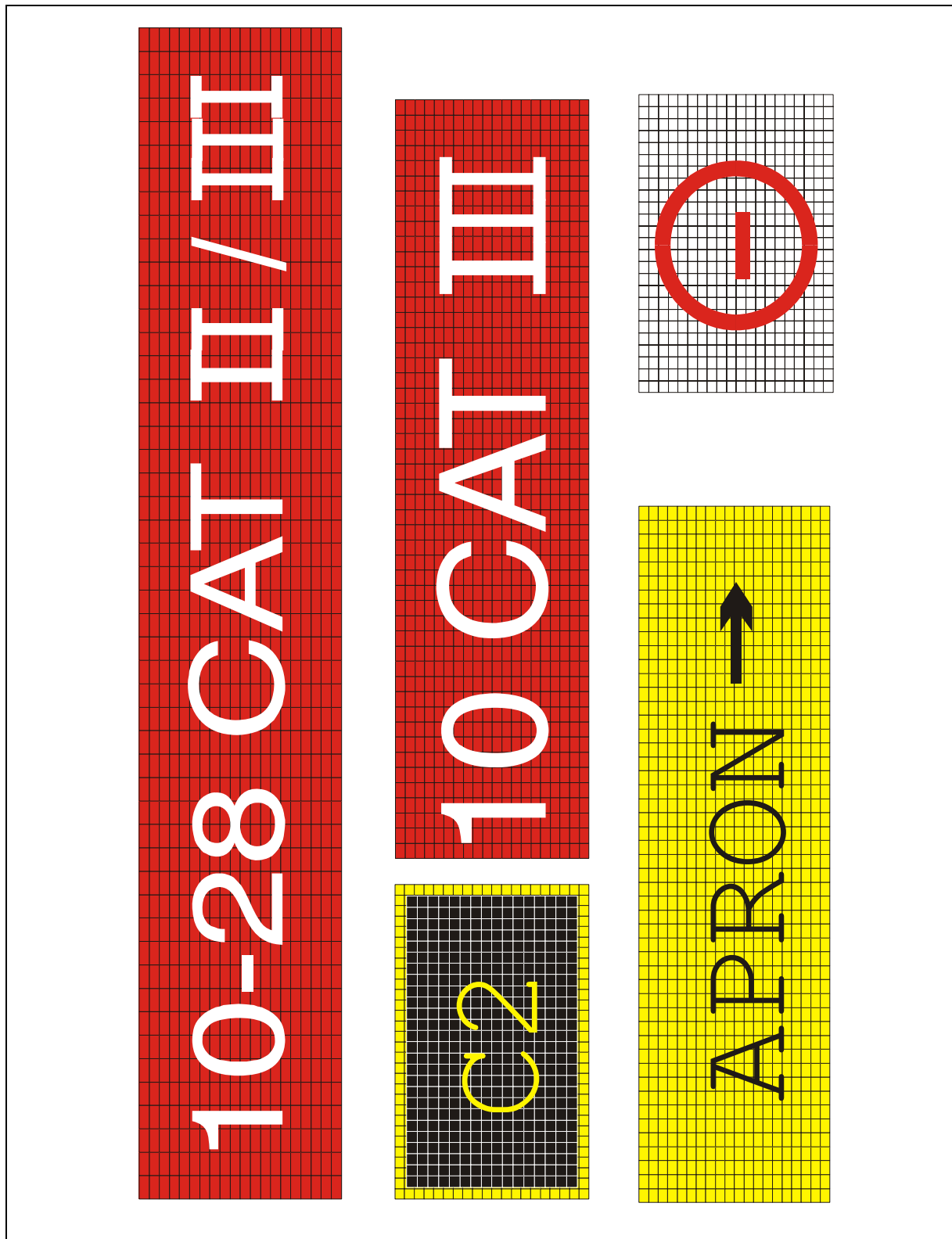
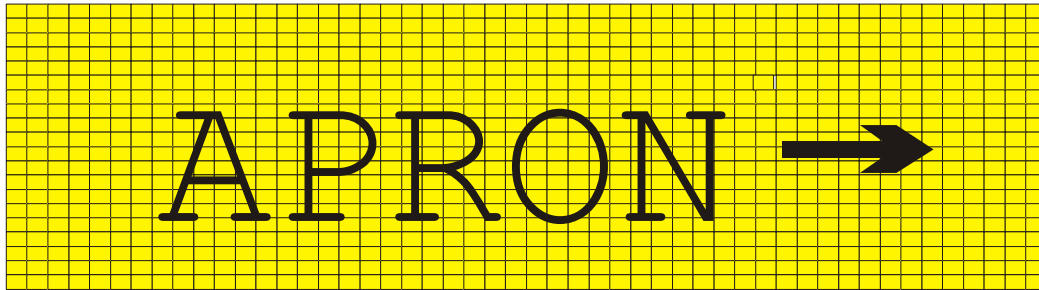


Figure 7A.8 Sign Face Size Proportions and Layout

NOTES:

- 1 The grid is shown only for the purpose of illustrating Sign Face and Character Proportions and should not show on a completed Sign Face.
- 2 For correct spacing between characters/symbols see Table 7A.1



Where an information sign contains 10 or more characters, it may be constructed in the manner shown below - using 20cm letter height.

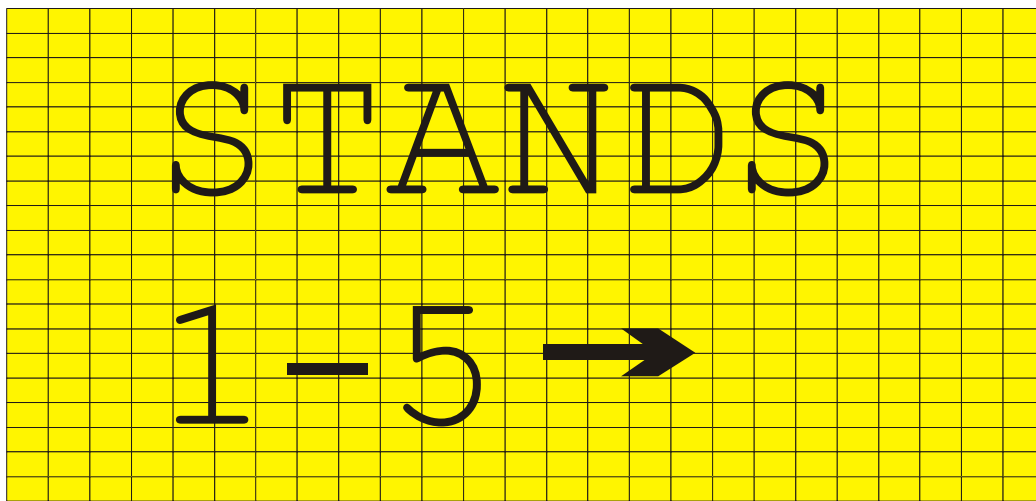


Figure 7A.9 Sign Face Size Proportions and Layout Continued

NOTES:

- 1 The grid is shown only for the purpose of illustrating Sign Face and Character Proportions and should not show on a completed Sign Face.
- 2 For correct spacing between characters/symbols see Table 7A.1.

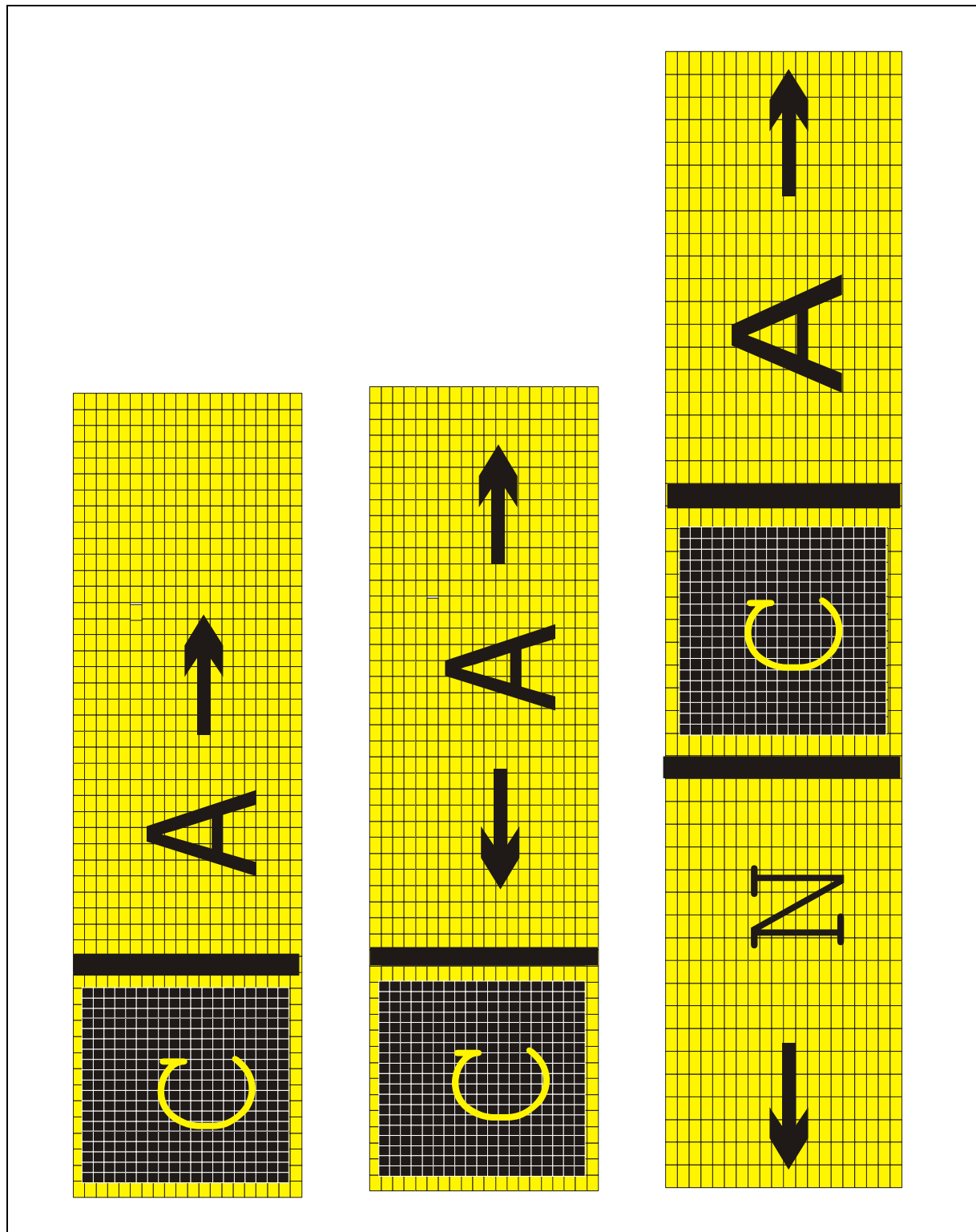


Figure 7A.10 Sign Face Size Proportions and Layout

NOTES:

- 1 The grid is shown only for the purpose of illustrating Sign Face and Character Proportions and should not show on a completed Sign Face.
- 2 For correct spacing between characters/symbols see Table 7A.1.

Appendix 7B Form and Proportions of Runway Designator Marking

This Appendix details the form and proportions of the characters that should be used for Runway Designator Marking drawn on a 5 mm grid in order to facilitate enlarging. The height of character to be employed is determined by the runway type and width and is listed at Table 7.3. The spacing between characters is detailed at Table 7B–1.

Table 7B.1 Runway Designator Marking – Spacing Between Characters

Designator		Character Height (m)		
1st Character	2nd Character	15	12	9
		Spacing (m)		
0	1	3.25	2.6	1.95
0	2–9	3.5	2.8	2.1
1	1	6.25	5	3.75
1	0,2–9	3.75	3	2.25
2	1	3.25	2.6	1.95
2	0,2–9	3.5	2.8	2.1
3	1	3.25	2.6	1.95
3	0,2–9	3.5	2.8	2.1

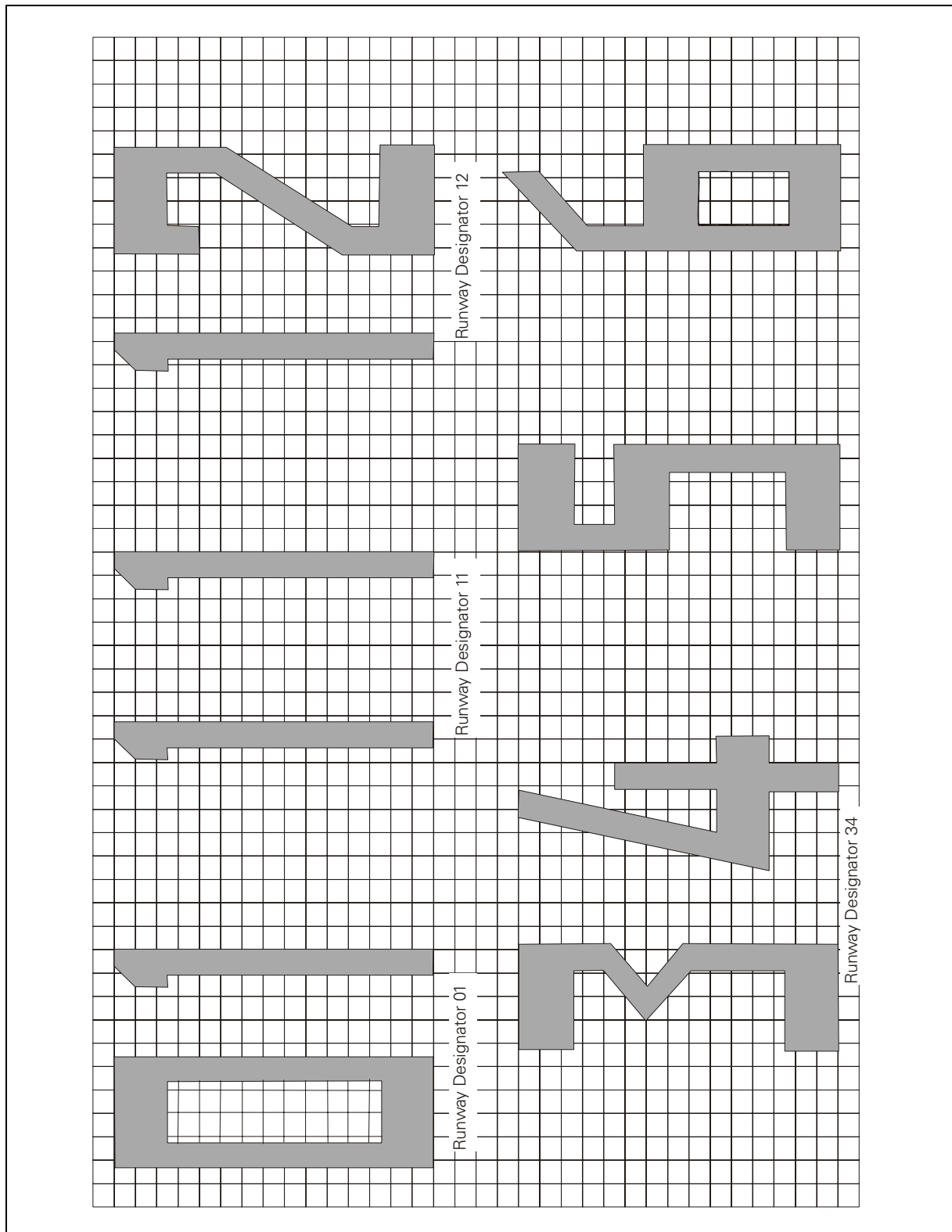


Figure 7B.1 Runway designator character dimensions – 15 m characters

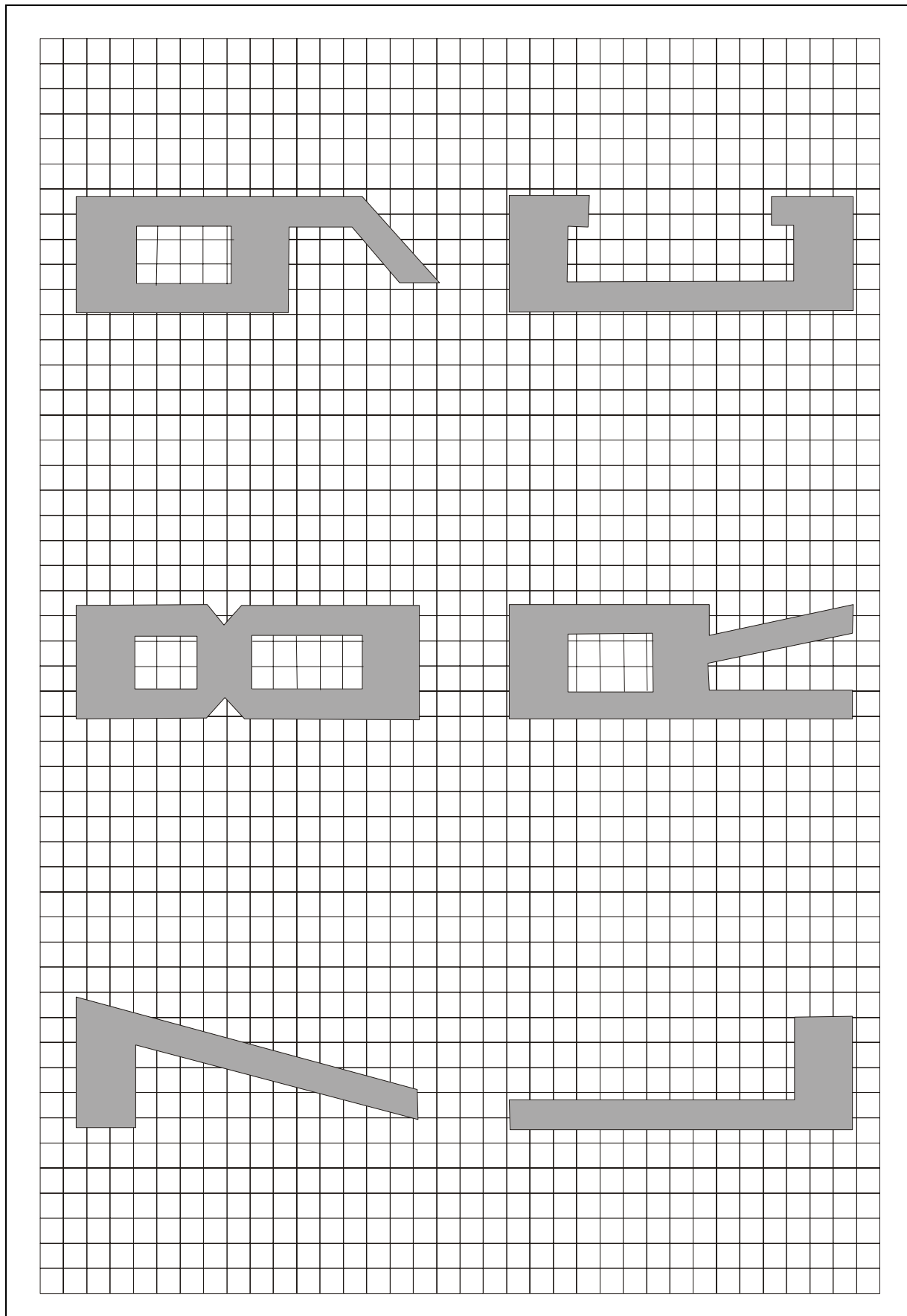


Figure 7B.2 Runway designator character dimensions – 15 m characters

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Appendix 7C Form and Proportions of Pavement Information Marking – Taxiways and Aprons

- 1 This Appendix details the form and proportions of the letters and numbers, that should be used for pavement information markings on taxiways and aprons, drawn on a 5 mm grid in order to facilitate enlarging. The characters and symbols may be enlarged to the desired size by any conventional process and will remain in proper proportion. To obtain characters of any height, divide the desired height in millimetres by 20 and use this value for size of the grid unit. For example, characters 2 m high will require a grid unit dimension of 100 mm. Similar means may be used to enlarge the symbols. Standard characters are twenty grid units high and five units wide. Horizontal strokes are three units deep. The space between characters should be two units, but optical spacing may be used. All characters having an arc at the top or bottom are extended slightly above or below the grid lines. An identical set of curves is used for 'B', 'D' and similar characters. Another identical set of curves is used for 'C', 'G', '2' etc.
- 2 The height of characters employed should be not less than 2 m and normally not more than 4 m.
- 3 Examples of Surface Painted Signs are shown at Figure 7C.6.

