UK Civil Aviation Authority

Licensing of Aerodromes

CAP168

Published by the Civil Aviation Authority 2025

Civil Aviation Authority
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

You can copy and use this text but please ensure you always use the most up to date version, credit the CAA and use it in context so as not to be misleading,

First published by the Civil Aviation Authority August 1974

Second edition December 1978

Third edition February 1984

Fourth edition October 1990

Fifth edition February 2001

Sixth edition May 2004

Seventh edition 8 May 2006

Seventh edition 8 May 2006 (corr.)

Seventh edition, incorporating amendments to February 2007

Eighth edition December 2008

Ninth edition, July 2010

Ninth edition, incorporating amendments to April 2011

Tenth edition, February 2014

Eleventh edition, January 2019

Twelfth edition, January 2022

Twelfth edition, January 2022 corr.

Thirteenth Edition July 2025 Incorporating Amendment 15 and visual aids updates from ICAO State letter 25/23 and all-weather operations

Enquiries regarding the content of this publication should be addressed to:
aerodromes.atm@caa.co.uk

The latest version of this document is available in electronic format by searching Publications Civil Aviation Publications (CAPs) and other documents at http://www.caa.co.uk/CAP168

Contents

Contents **4**

Glossary of terms **23**

Chapter 1 **36**

The licensing process **36**

Introduction 36

The legal background to aerodrome licensing 36

Charges 37

Type of licence 37

Application for a licence 37

Aerodrome boundaries 39

General requirements for the grant of a licence 39

Conditions of licence 40

Change of aerodrome licence holder 40

Change of provider of an air traffic service 42

Naming of aerodromes 42

Licensing action 43

Aerodrome licence 'public use' **45**

Aerodrome licence 'ordinary' **47**

Temporary aerodrome licence 'ordinary' **49**

Chapter 2 **51**

The Aerodrome Manual, Safety Management System and Low Visibility Operations **51**

Introduction 51

Ownership of an aerodrome manual 51

Aerodrome Safety Management Systems **65**

Management commitment and responsibility: 65

Safety accountability 65

Appointment of key personnel 65

Co-ordination of emergency response planning 66

SMS documentation 66

Safety risk management 66

Safety risk assessment and mitigation 66

Safety assurance 66

Management of change 67

Continuous improvement of the SMS 67

Safety promotion; 67

Accountable manager 67

Runway incursion awareness 69

Responsibility for monitoring third parties operating within the boundaries of licensed aerodromes 76

Work in progress 76

High-visibility clothing 81

Low Visibility Operations 81

Surface movement radar and other surveillance equipment 83

Low visibility safeguarding 84

Low visibility procedures responsibilities 85

Declaration of low visibility procedures in force 85

Low visibility procedures 85

Visibility conditions and associated actions 88

Low visibility take-off (LVTO) with an RVR less than 125 M 90

UK Air Operations Regulation UK (EU) 965/2012 90

Surface movement guidance and control system 91

Conversion of reported meteorological visibility to RVR 92

Enhanced visual flight systems (EFVS) 93

EFVS 200 Operation 93

Low visibility procedures - EFVS operations suitability of runways approach and landing operations 94

Equipment failures to be reported and effects on flight operations 95

Operations in adverse weather conditions 99

Calibration of runway lights 102

Operating procedures 104

Chapter 3 108

Aerodrome Physical Characteristics 108

Introduction 108

Aerodrome compass base 108
Number, siting and orientation of runways 109
Choice of maximum permissible crosswind components 111
Aerodrome (runway) reference code 111
Runways 112
Runways Width 113
Minimum distances between parallel runways 113
Runways longitudinal slopes 114
Sight distance 115
Distance between slope changes 115
Transverse slopes on paved runways 116
Runway shoulders 117
Blast pads and runway ends 118
Runway turn pads 119
Runway strips 120
Runway strip length 121
Runway strip width 122
Non-instrument Code 3 runways with RNP APCH 122
Use of the aerodrome by higher code letter aircraft 123
Agricultural crops and grass 124
Graded area (GA) 125
Strength of runway strips 126
Longitudinal slopes 126
Transverse slopes 127
Runway end safety areas (RESA) 127
The siting of aids to navigation within runway strips 128
Sighting of equipment and installations on operational areas 129
Engineered materials arresting system (EMAS) 129
Taxiways 133
Width of taxiways 133
Longitudinal slopes and sight changes 134
Sight distance 135

Transverse slopes 135
Taxiway shoulders 135
Taxiway strips 136
Grading of taxiway strips 136
Intermediate holding position 137
Taxiway holding bays and holding positions 137
Taxiway separation distances 139
Rapid exit taxiways 140
Taxiways on bridges 141
Clearways 141
Width of clearways 142
Length of clearways 142
Slopes on clearways 142
Stopway 143
Width of stopways 143
Slopes on stopways 143
Strength of stopways 144
Surface of stopways 144
Aprons and stands 144
Size of aprons 145
Slopes on Aprons 146
Paved surfaces 147
Taxiways and Aprons 148
Radio altimeter operating area 149
Preflight altimeter check location on aprons 150
Movement area cleanliness 150
Winter conditions 150
Unpaved surfaces 152
Movement area cleanliness 152
Movement area bearing strength 152
Operational requirements 153
CDF Values 154

Reporting pavement bearing strength 154

Consequences of PCR inaccuracies 159

Overload operations 159

Pavement Evaluation – Methods for Technical Evaluation 160

Foundation Layer Characterisation 160

Additional Technical Evaluations 161

PCR 'Using aircraft' evaluation method 161

Pavement condition and behaviour 162

Reference aircraft 163

Determination of the pavement type, subgrade strength and tyre pressure categories 163

Equivalencies between CBR or module of subgrade reaction k and modulus of elasticity E 163

Aerodromes without CBR or K data 164

Maximum age of historical CBR or K data 164

Determining the critical offset 165

Pavements for light aircraft 165

Unpaved surfaces 165

Published details 166

The use of block pavers on aerodrome movement areas 166

Threshold displacement 166

Declared distances from runway intersections 169

Runway surfaces – technical details 171

Surfacing materials 172

Porous friction course 172

Pavement Quality Concrete (PQC) 172

Grooving of PQC 172

Asphalt 173

Course textured slurry seal 173

Grooving of asphalt 173

Runway pavement overlays - runway ramping 174

Drainage characteristics of the movement area and adjacent areas 174

Temporary obstacles within runway strips 177

The use of runway, stopway and clearway – performance aspects 178
Runway surface condition assessment and reporting for licensed aerodromes 180
Reporting of surface contaminants 182
Runway condition report (RCR) 183
Aeroplane performance calculation section 185
Situational awareness section 189
SNOWTAM Issuance 192
Reporting by aerodromes with multiple runways 193
Significant changes 193
Use of Friction Measurement 195
Runway Condition Assessment 196
Available Means Used to Determine the RWYCC 198
Type of contaminant 198
Depth of the contamination 199
Surface or air temperature 199
Assignment of runway condition code 200
Single and multiple contaminants 200
Downgrading and upgrading 201
Use of special air-reports 203
Aerodrome movement areas 205
Pavement surfaces 206
Grit and spoil 207
Packages and wrappings 207
Inspection and standards of cleanliness 207
Aircraft debris 208
Aerodrome pavement maintenance and inspection procedures **Error! Bookmark not defined.**
Documentation 209
Daily inspections 209
Weekly inspections 210
Annual inspections 210
Optional inspections 210
Detailed pavement inspection and evaluation 211

Care of pavements during winter conditions – improving surface friction by removal of contaminants 211

Ice detectors 214

Starter extensions 214

Runway end safety areas (assessment 216

Aeroplane performance 216

Risk assessment 216

Optimising the available RESA 222

Reviewing the risk assessment 222

Chapter 4 223

The Assessment and Treatment of Obstacles 223

Obstacle limitation surfaces 223

The take-off climb surface 224

The approach surface 228

Inner transitional surface 229

Dimensions and slopes of obstacle limitation surfaces — Approach runways 231

The transitional surface 236

Balked landing surface 237

The inner horizontal surface 238

The conical surface 238

The outer horizontal surface 239

Inner approach surface 239

Obstacle limitations requirements 244

Non instrument runways 244

Non precision approach runways 245

Precision approach runways 246

Restriction and removal of obstacles 249

Aerodrome safeguarding 251

Marking and lighting of obstacles and unserviceable surface areas 252

Lighting of obstacles 252

Location of obstacle lights 253

Lighting of unserviceable parts of the movement area 255

Lighting of vehicles 255

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

Light characteristics 256

Periods of illumination of obstacle lighting 257

Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces 257

Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces 259

Objects to be marked and/or lighted outside the lateral boundaries of the obstacle limitation surfaces 259

Objects to be marked and/or lighted outside the lateral boundaries of the obstacle limitation surfaces 259

Marking of fixed objects 260

Lighting of fixed objects 262

Lighting of fixed objects with a height less than 45 m above ground level 272

Lighting of fixed objects with a height 45 m to a height less than 150 m above ground level 273

Lighting of fixed objects with a height 45 m to a height less than 150 m above ground level 274

Lighting of fixed objects with a height 150 m or more above ground level 274

Lighting of fixed objects with a height 150 m or more above ground level 275

Lighting of other objects 275

Marking and lighting of wind turbines 276

Marking and lighting of wind turbines 277

Marking and lighting of overhead wires, cables, supporting towers, etc. 277

Characteristics of obstacle lights 279

Light distribution for low-intensity obstacle lights 281

Chapter 5 **285**

Wildlife Strike Hazard Management for Aerodromes **285**

Wildlife control management 285

Chapter 6 **287**

Aeronautical Ground Lighting **287**

AGL General information 287

Periods of display of aeronautical ground lighting 289

AGL for helicopter night landing training 289

Aerodrome beacon 290

OFFICIAL - Public

Aeronautical beacon 290
Identification Beacon 291
Circling guidance lights 292
Approach lighting 293
High intensity coded centreline and crossbar approach lighting system 293
Supplementary approach lighting 293
Simple approach lighting system 296
Approach lighting profile and obstacle protection 297
Approach slope indicators 298
Precision Approach Path Indicator (PAPI) 300
(A)PAPI 300
Luminous intensity control requirements for approach slope indicators 301
Unserviceability of PAPI and (A)PAPI systems 301
Runway and stopway lighting 301
PAPI siting and setting angles 302
Approach slope and elevation setting of light units for PAPI and APAPI 305
Wheel clearance and Minimum Eye Height over Threshold (MEHT) 306
Obstacle protection surface for PAPI and APAPI 309
Runway edge lighting 310
Runway threshold and runway end lights 311
Starter extension lighting 314
Runway centreline lights 314
Touchdown zone lights (TDZ) 315
Simple touchdown zone lights 316
Rapid exit taxiway indicator lights 317
Runway turn pad lighting 318
Stopway lights 319
Taxiway edge lighting 319
Taxiway centreline lights 319
Stop-bars 322
Intermediate holding positions 324
De-icing/anti-icing facility exit lights 324

No entry bar 325
Runway Status Lights 326
Taxiway guidance and control systems 327
Runway guard lights 328
Road-holding position lights 331
Retroflective taxiway edge markers and centreline studs 331
Unpaved taxiway routes 332
Aerodromes without specific taxiway routes 332
Aircraft stand manoeuvring guidance lights 332
Apron lighting and visual docking guidance systems 333
Control of AGL luminous intensity 334
Typical luminous intensity settings 334
Luminous intensity balance considerations for coloured lighting 336
Alternate input power supply 336
Other services requiring secondary power supply 339
Control and monitoring of aeronautical ground lighting 340
Pilot Controlled Lighting (PCL) 340
New installations or modifications to existing installations 342
Control and monitoring system 343
Control system software 343
Control equipment 344
Monitoring equipment 345
IRVR interface 346
Hardwired IRVR Interfaces 347
Networked IRVR Interfaces 348
Audio visual alarms 348
AGL fault conditions 352
General 353
Maintenance objectives 356
Maintenance practices 356
Insulation value 357
Runway Edge (and centreline where applicable) AGL Degradation – Impact on reported IRVR. 361

AGL Photometric requirements 361
Checking of (A)PAPI systems 362
Checking of AGL system input power supply 364
Installation of AGL systems 364
AGL System Components 365
Constant Current Regulators (CCRs) 366
AGL Cables 367
Earthing of Circuits 369
Interleaving of AGL electrical circuits 369
Electromagnetic Compatibility (EMC) 371
Commissioning Flight Checks of New AGL installations 372
Aeronautical ground lighting characteristics 372
AGL flight checks 373
Procedure for the routine flight inspection of approach and runway lights 374
Construction and height of lighting fittings 380
Instrument runways and associated taxiways 381
Photometric characteristics 404
Colour requirements for AGL 407
Chromaticities 409
Discrimination between lights 411
Procedure for the flight inspection of PAPI and (A)PAPI 411
Chapter 7 414
Aerodrome Signals 414
Signals 414
Wind direction indicator 414
Signal Area 416
Signals 417
Signs 423
Taxi guidance signs 424
Mandatory signs 424
Runway taxi-holding position signs 424
Intermediate taxi-holding position signs 429

Information signs 429
Taxiway location signs 429
Taxiway ending sign 430
VOR aerodrome checkpoint sign 433
Runway location sign 434
Runway intersection take-off sign 434
Runway distance remaining signs (RDRS) 434
Runway exit sign 438
Runway vacated sign 438
Direction signs 439
Destination signs 439
Stand identification signs 440
Illumination of signs 444
Construction 448
Information marking 450
Markings on paved runways 451
Interruption of runway markings 451
Threshold marking 454
Starter extension markings 457
Aiming point marking 458
Touchdown zone marking 460
Runway side stripe marking 462
Runway turn pad markings 464
Day markers for snow-covered runways 465
Markings on unpaved runways 465
Taxiway markings 466
Runway-holding position marking 467
Intermediate holding position marking 469
Enhanced taxiway centreline marking 471
VOR aerodrome checkpoint marking 472
Stand and Apron markings 473
Apron safety lines 475

Mandatory instruction markings on taxiways 476
Mandatory instruction markings on runways 476
Marking of unfit areas 477
Other markers 479
Lights and Signs 483
Closed runways and taxiways or parts thereof 485
Closed runway markings 485
Closed taxiway marking 486
Closed runway lighting 487
Non-load-bearing surfaces 488
Road signs and markings 489
Road-holding position sign 489
Taxi guidance signs style and proportion of characters, sign layout and face size 491
Form and proportions of runway designator marking 503
Form and proportions of pavement information marking – taxiways and aprons 506

Chapter 8 512

Rescue and Firefighting Service (RFFS) 512

Introduction 512
RFFS principal objective 515
Operational objective 515
Continuous agent application 517
Minimum levels of personnel 517
Extraneous duties 518
Medical standards 518
RFFS training 520
Equipment 521
Appliances 521
Extinguishing agents 524
Principal extinguishing agents 524
Complementary extinguishing agents 526
Reserve supply of agents 526
Storage of extinguishing agents 527

Foam production performance testing 528

Foam properties 529

Foam performance levels and specifications 529

Provision of additional water supplies at licensed aerodromes 530

Fire station(s) 531

Communications and alerting systems 531

Difficult environs, the 1000 m area and access roads 532

Maintaining the response capability in low visibility conditions 534

Work in Progress (WIP) 536

Inspections and audits of the RFFS by CAA aerodrome inspectors 537

Surface Level Heliports 538

The minimum RFFS requirements, which are specifically applicable to surface level heliports. 538

Minimum scale of services to be provided 538

Level of protection 539

Extinguishing agents 540

Response time 542

Minimum number of staff designated as RFFS personnel 543

Extraneous duties 543

Vehicles and ancillary equipment 543

Medical provisions 545

Training 545

Emergency planning/emergency orders 546

Category I and II aerodromes rescue and firefighting service (RFFS) requirements 548

Minimum scale of services to be provided 548

Level of protection 548

Remission 549

Extinguishing agents 549

Response time 551

Minimum number of staff designated as RFFS personnel 551

Extraneous duties 552

Vehicles and ancillary equipment 552

Medical provisions 554

Training 554

Emergency planning/emergency orders 555

Inspections of the RFFS by CAA aerodrome inspectors 555

Initial Emergency Response (IER) RFFS Category Special Aerodromes 557

Aerodrome Emergency Procedures 557

IER personnel and training 557

IER vehicle and equipment 558

Firefighting agents 558

Chapter 9 560

Emergency Planning 560

Introduction 560

Civil Contingencies Act 2004 561

Emergency planning objectives 562

Emergency planning arrangements 563

Aerodrome emergency plan 564

Emergency orders 566

Medical equipment 566

Supporting services, operating companies or agents 567

Assembly of assisting services 568

Definitions of emergencies and incidents 569

Off-aerodrome accidents 569

Other duties 569

Command and control 570

Control of the incident site 570

Testing and exercises 570

Assessment of the aerodrome emergency plan 571

Chapter 10 572

Aeronautical Information 572

Information to be made available 572

Reporting 573

Origination of NOTAM 573

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

Presence of wildlife 577

Procedures origination of NOTAM 577

Initial training for aerodrome personnel involved in NOTAM origination and other aerodrome personnel 578

Recurrent, refresher and continuation training CAP 2174 579

NON-origination of NOTAM 579

NOTAM format 581

Provision of information 581

UK AIS contact details 582

Chapter 11 583

Water Aerodromes 583

Aerodrome manual and notification in the UK aeronautical information publication 584

Physical characteristics 585

Obstacle Limitation Surfaces (OLS) 586

Wildlife strike hazard 588

Visual aids 588

Signals 588

Rescue and Fire Fighting Services (RFFS) 588

Emergency planning 589

Chapter 12 590

Heliports 590

OFFICIAL - Public

Introduction

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). The Civil Aviation Authority (Chicago Convention) Directions 2007 require the Civil Aviation Authority (CAA) to ensure that it acts consistently with the obligations placed on the United Kingdom under the Convention on International Civil Aviation, enacted in Chicago on 7 December 1944 (the Chicago Convention).

Not all ICAO (International Civil Aviation Organisation) Standards and Recommended Practices (SARPs) and procedures have been fully implemented directly in the ANO. Therefore, where the CAA has discretionary powers to grant a licence, certificate or approval provided it is satisfied as to the suitability of the applicant, the CAA is expected to implement such SARPs through its policy documents such as CAP 168. Where the UK has formally notified ICAO of differences to any of the SARPs in Annex 14, significant differences are published in the UK Aeronautical Information Publication (AIP) at GEN 1.7.

The ANO requires that, in the United Kingdom, most flights for the public transport of passengers take place at a licensed aerodrome, or at a government aerodrome. The Order also makes provision for an applicant to be granted an aerodrome licence subject to such conditions as the CAA thinks fit.

The purpose of this document is to give guidance to applicants and licence holders on the procedure for the issue and continuation of or variation to an aerodrome licence issued under Article 212 of the ANO 2016, 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.

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 licence holder shows that the safety requirements will not be reduced below that intended by the requirement.

Any limiting conditions or mitigating measures, described in the safety assurance, which 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 licence holder and the CAA periodically, in particular when any significant changes in activity or aerodrome development are proposed.

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 the pre-audit aerodrome safety report sent 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.

The CAA places emphasis on the adoption, by licence holders, of safety management systems that describe the safety policy of the aerodrome licence holder, and its application, and operational management, in addition to the physical design and operating standards of aerodromes. The CAA will regularly audit aerodromes.

During an aerodrome audit ,inspector from the CAA shall 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 aerodrome safety report are key documents in this process, as is CAP 700, Operational Safety Competences. 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 licence holder 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.

An aerodrome licensed in accordance with aerodrome licensing requirements will normally be suitable for use by Short Take-Off and Landing (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 CAA, from which guidance is available.

From time to time the CAA will wish to supplement the guidance or requirements given in this publication, and this shall be in the form of either a safety directive, safety notice, or an information notice. Where applicable, such information will subsequently be included in this publication by amendment.

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.

Where a definition is not provided in the Glossary of Terms, the definition provided in ICAO annex 14, volume 1, Aerodrome Design and Operations, will apply unless otherwise stated. Where a requirement is not provided in CAP 168, the relevant SARP in ICAO annex 14, volume 1, Aerodrome Design and Operations, will normally apply.

Where an aerodrome licence holder believes that this SARP should not be applied, then this shall be assessed on a case-by-case basis. The relevant annex 14 SARP will form the basis of this assessment. The need for any subsequent amendment to CAP 168 to include the relevant SARP shall also be considered and actioned as appropriate.

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.

Aircraft Classification Rating (ACR) means the number expressing the relative effect of an aircraft on a pavement for a specified standard subgrade category.

Aerodrome: A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure, or surface movement of aircraft.

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.'

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.

Aerodrome operator*:* means any legal or natural person operating or proposing to operate one or more aerodromes.

Aeronautical information service means; a service established within the defined area of coverage responsible for the provision of aeronautical information and data necessary for the safety, regularity, and efficiency of air navigation;

Aeronautical information circular means; a notice containing information that does not qualify for the origination of a notice to air men (NOTAM) or for inclusion in the AIP, but which relates to flight safety, air navigation, technical, administrative, or legislative matters.

Aeronautical Information Publication (AIP) means; a publication issued by or with the authority of the CAA and containing aeronautical information of a lasting character essential to air navigation.

Aerodrome Reference Point (ARP); 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 5 of the ANO 2016 as being airspace in the vicinity of an aerodrome notified for the purposes of Rule 45 of the Rules of the Air Regulations.

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 (ARFL); 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 datasheets 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 classification rating (ACR); A number expressing the relative effect of an aircraft on a pavement for a specified standard subgrade category.

Note: The aircraft classification rating is calculated with respect to the centre of gravity (CG) position which yields the critical loading on the critical gear. Normally the aftmost CG position appropriate to the maximum gross apron (ramp) mass is used to calculate the ACR. In exceptional cases the forwardmost CG position may result in the nose gear loading being more critical.

Aircraft stand; A designated area on an aerodrome to be used for parking an aircraft.

Aircraft stand taxilane; means a portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

Alerting service means; a service provided to notify relevant organisations regarding aircraft in need of search and rescue aid, and to assist such organisations as required.

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, fuelling, and for parking.

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

Audit means; A systematic, independent, and documented process for obtaining evidence and evaluating it objectively to determine the extent to which requirements are complied with

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

Balanced field length; 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.

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

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; A defined rectangular area on the ground or water under the control of the aerodrome licence holder, 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.

Contaminated Runway; means a runway whose surface area (whether in isolated areas or not) within the length and width being used is covered in significant part by one or more of the substances listed under the runway surface condition descriptors;

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.

Dangerous goods; means articles or substances which are capable of posing a risk to health, safety, property, or the environment and which are shown in the list of dangerous goods in the Technical Instructions, or which are classified according to those Technical Instructions;

Decision height (DH); means a specified altitude or height in a 3D instrument approach operation at which a missed approach procedure must be initiated if the required visual reference to continue the approach has not been established.

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 these being;

(1) take-off run available (TORA),

(2) take-off distance available (TODA),

(3) accelerate-stop distance available (ASDA),

(4) landing distance available (LDA)

Delethalisation; Below ground ramping to buried vertical face of construction designed to reduce risk of damage to aircraft running on cleared and graded area of strip.

Displaced threshold; A threshold not located at the extremity of a runway.

Dry; in respect of runway conditions, means that the surface of the runway is free of visible moisture and not contaminated within the area intended to be used.

E - Modulus of Elasticity; Is the unit of measurement of an object's or substance's resistance to being deformed elastically (i.e., non-permanently) when a stress is applied to it.

Effective intensity; The effective intensity of a flashing light is equal to the intensity of a fixed light of the same colour which will produce the same visual range under identical conditions of observation.

Enhanced flight vision system 200 (EFVS 200) operation' means; An operation in which visibility conditions require an EFVS to be used down to 200 ft above the FATO or runway threshold. From that point to land, natural vision is used. The RVR is not less than 550 m.

Enhanced flight vision system (EFVS) - Approach (EFVS-A) means; A system that has been demonstrated to meet the criteria to be used for approach operations from a decision altitude/height (DA/H) or a minimum descent altitude/height (MDA/H) to 100 ft (30m) threshold elevation while all system components are functioning as intended but may have failure modes that could result in the loss of EFVS capability. It should be assumed for an EFVS-A that:

1. the pilot will conduct a go-around at or above 100 ft threshold elevation, in the event of an EFVS failure; and
2. descent below 100 ft above the threshold elevation through to touchdown and roll-out should be conducted using natural vision, so that any failure of the EFVS does not prevent the pilot from completing the approach and landing.

Enhanced flight vision system - landing (EFVS-L) means; A system that has been demonstrated to meet the criteria to be used for approach and landing operations that rely on sufficient visibility conditions to enable unaided roll-out and to mitigate for loss of EFVS function

Fixed light; A light having constant luminous intensity when observed from a fixed point.

Flight information service means; A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights;

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

Frangible object; An object of low mass designed to break, distort, or yield on impact so as to present the minimum hazard to aircraft.

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 presenting minimum hazard to an aircraft.

Human factors principles mean; Principles which apply to aeronautical design, certification, training, operations, and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance

Human performance means; Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations

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.

Heliport; An aerodrome or a defined area on a structure intended to be used either wholly or in part for the arrival, departure, and surface movement of helicopters.

Holding bay; A defined area where aircraft can be held or bypassed in order to facilitate the efficient movement of aircraft.

Holdover time; The estimated time the anti-icing fluid (treatment) will prevent the formation of ice and frost and the accumulation of snow on the protected (treated) surfaces of an aeroplane.

Hotspot; A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary.

Inspection means; an independent evaluation by observation and judgement accompanied as appropriate by measurement, testing or gauging, in order to verify compliance with applicable requirement

Instrument approach operations; An approach and landing using instruments for navigation guidance based on an instrument approach procedure.

There are two methods for executing instrument approach operations:

a) A two-dimensional (2D) instrument approach operation, using lateral navigation guidance only; and

b) A three-dimensional (3D) instrument approach operation, using both lateral and vertical navigation guidance.

Note: Lateral and vertical navigation guidance refers to the guidance provided either by:

a) A ground-based radio navigation aid; or

b) Computer-generated navigation data from ground-based, space-based, self- contained navigation aids or a combination of these.

Instrument approach operations shall be classified based on the designed lowest operating minima below which an approach operation shall only be continued with the required visual reference as follows:

a) Type A: a minimum descent height or decision height at or above 75 m (250 ft); and

b) Type B: a decision height below 75 m (250 ft).

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

(a) ‘non-precision approach runway.’ a runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type A and a visibility not less than 1000 m.

(b) ‘precision approach runway, category I’ : a runway served by visual aids and at least one non-visual aid, intended for landing operations following a type B CAT I instrument approach operation with a DH not lower than 60m (200ft) and either at a visibility not less than 800m or at an RVR of not less than 550m

(c) ‘precision approach runway, category II’: a runway served by visual aids and at least one non-visual aid intended for landing operations following a type B CAT II instrument approach operation with a DH lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range of not less than 300 m.

(d) 'precision approach runway category III': a runway served by visual aids and at least one non-visual aid intended for landing operations following a type B CAT III instrument approach operation with:

i. A DH lower than 30 m (100 ft)

ii. No DH and an RVR of less than 300m or;

iii. No runway visual range limitations

Integrity classification (aeronautical data); Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data is classified as:

1. routine data: there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;
2. essential data: there is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe; and
3. critical data: there is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.

Intermediate holding position; A designated position intended for traffic control at which taxying aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower.

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.

Low visibility procedures; means procedures applied at an aerodrome for the purpose of ensuring safety during low-visibility operations;

Low-visibility operations (LVOs) means; 'low visibility take-off' (LVTO) means a take-off operation with an RVR less than 550m

Low visibility take-off (LVTO)' means a take-off operation with an RVR less than 550m;

Manoeuvring area; That part of an aerodrome to be used for the take-off, landing, and taxiing of aircraft, excluding aprons.

Movement means; either a take-off or landing

Movement area; That part of an aerodrome to be used for the take-off, landing, and taxiing of aircraft, consisting of the manoeuvring area and the apron(s).

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.

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

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, or that stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

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 required for air navigation purposes, of low mass and of a frangible mount.

Obstacle limitation surface; Obstacle limitation surface' means a surface that defines the limits to which objects may project into the airspace.

Obstacle protection surface; means a surface established for visual approach slope indicator system above which objects or extensions of existing objects shall not be permitted except when, in the opinion of the CAA, the new object or extension would be shielded by an existing immovable object.

Outer main gear wheel span (OMGWS); The distance between the outside edges of the main gear wheels.

Pavement classification rating (PCR); A number expressing the bearing strength of a pavement.

Precision approach runway; See Instrument Runway: A defined rectangular area, on a land aerodrome prepared for the landing and take-off run of aircraft along its length.

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

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

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

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

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 holding position; A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxying aircraft and vehicles shall stop and hold, unless otherwise authorised by the aerodrome control tower.

Runway incursion; Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft.

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

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

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

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

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

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

Slippery wet runway; A wet runway where the surface friction characteristics of a significant portion of the runway have been determined to be degraded.

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

Note. Procedures on determination of contaminant coverage on runway are available in the ICAO PANS-Aerodromes (Doc 9981).

Runway surface condition descriptor; One of the following elements on the surface of the runway:

Note. The descriptions for e) i) to viii) are used solely in the context of the runway condition report and are not intended to supersede or replace any existing WMO definitions.

Compacted snow; Snow that has been compacted into a solid mass such that aeroplane tyres, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface.

Dry snow; Snow from which a snowball cannot readily be made.

Frost; Frost consists of ice crystals formed from airborne moisture on a surface whose temperature is below freezing. Frost differs from ice in that the frost crystals grow independently and therefore have a more granular texture.

Note 1. Below freezing refers to air temperature equal to or less than the freezing point of water (0 degree Celsius).

Note 2. Under certain conditions frost can cause the surface to become very slippery and it is then reported appropriately as reduced braking action.

Ice; Water that has frozen or compacted snow that has transitioned into ice, in cold and dry conditions.

Slush; Snow that is so water-saturated that water will drain from it when a handful is picked up or will splatter if stepped on forcefully.

Standing water; Water of depth greater than 3 mm.

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

Wet ice; Ice with water on top of it or ice that is melting.

Note. Freezing precipitation can lead to runway conditions associated with wet ice from an aeroplane performance point of view. Wet ice can cause the

surface to become very slippery. It is then reported appropriately as reduced braking action in line with procedures in the PANS-Aerodromes (Doc 9981).

Wet snow; Snow that contains enough water content to be able to make a well-compacted, solid snowball, but water will not squeeze out.

Runway threshold; The beginning of that portion of the runway usable for landing.

Runway turn pad; A defined area on a land aerodrome adjacent to a runway for the purpose of completing a 180-degree turn on a runway.

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.

Safety Management System (SMS); A systematic approach to managing safety including the necessary organisational structure, accountabilities, policies, and procedures.

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.

Special authorisation category I (SA CAT I) operation means; a CAT I approach operation with a decision height not lower than 45 m (150 ft) and an RVR not less than 400 m and requires special authorisation.

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; A defined path on a land aerodrome established for the taxying of aircraft and intended to provide a link between one part of the aerodrome and another, including:

1. Aircraft stand taxilane; a portion of an apron designated as a taxi route intended to provide access to aircraft stands only.
2. Apron taxiway; a portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.
3. 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; A designated position at which taxying aircraft and vehicles may be required to hold in order to provide adequate clearance from a runway or another taxiway.

Runway Taxi Holding Position; a taxi holding position intended to protect a runway.

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.

Type A Instrument approach operation means; an instrument approach operation with a minimum descent height or decision height at or above 75 m (250 ft);

Type B instrument approach operation means; an instrument approach operation with a decision height below 75 m (250 ft). Type B instrument approach operations are categorised as follows:

1. Category I (CAT I): a DH not lower than 60 m (200 ft) and with either a visibility not less than 800 m or a runway visual range not less than 550 m;
2. Category II (CAT II): a DH lower than 60 m (200 ft), but not lower than 30 m (100 ft) and a runway visual range not less than 300 m;

3. Category III (CAT III): a DH lower than 30 m (100 ft) or no decision height and a runway visual range less than 300 m or no runway visual range

CHAPTER 1

The licensing process

Introduction

In this chapter the Air Navigation Order and references to Articles of that Order mean the Air Navigation Order 2016. 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.

The legal background to aerodrome licensing

1.1 In addition to annex 14, ICAO has published the manual on Certification of Aerodromes, Document 9774, the purpose of which is to provide guidance to States in establishing their regulatory regime so that compliance with the specifications in annex 14 can be effectively enforced. In the UK, the term 'licensing' is used rather than 'certification.' Document 9774 is implemented in the Air Navigation Order and CAP 168.

1.2 The Air Navigation Order (ANO) Article 208 requires that, in the UK, specified flights for the purpose of public transport or for the purpose of instruction in flying, take place only at a licensed aerodrome or a government aerodrome. The grant of an aerodrome licence is governed by Article 212.

1.3 The aerodrome manual required under ANO Article 212 shall include information and instructions as specified in Schedule 12 to that Article. Guidance on aerodrome manual production is given in chapter 2 of this CAP.

1.4 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 in accordance with ANO Article 228.

1.5 CAP1074 contains the guidance where there is a need to revoke the aerodrome licence.

1.6 The Civil Aviation Authority Regulations 1991 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.

1.7 Where an application for the grant or variation of an 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 request within 14 days from the date of service of the notice that CAA review the case.

Charges

1.8 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 CAA web site www.caa.co.uk/ors5 .

Type of licence

1.9 An applicant may be granted a Public Use 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 on equal terms and conditions to all persons permitted to use the aerodrome.

1.10 An ordinary licence relates only to use of the aerodrome by the holder of the licence and persons specifically authorised by the licence holder.

1.11 The holder of an ordinary licence is not obliged to notify the hours of availability in the UK AIP but, if they do so, they 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.

Application for a licence

1.12 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 .

1.13 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.

1.14 The application for planning permission and the request for the aerodrome licence are not interdependent and are made separately. A similar constraint will almost certainly apply to any proposals for aerodrome development.

1.15 The granting of an aerodrome licence does not absolve the holder from observing other statutory requirements.

1.16 The initial application for an aerodrome licence must be made on form SRG 2002. The completed form should be returned to the CAA together with the appropriate fee, a map showing the aerodrome location and boundaries and a copy of the aerodrome manual (see chapter 2(A). 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.

1.17 An application for the variation of a licence must be made in writing by the licence holder, and be accompanied by the appropriate fee, and by the relevant survey and other information where there are any changes in the characteristics of the aerodrome or its environs. A variation to the licence can be requested for a change to the licence holder's details, a change to the licence conditions, or to Schedule 1 the aerodrome boundary map. A variation in this context means a change or amendment to an existing aerodrome licence.

1.18 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 SRG 2002. In the case of a temporary licence, for a period not exceeding 12 consecutive days, application must be made on form SRG 2003.

1.19 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.

1.20 A prospective applicant should, in their own interest, consult the CAA before committing themselves to expenditure on developing or equipping an aerodrome .

1.21 Application forms are obtainable from the CAA and in electronic format at; www.caa.co.uk/aerodromelicensingforms

Aerodrome boundaries

1.22 As part of the aerodrome licensing process, the holder of (or applicant for) an aerodrome licence is required to provide a map on a scale not larger than A4 size showing the exact location of the aerodrome, and to delineate on the map the boundary of the aerodrome land. If a licence is granted, this map will form a schedule to the aerodrome licence.

1.23 The aerodrome boundary for licensing purposes should not be confused with boundaries established for other purposes such as the operational boundaries used by local planning authorities, or those used to designate security restricted zones. These other boundaries may be coincident either in whole or in part with the aerodrome licence boundary, but there is no requirement for them to be so.

1.24 The map forming Schedule 1 to the aerodrome licence should show the boundary of the area of the aerodrome set aside for the movement of aircraft requiring the use of a licensed aerodrome, so should include runways, taxiways, aprons and, in most cases, the area adjacent to the terminal building. This is the area that will be audited by CAA Inspectors and is also the boundary of the area referred to in Condition 3 of the aerodrome licence

General requirements for the grant of a licence

1.25 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.

1.26 The CAA 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.

1.27 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 an aerodrome licence the CAA shall:

1. establish and maintain an oversight programme to verify continued compliance with the requirements set out in this publication, and the conditions of the aerodrome licence.

2. apply an appropriate oversight planning cycle (OPC), not exceeding 48 months.

1.28 The oversight programme will include within each OPC, audits and inspections, including unannounced inspections, as appropriate. The oversight programme and OPC will reflect the safety performance of the aerodrome operator and risk exposure of the aerodrome.

Conditions of licence

1.29 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 licenses at Aerodrome Licence 'Public Use,' Aerodrome Licence 'Ordinary,' Temporary Aerodrome Licence ''Ordinary.'

1.30 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.

1.31 It is also a standard condition of licenses that the holder must inform the CAA of changes to data concerning the aerodrome, appropriate promulgation of the change, and amendment to the UK AIP should be undertaken by the aerodrome operator. Guidance on the aeronautical information to be provided in respect of a licensed aerodrome, and the procedure for promulgating such information is given in chapter 10.

1.32 Aerodrome licence holders should develop procedures that describe the processes by which changes to the physical characteristics, including the erection of new buildings and alterations to existing buildings or to visual aids, are managed. Such procedures should be contained within the aerodrome manual and cross-referenced to other formally accepted or recognised publications, for example CAP 791, Procedures for Changes to Aerodrome Infrastructure.

Change of aerodrome licence holder

1.33 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, limited liability partnership) 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 licence holder continues to meet licensing requirements. An aerodrome licence is not a saleable asset and cannot be transferred from one person to another.

1.34 If the identity of a licence holder is to change, application for grant of a new licence should be made to the CAA by the prospective licence holder. (Please note: A change in the name only of a licence holding company does not constitute a change of identity; the licence holder 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.')

1.35 During a transition of ownership of an aerodrome if the aerodrome is to remain licensed the outgoing licence holder must be in a position to retain responsibility for the aerodrome licence until the licence is granted to the new licence holder. 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 licence holder can begin.

1.36 An application for an aerodrome licence in the name of the prospective licence holder 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.

1.37 When it is proposed to make other changes at the time of a change of licence holder (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 licence holder, 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.

1.38 As with any new application, grant of an aerodrome licence will be subject to the applicant satisfying the CAA on the requirements of Article 212 and Schedule 12 of the Air Navigation Order 2016; 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:

1. Previous conduct and experience of the applicant;

2. The organisation, staffing, and equipment to be provided;
3. The arrangements for the maintenance of the aerodrome and its facilities and equipment;
4. The adequacy of the aerodrome manual; and
5. Any other arrangements made including the adequacy of safety management systems.

Change of provider of an air traffic service

1.39 At some licensed aerodromes, the Air Traffic Services (ATS) are provided by contracted organisations. Occasionally the contracted organisations will change, and the aerodrome licence holder will wish the transition to be as seamless as possible, while maintaining high levels of safety, particularly if continuous operations are to be provided.

1.40 Aerodrome licence holders are reminded of their responsibilities under ANO Article 212 to secure the aerodrome and airspace especially during the change-over of providers of ATS.

1.41 Licence holders 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.

1.42 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, licence holders should consider retaining ownership of the existing, approved, MATS Part 2.

1.43 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 at www.caa.co.uk/CAP670)

Naming of aerodromes

1.44 Aerodrome operational information and other relevant data are notified by the Aeronautical Information Services (AIS) in accordance with international standards and recommended practices specified in ICAO Annex 15, and any applicable Aeronautical Data Requirements concerning data integrity and assurance specifications.

1.45 In guidance Document 8126 Aeronautical Information Services manual, ICAO requires to be shown in the Aeronautical Information Publication (AIP) of a State, a list of aerodrome and heliport names and ICAO location

indicators. The aerodrome name should indicate the name in capitals of the city or town served by the aerodrome, followed by an oblique strike and the name given to the aerodrome by the State concerned, thus LIVERPOOL/John Lennon.

1.46 In aviation safety terms the name of an aerodrome is directly connected with aeronautical communications and flight safety information. Furthermore, certain aerodromes, recognised for their international importance, are notified to ICAO, which in turn publishes details of existing and planned facilities available at the aerodrome in the regional Air Navigation Plan (FACID). It is therefore important for flight planning purposes, including international flights, that the aerodrome name is consistently recognisable, relevant, unambiguous, and promulgated accordingly.

1.47 The aerodrome name used in aeronautical information should therefore include the name used in the callsign for air traffic communications (for licensed aerodromes and where applicable, as specified in AD 2.17 or AD 2.18 of the AIP), be representative of its location (the nearest city or town) and should not have the potential to be confused with another aerodrome.

Licensing action

1.48 There may be occasions where aerodromes require greater regulatory oversight by the CAA, for instance where large or complex aerodrome developments are being undertaken, where significant operational changes are taking place or in order to achieve a satisfactory standard of regulatory compliance. Additionally, there may be occasions where the CAA has identified concerns about the safety of aircraft operations at an aerodrome, the maintenance of its facilities, equipment, or the aerodrome's organisational structure in meeting CAA licensing requirements. In these circumstances the aerodrome may be identified as requiring 'special attention.'

1.49 In such cases the CAA may provide additional resource, which could involve additional visits by Inspectors, to support the aerodrome so as to achieve the required safety standards and other objectives. The CAA will write to the aerodrome licence holder to explain the reasons for special attention being necessary and will agree the steps needed to return the aerodrome to normal oversight.

1.50 However, there are also occasions when this additional oversight fails to produce the improvements or changes necessary to maintain safety standards. Additionally, there are occasions when the CAA detects unchecked trends in some operations that indicate safety standards are

deteriorating. If left unchecked this could lead to a situation whereby the CAA is no longer satisfied as to a licence holder's competence to secure that the aerodrome is safe for use by aircraft.

1.51 With such aerodromes the CAA will take action in a consistent manner that makes it clear to the licence holder what it must do to recover the situation. The CAA will also make clear what the consequences are, should the aerodrome fail to adhere to an agreed recovery plan. In the event that the CAA has observed an adverse trend, which, if unchecked, would lead it to cease to be satisfied as to the competence of the licence holder, the CAA will contact the licence holder to set out the CAA's concerns. This may result in the aerodrome being placed 'on notice.' It is important to recognise that every case needs to be judged on the individual circumstances. Examples of what could prompt action include:

Level 1 Audit Findings;

1. Repetitive Level 2 audit findings, including a failure to identify root causes of audit findings or a 'sticking plaster' approach to findings;
2. Significant incidents, together with a failure to investigate properly and deal with the root causes;
3. An increasing number of incidents, indicating an underlying systemic failure;
4. Poor management attitude to compliance;
5. A management that prefers solutions that simply address the detail of the audit finding and that is unwilling or unable to put measures in place that address the root cause of non-compliances;
6. Unstable/ineffective management. Instability can be caused by changes in structure, personnel, or both.

1.52 The CAA will set out its concerns and request a recovery plan from the licence holder to address the causes of the adverse trend. The recovery plan should provide deliverables that can be measured, including specific timescales. The recovery plan should set out clearly the 'who, what, where and how.' The need for, and adherence to, agreed timescales is particularly important.

1.53 The licence holder will be informed that a failure to deliver, either in terms of quality and/or time, will result in firm regulatory action. This action may include the suspension of the aerodrome licence.

1.54 Where the licence holder completes, to the satisfaction of the CAA, the agreed actions in the recovery plan relating to the adverse trend(s)

observed by the CAA, the licence holder will be informed in writing that they are no longer 'on notice.' In most cases the aerodrome will revert to 'special attention' for a period to ensure that the improvements or changes are maintained and then return to normal levels of oversight.

Aerodrome licence 'public use'

1. The Civil Aviation Authority (in this licence referred to as 'the CAA') in exercise of its powers under Article 212 of the Air Navigation Order hereby licenses 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:

2. 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.

3. No aircraft shall take-off or land at the aerodrome unless such firefighting 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.

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 prior approval of the CAA.

5. The licence holder 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. 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. 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.

8. The licence holder 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 licence holder 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 licence holder 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 licence holder outside the times when it is generally available and is used pursuant to such arrangement.
9. 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 licence holder.
10. Expressions used in this licence shall have the same respective meanings as in the Air Navigation Order.
11. The Air Navigation Order' in this licence means the Air Navigation Order 2016 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.
12. This licence shall remain in force until it is varied, suspended or revoke

Aerodrome licence 'ordinary'

1. The Civil Aviation Authority (in this licence referred to as 'the CAA') in exercise of its powers under Article 212 of the Air Navigation Order hereby licenses 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:

2. The aerodrome is licensed for use only by the licence holder and by persons specifically authorised by the licence holder.

3. No aircraft shall take-off or land at the aerodrome unless such firefighting 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.

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 prior approval of the CAA.

5. The licence holder 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:

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.

   Or;

7. Day use only:

8. The aerodrome is not licensed for the take-off or landing of aircraft at night.

9. 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.

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

11. The ‘Air Navigation Order’ in this licence means the Air Navigation Order 2016 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.

Temporary aerodrome licence 'ordinary'

1. The Civil Aviation Authority (in this licence referred to as 'the CAA') in exercise of its powers under Article 212 of the Air Navigation Order hereby licenses 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:
2. The aerodrome is licensed for use only by the licence holder and by persons specifically authorised by the licence holder.
3. No aircraft shall take-off or land at the aerodrome unless such emergency services and equipment as specified 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 turn-out.
4. 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.
5. 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.
6. The licence holder 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.
7. The aerodrome is not licensed for the take-off or landing of aircraft at night.
8. Expressions used in this licence shall have the same respective meanings as in the Air Navigation Order.
9. The 'Air Navigation Order' in this licence means the Air Navigation Order 2016 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.

10. This licence is only valid while 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.

CHAPTER 2

The Aerodrome Manual, Safety Management System and Low Visibility Operations

Introduction

2.1 Article 212 of the Air Navigation Order (ANO) governs the grant of aerodrome licenses by the Civil Aviation Authority. The Article, together with Schedule 12, sets out the requirements for the aerodrome manual within the licensing process.

2.2 The CAA uses the manual to assess the suitability of aerodrome licence holders and their organisations against the safety-related requirements set out in Article 212(1)(a),(b) and (c) of the Order. The assessment is a continuous process; this is particularly relevant when changes likely to affect safety are proposed or made.

2.3 An application for an aerodrome licence should be accompanied by an aerodrome manual produced in accordance with CAP 168.

2.4 Once granted a licence, the licence holder 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 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.

2.5 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 CAA. The process for submission of an aerodrome manual is contained in this chapter.

Ownership of an aerodrome manual

2.6 The licence holder is responsible for providing the aerodrome manual. It should reflect the requirements and guidance material contained in Civil Aviation Publications and other documents.

2.7 It is the responsibility of the licence holder 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.

2.8 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 licence holder.

2.9 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

2.10 Responsibility for maintaining the accuracy of the manual should be clearly defined.

2.11 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.

2.12 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.

2.13 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 licence holder before or immediately after they come into effect.

Amendment of the manual

2.14 Responsibility for maintaining the accuracy of the manual should be clearly defined.

2.15 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.

2.16 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.

2.17 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 licence holder before or immediately after they come into effect.

Form of the manual

2.18 The aerodrome manual is a key document both for the licence holder and the CAA.

2.19 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.

2.20 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 12 to the ANO.;

2.21 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.

2.22 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.

2.23 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.

2.24 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.

2.25 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.

Contents of the manual

2.26 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.

1. 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. Items to be included;
2. Introduction;
3. Purposes of the manual;
4. Legal position regarding aerodrome licensing as contained in the ANO;
5. Distribution of the manual;
6. Procedures for distributing and amending the manual and the circumstances in which amendments may be needed;
7. Checklist of pages;
8. Preface by licence holder;
9. Content page;
10. 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.

Technical administration;

1. Name and address of aerodrome;
2. Name and address of licence holder;
3. Name and status of the accountable manager;

Named persons;

1. The name, status, and responsibilities of the official in charge of day-to-day operation;
2. The name, status, and responsibility of other senior operating staff;

3. Instructions as to the order and circumstances in which the above-named staff may be required to act as the official in charge;
4. The name, status and responsibility of staff authorised by the CAA under Article 257 of the Air Navigation Order 2016;
5. The name, status, and responsibilities of the accountable manager.
6. Details of the Aerodrome Safety Management System
7. Note: This should include 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 and safety related committees.

Aerodrome characteristics - details of the following;

1. Latitude and longitude of the aerodrome reference point in WGS 84 format;
2. The aerodrome reference point should be measured and reported to the aeronautical information services in degrees, minutes, and seconds. and remain where first established.
3. Elevations of;
    a) aerodrome;
    b) apron.
4. 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 sub-paragraphs (4) to (7) to accompany all copies of the manual, but they must be appended to the licence holder’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.
5. Description, height, and location of obstacles which infringe the standard protection surfaces, and whether they are lighted;
6. Location, reference number and date of the survey plans from which the data at 1 and 2 were derived, and details of the procedures for ensuring they are maintained and updated;

7. Data for, and the method of, calculation of declared distances and elevations at the beginning and end of each declared distance;
8. Method of calculating reduced declared distances when there are temporary objects infringing the runway strip, or the approach and take-off surfaces; Details of the surfaces, dimensions, and classification or bearing strengths of runways, taxiways, and aprons.
9. The aerodrome operator should ensure, either directly or through arrangements with third parties, that charts relevant to the aerodrome are published in the AIP by the aeronautical information service provider.
10. The aerodrome operator should ensure, either directly or through arrangements with third parties, that information on visual segment surface (VSS) penetration is provided to the aeronautical information services, including procedure and procedure minima affected. If the VSS is penetrated, the information to be provided to the AIS provider, to publish it under AD 2.25, should clearly indicate the name of the affected procedure and the procedure minima affected.
11. The aerodrome operator should ensure, either directly or through arrangements with third parties, that information on Information on the parts of the aerodrome lighting system where light units are light emitting diode (LED) lights is provided to the aeronautical information.

Operational procedures

1. The system of Aeronautical Information Service available and the system that the licence holder uses to promulgate Aeronautical Information Publication (AIP) requirements;
2. Routine aerodrome inspections, including lighting inspections, and reporting including the nature and frequency of these inspections;
3. 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;
4. Sweeping runways, taxiways, and aprons;
5. 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 Chapter 2.Protection of runways during low visibility

procedures (LVPs) if such operations are permitted (chapter 2 low visibility operations);

6. Measurement and promulgation of water and slush depths on runways and taxiways;
7. Measurement and/or assessment, and promulgation of runway surface friction conditions;
8. Promulgation of information on the aerodrome operational state, temporary withdrawals of facilities, runway closures etc;
9. The safe integration of other aviation activities such as gliding, parachuting and banner towing, operations from unlicensed runways on licensed aerodromes and unmanned aerial systems (UAS);
10. Recording aircraft movements;
11. The control of works, including trenching and agricultural activity, which may affect the safety of aircraft.
12. 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;
13. Maintaining apron control, including marshaller's instructions;
14. The availability of aviation fuel and its storage, handling, and quality control (ANO Article 220);
15. Complying with regulatory requirements relating to accidents, incidents, and Mandatory Occurrence Reporting (MOR). Mandatory Occurrence Reporting in the UK is outlined in UK Regulation 376/2014 with additional guidance presented in Implementing Regulation 1018/2015;
16. The removal of disabled aircraft;
17. The aerodrome snow plan;
18. The wildlife hazard control plan.
19. Aerodrome safeguarding (chapter 4);
20. Runway incursion prevention (Chapter 2 paragraph 2.12);
21. Responsibility for monitoring the third parties operating on the aerodrome (Chapter 2) and

22. Procedures for the management of on-aerodrome development and changes to physical characteristics.

Visual aids (reference should be made to chapters 6 and 7)

23. Responsibilities with respect to the aeronautical ground lighting (AGL) system;

24. A full description of all visual aids available on each approach, runway, taxiway, and apron. This shall include AGL signs, markings, and signals;

25. Procedures for operational use and brilliancy settings of the AGL system;

26. Standby and emergency power arrangements, including operating procedures both in LVPs and during mains failure;

27. procedures for routine flight inspection of approach lights, runway lights and PAPIs;

28. The location of and responsibility for obstacle lighting on and off the aerodrome; and

29. Procedures for recording inspection and maintenance of visual aids and actions to be taken in the event of failures.

Rescue and Fire Fighting Services (RFFS)

30. Policy statement of the RFF category or categories to be provided.

31. 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.

32. 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.

33. 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.

34. The licence holders' objectives for each RFF category provided should be defined. This should include a brief description of:

    a) amounts of media provided;

b) discharge rates;

c) number of foam-producing appliances;

d) manning levels;

e) levels of supervision.

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

Procedures for:

1. Monitoring the movement areas for the purpose of alerting RFF personnel;
2. 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;
3. Indicating how the adequacy of the response time capability throughout their functions and locations is monitored and maintained;
4. Indicating how RFF personnel engaged in extraneous duties are managed to ensure that response capability is not affected.
5. 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.
6. 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.
7. A statement describing the processes by which licence holders ensure the initial and continued competence of their RFF personnel. This should include the following:

    a) Realistic fuel fire training;

    b) Breathing apparatus training in heat and smoke;

    c) First Aid;

    d) LGV driving;

e) Low visibility procedures;

f) Health and Safety policy with regard to training of personnel in RPE and PPE. Additional guidance may be found in CAP 168, chapter 8, and CAP 699, Standards for Competence of Rescue and Fire Fighting Service Personnel Employed at UK Licensed Aerodromes;

g) Procedures indicating how accidents within 1000m 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;

8. Where licence holders 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;

9. Where licence holders 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;

10. The availability of additional water supplies following an aircraft accident should be described;

11. Details of the policy to be followed in the event of contractual work which requires isolation or depletion of supplies should be included (work in progress);

12. 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;

13. The licence holder's arrangements for ensuring the adequacy of responses in abnormal conditions i.e., low visibility procedures;

14. A policy statement indicating how the licence holder ensures the training and competence of first aid personnel; and

15. 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.

Integrated emergency planning;

2.27 The licence holder's arrangements for determining and implementing plans that ensure the integrated management of response to an aircraft incident/accident;

2.28 These arrangements should take account of the complexity and size of the aircraft operations.

Air traffic services

2.29 Details of the following:

1. the system for the safe management of air traffic operating on the aerodrome or in the airspace associated with it;
2. procedures for the selection of the runway in use and the circuit direction;
3. procedures for noise abatement;
4. procedures for evaluating the suitability for use and availability of the runway(s);
5. procedures for alerting emergency services;
6. except where these are included in documentation associated with an ATSU established at the aerodrome and approved by the CAA.

Communications and navaids

1. Description of and instructions for the use of air/ground and operational ground radio communications where these are not covered in ATC or AFIS manual; and
2. Description of and operating procedures for navigation aids.

2.30 Bibliography

Cross-referenced documentation.

Submission of the aerodrome manual and other required documents

2.31 The development, transmission, storage, dissemination and change control of documents is far more efficient and easier by electronic means than with paper copies.

2.32 The aerodrome manual, emergency orders and details of the safety management system, if contained in a separate document(s), should be submitted in electronic form. In order to facilitate assessments of aerodrome developments and the treatment of obstacles, the aerodrome plan may be provided in paper form.

2.33 The aerodrome manual and other documents should be submitted in either portable document format1 (.pdf) or a format that can be viewed using an application within the Microsoft Office software suite (e.g., Microsoft Word);

2.34 Documents must be saved to allow opening, printing, extracting (copy) and commenting without the need to enter a password. Documents received in an unsuitable format may not be accepted;

2.35 The number of pictures and graphics within a document should be kept to a minimum. Every effort should be made to provide large graphics and maps in electronic form; however, if they cannot be viewed clearly on a computer display with a resolution of 800x600 pixels the graphic or map only should be submitted in paper copy form to the address in paragraph 10. Electronic signatures are acceptable;

2.36 Submitted documentation must be complete and, if an amendment, not just the amended pages. An amendment should be clearly indicated, for example, using a line in the margin adjacent to the line containing the amendment, underlining new text, and strikethrough of deleted text. Substantial amounts of amended text, e.g., completely new paragraphs or chapters, may be annotated just using a margin line;

2.37 Every document should be controlled according to the version and date of issue/ applicability. All files should be named according to the following convention;

2.38 (Date as YYYYMMDD)(Aerodrome name)(Document name)(Version number) for example: 20070122ManpoolAeroManPart1V1.0.pdf .

2.39 Do not insert spaces or symbols but intuitive abbreviations may be used. An amendment record and list of effective pages should be included in the document and, where applicable, the saved filename of a previously submitted document that is to be replaced should be notified;

2.40 Documents must not contain hyperlinks to other documents or internet/intranet addresses. Large documents may, however, be split into different parts and individual files. The part number should also be indicated in the saved filename, for example; 20070122ManpoolAeroManPart1V1.0.pdf If a required document is split into parts, a list of the parts and, where appropriate, their relationship to each other, should be provided.

2.41 Documentation should be submitted, with suitable notification of the nature of the submission, by email only to the following address: asddocs@caa.co.uk

2.42 The size of individual emails, including file attachments, must not exceed 10mb. a series of emails may be sent to submit multiple attachments less than this limit. however, where the size of an individual file exceeds 10mb, the document should be submitted on a cd by post. DVD format is not acceptable. Notification of the content of the cd and any information specified in should be provided in a separate document. a cd should be posted only to the following address;

Airspace, ATM, and Aerodromes,

Civil Aviation Authority,

Aviation House,

Beehive Ring Road

Crawley

West Sussex RH6 0YR

2.43 Electronic versions or paper copies of required documents should not be submitted directly to an Aerodrome Inspector or CAA Regional Office. The identity of the aerodrome, the sender and his/her position and contact details should be clearly stated in each submission;

2.44 The form below provides an example checklist for the submission process, which could be used to accompany each email/CD submission;

2.45 Notification of receipt of a submitted document, its acceptance by the CAA or any deficiencies in the document, will be provided; Exemption from this requirement will be considered by the CAA on request.

Action	Approved by	Date
1. Document completed		
2. Amendments marked; list of effective pages updated		
3. Saved as File name(s):		
4. Where applicable – list of documents (file names and titles), relationships and amendment details:		
5. Document supersedes which document (file name)?		

6. Document submitted to the CAA via: Email (<4Mb only) Post (CD)		
7.Identity and contact details of sender	N/A	
8.Response received by the CAA	N/A	
9. Further action/amendment required? Yes – Go to 1 No – End		

CAA use only

Action	Approved by	Date
Email/CD received, content and source verified		
Format checked, amendments marked, file name checked		
Paper attached (YES/NO)		
Document rejected, response sent, and reason included		
Document accepted/saved; response sent		

Aerodrome Safety Management Systems

Introduction

2.46 An effective Safety Management System (SMS) is an organised approach to managing safety, including the necessary organisational structures, accountabilities, policies, and procedures, and forms the primary safety oversight covering the way an aerodrome manages safety. It also provides an identifiable and easily audited systematic control of the management of safety at an aerodrome. By applying lessons learned, an SMS should aim to make measurable improvements to the overall level of safety.

2.47 An aerodrome SMS should be commensurate with the size of the aerodrome and the level of complexity of the services provided.

2.48 Guidance on SMS can be found on the CAA website: www.caa.co.uk/sms

2.49 The ICAO SMS framework consists of four components and twelve elements, and where possible, aerodrome licence holders should include or refer to the ICAO SMS elements below. ICAO publishes SMS guidance in Document 9859 Safety Management manual (SMM).

2.50 SMS framework safety policy and objectives

Management commitment and responsibility:

2.51 An effective safety policy, endorsed by the accountable manager, sets a clear direction for the aerodrome to follow and contributes to all aspects of business and safety performance.

2.52 The safety policy should include a statement about the provision of adequate resources and show the commitment of senior management to manage safety effectively.

Safety accountability

2.53 The aerodrome licence holder should identify an accountable manager who is accountable for ensuring that all operational activities can be financed and carried out to the standard required.

Appointment of key personnel

2.54 The aerodrome licence holder should identify a manager to be the focal point for the implementation and day-to-day maintenance of an effective SMS.

Co-ordination of emergency response planning

2.55 The aerodrome licence holder should ensure that an emergency response plan provides for the orderly and efficient transition from normal to emergency operations and the return to normal operations;

2.56 The plan should be properly coordinated with the emergency response plans of those organisations it must interface with during the provision of its services. (CAP 168, chapter 9 gives further guidance on emergency planning).

SMS documentation

2.57 The aerodrome licence holder should develop and maintain documentation describing the safety policy and objectives, the safety accountabilities and responsibilities of senior managers, the SMS processes and procedures and any outputs from the SMS. SMS documentation may be integrated in the existing aerodrome manual, or a separate safety management system manual may be developed.

Safety risk management

2.58 Hazard identification;

1. The aerodrome licence holder should develop and maintain an effective process to identify safety hazards affecting the operation.

2. Hazard identification should be based on a combination of reactive (using safety data from an event that has happened), proactive (using safety data from a near-miss report) and predictive (actively looking at normal day-to-day operations to see where potential problems could occur) methods of safety data collection.

Safety risk assessment and mitigation;

2.59 The aerodrome licence holder should develop and maintain an effective process that ensures analysis and assessment of the safety risks in aerodrome operations and should implement any remedial action necessary to maintain risks at a level as low as reasonably practicable;

2.60 Risk assessments should be reviewed regularly, and when changes occur that may affect the safety hazards or the associated risks.

Safety assurance

2.61 Safety performance monitoring and measurement;

1. The aerodrome licence holder should ensure that safety performance is measured to determine whether safety measures are effective and to identify where improvement is needed;
2. Self-monitoring such as incident investigation, safety inspections and safety audits is a part of this process.

Management of change

2.62 The aerodrome licence holder should 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.

Continuous improvement of the SMS

2.63 The aerodrome licence holder should identify and determine the implications of sub-standard performance of the SMS in operation and eliminate or mitigate such causes.

Safety promotion;

Training and education;

2.64 The aerodrome licence holder should ensure all aerodrome personnel and third- party contractors receive safety training as appropriate to their role to ensure they understand their safety responsibilities within the aerodrome's SMS.

Safety communication

2.65 The aerodrome licence holder should develop and maintain safety communication mechanisms which ensure safety critical information is conveyed effectively and explain why particular safety actions are taken and why safety procedures are introduced or changed.

Accountable manager

2.66 Schedule 12 of the ANO requires an aerodrome to nominate an accountable manager and include the name and status of the accountable manager in the aerodrome manual.

2.67 The nominee will often be the chief executive, chief operating officer, board chairperson, president, managing director, general manager, or similar title; it is not necessary for the person to be the 'controlling mind' of the organisation. It is possible for an accountable manager to be answerable to and directed by another person or persons, and still retain the appropriate level of authority to ensure that activities are financed and carried out to the standard required. The organisational title of this post is at the licence

holder's discretion; however, the person named to the post must be advised to the CAA as the accountable manager.

2.68 The accountable manager should:

1. Ensure that all necessary resources are available to operate the aerodrome in accordance with the aerodrome manual. Where a reduction in the level of resources or abnormal circumstances which may affect aircraft safety occurs, the accountable manager should ensure that a corresponding reduction in the level of operations at the aerodrome is implemented as required;
2. Establish, implement, and promote the safety policy; and
3. Ensure compliance with relevant regulations, licensing criteria and the organisation's Safety Management System.

2.69 The accountable manager should have;

1. Appropriate seniority within the organisation;
2. An appropriate level of authority to ensure that activities are financed and carried out to the standard required;
3. Knowledge and understanding of the documents that prescribe relevant aerodrome safety standards;
4. Understanding of the requirements for competence of aerodrome
5. Management personnel so as to ensure that competent persons are in place;
6. Knowledge and understanding of SMS related principles and practices, and how these are applied within the organisation;
7. Knowledge of the role of the accountable manager; and
8. Knowledge and understanding of the key issues of risk management within the aerodrome.

2.70 The level of technical knowledge and understanding expected of an accountable manager is essentially high level, with reference to their own role in ensuring that standards are maintained.

2.71 During periods of absence, the day-to-day responsibilities of the accountable manager may be delegated; however, the accountability ultimately remains with the accountable manager.

Runway incursion awareness

2.72 Several fatal accidents involving runway incursions have occurred, resulting in significant loss of life. Aerodrome licence holders need to be aware of the potentially catastrophic hazard presented to aircraft by runway incursions and to focus on preventive 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.

2.73 Proactive measures should be taken by aerodrome licence holders to reduce the likelihood of a runway incursion occurring and to raise awareness of the hazards associated with runway incursions to all aerodrome users.

2.74 Runway incursions commonly have multiple causal factors generally involving flight crew, air traffic controllers and airfield operations. Errors that may contribute to runway incursions include;

1. Failure to follow a clearance or instruction;
2. Failure to follow procedures;
3. Issue of an incorrect clearance, instruction, or procedure;
4. Following an incorrect clearance, instruction, or procedure;
5. Loss of situational awareness;
6. Use of poor communication techniques;
7. Poor knowledge of the aerodrome;
8. Use of inadequate or inappropriate procedures;
9. Confusing or inadequate aerodrome signage; and
10. Taxiway layout

In November 2004, the International Civil Aviation Organisation (ICAO) published a new definition of a runway incursion for use by member states. The CAA has also adopted this definition, which is;

2.75 ‘Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.’

Action to be taken by aerodrome operators

2.76 Aerodrome operators should regularly review those areas of their aerodrome SMS relevant to the effectiveness and adequacy of the prevention measures in place at their aerodrome. 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, aerodrome licence holders should consider:

1. To what extent aerodrome visual aids, i.e., aeronautical ground lighting, signs, and markings, contribute towards reinforcing situational awareness;
2. 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;
3. Whether the layout of any movement areas on the aerodrome could cause confusion 'hot spots,' and how such confusion could be eliminated;
4. Whether airside driver training is sufficiently robust, reassessing vital topics such as aerodrome operations; radio communication procedures; and
5. Phraseology; the use and meaning of visual aids; and familiarisation of aerodrome layout; and
6. 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.
7. Aerodrome operators 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.
8. As a continuing part of this approach, aerodrome operators should continue to review the effectiveness and adequacy of the prevention measures in place at their aerodrome and take particular note of the proportion of runway incursions attributed to vehicles.
9. Attention is also drawn to ICAO Doc 9870 manual on the Prevention of Runway Incursions.

2.77 Attention is drawn to the GAPPRE and GAPPRI. The action plans suggest certain initiatives and recommendations to mitigate the level of operational

risk related to runway incursions and excursions, including the establishment of;

1. A permanent Local Runway Safety Team (LRST);
2. Improved operational procedures and training;
3. The development of awareness campaigns.
4. It is likely that a runway safety committee, or similarly named group, may perform the same role as the LRST.

2.78 Aerodrome operators, air traffic services providers and other key stakeholders should be especially aware of locations on an aerodrome with a history of, or potential risk for, collisions or runway incursions and excursions. These locations have been given the name ‘hot spots,’ their definition being’ a location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary.’ A hot spot is equally likely to result from:

1. Poor infrastructure design;
2. A confusing pavement layout;
3. Inadequate surface navigational facilities;
4. A deficiency of visual aids

2.79 Additionally, hot spots may be locations that, although fully compliant, are potentially difficult to navigate due to awkward geometry, or where additional awareness is required, such as at runway crossing locations.

2.80 Hot spots should be notified on the aerodrome chart published in the Aeronautical Information Publication (AIP) and examples of both local and AIP charts are provided.

2.81 The location of a hot spot is to be circled on the AIP aerodrome chart and that ‘properly annotated’ additional information is provided to describe the nature of the potential risk at the hot spot.

2.82 Publication on the aerodrome chart, supported by explanatory notes if considered helpful, is intended to facilitate pilot awareness.

2.83 Ideally, an effective LRST will ensure that hot spots do not exist. To achieve this aim, aerodrome licence holders, in conjunction with the LRST, should conduct an assessment to determine whether any hot spots exist currently on the aerodrome.

2.84 The assessment should also address the potential for air traffic procedures (particularly acknowledged runway incursion causal factors such as the use of conditional clearances and non-standard communications) and other aerodrome operating procedures to create any hot spots. Human factors should be given consideration in any assessment of hot spots.

2.85 If hot spots are identified, suitable strategies should be implemented to remove the hazard and, where this is not immediately possible, manage and mitigate risk. These strategies may include:

1. Awareness campaigns;
2. Additional visual aids (signs, markings, lights);
3. Use of alternative routeings;
4. Construction of new taxiways;
5. (Mitigating against blind spots in the aerodrome control tower;
6. Publishing the hot spot in the AIP.

2.86 Some hot spot causal factors can be addressed swiftly but others may take much longer to remove, or it may be impracticable to remove them altogether. Hence, plans for the permanent removal of a hot spot or suitable immediate mitigation measures must be developed and implemented.

2.87 A new hot spot is most likely to be established as a result of change to the movement area or an operating procedure. An assessment should be conducted before the start of any new work, such as new pavement layout, or the introduction of a new or revised operating procedure, to prevent new hot spots being created inadvertently. Ceasing operations in the affected areas should be considered as mitigation in the case of work in progress.

2.88 The assessment described above should be repeated periodically to ensure that it remains valid and takes into account current aerodrome operating practice and design.

2.89 Where the measures to mitigate or remove an identified hot spot will take some time to complete, or it is considered that the publication of a hot spot would benefit pilot awareness, the hot spot should be notified by;

1. An appropriate means to air traffic service personnel and pilots using the aerodrome.
2. The NOTAM process should be used for the notification of the short term (i.e. less than 3 months) existence of a hot spot.

3. If a hot spot is likely to exist for more than one AIP Air Regulation and Control (AIRAC) publication cycle, it should be notified on the aerodrome chart in the UK AIP as specified in Amendment 54 to ICAO annex 4 and as a warning in the specific aerodrome local traffic regulations section (AD 2.20). The warning should include details of ongoing work to remove, or measures to mitigate, the hot spot, or other information that will help situational awareness.

2.90 When reviewing visual aids additional measures should be considered whenever it has been shown that further runway incursion prevention mitigation measures are required. The use of additional measures will depend on the specific circumstances but could include the following:

1. The use of enhanced stop-bars where the light fittings making up a stop-bar are spaced equally across the taxiway in a line perpendicular to the taxiway centreline at reduced intervals;
2. The use of stop-bars 24 hours a day in all lighting conditions should be applied as runway incursions are not limited to low visibility conditions;
3. The use of inset runway guard lights (chapter 6);
4. The use of runway guard lights 24 hours a day in all lighting conditions;
5. The use of a runway ahead marking (as shown in figures 2D.1 and 2D.2) in addition to the mandatory instruction marking (chapter 7).

2.91 Where possible the runway ahead marking should be located before the mandatory marking as illustrated below and collocated with the CAT II/ III holding position marking (pattern B) where applicable.

2.92 The actual position of the runway ahead marking will depend on the aerodrome's particular circumstances and layout and should be decided in consultation with the LRST where appropriate Runway ahead surface markings size and proportions should be as described in chapter 7.

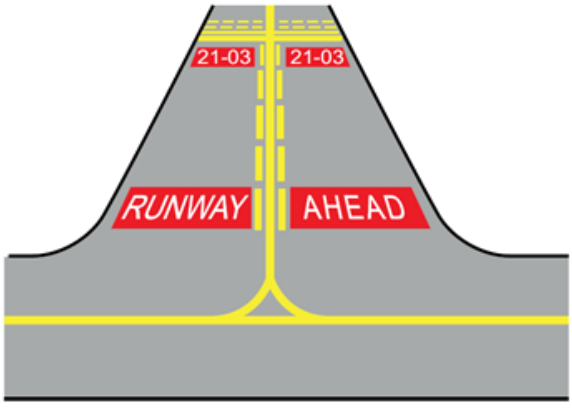


Figure 2D.1 Runway ahead marking for pattern A holding position and enhanced taxiway centreline marking



Figure 2D.2 Runway ahead marking – for pattern B (Cat II/III) holding position

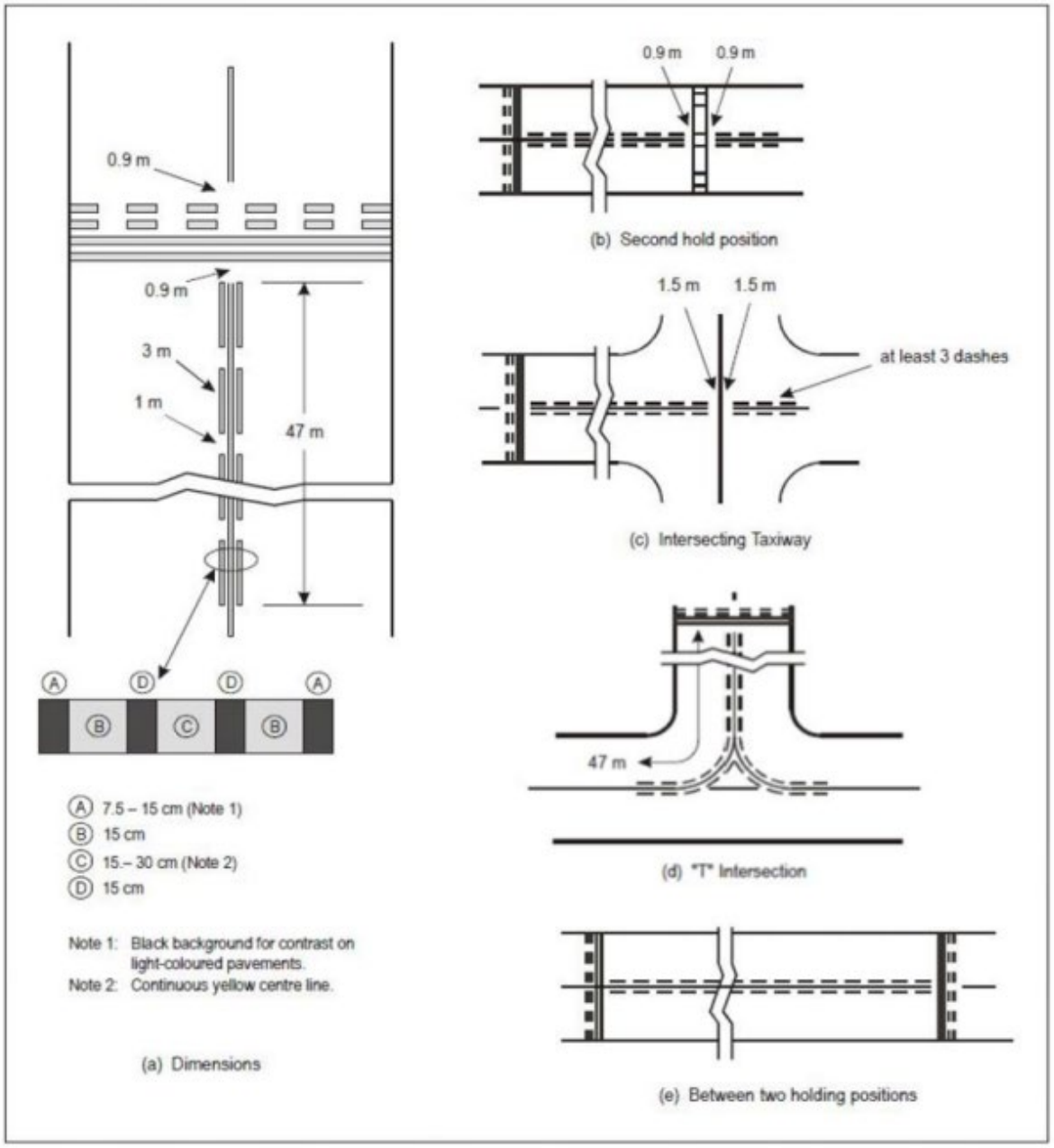


Figure 2D.3 Enhanced taxiway centreline marking

Notes:

1. Black background for contrast on light-coloured pavements.
2. Continuous yellow centre line

Responsibility for monitoring third parties operating within the boundaries of licensed aerodromes

2.93 The ANO, article 212, requires that an aerodrome be safe for use by aircraft. As part of this, aerodrome operators 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.

2.94 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;

1. Tenants and concessionaries under lease or other use agreements
2. Fuel farms sited within the aerodrome boundary and operated by fuel companies, and
3. The provision of Rescue and Fire Fighting Services (RFFS) where the licence holder contracts this to another party.
4. If the operations of third parties give the CAA cause for concern, it would have to take action with the party that it regulates, namely the licence holder.

2.95 Aerodrome operators have a responsibility to ensure that contractors and others operate correctly on their aerodromes. This is particularly important in areas that could affect the licence holders' ability to discharge their responsibility for securing the safety of aircraft on their aerodromes and to demonstrate that ability to the CAA.

2.96 The reference to responsibilities is not meant to indicate that aerodrome operators have total responsibility; many of these areas have shared responsibilities. The purpose should be 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.

2.97 It is accepted that aerodrome operators, in addition to airlines and aircraft ground handling companies, all share the responsibility for aircraft safety on the aerodrome ramp or apron.

Work in progress

2.98 Wherever major work affecting operational areas is planned, aerodrome operators 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.

2.99 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.

2.100 The aims of 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.

2.101 Aerodrome licence holders are required to comply with licence conditions (and the relevant air navigation legislation) concerning changes to, or work in progress, on their aerodrome. These Licence conditions include:

1. Condition 3 – prior approval of CAA is required before any changes are made in the physical characteristics of the aerodrome.
2. Condition 4 – the licence holder 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.
3. Article 212 and schedule 12 of the Air Navigation Order 2016
4. Article 212 (5) 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.
5. Article 212 and Schedule 12 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.

2.102 Work in progress procedures applicable to all parties involved with WIP:

1. The movement of aircraft and vehicles:
2. The availability of aircraft ground routes:
3. The promulgation of declared distances:
4. The notification and availability of navigation aids and procedures, for example, must work to an agreed programme of works authorisation and management, if the safety of the aerodrome is to be maintained.
5. The programme should set out clearly where responsibilities for the authorisation and implementation of any proposed change to operational facilities lie, the point at which the facilities will be withdrawn or changed and the methods by which such changes will be promulgated.
6. This programme should be formulated only after an assessment of the risks to aircraft safety have been undertaken by the aerodrome operator

in co-operation with interested parties, and appropriate mitigation measures introduced to keep risks to an acceptable level.

7. Human factors issues should be taken into account in the risk assessment.

8. 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.

9. 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.

10. 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.

11. It should also be borne in mind that changes to marking or lighting may give different perceptual effects at various times of day or in different weather conditions. Small, apparently insignificant changes can sometimes have unanticipated results.

12. Processes, developed procedures, actions and decisions made should be documented, and relevant documentation must be made available to and, when appropriate, be provided to agencies affected by the change in operations and WIP.

13. Consideration should be given to ensuring that all personnel and agencies involved in the operation of aircraft that might be affected by the revised information are aware of the type and extent of WIP and of any operational changes and restrictions that result.

14. All documentation should be retained and made available for audit purposes.

15. Where shift working is in operation it will be necessary to ensure that each shift is properly and fully briefed.

16. 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.

17. Regular monitoring of contractors is essential to ensure continued safety. Operators should ensure that contractors have made support available outside normal working hours.

18. 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.

19. 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.

20. Where work is already in progress, aerodrome operator should satisfy themselves that, as far as possible, the above issues are being addressed.

2.103 Procedures for the control of works should include any or all of the following tasks (this list is not exhaustive):

1. Works permit procedures:
2. Relevant safety procedures:
3. Restrictions during low visibility conditions:
4. R/T communications:
5. Staff briefing:
6. Site marking, by day or night, or in low visibility:
7. Work on an ‘on-off’ basis:
8. Hot works where relevant:
9. Aerodrome operating procedures during the works:
10. Emergency procedures:
11. Supervisory and contact information; and
12. Plans and diagrams

Work in progress reduced runway length operations

2.104 Additional hazards may arise when WIP involving a reduction in the available runway distances takes place. In such circumstances, where the runway length available is less than declared in the AIP, it is essential that the potential hazards before, during, and on ceasing operations with reduced runway length available and/or WIP are identified and mitigated as necessary in order to assure the safety of aircraft operations;

2.105 Note: Hazards may include inappropriate or potentially misleading display of visual aids; inappropriate or potentially misleading availability of navigational aids; adverse environmental impact; risks resulting from adverse or unusual meteorological conditions; and restricted obstacle clearance and wingtip separation distances. It is important to recognise that the hazards that may be identified can cover a wide range of areas, including those that do not pose a risk only to aircraft, for example the potential risk from interaction with jet blast.

2.106 A revised runway strip, Runway End Safety Area (RESA) and obstacle limitation surfaces, such as the approach and take-off climb surfaces, are implemented, where necessary;

2.107 A safety zone is established between that area of the runway that is to be used by aircraft and the WIP or unusable runway;

Note: The location, size and shape of the safety zone are dependent upon the circumstances described above, to provide for items such as runway end safety areas, blast protection and abbreviated or simple approach light systems.

2.108 Markings are provided to clearly indicate the extent of the safety zone, the WIP area and any movement area or roadways that are to be used by persons involved in the WIP and not to be used by aircraft;

2.109 The presence, activities, and movement on or around a runway or taxiway of contracted staff, who may not be as familiar with the aerodrome and aviation practices as expected, are effectively managed and controlled;

2.110 The impact on the ability of the rescue and firefighting and emergency services to perform their functions is considered and addressed;

2.111 All operational information is correct, available, and promulgated in a timely manner to all relevant parties.

2.112 Roles and responsibilities for operations and tasks associated with the reduction of the runway length available and the WIP are clearly understood and complied with; and

2.113 Wherever practicable, the suitability of a procedure is tested prior to implementation.

2.114 The aerodrome licence holder is responsible for the co-ordination and management of the opening and closing of the runway (and other movement areas, as necessary) and the WIP.

2.115 Management of aircraft operations may be contracted out to an independent organisation (e.g., an ANSP) but a tactical decision concerning aircraft

operations made by that organisation outside, or that deviate from, the agreed operational procedures, unless of an urgent safety nature, must be adopted only in co-operation with the aerodrome licence holder.

2.116 The aerodrome operator should put in place measures to monitor closely the safety of the aerodrome and aircraft operations during runway WIP such that timely corrective action is taken when necessary to assure continued safe operations. This is important when operational change or unprecedented or unpredicted events occur.

2.117 Wherever practicable the stakeholders should agree any strategic decisions that might need to be made after operations with reduced runway length available and/or WIP have commenced.

2.118 Aerodrome operators are reminded that they are not permitted to declare a distance exceeding that notified in the AIP without the prior approval of the CAA, see CAP 168 chapter 10.

High-visibility clothing

2.119 The aerodrome operator should require that all personnel working outside, on foot, on the movement area to wear high-visibility clothing

2.120 As a minimum EN ISO 20471 (formerly BS EN 471) should be complied with.

1. High-visibility clothing should be predominantly yellow or orange.
2. Aerodrome operators and organisations should assess the risk to personnel and the level of PPE required for the tasks being undertaken, for further information refer to; https://www.hse.gov.uk/ppe/ppe-regulations-2022.htm
3. Jackets and coats should be fastened at the front to remain fully effective. Loose clothing and articles can present a hazard to operatives using GSE equipment.
4. Dirty and worn high visibility clothing may not meet reflective requirements; all high visibility clothing should be maintained in a clean condition and in good working order.

Low Visibility Operations

2.121 Criteria for the preparation of LVPs services, as appropriate, information on the status of the aerodrome facilities.

2.122 When establishing the RVR and cloud ceiling values below which LVPs should be prepared, the aerodrome operator should consider:

1. The aerodrome layout and its complexity:
2. The location of the control tower:
3. The facilities and equipment available; and
4. The density of traffic.

2.123 The aerodrome operator shall ensure that the aerodrome is provided with appropriate aerodrome equipment and facilities, and that appropriate low-visibility procedures are established and implemented where it is intended to be used for any of the following operations:

1. Low visibility take-offs:
2. Approach and landing operations with visibility conditions less than 550 m RVR or DH less than 200 ft (60 m);
3. SA CAT 1
4. Category II:
5. SA CAT II
6. Category III
7. Approaches utilising an Enhanced Flight Vision System (EFVS) where the actual RVR is below 550 m.

2.124 The low-visibility procedures should coordinate the movement of aircraft and vehicles and shall restrict or prohibit activities on the movement area.

2.125 The aerodrome operator should establish and implement the low-visibility procedures in cooperation with the air traffic services provider.

2.126 The low-visibility procedures should include criteria for their preparation, initiation, and termination. The criteria shall be based on RVR and cloud ceiling values.

2.127 The aerodrome operator should inform the aeronautical information services provider and air traffic services provider, as appropriate, of any change on the status of the aerodrome equipment and facilities that have an impact on low-visibility operations.

2.128 When low visibility procedures (LVPs) are in effect, the aerodrome operator should make available to aeronautical information services and/or air traffic.

2.129 The aerodrome operator should establish and implement procedures to ensure that when low visibility procedures (LVP) are in effect, persons and vehicles operating on an apron are restricted to the essential minimum.

2.130 The procedures to be established by the aerodrome operator to ensure safe aerodrome operations during low visibility conditions should cover physical characteristics of the runway environment, including:

1. Pre-threshold, approach, and departure areas:
2. Obstacle limitation surface:
3. Surveillance and maintenance of visual aids:
4. Safeguarding of non-visual aids essential to low visibility procedures:
5. Secondary power supplies:
6. Movement area safety:
7. RFFS

2.131 Aircraft operations at aerodromes during reduced visibility or low cloud conditions present additional hazards to aircraft and to other aerodrome users. As visibility reduces, the ability of ATC, 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 visually assess the aerodrome environment is reduced.

2.132 Low Visibility Operations (LVOs) is a general term used for airside operations in conditions of reduced visibility or low cloud conditions and consists of low visibility safeguarding and low visibility procedures (LVPs).

2.133 Low visibility safeguarding is the process carried out which prepares the aerodrome for low visibility procedures.

2.134 Low visibility procedures are the actions carried out by ATC and the aerodrome operator in respect of aircraft operations and vehicle movements. This may include restricted access to the manoeuvring area, the protection of the ILS critical and sensitive areas and a reduced aircraft movement rate.

Surface movement radar and other surveillance equipment

2.135 Surface movement radar or any other suitable surveillance equipment for the manoeuvring area could be used at an aerodrome intended for use in runway visual range (RVR) conditions less than a value of 350 m.

2.136 Surface movement radar or any other suitable surveillance equipment for the manoeuvring area may also be used at an aerodrome, when the traffic density and operating conditions are such that regularity of traffic flow cannot be maintained by alternative procedures and facilities.

Low visibility safeguarding

2.137 The point at which LVPs are implemented will vary from one aerodrome to another and will depend on local conditions and facilities available. However, a period of time is required to prepare the aerodrome and, in particular, the manoeuvring area, in readiness for LVPs.

2.138 The safeguarding measures must ensure that at the point when LVPs are declared to be in force, all actions to protect aircraft operations have been put in place.

2.139 When the visibility deteriorates to approximately 1000 m RVR and is expected to fall further below 550 m RVR, or the cloud ceiling reduces to 300 ft and is expected to fall further below 200 ft, safeguarding should be initiated.

2.140 The withdrawal of vehicles and personnel involved in non-essential activities on the manoeuvring area shall be initiated;

2.141 Any temporary work in progress on the movement area should normally cease and the work areas shall be vacated and returned to operational condition or clearly marked/lit and notified as unavailable for use;

2.142 Routine maintenance on visual and non-visual aids shall be suspended, and the ILS localiser and glide path critical and sensitive areas shall be cleared of all traffic.

2.143 Aerodrome operators, in conjunction with ATC, should develop actions that ensure that, in good time prior to the introduction of LVPs, all airlines and other organisations with manoeuvring area access are notified. This is particularly important where companies exercise control over their own apron areas and maintenance facilities adjacent to the manoeuvring area.

2.144 Particular attention should be given to the protection of the runway and radio navigational aids. Access to the manoeuvring area should be restricted to essential operational safety vehicles and personnel.

2.145 The decision to commence or continue work, especially involving construction, when a significant probability for the need to invoke LVPs exists, should take account of the time it will take to cease the work, remove all persons and equipment, and prepare the site for LVPs. Alternatively, the planning process employed in the development of major construction projects should detail the control measures that would be implemented should it be deemed necessary to continue both WIP and aircraft operations during LVPs.

Low visibility procedures responsibilities

2.146 It is the responsibility of the aerodrome operator to develop and maintain the LVPs used at their aerodrome.

2.147 Whilst ATC are responsible for advising pilots of the status of LVPs at an aerodrome, it is the responsibility of the aerodrome operator to ensure that all measures required to protect aircraft operations in poor weather conditions are in place.

Declaration of low visibility procedures in force

2.148 It is essential that the aerodrome operator verifies to ATC that all safeguarding measures are in place before LVPs are declared to be in force by ATC.

2.149 LVPs should be declared as cancelled before the aerodrome operator withdraws any measures. It should be remembered that aircraft established on an approach may have commenced that approach believing that LVPs are in force.

2.150 All measures taken to protect the approach aids and runway should remain in place until all such aircraft have completed their approach.

2.151 At aerodromes that support operations) in conditions that preclude Category I operations, under no circumstances should LVPs be declared to be in force if the appropriate safeguards for these operations are not fully in place to protect the landing aids and runway.

2.152 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.

2.153 Procedures should ensure that the status of LVPs is clearly understood by all those that are involved in aerodrome operations. There should be a single point from which definitive information about the current status of LVPs can be confirmed wherever possible.

Low visibility procedures

2.154 As the RVR deteriorates to lower than 550 m, or the cloud ceiling reduces below 200 ft, low visibility procedures should be fully implemented. (The cloud ceiling criteria of below 200 ft is not required for aerodromes conducting take-offs below 550m RVR but limited to Category I operations

only). The withdrawal of non-essential vehicles and personnel from the manoeuvring area shall be completed.

2.155 Where possible free ranging shall have ceased and all activities on the manoeuvring area should be under the direct control of ATC. ATC should apply increased spacing between aircraft to allow additional time for the preceding arriving aircraft to vacate the Localiser Sensitive Area (LSA) or the previous departing aircraft to have overflown the localiser. Interference with the localiser and glide path signal can cause a deviation to an aircraft's flight path requiring a go-around to be flown.

2.156 The point at which LVPs are to be implemented must be clearly defined in terms of a specific RVR, expressed in metres, or cloud ceiling measurement, expressed as a height in feet, and must be promulgated in relevant notices and documentation to all those persons involved.

2.157 In order that flying operations may be safely conducted at aerodromes in low visibility conditions, aerodrome operators, in consultation with ATC, should determine the movement rate that they wish to sustain and develop LVPs that will support the desired movement rate. The aircraft movement rate will be dependent on the aerodrome infrastructure including the ground markings and lighting.

2.158 LVPs will vary with each aerodrome and are subject to acceptance by the CAA prior to inclusion in the aerodrome manual and the Manual of Air Traffic Services Part 2 and their subsequent implementation.

2.159 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

2.160 Where unguarded gates are provided, they should be kept locked and inspected regularly to ensure that they remain secure.

2.161 Where physical closure is not practicable, for example between aircraft maintenance areas and manoeuvring areas, entry points should be staffed and where the opening is too wide for visual surveillance, then it should be fitted with intruder detection equipment suitable for operation in 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.

2.162 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.

2.163 Where it is not practicable to secure the area in the manner recommended, the aerodrome operator shall satisfy the CAA as to the security of the aerodrome's operations in low visibility conditions.

2.164 When LVPs are in force, only vehicles essential to the aerodrome operation and driven by formally tested and authorised drivers should be allowed onto the manoeuvring area. All such vehicles should be equipped with an aerodrome chart available in the driver's cab clearly showing all taxiways, runways, holding points and vehicle routes marked with their appropriate designation.

2.165 All drivers should be aware of the action to take in the event that the vehicle should break down or that the driver should become unsure of his position on the aerodrome.

2.166 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 unless escorted by an operations vehicle equipped with R/T and in contact with ATC at all times.

2.167 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.

2.168 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 instructions.

2.169 In order to continue unrestricted operations for as long as possible while weather conditions deteriorate, many of the low visibility safeguarding measures are implemented in good time and in certain circumstances before they are absolutely necessary.

2.170 The reduction in the aircraft movement rate, which is activated by ATC, should be implemented only when the weather conditions demand it.

2.171 Rescue and Fire Fighting Service (RFFS) vehicles are essential to aerodrome operations at all times, response and deployment times are of vital concern to aerodrome operators. Although it is unlikely that the 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.

2.172 In visibilities below 200 m there is greater probability that response times will be affected. Operational instructions and training should be developed in accordance with the guidance in chapter 8.

2.173 Congregations of wildlife are difficult for both ATC and pilots to observe in poor weather conditions, wildlife hazard control operations should not be restricted during LVPs. Processes should ensure that adequate time between movements is afforded to permit wildlife 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.

2.174 The risk of an inadvertent runway incursion by an aircraft or vehicle, or aircraft mis-routeing, is increased in low visibility conditions. Wherever possible this risk should be minimised by keeping taxiway routeings 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 take-offs. 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. Markers used in this manner should either be retro - reflective or augmented by lights. In this way the procedural control of aircraft and vehicles at complex aerodromes can be simplified

2.175 On major aerodromes where traffic is such that several routes are operated simultaneously, a Surface Movement Guidance and Control System (SMGCS) is likely to be required in order to achieve the declared movement rate.

2.176 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 be regarded as the prime method by which collision avoidance can be affected.

Visibility conditions and associated actions

Visibility condition 1:

1. 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 to exercise control over all traffic on the basis of visual surveillance.

2. No additional requirements for the protection of ground operations by aircraft are required during visibility condition 1.

Visibility condition 2:

1. 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 to exercise control over all traffic on the basis of visual surveillance.
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.
3. In the lower ranges of visibility condition 2, the necessary measures might limit the movement rate unless some additional aids are available, such as SMGCS, which may enable a greater movement rate to be achieved safely.
4. Adequate safeguards against runway incursions should be in place, such as limited taxi routeing, surface movement radar and stop-bars or physical barriers at runway access points.

Visibility condition 3:

1. Visibility sufficient for the pilot to taxi but insufficient for the pilot to avoid collision with other traffic on taxiways and at intersections by visual reference, and insufficient for ATC to exercise control over all traffic on the basis of visual surveillance.
2. For taxying, this is normally taken as visibilities equivalent to an RVR of less than 400 m but more than 75 m.
3. In such visibility conditions it is likely further ATC measures, such as block control, to assist aircraft and vehicle movement including RFF vehicles, should be considered.

Visibility condition 4:

1. Visibility insufficient for the pilot to taxi by visual guidance only. This is normally taken as an RVR of 75 m or less.
2. During visibility conditions 3 and 4, Advanced Surface Movement Guidance Control Systems (A-SMGCS), where available, may be used to determine the position of aircraft and vehicles on the manoeuvring area.

   Note: Pilots will expect a precision instrument runway to be fully safeguarded and available for the operations) and any guided take-off, if LVPs are declared to be in force by ATC at the aerodrome.

Review of low visibility procedures

2.177 The aerodrome operator, in co-operation with ATC 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 inclusion in the aerodrome manual and the Manual of Air Traffic Services Part 2 and Manual of Flight Information Services, and before subsequent implementation.

2.178 LVP table-top exercises should be completed on a regular basis to ensure all stakeholders are familiar with the procedures. They should also be considered for any forthcoming operational changes and development works that may significantly impact on LVPs.

2.179 Low visibility operations are discussed in greater detail in ICAO Doc 9476 manual of Surface Movement and Guidance Control Systems chapter 5 and ICAO European Doc 013 European Guidance Material on All Weather Operations at Aerodromes.

Low visibility take-off (LVTO) with an RVR less than 125 M

2.180 In addition to the low-visibility procedures which are required for LVTOs, the following should also apply to LVTOs with an RVR less than 125 m:

2.181 If an ILS signal is used for lateral guidance, the ILS localiser signal meets the requirements for category III operations including the availability of a standby transmitter; and

2.182 If an ILS signal is used, the low-visibility procedures should include protection of the ILS-sensitive area.

UK Air Operations Regulation UK (EU) 965/2012

2.183 UK Air Operations Regulation and other national authority regulations may allow approved operators to carry out SA CAT I , SA CAT II, HELI CAT I and Enhanced Flight Vision Systems (EFVS) approach operations if certain conditions (specified in UK Regulation (EU) 965/2012) are met, the approach types are described as follows:

1. SA CAT I is an operational credit applied to CAT I operations that allows the instrument segment of the CAT 1 approach to be extended to a minimum DH of 150ft.

2. SA CAT II is an operational credit that applies to the visual segment of an approach conducted where aerodrome, runway and approach lighting systems do not meet the usual requirements for a CAT II precision lighting system. SA CAT II is not a separate approach classification; it is an operational credit applied to a CAT II operation usually in a CAT I

runway. It does not imply lower DHs to those of a standard CAT II approach.

3. HELI CAT I is an operational credit that applied for helicopters that allows the instrument segment of a CAT I approach to be extended to a minimum DH of 130 ft.

4. Enhanced Flight Vision Systems (EFVS) allows reductions of the RVR in the visual segment (not DH) under certain conditions for aircraft equipped with EFVS.

2.184 Aerodromes that are suitable for the specified approach operations should review their LVPs to ensure they are adequate for aircraft and vehicle operations in such visibilities

Additional information

2.185 Low visibility operations are discussed in greater detail in ICAO Doc 9476 manual of Surface Movement and Guidance Control Systems chapter 5 and ICAO European Doc 013 European Guidance Material on All Weather Operations at Aerodromes.

Surface movement guidance and control system

2.186 The SMGCS is an appropriate combination of visual aids, non-visual aids, procedures, control, regulation, and information facilities. Systems range from a very simple SMGCS at small aerodromes, with light air traffic operating in good-visibility conditions, to complex systems necessary at large aerodromes with heavy air traffic operating in low-visibility conditions. The system selected for an aerodrome will be appropriate to the operational environment in which the aerodrome will operate.

2.187 The SMGCS should:

1. Take into account the design characteristics and the operational and meteorological conditions of the aerodrome, as well as human factors principles:

2. Designed to assist in the prevention of:

   a) Inadvertent incursions of aircraft and vehicles on an active runway; and

   b) Collisions between aircraft as well as between aircraft and vehicles or objects on any part of the movement area; and

   c) Be supported by appropriate means and procedures:

3. The aerodrome operator should coordinate with the air traffic services provider the development of the SMGCS procedures at the aerodrome.

2.188 Where an SMGCS is provided by selective switching of stop bars and taxiway centreline lights, the following should apply:

1. Taxiway routes, which are indicated by illuminated taxiway centre line lights, are capable of being terminated by an illuminated stop bar.
2. The control circuits are so arranged that when a stop bar located ahead of an aircraft is illuminated, the appropriate section of taxiway centre line lights beyond it is suppressed; and
3. The taxiway centre line lights are activated ahead of an aircraft when the stop bar is suppressed.
4. Systems designed to enable movement rates to be sustained are discussed in ICAO Doc 9830 A-SMGCS manual.

Conversion of reported meteorological visibility to RVR

2.189 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.

Lighting elements available	RVR = Reported Met Visibility Day	RVR = Reported Met Visibility 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	-

Table 2B.1

2.190 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 or direct application by aerodrome operators but is included in order to provide assistance for aerodromes at which RVR is not available.

The conversion method is not to be applied by aerodrome operators and then provided to aircrew as an RVR.

Enhanced visual flight systems (EFVS)

2.191 EFVS technology relies on the infrared heat signature provided by incandescent lights. The replacement of incandescent lights with LED or alternative lighting technologies lights may render the use of EFVS not possible. This information is important to aircraft operators to assess the suitability of the runway in order to conduct EFVS operations.

2.192 The elements of the aeronautical ground lighting system that are LED should be detailed in the AIP.

2.193 An EFVS-A operation may be conducted on a runway if:

1. It is served by a straight-in instrument approach procedure:
2. An OFZ is established or a VSS is not penetrated by obstacles, and an instrument departure procedure is established:
3. The touchdown zone (TDZ) RVR is available:
4. Low-visibility procedures are in effect:
5. The switch-over time for runway edge, threshold and end lights meets the specifications for CAT II/III runways.
6. An EFVS-L operation may be conducted on a runway when;
    i. An aerodrome obstacle chart – ICAO Type A is published in the AIP; and
    ii. A precision approach terrain chart – ICAO is published in the AIP.

EFVS 200 Operation

2.194 A runway is suitable for EFVS 200 operation when:

1. An instrument approach procedure providing at least lateral guidance in which the final approach track is offset by a maximum of 3 degrees from the extended centre line of the runway is established; and
2. Either an obstacle free zone (OFZ) is established, or the visual segment surface (VSS) is not penetrated by obstacles, and an instrument departure procedure is established.
3. If the VSS is penetrated, the information is to be provided to the AIS to publish it under AD 2.25, the information should clearly indicate the name of the affected procedure, and the procedure minima affected. Apart from this, information about the obstacles that penetrate the VSS should be provided to AIS to publish it under ‘AD 2.10 Aerodrome obstacles.

4. Criteria related to the VSS are contained in PANS-OPS Volume II, paragraph 5.4.6, Part I – Section 4, Chapter 5.

Low visibility procedures - EFVS operations suitability of runways approach and landing operations

2.195 CAT II instrument approach operations may be conducted on a precision approach category II or III runway, using a CAT II instrument approach procedure.

2.196 CAT III instrument approach operations may be conducted on a precision approach category III runway, using a CAT III instrument approach procedure.

2.197 SA CAT I approach operations may be conducted in accordance with the following:

1. The runway is a precision approach category I runway and an obstacle free zone (OFZ) is established:
2. A CAT I instrument approach procedure that includes an OCH based on a radio altimeter is use:
3. Where an ILS/MLS is used, it is not promulgated with any restrictions affecting its usability and is not offset from the extended runway centre line:
4. Where a GBAS landing system (GLS) is used, it is not promulgated with any restrictions affecting its usability and should not be offset from the extended centre line:
5. The glide path angle is 3.0 degrees:
6. The pre-threshold terrain is surveyed and either a precision approach terrain chart (ICAO Annex 4, Chapter 6) is published in the AIP, or the required information is included in the aerodrome terrain and obstacle chart – ICAO (Electronic) (ICAO Annex 4, Chapter 5).

2.198 SA CAT II approach operations may only be conducted in accordance with the following:

1. The runway is a precision approach category I runway and an OFZ is established, and for operations with an RVR of less than 400 m, runway centre line lights are installed:
2. A CAT II instrument approach procedure is used:

3. Where an ILS/MLS is used, it is not offset from the extended runway centre line and no restrictions affecting its usability are published in the AIP:

4. Where a GLS is used, it is not offset from the extended runway centre line and no restrictions affecting its usability are published in the AIP:

5. Where an ILS is used, it is certified to class II/D/2;

6. The pre-threshold terrain is surveyed and either a precision approach terrain chart (ICAO Annex 4, Chapter 6) has been published, or the required information is included in the aerodrome terrain and obstacle chart – ICAO (Electronic) (ICAO Annex 4, Chapter 5).

2.199 The switch-over times of the different lighting elements on runways supporting SA CAT I/II approach operations should be as follows:

Element	Switch over time
Approach Lighting System	15 Seconds
Runway edge light	1 Second
Visual approach slope indicator	15 Seconds
Runway threshold light	1 Second
Runway end light	1 Second
Stopway end	1 Second
Stopway Edge	15 Seconds
Obstacle lights	15 Seconds

Table 2 B2

2.200 The switch-over time for runway edge lights may be increased to 15 seconds if runway centre line lights are provided. In this case, the switch-over time for runway centre line lights should be 1 second.

2.201 The aerodrome operator should inform the aeronautical information services provider and air traffic services provider, as appropriate, of any change on the status of the aerodrome equipment and facilities that have an impact on low-visibility operations as shown in tables 2B3 and 2B4.

Equipment failures to be reported and effects on flight operations

2.202 The following equipment failures should be reported if the system is degraded or unserviceable or if back-up procedures cannot provide the same level of service:

EQUIPMENT FAILURE TO BE REPORTED – LOW-VISIBILITY DEPARTURE OPERATIONS		
SYSTEM CONSIDERED	**FAILURE TO BE REPORTED**	**EFFECT ON FLIGHT OPERATIONS**
ILS (Where used for guided take-off)	ILS localiser downgraded to CAT II	No take-off guidance. Guided take-off not allowed
ILS (Where used for guided take-off)	ILS localiser downgraded to CAT I	No take-off guidance. Guided take-off not allowed
ILS (Where used for guided take-off)	ILS out of service	No take-off guidance. Guided take-off not allowed
MLS (Where used for guided take-off)	MLS downgraded to CAT II	No take-off guidance. Guided take-off not allowed
MLS (Where used for guided take-off)	MLS downgraded to CAT I	No take-off guidance. Guided take-off not allowed
MLS (Where used for guided take-off)	MLS out of service	No take-off guidance. Guided take-off not allowed
GBAS (Where used for guided take-off)	GBAS downgraded to CAT II	No take-off guidance. Guided take-off not allowed
GBAS (Where used for guided take-off)	GBAS downgraded to CAT I	No take-off guidance. Guided take-off not allowed
GBAS (Where used for guided take-off)	GBAS out of service	No take-off guidance. Guided take-off not allowed
RVR	Touchdown RVR system unserviceable	Restrictions depending on flight operations rules
RVR	Other RVR systems unserviceable	Restrictions depending on flight operations rules

Lighting Systems	Runway lighting unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Runway centre line lighting unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Runway edge lighting unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Taxiway lighting system unserviceable	Restrictions depending on flight operations rules
Ancillary	Stop bars unserviceable	No effect if runway protection is ensured by other means
Ancillary	Ceilometer unserviceable	No effect
Ancillary	Anemometer unserviceable	No effect if other sources available; otherwise, restrictions depending on flight operations rules

Table 2.B3

EQUIPMENT FAILURE TO BE REPORTED – LOW-VISIBILITY APPROACH AND LANDING OPERATIONS		
SYSTEM CONSIDERED	**FAILURE TO BE REPORTED**	**EFFECT ON FLIGHT OPERATIONS**
ILS	ILS localiser downgraded to CAT II	Flight operations limited to CAT II
ILS	ILS localiser downgraded to CAT I	Flight operations limited to CAT I
ILS	ILS out of service	Restricted to non-precision ion approach (or other precision approach if available)
ILS	Outer marker unserviceable	No limitation if replaced with other published equivalent position;

		otherwise restricted to non – precision approach
ILS	Glide path out of service	Restricted to non – precision approach (e.g. localiser only)
MLS	MLS downgraded to CAT II	Flight operations restricted to CAT II
MLS	MLS downgraded to CAT I	Flight operations restricted to CAT I
MLS	MLS out of service	Restricted to non-precision approach (or other precision approach aid if available)
GBAS	GBAS downgraded to CAT II	Flight operations restricted to CAT II
GBAS	GBAS downgraded to CAT I	Flight operations restricted to CAT I
GBAS	GBAS out of service	Restricted to non-precision approach (or other precision approach aid if available)
DME	DME (as alternative to marker beacons) unserviceable	No limitation if replaced by published equivalent position; otherwise restricted to non-precision approach
RVR	Touchdown RVR system unserviceable	Restrictions depending on flight operations rules
RVR	Other RVR systems unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Approach lighting unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Runway lighting unserviceable	Restrictions depending on flight operations rules

Lighting Systems	Runway centre line lighting unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Runway edge lighting unserviceable	Restrictions depending on flight operations rules
Lighting systems	TDZ lighting unserviceable	Restrictions depending on flight operations rules
Lighting Systems	Taxiway lighting system unserviceable	Restrictions depending on flight operations rules
Ancillary	Stop bars unserviceable	No effect if runway protection is ensured by other means
Ancillary	Ceilometer unserviceable	No effect
Ancillary	Anemometer unserviceable	No effect if other sources available; otherwise, restrictions depending on flight operations rules

Table 2.B4

Operations in adverse weather conditions

Procedures

2.203 The aerodrome operator should, together with the air traffic services and other relevant parties operating at the aerodrome, establish and implement procedures required to mitigate the risk of operation of the aerodrome under adverse weather conditions such as strong winds, heavy rain, and thunderstorms, including the suspension of operations on the runway(s) if deemed necessary.

Runway visual range (RVR) assessed by human observers.

1. Where Instrumented RVR is not available, RVR for the purposes of category I and non-precision instrument approach operations may be assessed by human observer.
2. The human observer assessment of RVR is not permitted for category II or category III operations.
3. This section sets out the CAA's specifications for establishing and operating RVR reporting systems using human observers.
4. This part should be read in conjunction with CAP 746, Requirements for Meteorological Observations at Aerodromes.

Method

2.204 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.

2.205 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;

2.206 The Runway observation position (ROP) - Siting and number of runway observation positions

1. 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.
2. An 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 in this part.

Lateral position

1. 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:
2. Within the runway cleared and graded area:
3. Within taxiway strips:
4. 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.
5. 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, for details of the relevant specifications and criteria.

Longitudinal position

1. 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.
2. 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. Position of ROP relative to lights/marker boards.

4. 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.

5. 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 2.151.

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

7. 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.

Marking and lighting

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.

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.

Equipment and facilities

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.

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. Transparency of glass surfaces

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

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.

5. ROP construction

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

Selection of lights to be used for observations

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

1. Opposite side runway edge lights.
2. Opposite side special reference lights.
3. Same side runway edge lights.
4. Same side special reference lights.

2.208 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.

2.209 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.

2.210 So as to ensure the accuracy of the assessment it is necessary for the positions of the lights to be used to be accurately determined. Accordingly, they require to be included in the aerodrome survey, the requirements for which are contained in CAP 232, Aerodrome Survey Information, chapter 5.

Calibration of runway lights

2.211 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 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.

2.212 The aerodrome operator should ensure that re-calibrations are carried out at the agreed intervals and that a new table is issued.

2.213 A re-calibration is to be carried out immediately following any alterations or changes to the system, for example when lights have been realigned, 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.

Maintenance of RVR reference lights

2.214 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

Inspection of lights

2.215 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.

1. This visual inspection should check for subsidence, damage, misalignment, ageing of bulbs/lenses and obscuration by grass.
2. It is recommended that this inspection is carried out at least monthly.

Selection and function of the observer

2.216 The function of the observer needs no particular skill since it consists of identifying and counting lights and reporting this count to ATC.

2.217 Assessment of RVR has a direct bearing on safety and regularity of aircraft operations, observers should be suitably trained and competent to undertake the task.

2.218 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.

Time on duty

2.219 Duty periods for RVR observers should be arranged so that extended 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.

Eyesight and hearing requirements

2.220 Personnel selected for RVR observer duties should have the necessary eyesight (visual acuity and colour perception) and hearing requirements for them to operate on the manoeuvring area. Correcting spectacles or contact lenses should be worn when required.

Operating procedures

Periods when RVR reporting is required

2.221 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.