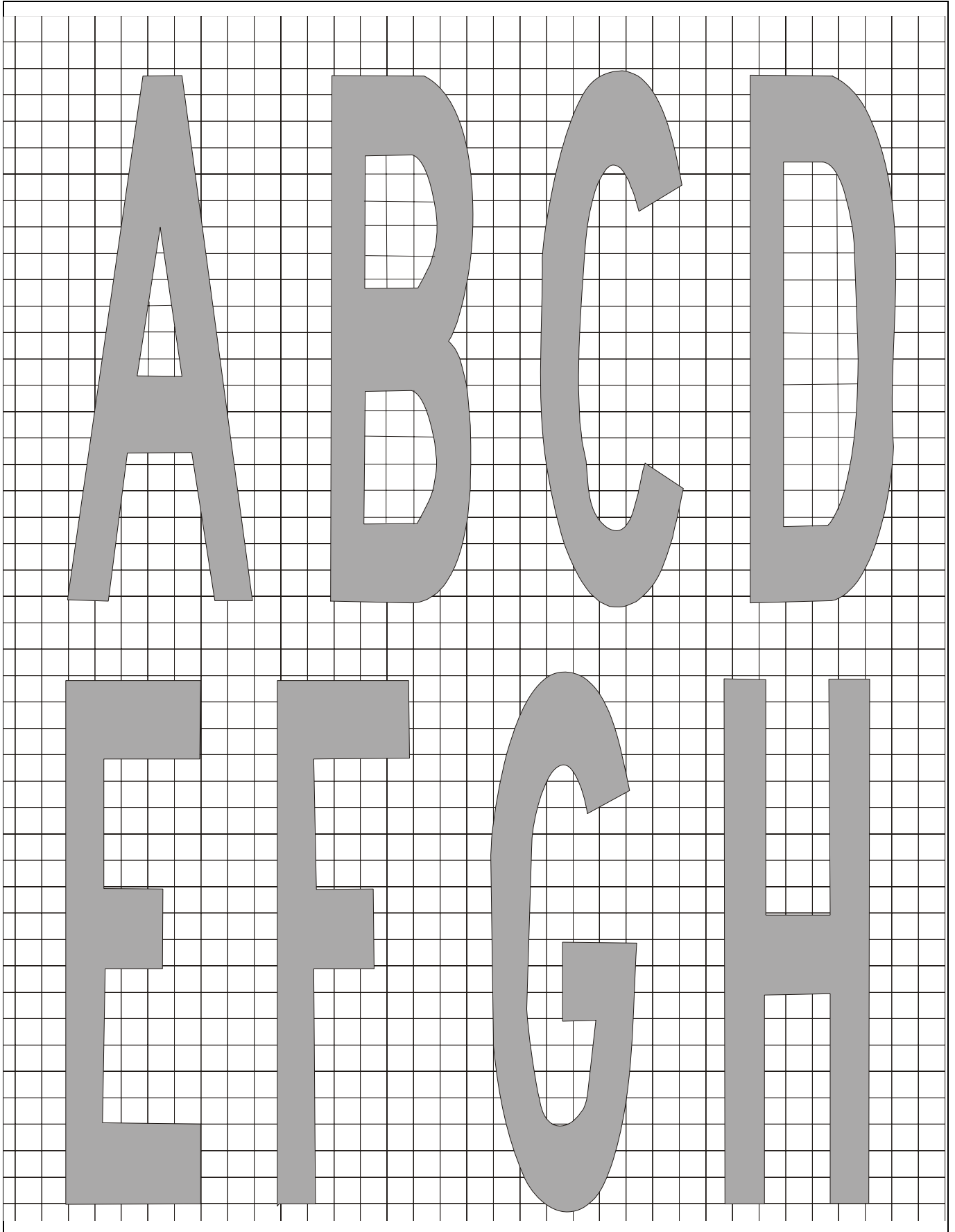


Figure 7C.1 Pavement Markings

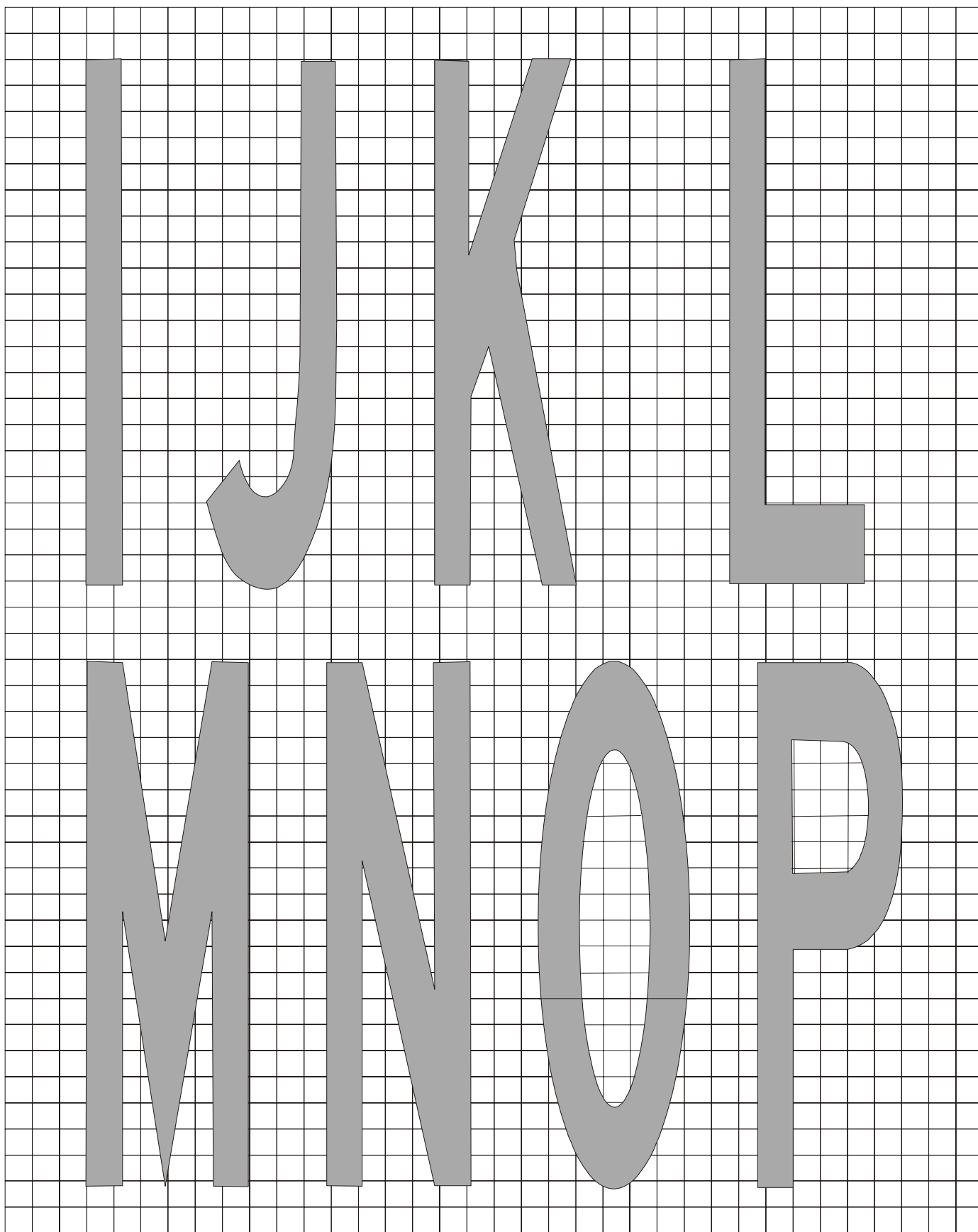


Figure 7C.2 Pavement Markings

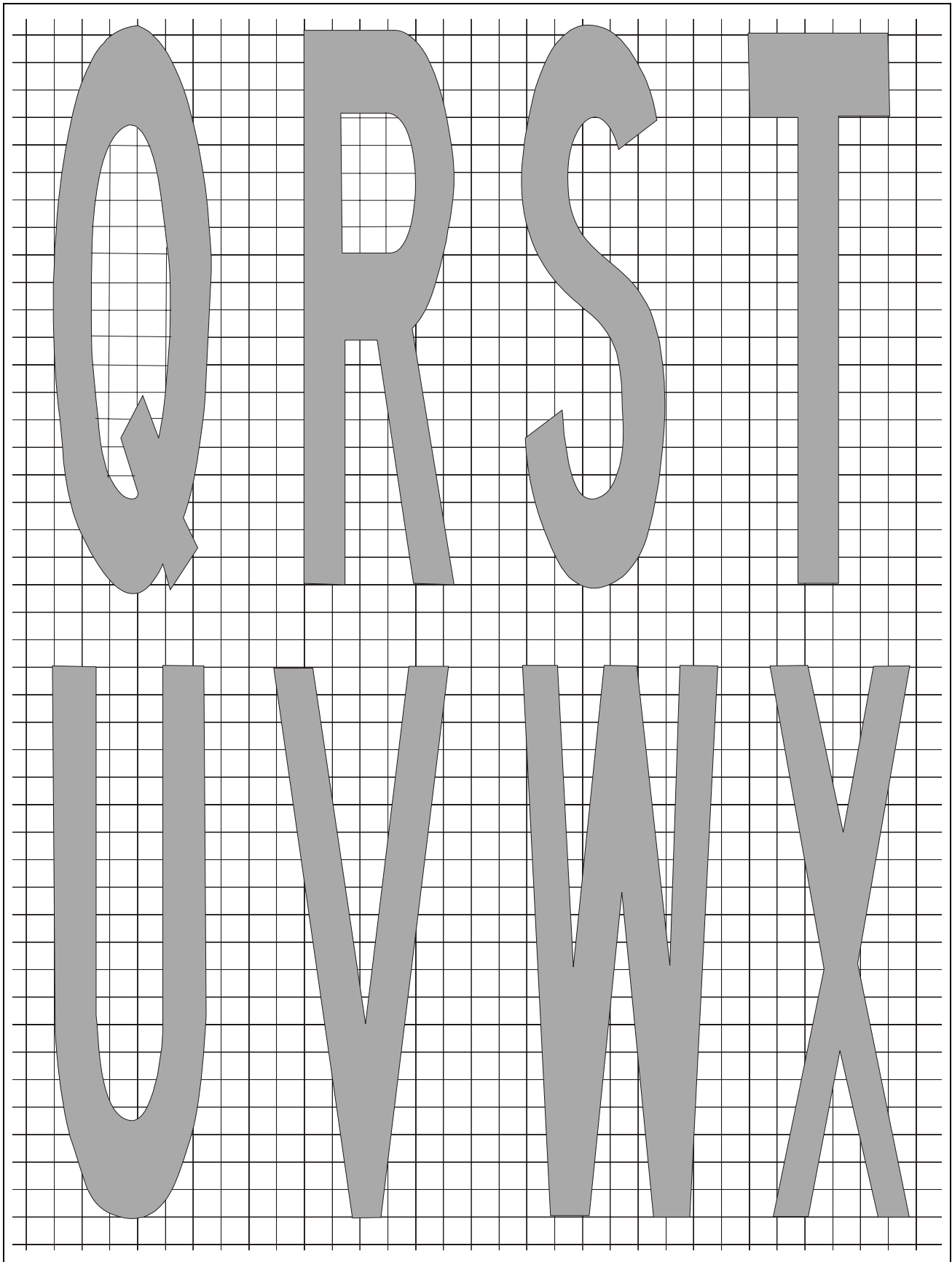


Figure 7C.3 Pavement Markings

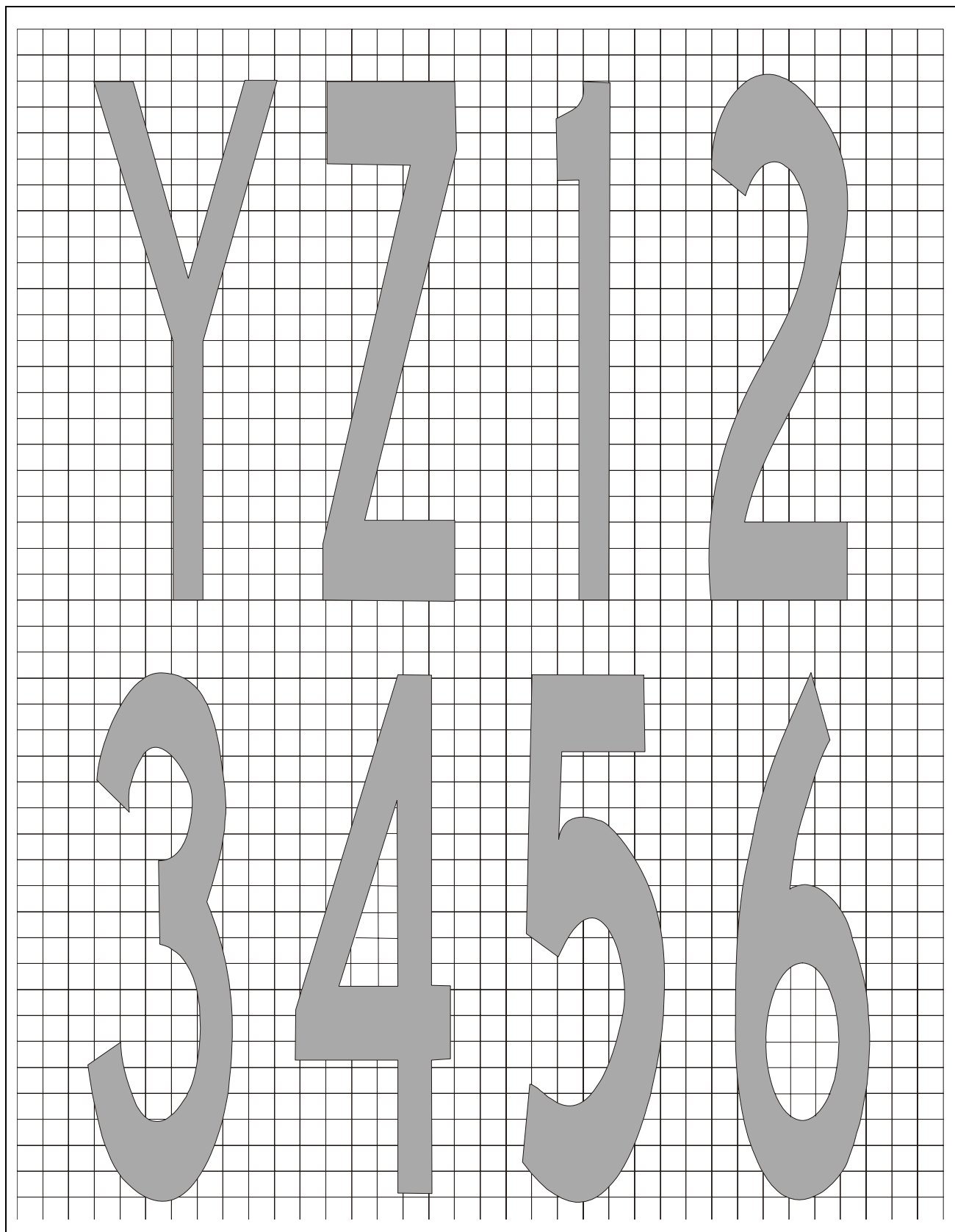


Figure 7C.4 Pavement Markings

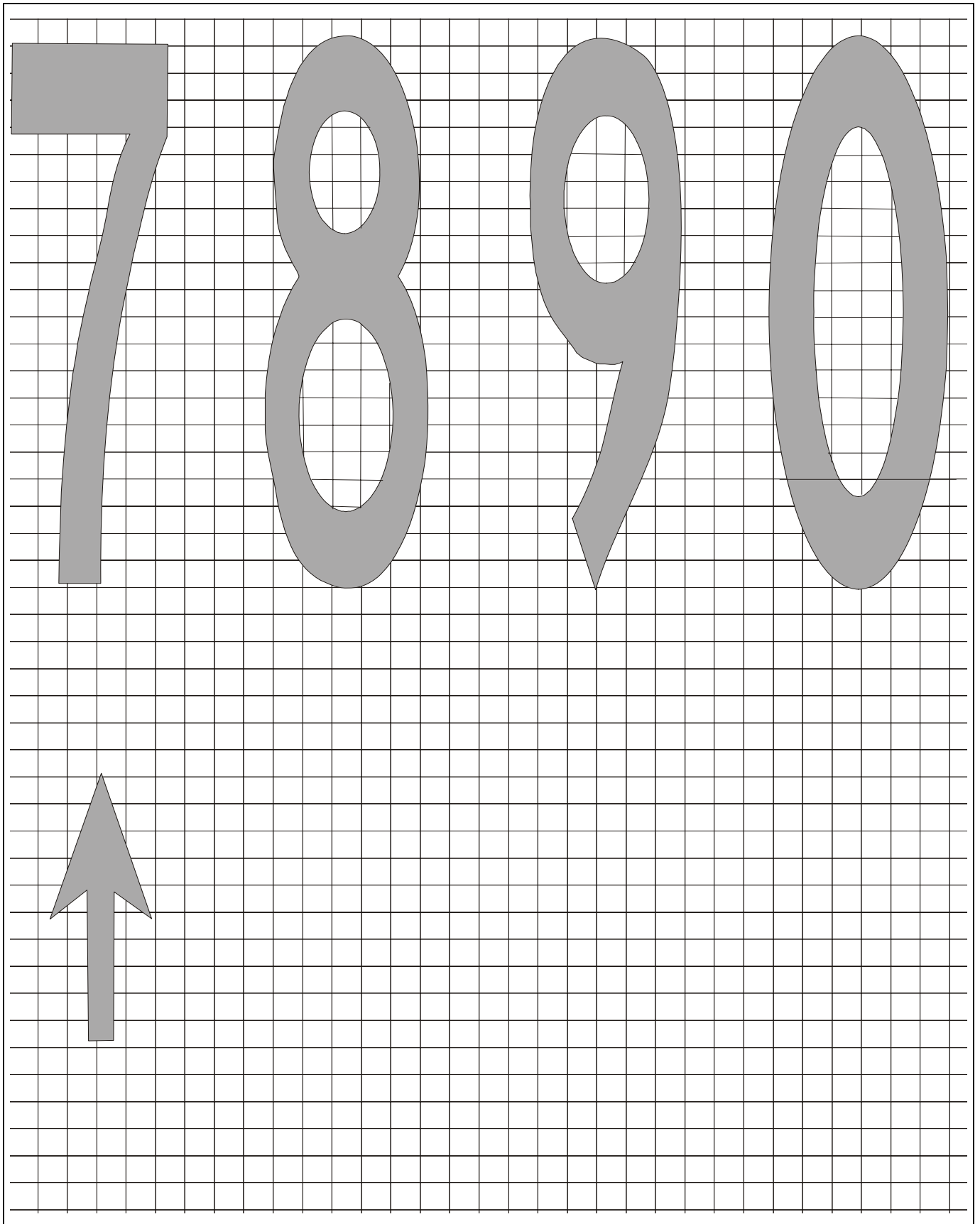


Figure 7C.5 Pavement Markings

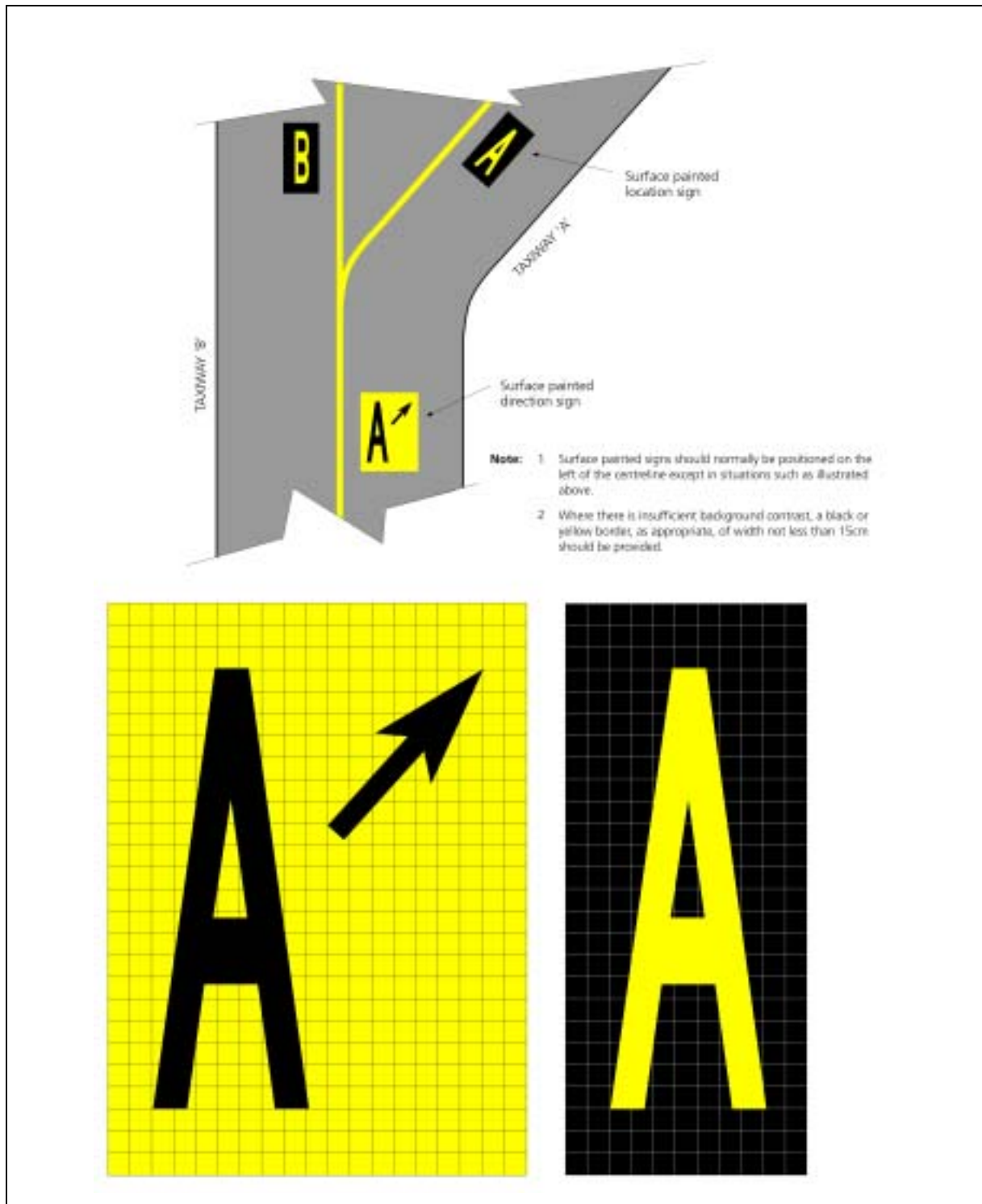


Figure 7C.6 Pavement Markings Taxiways and Aprons – Examples of Surface Painted Signs

NOTE: The Grid is shown only for the purpose of illustrating sign size in relation to character proportions and should not show on the completed sign.

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Appendix 7D Illuminated Wind sleeves

- 1 An illuminated wind sleeve is intended to provide the pilot of an aircraft both in the air and on the ground with a clear indication of wind speed and direction at night. In order to achieve this, a wind sleeve should have the following features:
 - a) A rigid (e.g. Drum type) mounting attached to a freely rotating assembly is essential in order that a clear indication of wind direction is provided in light wind conditions (a chain mounted sleeve hangs almost vertically under such conditions and is very difficult to see from above).
 - b) A lighting system that provides the following levels of illumination without causing unwanted glare:
 - i) Approximately 200–500 lux for the sleeve over its fully extended length throughout the full 360° of its rotation.
 - ii) Approximately 20–50 lux on the ground within a 10 m radius of the mounting pole.
- 2 Flight tests have shown that a minimum acceptable level of lighting can be provided by four 200 watt incandescent general purpose lamps in deep bowl reflectors mounted approximately 2 to 2.2 m above the sleeve and equally spaced around the central pole on arms 1.8–2 m long. The deep bowl reflectors provide a wide dispersal of light over the full area of movement of the sleeve and also ensure that there is no unwanted glare.
- 3 Parabolic Aluminised Reflector (PAR) lamps are not satisfactory for three reasons:
 - a) Total light output is inadequate.
 - b) Because a reflector is employed, the light output is too restricted for this application.
 - c) If mounted without a deep bowl reflector housing they can present serious distracting glare to a pilot, especially at ground level.
- 4 High Intensity Discharge (HID) lamps such as high pressure sodium (SON) of 70 watts rating or higher are very effective, efficient and have a long service life but are expensive because of the additional control equipment and may not be cost effective at an aerodrome which is only occasionally used at night. Moreover, because of the warm-up time (3 to 4 minutes) this type of lamp is more appropriate where the lighting is left on all night every night.
- 5 If SON type lamps are used, an external igniter system should be employed in order to minimise the restrike time after a power interruption or brief switch off/switch on.
- 6 Illuminated wind sleeves are normally powered by a separate mains supply. However, it is permissible to connect it to a convenient AGL constant current series circuit by means of an appropriate power regulating device. The use of such a device should ensure that the illumination of the wind sleeve conforms to the requirements stated in 1 b) irrespective of the luminance intensity setting selected for the AGL.
- 7 A suitable method of construction is illustrated at Figure 7D–1.
- 8 The following Test Procedure should be used by **manufacturers** in order to assess their equipment against the levels of illumination required in paragraph 1 b). Although it is not the intention of the CAA to introduce an approval scheme for illuminated wind

sleeves, manufacturers should notify Aerodrome Standards of the Test results in the format outlined in paragraph 9.7.

9 Test Procedure for Illuminated Wind sleeve

9.1 This procedure assumes a wind sleeve with overhead illumination. Other arrangements are outside the scope of this procedure.

9.2 This procedure also assumes that the illumination is from a number of lamp units equally spaced around the central pole. If this is the case, the areas to be measured may be divided into sectors (e.g. 4 - sectors if 4 lamps) and, if a visual inspection indicates that the sectors are similar in illumination, then only one sector need be tested.

9.3 Illumination levels should be measured using a calibrated light meter. The background luminance should be below 5 lux during all measurements.

9.4 Ground Level Illumination

9.4.1 Measurements should be taken at 1 m intervals starting at the base of the pole and working outwards on a radial to the pole, to a range of 10 m. This should be carried out along two radials, one in line with a light (best case) and one mid-way between lights (worst case).

9.4.2 The measurement should be taken with the sensor at ground level and angled as necessary toward the light source/s.

9.4.3 Each reading should be in the range 20 to 50 lux.

9.5 Sleeve Level Illumination

9.5.1 The measurements for the sleeve are carried out in a similar way to those for the ground. However, the sensor should be positioned at a height equivalent to the top of the sleeve at the pole end, for all ranges.

9.5.2 Again, the sensor should be positioned on radials in line with and mid-way between lights and angled toward them.

9.5.3 Measurements should be taken at 1 m intervals, over a distance corresponding to the sleeve itself, whatever its length.

9.5.4 Each reading should be in the range 200 to 500 lux.

9.6 Glare and Overall Performance

9.6.1 From an observer's standing position on ground level with the base of the pole, there should be no glare at a range of 25 m or more. This need only be assessed from those directions likely to be viewed from landing, taking-off or taxiing aircraft.

9.7 Test Results – Illuminated Wind sleeve

(This report should be accompanied by a side elevation drawing of the wind sleeve and mast showing the critical measurements.)

- 1 Manufacturer's Name and Address:
- 2 Model Number:
- 3 Illumination Levels:

LUX READING	DISTANCE FROM MAST (M)									
	1	2	3	4	5	6	7	8	9	10
Ground										
In-Line										
Mid-Way										
Sleeve	1	2	3	4	5	6	7	8	9	10
In-Line										
Mid-Way										

- 4 Background Lux Level, Glare and Overall Performance:
- 5 I certify on behalf of the above named company that this is a true record of the results of the Test Procedure listed at CAP 168 Chapter 7 Appendix 7D conducted on the wind sleeve listed at item 2 above.

Signature:.....

Name:.....

Date:.....

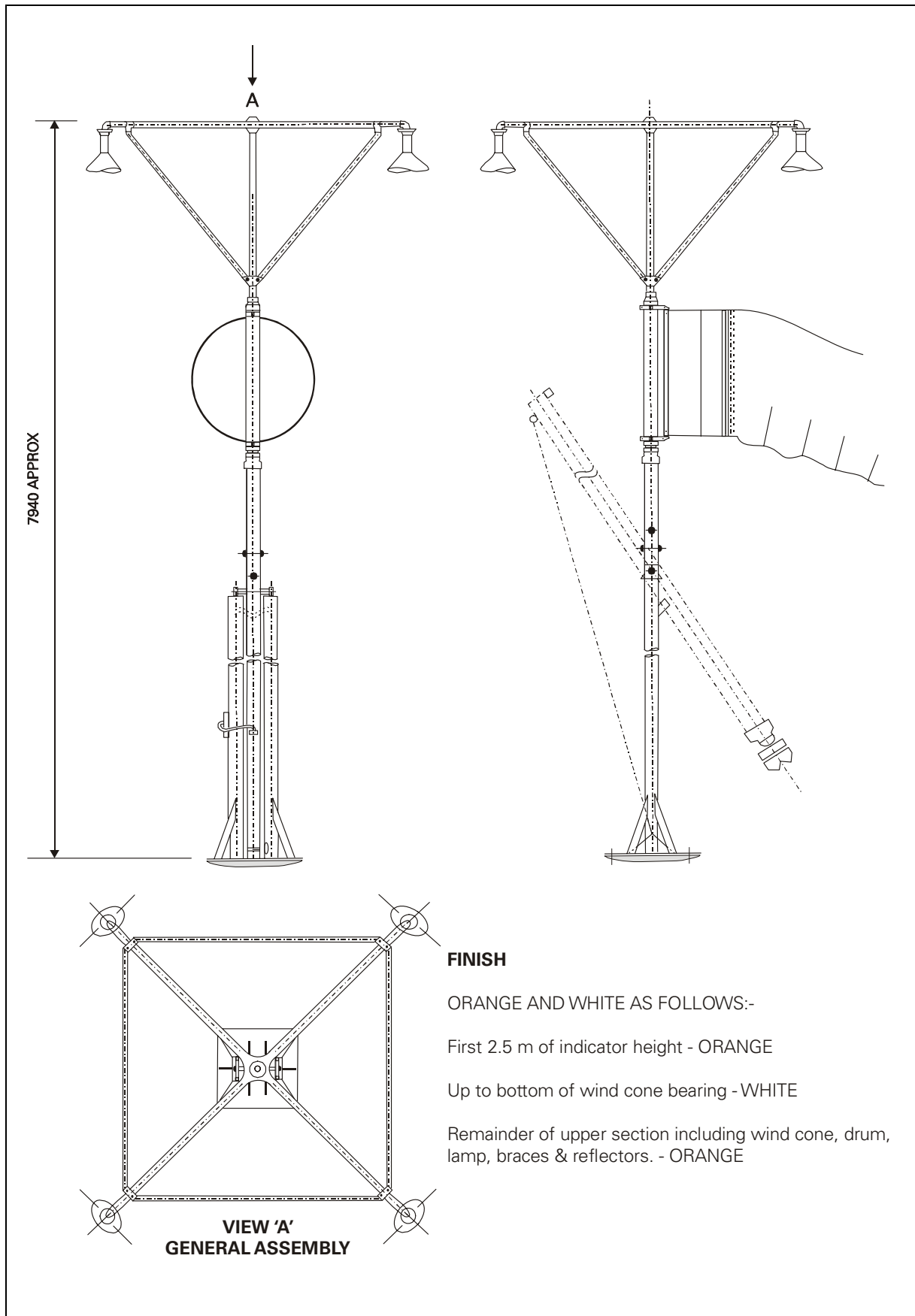


Figure 7D.1 Illuminated Wind Sleeve

Chapter 8 Rescue and Fire Fighting Service (RFFS)

1 Introduction

- 1.1 This Chapter sets out the minimum requirements to be met in the provision of Rescue and Fire Fighting Services at United Kingdom licensed aerodromes. The facilities required by this Chapter have been assessed as being the minimum necessary for flights required by the Air Navigation Order to use a licensed aerodrome. Guidance is also given on equipment, extinguishing agents, personnel, training and emergency procedures.
- 1.2 Condition 2 in the Public Use and Ordinary aerodrome licences makes it mandatory for licensees to provide a minimum Rescue and Fire Fighting Service (RFFS) appropriate to their aerodrome and as detailed in Chapter 8 of this CAP. The RFFS shall be provided throughout the hours a licensed aerodrome is available for use by aircraft engaged on flights required to use a licensed aerodrome and for 15 minutes after the departure of the last aircraft.
- 1.3 The scale and standards of RFFS to be provided at licensed aerodromes in the United Kingdom accords with the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs).
- 1.4 Information concerning the scale of protection provided by aerodromes shall be made available in the UK Aeronautical Information Publication (AIP).

2 Principal Objective of the Aerodrome Rescue and Fire Fighting Service

- 2.1 The principal objective of an aerodrome RFFS is to save lives in the event of an aircraft accident or incident. For this reason, the provision of means of dealing with an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome assumes primary importance because it is within this area that there are the greatest opportunities of saving lives. This must assume at all times the possibility of, and need for, extinguishing a fire that may occur either immediately following an aircraft accident or incident, or at any time during rescue operations.
- 2.2 The most important factors bearing on effective rescue in a survivable aircraft accident are: the training received, the effectiveness of the equipment, and the speed with which competent personnel and equipment designated for rescue and fire fighting purposes can be put to use. Requirements to deal with building fires and fires involving fuel installations, or recommendations for the foaming of runways are not taken into account. The CAA has no formal interest in the requirements to deal with these kinds of incidents. The quantities of extinguishing agents and numbers of personnel required for licensing of the aerodrome are not designed to deal with such eventualities. However, where licensees choose to deploy RFFS resources to any such incidents, this shall not prejudice the response objective and minimum discharge rates specified in this document.
- 2.3 The RFFS shall be established at a level commensurate with the size of aircraft using the aerodrome and organised, equipped, staffed and trained to ensure rapid and effective deployment in the event of an accident. Policies and procedures relating to the provision and management of the RFFS shall be described in, or referenced to, the Aerodrome Manual. Guidance on the types of information which should be considered for inclusion is provided in Chapter 2 of this CAP.

3 Minimum Scale of Services to be Provided

- 3.1 The level of protection provided by an aerodrome shall be described in terms of the aerodrome RFF category determined by the means identified below.
- 3.2 In relation to fixed wing aircraft, the term 'RFF Category' is supplemented with a number between one and ten, Category Ten being the highest.
- 3.3 The Aerodrome RFF Category is determined by the size of aeroplanes operating at the aerodrome. The facilities required by aerodromes accepting large public transport aircraft may be greater and more complex in organisation than those at aerodromes where only flying instruction is carried out or where only small public transport aircraft operate. To simplify the identification of applicable requirements, those relevant only to the lower category aerodromes (Rescue and Firefighting Category 'Special' up to and including RFF Category Two) have been separated from the main body of this chapter and are included at Appendix 8G. However, the licensing requirements set out below apply to all aerodromes irrespective of size.
- 3.4 The RFF Category provided and promulgated by an aerodrome shall be determined in a consistent manner with reference to Table 8.1 and shall be based on the largest aircraft expected to use the aerodrome over a given 12 month period.
- 3.5 When past traffic levels are unavailable, the level of RFFS should be assessed from the best available information. The basis for this assessment should be recorded.

Table 8.1 Category for Rescue and Fire Fighting

Aerodrome Category (RFF)	Aeroplane Overall Length	Maximum Fuselage Width
Special	up to but not including 9m	2m
1	up to but not including 9m	2m
2	9m up to but not including 12m	2m
3	12m up to but not including 18m	3m
4	18m up to but not including 24m	4m
5	24m up to but not including 28m	4m
6	28m up to but not including 39m	5m
7	39m up to but not including 49m	5m
8	49m up to but not including 61m	7m
9	61m up to but not including 76m	7m
10	76m up to but not including 90m	8m

- 3.6 When using Table 8.1 it is essential to consider both the aeroplane length and the maximum fuselage width. If, after selecting the category appropriate to the largest aeroplane's overall length, that aeroplane's fuselage width is greater than the maximum fuselage width in Table 8.1, then the requirement will be to apply the next highest category, as appropriate.

4 Temporary Depletion of RFFS

- 4.1 Provision of RFFS to the Category set out in paragraph 3.4 is a mandatory requirement. However, there may be circumstances when a part of the facility is temporarily unavailable due to an **unforeseen** circumstance e.g. an in-service mechanical failure of a vehicle or piece of equipment or sudden illness of a member of staff. Immediate action should be taken to reinstate facilities whilst considering whether landings and take-off by aircraft required to use a licensed aerodrome should be restricted.
- 4.2 At aerodromes of RFF Category Special and 1 fixed wing aircraft, temporary depletion shall not be permitted.
- 4.3 At aerodromes of RFF Category 2 and 3 fixed wing aircraft, the minimum Category of RFFS required during temporary depletion shall be no less than RFF Category 1.
- 4.4 At aerodromes of other categories (RFFS) during temporary depletion, the Category of RFFS shall not be less than the equivalent of two Categories below that of the RFF category according to the size of aeroplanes expecting to use the aerodrome (Table 8.1).
- 4.5 If any depletion is significant enough to warrant a restriction of aeroplane movements then the temporary level of RFFS stated in terms of specific RFF Category, should be immediately promulgated by NOTAM and radio. The policy regarding the maximum duration of temporary depletion should be considered in advance by each licensee and be published in the Aerodrome Manual. Generally, temporary depletion should not last more than twelve hours overnight at an aerodrome when few movements are expected or two hours at any aerodrome during peak traffic periods.
- 4.6 Exceptions to the above should be made for emergency landings, and for occasions when, in the pilot's opinion, a diversion or hold may introduce a more significant hazard.
- 4.7 Licensees should consider developing contingency plans to limit the need for temporary depletion of the promulgated level of services. This may involve, for example, a preventative maintenance plan to ensure the mechanical efficiency of equipment and vehicles, arrangements to cover unplanned leave and absence of its minimum level of RFF personnel, etc. Licensees should consider the provision of reserve facilities to limit the need for temporary depletion.

5 Extinguishing Agents

Successful extinguishment of fires involving aircraft requires the provision and correct application of sufficient quantities and types of extinguishing agents.

6 Principal and Complementary Extinguishing Agents

- 6.1 The following paragraphs must be read in conjunction with Table 8.2. They are related to principal and complementary agents and discharge rates. The principal extinguishing agent shall be a foam which meets either performance level A or B as defined in Appendix 8E, except that at aerodromes where the RFF category is Special, 1, 2 and 3 the foam shall meet performance level B.

- 6.2 Table 8.2 specifies the minimum quantity of foam concentrate required for each aerodrome RFF category based on solution strengths generally accepted for each type of foam concentrate. It is the responsibility of the licensee to be satisfied that the foam liquid is suitable for use in vehicles/equipment and that it is correctly inducted with the recommended accuracy to produce foams with the performance specified in Appendix 8E.
- 6.3 The required quantities of extinguishing agents and water must be available for immediate discharge from RFF vehicles and/or equipment. In addition, sufficient reserve stocks should be held readily available. Extinguishing agent quantities designated as reserve may be held in any appropriate manner which easily allows vehicles to be replenished promptly (e.g. including on vehicles themselves).
- 6.4 The minimum quantities and types of extinguishing agents required for each RFF Category are set out in Table 8.2. Quantities have been identified using the ICAO practical critical area concept which determines theoretically, based on the **average** size of aircraft in any particular category the quantity of agent required to obtain initial control of the practical critical area. A further quantity of agent is included for continued control of a fire after initial control. The concept is not intended to ensure extinguishment of any fire but provides sufficient extinguishing agents to create a survivable environment outside of the aircraft.
- 6.5 Where operations of an aircraft larger than the average size in the relevant RFF category are expected, the minimum quantities of extinguishing agent(s) should be assessed and increased as appropriate.
- 6.6 The amounts of water for foam production are predicated on an application rate of 8.2L/min/m² for foams meeting performance level A and 5.5L/min/m² for foams meeting performance level B.
- 6.7 Additional water supplies at adequate pressure and flow may be required to ensure rapid replenishment of aerodrome RFFS vehicles. The objective shall be to support the principle of continuous application of principal fire extinguishing agent (foam) to maintain a survivable environment around the immediate vicinity of an aircraft accident for far longer than that provided for by the **minimum** quantities of water for foam production set out in Table 8.2.
- 6.8 Any extinguishing agent used on the aerodrome shall be expected to conform to the normative requirements of the relevant National Standard and the requirements specified by ICAO.
- 6.9 Principal agents (e.g. foam concentrates) used at the minimum quantities and discharge rates specified in Table 8.2 shall meet the applicable fire extinguishment and burn back performance requirements of the appropriate ICAO fire test.
- 6.10 Further guidance regarding suitable specifications for agents is given in Appendix 8E and ICAO Airport Services Manual, Part 1.
- 6.11 Guidance regarding discharge rates, quality control, agent performance of dry powder extinguishing agent, etc. is provided at Appendix 8F.

7 Complementary Extinguishing Agents

- 7.1 The complementary extinguishing agents shall be any combination of dry powder and gaseous agents (e.g. BCF 1211 or halogenated hydrocarbon [halocarbon] agents with proven low environmental impacts or CO₂) or any other agent which demonstrates equivalent performance.

- 7.2 Dry powder and halogenated hydrocarbon fire extinguishing agents are normally considered more efficient than carbon dioxide for aircraft rescue and fire fighting operations. When selecting dry powder for use with foam, care must be exercised to ensure compatibility.
- 7.2.1 Where the main complementary agent is dry powder there shall be a quantity of halogenated hydrocarbon or CO₂ provided with a suitable applicator for use on engine fires. The appropriate minimum quantity of halogenated hydrocarbon is 9 kg. The appropriate minimum quantity of CO₂ shall be 18 kg.
- 7.2.2 Where the main complementary agent is halogenated hydrocarbon or CO₂ there shall be a quantity of dry powder provided to assist in dealing with a running fuel fire. The appropriate minimum quantity of dry powder shall be 9 kg. Where this additional quantity of dry powder is provided in hand held extinguishers of minimum capacity 9 kg, it will not be necessary to comply with the discharge rates of 1.35 or 2 kg/sec.

Table 8.2 Minimum Usable Amounts of Extinguishing Agents

Aerodrome Categorisation		Foam meeting performance Level A			Foam meeting performance Level B			Complementary Agents (kg)†	
Aerodrome Category (RFF)	Aircraft Average Length (m)	Water (litres)	Foam Concentrate (litres)*	Discharge Rate Foam solution (litres/minute)	Water (litres)	Foam Concentrate (litres)*	Discharge Rate Foam solution (litres/minute)	Dry Powder or Halogenated hydrocarbon	or CO ₂
3	15	Required to use foam meeting level B			1 200	72*	900	135	270
4	22	3 600	216*	2 600	2 400	144*	1 800	135	270
5	26	8 100	486*	4 500	5 400	324*	3 000	180	360
6	33	11 800	708*	6 000	7 900	474*	4 000	225	450
7	44	18 200	1 092*	7 900	12 100	726*	5 300	225	450
8	54	27 300	1 638*	10 800	18 200	1 092*	7 200	450	900
9	67	36 400	2 184*	13 500	24 300	1 458*	9 000	450	900
10	82	48 200	2892*	16 600	32 300	1 938*	11 200	450	900

NOTE:

* Approximate values. See Paragraph 7.5. These quantities are based on the use of foam concentrates designed for use at 6% solution strength. Licensees are advised of the availability of foam concentrates which may be used at other solution strengths. For example, 3% concentrates are 'stronger' than 6% concentrates. In certain instances operational advantages may be offered by using 3% concentrates.

† The complementary agent may be selected according to the requirements of paragraph 8.1.

Other than at Category Special, 1, 2, and 3 aerodromes, where hand line branch pipes and nozzles alone may be used, the discharge rates for foam shall be met using only the RFF vehicle monitors.

A 200% reserve supply of foam concentrate, and a 100% reserve supply of complementary agents shall be maintained at the aerodrome for prompt replenishment of vehicles/equipment. Where a major delay in the replenishment of exhausted extinguishing agents is anticipated, the quantity of reserve supplies should be increased.

RFF minimum usable amounts of extinguishing agents for categories Special, 1 and 2 can be found in Appendix 8G.

7.3 Where a dry powder which satisfies the requirements of the performance specification identified at Appendix 8F is used, a reduction in the quantity provided may be applicable.

7.4 At all aerodromes up to a maximum of 50% of the complementary extinguishing agents may be replaced by water for the production of a foam meeting performance level 'B'. For the purposes of substitution the following rates will apply:

1 kg Dry Chemical Powder or halogenated hydrocarbon = 1 litre water

2 kg Carbon Dioxide = 1 litre water

8 Discharge Rates for Complementary Extinguishing Agents

8.1 Where reference is made to complementary extinguishing agents the CAA will require to be satisfied that the selected agent is capable of being discharged at an effective rate, and, in the case of an agent intended for use on aircraft engine fires, is capable of delivery through equipment which will ensure its effective application. As a guide, the design of any complementary extinguishing agent installation should seek to optimise delivery patterns, offering alternative patterns of discharge as required. Applicators must be equipped with valves which facilitate interrupted discharge.

8.2 Complementary extinguishing agents should be delivered through one or more applicators at a minimum discharge rate of 1.35 kg/sec, however it should be noted that a discharge rate of at least 2 kg/sec may be needed to deal with fires occurring in large aircraft engines. The discharge rate should be selected for optimum effectiveness of the agent.

NOTE: As with all complementary agents, the successful use of dry chemical powders is strongly dependent on the technique of its application. When used with foam or water in dual agent attack, rapid knockdown of flammable liquid fires may be achieved. Complementary agents alone have little or no cooling effect and it must be appreciated that re-ignition of fires may be a constant hazard in certain circumstances, particularly during rescue operations.

9 Response Objective

9.1 The operational objective of the RFFS is to respond as quickly as possible to aircraft accidents and/or incidents in order to create maximum opportunity for saving life. Response times are dependent on the size of aerodrome, location of fire station(s) and disposition of vehicles and personnel at any given time. The primary objective of those involved with the provision of the RFFS shall be to achieve an expeditious response time commensurate with the operational objective defined at paragraph 10.3.

9.2 The response area is considered to be the area including any point of each operational runway and all other areas of the aerodrome where aircraft park or taxi immediately prior to, or following any flight which is required to use a licensed aerodrome.

9.3 The operational objective of the RFFS should be to achieve a response time of two minutes, and not exceeding three minutes, to the response area in all circumstances of optimum visibility and surface conditions.

9.4 Response time is considered to be the time between the initial call to the Rescue and Fire Fighting Service and the time when the first responding vehicle(s) is (are) in

position and producing foam at a minimum of 50% of the discharge rate specified in Table 8.2. The response time should be assessed with reference to the whole of the response area.

- 9.5 To meet the operational objective as nearly as possible in conditions of less than optimum visibility, specific training, procedures and/or equipment should be provided. See Appendix 8B.
- 9.6 Maximum effectiveness may only be achieved if the continued application of primary and/or complementary extinguishing agents is maintained. It is essential that personnel and vehicles are deployed at the scene of an accident with all vehicles and personnel arriving in sufficient time to ensure that the efforts of the first responding vehicle(s) are maximised. Therefore, any other vehicles required to deliver the amounts of extinguishing agents specified in Table 8.2 should arrive no later than one minute after the first responding vehicle(s).
- 9.7 When RFFS personnel designated as part of the minimum riding strength are engaged on extraneous duties they shall be capable of meeting response times whilst carrying out those duties. No extraneous duty should create conditions likely to affect individual or crew performance or introduce additional hazards.
- 9.7.1 At aerodromes where the RFF Category is 3 and above, it is not considered reasonable to require personnel designated as part of the minimum riding strength to be engaged on extraneous duties involving the handling of fuel.
- 9.8 Licensees shall ensure that any changes to their stated RFFS policies and procedures are properly assessed with regard to their impact upon safety prior to implementation and notified to the CAA at the earliest opportunity by amendment of the Aerodrome Manual.
- 9.9 A system of preventative maintenance of RFF vehicles shall be employed to ensure effectiveness of the equipment and compliance with the specified response times throughout the life of the vehicle.

10 Aerodromes Located Adjacent to Water, Swampy Areas or Other Difficult Environments

- 10.1 Where a significant portion of approach or departure operations take place over water, swampy areas or other difficult environments, consideration shall be given to the provision of special procedures or equipment when it has been deemed that conventional fire service vehicles may not be capable of an effective response. Special fire fighting equipment need not be provided for water areas. However this does not prevent its provision where licensees have assessed the practical advantages of such equipment to deal with the likelihood of aircraft fire(s) or the ignition of fuel spilled onto water.
- 10.2 The objective of water rescue equipment is to maintain the survivability of passengers. Appropriate life-saving flotation equipment should be provided, sufficient in number(s) commensurate with the typical anticipated passenger capacity of the largest aircraft using the aerodrome. This equipment should be deployed as soon as practicable after notification of an aircraft accident in the water, taking into account the prevailing weather conditions.
- 10.3 On-aerodrome facilities shall be required to cover difficult environments within a distance of 1000 m from the threshold or at least within the aerodrome boundary.

- 10.4 These facilities need not be located on or provided by the airport if they are readily available from off aerodrome agencies and procedures have been documented ensuring effectiveness and accessibility as part of the aerodrome emergency plan.
- 10.5 In all cases, the area within which an RFF response will be made and the equipment to be provided shall be determined and specified in advance and recorded in the Aerodrome Manual.
- 10.6 Appendix 8B contains guidance material proposed to assist licensees in developing operational procedures which will maintain acceptable response times in all normal conditions.

11 Appliances/vehicles

- 11.1 When selecting or designing RFF vehicles, consideration should be given to many factors: the amounts and types of extinguishing agents, equipment and personnel to be carried, the response time objectives to be met, the local weather and terrain conditions likely to be encountered, the types of aircraft using the aerodrome and the tactics necessary to deal with the hazards arising from aeroplane operations. The principal requirements relevant to vehicle design are set out in Appendix 8A.
- 11.2 The extinguishing agents and rescue equipment shall be carried on self-propelled vehicles which have maximum mobility in all weather conditions on and off paved surfaces.
- 11.3 The minimum number of foam producing vehicles shall not be less than that set out in Table 8.3.

Table 8.3

	RFF 3	RFF 4	RFF 5	RFF 6	RFF 7	RFF 8	RFF 9	RFF 10
Minimum number of Foam Producing Vehicles	1	1	2	2	2	3	3	4

- 11.4 Aerodrome authorities should consider the provision of reserve vehicles to maintain the appropriate level of services when any of the regular vehicles are temporarily unavailable due to maintenance requirements or becoming unserviceable. These vehicles shall comply with the requirements of this section and Appendix 8A.

12 Criteria for Selection of Personnel

- 12.1 Licensees are advised to determine an appropriate medical standard to be met by personnel employed as aerodrome fire fighters. Licensees should ensure that appointed medical practitioners are adequately qualified to conduct such medical examinations and are conversant with medical standards to be applied.
- 12.2 Licensees should refer to Fire and Rescue Service Circulars 41/2004, Medical and Occupational Evidence for Recruitment and Retention in the Fire and Rescue Service and 36/2005, Consultation on draft regulations to outlaw age discrimination, published by the Office of the Deputy Prime Minister. This guidance accords with The Employment Equality (Age) Regulations 2006 published by the Department of Trade and Industry.

13 Qualifications

- 13.1 The licensee is responsible for the initial selection and continuous assessment of the competence of personnel engaged in operational RFFS duties in accordance with the requirements set out below and the acceptable means of compliance published in CAP 699 (Standards for Competence of Rescue and Firefighting Service Personnel Employed at UK Licensed Aerodromes).
- 13.2 Given the criticality of the function, the lack of opportunities for the evaluation of vocational competence during attendance at incidents involving aircraft and with recognition of the need to have a consistent measurement of competence, the CAA operates a Certification scheme for all RFFS personnel. Certificates recognising Competence are endorsed by the CAA and issued following the satisfactory acquisition and application of competence which may be demonstrated by the completion of training programmes which have been conducted to standards set and monitored by the CAA.
- 13.3 All personnel forming part of the minimum staffing level shall hold a Certificate of Competence which confirms their possession of the necessary standard of competence as applicable to their task and role.
- 13.4 Certificates shall be endorsed 'Qualified'; 'Competent in Acquisition' or 'Competent in Application'. Only personnel who have satisfied certain criteria and are actively employed at a licensed aerodrome are able to be eligible for issue with a Certificate of Competence endorsed by the CAA.
- 13.5 Personnel who are not actively employed at an aerodrome at the time of their attendance on a course, will receive a Certificate endorsed 'Successfully Completed' or 'Competent in Acquisition'. Personnel may apply to the Approved Training Provider (ATP) who conducted the training to have their Certificates upgraded on finding an aerodrome willing to sponsor their application with a view to offering employment. Each case will be assessed on merit and will take into account previous experience as well as any time lapse between the date of the last training programme attended and the application. Applications must be accompanied by a letter from the sponsor (usually the licensee) indicating that the candidate meets the selection criteria of section 13 and an assurance regarding the licensee's satisfaction with the competence of the applicant, especially in local matters i.e. vehicles, topography, special risks etc., and how this will be achieved. Documentary evidence of the process used to confirm the applicant's competence shall be retained by the sponsor for audit and inspection.
- 13.6 The ATP will confirm its acceptance of the applicant's competence by writing to the sponsor stating that a Certificate endorsed 'Successfully Completed' will be accepted as if it were endorsed 'Qualified', for the period of its validity. This confirmation should be retained with the original certificate in the licensee's personnel training records. The original certificate will not be altered.
- 13.7 In exceptional circumstances, e.g. when recruiting or when programmes are not immediately available for revalidation, a licensee may write to the CAA for permission to utilise uncertificated staff as part of the minimum staffing level. This should not be undertaken without the conduct of an assessment of competence in the expected role. As a guide, no more than 25% of any working shift should comprise uncertificated personnel. The maximum period of use of an uncertificated person is six months after which time they shall be required to hold a valid Certificate of Competence.
- 13.8 **Supervisor (Lower Category Aerodrome)** - Certificates of Competence endorsed by the CAA are valid for a maximum duration of four years. **Firefighter (Lower**

Category Aerodrome) - Certificates of Competence issued to personnel employed at Lower Category Aerodromes (Special, 1 and 2) following completion of CAA approved local training shall be valid for a maximum duration of 2 years. These certificates are only valid for use at the aerodromes for which they have been issued.

- 13.9 Senior Airport Fire Officers in the role of supervisor or normally forming part of the minimum staffing level should be in possession of an appropriate Certificate of Competence. Guidance on the competencies required of a Senior Airport Fire Officer is given in CAP 699 (Standards for the Competence of RFFS Personnel Employed at UK Licensed Aerodromes).
- 13.10 Where a Senior Airport Fire Officer forms part of the minimum staffing level only as occasional cover or reserve then the licensee shall assure the CAA of that individual's competence in the task(s) and role(s) specified.

14 Minimum Number of RFF Personnel and Staffing of Appliances

- 14.1 During the promulgated hours of operation and while any other movements of aeroplanes that require to use a licensed aerodrome are taking place, sufficient competent personnel shall be designated to be readily available to respond and operate the RFF equipment. These personnel shall be deployed in a way that ensures that response objectives shall be achieved and that continuous agent application at the appropriate rate(s) shall be fully maintained.
- 14.2 Minimum staffing levels for all RFF Categories operated by an aerodrome shall be agreed with the CAA and promulgated in, or referenced to, the Aerodrome Manual.
- 14.3 At aerodromes where the RFF Category is 4 and above, the minimum number of personnel designated to be in the immediate vicinity of the RFFS equipment to ensure an effective response to an aircraft incident shall be assessed by licensees. Consideration shall be given to many factors including: types of aircraft using the aerodrome, response times, type, design, capacity and discharge rate of vehicles to be deployed, extraneous duties, operation of rescue, medical and any specialist equipment provided, availability of water supplies and the speed and scale of response of any external agencies. Consideration shall also be given to the need for personnel required to use hand lines, ladders and other RFF equipment normally associated with aircraft RFF operations.
 - 14.3.1 On a vehicle which is capable of producing foam or other extinguishing agents through a monitor, the role of monitor operator must not be performed by the driver of that vehicle, other than when sidelines from that vehicle are in use.
- 14.4 In assessing the acceptability of the minimum staffing levels proposed by the licensee the CAA will only take account of its safety regulatory requirements published in this Chapter. Licensees' duty of care and any subsequent or associated Health and Safety at Work etc. Act issues/requirements should be assessed independently.
- 14.5 An agreed minimum staffing level shall not be reduced without an assessment being conducted and forwarded, in writing, to the CAA for acceptance.
- 14.6 Through consultation, the CAA has concluded that there is an accepted and appropriate Fire Service Incident Command System, which is built upon best practice in the management of emergency incidents that had been developed throughout the United Kingdom over many years. The system and procedures are based upon the 'Safe Person Concept'. The following information sets out good practice, offers advice and guidance and is related to the management of the RFFS. Further guidance

can be found in the appropriate Fire Service Manual published by HM Fire Service Inspectorate titled 'Incident Command'.

- 14.6.1 There are three primary generic roles, which are attributable to personnel engaged in RFFS duties: Firefighter, Supervisor and Manager. The role of supervisor may differ considerably from one aerodrome to another. Therefore the function may be conveniently subdivided into two levels, 'Watch Commander' and 'Crew Commander'. Progression from Supervisor to Manager involves making a transition from (e.g.) Watch Commander to Station Commander introducing a higher management role. This significant change emphasizes the difference between an operational role involving the direct supervision of a watch, to one of managing the overall activities and performance of the RFFS.
- 14.6.2 The minimum level of staffing of the aerodrome RFFS shall include an adequate number of competent managers and supervisors, according to the RFF Category of the aerodrome. In assessing the level of personnel proposed, the licensee shall take account of the managers' and supervisors' competence in the role(s) and tasks applicable to their position. As a minimum, the CAA would expect that each licensed aerodrome RFFS have a Station Commander (Senior Airport Fire Officer) who would be responsible for the overall management of the RFFS. The Station Commander can also carry out the role of the Watch Commander providing he/she maintains the appropriate competence in role and task. However, the CAA would not expect the roles defined above to be combined at categories 5 to 10. At these levels the CAA would expect to see a dedicated Station Commander (SAFO).
- 14.6.3 The two functional operational roles, which are significant and attributable to the direct management of the RFFS, are Watch Commander and Crew Commander. As a minimum the CAA would expect each operational watch to have sufficient dedicated supervisors. The number of supervisors will be applicable to the size of each operational watch, and should be determined by a task analysis appropriate to each individual aerodrome. At categories 5 to 10 the CAA would expect a minimum of one dedicated Watch Commander and sufficient dedicated Crew Commanders to support the command system. At category 4 and below the role of Watch Commander and Crew Commander may be combined. However, this will be dependant on the role and task associated with managing the overall operational activities.
- 14.6.4 The RFFS Supervisors at an aircraft accident should wear a distinctive high-visibility tunic/waistcoat/surcoat/tabard and appropriate markings, which can be easily distinguished by attending external emergency services personnel.
- 14.6.5 If the CAA considers that minimum staffing levels provided are inappropriate for the level of aircraft operation or where a licensee's assessment is unacceptable to the CAA, it will assess and set the minimum staffing level based on the criteria set out above. This would include the supervisory grades.

15 Training

- 15.1 All RFF personnel shall be properly trained to perform their duties in an effective and efficient manner and shall participate in live fire drills commensurate with the types of aircraft and types of RFF equipment in use at the aerodrome, including pressure-fed fuel fires. Training facilities shall be commensurate with the type and size of aircraft in use at the aerodrome.
- 15.2 Due to the very nature of the work expected from rescue and fire fighting personnel some means of risk assessment should be conducted for the processes generally

involved and associated training. It is essential that all personnel involved in rescue and fire fighting duties receive appropriate initial and recurrent comprehensive training to maintain skills and provide additional competence in any techniques and procedures which did not form part of their certificated competence training. The overall aim is to ensure that they have sufficient knowledge, experience and technique to carry out their RFF functions safely and effectively. In such a complex and potentially dangerous occupation, the provision of adequate training is critical to the overall success of the RFFS.

- 15.3 The control of any training regime may be complex and wide-ranging and will depend on local conditions, equipment, roles, ability and experience of participating individuals. Time should be allocated specifically for training and regular assessment of skills should be conducted.
- 15.4 Training programmes shall take account of human factors performance including team co-ordination. Opportunities to function both as an individual and as part of a team shall be provided. Practical facilities suitable for maintaining ongoing competence should be available on the aerodrome or sourced and accessed externally. Opportunities shall be provided for co-ordination and inter-operability training where more than one vehicle is to be utilised as part of an accident response. Practical training should create or simulate the conditions and situations likely to be experienced.
- 15.5 In addition to initial and recurrent training undertaken at establishment(s) approved by the CAA the licensee shall designate a competent person with responsibility to oversee the conduct of local training and ensure adequate coverage and application. Assessment of the competency of the appointed person shall be the responsibility of the licensee. The CAA may ask for details of that assessment.
- 15.6 Health and safety risks arising from training shall be assessed and addressed by a competent person in accordance with local, national and statutory regulations.
- 15.7 Risk assessment will enable the RFFS provider to judge whether the training contemplated is the safest way to deliver the training objectives or whether other, equally effective alternatives, should be devised.
- 15.8 The core components of the local training system shall be identified by the competent person. Each member of the RFFS shall receive specific training in each core component at planned intervals.
- 15.9 A programme for the training of all non-core components shall be established. Periodicity will vary according to training needs but should be consistently applied. The criteria used to determine such a training programme should be clearly identified and recorded.
- 15.10 Examples of the components which should be included in a balanced training programme are included in Appendix 8J.
- 15.11 All personnel shall be trained and competent in First Aid. Details of the minimum competence requirements are given in Appendix 8H.
- 15.12 All drivers shall be competent in driving techniques appropriate to emergency response and all-terrain environments. All vehicle drivers should be in possession of a relevant driving licence where required by UK legislation.
- 15.13 Personnel shall be given regular and comprehensive training in any specialist equipment carried. Particular attention is to be given to operation of marine rescue equipment, vehicles with aerial capability and equipment provided for dealing with hazardous materials including radioactive substances where appropriate.

- 15.14 Personal training records for all employees shall be retained by the licensee for the duration of that person's employment and for a period of five years after cessation of employment. Records shall contain sufficient information to enable judgement of any individual's training achievements to be made. These may be retained electronically provided they are available to the CAA's Inspectors for examination.

16 Rescue Equipment

- 16.1 An aircraft accident will result in a need for rescue and medical equipment at some stage. Most aerodromes will request external emergency services assistance and supplementary equipment at a relatively early stage. However, licensees should consider the provision of specific resources and rescue equipment commensurate with the level of aircraft operations at the aerodrome. This equipment (where provided) should be carried on the responding rescue and fire fighting vehicle(s)).
- 16.2 Guidance on the nature of rescue equipment and quantities to be provided at aerodromes in RFF categories 3 to 10 may be found in the ICAO Airport Services Manual, Part 1 (Document 9137-AN/898; Part 1)
- 16.3 Hand lamps, and appropriate portable lighting equipment shall be provided at aerodromes which are licensed for use during the hours of darkness. Where these are to be used in an explosive or flammable atmosphere, the equipment should be selected according to its fitness for purpose.

17 Medical Equipment

- 17.1 The airport authority shall arrange to have sufficient medical supplies, available on or in the vicinity of the airport, to treat the passenger and crew capacity of the largest aircraft normally using the aerodrome. Experience has shown, however, that more than one aircraft may be involved in an aircraft accident. Consequently, medical supplies to handle this possibility should be determined accordingly.
- 17.2 The estimated maximum number of casualties at an aircraft accident at an airport may be anticipated by reference to the following statistical information published by ICAO:

Table 8.9

Aircraft occupants	Number of casualties	20 per cent casualties Immediate care Priority I	30 per cent casualties Delayed care Priority II	50 per cent casualties Minor care Priority III
500	375	75	113	187
450	338	68	101	169
400	300	60	90	150
350	263	53	79	131
300	225	45	68	112
250	188	38	56	94
200	150	30	45	75
150	113	23	34	56

Table 8.9

Aircraft occupants	Number of casualties	20 per cent casualties Immediate care Priority I	30 per cent casualties Delayed care Priority II	50 per cent casualties Minor care Priority III
100	75	15	23	37
50	38	8	11	19

- 17.2.1 These figures are based on the assumption that the maximum number of surviving casualties at an aircraft accident occurring on or in the vicinity of an airport is estimated to be about 75% of the aircraft occupants.
- 17.3 Resuscitators and infusion equipment shall only be operated by persons specifically trained and competent in their use.
- 17.4 The provision of portable casualty shelters and blankets for use during inclement weather conditions should be considered taking into account the numbers of casualties that could reasonably be expected.
- 17.5 Where the normal journey time for the first Local Authority ambulance exceeds 15 minutes the provision of an on site ambulance should be considered. Alternative arrangements may include the provision of external assistance such as search and rescue helicopters, private ambulances, military facilities etc.
- 17.6 The provision of portable lighting should be considered for illuminating an accident scene particularly triage and casualty handling areas.

18 Personal Protective Equipment

- 18.1 Irrespective of any specific requirements for the provision of personal protective clothing laid down by the CAA, United Kingdom Health and Safety at Work legislation requires that all employers conduct assessments to determine the adequate provision of Personal Protective Equipment (PPE) for employees. The term PPE includes protective clothing and respiratory protective equipment (RPE). Employers are also required to provide adequate training and facilities for the use and maintenance of appropriate PPE.
- 18.2 All personnel shall be provided with PPE and RPE appropriate to the hazard and risk and be given adequate training in its use, care and maintenance.
- NOTE:** Guidance on the requirements of the Health Safety Executive (HSE) PPE/RPE Regulations can be obtained from offices of the Health and Safety Executive.
- 18.3 A Technical Bulletin on the use of SCBA is available from the Home Office.

19 Radio Communications

- 19.1 The provision of effective communications is a key consideration when preparing to deal with an aircraft incident. Effective communications cannot be achieved without considerable pre-planning, provision of suitable equipment, specific training and frequent testing and re-assessment. The objective should be to provide communications equipment in all areas where discernible benefits can be achieved.
- 19.2 All fire and rescue vehicles shall be provided with adequate communications equipment.

- 19.3 Where more than one aerodrome fire vehicle has radio equipment there shall be a facility for two-way communication between vehicles.
- 19.4 The equipment provided on fire vehicles may be in fixed or portable form and shall have an effective range which will ensure reception within all areas that the fire service may be required to operate.
- 19.5 Radio facilities to enable the Airport Fire Service to communicate with responding Local Authority Fire Services shall be provided.
- 19.6 Equipment to provide effective communication between vehicle drivers and foam monitor operators shall be provided.
- 19.7 Radio equipment to enable Fire Officers to maintain communications when not in their vehicles shall be provided.
- 19.8 Where the deployment of personnel and vehicles for non-fire service duties includes entry to buildings, aircraft or aerodrome installations, portable communications equipment shall be provided to ensure that to respond to aircraft incidents capability is maintained.
- 19.9 Communication systems for use by the RFFS during an emergency shall be operated on licensed radio frequencies assigned specifically for that use.
- 19.10 At aerodromes where the RFF Category is 3 and above, RTF Communications equipment shall be provided to enable the airport fire officer(s) to communicate with the aircraft flight deck. An aeronautical radio frequency, 121.600 MHz, is to be used for this purpose. All RTF communications on this frequency shall be recorded on suitable equipment that has the capability to identify the time the communication took place. Procedures shall be in place to store recordings on archival media for a minimum period of 30 days from the date of the last recorded message. The CAA and AAI B may require access to the recordings.
- 19.10.1 To use 121.600 MHz, the RFFS must obtain prior approval to install and operate radio equipment from the relevant licensing authority. The use of 121.600 MHz is limited to direct communications between the fire officer and pilot when the aircraft is on the ground and only within the period of a declared emergency.

20 Inspection and Testing of Equipment and Appliances

- 20.1 All equipment and vehicles require regular and structured maintenance if reliability is to be assured. Guidance regarding the periodicity and methods of testing is available from manufacturers. In addition, the Home Office publishes guidance.
- 20.2 All vehicles equipped with foam-making equipment should be formally tested at least once per year to ensure that the quality of foam production is maintained.
- 20.3 These tests should include, for vehicles when equipped with foam monitors intending to produce foam whilst on the move, an assessment of the ability to meet this intention. Where both a high and low discharge capability has been provided on larger monitors, this provision should be considered in the annual test.
- 20.4 Foam generating systems shall be regularly checked for induction accuracy.
- 20.4.1 For systems designed to induce at 6%, induction should be in the range 5% to 7% at the optimum working conditions. For systems designed to induce at 3%, the range is 3% to 4% and for 1% systems, the range is 1% to 1.1%. Pre-mixed foam systems should have foam concentrate introduced to within a tolerance of 0.9 to 1.1 times the manufacturer's desired induction rate. Care should be taken in the use of freeze point

depressants where premixed foam systems are exposed to inclement temperatures since excessive amounts of additives may have adverse effects on fire extinguishing performance.

- 20.5 Suitable apparatus, procedures and requirements for conducting these tests may be identified by reference to Appendix 8E of this chapter.
- 20.6 Pre-mixed foam units should be hydraulically pressure tested in accordance with the intervals set by its manufacturer (usually 5 years). Only foam concentrates suitable for use in pre-mixed form shall be used in these kinds of pressure vessels.
- 20.7 Records of all tests and inspections shall be retained by the licensee for a period of five years. The records should include details of consequential action where an inspection has revealed a defect or deficiency.

21 Inspections of the RFFS by Inspectors of the CAA Aerodrome Standards Department

- 21.1 The CAA's Inspectors will require to be satisfied that the RFFS is capable of operating as an effective unit and will require to see evidence that the licensee has made a full assessment of the operational requirements, and that the necessary procedures and practices are in place for an effective response to aircraft accidents or incidents. Inspections will be carried out at regular pre-determined intervals or without prior warning. The licensee may be required to provide a full-scale demonstration of the RFFS to demonstrate the effectiveness of any element of the emergency arrangements. When this is called for, prevailing operational conditions will be taken into account.
- 21.2 The CAA's Inspectors will also require to see documentary evidence relating to the qualifications of personnel employed in the RFFS including Certificates of Competence and medical certification. Inspectors will also wish to examine records of training received and assessments made including those for training exercises conducted with other emergency services.
- 21.3 Records of inspections, test and maintenance of all vehicles and equipment used by the RFFS should be available for examination.