2.222 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.

2.223 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.

2.224 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.

Reporting procedures

2.225 Standardisation the UK standard for reporting RVR extends from 0 to 1500 m in the following steps:

1. 0 to 400 m in 25 m steps.
2. 400 to 800 m in 50 m steps.
3. 800 to 1500 m in 100 m steps.

2.226 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.

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

The count

1. The number of lights that can be seen (the count) should be reported to ATC, for example ‘four lights, the report should be read back to the observer by ATC.
2. The count is converted to RVR using the relevant conversion table.
3. 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.
4. Similar reports and read backs should be made if the count is converted to RVR at the ROP.

Low/high RVR values

1. 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.
2. 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.

Effect of light intensity on reporting

1. RVR observations, including those for transmission in meteorological reports, should be made with the lights set at the intensity appropriate to the prevailing conditions.
2. RVR should not be assessed with the lights set at an intensity for which there is no conversion table.
3. 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.

ATS functions

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

OFFICIAL - Public

Changes to procedures

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

Operating instructions

1. A comprehensive set of operating instructions should be drawn up for the aerodrome and included in the aerodrome manual.
2. 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. It may be desirable for instructions to be issued to RVR observers in a separate document.

The RVR log

2.227 The following material should be included.

1. The reason for RVR reports, with emphasis on the contribution to operational safety.
2. The alerting procedure and meteorological conditions for manning the ROPs.
3. 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.
4. The routes to be used to reach the ROPs and details of any authorisation or clearance required.
5. A comprehensive diagram of the runway environment is to be available at the ROP to enable the lights to be positively and individually identified.
6. The manner in which reports are to be passed to ATS together with an instruction that reports are to be passed immediately.
7. The method of use of the conversion table.
8. Specification of UTC as the time to be used and the need to synchronise the ROP clock or observer’s watch with ATS.
9. The action to be taken in the event of partial electrical failure extinguishing certain lights (if appropriate to the aerodrome);

10. The method of reporting an RVR value greater than, or less than the calibrated values.
11. 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.
12. Responsibility and instructions for maintaining and preserving the RVR log.
13. 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.
14. The frequency of re-calibration of the RVR lights; and
15. Arrangements for inspection and cleaning of the lights

CHAPTER 3

Aerodrome Physical Characteristics

Introduction

3.1 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.

3.2 The specifications for the individual requirements are interrelated by a two-element reference code, described in paragraph 3.7 below.

3.3 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 non-instrument runway if it is not so served.

3.4 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

Aerodrome compass base

3.5 Where a compass base is provided aerodrome operators should ensure the area is magnetically clean and it has been calibrated and certified.

1. A compass base survey aim is to establish an area of known magnetic characteristics, so that aircraft compasses and other magnetic direction-finding systems may be calibrated. It also ensures that deviations derived from a compass swing are only caused by aircraft magnetism.
2. The compass case may receive a class 1 or class 2 certification - depending on how many magnetic deviations there are across the base area, in accordance with CAA CAAIP, book 2, chapter 34-10 v4.1.
3. The compass base should be routinely surveyed according to its' classification as follows:
    a) every 5 years for Class 1, and
    b) every 2 years for Class 2.
4. The compass base survey should be conducted by a competent and qualified provider.

Number, siting and orientation of runways

3.6 The number and orientation of runways at an aerodrome should be such that the usability factor of the aerodrome is optimised taking into account that safety is not compromised. In practice the number and orientation of runways at an aerodrome should normally be such that the usability factor of the aerodrome would normally be not less than 95 %for the aeroplanes that the aerodrome is intended to serve.

3.7 Many factors affect the determination of the orientation, siting, and number of runways:

1. The wind distribution (to minimise crosswinds liable to affect runways):
    a) Wind statistics used for the calculation of the usability factor are normally available in ranges of speed and direction, and the accuracy of the results obtained depends, to a large extent, on the assumed distribution of observations within these ranges. In the absence of any sure information as to the true distribution, it is usual to assume a uniform distribution since, in relation to the most favourable runway orientations, this generally results in a slightly conservative usability factor.
    b) The maximum mean crosswind components refer to normal circumstances. There are some factors which may require that a reduction of those maximum values be taken into account at a particular aerodrome. These include:
2. The wide variations which may exist, in handling characteristics and maximum permissible crosswind components, among diverse types of aeroplanes (including future types) within each of the three groups given in 3.12.
    a) Prevalence and nature of gusts
    b) Prevalence and nature of turbulence
    c) The availability of a secondary runway
    d) The width of runways
    e) The runway surface conditions — water, snow, and ice on the runway.
    f) materially reduce the allowable crosswind component; and the strength of the wind associated with the limiting crosswind component.

3. The need to facilitate the provision of approaches conforming to the approach surface specifications, ensuring that obstacles in these areas or other factors should not restrict the operation of the aeroplanes for which the runway is intended. This may relate to individual obstacles or local geography (e.g. high ground).
4. The need to minimise interference with areas approved for residential use and other noise-sensitive areas close to the aerodrome.
5. The need to avoid the turbulence impacts of buildings on or close to the aerodrome.
6. Type of operation. Attention should be paid in particular to whether the aerodrome is to be used in all meteorological conditions or only in visual meteorological conditions, and whether it is intended for use by day and night, or only by day.
7. Topography of the aerodrome site, its approaches, and surroundings, particularly:
    a) Compliance with the obstacle limitation surfaces;
    b) Current and future land use. The orientation and layout should be selected so as to protect as far as possible, the particularly sensitive areas, such as residential, school and hospital zones, from the discomfort caused by aircraft noise. Detailed information on this topic is provided in ICAO Doc 9184, Airport Planning Manual, Part 2, Land Use and Environmental Control and in ICAO Doc 9829, Guidance on the Balanced Approach to Aircraft Noise Management;
    c) Current and future runway lengths to be provided;
    d) Construction costs; and
    e) Possibility of installing suitable non-visual and visual aids for approach-to land.
8. Air traffic in the vicinity of the aerodrome, particularly:
    a) Proximity of other aerodromes or ATS routes;
    b) Traffic density; and
    c) Air traffic control and missed approach procedures.
9. The number of runways to be provided in each direction depends on the number of aircraft movements to be catered for.

3.8 Whatever the factors that determine the runway orientation, the siting, and orientation of runways at an aerodrome should where possible, be such that safety is optimised.

3.9 One principal factor is the usability factor, as determined by the wind distribution which is specified hereunder. Another key factor is the alignment of the runway to facilitate the provision of approaches conforming to the approach surface. Further guidance on these and other factors is given in ICAO Annex 14, Attachment A, Section 1.

3.10 When a new instrument runway is being located, particular attention needs to be given to areas over which aeroplanes should be required to fly when following instrument approach and missed approach procedures so as to ensure that obstacles in these areas or other factors should not restrict the operation of the aeroplanes for which the runway is intended.

3.11 The selection of data to be used for the calculation of the usability factor should be based on reliable wind distribution statistics that extend over as long a period of time as possible, preferably of not less than five years. The observations used should be made at least eight times daily and spaced at equal intervals of time.

Choice of maximum permissible crosswind components

3.12 It should be assumed that landing or take-off of aeroplanes is, in normal circumstances, precluded when the crosswind component exceeds:

1. 37 km/h (20 kt) in the case of aeroplanes whose reference field length is 1 500 m or over, except that when poor runway braking action owing to an insufficient longitudinal coefficient of friction is experienced with some frequency, a crosswind component not exceeding 24 km/h (13 kt) should be assumed;
2. 24 km/h (13 kt) in the case of aeroplanes whose reference field length is 1 200 m or up to but not including 1 500 m; and
3. 19 km/h (10 kt) in the case of aeroplanes whose reference field length is less than 1 200 m.

Aerodrome (runway) reference code

3.13 An aerodrome reference code, consisting of a code number and letter which is selected for aerodrome planning purposes, should be determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended.

3.14 The aerodrome reference code numbers and letters should have the meanings assigned to them in Table 3-1.

3.15 The code number for element 1 should be determined from Table 3-1, by selecting the code number corresponding to the highest value of the aeroplane reference field lengths of the aeroplanes for which the runway is intended. The determination of the aeroplane reference field length is solely for the selection of a code number and is not intended to influence the actual runway length provided.

3.16 The code letter for element 2 should be determined from Table 3-1, by selecting the code letter which corresponds to the greatest wingspan of the aeroplanes for which the facility is intended.

3.17 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.

3.18 The CAA will determine the ARFL in consultation with the aerodrome licence holder.

Code 1 Element	**Aeroplane reference field length**
1	Less than 800 m
2	800 m up to but not including 1200 m
3	1200 m up to but not including 1800 m
4	1800 m and over
Code 2 Element	**Wingspan**
A	Up to but not including 15 m
B	15 m up to but not including 24 m
C	24 m up to but not including 36 m
D	36 m up to but not including 52 m
E	52 m up to but not including 65 m
F	65 m up to but not including 80 m

Table 3.1 Aerodrome reference code

Note 1. Guidance on planning for aeroplanes with wingspans greater than 80 m is given in the ICAO Aerodrome Design Manual (Doc 9157), Parts 1 and 2.

Note 2. Procedures on conducting aerodrome compatibility study to accommodate aeroplanes with folding wingtips spanning two codes letters are given in the procedure for air navigation services aerodromes (ICAO PANS Aerodromes, Doc 9881). Further guidance can be found in the aircraft manufacture's characteristics for airport panning manual.

Runways

3.19 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 non - instrument 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. The declared distances are to be approved and promulgated by the CAA.

Runways Width

3.20 Runways both paved and unpaved should have the following minimum widths.

Code number	Up to but not including 4.5 m	4.5 m up to but not including 6 m	6 m up to but not including 9 m	9 m up to but not including 15 m
1[a]	18 m	18 m	23 m	-
2[a]	23 m	23 m	30 m	-
3	30m	30	30 m	45 m
4	-	-	45 m	45m
a The width of a precision approach runway should be not less than 30 m where the code number is 1 or 2.				

Table 3.2 Runway minimum widths

1. Where additional runway distances are required for take-off, these may be achieved by adding a starter extension to the beginning of the runway.
2. Provided the extension is not more than 150 m in length, its width shall be reduced to not less than two-thirds of the normal requirement.
3. It may be necessary to provide extra width at the end of a runway or starter extension to enable aeroplanes to turn around.

Minimum distances between parallel runways

3.21 Where parallel non-instrument runways are intended for simultaneous use, the minimum distance between their centre lines should be:

1. 210 m where the higher code number is 3 or 4;
2. 150 m where the higher code number is 2; and
3. 120 m where the higher code number is 1

3.22 Except that for independent parallel approaches, combinations of minimum distances and associated conditions other than those specified in the PANS-ATM (Doc 4444) may be applied when it is determined that such combinations would not adversely affect the safety of aircraft operations.

3.23 Procedures for wake turbulence categorisation of aircraft and wake turbulence separation minima are contained in the Procedures for Air

Navigation Services, Air Traffic Management (PANS-ATM), Doc 4444, Chapter 4, and Chapter 5.

3.24 Where parallel instrument runways are intended for simultaneous use, the minimum distance between their centre lines should be:

1. 1 035 m for independent parallel approaches;
2. 915 m for dependent parallel approaches;
3. 760 m for independent parallel departures; and
4. 760 m for segregated parallel operations.

3.25 Apart from provided in (a) above, for segregated parallel operations the specified minimum distance may be decreased by:

1. 30 m for each 150 m that the arrival runway is staggered toward the arriving aircraft, to a minimum of 300 m; and
2. should be increased by 30 m for each 150 m that the arrival runway is staggered away from the arriving aircraft.

3.26 Other combinations of minimum distances should apply taking into account ATM and operational aspects

Runways longitudinal slopes

3.27 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% (1:100) for runways where the code number is 3 or 4; and
2. 2% (1:50) for runways where the code number is 1 or 2.

3.28 Local longitudinal slopes on runways should not exceed:

1. 1.25% (1:80) where the code number is 4;
2. 1.5% (1:66) where the code number is 3;
3. 2.0% (1:50) where the code number is 1 or 2.

3.29 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).

3.30 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.

3.31 Slope changes should be minimised on new construction and wherever possible on existing runways during the course of major runway maintenance.

3.32 Slope changes allowable during resurfacing are detailed in chapter 3.

3.33 Where a slope cannot be avoided, the change between two consecutive slopes should not exceed:

1. 1.5% where the code number is 3 or 4;
2. 2.0% where the code number is 1 or 2.

3.34 The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding:

1. 0.1% per 30 m (minimum radius of curvature of 30 000 m) where the code number is 4;
2. 0.2% per 30 m (minimum radius of curvature of 15 000 m) where the code number is 3;
3. 0.4% per 30 m (minimum radius of curvature of 7500 m) where the code number is 1 or 2

Sight distance

3.35 Where slope changes cannot be avoided, they should be such that there will be an unobstructed line of sight from;

1. Any point 3 m above a runway to all other points 3 m above the runway within a distance of at least half the length of the runway where the code letter is C, D, E, or F;
2. Any point 2 m above 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;
3. 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

Distance between slope changes

3.36 Undulations or appreciable changes in slopes located close together along a runway should be avoided.

3.37 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;

1. 300 where the code number is 4;
2. 150 where the code number is 3;
3. 50 where the code number is 1 or 2.

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

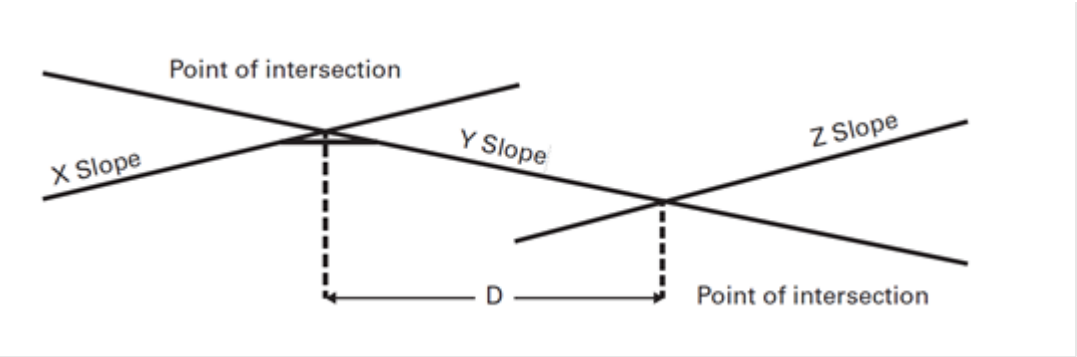


Figure 3.1 Example

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 Y	=	+1%
		=	-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) m = 750 m

Transverse slopes on paved runways

3.39 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.

3.40 The transverse slope on either side of the crown should be symmetrical and ideally should be;

1. 1.5% (1:66) where the code letter is C, D, E or F, and

2. 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.

3. A 1.5% slope should be provided on a straight cross-fall.

3.41 In the case of a cambered runway when a transverse slope of only 1% exists, 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.

3.42 A 1.5% slope should be provided on a straight cross-fall. In the case of a cambered runway when a transverse slope of only 1% exists, it is recommended that the surface of that runway demonstrates an ability to drain water effectively

Runway shoulders

3.43 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. To overcome the potential problems 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.

3.44 Runway shoulders should extend symmetrically on both sides of the runway so that the overall width of runway plus shoulders is not less than;

1. 60 m where the code letter is D or E, and

2. 75 m where the code letter is F.

3. Shoulders for runways where the code letter is E, or F normally should be paved.

3.45 For runways where the code letter is F, there may be circumstances where a lesser paved width may be acceptable; for example, where an aerodrome is nominated as an alternate, or where the frequency of operations is very low; in all circumstances the minimum paved width should be 60 m. Where a reduced paved width of 60 m is accepted:

3.46 The outer unpaved 7.5 m of runway shoulder should be stabilised; the ground is prepared so that there is full grass coverage with no loose gravel

or other material. This may include additional materials if the bearing strength and surface of the ground are not sufficient;

3.47 A programme of inspections of the shoulders and runway should be implemented to confirm its continuing serviceability and ensure that there is no deterioration that could create a risk of FOD or otherwise hazard aircraft operations; As movements of code letter F aircraft increase, the need for full paved width shoulders should be assessed by local hazard analysis;

3.48 The bearing strength of the shoulders, whether paved or not, should comply with the requirements in chapter 3; paved surfaces should be of an approved PCR classification and unpaved surfaces should be regularly assessed in accordance with chapter 3.

3.49 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).

3.50 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, while 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.

Blast pads and runway ends

3.51 Along with the runway shoulders, the areas at the ends of runways, such as blast pads, stopways and runway turn pads, may be subject to significant blast forces and jet engine vortex effects. Additional paved surface may be used to mitigate the effects of these factors.

3.52 Aerodrome operators should assess such paved surfaces which, if provided, should be able to accommodate the occasional passage of the critical aircraft for runway pavement design.

3.53 Pavement strength should subsequently take account of the taxying loads of the most critical aircraft and/or the critical axle load of emergency or maintenance vehicles.

3.54 Where additional paved surface is provided at runway ends, it should have a width equal to the width of the runway plus shoulders.

3.55 Irrespective of whether it is fit for the normal movement of aircraft, the surface should be such that it can withstand the extended blast from aircraft engines that may overhang and the effects of engine inlet forces.

Runway turn pads

3.56 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. Such areas may also be useful if provided along a runway to reduce taxying time and distance for aeroplanes that may not require the full length of the runway.

3.57 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 its 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.

3.58 Where the use of runway turn pads is deemed necessary, they should have the characteristics below;

1. The intersection angle of the runway turn pad should not exceed 30°
2. The nose wheel steering angle to be used should not exceed 45°.

3.59 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;

1. 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 wheel of 18 m or greater;
2. 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;
3. 2.25 m where the code letter is B;
4. 1.5 m where the code letter is A; or

3.60 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.

3.61 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.

3.62 The strength of a runway turn pad should be at least equal to that of the adjoining runway which it serves, 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.

3.63 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 maneuvers.

3.64 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 or resurfaced so as to provide good surface friction characteristics at least equal to that of the adjoining runway.

3.65 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.

3.66 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.

3.67 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.

3.68 The characteristics of runway turn pad lights are detailed in chapter 6 and runway turn pad markings in chapter 7.

Runway strips

3.69 A runway strip is an area enclosing a runway and any associated stopway. Its purpose is to:

1. 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
2. Protect aeroplanes flying over it during landing, balked landing, or take-off by providing an area which is cleared of obstacles except permitted aids to air navigation.
3. No fixed object, other than visual aids for air navigation or those required for aircraft safety purposes, and which must be sited on the runway strip, and satisfying the relevant frangibility requirements shall be permitted on any part of the runway strip of a precision approach runway delineated by the lower edges of the inner transitional surface. No mobile objects shall

be permitted on this part of the runway strip during the use of the runway for landing or take-off.

4. 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. Particular attention needs to be given to the design and maintenance of any open storm water conveyance in order to prevent wildlife attraction, notably birds. If needed it can be covered by a net.

3.70 Procedures on wildlife management are specified in the PANS- Aerodromes (Doc 9981). Further guidance can be found in the Airport Services Manual (Doc 9137) Part 3

3.71 Within the graded area of the runway strip, constructions such as plinths, runway ends, paved taxiway edges, etc. should be delethalised, 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.

3.72 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.

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

3.74 Newly constructed features complying with paragraph 3.69 point 4 are not required to be delethalised.

3.75 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

Runway strip length

3.76 A runway strip should extend beyond each end of a runway and of any associated stopway for a distance of at least;

1. 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.

2. when the code number is 1 and the runway is a non-instrument runway, the distance should be 30 m.

3.77 When a starter extension is provided, 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).

Runway strip width

3.78 The runway strip which encloses a non-instrument runway should extend laterally each side of the centreline and extended centreline of the runway and any associated stopway for a distance of:

1. 75 m where the code number is 4.
2. 55 m where the code number is 3.
3. 40 m where the code number is 2.
4. 30 m where the code number is 1.

Non-instrument Code 3 runways with RNP APCH

3.79 For Code 3 non-instrument runways with RNP APCH aerodrome operators are required to provide a minimum runway strip and graded area of 75 metres. Any consideration to reduce this distance to 55 metres requires a safety assessment and prior approval from the CAA.

3.80 Where there is a non-instrument runway of 10% or greater than the minimum width, the overall width of the runway strip should be increased to provide a distance measured laterally each edge of the runway for a distance of:

1. 28 m where the code number is 2.
2. 21 m where the code number is 1.

3.81 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 and laterally each side of the runway for a distance of:

1. 140 m where the code number is 3 or 4.
2. 70 m where the code number is 1 or 2.

3.82 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 (see runway strip length) at the widths specified (see runway strip length), based on the threshold end of Take-Off Run Available, end of Landing Distance Available or end of stopway as appropriate.

3.83 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.

3.84 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.

1. 75 m where the code number is 4.
2. 55 m where the code number is 3.
3. 40 m where the code number is 2.
4. 30 m where the code number is 1.

Note: See paragraph 3.79 referring to non – instrument runways with RNP APRH.

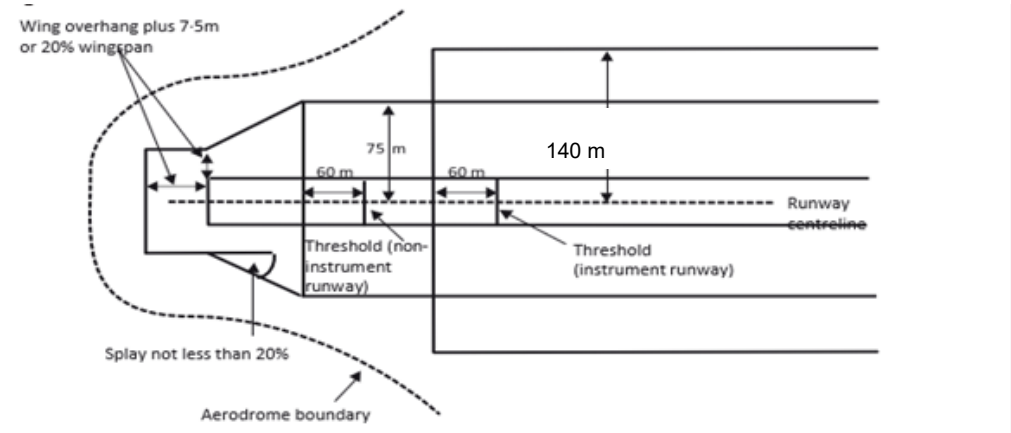


Figure 3.2

NB: Figure 3.2 does not reflect the reduction of strip width from 75 m to 70 m either side of the runway centreline, for a Code 3 or 4 runway.

a) Except for aircraft emergency situations, an aerodrome operator may, subject to prior approval by the CAA, permit the use of the aerodrome or parts thereof by aircraft with a higher code letter than the aerodrome design characteristics.

Use of the aerodrome by higher code letter aircraft

Elements to be Assessed

3.85 When assessing the possibility of operation of aircraft whose code letter is higher than the code letter of the aerodrome reference code, the aerodrome operator should, amongst other issues, assess the impact of the characteristics of the aircraft on the aerodrome, its facilities, equipment, and its operation, and vice versa.

3.86 Aircraft characteristics to be assessed include, but are not limited to:

1. fuselage length;
2. Fuselage width;
3. Fuselage height;
4. Tail height;
5. Wingspan;
6. Wing tip vertical clearance;
7. Cockpit view;
8. Distance from the pilot's eye position to the nose landing gear and to the main landing gear;
9. Outer main gear wheel span;
10. Wheelbase;
11. Main gear steering system;
12. Landing gear geometry;
13. Engine data;
14. Flight performance; and
15. Technology evolution.

Note: Further guidance on this issue is contained in ICAO Circular 305-AN/177 and ICAO Circular 301- AN/174.

3.87 Such assessments should include, but are not limited to:

1. The aircraft mass, tyre pressure and ACR values — with regard to overload operations; and
2. Maximum passenger and fuel carrying capacity — with regard to level of RFFS protection to be provided and the aerodrome emergency planning.
3. Runway strip width requirements

Agricultural crops and grass

3.88 Agricultural crops other than long grass should not be grown within the runway strip since they would either provide a wildlife-attractive environment or be a fire hazard.

3.89 Within the manoeuvring area on a grass aerodrome the length of grass should not exceed the limits described in CAP 772, Aerodrome Wildlife Strike Hazard Management and Reduction.

3.90 Grass should be grown in accordance with the grass management regime as described in CAP 772 within RESAs, unpaved stopways and the graded area of runway and taxiway strips.

Graded area (GA)

3.91 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 75 m each side of the centre line of the runway and its extended centre line to provide a graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

3.92 Subject to a satisfactory safety assessment, the distance in 3.84 may be increased to 105 m each side of the centreline and extended centreline at each strip end, starting at a width of 75 m at the start of operational direction and continuing at this width for the first 150 m of runway available, then increasing uniformly to 105 m from centreline by 300 m.

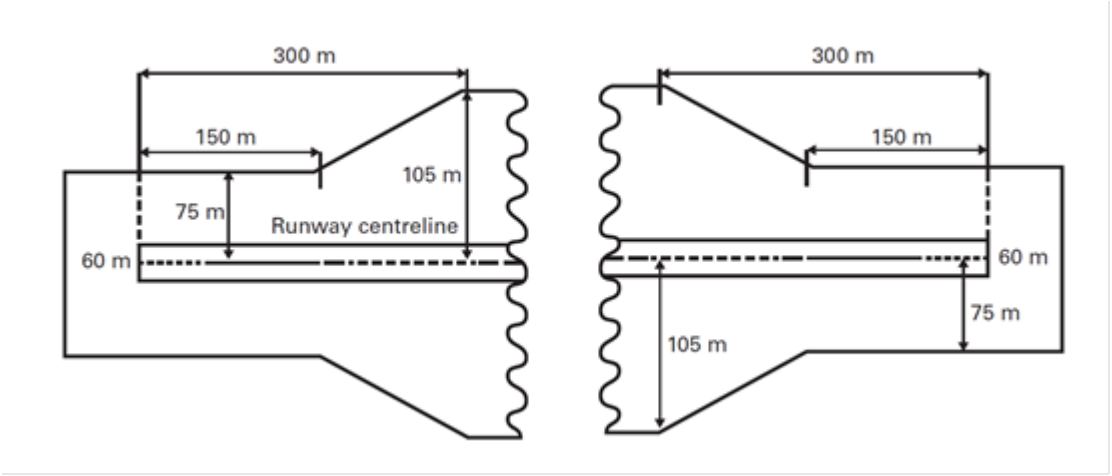


Figure 3.3

3.93 The runway strip which encloses a precision instrument approach runway where the code number is 1 or 2 should be cleared of obstacles and graded for a distance of at least 40 m each side of the centreline and extended centreline.

3.94 The runway strip which encloses a non-instrument, or a non-precision instrument 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:

1. 75 m where the code number is 4;
2. 55 m where the code number is 3
3. 40 m where the code number is 2;

4. 30 m where the code number is 1.

Note:1 See paragraph 3.79 referring to non – instrument runways with RNP APCH.

Note2. Additional guidance for temporary obstacles within the runway strip see section temporary obstacles within runway strips

Strength of runway strips

3.95 The runway strip should be flush with the runway, runway shoulder and stopway along their common edges. That portion a strip containing a non – instrument runway within a distance of;

1. 75 m where the code number is 4;
2. 55 m where the code number is 3;
3. 40 m where the code number is 2; and
4. 30 m where the code number is 1;

from the centre line of the runway and its extended centre line should be so prepared or constructed as to minimize hazards arising from differences in load-bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway without the aeroplane suffering considerable damage.

Note: See paragraph 3.79 referring to non – instrument runways with RNP APCH.

3.96 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, and to eliminate the effects of jet blast and inlet forces.

3.97 Where such areas have paved surfaces, they should be able to withstand the occasional passage of the critical aeroplane for runway pavement design. 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

Longitudinal slopes

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

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

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

Transverse slopes

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

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

3.100 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).

3.101 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.

Runway end safety areas (RESA)

3.102 RESAs are designated areas at each end of the runway intended to minimise the risk of damage to an aeroplane where an aeroplane overruns or undershoots a runway. The RESA is beyond and in addition to the runway strip, as shown in CAP 168, figure 3.11.

3.103 RESAs are required 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.

3.104 Additionally, RESAs should be considered for non-instrument 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.

3.105 A runway end safety area should extend from the end of a runway strip to a distance of at least 90 m and, as far as practicable, extend to a distance of:

1. 240 m where the code number is 3 or 4, and
2. 120 m where the code number is 1 or 2 and the runway is an instrument one.

3.106 A runway end safety area should extend from the end of a runway strip, as far as practicable, to a distance of 30 m where the code number is 1 or 2 and the runway is a non-instrument one.

3.107 The length of the runway end safety area may be reduced where an arresting system is installed, based on the design specifications of the system.

3.108 The width of a runway end safety area should be at least twice that of the associated runway and, wherever practicable, be equal to that of the graded portion of the associated runway strip.

3.109 For applicable runways where the RESA does not extend to the recommended distance, as part of their SMS, licence holders should assess the risk of a runway excursion on a regular basis as circumstances change and implement appropriate and suitable mitigation measures as necessary

3.110 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:

1. Hinder the movement of rescue and firefighting vehicles,
2. The effectiveness of the rescue and firefighting provision; or
3. Endanger aircraft in the event of an aeroplane undershooting or overrunning.

3.111 The overall longitudinal slope in a runway end safety area should not exceed:

1. 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.
2. 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.

3.112 Transverse slopes should not exceed an upward or downward slope 5% (1:20).

3.113 Slope changes and transitions between slopes should be gradual and abrupt changes or sudden reversals of slopes should be avoided.

The siting of aids to navigation within runway strips

3.114 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.

3.115 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.

3.116 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; and,

1. Not more than 0.9 m above local ground level and,
2. Not closer than 15 m from the edge of the runway.

3.117 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.

3.118 The limiting surface at 1:10 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

Sighting of equipment and installations on operational areas

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

1. Situated within 240 m from the end of the strip and within;
2. 60 m of the extended runway centre line where the code number is 3 or 4; or
3. 45 m of the extended runway centre line where the code number is 1 or 2; or
4. Penetrates the inner approach surface, the inner transitional surface, or the balked landing surface;
5. Shall be frangible and mounted as low as possible.

Engineered materials arresting system (EMAS)

3.120 Engineered materials; If an EMAS is installed it should be promulgated to operators and included in the AIP. The materials in an EMAS should have the following properties.

3.121 The materials are tailored to specific mechanical properties and are referred to as engineered materials. The engineered materials have to meet a force-

deformation profile within limits which have been shown to assure uniform characteristics, and therefore, predictable response to an aircraft entering the EMAS. The engineered materials will crush under the landing gears of the aeroplane when it engages the EMAS. The crushing is an irreversible or partly irreversible process, and the arresting performance of the system is proportional to the amount of energy that is dissipated.

3.122 The compatibility of the EMAS with the specific meteorological and aerodrome conditions is ensured by using materials which:

1. Are water-resistant to the extent that the presence of water does not affect system performance;
2. Do not attract or are physically vulnerable to wildlife (including vermin and birds) to the greatest extent possible.
3. Do not support unintended plant growth with proper application of herbicides;
4. Exhibit constant strength and density characteristics during all climatic conditions within a temperature range that is appropriate for the local conditions;
5. Are resistant to deterioration as a result of:
    a) Salt;
    b) Aircraft and runway de-icing and anti-icing fluids and solids;
    c) Aircraft fuels, hydraulic fluids, and lubricating oils;
    d) Ultraviolet;
    e) Water;
    f) Freezing/thawing;
    g) Blowing sand and snow;
    h) Hail;
    i) Paint;
6. Does not support unintended plant growth with proper application of herbicides.

Undershoot

3.123 An EMAS is not intended to reduce the risk of damage to an aeroplane undershooting the runway. However, the presence of an EMAS cannot increase the potential for damage in case of undershoot more than the risk that is associated with an undershoot in a RESA.

3.124 Compliance could be justified through experience of real cases of undershoot in an EMAS, flight simulator tests, other type of studies, or a combination of the three.

3.125 An EMAS is a passive system which does not require any specific action or procedures by the flight crew. However, a basic knowledge of the systems by the crew is considered advantageous to prevent undesired evasive manoeuvres that could cause the aircraft to avoid entering the bed or system. The EMAS is designed to be entered preferably straight ahead with the unrestricted use of wheel brakes and/or thrust reversers. Additionally, the availability of an EMAS cannot be used for flight planning purposes, i.e., it cannot be included in the declared distances.

Mechanical property

1. An EMAS is not intended to support vehicular traffic for maintenance or normal operating purposes.
2. The EMAS needs to be capable of supporting personnel walking on it for the purposes of its own maintenance and co-located air navigation aids without causing any damage to its surface.
3. Precaution needs to be taken during snow and ice removal to prevent damage to the EMAS bed.
4. Light equipment for snow removal may be used in accordance with the manufacturer´s specification to avoid any damage to the surface.

Setback distance

1. The setback distance is defined as the distance between the runway end or stopway, if provided, and the beginning of the EMAS.
2. The setback distance will vary depending on the available area and the EMAS design.
3. The calculation of the setback distance balances the risk objectives of:
    a) Providing enough area for arresting purposes;
    b) Providing enough separation to protect the bed from jet blast;
    c) Providing separation from the threshold to reduce the probability of undershoot in the EMAS; and
    d) Decreasing the probability of aircraft overruns passing by one side of the EMAS due to lateral dispersion. The safety assessment determines the relevance of each risk objective, taking into account the operating particularities of the associated runway, including usage of the runway, types of approach, weather conditions, fleet,

incidents and accidents, and any other particularity related with runway safety.

4. To reduce the probability of an aircraft travelling into the EMAS, aerodrome operators might consider setting the EMAS back from the end of the runway.

3.126 An EMAS normally includes steps and/or slopes at its end and both sides, but they are not considered functional for arresting purposes. Where possible, the functional width of the EMAS is to be maintained the same throughout the entire length of the system.

3.127 Exit speed is defined as the speed of the nose gear of the aeroplane as it passes the runway end or stopway, if provided.

3.128 The critical aircraft is defined as the aircraft that regularly uses the associated runway that imposes the greatest demand upon the EMAS.

3.129 Design aircraft list refers to the combination of aircraft types which are/will be operating regularly on the runway. The critical aircraft is usually, but not always, the heaviest/largest aircraft that regularly uses the runway. The performance of an EMAS is dependent not only on aeroplane weight, but also on the landing gear configuration, tyre pressure, and centre of gravity. In general, the operational maximum take-off weight (operational MTOW) is used for the critical aircraft. However, there may be instances where less than the MTOW will require a longer EMAS. All parameters are to be considered in optimising the EMAS design. However, to the extent practicable, the EMAS design may consider both the aeroplane that imposes the greatest demand upon the EMAS, and the range of aircraft expected to operate regularly on the runway. In some instances, a composite of design aircraft may be preferable to optimising the EMAS for a specific runway than a single critical aircraft. Other factors that are unique to a particular aerodrome, such as available RESA and air cargo operations, should also be considered in the final design.

Testing

1. Testing is to be based either on passage of an actual aircraft, or a single wheel bearing an equivalent load through a test bed.

2. The design will need to consider multiple aircraft parameters, including but not limited to allowable aircraft.

3.130 The CAA will permit an increase in runway declared distances that can be achieved from the installation of EMAS only where installation of EMAS has provided the equivalent to a 240 m RESA and 60 m strip end (a full length EMAS for the design size aircraft).

3.131 Should arresting systems other than EMAS be considered the licence holder needs to be aware of the risks to aircraft and possible increase in rescue and firefighting provision that their establishment may introduce.

3.132 Arresting systems may be sited inside the RESA only where their performance and frangibility has been demonstrated.

3.133 Aerodrome operators' holders evaluating such systems should contact the CAA for further advice.

3.134 Soft ground arrester beds are not intended to replace RESA and, therefore, should not be located within the minimum RESA distance.

Taxiways

3.135 Unless otherwise indicated, the requirements in this section are applicable to all types of taxiways.

3.136 Taxiways should be provided for the safe and expeditious surface movement of aircraft. Sufficient entrance and exit taxiways for a runway should be provided to expedite the movement of aeroplanes to and from the runway and provision of rapid exit taxiways considered when traffic volumes are high.

3.137 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. Guidance on layout and standardised nomenclature of taxiways is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 2

Width of taxiways

3.138 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 not less than that given by the following tabulation;

Outer Main Gear Wheel Span (OMGWS)				
Clearance	Up to but not including 4.5m	4.5m up to but not including 6m	6m up to but not including 9m	9m up to but not including 15m
	1.50m	2.25m	3m [a] or 4m [b]	4m

OFFICIAL - Public

a. on straight portions.

b. on curved portions if the taxiway is intended to be used by aeroplanes with a wheelbase of less than 18 m.

c. on curved portions if the taxiway is intended to be used by aeroplanes with a wheelbase equal to or greater than 18 m.

Note : Wheel base means the distance from the nose gear to the geometric centre of main gear.

3.139 Changes in direction of taxiways should be as few as possible.

3.140 Where curves are necessary, they should be compatible with the manoeuvring capability at normal taxying speed of the most critical aeroplane for which the taxiway is intended.

3.141 On order to provide the clearance distances it may be necessary to widen taxiways on the inside of curves to provide a fillet, the amount of widening depending on the wheelbase and track of the critical aeroplane and the radius of curvature of the taxiway centreline.

3.142 The design of the curve should be such that the intent of paragraph two of longitudinal slopes and sight changes is met at all points on the curve.

3.143 Fillets should be provided as required at junctions and intersections of taxiways with runways, aprons, and other taxiways.

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

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

Longitudinal slopes and sight changes

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

1. 1.5% (1:66) where the code letter is C, D, E or F;
2. 3.0% (1:33) where the code letter is A or B.

3.146 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:

1. 1% per 30 m where the code letter is C, D, E or F;
2. 1% per 25 m where the code letter is A or

Sight distance

3.147 Where slope changes cannot be achieved and slopes on a taxiway cannot be avoided, the transition from one slope to another slope should be accomplished by a curved surface which should allow the safe operation of all aircraft in all weather conditions.

Transverse slopes

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

1. 1.5% (1:66) where the code letter is C, D, E or F;
2. 2.0% (1:50) where the code letter is A or B.

Taxiway shoulders

3.149 Straight portions of a taxiway where the code letter is C, D, E, or F should be provided with shoulders which extend symmetrically on each side of the taxiway so that the overall width of the taxiway and its shoulders on straight portions is not less than:

1. 44 m where the code letter is F;
2. 38 m where the code letter is E;
3. 34 m where the code letter is D; and
4. 25 m where the code letter is C.

3.150 On taxiway curves and on junctions or intersections where increased pavement is provided, the shoulder width should be not less than that on the adjacent straight portions of the taxiway.

3.151 When a taxiway is intended to be used by turbine-engined aeroplanes, the surface of the taxiway shoulder should be prepared so as to resist erosion and the ingestion of the surface material by aeroplane engines. Guidance on characteristics of taxiway shoulders and on shoulder treatment is given in ICAO Doc 9157, Aerodrome Design Manual, Part 2 Taxiways, Apron and Holding bays

Taxiway strips

3.152 A taxiway should be enclosed by a strip extending symmetrically on each side of the taxiway an area clear of objects which may endanger taxying aeroplanes and to reduce the risk of damage to an aircraft running off the taxiway. A taxiway, other than an aircraft stand taxilane, shall be included in the strip The strip should extend on each side of the taxiway centreline throughout the length of the taxiway for a distance of:

1. 51 m where the code letter is F;
2. 43.5 m where the code letter is E;
3. 37 m where the code letter is D;
4. 26 m where the code letter is C;
5. 20 m where the code letter is B;
6. 15.5 m where the code letter is A.

Grading of taxiway strips

3.153 The centre portion of a taxiway strip should provide a graded area to a distance from the centre line of the taxiway of not less than that given by the following:

1. 10.25 m where the OMGWS is up to but not including 4.5 m;
2. 11 m where the OMGWS is 4.5 m up to but not including 6 m;
3. 12.50 m where the OMGWS is 6 m up to but not including 9 m;
4. 18.50 17 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is D;
5. 19 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is E;
6. 22 m where the OMGWS is 9 m up to but not including 15 m, where the code letter is F.

3.154 On taxiway curves, junctions, and intersections where extra pavement is provided, a corresponding increase should be made in the width of the taxiway shoulder and grade area.

3.155 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.

3.156 The transverse slope on the graded area of a taxiway shoulder, 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:

1. 2.5% (1:40) where the code letter is C, D, E or F;
2. 3.0% (1:33) where the code letter is A or B; measured relative to the transverse slope on the adjacent taxiway.

3.157 The downward transverse slope of the graded portion of a taxiway strip should not exceed 5% (1:20) measured relative to the horizontal.

3.158 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

Intermediate holding position

3.159 An intermediate holding position is a designated position intended for traffic control at which taxing aircraft and vehicles should stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower. An intermediate holding position should be established on a taxiway at any point other than a runway-holding position where it is desirable to define a specific holding limit.

Taxiway holding bays and holding positions

3.160 A taxi-holding position or positions should be established on the taxiway, at the intersection of a taxiway and a runway. A road holding position shall be established at an intersection of a road with a runway

3.161 The distance between a holding bay, runway-holding position established at a taxiway/runway intersection or road-holding position and the centre line of a runway should be in accordance with Table 3.3 and such that a holding aircraft or vehicle should not;

1. Interfere with the operation of radio navigation aids;
2. Penetrate the obstacle free zone by a holding aeroplane; or
3. Penetrate the inner transitional surface;
4. A holding aeroplane being accountable in the calculation of Obstacle Clearance Altitude/Height (OCA/H).

3.162 At grass aerodromes where taxiways are not provided, aircraft should hold no closer to the runway than the runway holding position sign.

Type of runway	Code number 1	Code number 2	Code number 3	Code number 4
Non-instrument	30 m	40 m	55 m	75 m
Instrument and take take-off	30 m	40 m	75 m	75 m
Precision instrument and category I	60 m [b]	60 m [b]	90 m [a, b]	90 m [a, b. c]
Category II & III	-	-	90 m [a, b]	90 m [a, b, c]
Take-off runway	30 m	40 m	55 m	75 m

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

Notes:

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

b. This distance may need to be increased to avoid interference with radio navigation aids, particularly the glide path and localiser facilities. Information on critical and sensitive areas of

ILS and MLS is contained in ICAO Annex 10, Volume I, Attachments C and G, respectively (see also 3.12.6).

Note 1.The distance of 90 m for code number 3 or 4 is based on an aircraft with a tail height of 20 m, a distance from the nose to the highest part of the tail of 52.7 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centre line, being clear of the obstacle free zone and not accountable for the calculation of OCA/H.

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

c. Where the code letter is F, this distance should be 107.5 m.

Note.3 For code number 4 where the width of the inner edge of the inner approach surface is more than 120 m, a distance greater than 90m may be necessary to ensure that a holding aircraft is clear of the obstacle free zone. For example, a distance of 100m is based on an aircraft with a tail height of

24 m, a distance from the nose to the highest part of the tail of 62.2 m and a nose height of 10 m holding at an angle of 45° or more with respect to the runway centreline, being clear of the obstacle free zone.

Note 4. If a holding bay, runway-holding position or road-holding position for a precision approach runway code number 4 is at a greater elevation compared to the threshold, the distance of 90 m or 107.5 m, as appropriate, specified in Table 3-2 should be further increased 5 m for every metre the bay or position is higher than the threshold.

Guidance for the positioning of runway-holding positions is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 2.

Taxiway separation distances

3.163 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. 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.

Code letter	Distance between taxiway centreline and runway centreline								Taxiway centreline to taxiway centreline (metres)	Taxiway, other that aircraft stand taxilane, centreline to object (metres)	Aircraft stand taxilane centre line to aircraft stand taxilane centre line (metres)	Aircraft stand taxilane centre line to object (metres)
	Instrument runway code number				Non-instrument code number							
	1	2	3	4	1	2	3	4				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	77.5	77.5	-	-	37.5	47.5	-	-	23	15.5	19.5	12
B	82	82	152	-	42	52	67	-	32	20	28.5	16.5
C	88	88	158	158	48	58	73	93	44	26	40.5	22.5
D	-	-	166	166	-	-	81	101	63	37	59.5	33.5
E	-	-	172.5	172.5	-	-	87.5	107.5	76	43.5	72.5	40
F	-	-	180	180	-	-	95	115	91	51	87.5	47.5

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

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

Table 3. Taxiway minimum separation distances

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

3.164 Objects essential to the use of a taxiway system which require to be sited closer than shown in table above 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 while keeping all wheels on the taxiway.

3.165 Restrictions may be placed on the types of aeroplanes which may use a particular taxiway if an object exceeds 0.36 m above the taxiway level within the following distances of the edge of the taxiway:

1. 22 m where the code letter is F;
2. 18 m where the code letter is D or E;
3. 11 m where the code letter is C;
4. 7.5 m where the code letter is A or B.

3.166 Between the distances specified above and those table in 3.4(c), objects should not exceed 1.5 m in height above taxiway level.

3.167 Acceptance of temporary obstacles near a taxiway will depend on the types of aeroplanes 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.

Rapid exit taxiways

3.168 Where rapid exit taxiways are provided, they should be designed with a radius of turn-off curve of at least:

1. 550 m where the code number is 3 or 4;
2. 275 m where the code number is 1 or 2;

To enable exit speeds under wet conditions of:

3. 93 km/h where the code number is 3 or 4;
4. 65 km/h where the code number is 1 or 2.

3.169 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.

3.170 A rapid exit taxiway should include a straight distance after the turn-off curve sufficient for a vacating aircraft to come to a full stop clear of an intersecting taxiway.

3.171 The intersection angle of a rapid exit taxiway with the runway should not be greater than 45° not less than 25° and preferably should be 30°.

3.172 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.

Taxiways on bridges

3.173 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.

3.174 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.

3.175 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. As bridge deck temperatures fall faster than pavements, licence holders should be alert to the presence of ice.

Clearways

3.176 A clearway is an area which may be provided beyond the end of the 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 chapter 3)

3.177 The runway, stopway, and clearway lengths to be provided are determined by the aeroplane take-off performance but a check should also be made of the landing distance required by the aeroplanes using the runway to ensure that adequate runway length is provided for landing. The length of a clearway, however, cannot exceed half the length of take-off run available.

3.178 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.

Width of clearways

3.179 The width of clearway at the end of TORA should extend laterally on each side of the centreline of the instrument runway to a distance of at least 75m.

3.180 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;

1. 180 m where the code number is 3 or 4, and
2. 150 m where it is 1 or 2.

Length of clearways

3.181 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.

Slopes on clearways

3.182 The ground in a clearway should not project above a plane having an upward slope of 1.25%. the lower limit of this plane being a horizontal line which is;

1. perpendicular to the vertical plane containing the runway centre line; and
2. passes through a point located on the runway centre line at the end of the take-off run available.
3. The slope may be increased to 2% where the code is 1 and 2.

3.183 An object situated on a clearway which may endanger aeroplanes in the air should be regarded as an obstacle and should be removed.

3.184 Because of transverse or longitudinal slopes of runways, shoulder, or strip, in certain cases the lower limit of the clearway place specified above may be below the corresponding elevation of the runway shoulder or strip. It is not intended that these surfaces be graded to conform with the lower limit of the clearway plane nor is it intended that the terrain or objects which are above the clearway plane beyond the end of the strip but below the level of the strip be removed unless it is considered that may endanger aeroplanes.

3.185 Abrupt upward changes in slope should be avoided when the slope on the ground in a clearway is relatively small or when the mean slope is upward. In such situations, in that portion of the clearway within a distance of 22.5 m or half the runway width whichever is greater, on each side of the extended centre line, the slopes, slope changes, and the transition from runway to clearway should generally conform with those of the runway with which the clearway is associated.

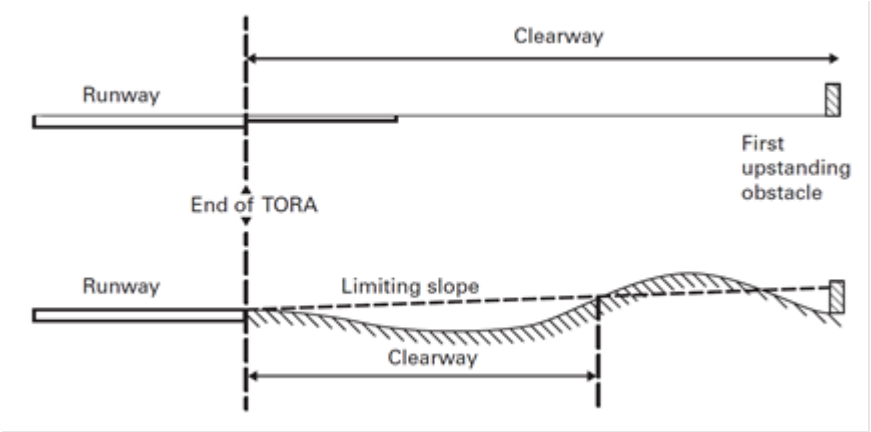


Figure 3.4

Stopway

3.186 The inclusion of detailed specifications for stopways below is not intended to imply that a stopway has to be provided. Any combination of runway, stop way and clear way provided should permit compliance with the operational requirements or take-off and landing of the aeroplane's runway is intended to serve

Width of stopways

3.187 A stopway should have the same width as the runway with which it is associated.

Slopes on stopways

3.188 Slopes and changes in slope on a stopway, and the transition from a runway to a stopway, should comply with the specifications for the runway with which the stopway is associated except that:

3.189 The limitation of a 0.8 per cent slope for the first and last quarter of the length of a runway need not be applied to the stopway; and

3.190 At the junction of the stopway and runway and along the stopway the maximum rate of slope change may be 0.3 per cent per 30 m (minimum

radius of curvature of 10 000 m) for a runway where the code number is 3 or 4.

Strength of stopways

3.191 A stopway should be prepared or constructed so as to be capable, in the event of an abandoned take-off, of supporting the aeroplane which the stopway is intended to serve without inducing structural damage to the aeroplane.

Surface of stopways

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

3.193 The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding:

1. 0.3 % per 30 m (minimum radius of curvature of 10 000 m) where the code number is 3 or 4; and
2. 0.4 % per 30 m (minimum radius of curvature of 7 500 m) where the code number is 1 or 2.

3.194 The friction characteristics of an unpaved stopway should not be substantially less than that of the runway with which the stopway is associated and above the minimum friction level stated in CAP 683.

3.195 The economy of a stopway can be entirely lost if, after each usage, it should be regraded and compacted. Therefore, it should be designed to withstand at least a certain number of loadings of the aeroplane which the stopway is intended to serve without inducing structural damage to the aeroplane. Notwithstanding that a stopway may have a paved surface, it is not intended that PCR Figures need to be developed for a stopway

Aprons and stands

3.196 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.

3.197 The design of aprons should take into consideration criteria for safe ground handling, including:

1. Sufficient space between aircraft stands to enable personnel and equipment to move safely and efficiently;
2. Adequate apron markings, apron signs and apron floodlighting;

3. Adequate staging and storage areas for ground support equipment (GSE);
4. Positioning of fixed ground services;
5. Storage areas for unit load devices (ULD);
6. Adequate access and egress routes for fuel, GSE and emergency vehicles;
7. Clearly delineated and visible access and egress routes for passengers;
8. New technologies such as electric charging points, hydrogen systems, autonomous vehicles, etc.;
9. Avoidance of rear of aircraft stand service roads wherever practicable; and
10. Appropriate protection for persons, equipment and infrastructure from jet blast and propeller wash.

3.198 An apron may be divided into stands in order to facilitate the safe parking and movement of aircraft and people.

3.199 Separate aprons for long-term parking or maintenance may be necessary to reduce congestion in the main terminal area.

3.200 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, the provision of a separated FATO and TLOF, with a helicopter air taxiway is recommended.

Size of aprons

3.201 The total apron area should be adequate to permit safe and expeditious handling of the aerodrome traffic at its maximum anticipated density with adequate safety margins from obstructions including parked aircraft.

3.202 The design of the apron should aim at facilitating the movement of aircraft and avoiding difficult maneuvers which might require undesirable use of excessive amounts of engine thrust or impose abnormal stress on tyres.

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

3.204 An aircraft stand should provide the following minimum clearances between an aircraft entering or exiting the stand and any adjacent building, aircraft on another stand and other objects:

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

3.205 An aircraft stand shall be visually monitored to ensure that the recommended clearance distances are provided to an aircraft using the stand.

3.206 Note 1: Procedures on the training of operational personnel and on apron safety and operations are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 7.

Note 2: Procedures on apron safety are specified in the PANS-Aerodromes (Doc 9981).

Guidance on an apron management service is given in the Airport Services Manual (Doc 9137), Part 8, and in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

Slopes on Aprons

3.207 Slopes on an apron, including those on an aircraft stand taxilane, should be sufficient to prevent accumulation of water on the surface of the apron but should be kept as level as drainage requirements permit but should not exceed 1% in any direction.

3.208 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.

3.209 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

3.210 Adversely when the movement area has a low surface friction or is contaminated by ice, snow, slush, water, mud, oil, or rubber deposits.

3.211 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.

3.212 Details of the minimum requirement for periodic monitoring of airfield pavements are given in this chapter

3.213 Advice on airfield pavement design and maintenance, and runway surface evenness, is given in this chapter.

3.214 When the surface is affected by winter contaminants, ICAO's Global Reporting Format (GRF) detailed in CAP 2174 Assessment, Measurement and Reporting of Runway Surface Conditions for Licensed Aerodromes should be followed.

3.215 The reporting of runway surface conditions to pilots by an ATS unit must follow the ICAO's Global Reporting Format, see MATS Pt 1, section 2, chapter 7 for further details. Also refer to CAP 2174.

Paved surfaces

3.216 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.

1. 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.

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. The runway should be subject to periodic assessment in order to ensure that the friction level

does not fall below an acceptable level. Notification should be given to relevant aerodromes users when the friction level of a paved runway or portion thereof is less than the minimum friction level. The procedures for runway surface friction assessment along with the friction criteria are given in CAP 683, The Assessment of Runway Surface Friction Characteristics.

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 ion this chapter and friction criteria in CAP 683, the finished surface should;

    a) Be checked for such irregularities.

    b) 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.

3.217 Further information can be found in ICAO annex 14 Volume 1, attachment A.

1. 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.

2. 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.) Brief technical details of various runway surfaces which have been shown to provide the required good wet runway braking action are described in in this chapter together with criteria for ‘feathering’ during runway resurfacing.

Taxiways and Aprons

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

Radio altimeter operating area

3.219 A radio altimeter operating area should be established in the pre-threshold area of a precision approach runway Category II and III, and where practicable in the pre-threshold area of a precision approach runway Category I.

Length of the area

3.220 A radio altimeter operating area should extend before the threshold for a distance of at least 300 m.

Width of the area

1. A radio altimeter operating area should extend laterally, on each side of the extended centre line of the runway, to a distance of 60 m, except that, when special circumstances so warrant, the distance may be reduced to no less than 30 m if a safety assessment indicates that such reduction would not affect the safety of operations of aircraft.

2. In order to accommodate aeroplanes making auto-coupled approaches and automatic landings (irrespective of weather conditions), it is desirable that slope changes be avoided or kept to a minimum, on a rectangular area at least 300 m long before the threshold of a precision approach runway. The area should be symmetrical about the extended centre line, 120 m wide. When special circumstances so warrant, the width may be reduced to no less than 60 m if a safety assessment indicates that such reduction would not affect the safety of operations of aircraft. This is desirable because these aeroplanes are equipped with a radio altimeter for final height and flare guidance, and when the aeroplane is above the terrain immediately prior to the threshold, the radio altimeter should begin to provide information to the automatic pilot for auto-flare. Where slope changes cannot be avoided, the rate of change between two consecutive slopes should not exceed 2 % per 30 m.

3. With a radio altimeter operating area in the pre-threshold area of a precision approach runway the margin to calculate the decision altitude should be smaller and the usability of the adjacent runway may be enhanced.

4. Further guidance on radio altimeter operating area is given in ICAO Doc 9365, Manual of All-Weather Operations, Section 5.2. Guidance on the use of radio altimeter is given in the ICAO, PANS-OPS, Volume II, Part II, Section 1.

5. In order to accommodate aeroplanes making auto-coupled approaches and automatic landings (irrespective of weather conditions), it is desirable that slope changes be avoided or kept to a minimum, on a rectangular

area at least 300 m long before the threshold of a precision approach runway. The area should be symmetrical about the extended centre line, 120 m wide. When special circumstances so warrant, the width may be reduced to no less than 60 m if a safety assessment indicates that such reduction would not affect the safety of operations of aircraft. This is desirable because these aeroplanes are equipped with a radio altimeter for final height and flare guidance, and when the aeroplane is above the terrain immediately prior to the threshold, the radio altimeter should begin to provide information to the automatic pilot for auto-flare. Where slope changes cannot be avoided, the rate of change between two consecutive slopes should not exceed 2 % per 30 m.

6. With a radio altimeter operating area in the pre-threshold area of a precision approach runway the margin to calculate the decision altitude should be smaller and the usability of the adjacent runway may be enhanced. Further guidance on radio altimeter operating area is given in ICAO Doc 9365, Manual of All- Weather Operations, Section 5.2. Guidance on the use of radio altimeter is given in the ICAO, PANS-OPS, Volume II, Part II, Section 1.

Preflight altimeter check location on aprons

3.221 Locating a preflight altimeter check location on an apron enables an altimeter check to be made prior to obtaining a taxi clearance and eliminate the need for stopping for that purpose after leaving the apron. Normally an entire apron can serve as a satisfactory altimeter check location.

Movement area cleanliness

3.222 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.

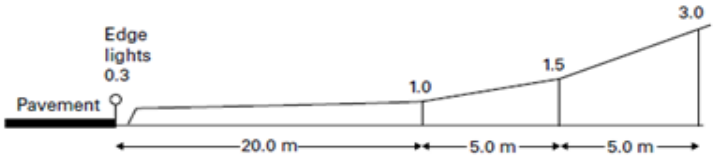
3.223 The surfaces should be kept free from loose stones, chippings, grit, and other debris which might damage an aeroplane, or its engines.

3.224 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

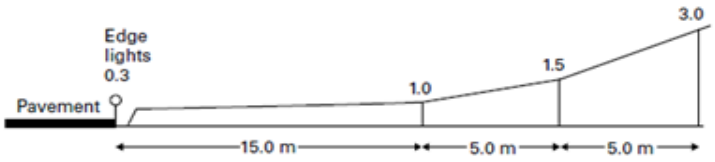
Winter conditions

3.225 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. When snowbanks 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.

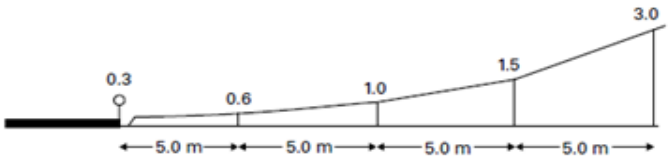
3.226 Aerodromes and airports listed as either a 'regular' or an 'alternate' in the current edition of ICAO Air Navigation Plan – European Region are required to draw up a snow plan in accordance with the National Snow Plan. Other aerodromes can be included in the National Snow Plan on request to the CAA.



(i) Runways used by A380



(ii) Runways used by B747, DC10 and L1011

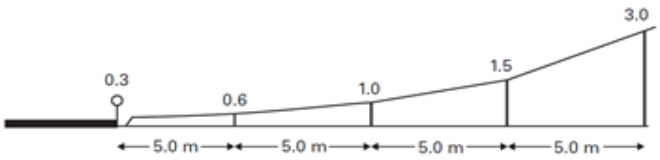


(iii) Runways used by other aeroplanes

Figure 3.8 Acceptable profile of snowbanks showing maximum height in metres

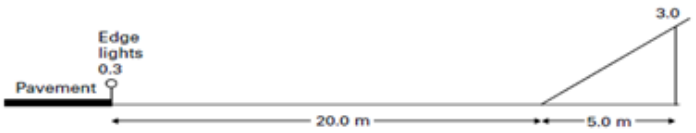


(i) Runways used by B747, A380

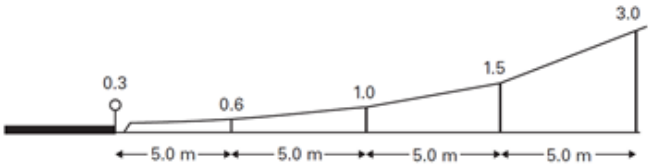


3.227 (ii) Runways used by other aeroplanes

Figure 3.8 Acceptable profile of snowbanks showing maximum height in metres



(i) Runways used by B747, A380



(ii) Runways used by other aeroplanes

Figure 3.9

Unpaved surfaces

Runways

3.228 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 a simple method of assessing the evenness of a natural surface is to drive over it in a suitable vehicle. The surface should not display undue signs (e.g., wheel ruts) of the vehicle's passage and, if the surface is acceptably even, this test should be accomplished without discomfort to the vehicle occupants.

Stopways

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

3.230 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.

Movement area cleanliness

3.231 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, the surface should be kept free from loose stones, chippings, grit, and other debris which might damage an aeroplane or its engines.

Movement area bearing strength

3.232 The ACR /PCR method is not based on a 'critical aircraft' but will consider all aircraft, which are intended to serve on a given pavement with their real

offset from pavement centreline. By doing so, the reported PCR will address, in a more accurate manner, the amount of damage that each aircraft produces within a mix, as a function of their operating weight, full landing gear geometry, individual tyre load and pressure.

3.233 The new system will be no longer based on a 'critical aircraft' but will consider all aircraft, which are intended to serve on a given pavement with their real offset from pavement centreline. By doing so, the reported PCR will address, in a more accurate manner, the amount of damage that each aircraft produces within a mix, as a function of their operating weight, full landing gear geometry, individual tyre load and pressure.

3.234 The new pavement reporting system will provide several benefits to the aerodrome operators: optimised usage of their pavements, consistency between pavement design and aircraft admissibility parameters, better pavement management (inspections and maintenance), and improved predictability of pavement life. It will also benefit aircraft operators by allowing optimised operating weights and frequencies.

3.235 By adopting the layered elastic analysis (LEA) within the pavement rating system, the subgrade strength categories have to be designated with the modulus of elasticity (E modulus).

3.236 The CBR for flexible pavement and the k-value (modulus of subgrade reaction) for rigid pavement are no longer applicable. However, the four subgrade strength categories will still be designated with the same letters.

3.237 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.

3.238 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 Reference – Pavement Classification Reference (ACR/PCR) method the bearing strength of a pavement shall be determined.

Operational requirements

3.239 The bearing strength of all pavements forming part of the movement area shall be determined and should be of adequate bearing strength for the types of aircraft expected to use the aerodrome.

3.240 All pavements should be regularly examined by a suitably qualified person.

3.241 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. Cumulative Damage Factor (CDF)

$$\text{CDF} = \frac{\text{Applied coverages}}{\text{Coverage to failure}}$$

1. the (subgrade) cumulative damage factor (CDF) is the amount of the structural fatigue life of the pavement which has been used up. It is expressed as the ratio applied load repetitions to allowable load repetitions to failure, or, for one aeroplane and constant departures;
2. where a coverage is one application of the maximum strain or stress due to load on a given point in the pavement structure

CDF Values

3.242 When CDF = 1 the pavement subgrade will have used a lot of its fatigue life.

3.243 When CDF <1 the pavement subgrade will have some remaining life, and the value of the CDF will give the fraction of the life used.

3.244 When CDF >1 all of the fatigue life will have been used and the pavement subgrade will have failed.

3.245 To calculate multiple aircraft (Miner's rule);

CDF = CDF1 + CDF2 + …. CDFN (where CDF1 is the CDF of each aeroplane in the traffic mix and N is the number of the aeroplane in the mix. CDF depends on

3.246 Type of aircraft and their number of annual departures, pavement characteristics.

3.247 The contribution of each individual aircraft to the max CDF is identified as the critical offset.

3.248 According to the studied manoeuvring area, pavement mechanical characteristics can be adjusted with regards to the aircraft speed and the standard deviation (lateral wandering).

Reporting pavement bearing strength

3.249 TORAThe ACR/PCR 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.

3.250 The PCR is the maximum ACR in the design aircraft mix for a new pavement. For an existing pavement, a reverse design is used to evaluate

future traffic options. Using these determinations, individual aerodrome authorities decide on the PCR to be published for the pavement concerned.

3.251 Pavement Evaluation is normally a two-part exercise. Firstly, a structural investigation is carried out to determine the pavement and subgrade properties and information gathered in respect of history of aircraft usage and pavement performance. Secondly the determination of the pavement strength and residual life is made by reverse design.

3.252 The CAA recommends the use of the new airfield pavement design and evaluation method as described in DMG 27 and DEAP2024 software which incorporates a fatigue/cumulative damage assessment thus enabling options for combinations of 'critical aircraft' and number of passes to be determined; the 'critical aircraft' being the aircraft with the maximum ACR that can use the pavement without restriction, but within the limits of usage over the life of the pavement as computed in the cumulative damage assessment.

3.253 DMG 27 combines the use of multi-layer elastic analysis with the long-term experience of performance of the various pavement types. The purpose being to facilitate enhanced modelling of the pavements with particular regard to the legacy of complex composite pavements, the trend towards bound recycled bases, the need especially in the case of pavements subject to high frequency trafficking by very heavy aircraft for more accurate analysis of cumulative damage and also to be able to set more than one failure criteria commensurate with maintenance strategies at different airports. Alternatively, other equivalent/national guides may be used for the determination of pavement designs, evaluations, and PCR values.

3.254 The transition from ACN/PCN to ACR/PCR will require the replacement of Airport promulgated PCNs with new PCR values. For existing pavements which have been the subject of a comprehensive design and construction regime, or technical evaluation, with all relevant data/site investigations / material test records currently available, consideration may be given to changing from a PCN value equal to the highest of all the ACN values of the aircraft mix using the pavement, to a PCR that is equal to the highest of all the ACR values in the same aircraft mix.

3.255 Much will depend on the efficacy of the existing pavement designs or technical evaluations, whether there has been any significant change to aircraft usage and future traffic projections since the previous design / technical evaluation was carried out, and that pavement performance to date has been consistent with the design/technical evaluation. It should also be noted that the ranges of the subgrade categories in the new ACR/PCR system are slightly offset from those of the ACN/PCN system, which particularly in respect of Flexible pavements, could result in subgrade

category changes in transitioning from current PCN values to new PCR values.

3.256 A further technical consideration is that the calculation models for Flexible and Rigid pavements used to derive ACR values are different to those used to derive the ACN values. Hence, apart from the factor of 10 introduced in the ACR calculation to clearly distinguish between ACNs and ACRs and hence PCNs and PCRs, the new ACR scales (i.e., Rigid and Flexible) of relative aircraft loading severity results in some changes from that determined by the ACN system. This can in certain circumstances, result in the aircraft with the maximum ACR value using a pavement, being a different aircraft to the one previously determined by the ACN scale. For guidance on the design and evaluation of airfield pavements including the above considerations in transitioning from PCN values to PCR values, refer to DMG 27 or other equivalent national guide.

3.257 The bearing strength of a pavement intended for aircraft of apron mass greater than 5,700 kg shall determine and be made available using the aircraft classification rating-pavement classification rating (ACR-PCR) method by reporting all of the following information:

1. Pavement classification rating (PCR) and numerical value;
2. Pavement type for ACR-PCR determination;
3. Subgrade strength category;
4. Maximum allowable tyre pressure category or maximum allowable tyre pressure value; and
5. Evaluation method.

3.258 The pavement classification rating (PCR) reported shall indicate that an aircraft with an aircraft classification rating (ACR) equal to or less than the reported PCR can operate on the pavement subject to any limitation on the tyre pressure, or aircraft all-up mass for specified aircraft type(s).

1. If the pavement CDF is lower than or equal to 1.0 (well or overdesigned) no weight restriction should occur for the aircraft in the evaluated traffic.
2. If the pavement CDF is higher than 1.0 (under designed) at least one aircraft for the elevated traffic will be weight restricted.

3.259 For the purpose of determining the ACR, the behaviour of a pavement shall be classified as equivalent to a rigid or flexible construction.

3.260 Information on pavement type for ACR-PCR determination, subgrade strength category, maximum allowable tyre pressure category and evaluation method shall be reported using the following codes:

Pavement type for ACR-PCR determination:

Pavement type	Code
Rigid pavement	R
Flexible pavement	F

Note.— If the actual construction is composite or non-standard, include a note to that effect (see example 2 below).

Sub-grade strength category

	Description	Code
High strength	Characterised by E = 200 MPa and representing all E values equal to or above 150 MPa, for rigid and flexible pavements.	A
Medium strength	Characterised by E = 120 MPa and representing a range in E values equal to or above 100 MPa and strictly less than 150 MPa, for rigid and flexible pavements.	B
Low strength	Characterised by E = 80 MPa and representing a range in E values equal to or above 60 MPa and strictly less than 100 MPa, for rigid and flexible pavements.	C
Ultra-low strength	Characterised by E = 50 MPa and representing all E values strictly less than 60 MPa, for rigid and flexible pavements.	D

Maximum allowable tyre pressure category

Pressure	Limitations	Code
Unlimited		W
High	Pressure limited to 1.75 MPa	X
Medium	Pressure limited to 1.25 MPa	Y
Low	Pressure limited to 0.50 MPa	Z

Evaluation method

Technical evaluation	Code
Representing a specific study of the pavement characteristics the types of aircraft which the pavement is intended to serve	**T**
Using aircraft experience representing a knowledge of the specific type and mass of aircraft satisfactorily being supported under regular use	**U**

Note; The following examples illustrate how pavement strength data are reported under the ACR-PCR method. Further guidance on this topic is contained in the Aerodrome Design Manual (Doc 9157), Part 3.

3.261 The following examples illustrate how pavement strength data are reported under the ACR-PCR method. Further guidance on this topic is contained in the Aerodrome Design Manual (Doc 9157), Part 3.

1. Example 1. If the bearing strength of a rigid pavement, resting on a medium-strength subgrade, has been assessed by technical evaluation to be PCR 760 and there is no tyre pressure limitation, then the reported information would be:

   PCR 760 / R / B / W / T

2. Example 2. If the bearing strength of a composite pavement, behaving like a flexible pavement and resting on a high strength subgrade, has been assessed by using aircraft experience to be PCR 550 and the maximum allowable tyre pressure is 1.25 MPa, then the reported information would be:

   PCR 550 / F / A / Y / U

   Note. — Composite construction.

3.262 Criteria should be established to regulate the use of a pavement by an aircraft with an ACR higher than the PCR reported for that pavement.

3.263 The bearing strength of a pavement intended for aircraft of apron (ramp) mass equal to or less than 5700 kg shall be made available by reporting the following information:

a) maximum allowable aircraft mass; and

b) maximum allowable tyre pressure.

Example: 4800 kg/0.60 MPa.

Consequences of PCR inaccuracies

3.264 Underestimated PCR (overestimated CDF) may result in aircraft weight/annual departure restrictions or operations not granted.

3.265 Overestimated PCR (underestimated CDF) may result in more traffic acceptance (weight/volume) than the pavement is able to withstand over its design life and premature damage, increased maintenance, repairs, and costs.

Overload operations

3.266 Overloading pavements can result from;

1. Loads larger than the design or evaluation load
2. A substantially increased application rate

3.267 With the exception of massive overloading, pavements in their structural behaviour are not subject to a particular limiting load above which they fail.

3.268 For those operations in which the magnitude of overload and/or the frequency of use do not justify a detailed analysis, the aerodrome operator should use the following criteria, in order not to adversely affect the pavement:

1. For flexible and rigid pavements, occasional movements by aircraft with ACR not exceeding 10 % above the reported PCR may be allowed; and
2. The annual number of overload movements should not exceed approximately 5 % of the total annual movements excluding light aircraft.
3. Overloads in excess of 10 % should be considered on a case-by-case basis if supported by technical analysis.

3.269 The ACR, when exceeding the reported PCR cannot predict accurately how the overload will affect the pavement damage (hence pavement life) since it is strongly dependent on its offset location of the maximum pavement damage.

3.270 The technical analysis should determine how the overload operations contribute to the maximum pavement damage (maximum CDF) when mixed with other traffic. The inputs required to perform such analysis are the same as the PCR technical evaluation;

1. Pavement structure
2. Aircraft traffic (including overload operations)
3. Damage model (consistent with the PCR calculation and pavement design)

3.271 The aerodrome operator should not permit overload operations on pavements exhibiting signs of distress or failure.

3.272 Overload operations should be avoided during any periods of thaw following frost penetration, or when the strength of the pavement or its subgrade could be weakened by water.

3.273 Where overload operations are conducted, the aerodrome operator should regularly monitor the pavement condition, and should review the criteria for overload operations periodically, repetition of overloads can cause severe shortening of pavement life or require major rehabilitation of pavement.

3.274 Excessive overloads may significantly reduce the pavement structural life.

3.275 The ultimate decision to grant overload operations belongs to the aerodrome operator, depending on the impact of such operations on pavement life and its management policy.

Pavement Evaluation – Methods for Technical Evaluation

3.276 To achieve a comprehensive technical PCR evaluation, aerodrome operators should employ a combination of Dynamic Cone Penetrometer (DCP), Unbound Material Sampling (UMS), Heavy Weight Deflectometer (HWD), and coring surveys to assess and analyse in-service pavements.

Foundation Layer Characterisation

3.277 Unbound Material Sampling (UMS):

Utilised to determine the composition and characteristics of the foundation layers.

3.278 Dynamic Cone Penetrometer (DCP):

Employed to evaluate the stiffness of the foundation layers. When conducted in sufficient quantities, the combined data sets from UMS and DCP can provide a reliable estimation of the in-situ California Bearing Ratio (CBR).

3.279 Pavement Layer Evaluation:

3.280 Heavy Weight Deflectometer (HWD):

HWD is used to determine the E-Modulus of each pavement layer, including the subgrade modulus, and to assess load transfer in rigid pavements. The HWD offers an overall view of pavement condition and, with appropriate calibration during back-analysis, provides reliable layer stiffness measurements.

Additional Technical Evaluations

3.281 Core samples, and Ground Penetrating Radar (GPR): Used to determine layer thicknesses.

3.282 Ground Penetrating Radar (GPR):

Employed to assess interface bonding conditions, such as the presence of water or moisture.

3.283 Laboratory Testing:

Conducted to determine the E-Modulus of material.

PCR 'Using aircraft' evaluation method

3.284 If an aerodrome operator wants to assess the PCR of its runway but due to financial constraints a technical evaluation is not feasible, if may undertake a using aircraft evaluation as an interim measure while plans are made to undertake the technical evaluation. Technical evaluations should be completed and published in the AIP by 30th November 2029.

Example of 'using aircraft' calculation;

Historical CBR = 9

The runway is flexible (**F)**

The subgrade - modulus can be estimated from the historical CBR of 9

E = 10 Mpa therefore CBR 9 = 90MPa subgrade category is **C**

There is no evidence of pavement distress attributable to high tyre pressures therefore the tyre pressure category is **W**.

Aircraft type	Operating weight	Annual Departures	ACR at operating weight
A330-300	233.9 t	104	650 F/C
A350-900	268.9 t	52	720 F/C

B777-300ER	352.4 t	6	790 F/C
B787-900	254.7 t	52	750 F/C

The pavements have been accommodating the following traffic without any significant damage

The number of annual departures for the B777-300ER is very low compared to the other aircraft, therefore it is dismissed form the PCR assignment.

The B787-900 is the heaviest most demanding using aircraft (**U**) therefore the PCR should be reported as **750F/C/W/U**

The 777-300ER would then be accepted based on the ICAO overload allowance (10% of PCR).

Note 1: The most demanding aircraft only are considered; other aircraft can be dismissed as they will not lead to the most critical ACR

Note 2: For such types of traffic, a technical evaluation is preferable.

Pavement condition and behaviour

3.285 There must next be a careful examination of what effect the traffic of using aircraft is having on the pavement. The condition of the pavement in relation to any cracking, distortion or wear, and the experience with needed maintenance are of first importance. Age must be considered since overload effects on a new pavement may not yet be evident, while some accumulated indications of distress may normally be evident in an old pavement. In general, however, a pavement in good condition can be considered to be satisfactorily carrying the using traffic, while indications of advancing distress show the pavement is being overloaded.

3.286 The condition examination should take note of relative pavement behaviour in areas of intense versus low usage, such as in and out of wheel paths or most and least used taxiways, zones subject to maximum braking (e.g., taxiway turn-off, etc.). Note should also be taken of behaviour of any known or observable weak or critical areas such as low points of pavement grade, old stream crossings, pipe crossings where initial compaction was poor, structurally weak sections, etc. These will help to predict the rate of deterioration under existing traffic and thereby indicate the degree of overloading or of underloading. The condition examination should also focus on any damage resulting from tyre pressures of using aircraft and the need for tyre pressure limitations.

Reference aircraft

3.287 Studying of the types and masses of aircraft will indicate those which must be of concern in establishing a reference aircraft, and the condition survey findings will indicate whether the load of the reference aircraft should be less than that being applied or might be somewhat greater. Since load distribution to the subgrade depends somewhat on pavement type and subgrade strength, the particular reference aircraft and its mass cannot be selected until those elements of the ACR-PCR method, which are reported in addition to the PCR, have been established.

Determination of the pavement type, subgrade strength and tyre pressure categories

3.288 The pavement type must be established as rigid or flexible. If the pavement includes a PCC (Portland Cement Concrete) slab as the primary structural element, it should be classified as rigid even though it may have a bituminous overlay resurfacing.

3.289 If the pavement includes no such load-distributing slab, it should be classified as flexible. The subgrade category must be determined as high, medium, low, or ultra-low strength.

3.290 If modulus of elasticity test data is available for the subgrade, these can be used directly to select the subgrade category. Such data, however, must represent in situ subgrade conditions. Similar data from any surrounding structures on the same type of soil and in similar topography can also be used.

3.291 Soil strength data in almost any other form (such as CBR data) can be used to project an equivalent modulus of elasticity E for use in selecting the subgrade category. Information on subgrade soil strength may be obtainable from local road or highway agencies, or local agricultural agencies.

3.292 A direct, though somewhat crude, or approximate, determination of subgrade strength can be made from classification of the subgrade material and reference to any of many published correlations.

Equivalencies between CBR or module of subgrade reaction k and modulus of elasticity E

3.293 For existing pavements initially designed with the California bearing radio (CBR) design procedure, subgrade modulus values can be determined in a number of ways. The procedure that will be applicable in most cases is to use available CBR values and substitute the relationship: E = 1 500 × CBR (E in psi) or 10 x CBR (E in MPa).

3.294 This method provides designs compatible with the earlier flexible design procedure based on subgrade CBR, but other accepted equivalencies can also be used (Shell method, Airport Pavement Design System Knowledge Base (APSDS) method, etc.).

3.295 Subgrade modulus values for PCR determination may also be determined from direct soil testing (e.g., lightweight deflectometer, plate test).

3.296 Similarly, for rigid pavement design, the foundation modulus can be expressed as the modulus of subgrade reaction K or as the elastic (Young's) modulus E. However, all structural computations are performed using the elastic modulus E.

3.297 If the foundation modulus is input as a K value, it can be converted to the equivalent E value using the following equations:

ESG=20.15×k1.284 where ESG = Elastic (Young's) modulus of the subgrade, pounds per square inch (PSI); and K = Modulus of subgrade reaction, pounds per cubic inch (PCI).

3.298 The tyre pressure category must be determined as unlimited, high, medium, or low. PCC surfacing and good to excellent quality bituminous surfacing can sustain the tyre pressures commonly encountered and should be classified as unlimited pressure category with no limit on pressure.

3.299 Bituminous surfacing of inferior quality and aggregate or earth surfacing will require the limitation of lower categories.

3.300 The applicable pressure category of the aircraft using the pavement without producing observable distress should be the basis for determining the tyre pressure category.

Aerodromes without CBR or K data

3.301 If CBR of K data is not available aerodrome operators should undertake pressure plate testing as close to the pavement edge as possible in order to determine a CBR or K value which can be converted to calculate the E value of the adjacent runway giving the runway theoretical strength.

3.302 The number of test areas should be sufficient in order to provide CBR data for the entire length and width of the surface being surveyed which should consider any differing pavement construction areas.

Maximum age of historical CBR or K data

3.303 Historical data used for technical evaluation should not be older than 5 years, however, if data greater than 5 years has significant assurance attached to it then the CAA may consider the use of the data.

3.304 If data is older than 5 years aerodrome operators may use the using aircraft evaluation method or undertake a new technical survey consisting of a combination of HWD, core samples with dynamic cone penetrometer and GPR.

Determining the critical offset

3.305 Using the aircraft mix operating at the aerodrome the wheel track of the aircraft types should be calculated in order to ascertain the distance from the centreline of the wheel track which may cause the most damage, this will be the critical offset.

3.306 The most used aircraft should be the reference aircraft given the number of passes of the particular aircraft is likely to have the most detrimental impact to the pavement. This distance dependant on the aircraft type is likely to be approximately 1 - 3 m.

Pavements for light aircraft

3.307 In evaluating pavements meant for light aircraft (5 700 kg mass and less) it is unnecessary to consider the geometry of the undercarriage of aircraft or how the aircraft load is distributed among the wheels. Therefore, the subgrade class and pavement type need not be reported, and only the maximum allowable aircraft mass and maximum allowable tyre pressure need to be determined and reported. For these, the guidance on techniques for “using aircraft” evaluation should be followed.

3.308 Because the 5 700kg limit for light aircraft represents pavement loads only two-thirds or less of common highway loads, the assessment of traffic using pavements should extend to consideration of heavy ground vehicles, relation to load limited pavements.

Unpaved surfaces

3.309 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.

3.310 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.

3.311 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.

Published details

3.312 Details of individual aerodrome ACR or PCR values are published in the AD 2 section of the UK AIP. See AD 2.12 - Runway Physical Characteristics, Column 4.

The use of block pavers on aerodrome movement areas

3.313 It is recommended that pavers should normally only be used to surface the following categories of aircraft pavements:

1. Aircraft stands;
2. Low speed taxiways not subject to significant jet blast or propeller wash.
3. Aircraft maintenance areas not subject to significant jet blast or propeller wash;
4. Helicopter pads.

3.314 Block pavers should not be used to surface the following categories of aircraft pavements:

1. Runways;
2. Areas where aircraft engines are run at high thrust values;
3. High speed taxiways.

3.315 Should aerodrome management wish to depart from these recommendations, they should first discuss this with their aerodrome inspector

Threshold displacement

3.316 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 the threshold will normally be located at the start of the runway.

3.317 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.

3.318 The amount by which the threshold is displaced will vary with the individual circumstances of each situation, regard being given to the nature, type, and level of traffic; Whether the runway is an instrument runway or a non-instrument runway, and if it is an instrument runway whether it is a precision instrument approach runway or non-precision instrument approach runway;

3.319 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;

3.320 When it necessary to displace a threshold temporarily, from its normal location, account should be taken of the various factors which may have a bearing on the location of the threshold. Where this displacement is due to the unserviceable runway condition, a cleared and graded area of least 60 m in length should be available between the unserviceable area and the displaced threshold. Additional distance should also be provided to meet the requirements of the runway and the runway and safety area as appropriate.

3.321 The amount by which the obstacle penetrates the approach surface, and its significance in the calculation of the obstacle clearance height;

3.322 The angle of the glidepath or nominal glidepath for an instrument approach procedure and the calculated obstacle clearance height;

3.323 The limiting visibility and cloud base conditions under which the runway will be used

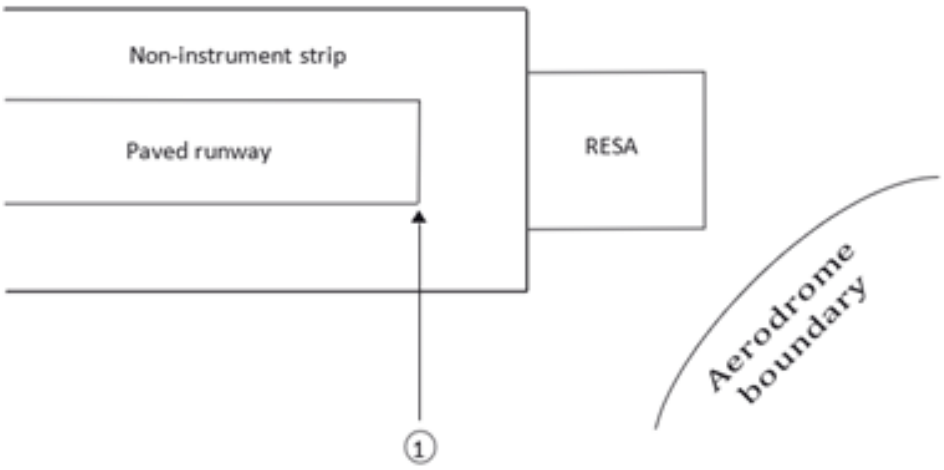


Figure 3.11

1 would be the end of TORA and ASDA (no stopway), and the end of LDA for a non-instrument 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.

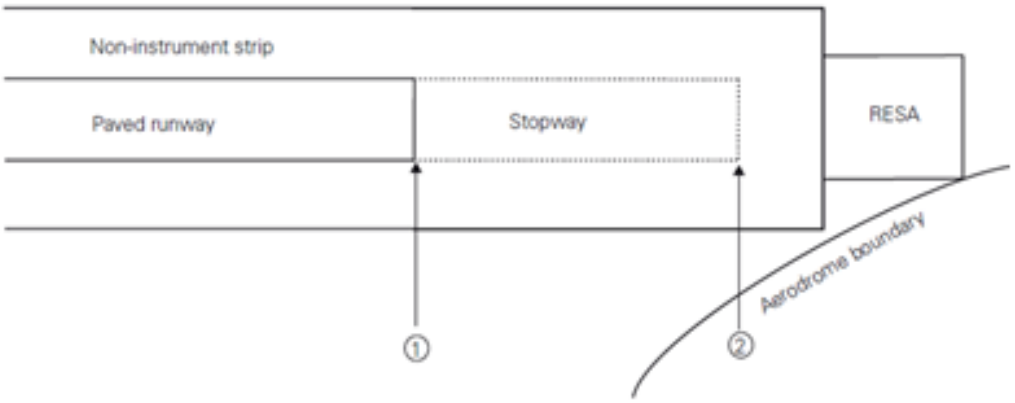


Figure 3.12

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 non-instrument 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.

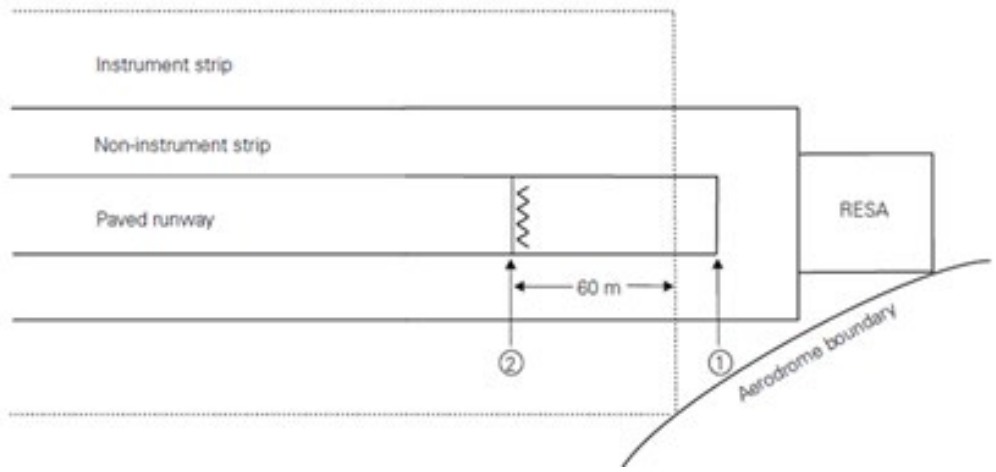


Figure 3.13

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 non-instrument 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.

Declared distances from runway intersections

3.324 Aerodromes make use of intersection take-offs to maintain runway capacity and efficiency. declared distances from a runway intersection shall be calculated from the downwind edge of the taxiway.

3.325 When defining the downwind edge, note should be taken of possible redundant paved areas at the side of a taxiway.

3.326 The edge of the taxiway should be used as the start of the projection to the runway for the origin, excluding the redundant area.

3.327 The origin of full-length declared distances is, in most cases, the end of concrete; therefore, following aircraft line-up, the origin is behind the aircraft.

3.328 An allowance for the length of the aircraft is taken into account when calculating the remaining distance.

Note: ICAO publishes the following in annex 6 Part I, chapter 5, 'In determining the length of the runway available, account shall be taken of the loss, if any, of runway length due to alignment of the aeroplane prior to take-off.'

3.329 Aircraft performance manuals make the same calculation for line-up allowance irrespective of where that line-up occurs along the runway. Therefore, flight crews would expect to calculate a similar correction distance at an intersection departure as for a full-length departure, regardless of where the origin is located.

3.330 The use of the downwind origin as the basis for calculating declared distances from a runway intersection provides consistency with the full-length calculation.

3.331 Figures 3.14–3.16 illustrate how to determine the origin of intersection departures. Aerodrome licence holders should use this method to determine the origin of the TORA, in order to measure the distances for intersection departures accurately.

3.332 Aerodrome operators should liaise with their Aerodrome Inspector in order to notify intersection take-off distances in the AGA section of the UK Aeronautical Information Publication (AIP).

3.333 A NOTAM should be issued to cover the period up to publication of the revised AIP entry.

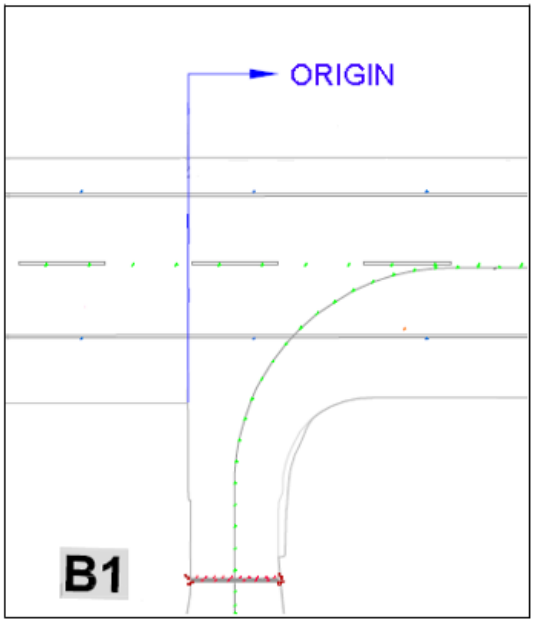


Figure 3.14 Perpendicular runway entrance

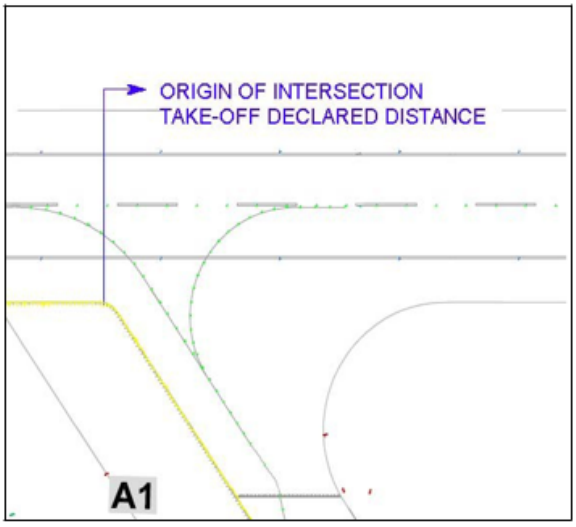


Figure 3.15 Redundant concrete at edge of entrance

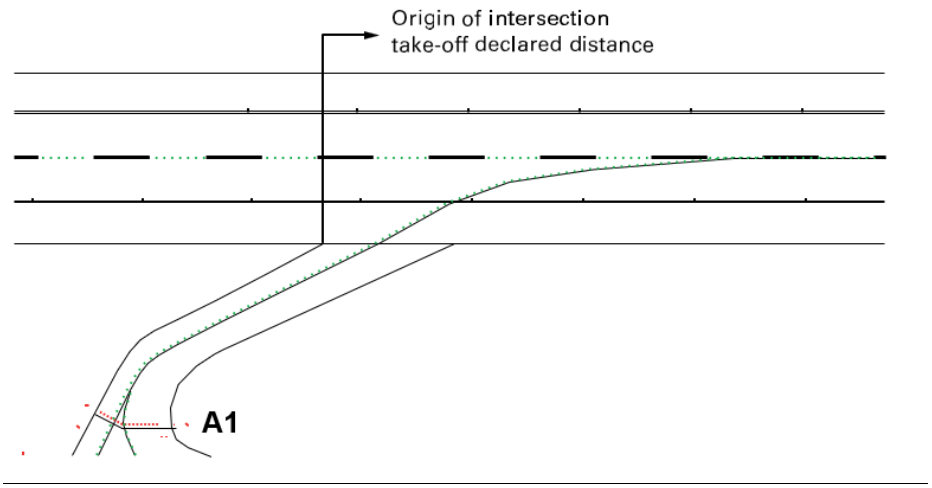


Figure 3.16 Rapid-access taxiway

Runway surfaces – technical details

Introduction

3.334 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:

1. Provide a surface friction level at or above the design objective level defined in CAP 683, The Assessment of Runway Surface Friction Characteristics;
2. Provide an average texture depth of not less than 1 mm;
3. Provide a hard durable surface that will not generate loose materials or contaminants;
4. Provide good rideability;
5. Provide good surface water drainage;
6. Avoid excessive tyre wear;
7. Avoid damage to the surface by aircraft manoeuvring;
8. Provide a stable surface that will not be damaged or removed by jet engine exhaust efflux;
9. Provide a suitable PCR for aircraft operations;
10. Provide an acceptable design life;
11. Meet the geometric criteria defined in chapter 3.

Further information can be found in ICAO Doc 9157 Aerodrome Design manual Part 3 Pavements and Doc 9137 Aerodrome Services manual Part 2 Pavement Surface Conditions or FAA Advisory Circular 150/5320-12C Change 8 Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces.

Surfacing materials

3.335 Brief details are given below of runway surfaces and treatments which have normally been found to provide good friction performance.

Porous friction course

3.336 Porous friction course is open-graded asphalt 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.

3.337 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.

3.338 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.

Pavement Quality Concrete (PQC)

3.339 Coarse directional texturing by wire broom or comb

3.340 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.

3.341 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.

Grooving of PQC

3.342 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.

Asphalt

3.343 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 microtexture of the aggregate. For a number of years hot rolled marshall asphalt has been employed to surface runways in the UK where a flexible pavement is required.

3.344 A design requirement for a new runway surface may include new materials that provide the necessary friction characteristics and offer at least 1 mm macro texture depth without the need for grooving. Such materials as stone mastic asphalt (SMA), béton bitumineux aéronautique (BBA) and béton bitumineux à module elevé (BBME) are all examples of this type of material.

Note; Aerodrome operators should satisfy themselves that the performance of any such materials can be demonstrated to meet the requirements set out in the introduction of Runway surfaces – technical details

Course textured slurry seal

3.345 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 any surface to which it is applied.

Grooving of asphalt

3.346 The primary purpose of grooving a runway surface is to enhance surface drainage. Natural drainage can be slowed down by surface texture, but grooving can speed up the drainage by providing a shorter drainage path and increasing the drainage rate. For further information see Drainage characteristics of the movement area and adjacent areas.

3.347 Grooving effectively adds macrotexture and there is a mathematical relationship between the width/depth of each groove plus the spacing at which they are cut and the amount of texture this adds. The asphalt surface course is grooved transversely by a machine incorporating diamond saw blades

3.348 It is the responsibility of the aerodrome operator to ensure that, should grooving be required, it is specified so that the additional benefit when added to the measured asphalt macrotexture exceeds the recommended minimum and takes local climatic characteristics into account.

Runway pavement overlays - runway ramping

3.349 The aerodrome operator should ensure that when a runway is to be returned temporarily to an operational status before resurfacing is complete and before operations recommence, the surface should be inspected to ensure that temporary ramps have been constructed as follows;

3.350 The longitudinal slope of the temporary ramp, measured with reference to the existing runway surface or previous overlay course, should be:

1. 0.5 to 1.0 % for overlays up to and including 5 cm in thickness; and
2. Not more than 0.5 % for overlays more than 5 cm in thickness.

3.351 Before a runway being overlaid is returned to a temporary operational status, a runway centre line marking conforming to the applicable specifications should be provided.

3.352 The location of any temporary threshold should be identified by a 3.6 m wide transverse stripe.

Drainage characteristics of the movement area and adjacent areas

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

3.354 Rapid drainage of surface water is a primary safety consideration in the design, construction and maintenance of movement area and adjacent areas.

3.355 There are two distinct drainage processes:

1. Natural drainage of the surface water from the top of the pavement surface until it reaches the final recipient such as rivers or other water bodies; and
2. Dynamic drainage of the surface water trapped under a moving tyre until it reaches outside the tyre-to-ground contact area.

3.356 Both drainage processes can be controlled through design, construction, and maintenance of the pavements in order to prevent accumulation of water on the pavement surface.

3.357 Surface drainage is a basic requirement and serves to minimise water depth on the surface. Adequate surface drainage is provided primarily by an appropriately sloped surface (in both the longitudinal and transverse directions). The resulting combined longitudinal and transverse slope is the

path for the drainage runoff. This path can be shortened by adding transverse grooves.

3.358 Dynamic drainage is achieved through built-in texture in the pavement surface. The rolling tyre builds up water pressure and squeezes the water out the escape channels provided by the texture. The dynamic drainage of the tyre-to-ground contact area may be improved by adding transverse grooves provided that they are subject to rigorous maintenance.

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

1. Slopes;
2. Texture:
    a) Microtexture;
    b) Macrotexture.

3.360 Slopes for the various parts of the movement area and adjacent parts are described in Chapters B to G and figures are given as per cent. Further guidance is given in ICAO Doc 9157, Aerodrome Design Manual, Part 1, Runways, Chapter 5.

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

3.362 Microtexture is the texture of the individual stones and is hardly detectable by the eye. Microtexture is considered a primary component in skid resistance at slow speeds. On a wet surface at higher speeds a water film may prevent direct contact between the surface asperities and the tyre due to insufficient drainage from the tyre-to-ground contact area. Microtexture is a built-in quality of the pavement surface. By specifying crushed material that will withstand polishing microtexture, drainage of thin water films are ensured for a longer period of time. Resistance against polishing is expressed in terms of the polished stone values (PSV) which is in principle a value obtained from a friction measurement in accordance with international standards. These standards define the PSV minima that will enable a material with a good microtexture to be selected. A major problem with microtexture is that it can change within short time periods without being easily detected. A typical example of this is the accumulation of rubber deposits in the touchdown area which will largely mask microtexture without necessarily reducing macrotexture.

3.363 Macrotexture is the texture among the individual stones. This scale of texture may be judged approximately by the eye. Macrotexture is primarily created by the size of aggregate used or by surface treatment of the pavement and is

the major factor influencing drainage capacity at high speeds. Materials should be selected so as to achieve good macrotexture.

3.364 For measurement of macrotexture, simple methods such as the ‘sand and grease patch’ methods described in ICAO Doc 9137, Airport Services Manual, Part 2, Pavement Surface Conditions were developed. These methods were used for the early research on which current airworthiness requirements are based and which refer to a classification categorising macrotexture from A to E. This classification was developed, using sand or grease patch measuring techniques, and issued in 1971 by the Engineering Sciences Data Unit (ESDU).

Runway classification based on texture information from ESDU 71026	
Classification (mm)	**Texture depths (mm)**
A	0.10 – 0.14
B	0.15 – 0.24
C	0.25 – 0.50
D	0.51 – 1.00
E	1.01 – 2.54

3.365 Using this classification, the threshold value between microtexture and macrotexture is 0.1 mm mean texture depth (MTD). Related to this scale, the normal wet runway aircraft performance is based upon texture giving drainage and friction qualities midway between classification B and C (0.25 mm). Improved drainage through better texture might qualify for a better aircraft performance class. However, such credit must be in accordance with aeroplane manufacturers’ documentation. Presently credit is given to grooved or porous friction course runways following design, construction, and maintenance criteria. The standards refer to texture giving drainage and friction qualities midway between classification D and E (1.0 mm).

3.366 For construction, design and maintenance, various international standards are used. Currently ISO 13473-1: ‘Characterization of pavement texture by use of surface profiles Part 1: Determination of Mean Profile Depth’ links the volumetric measuring technique with non- contact profile measuring techniques giving comparable texture values. These standards describe the threshold value between microtexture and macrotexture as 0.5 mm. The volumetric method has a validity range from 0.25 to 5 mm MTD. The profilometry method has a validity range from 0 to 5 mm mean profile depth (MPD). The values of MPD and MTD differ due to the finite size of the glass spheres used in the volumetric technique and because the MPD is derived from a two-dimensional profile rather than a three-dimensional surface.

Therefore, a transformation equation must be established for the measuring equipment used to relate MPD to MTD.

3.367 The ESDU scale groups runway surfaces based on macrotexture from A through E, where E represents the surface with best dynamic drainage capacity. The ESDU scale thus reflects the dynamic drainage characteristics of the pavement. Grooving any of these surfaces enhances the dynamic drainage capacity. The resulting drainage capacity of the surface is thus a function of the texture (A through E) and grooving. The contribution from grooving is a function of the size of the grooves and the spacing between the grooves.

3.368 Aerodromes exposed to heavy or torrential rainfall must ensure that the pavement and adjacent areas have drainage capability to withstand these rainfalls or put limitations on the use of the pavements under such extreme situations. These airports should seek to have the maximum allowable slopes and the use of aggregates providing good drainage characteristics. They should also consider grooved pavements in the E classification to ensure that safety is not impaired.

Temporary obstacles within runway strips

3.369 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 ATC 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.

3.370 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.

3.371 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.

3.372 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.

3.373 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.

3.374 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 m2 or exceptionally for narrow trenches a surface area of 30 m2. There should be no earth banks or equipment above the original ground level of the area

The use of runway, stopway and clearway – performance aspects

3.375 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 overriding.

3.376 Rules on the amount of stopway or clearway which may be used vary according to the aircraft performance classification

3.377 The weight and performance requirements of the Air Navigation (General) Regulations 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.

3.378 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 ASDA or continue a take-off with equal safety. If an engine fails below this speed the take- off must be abandoned, while above it the take-off must be continued.

3.379 The decision speed is not a fixed speed 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 TODA is long and the ASDA is short, a low decision speed may be chosen. As ASDA increases or take-off distance decreases, so the decision speed may be increased. A variety of combinations of ASDA 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.

3.380 The most familiar case is where the TODA is equal to the ASDA: 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 ASDA 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.

3.381 A decision speed other than that associated with the balanced field length conditions is selected when ASDA 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 ASDA 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. 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 ASDA will equal the runway length, while clearway will constitute the remainder of the take-off distance available.

3.382 If field length requirements at a particular aerodrome are critical for an aeroplane in Class ‘A,’ the minimum runway, stopway and/or clearway lengths which can be used may be determined from flight manual performance data, as follows;

1. If stopway is economically possible, the ASDA 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.

2. If the take-off distance/ASDA 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);

3. If stopway is not to be provided, the runway length required will be the greater of the landing distance required and the ASDA required corresponding to the lowest usable value of the decision speed. The lowest practical value is the speed at which the ASDA 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.

3.383 The paragraphs above provide guidance on how the proportions of runway, stopway and clearway may be determined to meet the needs of flight performance. Further information on aircraft flight performance can be obtained from ICAO Annex 6 ‘operation of aircraft’.

3.384 The decision to provide stopway and clearway rests with the aerodrome licence holder; proposals should be developed as part of the aerodrome SMS, in co-operation with relevant airline partners.

Runway surface condition assessment and reporting for licensed aerodromes

3.385 The global reporting system for assessing and reporting runway surface conditions (commonly known as the Global Reporting Format (GRF)) involves all stakeholders involved in collecting data, converting the data into structured operational information, and bringing the structured information to the end users, and the end users using the structured information.

3.386 A fundamental change in the new reporting system is the introduction of a runway condition code (RWYCC).

3.387 The assessment process of assigning a RWYCC is a deterministic process, starting with the identification of the various contaminants, that determines what initial RWYCC must be reported. Based on all other information available, this initial RWYCC can be downgraded or upgraded using procedures detailed paragraph 3.456.

3.388 The revised scale GOOD, GOOD TO MEDIUM, MEDIUM, MEDIUM TO POOR, POOR and LESS THAN POOR is used by the flight crew to characterize perceived braking action and lateral control of the aeroplane during landing roll. RWYCCs 0 through 5 are mapped to this terminology in the runway condition assessment matrix (RCAM) and describe a consistent runway surface condition in relation to its effect on aircraft braking performance and lateral control.

3.389 Another fundamental change is that WET runway conditions are included in the runway condition report (RCR) on a regular basis. The concept of the RCR is premised on:

1. An agreed set of criteria used in a consistent manner for runway surface condition assessment, aeroplane (performance) certification and operational performance calculation;
2. A unique runway condition code (RWYCC) linking the agreed set of criteria with the aircraft landing and take-off performance table, and related to the braking action experienced and eventually reported by flight crews;
3. Reporting of contaminant type and depth that is relevant to take-off performance;
4. A standardized common terminology and phraseology for the description of runway surface conditions that can be used by aerodrome operator inspection personnel, air traffic controllers, aircraft operators and flight crew; and
5. Globally harmonized procedures for the establishment of the RWYCC with a built-in flexibility to allow for local variations to match the specific weather, infrastructure, and other particular conditions.

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

3.391 It is recognized that information provided by the aerodrome's personnel assessing and reporting runway surface condition is crucial to the effectiveness of the runway condition report. However, a misreported runway condition alone should not lead to an accident or incident.

3.392 Operational margins should cover for a reasonable error in the assessment, including unreported changes in the runway condition. But a misreported runway condition can mean that the margins are no longer available to cover for other operational variance (such as unexpected tailwind, high and fast approach above threshold or long flare). This is further amplified by the need for providing the assessed information in the proper format for dissemination, which requires insight into the limitations set by the syntax for dissemination. This in turn restricts the wording of plain text remarks that can be provided.

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

Reporting of surface contaminants

3.394 The aerodrome operator shall report to the aeronautical information services and air traffic services units on matters of operational significance affecting aircraft and aerodrome operations on the movement area, particularly in respect of the presence of the following:

1. Water;
2. Snow;
3. Slush;
4. Ice;
5. Frost;
6. Anti-icing or de-icing liquid chemicals or other contaminants; and
7. Snowbanks or drifts.

3.395 The aerodrome operator shall report the runway surface condition over each third of the runway using a runway condition report (RCR). The report shall include a runway condition code (RWYCC) using numbers 0 to 6, the contaminant coverage and depth, and a description to be reported in capital letters using the following terms:

1. COMPACTED SNOW; (snow that has been compacted into a solid mass such that aeroplane tyres, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface)
2. DRY;
3. DRY SNOW; (snow from which a snowball cannot readily be made)
4. DRY SNOW ON TOP OF COMPACTED SNOW;
5. DRY SNOW ON TOP OF ICE;
6. FROST; (ice crystals formed from airborne moisture on a surface whose temperature is at or below freezing; frost differs from ice in that frost crystals grow independently and therefore, have a more granular texture)
7. ICE; (water that has frozen or compacted snow that has transitioned into ice in cold and dry conditions)
8. SLUSH; (snow that is so water-saturated that water will drain from it when a handful is picked up or will splatter if stepped on forcefully)
9. STANDING WATER; (water of depth greater than 3 mm)

10. WATER ON TOP OF COMPACTED SNOW;
11. WET;
12. WET ICE; (ice with water on top of it or ice that is melting)
13. WET SNOW; (snow that contains enough water to be able to make a well-compacted, solid snowball, but water will not squeeze out)
14. WET SNOW ON TOP OF COMPACTED SNOW;
15. WET SNOW ON TOP OF ICE;

3.396 Reporting shall commence when a significant change in runway surface condition occurs due to water, snow, slush, ice, or frost.

3.397 Reporting of the runway surface condition shall continue to reflect significant changes until the runway is no longer contaminated. When this situation occurs, the aerodrome operator shall issue an RCR that states that the runway is wet or dry as appropriate.

3.398 Significant changes in the runway surface condition used in the runway condition report are described in this chapter, see significant changes.

3.399 Friction measurements shall not be reported.

3.400 When a paved runway or portion thereof is slippery wet, the aerodrome operator shall make such information available to the relevant aerodrome users. This shall be done by issuing a NOTAM and shall describe the location of the affected portion.

Runway condition report (RCR)

3.401 Assessing and reporting the condition of the movement area and related facilities is necessary in order to provide the flight crew with the information needed for safe operation of the aeroplane. The RCR is used for reporting assessed conditions through the issuance of SNOWTAM, when necessary.

3.402 Generally, movement areas are exposed to a multitude of climatic conditions and consequently there is a significant difference in the conditions to be reported. The RCR describes a basic structure applicable for all these climatic variations. Assessing the runway surface condition relies on a great variety of techniques and no single solution can apply to every situation.

3.403 The RCR should consist of the:

1. Aeroplane performance calculation section; and
2. **S**ituational awareness section.

The information should be included in an information string in the following order:

3.404 Aeroplane performance calculation section:

1. Aerodrome location indicator;
2. Date and time of assessment;
3. Lower runway designation number;
4. RWYCC for each runway third;
5. Per cent coverage contaminant for each runway third;
6. Depth of loose contaminant for each runway third;
7. Condition description for each runway third; and
8. Width of runway to which the RWYCCs apply if less than the published width.

3.405 Situational awareness section:

1. Reduced runway length;
2. Drifting snow on the runway;
3. Loose sand on the runway;
4. Chemical treatment on the runway;
5. Snowbanks on the runway;
6. Snowbanks on the taxiway;
7. Snowbanks adjacent to the runway;
8. Taxiway conditions;
9. Apron conditions; and
10. Plain-language remarks.

3.406 The philosophy of the RCR is that the aerodrome operator assesses the runway surface condition whenever water, snow, slush, ice, or frost are present on an operational runway. From this assessment, a RWYCC and a description of the runway surface are reported, which can be used by the flight crew for aeroplane performance calculations.

3.407 This format, based on the type, depth, and coverage of contaminants, is the best assessment of the runway surface condition by the aerodrome operator; however, all other pertinent information is taken into consideration and kept up to date, and changes in conditions are reported without delay.

3.408 The RWYCC reflects the runway braking capability as a function of the surface conditions. With this information, the flight crew can derive from the performance information provided by the aeroplane manufacturer, the necessary stopping distance of an aircraft on the approach under the prevailing conditions.