22 General

- 22.1 The CAA publishes a number of Civil Aviation Publications which provide supporting information to that contained in this Chapter. Details can be found on the CAA website www.caa.co.uk/publications.
- 22.2 The Home Office publishes Dear Chief Officer Letters (DCOL) and Technical Bulletins (TB) the contents of which may be relevant to the Airport Fire Service. Whilst not obliged to do so, the CAA may circulate details of relevant DCOLs or TBs on an opportunity basis but this should not preclude licensees from obtaining copies direct from the Home Office. Some means of ensuring effective circulation of all these documents within the RFFS should be provided by the licensee.
 - 22.2.1 The address of H M Inspectorate of Fire Services is:
Office of the Deputy Prime Minister
Zone 17/D
Portland House
Stag Place
London SW1E 5LP

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Appendix 8A Specifications for Rescue and Fire Fighting Vehicles

1 Introduction

- 1.1 Vehicles shall be capable of carrying their full load with maximum traction and mobility on and off paved surfaces in optimum weather conditions. They shall be able to operate over all types of terrain on or around the aerodrome, at a speed commensurate with safety.
- 1.2 The following information is provided so that RFFS vehicles may be specified with characteristics that support the objective of conveying and delivering at least the minimum quantities of extinguishing agents provided at the aerodrome, according to the aerodrome RFF category. RFFS vehicles shall be specified so that the response objective is met in all circumstances of optimum visibility and surface conditions.
- 1.3 RFFS vehicles may also be designed to carry all or part of the rescue equipment provided at the aerodrome. Rescue equipment may be carried on one vehicle or distributed over a number of vehicles provided that the response objective is met.
- 1.4 Where personnel forming part of the minimum number of staff designated to be readily available to respond and operate the RFF equipment are intended to be carried in a vehicle, the vehicle shall be capable of being deployed in a way that ensures that response objectives are achieved and that continuous agent application at the appropriate rate(s) may be fully maintained.
- 1.5 On a vehicle which is capable of producing foam or other extinguishing agents through a monitor, the role of monitor shall not be performed by the driver of that vehicle, other than when sidelines from that vehicle are used.
- 1.6 Additional guidance and a detailed outline of the acceptable factors in the Specification Process of RFFS vehicles may be found in ICAO Doc 9137-AN/898 – Airport Services Manual, Part One, Rescue and Fire Fighting, Third Edition (1990), Chapter 5.

2 RFF Vehicles with Extinguishing Agent Capacity Less than 4500 Litres (Rapid Intervention Vehicles – RIV)

- 2.1 The main functions of an RIV are to reach accident sites quickly, carrying the Officer-in-Charge (OiC) and/or personnel to initiate rescue action and/or provide an effective means of fire suppression pending the arrival of the major foam tenders. The RIV shall be capable of crossing adverse terrain particularly where access for the major foam tenders may be slow or difficult.
- 2.2 The design shall combine speed, acceleration, flotation, traction and manoeuvrability as far as possible, bearing in mind these characteristics are not necessarily compatible. Speed and acceleration are considered to have preference at most aerodromes.
- 2.3 The vehicle shall carry an effective quantity of primary/complementary extinguishing agents appropriate to the airfield category.
- 2.4 The vehicle may also carry the rescue, lighting and miscellaneous equipment but due regard must be paid to the weight and performance characteristics of the chosen chassis.

2.5 Minimum characteristics

- 2.5.1 At the full operational weight on a dry level paved surface, the RIV shall have the following minimum characteristics:

Acceleration: 0 to 80 km/h (50 mph) within 25 seconds from rest at normal engine and transmission operating temperatures.

Top speed: Minimum 105 km/h (65 mph)

All-wheel drive capability.

2.6 Foam-making Equipment

- 2.6.1 Foam monitors shall be capable of producing foam in a jet or dispersed pattern with fully variable selections throughout the range.
- 2.6.2 All vehicles fitted with monitors are required to produce foam on the move at slow speed not exceeding 10 km/hour at optimum monitor operating pressure.
- 2.6.3 When selecting monitor discharge rates, consideration should be given to the minimum discharge rates set out in Chapter 8 Table 8.2 and the need to ensure continuous application as set out within the ICAO critical area concept.
- 2.6.4 At aerodromes where the RFF category is Special, 1, 2 or 3, portable foam-making equipment used with vehicle side lines should be capable of producing finished foam at a flow rate commensurate with the objective of achieving the discharge rates of foam solution specified in Table 8.2 of this chapter at normal operating pressures.
- 2.6.5 At aerodromes where the RFF category is 4 and above, portable foam-making equipment used with vehicle side lines is considered as supplementary equipment for the purposes of calculating water and foam concentrate tank capacities.

3 RFF Vehicles With Extinguishing Agent Capacity Over 4500 Litres (Major Foam Tenders)

- 3.1 At their full operational weight on a dry level paved surface major foam tenders shall have the following characteristics and performance:
- 3.1.1 Acceleration: Minimum 0-80 km/hour within 40 seconds from rest (with engine and transmission at normal operating temperatures).
- 3.1.2 Top speed: Minimum 100 km/hour (on a dry and paved surface).
- 3.1.3 Automatic or semi-automatic transmission.
- 3.1.4 All-Wheel Drive (Twin-wheel configuration is not acceptable).
- 3.1.5 Differential and cross axle locks should be fitted.
- 3.1.6 Some transmission trains may require a high/low range 'Drop' box.
- 3.1.7 Power dividers, separate pump engines or power take-offs are acceptable.

NOTE: Any system chosen shall be engineered so as to be fit for the specific purpose designated.

3.2 Clearances

- 3.2.1 The ground clearance shall be sufficient to permit full mobility during 'off-pavement' conditions.

3.2.2 The minimum acceptable ground clearances and angles shall be – (fully laden):

Approach Angle	30°
Departure Angle	30°
Inter Axle Clearance	12°
Under Chassis Clearance	356 mm (14 inches)

Additional information is provided by Figure 8A.1.

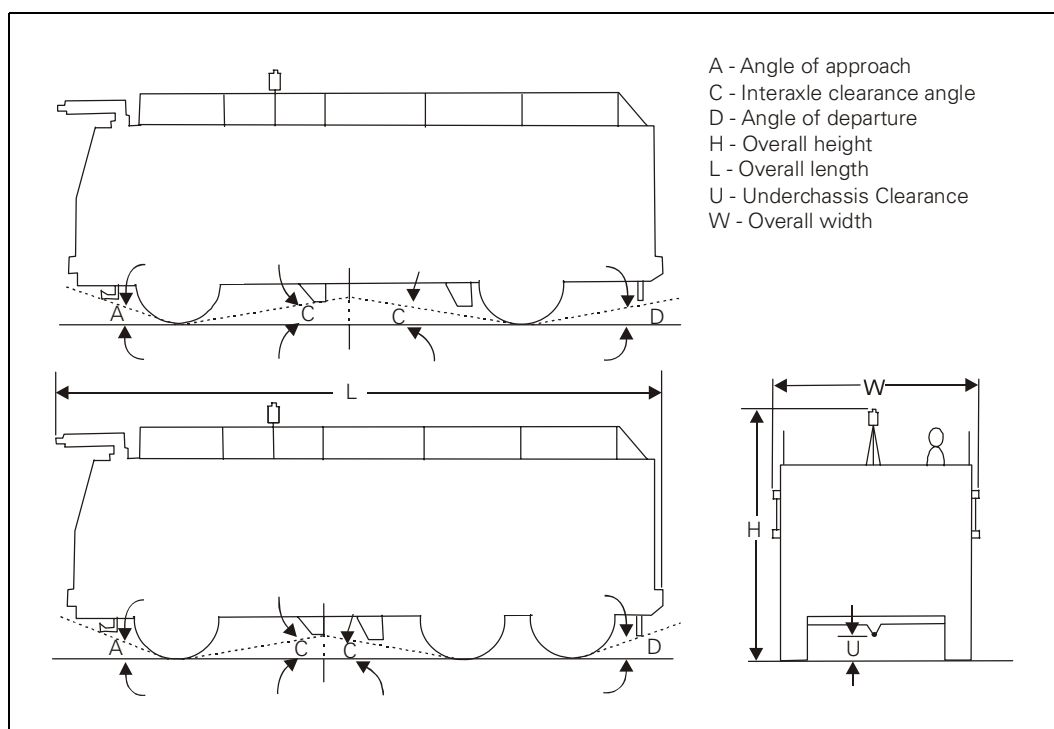


Figure 8A.1 Vehicle Acceptable Ground Clearance and Angles

3.2.3 Vehicle Tilt Angle, Left and Right hand sides:

The centre of gravity of the vehicle should be kept as low as possible and at its full operational weight with tyres inflated to normal working pressures, the vehicle should pass a static tilt test of not less than 28 degrees platform tilt, right and left, with not more than 33 degrees chassis tilt.

3.3 **Weight**

3.3.1 The gross weight of the vehicle should be distributed as equally as practicable over all the axles and tyres.

3.3.2 The difference in weight between tyres on any axle shall not exceed 5% of the average tyre weight for the axle. The difference in weight between any two axles shall not exceed 10% of the weight of the heaviest axle if the heavy axle is a rear axle. If the heavy axle is a front axle, the weight difference between that axle and any other shall not exceed 5% of the heavy axle weight. Under no circumstances shall the axle and tyre manufacturers' ratings be exceeded.

3.4 **Foam Concentrate**

Except in the case of vehicles having pressurised or pre-mixed foam tanks, the amounts of foam concentrate carried should be sufficient to supply at least two full loads of water tank capacity.

3.5 **Foam-making Equipment**

- 3.5.1 Foam tenders equipped with foam monitors should be able to produce foam whilst on the move at slow speeds (8-10 km/hr). These monitors must be capable of producing finished foam with the properties identified in Appendix 8E. Attention is drawn to the advisability of having both a high and low discharge capability on the larger monitors. Vehicles should be fitted with a monitor capable of a range appropriate to the longest aircraft operating at the aerodrome, measured using aspirated foam.
- 3.5.2 Monitors should have the capability to deliver foam in a dispersed pattern for blanketing purposes.
- 3.5.3 Monitors are to be capable of at least 50% of the discharge rate required for the RFF Category.
- 3.5.4 The option to fit a bumper monitor/turret, and under vehicle protection is permitted, however extinguishing agents used by such systems must be in addition to minimum extinguishing agents required for that aerodrome category.
- 3.5.5 The option of having a monitor operable by the driver and/or monitor operator exists but in considering this, due regard must be given to the level of staffing of the RFFS and particularly section 15.7.
- 3.5.6 Ergonomic Controls – the design and layout of controls for successful operation of vital equipment should be carefully planned for the operators.
- 3.5.7 Monitor Platforms should be designed to provide a safe area for working.
- 3.5.8 Hand rails and safety harnesses should be provided, particularly where access to rooftop or tank top areas is required.
- 3.5.9 At aerodromes where the RFF category is Special, 1, 2 or 3, portable foam-making equipment used with vehicle side lines should be capable of producing finished foam at a flow rate commensurate with the objective of achieving the discharge rates of foam solution specified in Table 8.2 of this chapter at normal operating pressures.
- 3.5.10 At aerodromes where the RFF category is 4 and above, portable foam-making equipment used with vehicle side lines is considered as supplementary equipment for the purposes of calculating water and foam concentrate tank capacities.

3.6 **Lockers and Stowage**

- 3.6.1 Suitable and adequate lockers and stowage facilities should to be provided to carry –
Required complementary extinguishing agents
Required Rescue equipment
- 3.6.2 All equipment shall be safely and securely stowed whilst allowing maximum accessibility.

3.7 **Rims Tyres and Wheels**

- 3.7.1 Vehicles shall be fitted with wheels, rims and tyres approved for use by manufacturers for paved and non-paved surfaces. Tyres should be of identical size and tread design and 'ply'.

- 3.7.2 Tyres selected should maximise acceleration, top speed, braking, manoeuvring control and optimise flotation.
- 3.7.3 The recommended tyre inflation pressures should be marked on each wheel arch.

4 Factors Applicable to all RFFS Vehicles

4.1 Lighting Equipment

Where aerodromes are licensed for use during the hours of darkness, vehicles shall be fitted with portable/fixed lighting equipment sufficient to illuminate the incident/accident site.

4.2 Radio, Fixed and Hand Portable

- 4.2.1 Adequate radio installations should be provided.
- 4.2.2 Radio antennae fitted to the top of the vehicle should be separated as necessary to minimise interference.

4.3 Cab/Crew Compartment

- 4.3.1 The crew compartment shall be capable of safely accommodating personnel and their equipment, including breathing apparatus sets and spare cylinders, if appropriate. Sufficient space shall be provided to facilitate the donning of PPE/RPE.
- 4.3.2 All seats should be fitted with safety restraints to accepted road use standards.
- 4.3.3 All seats should face forwards.
- 4.3.4 The noise level in the cab should not exceed 85 dBA at a road speed of 80 km/hour on a hard paved level surface.
- 4.3.5 The cab should provide a seated driver with good all round vision at least 5° above the horizontal plane and at least 90° each side from the straight ahead position.
- 4.3.6 Any equipment carried within the cab should be securely stowed to avoid injury to crew whilst ensuring rapid deployment when required.

4.4 Other Considerations

A number of additional factors may be found of benefit to the operation of RRF vehicles:

- 4.4.1 Forward and Rear facing cameras Infra red etc., with video recording.
- 4.4.2 Mapping/Global Positioning System Systems.
- 4.4.3 Automatic Tyre Deflation/Inflation.
- 4.4.4 Extending working platform.
- 4.4.5 Extending/telescopic walkway and/or monitor.
- 4.4.6 Safety warning/interlocks for the safe operation of critical systems fitted to the vehicle.
- 4.4.7 Traction Control.
- 4.4.8 Anti-lock braking systems.
- 4.5 Where these are desired as part of the vehicle specification these must meet or exceed national statutory requirements, subject to any special dispensations as may be applicable to emergency vehicles. The United Kingdom Vehicle Licensing Agency may be able to provide advice on dispensations.

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Appendix 8B The Development of Operational Procedures to Maintain Response Capability

1 General

- 1.1 The following **guidance** is intended to assist licensees with the development of operational procedures to maintain acceptable response times in all conditions night/day, weather, surface and traffic state. Account should be taken of all factors likely to interfere with the efficient functioning of the emergency services such as the effects of weather and associated surface conditions and traffic on runways, taxiways and roads which may be used or crossed by responding vehicles.
- 1.2 The aim is to achieve optimum response times during conditions likely to impede progress by determining and reviewing circumstances, identifying equipment needs and determining and practising procedures which will maximise effectiveness whilst minimising response times.

2 Preparation and Knowledge

- 2.1 A thorough knowledge of the topography of the airport and its immediate vicinity is fundamental. The use of grid maps and careful selection of routes is essential for success in meeting the response objective.
- 2.2 The existence of any areas that may from time to time become impassable because of weather or other conditions should be known to all RFF and associated emergency response personnel (outside agencies).
- 2.3 The location of obstacles both permanent and temporary should be known.
- 2.4 Operational procedures should be developed through which ATC stop or divert all aircraft and non-essential traffic that conflicts with responding RFF vehicles. RFF personnel should ascertain the minimum visibility operating conditions from the local ATC provider in order to establish response capability under such conditions. (CAP 168, Appendix 2B Low Visibility Operations and Procedures.)
- 2.5 Licensees considering or conducting airport development should take into account any factors which would improve/delay the response capability.
- 2.6 The load bearing characteristics of the airport soil structure under various weather conditions should be determined and taken into account.

3 Work in Progress (WIP)

- 3.1 WIP is likely to affect the response capability or operational performance of the RFFS and other emergency services. Prior notification of the work intended is essential so that amendments to overcome or minimise their effects can be to the emergency services' operational procedures.

4 Natural Features

- 4.1 Natural features may create obstructions that would delay or preclude access by RFF vehicles. i.e. rough terrain, soft ground, rivers etc. Consideration should be given to the provision of specialised vehicles/equipment.

- 4.2 Any delay in response capability is critical and mutual assistance agreements with off airport agencies should be established to provide an optimum response.
- 4.3 Where aerodromes are situated adjacent to large areas of water such as rivers or lakes, or where they are located on coastlines, special provisions should be made to facilitate rescue (CAP 168, Chapter 8, Section 11).

5 Emergency Access/Egress Roads

- 5.1 Direct access to the operational runway(s) will assist the objective of minimising response times.
- 5.2 Access routes to the response area should be designated and suitable for use by RFF vehicles. Routes should be maintained in a condition that facilitates use.
- 5.3 Access road construction should mitigate the possibility of one vehicle blocking ingress/egress by other emergency response vehicles. Access roads should be designed to take account of the gross weight and maximum dimensions of the RFF vehicle(s) expected to use them.
- 5.4 Emergency access roads should be capable of being traversed in all weather conditions. Roads within 90 m of a runway should be surfaced to prevent surface erosion and the transfer of debris to the movement area. Account should be taken of CAP 168, Chapter 3 paragraph 4.1.3 (graded area of the runway strip).
- 5.5 The total area within the runway strip should be capable of supporting unrestricted access for emergency service vehicles. (CAP 168, Chapter 3 paragraph 4.1.5.)
- 5.6 The provision of exit points (gates and or frangible sections) in the security fence should be considered. All points will need to be clearly identified. Retro-reflective tape or markers will be of assistance where the aerodrome may need to be accessible during the hours of darkness.
- 5.7 Access routes to cover difficult environs within a distance of 1000 m beyond the ends of each runway should be established and should be suitable for use by RFF vehicles.
- 5.8 Where the surface of the road(s)/route(s) is indistinguishable from the surrounding area, or in areas where these may be obscured by snow, edge markers should be placed at intervals of about 10 m.

6 Low Visibility Conditions

- 6.1 Procedures should be developed to place the RFF personnel on stand-by alert when the aerodrome visibility has deteriorated below a predetermined level. This should include the provision of forward stand-by positions where response times are likely to be compromised. (CAP 168, Appendix 2B paragraph 2.1.3.)
- 6.2 RFF personnel shall monitor applicable radio frequencies during stand-by periods.
- 6.3 ATC shall be made aware of the exact location of the RFF vehicles assigned to stand-by duties.
- 6.4 Where available, surface navigational aids, such as ground radar, shall be fully utilised through co-ordination between RFF personnel and ATC. (CAP 168, Appendix 2B paragraph 2.1.5.)
- 6.5 Infrared vision systems fitted to RFF vehicles have been shown to assist the response to and location of emergencies in low visibility conditions.

- 6.6 RFF vehicles shall be equipped with an airfield chart clearly showing all taxiways, runways, holding points and vehicle routes marked with their appropriate designation. The chart(s) should be accompanied by written instructions clearly detailing the action that the driver should take in the event that the vehicle should break down or that the driver should become unsure of the vehicle's position on the aerodrome. (CAP 168, Chapter 2 Appendix 2B.)
- 6.7 Positioning equipment installed on RFF vehicles has been shown to enable the drivers to be aware of the position of the vehicle on the aerodrome at all times.
- 6.8 In visibility conditions equivalent to 200 m RVR and less, it may be necessary to restrict further the operation of vehicles and persons in the aircraft manoeuvring area. Procedures developed for ATC to assist the RFFS in case of an accident or incident, should be initiated. (CAP 168, Appendix 2B paragraph 3.5.2.)

7 RFF Training

- 7.1 Training shall include actual RFF vehicle operations over primary and secondary travel routes on the airport and runway overrun areas likely to be used in the event of an aircraft incident/accident. Consideration should be given to the need for other personnel and responding agencies to be given similar training.
- 7.2 Preferred routes and standby points, especially those within the critical rescue and firefighting access area, shall be pre-selected. Training and practice response runs shall be made under ideal and where practicable, inclement, weather conditions.
- 7.3 RFF vehicles shall approach any aircraft accident by the quickest route commensurate with safety. This might not necessarily be the shortest distance to the scene. Traversing through unimproved areas can take longer than travelling a greater distance on paved surfaces.
- 7.4 Low visibility operations criteria vary from one airport to another depending on the type of instrument landing system available, the level of natural and artificial obstructions in the surrounding terrain, the type of runway lighting and the capability of the onboard instrument system of the aircraft using the airport. Development of procedures in conjunction with ATC for operation in LVPs using all means of guidance available on the aerodrome are essential. This shall take account of the ATC unit training plan and the emergency contingency training and may include selective switching of taxiway lighting, use of aerodrome surface movement radar and allocation of forward standby point(s).

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Appendix 8C Development of Existing and New Aerodrome Fire Stations

1 Fire Station Location

- 1.1 Emergency Fire Vehicles should have direct access to critical aircraft movement areas. The location of the airport fire station shall be based on minimising response times to areas where aircraft accidents and incidents might occur.
- 1.2 At large complex aerodromes it may be necessary to consider the provision of more than one fire station, each located strategically in relation to the runway patterns.
- 1.3 Where more than one station is provided, consideration shall be given to the number of vehicles to be located at each station in order to ensure that sufficient quantities of extinguishing agents are available to initiate fire control at an incident/accident pending the arrival of the responding units.
- 1.4 A layout plan of the aerodrome indicating the principal sites of any new fire station(s) should be developed.
- 1.5 All areas on the aerodrome should be evaluated when considering the fire station location.
- 1.6 Vehicle response time trials should be conducted to determine the optimum location in relation to potential accident areas.
- 1.7 When siting a new fire station the following operational factors should be considered:
 - 1.7.1 Immediate, straight, and safe access airside.
 - 1.7.2 Unimpeded access routes with a minimum of turns to runways, taxiways.
 - 1.7.3 Direct access to the terminal and apron areas minimising the need to cross active runways and taxiways and avoiding difficult terrain.
 - 1.7.4 Maximum opportunity for monitoring the movement area.
 - 1.7.5 Minimum obstructions or interference from existing facilities or uses, such as access roads, fuelling areas, and aircraft taxiing operations/parking areas.
- 1.8 Due consideration should be given to future development plans of the airport such as new runways, taxiways and parking areas, which may affect response distances and therefore response times.
- 1.9 The range and extent of facilities may vary but, in general may include:
 - 1.9.1 Adequate accommodation for the housing of vehicles and for the conduct of minor servicing or maintenance.
 - 1.9.2 Domestic and administrative facilities for personnel.
 - 1.9.3 Appropriate storage and technical support facilities.

2 Fire Station Apron

- 2.1 The apron design should provide responding RFF vehicles with a straight access from the vehicle bays to the movement area without any tight curves or other obstacles.

- 2.2 A warning device shall be provided if the station has pedestrian or vehicular traffic crossing the apron/driveway. It should be activated automatically whenever the vehicle bay doors are in use.
- 2.3 A drive-through facility is preferred as it reduces wear on vehicle tyres and transmission/steering. In the event that this is not possible, the station apron operating surface should be large enough to allow the largest vehicle to reverse into any bay of the station.
- 2.4 The station apron should be adequately illuminated. Lights should be mounted so as not to adversely affect drivers' vision or airport operations.
- 2.5 Station apron areas shall be strong enough to bear the weight of fully laden vehicles and should not be damaged when the vehicles are driven away rapidly.
- 2.6 There should be an exterior water connection or hydrant assembly for the refilling of vehicle water tanks.
- 2.7 The provision of means to rapidly replenish foam concentrate tanks is desirable.

3 Vehicle Bays

- 3.1 Vehicle bays shall provide sufficient room for personnel to walk around vehicles and gain access to equipment lockers and vehicle cabs.
- 3.2 Ceilings should be high enough to permit access to the tops of vehicles so that inspection of foam tanks etc. may be conducted.
- 3.3 Floors shall be strong enough to bear the weight of fully laden vehicles and should not be damaged when the vehicles are driven away rapidly.
- 3.4 Doorways shall be wide enough to enable a quick and safe exit by vehicles giving adequate clearance to ladders, obstruction lights and aerials etc. which may be fitted to vehicle roofs.
- 3.5 Vehicles shall be positioned so that the failure of any one shall not prevent the others from making an immediate response.
- 3.6 Vehicle bays shall be provided with adequate lighting and heating facilities.
- 3.7 Electrical systems of appropriate design, shall be required where vehicles are fitted with engine heaters, battery charging devices or other protective equipment.
- 3.8 Consideration shall be given to the provision of exhaust extraction equipment thus avoiding contamination within the vehicle bays when vehicles are started or run for prolonged periods.
- 3.9 All services provided for vehicles shall be designed to achieve immediate and safe disconnection without delaying the response of vehicles.
- 3.10 Doors may be provided with automatic opening devices, which could include remote operation from the watch room or in association with the operation of the station alarm. Where electronically operated vehicle bay doors are installed, these should fully open within 15 seconds of initial operation. These must be fitted with manual overrides which allow operation within similar timescales in the event of a power failure or breakage.

4 'Watch Room'

- 4.1 There shall be a central point/method for the reception of emergency calls.
- 4.2 The watch room should be sited in a position which enables surveillance of as much of the movement area as possible.
- 4.3 If an elevated structure is built and the watch room attendant is part of the minimum number of personnel designated for an immediate response by the RFFS, quick and safe access to the vehicle bays shall be provided.
- 4.4 Double glazing and other sound-proofing measures may be necessary to exclude excessive noise from aircraft which may interfere with verbal communications (e.g. telephone and radio transmissions).
- 4.5 Facilities may be required to minimise the effects of direct exposure to the sun i.e. tinted windows or sunshades.
- 4.6 Facilities should be provided for varying lighting intensity in the watch room to permit maximum external vision at night.
- 4.7 The Watch room/Fire Station should be provided with a public address system so that details of the emergency can be conveyed to crew members.
- 4.8 The importance of prompt and clear communications is paramount. Therefore, consistent with individual requirements of each airport there should be provision for:
 - 4.8.1 Direct communication between Air Traffic Control and the airport fire station(s).
 - 4.8.2 Communication between Air Traffic Control and the RFF crews en route to, or in attendance at, an aircraft accident/incident.
 - 4.8.3 Communication between the fire station, or the main station, where more than one is provided, and the RFF vehicles.
 - 4.8.4 Communication between the rescue and fire-fighting vehicles.
- 4.9 Where an air traffic control service is provided at an aerodrome a direct telephone line should be provided between ATC and the watch room. Similarly, a direct telephone line to the local authority fire brigade should be provided.

5 Domestic and Administrative Facilities (Where Provided)

- 5.1 The extent of domestic and administrative accommodation will depend on the range of technical control and duties required to be performed on the station.
- 5.2 The station alarm shall be sited so that it is audible in all parts of the station and its environs during high ambient noise levels.
- 5.3 These are facilities which can contribute to the efficiency of rescue and fire fighting services by preserving equipment and extinguishing agents in optimum condition, ensuring its prompt availability and in providing test/inspection and maintenance provisions.
- 5.4 Hose storage space should be provided, these facilities may require suitable racking and ventilation.
- 5.5 Storage space may be required for storing the reserve supply of foam concentrate, other extinguishing agents, first aid supplies and other departmental equipment.

- 5.6 Particular attention should be given to ensuring that storage temperatures for foam concentrates and other extinguishing agents are kept within the levels specified by the manufacturers.
- 5.7 A general workshop, where maintenance and repairs can be performed on RFF vehicles and other station equipment may be a valuable contribution towards the efficient and economical operation of the service.
- 5.8 A specific area should be provided for training purposes. The area is not required to be a separate enclosed room, although this may be desirable.
- 5.9 The provision of proper exercise facilities should be considered. Proper exercise encourages physical fitness and mental alertness and firefighter professional development standards and employment criteria specify minimum physical fitness standards for emergency personnel.
- 5.10 At aerodromes where the RFF Category is 3 and above, all fire stations should be provided with a secondary electrical power supply to ensure the continuous availability of essential equipment and facilities.

Appendix 8D The Provision of Additional Water Supplies for Use in Fire Fighting Operations Following an Aircraft Accident

1 The Provision of Additional Water Supplies for use in Fire Fighting Operations Following an Aircraft Accident

- 1.1 The objective of providing additional water supplies at adequate pressure and flow is to ensure rapid replenishment of aerodrome RFFS vehicles thus allowing the maintenance of survivable conditions around the scene of an aircraft accident for far longer than that provided for by the minimum amounts of water set out in Table 8.2.
- 1.2 It is not possible to specify a single operational requirement which ensures adequate provision in all circumstances for all sizes of aerodrome. Each aerodrome should conduct a needs analysis to determine requirements and should ensure that emergency planning arrangements fulfil those requirements. It is possible that additional water to replenish vehicles may be required in as little as five minutes after an accident.
- 1.3 The following factors should be considered when conducting a needs analysis:
 - 1.3.1 Sizes and types of aircraft using the aerodrome.
 - 1.3.2 The capacities and discharge rates of aerodrome fire vehicles.
 - 1.3.3 The provision of strategically located hydrants.
 - 1.3.4 The provision of strategically located static water supplies.
 - 1.3.5 Utilisation of existing natural water supplies.
 - 1.3.6 Vehicle response times.
 - 1.3.7 Historical data of water used during aircraft accidents.
 - 1.3.8 The need and availability of supplementary pumping capacity.
 - 1.3.9 The options for providing additional water may include additional vehicle-borne supplies and the development of plans to utilise support provided by Local Authority Emergency Services.
 - 1.3.10 Response of Local Authority Emergency Services including pre-determined attendance.
 - 1.3.11 The aerodrome should consult closely with the Local Authority Fire Service when determining needs.
- 1.4 It is important to ensure that adequate hard standing/access is provided for all supplementary water supplies. Consideration shall be given to provision of fixed pumps where these may provide a less resource-intensive and rapid method of replenishment.
- 1.5 Consideration shall be given to the provision of additional water supplies adjacent to airport fire service training areas. These should be configured in such a way as to provide the most rapid method of replenishment.

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Appendix 8E Availability of Extinguishing Agents, Specifications, Procedures and Performance Levels

1 Availability of Extinguishing Agents

1.1 The Management of Stocks of Extinguishing Agents

1.1.1 In addition to any statutory or legal requirements, stocks of fire extinguishing agents should be stored and used in a consistent manner in accordance with manufacturers' guidance. Consideration should be given to avoid prolonged or extreme storage conditions. As is the case with all fire extinguishing equipment, extinguishing agents should be subject to regular inspection and testing. This may require the keeping of log books and records of test to be assured of continual fitness for purpose. It is advisable to always observe the manufacturers' recommended service and test intervals in addition to any requirements placed upon the licensee as a result of experience gained by the CAA's Aerodrome Standards Department (ASD).

1.1.2 Where different types of extinguishing agents are used on the aerodrome, care must be taken to ensure that incompatible types are kept apart and care is exercised when these have to be used simultaneously against fires (e.g. powders and foams). In particular, the mixing of different types of foam concentrate may lead to serious sludging and possible malfunctioning of vehicle foam production systems. If it is necessary to change the concentrate type carried on a vehicle it is essential that the manufacturers of the concentrate and the vehicle are consulted for guidance to ensure that all parts of the foam system are thoroughly cleaned prior to the new concentrate being used. This is vital to prevent any damage to foam systems or detrimental foam performance caused by the inadvertent mixing of incompatible foam concentrate types.

1.2 Induction Accuracy

1.2.1 Foam generating systems shall be regularly checked for induction accuracy.

1.2.2 For systems designed to induce at 6%, induction should be in the range 5% to 7% at the optimum working conditions. For systems designed to induce at 3%, the range is 3% to 4% and for 1% systems, the range is 1% to 1.1%. Pre-mixed foam systems should have foam concentrate introduced to within a tolerance of 0.9 to 1.1 times the manufacturer's desired induction rate. Care should be taken in the use of freeze point depressants where pre-mixed foam systems are exposed to low temperatures.

1.3 Foam Properties

1.3.1 Methods pertaining to the measurement of finished foam properties may be found in BS5306: Section 6.1: 1988 and BS-ISO 7203-1: 1995. However, the requirements of this Chapter and Appendix prevail for specification purposes.

1.3.2 Expansion ratio: The amount of air entrained into a foam stream governs its expansion, which in turn may affect the fluidity of the finished foam and therefore the rate of spread over the surface of burning fuels. The expansion of a representative sample of the foam blanket produced in field operating conditions determined using the methods above should be no less than 6:1, a value between 8:1 and 12:1 being preferred.

- 1.3.3 Drainage time: The rate at which foam solution drains from a foam blanket may be a partial consideration in that foam blanket's efficiency in progressively controlling and extinguishing fires and subsequent post-fire security. Some guidance regarding an appropriate level of post-fire security provided by a finished foam blanket may be derived from experience of carrying out the ICAO fire tests as specified in this Appendix. A 25% drainage time of more than 5 minutes is preferred. However, the time taken for the drainage of 25% of the foam solution from a representative sample of the foam blanket produced in field operating conditions determined using the methods specified above shall be the greater of at least 3 minutes, or no less than 90% of the ideal figures agreed and quoted by the foam and equipment manufacturers concerned¹. Amongst other factors, the use of foam branchpipes capable of producing an aspirated foam of good consistency will be beneficial in prolonging foam drainage times. For this reason the use of any so-called 'non-aspirated' foam branchpipes should be quickly supplemented by using 'aspirating' foam branch attachments or additional branchpipes traditionally referred to as 'aspirating' types.
- 1.3.4 Certain combinations of types of foam concentrate and branchpipes may be found to perform differently to others. Care should be taken during the selection process to ensure that the optimum combination of foam and equipment is chosen. In the case of foam concentrates, the test procedures employed in British Defence Standard series 42-40 may offer appropriate guidance on selection criteria where no normative British Standard is considered appropriate.
- 1.4 **Foam Performance Levels, Specifications and Test Procedures**
- 1.4.1 In specifying foam concentrate for use at licensed aerodromes, the minimum requirements set out in this Appendix apply. The licensee shall demonstrate that the extinguishing agents in use shall always be of consistent good quality, fit for purpose, stored and used in accordance with manufacturers' recommendations.
- 1.4.2 The Civil Aviation Authority does not approve, inspect or certify fire fighting equipment, or materials, nor does it approve or evaluate testing laboratories. In determining the acceptability of equipment or materials, the licensee may base acceptance on compliance with current, relevant, national or international standards or CAA guidance.
- 1.4.3 Foam concentrates used to provide the extinguishing agents quantities listed at Table 8.2 are required to meet the relevant National Standard as stated in this chapter and also meet either Performance Level A or Performance Level B as designated by ICAO in the Airport Services Manual, Part 1, Third Edition, Chapter 8. For convenience, the foam performance fire test specified therein is reproduced here. The performance level A or B is to be determined by carrying out either of the tests described in paragraph 3 below as a 'type approval'. Foam concentrates which fail to meet performance level A will not be acceptable for use at licensed aerodromes.
- 1.4.4 Aerodrome authorities should ensure that suppliers of foam concentrates provide a certificate of assurance to the effect that the concentrate supplied meets all requirements of this Appendix and any supplementary conditions agreed with themselves prior to the occasion of the first purchase (e.g. suitability for use in pre-mixed form). A certificate of assurance should be obtained for each batch of extinguishing agents used on the aerodrome. The criteria used to determine compliance should be applied consistently. Such conditions may include the

1. The figures obtained during field tests are very dependent on the methods used and the environmental conditions prevalent during the tests. The ICAO Airport Services Manual, Doc 9137-AN/898 Part 1 Section 5.7.16 has been deemed to prevail when an interpretation of suitable figures is required.

declaration by the manufacturer of any incompatibility with alternative foams or extinguishing agents in general use, particularly with respect to simultaneous use on the same fire, corrosive effects in storage and use in contact with materials normally used in the construction of fire extinguishing apparatus, cleaning and removal of spilled extinguishing agents, health hazards and side effects, environmental consequences of use and/or disposal. It is suggested that it is good practice to determine in co-operation with an aerodrome's usual suppliers a purchasing specification to include all the characteristic values of the extinguishing agents and acceptable deviations from the typical values for these.

2 Regular Assessment of Extinguishing Agents

- 2.1 A regular programme of inspection and test should be determined to assure continued conformance of each batch of extinguishing agents with the manufacturer's declared original specification when measured according to relevant accepted national and international standard. The CAA's Inspectors may require to examine any evidence of this assurance from time to time.
- 2.2 Any stocks of fire extinguishing agents, especially foam concentrates held in bulk tanks or drums should be assessed for continued satisfactory performance by taking samples from each batch and having these analysed at regular intervals by a competent person. By way of guidance, the measurement of those physical and chemical properties determined as being important during the selection phase using methods outlined in national standards will be appropriate.

3 Specifications (ICAO)

- 3.1 pH value: pH value is a measurement used to express acidity (e.g. 1) or alkalinity (e.g. 14) on the scale 1 to 14. In order to prevent the corrosion of component parts of fire fighting vehicle foam tanks and systems, the foam concentrate should be as neutral as possible. The pH value of the foam concentrate shall be determined using a suitable meter and a glass electrode and should register between the values of 6 and 8.5.
- 3.2 Viscosity: The viscosity of a foam concentrate is an indication of the resistance to flow of the liquid in the pipework of a rescue and fire fighting vehicle foam system. The viscosity of a foam concentrate at its lowest anticipated use temperature should not exceed 200 mm/s. Any higher viscosity will restrict flow and retard its adequate induction into the water stream unless special precautions are taken.
- 3.3 Sediment/Undissolved Solids: Sediment may form in a foam concentrate which contains impurities, contaminants or if it is subjected to adverse storage conditions and/or varying temperatures. This sediment may affect the performance of a vehicle's foam proportioning system or negate its fire fighting efficiency. A representative sample of the concentrate may be examined for its sediment content by transfer to a graduated centrifuge tube and centrifuged until any sediment present forms a compact deposit of constant volume. The volume of the deposit shall be determined and recorded as a percentage of the foam concentrate in the tube. This value should not exceed 0.5% of sediment by volume.

4 The ICAO Fire Test Method

- 4.1 Procedures and/or substances required for the tests included in this appendix may be injurious to health if adequate precautions are not taken. The equipment designer, producer, supplier and user shall take all reasonable steps to ensure any statutory and/or legal obligations relating to health and safety at all stages of manufacture and use of fire extinguishing products are upheld.
- 4.2 Principle: To evaluate the ability of a foam concentrate to:
- a) Extinguish a fire of 2.8m² or 4.5m² as appropriate
 - b) Resist burn back due to exposure to fuel and heat.
- 4.3 Pre-requisites appropriate to both test levels:
- a) A circular steel fire tray of 2.8 m² or 4.5 m².
The nominal vertical wall height shall be 200 mm.
 - b) Equipment or access to facilities to enable accurate recordings of:
 - i) air temperature
 - ii) water temperature
 - iii) wind velocity
 - c) Fuel: 100 L of AVtur (Jet A1) for performance level type B tests;
Fuel: 60 L of AVtur (Jet A1) for performance level type A tests.
 - d) Branch pipe, 'UNI-86' straight stream, air aspirating nozzle as specified in BSISO 7203-1: 1995 and ICAO Doc. 9137-AN/898.
 - e) A suitable means to measure elapsed time.
 - f) A circular, burn back pot, of nominal dimensions 300 mm internal diameter, 200 mm height. 2 litres of gasoline or kerosene required to conduct the burn back test.
- Preferable conditions:
- a) Air temperature / °C > 15
 - b) Foam solution temperature / °C > 15
 - c) Wind velocity (m/s) < 3
- 4.4 Before carrying out any fire tests the characteristic physical and chemical properties of the foam concentrate and a representative sample of finished foam generated using the ISO branchpipe may be determined in the interests of economy: foam induction rate, foam expansion and 25% drainage time. There is no merit in carrying out the fire tests if the other foam properties do not comply with the specifications agreed between the licensee and the supplier.

4.5 Specific requirements for each test level:

Table 8E.1

		Performance Level Type A	Performance Level Type B
a)	Branch pipe Nozzle (air aspirated)	UNI 86 foam nozzle	UNI 86 foam nozzle
b)	Nozzle pressure (nominal)/kPa	700 (7 Bar)	700 (7 Bar)
c)	Application rate (L/min/m ²)	4.1	2.5
d)	Discharge rate (L/min)	11.4	11.4
e)	Fire Size	= approx. 2.8m ² (circular)	= approx. 4.5m ² (circular)
f)	Fuel (on water substrate)	AVtur, 60 litres	AVtur, 60 litres
g)	Pre-burn time (s)	60	60
Fire performance:			
a)	extinguishing time(s)	≤ 60	≤ 60
b)	total application time(s)	120	120
c)	25% re-ignition time (mins)	≥ 5	≥ 5

5 Test Procedure

- 5.1 Position the chamber holding the foam pre-mix upwind of the fire with the nozzle secured horizontally at a height of 1 m above the upper edge of the tray and at a fixed distance that will ensure that the foam will fall into the centre of the tray. The branch may be moved only in the horizontal plane during the test.
- 5.2 Prior to igniting the fuel, test the foam apparatus to ensure the discharge rate is as required for the appropriate level of test. Vary the nozzle pressure as necessary. A nozzle pressure of approximately 700 kPa (7 Bar) should be adequate. Once established, the discharge rate should remain constant throughout the duration of each fire test.
- 5.3 When testing performance level Type B foam, place 100L of water and 100 L of fuel into the 4.5m² tray.
- 5.4 When testing performance level Type A foam, place 60L of water and 60L of fuel into a 2.8m² tray.
- 5.5 Prepare the burn back pot in readiness for its use. Take care whilst it is filled with fuel.
- 5.6 Ignite the fuel contained in the fire tray and allow 60 seconds preburn from the time of full involvement.
- 5.7 Apply foam continuously for 120 seconds.
- 5.8 (Optional: In addition, record the 90% control time, being the time when the intensity of the fire has diminished by 90% of its original intensity).
- 5.9 Record the time taken to **completely extinguish** the fire (no flickers or persistent small flames are to be ignored).

- 5.10 Place the burn back pot in the centre of the fire tray.
- 5.11 When 120 seconds have elapsed after the end of foam application, ignite the fuel in the burn back pot.
- 5.12 Record the time taken for 25% of the fuel area within the main fire tray to be re-involved in fire.
- 5.13 (Optional: In addition, record the time when the whole surface of the fuel is re-involved in fire.)
- 5.14 Prepare a statement of the results and observations of this 'type approval' fire test. This will be useful for licensees to appreciate any limitations of the prevailing weather conditions on the running of the test. It may be useful to record some or all of the following ambient conditions prevalent during the test:

Date, location, witnesses, foam manufacturer, brand and type. Batch number, date of manufacture, test protocol, air temperature, wind speed and direction, inside or outside, rain or dry, fuel type, quantity and temperature (start and end of test), type of water used to make the foam solution, foam solution temperature, pressure at nozzle, pump/pressure vessel pressure, total foam and water used, water used in foam production.

6 Referenced Documents

- 6.1 The following documents and publications may be of some relevance. Due consideration is given to the owners of these publications for their permission to reproduce relevant parts as necessary.

6.2 International Civil Aviation Organisation

ICAO Doc. 9137-AN/898 Airport Services Manual. Part 1 – Rescue and Fire Fighting (Third edition., 1990, and amendments), Chapter 8

ICAO Annex 14 ...to the Convention on International Civil Aviation; Volume 1, Aerodrome Design & Operations, Third Edition, July 1999, Chapter 9.

6.3 British (BSI), European (CEN) and International (ISO) Standards

ISO 8412-4	Fire Protection Vocabulary, Part 4: Fire Extinction Equipment
BS4422: Part 4	Glossary of Terms Associated with Fire (Fire Extinguishing Equipment)
BS 188	Determination of the Viscosity of Liquids
BS-ISO 7203-1: 1995	Fire Extinguishing Agent – Foam Concentrates. Part 1. Specification for low expansion foam concentrates for top application to water-miscible liquids.
BS-EN 615: 1995	Fire Extinguishing Agent – -Specifications for powders (other than class D powders)
ISO 5923: 1989	Fire Extinguishing Agent – Specifications for Carbon Dioxide
ISO 7201-1: 1989	Fire Extinguishing Agent – Halogenated hydrocarbons – Part 1: Specifications for Halon 1211 and Halon 1301.
ISO 7201-2: 1991	Fire Extinguishing Agent – Halogenated hydrocarbons – Part 2: Code of practice for safe handling and transfer procedures of Halon 1211 and Halon 1301

6.4 **UK Defence Specifications**

Def Stan 42-40/2 Foams for Use on Fires Involving Hydrocarbon Liquids.

Def Stan 91-91(DERD 2494):Turbine Fuel, Aviation Kerosene Type, JET A-1 AVtur

DERD 2485: AVGAS 100LL Gasoline Aviation Grade 100/130

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Appendix 8F Test Specification for a Performance Test for Dry Powders

1 Introduction

- 1.1 The Civil Aviation Authority (CAA), through CAP 168 Licensing of Aerodromes, has hitherto permitted a 50% remission on the minimum amount of dry powder to be carried on fire vehicles at an aerodrome if Monnex® is used. More recently, alternative dry powders have been developed and the CAA made the decision that dispensation of the quantity of powder carried on fire vehicles at an aerodrome shall be determined from performance against a specifically designed test. A representative fire test rather than a laboratory-based test is preferred in order to fully exercise the powder under test.
- 1.2 The aim of this specification is to simulate the type of fires against which dry powder would be used to combat aircraft fires occurring at an aerodrome:
- a) **Cascade Test**
The rupture of a fuel tank running along the aircraft wing and cascading through space to form a running pool fire.
 - b) **Spray Test**
The break of a high-pressure fuel line with the fuel being sprayed from the broken pipe.
- 1.3 A full-scale test rig has been designed and developed to simulate these cascade and spray fire scenarios.

2 Objective of Testing

The objective of this test specification is to make a comparative assessment of a dry powder's performance, against the criteria as detailed in section 5.0 of this specification.

3 Test Equipment

3.1 Test Location

All tests shall be performed out of doors in an unobstructed area.

3.2 Fire Test Rig

- 3.2.1 A stainless steel tray of nominal dimensions 2 m by 2 m by 0.25 m deep forms the base of the test rig. A hollow rectangular pillar of nominal dimension 2 m high is welded into one corner of the base. This pillar is fitted with rectangular fins fitted at 0.25 m intervals down two adjacent faces. There are seven fins on each side in total. A detailed sketch of the test rig is provided at Figure 8.F.1.
- 3.2.2 The pillar has ten holes (0.9 mm diameter) drilled into its top section, five on each face. Fuel is stored inside the pillar on top of a water base and is pumped through the holes at the rate of approximately 40 litres per minute.
- 3.2.3 Four spray nozzles are mounted on top of the pillar structure, all fed from one source. A protective stainless steel plate is fitted to the top of the rig to ensure the copper

tubing running to the nozzles does not receive too much flame heat. The nozzles are a standard angle, hollow cone type, and are fed from a pressurised line at approximately 6 bar.

- 3.2.4 Two protective shields are attached to the outer edges of the two fuel-covered faces, ensuring flames do not move around the back of the rig.

3.3 Ambient Temperatures

A suitable measuring device is required to measure ambient temperatures.

3.4 Wind Speeds

A limit of 0.5 – 3.0 m per second is imposed on wind speed to ensure that representative airfield winds may be simulated. The wind speed shall be measured and recorded using a suitable anemometer.

3.5 Powder Application

- 3.5.1 The European standard EN615 does not specify a procedure for application of dry powder other than to 'apply the powder'. No criteria are given such as minimum distance for application, or attacking the fire from a leading edge. Such criteria are very important and the skill of the user has a significant bearing on the successful extinguishment of fires using dry powders.
- 3.5.2 Powder application should be from upwind. The full-scale test rig should always be positioned such that the apex of the rig is directly downwind of the firefighter, thereby constituting a leading edge, from which the powder is applied.
- 3.5.3 Care must be taken not to agitate the flames with the powder, as this reduces the repeatability of the test. The powder should be directed towards the test fire with the aim of achieving rapid extinction.
- 3.5.4 The operator should begin application from the leading edge, which as described is always the apex of the test rig. The tray fire in the bottom receives the application first, with the operator sweeping from side to side covering as large an area as possible. It may be necessary to step in either direction to ensure powder reaches into the two furthest corners of the tray.
- 3.5.5 Once the fire in the tray is extinguished, powder application should be concentrated upon the pillar of fire, and swept from side to side up the pillar 'mopping up' the flame until all flame has been extinguished.

3.6 Fuels

Jet A1 should be used as fuel for both the cascade and the spray tests.

Table 8F.1 Physical properties of Jet A1

Flash point	38°C
Auto ignition temperature	248°C
Limits of flammability	0.7 to 5.8%
Specific gravity	0.8
Flame spread (metres per minute)	30

The cascade tests contain the Jet A1 on a water base. The water level should be approximately 100 mm deep.

3.7 **Pre-burn**

A pre-burn of fifteen seconds is prescribed before powder application commences.

3.8 **Fire Extinguishing Units**

All units submitted for testing shall have passed BS EN 3, Parts 1 and 6.

3.9 **Instrumentation**

3.9.1 **Anemometer**

An air velocity meter (anemometer) should be used to measure the wind speed during the fire tests to an accuracy of ± 0.1 metres per second.

3.9.2 **Scales**

The mass of each extinguisher should be measured before and after each test using a suitable weighing device to a resolution of 0.001 kg.

3.9.3 A suitable device for measuring elapsed time (calibrated stopwatch).

3.10 **Timing**

All timing and associated instruction to the test personnel is to be performed by a designated individual. It is their job to ensure that the sequence of events are performed to the specific timescales required for that test. In all tests a calibrated stopwatch is used to measure pre-burn, from the moment of total involvement of the test fire. The dry powder extinguisher operator will then be given a count down to the moment when application of powder should begin.

3.11 **Video**

Each test should be recorded by a video camera. The camera should be positioned upwind of the test fires.

3.12 **Safety**

3.12.1 A risk assessment should be carried out prior to testing. This analysis should then be used to create safety procedures.

3.12.2 Particular issues to receive attention are; fire fighting training for all personnel associated with the project; the wearing of appropriate protective safety clothing; and having alternative extinguishing agents available.

3.12.3 Fuel is stored in reservoir tanks prior to it being pumped through to feed the spray nozzles. The design of the test rig should ensure a safe distance between this fuel and the test fire.

3.13 **Environmental Impact**

Contaminated fuel and dry powder should be removed from the base of the rig and transferred into storage containers which should then be disposed of through an approved effluent disposal agency or appropriate facilities.

4 **Testing Programme**

4.1 **Cascade Tests**

4.1.1 The test rig is moved to ensure the apex of the rig is downwind of the operator, thereby providing the operator with a leading edge.

4.1.2 Fuel is poured into the top of the central tank, floating on a layer of water.

- 4.1.3 The base tray is filled to a level 100 mm from the top of the tray edge with water. Prior to the first of the ten tests, 30 litres of fuel is poured on top of the water in the base of the tray.
- 4.1.4 The weather conditions are recorded, that is ambient temperature and a description of the climate. No tests shall be carried out in the rain.
- 4.1.5 A propane lighting torch is ignited and left lit on standby.
- 4.1.6 The video camera is switched to record.
- 4.1.7 To initiate the cascade fire, the pump is switched on, causing the fluid level in the pillar to rise, thereby displacing the floating fuel through the holes, down the fins and cascading into the base tray, forming a pool. Petrol is then added to the cascading fuel, and lit with the propane torch.
- 4.1.8 Pre-burn timing of fifteen seconds begins once the whole test rig is involved in flame.
- 4.1.9 After the pre-burn time has elapsed, an audible count down to time to extinguish is made, for the benefit of the extinguisher operator. During the pre-burn period the wind speed is measured, and recorded.
- 4.1.10 Powder is applied until the fire is extinguished. If the fire is not extinguished the powder is judged to have failed the test.

4.2 **Spray Tests**

- 4.2.1 The test rig is moved to ensure the apex of the rig is downwind of the operator, thereby providing the operator with a leading edge.
- 4.2.2 For the spray fires, the reservoir tank feeding the four spray nozzles shall be filled with a quantity of fuel, sufficient for the ten tests. The base of the tray is empty throughout the spray tests.
- 4.2.3 The weather conditions are recorded, that is ambient temperature and a description of the climate. No tests shall be carried out in the rain.
- 4.2.4 A propane lighting torch is ignited and left lit on standby.
- 4.2.5 The video camera is then switched to record.
- 4.2.6 To initiate the spray fire, the pump is switched on and the fuel is then pumped through the four spray nozzles.
- 4.2.7 Pre-burn timing of fifteen seconds begins once the spray nozzles are all ignited.
- 4.2.8 After the pre-burn time has elapsed, an audible count down to time to extinguish is made, for the benefit of the extinguisher operator. During the pre-burn period the wind speed is measured and recorded.
- 4.2.9 Powder is applied until the fire is extinguished. If the fire is not extinguished the powder is judged to have failed the test.

5 **Test Criteria**

- 5.1 All dry powders together with their extinguishing units submitted for testing shall have passed BS EN3, Parts 1 and 6.

5.2 **Cascade Testing**

The cascade test is designed to represent the rupture of a fuel tank running along the aircraft wing and cascading through space to form a running pool fire. It is a severe test of dry powder extinguishing agents.

- 5.2.1 Ten cascade tests are to be carried out on the cascade test rig by the appropriate personnel.
- 5.2.2 The tests should be carried out in open spaces where possible to simulate airfield conditions, preventing vortex formation of wind in enclosed spaces.
- 5.2.3 The wind speed must be between 0.5 – 3.0 m per second.
- 5.2.4 The extinguishing units containing the dry powder under test should deliver the powder at a rate of greater than or equal to 0.28 kg/s. (This figure of 0.28 kg/s represents the average discharge rate for a 4.5 kg dry powder extinguisher.)
- 5.2.5 Six out of ten cascade tests must extinguish the fire for a powder to be judged as acceptable.

Adherence to these criteria constitutes a pass of the cascade tests.

5.3 **Spray testing**

The spray test is designed to simulate the break of a high-pressure fuel line with the transfer liquid being sprayed from the broken pipe.

- 5.3.1 Ten spray tests are to be carried out on the spray test rig by the appropriate personnel.
- 5.3.2 The tests must be carried out on open spaces to simulate airfield conditions to prevent vortex formation of wind in enclosed spaces.
- 5.3.3 The wind speed must be between 0.5 – 3.0 m per second.
- 5.3.4 The extinguishing units containing the dry powder under test should deliver the powder at a rate of greater than or equal to 0.14 kg/s. (This figure of 0.14 kg/s represents the average discharge rate for a 1.13 kg dry powder extinguisher.)
- 5.3.5 All ten tests must be extinguished for a powder to be judged as acceptable.
- 5.3.6 The average mass of dry powder used to extinguish the ten spray fires must be less than or equal to 0.32 kg. (This figure of 0.32 kg was derived from the results of an extensive research programme into the performance of Monnex® dry powder in a spray fire scenario.)

Adherence to these criteria constitutes a pass of the spray tests.

For an overall pass a powder must adhere to sections 5.1, 5.2 and 5.3.

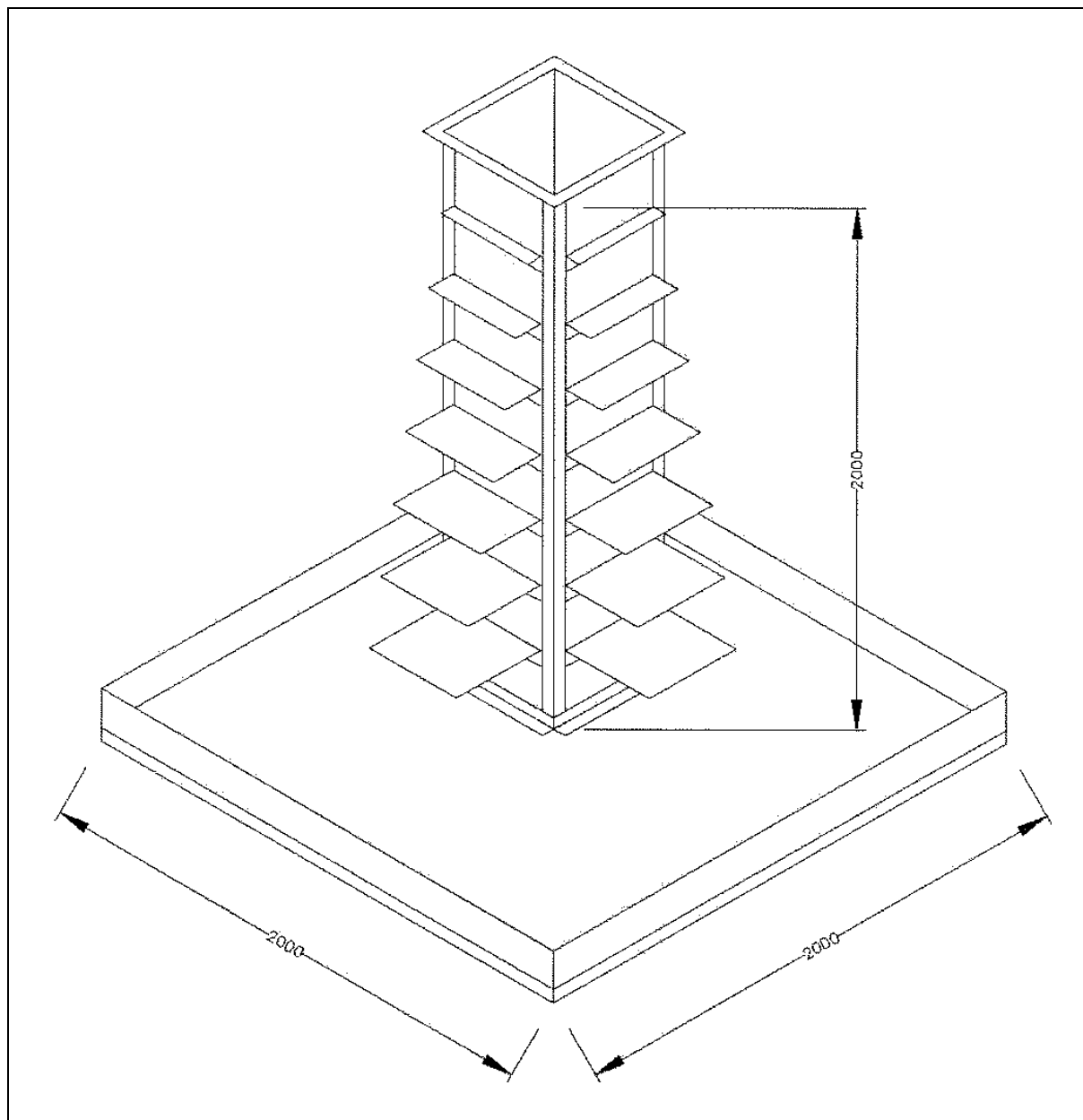


Figure 8F.1 General Drawing of Test Rig

Appendix 8G Rescue and Fire Fighting (RFF) Facilities at RFF Category Special, One & Two Aerodromes

1 Introduction

- 1.1 During a recent review of aerodrome licensing criteria it was identified that the needs of licensees operating smaller aerodromes would be better served by extracting the applicable RFF requirements into a distinct appendix to CAP 168 Chapter 8.
- 1.2 This Appendix describes some minimum RFF requirements which are specifically applicable to aerodromes where the RFF category is Special, 1 or 2. The requirements applicable to aerodromes where the RFF category is greater than 3 are published in the main body of CAP 168 Chapter 8.
- 1.3 Licensees should note that certain requirements related to RFFS provisions are applicable at all licensed aerodromes irrespective of the RFF category. Therefore, Appendix 8G should be read in conjunction with CAP 168 Chapters 8 and 9.

2 Minimum Scale of Services to be Provided

The aerodrome management shall provide and staff an effective RFF facility which can respond to an aircraft accident/incident pending the arrival of external emergency services.

3 Availability of RFFS

The facility shall be available whenever flights required to use a licensed aerodrome are taking place. It shall be maintained for at least fifteen minutes after the time of departure of any aircraft requiring the use of a licensed aerodrome.

4 Temporary Depletion of RFFS

If the facility is not available for any reason, pilots shall be made aware of its non-availability and movements by aircraft required to use a licensed aerodrome shall cease until it has been re-established. Exceptions may be made for emergency landings and for occasions when, in the pilot's opinion, a diversion or hold may introduce a more significant hazard.

5 Scale of RFFS

Facilities shall be provided on a scale commensurate with the size of aircraft using the aerodrome taking account of its intended use in accordance with Section 3 of CAP 168 Chapter 8.

- 5.1 Category Special – Fixed wing aircraft up to but not including 9 metres in length engaged in flying instruction. Fixed wing aircraft engaged in public transport of passengers, beginning and ending at the same aerodrome, in aircraft up to 2730 kg maximum total weight authorised. Helicopters of overall length, including the tail boom and rotors, up to but not including 15 metres engaged in flying instruction.

- 5.2 Category One – Fixed wing aircraft of overall length up to but not including 9 metres, engaged in public transport of passengers.
- 5.3 Category Two – Fixed wing aircraft of overall length equal to, or greater than 9 metres, up to but not including 12 metres, engaged in the public transport of passengers.
- 5.4 The facility shall consist of at least the following:
- 5.4.1 A mechanically reliable and serviceable vehicle capable of accommodating the RFF personnel and traversing the terrain likely to be encountered in response to any incident. All wheel drive should be necessary. The specified equipment shall be carried either on the vehicle or on a suitable trailer connected to the vehicle.
- 5.4.2 The vehicle and equipment should be protected from the adverse effects of weather.
- 5.4.3 Sufficient quantities of principal and complementary fire fighting agent. See Table 8.H.1. Foam concentrate shall meet ICAO Performance Level 'B'. See Appendix 8E.
- 5.4.4 Dry powder and halogenated hydrocarbon fire extinguishing agents are normally considered more efficient than carbon dioxide for aircraft rescue and fire fighting operations. When selecting dry powder for use with foam, care must be exercised to ensure compatibility. Where the main complementary agent is a dry powder there shall be a quantity of halogenated halocarbon or CO₂ provided with a suitable applicator for use on aircraft engine fires. The appropriate minimum quantity of halogenated hydrocarbon is 9 kg. The appropriate minimum quantity of CO₂ shall be 18 kg.