Aeroplane performance calculation section

3.409 The aeroplane performance calculation section is a string of grouped information, separated by a space ‘ ’ ending with a return and a two-line feed ‘<<≡,’ in order to distinguish the aeroplane performance calculation section from the following situational awareness section or the following aeroplane performance calculation section of another runway.

3.410 The information to be included in this section consists of the following:

1. Aerodrome location indicator: a four-letter ICAO location indicator in accordance with ICAO Doc 7910, Location Indicators.

   This information is mandatory.

   Format: nnnn

   Example ENZH

2. Date and time of the assessment: date and time (UTC) when the assessment was performed.

   This information is mandatory.

   Format: MMDDhhmm

   Example 09121335

3. Lower runway designation number: a two- or three-character number identifying the runway for which the assessment is carried out and reported.

   This information is mandatory.

   Format: nn[L] or nn[C] or nn[R]

   Example 09L

3.411 Runway condition code for each runway third: a one-digit number identifying the RWYCC assessed for each runway third. The codes are reported in a three-character group separated by a ‘/’ for each third. The direction for listing the runway thirds is the direction as seen from the lower designation number.

3.412 This information is mandatory.

3.413 When transmitting information on the runway surface condition by air traffic services to flight crews, the sections are, however, referred to as the first, second or third part of the runway. The first part always means the first third of the runway as seen in the direction of landing or take-off as illustrated in Figures 1 and 2.

The order ATC transmitted is differently, it is reported as; Runway in us, Type, Depth, Coverage

Format: n/n/n

Example: 5/5/2

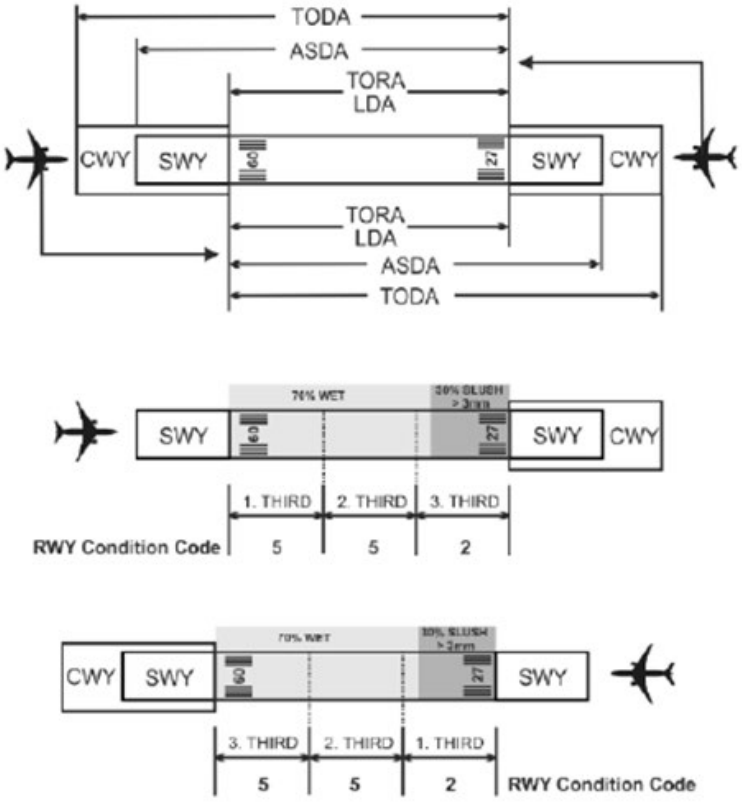


Figure 1 - Reporting of RWYCC (from air traffic services to flight crew for runway thirds

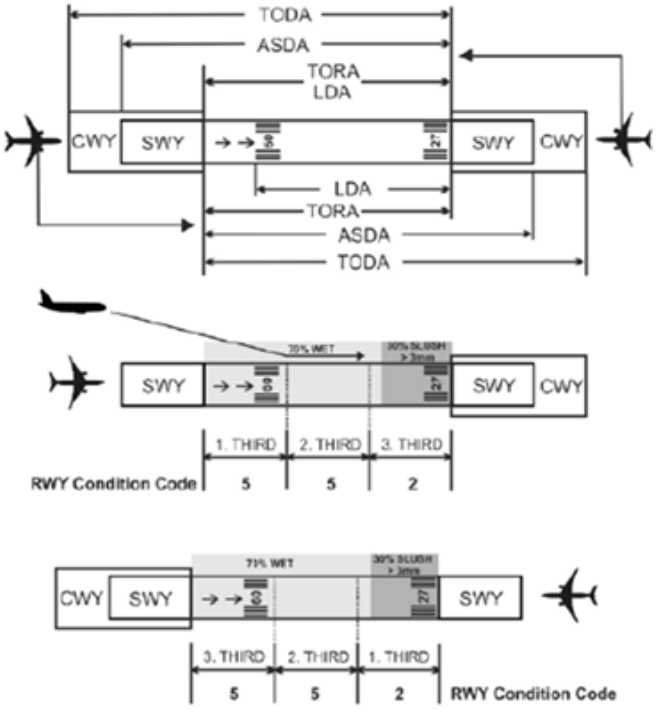


Figure 2 - Reporting of RWYCC (for runway thirds from air traffic services to flight crew on a runway with displaced threshold)

3.414 Per cent coverage contaminant for each runway third: a number identifying the percentage coverage. The percentages are to be reported in an up-to-nine-character group separated by a '/' for each runway third. The assessment is based upon an even distribution within the runway thirds using Table 1.

3.415 This information is conditional. (It is not reported for any runway third that is dry or covered with less than 10 per cent).

Format: [n]nn/[n]nn/[n]nn

Example: 25/50/100

NR/50/100 if contaminant coverage is less than 10% in the first third

25/NR/100 if contaminant coverage is less than 10% in the middle third

25/50/NR if contaminant coverage is less than 10% in the last third

3.416 In case of uneven distribution of the contaminants, additional information is given in the plain-language remark part of the situational awareness section of the RCR. Where possible, a standardised text is used.

3.417 When no information is to be reported, 'NR' is inserted at the relevant position of the message to indicate to the user that no information exists.

3.418 Depth of loose contaminant: dry snow, wet snow, slush or standing water for each runway third: a two - or three-digit number representing the assessed depth (mm) of the contaminant for each runway third. The depth is reported in a six-to-nine-character group separated by a “/” for each runway third as defined in Table 2. The assessment is based upon an even distribution within the runway thirds as assessed by trained personnel. If measurements are included as part of the assessment process, the reported values are still reported as assessed depths, as the trained personnel have placed their judgment upon the measured depths to be representative for the runway third.

3.419 This information is conditional. It is reported only for DRY SNOW, WET SNOW, SLUSH and STANDING WATER.

Format: [n]nn/[n]nn/[n]nn

Examples

04/06/12 [STANDING WATER]

03/04/09 [SLUSH]

03/05/10 [WET SNOW or WET SNOW ON TOP OF ...]

02/20/100 [DRY SNOW or DRY SNOW ON TOP OF]

NR/NR/100 [DRY SNOW in the last third only]

This information is conditional. It is reported only for DRY SNOW, WET SNOW, SLUSH and STANDING WATER.

Whenever a contaminant not in this list is reported for a given third, the depth value for that third is replaced by “NR” (not reported).

Note.- When the assessed depth is below the minimum reportable depth shown in Table 2, the reported depth should be equal to the minimum valid value, e.g. 03 for an assessed depth of 2 mm of SLUSH.

3.420 Condition description for each runway third: to be reported in capital letters using the terms specified in Para 3.276. The condition types are separated by an oblique stroke ‘/.’

This information is mandatory.

Format: nnnn/nnnn/nnnn

3.421 Width of runway to which the RWYCCs apply if less than the published width: two-digit number representing the width of cleared runway in metres.

This information is mandatory.

Format: nn

Example 30

3.422 If the cleared runway width is not symmetrical along the centre line, additional information is given in the plain-language remark part of the situational awareness section of the RCR.

Situational awareness section

3.423 All individual messages in the situational awareness section end with a full-stop sign, in order to distinguish the message from subsequent message(s).

3.424 The information to be included in this section consists of the following:

1. Reduced runway length:

   The information is conditional when a NOTAM has been published with a new set of declared distances affecting the landing distance available (LDA).

   Format: Standardised fixed text ;

   RWY nn [L] or nn [C] or; nn [R] LDA REDUCED TO [n]nnn

   Example: RWY 22L LDA REDUCED TO 1450.

2. Drifting snow on the runway:

   This information is conditional.

   Format: Standardised fixed text – RWY nn [L] or nn [C] or nn[R] DRIFTING SNOW

3. Loose sand on the runway

   This information is conditional.

   Format: RWY nn[L] or nn[C] or nn[R] LOOSE SAND

4. Chemical treatment on the runway

   This information is conditional.

   Format: RWY nn[L] or nn[C] or nn[R] CHEMICALLY TREATED

5. Snowbanks on the runway

   This information is conditional.

   Left or right distance in metres from centre line.

   Format: RWY nn[L] or nn[C] or nn[R] SNOWBANK Lnn or Rnn or LRnn FM CL

Example: RWY 06L SNOWBANK LR19 FM CL.

6. Snowbanks on taxiway

   This information is conditional.

   Format: TWY [nn]n or TWYS [nn]n/[nn]n/[nn]n/… or ALL TWYS SNOWBANKS

   Example: TWY A SNOWBANK LR20 FM CL.

7. Snowbanks adjacent to the runway penetrating level/profile set in the aerodrome snow plan.

   This information is conditional.

   Format: RWY nn[L] or nn[C] or nn[R] ADJ SNOWBANKS

   Example: RWY 06R ADJ SNOWBANKS

8. Taxiway conditions

   This information is optional.

   Format: TWY [nn]n POOR

   Example: TWY B POOR

9. Apron conditions

   This information is conditional.

   Format: APRON [nnnn] POOR

10. Plain-language remarks using only allowable characters in capital letters

    Where possible, standardised text is used. ‘UPGRADED’ or ‘DOWNGRADED’ is used whenever assessed RWYCC differs from what follows directly from RCAM

    This information is optional.

    Format: Combination of allowable characters where use of full stop ‘.’ marks the end of the message.

Allowable Characters

Letters: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Numbers: 1 2 3 4 5 6 7 8 9

Symbols: / (Oblique stroke), . (Period), (Space)

Runway Condition Reporting

If ICE, SNOW or SNOW ON ICE affects only the runway edge, the following text may be used:

RWY nn[L] or nn[C] or nn[R] ICE or SNOW ON ICE L nn or R nn or LR nn FM EDGE

Example of a Complete Information String

Com header and abbreviated header (completed by AIS):

GG EADBZZQZX EADNZQZX EADSZZQZX

070645 EADDYNYX

SWEA0151 EADD 02170055

SNOWTAM 0151

Aeroplane Performance Calculation Section

EADD 02170055 09L 5/5/5 100/100/100 NR/NR/NR WET/WET/WET

EADD 02120225 09C 2/3/3 75/100/100 06/12/12 SLUSH/WET SNOW/WET SNOW

Situational Awareness Section

RWY 09L SNOWBANK R20 FM CL. RWY09R ADJ SNOWBANKS. TWY B POOR. APRON POOR

Example 1

SNOWTAM proposal issued by London Heathrow Tower which includes situational awareness and Plain Text remarks.

GG EUECYIYP

311842 EGLLZTZX

(SNOWTAM PROPOSAL EGGN 0351)

EGLL

10311800 09L 2/2/2 100/100/100 04/04/04 SLUSH/SLUSH/SLUSH

10311730 09R 5/2/2 100/50/75 NR/06/06 WET/SLUSH/SLUSH

RWY 09L SNOWBANK R20 FM CL. RWY 09R ADJ SNOWBANKS. TWY B POOR. APRON NORTH POOR. RMK/ APN STANDS CONTAIN GRIT / STAND 12 CLOSED DUE ICE.)

Example 2

SNOWTAM proposal issued by London Heathrow Tower with no situational awareness or plain text remarks

GG EUECYIYP

311855 EGLLZTZX

(SNOWTAM PROPOSAL EGGN)

EGLL

10311800 09L 5/5/5 100/100/100 NR/NR/NR WET/WET/WET

10311730 09R 5/5/5 100/100/100 NR/NR/NR WET/WET/WET)

Example 3

SNOWTAM Proposal issued by London Heathrow Tower with situational awareness but no plain text remarks.

GG EUECYIYP

311855 EGLLZTZX

(SNOWTAM PROPOSAL EGGN)

EGLL

10311800 09L 5/5/5 100/100/100 NR/NR/NR WET/WET/WET

10311730 09R 5/5/5 100/100/100 NR/NR/NR WET/WET/WET

RWY 09L CHEMICALLY TREATED. RWY 09R CHEMICALLY TREATED

SNOWTAM Issuance

3.425 On receipt of a correctly constructed proposal the UK NOTAM OFFICE will issue a SNOWTAM message. In cases where the SNOWTAM proposal is incorrectly addressed, formatted, or constructed, it will be rejected either systematically or manually by EAD or the UK NOTAM OFFICE to the originating AFTN address.

3.426 It is the responsibility of the Sponsor to monitor for rejection messages and take appropriate action. Sponsors are also responsible for reviewing the SNOWTAM back copies and raising any potential issues directly with the UK NOF

Reporting by aerodromes with multiple runways

3.427 On aerodromes with multiple runways, SNOWTAM should include all the runways, in case that at least one runway is contaminated. This improves pilots' situational awareness and support their decision on the selection of the landing/take-off runway.

Significant changes

3.428 A change in the runway surface condition used in the RCR is considered significant whenever there is any:

1. Change in the RWYCC;
2. Change in the contaminant type;
3. Change in reportable contaminant coverage according to Table 1;
4. Change in contaminant depth according to Table 2; and
5. Other information, for example a SPECIAL AIR-REPORT of runway braking action, which according to assessment techniques used, is known to be significant.

Assessed per cent	Reported per cent
10-25	25
26-50	50
51-75	75
76-100	100

Table 1 — Percentage of coverage for contaminants

Contaminant	Valid values to be reported	Significant change
STANDING WATER	04, then assessed value	3 mm
SLUSH	03, then assessed value	3 mm
WET SNOW	03, then assessed value	5 mm
DRY SNOW	03, then assessed value	20 mm

Table 2 – Depth assessments for contaminants

Note 1 — For STANDING WATER, 04 (4 mm) is the minimum depth value at and above which the depth should be reported. From 3 mm and below, the runway third should be considered WET.

Note 2 — For SLUSH, WET SNOW and DRY SNOW, depths up to and including 3 mm should be reported as 03 (3 mm).

Note 3 — Above 4 mm for STANDING WATER and above 3 mm for SLUSH, WET SNOW and DRY SNOW, an assessed value should be reported, and a significant change relates to the observed change from this assessed value.

An example of reporting depth of contaminant whenever there is a significant change is as follows.

1. After the first assessment of runway condition, a first runway condition report is generated.

   The initial report is:

   5/5/5 100/100/100 02/02/02 SLUSH/SLUSH/SLUSH

   Note; The full information string is not used in this example.

2. With continuing precipitation, a new Runway Condition Report is required to be generated as a subsequent assessment reveals a change in the RWYCC is needed. A second Runway Condition Report is therefore created as:

   2/2/2 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH

3. With even more precipitation, a further assessment reveals the depth of contamination has increased from 3 mm to 7 mm along the entire length of the runway. However, a new Runway Condition Report is not required because the RWYCC has not changed (change in depth is less than the significant change threshold of 3 mm).

4. A final assessment of the contamination reveals that the depth has increased to7 mm. A new RWYCC is required because the change in depth from the last RCR (second RWYCC), i.e., from 3 mm to 7 mm is greater than the significant change threshold of 3 mm. A third Runway Condition Report is thus created as below:

   2/2/2 100/100/100 7/7/7 SLUSH/SLUSH/SLUSH

   Note; For contaminants other than STANDING WATER, SLUSH, WET SNOW or DRY SNOW, the depth is not reported. The position of this type of information in the information string is then identified by /NR/.

3.429 When the depth of the contaminants varies significantly within a runway third, additional information is to be given in the plain-language remark part of the situational awareness section of the Runway Condition Report.

Use of Friction Measurement

3.430 Friction measurements cannot be used by flight crews to determine landing performance requirements, because there is no correlation between the measurements and aeroplane performance data. Nevertheless, continuous friction measuring devices may be used, together with all other available means, to support upgrade or downgrade of the RWYCC, by using friction measurements in a comparative way and not as absolute values.

Runway Condition Assessment

RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)

3.431 The aerodrome operator should use the following RCAM in order to assign the RWYCC:

Runway Condition Assessment Matrix (RCAM)			
Assessment criteria		**Downgrade assessment criteria**	
Runway condition code	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	• DRY	———	———
5	• FROST • WET (The runway surface is covered by any visible dampness or water up to and including 3 mm depth) **Up to and including 3 mm depth:** • SLUSH • DRY SNOW • WET SNOW	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	GOOD
4	**−15ºC *and Lower outside air temperature***: • COMPACTED SNOW	Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	• WET (“slippery wet” runway) • DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW ***More* than *3 mm depth:***	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control	MEDIUM

	• DRY SNOW • WET SNOW ***Higher* than −15ºC outside air temperature[1]:** • COMPACTED SNOW	is noticeably reduced.	
2	***More than 3 mm depth:*** • STANDING WATER • SLUSH	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR
1	• ICE	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	POOR
0	• WET ICE • WATER ON TOP OF COMPACTED SNOW • DRY SNOW or WET SNOW ON TOP OF ICE	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

Table 3 The RCAM Matrix

3.432 The RCAM is a tool to be used when assessing runway surface conditions. It is not a standalone document and should be used in compliance with the associated procedures of which there are two main parts:

1. Assessment criteria; and
2. Downgrade assessment criteria

[1] Runway surface temperature should preferably be used where available.

Available Means Used to Determine the RWYCC

3.433 The visual inspection of the movement area to assess the surface condition is the core method to determine the RWYCC. An overall assessment however implies more than that. The continuous monitoring of the development of the situation and the prevailing weather conditions is essential to ensure safe flight operations. Other aspects to be considered in the assessment result are the outside air temperature, the surface temperature, the dew point, the wind speed and direction, the effect of surface treatment, control and deceleration of the inspection vehicle, the special-air-reports of braking action, the output from friction measuring devices, the weather forecast, etc. Due to interaction between them, a deterministic method on how these factors affect the RWYCC to be reported cannot be precisely defined.

3.434 The RCAM supports the classification of runway surface conditions by their effect on aeroplane braking performance using a set of criteria identified and quantified based on the best industry knowledge, built upon dedicated flight testing and in-service experience. The thresholds at which a criterion changes the classification of a surface condition are intended to be reasonably conservative, without being excessively pessimistic.

3.435 The following describes why the primary classification criteria in the RCAM have been set this way, and why it is important for aerodrome personnel to monitor and accurately report conditions when operating close to the boundaries of each RWYCC:

Type of contaminant

3.436 Different contaminants affect the contact area between tyre and runway surface, where the stopping force is generated, in different ways. A water film of any depth leads to the partial viscous aquaplaning) or total separation (dynamic aquaplaning) of the tyre from the surface. The smaller the surface, the smaller the force of adhesion, the less braking is available. This is why the maximum braking force decreases at higher speed and depends on contaminant depth. Other fluid contaminants have a similar effect. Hard contaminants, such as ice or compacted snow, prevent the contact between tyre and runway surface completely and at any speed, effectively providing a new surface that the tyre rolls on. A deterministic classification of the stopping performance can be made only for the contaminants listed in the RCAM. For other reportable contaminants (oil, mud, ash, etc.), a large variance in the aeroplane performance effect exists, or insufficient data is available to permit a deterministic classification. An exception is rubber contamination, for which in-service data indicates that an assumption of RWYCC 3 provides a satisfactory performance margin. Runway surface treatments with sand, grit or chemicals may be very effective or even

detrimental depending on the conditions of the application, and no credit can be attributed to such treatment without verification and validation.

Depth of the contamination

3.437 The industry accepts that the threshold for the effect of depth of fluid contaminants on aeroplane performance is at 3 mm. Below this threshold, any type of fluid contaminant can be removed from the tyre/runway contact zone either by forced drainage or by compressing it into the macrotexture of the surface, thus allowing adhesion between tyre and surface to exist, albeit on less than the full footprint surface area. This is the reason that contamination depths up to 3 mm are expected to provide similar stopping performance as a wet runway. It should be noted that the physical effects causing reduced friction forces begin to take effect from very small film thickness, therefore damp conditions are considered to provide no better braking action than a wet runway.

3.438 Aerodrome personnel should be aware of the fact that the capability to generate friction in wet (or with thin layers of fluid contaminants) conditions is very dependent upon the inherent qualities of the runway surface (friction characteristics) and may be less than normally expected on poorly drained, polished or rubber contaminated surfaces.

3.439 Above the 3 mm threshold, the impact on friction forces is more significant, leading to classification in lower RWYCCs. Above this depth, and depending on the density of the fluid, additional drag effects start to apply, due to displacement or compression of the fluid and impingement on the airframe of the aeroplane. These latter effects depend on the depth of the fluid and affect the ability of the aeroplane to accelerate for take-off.

Surface or air temperature

3.440 It is self-evident that close to the freezing point significant changes in surface conditions can occur very quickly. Surface temperature is more significant for the relevant physical effects, and surface and air temperature may be significantly different due to latency and radiation. However, surface temperature may not be readily available, and it is acceptable to use air temperature as a criterion for the contaminant classification.

3.441 The threshold for the classification of compacted snow in RWYCC 4 (below OAT -15 degrees) or RWYCC 3 (above this temperature) is based on historical North American operational practice and may be very conservative, therefore other assessment means should be used to support the classification. Such assessment means should be based upon specific rationale, specific procedures, and substantiating aeroplane data.

3.442 ICE is considered to be untreated ice that covers the runway macrotexture.

Assignment of runway condition code

3.443 The aerodrome operator should:

1. Assign a RWYCC 6, if 10 per cent or less area of a runway third is wet or covered by contaminant;
2. Describe in the plain-language remarks part of the situational awareness section of the RCR the location of the area that is wet or covered by the contaminant, if the distribution of the contaminant is not uniform;
3. Assign a RWYCC based on the contaminant that will most likely affect the aeroplane's performance, if multiple contaminants are present and the total coverage is more than 25 per cent but no single contaminant covers more than 25 per cent of any runway third;
4. Not upgrade an assigned RWYCC 5, 4, 3, or 2; and
5. Not upgrade beyond RWYCC 3 an assigned RWYCC 1 or 0.

3.444 The aerodrome operator may upgrade an assigned RWYCC 1 or 0 when all available means of assessing runway slipperiness, including properly operated and calibrated measuring devices, if available, have been used to support the decision.

3.445 The aerodrome operator, when RWYCC 1 or 0 is upgraded, should assess the runway surface frequently during the period the higher RWYCC is in effect, to ensure that the runway surface condition does not deteriorate below the assigned code.

3.446 The aerodrome operator, if sand or other runway treatments are used to support upgrading of the RWYCC, should assess the runway surface frequently to ensure the continued effectiveness of the treatment.

3.447 The aerodrome operator should appropriately downgrade the RWYCC taking into consideration all available means of assessing runway slipperiness, including special air-reports.

Single and multiple contaminants

3.448 When single or multiple contaminants are present, the RWYCC for any third of the runway is determined as follows:

1. When the runway third contains a single contaminant, the RWYCC for that third is based directly on that contaminant in the RCAM as follows:
2. If 10% per cent or less area of a runway third is wet or covered by contaminant, a RWYCC 6 shall be reported.

3. If more than 10 and up to 25 per cent area of a runway third is wet or covered by contaminant, a RWYCC 5 shall be reported.

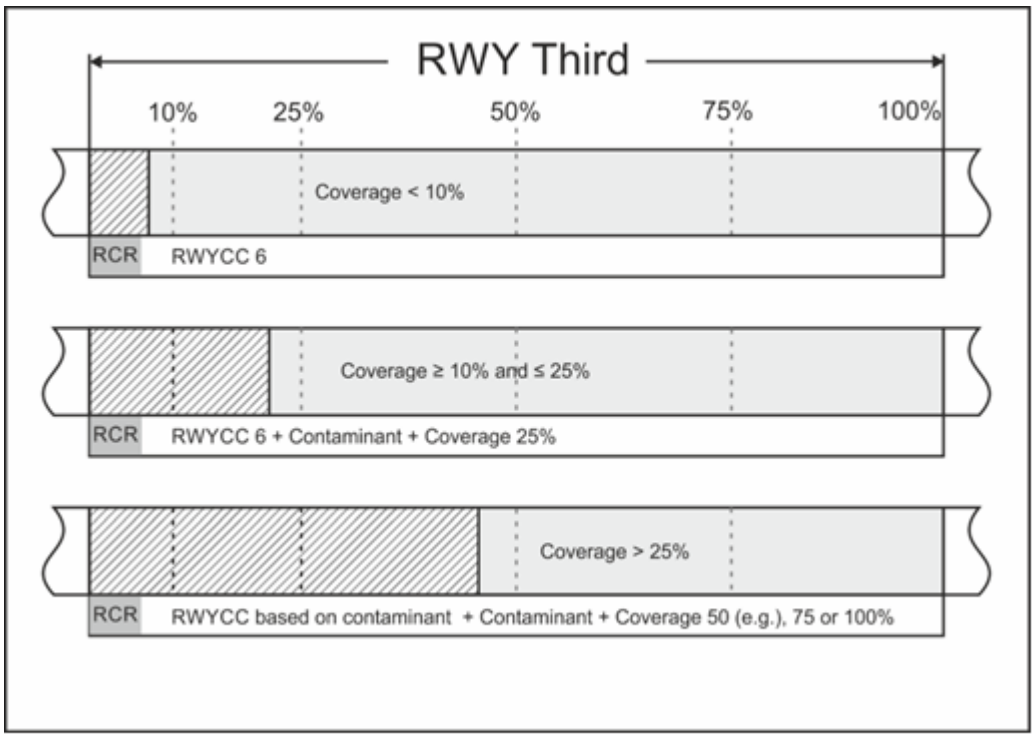


Figure 1 — Single contaminant

3.449 If multiple contaminants are present where the total coverage is more than 25 per cent but no single contaminant covers more than 25 per cent of any runway third, the RWYCC is based upon the local knowledge and the judgement of the runway inspector, considering what contaminant will most likely be encountered by the aeroplane and its likely effect on the aeroplane's performance. Typically, this would be the most widespread contaminant, but this is not an absolute.

3.450 The structure of the RCAM is ranking the contaminants in the column 'Runway surface description' from top to bottom and is having the most slippery contaminants at the bottom. However, this ranking is not an absolute, as the RCAM by design is landing oriented and if judged in a take-off scenario, the ranking could be different due to drag effects of loose contaminants.

Downgrading and upgrading

3.451 The RCAM allows making an initial assessment based on visual observation of contaminants on the runway surface: their type, depth, and coverage, as well as the outside air temperature.

3.452 Downgrading and upgrading is an integral part of the assessment process and essential to developing relevant reports of the prevailing runway surface condition

3.453 Downgrading of the RWYCC is an inherent part of the assessment process. When all other observations, experience and local knowledge and judgement of the inspector indicate that the primary assignment of the RWYCC does not reflect the prevailing conditions accurately, a downgrade or upgrade should be made. Examples of aspects to be considered in assessing the runway slipperiness for the downgrade process:

Prevailing weather conditions

1. Stable sub-freezing temperature
2. Dynamic conditions
3. Active precipitation

Observations

1. Measurements
2. Friction measurements
3. Vehicle behaviour
4. Shoe scraping
5. Experience (local knowledge)
6. Special air-reports

An assigned RWYCC 5, 4, 3 or 2 shall not be upgraded.

Note: Further details on additional means of assessing runway slipperiness can be found in Airport Services Manual Part 2 (Doc 9981).

3.454 When the complete removal of contaminants cannot be achieved, but the RWYCC initially assigned does not reflect the real surface condition, the aerodrome personnel may apply the upgrade procedures.

3.455 Upgrading is applicable only when the initial RWYCC is 0 or 1.

3.456 Upgrading can only occur up to RWYCC 3.

3.457 An assigned RWYCC 1 or 0 can be upgraded using the following procedures:

3.458 If a properly operated and calibrated approved measuring device and all other observations support a higher RWYCC as judged by trained personnel;

3.459 The decision to upgrade RWYCC 1 or 0 cannot be based upon one assessment method alone. All available means of assessing runway slipperiness are to be used to support the decision;

3.460 When RWYCC 1 or 0 is upgraded, the runway surface is assessed frequently during the period the higher RWYCC is in effect to ensure that the runway surface condition does not deteriorate below the assigned code; and

3.461 Variables that may be considered in the assessment that may affect the runway surface condition, include but are not limited to:

1. Any precipitation conditions;
2. Changing temperatures;
3. Effects of wind;
4. Frequency of the runway in use; and
5. Type of aeroplane using the runway.

3.462 When a friction measuring device is used for upgrading purposes, a preponderance of evidence should exist. In order to upgrade a RWYCC 0 or 1 to no higher than RWYCC 3, the friction measuring device should demonstrate an equivalent friction to that of a wet runway (RWYCC 5) or higher.

Use of special air-reports

3.463 Where available, the pilot reports of runway braking action should be taken into consideration as part of the ongoing monitoring process, using the following principle:

1. A pilot report of runway braking action is taken into consideration for downgrading purposes; and
2. A pilot report of runway braking action can be used for upgrading purposes only if it is used in combination with other information qualifying for upgrading.

3.464 The aerodrome operator should:

1. Re-assess the runway surface condition if RWYCC 2 or better has been reported and two consecutive pilot reports of POOR runway braking action are received; and
2. Re-assess the runway surface condition and consider the suspension of operations on that runway when one pilot has reported a LESS THAN POOR runway braking action and the suspension of operations on that runway shall be considered.

3.465 The aerodrome operator may use a special air-report of runway braking action for upgrading purposes only if it is used in combination with other information qualifying for upgrading

3.466 Special air-reports typically provide aerodrome personnel and other pilots with an observation that can confirm the ground-based assessment of or alert to degraded conditions experienced in terms of braking capability and/or lateral control during the landing roll.

3.467 The braking action observed is dependent on the type of aircraft, aircraft weight, runway portion used for braking, and other factors. Pilots will use the terms GOOD, GOOD TO MEDIUM, MEDIUM, MEDIUM TO POOR, POOR and LESS THAN POOR. See table 5.

3.468 When receiving a special air-report, the recipient should consider that it rarely applies to the full length of the runway and is limited to the specific sections of the runway surface in which sufficient wheel braking was applied to reach friction limitation.

3.469 As special air-reports are subjective and contaminated runways may affect the performance of different aeroplane types in a different way, the reported braking action may not be directly applicable to another aeroplane.

SNOWTAM PROPOSAL FORMAT

(COM heading)	(PRIORITY INDICATOR)	(ADDRESSES)			<≡
	(DATE AND TIME OF FILING)	(ORIGINATOR'S ADDRESS)			<≡
(SNOWTAM PROPOSAL EGGN) ------►	(Serial number) (optional)				<≡
Aeroplane performance calculation section					
(AERODROME LOCATION INDICATOR)		M	A)		<≡
(DATE/TIME OF ASSESSMENT (Time of completion of assessment in UTC)		M	B)		------►
(LOWER RUNWAY DESIGNATION NUMBER)		M	C)		------►
(RUNWAY CONDITION CODE (RWYCC) ON EACH RUNWAY THIRD) (From Runway Condition Assessment MATRIX (RCAM) 0, 1, 2, 3, 4, 5 or 6)		M	D)	/ /	------►
(PERCENT COVERAGE CONTAMINANT FOR EACH RUNWAY THIRD)		C	E)	/ /	------►
(DEPTH (mm) OF LOOSE CONTAMINANT FOR EACH RUNWAY THIRD)		C	F)	/ /	------►
(CONDITION DESCRIPTION OVER TOTAL RUNWAY LENGTH) (Observed on each runway third, starting from threshold having the lower runway designation number) COMPACTED SNOW DRY DRY SNOW DRY SNOW ON TOP OF COMPACTED SNOW DRY SNOW ON TOP OF ICE FROST ICE SLUSH STANDING WATER WATER ON TOP OF COMPACTED SNOW WET WET ICE WET SNOW WET SNOW ON TOP OF COMPACTED SNOW WET SNOW ON TOP OF ICE		M	G)	/ /	------►
(WIDTH OF RUNWAY TO WHICH THE RUNWAY CONDITION CODE APPLY, IF LESS THAN PUBLISHED WIDTH)		O	H)		<≡≡
Situational awareness section – Each item if reported, separated by a "Full Stop" and Space.					
(REDUCED RUNWAY LENGTH, IF LESS THAN PUBLISHED LENGTH (m)		O	I)		------►
(DRIFTING SNOW ON THE RUNWAY)		O	J)		------►
(LOOSE SAND ON THE RUNWAY)		O	K)		------►
(CHEMICAL TREATMENT ON THE RUNWAY)		O	L)		------►
(SNOWBANKS ON THE RUNWAY) (if present, distance from runway centre line (m) followed by "L", "R", or "LR" as applicable		O	M)		------►
(SNOWBANKS ON A TAXIWAY)		O	N)		------►
(SNOWBANKS ADJACENT TO THE RUNWAY)		O	O)		------►
(TAXIWAY CONDITIONS)		O	P)		------►
(APRON CONDITIONS)		O	R)		------►
(MEASURED FRICTION COEFFICIENT)		O	S)		------►
(PLAIN LANGUAGE REMARKS) RMK/		O	T)		)

Notes:

1. SNOWTAM proposal serial number is optional – if included, it must be a 4-digit number, starting at 0001 at the beginning of each calendar year, however the number is replaced by EADs own numbering system for each Aerodrome for the transmitted SNOWTAM.
2. For additional runways repeat items B to H.
3. Information in situational awareness section repeated for each runway, taxiway and apron where they exist. Repeat as applicable when reported and separate each item with a "full stop" and space.
4. Words in brackets ( ) not to be transmitted.
5. start item T with RMK/. If more than one set of info is included in item T then separate each with an oblique "/" and end item T with a "Full Stop", do not use "Full Stop" to separate Item T elements.

Aerodrome movement areas

Clearance of Foreign Objects and Debris (FOD)

3.470 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.

3.471 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;

3.472 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. Apart from the safety aspect, unscheduled replacement of parts or components damaged by debris will result in economic penalties for an aircraft operator;

3.473 Damage to tyres resulting from contact with sharp objects, untreated joints or deteriorating pavement edges are responsible for reduced tyre life;

3.474 The cleanliness of the surface of the movement area should be a matter of continuous concern and attention to an aerodrome authority. FOD typically falls into two main categories:

1. 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;

2. 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 WIP.

3.475 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.

3.476 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.

3.477 Closer co-operation between aerodrome licence holders, 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.

3.478 No proprietary system has yet been proven to be fully effective in the detection and identification of FOD on runways. However, while future developments of such systems should not be discounted, the use of advanced technology should only supplement current methods of inspection.

3.479 Aerodrome licence holders 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.

Pavement surfaces

3.480 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.

3.481 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.

3.482 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.

Grit and spoil

3.483 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.

3.484 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 loads 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.

3.485 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.

3.486 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.

Packages and wrappings

3.487 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.

3.488 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.

Inspection and standards of cleanliness

3.489 For details of inspection procedures see aerodrome pavement maintenance and inspection procedures.

3.490 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.

3.491 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.

Aircraft debris

3.492 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.

3.493 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.

3.494 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.

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

3.495 Aerodrome pavements to runways, taxiways and aprons are critical to ensure that hazards to aircraft are minimised and 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.

3.496 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.

3.497 Aerodrome operators 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.

3.498 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:

1. Inspection of the runway surface condition, including water drainage characteristics;
2. FOD detection and removal;

3. Aeronautical ground lighting fittings within the pavement including the structural integrity of the fittings;
4. Signage, markings, and other visual aids;
5. Cleared and graded areas;
6. Wildlife control and the removal of remains.

3.499 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.

3.500 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.

3.501 The aerodrome operators should ensure that the development and use of runway inspection procedures are addressed in the safety management system employed at the aerodrome.

Documentation

3.502 All aerodrome inspections, maintenance activities and matters arising from such should be formally documented by the aerodrome licence holder and records maintained for future reference.

3.503 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.

Daily inspections

3.504 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 the inspections should be spread over the main times of operational activity.

3.505 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.

Weekly inspections

3.506 All aerodrome pavements within the movement area should be inspected in more detail at least once a week.

3.507 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.

Annual inspections

3.508 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.

Optional inspections

3.509 Specific additional on-runway inspections, for example, wildlife hazard control or FOD detection, might be undertaken by a single vehicle and should be carried out at an appropriate speed for effective monitoring.

3.510 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.

3.511 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.

3.512 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.

3.513 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.

Detailed pavement inspection and evaluation

3.514 The inspection procedures described 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.

3.515 The pavement structure has a limited operational life that will be related in part to the declared PCR. The ACR/PCR method is described in chapter 3.

3.516 The aerodrome should review declared PCR values in the light of the functional condition.

3.517 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.

3.518 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.

Care of pavements during winter conditions – improving surface friction by removal of contaminants

Chemical methods

3.519 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.

3.520 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.

3.521 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 Icey surface to loosen the ice which should then be removed mechanically.

3.522 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.

3.523 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.

3.524 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.

3.525 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.

3.526 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 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.

Mechanical methods

3.527 Mechanical methods of clearance should commence as soon as the snow begins to accumulate on the surface.

3.528 The machinery employed will depend upon the type of snow, whether wet or dry, and the direction and strength of the wind.

3.529 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.

3.530 The use of vehicles with chains, high speed snow drags, and underbody metal scrapers should be forbidden.

Sand/grit

3.531 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 3.395 below and is free from soluble salts. loads containing oversized particles should be rejected, as should any flint-type material.

3.532 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.

3.533 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

3.534 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.

Porous friction course

3.535 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.

3.536 Aerodrome operators should satisfy themselves that the use of such chemicals does not breach environmental protection laws.

Ice detectors

3.537 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 material

Starter extensions

3.538 There are circumstances where additional declared distances may be provided at the start of the runway. Consequently, the term' starter extension' was introduced to permit additional runway distances to be utilised for take-off. For the requirements for these additional distances see chapter 3.

3.539 Starter extensions may be utilised to provide additional runway declared distances. So as to ensure that its purpose cannot be mistakenly interpreted as pre-threshold runway, stopway or clearway, the length of a starter extension is limited to a maximum of 150 m and the width to two-thirds of the normal runway requirement. The starter extension is not considered as a part of the runway dimensions.

3.540 Note: It may be necessary to provide extra width at the end of a starter extension to enable aeroplanes to turn around.

3.541 To differentiate further between a starter extension and pre-threshold runway, runway edge markings for the pre-threshold runway are to be consistent with those of the post-threshold runway, i.e., solid white lines, while those of the starter extension should be dashed white lines of 15 m length with 15 m spacing between each line. The width of the dashed white lines should be half the width of the centreline marking.

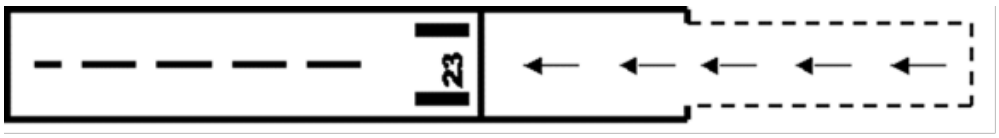


Figure 3H.1 Starter extension and pre threshold markings

OFFICIAL - Public

3.542 Starter extensions should be lit in accordance with the requirements given in chapter 6 with runway strip requirements as shown in chapter 3.

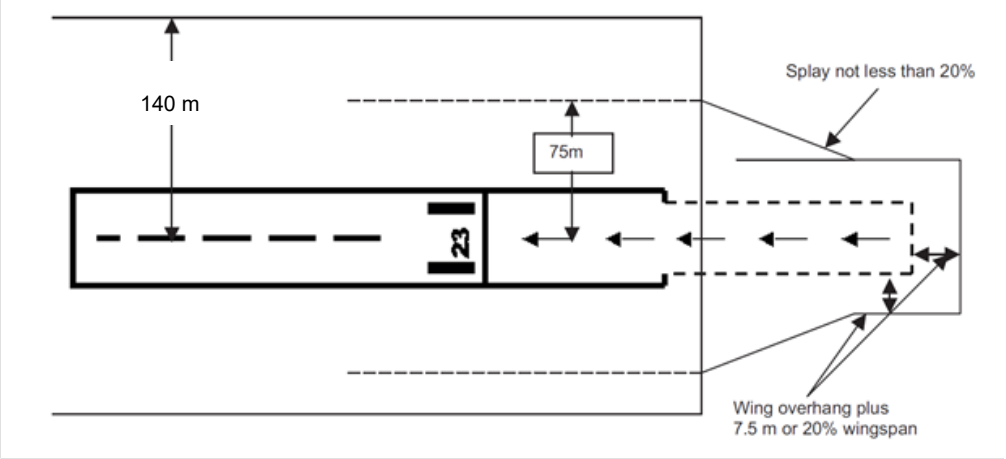


Figure 3H.2 Starter extension safeguarding

3.543 Aerodrome licence holders should ensure runway declared distances published in the AIP are amended to include starter extensions at the earliest opportunity. To get a full picture of the effect the starter extension has on declared distances, TORA, TODA, and ASDA should include the length of any starter extension. Promulgation should follow the example shown below;

3.544 Aerodrome licence holders should ensure runway declared distances published in the AIP are amended to include starter extensions at the earliest opportunity. To get a full picture of the effect the starter extension has on declared distances, TORA, TODA, and ASDA should include the length of any starter extension. Promulgation should follow the example shown below;

AD 2.12 – RUNWAY PHYSICAL CHARACTERISTICS

This section should indicate length of full-width runway only. The remarks column could include the description of any starter extensions in use and which runways are affected, e.g., ‘Runway 10 has a starter extension of 150 x 30 m. Hard shoulder width at starter extension is 15 m’

AD 2.13 – declared distances.

3.545 Should a starter extension be utilised, the published TORA, TODA and ASDA should include the starter extension distance. The remarks column should then include a statement like: ‘Runway 10 declared distances include a starter extension of 150 x 30.

Runway end safety areas (assessment)

3.546 Aerodromes are required to provide Runway End Safety Areas (RESA) for runways as specified in chapter 3. For applicable runways where the RESA does not extend to the recommended distance, as part of their safety management system, licence holders should assess the risk of both a runway excursion and a runway undershoot and implement appropriate and suitable mitigation measures, as necessary.

3.547 For the purpose of this guidance, runway excursions include an overrun or veer off on landing or during an aborted take-off. An aerodrome's assessment of RESA should consider each of these scenarios.

3.548 The aim of this guidance is to assist licence holders in assessing the level of risk of an aeroplane undershooting or overrunning a runway at their aerodrome and suggest mitigation measures that may be appropriate, both to reduce the likelihood and to reduce the potential effects of an event.

Aeroplane performance

3.549 In general pilots must calculate the take-off and landing distance required using performance charts/tables provided for each type of aeroplane by the manufacturer. These calculations must take into account the mass and configuration of the aeroplane and operational variables such as the physical characteristics of the runway, the obstacle environment surrounding the runway and environmental conditions such as temperature, pressure, precipitation and the head or tail wind component.

3.550 For public transport or commercial air transport operations, there is a legal requirement to include a safety margin in the calculations to allow for unforeseen variations in conditions and to provide an assured level of safety. These include an additional safety margin for wet or contaminated runway conditions. It is important to note that non-public transport or non-commercial air transport operations are not legally required to add these additional safety margins.

3.551 The likelihood of an aeroplane actually undershooting or overrunning a runway and needing the use of a RESA is very low and generally only happens in extreme circumstances.

Risk assessment

3.552 The risk of an aeroplane undershooting or overrunning a runway involves a large number of variable factors. These factors include prevailing weather conditions, the type of aeroplane (e.g., large jet aircraft, business jet, turboprop), the landing aids available, frequency of use, runway characteristics, the surrounding environment and pilot performance. Many of

these factors are completely outside the control of the aerodrome but each of them can make a significant contribution to the overall level of risk. The nature of the hazard and level of risk will be different for each aerodrome and even for each runway direction at any one aerodrome. The risk assessment should be able to:

1. Show that the risk of an undershoot or overrun has been assessed in terms of severity and likelihood;
2. Show that the risk has been mitigated as much as is reasonable and practicable;
3. Show that the level of remaining risk meets the safety standards of the aerodrome licence holder;
4. Provide the aerodrome management with a means of assessing the impact on the undershoot and overrun risk of any future changes to the aerodrome environment or the number or type of aeroplanes using the aerodrome.

3.553 Aerodrome operators should take into account in their risk assessments, factors such as:

1. The nature and location of any hazard beyond the runway end, including the topography and obstruction environment beyond the RESA and outside the runway strip;
2. The types of aeroplanes and level of traffic at the aerodrome, and actual or proposed changes to either;
3. Aircraft performance limitations arising from runway length and slope;
4. Aerodrome overrun history;
5. The percentage of operations not using public transport performance safety factors;
6. Runway surface texture depth, transverse slope and drainage, irregularities that would result in a loss of friction, and the general friction characteristics when the runway is wet;
7. Degradation of runway surface friction which may affect aeroplane braking action due to the presence of contaminants or the accumulation of rubber deposits;
8. ATC procedural risk mitigation measures to avoid creating conditions that increase the chance of a rushed/unstabilised approach.
9. Actual RESA provision and options for enhancement;

10. The type and level of use of navigation aids, such as ILS/RNAV (GNSS) and/or PAPI.

Level of risk

3.554 There are different methods available to try to assess the overall level of risk. CAP 760, Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases details a suitable risk assessment process.

3.555 In general, the level of risk should be assessed in terms of severity and likelihood so that an overall level of risk can be identified using a suitable risk tolerability matrix.

3.556 Once the level of risk has been identified, where necessary, suitable risk mitigation measures can be used to reduce the level of risk to an acceptable level either by reducing the severity if the risk actually occurs or reducing the likelihood of the risk occurring.

Severity

3.557 In most scenarios the level of severity of an aeroplane undershooting or overrunning will depend on the area surrounding the runway. Any improvements to the area surrounding the runway, such as increasing the RESA distance, removing any obstacles, delethalising buried objects, removal of or improvement to the infrastructure surrounding the runway will decrease the severity if an undershoot or overrun actually occurs.

3.558 The severity of an undershoot or overrun should be assessed in terms of the most realistic scenario and will depend on the hazards surrounding the runway end.

3.559 Determining the likelihood of an aeroplane undershooting or overrunning a runway is more difficult to assess. Some aerodromes have accumulated data over many years and use this to work out a reasonable likelihood of an undershoot or overrun by comparing the number of events with the number of total movements. However, most aerodromes will not have had previous experience of an event and may choose to use UK or worldwide statistical data from various sources to identify an appropriate level of likelihood.

3.560 Use of this type of data alone does not consider the increased risk of an undershoot or overrun from an increase in traffic, new and larger types of aeroplanes using the runway, or changes to the infrastructure or physical characteristics of the runway.

3.561 Even though there may be a safety margin built into the performance calculations used by operators, the likelihood of an overrun increases as the proportion of the declared distance required for take-off or landing increases.

3.562 Aeroplanes that do not require the full distance available for either take-off or landing effectively have a built-in additional distance that could be used for stopping the aeroplane in addition to any RESA provided.

3.563 Although the distances required will depend on the actual mass of the aeroplane and the weather conditions on the day, it should be possible to identify aeroplanes that could be described as being more likely to be performance limited for a particular runway.

3.564 Depending on the actual conditions (aeroplane mass, temperature, pressure altitude, wind component, runway surface condition and obstacle environment) it may sometimes be necessary for an aircraft operator to reduce or limit the take- off mass of the aeroplane in order to use a particular runway due to the length of the runway. Similarly, the mass of the aeroplane on landing will affect the landing distance required and sometimes an aeroplane will not be able to land on a particular runway until the mass is reduced below a specified figure.

3.565 Under these conditions the aeroplane is performance-limited and needs all the available runway length (taking into account any safety margins added) in order to take off or land. Even though this is acceptable from a performance perspective it does mean the aeroplane is operating at the limit for that runway and there is no excess runway available beyond the included safety margins.

3.566 To help assess the likelihood of an aeroplane overrunning a runway, licence holders should assess the traffic using their aerodrome to identify what percentage of operations is likely to be performance limited.

3.567 An objective assessment of the severity, likelihood, and overall level of risk of an aeroplane undershooting, veering off or overrunning a runway will have to be made using all the information available. Depending on the level of risk further mitigation measures to reduce either the severity and/or likelihood of an event happening may need to be considered.

Possible mitigation measures to consider

3.568 If the risk assessment reveals that the level of risk of an undershoot or overrun is of concern, mitigation measures will be required to reduce the level of risk to As Low As Reasonably Practicable (ALARP). It may be that the cost of a particular mitigation measure is beyond the scope of an aerodrome and will not be feasible; however, it is likely that many mitigation measures will be reasonably practicable and should therefore be considered.

3.569 The following list outlines some of the measures that may be considered, singly or in combination, to reduce the risks (in terms of severity or likelihood)

of an undershoot, veer off and/or an overrun occurring. Mitigation measures that reduce the likelihood of either an undershoot, veer off or overrun include:

1. Improve the friction characteristics of runway surfaces and/or limit the lowest friction values allowed. CAP 683, The Assessment of Runway Surface Friction Characteristics, specifies the requirements for runway friction.
2. Resurface and if needed reshape the runway to improve runway surface texture depth, increase transverse slope for rapid drainage and remove any irregularities that would result in a loss of friction.
3. Any surface should be constructed to provide good friction characteristics when the runway is wet, and this would include grooving or providing a specific surface friction layer.
4. Improve the friction characteristics of runway surfaces either by maintenance or the removal of contamination or rubber deposits to increase the chances of an aeroplane stopping on the paved surface especially when wet or contaminated.
5. Ensure that a regular assessment and maintenance programme is in place to maintain adequate levels of grip at all times.
6. Ensure that accurate and up-to-date information on weather and the runway state is available to pilots.
7. Upgrade 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 and/or PAPIs).
8. Consider RNAV (GNSS) approaches for runways with non-precision approaches.
9. Ensure that touchdown zone markings are correctly located and clearly visible.
10. Install touchdown zone lighting.
11. Install coded runway centreline lights or yellow caution zone edge lights to indicate that the end of the runway is near.
12. In consultation with aeroplane operators and air navigation service providers formulate procedures to help ensure stabilised approaches.
13. In consultation with aeroplane operators and air navigation service providers consider operating procedures or restrictions for severe weather conditions.

14. Ensure the accuracy of any AIP entries with regard to the obstacle environment and declared distances.

15. Ensure an open dialogue between the aerodrome, air navigation service provider and aeroplane operators to raise awareness of the factors that could lead to a runway excursion.

16. Where possible reduce the number of tail wind landings and review any limitations in the use of reverse thrust due to noise abatement requirements.

17. Implement/promote a go-around policy for aircraft that have not touched down by the end of the touchdown zone.

18. During work in progress ensure that any temporarily reduced declared distances are clearly communicated to pilots and that any lighting, signs, and markings correspond to the actual declared distances available.

19. During runway rehabilitation projects ensure that accurate information regarding the condition of the runway surface is effectively promulgated to pilots.

20. Mitigation measures that reduce the severity of either an undershoot, veer off or overrun include:

21. Reduce the declared runway distances in order to provide an increased length of RESA. Aerodrome licence holders should consult with their operators to determine what effect a reduction in declared distances would have on their operations. Any increase in the length of a RESA provided will help to reduce the severity of an aeroplane actually undershooting or overrunning a runway and should be considered a high priority wherever possible.

22. Install suitably positioned and designed arresting systems to supplement a RESA where appropriate. Further guidance on suitable arresting systems is available on the CAA website.

23. Minimise the obstruction environment surrounding the runway and in the area beyond the RESA. A reduction in obstructions surrounding the runway should decrease the severity if an aeroplane departs the runway unintentionally. This includes making obstructions frangible wherever possible and making the surrounding areas safe appropriately.

3.570 The above list is not exhaustive or in any particular order and should complement action by aeroplane operators, designers, and aviation regulators.

3.571 Aerodrome operators are reminded of the need to advise the CAA about changes to the physical characteristics of the aerodrome, in accordance with the licence conditions.

Optimising the available RESA

3.572 It is recognised that improving RESA distance is often difficult. However, it is important to note that incremental gains should be obtained wherever possible, as any gain is valuable. Therefore, whenever a runway project involves construction consideration should also be given to improving the RESA further. This includes;

1. Relocation or realignment of the runway - it may be possible to construct additional pavement at the start of take-off end to make more pavement available to retain the declared distances. The start and end of declared distances can be moved towards the downwind (start of take-off) end, thereby retaining the declared distance, and creating space for a longer RESA.
2. In the case where landing RESA is limited and the runway has a displaced landing threshold, examine whether the threshold can be moved (downwind) to increase the RESA.
3. Increasing the RESA provision including land acquisition, improvements to the grading and realigning fences or roads to provide additional area.
4. Improving the slopes in the RESA to minimise or remove downward slopes.
5. Providing paved RESA with known friction characteristics.

Reviewing the risk assessment

3.573 As part of the aerodrome's SMS, licence holders should review the risk of a runway excursion whenever significant changes occur that would affect either the likelihood or severity of a runway excursion. Changes affecting the level of risk include;

1. Changes to the declared distances;
2. New aircraft types;
3. Changes to the number of movements;
4. Changes to the traffic mix;
5. Runway rehabilitation projects;
6. Proposed changes or projects involving the surrounding infrastructure;
7. Changes to ATC procedures.

CHAPTER 4

The Assessment and Treatment of Obstacles

Obstacle limitation surfaces

4.1 The effective utilisation of an aerodrome may be influenced by natural features and manufactured 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 CAP1732, Aerodrome Survey Guidance and CAP232, Aerodrome Survey Information.

4.2 Licensed aerodromes with IFPs are required to undertake an aerodrome survey to the requirements of CAP1732 and meet the requirements of CAP1054. In this instance CAP785(B) Implementation and Safeguarding of IFPs in the UK also applies.

4.3 Licensed aerodromes that do not have IFPs are required to undertake a survey to the requirements of CAP232.

4.4 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.

4.5 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:

1. 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
2. The amount by which the surface is infringed
3. The gradient presented by the obstacle to the surface origin

4. The type of air traffic at the aerodrome; and
5. The instrument approach procedures published for the aerodrome

Safety measures could be as follows:

1. Promulgation in the UK AIP of appropriate information
2. Marking and/or lighting of the obstacle
3. Variation of the runway distances declared as available
4. Limitation of the use of the runway to visual approaches only
5. Restrictions on the type of traffic

4.6 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 the CAA.

4.7 Particular attention should also be given to the security of the movement area and access denied to unauthorised persons and/or vehicles.

The take-off climb surface

4.8 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.

4.9 A take-off climb surface is established for each runway direction intended to be used for take-off.

4.10 The limits of a take-off climb surface comprise:

1. 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:
2. 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
3. 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.
4. 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:

5. An outer edge parallel to the inner edge.

4.11 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.

4.12 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.

4.13 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.

4.14 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.

4.15 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.

4.16 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.

4.17 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.

4.18 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.

4.19 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.

4.20 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).

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

[1] and [2]. Where clearway is provided, the length of the inner edge should be 150m.

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 1800m.

Table 4.1 Dimensions and slopes of take-off climb surfaces

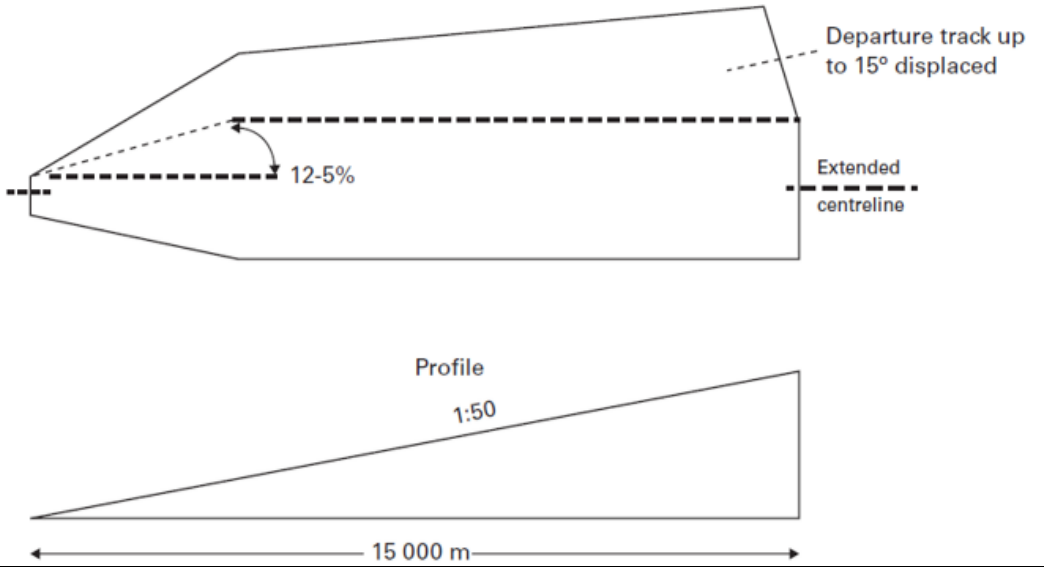


Figure 4.1 Take-off climb surface associated with a runway where the code number is 3 or 4, also showing slewed TOCS

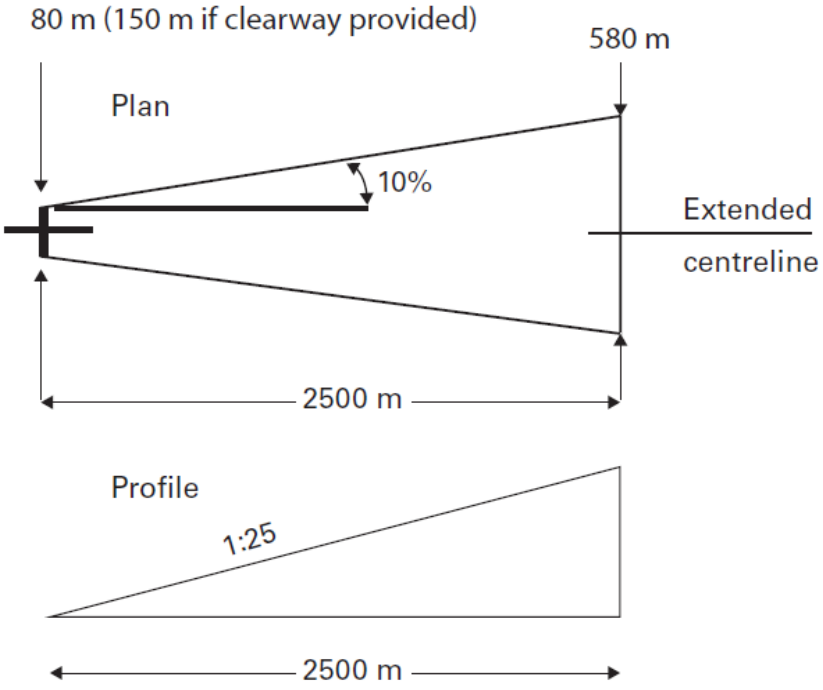


Figure 4.2 Take-off climb surface associated with a runway where the code number is 2

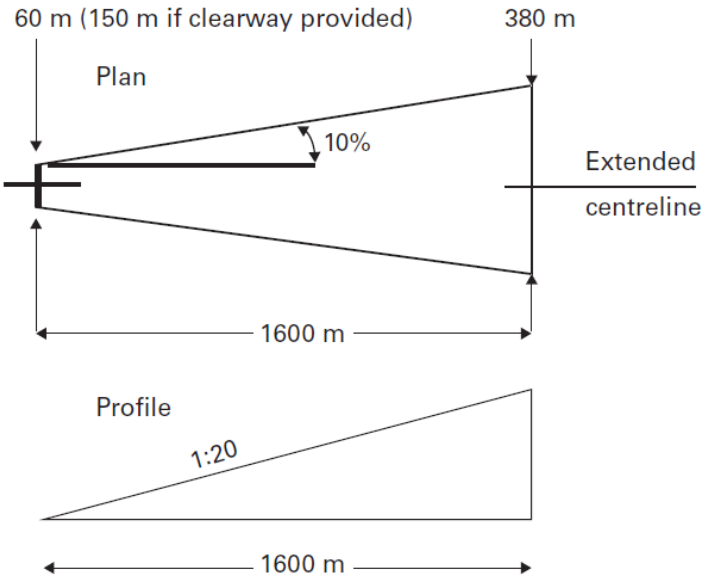


Figure 4.3 Take-off climb surface associated with a runway where the code number is 1

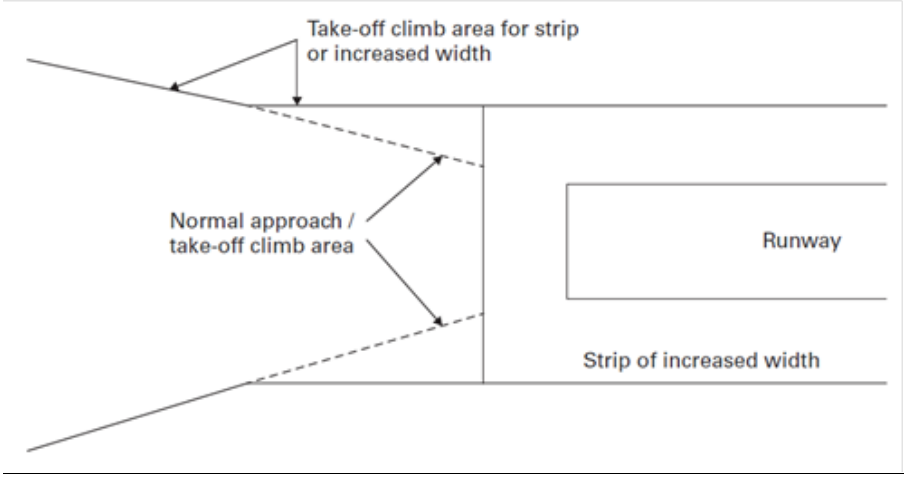


Figure 4.4 Approach/take-off climb surface associated with a runway of substantially more than minimum width

The approach surface

4.21 An approach surface is an inclined plane or combination of planes preceding the threshold.

4.22 An approach surface is established for each runway direction intended to be used for the landing of aircraft.

4.23 The limits of the approach surface comprise:

1. 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 non-instrument runways where the code number is 1 and where the distance is 30 m;
2. 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.
3. An outer edge parallel to the inner edge.
4. The above surfaces should be varied when lateral offset, offset approaches are utilised, specifically, two sides originating at the ends of the inner edge and diverging uniformly at specified rate from the extended centre line of lateral offset, offset or curved ground track.

4.24 The dimensions and slope of the approach surface are specified in table 4.2 and illustrated in figures 4.5 to 4.10.

4.25 The elevation of the inner edge is equal to the elevation of the mid-point of the landing threshold.

4.26 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.

4.27 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.

Inner transitional surface

Applicability

4.28 The purpose of the inner transitional surface is to protect aeroplanes during precision approaches and balked landing.

Description

4.29 A surface similar to the transitional surface but closer to the runway.

Characteristics

4.30 The limits of an inner transitional surface should comprise:

1. A lower edge beginning at the end of the inner approach surface and extending down the side of the inner approach surface to the inner edge of that surface, from there along the strip parallel to the runway centre line to the inner edge of the balked landing surface, and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and
2. An upper edge located in the plane of the inner horizontal surface. The elevation of a point on the lower edge should be:
3. Along the side of the inner approach surface and balked landing surface equal to the elevation of the particular surface at that point; and
4. Along the strip equal to the elevation of the nearest point on the centre line of the runway or its extension.

4.31 The slope of the inner transitional surface should be measured in a vertical plane at right angles to the centre line of the runway

4.32 It is intended that the inner transitional surface be the controlling obstacle limitation surface for navigation aids, aircraft, and other vehicles that should be near the runway, and which is not to be penetrated except for frangible objects. The transitional surface is intended to remain as the controlling obstacle limitation surface for buildings, etc.

4.33 The inner horizontal surface along the strip should be curved if the runway profile is curved or a plane if the runway profile is a straight line. The intersection of the inner transitional surface with the inner horizontal surface should also be curved or straight.

Dimensions and slopes of obstacle limitation surfaces — Approach runways

Applicable until 20 November 2030

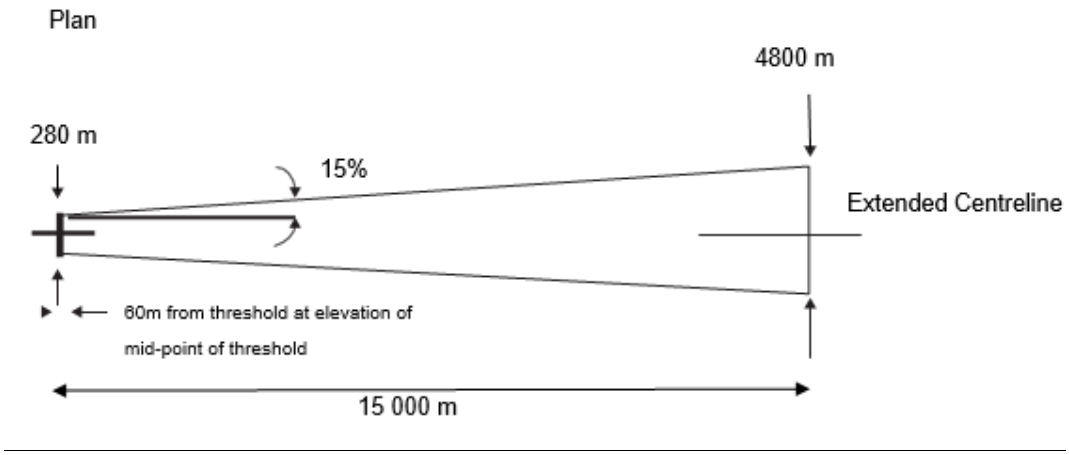
APPROACH RUNWAYS										
RUNWAY CLASSIFICATION										
Surface and dimensions	Non instrument code number				Non- precession approach code number			Precision approach category		
								I Code number		II or II Code number
	1	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35m	55m	75m	100m	60m	75m	100m	60m	100m	100m
INNER HORIZONTAL										
Height	45m	45m	45m	45m	45m	45m	45m	45m	45m	45m
Radius	2000 m	2500m	4000 m	4000 m	3500 m	4000 m	4000 m	3500 m	4000 m	4000 m
INNER APPROACH										
Width	-	-	-	-	-	-	-	90m	120m	120m
Distance from threshold	-	-	-	--	-	-	-	60m	60m	60m
Length	-	-	-	-	-	-	-	900m	900m	900m
Slope	-	-	-	-	-	-	-	2.5%	2%	2%
APPROACH										
Length of inner edge	60m	80m	150m	110m	140m	280m	280m	140m	280m	280m
Distance from threshold	30m	60m	60m	60m	60m	60m	60m	60m	60m	60m
Divergence each side	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%

FIRST SECTION										
Length	1600 m	2500m	3000 m	3000 m	2500 m	3000 m	3000 m	3000 m	3000 m	3000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
SECOND SECTION										
Length	-	-	-	-	-	3600 m[b]	3600 m[b]	12000 m	3600 m[b]	3600 m
Slope	-	-	-	-	-	2.5%	2.5%	3%	2.5%	2.5%
Horizontal section										
Length	-	-	-	-	-	8400 m[b]	8400 m[b]	-	8400 m[b]	8400 m[b]
Total length	-	-	-	-	-	15000 m	15000 m	15000 m	15000 m	15000 m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope	-	-	-	-	-	-	-	40%	33.3%	33.3%
BAULKED LANDING SURFACE										
Length on inner edge								90m	120m[e]	120m[e]
Distance from threshold								c	1800 m[d]	1800 m[d]
Divergence each side								10%	10%	10%
Slope								4%	3.33%	3.33%

Notes:

a. All dimensions are measured vertically
b. Variable length
c. Distance to the end of strip.
d. Or end of runway whichever is less.
e. Where the code letter is F (Code element 2 of Table 3.1), the width is increased to 140 m.

Table4.2 Dimensions and slopes of obstacle limitation surfaces — Approach runways



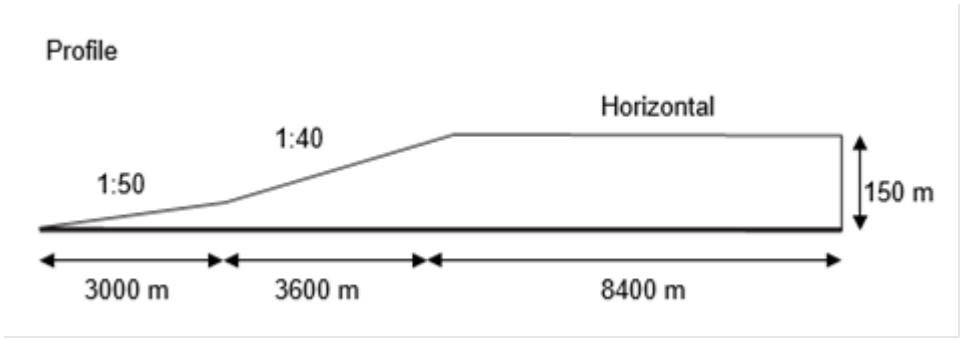


Figure 4.5 Approach surface associated with an instrument runway where the code number is 3 or 4

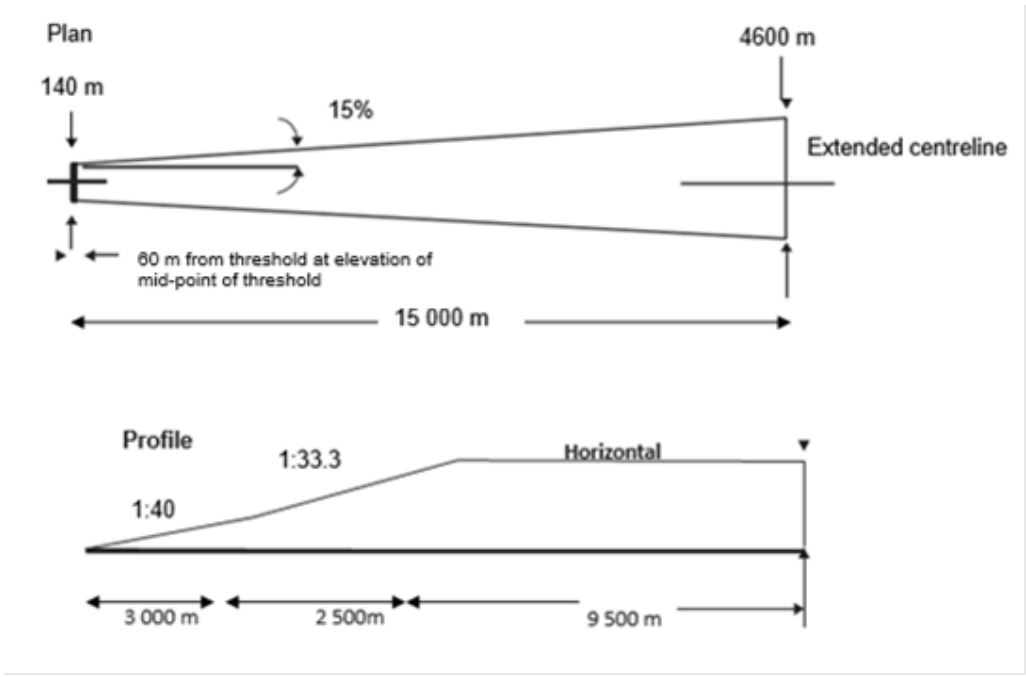


Figure 4.6 Precision instrument approach where the code number is 1 or 2

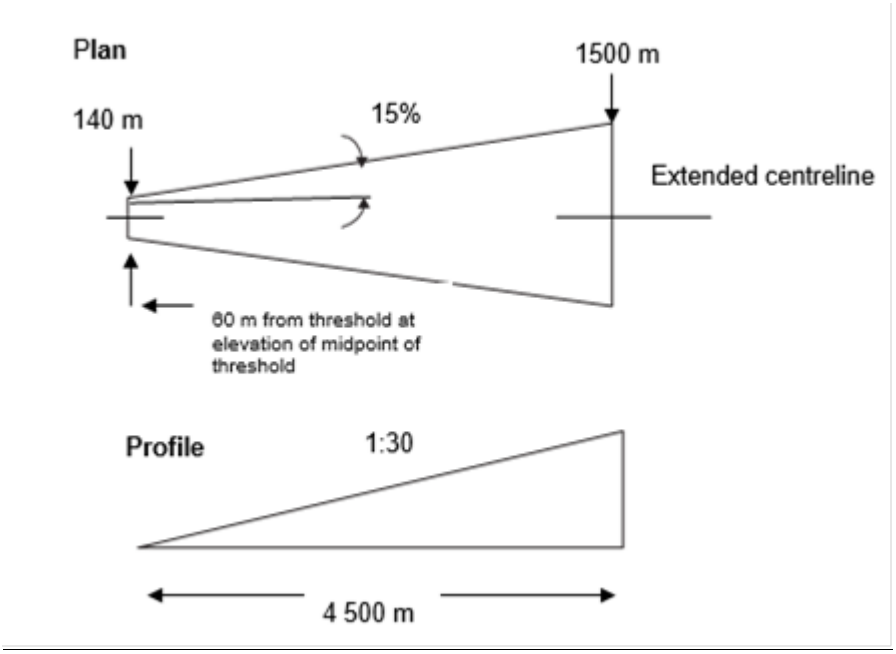


Figure 4.7 Non-precision instrument approach where the code number is 1 or 2

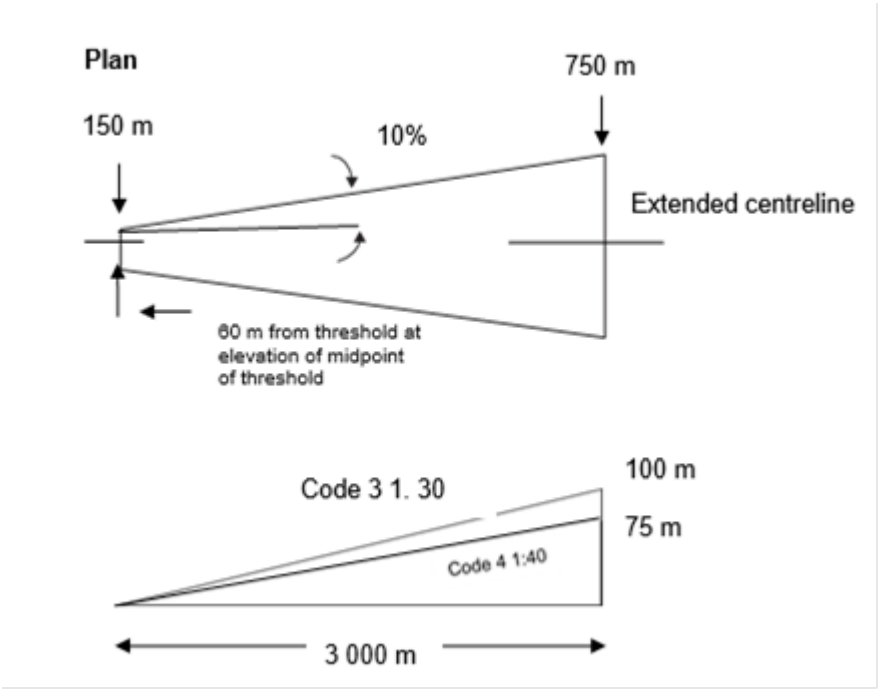


Figure 4.8 Approach surface associated with a non-instrument runway where the code number is 3 or 4

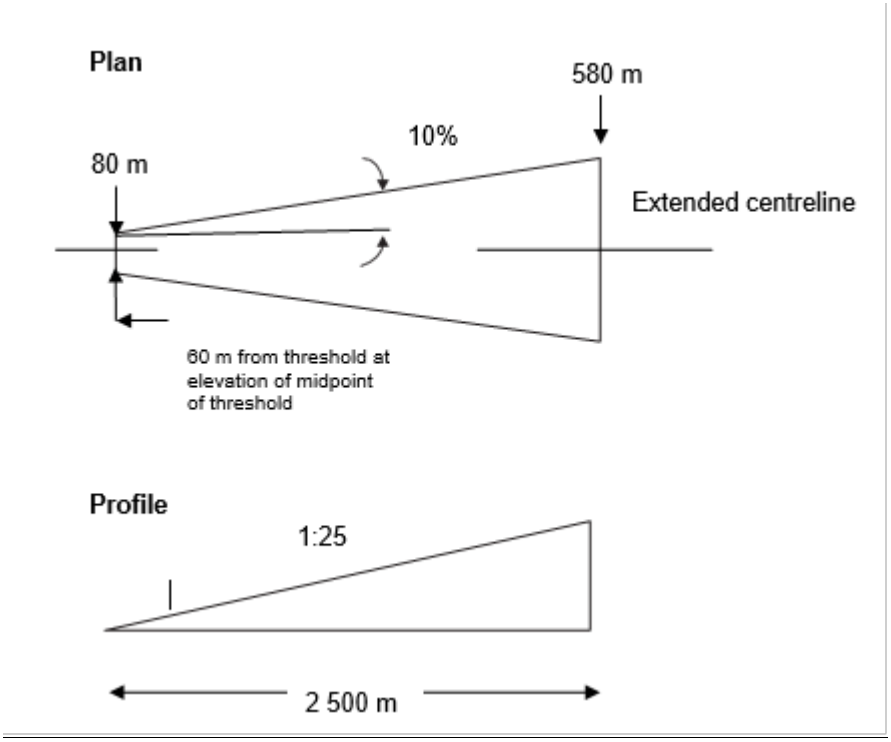


Figure 4.9 Approach surface associated with a non-instrument runway where the code number is 2

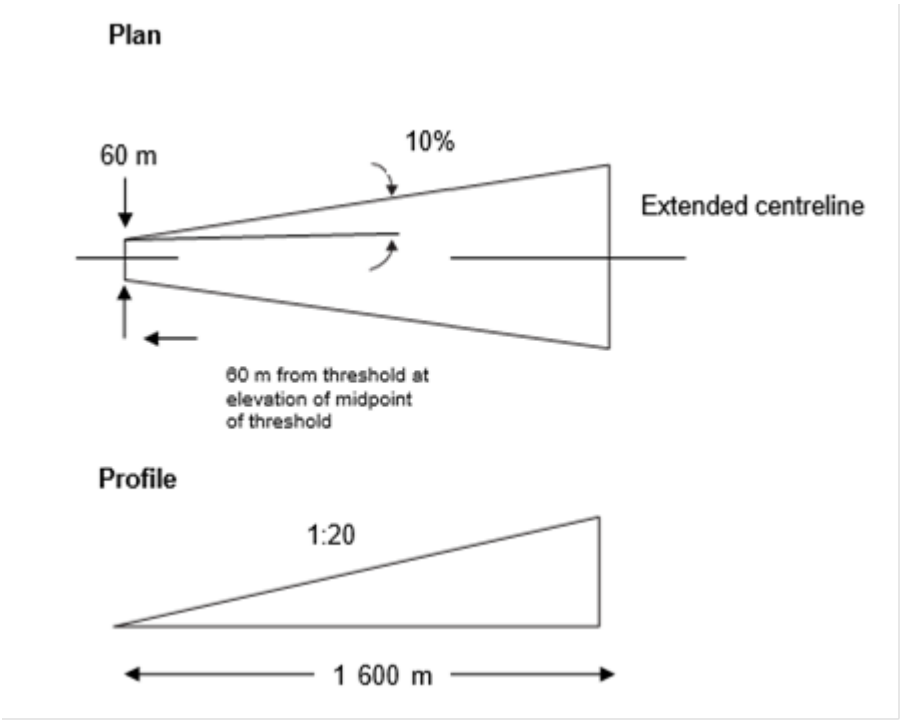


Figure 4.10 Approach surface associated with a non-instrument runway where the code number is 1

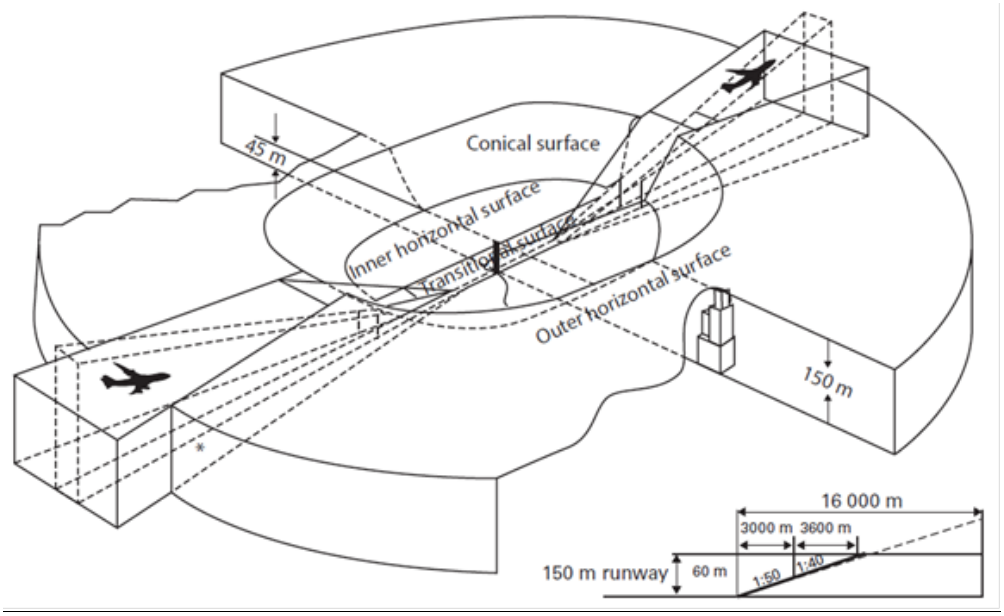


Figure 4.11 Obstacle limitation surfaces for an instrument runway where the main runway is 1800 m or more in length

Note: The take-off funnels are shown in chain-dot line in both views. To assess clarification the vertical scale on this chart is 20 times that of the horizontal scale.

The transitional surface

4.34 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.

4.35 Transitional surfaces are established for every runway intended to be used for landing.

4.36 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 non-instrument or non-precision instrument approach, the slope is 20% (1:5). For all other runways, the slope is 14.3% (1:7).

4.37 The elevation of any point on the lower edge of the surface is;

1. Along the side of the approach surface, equal to the elevation of the approach surface at that point;
2. Along the strip, equal to the elevation of the centreline of the runway opposite that point.

4.38 The outer limit of a transitional surface is determined by its intersection with the plane of the inner horizontal surface.

4.39 An obstacle may be sited in a position that would cause it to infringe the transitional surface only if:

1. It is an aid to navigation;
2. The entire structure complies with the frangibility requirements of obstacles sited within runway strips (chapter 3 refers); and
3. 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.
4. Meets the transitional surface, or where no such intersection occurs;
5. 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.

Balked landing surface

Applicability

4.40 The purpose of the balked landing surface is to protect balked landing.

Description

4.41 An inclined plane located at a specified distance after the threshold, extending between the inner transitional surfaces.

Characteristics

4.42 The limits of the balked landing surface should comprise:

1. An inner edge horizontal and perpendicular to the centre line of the runway and located at a specified distance after the threshold;
2. Two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centre line of the runway; and
3. An outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.

4.43 The elevation of the inner edge should be equal to the elevation of the runway centre line at the location of the inner edge.

4.44 The slope of the balked landing surface should be measured in the vertical plane containing the centre line of the runway.

The inner horizontal surface

4.45 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.

4.46 An inner horizontal surface is established for every aerodrome.

4.47 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.

4.48 The limits of the inner horizontal surface are established as follows:

4.49 Where the main runway is 1800m 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.

4.50 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 non-instrument runways where the code number is 1 or 2. For these runways the radii are 2000m and 250 m respectively.

4.51 Where an end of a subsidiary runway more than 1800 m long is less than 3000m from any point on the periphery of the surface 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.

4.52 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.

The conical surface

4.53 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.

4.54 A conical surface is established for every aerodrome. The slope of the conical surface measured in the vertical plane above the horizontal is 5% (1:20).

4.55 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 non-instrument 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.

The outer horizontal surface

4.56 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.

4.57 An outer horizontal surface is established for every aerodrome where the main runway is 1100 m or more in length.

4.58 The outer horizontal surface extends from the periphery of the conical surface to a minimum radius of 15000m from the aerodrome reference point when the main runway is 1860m or more in length and to a minimum radius of 10000m where the main runway is 1100m or more but less than 1860m in length.

Inner approach surface

Applicability

4.59 The purpose of the inner approach surface is to protect final precision approaches.

Description

4.60 A rectangular portion of the approach surface immediately preceding the threshold.

Characteristics

4.61 The limits of the inner approach surface should comprise:

1. An inner edge coincident with the location of the inner edge of the approach
2. Surface but of its own specified length;
3. Two sides originating at the ends of the inner edge and extending parallel to the
4. Vertical plane containing the centre line of the runway; and an outer edge parallel to the inner The Obstacle Free Zone (OFZ)

4.62 The OFZ is the airspace extending above the inner approach surface, inner transitional surfaces and baulked landing surface and that portion of the strip bounded by these surfaces which is not penetrated by any fixed object other than a low mass and frangibly mounted one required for air navigation purposes.

4.63 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 balked landing with all engines operating normally. It is not intended to supplant the requirement of other surfaces or areas where these are more demanding.

4.64 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.

4.65 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.

4.66 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.

4.67 A narrower OFZ may be acceptable if the wingspan of the aeroplanes at a particular aerodrome is limited to less than 60 m.

4.68 The limits of the OFZ where the code number is 1 or 2 are described in this chapter and illustrated in figure 4.13. The rationale is similar to that detailed in this chapter except that the maximum wingspan is reduced to 30m, the rate of climb on missed approach increased to 4%, and the origin of the balked landing surface is at the upwind end of the runway strip.

4.69 An OFZ is established for each precision instrument approach Category II or III runway and shall be maintained during operations conforming to those categories. An OFZ should be established for precision instrument approach Category I runways and should be maintained during operations conforming to this category.

4.70 The limits of the OFZ where the code number is 3 or 4 comprise;

1. A portion of the instrument approach surface commencing at its inner edge at a width of 60m on each side of the extended centreline of the runway and extending at this width for a distance of 1500m away from the direction of landing, and with an outer edge parallel to the inner edge. This distance shall increase to 70.0m for code F runways;

2. A portion of the runway strip extending to 60m on each side of the runway centreline from a distance of 60 m before threshold to a distance of 1800m beyond threshold. This distance shall increase to 70.0m for code F runways;

4.71 A balked landing surface with;

1. An inner edge coincident with the upwind edge of the area described at 4.70 above, with an elevation of the centreline of the runway at that point;

2. 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;

3. An outer edge parallel to the inner edge and located in the plane of the inner horizontal surface;

4. A slope of 3.33% (1:30) measured in the vertical plane containing the centreline of the runway.

5. Side surfaces which slope upwards at 33.3% (1:3) measured in a vertical plane normal to the centreline of the runway:

6. From the sides of that portion of the approach surface to a height equal to the plane of the inner horizontal surface, with the elevation of any point on the lower edge equal to the elevation of the approach surface at that point.

7. From the sides to a height equal to the plane of the 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.

8. From the sides of the balked landing surface to a height equal to the plane of the inner horizontal surface with the elevation of any point on the lower edge equal to the elevation of the balked landing surface at that point.

4.72 The limits of the OFZ where the code number is 1 or 2 comprise:

1. A portion of the instrument approach surface commencing at its inner edge at a width of 45 m on each side of the runway centreline and extending at this width for a distance of 1500m away from the direction of landing, and with an outer edge parallel to the inner edge.

2. A portion of the runway strip extending to 45 m on each side of the runway centreline from a distance of 60m before threshold to a distance of 60 m beyond the end of the landing distance available.

4.73 A balked landing surface with.

1. An inner edge coincident with the upwind edge of the area described at paragraph 4.70 with an elevation equal to that of the centreline of the runway at that point.
2. 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.
3. An outer edge parallel to the inner edge and located in the plane of the inner horizontal surface.
4. A slope of 4% (1:25) measured in the vertical plane containing the centreline of the runway.
5. Side surfaces which slope upwards at 40% (1:2.5) in a vertical plane perpendicular to the centreline of the runway:
6. From the sides of that portion of the approach surfaces to a height equal to that of the plane of the inner horizontal surface, with the elevation of any point on the lower edge equal to the elevation of the approach surface at that point.
7. From the sides of the area to a height equal to that of the plane of the 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.
8. From the sides of the balked landing surface to a height equal to that of the plane of the inner horizontal surface with the elevation of any point on the lower edge equal to the elevation of the balked landing surface at that point.

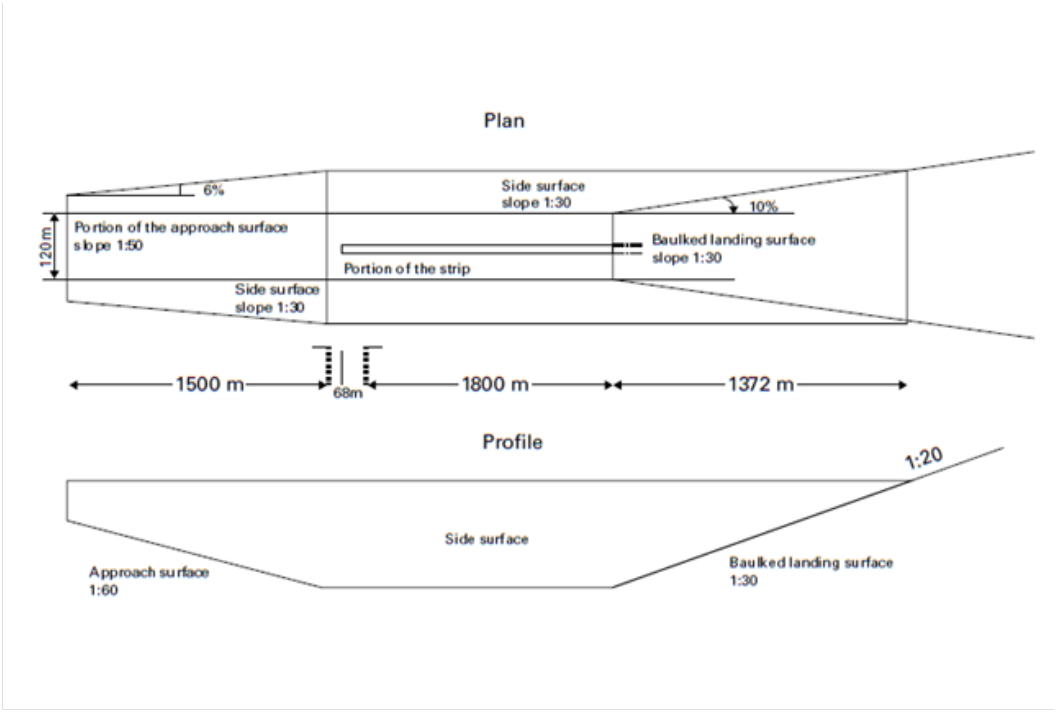


Figure 4.12 OFZ for category I, II and III operations where the code number is 3 or 4 (not to scale)

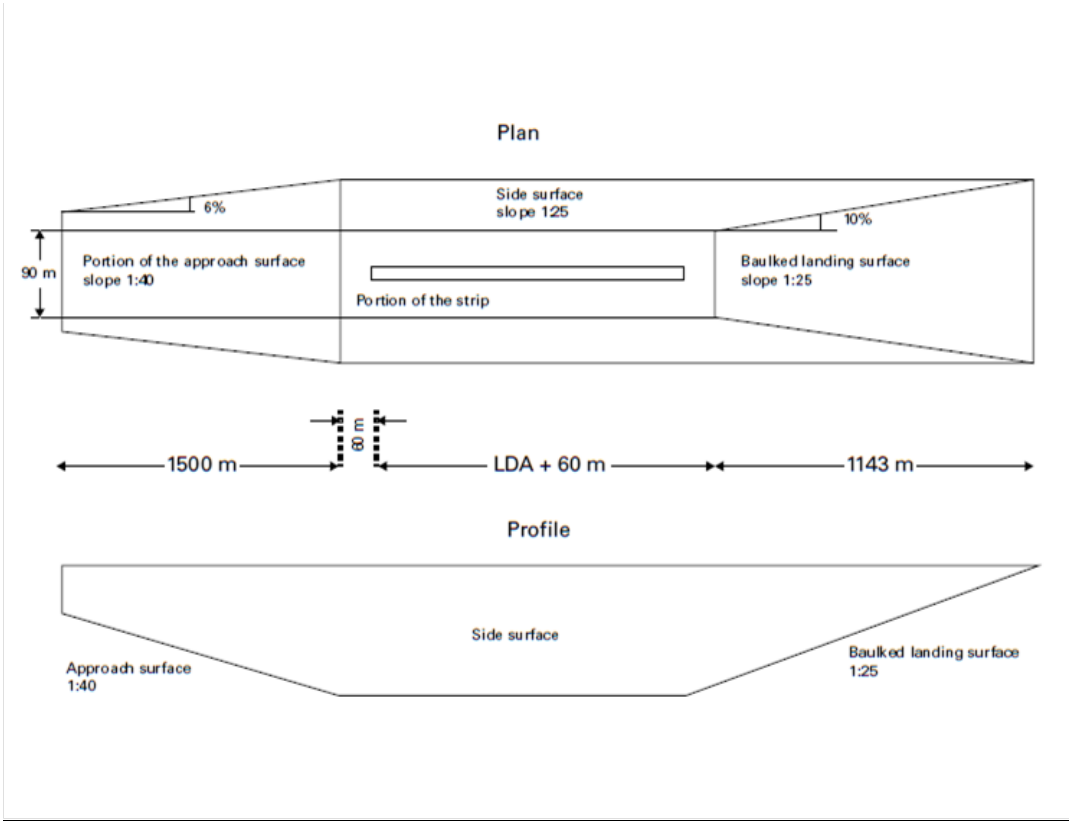


Figure 4.13 OFZ for category I operations where the code number is 1 or 2 (not to scale

Obstacle limitations requirements

4.74 Obstacle limitation requirements should be distinguished between:

1. Non-instrument runways.
2. Non-precision approach runways.
3. Precision approach runways; and
4. Runways meant for take-off

4.75 The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e., take-off or landing, and type of approach, and are intended to be applied when such use of the runway is made. In cases where operations are conducted to or from both directions of a runway, the function of certain surfaces may be nullified because of more stringent requirements of another lower surface.

Non instrument runways

4.76 The following obstacle limitation surfaces should be established for a non-instrument runway:

1. Conical surface;
2. Inner horizontal surface;
3. Approach surface; and
4. Transitional surfaces.

4.77 The heights and slopes of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table 4.2

4.78 New objects or extensions of existing objects should not be permitted above the approach surface beyond 3 000 m from the inner edge, the conical surface or inner horizontal surface except when the object would be shielded by an existing immovable object, or after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

4.79 Existing objects above any of the surfaces required by 1- 4 above should as far as practicable be removed except when the object would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

4.80 Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Doc 9137, Airport Services Manual, Part 6, Control of Obstacles.

4.81 Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered that they may endanger aeroplanes.

4.82 In considering proposed construction, account should be taken of the possible future development of an instrument runway and consequent requirement for more stringent obstacle limitation surfaces.

Non precision approach runways

4.83 The following obstacle limitation surfaces should be established for a non-precision approach runway:

1. Conical surface;
2. Inner horizontal surface;
3. Approach surface; and
4. Transitional surfaces.

4.84 The heights and slopes of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table xxx except in the case of the horizontal section of the approach surface (see paragraph (h) below).

4.85 The approach surface should be horizontal beyond the point at which the 2.5 % slope intersects:

1. A horizontal plane 150 m above the threshold elevation; or
2. The horizontal plane passing through the top of any object that governs the obstacle clearance altitude/height (OCA/H); whichever is the higher

4.86 If it is of particular importance for safe operation on circuits, arrival routes towards the aerodrome or on departure or missed approach climb-paths, an outer horizontal surface for non-precision approach runways should be established.

4.87 Circumstances in which the shielding principle may reasonably be applied are described in ICAO Doc 9137, Airport Services Manual, Part 6, Control of Obstacles.

4.88 Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip

be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger aeroplanes

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

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

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

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

4.93 Circumstances in which the shielding principle may reasonably be applied are described in the ICAO Doc 9137, Airport Services Manual, Part 6, Control of Obstacles.

4.94 Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered that they may endanger aeroplanes

Precision approach runways

4.95 The following obstacle limitation surfaces should be established for a precision approach runway Category I:

1. Conical surface;
2. Inner horizontal surface;

3. Approach surface; and
4. Transitional surfaces.

4.96 The following obstacle limitation surfaces should be established for a precision approach runway Category II or III:

1. Conical surface;
2. Inner horizontal surface;
3. Approach surface and inner approach surface;
4. Transitional surfaces and inner transitional surfaces; and
5. Balked landing surface.

4.97 The heights and slopes of the surfaces should not be greater than, and their other dimensions not less than, those specified in Table 4.2 except in the case of the horizontal section of the approach surface.

4.98 The approach surface should be horizontal beyond the point at which the 2.5 % slope intersects:

1. A horizontal plane 150 m above the threshold elevation; or
2. The horizontal plane passing through the top of any object that governs the obstacle clearance limit; whichever is the higher.

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

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

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

4.102 Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface should, as far as practicable, be removed except when an object would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would

not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.

4.103 In guidance material in ICAO annex 14 Volume 1, all roads are considered to be obstacles extending to 4.8 m above the crown of the road. Similarly, railways, regardless of the amount of traffic, are considered to be obstacles extending 5.4 m above the top of the rails.

4.104 On receipt of an acceptable safety assessment that considers the maximum possible height of the obstacle and has assessed, as far as practicable, future development of the surrounding infrastructure, the CAA may use its discretion in accepting lower values for mobile and fixed obstacles.

4.105 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.

4.106 Anything which may, after a safety assessment or in the opinion of the CAA, endanger aircraft on the movement area must be removed. 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.

4.107 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.

4.108 No object, whether fixed or mobile, is to be permitted to penetrate the balked landing surface of an OFZ established for Category II or III operations. 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.

4.109 Confirmation that the extended OFZ balked 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.

4.110 Objects which would endanger aircraft in the air are not permitted in a clearway.

4.111 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.

4.112 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 0.46m in height.

4.113 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.

4.114 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 does not apply to the shielding of overhead wires.

Restriction and removal of obstacles

4.115 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.

4.116 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.

4.117 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).

4.118 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.

4.119 The second plane extends from the top of the shielding obstacle, towards the runway with a negative slope of 10%. 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).

4.120 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.

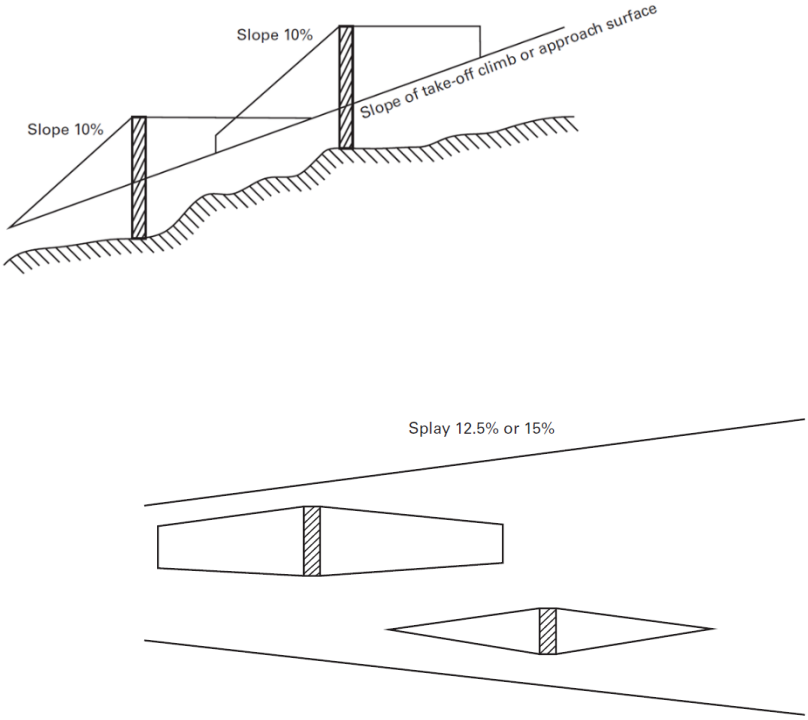


Figure 4.14

4.121 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 4.15).

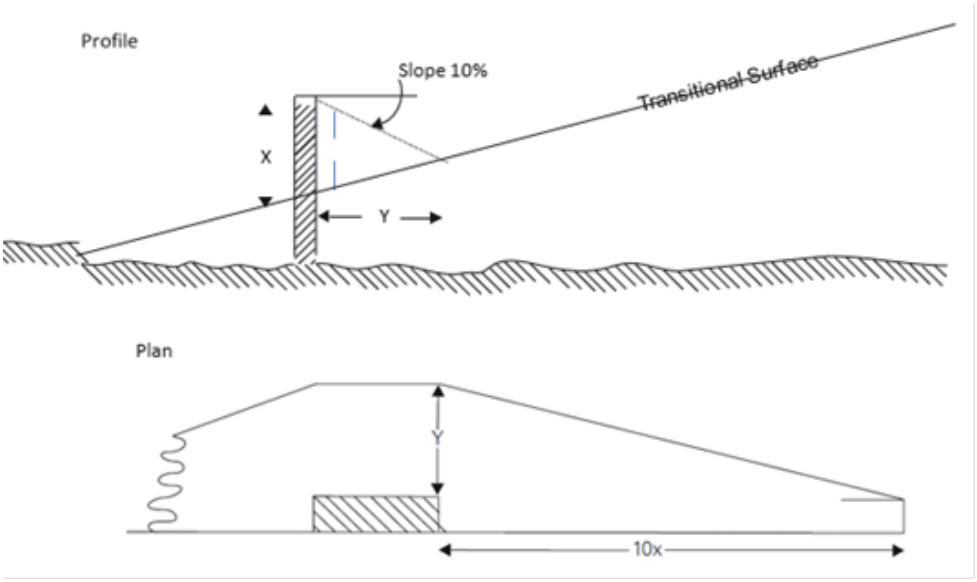


Figure 4.15

Aerodrome safeguarding

4.122 Detailed guidance is incorporated in CAP 738, Safeguarding of Aerodromes.

4.123 Aerodrome operators 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:

1. 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;
2. Procedures for notifying planning authorities of objections;
3. Procedures for consulting the aerodrome's ATC provider to ensure development has no electromagnetic/line of sight issues, either temporary or permanent;
4. Procedures for assessing and monitoring the wildlife hazard risk;
5. Procedures for evaluating potential impacts on instrument approach procedures;
6. Procedures for promulgating infringements in the UK Aeronautical Information Publication (AIP), if appropriate.

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

Marking and lighting of obstacles and unserviceable surface areas

4.125 Markers 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 described in chapter 7.

4.126 When the portion is sufficiently small as to be bypassed safely by aircraft, flags or traffic cones may be used to outline its limits.

4.127 Marker boards alternating with flags or cones, should be used to delineate an unserviceable portion of a grass aerodrome.

Lighting of obstacles

4.128 Obstacle lights should be used to indicate the existence of objects which are to be lit as follows:

4.129 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.

4.130 There are two types of low intensity obstacle lights for fixed obstacles;

1. Group A and Group B (see table 6A.1).
2. Low intensity Group A lights should be used for obstacles on the movement area where Group B lights may cause dazzle.

4.131 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.

4.132 Medium intensity red steady obstacle lights should be used on obstacles between 45 m and less than 150 m in height.

4.133 Medium intensity steady red obstacle lights should be used to indicate the presence of;

1. An obstacle if its height is 150 m or more; or
2. 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.

4.134 Where an aeronautical study conducted by 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.

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

Location of obstacle lights

The top light

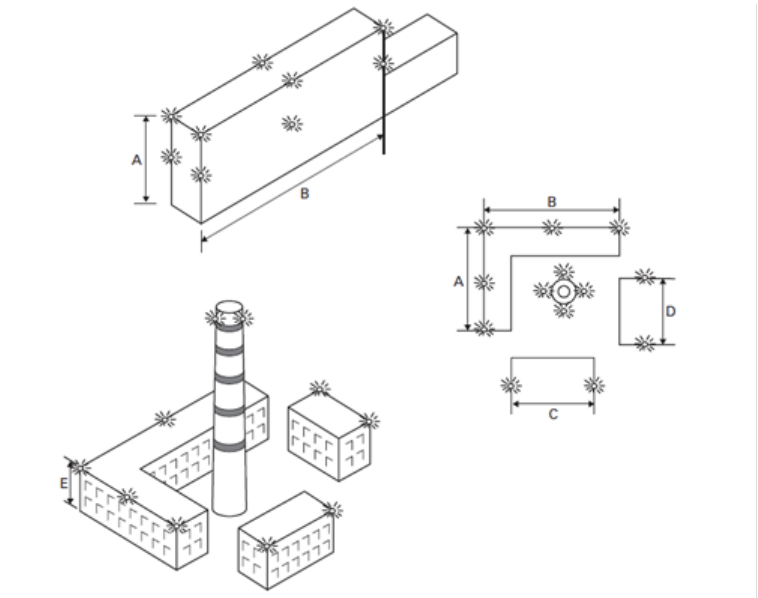
4.136 Except in the case of a chimney or other similar structure, one or more lights should be located at the top of the obstacle. The lights should be so arranged as to indicate the highest points or edges of the obstacle relative to the obstacle limitation surface. If two or more edges are of the same height, the edge nearest the flight path should be lit.

4.137 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.

4.138 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.

4.139 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.

4.140 In the case of a wind turbine, obstacle lights should be installed on the highest point of the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.



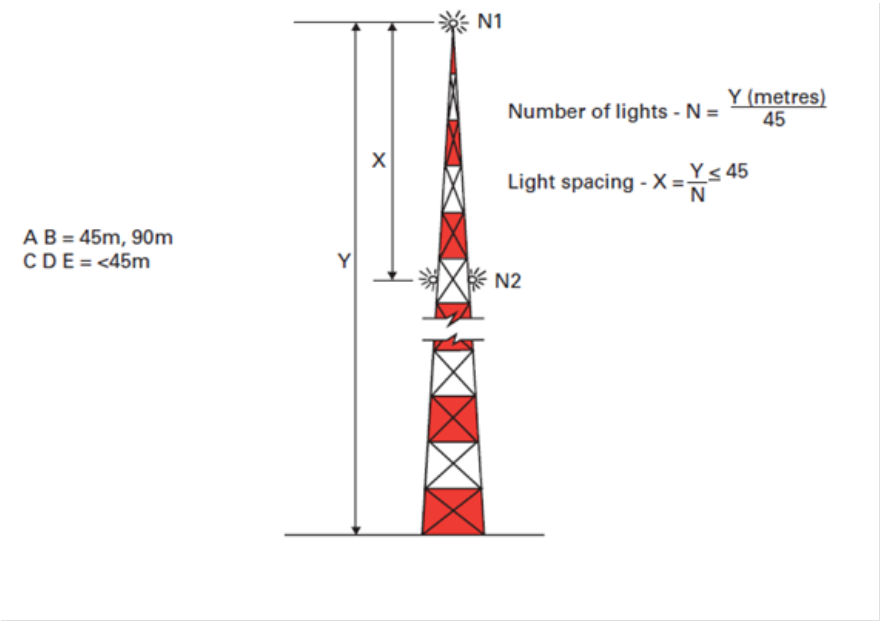


Figure 4.18 Lighting of objects

Intermediate lights

4.141 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:

1. When low or medium intensity obstacle lights are used the spacing should not exceed 52 m;
2. 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.

4.142 Where obstacle lights are used on a tower supporting overhead wires or cables (figure 4.19) they should be located at three levels:

1. On the top of the tower;
2. On the tower at the lowest level of the catenary of the wires or cables; and
3. At approximately mid-way between these two levels.
4. At each level, the lights should be arranged to give full cover in azimuth

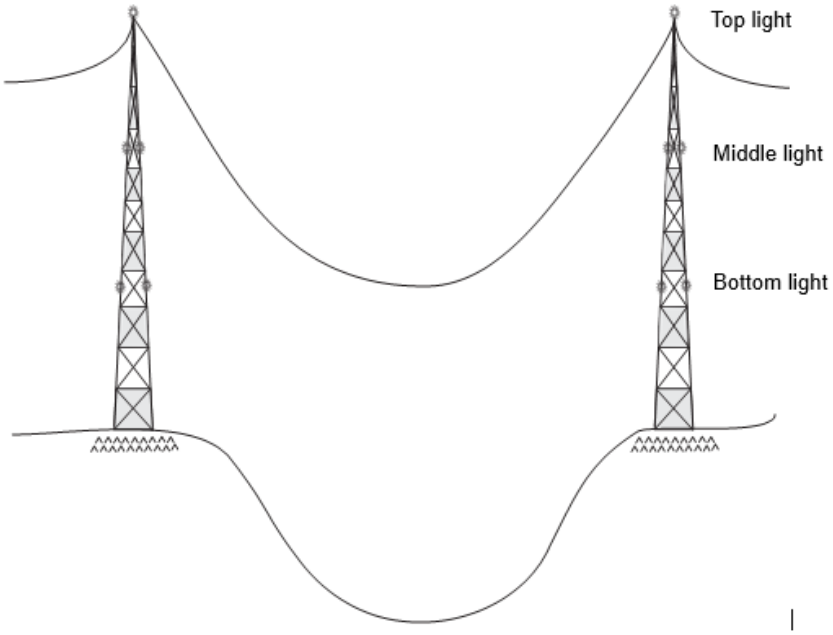


Figure 4.19 Example of intermediate lighting

Lighting of unserviceable parts of the movement area

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

1. To delineate unsafe areas, lights should be spaced at intervals of not more than 7.5 m;
2. 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.

4.144 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.

Lighting of vehicles

4.145 The responsibility for marking and lighting vehicles used on the movement area must be determined between the aerodrome operator and the operators of the vehicles.

4.146 Aerodrome operators are responsible for ensuring that vehicles on the movement area are lit and/or marked as required, irrespective of ownership.

4.147 The specification for yellow flashing vehicle obstacle lights is given in table 6A.1. Strobe lighting is unacceptable this includes the rapid flash of led to simulate the 'on' phase of the sequence.