Table 8G.1: Minimum Quantities of Principal and Complementary Fire Extinguishing Agents Required

Aerodrome Category (RFF)	Foam meeting Performance Level B				Complementary Agent (kg)	
	Water (litres)	Foam Concentrate (litres)		Discharge Rate Foam solution (litres/minute)	Dry powder or Halogenated hydrocarbon	or CO ₂
		at 6% at 3%				
Special	90	6	3	60	18	36
1	230	14	7	230	45	90
2	670	40	20	550	90	180

- 5.4.5 Where the main complementary agent is halogenated hydrocarbon or CO₂ there shall be a quantity of dry powder provided to assist in dealing with a running fuel fire. Where this additional quantity of dry powder is provided in hand-held extinguishers of minimum capacity 9 kg, it will not be necessary to comply with the discharge rates of 1.35 kg/s or 2 kg/s. The appropriate minimum amount of powder to be provided is 9 kg.
- 5.4.6 Hose line(s) of sufficient length(s) appropriate to dealing with fires involving the sizes and types of aircraft normally using the aerodrome and a hand controlled foam-making branch.
- 5.4.7 A 200% reserve of foam concentrate and 100% reserve of complementary agent shall be available at the aerodrome.

5.4.8 Minimum quantity of ancillary equipment appropriate to the sizes and types of aircraft:

Table 8G.2

Equipment	Category Special One/Two
Axe, aircraft non-wedging	1
Saw, general purpose	1
Crowbar, 1m	1
Side cutting pliers	1 pair
Set Screwdrivers (Phillips and Slotted)	1 each
Fire resistant blanket	1
Ladder/steps (appropriate to aircraft size and type)	1
Bolt cropper	1
Hacksaw complete with six blades	1
Harness Knife (with sheath)	1
Tin snips	1
General Purpose Line (50 mm circumference x 15 m length)	1
Hook, grab or salving	1
Adjustable wrench	1
Ambulance Dressing No 1 (127 mm x 102 mm)	3
Ambulance Dressing No 2 (203 mm x 178 mm)	4
Ambulance Dressing No 3 (280 mm x 178 mm)	4
Ambulance Dressing No 4 (330 mm x 203 mm)	2
Eye pads	2
Triangular bandages	4
'Tuf Cut' scissors	1 pair
Blankets (foil/woollen)	4
Stretcher/corpse carrying bag	1

- 5.4.9 Radio communications equipment shall be provided in fixed or portable form and should have a range which will ensure effectiveness within response areas.
- 5.4.10 The above list of rescue and medical equipment is not exhaustive and the licensee should assess the level commensurate with the hazard and risk of the scale of aircraft operations at the aerodrome (e.g. the anticipated maximum number of occupants of the largest type of aircraft using the aerodrome).
- 5.4.11 Hand lamps and appropriate portable lighting equipment shall be provided at aerodromes which are licensed for use during the hours of darkness.
- 5.4.12 Personal protective equipment and respiratory protective equipment appropriate to the hazard and risk shall be provided. Guidance on the selection of appropriate equipment is available from the Health and Safety Executive.

- 5.4.13 In order to ensure reliability and effectiveness, all equipment shall be properly maintained and regularly checked for serviceability. As a guide all equipment should be checked for serviceability at least once every three months.
- 5.4.14 The following checks should be made daily before the commencement of any flying at the aerodrome:
- Check extinguishing agents' availability.
 - Check availability, condition and security of RFF equipment including hose line and hand branch.
 - Check personal protective equipment.
 - Check vehicle including lubricant and coolant levels, tyres, battery and electrical systems.
 - Start engine and check general operation of all controls.
 - Check radio equipment and alerting system.
- 5.4.15 Some items, such as vehicle servicing and pressure unit testing will require more formalised arrangements.
- 5.4.16 The Home Office provides guidance on the inspection and testing of most pieces of fire-related equipment in its Technical Bulletin 1/1994. In addition, manufacturers of the equipment will generally be able to provide guidance on maintenance and testing.
- 5.4.17 All inspections shall be conducted by a competent person. Records of tests and inspections shall be kept.

6 Minimum Number of Staff Designated as RFFS Personnel

- 6.1 The operational objective shall be to staff the facility and respond as quickly as possible to any aircraft incident. In any event, a meaningful response to an accident involving fixed wing aircraft shall be made within three minutes in conditions of optimum visibility and surface state.
- 6.2 The response to an accident involving helicopters shall be made within two minutes.
- 6.2.1 A method of monitoring the aircraft movement area for the purpose of alerting and deploying the facility shall be provided.
- 6.2.2 An instantaneous method of alerting the designated RFF operating personnel of an incident shall be provided.
- 6.2.3 A reliable method of summoning assistance from off-aerodrome local emergency services shall be provided.
- 6.3 Trained personnel shall be designated to operate the RFF facility whenever flights required to use a licensed aerodrome are taking place. The number of personnel and minimum supervisory level of supervision shall be determined by the licensee taking into account the operating characteristics of the equipment, efficiency of operation and safe working practices but shall not be less than:

Table 8G.3

RFF Category	Minimum number of personnel	Minimum supervision level
Special	Two	To be determined locally
One	Two	To be determined locally
Two	Three	Lower Category Airport Junior Officer/Supervisor

- 6.3.1 Personnel detailed to be available to operate the facility may be engaged on other activities provided that a response to an aircraft accident meeting the objectives of Paragraph 6 above can be made. If fuelling of aircraft is one of the activities undertaken, then measures to ensure that fuel-contaminated clothing can be quickly changed, shall be in place.
- 6.3.2 At aerodromes where the RFF category is Special, 1 or 2, personnel designated to operate the RFF facility may be engaged on fuelling of aircraft provided that:
- a) response time(s) are not compromised;
 - b) they remain throughout the fuelling operation immediately available to respond. This requires the fuelling system to be of a type which allows instantaneous shut off, preferably by release of a handgrip;
 - c) that fuel-contaminated clothing may be quickly removed and personnel may quickly don personal protective clothing appropriate for use in fire fighting activities;
 - d) personnel are fully trained for all relevant duties specific to the fuelling of aircraft **and** the RFFS.
- 6.3.3 Regard shall be given to the arduous nature of activities likely to be undertaken. Licensees shall assess the medical and fitness suitability of all personnel detailed to participate in the task.

7 Training

- 7.1 Licensees shall ensure that participating personnel are trained and competent in the operation of the RFF equipment provided at the aerodrome, taking into account the hazards likely to be experienced.
- 7.2 The licensee shall ensure that the health and safety risks arising from training are assessed and addressed.
- 7.3 The licensee shall nominate a competent person(s) to conduct training.
- 7.4 Assessment of the competency of the person(s) determining, evaluating and conducting training shall be the responsibility of the licensee. The CAA may ask for details of that assessment.
- 7.5 Personnel shall receive training prior to initial participation and periodically thereafter. Periodicity will be determined by the licensee or his nominated competent person.
- 7.6 Inexperienced operatives shall receive detailed theoretical and practical training relevant to their role. An example of the topics to be included in a balanced training programme is given below:
- 7.7 **Typical Course Syllabus (Lower Category Aerodromes)**
- 7.7.1 Licensee's Safety Policies
 - 7.7.2 Hazards Arising from Aircraft Operation and Safety-related Procedures
 - 7.7.3 Chemistry of Combustion
 - 7.7.4 Extinguishing Agents – Use and Methods of Application
 - 7.7.5 First Aid Fire Extinguishers
 - 7.7.6 Fire Hose
 - 7.7.7 Fire Appliances and Equipment:

- 7.7.7.1 Selection, Storage and Handling, Use, Inspection and Test, Maintenance and Record Keeping
- 7.7.8 Personal Protective Equipment
- 7.7.9 Aircraft Construction
- 7.7.10 Aircraft Familiarisation
- 7.7.11 Aerodrome Topography
- 7.7.12 Fire and Rescue Procedures
- 7.7.13 Fixed Wing Aircraft (Tactics and Techniques):
 - 7.7.13.1 Appliance Positioning, External/Internal Fires, Access, Forcible Entry, Assistance with Evacuation
- 7.7.14 Rotary Wing Aircraft (Tactics and Techniques):
 - 7.7.14.1 Appliance Positioning, External/Internal Fires, Access, Forcible Entry, Assistance with Evacuation
- 7.7.15 First Aid and Casualty Handling
- 7.7.16 Emergency Planning
- 7.7.17 Statutory Obligations:
 - 7.7.17.1 Air Navigation Order, Licensing Requirements (CAP 168), Aerodrome Manual, Fire Prevention, Health and Safety at Work etc. Act, Duty of Care
- 7.7.18 Theoretical, Practical, Written and Oral Assessment
- 7.7.19 Issue and Amendment of Personal Training Record(s)
- 7.8 Personnel should be given every opportunity to familiarise themselves with all equipment on a regular basis. Some of the topics listed at paragraph 7.7 may be more specific to initial rather than recurrent training where the effectiveness of personnel operating as a team may be more important.

8 Emergency Planning/Emergency Orders

- 8.1 Emergency Orders, which form part of the Aerodrome Manual, shall include arrangements for alerting the facility, for the immediate notification of other key aerodrome personnel and for summoning externally based emergency services. These Orders shall detail procedures for anticipated emergency situations including accidents/incidents which occur up to 1000 metres from the runway threshold. The areas within which a response will be made shall be shown in the Aerodrome Manual.
- 8.2 Off-aerodrome emergency services should be given the opportunity to familiarise themselves with the emergency procedures as well as the topography of the aerodrome.
- 8.3 The RFFS should operate as an effective unit. The licensee shall be required by the CAA to demonstrate that effectiveness from time to time.

9 Inspections of the RFFS by Inspectors of the CAA Aerodrome Standards Department

- 9.1 Section 22 of CAP 168 Chapter 8 is applicable to aerodromes where the RFF category is Special, 1 or 2.
- 9.2 At aerodromes where the RFF category is Special, 1 or 2 the CAA will, prior to initial licensing, be required to be satisfied that off-aerodrome emergency services are familiar with the emergency procedures and the topography of the aerodrome.
- 9.3 Prior to initial licensing, licensees will be required to demonstrate the effectiveness of the RFFS to operate as an effective unit. This may require the participation of the local emergency services at an operational demonstration of the aerodrome emergency plan.

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Appendix 8H Training of RFFS Personnel at All Licensed Aerodromes

1 Introduction

1.1 Fire fighting personnel require proper training if they are to operate in an effective manner. All personnel engaged on rescue and fire fighting duties must receive initial and recurrent competence-based training relevant to their role. CAP 699 describes the Standards of Competence applicable to personnel employed in the RFFS at United Kingdom licensed aerodromes. It also describes the criteria by which the CAA will judge the suitability of training providers and assessors.

1.2 The following list of topics is representative but not exhaustive. This list may be used to construct a balanced on-station local training programme.

2.1 Aerodrome familiarisation

Recognise the runway and taxiway identification system and associated pavement marking, lighting and signs.

Comply with local rules regarding vehicle movements and access.

Locate a given point on the aerodrome using references given by ATC.

Locate all emergency access routes and other non standard routes used to traverse areas where aircraft accidents may occur including difficult environs and runway undershoot/overshoot areas.

Understand and comply with special procedures during low visibility conditions.

Identify areas where hazardous materials including freight may be stored.

2.2 Aircraft Familiarisation

Locate normal entry doors and emergency exits for aircraft normally using the aerodrome and describe methods of operation.

Describe slide deployment and methods of evacuation.

Identify aircraft seating and cargo configurations.

Locate and utilise aircraft break-in areas where installed.

Locate and utilise battery isolators.

Locate and utilise installed aircraft fire protection systems.

Identify types of fuel and locations of fuel tanks.

Identify component parts of aircraft using correct terminology.

Identify aircraft construction materials and describe the hazards arising from aircraft construction.

2.3 Emergency Plan

Recognise different types of emergency contained in the emergency plan.

Comply with role as described in emergency plan.

Understand relevant roles of other aerodrome departments and/or external agencies.

2.4 Communications

Identify relevant radio frequencies.

Demonstrate correct radio procedures, terminology, and standard messages.

Demonstrate hand signals used to communicate with air crew.

2.5 Personal Safety

Identify the hazards arising from aircraft incidents and aircraft systems.

Demonstrate correct and expeditious use of personal protective equipment.

Understand the limitations of personal protective equipment.
Demonstrate techniques to be used when working in confined areas.
Demonstrate techniques to be used when trapped or disoriented.
Describe the purpose and limitations of self contained breathing apparatus (SCBA).
Demonstrate correct and expeditious donning and start up procedures for SCBA.
Demonstrate use of SCBA in actual or simulated conditions i.e. smoke, heat and humidity etc.
Demonstrate correct techniques when working as a team in SCBA.
Demonstrate emergency actions to be taken in the event of; low air, DSU operations, unit malfunction, face mask displacement, etc.

2.6 **Fire Behaviours**

Demonstrate an understanding of causes of fire development, heat transfer and fire classification.
Demonstrate an understanding of the fire characteristics of materials used in aircraft construction including aviation fuel.

2.7 **Extinguishing Agents**

Understand the principles of fire initiation, spread and suppression/extinction.
Understand the various types of extinguishing agents commonly available.

2.8 **Foam Monitors/Bumper Turrets**

Demonstrate operation of foam monitors in jet and dispersed pattern.
Demonstrate correct application methods.
Demonstrate judicious use of extinguishing agents.
Understand effects of wind on foam monitor use.

2.9 **Hand Line Use**

Demonstrate selection and deployment of hand lines.
Demonstrate correct application of foam, foam solution and water.
Demonstrate judicious use of extinguishing agents.
Understand effect of wind on hand line and branch pipe effectiveness.

2.10 **Complementary Agent**

Select and deploy complementary agents carried.
Demonstrate correct application of complementary agents.
Demonstrate tactics for dual agent application.
Understand effects of wind on complementary agent application.

2.11 **Tools/Equipment**

Identify and locate each tool carried.
Demonstrate an understanding of the safety procedures necessary when operating equipment.
Demonstrate tactical use of each tool carried.

2.12 **Vehicle Replenishment**

Identify location of local water supplies.
Demonstrate procedures for replenishment using local water supplies (hydrants, tanks, static water, etc.).

2.13 **Fire Fighting Operations**

Demonstrate correct fire fighting tactics for a variety of scenarios involving aircraft normally using the aerodrome (engines, undercarriage, APU, cargo hold, avionics, etc.).

Demonstrate tactics for securing and maintaining rescue paths.
Demonstrate tactics necessary to protect fuselage from fire exposure.
Demonstrate tactics necessary to control/extinguish three dimensional fires.
Describe the procedures for maintaining integrity of foam blankets.
Describe procedures for controlling/containing fuel spillage.
Demonstrate casualty handling and removal from an aircraft fuselage.

2.14 **First Aid**

Carry out primary and secondary surveys for life threatening injuries.
Establish airway.
Carry out cardiopulmonary resuscitation.
Identify and treat internal/external bleeding.
Identify and treat casualty suffering from shock.
Identify injuries to skull, spine, chest and extremities.
Identify internal injuries.
Place casualties in recovery position.
Move casualties.
Treat burns.
Understand particular problems related to injured children/babies.
Manage unconscious casualties.

2.15 **Vehicle Driving**

Correctly operate all vehicle controls.
Drive vehicle within limits of design.
Drive vehicle in compliance with legislation and local by-laws.
Operate vehicle to traverse difficult terrain.
Correctly position vehicle at an aircraft incident.
Pump 'on the move'.

2.16 **Supervision/Command**

Ensure adherence to safety procedures.
Assess tactical priorities to maximise passenger survivability.
Select, deploy and direct fire fighting tactics.
Manage resources to ensure effectiveness.
Communicate with external agencies.

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Chapter 9 Emergency Planning

1 Introduction

- 1.1 Aircraft accidents have the potential to involve a large number of casualties and fatalities. However, although they may be considered as disasters for the purposes of emergency planning, it would be incorrect to suggest that all aircraft accidents have the capability to achieve disaster proportions. Many will be capable of being dealt with locally using the facilities provided by the aerodrome or with limited support from local authority emergency services. Nevertheless, an incident involving even the smallest aircraft can be life threatening, not only to the occupants but also to those in the vicinity of the incident. Whilst the scale of response to a disaster may be much greater than that required for the majority of aircraft accidents, the principles of prevention, preparedness, response and recovery do not change.
- 1.2 Even though the licensee will have demonstrated to the CAA's Inspecting Officers the ability of the aerodrome to meet the fire, rescue and medical requirements specified earlier in this publication, the mere provision of equipment, supplies, or personnel, to the required standard does not necessarily constitute an efficient operational unit. The licensee should also be able to demonstrate that the aerodrome's emergency arrangements are effective, and that appropriate use can be made of all available resources, in particular external emergency services, if an aircraft accident or other incident were to occur.
- 1.3 An aerodrome may generate hazards in addition to those that relate directly to the operation of aircraft e.g. the handling of hazardous cargoes or bulk fuel storage. Where appropriate, licensees should make plans to deal with emergencies which arise from these peripheral activities. The quantities of equipment, extinguishing agents and personnel required to deal with such emergencies may exceed those provided by the aerodrome for the scale of RFFS required to protect the movements of aircraft only.
- 1.4 In terms of emergency planning, certain Regulations that apply to other industries may also apply to aerodromes, for example the Control of Major Accident Hazards Regulations 1999 (COMAH) applies where threshold quantities of dangerous substances identified in the Regulations are kept or used.
- 1.5 Detailed guidance regarding emergency planning can be found in the documents listed in the bibliography provided at paragraph 14 of this chapter. The way in which individual services or agencies are organized varies throughout the country. However, while many of the principles are universally applicable, the United Kingdom Home Office publication 'Dealing with Disaster' reflects the arrangements and terminology commonly used in England and Wales. It also contains consolidated advice regarding a framework within which more detailed plans may be prepared.
- 1.6 Licensees should be aware of Government Emergency Planning programmes relating to large-scale national emergencies which could include terrorist attacks in various forms, and should develop a 'Strategic Focus' that is based on the Civil Contingencies Act. They are also encouraged to establish and maintain close liaison with their Local Authority Fire Brigade Liaison Officer who should be able to provide advice regarding special arrangements that may have an impact on the aerodrome.
- 1.7 Further information can be obtained from the Office of the Deputy Prime Minister (website www.odpm.gov.uk).

2 Objectives

2.1 Emergency Planning

The objective of aerodrome Emergency Planning is to anticipate the effects an emergency might have on life, property, and aerodrome operations, and to prepare a course, or courses, of action to minimize those effects, particularly in respect of saving lives.

2.2 Emergency Plan

The objective of an Emergency Plan is to consider and record how an emergency situation or incident can be managed in order to minimize the effects it may have on life, property, and aerodrome operations, and how the best use of appropriate available resources should be applied to achieve that aim.

3 Aerodrome Emergency Planning

3.1 An Aerodrome Emergency Plan, commensurate with the level of aircraft operations and other activities, shall be established at an aerodrome as part of the process of preparing an aerodrome to cope with an emergency.

3.2 The aerodrome Emergency Plan shall anticipate the need to alert and coordinate the responses of the different aerodrome agencies (or services), in particular the aerodrome Rescue and Fire Fighting Service (RFFS), and of those agencies in the surrounding community that could be of assistance in responding to an emergency.

3.3 Emergency Orders shall clearly translate the Emergency Plan into a course or courses of action to be followed, for a given emergency or incident, that will ensure the achievement of the objectives stated at paragraph 2.

3.4 Emergency Instructions should provide detailed instructions to individuals, or to departments, of the actions required to initiate the Emergency Plan.

3.5 The Aerodrome Emergency Plan shall include procedures for leading passengers, evacuated from aircraft, to secure areas away from the scene of an incident, and shall ensure that the relevant Aerodrome Emergency Orders suitably address this topic.

4 Emergency Planning Committee

4.1 The aerodrome licensee should form an Emergency Planning Committee to discuss, determine and implement emergency planning arrangements commensurate with the sizes and types of aircraft using the aerodrome. The committee should include the appropriate Heads of Sections and local government assisting services. Some of the organisations from which potential committee members might be considered are listed at Appendix A.

4.2 The Committee while forming the Emergency Plan, should meet regularly to discuss tactics, liaison, co-operative training, and exercise planning etc. (See Guidance Notes at Appendix 9B). Post accident and post exercise meetings should be held to consider the work carried out by the organisation and to analyse the results with reference to improvement possibilities. The meetings should be chaired by a senior member of the aerodrome management team with the direct support of the Licensee. Records of the meetings should be taken and retained and the person accountable for the emergency planning arrangements shall be identified within the aerodrome manual.

- 4.3 Core component parts of the plan should be identified and it should be established how and when these are to be tested. It may be appropriate to test some parts of the plan in isolation, provided satisfactory assurance of overall effectiveness can be achieved.
- 4.4 The Committee shall ensure that comprehensive plans are promulgated setting out the actions to be taken by, and the responsibilities of, all those concerned with the handling of emergencies.
- 4.5 Where a response from off-aerodrome emergency services is included within the Emergency Plan, the effectiveness of a concerted response depends on the preparedness and familiarity of all the emergency services with all elements of the plan. Many off-aerodrome emergency services have a statutory obligation to respond to significant emergencies arising within their geographical area. This obligation places on them a responsibility to become involved with the process of aerodrome emergency planning. Licensees should provide external emergency services with every opportunity to be involved in the planning and exercising of the Emergency Plan.
- 4.6 It is important to consider budgetary factors when planning emergency exercises. Many Local Authorities may need up to two years notice to ensure participation and some may wish to charge for attendance. It should be noted that the existence of such charges will not be accepted by the CAA as adequate reason for non participation.
- 4.7 The Emergency Planning Committee should formally review and resolve all findings and actions arising from the exercises to correct any deficiencies found in the emergency planning arrangements. Where significant changes to the Emergency Plan become necessary, further partial exercises are recommended to test the effectiveness of these changes
- 4.8 Aerodrome licensees themselves need not necessarily provide resources to deal with all eventualities. They may contract other organisations to make that provision on their behalf. However, these contractual arrangements must be agreed and formally recorded in the Aerodrome Manual so that no agency is in any doubt as to its obligations.

5 Drawing up Emergency Orders

- 5.1 Emergency Orders should be drawn up detailing the lines of communication that will ensure all the agencies (or services) appropriate to the emergency are notified and alerted. These Orders should be confined exclusively to actions to deal with emergencies or incidents.
- 5.2 The model Emergency Orders shown in this document (see appendix 9C) are appropriate to aerodromes graded from Categories 3 to 10 for Rescue and Fire Fighting purposes. For Special, and Category 1 or 2 aerodromes the licensee should be able to demonstrate to the regional aerodrome inspector that there is an appropriate emergency plan in place to deal with emergencies likely to be encountered on the aerodrome.
- 5.3 The Emergency Committee should liaise with local fire services and establish responsibilities for command particularly for the scene immediately adjacent to the aircraft. It is recommended that the senior airport fire officer on duty should retain that responsibility, because of the specialized nature of a rescue and fire fighting operation at an aircraft accident and the risks to personnel not completely familiar with aircraft. Any agreements should be formally recorded in the aerodrome manual.

- 5.4 Emergency Instructions should be drawn up and displayed, detailing the actions to be taken by any particular person or service under each emergency situation, to ensure that the Emergency Orders are completed. They should contain separate sections for display and use by the various persons or services concerned, e.g. Air Traffic Control, Aerodrome Rescue and Fire Fighting Service, Aerodrome Telephone Exchange; Police, etc. (see Appendix 9D)

6 Emergencies or Incidents

6.1 Aircraft Accident/Aircraft Accident Imminent

Aircraft accidents which have occurred or are inevitable on, or in the vicinity of, the aerodrome.

6.2 Aircraft Ground Incident

Where an aircraft on the ground is known to have an emergency situation other than an accident, requiring the attendance of emergency services.

6.3 Full Emergency

When it is known that an aircraft in the air is, or is suspected to be, in such difficulties that there is a danger of an accident.

6.4 Local Standby

When it is known that an aircraft has, or is suspected to have, developed some defect but the trouble would not normally involve any serious difficulty in effecting a safe landing.

6.5 Weather Standby

When weather conditions are such as to render a landing difficult or difficult to observe.

7 Other Duties

- 7.1 The principal objective of the RFFS is to save lives in the event of an aircraft accident or incident. Equipment and techniques recommended are generally directed towards this goal. However, aerodrome RFFS personnel may be called upon to perform other duties that occur such as attending domestic fires, providing special services or to provide precautionary cover during hazardous operations, e.g. fuel flow tests, or during the refuelling of aircraft with passengers on board. Emergency Orders should include the action to be taken by the RFFS and, where appropriate external emergency services, in the event of such calls being received.

- 7.2 The classification 'Domestic' is given to any fire:

- a) On the aerodrome not included in paragraph 6.
- b) Outside the aerodrome boundary (other than aircraft accidents) which is liable to constitute a danger to flying or aerodrome property.
- c) Which the Aerodrome Rescue and Fire Fighting Service might attend:
 - i) according to an agreement with the local fire service;
 - ii) in response to calls for the public or police on humanitarian grounds.

8 Unlawful Acts

Action to be taken in the case of any unlawful act will be contained in the airport's contingency plan which will be drawn up in conjunction with the local Police Authority.

9 Off-Aerodrome Accidents

Emergency Orders should contain details of the action to be taken in the case of aerodrome accidents occurring outside the aerodrome boundaries.

10 Command and Control

- 10.1 The importance of an agreed framework for command and control should not be underestimated. This enables each agency to tailor its own response and interface with the plans of other agencies without disrupting its own procedures.
- 10.2 A system comprising three management tiers; strategic, tactical, and operational has been adopted by many emergency services. The definitions relating to these three levels of command and control are set out below. Whether it should be fully implemented at an aircraft accident should be determined by the severity and numbers of casualties. At the start of any incident for which there has been no warning, the Operational level should be activated first, with the other levels coming into being with the escalation of the incident, or a greater awareness of the situation.
- 10.3 Suitable facilities should be provided appropriate to the scale of operation at the aerodrome, to ensure effective coordination and management of all the services responding to an emergency. [See ICAO Annex 14 Vol. 1 which makes recommendations on the establishment of Emergency Operations Centres and Mobile Command Posts and the roles of personnel assigned to them].
- 10.4 A suitable communications system linking the coordinator(s) with all participating services should be provided,
- 10.5 **Operational Level (Bronze)**
 - 10.5.1 On arrival at the scene of an accident or incident, the emergency services should take appropriate immediate measures and assess the extent of the problem, under the command of their respective Incident Officers. They should concentrate on their specific tasks within their areas of responsibility and act on delegated responsibility from their parent organisations until other levels of command are established. The command of the resources belonging to any agency or used for a specific purpose, should be retained by that agency. Each agency must liaise fully and continually with others deployed within the same area to ensure an efficient and combined effort. Where appropriate, the police should normally act as the coordinator of this response at the scene.
 - 10.5.2 These arrangements should usually be adequate for the effective resolution of most incidents. However, for more serious incidents – requiring significantly greater resources – it may be necessary to implement Tactical and Strategic levels of incident management.
- 10.6 **Tactical Level (Silver)**
 - 10.6.1 A '**Tactical**' level of management is introduced to prioritise the allocation of resources, to plan and co-ordinate when a task should be undertaken, and to obtain other resources as required.

- 10.6.2 Most but not all, of the **Tactical** functions should be discharged at or close to the scene of the incident. Some agencies, particularly local authorities, may prefer to operate from their administrative offices but should normally send an officer to the scene to liaise with the Incident Officer(s). Planning must also take into account that resources may be required to be deployed over a diverse area.
- 10.6.3 When more than one agency is operating at the Tactical level there must be consultation between the various agency Incident Officers. The Tactical Commanders should not become involved with the activities at the scene being discharged by Incident Officers, but concentrate on the overall general incident management. In order to effect co-ordination, an inter-agency meeting should be held at regular intervals attended by each Tactical Commander and normally chaired by the police. Liaison officers from the Local Authority and other agencies as appropriate should attend.
- 10.6.4 If it becomes apparent that resources, or expertise beyond the level of the Tactical Commander are required, or should there be the need to co-ordinate more than one incident/scene (where tactical command has been established), it may be necessary to implement a 'Strategic' level of management.

10.7 **Strategic Level (Gold)**

The purpose of the Strategic level of management is to establish a framework of policy within which Tactical Commanders will work, to give support to the Tactical Commanders by the provision of resources, to prioritise demands from any number of Incident Officers and to determine plans for the return to a state of normality once the incident is brought under control. The requirement for Strategic management may be confined to one particular agency. However, certain incidents require a multi-agency response at the **Strategic** level in order to effect resolution.

10.8 **Use of 'Zoning' to effect overall control at an accident site**

- 10.8.1 The principle of dividing an accident site into separate areas is to establish effective overall control of the site by the Incident Control Officer or Tactical Commander, and to maximize the efficiency of the various disciplines dealing with different aspects of the emergency.
- 10.8.2 The process requires the establishment of a number of zones:
- Zone 1. This is the area within which the attending Fire Services will operate with the aim of establishing fire control and of rescuing the occupants.
 - Zone 2. This is the Casualty Clearance Zone and is sited upwind of Zone 1. Here medical services will initiate the removal of the injured to hospitals or rest centres as appropriate.
 - Zone 3. This zone is sited at the nearest hardstanding to Zone 2 and should be designated the Ambulance Loading Point.

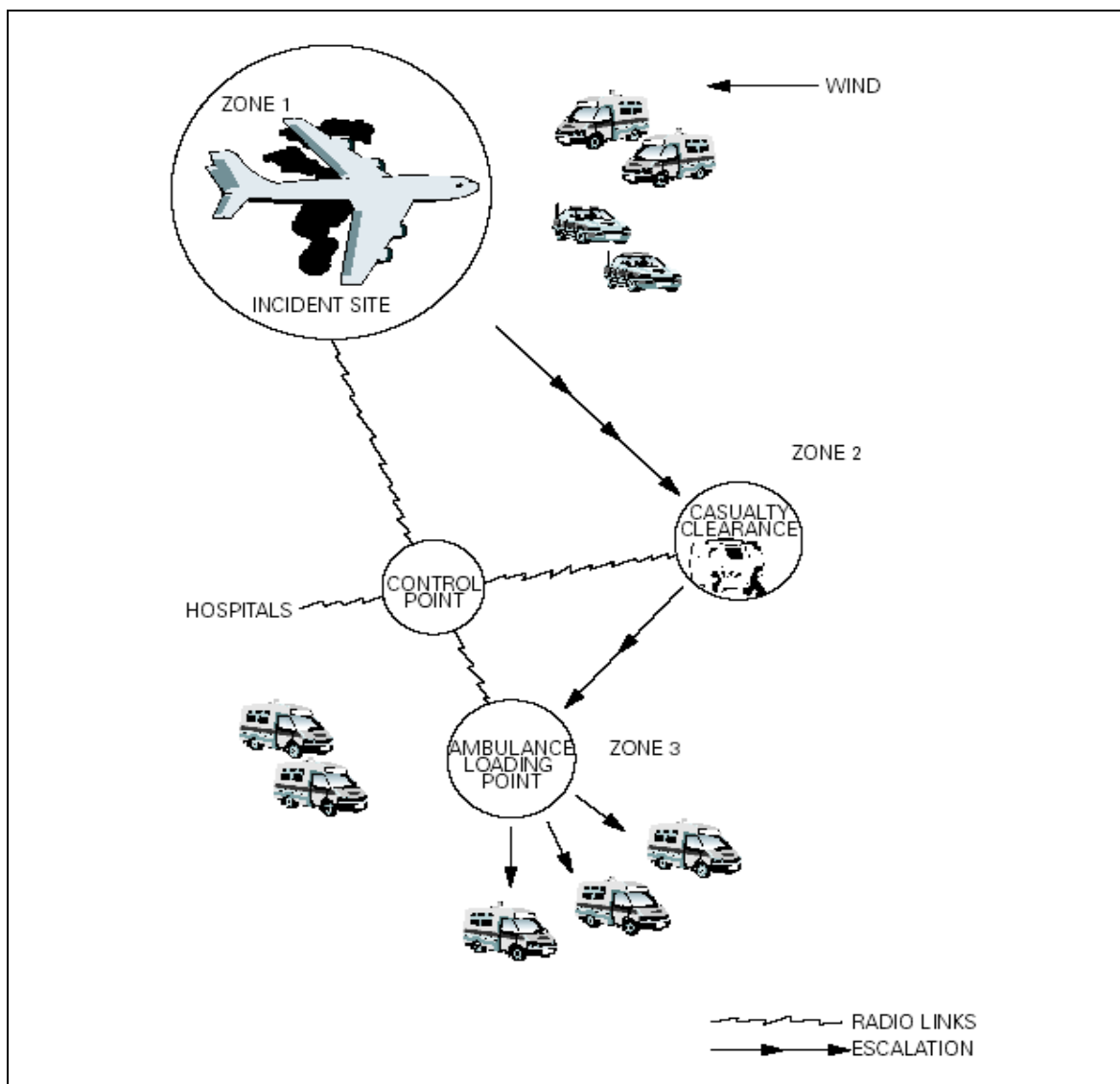


Figure 1 Zoning Plan

- 10.8.3 An Incident Control Point should be established close to Zones 1 and 2 where the Incident Control Officer will maintain overall control of those responding to the emergency. A communication system should be set up linking the Incident Control Officer with the Officers-in-Charge of each Zone, with local hospitals and other organizations as appropriate.

11 Exercises

- 11.1 There are basically three types of exercise though there are variations on the theme of all three of them. The three main types are:
- 11.1.1 'Discussion' based which are generally low-cost activities designed to inform participants about the organization and procedures which would be used to respond to an incident.
- 11.1.2 'Table-top' which are a form of role-play exercises. These are a cost effective and efficient method of testing plans, procedures and people, and will provide the players involved with an opportunity to interact with and understand the roles and responsibilities of the agencies taking part.

- 11.1.3 'Live' exercises which range from small scale testing of one component of the response through to a full scale multi-agency test of the whole emergency plan.

12 Testing

- 12.1 The Committee shall arrange for periodic testing of the adequacy of the plan and for reviewing the results in order to improve its effectiveness. This may be via meetings, partial exercises, or table-top exercises but must include a full scale test of the emergency planning arrangements at least biennially.
- 12.2 Each emergency planning exercise should be adequately pre-briefed and the objectives of the exercise clearly stated and understood by all.
- 12.3 Members of the Senior Management team should also fulfil their planned emergency roles as part of the test.
- 12.4 A sufficient number of observers should be appointed to assess the effectiveness of the exercise in fulfilling its objectives. Each observer should formally record their findings.
- 12.5 The plan shall be tested by conducting:
- a) a full-scale aerodrome emergency exercise at intervals not exceeding two years; and
 - b) partial emergency exercises in the intervening year to ensure that any deficiencies found during the full-scale exercise or actual emergencies have been corrected.
- 12.6 The purpose of a full-scale exercise is to ensure the adequacy of the plan to cope with different types of emergencies. A partial exercise is to ensure the adequacy of the response to individual participating agencies and components of the plan, such as the communications system. Where aircraft movements take place at night alternate exercises (or partial exercises) should be conducted during the hours of darkness.
- 12.7 Where an aircraft accident occurs to which the response could be said to have tested adequately all or part of the plan, a licensee may request to defer the biennial exercise. This request should be made in writing to Aerodrome Standards Department of the CAA.

13 Assessment of the Aerodrome Emergency Plan

- 13.1 The CAA's Inspectors will require to be assured of the suitability of the licensee's Emergency Plan. Consequently, Inspectors will wish to see documentary evidence relating to the arrangements put in place by the Emergency Planning Committee. Inspectors may attend an exercise pre-briefing, testing or debriefing, or may choose to attend emergency exercises conducted by the aerodrome. Notification of a proposed biennial exercise must be given at least two months in advance.
- 13.2 At Lower Category Aerodrome (RFF Special, 1 and 2), Inspectors will require to be satisfied that off-aerodrome emergency services are familiar with the emergency planning arrangements and topography of the aerodrome.

14 Bibliography

- 14.1 ICAO Doc 9137-AN/898 – Airport Services Manual, Part 7, Airport Emergency Planning, Second Edition – 1991.
- 14.2 'Dealing with Disaster', Third Edition, United Kingdom Home Office ©, ISBN 185 893 9208, www.homeoffice.gov.uk.

Appendix 9A Emergency Planning Committee Formation

- 1 An Emergency Planning Committee should comprise representatives from all those organizations both on- and off-aerodrome, whose expertise could assist in the anticipation of the effects an emergency might have on life, property, and aerodrome operations, and who could help to prepare a course, or courses, of action to minimize those effects, particularly in respect of saving lives.
- 2 The list below (Table 1) is intended to assist an aerodrome operator in choosing those organizations that should be represented on the aerodrome's Emergency Planning Committee. However, the list is not comprehensive and some aerodromes may have a unique need of expertise from organizations not shown, while others may find some of the organizations shown to be inappropriate.

Table 9A.1 On- and off-aerodrome services from which Planning Committee Members could be selected

Aerodrome services	Local Authority & other services
Aerodrome Police	Ambulance
Aerodrome Security	Coastguard & off shore rescue
Airline Operators	Doctors
Customs & Excise	Fire Service
Medical	First Aid Organisations
Mechanical transport	Hospitals
RFFS	Police
Telecommunications	Press
Works	Religious Leaders

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Appendix 9B Notes for Guidance in Making Emergency Arrangements at Aerodromes

1 Introduction

- 1.1 The following notes are intended as guidance material to assist in the development of an Emergency Plan. It is impossible to give advice on every aspect of emergency planning that might apply to an individual aerodrome, but it is hoped that this material will provide a general outline. More detailed advice will be available from the regional aerodrome inspector
- 1.2 The Emergency Committee should consider that certain facilities on which an emergency plan may depend may not always be available, e.g. the aerodrome telephone exchange may not be fully manned throughout the aerodrome's promulgated operating times. The Emergency Plan should be sufficiently robust to cater for such circumstances.

2 Sources of Support

- 2.1 Although the circumstances at any individual aerodrome may require particular services to be involved in the event of an accident or incident, the following sources of support should be included in any emergency plan.

2.2 Fire Service

Normally the Local Authority Fire Service will be the only source of assistance but in exceptional cases, and with prior arrangement, it may also be possible to secure the assistance of Service or Works Services from nearby industrial establishments or military fire services.

2.3 Police

- 2.3.1 The early attendance of police at an incident is essential if traffic and crowd control is to be instituted so that the emergency services can operate without hindrance. It is usual to find that the local Constabulary has reached agreement with the County or County Borough Fire and Ambulance Services which give the Senior Police Officer present the duties and responsibilities of 'Incident Officer'. This officer will provide a central Control Point through which the subsequent action at a major incident will be conducted, at the accident scene itself.
- 2.3.2 The duties of 'Incident Officer' will vary in detail according to the extent of emergency assistance in each locality but the Home Office intention is that this officer will coordinate the utilisation of each responding service. The individual services will carry out their tasks under the command of their own officers but the senior members of each service will ensure that the 'Incident Officer' is made aware of the progress of their operations. This is particularly important in compiling the total number of persons rescued or removed to hospitals, mortuaries, etc. The 'Incident Officer' can also serve as a mobilisation centre, making use of police communications facilities or other channels to meet the requirements at the incident as the action develops.
- 2.3.3 It is essential that every possible assistance is given to the 'Incident Officer' by the aerodrome authorities and operating companies by providing information about the various services which may be available on the aerodrome which could be of assistance in dealing with the incident. This information should include details of the

Fire and Rescue facilities, medical services (first aid rooms, temporary mortuaries etc.), salvage equipment (cranes, lifting equipment and transport), resident civil engineering services (engineers, electricians, portable lighting etc.). Guidance should also be given to the 'Incident Officer' in clarifying various responsibilities as between the aerodrome authority, operating companies and other agencies which may be involved.

2.4 **Ambulance Services**

The local Ambulance Service may be provided by a separate organisation, by Fire Service or Police – controlled services, by St John, British Red Cross or St Andrew's Organisations or by the local and regional health authorities. It may also be possible to obtain additional assistance from Service or Works Units. One feature of ambulance assistance which should be considered in completing emergency arrangements is the possibility of the Ambulance Control Room undertaking the alerting of local hospitals for casualty reception and the liaison with hospitals so that casualties are directed to hospitals where beds are available. The County Medical Officer will be of great assistance in formulating procedures for ambulance assistance and for securing doctors. He will also be a key figure in ensuring effective casualty disposal to appropriate hospitals (see paragraphs 2.5 and 2.6 below).

2.5 **Doctors**

It is usual to have a panel of local doctors who have agreed to attend accidents at the aerodrome. In most cases the doctors will agree to attend without charge but it will be necessary to discuss fees when obtaining the agreement of individual doctors to attend. In compiling a panel it will be necessary to provide a sufficiently large number of names and telephone numbers to acknowledge the probable absence of some doctors on their professional duties at the time an accident occurs.

2.6 **Hospitals**

The need for alerting hospitals when an accident has occurred has been mentioned in sub-paragraph 2.4 above, in connection with the Ambulance Service. It is important to give the earliest indication of intention to deliver casualties so that preparation can be made for their reception. If this warning can be ensured through Ambulance Control facilities this will relieve the aerodrome switchboard of one call and save some time.

2.7 **Ministers of Religion**

Arrangements should exist for the calling of Ministers of Religion. It is usual to provide a minister from each of the large denominations but in some areas this may not be possible. It is essential, however, to make some provision in this matter and failure to do so may lead to public criticism following an accident. Consideration should be given to social diversity, as appropriate.

2.8 **Operating Companies or their Agents**

It is important that full details of the aircraft are available, i.e. number of persons aboard, details of any special or hazardous freight (radio-active materials, livestock, etc.) and in this respect the aircraft operating company or its agents should be responsible for providing any documents, passenger lists and manifests concerning the aircraft involved. In addition, they should also be responsible for post accident arrangements for any survivors who are not injured and who may require to continue their journey, or need accommodation or other assistance. This is even more important if the incident occurs 'off the aerodrome'. The aircraft operating company or its agents should also pay attention to passengers' relatives and friends who may

be at the aerodrome waiting for the aircraft to land and may be unaware that an accident has occurred.

2.9 **Additional Facilities**

- 2.9.1 Where an aerodrome is near the sea or any large area of water the Emergency Orders should provide for the summoning of assistance from the RNLI, Coastguard or other marine craft users, as well as the initiation of search and rescue (SAR) procedures where this is appropriate. In mountainous, swampy or heavily wooded country the support of Service Helicopter Units would be of value.
- 2.9.2 Following an aircraft accident, specialist equipment e.g. additional lighting or heavy lifting gear may be required that may not normally be readily available to the RFFS. The Emergency Committee should consider the potential need for this equipment and arrange for it to be available should circumstances require it. Care should be taken to ensure that the type and use, of this equipment does not introduce the risk of fire in areas which may have become contaminated by fuel spillage.
- 2.9.3 Incidents involving aircraft will attract the attention of the press and media. Aerodrome licensees may wish to appoint a member of staff to liaise with members of the local and national press.

3 **Assembly of Assisting Services**

- 3.1 An aerodrome Emergency Plan must consider that an accident can occur in weather conditions that could hamper the ability of Emergency Services to find the accident site. A system must be devised whereby Emergency Services familiar or unfamiliar with the aerodrome can be easily guided to the accident or incident. One such system is to distribute a plan of the aerodrome overlaid with a grid, such that each square has an individual identifier. It may be advantageous if Ordnance Survey grid were used, as this could help Local Authority assisting services, that may arrive from any direction, to find the allocated rendezvous point.
- 3.2 The Emergency Plan should take into account that Local Authority assisting services are not likely to be familiar with the aerodrome layout, so suitable assembly, or Rendezvous Points, should be established, to which incoming appliances should report, and from which they can be escorted to the accident or incident site with the minimum of delay. In all cases a person should be posted at the aerodrome main gate, and the Rendezvous Point and a telephone should be made available at both locations.

4 **Exercises**

- 4.1 When the Emergency Orders have been issued and the Appendices giving executive action details have been posted at the appropriate points, e.g. Fire Service Watchroom, ATC Tower, PBX, the next phase of operation will be to consider an exercise in which the orders may be tested. There are three types of Live exercise which can be used, these are: Communications, Mobility and Casualty Handling, and Operational Exercises.
- 4.2 **Communications Exercises**
 - 4.2.1 Communications exercises do not require the movement of any persons or equipment, the whole test falling on the communications system which would, in an emergency, be used to summon assistance.

- 4.2.2 To hold an exercise of this type it is usual to send a letter to the services and individuals who would respond to an emergency call, stating that a communications exercise will be held on a particular date. The recipient should be asked to reply giving;
- a) the time the call was received,
 - b) the exact message received,
 - c) a brief note stating the action that would have been taken if the call had been to a genuine emergency.
- 4.2.3 When the proformas have been returned to the aerodrome, an analysis of the information should be made. These inexpensive exercises can be of great value but it is essential to prefix all messages from the aerodrome with the word 'EXERCISE'. A measure of secrecy helps to ensure that full benefit is obtained from each test.

4.3 **Mobility Exercises, Casualty Handling Exercises**

Following a communications exercise, mobility and casualty handling exercises carried out separately, provide a great deal of valuable information and experience to individual units without committing large numbers of persons, appliances and equipment and can be used as a preliminary to the main operational exercise.

4.4 **Operational Exercises**

- 4.4.1 Operational exercises are more complicated, and are difficult to organise without some loss of the element of surprise. It is essential to consult with the local officers of the Fire Service, Police and Ambulance Services and it may be necessary to plan an exercise at a particular time of day or on an agreed day to meet local requirements. An exercise cannot be held without the co-operation of all concerned so some prior discussion is unavoidable. However, it should still be possible to withhold the precise time of the exercise and some of the details to be set.
- 4.4.2 It is seldom possible to test more than two or three aspects of a simulated aircraft accident at one exercise, as to test more often leads to inadequate observation and loss of benefit from the exercise. The following can be tested in combinations of two or three:
- a) Fire-fighting by the aerodrome unit, with reinforcement and water transfer from the local authority fire service.
 - b) An aircraft accident without fire but with a complex rescue operation involving many casualties. This would test the aerodrome RFFS, with possible assistance from local Fire Service and Ambulance personnel.
 - c) Casualty evacuation, after removal from the aircraft, testing Ambulance and Hospital arrangements, the setting-up of casualty clearance stations, the attendance of doctors, and Police control, including the segregation of deceased persons and the assembly of personal effects.
 - d) Crowd control and the preservation of aircraft debris for accident investigation purposes.
 - e) Fireground control and communications.
 - f) The setting-up of the Incident Officer post.

NOTE 1: In exercises a), b) and c) it will be necessary to establish the relative responsibilities of the Fire Service and the medical services.

NOTE 2: Once a person has been removed from the aircraft the after-care becomes the responsibility of the medical services, so that the RFFS can return to its fire and rescue duties.

NOTE 3: Failure to recognize these facts will result in confusion and dissipation of effort.

- 4.4.3 There are many more variations which can be introduced and it will be evident that there will be a requirement for simulation in an exercise.

NOTE 1: It is seldom possible to provide a sufficiently large fire which will engage the aerodrome RFFS until the local authority fire service can attend and provide support. This difficulty can be overcome by delaying ignition until the local Fire Service can be seen approaching the incident.

NOTE 2: The 'casualties' should be labelled or provided with simulated injuries and here the Casualties Union, a body of volunteers with branches throughout the United Kingdom, provides a unique service. By arrangement with the local branch an agreed number of 'casualties' can be provided and with realistic make-up and considerable acting ability can add a dramatic touch to incidents. The terms of this assistance are modest and are usually limited to travel charges, plus refreshments after the exercise.

- 4.4.4 Where an aerodrome operates at night it is a requirement to have alternate exercises in hours of darkness, which adds a further complication and may bring attention to the need for special lighting equipment.

4.5 **Exercises – General**

- 4.5.1 A typical programme of exercises might require three communications and three operational exercises in each year, suitably spaced at two-monthly intervals. Following each exercise it is essential to conduct an analysis of events so that deficiencies in the emergency plan may be identified and eliminated. This may entail periodic revision of emergency orders but this is inevitable to meet organizational changes, on and off the aerodrome.

- 4.5.2 It is advisable to invite local Press representatives to attend an operational exercise and to provide them with an exercise narrative. If the Press do not attend or are not warned that an exercise is to take place the activity at the aerodrome may be misunderstood and unnecessary anxiety incurred.

5 **Lessons Learned**

Assisting Services may find it of value to arrange to receive copies of accident reports published from time to time. These normally bring out any weaknesses found in the operation of aerodrome emergency services, thus providing those services with an opportunity to revise and amend their own procedures as may seem appropriate.

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Appendix 9C Model Emergency Orders

1 Objective

The objective of Emergency Orders is to determine which services are appropriate to the management of a particular emergency situation or incident, and to record how these services should be alerted to the need to perform their designated tasks.

2 Aircraft Accident or Ground Incident

2.1 Responsibility for initiating action by the Aerodrome Rescue and Fire Fighting Service and other bodies concerned in the event of an aircraft accident or ground incident will normally rest with the Senior Air Traffic Control Officer on duty.

2.2 Action by the Air Traffic Control Officer

2.2.1 Whenever the Air Traffic Control Officer on duty becomes aware that: an Aircraft Accident has occurred, or is inevitable, on, or near the aerodrome; or when an Aircraft Ground Incident has occurred, or an aircraft on the Movement Area is in difficulty he/she will:

- a) Operate the alarm system.
- b) Inform the Aerodrome Rescue and Fire Fighting Service of the Accident status i.e. 'Aircraft Accident' (or 'Aircraft Ground Incident'), and will provide the following information:
 - i) Grid reference or place
 - ii) Aircraft type or seating capacity
 - iii) Persons on board

2.2.2 The number of persons in the aircraft will be stated if already known, but the call to the Aerodrome Rescue and Fire Fighting Service must not in any circumstances be delayed whilst this information is obtained.

2.2.3 The same information will be conveyed to the aerodrome telephone exchange.

2.3 Action by the Aerodrome Rescue and Fire Fighting Service

2.3.1 Calls to Aircraft Accidents (or Ground Incidents) will normally be received from the Air Traffic Control Officer on duty. However, when a call is received from any other person, or an accident is observed, or there is reason to consider that one is imminent, the Aerodrome Rescue and Fire Fighting Service will, if the location is on the aerodrome, take action in the same manner as if the Air Traffic Control Officer had originated the call, and the Air Traffic Control Officer will be informed of the nature of the call and of the appliances sent. If the location is off the aerodrome, airport fire appliances will not proceed until the Air Traffic Control Officer has been informed and agrees.

2.3.2 Attendance of airport fire appliances will be made to all aircraft accidents as follows:

- a) On aerodrome accidents/Ground incidents – all airport fire appliances.
- b) Off aerodrome accidents – as pre-determined.

2.3.3 The Officer-in-Charge of the Aerodrome Rescue and Fire Fighting Service will be responsible for all subsequent action by the Service.

2.4 **Action by the Aerodrome Telephone and/or Terminal Staff**

2.4.1 On receipt of the message from the Air Traffic Control Officer initiating 'Aircraft Accident' (or 'Ground Incidents') procedure (see paragraph 2.2.3 above), the Aerodrome Telephone and/or Terminal Staff will call the following and repeat the message:

- a) The local authority Fire Service.
- b) The aerodrome ambulance (*if applicable*).
- c) The public ambulance service.
- d) The aerodrome police or security service.
- e) The predetermined local Hospital.
- f) The local police.
- g) The Aerodrome Director.
- h) Predetermined local doctors (Aircraft Accident procedure only).
- i) Predetermined local Ministers of Religion (Aircraft Accident procedure only).
- j) The Station Engineer.
- k) The aerodrome Customer Services (Aircraft Accident procedure only).

2.5 **Action of the Aerodrome Police or Security Service pending the arrival of the local police force**

2.5.1 The Officer-in-Charge of the Aerodrome Police or Security Service will:

- a) Inform officers at the gates.
- b) Post guides to direct incoming fire appliances, ambulances and doctors' cars, and police vehicles.
- c) Post guards to keep all unauthorised persons from the aircraft.
- d) Render such other assistance as is possible.

2.6 **Action by Aerodrome Customer Services (or the operating companies or handling agents as applicable)**

2.6.1 On receipt of an 'Aircraft Accident' message the aerodrome Customer Services (or operating company or handling agent) will:

- a) Dispatch a senior technician to the scene to report to the Officer-in-Charge of the fire and rescue services.
- b) Dispatch a senior traffic official to the scene to liaise with the Officer-in-Charge of the ambulance service (or Incident Officer according to the degree of accident).
- c) Provide transport and shelter for persons who are not injured or do not require ambulance facilities.
- d) Provide baggage staff to liaise with H. M. Customs as necessary.
- e) Provide a responsible member of the staff to liaise with the waiting relatives and friends of the passengers concerned.

2.7 **Cancellation of Ground Incident**

Cancellation of an aircraft Ground Incident will be taken only after consultation with the Aerodrome Fire Officer-in-Charge.

3 Aircraft Emergencies

- 3.1 When an aircraft is known to be in difficulty one of the procedures detailed in paragraphs 3.3, 3.4 and 3.5 will be adopted.
- 3.2 The decision as to the procedures to be followed will be the responsibility of the Air Traffic Control Officer on duty. When there is doubt as to the degree of risk involved 'Full Emergency' procedures will be adopted.
- 3.3 **'Full Emergency' procedures**
- 3.3.1 When it is known that an aircraft approaching the aerodrome is in such trouble that there is danger of an accident on landing, the following procedures will be followed:
- 3.3.2 **Action by the Air Traffic Control Officer**
- a) Operate the alarm system.
 - b) Call the Aerodrome Rescue and Fire Fighting Service stating that the 'Full Emergency Procedure' is in force, and provide the appropriate information shown at appendix 9D.
 - c) Call the Aerodrome Telephone Exchange, stating that the 'Full Emergency Procedure' is in force and provide the appropriate information shown at appendix 9D.
- 3.3.3 **Action by the Aerodrome Rescue and Fire Fighting Service**
- 3.3.3.1 The Aerodrome Rescue and Fire Fighting Service will immediately turn out a full attendance which will normally be stationed at the pre-determined standby points for the runway in use.
- 3.3.3.2 Any subsequent action is the responsibility of the Officer-in-Charge of the Aerodrome Rescue and Fire Fighting Service and the appliances will not return to the fire station until he has satisfied himself that they are no longer required. The Air Traffic Control Officer will only declare the incident closed after agreement with the Aerodrome Rescue and Fire Fighting Service Officer.
- 3.3.4 **Action by the Aerodrome Telephone and/or Terminal Staff**
- On receipt of the 'Full Emergency' message, the Aerodrome Telephone and/or Terminal staff will call the following and repeat the message given by the Air Traffic Officer:
- a) The local authority Fire Service.
 - b) The aerodrome ambulance (*if applicable*).
 - c) The public ambulance service.
 - d) The aerodrome police or security service.
 - e) The Airport Director.
 - f) The operating company or the handling agent.
- 3.3.5 **Action by the Aerodrome Police or Security Service**
- 3.3.5.1 The Officer-in-Charge of the Aerodrome Police or Security Service will inform the officers at the gates and post a guide at the Rendezvous Point in use to direct incoming fire appliances if necessary.
- 3.3.5.2 Incoming fire appliances, ambulances and police vehicles will be held at the Rendezvous Point until it is known that they are required to get to work or they are released to return to their stations.

3.3.6 Upgrading 'Full Emergency' or 'Local Standby' procedures to 'Aircraft Accident' status

3.3.6.1 If an aircraft which is the subject of 'Full Emergency' or 'Local Standby' Procedure is involved in an accident on landing the Air Traffic Control Officer will inform the Aerodrome Telephone Exchange that 'Aircraft Accident' procedures are in force.

3.3.6.2 The Aerodrome Telephone Exchange staff will then take action as in Appendix 9D paragraph 4.1.

3.4 'Local Standby' Procedure

3.4.1 When an aircraft approaching the aerodrome is known or is suspected to have developed some defect but the trouble is not such as would normally involve any serious difficulty in effecting a safe landing, the Aerodrome Rescue and Fire Fighting Service will be called to Standby.

3.4.2 Action by the Air Traffic Control Officer

3.4.2.1 Inform the Aerodrome Rescue and Fire Fighting Service that 'Local Standby' procedures are in force and provide the information shown in Appendix 9D.

3.4.3 Action by the Aerodrome Rescue and Fire Fighting Service

3.4.3.1 A full attendance will be turned out and stationed at the pre-determined standby points for the runway in use.

3.4.3.2 Any subsequent action is the responsibility of the Officer-in-Charge of the Aerodrome Rescue and Fire Fighting Service and the appliances will not return to the fire station until he has satisfied himself that they are no longer required. The Air Traffic Control Officer will only declare the incident closed after agreement with the Aerodrome RFFS Officer.

3.5 'Weather Standby' Procedure

3.5.1 When weather has deteriorated to such an extent as to render the landing of aircraft more difficult or more difficult to observe, the Aerodrome Rescue and Fire Fighting Service may be called to 'Standby' if this is felt to be in the interests of safety.

3.5.2 Action by the Air Traffic Control Officer

Inform the Aerodrome Rescue and Fire Fighting Service that 'Weather Standby' procedures are in force and state the runway in use.

3.5.3 Action by the Aerodrome Rescue and Fire Fighting Service

A full attendance should be turned out and stationed at the pre-determined standby points for the runway in use. However, should there be a likelihood of the weather conditions being of prolonged duration, the officer in charge should agree with ATCO a reduced attendance at the standby point so that a proportion of the personnel available can be withdrawn to the station in rotation for rest and warmth. This would also enable essential maintenance etc. to continue.

4 Domestic Fires

4.1 Action by person discovering fire

4.1.1 Any person discovering a fire, or being informed of a fire, whether on or off the aerodrome, will raise the alarm by calling the Aerodrome Telephone Exchange giving the location of the fire.

NOTE: Some aerodromes may have fire alarms terminating in the Fire Station, others may have emergency numbers. Account will need to be taken of this when detailing emergency actions.

4.2 **Action by Aerodrome Telephone Exchange Staff**

4.2.1 On receipt of the fire alarm message, the Aerodrome Telephone Exchange staff will call the following and pass them the message as shown in Appendix 9D.

- a) The aerodrome Rescue and Fire Fighting Service.
- b) The local authority Fire Service.
- c) The aerodrome police or security service.
- d) The Air Traffic Control Officer.
- e) The Aerodrome Director.
- f) The station engineer.

4.3 **Action by Aerodrome Rescue and Fire Fighting Service**

4.3.1 For a fire on the aerodrome, turn out the pre-determined attendance for the building or area concerned.

4.3.2 For a fire off the aerodrome – inform ATCO and, if permission is granted, send the appliances and crews (as determined locally). However, a response to domestic fires should not be permitted if it is likely to cause a depletion in the promulgated level of services.

4.3.3 When aircraft movements are expected, the Aerodrome Rescue and Fire Fighting Service attendance should continue to work at a domestic fire only so long as the fire situation demands its retention. It should then, with the agreement of the Officer-in-Charge of the Local Authority Fire Service in attendance, return to station as soon as possible to cover such expected aircraft movements.

4.4 **Action by the Aerodrome Police or Security Service**

4.4.1 The Officer-in-Charge of the Aerodrome Police or Security Service will fulfill the actions shown in Appendix 9D.

5 **Notes for General Guidance**

5.1 Whenever there are insufficient RFFS appliances available to provide the full attendance the Air Traffic Control Officer and the Licensee must be informed immediately.

5.2 The Aerodrome Rescue and Fire Fighting Service may be called upon to make an attendance outside the aerodrome boundary:

- a) For fires which constitute a danger to flying or to aerodrome property.
- b) In response to calls from public or police on humanitarian grounds.

5.3 The decision as to whether or not fire appliances shall be sent to accidents or fires outside the aerodrome boundary is the responsibility of the Licensee, or a designated representative, in consultation with the Senior Aerodrome RFFS Officer on duty.

5.4 Aerodrome fire appliances will not normally be sent to accidents or other emergencies occurring more than 8 km (5 miles) from the aerodrome boundary.

5.5 Emergency vehicles proceeding on public roads must be properly insured, and drivers of such vehicles must hold an appropriate driving licence.

- 5.6 Any repair or maintenance work that is being carried out on the aerodrome which may have an effect on the emergency services in either attending or dealing with an incident should be made the subject of a 'Permit to Work' and comply with the rules of the authority granting the permit.

Appendix 9D Model Emergency Instructions

1 Objective

The objective of Emergency Instructions is to list the actions to be taken by the duty personnel in each department responsible for ensuring that those services, essential to successful management of a particular accident or incident situation, are alerted to the need to perform their designated tasks.