4.148 Obstacle lights for 'Follow-me' vehicles only shall have characteristics described in figure 6A19.

4.149 The lights specified should be fitted at the highest point of the prime mover vehicle.

4.150 The highest point of trailers should be fitted with steady red lights of not less than 10 cd.

4.151 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.

4.152 Aerodrome ambulances, fire and rescue appliances should, in addition, carry blue flashing lights for use while carrying out emergency duties.

4.153 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.

Light characteristics

Low intensity obstacle lights

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

Medium intensity obstacle lights

4.155 Medium intensity obstacle lights should be steady red light.

High intensity obstacle lights

4.156 High intensity obstacle lights should be flashing white lights.

Replacement of lamps

4.157 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.

4.158 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.

4.159 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.

Periods of illumination of obstacle lighting

4.160 High intensity flashing white obstacle lights should be lit at all times throughout the day and night.

4.161 Steady red medium and low intensity obstacle lights should be lit:

1. 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;
2. On enroute obstacles from 30 minutes before sunset to 30 minutes after sunrise. Should switching present problems, these lights may remain lit continuously.

Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces

4.162 The specifications for objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces apply only to the area under control of the aerodrome operator.

4.163 Elevated aeronautical ground lights within the movement area should be marked so as to be conspicuous by day. Obstacle lights should not be installed on elevated ground lights or signs in the movement area.

4.164 All obstacles within the distance specified in Chapter 3 Table 3.4 column (5),(6) or (7), from the centre line of a taxiway, an apron taxiway or aircraft stand taxilane should be marked and, if the taxiway, apron taxiway or aircraft stand taxilane is used at night, lighted.

4.165 A fixed obstacle that extends above a take-off climb, approach or transitional surface within 3 000 m of the inner edge of the take-off climb or approach surface should be marked and if the runway is used at night, lighted, except that:

1. Such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;
2. The marking may be omitted when the obstacle is lighted by medium intensity

3. Obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m; the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient; and

4. The lighting may be omitted where the obstacle is a lighthouse, and a safety assessment indicates the lighthouse light to be sufficient.

5. A fixed object, other than an obstacle, adjacent to a take-off climb, approach or transitional surface should be marked and, if the runway is used at night, lighted, if such marking and lighting is considered necessary to ensure its avoidance, except that the marking may be omitted when the object is;

    a) Lighted by medium-intensity obstacle lights, Type A, by day; and

    b) Its height above the level of the surrounding ground does not exceed 150 m; or the object is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient.

4.166 A fixed obstacle that extends above a horizontal surface should be marked and if the aerodrome is used at night, lighted, except that:

1. Such marking and lighting may be omitted when:

    a) the obstacle is shielded by another fixed obstacle; or

    b) for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or

    c) a safety assessment shows the obstacle is not of operational significance.

2. The marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day, and its height above the level of the surrounding ground does not exceed 150 m;

3. The marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day if medium intensity lights, Type A, are deemed insufficient; and

4. The lighting may be omitted where the obstacle is a lighthouse, and a safety assessment indicates the lighthouse light to be sufficient.

4.167 A fixed object that extends above an obstacle protection surface should be marked and, if the runway is used at night, lighted, except that such marking

and lighting may be omitted when the obstacle is shielded by another fixed obstacle.

Objects to be marked and/or lighted within the lateral boundaries of the obstacle limitation surfaces

4.168 The marking and/or lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle.

4.169 Other objects inside the obstacle limitation surfaces should be marked and/or lighted if a safety assessment indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway or highway).

4.170 Overhead wires, cables, etc., crossing a river, waterway, valley, or highway should be marked and their supporting towers marked and lighted if a safety assessment indicates that the wires or cables could constitute a hazard to aircraft.

Objects to be marked and/or lighted outside the lateral boundaries of the obstacle limitation surfaces

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

4.172 Obstacles should be marked and lighted, except that the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day.

4.173 When considered as an obstacle, other objects outside the obstacle limitation surfaces should be marked and/or lighted.

Objects to be marked and/or lighted outside the lateral boundaries of the obstacle limitation surfaces

4.174 Other objects outside the obstacle limitation surfaces should be marked and/or lighted if a safety assessment indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway, highway).

4.175 Overhead wires, cables, etc., crossing a river, waterway, valley, or highway should be marked and their supporting towers marked and lighted if a safety assessment indicates that the wires or cables could constitute a hazard to aircraft.

Marking of fixed objects

4.176 All fixed objects to be marked should, whenever practicable, be coloured but if this is not practicable, markers or flags should be displayed on or above them, except those objects that are sufficiently conspicuous by their shape, size, or colour need not be otherwise marked.

4.177 Marking by colour

1. An object should be coloured to show a chequered pattern if it has essentially unbroken surfaces, and its projection on any vertical plane equals or exceeds 4.5 m in both dimensions.
2. The pattern should consist of rectangles of not less than 1.5 m and not more than 3 m on a side, the corners being of the darker colour.
3. The colours of the pattern should contrast with each other and with the background against which they should be seen.
4. An object should be coloured to show alternating contrasting bands if:
    a) it has essentially unbroken surfaces, and has one dimension, horizontal or
    b) vertical, greater than 1.5 m, and the other dimension, horizontal or vertical, less than 4.5 m; or
    c) it is of skeletal type with either a vertical or a horizontal dimension greater than1.5 m.
5. The bands should be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less. The colours of the bands should contrast with the background against which they should be seen.
    a) Orange and white should be used, except where such colours are not conspicuous when viewed against the background.
    b) The bands on the extremities of the object should be of the darker colour (see Figures 4.20 and 4.21). The dimensions of the marking band widths are shown in Table 4.6.
6. An object should be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red should be used, except where such colours merge with the background.

4.178 Marking by flags

1. Flags used to mark fixed objects should be displayed around, on top of, or around the highest edge of the object. When flags are used to mark extensive objects or groups of closely spaced objects, they should be displayed at least every 15 m. Flags should not increase the hazard presented by the object they mark.

2. Flags used to mark fixed objects should not be less than 0.6 m on each side.

3. Flags used to mark fixed objects should be orange in colour or a combination of two triangular sections, one orange and the other white, or one red and the other white. Except where such colours merge with the background, other conspicuous colours should be used

4.179 Marking by markers

1. Markers displayed on or adjacent to objects should be located in conspicuous positions so as to retain the general definition of the object and should be recognisable in clear weather from a distance of;

   a) At least 1 000 m for an object to be viewed from the air; and

   b) 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object.

   c) The shape of markers should be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they should be such that the hazard presented by the object they mark is not increased.

2. A marker should be of one colour. When more than one markers are installed, white and red, or white and orange markers should be displayed alternately. The colour selected should contrast with the background against which it should be seen.

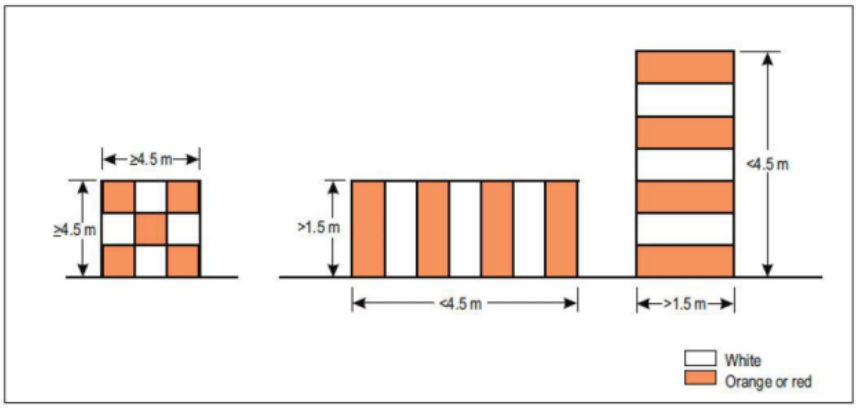


Figure 4.20. Basic marking patterns

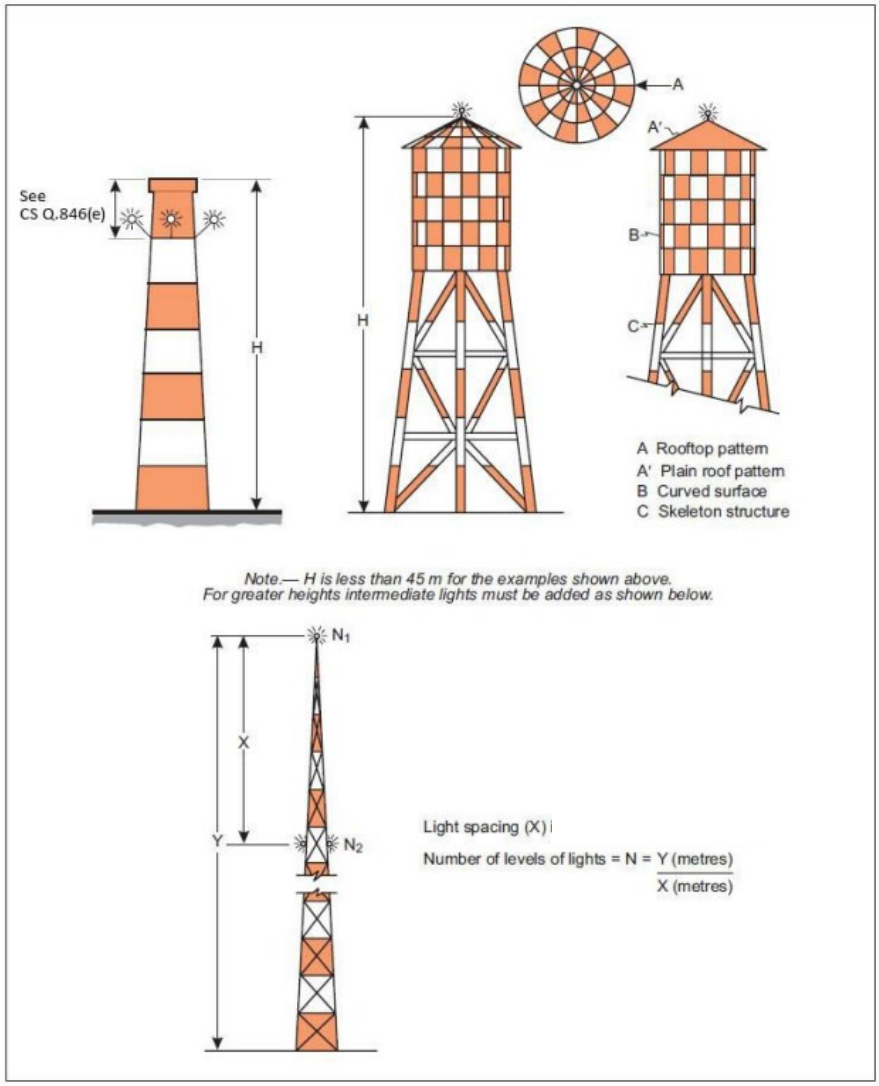


Figure 4.20. Examples of marking and lighting of tall structures

4.180 Orange and white or alternatively red and white are preferably used, except where such colours merge with the background.

4.181 Table Q-4 shows a formula for determining band widths, and for having an odd number of bands, thus permitting both the top and bottom bands to be of the darker colour.

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

4.183 Alternative spacing may be suitable; priority is to highlight the location and definition of the object.

Lighting of fixed objects

4.184 The presence of objects which should be lighted, should be indicated by low, medium, or high-intensity obstacle lights, or a combination of such lights to provide 360-degree coverage.

4.185 Low-intensity obstacle lights, Types A, B, C and D, medium-intensity obstacle lights, Types A, B and C and high-intensity obstacle lights Types A and B, should be in accordance with the specifications in Table 4.3, Chapter 6 and Figure 6.A22 or 6.A23 as appropriate.

4.186 The number and arrangement of low, medium, or high-intensity obstacle lights at each level to be marked should be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object or by an adjacent object, additional lights should be provided on that adjacent object, or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

4.187 In case of an object to be lighted one or more low, medium, or high-intensity obstacle lights should be located as close as practicable to the top of the object.

4.188 In the case of chimney or other structure of like function, the top lights should be placed sufficiently below the top so as to minimise contamination by smoke, etc. (see

4.189 In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance such as a rod or an antenna greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance such a light should be located at the highest practicable point, and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.

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

1. Penetrating a horizontal obstacle limitation surface (OLS) or located outside an OLS, the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to OLS or above the ground, and so as to indicate the general definition and the extent of the objects; and

2. Penetrating a sloping OLS, the top lights should be so arranged as to at least indicate the points or edges of the object highest in relation to the OLS, and so as to indicate the general definition and the extent of the objects. If two or more edges are of the same height, the edge nearest the landing area should be marked.

4.191 When the obstacle limitation surface concerned is sloping and the highest point above the obstacle limitation surface is not the highest point of the

object, additional obstacle lights should be placed on the highest point of the object.

4.192 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and

1. Low-intensity lights are used, they should be spaced at longitudinal intervals not exceeding 45 m.
2. Medium-intensity lights are used, they should be spaced at longitudinal interval not exceeding 900 m.

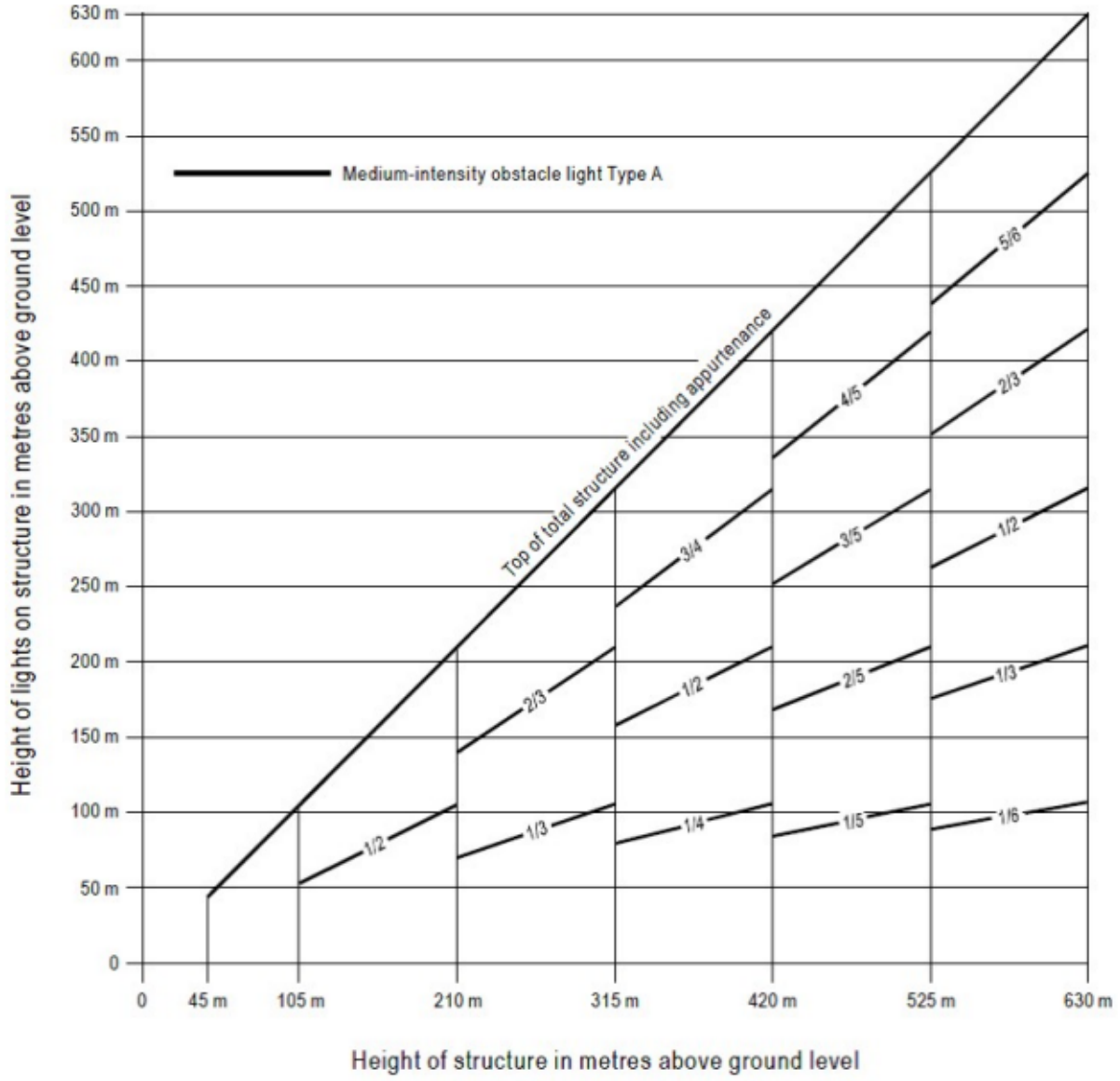
4.193 High-intensity obstacle lights, Type A, and medium-intensity obstacle lights, Types A and B, located on an object should flash simultaneously.

4.194 The installation setting angles for high-intensity obstacle lights, Type A, should be in accordance with Table Q-5.

4.195 Guidance on how a combination of low, medium, and/or high-intensity lights of obstacles should be displayed is given in Figures GM4.1 to GM 4.8.

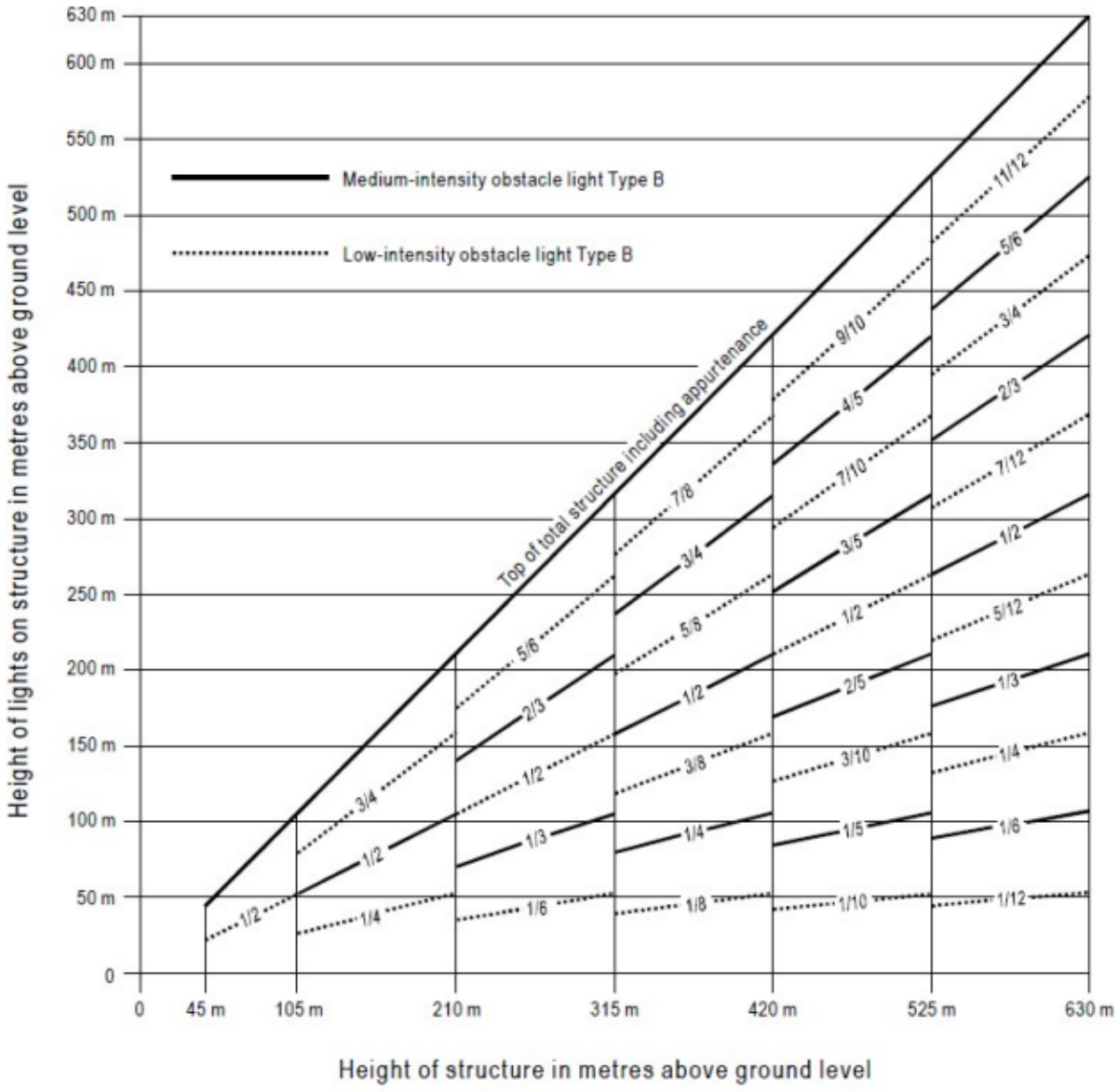
4.196 High-intensity obstacle lights are intended for day use as well as night use. Care should be taken to ensure that these lights do not create disconcerting dazzle or environmental concerns. Guidance on the design, location, and operation of high-intensity obstacle lights is given in ICAO Doc 9157, Aerodrome Design Manual, Part 4,Visual Aids.

4.197 Where, the use of high-intensity obstacle lights, Type A, or medium-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, a dual obstacle lighting system should be provided. This system should be composed of high intensity obstacle lights, Type A, or medium intensity obstacle lights, Type A, as appropriate, for daytime and twilight use and medium-intensity obstacle light, Type B or C, for night-time use.



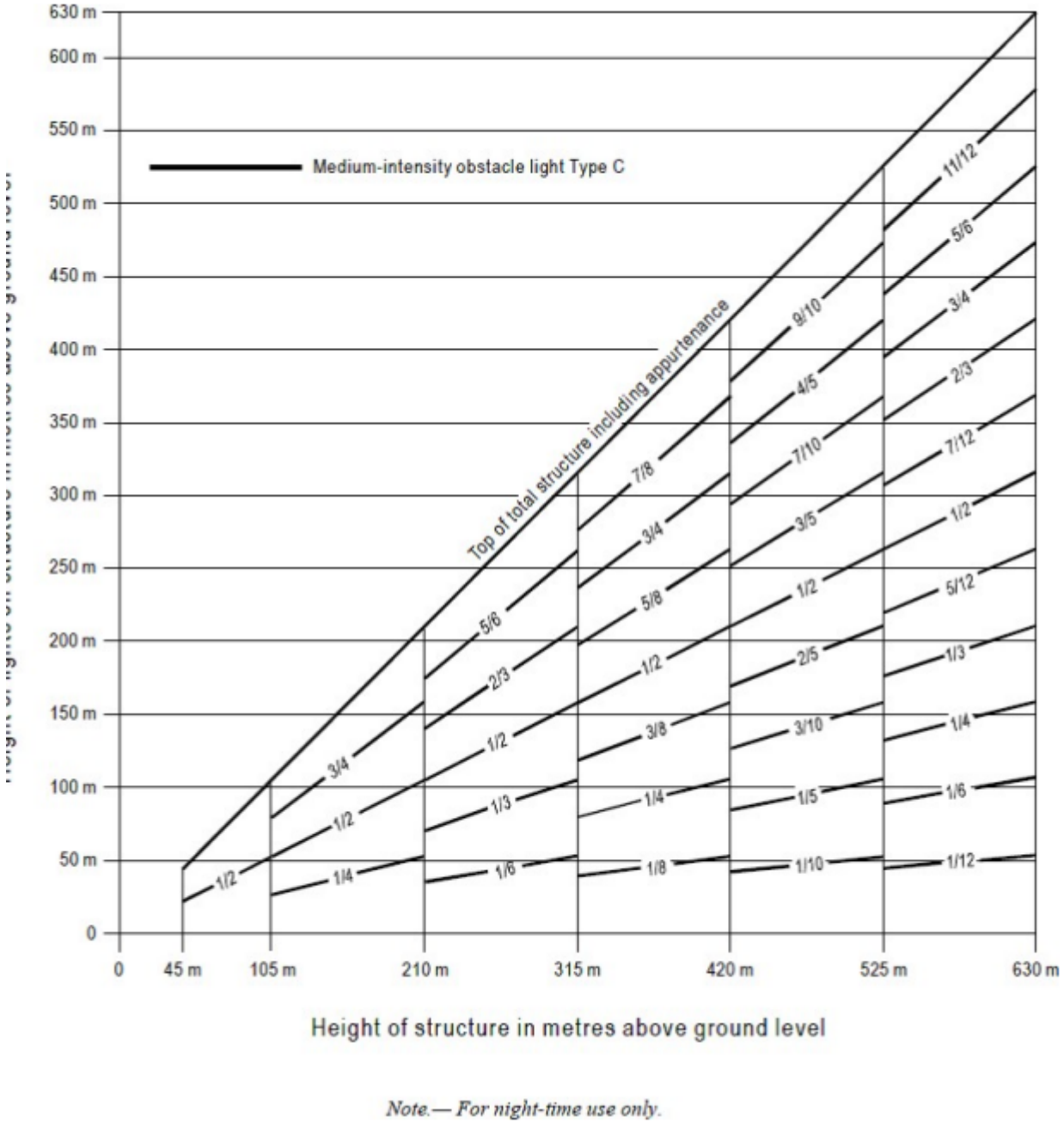
Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level. If medium-intensity lighting is used, marking will also be required.

Figure GM 4.1 Medium-intensity flashing-white obstacle lighting system, Type A



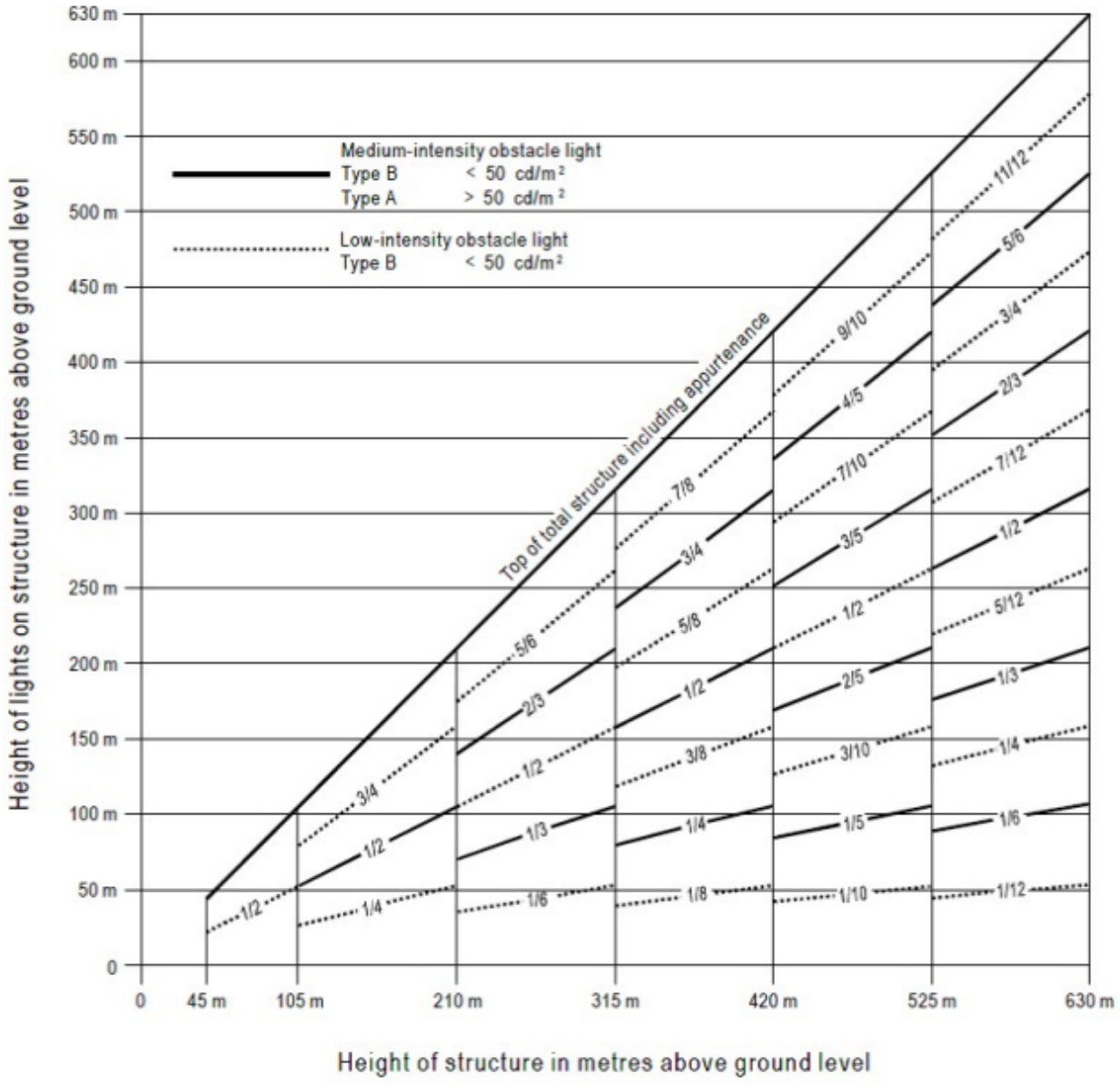
Note.— For night-time use only.

Figure GM 4.2 Medium-intensity flashing-red obstacle lighting system, Type B



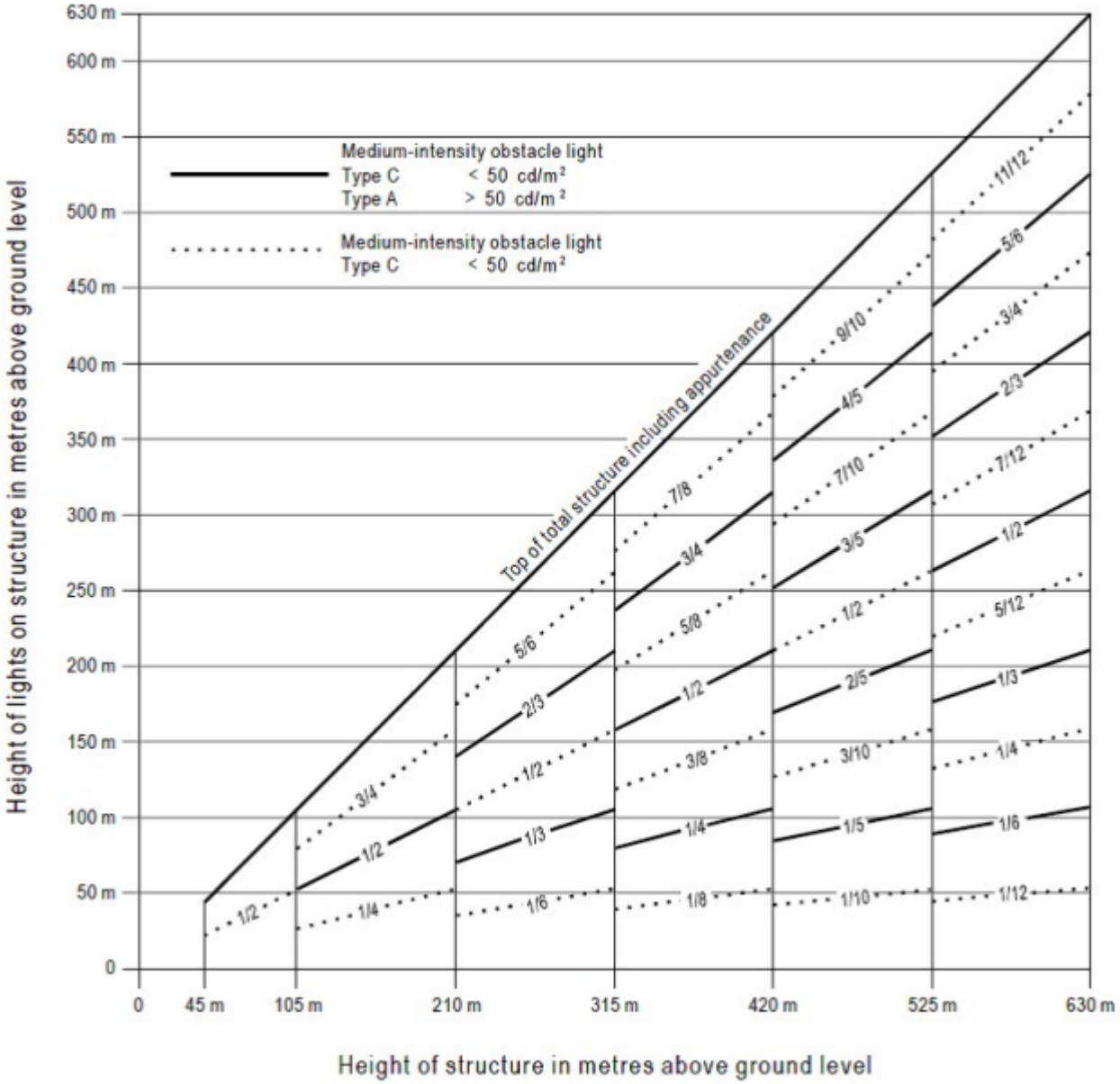
Note.— For night-time use only.

Figure GM 4.3. Medium-intensity fixed-red obstacle lighting system, Type C



Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level. If medium-intensity lighting is used, marking will also be required.

Figure GM 4.4 Medium-intensity dual obstacle lighting system, Type A/Type B



Note.— High-intensity obstacle lighting is recommended on structures with a height of more than 150 m above ground level. If medium-intensity lighting is used, marking will also be required.

Figure 4.5 Medium-intensity dual obstacle lighting system, Type A/Type C

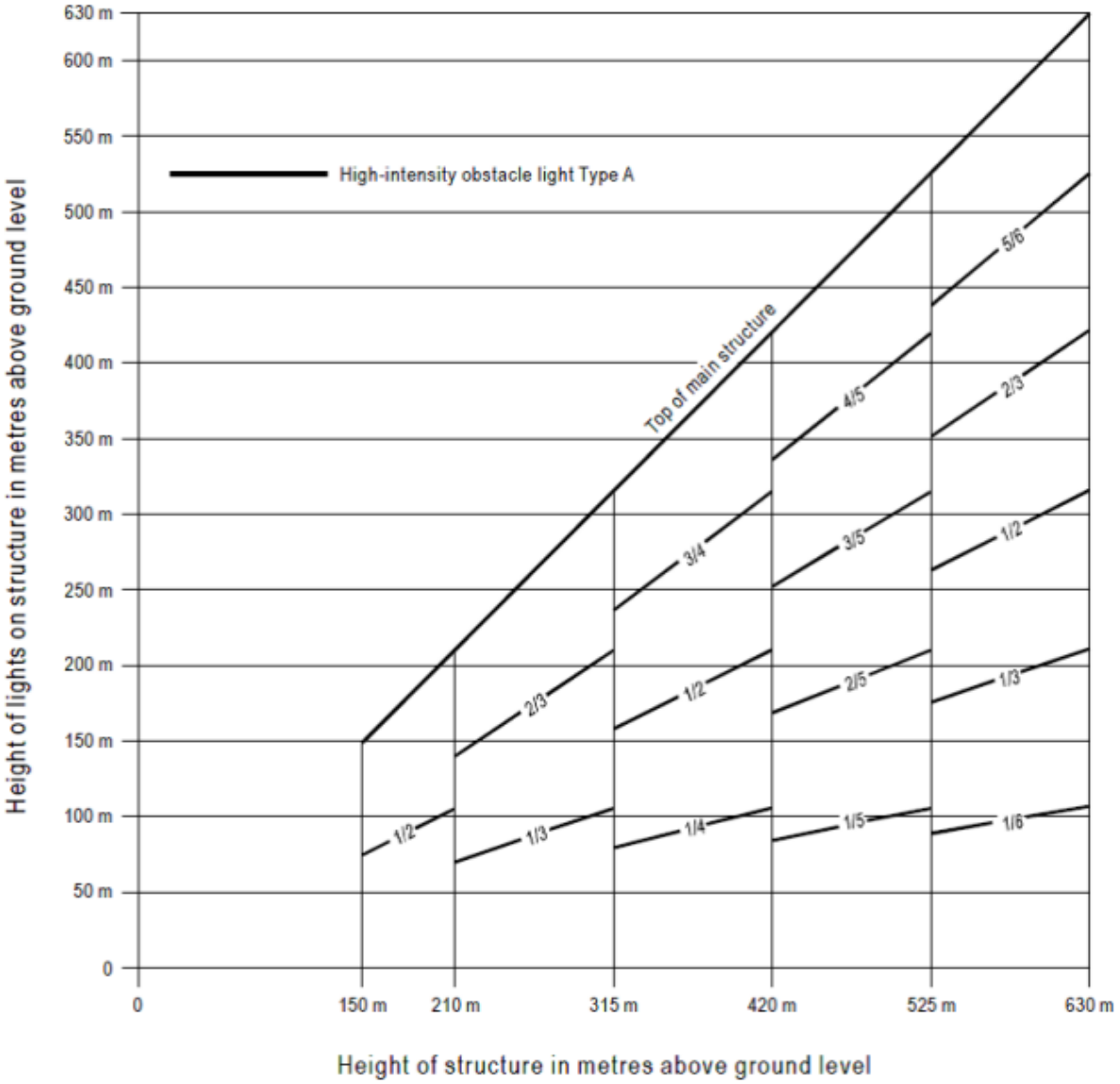


Figure GM 4.6 High-intensity flashing-white obstacle lighting system, Type A

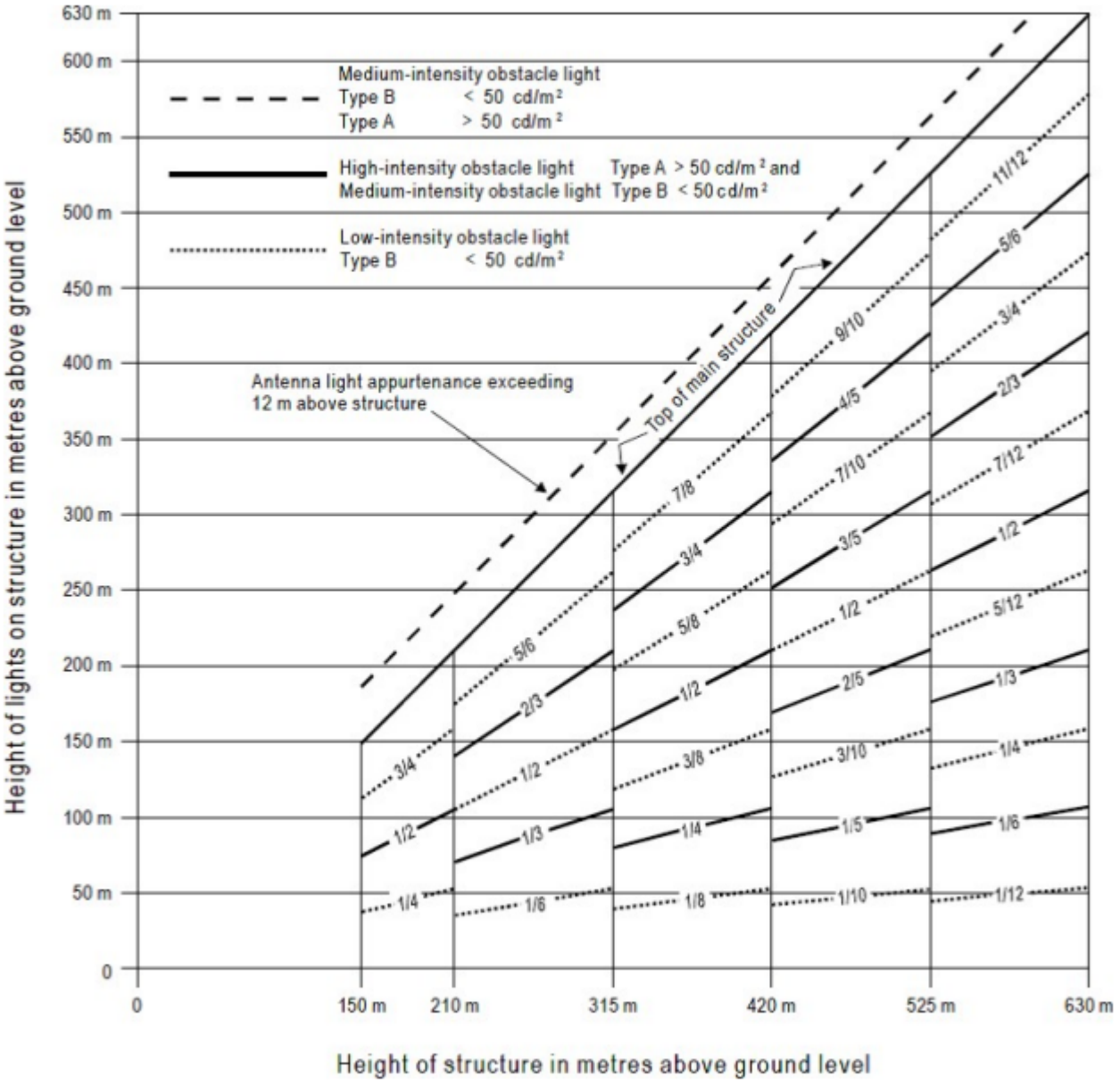


Figure GM 4.7 High-/medium-intensity dual obstacle lighting system, TypeA/Type B

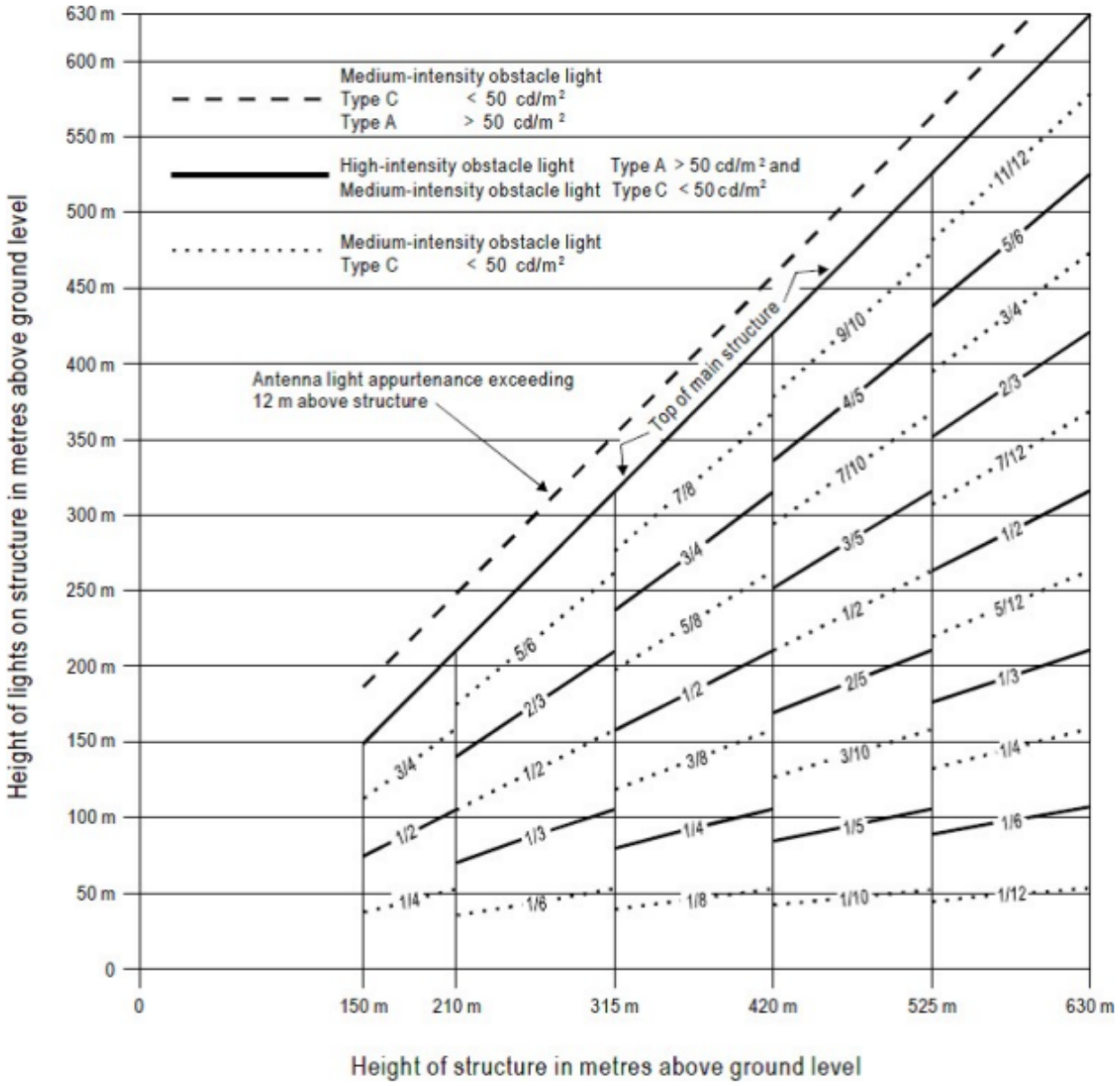


Figure GM 4.8 High-/medium-intensity dual obstacle lighting system, Type A/Type C

In the cases as stated in 4.207 and 4.208), normally the spacing would not exceed 52 m.

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

4.198 Low-intensity obstacle lights, Type A or B, should be used where the object is a less extensive one and its height above the surrounding ground is less than 45 m.

4.199 Where the use of low-intensity obstacle lights, Type A or B, would be inadequate, or an early special warning is required, then medium- or high-intensity obstacle lights should be used.

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

4.201 Medium-intensity obstacle lights, Type A, B, or C should be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, should be used alone, whereas medium-intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.

4.202 A group of buildings is regarded as an extensive object.

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

4.203 Medium-intensity obstacle lights, Type A, B, or C should be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, should be used alone, whereas medium-intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.

4.204 Where an object is indicated by medium-intensity obstacle lights, Type A, and the top of the object is more than 105 m above the level of the surrounding ground, or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings as appropriate, with the spacing not exceeding 105 m.

4.205 Where an object is indicated by medium-intensity obstacle lights, Type B, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels.

4.206 Additional intermediate lights should be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and should be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings as appropriate, with the spacing not exceeding 52 m.

4.207 Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced as equally as practicable, between the top lights and ground level

or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

4.208 Where high-intensity obstacle lights, Type A, are used, they should be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) except that where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be use as the equivalent of the ground level when determining the number of light levels.

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

4.209 Low-intensity obstacle lights, Type A or B, may be used for obstacles higher than 45 m if it is determined to be sufficient.

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

4.210 High-intensity obstacle lights, Type A, should be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and a safety assessment indicates such lights to be essential for the recognition of the object by day.

4.211 Where high-intensity obstacle lights, Type A, are used, they should be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) except where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

4.212 Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.

4.213 Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights should be provided at intermediate levels. These additional intermediate lights should be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and should be spaced, as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

4.214 Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights should be provided at intermediate levels. These additional intermediate lights should be spaced, as equally as practicable, between the

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

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

4.215 Where, the use of high-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, medium-intensity obstacle lights, Type C, should be used alone, whereas medium-intensity obstacle lights, Type B, should be used either alone or in combination with low-intensity obstacle lights, Type B.

Lighting of other objects

4.216 Low-intensity obstacle lights, Type C, should be displayed on vehicles and other mobile objects excluding aircraft.

4.217 Low-intensity obstacle lights, Type C, displayed on vehicles associated with emergency or security should be flashing-blue and those displayed on other vehicles should be flashing yellow.

4.218 Low-intensity obstacle lights, Type D, should be displayed on follow-me vehicles.

4.219 Low-intensity obstacle lights on objects with limited mobility such as aerobridges should be fixed-red, and, as a minimum, be in accordance with the specifications for low intensity obstacle lights, Type A, in Table 4.3. The intensity of the lights should be sufficient to ensure conspicuity considering the intensity of the adjacent lights and the

4.220 Low-intensity obstacle lights, Type C, should be displayed on vehicles and other mobile objects excluding aircraft.

4.221 Low-intensity obstacle lights, Type C, displayed on vehicles associated with emergency or security should be flashing blue and those displayed on other vehicles should be flashing yellow.

4.222 Low-intensity obstacle lights, Type D, should be displayed on follow-me vehicles.

4.223 Low-intensity obstacle lights on objects with limited mobility such as aerobridges should be fixed-red, and, as a minimum, be in accordance with the specifications for low-intensity obstacle lights, Type A, in Table 4.3. The intensity of the lights should be sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general levels of illumination against which they would normally be viewed.

Marking and lighting of wind turbines

4.224 When considered as an obstacle a wind turbine should be marked and/or lighted.

4.225 The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, or if after a safety assessment, it is determined that other colour will improve safety.

4.226 Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation should be in accordance with paragraph 4.224 sub para 5 below, or as determined by a safety assessment.

4.227 When lighting is deemed necessary in the case of a wind farm (i.e. a group of two or more wind turbines), the wind farm should be regarded as an extensive object, and lights should be installed:

1. To identify the perimeter of the wind farm;
2. Respecting the maximum spacing, between the lights along the perimeter, or if after a safety assessment, it is determined that a greater spacing can be used;
3. So that, where flashing lights are used, they flash simultaneously throughout the wind farm;
4. So that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and
5. At locations prescribed in (1), (2) and (5):
    a) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium intensity lighting on the nacelle;
    b) for wind turbines from 150 m to 315 m in overall height, in addition to the medium intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light; the lights should be installed to assure that the output of either light is not blocked by the other;
    c) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low intensity Type E lights, that are configured to flash at the same rate as the light on the nacelle; low intensity Type A or B lights may be used if an safety assessment shows that low intensity Type E lights are not suitable.

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

Marking and lighting of wind turbines

4.229 Additional markings and lighting may be provided to the wind turbines if indicated by safety assessment.

4.230 Case by case studies for wind turbines of more than 315 m of overall height may conclude that additional markings and lighting are required.

Marking and lighting of overhead wires, cables, supporting towers, etc.

4.231 The wires, cables, etc. to be marked should be equipped with markers; the supporting tower should be coloured.

4.232 Marking by colours: The supporting towers of overhead wires, cables, etc. that require marking should be marked except that the marking of the supporting towers may be omitted when they are lighted by high-intensity obstacle lights by day.

4.233 Marking by markers:

1. Markers displayed on or adjacent to objects should be located in conspicuous positions so as to retain the general definition of the object and should be recognisable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object.

2. The shape of markers should be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they should be such that the hazard presented by the object they mark is not increased.

3. A marker displayed on an overhead wire, cable, etc., should be spherical and have a diameter of not less than 60 cm.

4. The spacing between two consecutive markers, or between a marker and a supporting tower, should be appropriate to the diameter of the marker. The spacing should normally not exceed:

   a) 30 m where the marker diameter is 60 cm, increasing progressively with increase of the marker diameter to:

   b) 35 m where the marker diameter is 80 cm; and further progressive increases to a maximum of 40 m where the marker diameter is of at least 130 cm.

   c) Where multiple wires, cables, etc., are involved, a marker should be located not lower than the level of the highest wire at the point marked.

5. A marker should be of one colour. When installed, white and red, or white and orange, markers should be displayed alternately. The colour selected should contrast with the background against which it should be seen.

6. When it has been determined that an overhead wire, cable, etc., needs to be marked but it is not practicable to install markers on the wire, cable, etc., then high-intensity obstacle lights, Type B, should be provided on their supporting towers.

4.234 Lighting:

1. High-intensity obstacle lights, Type B, should be used to indicate the presence of the tower supporting overhead wires, cables, etc. where:

   a) a safety assessment indicates such light to be essential for the recognition of the presence of wires, cables, etc.; or

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

2. Where high-intensity obstacle lights, Type B, are used, they should be located at three levels:

   a) at the top of the tower;

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

   c) at approximately midway between these two levels.

3. High-intensity obstacle lights, Type B, indicating the presence of a tower supporting overhead wires, cables, etc., should flash sequentially; first the middle light, second the top light, and last the bottom light. The intervals between flashes of the lights should approximate the following ratios:

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

4. The installation setting angles for high-intensity obstacle lights, Types B, should be in accordance with Table 4.7.

Characteristics of obstacle lights

Light type	Colour	Signal type/ (Flash rate)	Peak intensity (cd) at given Background Luminance (b)			Light Distribution Table
			Day (Above 500 cd/m2)	Twilight (50 - 500 cd/m2)	Night Below 50 cd/m2	
Low-intensity Type A (fixed obstacle)	Red	Fixed	N/A	N/A	10	Table 4.4
Low-intensity Type B (fixed obstacle)	Red	Fixed	N/A	N/A	32	Table 4.4
Low-intensity Type C (mobile obstacle	Yellow / Blue (a)	Flashing (60 – 90 fpm)	N/A	40	40	Table 4.4
Low intensity Type D (follow me vehicle)	Yellow	Flashing (60 – 90 fpm)	N/A	200	200	Table 4.4
Low intensity Type E	Red	Flashing (c)	N/A	N/A	32	Table 4.4 (Type B)
Medium intensity Type A	White	Flashing (20 – 60 fpm)	20 000	20 000	2 000	Table 4.5

Medium intensity Type B	Red	Flashing (20 – 60 fpm)	N/A	N/A	2 000	Table 4.5
Medium intensity Type C	Red	Fixed	N/A	N/A	2 000	Table 4.5
High intensity Type A	White	Flashing (40 – 60 fpm)	200 000	20 000	2 000	Table 4.5
High intensity Type B	White	Flashing (40 – 60 fpm)	100 000	20 000	2 000	Table 4.5

Table 4.2 Characteristics of obstacle lights

Notes:

a) Vehicles see Para 4.218.

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

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

Light distribution for low-intensity obstacle lights

			Vertical beam spread (f)	
	Minimum Intensity (a)	**Maximum Intensity (a)**	**Minimum Beam Spread**	**Intensity**
Type A	10 cd (b)	N/A	10°	5 cd
Type B	32 cd (b)	N/A	10°	16 cd
Type C	40 cd (c)	400 cd	12° (d)	20 cd
Type D	200 cd (c)	400 cd	N/A (e)	N/A

Table 4.4 Light distribution for low-intensity obstacle lights

Notes:

The tables do not include recommended horizontal beam spreads. Para 4.188 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

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

a) Between 2 and 10° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.

b) Between 2 and 20° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.

c) Peak intensity should be located at approximately 2.5° vertical.

d) Peak intensity should be located at approximately 17° vertical.

e) Beam spread is defined as the angle between the horizontal plan and the directions for which the intensity exceeds that mentioned in the ‘intensity’ column.

Light distribution for medium and high-intensity obstacle lights

Minimum requirements			
Benchmark intensity	Vertical elevation angle (b)		
	0°	-1°	
	Minimum average intensity (a)	Minimum intensity (a)	Minimum intensity (a)
200 000	200 000	150 000	75 000
100 000	100 000	75 000	37 500
20 000	20 000	15 000	7 500
2 000	2 000	15 00	750

Table 4.5(a). Light distribution for medium and high-intensity obstacle lights

Light distribution for medium- and high-intensity obstacle lights

Minimum requirements		
Benchmark intensity	Vertical beam spread (c)	
	Minimum beam spread	Intensity (a)
200 000	7°	75 000
100 000	7°	37 500
20 000	N/A	N/A
2 000	N/A	N/A

Table 4.5(b). Light distribution for medium- and high-intensity obstacle lights

Light distribution for medium- and high-intensity obstacle lights

Recommendations			
Benchmark intensity	Vertical elevation angle (b		
	0°	-1°	-10°
	Maximum intensity (a)	Maximum intensity (a)	Maximum intensity (a)
200 000	250 000	112 500	7 500
100 000	125 000	56 200	3 750
20 000	25 000	11 250	750
2 000	2 500	1 125	75

Table 4.5(c). Light distribution for medium- and high-intensity obstacle lights

Light distribution for medium- and high-intensity obstacle lights

Recommendations		
Benchmark intensity	Vertical elevation angle (c)	
	Maximum beam spread	Maximum intensity (a)
200 000	250 000	112 500
100 000	125 000	56 200
20 000	25 000	11 250
2 000	2 500	1 125

Table 4.5(d). Light distribution for medium- and high-intensity obstacle lights

Note: The tables does not include recommended horizontal beam spreads. Chapter 4 para 4.184 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

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

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

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

Note: an extended beam spread may be necessary under specific configuration and justified by an aeronautical study.

Marking band widths

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

Table 4-6. Marking band widths

Installation setting angles for high-intensity obstacle lights

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

Table 4.7. Installation setting angles for high-intensity obstacle lights

CHAPTER 5

Wildlife Strike Hazard Management for Aerodromes

5.1 Wildlife, birds especially, waterfowl, birds in flocks and other forms of wildlife, have the potential to cause significant damage to airframes and engines, especially turbine engines, and therefore their presence on an aerodrome and its immediate flight paths should be deterred.

5.2 All reasonable measures should be taken to address those features on the aerodrome that may attract wildlife, control the existence wildlife on the aerodrome, and, where practicable, in the vicinity of the aerodrome to prevent bird flight lines across the aerodrome and its approach and departure routes.

5.3 The aerodrome operator should:

1. Assess the wildlife hazard on and in the vicinity of the aerodrome;
2. Take action to establish means and procedures to minimise the risk of collision between wildlife and aircraft at the aerodrome; and
3. Notify the appropriate authority if a wildlife assessment indicates conditions in the vicinity of the aerodrome are conducive to a wildlife hazard problem.

   Guidance material on current best practice for all aspects of wildlife control is detailed in CAP 772, Aerodrome Wildlife Strike Hazard Management and Reduction.

Wildlife control management

5.4 A Wildlife Management Plan (WMP) should be developed in order to:

1. Assess the potential wildlife strike risk;
2. Reduce wildlife infestation on the aerodrome as much as practicable;
3. 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 wildlife strike risk;
4. Monitor and assess wildlife strike or wildlife strike events; and

5. Strive to improve the effectiveness of the plan through ongoing evaluation by competent personnel.

5.5 Details of, or reference to, the wildlife management plan should be included in the aerodrome manual.

CHAPTER 6

Aeronautical Ground Lighting

AGL General information

6.1 AGL provides flight crew 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.

6.2 In dusk or poor visibility conditions by day, lighting can be more effective than marking. For lights to be effective in such conditions or in poor visibility by night, they must be of adequate intensity. To obtain the required intensity, it will usually be necessary to make the light directional, in which case the arcs over which the light shows will have to be adequate and so orientated as to meet the operational requirements.

6.3 The runway lighting system will have to be considered as a whole, to ensure that the relative light intensities are suitably matched to the same end and are maintained over time.

Guidance on maintenance criteria for aeronautical ground lights and on the use of a site standard is contained in the Aerodrome Design Manual (Doc 9157), Part 4).

6.4 The type of lighting is specified according to the runway approach category and take-off (T/O) minima.

6.5 Where the prescribed scale cannot be provided for an instrument runway, there may be a consequential penalty on operational minima (UK AIP AD 1.1.2 Aerodrome Operating Minima.

6.6 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 this chapter.

6.7 AGL for precision instrument 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 instrument approaches and should be provided where there are public transport passenger operations.

6.8 AGL requirements for SA Category I and SA Category II approach operations can be found in The UK Air Operations Regulation

AGL – Minimum licensing requirements

	Day or night operations					Night only operations		
	App Cat II & III	T/O RVR <400	App Cat I	T/O RVR 400–800	App N/P Instrument	T/O RVR 800–1200	App Non-Instrument	T/O >1200
Equipment	**Scale L1**		**Scale L2**		**Scale L3**		**Scale L4**	
Aerodrome Beacon	O	–	R	–	R	–	R	–
Approach								
HI C/L 5-bars	R	–	R	–	–	–	–	–
Supplementary	R	–	–	–	–	–	–	–
Simple	–	–	–	–	R	–	O	–
Sequenced strobe	–	–	–	–	–	–	–	–
Approach Slope								
PAPI	R	–	R	–	O	–	–	–
HI (A)PAPI	–	–	–	–	R	–	O	–
LI (A)PAPI	–	–	–	–	–	–	R	–
Runway								
HI edge, threshold, end	R	R	R	R	R	O	–	–
LI edge, threshold, end	–	–	–	–	–	R	R	R
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	–	–	–	–
Edge	–	–	R	R	R	R	O	O
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
Alternate Input Power Supply	R	R	R	R	O	O	O	O

Illuminated Wind Sleeve	R	R	R	R	R	R	R	R

Table 6.1 AGL – minimum licensing requirements

Key:

R = Required O = Operationally desirable

C/L = Centreline HI = High Intensity

LI = Low Intensity NP = Non-Precision

App = Approach

Notes:

6.9 All runways used for public transport passenger operations should be equipped with PAPI.

Additional guidance on the purpose and significance of AGL may be found in the Visual Aids Handbook, CAP 637.

Periods of display of aeronautical ground lighting

6.10 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:

6.11 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:

6.12 Irrespective of weather conditions.

6.13 Aerodrome beacons and obstacle lighting should be displayed at night whenever the aerodrome is available for use.

AGL for helicopter night landing training

6.14 Where helicopter night landing training is conducted at an aerodrome, a six-light helicopter lit aiming point (see figure 6.1) may be provided. The lights of the aiming point should be omni-directional, white, and useable from a distance of 4 nm.

6.15 When positioned on an aerodrome with a fixed wing runway also in use, the aiming point should be sited so as to permit safe parallel approaches, to avoid obstructions and to minimise noise nuisance. Alignment lighting may be used, where no less than 3 white lights on either side of the triangle

spaced between 1.5m to 3m, in the preferred approach directions are installed.

6.16 Temporary installations may be provided using removable lights where no marking is provided. Care should be taken to ensure the FATO is suitably graded and has suitable load bearing to receive an emergency landing. In all cases permanent installations with markings are recommended.

6.17 If already provided, a proportional T may be used and be notified to the CAA and included in the Permission to display.

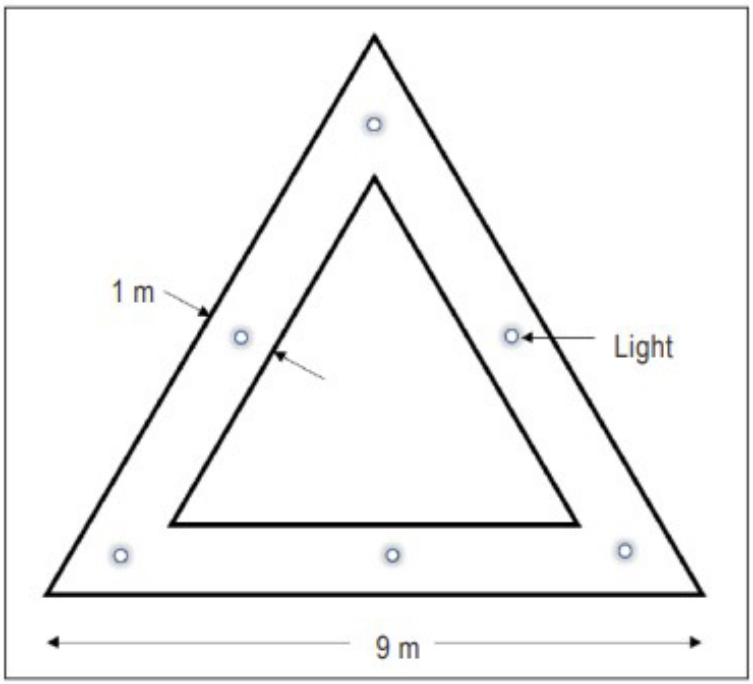


Figure 6.1

Aerodrome beacon

Application

6.18 Where operationally necessary an aerodrome beacon or an identification beacon shall be provided at each aerodrome intended for use at night.

6.19 The operational requirement shall be determined having regard to the requirements of the air traffic using the aerodrome, the conspicuity of the aerodrome features in relation to its surroundings and the installation of other visual and non-visual aids useful in locating the aerodrome.

Aeronautical beacon

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

1. Aircraft navigate predominantly by visual means;

2. Reduced visibilities are frequent; or
3. It is difficult to locate the aerodrome from the air due to surrounding lights or terrain.

Location

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

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

6.23 Aerodrome beacons should be omni-directional and have a minimum effective flash luminous intensity equivalent to not less than 2000 cd in white.

6.24 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.

6.25 The flash rate should be fixed as follows:

1. Coded beacons – 6 to 8 words per minute;
2. Non-coded beacons – 20 to 30 flashes per minute.

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

Identification Beacon

6.27 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.

6.28 The type of identification beacon and any associated morse code symbol to be provided at an aerodrome will be determined by the CAA.

6.29 An identification 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.

6.30 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.

Circling guidance lights

6.31 Circling guidance lights should be provided when existing approach and runway lighting systems do not satisfactorily permit identification of the runway and/or approach area to a circling aircraft intending to carry out circling approaches.

6.32 Circling guidance lighting should be provided where visual approaches to the aerodrome or flying training take place at night.

6.33 It should 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.

Location and positioning

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

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

6.35 Circling guidance lights should consist of:

1. Lights indicating the extended centre line of the runway and/or parts of any approach lighting system; or
2. lights indicating the position of the runway threshold; or
3. lights indicating the direction or location of the runway; or a combination of such lights as is appropriate to the runway under consideration.

Characteristics

6.36 Circling guidance lights should be fixed, or flashing lights of an intensity and beam spread adequate for the conditions of visibility and ambient light in which it is intended to make visual circling approaches. The flashing lights should be white, and the steady lights either white or gaseous discharge lights.

6.37 The lights should be designed and be installed in such a manner that they should not dazzle or confuse a pilot when approaching to land, taking off, or taxiing.

Approach lighting

6.38 Approach lighting provides alignment, roll guidance and limited distance-to-go information for the visual completion of an instrument approach.

High intensity coded centreline and crossbar approach lighting system

6.39 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 150m 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.

6.40 The illustration at figure 6.2 shows the plan view for precision instrument approach operations. Vertical setting angles are contained in table 6A.2 and the associated Notes, and in figure 6A.1.

6.41 The length is installed should be appropriate to the approach procedure and specified pattern.

6.42 The length of 900 m is based on providing guidance for operations under Category I, II and III conditions. 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, however, reduced lengths may support Category II and III operations but may impose limitations on Category I operations. Additional guidance is given in ICAO Annex 14, Attachment A, Section 11

Supplementary approach lighting

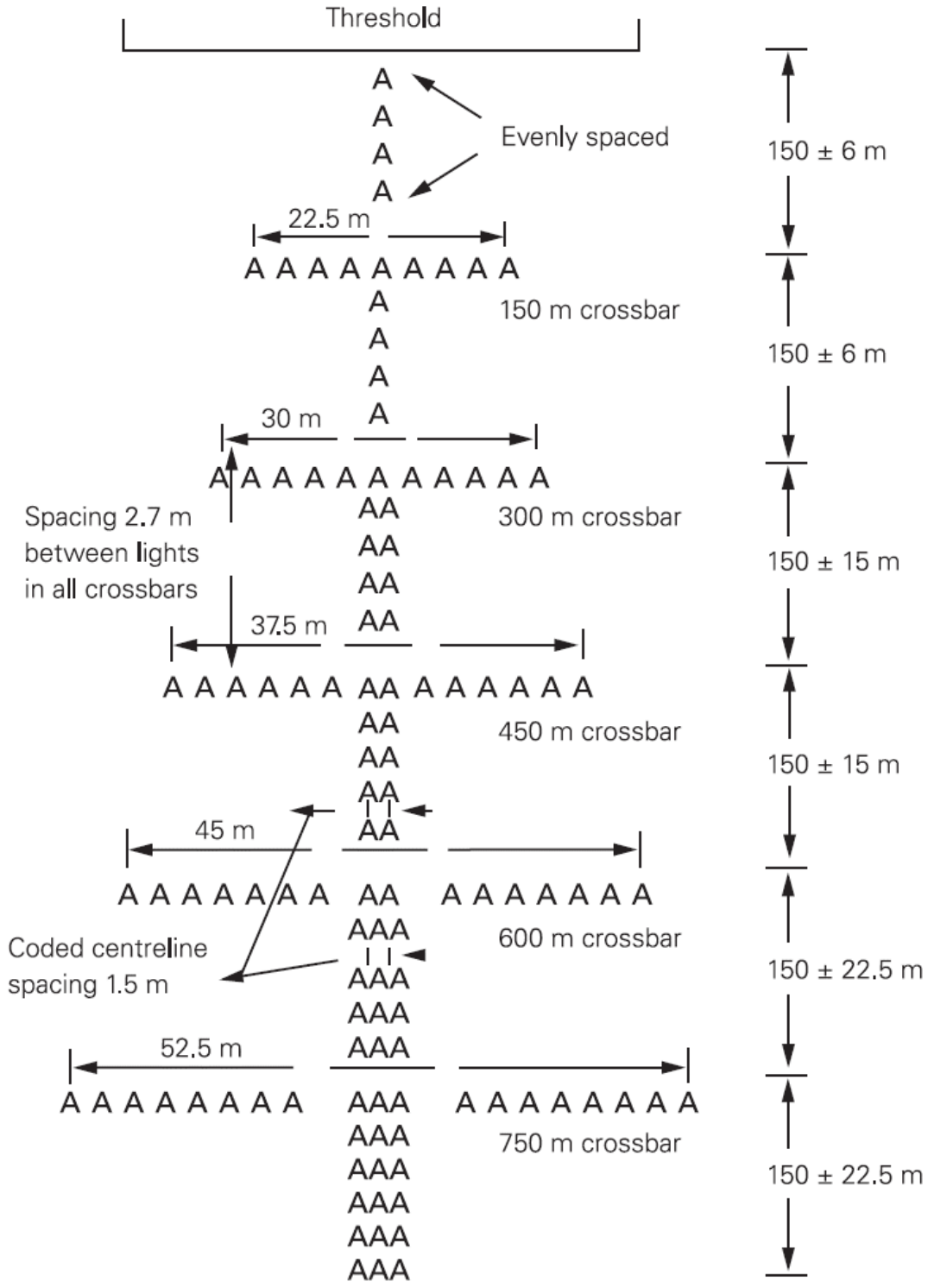
6.43 Supplementary approach lighting required for Category II and III operations consists of;

1. 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.

2. The lateral gauge of the barrettes should be equal to that of the Touchdown Zone (TDZ) lighting.

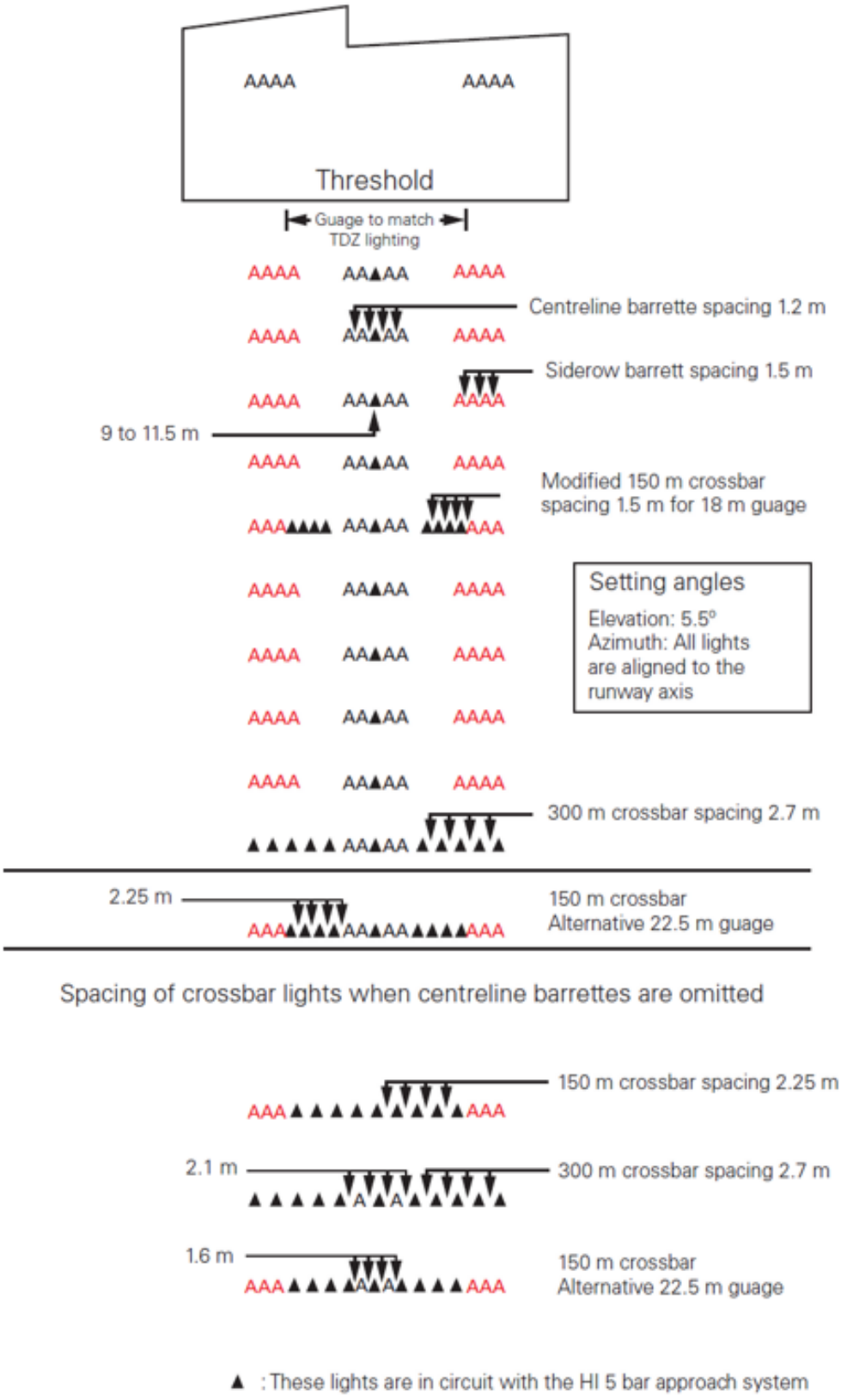
6.44 The pattern is illustrated in figure 6.3 and the light characteristics are specified in figure 6A.2.

6.45 Three stages of luminous intensity are required for this part of the system.



Note: See paragraph 6.8 for profile limits and table 6A 2 note 3, and figure 6A 1 for elevation

Figure 6.2 High intensity coded centreline and crossbar approach lighting system



Spacing of crossbar lights when centreline barrettes are omitted

Figure 6.3 Supplementary approach lighting system

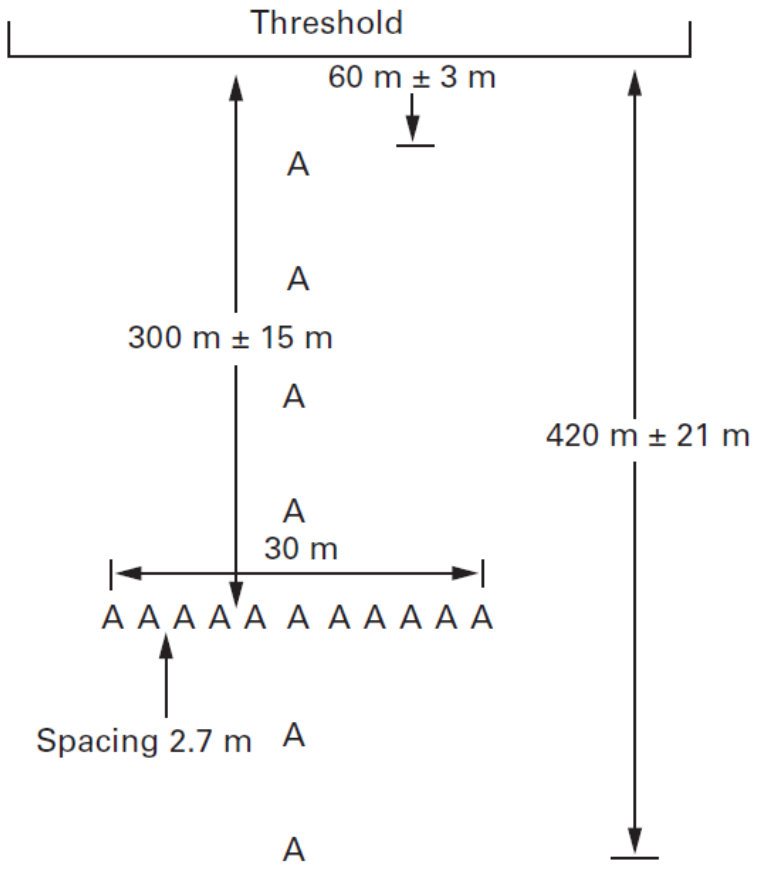
Simple approach lighting system

6.46 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 6.4 and the light performance requirements are given in figure 6A.1 for HI lights and table 6A.1 for LI lights.

6.47 A high intensity system should have five stages of luminous intensity.

6.48 Sequenced capacitor discharge (strobe) approach lighting is an alternative means of providing simple approach and circling guidance lighting.

6.49 This system should consist of seven omni- directional strobe lights, five of them located on the extended runway centreline and the other two at the runway threshold as shown in figure 6.5. The light performance requirements are given in table 6A.1.



Note: The number indicates order of the pulse sequence

Figure 6.4 Simple approach lighting system

OFFICIAL - Public

6.50 The objective is to provide a continuous ripple along the length of the extended centreline.

6.51 The duration of each discharge should not exceed 200 milliseconds and the next discharge in sequence should commence within 1.2 seconds of the initiation of the previous discharge.

6.52 Adjustment to the discharge duration and trigger rate should be made in order to achieve the optimum ripple effect without any breaks.

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

Approach lighting profile and obstacle protection

6.54 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.

6.55 The profile of the centreline lights should not exceed the limits shown at figure 6.6. 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.

6.56 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.

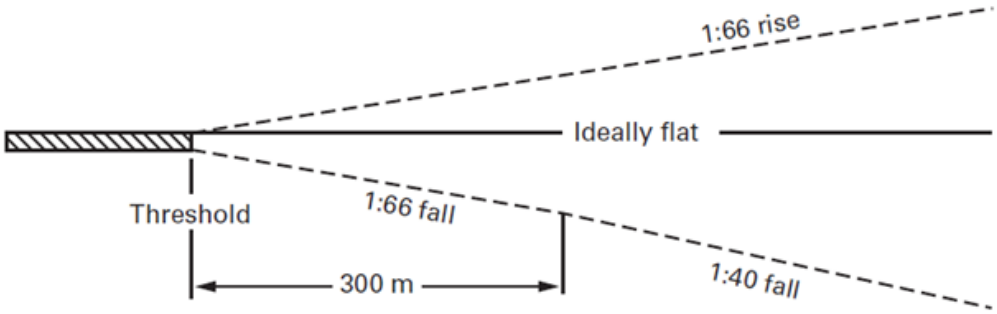


Figure 6.6 Approach light centreline profile limits

6.57 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.

6.58

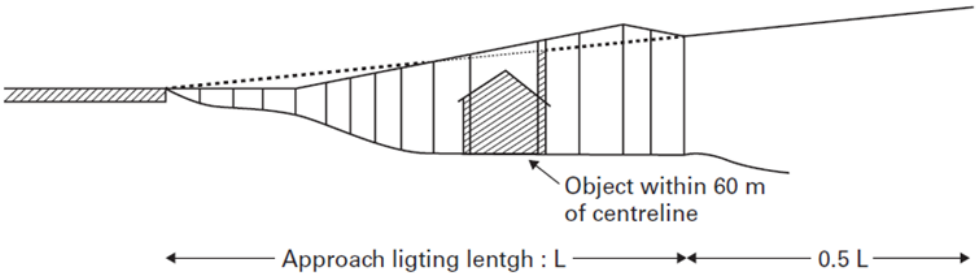


Figure 6.7 Approach light plane

Approach slope indicators

6.59 Approach slope indicators provide flight crew with information on the achieved approach angle, as well as giving clearance over approach obstacles.

6.60 The basic system is the 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 paragraph 6.88

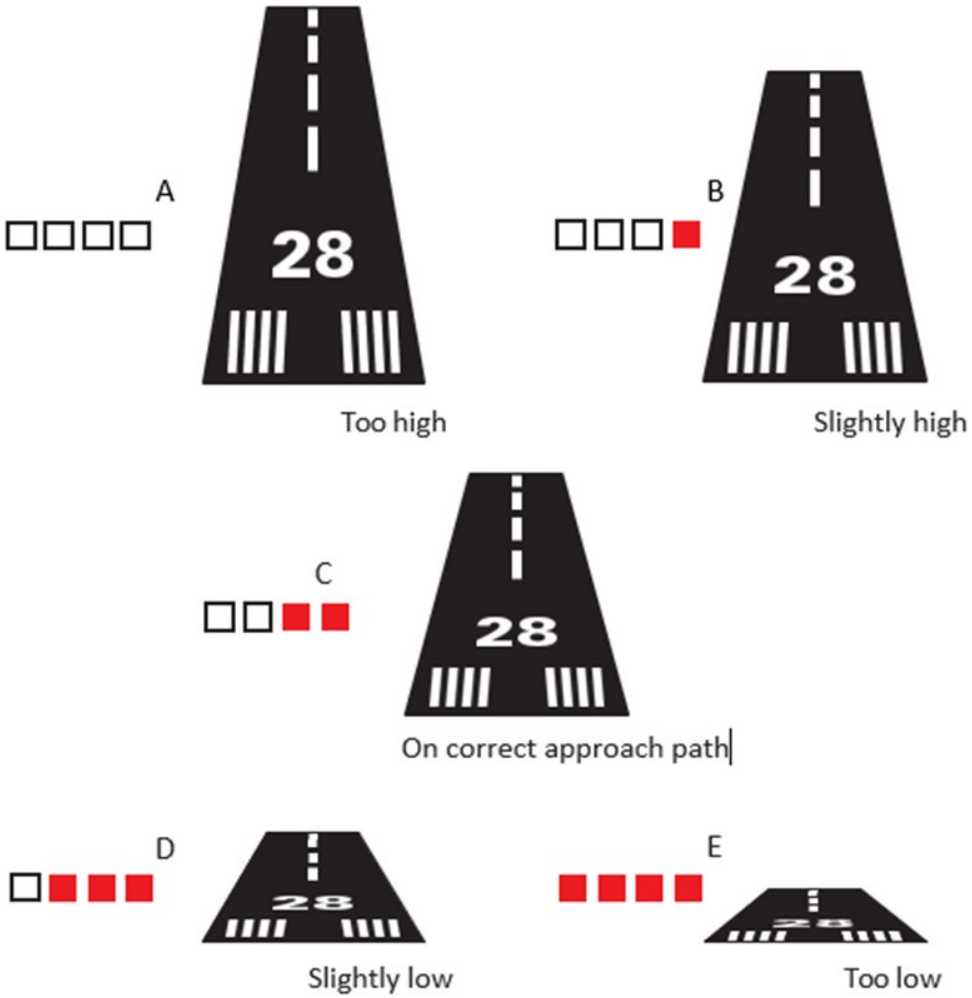


Figure 6.8 Typical PAPI system

6.61 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. 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.

6.62 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.

6.63 Systems required for day and night use should consist of high intensity units with a luminous intensity control.

6.64 The CAA should be consulted before any approach slope indicator is installed or repositioned. The following information should be provided;

1. The number and type of units, their proposed location, and angular settings;
2. 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
3. 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.

Precision Approach Path Indicator (PAPI)

6.65 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.

6.66 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.

6.67 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 ‘Interleaving of AGL Electrical Circuits’).

6.68 PAPI installations should be equipped with a monitoring system which will detect lamp failure so that flight crew may be advised, and the failure investigated and remedied without delay.

6.69 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 other such period recommended by the units’ manufacturer, before they are required for use.

(A)PAPI

6.70 (A)PAPI 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.

6.71 (A)PAPI 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).

Luminous intensity control requirements for approach slope indicators

6.72 PAPI, and high intensity (A)PAPI should have at least five luminous intensity stages: 100%, 30%, 10%, 3% and 1%.

6.73 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.

6.74 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/(A)PAPI at low intensity where a further 10% stage is advisable in most cases.

Unserviceability of PAPI and (A)PAPI systems

6.75 PAPI and (A)PAPI installations should be withdrawn from service if one unit is found to be unserviceable, except;

6.76 Where installations are on both sides of the runway, in which case only the affected side should be withdrawn.

6.77 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 (A) PAPI without altering the setting angles.

Runway and stopway lighting

6.78 Runway threshold, end and edge lighting are intended to define the usable extent of the runway not the declared distances.

6.79 For low visibility operations, centreline lighting is added in order to provide alignment and some distance-to- go information by colour coding;

6.80 Touchdown zone lighting is added in order to improve texture and perspective and to give flight crew an indication of the area within which a balked landing must be initiated if it is to be contained within the OFZ.

6.81 Stopway lights delineate the stopway. The cabling for these lights should be buried.

6.82 The characteristics of the lights, including height limits, are detailed at paragraph 6.83, and layouts are shown at figures 6.9 and 6.10. Setting angles are given in table 6A.1, table 6A.2 and figures 6A.3 to 6A.10.

6.83 High intensity lights should have five luminous intensity stages.

6.84 Low intensity lighting needs only one setting.

PAPI siting and setting angles

Layout and elevation setting angles

6.85 The PAPI system comprises a four-unit wing bar normally located in a line at right angles to the runway. Each unit should contain three light projectors.

Definition and positioning

6.86 The PAPI system should consist of a wing bar of four sharp transition multi-lamp (or paired single lamp) units equally spaced. The APAPI system should consist of a wing bar of two sharp transition multi-lamp (or paired single lamp) units. The PAPI and APAPI system should be located on the left side of the runway unless it is physically impracticable to do so. Where a runway is used by aircraft requiring visual roll guidance, which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway for PAPI or APAPI.

6.87 The wing bar of a PAPI should be constructed and arranged in such a manner that a pilot making an approach should when on or close to the approach slope, see the two units nearest the runway as red and the two units farthest from the runway as white;

6.88 When above the approach slope, see the one unit nearest the runway as red and the three units farthest from the runway as white; and when further above the approach slope, see all the units as white; and when below the approach slope, see the three units nearest the runway as red and the unit farthest from the runway as white; and when further below the approach slope, see all the units as red.

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

6.90 When on or close to the approach slope, see the unit nearer the runway as red and the unit farther from the runway as white;

1. When above the approach slope, see both the units as white; and
2. When below the approach slope, see both the units as red.

6.91 The light units should be located as in the basic configuration illustrated in Figure 6B.1, subject to the installation tolerances given below. The units forming a wing bar should be mounted so as to appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units should be mounted as low as possible and should be frangible.

Characteristics

6.92 The system should be suitable for both day and night operations.

Colour

6.93 The colour transition from red to white in the vertical plane should be such as to appear to an observer, at a distance of not less than 300 m, to occur within a vertical angle of not more than 3´.

6.94 At full intensity, the chromaticity of lights units should be in accordance with the specifications in Figure 6A.19, as appropriate, and the red light should have a Y coordinate not exceeding 0.320.

Intensity

6.95 The light intensity distribution of the light units should be as shown in Figure 6A.19.

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

Light orientation

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

Other characteristics

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

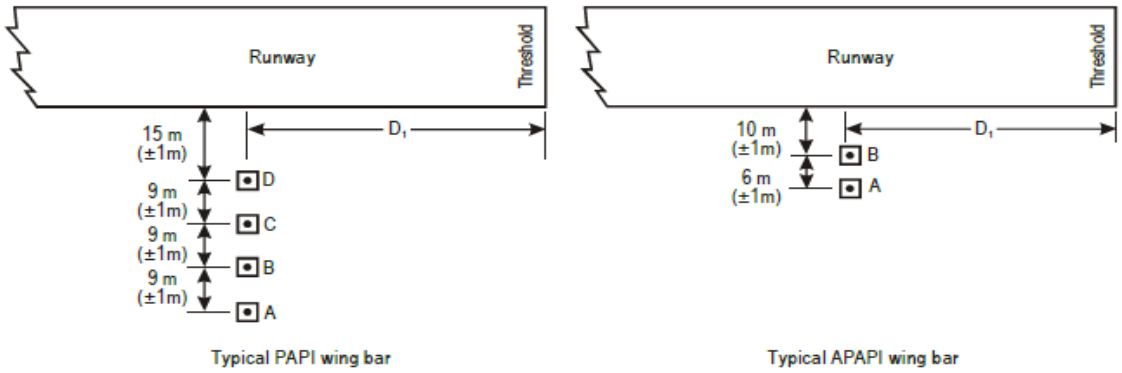


Figure 6B.1 PAPI: Siting of PAPI and APAPI Installation tolerances

Notes:

1. Where a PAPI or APAPI is installed on a runway not equipped with an ILS or MLS, the distance D1 should be calculated to ensure that the lowest height at which a pilot will see a correct approach path indication (Figure 6B.2, angle B for a PAPI and angle A for an APAPI) provides the wheel clearance over the threshold specified in Table 6B.1 for the most demanding amongst aeroplanes regularly using the runway.

2. Where a PAPI or APAPI is installed on a runway equipped with an ILS and/or MLS, the distance D1 should be calculated to provide the optimum compatibility between the visual and non-visual aids for the range of eye-to-antenna heights of the aeroplanes regularly using the runway. The distance should be equal to that between the threshold and the effective origin of the ILS glide path or MLS minimum glide path, as appropriate, plus a correction factor for the variation of eye-to-antenna heights of the aeroplanes concerned.

3. The correction factor is obtained by multiplying the average eye-to-antenna height of those aeroplanes by the cotangent of the approach angle. However, the distance should be such that in no case will the wheel clearance over the threshold be lower than that specified in column (3) of Table 6B-1

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

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

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

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

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

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

10. Further guidance on the harmonisation of PAPI, ILS and/or MLS signals is contained in ICAO Doc 9157, Aerodrome Design Manual, Part 4, Visual Aids

Approach slope and elevation setting of light units for PAPI and APAPI

Approach slope

6.99 The approach slope as defined in Figure 6B.2, should be so designed to be appropriate for use by the aeroplanes in the approach.

6.100 When the runway is equipped with an ILS and/or MLS, the siting, and the angle of elevation of the light units should be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.

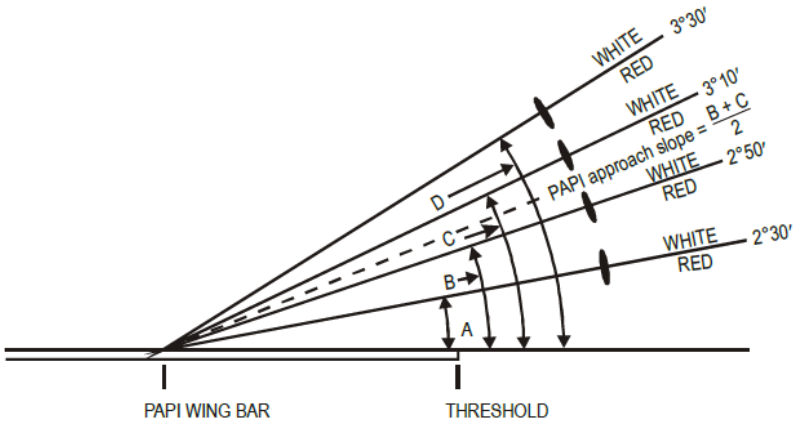
Elevation setting of light units

6.101 The angle of elevation settings of the light units in a PAPI wing bar should be such that, during an approach, the pilot of an aeroplane observing a signal of one white and three reds should clear all objects in the approach area by a safe margin (see Table 6B.1).

6.102 The angle of elevation settings of the light units in an APAPI wing bar should be such that, during an approach, the pilot of an aeroplane observing the lowest on-slope signal, i.e., one white and the red, should clear all objects in the approach area by a safe margin (see Table 6B.1).

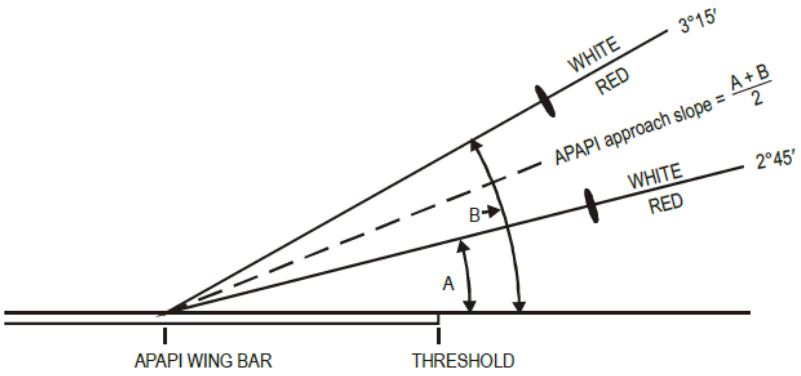
6.103 The azimuth spread of the light beam should be suitably restricted where an object located outside the obstacle protection surface of the PAPI or APAPI system but within the lateral limits of its light beam, is found to extend above the plane of the obstacle protection surface and a safety assessment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

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



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

A — 3° PAPI ILLUSTRATED



B — 3° APAPI ILLUSTRATED

Wheel clearance and Minimum Eye Height over Threshold (MEHT)

6.105 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.

6.106 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.2). 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.

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)
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

Table 6B.1 Wheel clearance over threshold for PAPI and (A)PAPI

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 among 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-turbojet aeroplanes

	Runway type/code number							
	Non-instrument				Instrument			
	Code number				Code number			
Surface dimensions	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Length of inner edge	60 m	80 m	150 m	150 m	150 m	150 m	300 m	300 m
Distance from the visual approach slope indicator system 2	D1+30 m	D1+60 m	D1+60 m	D1+60 m	D1+60 m	D1+60 m	D1+60 m	D1+60 m
Divergence (each side)	10 %	10 %	10 %	10 %	15 %	15 %	15 %	15 %
Total length	7 500 m	7 500 m	15 000 m	15 000 m	7 500 m	7 500 m	15 000 m	15 000 m
a) PAPI 1	—	A–0.57°	A–0.57°	A–0.57°	A–0.57°	A–0.57°	A–0.57°	A–0.57°
b) APAPI 1	A–0.9°	A–0.9°	–	–	A–0.9°	A–0.9°	–	–
1 Angles as indicated in Figure 6B.2 2 D1 is the distance of the visual approach slope indicator system from threshold prior to any displacement to remedy object penetration of the obstacle protection surface (refer to Figure 6B.1). The start of the obstacle protection surface is fixed to the visual approach slope indicator system location, such that displacement of the PAPI results in an equal displacement of the start of the obstacle protection surface.								

Table 6B.2(b) Dimensions and slopes of the obstacle protection surface

Notes:

1. Angles as indicated in Figure 6B.2
2. D1 is the distance of the visual approach slope indicator system from threshold prior to any displacement to remedy object penetration of the obstacle protection surface (refer to Figure 6B.1The start of the obstacle protection surface is fixed to the visual approach slope indicator system location, such that displacement of the PAPI results in an equal displacement of the start of the obstacle protection surface.

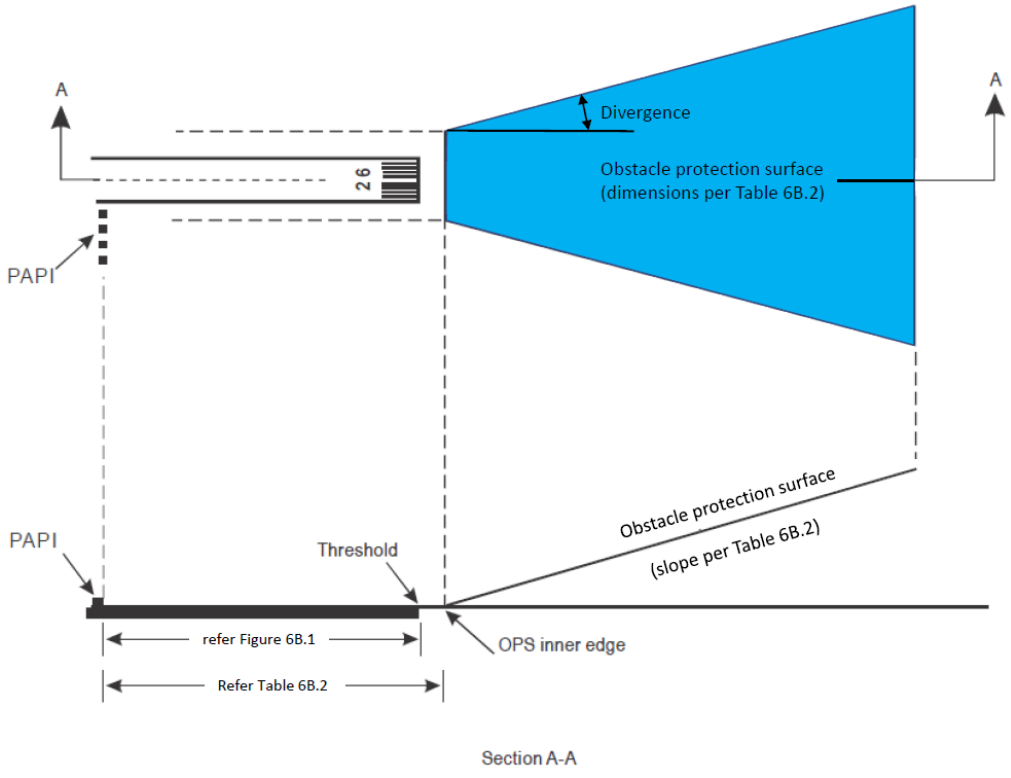


Figure 6B.3 Obstacle protection surface for visual approach slope indicator system

Obstacle protection surface for PAPI and APAPI

Applicability

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

Characteristics

6.108 The characteristics of the obstacle protection surface, i.e., origin, divergence, length, and slope should correspond to those specified in the relevant column of Table 6B.2 and in Figure 6B.3.

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

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

1. Remove the object;

2. Suitably raise the approach slope of the system;
3. Reduce the azimuth spread of the system so that the object is outside the confines of the beam;
4. Displace the axis of the system and its associated obstacle protection surface by no more than 5°;
5. Suitably displace the threshold; and
6. Where an object could adversely affect the safety, suitably displace the system upwind of the threshold such that the object no longer penetrates the obstacle protection surface.

Runway edge lighting

6.111 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 licence holder 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.

6.112 On runways of up to 50 m in width, the longitudinal spacing of the lights should be 60 m ± 6 m.

6.113 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.

6.114 The lights on opposite sides of the runway should be on lines at right angles to the centreline, as shown at figure 6.9.

6.115 Where uni or bi-directional light units are used at aerodromes and visual approaches to the airfield or flying training take place at night, an omni-directional light should be provided at each alternate position in order to provide circling guidance.

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

1. On a precision instrument 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.
2. If centreline lights are installed subsequently, the yellow caution zone lights should be replaced with white lights.

3. Where a threshold is displaced, the lights between the beginning of the runway and the displaced threshold should show red in the approach direction.

4. One or two omni-directional blue lights may replace or supplement the edge lights to indicate an exit taxiway.

6.117 Scale L4 lighting may comprise fixed or portable lights.

6.118 The location of portable lights should be marked permanently.

6.119 The power for electric edge lights should be provided preferably by mains or locally generated electricity.

6.120 Battery powered lights are acceptable, aerodrome operators should ensure that the battery lives are adequate for the duration of night flying operations.

Runway threshold and runway end lights

6.121 Runway threshold lights are green and indicate the start of the available landing distance.

6.122 Runway end lights are red and delineate the extremity of the runway that is available for manoeuvring not the declared distances.

6.123 Figure 6.10 shows the layouts permitted according to circumstances.

6.124 Threshold wingbars should be provided for;

1. Scales L1 and L2, and for;

2. Other Scales where the threshold is displaced.

6.125 They are recommended for Scales L3 and L4 in the interests of added conspicuity.

6.126 Threshold lights should have luminous intensity compatible with that of the runway edge lights.

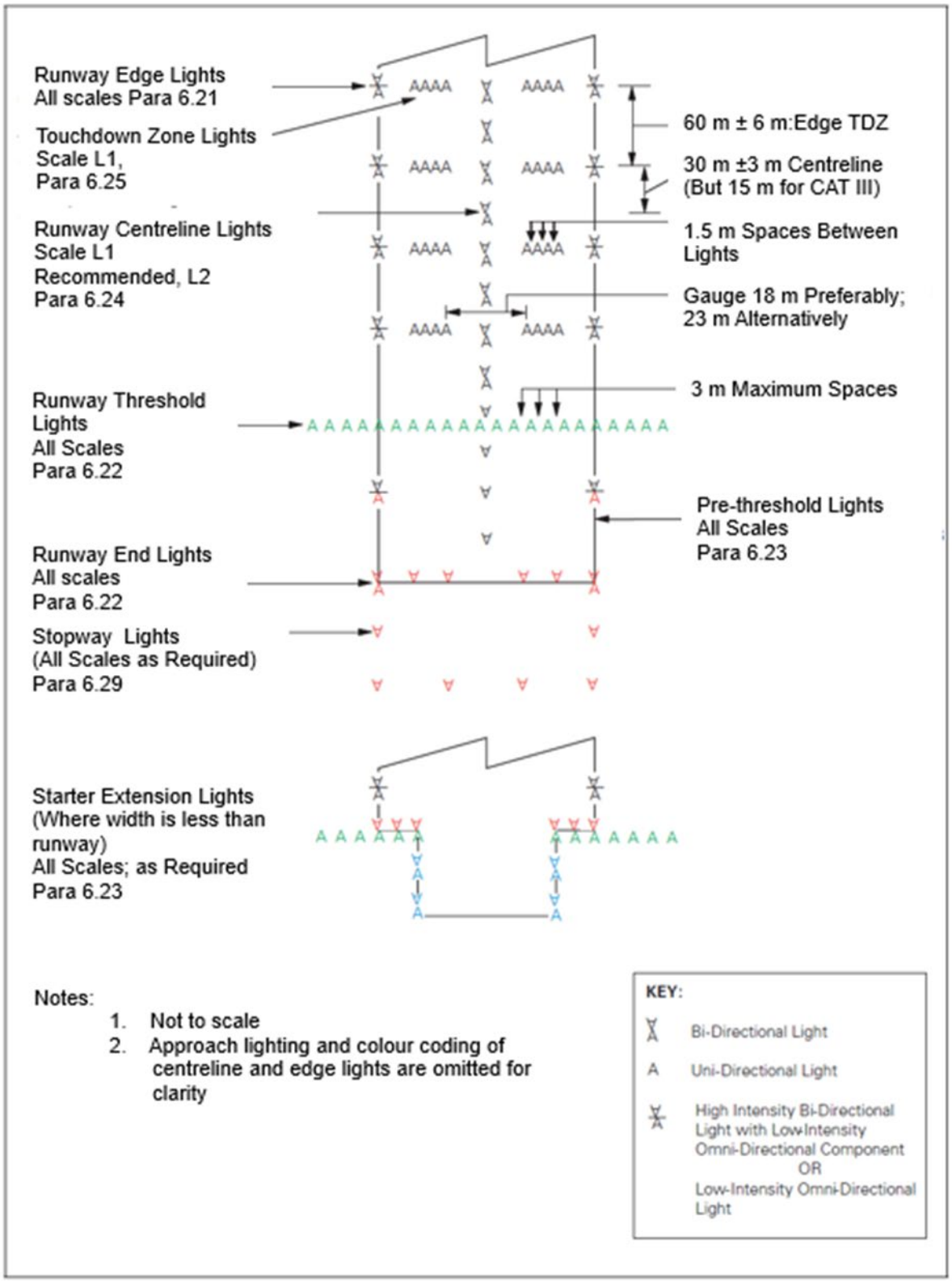


Figure 6.9 Runway lighting

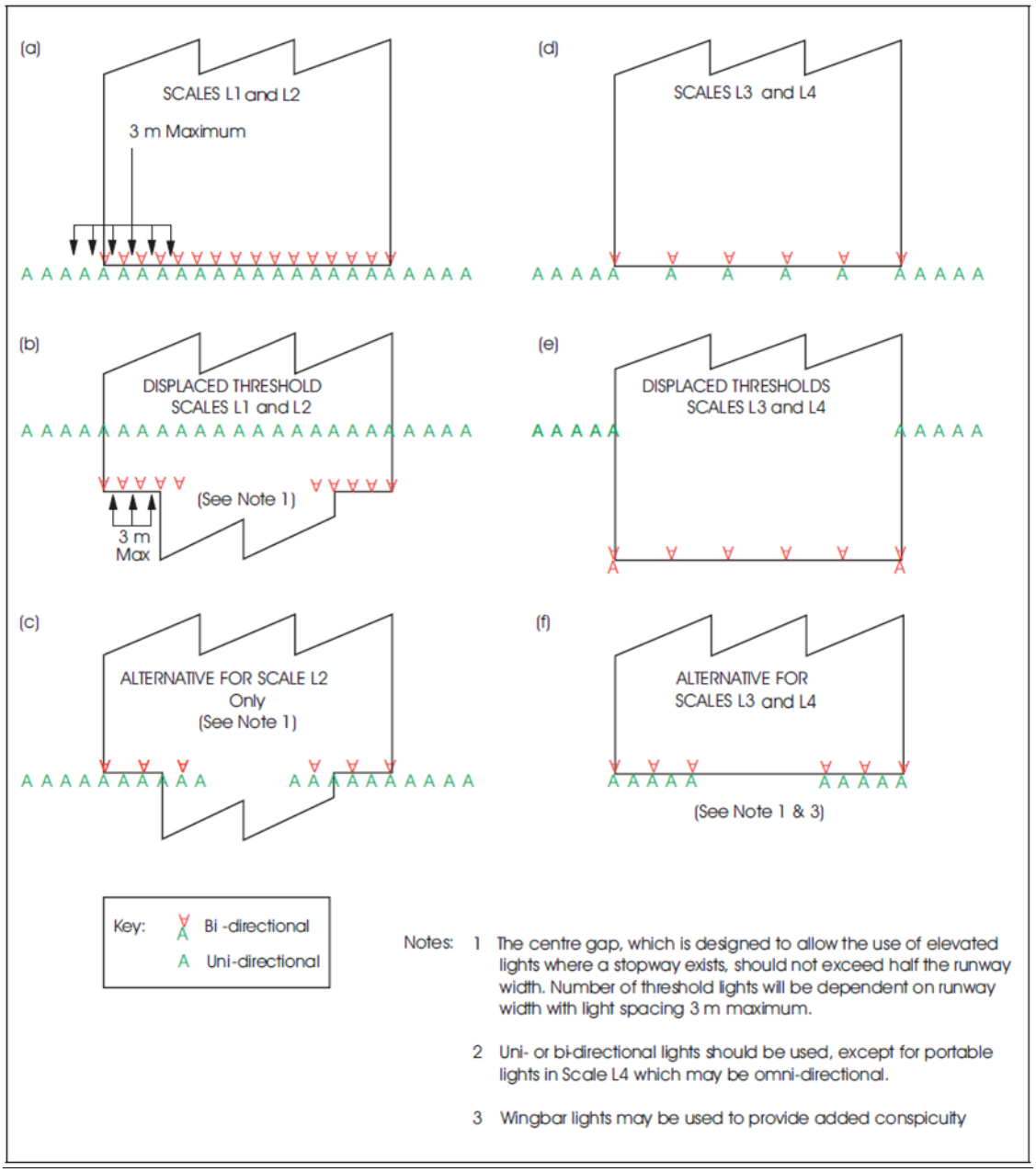


Figure 6.10 Runway threshold and runway end lighting

Notes:

1. The centre gap, which is designed to allow the use of elevated lights where a stopway exists, should not exceed half the runway width.

2. Number of threshold lights will be dependent on runway width with light spacing 3m maximum

3. Uni- or bi-directional lights should be used, except for portable lights in Scale L4 which may be omni-directional.

4. Wing bar lights may be used to provide added conspicuity.

Starter extension lighting

6.127 A starter extension which is narrower than its associated runway should have blue edge lighting.

6.128 A pre-threshold runway 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.

6.129 Centreline guidance for take-off from the beginning of a runway to a displaced threshold should be provided by;

1. An approach lighting system if its characteristics and intensity settings afford the guidance required during take-off, and it does not dazzle the pilot of an aircraft taking off; or
2. Runway centreline lights

Runway centreline lights

6.130 White runway centreline lights are required for take-off in RVR below 400m and for precision instrument approach runways Category II and III. They extend from the threshold of the runway to 900m from the upwind runway end, then the following 600m should be alternate white and red lights, and the final 300 m to the runway end, all red lights.

6.131 Where the end of TORA/LDA does not coincide with the runway end, the section of red lights should be extended to the runway end.

6.132 Runway centre line lights should be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of the runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line.

6.133 Runway centre line lights should be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of the runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line. The lights should be located from the threshold to the end at longitudinal spacing of approximately 15 m

6.134 Where the serviceability level of the runway centre line lights achieves the required maintenance objectives as appropriate, and it can be demonstrated and the runway is intended for use in runway visual range conditions of 300 m or greater, the longitudinal spacing may be approximately 30 m.

6.135 For Category III operations and for take-off in RVR below 300m, the spacing should be 15m.

6.136 Runway centre line lights should be provided on a precision approach runway Category I when the runway is used by aircraft with high landing speeds or where the width between the runway edge lights is greater than 50 m.

6.137 Runway centre line lights should be provided on a runway intended to be used for take-off with an operating minimum of an RVR of the order of 400 m or higher when used by aeroplanes with a very high take-off speed where the width between the runway edge lights is greater than 50 m.

6.138 Consideration should be given to providing runway centre line lights where additional conspicuity is required (such as local environment, weather conditions, operational provisions, and minima)

6.139 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.

6.140 The layout of runway centreline lights is illustrated at figure 6.9.

6.141 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.

Touchdown zone lights (TDZ)

6.142 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.

6.143 Each barrette has four white lights spaced not more than 1.5 m apart, the innermost lights being not less than 9m nor more than 11.5 m either side of the centreline.

6.144 The longitudinal spacing between barrettes should be 60 m ±6 m.

6.145 The lateral gauge of the barrettes should be equal to that of the Supplementary Approach lighting red side row barrettes.

6.146 The layout of the touchdown zone lights is illustrated in figure 6.9.

6.147 A setting angle of 3° should be used for Category II operations.

6.148 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.

6.149 Newly constructed or re-equipped runways for Category III operations should have TDZ lighting and touchdown zone lights with the characteristics specified in figure 6A.5.

Simple touchdown zone lights

6.150 The purpose of simple touchdown zone lights is to provide pilots with enhanced situational awareness in all visibility conditions and to help them to decide whether to commence a go-around if the aircraft has not landed by a certain point on the runway. It is essential that pilots operating at aerodromes with simple touchdown zone lights be familiar with the purpose of these lights.

6.151 Except where TDZ lights are provided at an aerodrome where the approach angle is greater than 3.5 degrees and/or the landing distance available combined with other factors increases the risk of an overrun, simple touchdown zone lights should be provided.