2 Introduction

- 2.1 People will react differently when suddenly confronted with a situation that could be life threatening, even if the threat is to a third party, particularly if they have some responsibility for the outcome of the situation. These reactions could hamper the efficiency of the aerodrome's emergency plan. Therefore, Emergency Instructions should be compiled that list, in a clear and precise manner, the actions to be taken by an individual or section with a role to play in the process of dealing with emergency situations.
- 2.2 Emergency Instructions are derived from the aerodrome's Emergency Orders, and should list in detail the immediate actions to be taken following the alarm being raised, in order to ensure that Emergency Plan is successfully initiated.
- 2.3 Each department, section or individual should have on display, or immediately to hand, the Emergency Instructions that apply to their role in each emergency procedure only. Therefore, the model Instructions that follow are separated into lists of the actions to be taken by an individual section or person.
- 2.4 The model Emergency Instructions illustrated in this appendix are intended as guidelines to assist in the development of versions appropriate to the needs of the individual aerodrome and they should be adapted accordingly

3 Action by Air Traffic Control Officers (Model Instructions) (To be posted in Air Traffic Control)

3.1 Aircraft Accidents

- 3.1.1 Operate alarm system.
- 3.1.2 Call Aerodrome Rescue and Fire Fighting Service.
 - a) Message 'Aircraft Incident at.....'
 - b) Type of aircraft, or approximate seating capacity
 - c) Number of persons aboard.....'
- 3.1.3 Call the Aerodrome Telephone Exchange.
 - a) Message 'Aircraft Accident at
 - b) Type of aircraft, or approximate seating capacity
 - c) Number of persons aboard.....'
 - d) Access point or rendezvous point.....'

NOTE: Do not delay these calls if the number of occupants is not known.

3.2 **Aircraft Ground Incident**

3.2.1 Operate alarm system.

3.2.2 Call the Aerodrome Rescue and Fire Fighting Service saying:

- a) 'Aircraft Ground Incident' at.....
- b) Type of aircraft.....
- c) Number of persons aboard.....

3.2.3 Call the Aerodrome Telephone Exchange, saying:

- a) 'Aircraft Ground Incident' at.....
- b) Type of aircraft.....
- c) Number of persons aboard (if known)
- d) Access point or rendezvous point..... '

NOTE: Do not delay these calls if the number of occupants is not known.

3.3 **Aircraft Emergencies**

3.3.1 **Full Emergency**

3.3.1.1 Operate alarm system.

3.3.1.2 Call Aerodrome Rescue and Fire Fighting Service, saying.

- a) 'Full Emergency Standby' at.....
- b) Runway in use
- c) Type of aircraft.....
- d) Registration No
- e) ETA hours
- f) Number of persons aboard.....
- g) Nature of problem.....

3.3.1.3 Call the Aerodrome Telephone Exchange, saying.

- a) 'Full Emergency' at
- b) Type of aircraft, or approximate seating capacity
- c) Number of persons aboard.....
- d) ETAhours
- e) Runway.....
- f) Access point or rendezvous point..... '

3.3.2 **Local Standby**

Call Aerodrome Rescue and Fire Fighting Service, saying:

- a) 'Local Standby' at
- b) Runway in use
- c) Type of aircraft.....
- d) Registration No.....
- e) ETAhours

- f) Number of persons aboard
- g) Nature of problem.....

3.3.3 **Weather Standby**

3.3.3.1 Call Aerodrome Rescue and Fire Fighting Service, saying.

- a) 'Weather Standby'
- b) Standby Reason (i.e. Low Visibility, Snow on Runway etc.) at.....
- c) Runway in use

4 Action by Telephone Exchange Staff (To be posted in Aerodrome Telephone Exchange)

4.1 **'Aircraft Accident' procedure**

4.1.1 On receiving an 'Aircraft Accident' call from the Air Traffic Control Officer the aerodrome telephone staff will:

- a) WRITE DOWN the message, and the time.
 - i) Aircraft Accident at.....
 - ii) Type of aircraft and approximate seating capacity
 - iii) Number of persons aboard (if known).....
 - iv) Access point or rendezvous point.....
- b) Call the
 - i) Local authority Fire Service (Tel. No.)
 - ii) Aerodrome ambulance (Ext.)
 - iii) Public ambulance service (Tel. No.)
 - iv) Aerodrome police or security service (Ext)
 - v) Local police (Tel. No.)
 - vi) Aerodrome Director (Ext.)
 - vii) Station Engineer (Ext.) saying:

"This is Aerodrome" and repeat the message at 4.1.1a. above,

- c) Call the:
 - i) " Hospital (Tel. No.)
 - ii) Doctor (Tel. No)
 - iii) Doctor (Tel. No)
 - iv) Doctor (Tel. No)
 - v) Minister of Religion (Tel. No)
 - vi) Minister of Religion (Tel. No)
 - vii) Minister of Religion (Tel. No)

"This is Aerodrome" and repeat the message at 4.1.1a. above.

4.2 **'Aircraft Ground Incident' procedure**

4.2.1 On receiving an 'Aircraft Ground Incident' call from the Air Traffic Control Officer the aerodrome telephone staff will:

a) WRITE DOWN the message, and the time.

- i) 'Aircraft Ground Incident' at
- ii) Type of aircraft
- iii) Number of persons aboard (if known)
- iv) Rendezvous point
- v) Time Hours

b) Then call the:

- i) Local authority Fire Service (Tel. No.)
- ii) Public ambulance Service (Tel. No.)
- iii) Aerodrome ambulance (Ext. No.)
- iv) Local police (Tel. No.)
- v) Aerodrome police or security service (Ext.)
- vi) Aerodrome Director (Ext.)
- vii) Station Engineer (Ext.) saying:

"This is " " Aerodrome", and repeat the message given at 4.2.1a. above.

4.3 **'Full Emergency' procedure**

4.3.1 On receiving a 'Full Emergency' call from the Air Traffic Control Officer the aerodrome telephone staff will:

a) WRITE DOWN the message, and the time.

- i) 'Full Emergency' at
- ii) Type of aircraft
- iii) Number of persons aboard
- iv) ETAhours
- v) Runway in use.....
- vi) Access point or rendezvous point

b) Then call the

- i) Local authority Fire Service (Tel. No.)
- ii) Aerodrome ambulance (Tel. No.)
- iii) Public ambulance Service. (Tel. No.)
- iv) Local police (Tel. No.)
- v) Aerodrome police or security service (Ext.)
- vi) Aerodrome Director (Ext.)
- vii) Station Engineer (Ext.) saying:

This is “ ” Aerodrome”, and repeat the message given at 4.3.1a. above.

4.4 **Domestic fires**

4.4.1 On receiving a Fire call, the aerodrome telephone staff will:

a) WRITE DOWN:

- i) time,
- ii) address or location of the fire.

b) Then call the:

- i) Aerodrome Rescue and Fire Fighting Service, clearing lines as necessary.
- ii) Local authority Fire Service (Tel. No.)
- iii) Aerodrome police or security service (Ext.)
- iv) Air Traffic Control Officer (Ext.)
- v) Aerodrome Director (Ext.)
- vi) Station Engineer (Ext.)

5 **Action by Aerodrome Police or Security Service (To be posted in Aerodrome Police or Security Office)**

5.1 **‘Aircraft Accidents’ on the aerodrome, ‘Aircraft Ground Incident’ and ‘Domestic Fire’ on the aerodrome procedures**

- a) Inform officers at gates of the location of the accident, and instruct them to expedite the passage of fire appliances, ambulances and doctors’ cars.
- b) Post guides to direct incoming fire appliances etc. as applicable. Guides should have access to a telephone (See Appendix 9B paragraph 3.2).
- c) Post guards at the scene of the accident to keep unauthorised persons away from accident or incident site.
- d) Render any other assistance which may be possible.

6 **Action by Aerodrome Rescue and Fire Fighting Service (To be posted in Aerodrome Rescue and Fire Fighting Service Watch Room)**

6.1 **‘Aircraft Accident’ procedure**

6.1.1 **On Aerodrome:** Turn out full attendance immediately and inform ATCO (if call not received from ATC).

6.1.2 **Off Aerodrome:** Turn out pre-determined attendance after consultation with ATCO.

6.2 **‘Aircraft Ground Incident’ procedure**

6.2.1 On receipt of call from ATCO; or on observation or running call; or on receipt of call from telephone system, turn out full attendance immediately.

6.2.2 The Officer-in-Charge of the Aerodrome Rescue and Fire Fighting Service will be responsible for all subsequent action by the Service.

6.3 **Aircraft Emergencies**

6.3.1 **'Full Emergency' and 'Local Standby' procedures**

On instructions from ATCO turn out full attendance to pre-determined standby points or elsewhere as directed.

6.3.2 **'Weather Standby' procedures**

Turn out full or partial attendance as agreed with ATCO according to likely duration of Standby.

6.4 **Domestic Fires procedure**

6.4.1 **On Aerodrome procedures**

6.4.1.1 **Call from Aerodrome Telephone Exchange:** Turn out pre-determined attendance and inform ATCO.

6.4.1.2 **Call from ATCO:** Turn out pre-determined attendance and inform Aerodrome Telephone Exchange.

6.4.1.3 **On observation or running call:** Turn out pre-determined attendance and inform ATCO and Aerodrome Telephone Exchange.

6.4.2 **Off Aerodrome procedure**

Obtain permission of ATCO then despatch pre-determined attendance. Inform Aerodrome Telephone Exchange if call not received from there.

Appendix 9E Rendezvous point signs

1 Specifications for Rendezvous Point Signs

The following signs are accepted and recognised nationally by Local Authority Police, Fire and Ambulance services. The sizes given are the minimum likely to allow them to be recognised easily by attending Emergency Services.

2 Rendezvous Point (RVP) Signs

- 2.1 Rendezvous Point signs should be displayed at the point(s) designated by the Aerodrome Emergency Orders as the rendezvous point(s) for all responding Emergency Services. Signs should be clearly visible from any direction from which responding Emergency Service vehicles/personnel are likely to approach when attending aircraft accidents/incidents within the response area defined by or cross-referenced in the Aerodrome Manual.
- 2.2 Signs should have nominal dimensions 1000 mm x 1000 mm and comprise bright, white letters 'EMERGENCY SERVICES RENDEZVOUS POINT' on a contrasting green background. (The white lettering may also be retro-reflective.) The sign should have a bright, contrasting yellow border of 25 mm dimensions. (The border may also be retro-reflective):

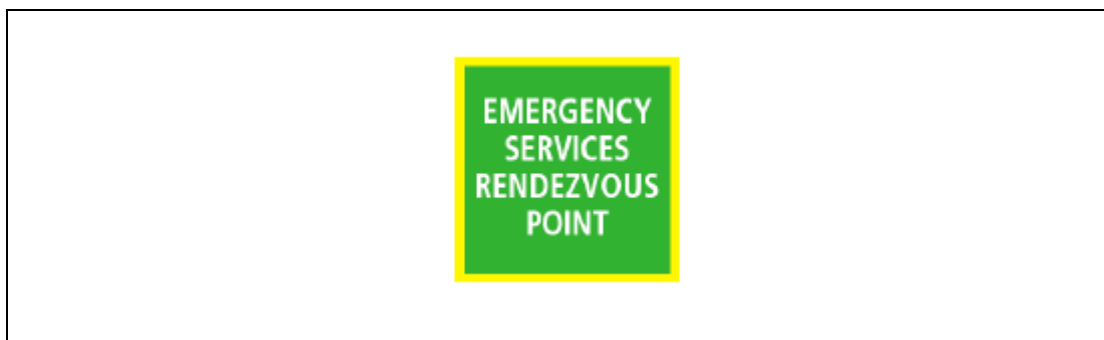


Figure 1

3 Rendezvous Point Directional Arrow Signs

- 3.1 Sufficient signs bearing RVP directional arrows should be placed in such a manner that 'off-aerodrome' Emergency Service vehicles/personnel responding to an incident on the aerodrome are directed expeditiously to any previously designated RVP.
- 3.2 Sign(s) should be placed within and around the aerodrome perimeter so that they are visible and legible from any practicable direction of approach.
- 3.3 Sign(s) should have nominal dimensions 525 mm x 625 mm and comprise a bright, white arrow and the letters 'RVP' on a contrasting green background. The sign should have a bright, contrasting yellow border of 25 mm dimensions. (The lettering and border may also be retro-reflective).
- 3.4 Where appropriate, RVP signs and RVP Directional Arrow signs should be illuminated.



Figure 2

Chapter 10 Aeronautical Information

1 Information to be Available

- 1.1 The Aeronautical Information Publication (AIP) is identified as the publication used for the provision of aeronautical information/data necessary for the regularity and efficiency of air navigation.
- 1.2 The licensee should ensure that all information relating to the aerodrome and its facilities, which is significant for the conduct of flights to and from the aerodrome, is available to users of the aerodrome.
- 1.3 The licensee is responsible for notifying NATS Aeronautical Information Service (AIS) of any information for inclusion into the AIP, including errors or omissions in the aerodrome information, and any impending changes in the aerodrome or its facilities likely to affect this information. For reasons of data integrity, any notification of permanent changes to the AIP must be accompanied by a completed Form 933, available from www.ais.org.uk.
- 1.4 For the guidance of pilots and operators seeking a briefing from the aerodrome authority details of the following should always be available:
 - a) construction or maintenance work on or immediately adjacent to the manoeuvring area;
 - b) unserviceable portions of any part of the manoeuvring area;
 - c) the presence and depth of snow, ice or slush on runways and taxiways, and their effect on braking action;
 - d) runway surface condition when affected by water - damp, wet, water patches or flooded as appropriate;
 - e) snow drifted or piled on or adjacent to runways or taxiways;
 - f) parked aircraft or other objects on or immediately adjacent to taxiways;
 - g) the presence of other temporary hazards;
 - h) failure or irregular operation of any part of the aerodrome lighting system or of the aerodrome main and secondary power supplied;
 - i) failure, irregular operation and changes in the operational status of any electronic approach or navigation aid or aeronautical communications facility;
 - j) failures and changes in the RVR observer system;along with any other information of operational significance.

2 Action Required for Occurrences of Operational Significance other than those Involving Electronic Aids and Communication Facilities

- 2.1 Whenever any of the following conditions occur or can be anticipated and are of operational significance, the licensee should take action to amend the UK AIP and/or to promulgate the change by NOTAM by contacting AIS:
 - a) changes in the availability of the manoeuvring area and changes in the runway declared distances; except that increases in declared distances may only be made with the agreement of the Aerodrome Standards Department.

- b) changes in the permanent level of RFFS category; except that changes may only be made with the agreement of the Aerodrome Standards Department;
- c) significant changes in aerodrome lighting and other visual aids;
- d) presence or removal of temporary obstructions to aircraft operation in the manoeuvring area;
- e) presence or removal of hazardous conditions due to snow, ice or slush on the movement area;

NOTE: Notification of such conditions may be by use of the SNOWTAM proforma (form CA 1271). Details on how to complete the SNOWTAM form are published in an AIC.

- f) presence of airborne hazards to air navigation;
- g) interruption, return to service, or major changes to rescue facilities and fire fighting services available, except that permanent changes to the promulgated RFF Category may only be made with the agreement of the Aerodrome Standards Department;
- h) failure or return to operation of hazard beacons and obstruction lights on or in the vicinity of the aerodrome;
- i) erection or removal of obstructions to air navigation, and erection or removal of significant obstacles in take-off, climb or approach areas;
- j) air displays, air races, parachute jumping, or any unusual aviation activity along with any other information of operational significance.

2.2 When any of the above arises at short notice a request for NOTAM action should be made to AIS.

2.3 When the situation is premeditated a written request for AIP Amendment or Supplement action should be made to AIS with a copy sent to the Aerodrome Standards Department. Licensees should be aware that certain types of information are required to be published in accordance with the AIRAC System, which requires significant advance notice to be given.

2.4 Any of these occurrences could affect the operation of the electronic aids or communication facilities. Advice in this respect should always be sought from the authority responsible for their operation who in turn will decide whether further NOTAM action is required.

3 Action Required for Occurrences Affecting Electronic Aids and Communications Facilities

3.1 NOTAM action will be necessary in the following circumstances:

- a) the establishment or withdrawal of electronic aids to air navigation;
- b) changes in the regularity or reliability of operation of any electronic aid to air navigation or aeronautical communication facility.

3.2 The operating authority for these aids should:

- a) request NOTAM action by AIS; or
- b) request AIP Amendment or Supplement action through liaison with the appropriate ATSD Area Inspectorate or through appropriate channels for NATS facilities.

- 3.3 The operating authority will be consulted on any other occurrences detailed in paragraph 2.1 (see paragraph 2.4).

4 Information Centre

AIS for AIP Amendment, Supplement, AIC and NOTAM is:

Aeronautical Information Service
National Air Traffic Services Ltd.
Control Tower Building
London (Heathrow) Airport
Hounslow
Middlesex
TW6 1JJ

UK NOTAM Office (available H24): 020 8745 3450/3451

UK AIS Publications (AIP etc.) (available Monday to Friday): 020 8745 3456

Facsimile: 020 8745 3453 or 3448

AIS website: www.ais.org.uk

AFTN address: EGGNYNYX

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Chapter 11 Water Aerodromes

1 Introduction

- 1.1 ICAO Annex 14 does not differentiate between land and water as a surface from which aircraft can operate; nor, since Article 155 defines that an aerodrome can be an area of water, does the ANO.
- 1.2 Operations on water differ significantly from those conducted on land, and the licensing criteria for land aerodromes are inappropriate in some areas. Although based on the existing land aerodrome criteria, the different operational and safety risks when operating onto and from water, particularly in more challenging environments such as rivers and lochs, have been recognised and addressed. For example, seaplanes require more flexibility in choosing optimum areas of water for take-off and landing; hence, solutions have been developed to address the designation and identification of the water on which seaplane operations will take place.
- 1.3 The process of granting a licence by the CAA for a water aerodrome is no different from that of a land aerodrome, and each application would be assessed on the ability to meet the relevant requirements. The following licensing criteria focus on those licensing factors where water aerodromes differ from land aerodromes. These factors primarily include the physical characteristics of the operating environment, mooring procedures, and rescue and firefighting services; however, one fundamental licensing criterion that requires the Licensee to establish and maintain an appropriate Safety Management System (SMS) remains the same. The criteria should therefore be considered in addition to criteria outlined elsewhere in this document that apply to land and water aerodromes equally.
- 1.4 The water aerodrome licensing criteria are designed to cater for day, Visual Flight Rules (VFR) operations only; they do not cater for night, Instrument Meteorological Conditions (IMC) or, currently, operations by seaplanes of performance groups A and B.
- 1.5 In addition to aviation legislation, a seaplane in contact with the water is subject to maritime legislation; including the International Regulations for the Prevention of Collision at Sea, harbour regulations and local bylaws that are not addressed in this document. Where appropriate, Licensees should consult with those bodies that have a regulatory or statutory interest in the use of, or in the operation of, an aerodrome within the licensed area. These include the Maritime Coastguard Agency; the Ports Authorities; the Health and Safety Executive; the Environmental Agency; local government and national parks authorities; and the Transport Security and Contingencies Directorate at the Department for Transport.

NOTE: All commercial flight activities (fixed wing and rotary) of 10 tonnes or more maximum authorised take-off weight or with more than 19 seats, and de facto the locations that they operate from, are subject to EU regulation 2320/02 on aviation security and, therefore, the UK National Aviation Security Programme administered and enforced by Transport and Contingencies Directorate at the DfT.

2 Aerodrome Manual and Notification in the UK Aeronautical Information Publication

- 2.1 ANO Article 128(8) requires the inclusion in the Aerodrome Manual of information and instructions relating to the matters listed under Schedule 13. Items (ix), (x), (xi) and (xii) of Schedule 13 do not directly apply to water aerodromes.
- 2.2 The following items, in addition to those notified for a land aerodrome and applicable to a water aerodrome, should be published in the Aerodrome Manual and the AIP:
- a) the Aerodrome Reference Point (ARP) coordinates and the Aerodrome Reference Elevation (ARE), see paragraph 3.1;
 - b) the shape of the manoeuvring area(s); the lengths and bearings of the edges (in degrees magnetic); and the means of identification; and
 - c) specific procedures and measures by which the safety of seaplane operations is assured, and an indication of any areas where seaplane operations are restricted or prohibited.

3 Physical Characteristics

3.1 Reference Point and Elevation

- 3.1.1 The Aerodrome Reference Point (ARP) should be located at the planned geometric centre of the manoeuvring area, or of the main one if more than one is provided.
- 3.1.2 An Aerodrome Reference Elevation (ARE) should be determined at the ARP. This elevation should be determined from the Chart Height, or from the lowest recorded water level, converted to an elevation in metres above Ordnance Datum.

3.2 Movement Area

- 3.2.1 Licensees should determine the area of any land and water on which seaplane operations may take place. It is this area that shall be the movement area.
- 3.2.2 One or more manoeuvring area(s) should be established within the movement area from which all seaplane operations requiring the use of a licensed aerodrome should take place.
- 3.2.3 Operational procedures should be developed for safe seaplane taxiing and mooring in the proximity of other seaplanes and obstacles that minimise the risk of damage to occupied or unoccupied seaplanes, particularly where this might result from variations in wind direction; water current, depth and ebb; and flow of tide. ICAO Annex 2, *Rules of the Air*, specifies Standards applicable to water operations that, although similar to those applicable to land aerodrome operations, are not reproduced in CAP 393, *Air Navigation: The Order and the Regulations*.
- 3.2.4 As far as practicable, all reasonable effort should be made to provide a movement area that is free from debris likely to cause damage to a seaplane. In particular, procedures should be established for the regular inspection of the manoeuvring area(s) to remove FOD.

3.3 Manoeuvring Area

- 3.3.1 In some cases, the available manoeuvring area will be large enough to provide a choice of take-off and landing direction, dependent upon prevailing water surface and weather conditions. For the purpose of this Chapter, this type of manoeuvring area is termed 'omnidirectional'. However, in other cases, such as on a river or narrow loch, it may be more appropriate to provide a manoeuvring area that caters for take-off and

landing in one direction and its reciprocal only, in a direction parallel to the longer sides of the manoeuvring area. This type of manoeuvring area is termed 'bidirectional'. Unless specified otherwise, the licensing criteria apply to both types of manoeuvring area.

- 3.3.2 The manoeuvring area(s) should be square, rectangular or rhomboidal in shape, and should encompass all parts of the water surface intended for the taking off and landing of seaplanes.
- 3.3.3 For the purpose of providing the appropriate minimum strip width and obstacle limitation surfaces, manoeuvring areas are coded according to the maximum take-off mass, or performance group, of the largest seaplane likely to operate from the water aerodrome, as shown in Table 11.1.
- 3.3.4 Code W1, W2 and W3 manoeuvring areas should have a minimum width, at any point, equal to the visual strip width for code numbers 1, 2 and 3 land runways respectively, as outlined in Chapter 3 paragraph 4.3.

Table 11.1 Water Aerodrome Manoeuvring Area Coding

Manoeuvring Area Code	W1	W2	W3
Seaplane maximum take-off mass	Less than 2730 kg	2730 kg to 5700 kg	5701 kg or more and seaplanes of performance groups A and B

4 Obstacle Limitation Surfaces (OLS)

NOTE: Licensees should consult the CAA for code W3 criteria not specified below.

4.1 Take-Off Climb and Approach Surface

- 4.1.1 A take-off climb surface and an approach surface should be established in the direction of take-off or landing for each manoeuvring area, with the elevation of the inner edges of both surfaces equal to the ARE. The inner edges of the take-off climb surface and an approach surface originate at a distance of 30 m from the appropriate edges of a code W1 manoeuvring area, and 60 m from the appropriate edges of code W2 and W3 manoeuvring areas, and slope upwards and outwards until reaching their limiting distance.
- 4.1.2 The take-off climb surface and an approach surface for a code W1, W2 and W3 omnidirectional manoeuvring area should form a continuous surface surrounding the manoeuvring area and be equal to the corresponding length and slope dimensions for land-based runway code numbers 1, 2 and 3 respectively.
- 4.1.3 The dimensions of the take-off climb surface and an approach surface relating to a code W1, W2 and W3 bidirectional manoeuvring area should correspond to the dimensions for land-based runway code numbers 1, 2 and 3 respectively; see Chapter 4 (particularly paragraph 2.8) and Figure 11.1.

4.2 Transitional, Inner Horizontal and Conical Surface

- 4.2.1 The inner edge of the transitional surface is coincidental with the edge of the manoeuvring area in both elevation and position. It slopes upwards and outwards with distance from the manoeuvring area until it intercepts the plane of the inner horizontal surface.

- 4.2.2 A transitional surface is not required for an omnidirectional manoeuvring area.
- 4.2.3 An inner horizontal surface should be established at a height of 45 m above the ARE, and should be circular in shape radiating from the ARP to a distance of 2000 m and 2500 m for codes W1 and W2 manoeuvring areas respectively.
- 4.2.4 The conical surface relating to codes W1 and W2 manoeuvring areas slopes upwards and outwards from the periphery of the inner horizontal surface in accordance with the criteria shown in Chapter 4 for the land-based runway code numbers 1 and 2 respectively.

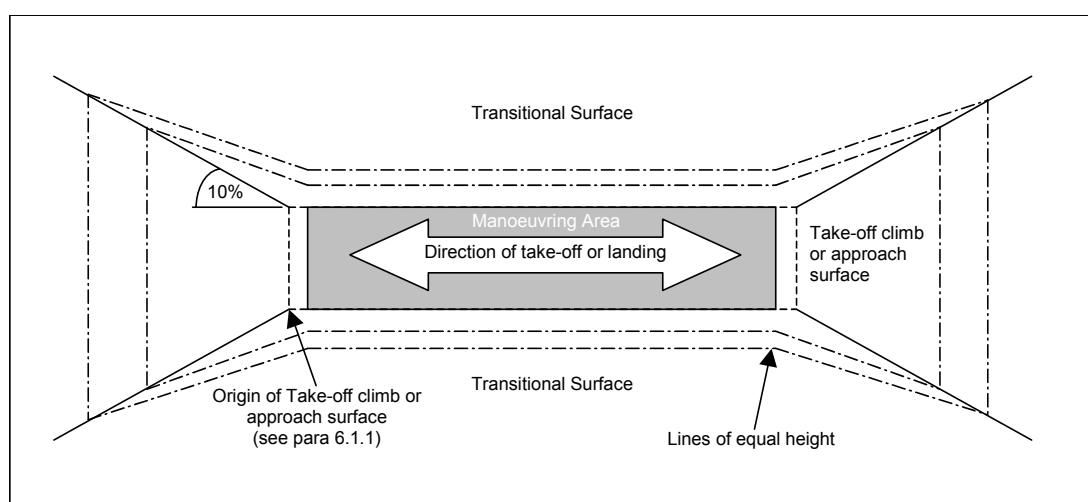


Figure 11.1 Take-Off Climb, Approach and Transitional Surfaces for a Bidirectional Manoeuvring Area

5 Bird Strike Hazard

- 5.1 Licensees should provide a bird hazard management plan that includes the identification of the risk and hazards that may exist, and suitable mitigation measures.
- 5.2 All reasonable measures should be taken to discourage birds from gathering in the movement area, and under anticipated departure and arrival flight paths.

6 Visual Aids

- 6.1 The edges of each manoeuvring area should be easily identifiable by pilots departing from, or arriving at, the water aerodrome.
- 6.2 Floating visual aids should be conspicuous and conform to maritime regulations or, where such regulations and requirements do not exist or are not applicable, the principle use of shapes, colours and lights specified in Chapters 4, 6 and 7 should be considered.

7 Signals

- 7.1 Aerodrome signals, to assist pilots in complying with the Rules of the Air Regulations 1991 (the Rules) and ICAO Annex 2 relevant to the operation of the water aerodrome, should be provided as specified in Chapter 7 paragraph 2, unless the same guidance and information can be provided to pilots by an alternative means of compliance.

8 Rescue and Fire Fighting Services (RFFS)

- 8.1 Procedures for the enhancement of passenger and crew post-accident survival should be developed, and facilities in terms of staff and equipment, appropriate to the type of seaplane operations anticipated at the water aerodrome, should be provided. Within the provision of these procedures and facilities, account should be taken of the effect that variable environmental conditions might have on the ability of the RFFS to respond rapidly to accidents and incidents.
- 8.2 Where provided, a rescue vessel should be of a design and size that would allow survivors to be brought aboard, or it should be equipped with an adequate number of floatation devices of a design that would enable survivors to remove themselves from the water.
- 8.3 The RFFS should achieve a response time not exceeding 15 minutes to any point of the movement area in good visibility and water surface conditions.
- 8.4 At a water aerodrome where the hours of operation are notified, the RFFS should be available 15 minutes before and after the times published. Where the hours of operation are not notified, the RFFS should be available prior to the engine start of the first departing seaplane, or to the first arriving seaplane commencing its final approach; and until the last arrival is moored, or 15 minutes after take-off of the final seaplane.
- 8.5 RFFS personnel should receive initial and recurrent competence-based training relevant to their role and task, and should at all times be physically capable of performing the tasks expected of them.

9 Emergency Planning

- 9.1 The objectives of emergency planning outlined in Chapter 9 apply equally to a water aerodrome.
- 9.2 The emergency plan should consider the particular hazards associated with seaplane operations, including:
 - a) passenger evacuation into a further life-threatening environment, e.g. deep water;
 - b) the onset of hypothermia, and its associated effects, during and following prolonged immersion in cold water; and
 - c) the immediate toxicity and respiratory effects on survivors in the water following the ingestion of floating fuel and oils and their associated vapours, and fire suppressant foams, powders and gases.
- 9.3 Additional guidance on seaplane accidents in the water is outlined in Appendix 6 to the ICAO Airport Services Manual (Doc 9137) Part 7.

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Chapter 12 Heliports

- 1 This chapter applies to land heliports that wish to be licensed.
- 2 ANO Article 126 indicates what helicopter operations are required to be conducted at, from or to a licensed facility.
- 3 The licensing process for a heliport is identical to that required for fixed-wing aerodromes, and is laid out in CAP 168, Chapters 1 and 2.
- 4 The standards and best practice against which the application for a licence will be assessed are those laid out in ICAO Annex 14 Volume 2, and where applicable also Annex 14 Volume 1. ICAO document 9261 - AN/903, The Heliport Manual, provides expanded guidance on the requirements of Annex 14 Volume I.
- 5 When compiling the Aerodrome Manual, licence applicants should also be aware of any requirements that might apply to their operations from ICAO Annex 6, Operation of Aircraft, Part III International Operations, Helicopters.
- 6 Certain aspects of the requirements of other ICAO Annexes may also apply and should be considered or discussed with their nominated aerodrome/heliport inspector when applying for an aerodrome Licence.
- 7 Guidance on the standards and best practice for the operation of heliports that do not require a licence can be obtained from Flight Operations (Helicopters), SRG, Aviation House, Gatwick, and also from the British Helicopters Advisory Board (BHAB), The Graham Suite, West Entrance Fairoaks Airport, Chobham, Woking, Surrey, GU24 8HX, Telephone 01276 856100.

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