6.152 Simple touchdown zone lights shall be a pair of lights located on each side of the runway centreline 0.3m beyond the upwind edge of the final touchdown zone marking.

6.153 The lateral spacing between the inner lights of the two pairs of lights shall be equal to the lateral spacing selected for the touchdown zone marking.

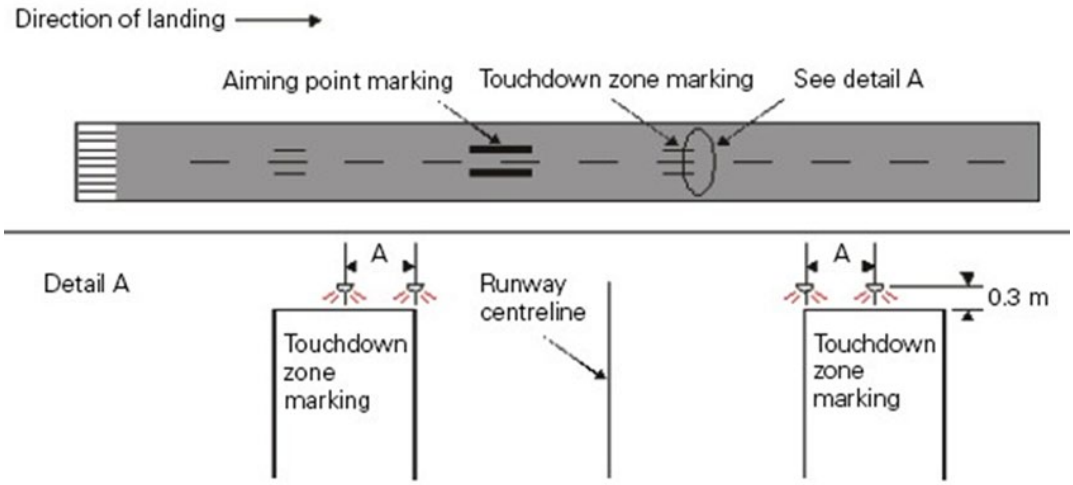
6.154 The spacing between the lights of the same pair shall not be more than 1.5 m or half the width of the touchdown zone marking, whichever is greater. (See figure 11.)

6.155 Where provided on a runway without TDZ markings, simple touchdown zone lights should be installed in such a position that provides the equivalent TDZ information.

6.156 Simple touchdown zone lights shall be fixed unidirectional lights showing variable white, aligned so as to be visible to the pilot of a landing aeroplane in the direction of approach to the runway.

6.157 Simple touchdown zone lights shall be in accordance with the specifications in chapter 6 paragraph 6.74 A figure 6A 5.

6.158 As a good operating practice, simple touchdown zone lights 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.



Note: Dimension A is 1.5 m or half the width of the touchdown zone marking, whichever is greater

Figure 6.11 Spacing between the lights of the same pair

Rapid exit taxiway indicator lights

6.159 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, and;

1. Enhance situational awareness in low visibility conditions and;
2. Enable pilots to apply braking action for more efficient roll-out and runway exit speeds.

6.160 It is essential that pilots operating at aerodromes with runways displaying RETILs be familiar with the purpose of these lights.

6.161 RETILs may be considered for all paved runways, but their use is enhanced on runways used in RVR less than 300 m and/or where the traffic density is heavy.

6.162 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 figure 6.12.

6.163 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.

6.164 Where more than one rapid exit taxiway exists on a runway, the set of RETILs for each exit should not overlap when displayed.

6.165 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 figures 6A.6 and 6A.7.

6.166 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 6.11 in full.

6.167 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.

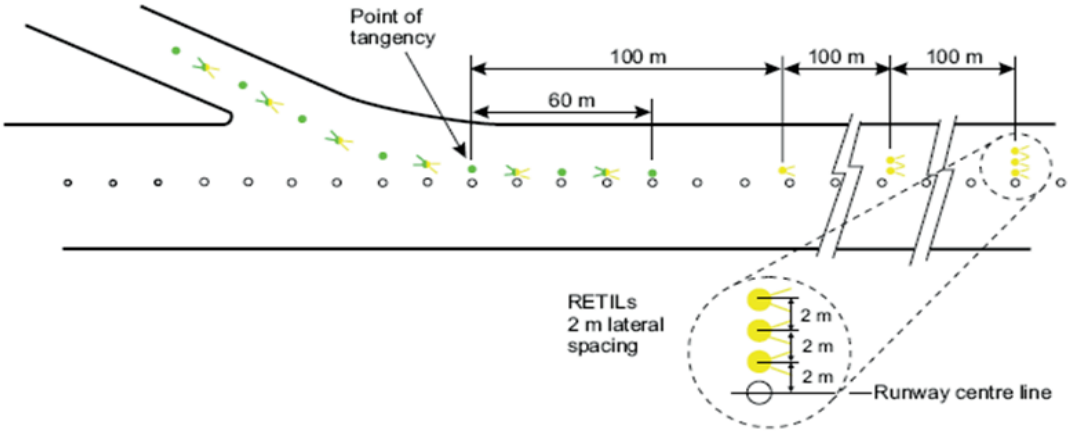


Figure 6.12 Rapid exit taxiway indicator lights

Runway turn pad lighting

6.168 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 300 m, to enable an aeroplane to complete a 180° turn and align with the runway centreline.

6.169 Runway turn pad lights should normally be located on the runway turn pad marking, except that they may be offset by not more than 0.30m where it is not practicable to locate them on the marking.

6.170 Runway turn pad lights on a straight section of the turn pad marking should be spaced at intervals of not more than 15m, while the spacing for lights on the curved sections of the turn pad should not exceed 7.5m.

6.171 Runway turn pad lights should be uni-directional 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.

6.172 Taxiway edge lights on a runway turn pad should be placed at uniform longitudinal intervals not exceeding 30m.

Stopway lights

6.173 Stopway lights should be provided for a stopway intended for use at night.

6.174 Location; Stopway lights should be placed along the full length of the stopway and should be in two parallel rows that are equidistant from the centre line and coincident with the rows of the runway edge lights.

6.175 At least four unidirectional stopway lights equally spaced across the width of the stopway should be provided across the end of a stopway on a line at right angles to the stopway axis as near to the end of the stopway as possible

6.176 Stopway lights should be fixed unidirectional lights showing red in the direction of the runway The layout is illustrated in figure 6.9.

Taxiway edge lighting

6.177 Blue lighting is used to indicate the edge of a taxiway and should be installed on paved taxiways where centreline lighting is not provided.

6.178 The lights should be placed in pairs, one on each side of the taxiway on lines at right angles to the centreline except at junctions.

6.179 The spacing of the lights on straight sections and curves of radius 150m or greater serving runways with scale L 2 lighting should not exceed 30m.

6.180 On taxiways serving runways with scale L3 and L4 lighting, the spacing should not exceed 60m but should preferably be no greater than 45m.

6.181 On curves of radius less than 150m, 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.

6.182 On small fillets less than 15m radius at the taxiway edge, a minimum spacing of 3m should be used.

6.183 Retroflective edge markers may be used instead of edge lights for scale L4

6.184 Taxiway edge lighting may be used to augment centreline lighting where aircraft are required to negotiate difficult curves.

6.185 The edges of turning and holding areas should be marked with blue lights.

6.186 The characteristics of elevated taxiway edge lights are given at table 6A1.

Taxiway centreline lights

6.187 Green taxiway centre line lights shall be provided on an exit taxiway, taxiway, de-icing/anti-icing facility and apron intended for use in runway visual range conditions less than a value of 300 m in such a manner as to provide

continuous guidance between the runway centre line and aircraft stands, except;

6.188 These lights need not be provided where the traffic density is light and taxiway edge lights and centre line marking provide adequate guidance.

6.189 Taxiway centre line lights should be provided in all visibility conditions on a runway forming part of a standard taxi-route where specified as components of an advanced surface movement guidance and control system.

6.190 Taxiway centre line lights should be provided on a taxiway intended for use at night in runway visual range conditions of 300 m or greater, and particularly on complex taxiway intersections and exit taxiways, except that these lights need not be provided where the traffic density is light and taxiway edge lights and centre line marking provide adequate guidance.

6.191 Taxiway centre line lights should be provided on a runway forming part of a standard taxi-route and intended for taxiing in runway visual range conditions less than a value of 300 m, except that these lights need not be provided where;

1. The traffic density is light and taxiway edge lights and,
2. Centre line marking provides adequate guidance.

6.192 Where higher intensities are required, from an operational point of view, taxiway centre line lights on rapid exit taxiways intended for use in runway visual range conditions less than a value of 300 m the number of levels of brilliancy settings for these lights should be the same as that for the runway centre line lights.

6.193 The characteristics of centreline lights required for day/night use in RVRs of less than 300m are given at figures 6a.12 to 6a.14.

6.194 Taxiway centre line lights should normally be located on the taxiway centre line marking.

6.195 A three-stage luminance intensity control should be provided.

6.196 Low intensity centreline lights are suitable for night use only and are not intended to support operations in RVRs of less than 400m; their characteristics are given in figures 6a.15 and 6a.16.

6.197 Where occasional take-off movements take place in RVRs less than 350 m, taxiway edge lighting supplemented by centreline marking may exceptionally be approved by the CAA.

6.198 The effectiveness of taxiway centreline lights is dependent upon the slant visibility from the cockpit, the distance between successive lights and their

luminous intensity. spacings on curves that have been found suitable for a taxiway intended for use in RVR conditions of 300 m or greater are shown in table 6.2

Taxiway	Minimum RVR	
	< 350m	> 350m
Straight	15m	30m
Curved	7.5m	15m

Note: Spacing may be altered by up to ±10% to facilitate pavement design.

Table 6.2 Taxiway Centreline Light Spacing

6.199 On a taxiway intended for use in RVR conditions of less than 300 m, the lights on a curve should not exceed a spacing of 15 m, and on a curve of less than 400 m radius the lights should be spaced at intervals of not greater than 7.5 m. This spacing should extend for 60 m beyond and end of curve. For operations in RVR of 300 m or greater, this distance is reduced to 30 m.

6.200 The system of preventive maintenance employed for a taxiway intended for use in runway visual range conditions less than a value of 300 m shall have as its objective that no two adjacent taxiway centre line lights be unserviceable.

6.201 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.

6.202 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. Care should be taken to limit the light distribution of green lights on or near a runway so as to avoid possible confusion with threshold lights.

6.203 Taxiway centre line lights on a runway forming part of a standard taxi-route and intended for taxiing in runway visual range conditions less than a value of 300 m should be spaced at longitudinal intervals not exceeding 15 m.

6.204 At rapid exit taxiways the lead-off lights should commence adjacent to the runway centreline at least 60m before the intersection with the exit taxiway curvature.

6.205 At all other taxiway/runway intersections the lead-off lights should commence at the start of the curve

6.206 The section of lighting running parallel to the runway centreline should be offset transversely by 0.75m ±0.15m.

Stop-bars

6.207 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.

6.208 Stop-bars should be provided at all runway taxi-holding positions and intermediate taxi-holding positions intended for use in RVR conditions less than a value of 550 m except where,

1. appropriate aids and procedures are available to assist in preventing inadvertent incursions of traffic onto the runway; or
2. operational procedures exist to limit, in runway visual range conditions less than a value of 550 m, the number of:
    a) aircraft on the manoeuvring area to one at a time; and
    b) vehicles on the manoeuvring area to the essential minimum; or
    c) 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 aircraft at any given time.

6.209 Where there is more than one stop bar associated with a taxiway/runway intersection, only one should be illuminated at any given time.

6.210 A stop bar should be provided at an intermediate holding position when it is desired to supplement markings with lights, and to provide traffic control by visual means.

6.211 Where stop bars are specified as components of an advanced surface movement guidance and control system, and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications in, Figures 6A.12 to 6A.16 , as appropriate.

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

6.213 Stop-bars installed at taxiway/runway intersection should be unidirectional and show red towards the direction of approach to the runway.

6.214 Stop-bars installed at intermediate taxi-holding positions may be bi-directional where the holding position is intended for use in each direction.

6.215 Stop-bars installed at runway taxi-holding positions and intermediate taxi-Holding positions should be independently switchable; all other stop-bars protecting the runway should be permanently illuminated during LVO.

6.216 Where there is more than one stop bar associated with a taxiway/runway intersection, only one should be illuminated at any given time.

6.217 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.

6.218 The lighting circuit should be designed so that;

1. Stop bars located across entrance taxiways are selectively switchable;
2. Stop bars located across taxiways intended to be used only as exit taxiways are switchable selectively or in groups
3. When a stop bar is illuminated, any taxiway centre line lights installed beyond the stop bar should be extinguished for a distance of at least 90 m; and
4. The section of interlocked taxiway centreline lead-on lighting should, wherever practicable, be at least 90m in length.
5. Stop bars are interlocked with the taxiway centre line lights so that when the centre line lights beyond the stop bar are illuminated, the stop bar is extinguished and vice versa. Care is required in the design of the electrical system to ensure that all of the lights of a stop bar will not fail at the same time. Guidance on this issue is given in ICAO Doc 9157, Aerodrome Design Manual, Part 5, Electrical Systems...

6.219 High intensity stop bars should only be used in the case of necessity and following a specific study.

6.220 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.

6.221 They should be positioned coincident with any associated taxiway holding position marking so as not to obscure or interfere with the integrity of the marking.

6.222 The outer lights of the stop-bar should be located on the edges of the taxiway.

6.223 At holding positions where a flight crew'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.

6.224 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.

6.225 The characteristics of lights, including elevated side lights used in stop-bars, are given in figures 6A.12 to 6A.16.

6.226 Where a wide beam fixture is required, the intensity in red light and beam spreads of stop bar lights should be in accordance with the specifications in Figures 6A.12 to 6A.16 as appropriate.

6.227 The system of preventive maintenance employed for a stop bar provided at a runway-holding position used in conjunction with a runway intended for operations in runway visual range conditions less than a value of 300 m should have the following objective;

1. No more than two lights will remain unserviceable; and
2. Two adjacent lights will not remain unserviceable unless the light spacing is significantly less than that specified.

Intermediate holding positions

6.228 Stop bars should be provided at an intermediate holding position intended for use in runway visual range conditions less than a value of 300 m.

De-icing/anti-icing facility exit lights

6.229 The purpose of the de-icing/anti-icing facility exit lights is to indicate the exit boundary of a remote de-icing/anti-icing facility adjoining a taxiway should the facility be available on the aerodrome.

6.230 Location: Where provided, de-icing/anti-icing facility exit lights should be located 0.3 m inward of the intermediate holding position marking displayed at the exit boundary of a remote de-icing/ anti-icing facility.

Characteristics

6.231 Where provided, de-icing/anti-icing facility exit lights should consist of in-pavement fixed unidirectional lights spaced at intervals of 6 m showing yellow in the direction of the approach to the exit boundary with a light distribution similar to taxiway centre line lights (see Figure 6.12a) below.

6.232 De-icing/anti-icing facility exit lights chromaticity should be in accordance with the specifications in Table 6A.2 and Figure 6A.22 or 6A.23, as appropriate.

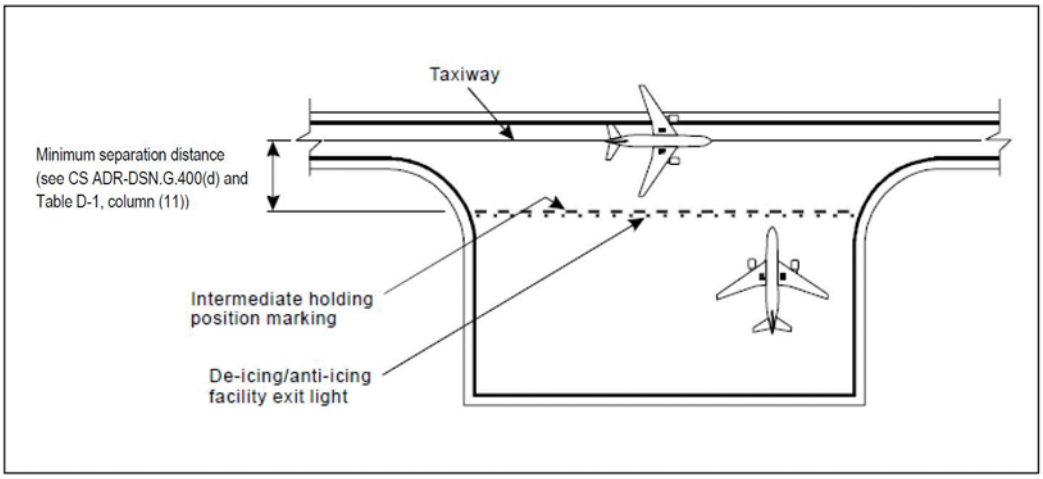


Figure 6.12a De-Icing/anti-icing facility exit lights

No entry bar

6.233 Runway incursions take place in all visibility or weather conditions. The use of a no-entry bar can form part of effective runway incursion prevention measures.

6.234 A no entry bar should be located across a taxiway at the end of an exit only taxiway, where it is deemed to prevent traffic from entering the taxiway in the wrong direction.

6.235 A no entry bar should be collocated with a no entry sign and/or a no entry marking.

Note: Specifications of a no entry sign are described in Chapter 7.

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

6.237 A pair of elevated lights should be added to each end of the no entry bar where the in-pavement no entry bar lights might be obscured from a pilot's view, for example, by snow or rain, or where a pilot may be required to stop

the aircraft in a position so close to the lights that they are blocked from view by the structure of the aircraft.

6.238 The intensity in red light and beam spreads of no entry bar lights shall be in accordance with the specifications in ICAO annex 14, Volume I, appendix 2, AGL Characteristics, figures A2-17 and A2-19., as appropriate.

6.239 Where a wide beam fixture is required, the intensity in red light and beam spreads of no-entry bar lights should be in accordance with the specifications of ICAO annex 14, Volume I, appendix 2, AGL Characteristics, figures A2-17 and A2-19.

6.240 Taxiway centreline lights installed beyond the no-entry bar, looking in the direction of the runway shall not be visible when viewed form the taxiway.

Runway Status Lights

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

Location

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

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

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

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

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

Characteristics

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

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

6.247 Intensity and beam spread of RELs shall be in accordance with the specifications located within instrument runways and associated taxiways requirements, Figures 6A.12 and 6A.14.

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

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

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

6.251 Intensity and beam spread of THLs shall be in accordance with the specifications of paragraph 6.74, Figure 6A.22.

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

6.253 Where an ARIWS is installed at an aerodrome, information on its characteristics and status shall be provided to the Aeronautical Information Service for promulgation in the AIP with the description of the surface movement guidance and control system and markings as specified in ICAO Annex 15.

Note; Detailed specifications concerning the AIP are contained in PANS-AIM (Doc 10066).

Taxiway guidance and control systems

6.254 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 para 6.207.

6.255 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.

Runway guard lights

6.256 The use of runway guard lights at runway-holding positions can form part of effective runway incursion prevention measures. The purpose of runway guard lights is to warn pilots, and drivers of vehicles, when they are operating on taxiways, that they are about to enter a runway. There are two standard configurations of runway guard lights as illustrated in Figure 6.13

6.257 Runway guard lights should be provided on all taxiways/runway intersections associated with a runway intended for use in RVR less than 1200m.

6.258 The light beam shall be unidirectional and shall show yellow in the direction of approach to the runway-holding position.

6.259 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.

6.260 The lights should be in operation whenever the RVR is less than 1200 m and be switched independently of any stop-bar lights.

6.261 Consideration should be given to the operations of the guard lights at all times during operational hours given their effectiveness in the prevention of runway incursions.

6.262 Runway Guard Lights should not exceed a height above which their presence may endanger aircraft and should meet frangibility requirements.

6.263 Runway guard lights configuration A should be located on each side of the taxiway on the holding side of the runway as close as possible to the pavement edge and adjacent to the Runway Taxi-Holding Position closest to the runway.

6.264 Runway guard lights configuration B should be located across the taxiway on the holding side of the runway

6.265 Where more than one runway-holding positions exist at a runway/taxiway intersection, only the set of runway guard lights associated with the operational runway-holding position shall be illuminated.

6.266 Where runway guard lights are operated in good visibility conditions at night, the luminous intensity may be reduced to 30% but the signal characteristics must be retained.

6.267 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 (Configuration B).

6.268 This consists of a row of inset lights equally spaced at no more than 3 m intervals across the taxiway at the distance from the runway centreline aligned so as to be visible to the pilot or vehicle driver approaching the holding position.

6.269 The lights should have the characteristics described 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 collocated with a stop-bar.

6.270 The light performance characteristics are given in figure 6a.12 for li lights and 6a.17 for hi lights.

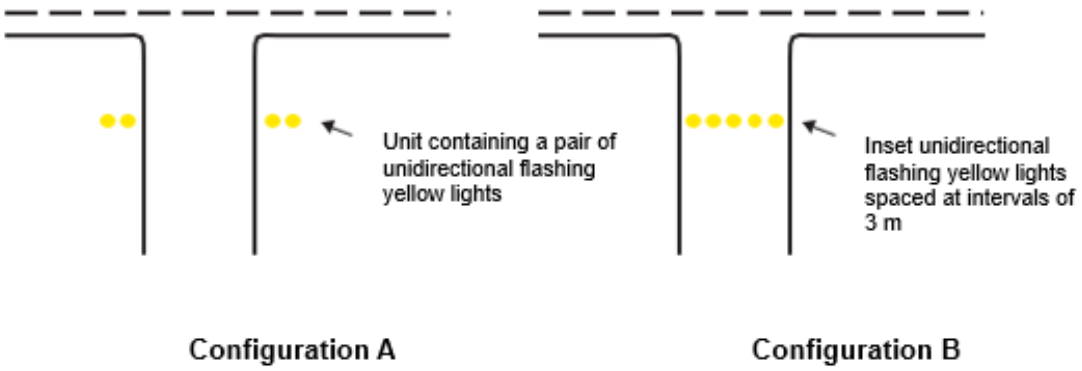


Figure 6.13 Runway guard lights

Note 1. Runway guard lights, Configuration B may supplement Configuration A when deemed necessary.

Note 2. For guidance on orientation

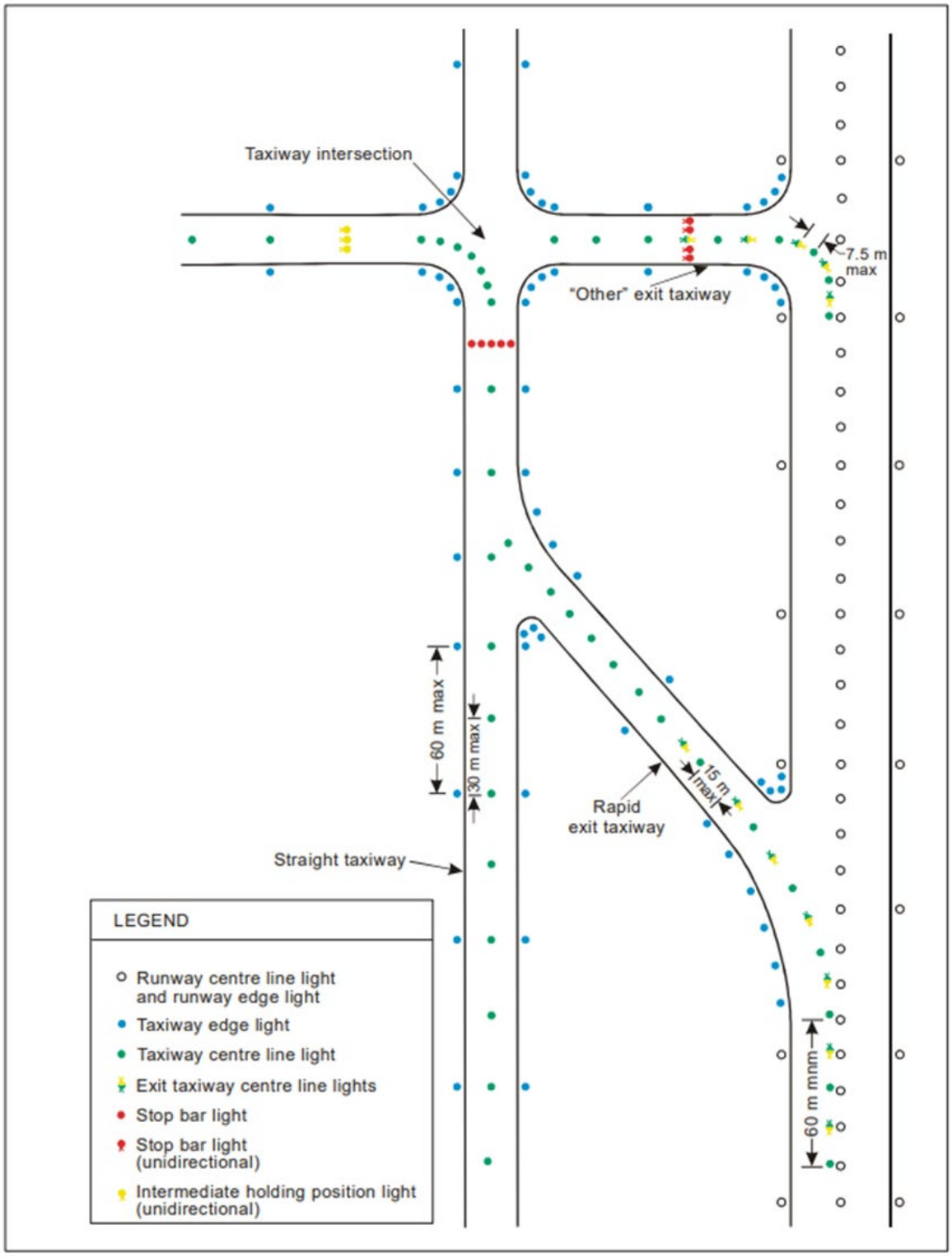


Figure 6.14 Taxiway lighting

Road-holding position lights

6.271 A road-holding position light should be provided at each road-holding position serving a runway when it is intended that the runway will be used in runway visual range conditions less than a value of <1200 m.

6.272 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.

6.273 The road-holding position light should consist of either:

1. A controllable red/green traffic light where a controlled crossing exists; or
2. An amber light system meeting the characteristics of runway guard lights at a point where caution should be exercised.

6.274 The road-holding position light beam shall be uni-directional and aligned so as to be visible to the driver of a vehicle approaching the holding position.

6.275 The intensity of the light beam shall be adequate for the conditions of visibility and ambient light in which the use of the holding position is intended but shall not dazzle the driver.

6.276 The flash frequency of the flashing red light should be between 30 and 60 flashes per minute.

6.277 Road-holding position lights should always be accompanied by a road-holding position sign such as that illustrated at figure 7.40 and, where appropriate, an instruction or cautionary notice. The requirements for the lighting of signs are detailed at chapter 7.

Retroflective taxiway edge markers and centreline studs

6.278 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.

6.279 Edge markers should not exceed 0.36 m in height.

6.280 Edge markers should have a minimum viewing area of 150 cm2 and be blue in colour.

6.281 Centreline studs should not exceed 25 mm in height.

6.282 Centreline studs should be green and have a minimum viewing area of 20 cm2.

Unpaved taxiway routes

6.283 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.

6.284 At the discretion of the CAA, apron floodlighting may be accepted as sufficient illumination of taxiways in the vicinity of the apron.

Aerodromes without specific taxiway routes

6.285 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.

6.286 The lights should be spaced not more than 90 m apart and emit a minimum of 10 candelas.

Aircraft stand manoeuvring guidance lights

Applicability

6.287 Aircraft stand manoeuvring guidance lights should be provided to facilitate the positioning of an aircraft on an aircraft stand on a paved apron, or on a de-icing/anti-icing facility intended for use in poor visibility conditions unless adequate guidance is provided by other means.

Location

6.288 Aircraft stand manoeuvring guidance lights should be collocated with the aircraft stand markings.

Characteristics

6.289 Aircraft stand manoeuvring guidance lights, other than those indicating a stop position, should be fixed yellow lights, visible throughout the segments within which they are intended to provide guidance.

6.290 The lights used to delineate lead-in, turning, and lead-out lines should be spaced at intervals of not more than 7.5 m on curves and 15 m on straight sections.

6.291 The lights indicating a stop position should be fixed, unidirectional lights showing red.

6.292 The intensity of the lights should be adequate for the condition of visibility and ambient light in which the use of the aircraft stand is intended.

6.293 The lighting circuit should be designed so that the lights may be switched on to indicate that an aircraft stand is to be used and switched off to indicate that it is not to be used.

Apron lighting and visual docking guidance systems

Apron lighting

6.294 The edges of aprons should be marked with blue lights in accordance with the specifications given in taxiway lighting.

6.295 Where aerodrome operators consider that blue edge lights are not required, advice should be sought from the CAA.

6.296 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.

6.297 The arrangement and aiming of floodlights should be such that an aircraft stand receives light from two or more directions to minimise shadows.

6.298 The spectral distribution of apron floodlights shall be such that the colours used for aircraft marking connected with routine servicing, and for surface and obstacle marking, can be correctly identified. The average illuminance should be at least the following:

Aircraft stand

6.299 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

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

Visual Docking Guidance Systems (VDGS)

6.301 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.

6.302 VDGS should meet the requirements specified in ICAO annex 14, chapter 5.

Obstacle lighting

Details of this lighting are given in chapter 4

Control of AGL luminous intensity

6.303 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 flight crew lining up for take-off.

6.304 The final choice of AGL luminous intensity setting rests with the flight crew.

6.305 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.

Lighting	Stages	
	Minimum	Recommended
High intensity approach and runway systems, PAPI and High intensity (A)PAPI, 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)

Table 6.3 Luminous intensity control stages

Notes:

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

Typical luminous intensity settings

6.306 It is essential that the various services that make up the AGL present a well-balanced and even pattern to flight crew; hence the provision of an additional ability to select pre-set combinations of luminous intensity settings with one switch may be of benefit.

6.307 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/(A)PAPI systems.

6.308 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.

6.309 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. It is essential that the light output and alignment of every light is correct in order to achieve the optimum overall lighting pattern.

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 set 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. 0% may be used if available.
6. Where required.

6.310 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.

6.311 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%.

Luminous intensity balance considerations for coloured lighting

6.312 Colour filters reduce the light output. The best balance between coloured and white lights may be obtained by either of the following means:

1. 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.

2. 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.

Alternate input power supply

6.313 Adequate primary power supply should be available at aerodromes for the safe functioning of air navigation facilities.

6.314 Electric power supply connections to those facilities for which secondary power is required should be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.

6.315 The design and provision of electrical power systems for aerodrome visual and radio navigation aids should be such that an equipment failure should not leave the pilot with inadequate visual and non-visual guidance, or misleading information.

6.316 Requirements for a secondary power supply should be met by either of the following;

1. Grid power which is a source of power supplying the aerodrome service from a substation other than the normal substation through a transmission line following a route different from the normal power supply.

2. Standby power unit(s) which are engine generators, batteries, etc. from which electric power can be obtained.

6.317 Where the power supply to an aerodrome is provided by two separate national grid sources, they should be physically and electrically separate, 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.

6.318 Routine checks should be carried out on AGL input power supplies. The checks should include assurance that minimum switchover times can be achieved as indicated in table 6.5

6.319 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.

6.320 At least one alternate input power supply should be provided for scales L1 and L2 including internally lit mandatory signs where appropriate and is recommended for other scales.

6.321 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 (MST) when in the associated visibility conditions. An MST of one second can be achieved by automatic changeover either between two incoming power supplies and a closed ring system or between a diesel generating set supplying the load with reversion to the normal supply on failure of the generating set.

6.322 MST 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.

6.323 ATS should notify flight crew on initial RTF contact and by ATIS when possible. Flight crews can then be expected to follow the appropriate instructions in their operations manual.

6.324 Where there is no alternate power supply to support lighting to Scales 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.

6.325 Aerodrome operators should put in place procedures that will ensure that emergency lighting provided will be in operation within 15 minutes of any loss of the input power supply.

Runway	Aids requiring power	Maximum switchover time
Precision instrument approach Categories II and III (Scale L1)	Inner 300m of the 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	15 second
	Category II stop-bars at taxi holding position	1 second
	Other stop-bars	15 seconds
	Essential taxiway, mandatory signs	15 seconds
	Obstacle	15 seconds
	PAPI	15 seconds
Precision instrument approach Category I (Scale L2)	Approach lighting	15 seconds
	Runway edge	15 seconds
	Runway threshold and end	15 seconds
	Essential taxiway lights and mandatory	15 seconds
	Obstacle	15 seconds
	PAPI	15 seconds
Non-precision instrument approach (Scale L3)	Approach lighting	15 seconds
	Runway edge	15 seconds
	Runway threshold and end	15 seconds
	Obstacle	15 seconds
	PAPI and (A)PAPI	15 seconds
Take-off runway intended for use in runway visual range conditions less than 800 m	Runway edge	15 seconds*
	Runway end	1 second
	Runway centreline (where fitted)	1 second
	All stop-bars	1 second
	Essential taxiway	15 seconds
	Obstacle	15 seconds

*1 second where no runway centreline lighting provided

Table 6.5 Alternate power supply – maximum switchover time

Other services requiring secondary power supply

6.326 The following aerodrome facilities should be provided with a secondary power supply capable of supplying power when there is a failure of the primary power supply:

1. Closed runway lighting if provided, should be connected to the primary power supply, The electrical systems for the power supply and the control of the closed runway lighting should be so designed that the closed runway lighting system is operated independently of runway lighting systems.
2. For a precision approach runway, a secondary power supply capable of meeting the requirements of table 6.5 for the appropriate category of precision approach runway should be provided.
3. For a runway meant for take-off in runway visual range conditions less than a value of 800 m, a secondary power supply capable of meeting the relevant requirements of Table 6.5 should be provided.
4. At an aerodrome where the primary runway is a non-precision approach runway, a secondary power supply capable of meeting the requirements of Table 6.5 should be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway.
5. At an aerodrome where the primary runway is a non-instrument runway, a secondary power supply capable of meeting the requirements of table 6.5 should be provided, except that a secondary power supply for visual aids need not be provided when an emergency lighting system is provided and capable of being deployed in 15 minutes.
6. Approach and runway lighting for precision runways, runways meant for take-off in RVR of less than 800 m.
7. The signalling lamp and the minimum lighting necessary to enable air traffic services personnel to carry out their duties.
8. All obstacle lighting which are essential to ensure the safe operation of aircraft.
9. Meteorological equipment including IRVR.
10. CCTV used to enable the control of aircraft (this may include apron areas and areas under the control of ATC that is not visible from the control tower.
11. Essential security lighting, if provided.

12. Essential equipment and facilities for the aerodrome responding emergency agencies.
13. Floodlighting on a designated isolated aircraft parking position, if provided.
14. Illumination of apron areas over which passengers may walk.

Control and monitoring of aeronautical ground lighting

General requirements

6.327 At the majority of aerodromes, the AGL should be controlled remotely from an ATC VCR. In such a 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.

6.328 In the absence of a VCR and/or remote-control facilities, the AGL should;

1. Be switched directly from its power source (in most cases the constant current regulator (CCR)).
2. The AGL should be verified as operationally serviceable by means of a visual inspection and/or indications from the AGL equipment.
3. Where operationally significant, this information should be notified immediately to the AGL operator and, where necessary, flight crew.

6.329 All installations should comply with CAP670 Part C, Section 5 IAS01: Information and Alerting Systems. Additionally, those systems utilising software in their design will need to demonstrate compliance with CAP670 Part B, Section 3, SW 01: Regulatory Objectives for Software Safety Assurance in ATS Equipment for an Approval to be issued.

Pilot Controlled Lighting (PCL)

6.330 The control of an AGL system from beyond the boundary of a licensed aerodrome whether from the ground or in the air is required to be approved subject to a satisfactory proposal by the aerodrome operator to the CAA.

6.331 PCL should not be operated until CAA approval has been granted.

6.332 Where PCL is intended to be installed, the aerodrome operator should submit an operational requirement to the CAA as part of the CAP791 notification requirement.

6.333 PCL should only be available when enabled by the ATCO/FISO/AGCS operator.

6.334 A method of clearly showing that PCL is enabled should be provided.

6.335 Where PCL interfaces to AGL Control and Monitoring equipment, it shall not interfere with the normal operation of the AGL CMS.

6.336 PCL when activated shall only operate the AGL for a pre-set time of 15 minutes after which the AGL shall automatically return to previous setting. This time may be adjusted dependent on the type of operation conducted the aerodrome subject to CAA approval.

6.337 PCL Configuration, including;

1. Activation time;
2. Number of Press-to-Talk Clicks (PTT - Microphone Keying);
3. Lighting systems activated; and
4. Lighting intensities shall be clearly described in the relevant procedure manuals.

6.338 ICAO Doc 9157 Aerodrome Design Manual Part 5 Chapter 10 ‘Aircraft radio control of aerodrome lighting (ARCAL)’ provides guidance on the configuration of PCL, with examples provided in Table 10-1. Justification for the selection of the lighting controlled by PCL should be included in the operational requirement.

6.339 Where an existing Pilot Controlled Lighting (PCL) system previously approved by the CAA for the sole use of the emergency services is to be made available to others, an appropriate method of operation should be agreed between all users.

6.340 The operational requirement proposed by the aerodrome operator should include;

1. A description of the control equipment;
2. Any AGL to be installed;
3. The method(s) of switching the system; and demonstration that any additional control equipment does not introduce a detrimental effect;
4. The extent of AGL to be controlled by PCL;
5. A comprehensive safety case part of the change management process;
6. Examples of documentary or other control measures to cover out of hours operations;
7. Arrangements between based operators; and

8. Details of the changes to the Aerodrome Manual, associated manuals and ATS manuals;

9. Details of the arrangements for the notification of periods when PCL is available, and when unavailable.

New installations or modifications to existing installations

6.341 All new installations or modifications to existing installations should be notified to the CAA and supported by the appropriate safety assurance documentation, including a human factors assessment in accordance with UK regulatory requirements.

6.342 The system should only provide conformation of controller selection once the setting requested has cross checked with the “tell-back” derived from the appropriate field circuits. Should the commanded settings not be set or there is a difference between associated field circuit settings, (for example an interleaved runway edge circuit), an appropriate fault indication should be provided at the operational position.

6.343 Software driven control positions should have a method for detecting a loss of communication with the main control system and alert the user to the failure. In addition, where possible, the loss of communication to that position should be notified to other controller positions if installed.

6.344 When in use, the operational status of the AGL system should be continuously monitored.

6.345 An appropriate means of detecting an AGL system failure or fault and other serviceability information should be provided.

6.346 The AGL system serviceability information should be derived from the actual settings on the CCR(s) / field circuits, and the functionality of the control system provided to the AGL operator in a simple but accurate and concise way, so that, if necessary, the user may pass a report to flight crew.

6.347 The report should enable flight crew to determine whether the AGL meets their current operational flight requirements or not.

6.348 Any loss of communication with the IRVR or pilot-controlled lighting interface should also be reported where installed.

6.349 The design of the control and monitoring system should be kept as simple as possible.

6.350 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.

6.351 The remote control and monitoring facilities provided for ATC use shall be approved by the CAA under Article 169 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. Part B, Section 2: ATC 01: ATC Support Systems and Facilities and Part C, Section 5 IAS01: Information and Alerting Systems

6.352 The complexity of the AGL control and monitoring system will depend upon the operational requirements of the aerodrome concerned. The functional requirements of the AGL system should meet the current operational requirements but have due regard for ease of routine maintenance and future modifications or expansion.

6.353 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 routeing systems and heavy volumes of traffic find that programmable electronic systems provide the capability and flexibility needed.

Control and monitoring system

6.354 The AGL control and monitoring system should:

1. Be suitable for the aerodrome, and be adaptable to changes in an aerodrome's physical characteristics (layout, installations, etc.) or operational procedures;
2. Be inspired by safety in such a way that allows for the redundancy of equipment or elements which are critical for failsafe design;
3. Have a high dependability;
4. Be capable of communicating with other related systems, as required;
5. Demonstrate the correct operation of any interfaces and the detection of faults or incorrect operation, (such as regular polling as one method);
6. Ensure component parts should be designed to fail safe and provide an accurate indication of their status under various fault conditions, (for example loss of power to a CCR).

Control system software

6.355 Where software is used for the purpose of control or monitoring of the AGL, the following aspects shall be addressed:

1. 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.

2. 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;
3. Known hazardous software states shall be either removed or mitigated by the total system design; and
4. Documented evidence shall be produced to demonstrate accomplishment of the target safety integrity levels.
5. The requirements for software in safety related ATS systems are contained in CAP 670, ATS Safety Requirements. Part B, Section 3, SW 01: Regulatory Objectives for Software Safety Assurance in ATS Equipment.

6.356 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.

6.357 COTS includes all types of software and electronic or electrical processing equipment and may also be applied to light fittings and other hardware.

6.358 The following conditions shall be satisfied where a COTS product is being considered for AGL safety-related applications:

1. The scope of the design specification for the COTS product shall include the purpose for which it is intended to be used;
2. 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;
3. The functionality of the COTS product shall conform to the applicable safety requirements;
4. Any changes or user-defined modifications to the COTS product shall be made under a suitable configuration change control system;
5. Proof of 1 to 4 above should be submitted to the CAA as part of the safety case for the system.

Control equipment

6.359 The control equipment should:

1. Provide a clear layout with efficient ergonomics to support simple and safe handling.
2. Facilitate the switching on or off of the AGL;

3. Facilitate the switching of luminous intensity settings of the AGL; facilitate alarm handling (visual and audible), providing an accurate indication of status derived from the actual field settings and/or any difference between selected and actual field settings;

4. If necessary, for complex aerodrome layouts, provide programmable inputs (for example taxiway routeing).

6.360 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.

6.361 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.

6.362 Where the air traffic 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.

Monitoring equipment

6.363 The task of the monitoring function is to indicate the actual operational state of the AGL system derived from the field circuits and to detect a failure of the control and monitoring system itself. The monitoring equipment should provide information concerning the operational status of the AGL system / field circuits and should display it at all times. the information required would typically include the following:

1. AGL on or off;

2. AGL performance, e.g., luminous intensity correct or within tolerance and lamp failure.

3. notify the existence of an alarm by appropriate visual and aural means.

6.364 Where a change in the operational status of lights has occurred, an indication should be provided within two seconds for a stop bar at a runway-holding position and within five seconds for all other types of visual aids.

6.365 For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems should be monitored automatically so as to provide an indication when the serviceability level of any element falls below a minimum serviceability level This information should be automatically relayed to the maintenance crew.

6.366 For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems should be monitored automatically to provide an indication when the serviceability level of any element falls below a minimum level, below which operations should not continue. This information should be automatically relayed to the air traffic services unit and displayed in a prominent position

Note: Guidance on air traffic control interface and visual aids design is included in the aerodrome Design Manual (Doc 9157) Part 5.

6.367 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.

6.368 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.

6.369 The selection of any AGL (or part thereof) should illuminate the corresponding display on the mimic panel only when the selected field service is activated and verified as serviceable.

6.370 The requirements above and of CAP670 Part C Section 5, IAS01: Information and Alerting Systems 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 CAP670 Part B Section 3, SW01: Regulatory Objectives for Software Safety Assurance in ATS Equipment.

IRVR interface

6.371 The IRVR interface should be designed to meet the integrity requirements required by both the AGL Control System and the IRVR, where installed.

6.372 The information used for IRVR interfaces output should be derived from the primary circuit monitoring on the selected runways CCRs (or an independent approved circuit monitoring device if fitted). Only if the runway edge CCRs and runway centreline CCR’s where applicable, (see note below) confirm they have the same primary circuit setting, there are no faults except;

1. Minor warning such as a lamp out) and these settings match the controller’s selection should the information be presented to the IRVR system.

2. The IRVR interface output SHOULD NOT be derived directly from the controller's selection.

6.373 ICAO Doc.9328-EN Manual of Runway Visual Range Observing and Reporting Practices states that;

"It is highly desirable that the RVR assessments be based on the lights from which pilots derive their main guidance. Where there are both edge lights and centre line lights, it is normal to use edge lights when RVR assessment is above 550 m; with lower visual range, however, practices vary from State to State.

6.374 The use of centre line lights for the lowest RVR values is preferred because of the inferior directional guidance provided by edge lights at short range; and the fact that edge lights become dimmer than centre line lights when viewed off axis.

6.375 Where runway centre line lighting is to be used in the IRVR calculations for CATII and CATIII operations, it shall be identified within the safety assurance documentation for both the AGL and IRVR systems.

6.376 If the intensity of the centreline fittings is the same as that of the runway edge fittings, the standard set of intensity levels programmed into the IRVR system can be used.

6.377 Should the runway centre line lighting have a different output intensity to the runway edge lights for a given lighting level selection, either;

1. The lower of the two figures should be used for the IRVR calculation or,
2. The IRVR software shall be capable of switching to the runway centreline intensity when the reported visibility goes below 550m at a given lighting intensity selection.
3. Justification for the selection and information relating to the capability of the IRVR system to address this should be included in the Safety Assurance documentation submitted to the CAA.

Hardwired IRVR Interfaces

6.378 Table 6.6 provides a typical example of a AGL runway edge, hardwired IRVR interface logic table with the input and standard / expected output for various conditions.

6.379 The correct operation of the IRVR interface and IRVR system should be defined and tested as part of the site acceptance and commissioning checks for both new installations and system modifications that may have an impact.

6.380 The standard runway edge and centreline – IRVR interface will normally consist of a set of 6, volt free contacts or earthed contacts indicating 0%, 1%, 3%, 10%, 30% and 100%.

6.381 Some systems may provide an alarm contact, 80%, 0.3% and 0.1% as additional indications. 0.3% and 0.1% are not used for runway edge and 80% would normally replace 100% and the appropriate intensity programmed into the IRVR system.

6.382 The loss of all inputs to the IRVR should result in a fault message, but on older systems this may not be the case and the output of 0% for a fault condition should result in a “Lamps Too Low” output on the IRVR display.

6.383 The IRVR interface should be designed to fail safe, in that should the IRVR interface lose its connection from the control system, or the system loses power, the output of the interface will either provide an indication of 0%, alarm or no output on any of the six lines, depending on the configuration or input capabilities of the connected IRVR system.

Networked IRVR Interfaces

6.384 A networked IRVR interface should have a handshaking mechanism allowing both the AGL control system and the IRVR system to detect a loss of communication.

6.385 The correct operation of the IRVR interface and IRVR system should be defined and tested as part of the site acceptance and commissioning checks for both new installations and system modifications that may have an impact.

6.386 The exact configuration will depend on the capabilities of the connected IRVR system and should be defined for the system and included in any safety assurance documentation.

Audio visual alarms

6.387 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, derived from the field / CCR tell-back indication, whenever a selected AGL circuit fails, fails to activate or fails to meet the requirements set out in table 6.6.

Note: Only faults on the runway edge lights (and centreline lights if applicable) or a control system failure should be sent to the IRVR interface.

Controller Selection	Runway Edge Lights CCR1	Runway Edge Lights CCR2	IRVR Interface Input						IRVR Interface	
			Off /0 %	1 %	3 %	10 %	30 %	100 %	Alarm*	Output
Off / 0 %	**Off / 0 %**	**Off / 0 %**	Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Off / 0 %
1 %	**1 %**	**1%**	Inactive	Active	Inactive	Inactive	Inactive	Inactive	Inactive	1 %
3 %	**3 %**	**3 %**	Inactive	Inactive	Active	Inactive	Inactive	Inactive	Inactive	3 %
10 %	**10 %**	**10 %**	Inactive	Inactive	Inactive	Active	Inactive	Inactive	Inactive	10 %
30 %	**30 %**	**30 %**	Inactive	Inactive	Inactive	Inactive	Active	Inactive	Inactive	30 %
100 %	**100 %**	**100 %**	Inactive	Inactive	Inactive	Inactive	Inactive	Active	Inactive	100 %
Any Significant Fault			Any Other Condition						Active	No Output or Off / 0 %
CCR's Disagree										
Controller Selection and One / both CCR's Disagree										
Control System failure										
Corruption										

***Alarm Output if fitted**

Note: The same principle to be applied if more than 2 CCRs are used to provide the edge lighting (and centreline if applicable) on the runway.

Table 6.6 Hardwired IRVR Interface Output Logic

6.388 The audio alarm should be capable of being temporarily suppressed while 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.

6.389 The aspects to consider for a monitoring display are:

1. If the indicator is on, the relevant AGL circuit(s) is on and serviceable;
2. If the indicator is off, the relevant AGL circuit(s) is (are)off;
3. If the indicator is active (i.e., flashing) and accompanied by an audible alert, the AGL serviceability state has changed, or a relevant fault / mismatch has occurred

6.390 When reporting to flight crew 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:

1. Serviceable;
2. Downgraded;
3. Or failed;

6.391 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 states above applies.

6.392 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.

6.393 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.

6.394 Further guidance on the assessment of AGL serviceability and the presentation of this information is provided in CAP 670, ATS Safety Requirements Part B, Section 2: ATC 01.

6.395 Consideration should be given to the provision of an intermediate warning level or pre alarm 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.

6.396 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.

6.397 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 typical logarithmic current values for a tungsten halogen (or retrofit LED) installation and tolerances for serviceable AGL using such a device.

6.398 Direct fit LED fittings with the correct CCR produces different results. When matched correctly they are typically in the low amps range. Until such time as definitive guidance is available, information on the luminance intensity, tolerance and equivalent current ratings and tolerances should be extracted from the manufacturers site acceptance test and commissioning documentation, provided as part of the safety assurance documentation, and included in the associated equipment maintenance schedule as “red” figures.

6.399 This type of verification for either system does not however provide an assurance that the AGL meets the photometric requirements outlined in photometric requirements.

6.400 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.

6.401 Technical serviceability information about the AGL system other than those required to meet the requirements detailed in typical luminosity settings must be displayed and trigger alerts at ATC or other operational positions; warnings should be given to engineering positions and alarms displayed or al trigged at ATC or other operational positions.

6.402 All operationally significant events, alarms or failures should be recorded and retained for at least 30 days.

6.403 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.

6.404 Magnetic, optical, or electronic storage should contain all monitored data.

Luminous Intensity	
Setting %	**Tolerance %**
100	±9
80	±9
30	±20
10	±40
3	±40
1	±40
0.3	±40
0.1	±40
0	-

Table 6.6A AGL Luminous Intensity RMS Current Limits (tungsten halogen or retro fit LED)

Notes:

1. The specifications contained in this table have been derived through consultation with equipment manufacturers.
2. Direct fit LED fittings with the correct CCR produces different results. See the guidance below

AGL fault conditions

6.405 An AGL system fault exists if:

1. There is a difference between a requested status and the actual status of the AGL; or
2. A malfunction of a significant component or function is detected; or
3. The result of a measurement is not within the specified tolerance.

6.406 Unserviceable light fittings should not be permitted to alter the basic pattern of the AGL system, which should always give adequate guidance.

6.407 For AGL in use in RVR less than 400 m, no two adjacent light fittings should be unserviceable.

6.408 Where a stop-bar fails to function and is required for use, the stop-bar and the associated section of taxiway should be withdrawn from service until the fault is rectified.

6.409 In the event of a failure that disables the control equipment, the AGL should assume a pre-determined fail-safe condition. Reversion should normally be to the last set selection where that is a safe condition.

6.410 If an IRVR interface is in use, in the event of a failure of the control system to set the correct setting on the runway edge light circuits (and centreline if applicable) or that disables the control equipment, the AGL IRVR should set the IRVR interface to output 0%. (The control system could also either provide an alarm output or no output on the interface, but compatibility / testing with the IRVR system would be required.

6.411 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 pre-set condition and there should be no loss of logging facilities. The IRVR interface shall provide or indicate the actual field settings during the power outage (fault or 0%), returning to normal operation following restoration.

General

6.412 The Electricity at Work Regulations 1989 encompass all work carried out on AGL and other electrical installations in and around aerodromes.

6.413 Under certain circumstances the Electricity Safety, Quality and Continuity Regulations 2002 may also apply. As these are Statutory Instruments, compliance with them is mandatory.

6.414 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 2006/95/EC where applicable.

6.415 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:

1. The organisation, roles, and responsibilities;
2. The maintenance philosophy, that includes and takes account of:
3. The maintenance objectives;
4. The operational requirements;

5. The maintenance resources.
6. A maintenance schedule and procedures, which include:
7. Planned, controlled, conditional and corrective maintenance programmes;
8. Setting up and testing of the warning (lamp out) and alarm levels in accordance with or better than the levels listed in table 6.7.
9. Post-maintenance activities;
10. The modification or upgrading of equipment following approval by the CAA
11. Specific safety procedures;
12. The management of records and documentation;
13. The provision of spares, tools, and test equipment;
14. Inspections.

6.416 The maintenance of AGL equipment should consider the objectives of aerodrome operations and address the impact on such operations while maintenance activities are being carried out.

6.417 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 while the work is being carried out.

6.418 A procedure for local operation should be agreed with ATC before local switching of AGL circuits commences.

6.419 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.

6.420 A logbook should be provided at each power centre for this purpose and retained for at least three years after the date of the last entry.

6.421 All logbooks, together with installation drawings and operating and maintenance manuals, should be available for examination during licensing inspections.

6.422 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.

AGL	Landing		Take-off	
	Category I	Category II/III	RVR <800m	RVR >800m
Approach beyond 450 m	85%	85%		–
Approach inner 450 m	85%	95%		–
Runway threshold	85%	95%	–	–
Runway end	85%	85%	85%	75%
Runway edge	85%	95%	95%	85%
Runway C/L where fitted	85%	95%	95%	85%
TDZ where fitted	85%	90%	–	–

Table 6.7 Minimum percentage of serviceable light fittings

6.423 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.

6.424 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.

6.425 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 dependent 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.

Table 6.7 Minimum percentage of serviceable light fittings

6.426 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%.

Maintenance objectives

6.427 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.

6.428 The objectives contained in table 6.7 specifically target precision instrument approach runways and operations in low visibility.

6.429 For precision instrument 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.

Maintenance practices

6.430 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.

6.431 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 flight crew. If local circumstances permit, maintenance staff should be given the opportunity to view the AGL from the air.

6.432 The overall performance of AGL can be dramatically improved and maintained with the introduction of an adequate cleaning regime.

6.433 The nature of their general location makes inset fittings particularly susceptible to the presence of dirt, dust, moisture, and the effects of heavy loads.

6.434 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.

6.435 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, and other AGL should be cleaned at least once every two weeks.

6.436 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.

6.437 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:

1. Lights in paved areas;
2. Numbers painted with white road paint adjacent to the light fitting;
3. Lights in grassed areas;
4. Numbers painted on the light fitting;
5. Pole or mast mounted lights;
6. Numbers painted on plates attached to the poles or masts.

6.438 An up-to-date set of drawings showing the AGL layout, light fitting location numbers and cable routeing, 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.

6.439 Where AGL and equipment is installed on private land, rights of access should be maintained in order that regular maintenance may be carried out.

6.440 If the process detailed in paragraph 6.198 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.

6.441 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.

6.442 Lamps should be changed after 90% of nominal life at maximum luminous intensity (operating time at other luminous intensity levels being ignored).

6.443 Any observed deterioration of an AGL pattern should be promptly corrected. The replacement of AGL lamps only on failure should be a last resort.

Insulation value

6.444 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.

6.445 A calibrated device should be provided to measure the insulation value of the primary series circuit with a test voltage exceeding the normal maximum primary circuit working voltage and 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.

6.446 A calibrated device should also be provided to measure the insulation value of the secondary series circuit, with a test voltage exceeding 450V.

6.447 Where an automatic measurement facility is provided, the measurement shall be done at a rate of not less than once per hour.

6.448 A schedule should however be produced to test the primary circuits using separate, calibrated test equipment to confirm the accuracy of the automatic system. The periodicity of these checks should be agreed with the CAA.

6.449 For a new installation, or for the total replacement of a circuit including AGL series transformers, the insulation resistance between primary and secondary series circuits and between primary series circuit and earth should exceed 30M ohms and ideally be above 50 MΩ.

6.450 Should the insulation resistance between primary and secondary series circuits and between primary series circuit and earth fall below 30 MΩ, consideration should be given to investigating the source during any subsequent maintenance on the affected field circuit.

6.451 Remedial action should be taken if the insulation resistance between primary and secondary series circuits and between primary series circuit and earth falls below 10 MΩ. The fault should be investigated as part of the next planned maintenance or additional maintenance should be applied to the affected field circuit.

6.452 Immediate remedial action and additional safeguarding measures should be taken where the insulation between primary and secondary series circuits and between primary series circuit and earth falls below 30 MΩ.

6.453 The insulation properties of secondary series circuit cables should be checked using a calibrated device 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 ohms.

6.454 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.

6.455 Aerodrome operators 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.

6.456 To minimise future cracking of aluminium alloy light fittings due to intergranular corrosion, licence holders 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.

6.457 Aerodrome operators 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.

6.458 Mechanical loading may affect the structural integrity of AGL fixtures and fittings while in service and may also exacerbate the effects of corrosion.

6.459 Staff should look for the effects of poor installation, especially with regard to debris entrapment between fitting, seating ring and base, and rectify as necessary;

6.460 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;

6.461 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.

6.462 BS 3224 (1988) Part 5, Light Fittings for Civil Land Aerodromes, was withdrawn following concerns raised by independent research into the impact loads suffered by inset runway assemblies. The following process should be adopted:

6.463 A maintenance inspection regime, where appropriate, designed to take into account the following:

1. Aircraft traffic volume;
2. Location of assemblies;
3. Age of assemblies;
4. Chemical usage; and

5. Previous maintenance history.
6. A risk assessment for inspection periods should be developed
7. Aircraft traffic volume should be expressed in terms of total ATMS i.e. including both take-off and landings;
8. Location of assemblies should be defined in terms of structural risk. It may be appropriate to consider dividing the runway into three zones defined as high, medium, and low equating to the touchdown area, parts of the runway where more than, say, 50% of traffic vacates and all other areas.

6.464 The maintenance procedures detailed in this paragraph should be adopted as a minimum requirement taking paragraph 6.51 into account.

6.465 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.

6.466 A competent engineer should assess the AGL maintenance requirements and augment the minimum requirements in scope and frequency where necessary.

6.467 The minimum maintenance procedures are as follows:

1. Daily: A visual inspection of the AGL should be undertaken. Unserviceabilities should be recorded, and appropriate remedial action taken.
2. Six-monthly (or more often as indicated by risk assessment): check and take remedial action as required to ensure that the alignment of all elevated lights is within tolerance.
3. If hinged masts are used with alignment carried out at ground level, the checking procedure should include the mast settings when reinstated; primary series circuit current levels at all luminous intensity settings comply with the levels and tolerances given in table 6.6.
4. Actual values and the type and serial number of the test instrument used should be noted in the maintenance log.
5. It is desirable that a percentage of secondary series circuit currents should be checked;
6. All AGL control and monitoring facilities are serviceable
7. All earth connections are satisfactory;
8. The insulation resistance of all primary series circuits is satisfactory

9. The structural integrity of the assembly is satisfactory.

6.468 At regular intervals 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.

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.
3. 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.
4. 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.

Runway Edge (and centreline where applicable) AGL Degradation – Impact on reported IRVR.

6.469 Aerodrome operators / Air Traffic Service providers shall have procedures in place to account for the loss of the IRVR systems fitted at the aerodrome resulting from a failure or partial failure of the runway edge lighting.

6.470 The inability to provide IRVR and the nature of the edge (or centreline if applicable) lighting fault shall be promulgated to aircrew and notified via (D)ATIS, NOTAM, or directly by the controller to ensure aircrew can consider their options. This should continue until such time the unserviceability is rectified and the system restored to full capability.

6.471 During an AGL failure the aerodrome operator should consider the impact to aircraft operations particularly at night, in poor metrological conditions and low visibility conditions taking appropriate actions to ensure safety is maintained.

AGL Photometric requirements

6.472 The maintenance objectives for AGL are detailed in maintenance objectives and table 6.7.

6.473 The objectives are specified in terms of the maximum number of unserviceable lights at any one time.

6.474 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 or;

6.475 The brightest part of the beam is not within the specified main beam area.

6.476 For light units where the main beam average intensity is required to be higher than the value specified, a light shall be deemed to be unserviceable when the main beam average intensity value is less than 50 per cent of this higher value.

6.477 Guidance on maintenance criteria for aeronautical ground lights, on the use of a site standard and on using a higher main beam average intensity is contained in the Aerodrome Design Manual (Doc 9157), Part 4

6.478 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.

6.479 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 licence holder should establish and maintain the best AGL photometric performance achievable, taking into consideration the following factors;

1. The design performance of the lights when new;
2. The aerodrome traffic type and density; and
3. The prevailing weather conditions

6.480 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.

Checking of (A)PAPI systems

6.481 (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:

6.482 On a daily basis, particular attention should be paid to the following items with respect to (A)PAPI systems:

1. All lamps are serviceable and evenly illuminated;
2. There is no apparent damage to units;
3. The change from red to white is coincident for all elements of a unit;
4. The heating facilities are functioning correctly;
5. All lenses are clean.

6.483 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.

6.484 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.

6.485 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.

6.486 Clinometers should be calibrated annually or as recommended by the manufacturer or when an error is suspected.

6.487 At weekly intervals the (A)PAPI system should be inspected internally and cleaned, lenses should be polished, and anti-misting fluid applied if appropriate.

6.488 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.

6.489 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.

6.490 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.

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

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

Checking of AGL system input power supply

6.492 Where back up power systems are provided, alternate main supply, UPS or generator power, the systems shall be regularly tested to ensure switchover times are achieved. Results must be documented; remedial action must be undertaken where deficiencies are detected in order to meet the power switchover requirements.

6.493 Aerodrome ATS providers should familiarise themselves with the degradation modes of operations depending on the condition of the power being supplied and the impact on to other interdependent systems such as IRVR.

6.494 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.

6.495 Where automatic switch-over is provided for the AGL system input power supplies, a check of the switching system should be made in order to ensure that the switchover times required at table 6.5 can be met.

6.496 A log should be kept detailing each check undertaken. Switch-over times and generator running times should be noted along with any action taken to ensure that the requirements are met.

Installation of AGL systems

General

6.497 An AGL system should normally comprise a single control and monitoring installation and several constant current series circuits. The following elements make up a typical constant current series circuit (see figure 6.13):

1. A constant current regulator (CCR);
2. A primary series circuit, which includes:
3. Primary cable;
4. AGL series transformer(s) (may be known as isolating transformer).
5. A secondary series circuit, which includes:
6. Secondary cables;
7. The light fitting or other devices

AGL System Components

6.498 An AGL system should normally comprise a single control and monitoring installation and several constant current series circuits.

6.499 The following elements make up a typical constant current series circuit (see Figure 6.13):

1. A constant current regulator (CCR);
2. A primary series circuit, which includes:
3. Primary cable

6.500 AGL series transformer(s) (may be known as isolating transformer).

1. A secondary series circuit, which includes:
2. A secondary cables;
3. The light fitting or other devices

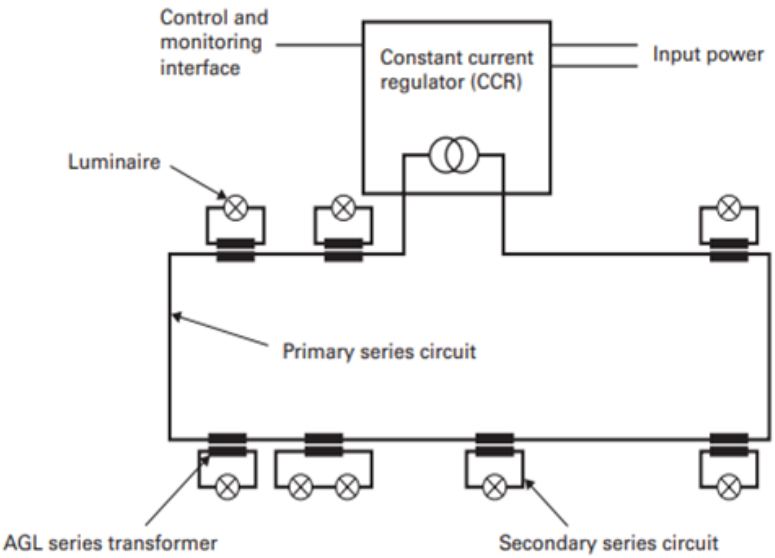


Figure 6.13: Typical AGL constant current series circuit

6.501 Aerodrome operators should contact the CAA for approval requirements associated with the design and installation of AGL systems.

6.502 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 7671:2018+A2:2022 IEE Wiring Regulation requirements should be applied. However, BS 7671:2018+A2:2022 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.

6.503 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.

Earthing

6.504 The equipment in the control and distribution centres should be bonded to earth in accordance with BS 7671:2018+A2:2022

Constant Current Regulators (CCRs)

6.505 In order to provide the AGL operational luminous intensity, the CCR should have a range of output current steps in accordance with table 6.6A for halogen or retrofit LED fittings or sight / installation specific readings for direct fit LED fittings with the associated LED CCRs installed. 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.

6.506 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.

6.507 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;

1. Assurance of no voltage or current in the CCR or primary series circuit;
2. Mechanical disablement (e.g., key switch mechanisms, padlocks etc.);
3. An indication of the disconnection.

6.508 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.

6.509 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.

6.510 The CCR should incorporate output 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.

6.511 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.

6.512 If a hardwired CCR loses its mains supply or goes unserviceable it shall provide a failsafe indication of the failure back to the control system.

6.513 An unserviceable software driven / networked CCR should provide a failsafe indication of that failure back to the control system, or the control system should be able to detect a failure / lack of response and alarm appropriately.

AGL Cables

6.514 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 0.30 m and to separate cables of different circuits by sufficient margin in order to eliminate possible EMC problems.

6.515 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.

6.516 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 0.45 m below the finished grade. All cables installed shall be tested for continuity.

6.517 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.

6.518 Where voltage with respect to earth is less than 150 V, the resistance shall be 100 k ohms or greater; where the voltage with respect to earth is between 150–300 V, the resistance shall be 200 k ohms 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 ohms or greater. Where provided, earth and bonding connections shall be tested and verified as correct.

6.519 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.

6.520 The maximum circuit rating should include the insulation rating of the cables, connectors and AGL series transformers.

6.521 The CCR and lightning arresters 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.

6.522 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.

6.523 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:

1. 2μ A for each AGL series transformer;
2. 1μ A for each 100 m of cable (this value includes allowances for a nominal number of connectors and splices).

6.524 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.

6.525 Cables should not be installed if;

1. It has been kinked;
2. The shield (if fitted) has been damaged;
3. The surface of the sheath or jacket has been damaged so that the insulation properties have been degraded;
4. It shows signs of cross-sectional distortion.

6.526 Where accessible, including at each cable end, joint or connection, all cables should be labelled with an appropriate, indelible, and secure identification mark.

Earthing of Circuits

6.527 Primary series circuits shall not be earthed and all attempts to work on circuits when live shall be prevented.

6.528 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, adequate protection from electric shock must be provided.

6.529 Where provided, earth connections should be measured to be no greater than 6 ohms in order to provide protection from electric shock.

6.530 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.

6.531 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

6.532 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

Interleaving of AGL electrical circuits

6.533 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:

6.534 Two separate interleaved circuits for each of the following systems:

1. Approach lighting on precision instrument approach runways;
2. Supplementary approach lighting;
3. HI runway edge, threshold, and end lighting. See Note 1 below and Note 1 of table 6.5;
4. HI runway centreline lighting;
5. Touchdown zone lighting;
6. For each stop-bar (sub-paragraphs 3., 4. and 5. below refer);
7. 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 flight crew with a hazardous situation in low visibility).

Note; Threshold lighting should be on independent interleaved circuits.

Note; 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.

One separate circuit for each of the following systems;

1. HI simple approach lighting;
2. Approach lighting on non-precision instrument approach runways;
3. LI runway edge, threshold, and end lighting;
4. PAPI or (A)PAPI but see Unserviceability of (A)PAPI systems
5. Taxiway and apron edge lighting

6.535 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.

6.536 The stop-bar and lead-on lighting circuits should be interlocked so that the stop-bar and lead-on lighting cannot be illuminated simultaneously.

6.537 Verification of the stop-bar and lead-on lighting selection should be provided.

6.538 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.

6.539 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.

6.540 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.

6.541 Runway guard lights may be served by the taxiway lighting circuits other than those for stop-bars provided that the requirements set out in the runway guards lights section in this chapter are met. Verification that the runway guard lights are operating is required.

6.542 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.

6.543 Interleaved circuits may be provided for the services listed in Interleaving of AGL electrical circuits in order to increase integrity or to overcome a technical difficulty.

6.544 Approach slope indicator installations should be limited to two circuits per runway end.

6.545 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.

6.546 The interleaving criterion is still applicable where individual or addressable AGL switching is installed.

Electromagnetic Compatibility (EMC)

6.547 The AGL system and its components shall conform to the Electromagnetic Compatibility Regulations 2016, as amended by the Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019.

6.548 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.

6.549 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.

6.550 An aerodrome movement area is generally considered an uncontrollable electromagnetic environment.

6.551 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.

6.552 Shielded cables in the constant current series circuits are recommended in order to achieve EMC.

6.553 When installing new equipment or undertaking development, the new infrastructure should not alter significantly the local magnetic field density. This is especially critical in areas where aircraft hold prior to departure.

Commissioning Flight Checks of New AGL installations

6.554 Commissioning flight checks of new AGL installations, including A(PAPI), shall be conducted prior to their operational use. The CAA may choose to participate in or conduct such checks.

6.555 AGL flight checks shall be conducted by competent persons, holding appropriate flight crew qualifications. The aerodrome licence holder should ensure that such persons are competent.

6.556 The aerodrome operator should ensure that the results of flight checks, which may be subject to audit by the CAA, are evaluated and actioned accordingly.

6.557 Runway lighting deployed on a temporary basis, including (A)PAPI and approach lighting where appropriate, should be flight checked daily prior to being used at night. This procedure should be adopted for each subsequent deployment.

Aeronautical ground lighting characteristics

General

6.558 The characteristics of low intensity AGL and of enroute 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.

6.559 A light is considered to have failed if its average luminous intensity is, for any reason, less than half of the minimum average luminous intensity specified in the relevant isocandela diagrams.

6.560 Where more than one light is used in a unit, the unit is considered to have failed if its light output is similarly reduced.

6.561 Only AGL conforming to the specified colours should be displayed to flight crew and vehicle drivers

6.562 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 aerodrome licence holders to maintain a level of light exceeding the specified minimum intensities.

AGL flight checks

6.563 All approach and runway AGL on an instrument runway shall be flight checked in accordance with the procedure for the routine flight inspection of approach and runway lights at least once every six months.

6.564 All approach and runway AGL on runways other than those applicable in the paragraph above shall be flight checked in accordance with the procedure for the routine flight inspection of approach and runway lights.at least once every 12 months.

6.565 An (A)PAPI system shall be flight checked in accordance with the checking of (A) PAPI systems at least once every six months.

6.566 Commissioning flight checks of new AGL installations, including A(PAPI), shall be conducted prior to their operational use. The CAA may choose to participate in or conduct such checks.

6.567 AGL flight checks shall be conducted by competent persons, holding appropriate flight crew qualifications. The aerodrome licence holder should ensure that such persons are competent.

6.568 The aerodrome licence holder should ensure that the results of flight checks, which may be subject to audit by the CAA, are evaluated and actioned accordingly.

6.569 Runway lighting deployed on a temporary basis, including (A)PAPI and approach lighting where appropriate, should be flight checked daily prior to being used at night. This procedure should be adopted for each subsequent deployment.

Procedure for the routine flight inspection of approach and runway lights

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.

Note; 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 omni-directional 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 flight crew.

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	
☐	W	W	W	W	☐	W	W
☐	W	W	W	R	☐	W	R
☐	W	W	R	R	☐	R	R
☐	W	R	R	R			
☐	R	R	R	R			

Range (FAF) _____ nm

Intensity Changes

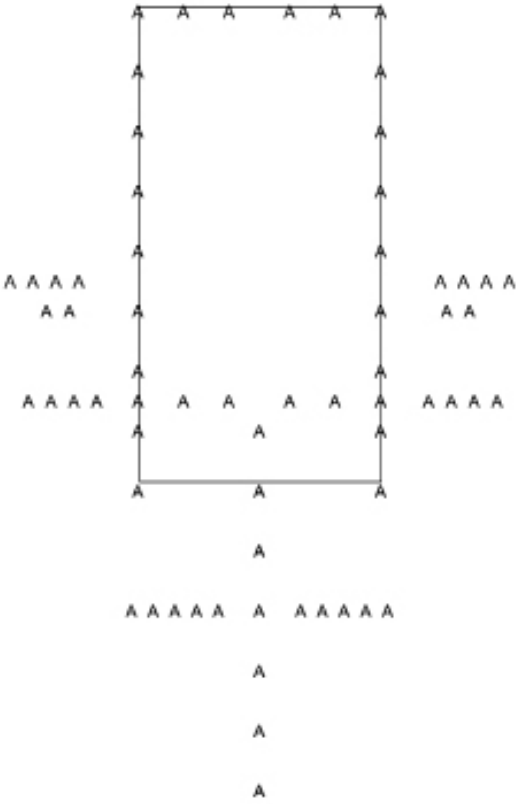
- ☐ 100%
- ☐ 80%
- ☐ 30%
- ☐ 10%
- ☐ 3%
- ☐ 1%
- ☐ OFF

Continuous Assessment

	Low	On-slope	High
Intensity	☐	☐	☐
Alignment	☐	☐	☐

Overall Assessment

- ☐ Approach/Runway Balance
- ☐ Circling Guidance
- ☐ Approach
- ☐ Strobe
- ☐ Threshold
- ☐ Runway Edge
- ☐ Stop-end
- ☐ Windsleeves
- ☐ Beacon
- ☐ Obstacle



Inspected by _____ **Date**_____

CA 1590 E (Part 1)
170400

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

CIVIL AVIATION AUTHORITY

Aeronautical Ground Lighting Flight Inspection Report (CAT I)

(This form is to be completed during or immediately after the flight)

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

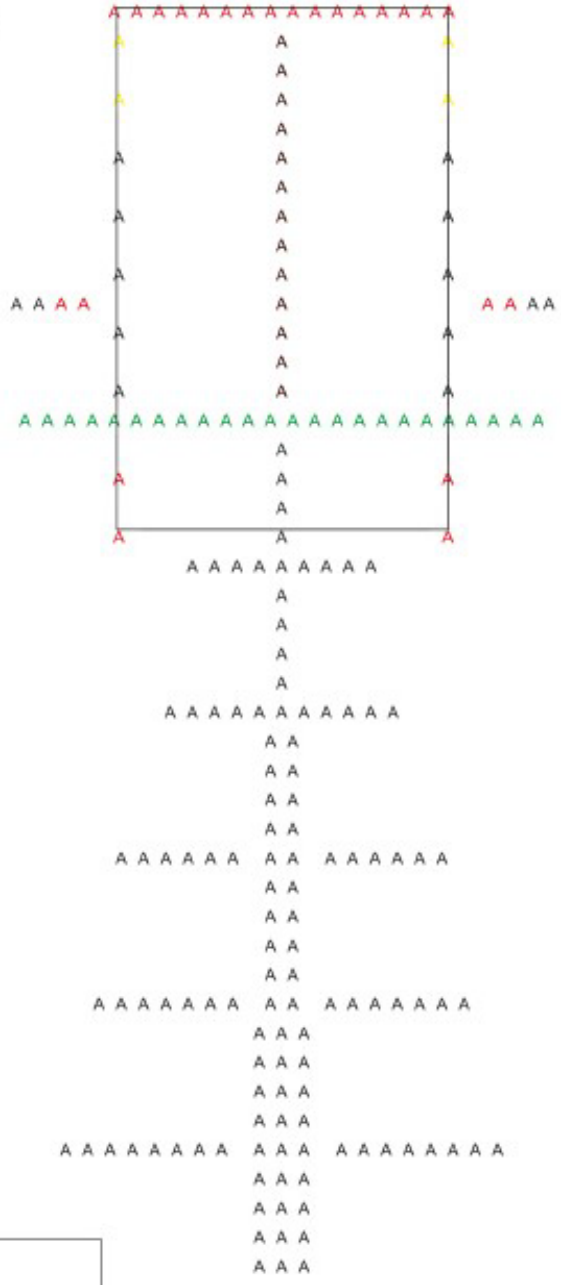
- ☐ 100%
- ☐ 80%
- ☐ 30%
- ☐ 10%
- ☐ 3%
- ☐ 1%
- ☐ OFF

Continuous Assessment

	Low	On-slope	High
Intensity	☐	☐	☐
Alignment	☐	☐	☐

Overall Assessment

- ☐ Approach/Runway Balance
- ☐ Circling Guidance
- ☐ Approach
- ☐ Threshold
- ☐ Runway Centreline
- ☐ Runway Edge
- ☐ Runway Centreline Coding
- ☐ Stop-end
- ☐ Windsleeves
- ☐ Beacon
- ☐ Obstacle



Inspected by _____ **Date**_____

CA 1590 E (Part 2)
170400

OFFICIAL - Public

CIVIL AVIATION AUTHORITY

Aeronautical Ground Lighting Flight Inspection Report (CAT II/III)

(This form is to be completed during or immediately after the flight)

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

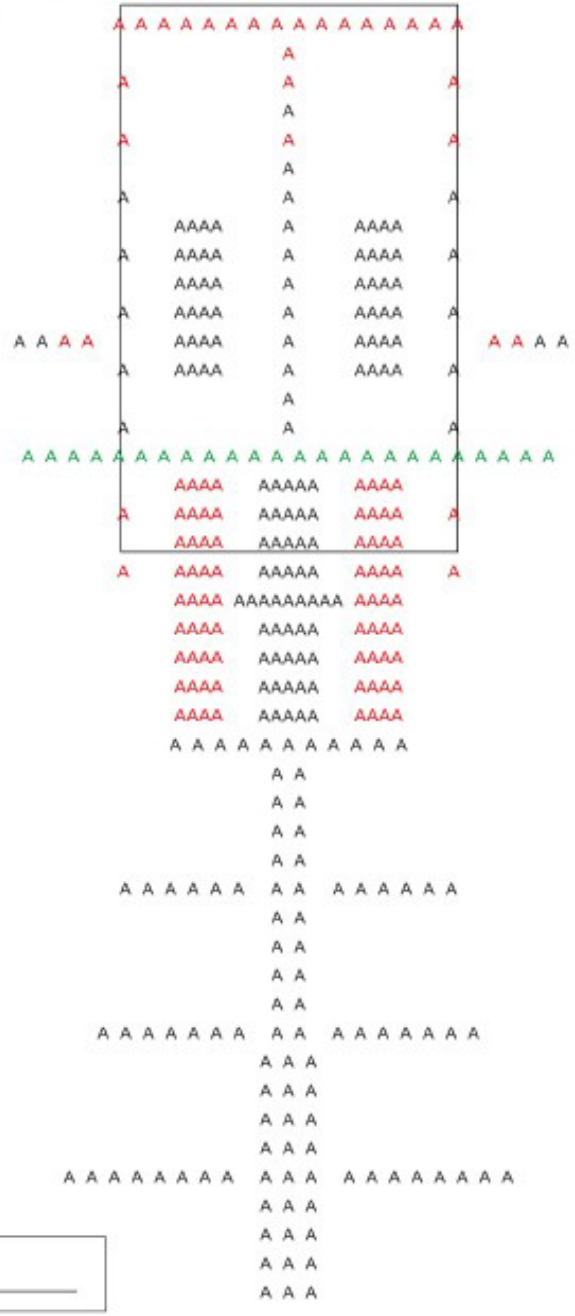
- ☐ 100%
- ☐ 80%
- ☐ 30%
- ☐ 10%
- ☐ 3%
- ☐ 1%
- ☐ OFF

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
- ☐ Windsleeves
- ☐ Beacon
- ☐ Obstacle



Inspected by _____ **Date**_____

CA 1560 E (Part 3)

Construction and height of lighting fittings

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

6.571 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:

6.572 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:

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

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

6.574 Elevated light fittings should not exceed 0.36 m 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;

1. 0.46m above ground level in stopways;
2. 0.9m above local ground level in clearways.

6.575 Inset fittings should be capable of bearing the loads imposed by any aircraft normally using the aerodrome when landing, taking off or taxying. The contours and temperature of the top surface of the light fitting should not cause damage to aircraft undercarriage components, especially tyres.

6.576 The projection of an inset fitting above the surrounding surface should not exceed:

1. 16mm within 7.5m 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 25mm;
2. 19mm between 7.5m from the runway centreline to 3 m from the runway edge except that inset approach lights in these areas may project 3 mm

and taxiway lights crossing or leading to a runway centreline may project 25mm;

3. 38mm within 6m of the runway end or within 3 m of the runway edge;
4. 32mm for displaced threshold lights;
5. 2 mm in taxiway surfaces.

6.577 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.

Instrument runways and associated taxiways

6.578 Figures 6A.1 to 6A.18 of this chapter 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.

6.579 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. Figures 6A.12 to 6A.16 give details of characteristics for taxiway centreline and stop-bar lights

Lighting system (purpose of the light fitting	Colour	Beam coverage (degrees) average		Minimum setting intensity (Candelas)	Elevation projection angle (degrees)	Remarks
		Horizontal	Vertical			
Low intensity approach	Red	Omni-directional	5 to +8 0 to +14	200 50	50	Elevated fitting
Low intensity runway edge	White	Omni-directional	±4	200	4.0	-
Low intensity runway edge (battery)	White	Omni-directional	±4 to ±8 +8 to +8	50 10	4.0	Portable elevated fittings
Low intensity threshold	Green	Omni-directional	±4	100	4.0	Elevated fittings
Low intensity threshold (battery)	Green	Omni-directional	±4	40	4.0	Portable elevated fittings
Low intensity runway end	Red	Omni-directional	±4	100	4.0	Elevated fittings
Low intensity runway end (battery)	Red	Omni-directional	±4	18	40	Portable elevated fittings
Taxiway edge	Blue	Omni-directional	0 to 6 6 to 75	2	0.2	3.5
Stopway	Red	Omni-directional + 6.5	0 to +15	100	-	-
Runway guard lights	Yellow	Omni-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
Low intensity obstacle (group A)	Red	Omni-directional	0 to +30	10	-	Steady
Low intensity obstacle (group B)	Red	Omni-directional	+5 to +8 0 to +15	200	50	Steady
Vehicle obstacle	Yellow	360°	±10° (note 1)	40	-	Flash rate 60 to 90 minute. Maximum intensity not to exceed 400 Cd
Medium intensity obstacle	Red	Omni-directional	±4°	2000 ±20%	-	Steady
High intensity obstacle	White	120°	3	200,000 day 20,000 dusk 2000 night	-	40 flashed per minute (notes 2, 3, 4)
Simple sequenced approach	White	Omni-directional	0 to +15	5000		Elevated fittings. Flash sequence 1 per second per unit

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

Notes:

1. The coverage requirement for ‘follow me’ vehicles only is illustrated in figure 6A.21.
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 agl.

3. If more than one light is fitted, the lights should flash simultaneously.
4. Lights should flash sequentially if indicating overhead wires or cables

Light	Colour	Minimum beam coverage (degrees) (note 1)		Ratio of average intensity	Minimum average intensity in specified colours Cd x 10^3 (note 2)	Isocandela diagram reference
		Horizontal	Vertical			
Approach centreline and crossbars	White	20	8	2	20	6A.1
Approach side row	Red	15	7	0.5	5	6A.2
Threshold	Green	11	5.5	1	10	6A.3
Threshold wing bars	Green	15	7	1	10	6A.4
Touchdown zone	White	9	5	0.5	5	6A.5
Runway centreline 30 m	White/red/yello	9	5	0.5	5 (note 5)	6A.6
Runway centreline 15 m spacing	White/red/yello w	9	5	0.25 to 0.5 (note	2.5 (notes 2, 5)	6A.7
Runway end	Red	11	5.5	0.25 to	2.5	6A.8
Runway edge 45 m wide	White Yellow Red	11 11 11	5.5 5.5 5.5	1 0.4 0.15	10 10 10	6A.9
Runway edge 60 m wide	White Yellow Red	13 13 13	6 6 6	1 0.4 0.15	10 10 10	6A.10

Table 6A.2 Characteristics of high intensity aeronautical ground lights

Notes:

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%.

1. A luminous intensity of 5 kilocandelas, intensity ratio 0.5, should be used for Category III operations.
2. Alignment tolerances have not been included in the beam spread angles given in Columns 3 and 4.

3. Where inset lights are used instead of elevated lights, e.g., on a runway with a displaced threshold, the luminous intensity requirements can be
4. met by installing multiple fittings of lower intensity at each position.
5. Values given are for white light.
6. Beam coverages quoted are for the extremities of an ellipse

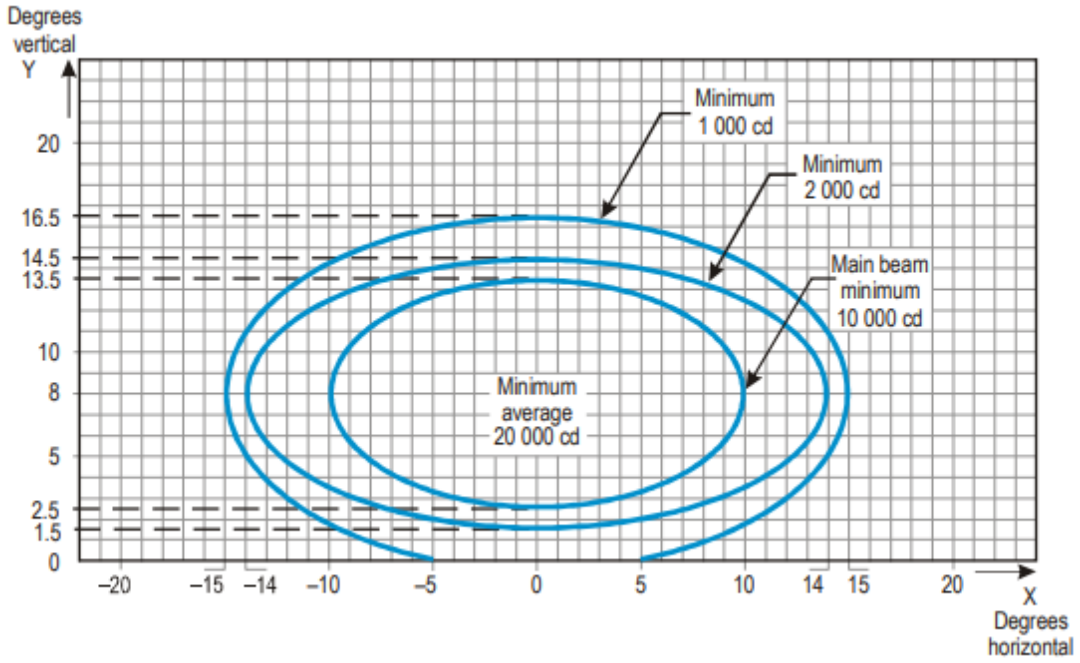


Figure 6A.1 Isocandela diagram for approach centreline light and crossbars (white light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	10	14	15
b	5.5	6.5	8.5

2. Toe-in 2 degrees any light crossbars beyond 22.5 m from centreline

3. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met.

Distance from threshold	Vertical main beam coverage
Threshold to 315 m	0° – 11°
316 m to 475 m	0.5° – 11.5°
476 m to 640 m	1.5° - 12.5°
641 and beyond	2.5° - 13.5° as illustrated above

4. See collective notes for figures 1 – 11

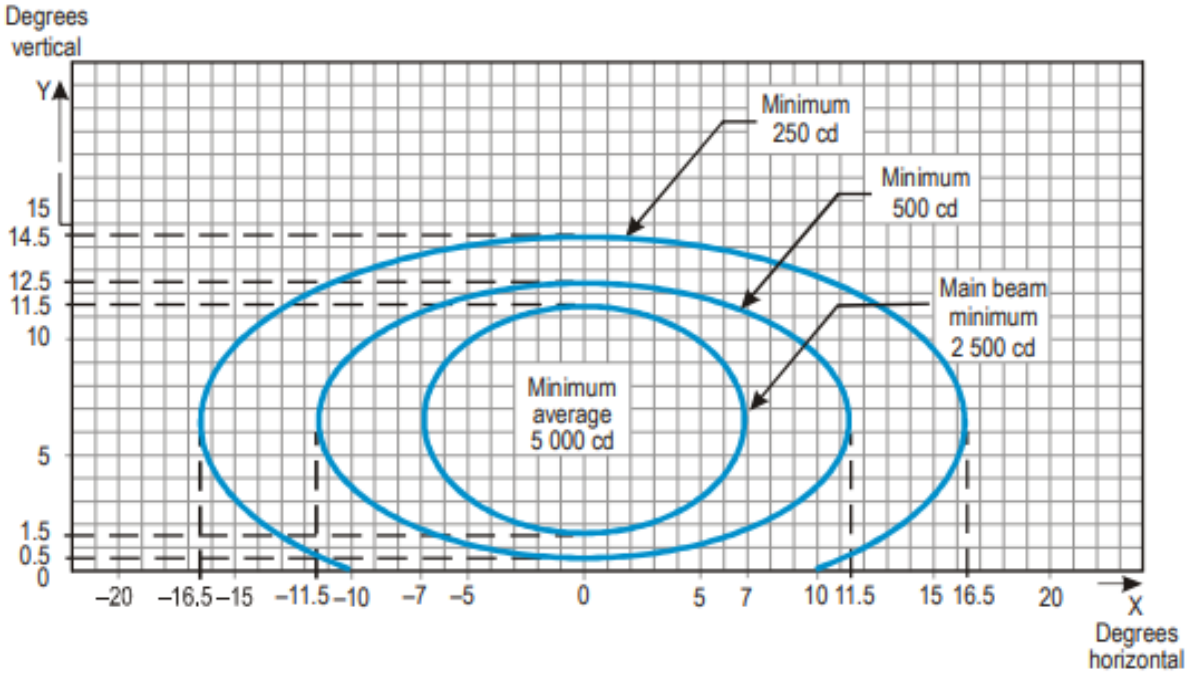


Figure 6A.2 Isocandela diagram for approach side row light (red light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	7.0	11.5	16.5
b	5.0	6.0	8.0

2. Toe-in 2 degrees any light crossbars beyond 22.5 m from centreline
3. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met

Distance from threshold	**Vertical main beam coverage**
Threshold to 115 m	0° – 11°
116 m to 215 m	0.5° – 11.5°
216 m and beyond	1.5° - 12.5°

4. See collective notes for figures 1 – 11

OFFICIAL - Public

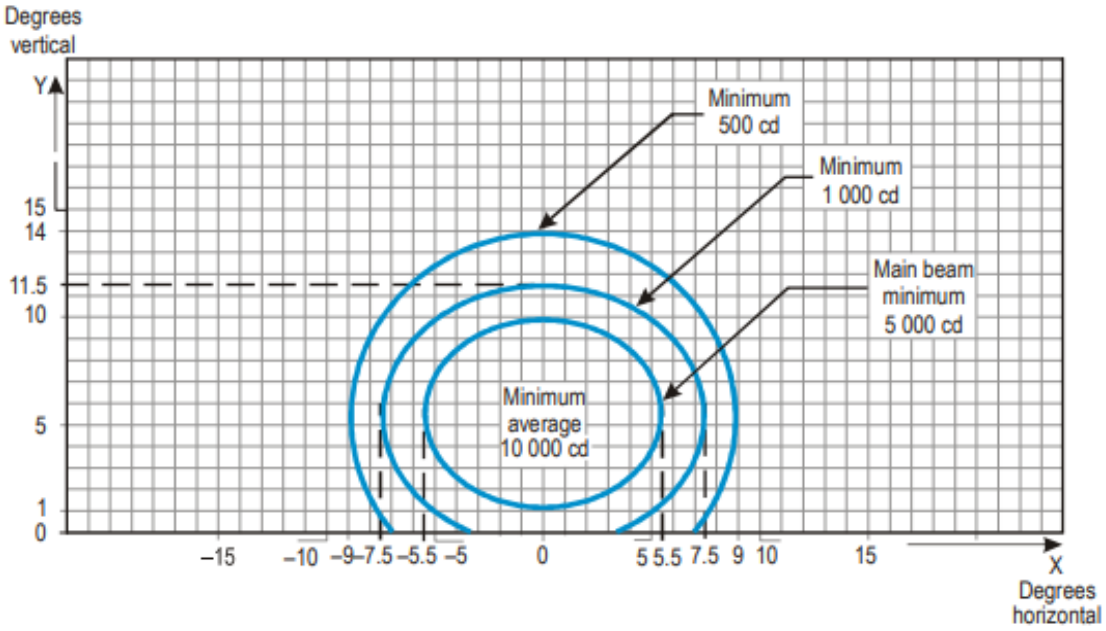


Figure 6A.3 Isocandela diagram for threshold light (green light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	5.5	7.5	9.0
b	4.5	6.0	8.5

2. Toe-in 3.5 degrees
3. See collective notes for figures 1 – 11

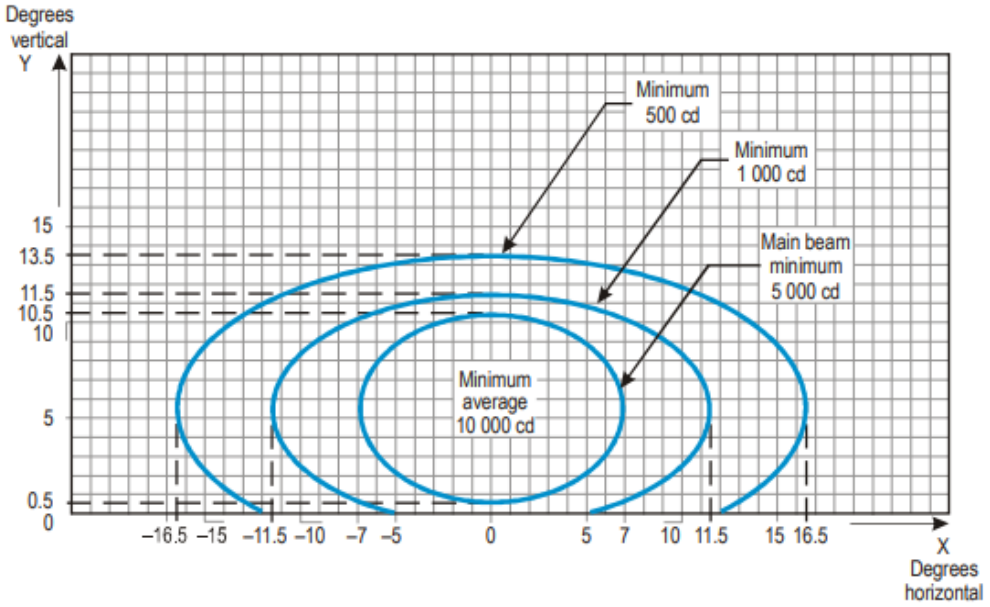


Figure **6A-4 Isocandela diagram for threshold wing bar light (green light)**

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	7.0	11.5	16.5
b	5.0	6.0	8.0

2. Toe-in 2 degrees
3. See collective notes for figures 1 – 11

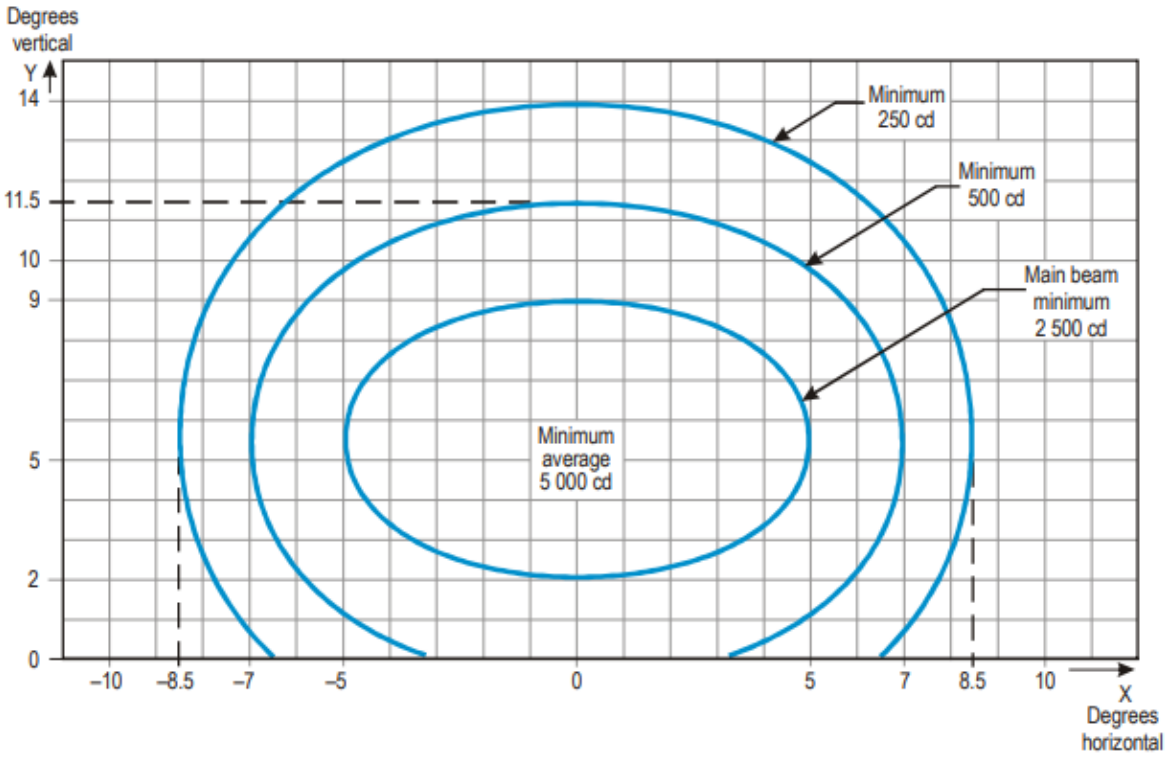


Figure 6A.5 Isocandela diagram for touchdown zone light (white light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	5.0	7.0	8.5
b	3.5	6.0	8.5

2.

3. Toe-in 4 degrees

4. See collective notes for figures 1 – 11

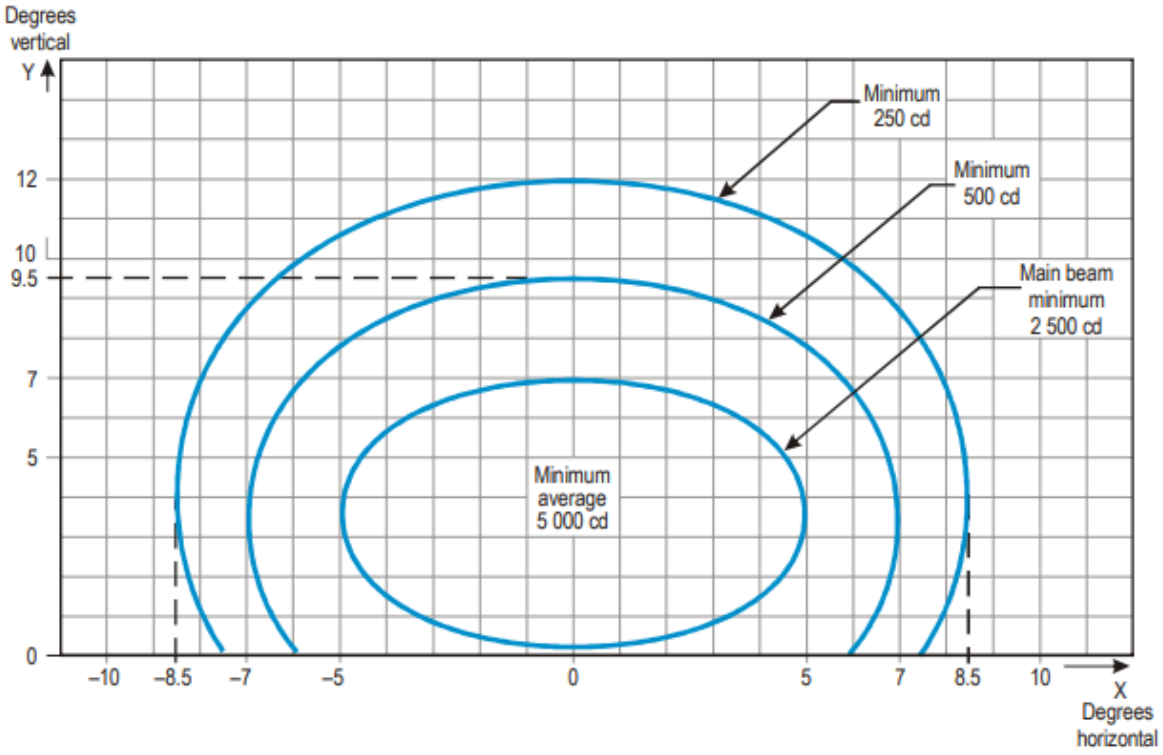


Figure 6A.6 Isocandela diagram for runway centreline light with 30 m longitudinal (white light) and rapid exit taxiway indicator light (yellow light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	5.0	7.0	8.5
b	3.5	6.0	8.5

2. For red light multiply values by 0.15
3. For yellow light multiply values by 0.40
4. See collective notes for figures 1 – 11

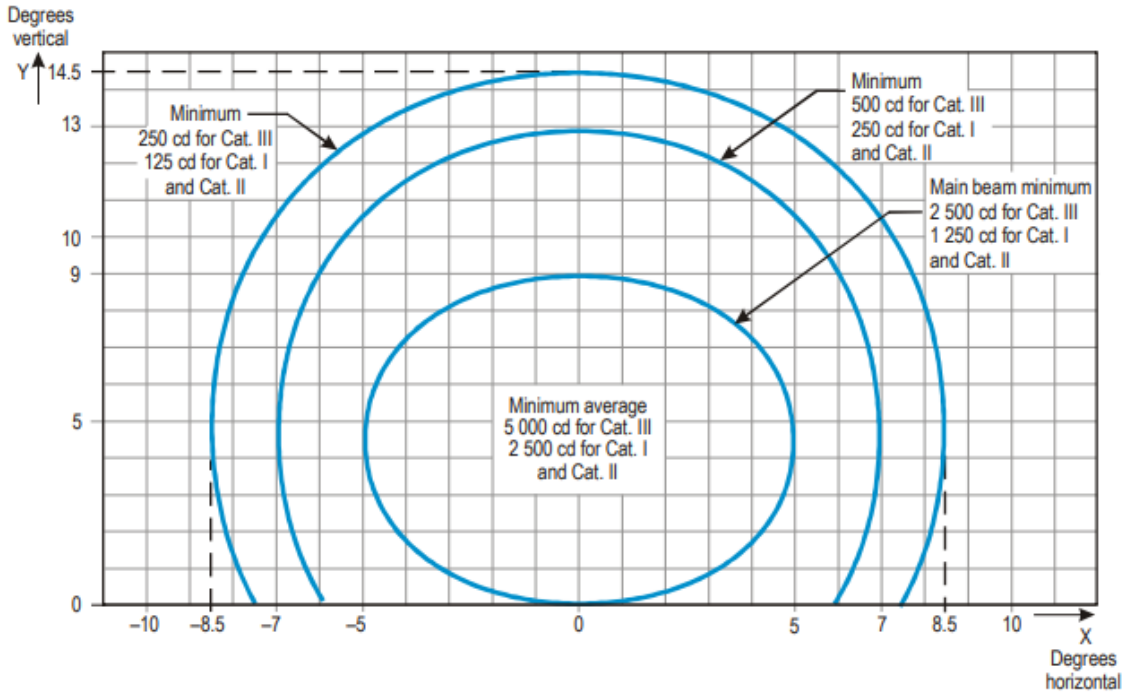


Figure 6A.7 Isocandela diagram for runway centreline light with 15 m longitudinal spacing (white light) and rapid exit taxiway indication light (yellow light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	5.0	7.0	8.5
b	4.5	8.5	10.0

2. For red light multiply values by 0.15
3. For yellow light multiply values by 0.40
4. See collective notes for figures 1 – 11

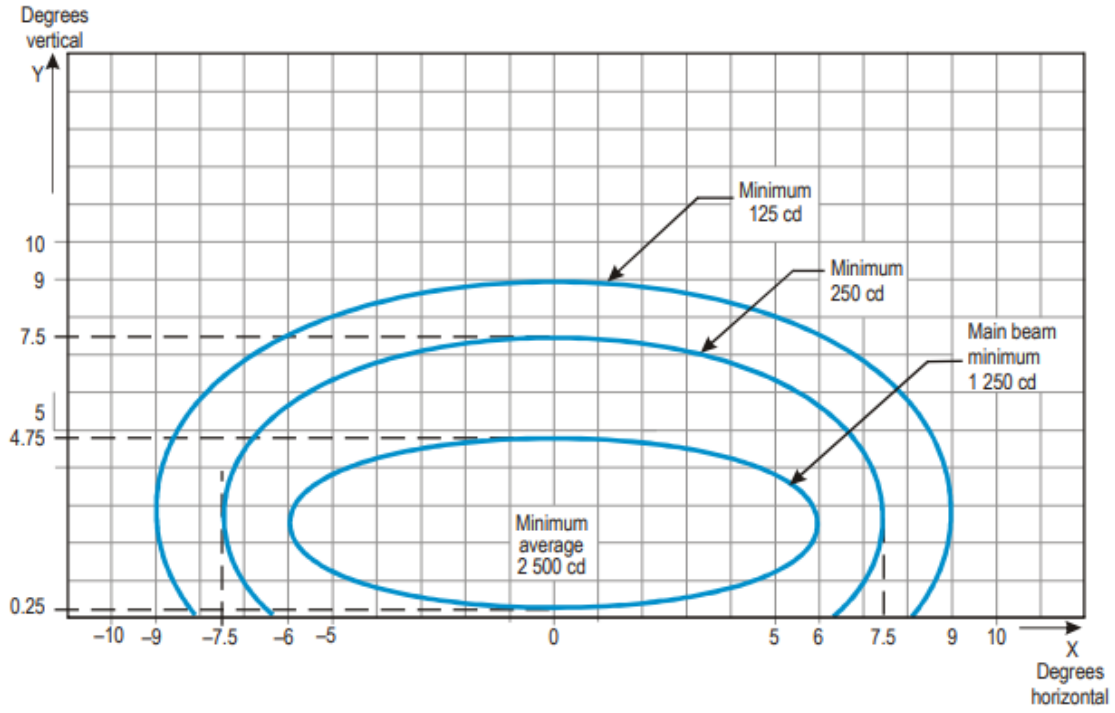


Figure 6A.8 Isocandela diagram for runway end light (red light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	6.0	7.5	9.0
b	2.25	8.0	6.5

2. See collective notes for figures 1 – 11

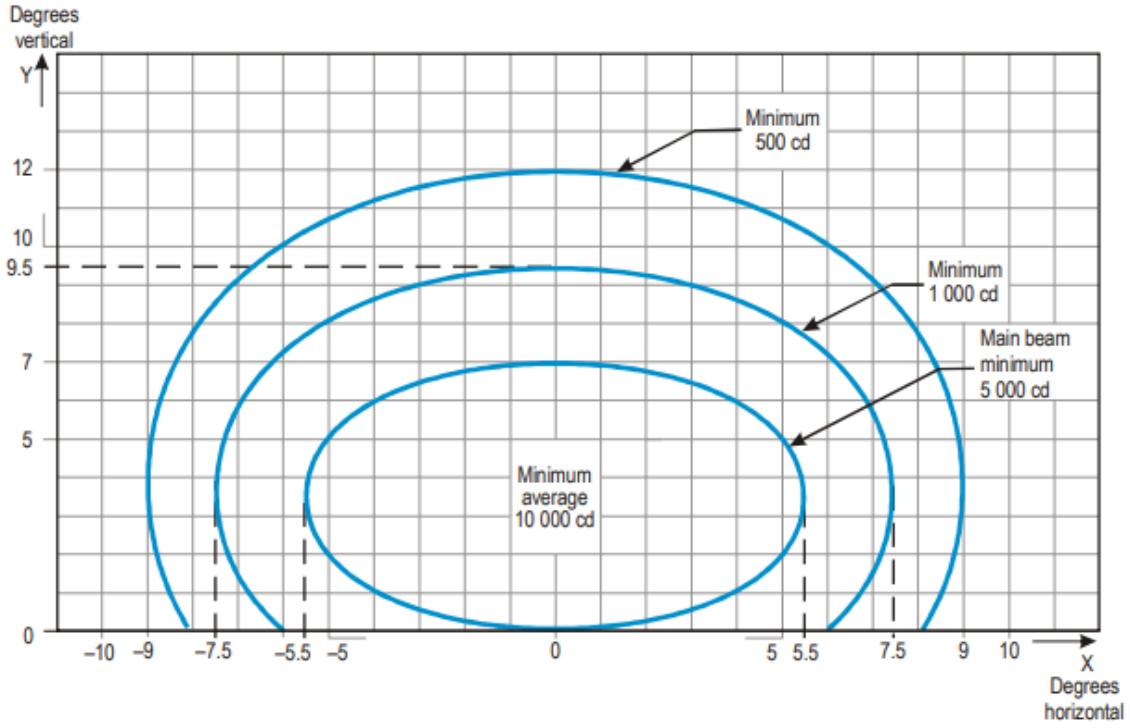


Figure 6A.9 Isocandela diagram for runway edge light where width of runway is 45 m (white light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	5.5	7.5	9.0
b	3.5	6.0	8.5

2. Toe in 3.5 degrees
3. For red light multiply values by 0.15
4. For yellow light multiply values by 0.40
5. See collective notes for figures 1 – 11

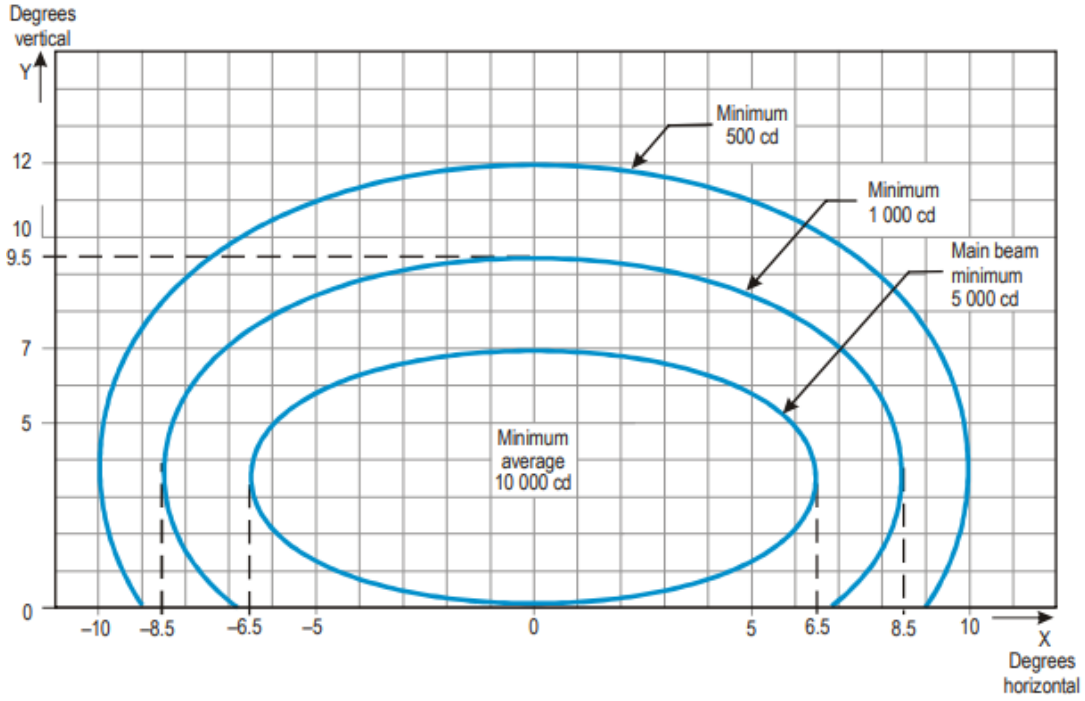


Figure 6A.10 Isocandela diagram for runway edge light where width of runway is 60 m (white light)

Notes:

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	6.5	8.5	10.0
b	3.5	6.0	8.5

2. Toe in 4.5 degrees
3. For red light multiply values by 0.15
4. For yellow light multiply values by 0.40
5. See collective notes for figures 1 – 11

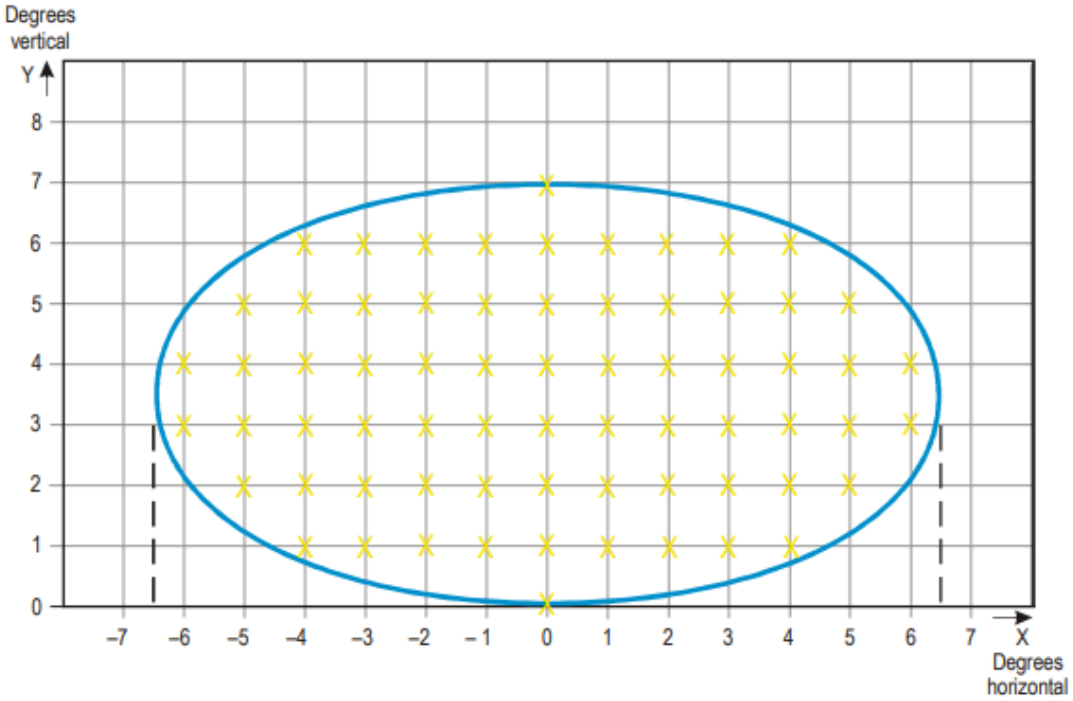


Figure 6A.11 Grid points to be used for the calculation of average intensity of approach and runway lights

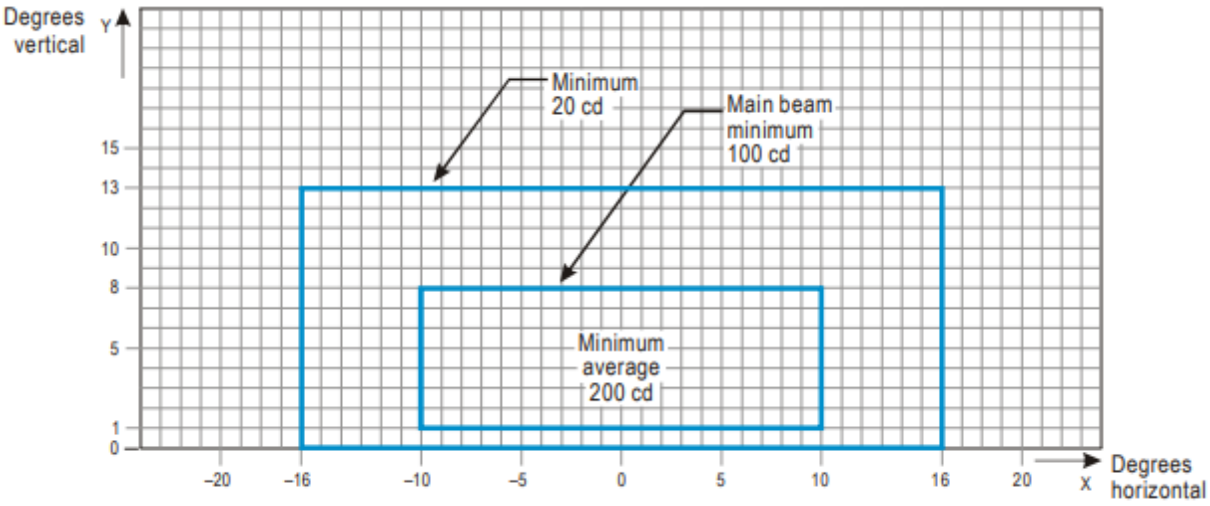


Figure 6A.12 Isocandela diagram for taxiway centreline (15 m spacing), RELs, no-entry bar, turn pad lights and stop-bar lights in straight sections intended for use in runway visual range conditions of less than a value of the order of 350 m where large offsets can occur and for low-intensity runway guard lights (configuration B).

Notes:

1. These beam coverages allow for displacement of the cockpit from the centreline up to distances of the order of 12 m and are intended for use below and after curves

2. See collective notes for Figures 12 to 17

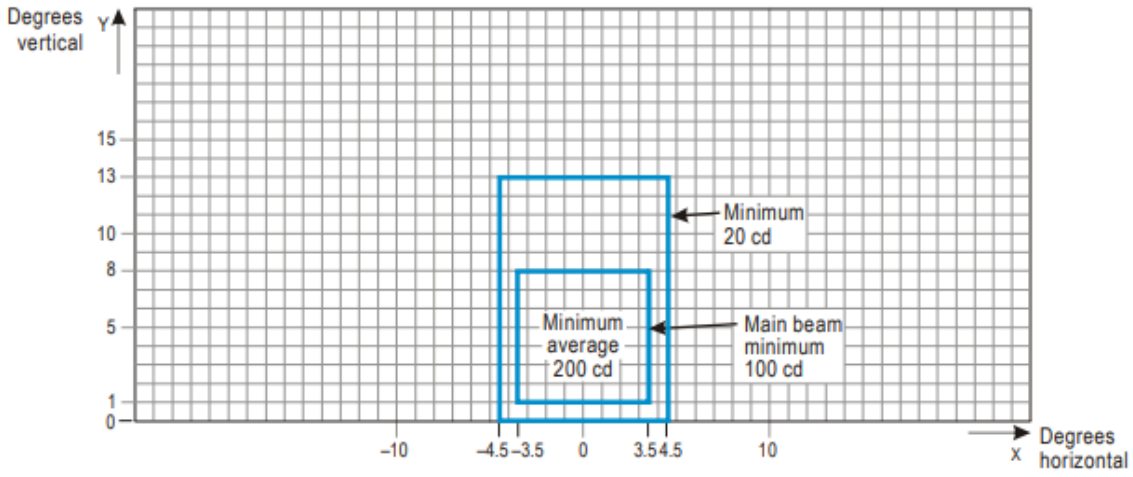


Figure 6A.13 Isocandela diagram for taxiway centreline (15 m spacing), turn pad lights and stop-bar lights in straight sections intended for use in runway visual range conditions of less than a value of the order of 350 m

Notes:

1. These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit from the centreline of approximately 3 m

2. See collective notes for Figures 12 to 17

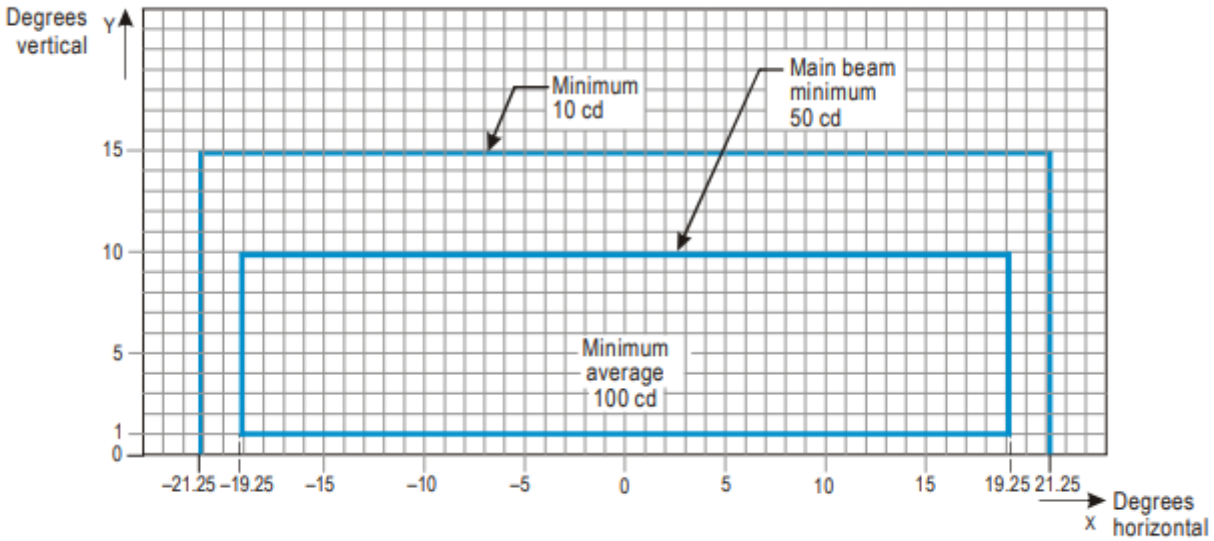


Figure 6A.14 Isocandela diagram for taxiway centreline (7.5 m spacing), RELs, no-entry bar, turn pad lights and stop-bar lights in curved sections intended for use in runway visual range conditions of less than a value of the order of 350 m

Notes:

1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve.
2. See collective notes for Figures 12 to 17

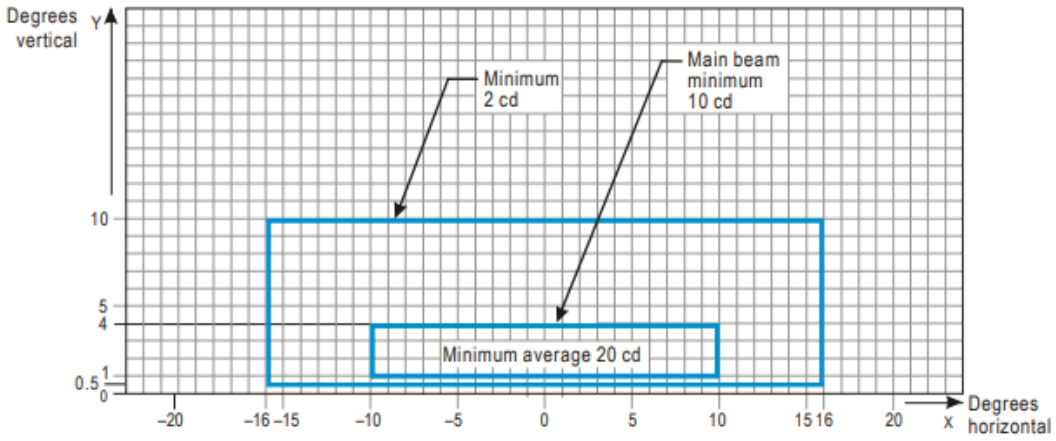


Figure 6A.15 Isocandela diagram for taxiway centreline (30 m, 60 m spacing) and stop-bar lights in straight sections intended for use in runway visual range conditions of the order of 350 m or greater

Notes:

1. At locations where high background luminance is usual and where deterioration of light output resulting from dust, snow and local contamination is a significant factor, the cd-values should be multiplied by 2.5
2. Where omni-directional lights are used they shall comply with the vertical beam requirements in this figure
3. See collective notes for Figures 12 to 17

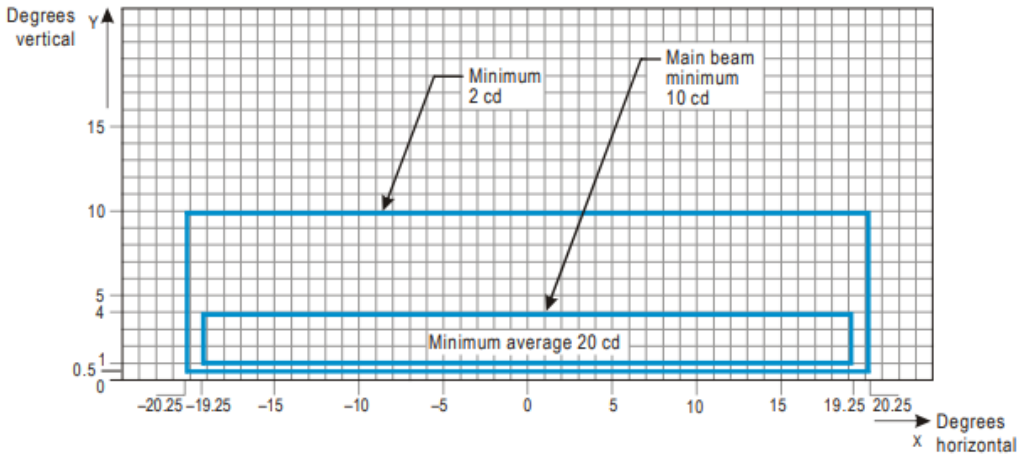


Figure 6A.16 Isocandela diagram for taxiway centreline (7.5 m, 15 m, 30 m spacing) and stop-bar lights in curved sections intended for use in runway visual range conditions of the order of 350 m or greater.

Notes:

1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve
2. At locations where high background luminance is usual and where deterioration of light output resulting from dust, snow and local contamination is a significant factor, the cd-values should be multiplied by 2.5
3. These beam coverages allow for displacement of the cockpit from the centreline up to distances of the order of 12 m as could occur at the end of curves
4. See collective notes for Figures 12 to 17

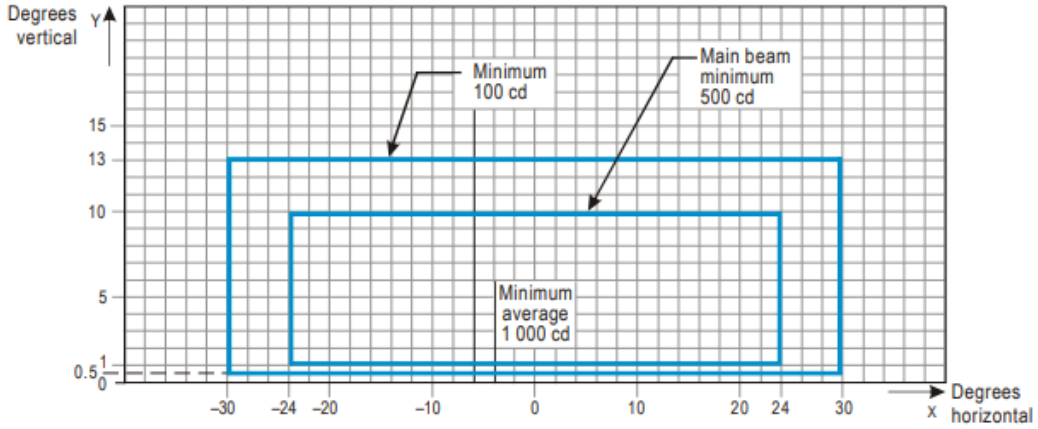


Figure 6A.17 Isocandela diagram for high-intensity runway guard lights (configuration B

Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

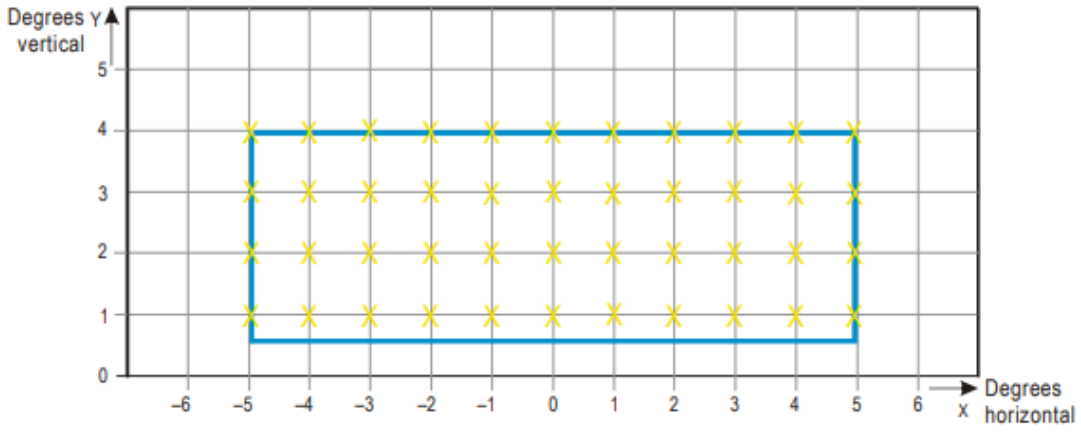


Figure 6A.18 Grid points to be used for the calculation of average intensity of taxiway centreline and stop-bar lights

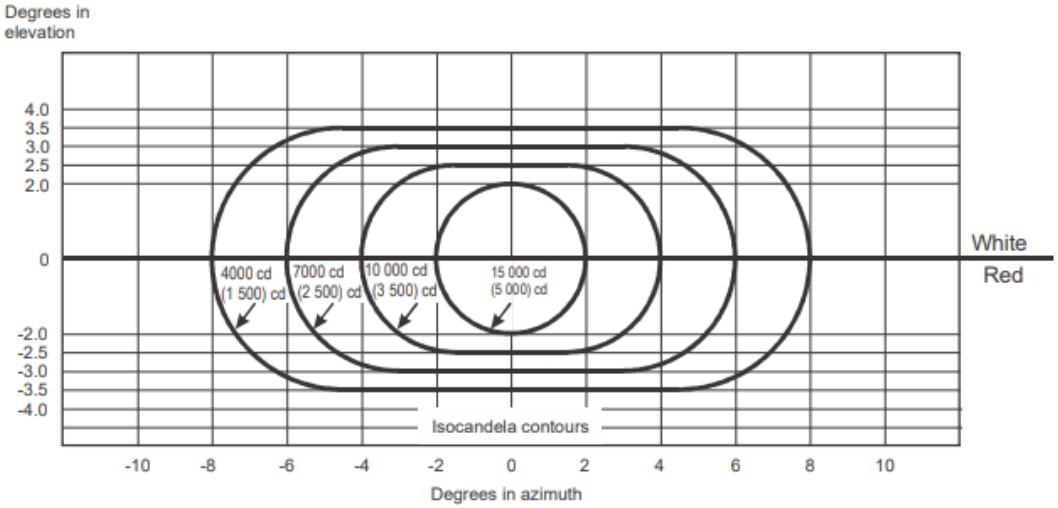


Figure 6A.19 Light intensity distribution of PAPI and (A)PAPI

Notes:

1. These curves are for minimum intensities in red light.
2. The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.
3. The intensity values shown in brackets are for APAPI

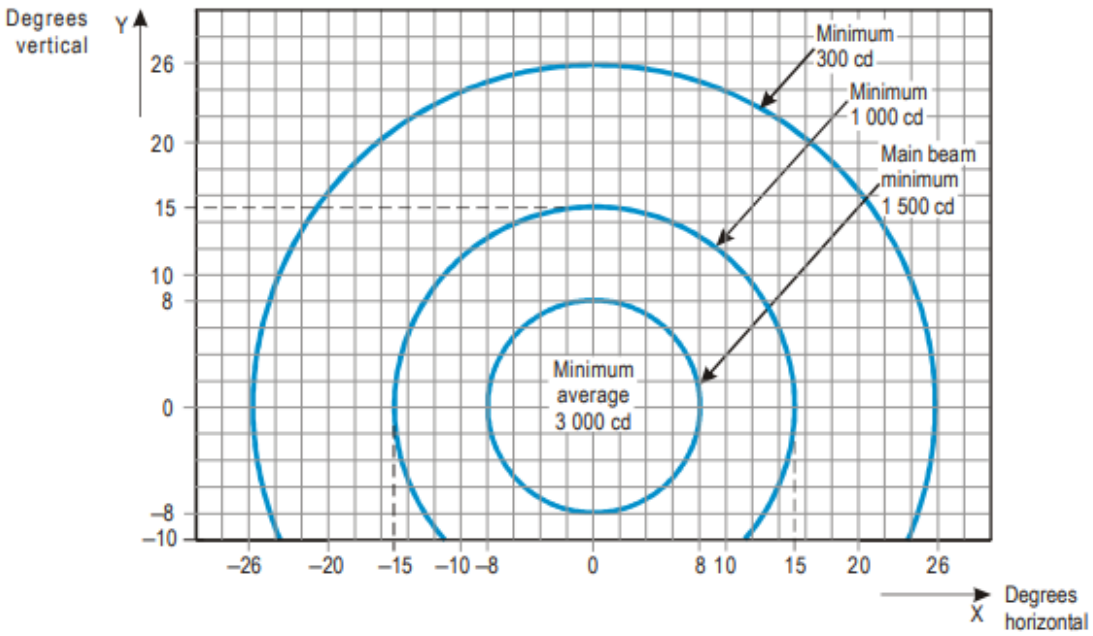


Figure 6A.20 Isocandela diagram for each light in low-intensity runway guard lights (configuration A)

Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.
2. The intensities specified are in yellow light.

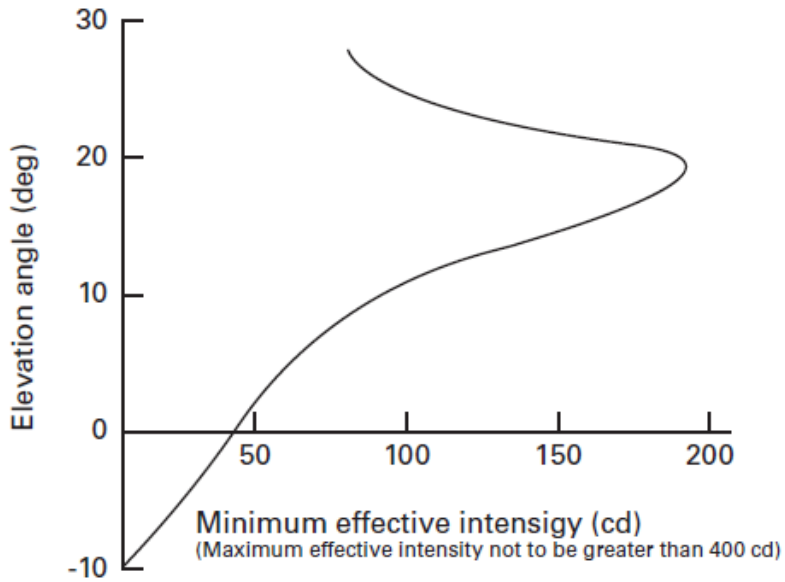


Figure 6A.21 Follow me vehicle obstruction light

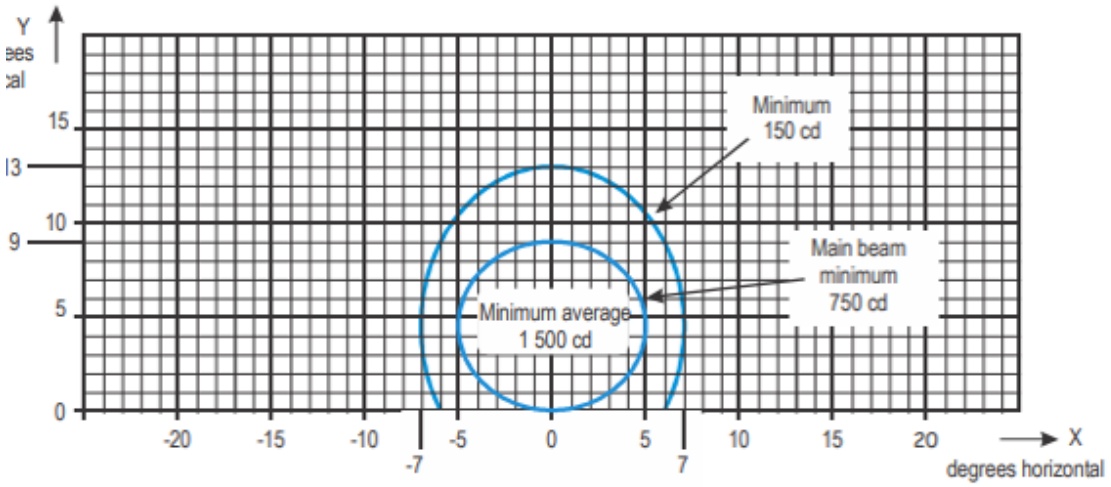


Figure 6A.22 Isocandela diagram for take-off and hold lights (THL) (red light)

Notes

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	5.0	7.0
b	4.5	8.5

2. See collective notes for figures 6A.1 to 6A.11 and 6A.12 to 6A.22

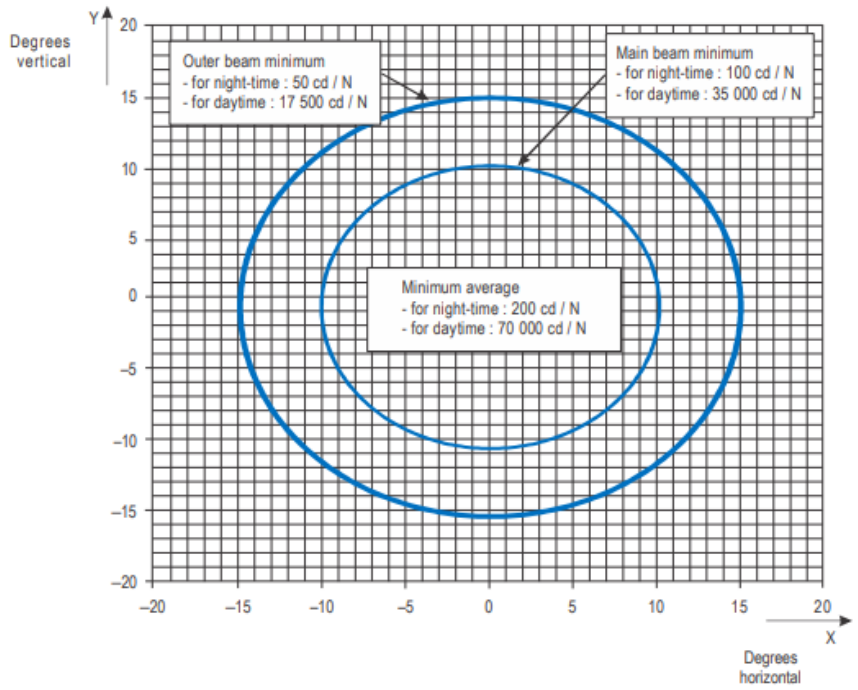


Figure 6A.22 (1) Isocandela diagram for closed runway lights (white light)

Notes

1. Curves calculated on formula

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} = 1$$

a	10.	15
b	10	15

2. N is the total number of lights of the closed runway

Photometric characteristics

Collective notes for figures 6A.1 to 6A.11

6.580 The ellipses in each figure are symmetrical about the common vertical and horizontal axis.

6.581 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.

6.582 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.

6.583 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 degrees of the specified requirement.

6.584 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 30m)	Figure 6A.6	0.5 – 1.0 (white light)
Runway centreline (longitudinal spacing 15m)	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 (45m runway width)	Figure 6A.9	1.0 (white light)
		0.4 (yellow light)
		0.15 (red light)
Runway edge (60m runway width)	Figure 6A.10	1.0 (white light)
		0.4 (yellow light)
		0.15 (red light)

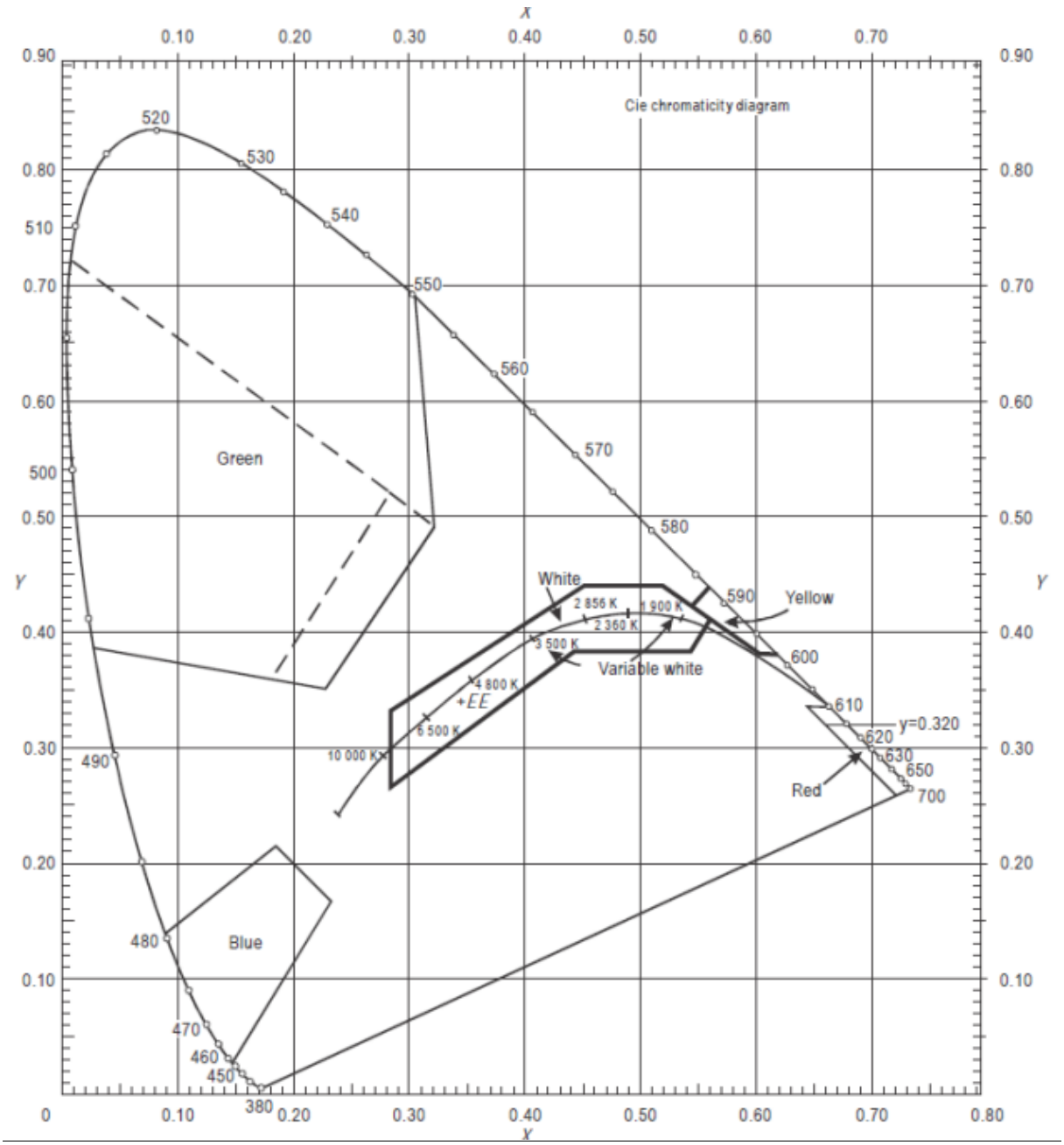


Figure 6A.22 Colours for aeronautical ground lights (filament-type lamps)

6.585 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.

Collective notes for figures 6A.12 to 6A.22

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

6.587 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.

6.588 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 arithmetical average of the light intensities measured at all considered grid points.

6.589 No deviation is acceptable in the main beam when the lighting fixture is properly aimed.

6.590 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.

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

6.592 The light unit shall be installed so that the main beam is aligned within ± 0.5 degree of the specified requirement.

Colour requirements for AGL

General

6.593 The colour of light signals is an important characteristic of the guidance provided by the AGL. It is incumbent upon aerodrome licence holders 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 beam spread or at any angle within the intended viewing segment.

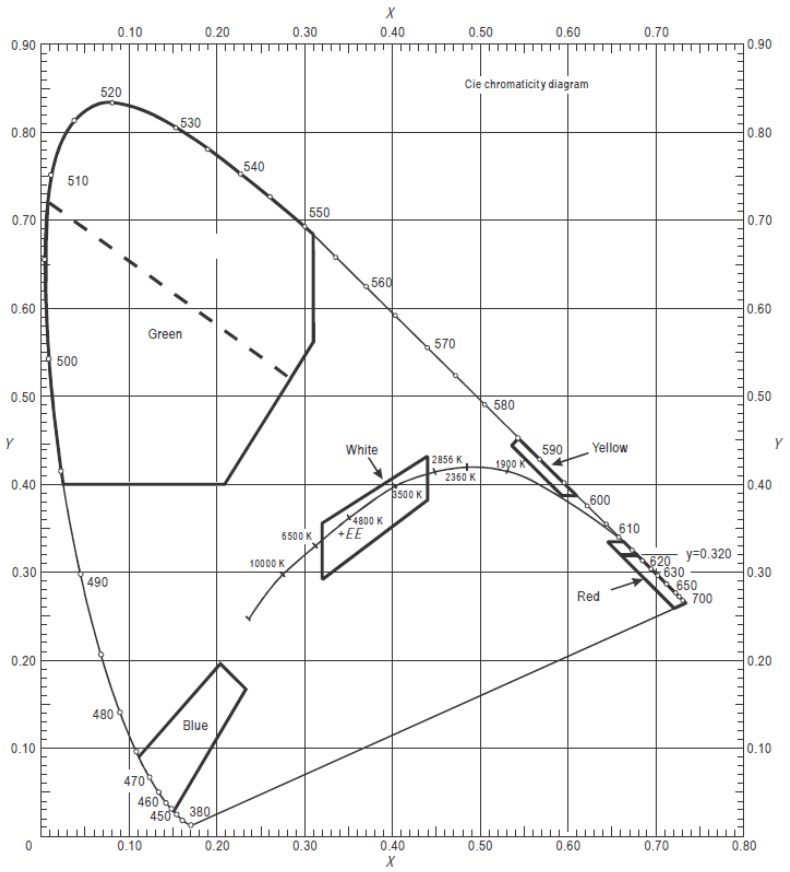


Figure 6A.23 Colours for aeronautical ground lights (solid state lighting

6.594 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 flight crew 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.

6.595 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:

1. 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;

2. In the case of rectangular isocandela curves, the colour measurements should be taken at the centre and the limits of the diagonals (corners);

3. 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;

4. 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;

6.596 Where lights may be viewed and used by flight crew 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

6.597 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.

Chromaticities

The Chromaticities of AGL shall be within the following boundaries: CIE Equations (see figure 6A.20).

a) Red	
Purple boundary	y = 0.980 – x
Yellow boundary	y = 0.335
b) Yellow	
Red boundary	y = 0.382
White boundary	y = 0.790 – 0.667x
Green boundary	y = x – 0.120
c) Green	
Yellow boundary	x = 0.360 – 0.080y
White boundary	x = 0.650y
Blue boundary	y = 0.390 – 0.171x

d) Blue	
Green boundary	y = 0.805x + 0.065
White boundary	y = 0.400 – x
Purple boundary	x = 0.600y + 0.133
e) White	
Yellow boundary	x = 0.500
Blue boundary	x = 0.285
Green boundary	y = 0.440
and	y = 0.150 + 0.640x
Purple boundary	y = 0.050 + 0.750x
and	y = 0.382
f) Variable white	
Yellow boundary	x = 0.255 + 0.750y
and	x = 1.185 – 1.500y
Blue boundary	x = 0.285
Green boundary	y = 0.440
and	y = 0.150 + 0.640x
Purple boundary	y = 0.050 + 0.750x
and	y = 0.382

6.598 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:

1. Yellow boundary y = 0.726 – 0.726x
2. White boundary x = 0.650y
3. Blue boundary y = 0.390 – 0.171x

6.599 Where increased certainty of recognition is more important than maximum visual range, green signals should be within the following boundaries:

1. Yellow boundary y = 0.726 – 0.726x
2. White boundary x = 0.625y – 0.041
3. Blue boundary y = 0.390 – 0.171x

Discrimination between lights

6.600 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.

6.601 If there is a requirement to discriminate yellow from green and/or white, as for example on exit taxiway centreline lights, the y co-ordinates of the yellow light should not exceed a value of 0.40.

6.602 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.

6.603 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;

1. The x co-ordinate of the yellow is at least 0.050 greater than the x co-ordinate of the white; and
2. The disposition of the lights will be such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

Procedure for the flight inspection of PAPI and (A)PAPI

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 (A)PAPI) 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 into 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.

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

FLIGHT CHECK: PAPI/APAPI **Aerodrome:**.....

Runwey designation				Date	Day/Dusk/Night
Effective range (km)				Time GMT	Weather
Colour change: Red-to-White (Level run 1000 ft QFE from 7.5 km)				Aircraft Registration:	W/V Visibility
Intensity balance of individual units (and of Left and Right sides if applicable)				Captain	Cloud Turbulence
Intensity check	100%			NOTES:	
	80%				
	30%				
	10%				
	3%				
	1%				
	< 1%				
Integration with non-visual aids					
Synchronisation L–R (if applicable)					
Obstacle clearance				Inspected by:	
Fitting type					

	L					R			
1	2	3	4		4	3	2	1
0	0	0	0		0	0	0	0
1	1							
2	2							
3	3							
4	4							

CA1560 E
000000

OFFICIAL - Public

CHAPTER 7

Aerodrome Signals

7.1 Aerodrome signals, signs and markings provide guidance and information to pilots and assist them in complying with the Rules of the Air Regulations 2008. All signals, signs and markings should be repainted, cleaned, or replaced as soon as their conspicuity is degraded.

7.2 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.

7.3 Licensed aerodromes should meet the requirements for signals, signs and markings described in this chapter. Signals they are allowed a dimensional tolerance of 10%.

7.4 Any marshalling service provided should comply with Annex 1 Rules of the Air Appendix 1 Marshalling Signals.

Signals

7.5 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.

7.6 An aerodrome used extensively by non-radio-equipped aircraft should display the name of the aerodrome in letters at least 3 m high.

7.7 Where appropriate, an aerodrome should have a signal lamp capable of producing white, red and green lights, to make the signals specified in SERA SIGNALS FOR AERODROME TRAFFIC.

Wind direction indicator

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

Location

7.9 Each wind direction indicator should be located so that at least one wind direction indicator is visible from aircraft in flight, during approach or on the

movement area before take-off, and in such a way as to be free from the effects of air disturbances caused by nearby objects.

Characteristics

7.10 Each wind direction indicator should be in the form of a truncated cone made of fabric and should have a length of not less than 3.6 m and a diameter, at the larger end, of not less than 0.9 m.

7.11 It should be constructed so that it gives a clear indication of the direction of the surface wind and a general indication of the wind speed.

7.12 The colour or colours should be so selected as to make the wind direction indicator clearly visible and understandable from a height of at least 300 m. Having regard to background:

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

Night conditions

7.13 Provision should be made for illuminating a sufficient number of wind indicators at an aerodrome intended for use at night.

7.14 Wind direction indicators are important visual aids for all runway ends. Large wind direction indicators are particularly important at aerodromes where landing information is not available through radio communications. On the other hand, landing direction indicators are seldom used due to the necessity and, consequently, responsibility, of changing their direction as wind direction shifts. Visual ground signals for runway and taxiway serviceability are contained in ICAO Annex 2. Additional guidance is given in ICAO Doc 9157, Aerodrome Design Manual, Part 4, Visual Aids, Chapter 3.

7.15 A fabric wind cone is generally the type preferred by pilots because it provides a general indication of wind speed. Cones that extend fully at wind speeds of about 15 kt to 25 kt are most useful for flight operations.

7.16 It may be possible to improve the perception by the pilot of the location of the wind direction indicator by several means notably by circular marking around this indicator. The location of at least one wind direction indicator should be marked by a circular band 15 m in diameter and 1.2 m wide. The band should be centred about the wind direction indicator support and should be in a colour chosen to give adequate conspicuity, preferably white.

7.17 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 can be usefully interpreted is 1 km. 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 centre line.

7.18 This means, in effect, that only those aerodromes where the thresholds are less than 1 200 m apart can meet the minimum requirement with a single unit.

7.19 Code 3 and 4 aerodromes are required to provide two or more units suitably sited in order to provide the best possible coverage.

7.20 The final choice of unit numbers and location should depend on a number of factors which should vary from aerodrome to aerodrome. However, when deciding on the most appropriate location, account should be taken to ensure that the wind direction indicator is:

1. Outside the cleared and graded area of the runway and taxiway strips;
2. Clear of the OFZ and ILS critical/sensitive areas where appropriate;
3. preferably not more than 200 m lateral displacement from the runway edge;
4. Preferably between 300 m and 600 m from the runway threshold measured along the runway;
5. in an area with low background levels of illumination;
6. Visible from the approach and take-off positions of all runways; and
7. Free from the effects of air disturbance caused by nearby objects

Signal Area

7.21 Where established a signal area should be located so as to be visible for all angles of azimuth above an angle of 10° above the horizontal when viewed from a height of 300 m.

7.22 The signal area should be an even horizontal surface at least 9 m square.

7.23 The signal area should be constructed of cement concrete reinforced with an adequate quantity of steel to avoid cracks resulting from unequal settlement. The top surface should be finished smooth with a steel trowel and coated with paint of appropriate colour.

7.24 The colour of the signal area should be chosen to contrast with the colours of the signal panels to be displayed thereon. More guidance is given in ICAO Doc 9157, Aerodrome Design Manual Part 4, Visual Aids, Chapter 3.

7.25 The colour of the signal area should be chosen to contrast with the colours of the signal panels used, and it should be surrounded by a white border not less than 0.3 m wide.

Signals

7.26 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.

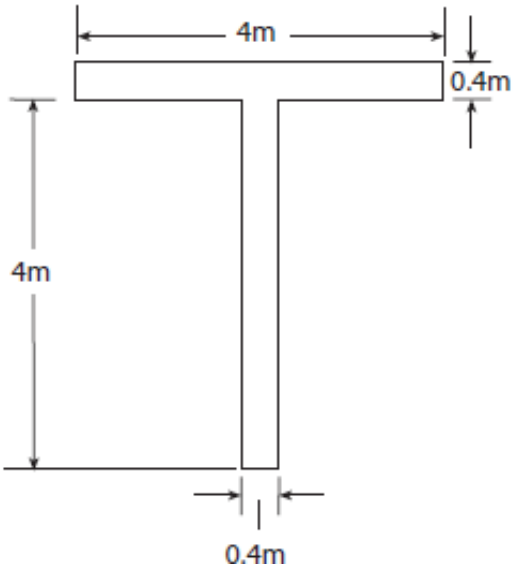


Figure 7.2 Landing T

7.27 A white disc as shown in figure 7.3 of 0.6m 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.

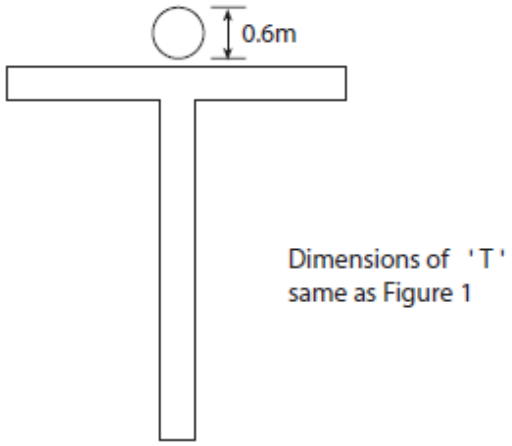


Figure 7.3 Landing/take-off direction

7.28 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.

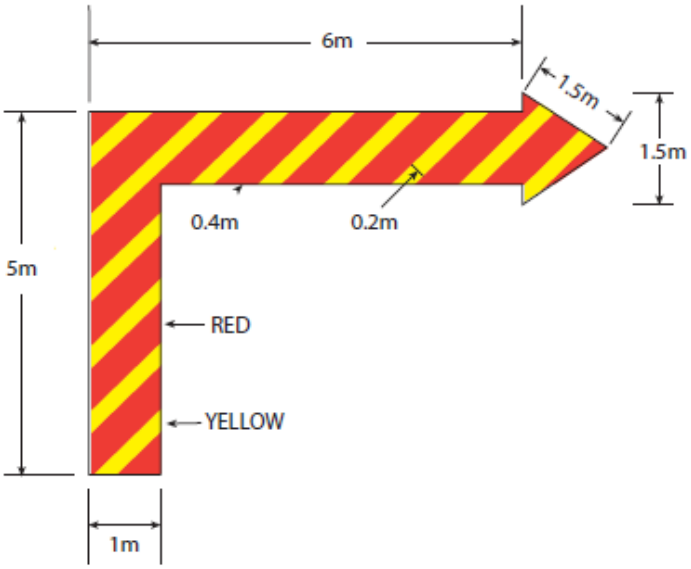


Figure 7.4 Right-hand circuit

7.29 A red panel of 3m square when displayed in conjunction with yellow diagonal stripes has the following meaning:

7.30 A yellow diagonal stripe at least 0.5m 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.

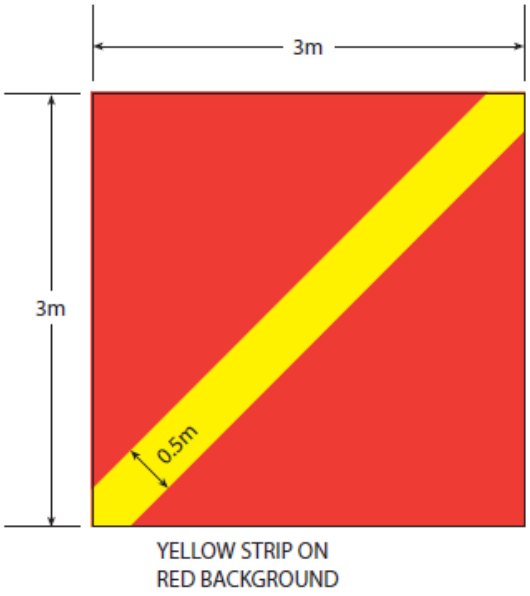


Figure 7.5 State of manoeuvring area

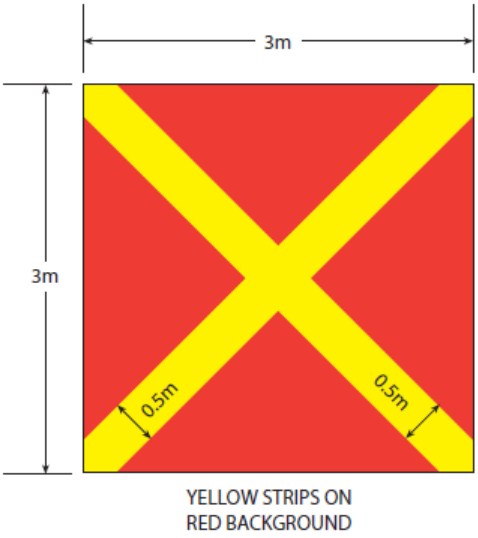


Figure 7.6 Aerodrome unsafe

7.31 Yellow stripes at least 0.5m 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

7.32 A white dumbbell 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.

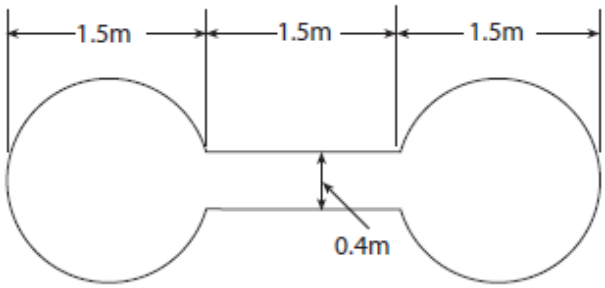


Figure 7.7 Restricted ground movement

7.33 A black stripe as shown at figure 7.8 of 0.6m width, placed across each disc of the dumbbell 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.

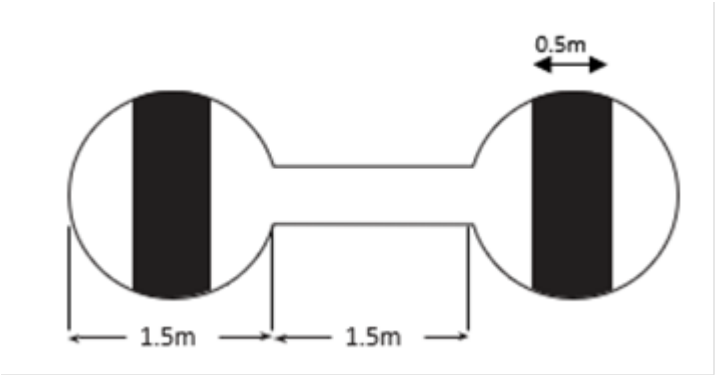


Figure 7.8 Unrestricted ground movement

7.34 A red-letter L as shown in figure 7.9 displayed on the dumbbell signifies that light aircraft are permitted to take off and land either on a runway or on the area designated by the marking specified by figure 7.2.

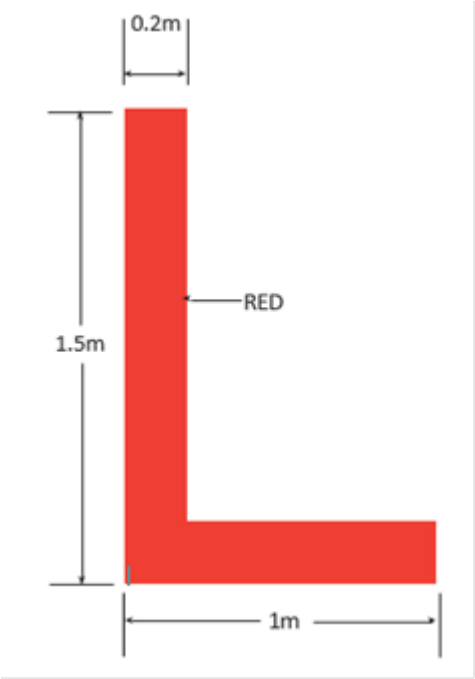


Figure 7.9 Designated light aircraft operating area

7.35 A white letter H as shown in figure 7.10 signifies that helicopter shall take off and land only within the area designated by the marking.

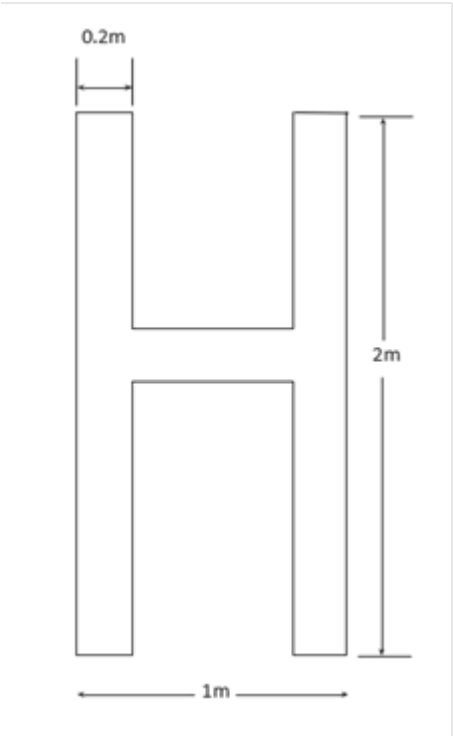


Figure 7.10 Helicopter landing area

7.36 A white double cross as shown at figure 7.11 signifies that glider flying is in progress.

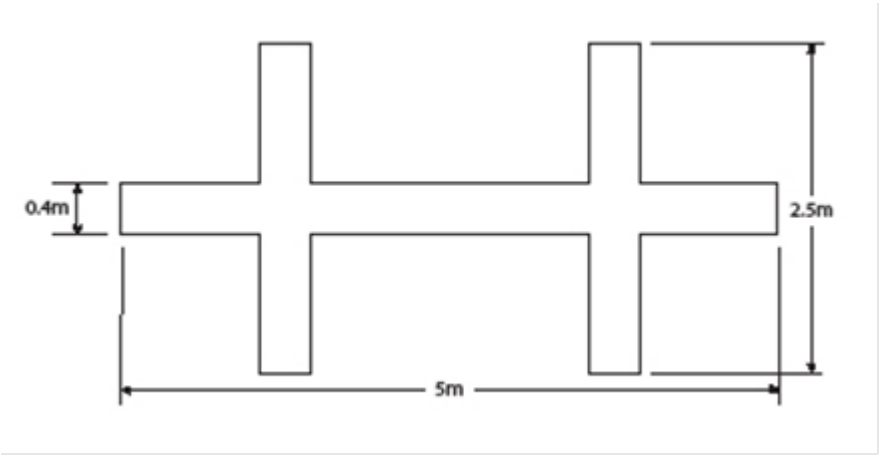


Figure 7.11 Glider flying in progress

7.37 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

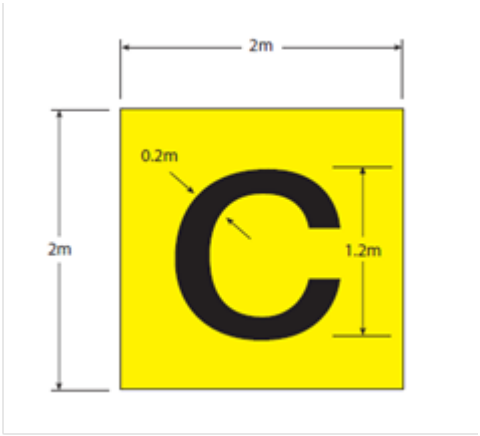


Figure 7.12 Reporting point

7.38 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.

7.39 A checkered flag or board 1.2 m by 0.9 m containing 12 equal squares, 4 horizontally and 3 vertical coloured red and yellow alternately, signifies that aircraft may move on the manoeuvring area and in accordance with the permission of the air traffic control unit at the aerodrome.

7.40 A black ball 0.6 m in diameter suspended from a mast signifies that the directions of take-off and landing not necessarily the same.

7.41 Two red balls each 0.6 m in diameter, disposed vertically one above the other, 0.6m apart and suspended from a mast, signify that glider flying is in progress at the aerodrome.

7.42 A rectangular green flag of not less than 0.6 m side flown from a mast indicates that a right-hand circuit is in force.

7.43 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.

7.44 A checkered flag or board 1.2 m by 0.9 m containing 12 equal squares, 4 horizontally and 3 vertical coloured red and yellow alternately, signifies that aircraft may move on the manoeuvring area and in accordance with the permission of the air traffic control unit at the aerodrome.

7.45 A black ball 0.6 m in diameter suspended from a mast signifies that the directions of take-off and landing not necessarily the same.

7.46 Two red balls each 0.6 m in diameter, disposed vertically one above the other, 0.6m apart and suspended from a mast, signify that glider flying is in progress at the aerodrome.

7.47 A rectangular green flag of not less than 0.6 m side flown from a mast indicates that a right-hand circuit is in force.

Signs

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

7.49 Signs should be either fixed message signs or variable message signs

7.50 The installed height of the sign shall not exceed the dimension shown in the appropriate column of Table 7.1, except for runway distance remaining signs.

7.51 A variable message sign should be provided where:

1. The instruction or information displayed on the sign is relevant only during a certain period of time; and/or
2. There is a need for variable predetermined information to be displayed on the sign to meet the requirements of the implementation of surface movement guidance and control system (SMGCS) at an aerodrome

7.52 If instruction or information during a certain period of time, and/or there is a need to display variable pre-determined information, a variable information sign should be provided.

7.53 A variable message sign should show a blank face when not in use.

7.54 In case of failure, a variable message sign should not provide information that could lead to unsafe action from a pilot or a vehicle driver.

7.55 The time interval to change from one message to another on a variable message sign should be as short as practicable and should not exceed 5 second

7.56 The only signs on the movement area utilising red should be mandatory instruction signs

Taxi guidance signs

7.57 Taxi guidance signs are provided to convey a mandatory instruction, information on a specific location, or destination on a movement area or to provide other information necessary for the implementation of surface movement guidance and control system (SMGCS) at an aerodrome.

Mandatory signs

7.58 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 auth ATC. Mandatory signs display white characters on a red background. Except for the provisions of 7.9(e), Mandatory signs should not be accompanied by information signs.

7.59 Mandatory signs should be located in line with the surface marking used to define the associated Holding Position described in this chapter. See figure 7.14

7.60 Internally lit mandatory signs should be provided with an alternative power source in accordance requirements of chapter 6.

Runway taxi-holding position signs

7.61 Runway taxi-holding position signs identify the designated taxi-holding position (as determined in accordance with chapter 3) associated with a particular runway and consist of the runway designation white on a red background as illustrated at figure 7.13. Figure 7.14 illustrates runway holding position sign layouts.

7.62 Where the runway is equipped with ILS, the runway taxi-holding position should be established at of the critical/sensitive area in order to protect the ILS when in use.

7.63 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 illustrated in figure 7.13 (b), (c), (d) and (e) except that;

7.64 Where the non-instrument runway taxi-hold and the CAT I runway taxi-holding position are collocated, the CAT I annotation is not used (see fig 7.13 (a)).

7.65 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 non-instrument Runway Taxi-Holding Position should also be established closer to the runway as illustrated in Figure 7.14 (e), (f) and (g).

7.66 Where a runway is served by more than one taxiway, the runway taxi-holding position sign should be accompanied by a taxiway location sign.

7.67 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.

7.68 At aerodromes where no ATC service is provided, non-instrument 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.

7.69 A runway exit sign shall be provided where there is an operational need to identify a runway exit.

7.70 A runway exit sign shall be located on the same side of the runway as the exit is located (i.e., left, or right).

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

7.72 Signs shall be rectangular with the longer side horizontal.

7.73 The only signs on the movement area utilising red shall be mandatory instruction signs.

7.74 The inscriptions on a sign shall be in accordance with the provisions detailed in road signs and markings.

Sign Height (mm)				Perpendicular distance from defined taxiway pavement edge to near side of sign	Perpendicular distance from defined runway pavement edge to near side of sign
Code number	**Legend**	**Face (min)**	**Installed (max)**		
1 or 2	200	300	700	5 - 11 m	3 – 10 m
1 or 2	300	450	900	5 - 11 m	3 – 10 m
3 or 4	300	450	900	11 - 21 m	8 – 15 m
3 or 4	400	600	1100	11 - 21 m	8 – 15 m

Table 7.0 (a) Location distances for taxiing guidance signs including runway exit signs.

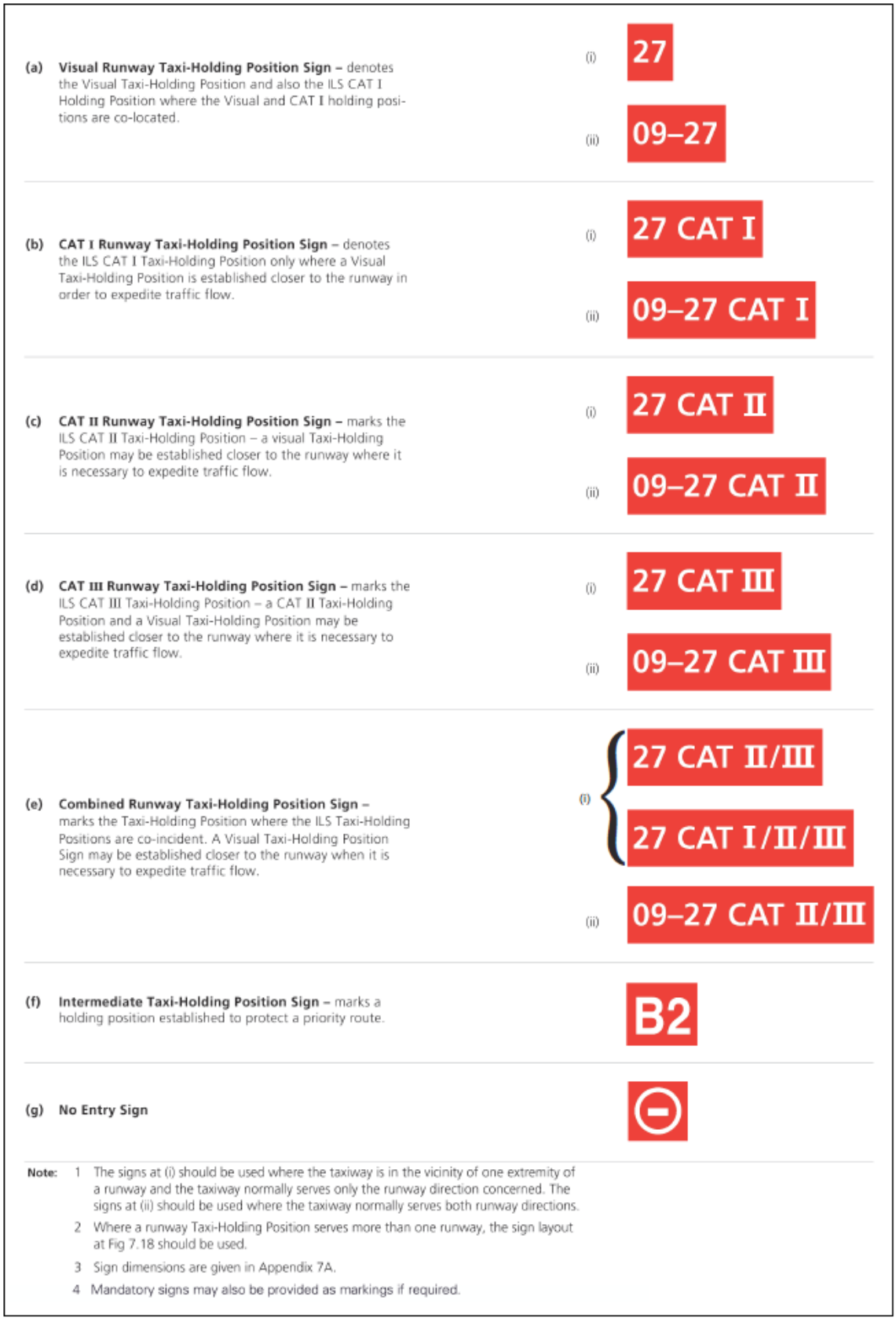


Figure 7.13 Mandatory Signs for Aircraft Surface Movements

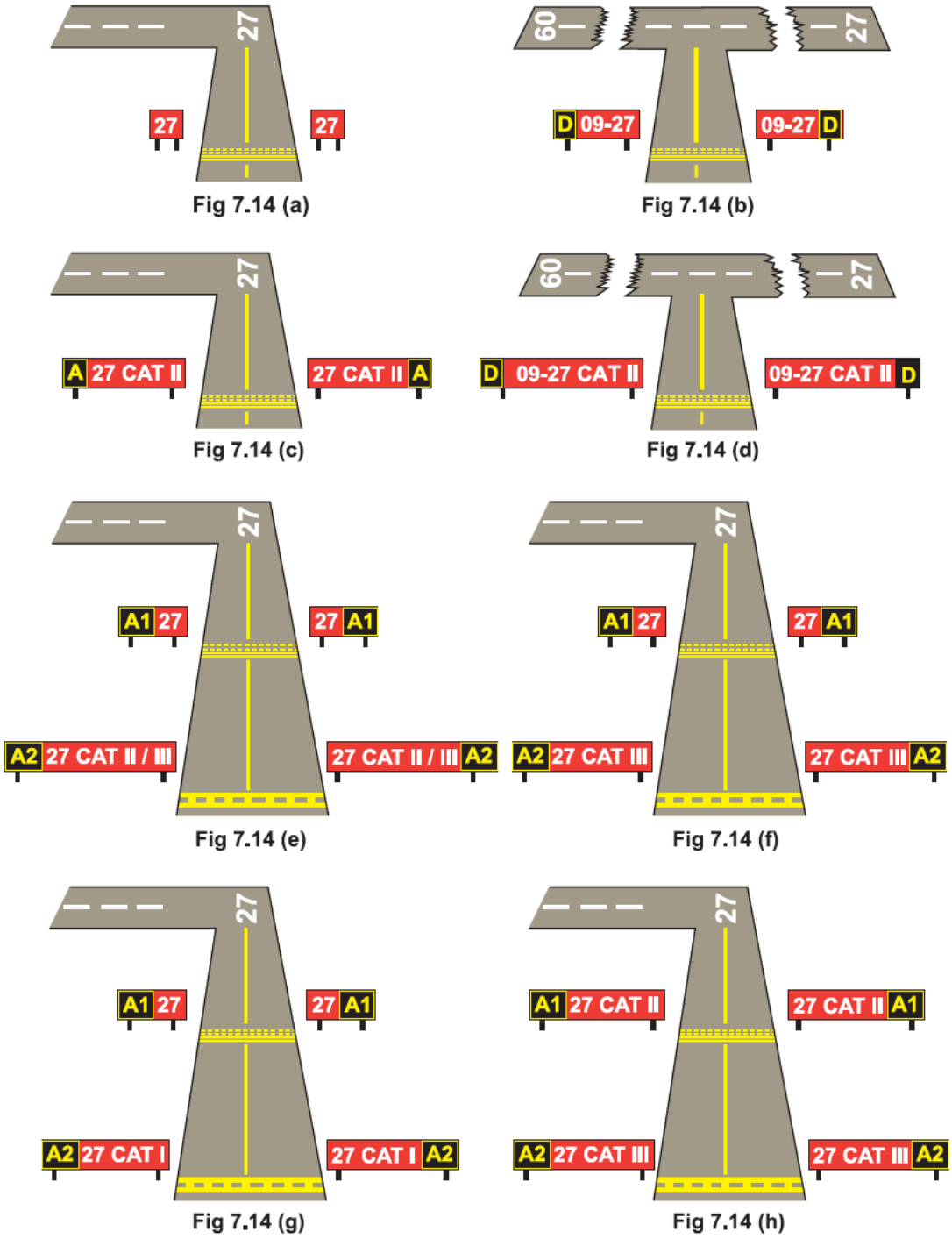


Figure 7.14 Typical runway taxi-holding position signs and associated taxiway marking

7.75 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’ leading to an intermediate taxiway entrance to runway 09-27.

Note 1:

The signs at intermediate taxiway entrances as shown at figures 7.14 (b) and (d) above are handed to show a left turn is required to reach the threshold of runway 09 and a right turn to reach the threshold of runway 27.

Note 2:

At grass aerodromes the runway taxi-holding position sign, which marks that point beyond which aircraft should not proceed without the approval of ATC should be sited no closer to the runway centreline than the distances specified in table 3.3.

Intermediate taxi-holding position signs

7.76 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.

7.77 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. No entry signs

7.78 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.

Information signs

7.79 The following information signs should be provided where there is an operational need to provide additional guidance to pilots manoeuvring aircraft on the ground.

Taxiway location signs

7.80 Taxiway location signs should be used to identify individual taxiways.

7.81 Taxiway location signs should be positioned at the approach to a taxiway intersection.

7.82 A location sign should be provided at an intermediate holding position.

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

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

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

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

7.87 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.

7.88 A taxiway shall be identified by a designator that is used only once on an aerodrome comprising a single letter or a combination of a letter or letters followed by a number.

7.89 When designating taxiways, the use of words such an inner and outer should be avoided wherever possible.

7.90 When designating taxiways, the use of the letter i,o or x shall not be used to avoid confusion with the numeral’s, 1, 0 and closed marking.

7.91 Apron stand designators should not be the same as a taxiway designator.

7.92 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.

7.93 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).

7.94 Where a taxiway location sign is collocated with a runway taxi-holding position sign, 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.

Taxiway ending sign

7.95 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.

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

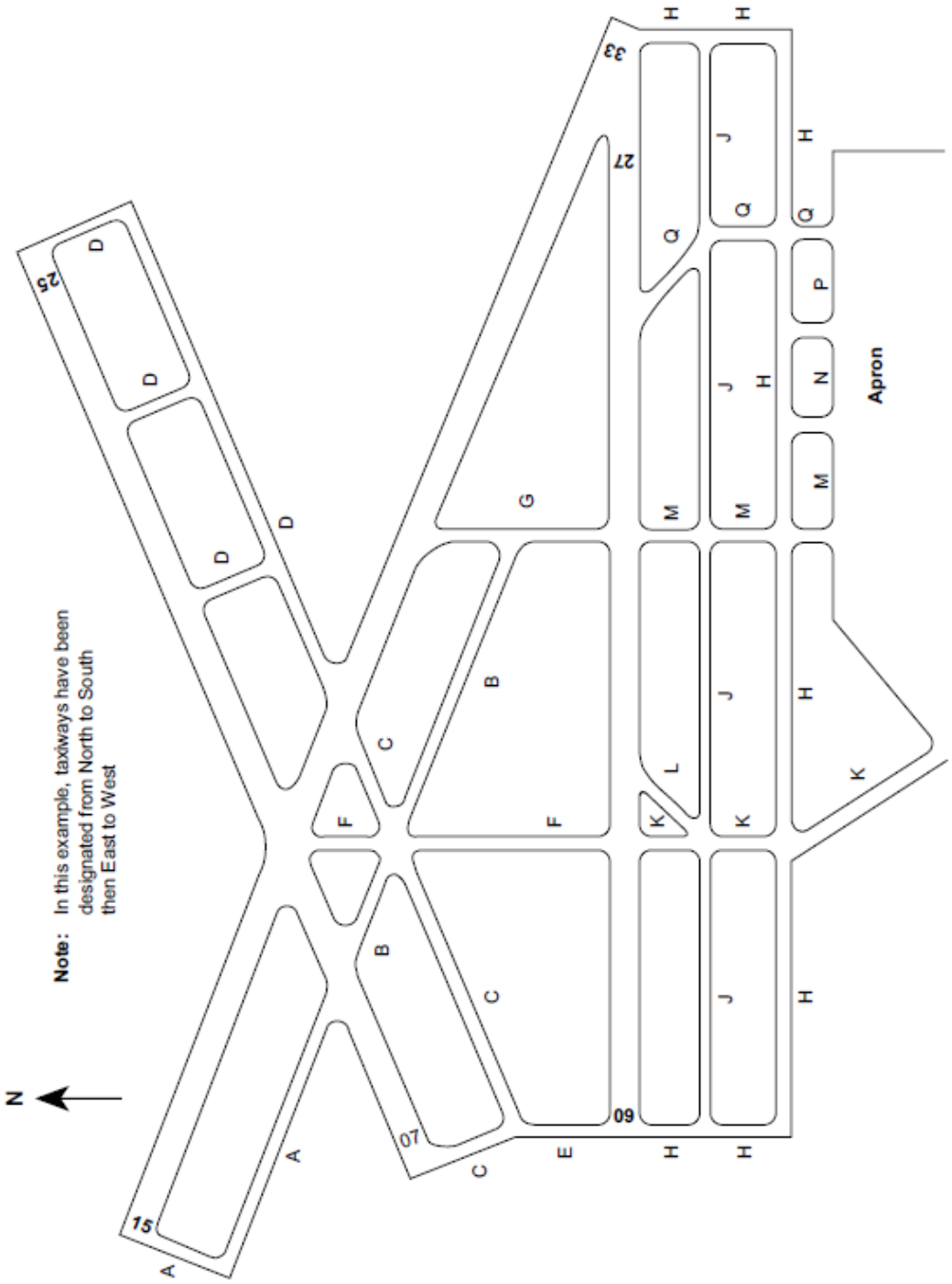
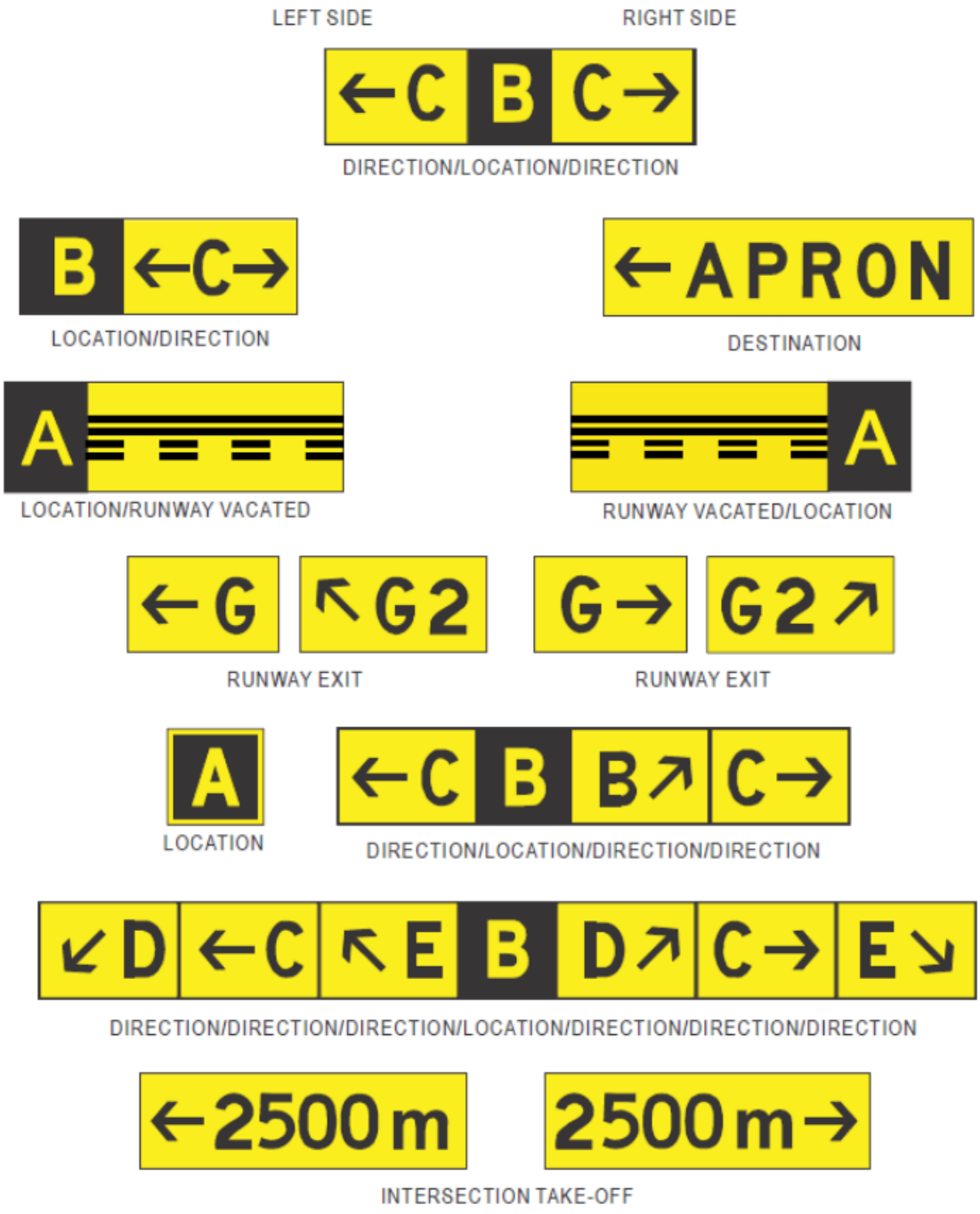


Figure 7.15 Example: designating taxiway





Taxiway ending sign

Figure 7.16 Examples of information signs

VOR aerodrome checkpoint sign

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

Location

7.98 A VOR aerodrome check-point sign should be located as near as possible to the check- point and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the VOR aerodrome checkpoint marking in order to receive the correct VOR signal,

Characteristics

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

7.100 The inscriptions on a VOR check-point sign should be in accordance with one of the alternatives shown in Figure 7.16(a).

VOR	VOR is an abbreviation identifying this as a VOR check point
116.3	116.3 is an example of the radio frequency of the VOR concerned
147°	Is an example of the VOR bearing; to the nearest degree, which should be indicated at the VOR checkpoint
4.3 NM	Is an example of the distance in nautical miles to a DME collated with the VOR concerned

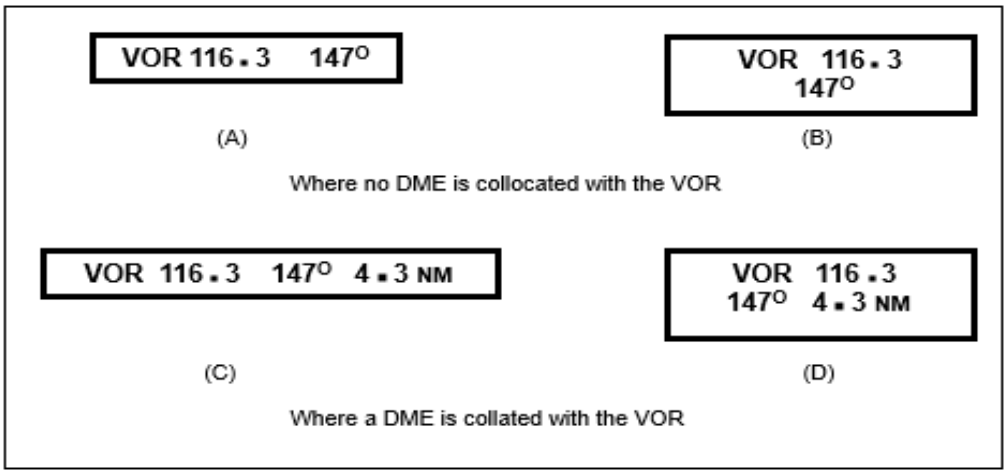


Figure 7.16(a) VOR Aerodrome check-point sign

Runway location sign

7.101 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 7.19.

7.102 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).

Runway intersection take-off sign

7.103 An intersection take-off sign should be provided when there is an operational need to indicate the remaining take-off run available (TORA) for intersection take-offs.

7.104 Where provided the inscription on an intersection take-off sign should consist of a numerical message indicating the remaining take-off run available in metres, plus an arrow, appropriately located and oriented, indicating the direction of the take-off

7.105 An intersection take-off sign should be located at the left-hand side of the entry taxiway. The distance between the sign and the centre line of the runway should be not less than;

1. 60 m where the code number is 3 or 4; and
2. not less than 45 m where the code number is 1 or 2.

Runway distance remaining signs (RDRS)

7.106 Runway excursions may take place in all visibility or weather conditions. The use of RDRS can form part of effective runway excursion prevention measures.

7.107 The inclusion of detailed specifications for runway distance remaining signs (RDRS) is not intended to imply that an RDRS has to be provided.

7.108 An aerodrome considering the installation of such signs may wish to assess their need individually, depending on factors such as runway length, aerodrome elevation, aerodrome geometry, traffic levels, lack of runway end safety area, lack of runway friction and climate.

7.109 The purpose of RDRSs is to provide pilots with distance-to-go information to the extremity of the runway, to enhance situational awareness and enable pilots to decide whether to commence a go-around and to apply braking action for more efficient roll-out and runway exit speeds.

7.110 It is essential that pilots operating at aerodromes with RDRS be familiar with the purpose of these signs.

7.111 Runway distance remaining signs (RDRSs) do not have to be provided at all aerodromes. An aerodrome considering the installation of such signs may wish to assess their need individually, depending on factors such as runway length, aerodrome elevation, aerodrome geometry, traffic levels, lack of runway end safety area, lack of runway friction and climate.

7.112 RDRSs are placed along the full length of the runway at longitudinal spacing of 300 m (±30 m), parallel and equidistant from the runway centre line as in Configurations A, B or C, illustrated in Figure 7.15 (a)

7.113 RDRSs are arranged by any of three different configurations as shown in Figure 7.16a

7.114 In configuration a, the RDRSs consist of double-faced signs and are located on both sides of the runway. where the runway length is not an exact multiple of 300 m, the signs are placed at locations where the runway total length is divided equally.

7.115 In configuration b, the RDRSs consist of double-faced signs and are located on both sides of the runway. where the runway length is not an exact multiple of 300 m, one-half of the excess distance is added to the distance of each sign from each runway extremity.

7.116 To illustrate the case where the distance between the end of the runway and the sign is the maximum, for a runway length of 1 950 m, the excess distance is 150 m and the location of the last sign on each runway end is 300 m plus one-half of 150 m, or 375 m. this configuration allows a maximum of 375 m at the end of the runway, but the other signs are exactly 300 m apart

7.117 For configurations a and b, the signs may be omitted on one side of the runway because of clearance conflict or by design.

7.118 In configuration c, the RDRSs consist of single-faced signs and are located on one side of each runway, viewed in the direction of take-off or landing. the advantage of configuration c is that the runway distance remaining is more accurately reflected for a runway length that is not an exact multiple of 300 m.

7.119 An RDRS may be omitted if the sign cannot be placed within the tolerance of ±30 m.

Location

7.120 Where provided, runway distance remaining signs (RDRS) shall be placed along the full length of the runway at longitudinal spacing of approximately 300 m, parallel and equidistant from the runway centre line.

7.121 Displaced threshold areas that are used for take-off and/or roll-out are treated as part of the runway for purposes of locating the signs.

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

7.122 Runway distance remaining signs shall be placed outside the edges of the runway at a distance shown in Table 7.0(b)

Characteristics

7.123 Where provided, an RDRS shall consist of an inscription in white on a black background.

7.124 The installed height of the RDRS shall not exceed the dimension shown in the appropriate column of Table 7.1.

7.125 The face width of runway distance remaining sign (RDRS) shall be determined using Figure 7.16(b)

7.126 All RDRSs on one runway shall be the same size.

7.127 Guidance on installing RDRSs is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.

Note:

Provisions related to the identification and mitigation of hazards, including the need for safety assessment related to runway safety, is available in PANS-Aerodromes (Doc 9981), Chapter 8.

OFFICIAL - Public

Sign height (mm)				Perpendicular distance from defined runway pavement edge to near side of sign
Code Number	Legend	Face (min)	Installed (max)	
1 or 2	600	760	1070	6 – 10.5 m
3 or 4	1000	1200	1520	15 – 22.5 m
3 or 4	1200	1500	1600	25 m or more

Table 7.0 (b) Location distances for runway distance remaining signs

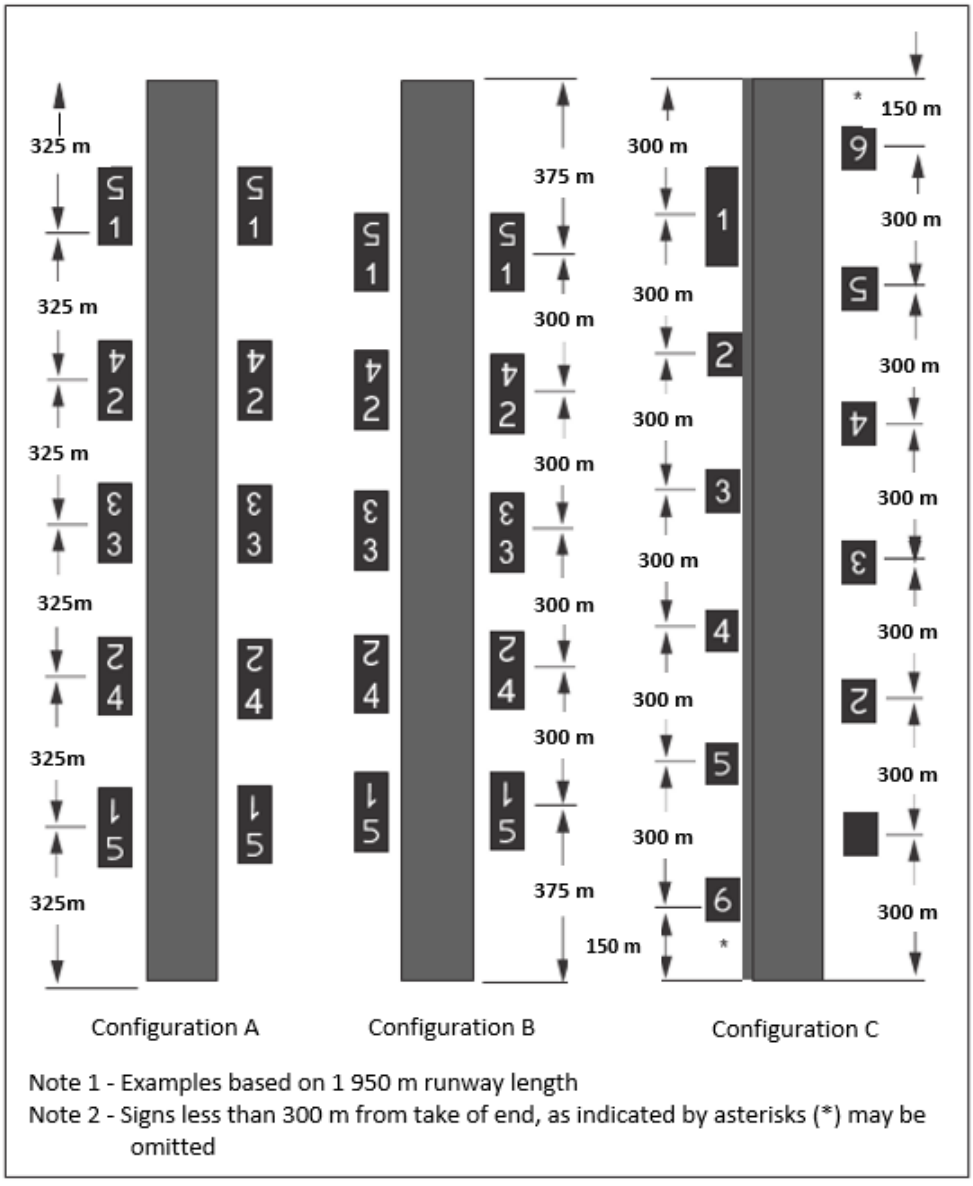
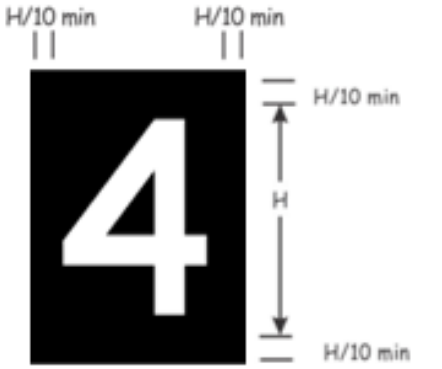


Figure 7.16(a) Runway distance remaining sign configuration



"H" stands for the inscription height.

Figure 7.16(b). Sign dimensions for RDRS

Runway exit sign

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

7.129 Where provided a runway exit sign should be located on the same side of the runway as the exit is located (i.e. left or right).

7.130 Where provided a runway exit sign should be located prior to the runway exit point in line with a position at least;

1. 60 m prior to the point of tangency where the code number is 3 or 4, and
2. at least 30 m where the code number is 1 or 2.

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

Runway vacated sign

7.132 Where it is considered necessary for pilots to report runway vacated, a taxiway location sign should be used to indicate to the pilot the position at which the report should be made. The inscription on the sign should depict the pattern A runway holding position marking as shown in figure 7.16.

7.133 The distance between the centre line of the runway and the perimeter of the ILS/MLS critical/sensitive area; or

7.134 The distance between the centre line of the runway and the lower edge of the inner transitional surface.

7.135 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 non-instrument runways and correspond in designation with the taxiway location sign identifying the runway taxi-holding position.

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

Direction signs

7.137 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.

7.138 The designation letter and the arrow are black on a yellow background as shown at figure 7.16.

7.139 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 7.18.

Destination signs

7.140 Destination signs such as those illustrated at figure 7.16 should be used where it is determined that the combination of location and direction signs would not provide adequate guidance to a destination.

7.141 Destination signs should not be accompanied by location or direction signs.

7.142 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

Stand identification signs

7.143 Stand identification signs (also known as stand number indicator boards) should be provided where practicable, to identify the aircraft parking stand from the taxiway centreline. An aircraft stand identification sign should consist of an inscription in black on a yellow background. Such signs should be clearly visible from the cockpit of an aircraft prior to entering the aircraft stand. Apron stand designators should not be the same as taxiway designators.

7.144 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, the character size shall be that of the mandatory sign and where an information

7.145 Signs which contain 10 or more characters, 0.2m characters may be used in the manner illustrated in figure 7a.9. Where the conspicuity of the inscription on a mandatory instruction sign needs to be enhanced, the outside edge of the white inscription may be supplemented by a black outline. The black outline should be 10mm in width for runway code letters 1 and 2, and 20 mm in width for runway code letters 3 and 4, as shown in figure 7.17



Example of sign face



Example of unlighted sign face

Figure 7.17 Enhanced mandatory instruction sign

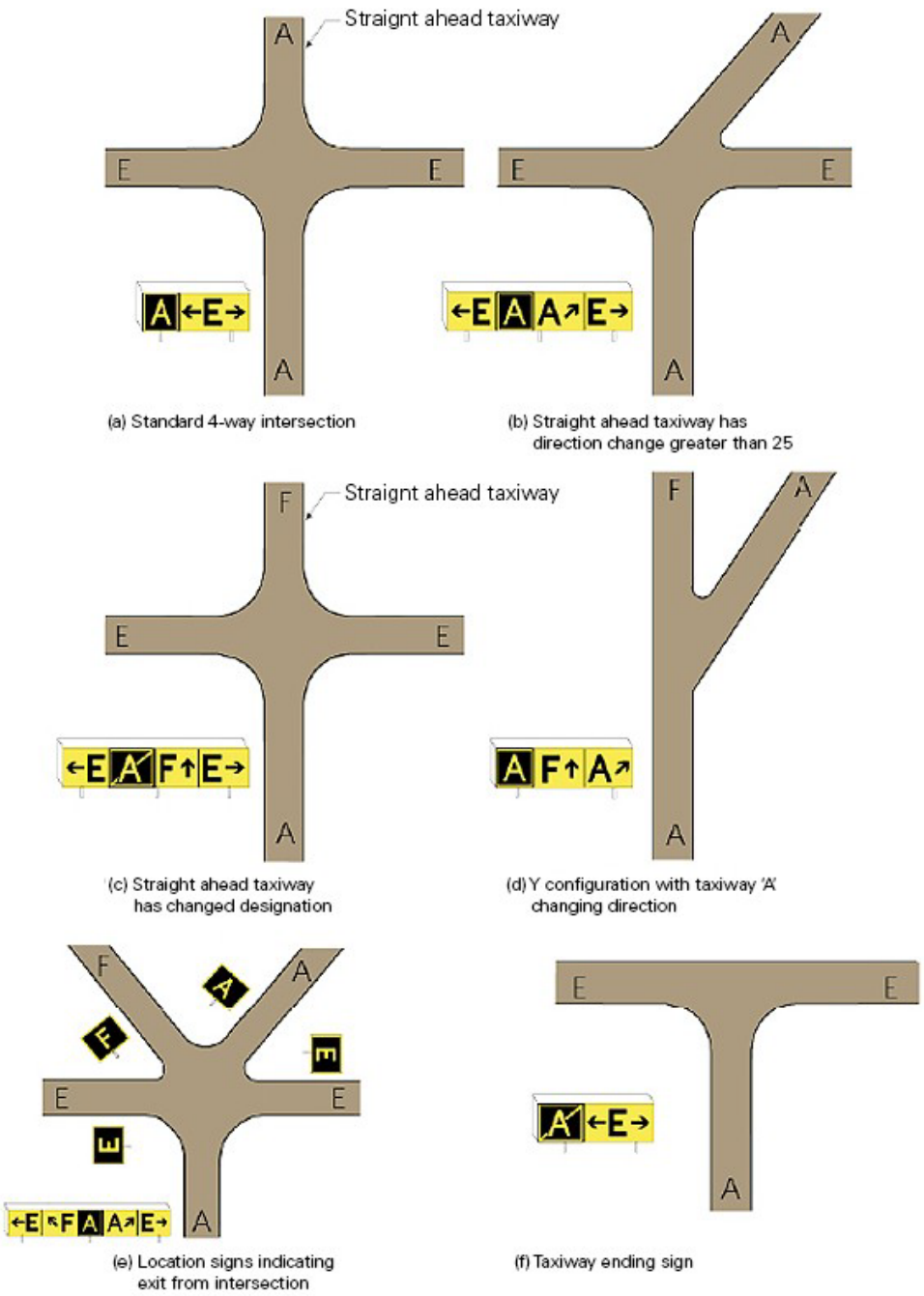


Figure 7.18 Examples of taxi guidance signs at taxiway intersections

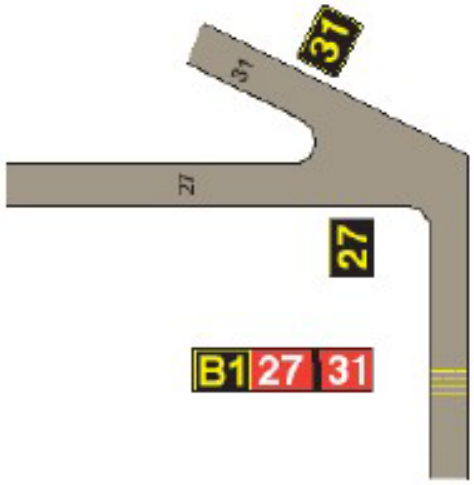
Notes:

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.



(a) Taxiway entrance at intersection to two runways



(b) Taxiway entrance at intersection of two runway ends

Figure 7.19 Examples of use of runway location signs and signs at runway taxi-holding positions serving more than one runway

Notes:

1. Taxi-holding position signs installed at intersections such as those illustrated above are used in the manner shown.
2. Runway location signs for runways 31 and 13 are positioned in this example on the right side of the runway in order to avoid confusion.

7.146 The character size to be used for other characters is as follows:

DOTS

Where a dot is employed on a sign such as that illustrated in figure 7.16, the diameter of the dot shall be equal to the stroke width of the other characters employed, as illustrated in paragraph 7.51, figure 7A.6.

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 1/3 of the height of the other characters, as illustrated in paragraph 7.51, figure 7A.6.

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 paragraph 7.51 figure 7.A.6.

DIAGONAL LINES

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 paragraph 7.47a, figure 7a.6.

Where diagonal lines are used on taxiway ending signs, as illustrated at figure 7.16, the stroke width of the diagonal shall be equal to 3/4 of the stroke width of the character. the size of the break between the diagonal and the character should be approximately 1/2 the character stroke width.

7.147 The space between individual characters making up a sign shall be determined as outlined at paragraph 7.51, table 7A–1.

7.148 The style and proportions of characters used shall be those given at 7.51.

7.149 Roman numerals as illustrated at figure 7A.6 shall be used on category I, II and III signs.

Face size

7.150 The face size of taxi guidance signs shall conform to the proportions and layout as illustrated at figure 7A.1.

Borders and delineators

7.151 Signs having a black background shall be provided with a yellow border, as shown in figure 7.16 equal in width to 1/2 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 7.48.

7.152 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 7.18 and 7.19.

7.153 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

Illumination of signs

7.154 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.

7.155 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/m2.

7.156 All signs 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, signs may be externally lit in the manner prescribed in paragraph 6.8.

7.157 Where operations are conducted in RVR 800 – 1500m 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

1. 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;
2. 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;
3. 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.

7.158 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.

Colour	Luminance cd/m²
Red	30
Yellow	150
White	300
Green	45

Table 7.2 Minimum average sign luminance (signs used in support of operation RVR less than 800 m)

Notes:

1. The method of calculating average sign luminance is described at Figure 7.22. 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.

7.159 The colour specification for signs is prescribed at Figure 7.20 (internally lit) and Figure 7.21 (externally lit).

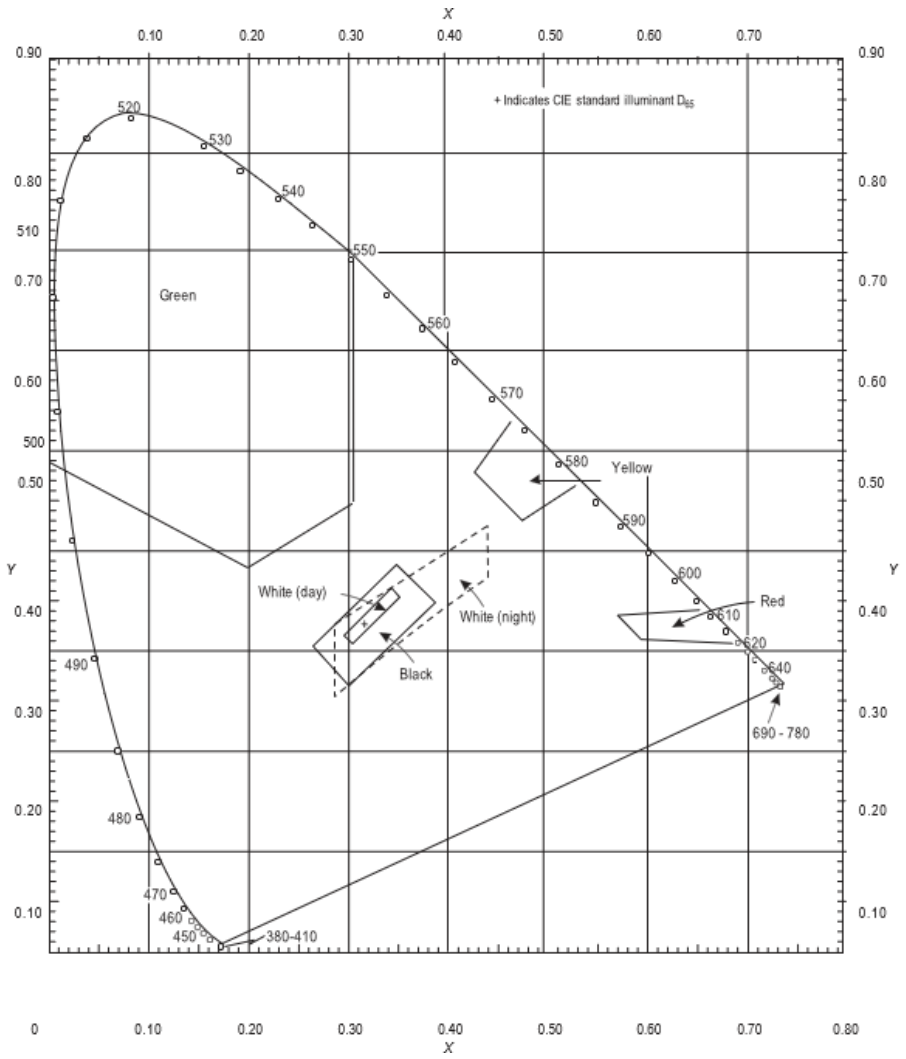


Figure 7.20 Colours of luminescent or transilluminated (internally illuminated) signs and panels

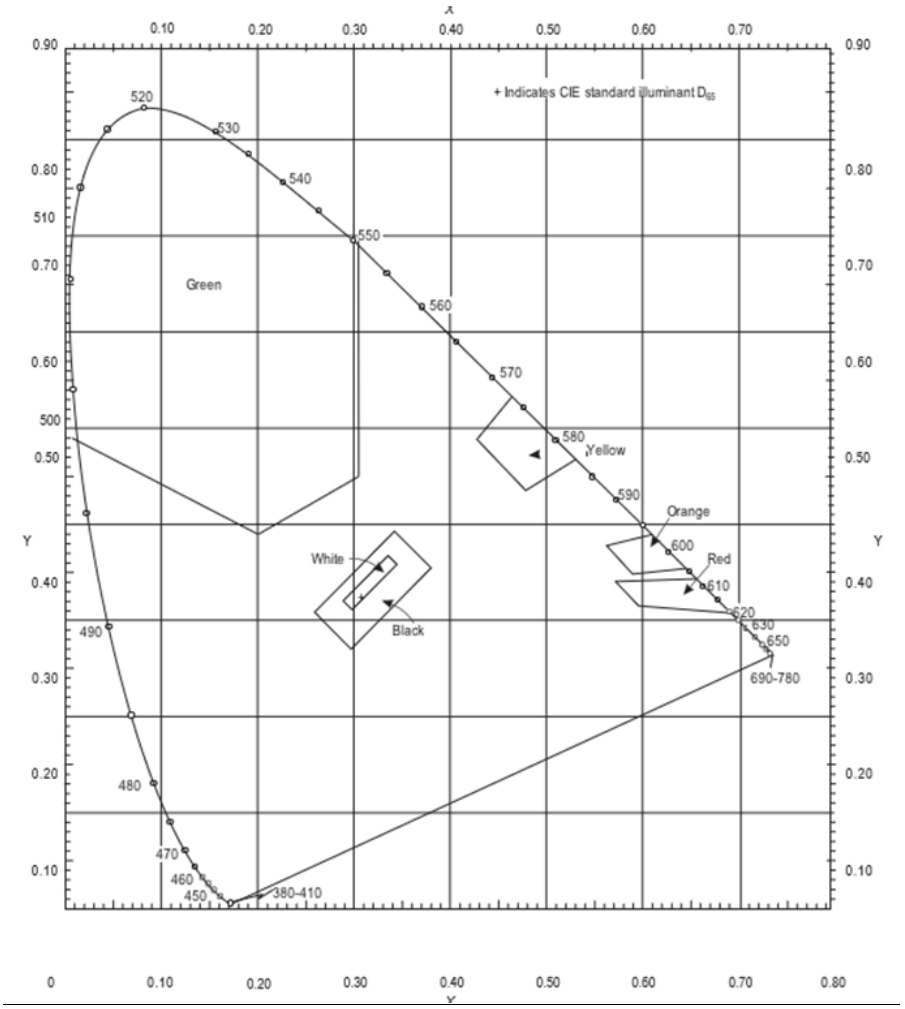


Figure 7.21 Colours for surface markings and externally lit signs

7.160 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.

7.161 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.

7.162 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.

7.163 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.

Construction

7.164 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 collocated 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 detailed in this chapter are met. Signs constructed in this manner should not display a frame to the face of the sign greater than 45 mm in width; the colour of this frame should be black.

7.165 Where a number of signs are collocated, 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.

7.166 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 frame 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.

7.167 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 in chapter 4 and for marking fixed obstacles. Normally a single conspicuous colour, preferably orange or yellow, will suffice.

7.168 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.

7.169 In order to determine conformance, the average luminance of a sign should be calculated in the following manner:

1. Starting at the top left corner of the sign face establish a reference grid point at 75 mm from both the left edge and the top of the sign face.

2. Construct a grid pattern as illustrated in figure 7.22, 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 225 mm and 150 mm away from the last grid point, add a further row and/or column 75 mm away from the edge of the 150 mm grid.

3. Measure the luminance levels at each grid point established in paragraphs 1 and 2, ensuring that the area used for each individual measurement does not exceed that prescribed by a circle of diameter 30 mm centred on the grid point.

7.170 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.

7.171 In calculating average luminance and inspecting for uniformity, the luminance value measured on any character should be deleted from the calculation. Grid points within 75 mm of the edge of the sign should be excluded from the calculation. The ratio between points 75 mm 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.

7.172 Measurements made for compliance with the sign colour specifications should be made at the same grid points and over the same areas as specified in this chapter.

7.173 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.

7.174 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.

7.175 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

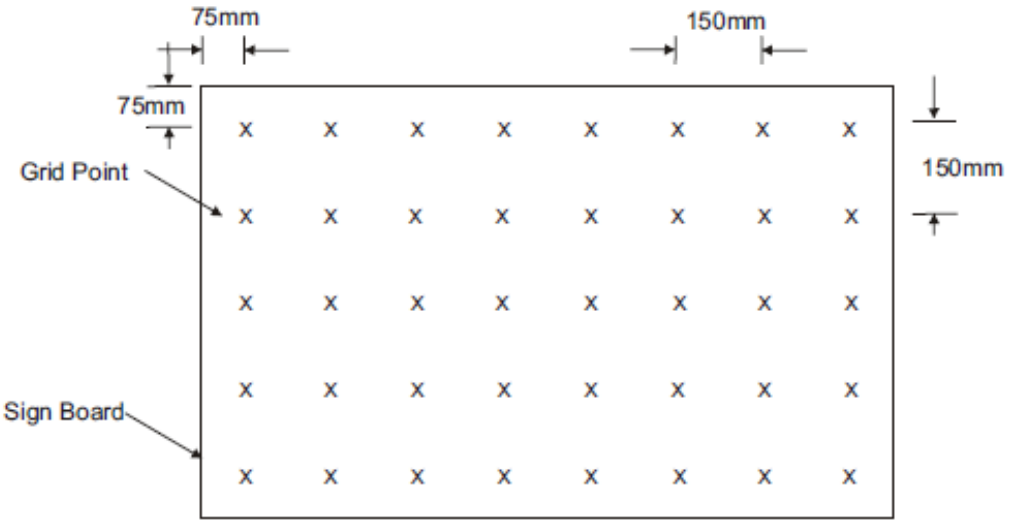


Figure 7.22 Means of calculating average luminance of a sign

Siting

7.176 Taxi guidance signs should be sited so as to comply with the criteria laid down in chapter 3. 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.

7.177 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 1500m 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.

7.178 Mandatory signs should be located in line with the surface marking used to define the associated Holding Position described in this chapter.

7.179 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.

Information marking

7.180 Markings provide perspective information, alignment, location and runway and threshold identification.

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

7.182 Markings shall be white for runways and yellow for taxiways, runway turn pads and aircraft stands.

7.183 Apron safety lines should be of a conspicuous colour which should contrast with that used for aircraft stand markings. Black outlining (at least 150 mm in width) should be provided where there is insufficient background contrast. Colour specifications for paved surface markings are detailed at Figure 7.22.

7.184 Markings should consist of solid areas or a series of longitudinal stripes providing an effect equivalent to the solid areas.

7.185 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.

7.186 At aerodromes where operations take place at night, where operationally required pavement markings may be made with reflective materials designed to enhance the visibility of the markings. Guidance on reflective materials is given in the ICAO Doc 9157, Aerodrome Design Manual, Part 4, Visual Aids.

7.187 When it is operationally necessary to apply temporary runway or taxiway markings, those markings should comply with the relevant requirements of this chapter.

7.188 The character height should be as for mandatory instruction markings.

Markings on paved runways

Runway centre line marking

7.189 Runway centreline marking should be provided on all paved runways and consists of lines 30 m apart throughout the length of the runway.

Interruption of runway markings

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

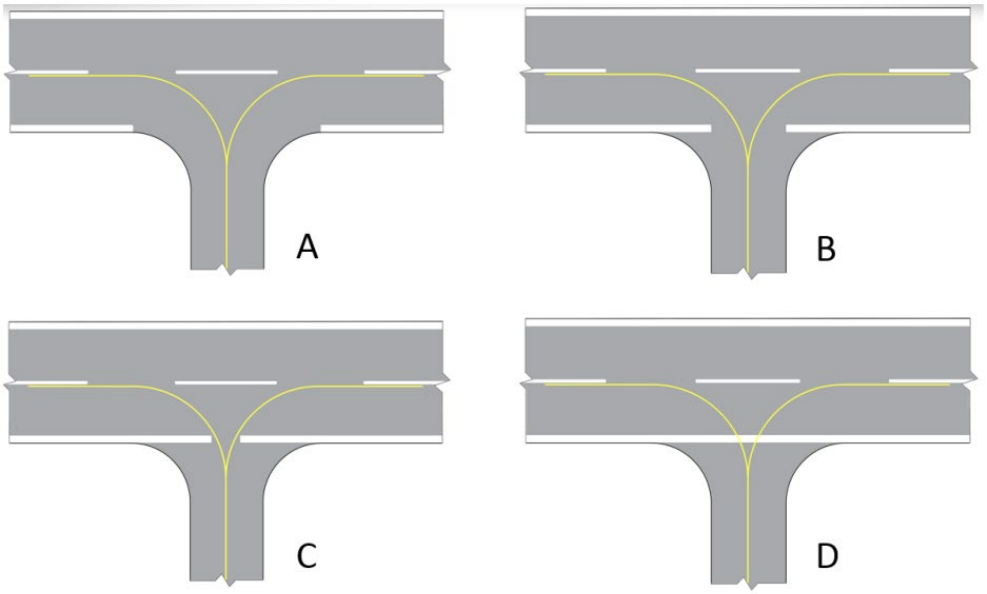
7.191 At an intersection of a runway and taxiway the markings of the runway should be displayed and the markings of the taxiway interrupted, except that runway side stripe markings should be either continued across the intersection or interrupted.

7.192 The runway side stripe marking stops at the point where the taxiway fillet starts at either side of the taxiway (see illustration A below) or

7.193 The runway side stripe marking stops at the point where the extended line of the taxiway edge crosses the runway (see illustration B below) or;

7.194 The runway side stripe marking stops at a short distance on either side of the taxiway centre line marking in order to allow visible and continuous taxiway centre line marking (see illustration C below)

7.195 The taxiway centre line marking overlays and therefore interrupts a continuous runway side stripe marking see illustration D below .



7.196 The overall perception of the runway side stripe marking depends on conspicuity needs and local conditions, such as the number, location and disposition of runway/taxiway intersections, nature of the surrounding terrain, operational needs at aerodrome, weather, etc.

7.197 The order of importance of runways for the display of runway markings should be as follows:

1. Precision approach runway;
2. Non-precision approach runway; and
3. Non-instrument runway

The dimensions of the markings are shown at table 7.3.

7.198 A runway centre line marking should consist of a line of uniformly spaced stripes and gaps. The length of a stripe plus a gap should be not less than 50 m or more than 75 m.

7.199 The length of each stripe should be at least equal to the length of the gap or 30 m, whichever is greater.

7.200 The width of the stripes should be not less than:

1. 0.90 m on precision approach Category II and III runways;

2. 0.45 m on non-precision approach runways where the code number is 3 or 4, and precision approach Category I runways; and

3. 0.30 m on non-precision approach runways where the code number is 1 or 2, and on non-instrument runways.

7.201 For the centre line marking the 30 m length of and gap between stripes may be adjusted to take into consideration the runway thresholds locations

	Runway C/L marking			Threshold marking								
Runway width m	Length of and distance between each	Width m		Number of stripes		Length of stripes m	Width of and distance between stripes		Width of centre gap m		Character height m	
						W	X		Y		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

Table 7.3 Runway centreline marking – dimensions

7.202 A runway designator comprising a two-figure group showing the magnetic heading to the nearest whole ten degrees, should be located at each threshold.

7.203 In the case of parallel runways, a white letter (L – Left or R – Right) is added to the designator. Examples of layout are shown at figure 7.23(d),

Threshold marking

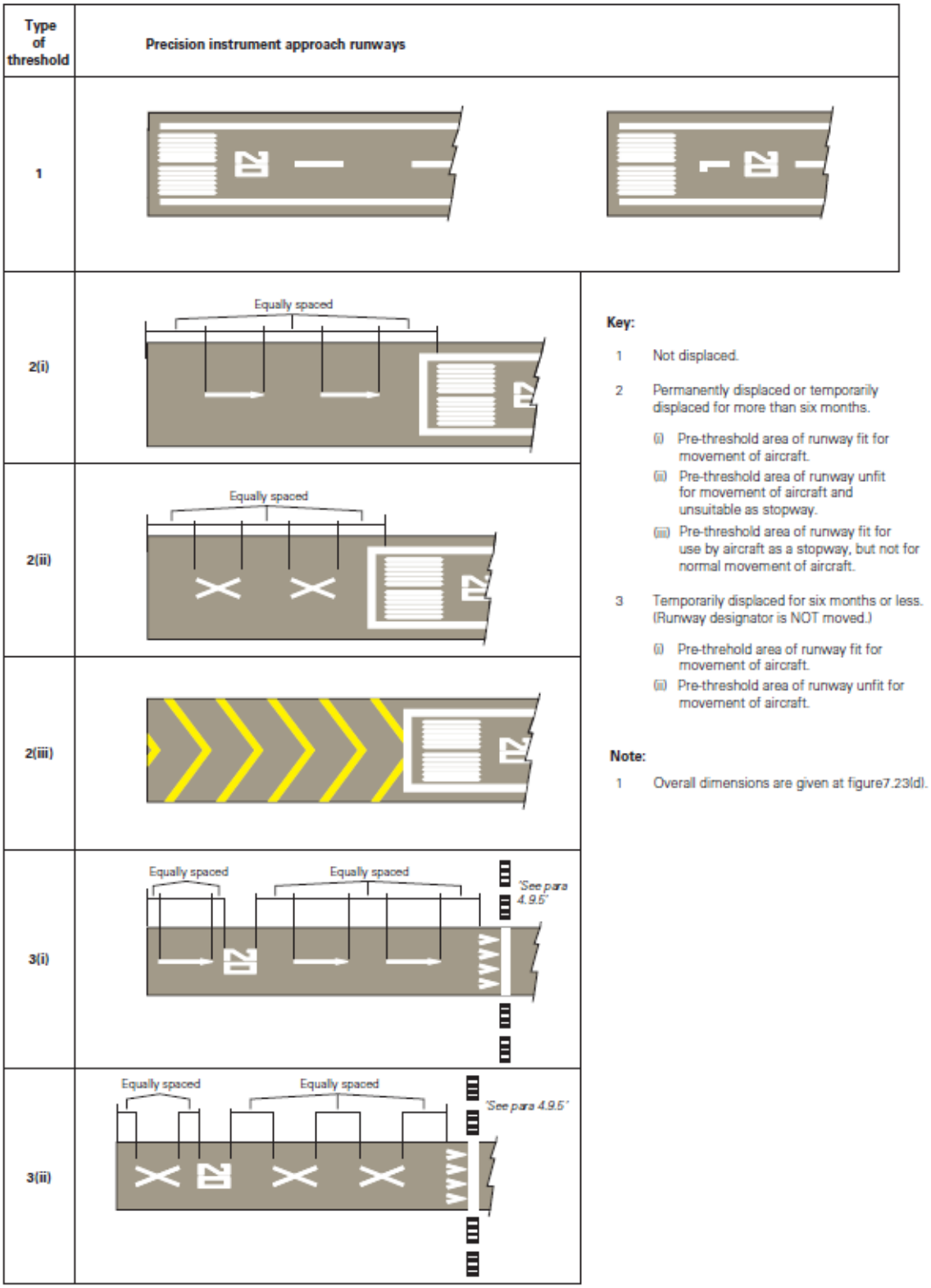


Figure 7.23(a) Paved runway threshold markings

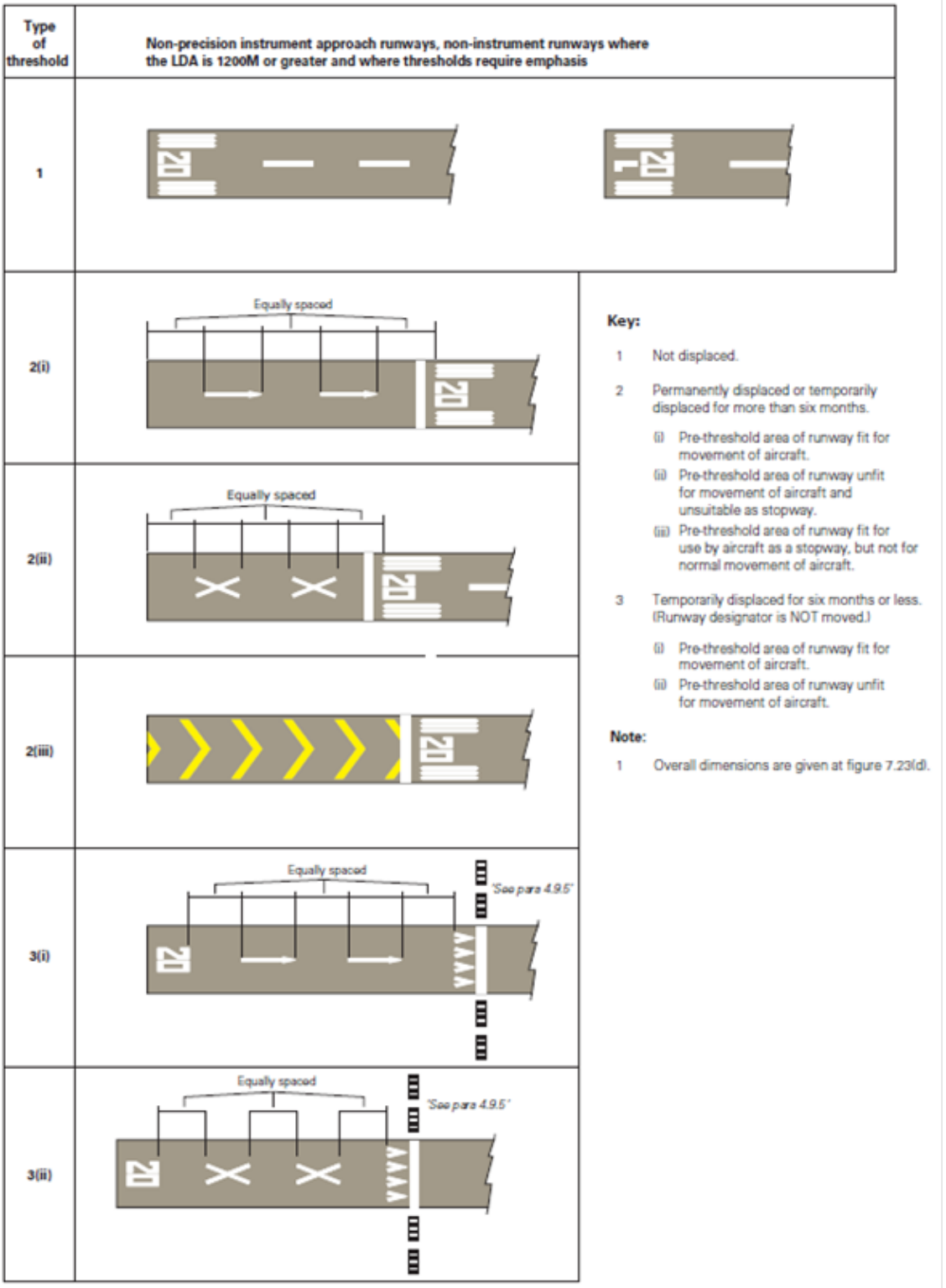


Figure 7.23(b) Paved runway threshold markings

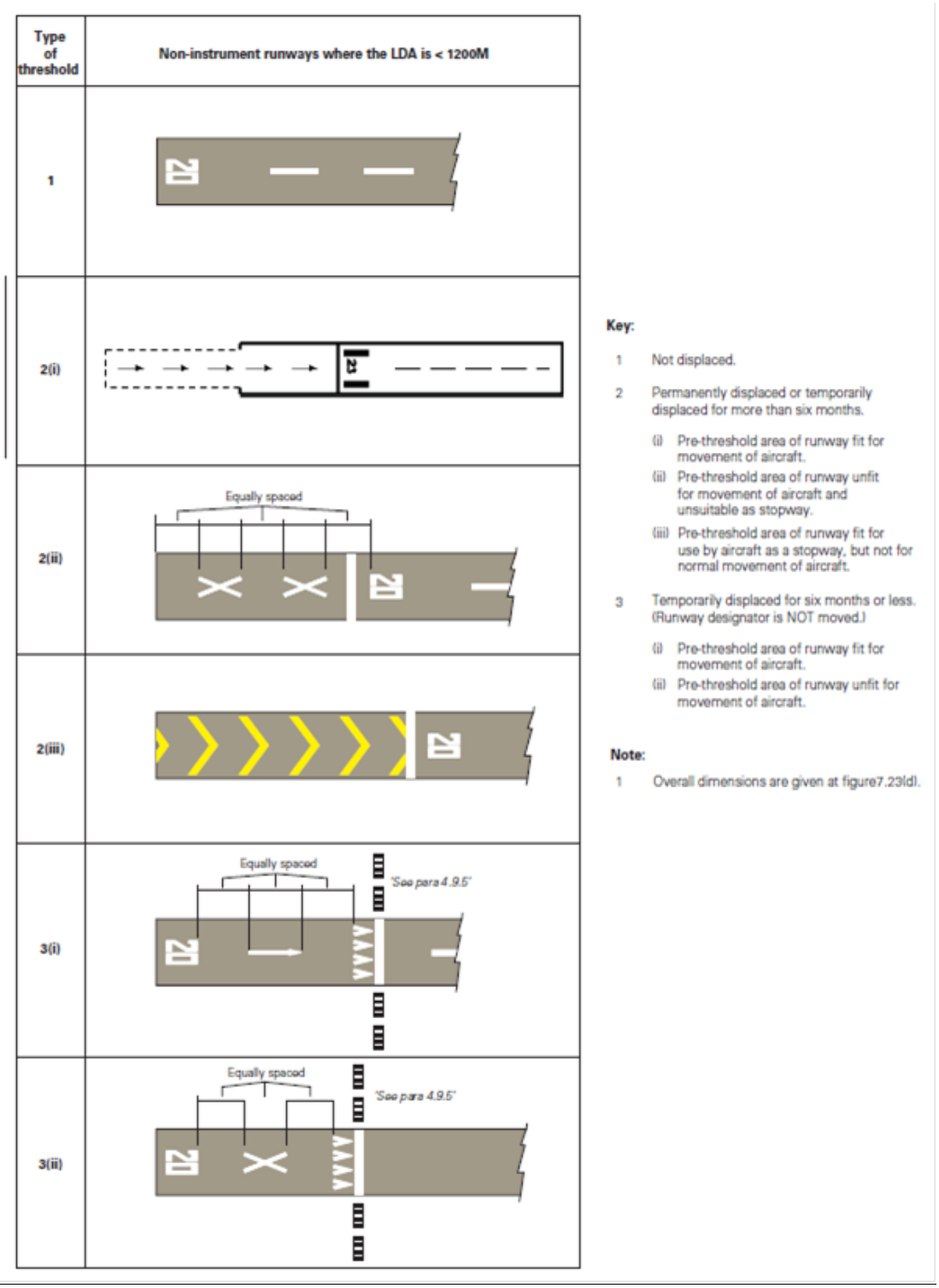
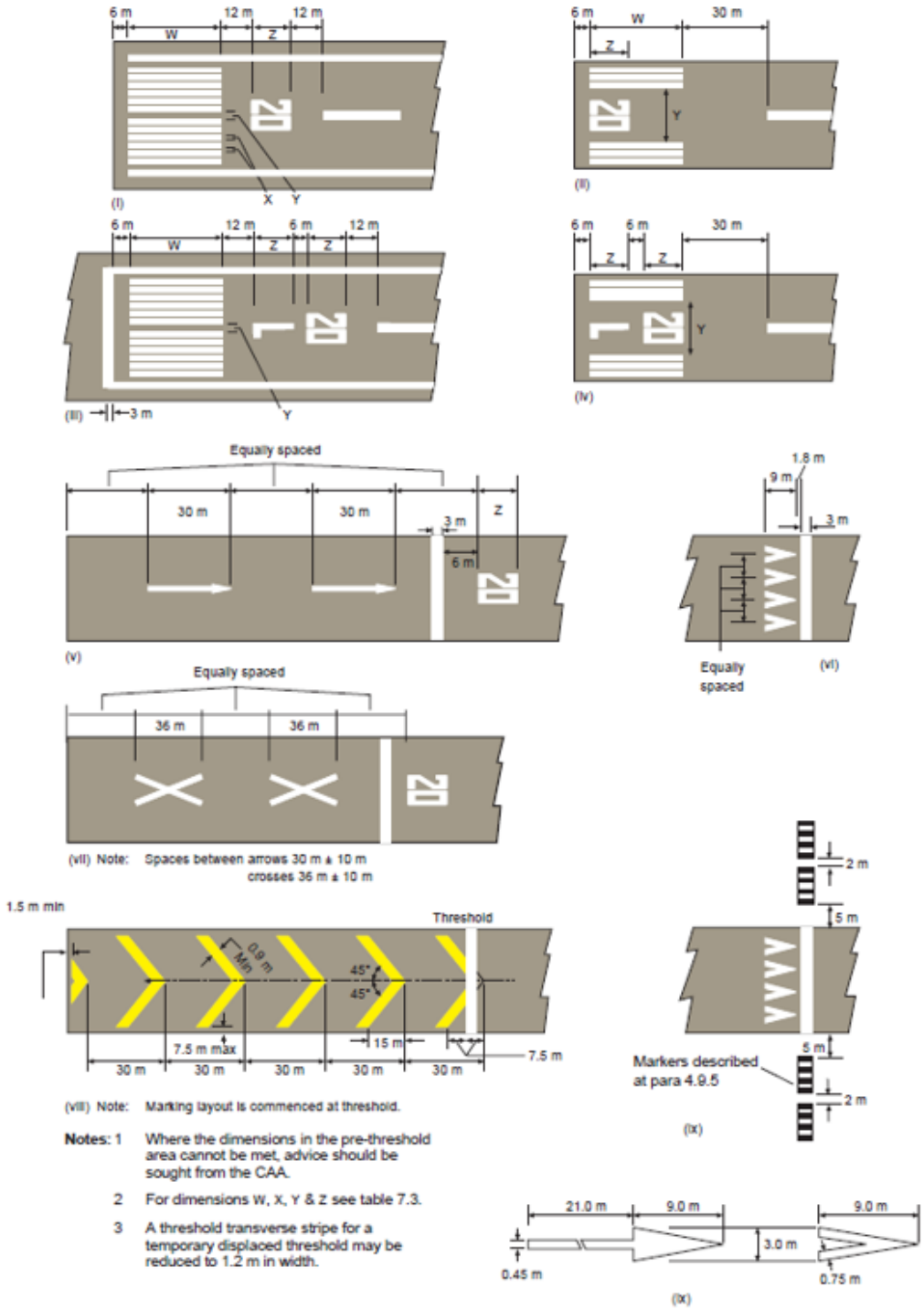


Figure 7.23(c) Paved runway threshold markings

7.204 A temporarily displaced threshold should be marked as illustrated in figure 7.23 depending on the runway type.



Notes: 1 Where the dimensions in the pre-threshold area cannot be met, advice should be sought from the CAA.

2 For dimensions W, X, Y & Z see table 7.3.

3 A threshold transverse stripe for a temporary displaced threshold may be reduced to 1.2 m in width.

Figure 7.23(d) Threshold markings dimensions

Starter extension markings

7.205 Where a starter extension does not extend to the full length of the available pavement, the starter extension marking, as illustrated in figure 7.23(e) may be used.

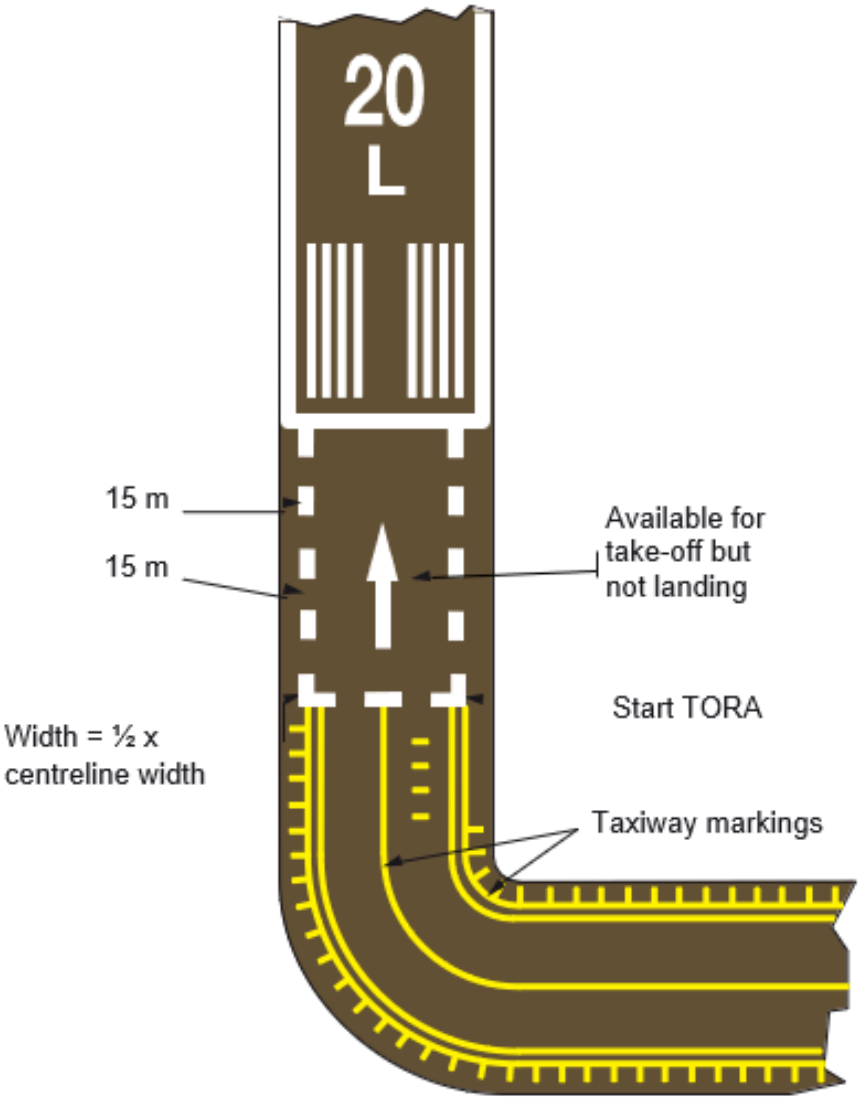


Figure 7.23(e) Starter extension marking

Aiming point marking

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

7.207 An Aiming Point marking should be provided on paved non-instrument runways where there is no visual approach slope guidance.

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

1. A non-instrument runway where the code number is 3 or 4,
2. An instrument runway where the code number is 1.

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

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

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

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

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

Table 7.24 Location and dimensions of aiming point markings

Notes:

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

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

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

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

7.209 The aiming point marking should commence no closer to the threshold than the distance indicated in the appropriate column of Table 7.24, except that, on a runway equipped with a PAPI system, the beginning of the marking should be coincident with the visual approach slope origin.

Touchdown zone marking

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

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

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

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

7.213 A touchdown zone marking should conform to the patterns shown in Figure 7.25. For the pattern shown in Figure 7.25(A), the markings should be not less than 22.5 m long and 3 m wide. For the pattern shown in Figure 7.25(B), each stripe of each marking should be not less than 22.5 m long and 1.8 m wide with spacing of 1.5 m between adjacent stripes.

7.214 The lateral spacing between the inner sides of the rectangles should be equal to that of the aiming point marking where provided. Where an aiming point marking is not provided, the lateral spacing between the inner sides of the rectangle should correspond to the lateral spacing specified for the aiming point marking in Table 7.24 (columns (2), (3), (4), or (5), as appropriate). The pairs of markings should be provided at longitudinal spacings of 150 m beginning from the threshold, except that pairs of touchdown zone markings coincident with or located within 50 m of an aiming point marking should be deleted from the pattern.

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

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

7.216 For runways with widths of 30 m, the width of the rectangular stripes of the aiming point marking and the lateral spacing between the inner sides of the stripes may be adjusted in proportion to the available runway width to avoid overlapping of the aiming point marking with the runway side stripe marking.

7.217 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.

7.218 In order to give information regarding the overall extension of a distance coding touchdown marking, the last pair of markings after the threshold should consist of two single stripes, and the other pairs should correspond to the patterns shown in Figure 7. 25. Such sequential layout gives intuitive information about the extension of the touchdown zone and, as a consequence, of the LDA or of the distance between thresholds.

OFFICIAL - Public

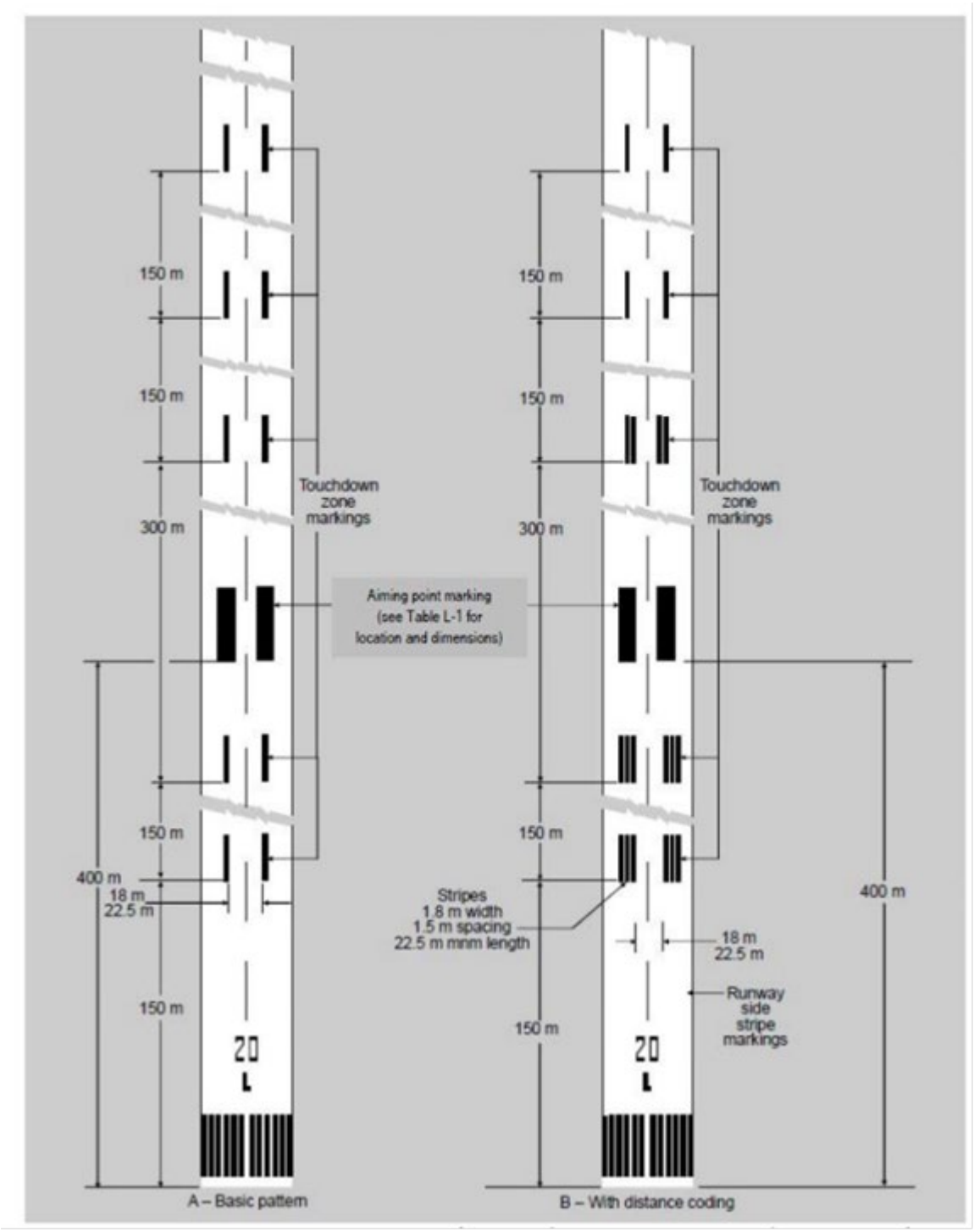


Figure 7.25 Paved runways – location of touchdown zone and aiming point markers (illustrated for a runway length of 2400 m of more)

Runway side stripe marking

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

7.220 A runway side stripe marking should be provided on a precision approach runway irrespective of the contrast between the runway edges and the shoulders or the surrounding terrain.

7.221 A runway side stripe marking should consist of two stripes, one placed along each edge of the runway with the outer edge of each stripe approximately on the edge of the runway, except that, where the runway is greater than 60 m in width, the stripes should be located 30 m from the runway centre line.

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

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

7.224 When turn pads are not available at the end of a runway for back-track manoeuvres and threshold is displaced, in order to better identify full-strength bearing surface, it may be useful to display specific dashed markings as shown by Figure 7.26a and with dimensions described in Table 7.26.

Runway Width (m)	Single dash dimensions	
	Length (Minimum m)	Width (m)
60	15	0.45
45	15	0.45
30	10	0.45
23	6	0.25
18	4	0.25

Table 7.26 Dashed runway side stripe marking

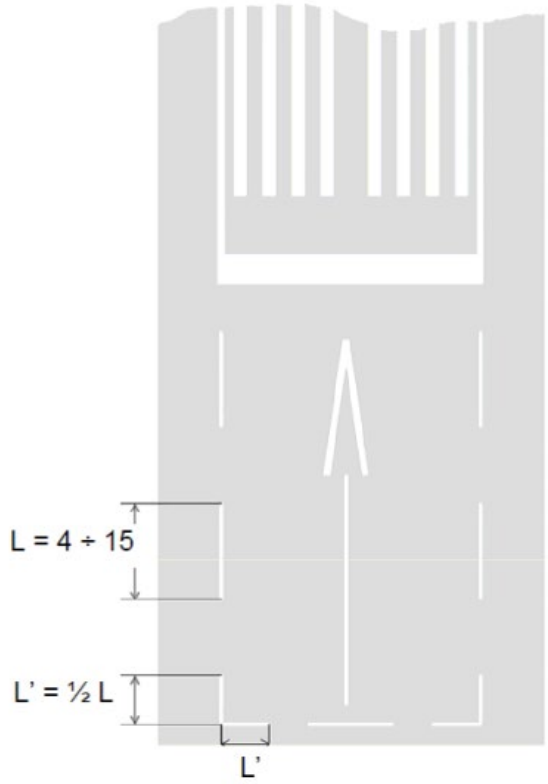


Figure 7.26a Dashed runway Side stripe marking

Runway turn pad markings

7.225 Where a runway turn pad is provided, a runway turn pad marking should be provided for continuous guidance to enable an aircraft to complete a180° turn and align with the runway centreline. These markings should be yellow.

7.226 A runway turn pad marking should be at least 150 mm 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 taxying 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°.

7.227 The runway turn pad marking should extend parallel to the runway centreline marking for at least 60m beyond the point of tangency where the code number is 3 or 4, and for at least 30m where the code number is 1 or 2.

7.228 The runway turn pad marking should guide the aircraft in such a way as to allow a straight portion of taxying before the point where the 180° turn is to be made.

7.229 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.

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

Day markers for snow-covered runways

7.231 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.

7.232 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.

7.233 Where necessary the threshold should additionally be marked with Runway Threshold Marker Boards and positioned as illustrated in figure 7.23(d).

Markings on unpaved runways

7.234 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 2km. Delineation should be affected by either of the following methods:

1. White, flat, rectangular markers flush with the surface, 3m long, 1m wide and spaced at intervals not exceeding 90m; or,

2. Frangible markers are single-coloured to contrast with their background and firmly secured to the surface spaced at intervals not exceeding 90m; the height of the markers should not exceed 500mm.

7.235 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 retain their frangibility, considering the types of aircraft that commonly use the runway.

7.236 Runway edge markers should be arranged in pairs on opposite sides of and equidistant from the centreline.

7.237 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.

7.238 The threshold of an unpaved runway should be marked with a designator showing the magnetic heading to the nearest whole ten degrees as shown in figure 7.23(a). Spacing and dimensions are given at paragraph in table 7B.1.

7.239 Elevated markers used to indicate a displaced threshold should be located as wing bars as illustrated at figure 7.23 and figure 7.32.

7.240 A temporarily displaced threshold should be marked in the manner illustrated at figure 7.23(d). However, the chevrons and displacement arrows may be omitted.

7.241 An unpaved runway should be provided with centreline marking if the runway edge marking is not easily seen during take-off or landing dimensions are given in table 7.3.

7.242 Where landings and take-offs are not confined to marked runways and the aerodrome boundary is not readily apparent, boundary markers should be provided.

Taxiway markings

7.243 The centreline of paved taxiways serving precision instrument approach runways and other taxiways where the route is difficult to follow should be marked by a continuous yellow line 0.15 m wide, so as to provide guidance between the runway and aircraft stands.

Note: The term ‘continuous’ is not intended to require that taxiway centre line markings are provided onto aircraft stands. Instead, it is intended that the centre line marking be provided on taxiways leading to aircraft stands or other apron areas from which visual cues or other means exist, such as lead-in arrows and stand number indicators, to enable aircrew to manoeuvre the aircraft onto a stand or other parking area.

7.244 Where the taxiway leads onto or off the runway, the yellow line should be curved into the nearside of and 0.75m ± 0.15m 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 7.28.

7.245 When a taxiway crosses a runway, the centreline may be continued across the runway, interrupted as necessary for the runway markings.

7.246 Taxiway centre line marking should be provided on a runway when the runway is part of a standard taxi-route and where the taxiway centre line is not coincident with the runway centre line or there is no runway centre line marking.

7.247 At taxiway intersections the taxiway centrelines should be intersected in the manner illustrated at figure 7.26.

7.248 At rapid exit taxiways the taxiway marking should commence adjacent to the runway centreline at least 60 m before the intersection with the exit taxiway curvature.

7.249 At all other taxiway/runway intersections the lead-off lines should commence at least 30m before the intersection.

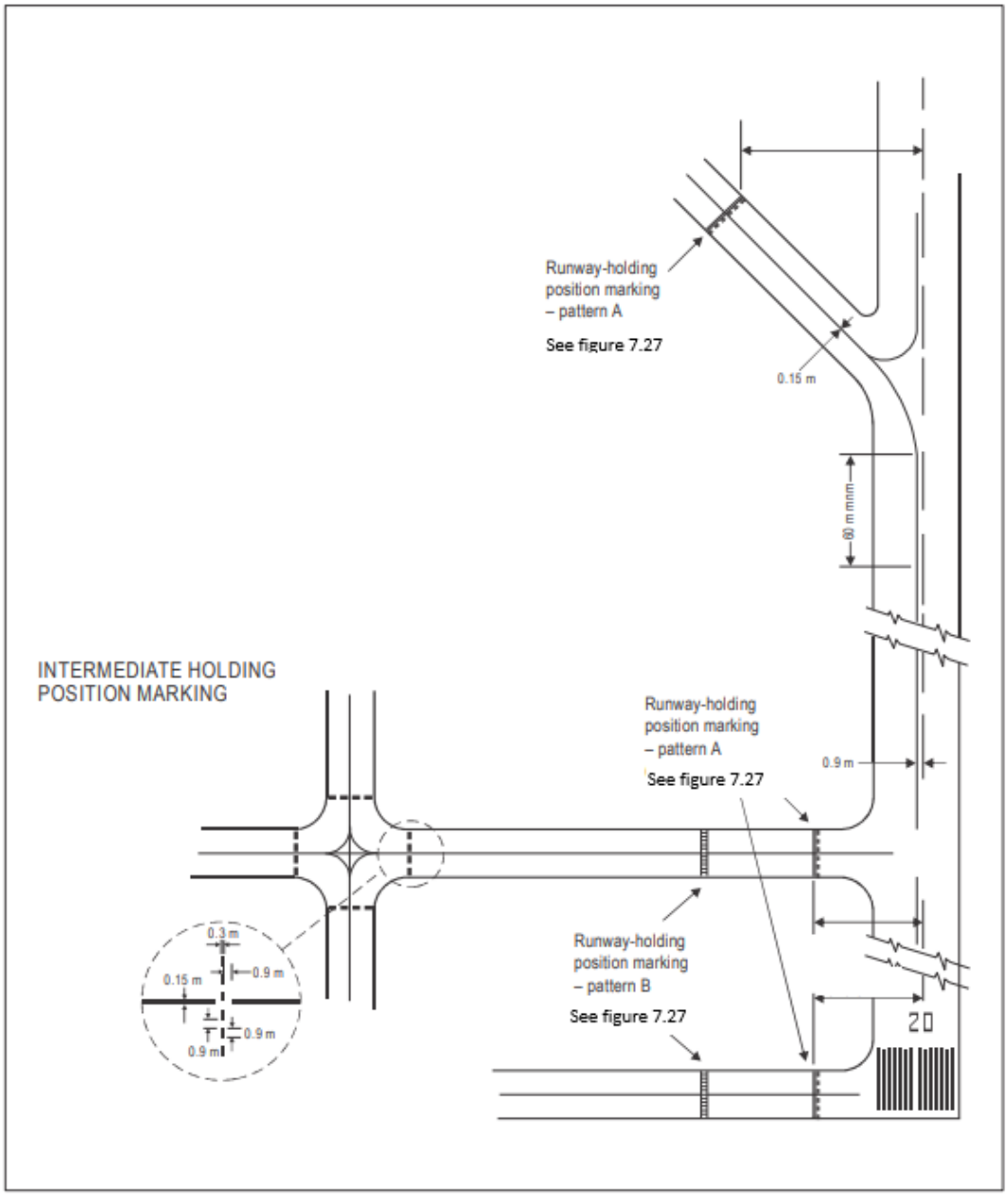


Figure 7.26 Taxiway markings

Runway-holding position marking

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

7.251 Characteristics:

At an intersection of a taxiway and a non-instrument, non-precision approach or take-off runway, the runway-holding position marking should be as shown in Figure 7.27, pattern A.

7.252 Where a single runway-holding position is provided at an intersection of a taxiway and a precision approach Category I, II or III runway, the runway-holding position marking should be as shown in Figure 7.26, pattern A.

7.253 Where two or three runway-holding positions are provided at such an intersection, the runway-holding position marking closer (closest) to the runway should be as shown in Figure 7.26, pattern A, and the markings farther from the runway should be as shown in Figure 7.26, pattern B.

7.254 The runway-holding position marking displayed at a runway-holding position should be as shown in Figure 7.27, pattern A.

7.255 Where increased conspicuity of the runway-holding position is required, the runway- holding position marking should be as shown in Figure 7.27, pattern A or pattern B, as appropriate.

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

7.257 The runway-holding position marking displayed at a runway/runway intersection should be perpendicular to the centre line of the runway forming part of the standard taxi-route. The pattern of the marking should be as shown in Figure 7.27 pattern A.

7.258 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.

7.259 When the Runway-holding position marking is supplemented with the term ‘CAT II’ or ‘CAT III’ on the areas or taxiways exceeding 60 and should be placed along with the Mandatory instruction marking both markings should be equally and symmetrically placed one next to another.

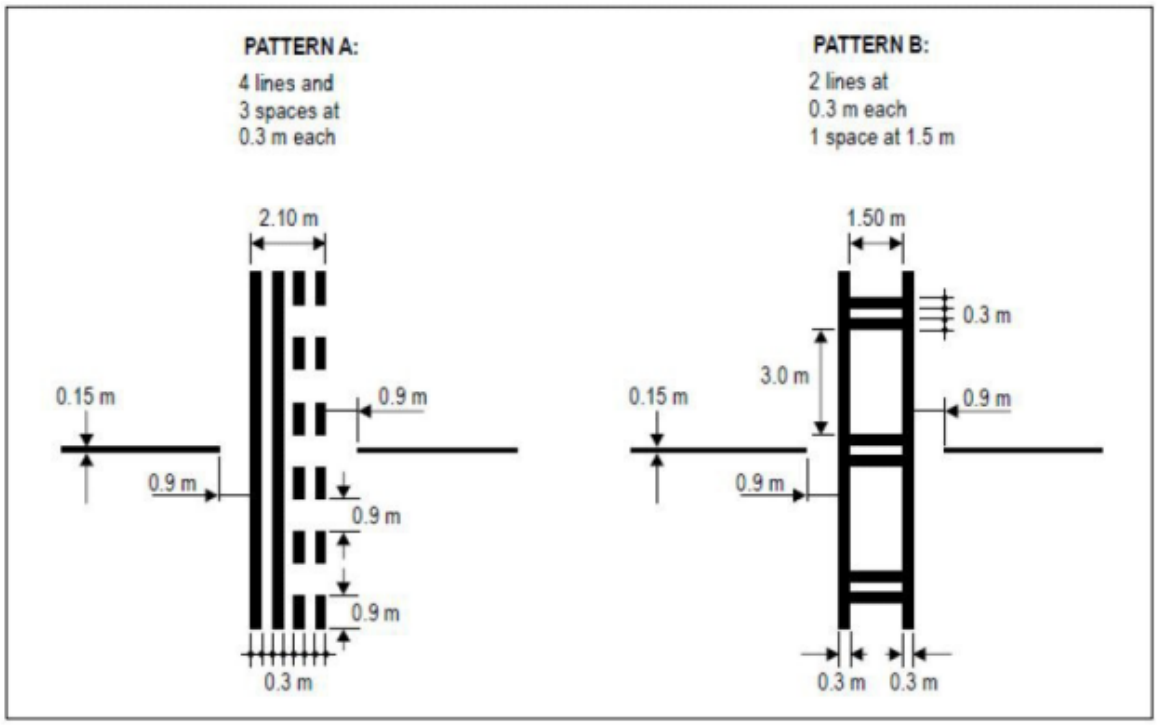


Figure 7.27 Dimensions of runway-holding position markings

Intermediate holding position marking

7.260 Intermediate taxi-holding position markings as illustrated in figure 7.28 should be displayed wherever it is intended to locate an Intermediate taxi-holding position.

Location:

7.261 Where an intermediate holding position marking is displayed at an intersection of two taxiways, it should be located across the taxiway at sufficient distance from the near edge of the intersecting taxiway to ensure safe clearance between taxiing aircraft. It should be coincident with a stop bar or intermediate holding position lights where provided.

7.262 The distance between an intermediate holding position marking at the exit boundary of a remote de-icing/anti-icing facility and the centre line of the adjoining taxiway should not be less than the dimension specified in the table below.

Code letter	Distance (metres)
A	15.5
B	20
C	26

D	37
E	43.5
F	51

7.263 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 7.28. The mark should be so positioned that the inner edge of the mark represents the outer edge of the taxiway.

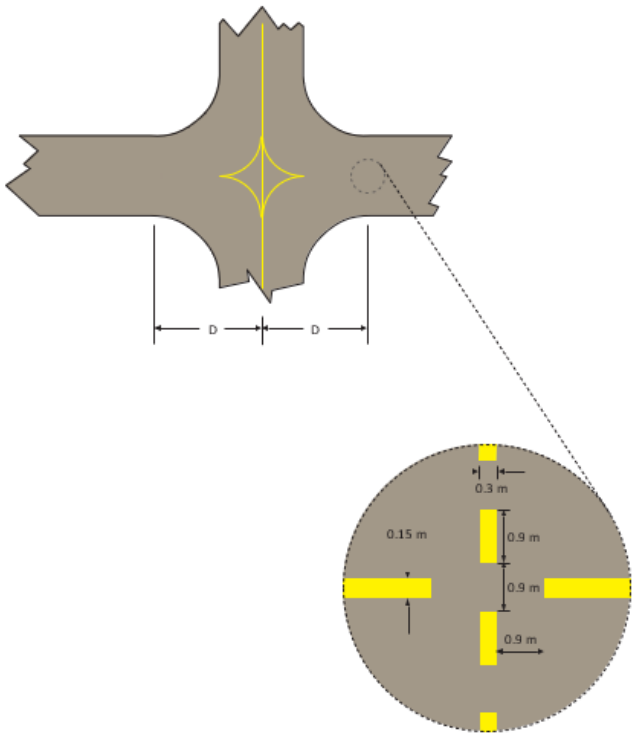


Figure 7.28 Intermediate taxi-holding position marking

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 of table 3.4 (In chapter 3) are achieved.

7.264 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 so as to be legible from the cockpit of an approaching aircraft.

7.265 Where it is necessary to define the edges of an unpaved taxiway, suitable frangible markers, such as linlaners, coloured blue, should be provided. If used at night, suitable retro-reflective material should be applied.

Enhanced taxiway centreline marking

7.266 Where provided, an enhanced taxiway centreline marking shall extend from the runway-holding position pattern A to a distance of up to 45 m (a minimum of three (3) dashed lines) in the direction of travel away from the runway or to the next runway-holding position, if within 45m distance.

7.267 Where provided: an enhanced taxiway centreline marking shall extend from the runway holding position pattern A to a distance of up to 47 m in the direction of travel away from the runway (see figure 2D.3).

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

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

7.270 Where two taxiway centrelines converge at or before the runway-holding position marking, the inner dashed line shall not be less than 3 m in length.

7.271 Where there are two opposing runway-holding position markings and the distance between the markings is less than 94 m, the enhanced taxiway centreline markings shall extend over this entire distance. The enhanced taxiway centreline markings shall not extend beyond either runway-holding position markings

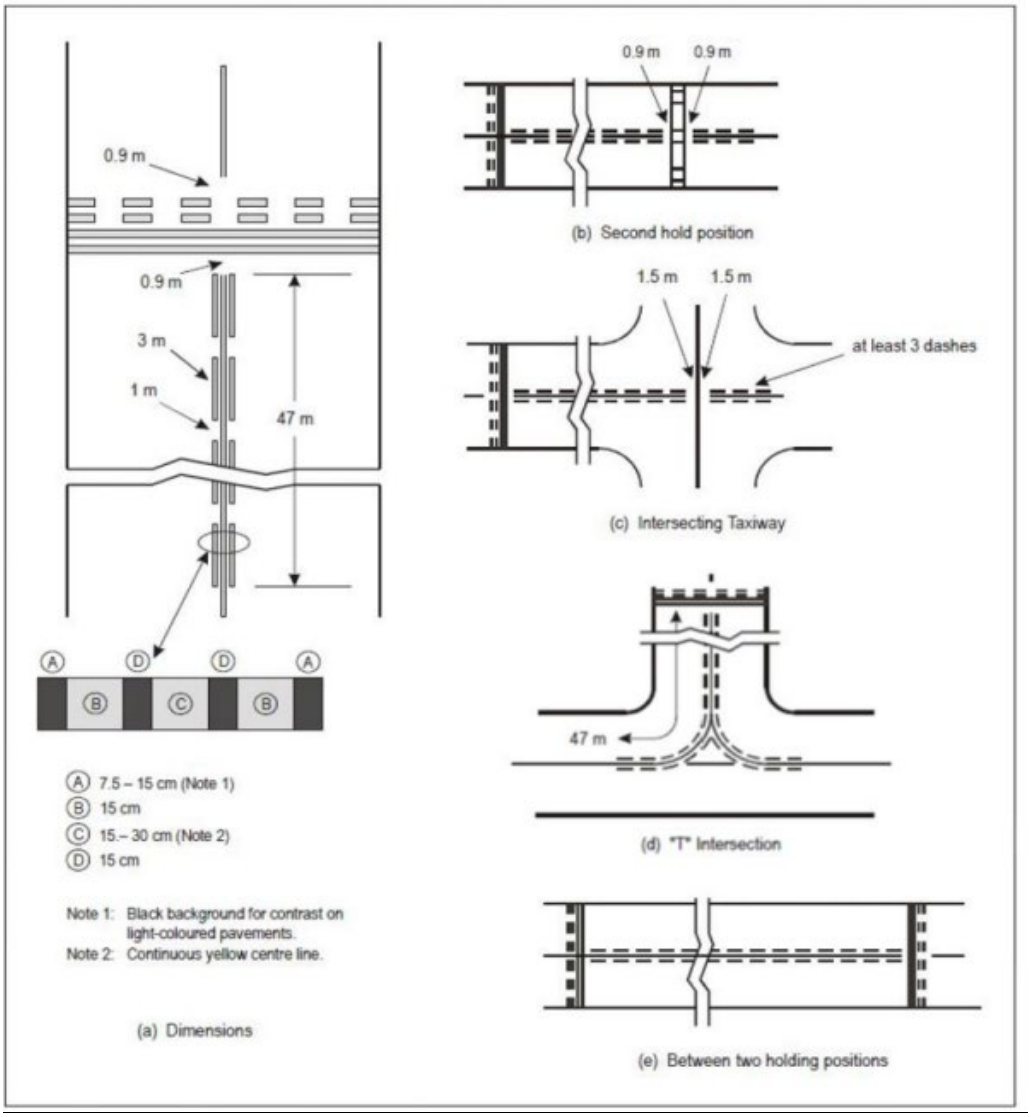


Figure 7.30 Enhanced taxiway markings

VOR aerodrome checkpoint marking

Applicability:

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

Location:

7.273 A VOR aerodrome check-point marking should be centred on the spot at which an aircraft is to be parked to receive the correct VOR signal.

Characteristics:

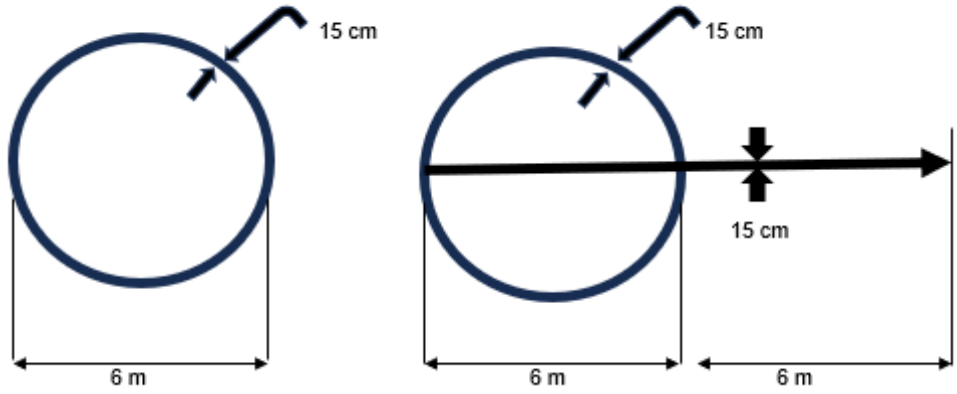
7.274 A VOR aerodrome check-point marking should consist of a circle 6 m in diameter and have a line width of 15 cm see Figure 7.30a.

7.275 When it is preferable for an aircraft to be aligned in a specific direction, a line should be provided that passes through the centre of the circle on the

desired azimuth. The line should extend 6 m outside the circle in the desired direction of heading and terminate in an arrowhead. The width of the line should be 15 cm (see Figure L-8(B)).

7.276 A VOR aerodrome check-point marking should differ from the colour used for the taxiway markings and when applicable from a contrasting viewpoint, be white in colour

7.277 Further guidance on the selection of sites for VOR aerodrome checkpoints is given in ICAO Annex 10, Volume I, Attachment E.



(A) WITHOUT DIRECTION LINE (B) WITH DIRECTION LINE

Note:

A direction line need only be provided when an aircraft must be aligned in a specific direction

Figure 7.30(a) VOR check-point markings

Stand and Apron markings

7.278 Unless marshalling guidance is available, aircraft stand markings should be provided for designated parking positions on an apron and on a de-icing/anti-icing facility. These markings should be yellow.

General characteristics

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

7.280 Markings should be located so as to provide the obstacle clearances specified in chapter 3 when the nose wheel follows the stand marking.

Aircraft stand identification

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

7.282 Identification of the aircraft for which each set of markings is intended, should be added to the stand identification where two sets of aircraft stand markings are superimposed on each other in order to permit more flexible use of the apron and safety would be impaired if the wrong marking were followed.

Lead-in, turning, and lead-out lines

7.283 Lead-in, turning, and lead-out lines should, as far as practicable, be continuous in length and have a width of not less than 15 cm. Where one or more sets of stand markings are superimposed on a stand marking, the lines should be continuous for the most demanding aircraft and broken for other aircraft.

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

7.285 Where it is intended that an aircraft proceeds in one direction only, arrows pointing in the direction to be followed should be added as part of the lead-in and lead-out lines.

Alignment bar

7.286 An alignment bar should be placed so as to be coincident with the extended centre line of the aircraft in the specified parking position and visible to the pilot during the final part of the parking manoeuvre. It should have a width of not less than 15 cm.

Turn bar and stop line

7.287 A turn bar should be located at right angles to the lead-in line, abeam the left pilot position at the point of initiation of any intended turn. It should have a length and width of not less than 6 m and 15 cm respectively and include an arrowhead to indicate the direction of turn.

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

7.289 If more than one turn bar and/or stop line is required, they should be designated for the appropriate aircraft types

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

Apron safety lines

7.291 Apron markings are installed to support the safe operation of aircraft on stands and apron areas. Where appropriate procedures are employed, markings may not be required, giving flexibility of operations. Examples would include situations where aircraft marshallers are used or where aircraft are required to self-park on an open apron where different combinations of aircraft preclude dedicated markings. Specific markings/stands are normally more applicable for larger aircraft.

7.292 Apron safety lines and other markings should be provided as required to define the areas intended for use by ground vehicles and other aircraft servicing equipment, etc., to provide safe separation from aircraft such as wing tip. They should include items such as wing tip clearance lines and service road boundary lines, vehicle parking and no parking areas, pedestrian routes and airbridge operating areas as required by the parking configurations and ground facilities.

7.293 Markings should be of colours that do not conflict with markings used by aircraft and should be maintained so as to retain their conspicuity. Examples of markings are provided in CAP 637, Visual Aids Handbook, this chapter also provides guidance on the dimensions of markings.

7.294 Ground equipment and vehicles should be kept outside predetermined limits when aircraft are manoeuvring or when the equipment is left unattended.

7.295 Safety lines are required on an apron to mark the limits of parking areas for ground equipment, apron service roads and passengers' paths, etc. These lines are narrower and of a different colour to differentiate them from the guidelines used for aircraft.

Wing tip clearance lines

7.296 These lines should delineate the safety zone clear of the path of the critical aeroplane wing tip. The line should be drawn at appropriate distance outside the normal path of the wing tip of the critical aeroplane.

Equipment limit lines

7.297 These lines are used to indicate the limits of areas which are intended for parking vehicles and aircraft servicing equipment when they are not in use.

7.298 Several methods may be used to identify which side of a safety line is safe for storage of such vehicles and equipment:

7.299 Spurs or an additional line (a discontinuous line of the same colour or a continuous line of a different conspicuous colour) may be provided on one side of the safety line. The side on which such spurs or an additional line is located is considered safe for parking vehicles and equipment.

7.300 The words ‘Equipment Limit’ may be painted on the side used by ground equipment and readable from that side.

Passenger path lines

7.301 These lines are used to indicate to passengers and escorting personnel the route that needs to be followed, when walking on the apron, in order to be clear of hazards. A pair of lines with zebra hatching between them may be used.

Mandatory instruction markings on taxiways

7.302 Where operationally required, such as on wide taxiways, or to assist in the prevention of a runway incursion, a runway taxi-holding position sign may be supplemented by a mandatory instruction marking in the form of a runway designation marking. This marking should also be used where it is impractical to install a mandatory instruction sign.

7.303 Where required, the mandatory instruction marking on taxiways with code letters A-D should be located across the taxiway equally placed about the taxiway centreline and

7.304 On the holding side of the runway-holding position marking as shown in figure 7.30(a).

7.305 For taxiways where the code letter is E or F, the marking should be located on both sides of the taxiway centreline marking and on the holding side of the runway-holding position marking as shown in figure 7.30(b). In both cases the distance between the nearest edge of the marking and the runway holding position marking or the taxiway centreline marking should be not less than 1 m.

7.306 The character height should be 4 m for inscriptions where the code letter is C, D, E or F, and 2 m where the code letter is A or B.

Mandatory instruction markings on runways

7.307 Except where operationally required, a mandatory instruction marking should not be located on a runway.

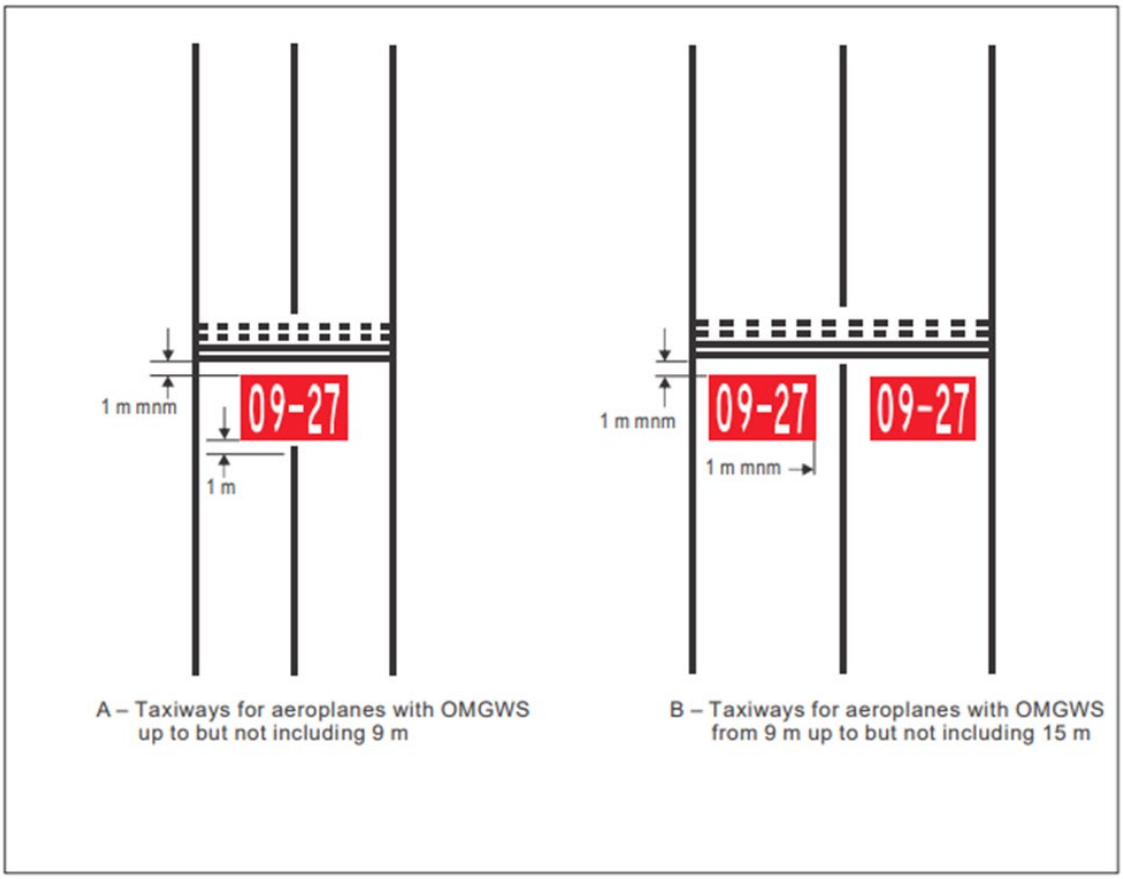


Figure 7.30 Enhanced taxiway markings

Marking of unfit areas

7.308 Unserviceability markers should be displayed wherever any portion of a taxiway, apron or holding bay is unfit for the movement of aircraft but it is still possible for aircraft to bypass the area safely.

7.309 Unserviceability markers are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of pavement, such as on an apron, which is under repair. They are not suitable for use when a portion of a runway becomes unserviceable, nor on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is normally closed.

7.310 Unserviceability markers shall be placed at intervals sufficiently close, so as to delineate the unserviceable area.

7.311 Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones, or marker boards.

7.312 Type ‘A’ ground markers as illustrated in figure 7.31, 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.

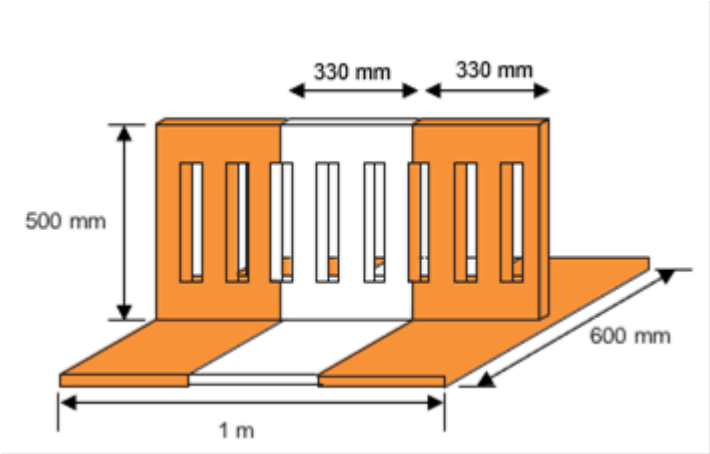


Figure 7.31 Bad ground marker type 'A'

7.313 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 7.40 and bounded by ground marker type 'B' alternating with type 'C' illustrated at figure 7.32. The type's' marker should also be used to mark the usable portion of a snow-covered runway and should be located where runway edge lighting would normally be expected. The distance between successive type's' markers therefore should not exceed 60 m.

7.314 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.

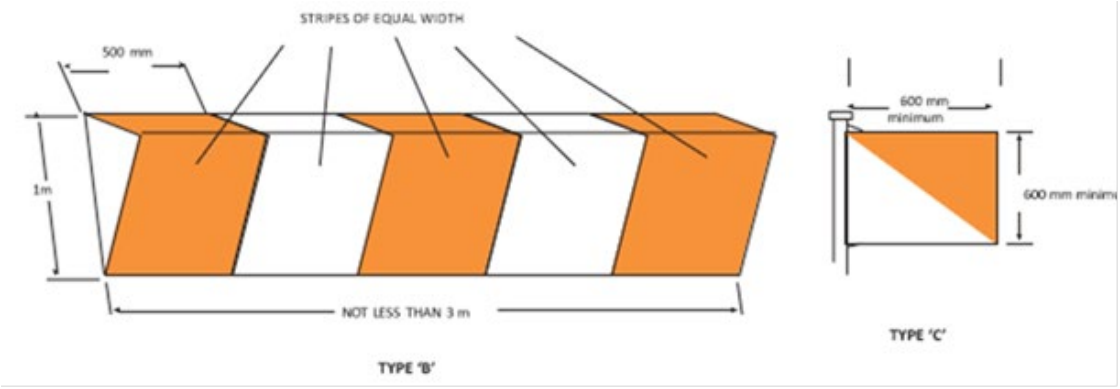


Figure 7.32 Bad ground markers types 'B' and 'C'

7.315 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 7.33 (in addition to the pavement markings), positioned in accordance with the illustrations at figure 7.23.

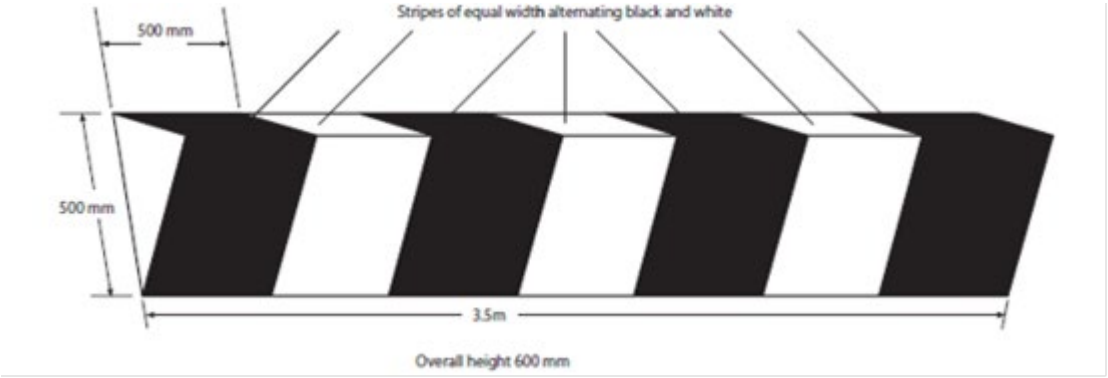


Figure 7.33 Runway threshold marker board

7.316 When a runway or taxiway, or portion thereof, is permanently closed, all normal runway and taxiway markings should be obliterated.

Other markers

7.317 An aerodrome boundary marker should be provided at an aerodrome where the boundary is insufficiently conspicuous should be delineated by orange and white striped markers as illustrated in figure 7.34. Spacing should not exceed 45m.

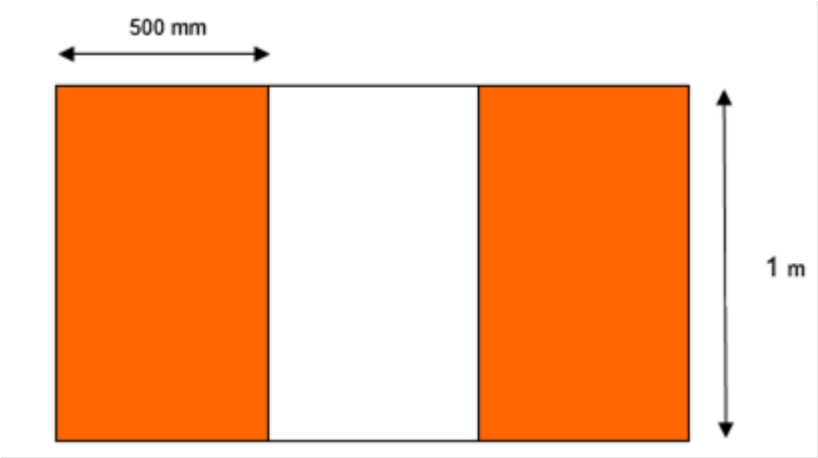


Figure 7.34 Aerodrome boundary marker

7.318 A white letter H as illustrated in figure 7.35A indicates the minimum dimensions of the Heliport Identification Marking identifying part of the manoeuvring area to be used only for the Final Approach and Take-off (FATO) of helicopters.

7.319 For runway type FATOs the heliport identification marking dimensions should be multiplied by a factor of 3.

7.320 On a FATO which contains a Touchdown and Liftoff Surface (TLOF), the heliport identification marking should be located in the centre of the TLOF

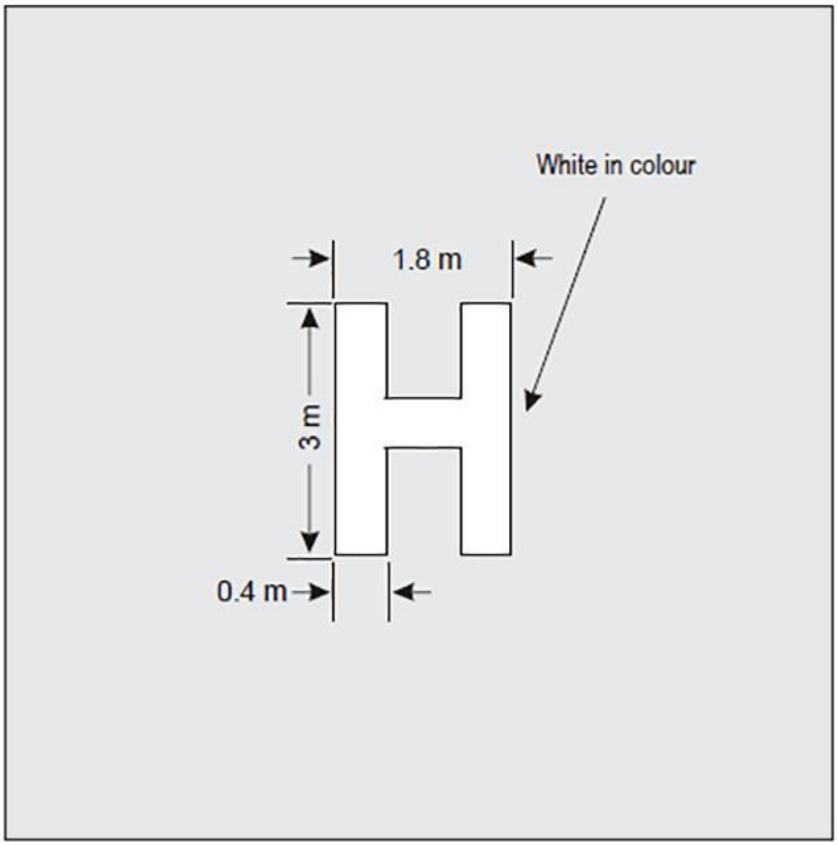


Figure 7.35A Heliport Identification Marking

7.321 A helicopter aiming point marking should be provided where a FATO and TLOF are not coincidental. The aiming point is not the intended location for the touchdown of the helicopter and should include a hover taxi route to a TLOF.

7.322 Dashed perimeter markings should be provided where the boundaries of the FATO are not self-evident.

7.323 The aiming point should be lit with 3 white lights in the points of the triangle, and 3 white lights in the centre points of the bars. The perimeter may be lit in white.

7.324 Where other markings exist such as taxiway centrelines they should be broken and not cross the FATO area or otherwise disturb the heliport marking.

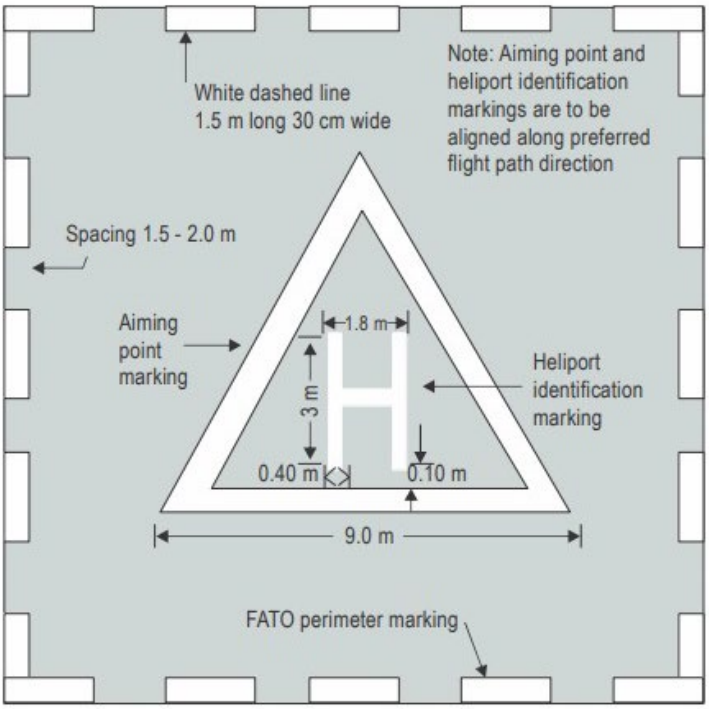


Figure 7.35B Helicopter Aiming Point Marking

7.325 A white letter L as illustrated in figure 7.36 indicates a part of the manoeuvring area to be used only for the take-off and landing of light aircraft.

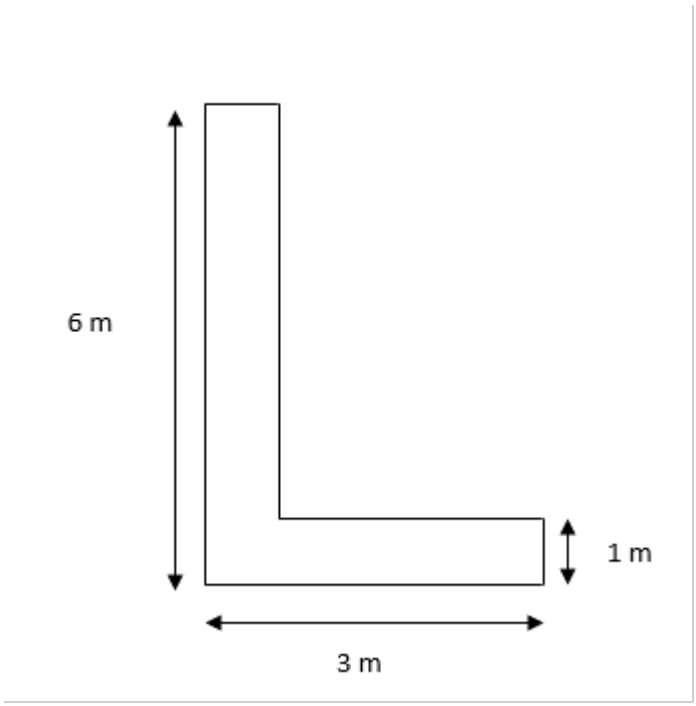


Figure 7.36 Light aircraft landing/take-off area marker

7.326 A yellow cross of dimensions illustrated in figure 7.37 indicates that tow ropes and similar articles towed by aircraft are to be dropped only in the area in which the cross is placed.

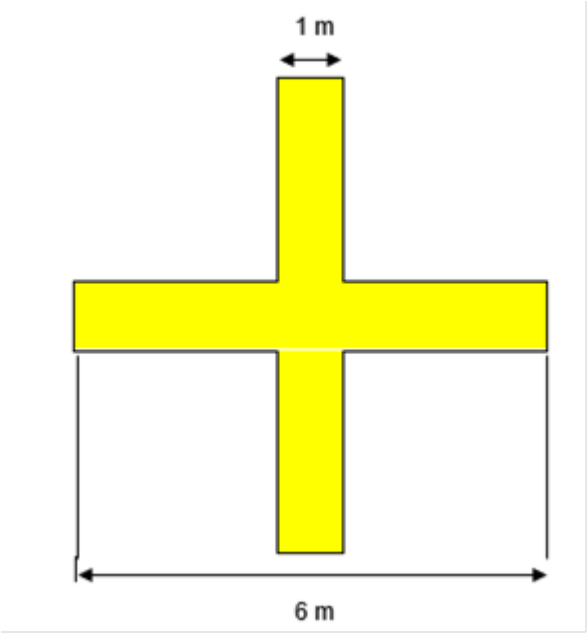


Figure 7.37 Yellow cross

7.327 A white double cross as illustrated at figure 7.38 indicates an area to be used only for the taking off and landing of gliders.

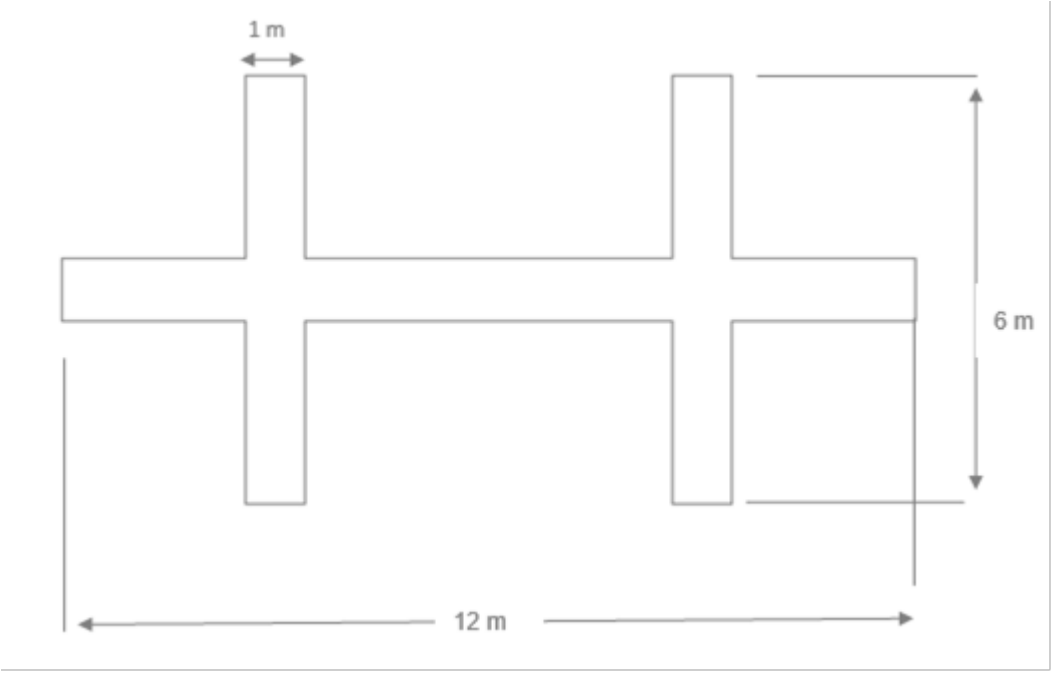


Figure 7.38 White double cross – dimensions

7.328 A white landing T placed at the left-hand side of the runway when viewed from the direction of landing indicates the runway to be used.

Lights and Signs

Unserviceability Lights

7.329 Unserviceability lights shall be provided on a movement area used at night, wherever any portion of the movement area is unfit for the movement of aircraft, but it is still possible for aircraft to bypass the area safely.

7.330 Unserviceability lights and markers are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of pavement, such as on an apron, which is under repair. They are not suitable for use when a portion of a runway becomes unserviceable, nor on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is normally closed.

7.331 Procedures pertaining to the planning, coordination, monitoring, and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (Doc 9981).

7.332 Unserviceability and lights shall be placed at intervals sufficiently close so as to delineate the unserviceable area.

7.333 Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones, or marker boards.

Characteristics of unserviceability lights

7.334 An unserviceability light shall consist of a red fixed light. The light shall have an intensity sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general level of illumination against which it would normally be viewed. In no case shall the intensity be less than 10 cd of red light.

7.335 Temporary changes to the movement area may include, inter alia, reduction in the runway length, reduction in the maximum allowable wingspan, taxiway closure or any other closure to the movement area. Unserviceability signs provide relevant information to aerodrome users to maintain an acceptable level of safety during aircraft and vehicle operations, by reducing the risk of confusion and enhancing the awareness of such temporary changes.

Unserviceability signs

7.336 Unserviceability signs can be used to indicate temporary closed or restricted areas, as well as to provide information on operational restrictions to aerodrome users.

7.337 Unserviceability signs should be provided where there is an operational need to indicate temporary changes to runway declared distances.

7.338 Unserviceability signs should be provided where there is an operational need to indicate temporary changes to taxiways and aprons.

7.339 Existing signs should be removed or obscured at an aerodrome if they provide inadequate or misleading information regarding unserviceability areas.

7.340 The information provided by unserviceability signs should not be in conflict with the information provided by the appropriate aeronautical information services.

7.341 The information provided by unserviceability signs supplements that which is provided by the appropriate aeronautical information services unit.

7.342 Unserviceability signs should be located where operationally needed on the movement area. The location distances on the manoeuvring area shall be as per taxiing guidance signs.

7.343 The location of unserviceability signs should not visually obscure or provide conflicting information with existing operationally required visual aids.

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

7.345 The installed height of unserviceability signs should not exceed the dimension for taxiing guidance signs shown in Table 7.0(a).

7.346 Unserviceability signs should be rectangular, as shown in Figure 7-39, with the longer side horizontal.

7.347 The inscriptions on an unserviceability sign should be in accordance with the provisions as detailed in this chapter, see Road Holding Signs and Markings.

7.348 Unserviceability signs should consist of an inscription in black on an orange background.

7.349 Unserviceability signs should be supplemented by a black outline measuring 10 mm in width for runways where the code number is 1 or 2, and 20 mm in width for runways where the code number is 3 or 4.

7.350 Unserviceability signs should be retro-reflective.

7.351 Where there is a need to enhance the conspicuity of unserviceability signs, they should be supplemented by two red or yellow simultaneously flashing lights. The intensity and the beam spread of these lights should be in accordance with the specifications in Chapter 6, Figure 6A-20.

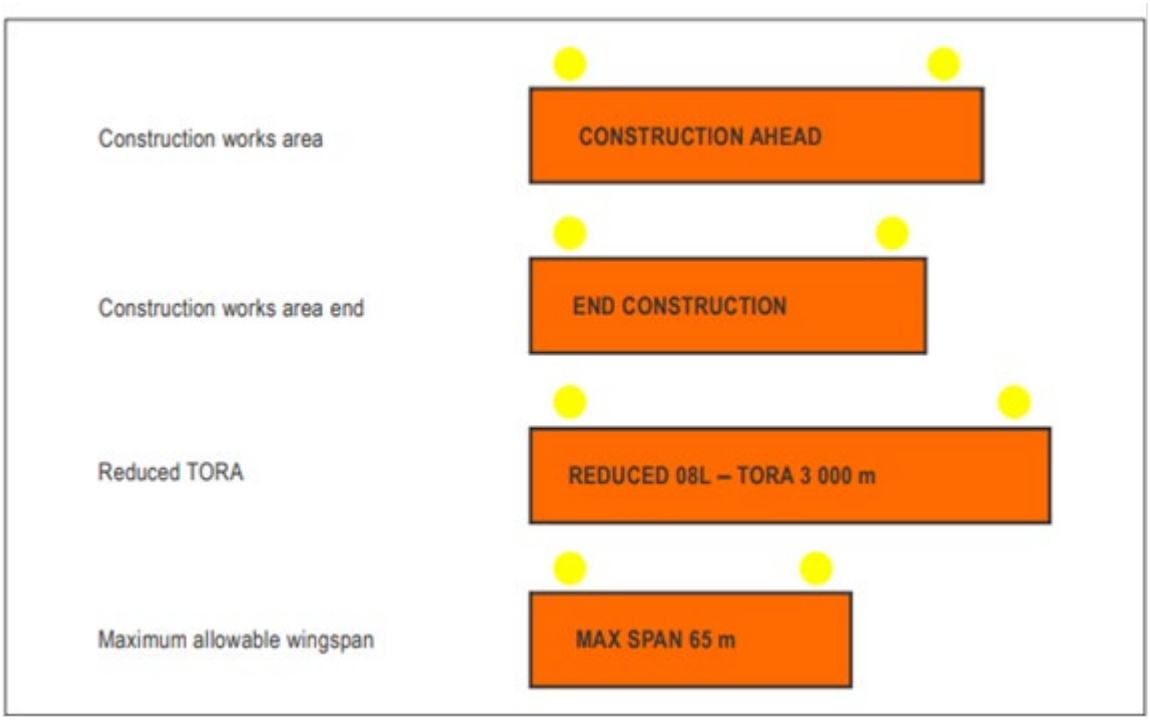


Figure 7-39. Examples of unserviceability signs

Closed runways and taxiways or parts thereof

7.352 When a runway or taxiway or portion thereof is permanently closed, all normal runway and taxiway markings shall be obliterated.

7.353 Lighting systems provided for a closed runway or taxiway, or portion thereof shall not be operated, except as required for maintenance purposes.

Note: Lighting systems provided for a runway include both approach and runway lighting systems.

7.354 In addition to closed markings, when a closed runway or taxiway or portion thereof is intercepted by a usable runway or taxiway which is used at night, unserviceability lights shall be placed across the entrance to the closed area at intervals not exceeding 3 m.

Closed runway markings

7.355 A closed runway marking shall be displayed on a runway or portion thereof which is permanently closed to the use of all aircraft.

7.356 A closed runway marking shall be placed at least at each extremity of the runway or portion thereof except that such marking may be omitted when the closing is of short duration and adequate warning by air traffic services is provided.

7.357 A closed runway marking should be placed at each end extremity of the runway, or portion thereof, declared closed, and additional markings shall be

so placed that the maximum interval between markings does not exceed 300 m.

7.358 The closed taxiway marking should be yellow and of the form and proportions as detailed in Figure 7-40.

7.359 When an area is temporarily closed, frangible barriers or markings utilising materials other than paint or other suitable means may be used to identify the closed area.

7.360 Note: Procedures pertaining to the planning, coordination, monitoring, and safety management of works in progress on the movement area are specified in the ICAO PANS-Aerodromes (Doc 9981).

Closed taxiway marking

7.361 A closed taxiway a closed marking should be placed at least at each end extremity of the taxiway or portion thereof closed.

7.362 The closed taxiway marking should be yellow and of the form and proportions as detailed in Figure 7.40.

7.363 When an area is temporarily closed, frangible barriers or markings utilising materials other than paint or other suitable means may be used to identify the closed area.

Note: Procedures pertaining to the planning, coordination, monitoring, and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (Doc 9981).

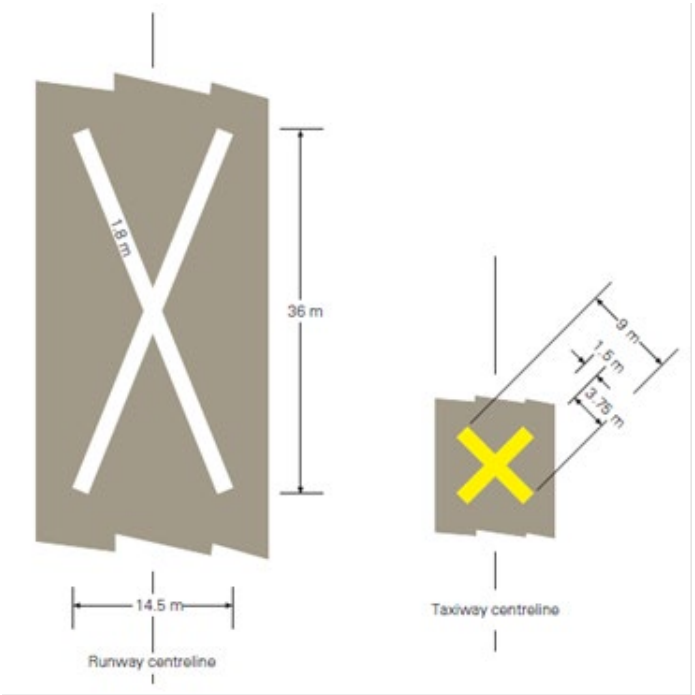


Figure 7.40 Closed runway and taxiway markings

Closed runway lighting

7.364 Where operationally desirable at an aerodrome provided with runway lighting closed runway lighting should be provided on a temporarily closed runway(s) that are temporarily closed or temporarily restricted for take-off.

7.365 The purpose of the closed runway lighting is to reduce the likelihood of unintended landings during periods of poor visibility or at night whenever the runway lighting must be switched on for electrical maintenance.

7.366 In dusk or poor visibility conditions by day, lighting can be more effective than markings.

7.367 The closed runway lighting is intended to be controlled either automatically or manually by air traffic services or by the aerodrome operator.

7.368 A closed runway lighting should be placed on the centre line, at each extremity of the runway temporarily declared closed.

7.369 Placement of a closed runway lighting on the runway designation marking would enhance the situational awareness of the runway closure to the pilot.

7.370 The closed runway lighting as viewed by the pilot should be of the equivalent elevated form and proportions as detailed in Figure 7.41 showing a minimum of five lights uniformly spaced on each branch, with a minimum interval as specified by following tabulation.

Minimum interval between closed runway lights centres	
Number of lights	**Minimum interval between lights**
5	1.5 m
7	1.0 m
9	0.8 m

7.371 The closed runway lighting may be either fixed or mobile.

7.372 The fixed closed runway lighting may be formed as if shadowed (i.e. stretched) from the equivalent elevated structure.

Note; Guidance on the sizing of a fixed closed runway lighting is given in the ICAO Aerodrome Design Manual (Doc 9157), Part 4.

7.373 Closed runway lights should show flashing variable white in the direction of approach to the runway, at a rate of one second on and one second off.

7.374 Closed runway lights should automatically revert to fixed lights in the event of the flashing system failure.

7.375 Closed runway lights should be in accordance with the specifications chapter 6 Figure 6a.22.

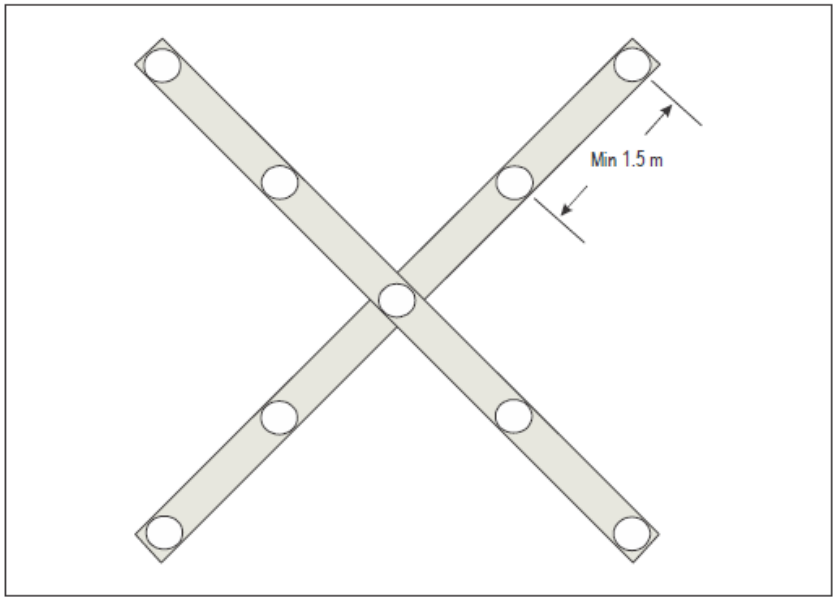


Figure 7.41 Closed runway lighting

Non-load-bearing surfaces

7.376 Shoulders for taxiways, runway turn pads, holding bays and aprons, and other non-load-bearing surfaces which cannot readily be distinguished from load-bearing surfaces and which, if used by aircraft, might result in damage to the aircraft, should have the boundary between such areas and the load-bearing surface marked by a taxi side stripe marking.

7.377 A taxi side stripe marking should consist of a pair of solid lines, each 15 cm wide and spaced 15 cm apart, and the same colour as the taxiway centre line marking.

7.378 A taxi side stripe marking could also be placed along the edge of the load-bearing pavement to emphasise the location of the taxiway edge, with the outer edge of the marking approximately on the edge of the load-bearing pavement.

7.379 At intersections of taxiways and on other areas where, due to turning, the possibility for confusion between the side stripe markings and centre line markings may exist, or where the pilot may not be sure on which side of the edge marking the non-load bearing pavement is, the additional provision of transverse stripes on the non-load bearing surface has been found to be of assistance.

7.380 As shown in Figure 7.41(a), the transverse stripes should be placed perpendicular to the side stripe marking.

7.381 On curves, a stripe should be placed at each point of tangency of the curve and at intermediate points along the curve so that the interval between stripes does not exceed 15 m. If deemed desirable to place transverse stripes on small straight sections, the spacing should not exceed 30 m.

7.382 The width of the marks should be 0.9 m, and they should extend to within 1.5 m of the outside edge of the stabilised paving or be 7.5 m long whichever is shorter. The colour of the transverse stripes should be the same as that of the edge stripes, i.e. yell

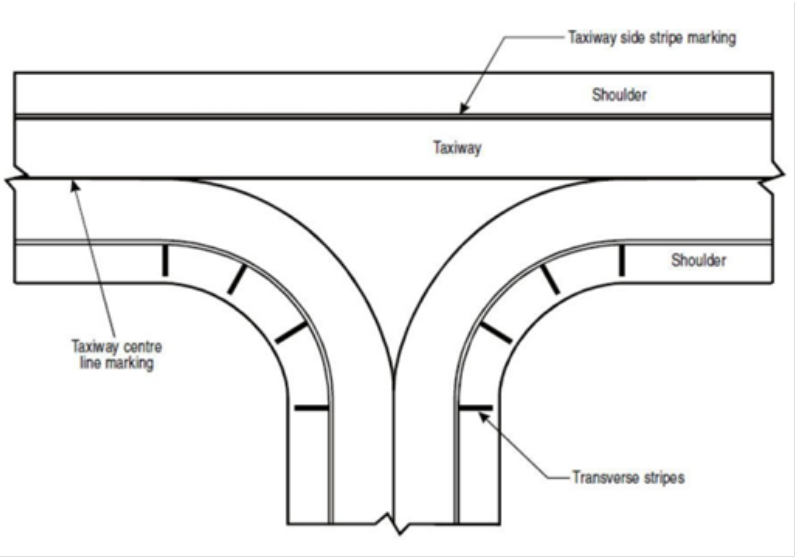


Figure 7.41(a) Marking of non-load bearing paved taxiway surface

More guidance on providing additional transverse stripes at an intersection or a small area on the apron is given in ICAO Doc 9157, Aerodrome Design Manual, Part 4, Visual Aids.

Road signs and markings

7.383 Road signs and markings used on aerodrome movement areas should, where practicable, conform with:

1. Statutory Instrument 2002 No. 3113 – The Traffic Signs Regulations and General Directions 2002.
2. Statutory Instrument 1997 No. 2400 – The Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997.
3. Statutory Instrument 1998 No. 901 – The Pelican and Puffin Pedestrian Crossings General (Amendment) Directions 1998.

Road-holding position sign

7.384 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 and 1.5 m from the defined edge of the vehicular traffic route.

7.385 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 7.42 and 7.43.

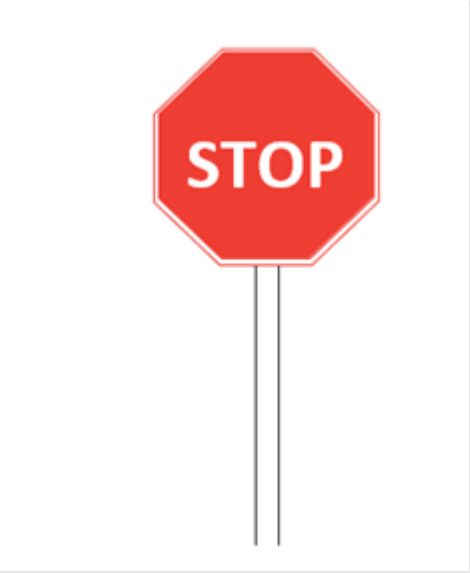
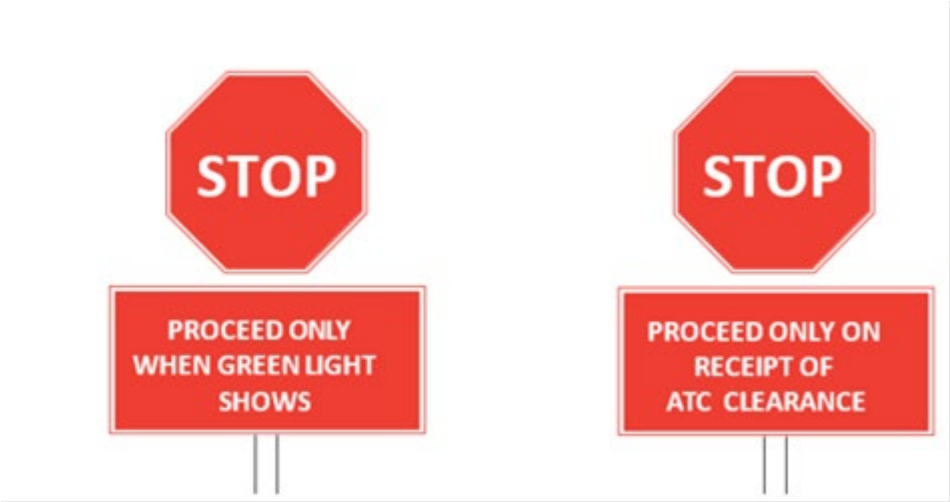


Figure 7.42 Road-holding position signs Standard stop sign



Note: For dimensions see 'The Traffic Signs Regulations and General Directions 1994'

Figure 7.43 Road-holding position signs Stop sign with supplementary instructions (not to scale)

Taxi guidance signs style and proportion of characters, sign layout and face size

Characters, sign layout and face size

7.386 The style and proportions of the characters to be employed on and the layout and face size of taxi guidance signs.

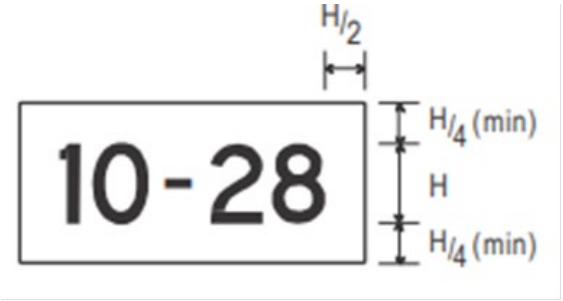
7.387 The characters are shown at figures 7A.2 to 7A.6 for a 50 mm letter height. The characters may be enlarged to the desired letter height by any conventional enlarging process and the letters will remain in the proper proportion. However, any errors and inconsistencies in the space and character 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.

7.388 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

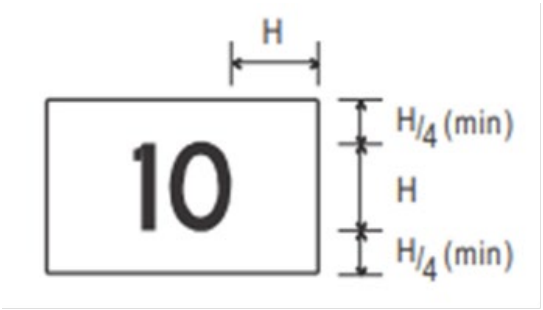
7.389 The width of a word or name may be readily determined by adding the sum of the letter widths to the sum of the spaces between letters

7.390 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.

7.391 Sign face size shall be determined in the manner shown in figure 7A.1.



A. Sign with two runway designators



B. Sign with one runway Designator

Figure 7A.1

Examples of sign layout and face size proportions are given in figures 7A.7 to 7A.10.

Notes:

1. Vertical dimensions may be increased by up to H/10 to accommodate construction tolerance
2. Horizontal dimensions are a minimum.
3. Where a taxiway location sign is installed in conjunction with a runway designation sign the character size should be that specified for mandatory instruction signs
4. Inscription heights should conform to the minimum character height as indicated in table 7.1(A)

Sign Height (mm)			**Perpendicular distance from defined runway pavement edge to near side of sign**	**Perpendicular distance from defined runway pavement edge to near side of sign**
Runway code number	**Legend**	**Face (min)**		
1 or 2	200	300	5 - 11 m	3 - 10 m
1 or 2	300	450	5 - 11 m	3 - 10 m
3 or 4	300	450	11 - 12 m	8 - 15 m
3 or 4	400	600	11 - 12 m	8 - 15 m

Table 7.1 Location distances for taxiing guidance signs including runway exit signs

Runway code number	Minimum character height		
	Mandatory instruction sign	Information sign	
		Runway exit sign and runway	Other signs
1 or 2	300 mm	300 mm	200 mm
3 or 4	400 mm	400 mm	300 mm

Table 7.1 (A) Minimum character height

Arrow dimensions should be as follows:

Legend Height	Stroke
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

Table 7.1.B Arrow Dimensions

5. Stroke width for single letter should be as follows:

Legend Height	Stroke
200 mm	32 mm
300 mm	48 mm
400 mm	64 mm

Table 7.1C Stroke width for single letter

6. The face height of signs should be as follows:

Legend Height	Face Height (min)
200 mm	400 mm
300 mm	600 mm
400 mm	800 mm

Table 7.1D Face heights of signs

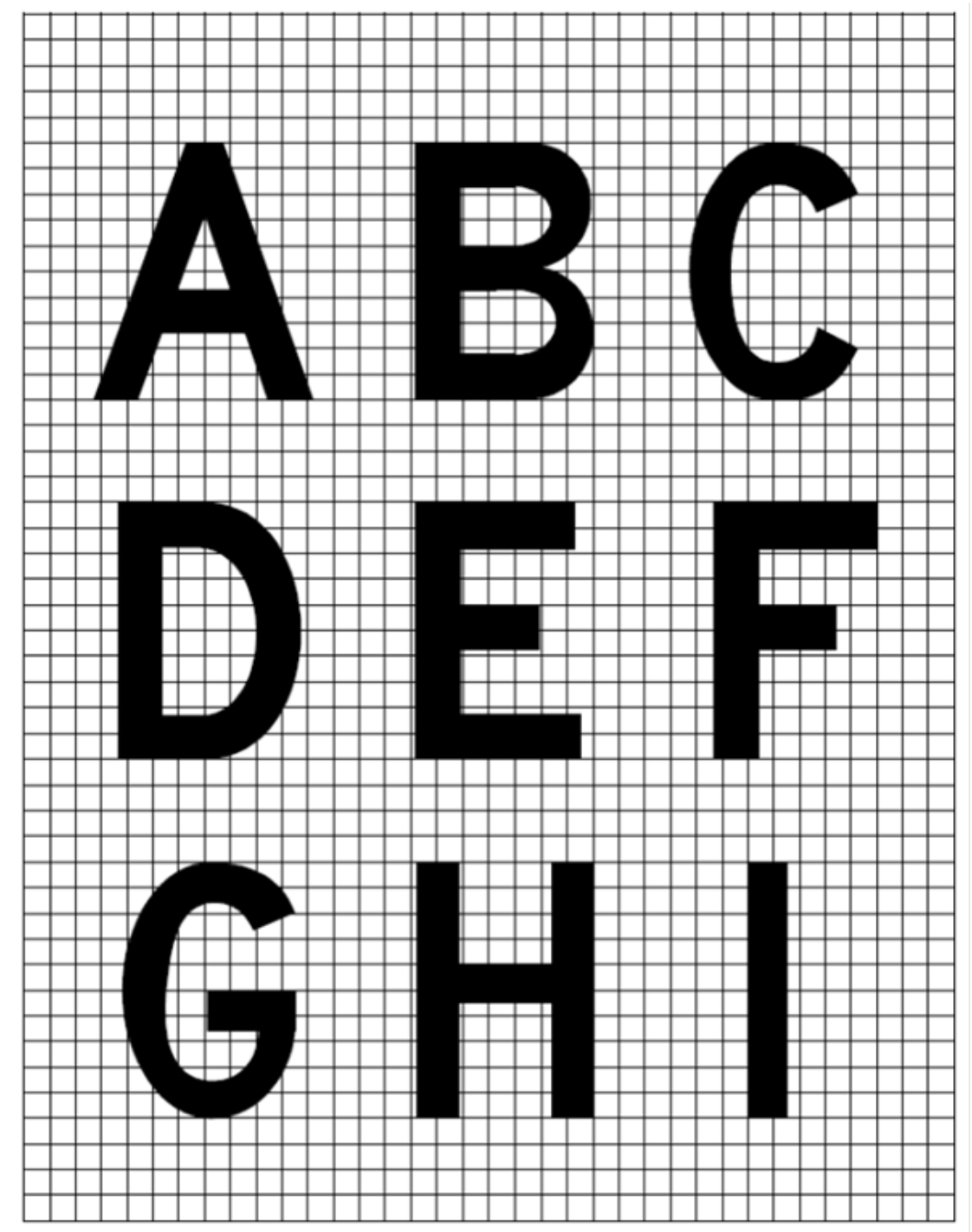


Figure 7A.2 Sign characters proportions and style

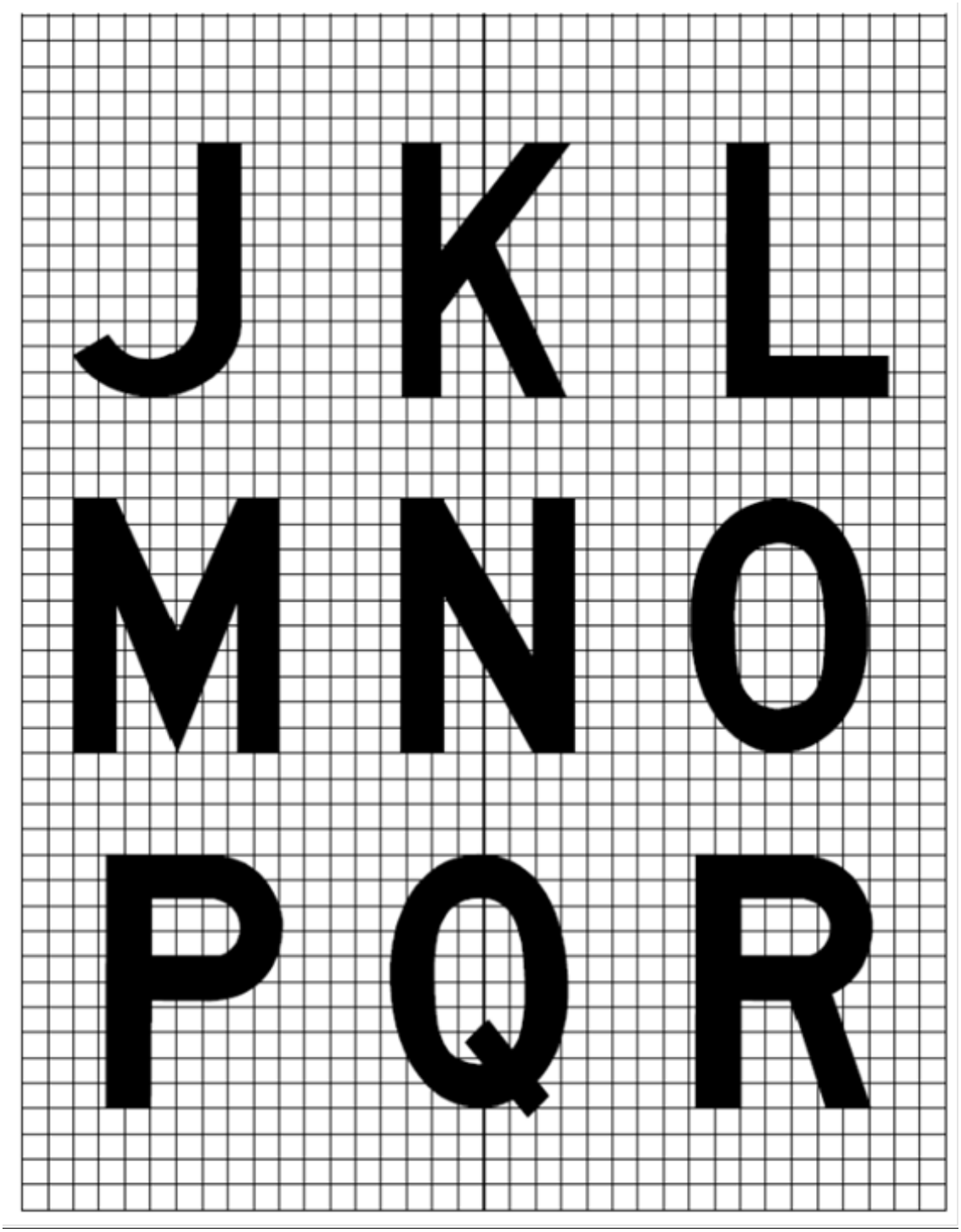


Figure 7A.3 Sign characters proportions and style

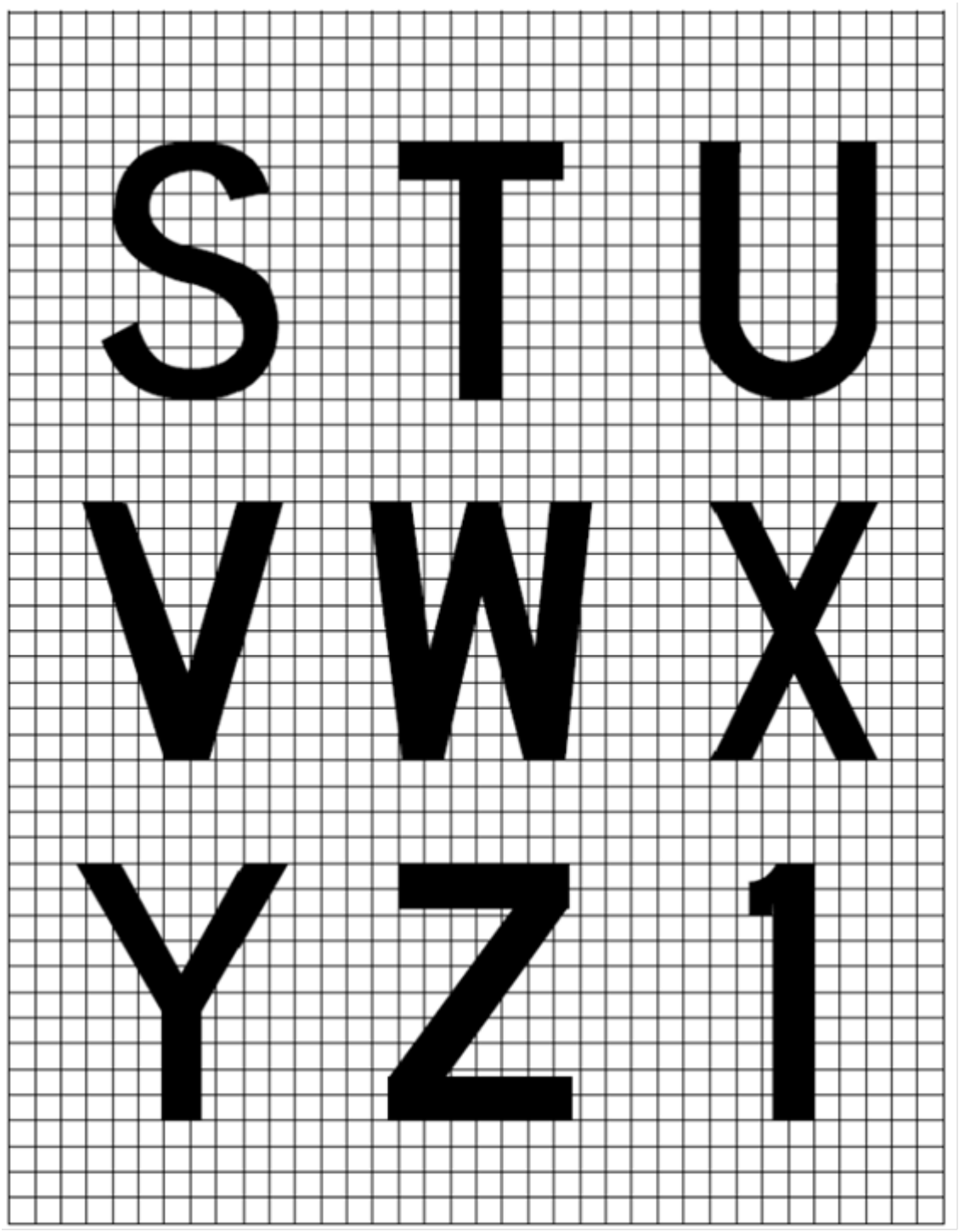


Figure 7A.4 Sign characters proportions and style

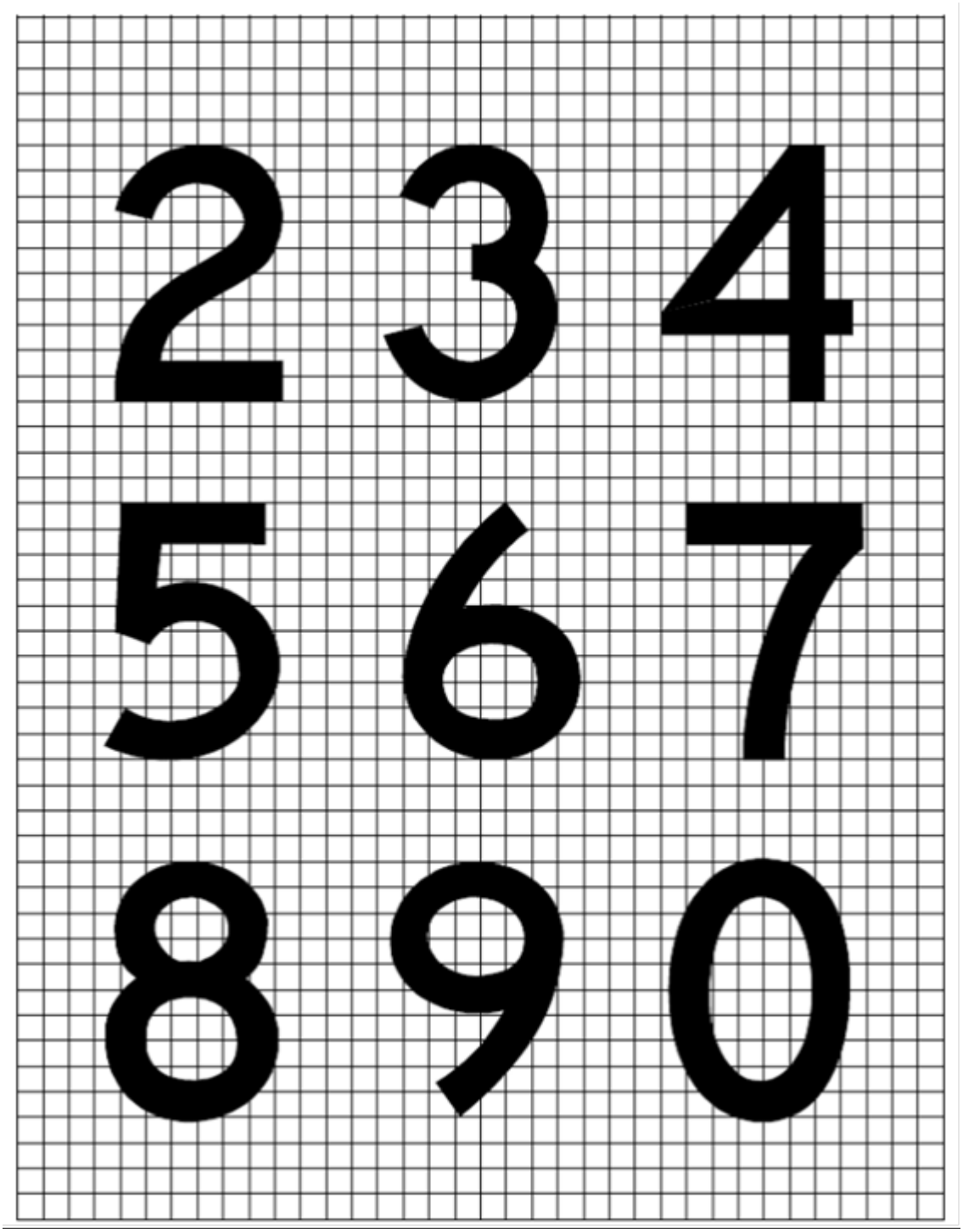


Figure 7A.5 Sign characters proportions and style

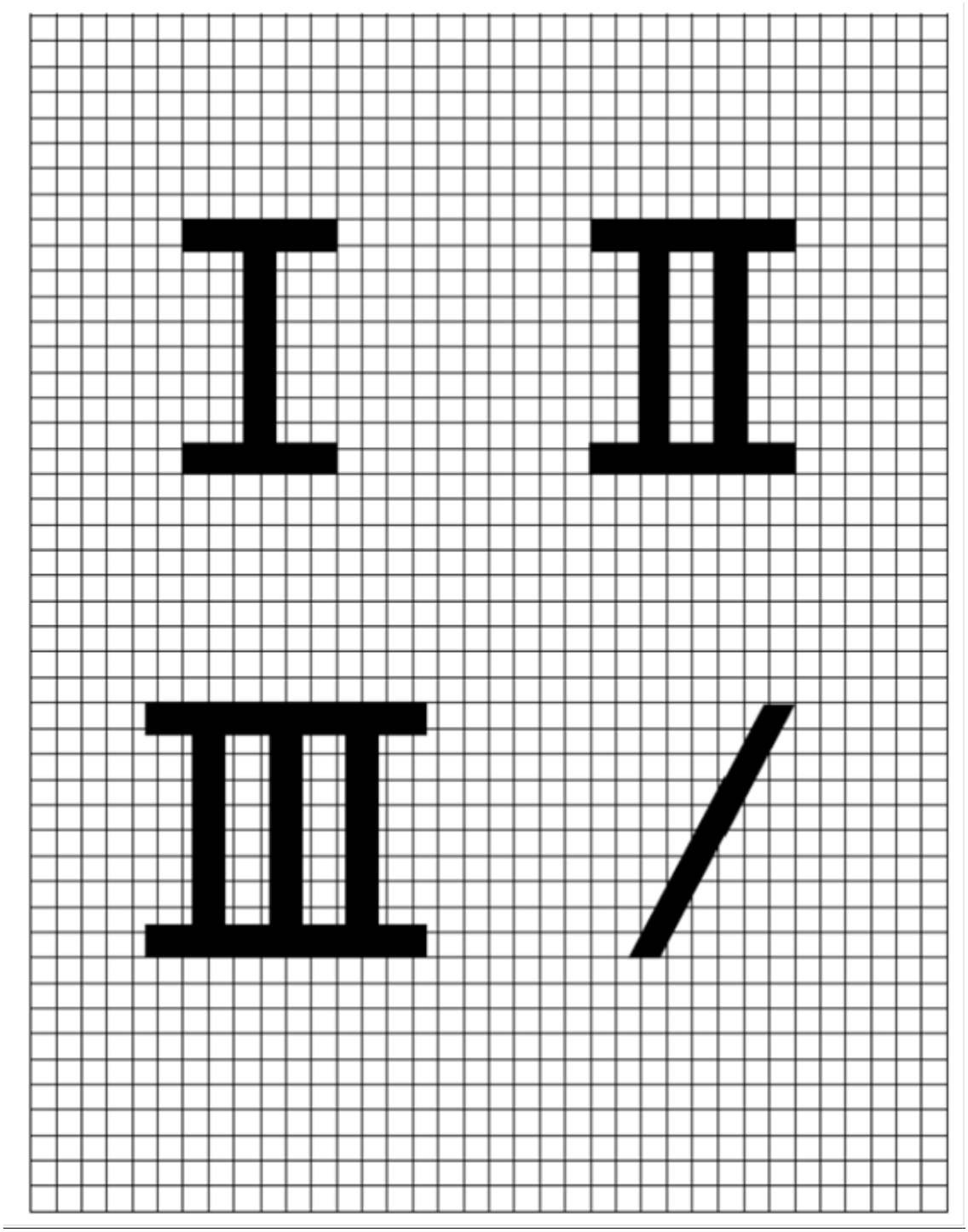


Figure 7A.6 Sign characters proportions and style

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(a) Letter and numeral widths and space between letters or numerals

Numeral to numeral code number			
	Following number		
Preceding numeral	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(b) Letter and numeral widths and space between letters or numerals

Code number	Letter height (mm)		
	200	300	400
	Space (mm)		
1	48	71	96
2	38	57	76
3	25	38	50
4	13	19	26

Code number	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(c) Letter and numeral widths and space between letters or numerals

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(d) Letter and numeral widths and space between letters or numerals

Instructions

1. To determine the proper space between letters or numerals, obtain the code number from table 7A.1(a) or (b) and cross-refer to table 7A.1(c) as appropriate to establish the letter height for that code number.

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.

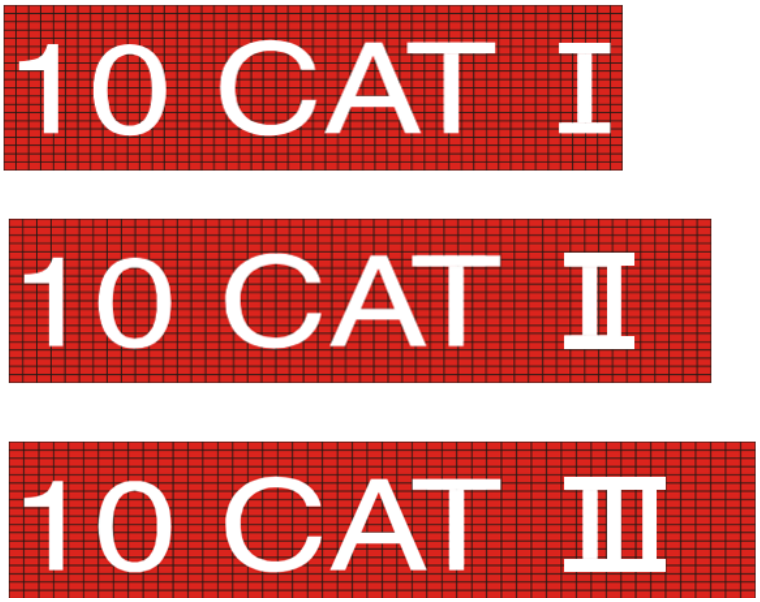


Figure 7A.7 Sign face size proportions and layout

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 7 A . 1

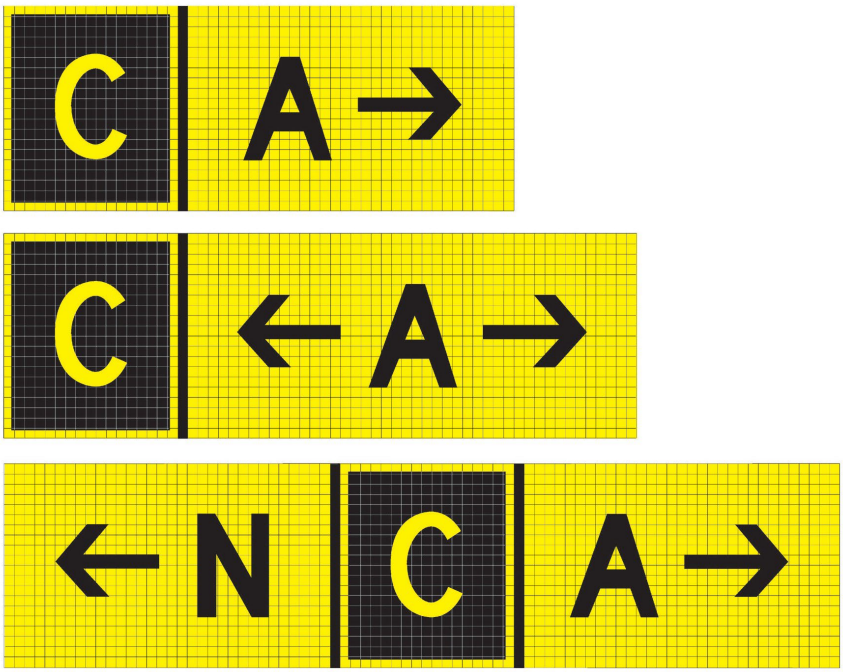


Figure 7A.10 Sign face size proportions and layout

7.392 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 7 A . 1 .

Form and proportions of runway designator marking

7.393 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.

7.394 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.

Designator		Character height (m)		
1st character	2nd character	15	12	9
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

Table 7B.1 Runway designator marking – spacing between characters

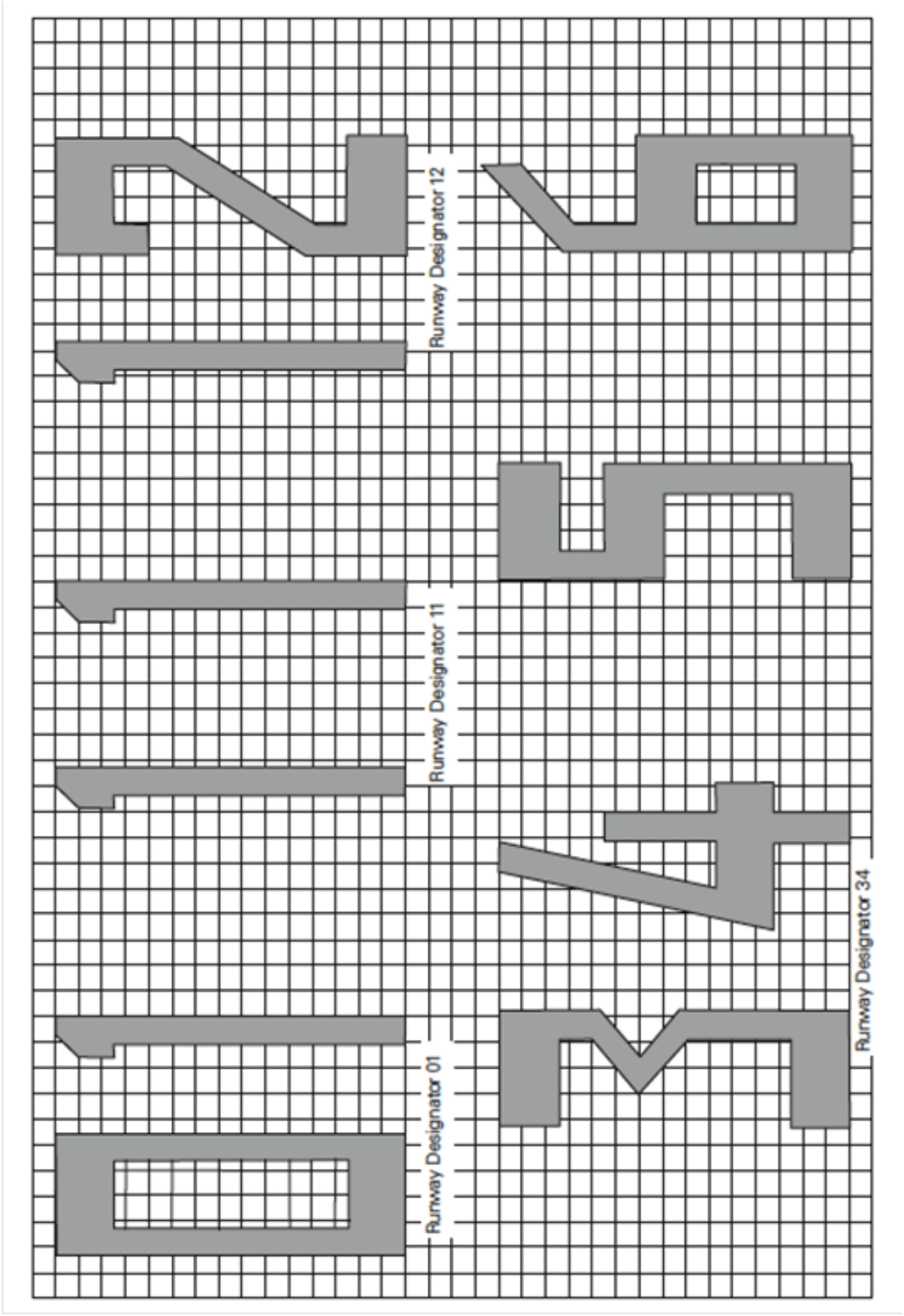


Figure 7B.1 Runway designator character dimensions – 15m characters

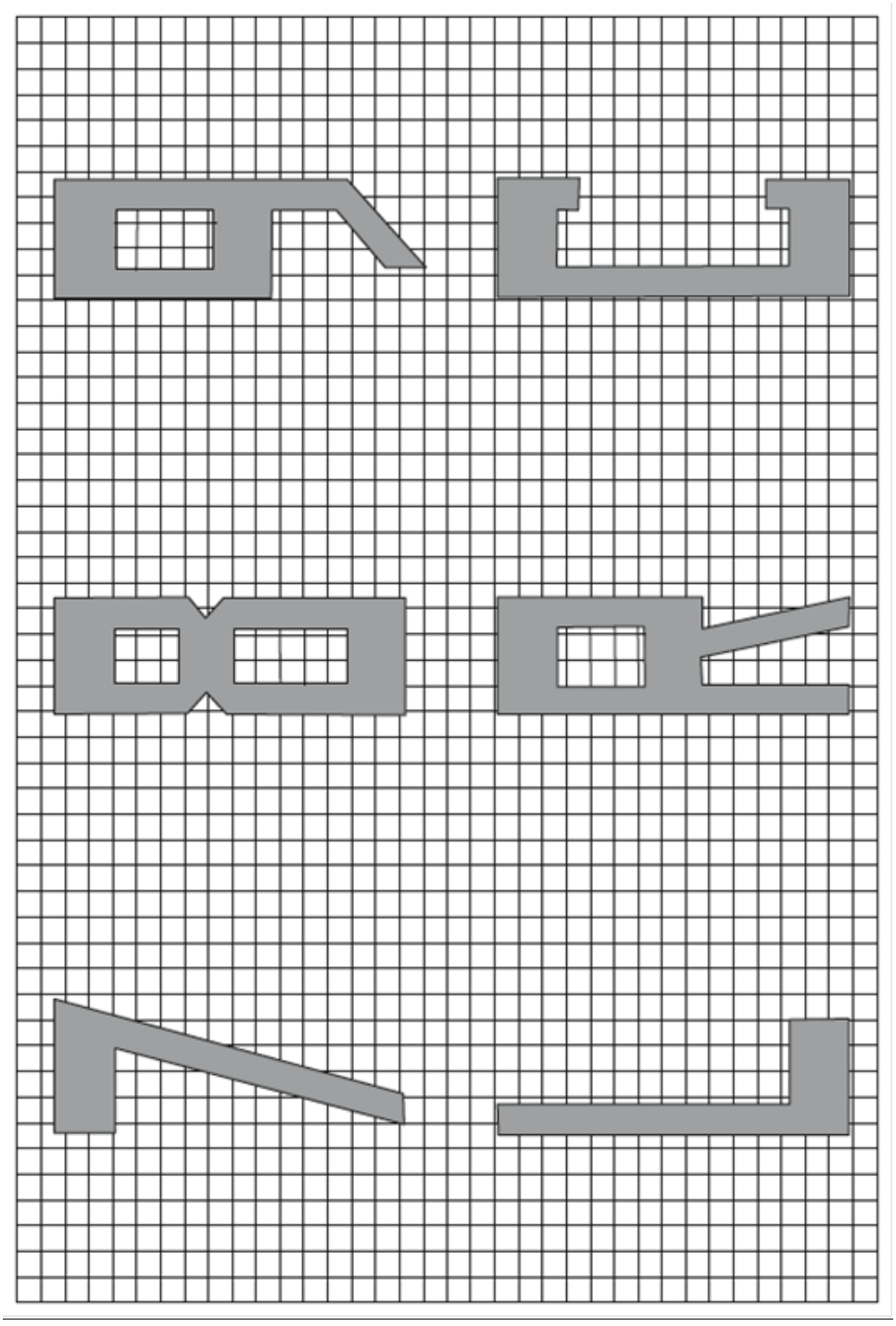


Figure 7B.2 Runway designator character dimensions – 15m characters

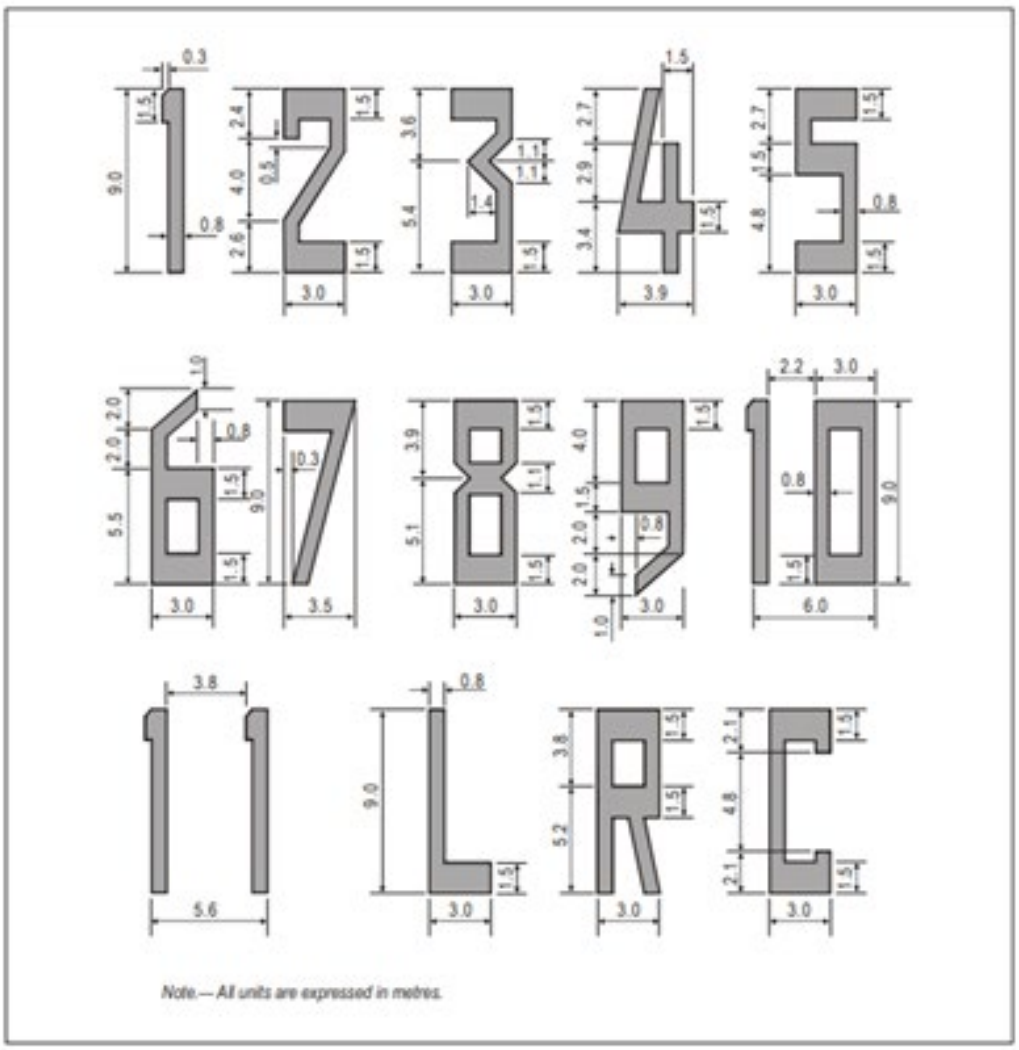


Figure 7.B3 Form and proportions of numbers and letters for runway designation markings

Form and proportions of pavement information marking – taxiways and aprons

7.395 This section 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.

7.396 The characters and symbols may be enlarged to the desired size by any conventional process and will remain in proper proportion.

7.397 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.

7.398 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.

7.399 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.

7.400 The height of characters employed should be not less than 2 m and normally not more than 4 m.

7.401 Examples of surface painted signs are shown at figure 7C.5.

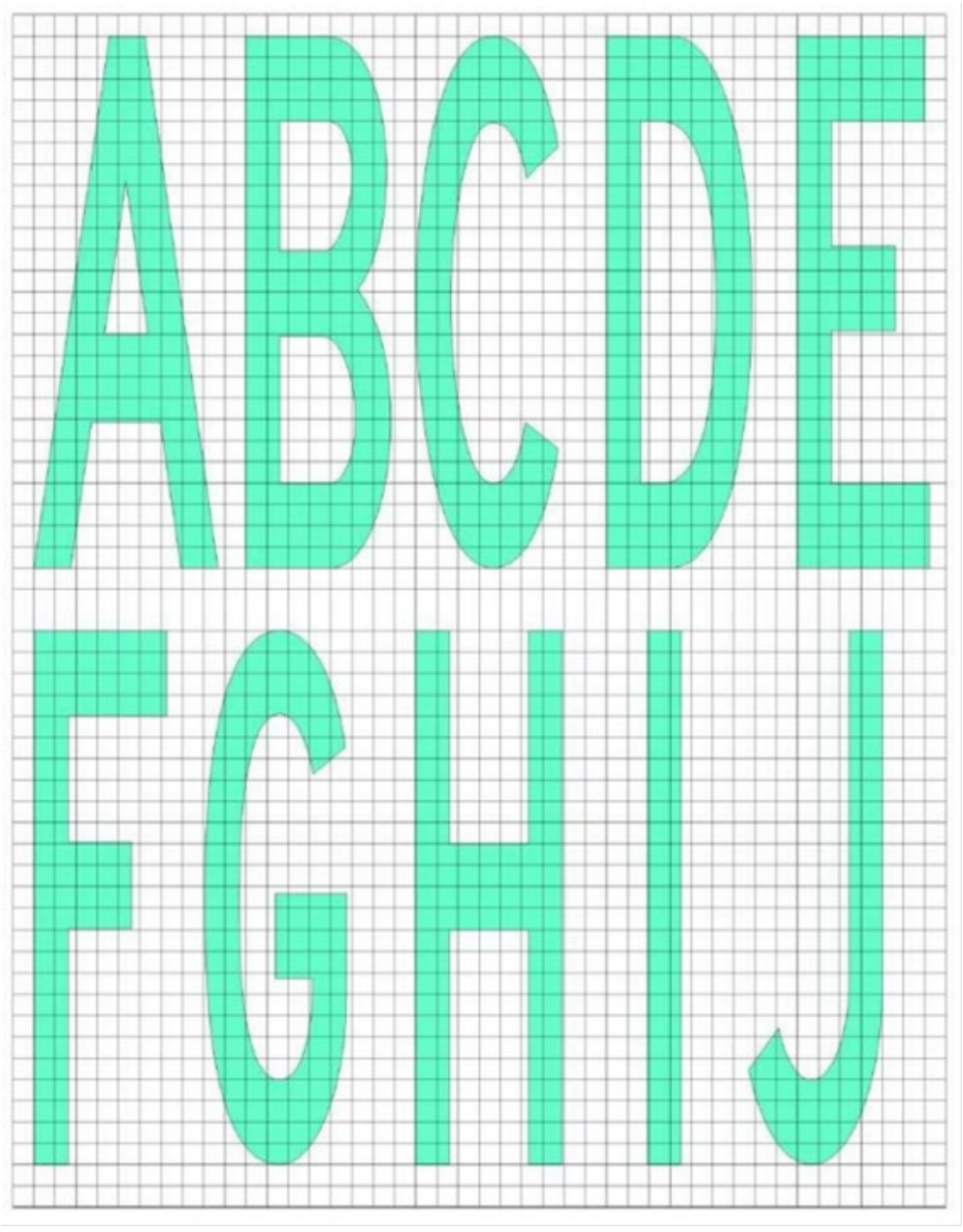


Figure 7C.1 Pavement markings

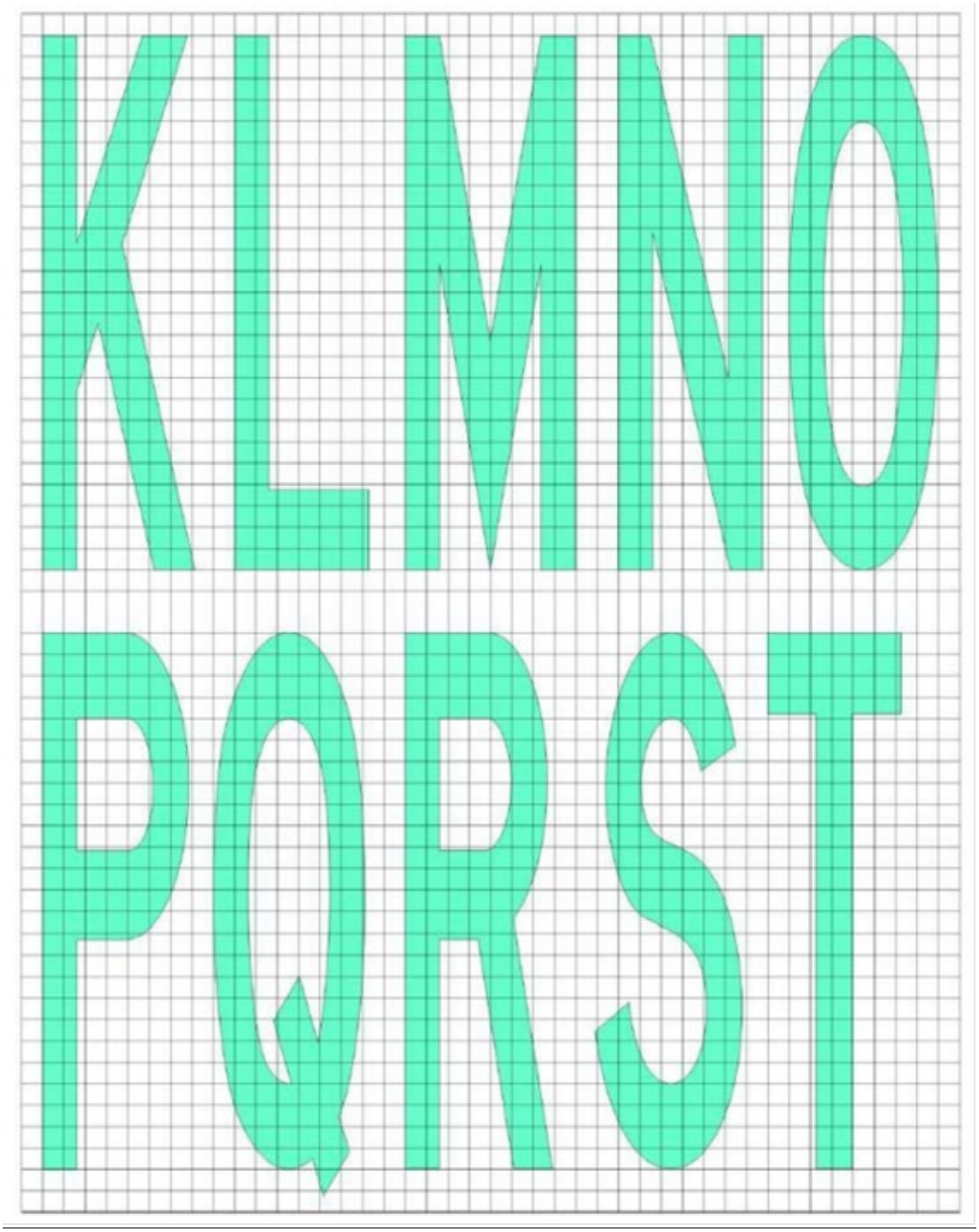


Figure 7C.2 Pavement markings

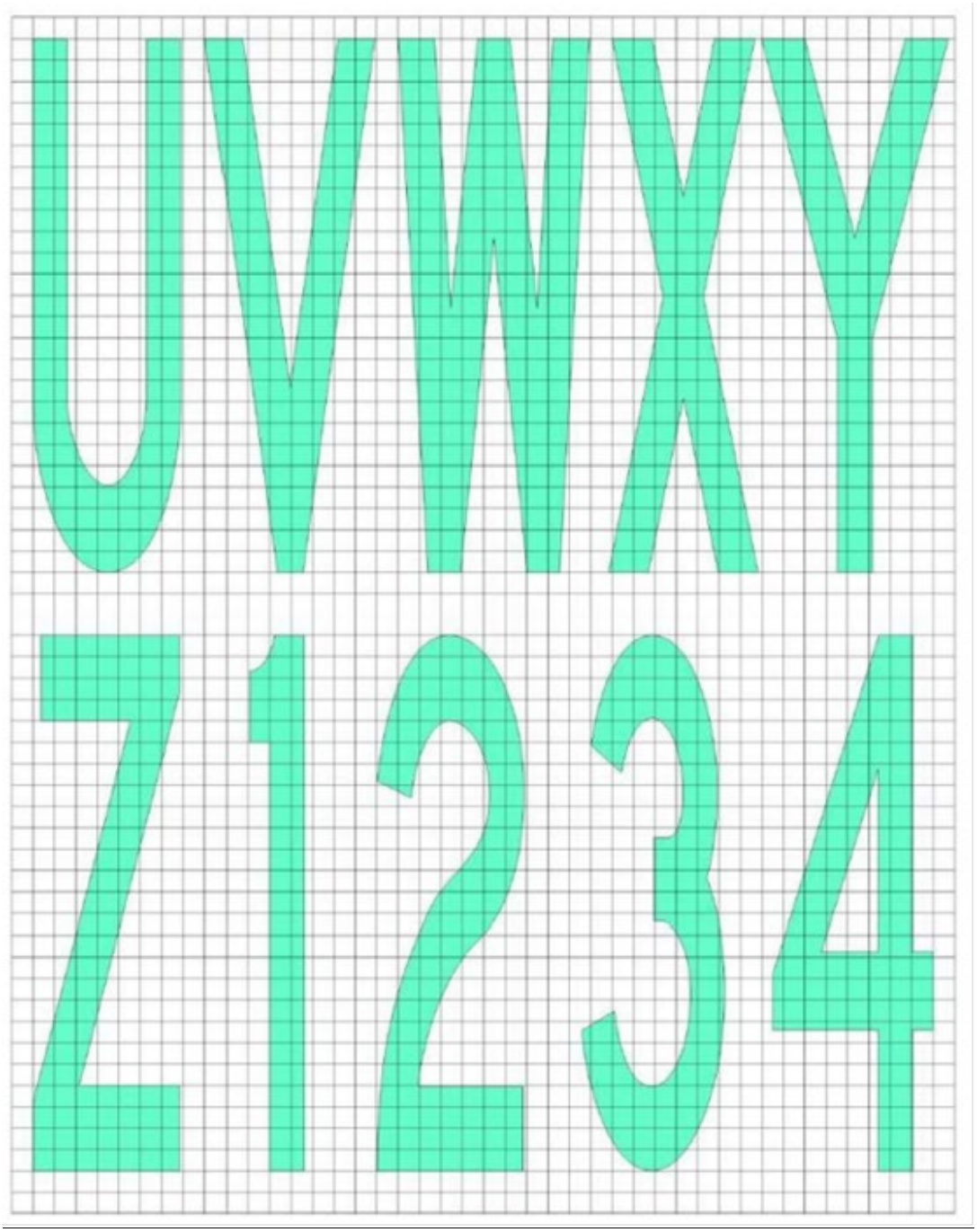


Figure 7C.3 Pavement markings

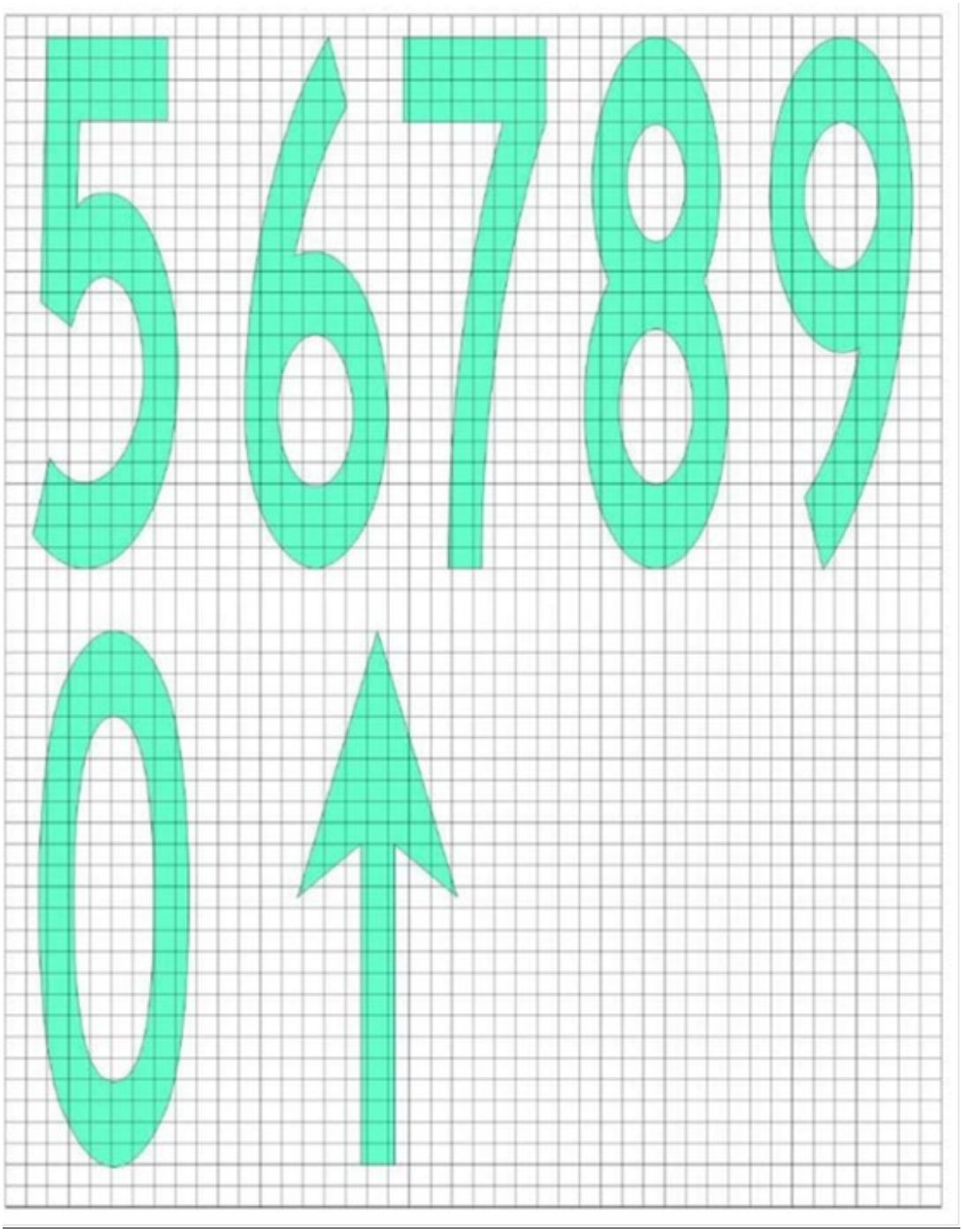
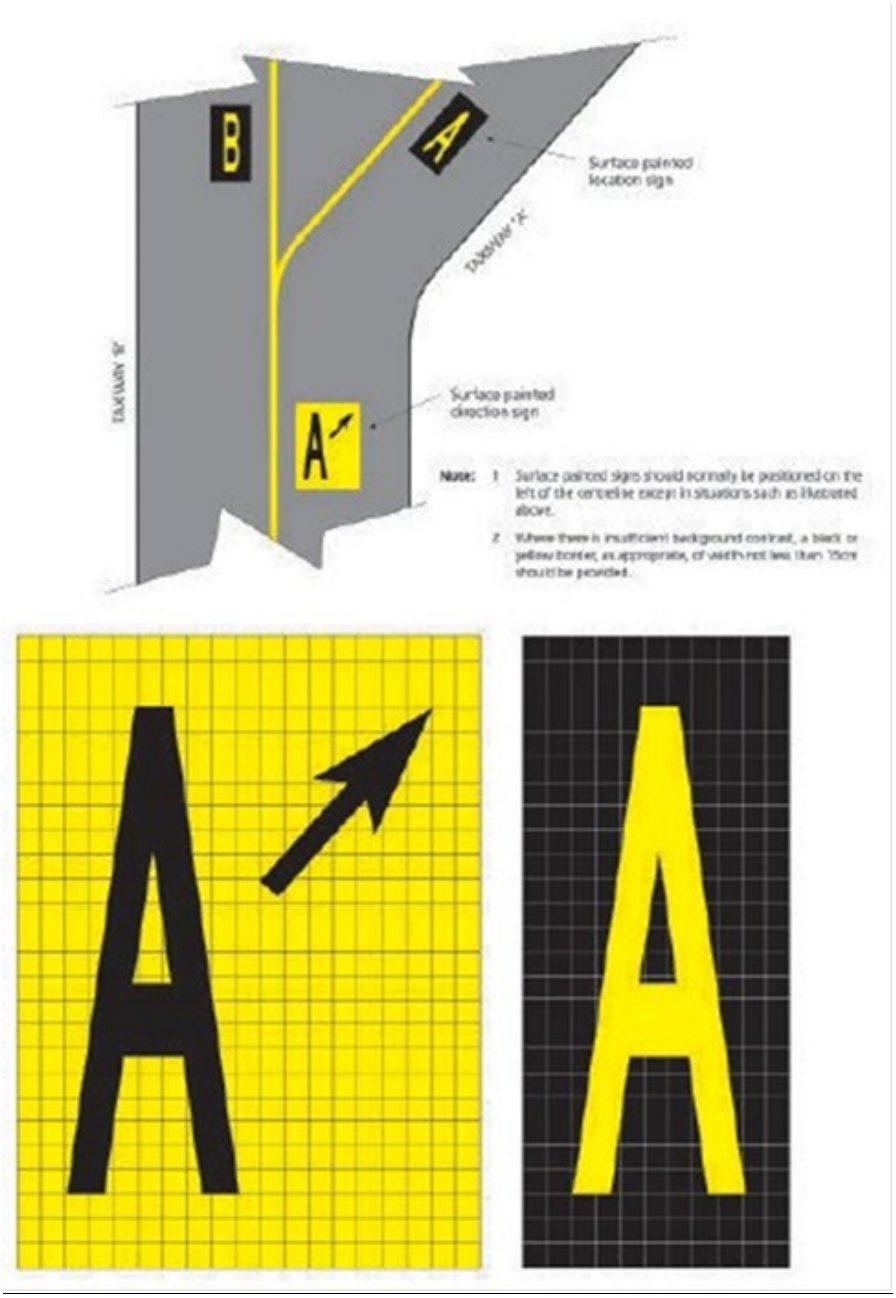


Figure 7C.4 Pavement markings



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.

Figure 7C.5 Pavement markings for taxiways and aprons – examples of surface painted signs

CHAPTER 8

Rescue and Firefighting Service (RFFS)

Introduction

8.1 Condition 2 in the public use and ordinary aerodrome licenses makes it mandatory for aerodrome operators to provide a RFFS appropriate to their aerodrome and as detailed in this chapter.

8.2 This chapter sets out the minimum requirements for the provision of RFFS, and is arranged as follows:

1. RFFS Category 3 – 10 Aerodromes
2. Surface Level Heliports
3. Rescue and Firefighting Category I and II Aerodromes
4. Initial Emergency Response (IER) RFFS Category Special Aerodromes

8.3 The objective of this chapter is to provide guidance to aerodrome operators on meeting CAA requirements relating to the establishment of a RFFS at a UK licensed aerodrome, and on ensuring the RFFS is capable of meeting ongoing regulatory requirements.

8.4 The scale and standards of RFFS including medical resources to be provided at licensed aerodromes in the United Kingdom accord with the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs).

8.5 The Air Navigation Order (ANO) requires aerodrome operators to include in the aerodrome manual the scale of rescue, first aid and fire service facilities and the aerodrome emergency procedures. Guidance on the preparation and contents of the aerodrome manual is provided in chapter 2 of this CAP. Where all or part of the RFFS is contracted out the aerodrome operator remains accountable for its compliance with these requirements, and its effective performance.

8.6 The environment effects of RFFS activities should be considered and mitigated.

8.7 Rescue and firefighting equipment and services shall be provided at an aerodrome.

8.8 The level of protection normally available at an aerodrome should be expressed in terms of the category of the rescue and firefighting services as

described in table 8.1 and in accordance with the types and amounts of extinguishing agents normally available at the aerodrome.

8.9 The rescue and firefighting level of protection is appropriate to the aerodrome category determined using the principles in 1 and 2 below except that where the number of movements (landing or take-off) of aeroplanes performing passenger transportation in the highest category, normally using the aerodrome, is less than 700 in the busiest consecutive three months, the level of protection provided in accordance with 1 and 2 below may be reduced by no more than one category below the determined one.

1. The aerodrome (RFFS) category shall be determined from table 8.1 and shall be based on the longest aeroplanes normally using the aerodrome and their fuselage width.

2. If, after selecting the category appropriate to the longest aeroplane's overall length, the aeroplane's fuselage width is greater than the maximum width for that category, then the category for that aeroplane shall be one category higher.

Aerodrome category	Aeroplane overall length	Maximum fuselage width
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

Table 8.1

8.10 The aerodrome operator, in order to assess whether the rescue and firefighting level of protection to be provided at the aerodrome is appropriate to the aerodrome rescue and firefighting category, should, at least annually, forecast the aeroplane traffic expected to operate at the aerodrome for the next twelve-month period. Upon knowledge of planned changes to traffic volume and structure, additional assessments might be necessary. In doing so, the aerodrome operator may use all information

available from aeroplane operators as well as statistics on aeroplane movements during the year preceding the day of the review.

8.11 During anticipated periods of reduced activity, the level of protection available shall be no less than that needed for the highest category of aeroplane planned to use the aerodrome during that time regardless of the number of movements.

8.12 Changes in the level of protection normally available at an aerodrome for rescue and firefighting shall be notified to the appropriate air traffic services units and aeronautical information units to enable those units to provide the necessary information to arriving and departing aircraft. When such a change has been corrected, the above units shall be advised accordingly. Notification should be by radio and NOTAM.

8.13 A change should be expressed in terms of the new category of the rescue and firefighting service available at the aerodrome.

8.14 Aerodrome Operators should develop contingency plans to limit the need for changes to the promulgated level of services. This may involve, for example, a preventative maintenance plan to ensure the mechanical efficiency of equipment and vehicles, and arrangements to cover unplanned leave and absence of the minimum level of RFF personnel including supervisory level.

8.15 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 or until the aircraft has reached its destination, whichever is the shorter.

8.16 The level of protection required for all-cargo, mail, ferry, training, test, positioning, and end-of-life aeroplane operations, including those carrying dangerous goods, irrespective of the number of movements, may be reduced in accordance with Table 8.1A as follows

Aerodrome category	RFF level of protection required
3	3
4	4
5	5
6	5
7	6
8	6

9	7
10	7

Table 8.1A

RFFS principal objective

8.17 The principal objective of a RFFS is to save lives. 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 for saving lives. This must assume at all times the possibility of, and need for, extinguishing a fire which may occur either immediately following an aircraft accident or incident, or at any time during rescue operations.

8.18 The most important factors bearing on effective rescue in a survivable aircraft accident are the training received, and the effectiveness of the equipment and the speed with which personnel and equipment designated for rescue and firefighting purposes can be put into use.

8.19 Requirements to combat building fires and fuel farm fires, or to deal with foaming of runways are not taken into account.

Operational objective

8.20 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. Achievement of response times is dependent on the size of aerodrome, location of fire station(s) and disposition of vehicles and personnel at any given time.

8.21 The operational objective of the RFFS shall be to achieve a response time not exceeding three minutes to any point of each operational runway, in optimum visibility and surface conditions. The operational objective of the rescue and firefighting service should be to achieve a response time not exceeding three minutes to any other part of the movement area in optimum visibility and surface conditions.

8.22 The operational objective of the RFFS should be to achieve a response time not exceeding two minutes to any point of each operational runway, in optimum visibility and surface conditions.

8.23 Response time is considered to be the time between the initial call to the rescue and firefighting service, and the time when the first responding vehicle(s) is (are) in position to apply foam at a rate of at least 50% of the discharge rate specified in table 8.3.

8.24 Optimum visibility and surface conditions are defined as daytime, good visibility, no precipitation with normal response route free of surface contamination e.g. water, ice, or snow.

8.25 A response safe system of work includes a number of elements that must come together to deliver an effective and safe response.

8.26 A comprehensive hazard and risk analysis should be conducted over the optimum response routes within the aerodrome boundary that RFFS vehicles are likely to use to achieve the operational objective. The analysis and system of work should consider;

1. Standard operating procedures
2. Call handling
3. Alerting system
4. Position of the fire station or standby area
5. Position of training area where a response may be made from
6. Suitable access roads and routes
7. Visibility and surface conditions
8. A clear route
9. Vehicle performance
10. Vehicle maintenance
11. Effective equipment
12. Competent staff
13. Communications
14. An effective safety culture
15. Effective leadership and incident command
16. Human factors
17. Monitoring and review including records

8.27 In assessing an effective response all these areas will be scrutinised and reviewed. Aerodrome operators should not focus on any one aspect in isolation in measuring effectiveness.

Continuous agent application

8.28 During flight operations, sufficient trained and competent personnel should be designated to be readily available to ride the rescue and fire fighting vehicles and to operate the equipment at maximum capacity.

8.29 These trained personnel should be deployed in a way that ensures that minimum response times can be achieved and that continuous agent application at the appropriate rate can be fully maintained.

8.30 Consideration should also be given for personnel to use hand lines, ladders and other rescue and firefighting equipment normally associated with aircraft rescue and firefighting operations.

8.31 Any other vehicles required to deliver the amounts of extinguishing agents specified in table 8.3 should arrive no more than one minute after the first responding vehicle(s) so as to provide continuous agent applications.

Minimum levels of personnel

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

8.33 In determining the minimum number of rescue and firefighting personnel and supervisory levels required, a Task Resource Analysis (TRA) should be completed, and the level of staffing and qualification promulgated in, or referenced to, the aerodrome manual. CAP 1150 should be referred to for additional guidance.

8.34 The objective of providing an adequate level of competent personnel is to have available sufficient staff at all responsibility levels to ensure that:

1. The RFFS is capable of achieving the Principal Objective;
2. All vehicles and equipment can be operated effectively and safely;
3. Continuous agent application at the appropriate rate(s) can be fully maintained;
4. Sufficient supervisory grades can implement an Incident Command System;
5. The RFFS elements of the aerodrome emergency plan can be effectively achieved.

8.35 The minimum staffing and supervisory levels resulting from the analysis should be detailed in the aerodrome manual.

8.36 The aerodrome operator shall develop and implement a training programme to ensure that RFFS personnel are competent in their task and role.

8.37 Aerodrome operators are, or should designate a person who is, responsible for the overall control and management of the aerodrome RFFS, and this person should adopt the role of fire service manager. The RFFS management structure should provide for a competent person to take command of an emergency response throughout the promulgated hours of operation.

8.38 RFFS personnel should be identified by markings in accordance with the National Incident Command System. The officer in charge of the aerodrome RFFS should wear a conspicuous coloured tunic or tabard in order to become distinguishable from the local authority fire officer.

Extraneous duties

8.39 No extraneous duty should create conditions likely to compromise individual or crew performance or introduce additional hazards.

8.40 RFFS personnel designated as part of the minimum level for response, and who are engaged on extraneous duties, shall be capable of meeting the response time objective while carrying out those duties.

8.41 It is not considered reasonable to require personnel designated as part of the minimum riding strength to be engaged on duties involving the handling of fuel.

Medical standards

8.42 The objective of requiring medical assessments for aerodrome RFFS personnel is to ensure an acceptable standard for the fitness of personnel likely to be engaged in operational duties.

8.43 As the nature of RFF operations involves periods of intense physical activity, all RFF personnel have to possess a minimum level of physical fitness and medical fitness to be able to perform the tasks associated with these operations. Physical fitness and medical fitness is often described as the overall physical condition of the body, which can range from peak condition for performance at one end of the spectrum to extreme illness or injury at the other.

8.44 The key fitness components for RFF are generally aerobic fitness, anaerobic fitness, flexibility, and medical fitness. Optimum physical fitness and medical fitness for RFF personnel would mean that a firefighter is able to carry out RFF activities safely, successfully and without undue fatigue.

Aerobic fitness

8.45 This is the ability to continue to exercise for prolonged periods of time at low to moderate or high intensity. This is typically what limits the ability to continue to run, cycle or swim for more than a few minutes and is dependent upon the body's heart, lungs, and blood to get the oxygen to the muscles (VO2) providing the sustained energy needed to maintain prolonged exercise. Typical aerobic activities include walking, jogging, cycling, rope skipping, stair climbing, swimming, or any other endurance activities.

Anaerobic fitness

8.46 This works differently to aerobic fitness. It is an activity that requires high levels of energy and is done for only a few seconds or minutes at a high level of intensity.

8.47 The term anaerobic means "without oxygen." Participation in anaerobic activities leads to anaerobic fitness, which may be defined as higher levels of muscular strength, speed, and power.

8.48 Anaerobic activities include heavy weightlifting, running up several flights of stairs, sprinting, power swimming, or any other rapid burst of hard exercises.

Flexibility

8.49 This refers to the ability to move the limbs and joints into specific positions at the end of their normal range of movement.

8.50 Flexibility is important as it will allow the body to work in cramped positions without unduly stressing the muscles, tendons and ligaments and may reduce the risk of injury. Flexibility is best developed using slow controlled stretching exercises.

8.51 The physical fitness assessment should be catered to the components mentioned above. RFF services should develop various types of tests to ensure that these components are tested to determine if the RFF personnel have the required physical fitness level for the job.

8.52 The physical fitness assessment should also be conducted at least once a year. The physical fitness assessment should be conducted for pre-employment entry as a firefighter as well as ongoing physical fitness assessments for existing RFF staff to ensure they are maintaining their level of physical fitness.

Medical fitness

8.53 Medical fitness assessments specific to RFF services should be developed.

8.54 The medical fitness assessments should be conducted for pre-employment entry as a firefighter as well as ongoing medical fitness assessments for existing staff.

8.55 The frequency of medical fitness assessments should be determined by each agency.

8.56 The medical fitness assessments should be used to identify any underlying medical conditions, which may pose a risk to the individual firefighter during physically demanding activities.

8.57 The objective of requiring medical assessments for aerodrome RFFS personnel is to ensure an acceptable standard for the fitness of personnel likely to be engaged in operational duties.

8.58 Operators should ensure that initial and ongoing medical assessment is conducted by a competent organisation.

RFFS training

8.59 All rescue and firefighting personnel shall be properly trained to perform their duties in an efficient manner and shall participate in live fire drills commensurate with the types of aircraft and the type of rescue and firefighting equipment in use at the aerodrome, including pressure-fed fuel fires.

8.60 Pressure-fed fuel fires can be either hydrocarbon or liquefied petroleum gas (LPG) and the training facilities should be commensurate with the risks.

8.61 Where LPG is used for live fire drills, provision should also be made for RFFS personnel to periodically practice the application of the types of extinguishing agent available at the aerodrome onto a hydrocarbon liquid fire.

8.62 The frequency of live fire drills, and the periodic application of firefighting agent to control and extinguish a hydrocarbon liquid fire, should be determined through a suitable training needs analysis.

8.63 RFFS personnel should receive appropriate initial and regular comprehensive recurrent training appropriate to their role and task to maintain the skills necessary to ensure that RFFS equipment can be put to use effectively. Guidance on developing and implementing an RFFS training programme can be found in CAP 699, Framework for the Competence of Rescue and Fire Fighting Service (RFFS) Personnel.

8.64 The rescue and firefighting personnel training programme shall include training in human performance, including team co-ordination as set out in CAP 699.

Equipment

8.65 Rescue equipment commensurate with the level of aircraft operations should be provided on the rescue and fire fighting vehicle(s) or should be available for timely deployment and be based on the task and resource analysis.

8.66 All responding rescue and firefighting personnel shall be provided with personal protective equipment to enable them to perform their duties in an effective manner.

8.67 Account should be taken of the Provision and Use of Work Equipment Regulations (PUWER) and the Personal Protective Equipment at Work Regulations which require that equipment is:

1. Suitable for the intended use;
2. Safe for use, maintained in a safe condition and, in certain circumstances, inspected to ensure this remains the case;
3. Used only by people who have received adequate information, instruction, and training; and
4. Accompanied by suitable safety measures, e.g. protective devices, markings, warnings.

8.68 Guidance on the rescue equipment to be provided at an aerodrome is given in the ICAO Airport Services Manual, Part 1.

8.69 Records of all tests and inspections shall be maintained by the aerodrome operator for a period of five years. The records should include details of consequential action where an inspection has revealed a defect or deficiency

Appliances

8.70 The objective is to design and procure appliance(s) that are fit for the purpose for which they are required.

8.71 The minimum number of foam-producing vehicles shall not be less than that set out in table 8.2.

8.72 Procurement should be based on a formal specification process that provides a phased approach and considers the preliminary preparation of specification, and additional contractual considerations.

8.73 Guidance on minimum characteristics of RFFS vehicles is given in the ICAO Airport Services Manual Part 1, which also gives guidance on procurement.

8.74 A system of preventative maintenance of rescue and fire fighting vehicles should be employed to ensure effectiveness of the equipment and compliance with the specified response time throughout the life of the vehicle.

Aerodrome category	3	4	5	6	7	8	9	10
Minimum number of foam producing vehicles	1	1	1	2	2	3	3	3

Table 8.2 Minimum number of RFFS appliances/vehicles

Minimum useable amounts of extinguishing agents								
	Foam meeting performance level A		Foam meeting performance level B		Foam meeting performance level C		Complementary agents	
Aerodrome category	Water (L)	Discharge rate foam solution (L/min)	Water (L)	Discharge rate foam solution (L/min)	Water (L)	Discharge rate foam solution (L/min)	Dry chemical powders (kg)	Discharge rate (kg/ sec)
3	1 800	1 300	1 200	900	820	630	135	2.25
4	3 600	2 600	2 400	1800	1 700	1 100	135	2.25
5	8 100	4 500	5 400	3 000	3 900	2 200	180	2.25
6	11 800	6 000	7 900	4 000	5 800	2 900	225	2.25
7	18 200	7 900	12 100	5 300	8 800	3 800	225	2.25
8	27 300	10 800	18 200	7 200	12 800	5 100	450	4.5
9	36 400	13 500	24 300	9 000	17 100	6 300	450	4.5
10	48 200	16 600	32 300	11 200	22 800	7 900	450	4.5

Notes:

the quantities of water shown in columns 2, 4 and 6 are based on the average overall length of aeroplanes in a given category
See paragraphs 8.64, 8.65, 8.72, 8.75, 8.76, 8.77, 8.78 and 8.79

Table 8.3

8.75 At aerodromes where operation by aeroplanes larger than the average size in the given category are planned, the quantities of water should be recalculated and the amount of water for foam production and the discharge rates for foam solution should be increased accordingly. Additional guidance is available in chapter 2 of the ICAO (Doc.9137), Airport Services Manual, Part 1. In addition to the above the following should be taken into account:

8.76 Where the level of protection is reduced in accordance with 8.12 and 8.13 , a recalculation of quantities of extinguishing agents should be carried out based on the largest aeroplane in the reduced category;

8.77 For all-cargo, mail, training, test, positioning and end-of-life aeroplane operations, including those carrying dangerous goods, the recalculation of extinguishing agents should be based on the largest aeroplane in the category specified in Table 8.1.

Extinguishing agents

8.78 The objective of an extinguishing agent is to extinguish/suppress a fire on which it is applied. Principal agents are provided for permanent control, i.e., for a period of several minutes or longer. Complementary agents may provide rapid fire suppression but generally only offer a transient control, which is available during application. The ICAO Critical Area Concept is not intended to ensure extinguishment of the entire fire, it seeks to control only the area of fire adjacent to the fuselage. The objective is to safeguard the integrity of the fuselage and maintain tolerable conditions for its occupants.

8.79 Both principal and complementary agents should normally be provided at an aerodrome.

Principal extinguishing agents

8.80 The principal extinguishing agent should be:

1. A foam meeting the minimum performance level A; or
2. A foam meeting the minimum performance level B; or
3. A foam meeting the minimum performance level C; or
4. A combination of these agents except that the principal extinguishing agent for aerodromes in categories 1 to 3 should preferably meet a minimum performance level B or C foam.

8.81 The required quantities of extinguishing agents should be in accordance with the aerodrome category, determined by tables 8.1, 8.2, and 8.3 and be available for immediate discharge from RFFS appliances.

8.82 For RFFS Categories 3-10, the discharge rates for foam shall be met using vehicle monitor(s).

8.83 Where different types of extinguishing agents are used on an aerodrome, care must be taken to ensure that incompatible types are kept apart and stored in accordance with manufacturer's guidance.

8.84 Alternative principal extinguishing agents which are not defined in the ICAO Airport Services Manual (Doc.9137) Part 1, will require evidence that demonstrates the agent achieves an equivalent level of performance.

8.85 The quantity of foam concentrates separately provided on vehicles for foam production shall be in proportion to the quantity of water provided and the foam concentrate selected.

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

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

8.88 The amounts of water specified for foam production are predicated on an application rate of 8.2 L/min/m2 for a foam meeting performance level A, 5.5 L/ min/m2 for a foam meeting performance level B and 3.75 L/min/m2 for a foam meeting performance Level C.

8.89 Some foams contain persistent organic pollutants (POPs) e.g., Perfluorooctanoic acid (PFOA). POPs remain in the environment for very long periods of time. They are toxic and gradually build up to harmful levels in living organisms and present a risk to the environment and human health. Legal controls that apply to these foams must be complied with. Guidance regarding these controls can be found in the Environment Agency's The Storage and Disposal of Class B Fire Fighting Foams document. chemicalrestrictions@environment-agency.gov.uk

8.90 Fluorine and organohalogen free foams complying with performance levels A, B and C requirements are available. They are sometimes described as synthetic foams. These products are less damaging to the environment in the long term and are stable against polar and non-polar hydrocarbons. Some fluorine and organohalogen free firefighting foams may be pseudo plastic in nature. Storage should be in accordance with manufacturers' instructions.

Complementary extinguishing agents

8.91 The complementary extinguishing agent should be a dry chemical powder suitable for extinguishing hydrocarbon fires, or any other alternative agent having equivalent firefighting capability.

8.92 The complementary agents should comply with the appropriate specifications of the International Organisation for Standardisation (ISO).

8.93 A quantity of gaseous agent or CO2 shall be provided for use on small or hidden fires. A minimum extinguisher size is 5 kg for major and 2 kg for smaller vehicles.

8.94 Systems should be capable of delivering the agent through equipment which will ensure its effective application.

8.95 The discharge rate of complementary agents should be not less than the values shown in Table 8.3.

8.96 If a ‘high performance’ dry powder is used it may be permissible to reduce the amount provided.

8.97 If an aerodrome operator wishes to reduce the quantity of dry powder provided as outlined above, they must apply to the CAA for such a concession.

8.98 The application must be supported by an assessment that shows how the aerodrome operator is assured that the lower quantity of dry powder can provide an equivalent level of fire extinguishing performance for the types of fires where the agent is expected to be used.

Reserve supply of agents

8.99 A 200% reserve of foam concentrate and 100% of complementary agents and propellant gas shall be available at the aerodrome.

8.100 Extinguishing agent quantities designated as reserve should be held in any appropriate manner which easily allows vehicles to be replenished promptly (including on vehicles themselves).

8.101 Agent carried on appliances in excess of the minimum quantities can contribute to the reserve.

8.102 Where a major delay in the replenishment of the supplies is anticipated, the amount of reserve supply should be increased as determined by a risk assessment.

Storage of extinguishing agents

8.103 In addition to any statutory or legal requirements, consideration should be given to:

1. Avoiding prolonged or extreme storage conditions;
2. Regular inspection and testing;
3. Keeping of logbooks and records;
4. Manufacturers' recommended service and test intervals.

8.104 Where different generic 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).

8.105 The mixing of different types of foam concentrate may lead to serious sludging and possible malfunctioning of vehicle foam production systems.

8.106 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.

8.107 For extinguishing agents that have a certificate of conformity and have remained sealed and stored according to manufacturer's guidance, a test to assess condition is not required within their shelf life unless the manufacturer's guidance recommends it.

8.108 Any stocks of fire extinguishing agents, such as foam concentrates held in bulk tanks, including appliance tanks, and drums where the seal has been broken, 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).

8.109 Aerodrome operators should ensure that suppliers of fire extinguishing media provide a certificate of assurance for each batch to the effect that the media supplied meets all requirements and any supplementary conditions agreed with themselves prior to the occasion of the first purchase (e.g. suitability for use in premixed form).

8.110 Material Safety Data Sheets should be used to determine the best practice with respect to hazards, use, storage, and disposal of extinguishing agents.

Foam production performance testing

8.111 It is essential that firefighting foam produced by an RFFS vehicle, or other such appliance, is of an acceptable quality and the delivery parameters meet and are maintained to the appropriate operational requirement as recommended by the appliance and/or equipment manufacturer.

8.112 To ensure that foam production by an RFFS vehicle is of an acceptable standard, it must subject to a test regime.

8.113 The test regime should include;

1. Foam Production Performance Test (i.e. an 'Acceptance Test') carried out;

    a) when a RFFS vehicle is first acquired by the aerodrome operator for operational use at an aerodrome. (acquisition may mean the new or second- hand purchase, leasing or hire of a RFFS Vehicle);

    b) when significant maintenance, refurbishment or component replacement has been undertaken on a RFFS vehicle that could affect a change in the foam quality or production performance of the foam-making system

2. In-service test carried out;

    a) To ensure the ongoing capability of the foam production system;

    b) At least every 12 months.

    c) After significant repair or maintenance

8.114 The Foam Production Performance test and In- Service tests should be conducted in conjunction with the vehicle/equipment manufacturer or a competent authority as per paragraph 1(b) above

8.115 Pre-mixed foam units shall be maintained and hydraulically pressure tested in accordance with the intervals set by manufacturer's guidance. Only foam concentrates suitable for use in pre-mixed form shall be used in these kinds of pressure vessels.

Foam properties

8.116 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.

8.117 The expansion of a representative sample of the foam blanket produced should be no less than 6:1, a value between 8:1 and 12:1 being preferred.

8.118 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.

8.119 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.

8.120 The time taken for the drainage of 25% of the foam solution from a representative sample of the foam blanket produced should be at least three minutes, and preferably more than five minutes.

8.121 Any use of non-aspirated foam may need to be quickly supplemented by using aspirating foam to achieve a foam blanket of satisfactory stability.

8.122 Certain combinations of types of foam concentrate and branch pipes may be found to perform differently from others. Care should be taken during the selection process to ensure that the optimum combination of foam and equipment is chosen.

Foam performance levels and specifications

8.123 Foam concentrates used to provide the extinguishing agents quantities listed at table 8.3 are required to meet either performance level A, B or C as designated by ICAO in the Airport Services Manual (Doc 9137), Part I – Rescue and Fire Fighting, chapter 8. The performance level A, B or C is to be certificated by a recognised, accredited third party testing authority.

8.124 Training foams do not comply with any recognised national or international standards; however, they will be quality assured by the manufacturer.

8.125 They may be formulated to mimic the operational foams for induction, drainage, and expansion properties; however, their firefighting properties may be reduced. Personnel must understand this feature of training foams before they are used.

8.126 Care should be taken to prevent confusion between the storage and use of training foams with their operational counterparts.

8.127 Where the manufacturer can demonstrate that the training foam produces identical test results to those expected to be obtained by the operational firefighting foam, it may be used to conduct the foam production performance and in-service tests.

8.128 The management of training foam should be in line with operational foam as set out in this chapter.

Provision of additional water supplies at licensed aerodromes

8.129 Supplementary water supplies, for the expeditious replenishment of rescue and fire fighting vehicles at the scene of an aircraft accident, should be provided.

8.130 The objective of providing additional water supplies at adequate pressure and flow is to ensure rapid replenishment of aerodrome RFFS vehicles. This supports the principle of continuous application of extinguishing media to maintain survivable conditions at the scene of an aircraft accident for far longer than that provided for by the minimum amounts of water set out in table 8.3.

8.131 Additional water to replenish vehicles may be required in as little as five minutes after an accident; therefore, aerodrome operators should conduct an analysis to determine the extent to which it, and its associated storage and delivery facilities, should be provided.

8.132 The aerodrome should consult closely with the local authority fire and rescue service when conducting this analysis, and the following factors are among those items which should be considered (but not limited to):

1. Sizes and types of aircraft using the aerodrome
2. The capacities and discharge rates of aerodrome fire vehicles
3. The provision of strategically located hydrants
4. The provision of strategically located static water supplies
5. Utilisation of existing natural water supplies
6. Vehicle response times
7. Historical data of water used during aircraft accidents
8. The need and availability of supplementary pumping capacity

9. The provision of additional vehicle-borne supplies
10. The level of support provided by local authority emergency services
11. The pre-determined response of local authority emergency services
12. Fixed pumps where these may provide a rapid and less resource intensive method of replenishment.
13. Additional water supplies adjacent to airport fire service training areas
14. Overhead static water supplies
15. Foam concentrate compatibility

Fire station(s)

8.133 All rescue and fire fighting vehicles should normally be housed in a fire station.

8.134 Satellite fire stations should be provided whenever the response time cannot be achieved from a single fire station.

8.135 The fire station should be located so that the access for rescue and fire fighting vehicles into the runway area is direct and clear, requiring a minimum number of turns.

8.136 Guidance on the design and construction of fire stations can be found in ICAO Airport Services Manual (Doc.9137), Part 1 - Rescue and Fire Fighting

Communications and alerting systems

8.137 A discrete communication system should be provided linking a fire station with the control tower, any other fire station on the aerodrome and the rescue and fire fighting vehicles.

8.138 An alerting system for rescue and firefighting personnel, capable of being operated from that station, should be provided at a fire station, any other fire station on the aerodrome and the aerodrome control tower.

8.139 Communications equipment provided should ensure effective two-way communication between parties with an effective range that ensures reception within all areas that the RFFS may be required to operate in.

8.140 Radio facilities to enable the RFFS to communicate with responding Local Authority Fire Services shall be provided.

8.141 A method of monitoring the movement area for the purpose of alerting and deploying the RFFS without delay shall be provided.

8.142 Equipment to provide effective communication between vehicle drivers and foam monitor operators shall be provided.

8.143 Radio equipment to enable fire officers to maintain communications when not in their vehicles shall be provided.

8.144 Radio telecommunications (RTF) equipment shall be provided to enable the airport fire officer(s) to communicate with the aircraft flight deck. An aeronautical radio frequency, 121.605 MHz, is to be used for this purpose.

8.145 All RTF communications on this frequency shall be recorded on suitable equipment that has the capability to identify the time the communication took place.

8.146 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.

8.147 The CAA and Air Accident Investigation Branch (AAIB) may require access to the recordings.

8.148 To use 121.605 MHz, the RFFS must obtain prior approval to install and operate radio equipment from the relevant licensing authority.

8.149 The use of 121.605 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

Difficult environs, the 1000 m area and access roads

8.150 Where an aerodrome is located close to water/swampy areas, or difficult terrain, and where a significant portion of approach or departure operations takes place over these areas, specialist rescue services and firefighting equipment appropriate to the hazard and risk shall be available

8.151 Emergency access roads should be provided on an aerodrome where terrain conditions permit their construction, so as to facilitate achieving minimum response times.

8.152 Particular attention should be given to the provision of ready access to approach areas up to 1000 m from the threshold, or at least within the aerodrome boundary.

8.153 Where a fence is provided, the need for convenient access to outside areas should be taken into account.

8.154 An assessment of the approach and departure areas within 1000 m of the runway threshold should be carried out to determine the options available for

intervention. In considering the need for any specialist rescue and access routes, the following should be considered:

1. The environment of the risk area, in particular the topography and composition of the surface
2. The physical hazards and associated risks that exist within the area
3. The options for access and for rescue and firefighting purposes
4. Changes to the response area, e.g. tidal, seasonal
5. The hazards, risks, and control measures of the options for rescue
6. The use of external services
7. An analysis of the advantages and disadvantages of the options
8. Policies and procedures to define and implement standards
9. Competence standards to match the above
10. Monitoring and review of the capability

8.155 Aerodrome operators should ensure the development of special procedures and availability of equipment to deal with accidents that may occur in these areas. These facilities need not be located on, or provided by, the aerodrome if they can be made available by off-aerodrome agencies as detailed in the aerodrome emergency plan.

8.156 Where RFFS vehicles respond to incidents using the public highway, an assessment of the implications of such a response should be carried out. The following should be considered;

1. The legal requirements for vehicles and drivers
2. That suitable policies and procedures are in place
3. Competence and training requirements for drivers
4. Pre-planning of routes for suitability
5. The monitoring and review of such response

8.157 Emergency access roads should be capable of supporting the heaviest vehicles that will use them and be usable in all weather conditions.

8.158 Roads within 90m of a runway should be surfaced to prevent surface erosion and the transfer of debris to the runway.

8.159 Sufficient vertical clearance should be provided from overhead obstructions for the largest vehicles.

8.160 When the surface of the road is indistinguishable from the surrounding area, or in areas where snow may obscure the location of the roads, edge markers should be placed at intervals of about 10 m.

8.161 With regard to access, aerodrome operators should consider the following:

1. Providing direct access to the operational runway(s);
2. Designating access routes to the response area;
3. The maintenance of roads and access routes;
4. Eliminating the possibility of any vehicle blocking the progress of responding emergency vehicles;
5. Taking account of the gross weight and maximum dimensions of the RFFS vehicle(s) expected to use them;
6. That roads are capable of being traversed in all conditions;
7. Exit gates or frangible sections in the security fence;
8. Exit 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 or conditions of low visibility;
9. Any delethalisation requirements;
10. Providing sufficient vertical clearance from overhead obstructions for the largest vehicle.
11. Runway incursion prevention measures

Maintaining the response capability in low visibility conditions

8.162 To meet the operational objective as nearly as possible in less than optimum conditions of visibility, especially during low visibility operations, suitable guidance, equipment and/or procedures for rescue and firefighting services should be provided.

8.163 RFFS vehicles should approach any aircraft accident by the quickest route commensurate with safety, although this might not necessarily be the shortest distance to the scene.

8.164 Traversing through unimproved areas can take longer than travelling a greater distance on paved surfaces, therefore a thorough knowledge by

RFFS personnel of the topography of the aerodrome and its immediate vicinity is fundamental.

8.165 The use of grid maps and careful selection of routes is essential for success in meeting the response objective.

8.166 RFFS vehicles should be equipped with an airfield chart clearly showing all taxiways, runways, holding points and vehicle routes marked with their appropriate designation.

8.167 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.

8.168 Consideration should be given to the provision and use of technical equipment, e.g. surface movement radar, infrared vision systems, taxiway centreline lighting, vehicle positioning equipment and other navigation aids that could enhance RFFS response to the location of an accident site in low visibility conditions.

8.169 Once low visibility operations have been initiated it may be necessary to restrict 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.

8.170 RFFS and associated external emergency response personnel should be made aware of the existence of any areas that may from time to time become impassable because of weather or other conditions, and of the location of obstacles both permanent and temporary.

8.171 Operational procedures should be developed through which ATC stop or divert all aircraft and non-essential traffic that conflicts with responding RFFS vehicles.

8.172 RFFS personnel should continuously monitor the minimum visibility operating conditions in order to maintain response capability under such conditions. Further guidance can be found in CAP 168, chapter 2 low visibility operations.

8.173 At aerodromes where aircraft operations may continue in very low visibility conditions, a movement area search plan should be developed and practiced in coordination with ATC, the purpose of which is to identify an incident site when it cannot be identified in any other way.

Work in Progress (WIP)

8.174 The extent to which WIP is likely to affect the response capability or operational performance of the RFFS and other emergency services should be considered during the work planning process and CAP791 process where applicable.

8.175 Where it is considered, the proposed works might have an impact, suitable mitigations should be developed and, if necessary, adjustments to the emergency plan should be made and promulgated, prior to the commencement of work.

8.176 Data from incidents attended by the RFFS can be useful in a several ways. They can be used to inform task and resource analysis, procurement, response policies and procedures.

8.177 Whilst it is at the discretion of aerodrome operators how and what data they record, it is suggested that the example below are key fields for a template design.

Type of incident	Time incident closed
Type of aircraft	No. of PAX on board
Location of incident	No. of PAX evacuated
Time of call	No. of PAX rescued
Called by	Slides deployed
Time in attendance	Slides used
Size of fire	By how many pax
Firefighting agents used	Was PEMS used (passenger evacuation management system)
Quantity of agents used; initial extinguishment and prolonged control	Hazardous materials involved What How much
Time of burn before agent applied	Source of ignition
Category reduced	Category restored
RFFS vehicles at tending	Firefighting equipment used
FRS vehicles attending	Rescue equipment used
No. Of RFFS personnel	Damage to aircraft
Actions by others, FFG. or rescue	Area of damage sq m

Fatalities	Time to evacuate
Casualties	Follow up actions date closed
RFFS vehicle accidents/incidents	

Inspections and audits of the RFFS by CAA aerodrome inspectors

8.178 The objective of audits and inspections by the CAA is to establish and ensure continued regulatory compliance and the ability of the RFFS to achieve the principal and operational objectives.

8.179 The CAA will perform an initial inspection of an aerodrome's RFFS unit prior to, and then after the issue of an aerodrome licence. Once the licence has been issued, the CAA will undertake regular inspections/audits. This applies to all categories of aerodromes and heliports.

8.180 The CAA Inspectors will seek:

1. Evidence that the aerodrome operator has made a full assessment of the operational requirements;
2. Evidence that the necessary procedures and practices have been documented and are in place for an effective response to aircraft accidents or incidents;
3. Documentary evidence relating to the training, and assessment of competence, of personnel employed in the RFFS;
4. Records of training received, and assessments made, including those for training exercises conducted with other emergency services;
5. Records of inspections, test and maintenance of all vehicles and equipment.

8.181 The Aerodrome Operator may be required to demonstrate the effectiveness of any of the objectives contained within this chapter. This may include any element, or all elements, of the aerodrome emergency plan.

Surface Level Heliports

The minimum RFFS requirements, which are specifically applicable to surface level heliports.

8.182 A heliport is defined as 'an area intended to be used wholly or in part for the arrival, departure and surface movement of helicopters.

8.183 For areas for the exclusive use of helicopters at aerodromes primarily for the use of aeroplanes, distribution of extinguishing agents, response time, rescue equipment and personnel have not been considered in this section.

8.184 The principal objective of a rescue and firefighting service is to save lives in the event of a helicopter accident or incident. This must always assume the possibility of and need for extinguishing a fire which may:

1. Exist at the time a helicopter is touching down, lifting off, taxying, parked, etc;
2. Occur immediately following a helicopter accident or incident; or
3. Occur at any time during rescue operations.

8.185 For this reason, the provision of adequate means of dealing promptly with an accident or incident occurring at, or in the immediate vicinity of, a heliport assumes primary importance because it is within this area that there are the greatest opportunities to save lives.

8.186 The most important factors influencing effective rescue in a survivable helicopter accident are; the training received, the effectiveness of the firefighting equipment and the speed with which personnel and equipment designated for rescue and firefighting purposes can be put into use.

8.187 Guidance material on rescue and firefighting services for heliports can be found in ICAO Airport Services manual (Doc 9137), Part 1 – Rescue and Firefighting ICAO Heliport manual (Doc 9261).

8.188 The scale and standards of RFFS to be provided at licensed surface level heliports in the United Kingdom accord with the ICAO Standards and Recommended Practices (SARPs).

Minimum scale of services to be provided

8.189 The heliport operator should provide, and staff, an effective RFFS capability that can respond to a helicopter accident/incident pending the arrival of external emergency services. Information concerning the level of protection

provided at a heliport for helicopter rescue and firefighting purposes shall be made available in the UK AIP.

8.190 The level of protection normally available at a heliport should be expressed in terms of the category of the rescue and firefighting service as described in Table 8.A1 below, and in accordance with the types and amounts of extinguishing agents normally available at the heliport.

8.191 The provisions shall be available whenever flights required to use a licensed heliport are taking place. They shall be maintained for at least 15 minutes after the time of departure of any aircraft requiring the use of a licensed heliport or until the aircraft has reached its destination, whichever is the shorter.

8.192 Changes in the level of protection normally available at a heliport for rescue and firefighting shall be notified to the appropriate air traffic services units and aeronautical information units to enable those units to provide the necessary information to arriving and departing aircraft. When such a change has been corrected, the above units shall be advised accordingly. Notification should be by radio and NOTAM.

8.193 Changes in the level of protection from that are normally available at the heliport could result from, but may not be limited to, a change in the availability of extinguishing agent or equipment used to deliver agents, or of personnel used to operate the equipment.

8.194 A change should be expressed in terms of the new category of the rescue and firefighting service available at the heliport.

Level of protection

8.195 The level of protection to be provided for rescue and firefighting shall be based on the overall length of the longest helicopter normally using the heliport and in accordance with the heliport firefighting category determined from table 8A.1.

8.196 The level of protection to be provided at a heliport (heliport RFFS category) shall be determined from table 8A.1 appropriate to the overall length of the longest helicopter using the heliport irrespective of its frequency of operations. However, during anticipated periods of operations by smaller helicopters, the heliport firefighting category may be reduced to that of the highest category of helicopter planned to use the heliport at that time.

Category	Maximum Fuselage Length	Maximum Fuselage Width
H0	Up to but not including 8m	1.5m
H1	From 8m up to but not including 12m	2m
H2	From 12m up to but not including 16m	2.5m
H3	From 16m up to but not including 20m	3m

Table 8A.1 Heliport Fire Fighting Category

Note: The relevant dimensions of commonly used helicopters can be found in ICAO Heliport Manual (Doc 9261

8.197 To determine the appropriate heliport firefighting category the higher category of fuselage length or fuselage width should be applied. See Initial emergency response (IER) requirements for RFFS category special aerodromes - aeroplanes and helicopters for guidance on HS (Special) category helicopters.

8.198 For a helicopter take-off and landing area located on the manoeuvring area of an aerodrome licensed for use by fixed wing aircraft, the RFFS at the aerodrome will be acceptable for helicopter operations provided that the amounts are at least equal to those required for H0, H1, H2 or H3 operations, as appropriate and as shown in table 8A.2, and that the response time can be achieved.

Extinguishing agents

8.199 Principal and complementary agents shall be provided at a surface level heliport, as specified in table 8A.2.

8.200 Principal agents provide a level of post-fire security i.e. for a period of several minutes or longer. Complementary agents have rapid-fire suppression capability but provide control only during application and for a short period thereafter.

8.201 Hose line(s) of sufficient length(s) appropriate to dealing with fires involving the sizes and types of aircraft normally using the heliport, and which include a hand-controlled foam-making branch, shall be provided.

8.202 The discharge rate of complementary agents should be selected for optimum effectiveness of the agent used.

8.203 Complementary Fire Fighting Agents shall comply with the appropriate specifications of the International Organisation for Standardisation (ISO).

8.204 Dry chemical powder and gaseous agents are normally considered more efficient than carbon dioxide for aircraft rescue and firefighting operations.

8.205 Where the main complementary agent is a dry chemical powder, a quantity of gaseous agent or CO2 shall be provided for use on small or hidden fires. The minimum extinguisher size is 5 kg for major and 2 kg for smaller vehicles.

8.206 Where the main complementary agent is gaseous agent or CO2, there shall be a minimum 9 kg of dry powder provided to assist in dealing with a running fuel fire.

8.207 A 200% reserve of foam concentrate and 100% of complementary agents shall be available at the heliport.

8.208 At a surface level heliport up to 100% of the water may be substituted with complementary agent.

8.209 For the purpose of substitution, the following equivalents should be used;

1. 1 kg of gaseous agent or dry powder = 0.66 litres of water for the production of foam meeting performance level B.
2. 2 kg of CO2 = 0.66 litres of water for the production of foam meeting performance level B.

Note: Where a heliport has substituted up to 100% of the water with complementary agent, it is recommended that the reserve supply of complementary agent held is increased to 200%

8.210 If a ‘high performance’ dry powder is used it may be permissible to reduce the minimum amount provided, see para 8.97 - 8.99.

	Foam meeting performance level B		Foam meeting performance level C		Complementary agents	
Category	Water (L)	Discharge rate foam solution/min (L)	Water (L)	Discharge rate foam solution/min (L)	Dry chemical powder (kg)	Gaseous media (kg)
H0	500	250	330	165	23	9
H1	800	400	540	270	23	9
H2	1200	600	800	400	45	18
H3	1600	800	1100	550	90	36

Table 8A.2 Minimum usable amounts of principal fire extinguishing agents required for surface level heliports

Response time

8.211 Response time is considered to be the time between the initial call to the rescue and firefighting service and the time when the first responding vehicle(s) is (are) in position to apply foam at a rate of at least 50% of the discharge rate specified in table 8A.2.

8.212 At a surface level heliport, the operational objective of the rescue and firefighting service should be to achieve response times not exceeding two minutes in optimum conditions of visibility and surface conditions.

8.213 The response area is considered as Final Approach and Take-Off area(s) (FATO), designated aiming point(s) and Touchdown and Lift Off area(s) (TLOF), including all areas used for the manoeuvring, rejected take-off, taxiing, air taxiing and parking of helicopters.

8.214 To ensure an effective response as close to the operational objective in less than optimum conditions, the heliport fire service should provide and instigate suitable guidance and/or procedures.

8.215 It is recognised that the two-minute response time may not always be achievable to all areas of a surface level heliport where helicopters may arrive or depart, especially training areas, which may be designated outside the heliport boundary. In these cases, the RFFS should respond as safely as possible.

8.216 In the case of training areas designated outside the heliport boundary, the operator of the helicopter has a duty of care to ensure that the appropriate RFFS requirements and response are provided.

Minimum number of staff designated as RFFS personnel

8.217 Trained personnel shall be designated to respond and operate the RFFS provision whenever flights required to use a licensed heliport are taking place. The minimum number of personnel and level of supervision are defined in table 8A.4.

8.218 Heliport Operators should assess the medical and fitness suitability of all personnel detailed to respond as part of the RFFS.

Heliport RFFS category	Minimum number of personnel	Minimum supervision level
H0	Two	To be determined locally.
H1	Two	To be determined locally.
H2	Three	A competent person to supervise an emergency response throughout the promulgated hours of operation.
H3	Four	A competent person to supervise an emergency response throughout the promulgated hours of operation.

Table 8A.4

Extraneous duties

8.219 No extraneous duty should create conditions likely to compromise individual or crew performance or introduce additional hazards.

8.220 RFFS personnel designated as part of the minimum level for response, and who are engaged on extraneous duties, shall be capable of meeting the response time objective while carrying out those duties.

Vehicles and ancillary equipment

8.221 A vehicle fit for purpose shall be provided and be readily available for immediate use to carry personnel and RFFS equipment to the scene of the incident.

8.222 Non-self-propelled appliances (trailers) are permissible, but they must be connected to a suitable towing vehicle during helicopter movements.

8.223 Where soft or other difficult terrain is immediately adjacent to, or comprises part of the response area, a suitable all-wheel drive vehicle will be required to ensure an effective response. In other situations, the vehicle must be suitable for the terrain at the specific site.

8.224 For night operations, sufficient lighting equipment for adequate illumination of an incident must be provided. This equipment may be carried on the vehicle, or by any other suitable means.

8.225 A method of monitoring the helicopter movement area for the purpose of instantaneously alerting and deploying the facility shall be provided.

8.226 A reliable method of summoning assistance from off-heliport local emergency services shall be provided.

8.227 Communications equipment should be provided, which will have a transmitting range effective within the response areas.

8.228 Where a considerable proportion of helicopter movements take place over water areas, the provision of a rescue craft should be considered. The objective should be to recover the maximum anticipated number of occupants of the largest helicopter in use in the most expeditious manner.

8.229 Rescue equipment commensurate with the level of aircraft operations should be provided. (See table 8A.5.)

8.230 All responding rescue and firefighting personnel shall be provided with personal protective equipment to enable them to perform their duties in an effective manner.

8.231 Account should be taken of the PUWER and the Personal Protective Equipment at Work Regulations which require equipment is:

1. Suitable for the intended use;
2. Safe for use, maintained in a safe condition and, in certain circumstances, inspected to ensure this remains the case;
3. Used only by people who have received adequate information, instruction, and training; and
4. Accompanied by suitable safety measures, e.g. protective devices, markings, warnings.

8.232 Records of all tests and inspections shall be maintained by the Heliport Operator for a period of five years. The records should include details of

consequential action where an inspection has revealed a defect or deficiency.

Equipment resource RFFS categories H1, H2 & H3	
Axe, Aircraft non-wedging Saw, General purpose Crowbar Side cutting pliers Set screwdrivers Fire-resistant blanket Ladder/steps (appropriate to helicopter size) General purpose line	Bolt cropper Hacksaw (with spare blades) Harness knife (with sheath) Tin snips Adjustable wrench Hook, grab or salving Powered cutting tool (H3 only)

Table 8A.5

Medical provisions

8.233 Minimum quantities of medical equipment resources appropriate to the sizes and types of aircraft should be provided. Advice can be found on the Health and Safety Executive (HSE) website.

Training

8.234 Heliport Operators shall ensure that participating personnel are trained and competent in the operation of the RFFS equipment provided at the heliport. The training should be competence-based.

8.235 The Heliport Operators shall nominate a competent person(s) to conduct training.

8.236 Personnel shall receive training prior to initial participation and periodically thereafter. The Heliport Operator or the nominated competent person will determine periodicity. Examples of areas where training should be provided are detailed in table 8A.6.

1	Heliport Operator's safety policies
2	Hazards arising from aircraft operation and safety-related
3	Triangle of fire
4	Extinguishing agents - use and methods of application
5	Fire appliance operations, driving training for emergency
6	Ancillary equipment, selection, storage and handling, use, inspection and testing, maintenance and record-keeping
7	Personal protective equipment
8	Helicopter construction
9	Helicopter familiarisation
10	Response area topography
11	Fire and rescue procedures
12	Helicopter tactics and techniques – appliance positioning, external/internal fires, access, forcible entry, assistance with evacuation
13	Initial emergency medical aid and casualty handling
14	Personal training record(s)
15	Emergency plans
16	Preservation of evidence

Table 8A6

8.237 Assessment of the competency of the person(s) determining, evaluating, and conducting training shall be the responsibility of the Heliport Operator.

8.238 Note; Principles and procedures on training, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981). Further guidance on the training of personnel, rescue equipment for difficult environments and other facilities and services for rescue and firefighting is given in Attachment A, Section 18, and in the Airport Services Manual (Doc 9137), Part 1.

Emergency planning/emergency orders

8.239 Emergency orders, which form part of the heliport manual, shall include arrangements for alerting the facility, for the immediate notification of other key heliport personnel and for summoning externally based emergency services.

8.240 The orders shall detail procedures for anticipated emergency situations, including accidents/incidents which occur in the approach and departure

areas. The areas within which a response will be made shall be shown in the heliport manual.

8.241 Off-heliport emergency services should be given the opportunity to familiarise themselves with the emergency procedures as well as the topography of the heliport. Rescue and Firefighting Category I and II Aerodromes.

Category I and II aerodromes rescue and firefighting service (RFFS) requirements

Introduction

8.242 The minimum RFFS requirements, which are applicable to aerodromes where the category is I or II are detailed in this section.

8.243 This section has been compiled in such a way as to assist an aerodrome operator in demonstrating compliance with the requirements at the levels stated.

Minimum scale of services to be provided

8.244 The aerodrome operator shall provide and staff an effective RFFS capability that can respond to an aircraft accident/incident pending the arrival of external emergency services.

8.245 The RFFS should be available whenever flights required to use a licensed aerodrome are taking place. It should be maintained for at least 15 minutes after the time of departure of any aircraft requiring the use of a licensed aerodrome or until the aircraft has reached its destination, whichever is the shorter.

8.246 Changes in the level of protection normally available at an aerodrome for rescue and firefighting shall be notified to the appropriate air traffic services units and aeronautical information units to enable those units to provide the necessary information to arriving and departing aircraft. When such a change has been corrected, the above units shall be advised accordingly. Notification should be by radio and NOTAM.

8.247 A change should be expressed in terms of the new category of the rescue and firefighting service available at the aerodrome.

8.248 Aerodrome operators should develop contingency plans to limit the need for changes to the promulgated level of services. This may involve, for example, a preventative maintenance plan to ensure the mechanical efficiency of equipment and vehicles, and arrangements to cover unplanned leave and absence of the minimum level of RFF personnel including supervisory level.

Level of protection

8.249 The level of protection to be provided shall be based on the overall length of the longest aeroplane using the aerodrome.

8.250 The level of protection to be provided at an aerodrome shall be determined from table 8B.1 appropriate to the overall length of the longest aeroplane using the aerodrome irrespective of its frequency of operations.

8.251 During anticipated periods of operations by smaller aeroplanes, the category may be reduced to that of the highest category of aeroplane planned to use the aerodrome at that time.

Aerodrome category (RFF)	Aircraft overall length		
I		Up to but not including	9 m
II	From 9 m	Up to but not including	12 m

Table 8B.1 RFF category

Remission

8.252 Remission enables aerodromes to provide RFFS facilities to one category below that determined by the size of the largest aeroplane.

8.253 Where the number of movements of the aeroplanes in the highest category normally using the aerodrome is less than 700 in the busiest consecutive three months, the level of protection provided shall not be less than one category below the determined category.

8.254 Aerodromes currently promulgating RFFS Category 1 or 2 may apply remission on only one category higher than their promulgated category.

Extinguishing agents

8.255 Principal and complementary agents shall be provided as specified in tables 8B.2 and 8B.3. Principal agents provide a level of post-fire security i.e. for a period of several minutes or longer. Complementary agents have rapid fire suppression capability but provide control only during application and for a short period thereafter.

Aerodrome category (RFFS)	Foam meeting performance level B			Discharge rate foam solution (litres/minute)
	Water (litres)	Foam concentrate (litres)		
		At 3%	At 6%	
I	230	7	14	230
II	670	20	40	550
Aerodrome category (RFFS)	**Foam meeting performance level C**			**Discharge rate foam solution (litres/minute)**
	Water (litres)	**Foam concentrate (litres)**		
		At 3%	**At 6%**	
I	155	5	10	155
II	450	14	27	370

Table 8B.2 Min quantities of principal fire extinguishing agents required

8.256 Hose line(s) of sufficient length(s) appropriate to dealing with fires involving the sizes and types of aircraft normally using the aerodrome, and which include a hand-controlled foam-making branch, shall be provided.

Aerodrome category (RFFS)	Complementary agent (Kg)		
	Dry chemical powder	or gaseous agent	or carbon dioxide CO_2
	Or a combination (in proportion)		
I	45	45	90
II	90	90	180

Table 8B.3 Min quantities of complementary fire extinguishing agents required

8.257 Complementary firefighting agents shall comply with the appropriate specifications of the ISO.

8.258 Dry chemical powder and gaseous agents are normally considered more efficient than carbon dioxide for aircraft rescue and firefighting operations.

8.259 Where the main complementary agent is a dry chemical powder, a quantity of gaseous agent or CO2 shall be provided for use on small or hidden fires. A minimum extinguisher size is 5 kg for major and 2 kg for smaller vehicles.

8.260 Where the main complementary agent is gaseous agent or CO2, there shall be a minimum 9 kg of dry powder provided to assist in dealing with a running fuel fire.

8.261 The discharge rate of complementary agents should be selected for optimum effectiveness of the agent.

8.262 A 200% reserve of foam concentrate and 100% of complementary agents shall be available at the aerodrome.

8.263 At aerodrome categories 1 and 2 up to 100% of the water may be substituted by complementary agent.

8.264 For the purpose of substitution, the following equivalents should be applied:

1. 1 kg of gaseous agent or dry powder = 0.66 litres of water for the production of foam meeting performance level B.
2. 2 kg of CO2 = 0.66 litres of water for the production of foam meeting performance level B.

Note: where an aerodrome has substituted up to 100% of the water with complementary agent, it is recommended that the reserve supply of complementary agent held is increased to 200%

8.265 If a 'high performance' dry powder is used it may be permissible to reduce the minimum amount provided. See para 8.97 - 8.99.

Response time

8.266 The operational objective of the RFFS should be to achieve a response time not exceeding three minutes to any part of the manoeuvring area in optimum visibility and surface conditions.

8.267 Response time is considered to be the time between the initial call to the rescue and firefighting service and the time when the first responding vehicle(s) is (are) in position to effect firefighting and rescue operations.

8.268 Any other vehicles required to deliver the amounts of extinguishing agents specified in table 8B.2 should arrive no more than one minute after the first responding vehicle(s) so as to provide continuous agent applications.

Minimum number of staff designated as RFFS personnel

8.269 Trained personnel shall be designated to respond and operate the RFFS provision whenever flights required to use a licensed aerodrome are taking place. The minimum number of personnel and level of supervision are defined in table 8B.4

RFFS category	Minimum number of personnel	Minimum supervision level
I	Two	To be determined locally.
II	Three	A competent person to supervise an emergency response throughout the promulgated hours of operation.

Table 8B.4

8.270 Aerodrome operators should assess the medical and fitness suitability of all personnel detailed to respond as part of the RFFS.

Extraneous duties

8.271 No extraneous duty should create conditions likely to compromise individual or crew performance or introduce additional hazards.

8.272 RFFS personnel designated as part of the minimum level for response, and who are engaged on extraneous duties, shall be capable of meeting the response time objective while carrying out those duties.

Vehicles and ancillary equipment

8.273 A vehicle fit for purpose shall be provided and be readily available for immediate use to carry personnel and RFFS equipment to the scene of the incident.

8.274 Non-self-propelled appliances (trailers) are permissible, but they must be connected to a suitable towing vehicle during aircraft movements.

8.275 Where soft or other difficult terrain is immediately adjacent to, or comprises part of the response area, a suitable all-wheel drive vehicle will be required to ensure an effective response. In other situations, the vehicle must be suitable for the terrain at the specific site.

8.276 For night operations, sufficient lighting equipment for adequate illumination of an incident must be provided. This equipment may be carried on the vehicle, or by any other suitable means.

8.277 A minimum quantity of ancillary equipment resource appropriate to the sizes and types of aircraft should be provided. table 8B.5 provides a generic list of equipment for Categories 1 and 2 aerodromes that has been identified as acceptable.

8.278 The Aerodrome operator may carry out an assessment and provide alternative equipment, which can facilitate effective access to the types of aircraft operating or likely to operate at the aerodrome.

8.279 A method of monitoring the aircraft movement area for the purpose of instantaneously alerting and deploying the facility shall be provided.

8.280 A reliable method of summoning assistance from off-aerodrome local emergency services shall be provided.

8.281 Communications equipment should be provided, which will have a transmitting range effective within the response areas.

8.282 All responding rescue and firefighting personnel shall be provided with personal protective equipment to enable them to perform their duties in an effective manner.

8.283 Account should be taken of the Provision and Use of Work Equipment Regulations (PUWER) and the Personal Protective Equipment at Work Regulations which require that equipment is:

1. Suitable for the intended use;
2. Safe for use, maintained in a safe condition and, in certain circumstances, inspected to ensure this remains the case;
3. Used only by people who have received adequate information, instruction, and training; and
4. Accompanied by suitable safety measures, e.g. protective devices, markings, warnings.

8.284 Records of all tests and inspections shall be maintained by the aerodrome operator for a period of five years. The records should include details of consequential action where an inspection has revealed a defect or deficiency.

Equipment resources – Categories I and II	
Axe, Aircraft non-wedging Saw, General purpose Crowbar Side-cutting pliers Set screwdrivers Fire-resistant blanket Ladder/steps (appropriate to aircraft size) General purpose line	Bolt cropper Hacksaw (with spare blades) Harness knife (with sheath) Tin snips Adjustable wrench Hook, grab or salving Breathing masks (filter)

Table 8B.5

Medical provisions

8.285 Minimum quantities of medical equipment resources appropriate to the sizes and types of aircraft should be provided. Advice can be found on the Health and Safety Executive (HSE) website

Training

8.286 Aerodrome operators shall ensure that participating personnel are trained and competent in the operation of the RFFS equipment provided at the aerodrome. The training should be competence-based.

8.287 The aerodrome operator shall nominate a competent person(s) to conduct training.

8.288 Personnel shall receive training prior to initial participation and periodically thereafter.

8.289 The aerodrome operator or the nominated competent person will determine periodicity. Examples of areas where training should be provided are detailed in table 8B.6.

8.290 Assessment of the competency of the person(s) determining, evaluating, and conducting training shall be the responsibility of the aerodrome operator.

Note - Principles and procedures on training, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981). Further guidance on the training of rescue and firefighting is given in Attachment A, Section 18, and in the Airport Services Manual (Doc 9137).

1	Aerodrome Operator's safety policies
2	Hazards arising from aircraft operation, dangerous goods and safety-related procedures

3	Triangle of fire
4	Extinguishing agents - use and methods of application
5	Fire appliance operations, driving training for emergency response
6	Use of equipment, selection, storage and handling, inspection and testing, maintenance and record-keeping
7	RFFS personnel safety and personal protective equipment
8	Aircraft construction and evacuation assistance
9	Aircraft familiarisation
10	Aerodrome familiarisation and topography
11	Firefighting and rescue operations
12	Fixed wing and rotary aircraft (tactics and techniques) – appliance positioning, external/internal fires, access, forcible entry, assistance with evacuation
13	Emergency first aid and casualty handling
14	Personal training record(s)
15	Emergency plans
16	Emergency communications systems
17	Preservation of evidence

Table 8B.6 Example training competence (initial and ongoing)

Emergency planning/emergency orders

8.291 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.

8.292 The orders shall detail procedures for anticipated emergencies including accidents/incidents which occur up to 1000 metres from the runway threshold.

8.293 The areas within which a response will be made shall be shown in the aerodrome manual.

8.294 Off-aerodrome emergency services should be given the opportunity to familiarise themselves with the emergency procedures as well as the topography of the aerodrome.

Inspections of the RFFS by CAA aerodrome inspectors

8.295 The RFFS should operate as an effective unit.

8.296 The shall be required by the CAA to demonstrate that effectiveness from time to time.

8.297 The CAA inspectors may also require review documentary evidence relating to the training of personnel employed in the RFFS e.g. certificates of competence, records of training and assessment including those for training exercises conducted with other emergency services.

8.298 Records of inspections, test and maintenance of vehicles and equipment provided for the use of the RFFS should be available for audit.

Initial Emergency Response (IER) RFFS Category Special Aerodromes

Aerodrome Emergency Procedures

8.299 A responsible person should be designated to promulgate clear and concise emergency procedures.

8.300 Emergency orders, which form part of the aerodrome manual, shall include arrangements for alerting the IER 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 the aerodrome boundary.

8.301 Off-aerodrome emergency services should be given the opportunity to familiarise themselves with the emergency procedures and the topography of the aerodrome.

8.302 The IER should operate as an effective unit. The aerodrome operator shall be required by the CAA to demonstrate that effectiveness.

IER personnel and training

8.303 A minimum number of competent IER personnel shall be detailed to operate the IER equipment and should be available for immediate response during flying operations. A competent person should conduct an assessment of the hazards and associated risks following which IER personnel should be provided with sufficient training to carry out their role.

8.304 IER Personnel should be competent in at least the following:

1. The aerodrome emergency procedures;
2. The aerodrome topography;
3. Achieving a response as expediently as possible;
4. Application of the necessary procedures to deal with the types of emergencies appropriate to the operation, hazards, and risks;
5. The selection, use, and maintenance of equipment;
6. The application of the extinguishing agents;
7. Initial emergency medical aid (IEMA) and casualty handling.

8. Records of all training should be maintained.

IER vehicle and equipment

8.305 A vehicle that is mechanically reliable, fit for purpose, and which is capable of accommodating IER personnel should be provided.

8.306 The vehicle, including any towed equipment, should be capable of traversing the terrain likely to be encountered in response to any incident; all-wheel drive may be necessary.

8.307 Specified equipment should be carried either on the vehicle or on a suitable trailer connected to the vehicle.

8.308 Radio communications equipment should be provided and should have a range that will ensure effectiveness within the expected response area.

8.309 A minimum quantity of ancillary equipment appropriate to the sizes and types of aircraft should be provided.

8.310 Account should be taken of the PUWER and the Personal Protective Equipment at Work Regulations which require that equipment is:

1. Suitable for the intended use;
2. Safe for use, maintained in a safe condition and, in certain circumstances, inspected to ensure this remains the case;
3. Used only by people who have received adequate information, instruction, and training; and
4. Accompanied by suitable safety measures, e.g., protective devices, markings, warnings.

Firefighting agents

8.311 The following tables identify the quantities of firefighting agent that are recommended. The agent should be available for immediate discharge from the vehicle/pressure unit.

Minimum usable amounts of extinguishing agents				
Foam meeting performance level B			**Complementary agent**	
Water (litres)	Foam concentrate (litres/min)	Discharge rate of foam solution (litres/min)	Dry powder or gaseous agents (kg)	or CO_2 (kg)
90	6 @ 6% 3 @ 3%	60	18	36

Foam meeting performance level C			Complementary Agent	
Water (litres)	Foam concentrate (litres/min)	Discharge rate of foam solution (litres/min)	Dry powder or gaseous agents (kg)	or CO_2 (kg)
60	4 @ 6% 2 @ 3%	40	18	36

Table 8C.1

Minimum usable amounts of extinguishing agents compressed air foam system					
Foam meeting performance level B				**Complementary agent**	
Water (litres)	Foam concentrate		Discharge rate of foam solution (litres/min)	Dry powder or gaseous agents (kg)	or CO_2 (kg)
	Induction rate	Expansion ratio			
60	0.2–0.4%	8–9:1	60	18	36
Foam meeting performance level C				**Complementary agent**	
Water (litres)	Foam concentrate		Discharge rate of foam solution (litres/min)	Dry powder or gaseous agents (kg)	or CO_2 (kg)
	Induction rate	Expansion ratio			
40	0.2–0.4%	8–9:1	40	18	36

Table 8C.2

8.312 Dry powders and gaseous agents are normally considered more efficient than CO_2 for aircraft rescue and firefighting operations. When selecting dry powder for use with foam, care must be exercised to ensure compatibility.

8.313 It is acceptable to replace all or part of the amount of water for foam production by complementary agents. For the purpose of agent substitution, the following equivalents should be used:

8.314 1 kg of complementary = 0.66 L water for production of a foam meeting performance level B

CHAPTER 9

Emergency Planning

Introduction

9.1 The guidance contained in this chapter is developed from UK best practice, the requirements of Civil Contingency legislation and ICAO Standards and Recommended Practices (SARPs). Further information is contained in the ICAO Airport Services manual, Part 7, Airport Emergency Planning (Doc 9137–AN/898).

9.2 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 category I responders.

9.3 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.

9.4 Even though the aerodrome operator will have demonstrated to the CAA inspectors 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.

9.5 The aerodrome operator 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.

9.6 An aerodrome may generate hazards in addition to those that relate directly to the operation of aircraft, e.g. the handling of bulk fuel storage. aerodrome operators should make plans to deal with emergencies that arise from these 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.

9.7 Where an aerodrome accepts flights involving the carriage of dangerous goods, the RFFS should develop appropriate policies and procedures to deal with types of dangerous goods likely to be encountered in an incident and ensure that RFFS personnel are adequately trained and protected.

9.8 The terminology used in this chapter is drawn from ICAO SARPs and the different arrangements that exist within the devolved administrations within the UK. As such there may be local differences of the terms used. It is important that whatever term are used locally they are set out in the plans and understood by all stakeholders.

Civil Contingencies Act 2004

9.9 The Civil Contingencies Act 2004 and supporting regulations and statutory guidance establish a clear set of roles and responsibilities for those involved in emergency preparation and response at the local level. The Act divides local Responders into two categories, imposing a different set of duties on each.

9.10 Category I organisations are at the core of the response to most emergencies (e.g. emergency services, local authorities, NHS bodies). Category I responders are subject to the full set of civil protection duties.

9.11 Category II organisations are less likely to be involved in the heart of planning work but will be heavily involved in incidents that affect their sector. Category II responders have a lesser set of duties - co-operating and sharing relevant information with other category I and II responders.

9.12 Aerodrome Operators are included as Category 2 responders in the Civil Contingencies Act 2004, Schedule 1, Part 3, CATEGORY 2 RESPONDERS: GENERAL, Paragraph 26 - An airport operator, within the meaning of section 82(1) of the Airports Act 1986 (c. 31), in Great Britain.

9.13 In 2012, the Cabinet Office published supporting policy in the form of Chapter 2 Co-operation Revision to Emergency Preparedness.

The following statement from that document clarifies the status of Airport Operators as category 2 responders: “Airport operators. Not every LRF area will have an airport within it. And not every airport will be subject to the obligations. Only “relevant airport operators” are covered by the Act.” Relevant airport operators” are defined as those with an annual throughput of at least 50,000 passengers or 10,000 tonnes of freight. During an emergency

affecting an airport, the airport retains control of its operations and has to meet its obligations as prescribed by the regulator. It is crucial that its planning arrangements be understood by the Category 1 responders, and vice versa, and that there be a free flow of information between them. Each airport is likely to represent itself directly in the LRF process, either at the main group or at a relevant sub-group.

Due to the variety of risk profiles at UK aerodromes outside of passenger and freight throughput, it is recommended that Aerodrome Operators are represented on their relevant LRFs to ensure that there is a free flow of information between aerodromes and Category 1 responders.

9.14 The mechanisms for multi-agency co-operation at the local level are generally based on local police areas (with the exception of London) and bring together all the organisations who have a duty to co-operate under the Civil Contingencies Act, along with others who would be involved in the response.

9.15 In England these are Local Resilience Forums (LRF), in Scotland Strategic Co-ordinating Groups (SCG); in Wales the Wales Resilience Forum (WRF) and in Northern Ireland the Civil Contingencies Group (CCG). For this guidance these will be known by the term Local Emergency Management Arrangements (LEMA).

9.16 Regardless of whether a duty exists under the Civil Contingencies Act 2004 or not, aerodrome operators should liaise with their LEMA to ensure that there is appropriate and adequate consideration of the risks and response required to aircraft incidents.

9.17 The arrangements at an aerodrome may include setting up an Emergency Planning Committee. Either there should be a link from the emergency planning arrangements at an aerodrome to the LEMA by direct membership, or representation through a member of the LEMA who has the aerodrome emergency planning included in their terms of reference or responsibilities.

9.18 Detailed guidance regarding emergency planning and the Civil Contingencies legislation can be found on the www.gov.uk website.

Emergency planning objectives

9.19 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 minimise those effects, particularly in respect of saving lives.

Emergency planning arrangements

9.20 The list at table 9.1 is intended to assist an aerodrome operator in choosing those organisations that should be represented on the aerodrome's emergency planning committee. However, the list is not comprehensive, and some aerodromes may need expertise from organisations not shown, while others may find some of the organisations shown to be inappropriate.

Aerodrome RFFS	Local Ambulance Trust
Aerodrome Police	Coastguard and Offshore Rescue
Aerodrome Security	Doctors
Airline Operators	Local Authority Fire and Rescue Service
Customs and Excise	First Aid Organisations
Occupational Medical	Local Hospital Trust
Mechanical Transport	Police
Telecommunications	Press
Works Facilities	Religious Leaders
Environment Agency	

Table 9.1 On and off-aerodrome services from which planning committee members could be selected

9.21 The tasks that the emergency planning arrangements may consider are:

1. Terms of reference of the planning committee
2. Development of an emergency plan and orders
3. Tactics
4. Liaison
5. Co-operative training
6. Exercise planning
7. Post-accident/incident and post-exercise reviews
8. Review and monitoring
9. Recording

9.22 A senior member of the aerodrome management team with the direct support of the Accountable Manager should chair any meetings.(Records of the meetings should be taken and retained and the person accountable for

the emergency planning arrangements, the person shall be identified within the aerodrome manual.

Aerodrome emergency plan

9.23 The aerodrome emergency plan should set out how an emergency situation or incident can be managed in order to minimise 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.

9.24 An aerodrome emergency plan shall be established at an aerodrome, commensurate with the aircraft operations and other activities conducted at the aerodrome.

9.25 The aerodrome emergency plan shall provide for the co-ordination of the actions to be taken in an emergency occurring at an aerodrome or in its vicinity.

9.26 The plan shall co-ordinate the response or participation of all existing agencies which, in the opinion of the appropriate authority, could be of assistance in responding to an emergency.

9.27 The plan should provide for the co-operation and co-ordination with the rescue co-ordination centre, as necessary.

9.28 The aerodrome emergency plan document should include at least the following:

1. The types of emergencies planned for;
2. Agencies involved in the plan;
3. Responsibility and role of each agency, the emergency operations centre, and the command post, for each type of emergency;
4. Information on names and telephone numbers of the offices or people to be contacted in the case of a particular emergency; and
5. A grid of the aerodrome and its immediate vicinity.

9.29 The plan shall observe human factors principles to ensure optimum response by all existing agencies participating in emergency operations. The principles should include:

1. The effects of human performance on the plan, for example workload, capabilities, functions, decision aids, environmental constraints, team versus individual performance;

2. Training effectiveness;
3. Staffing including numbers, skills levels, and organisational structure;
4. Personnel selection;
5. Safety and health aspects, for example hazardous materials, safety systems and protective equipment.

Note 1. Guidance material on Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

Note 2. General principles and procedures on the training of aerodrome personnel, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981).A fixed emergency operations centre and a mobile command post should be available for use during an emergency. The mobile command post may be provided as part of the supporting emergency services response.

9.30 The emergency operations centre should be a part of the aerodrome facilities and should be responsible for the overall co-ordination and general direction of the response to an emergency. However, local arrangements will dictate the exact location and nature of this facility.

9.31 The command post should be a facility capable of being moved rapidly to the site of an emergency, when required, and should undertake the local co-ordination of those agencies responding to the emergency.

9.32 A person should be assigned to assume control of the emergency operations centre and, when appropriate, another person the command post. These would normally be category I responders.

9.33 Adequate communication systems linking the command post and the emergency operations centre with each other and with the participating agencies should be provided in accordance with the plan and consistent with the particular requirements of the aerodrome.

9.34 The plan shall include the ready availability of and co-ordination with appropriate specialist rescue services to be able to respond to emergencies where an aerodrome is located close to water and/or swampy areas and where a significant portion of approach or departure operations takes place over these areas. Further guidance on search and rescue can be found in the document ‘Search and Rescue Framework for the United Kingdom of Great Britain and Northern Ireland’ available on the Maritime and Coastguard Agency website.

9.35 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 emergency planning objectives.

9.36 Emergency instructions should provide details to individuals, or to departments, of the actions required to initiate the emergency plan.

9.37 The aerodrome emergency plan and orders shall include procedures for leading passengers evacuated from aircraft to secure areas away from the scene of an incident.

Emergency orders

9.38 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.

9.39 The aerodrome operator should liaise with local emergency responders and establish responsibilities for incident command, particularly for the scene immediately adjacent to the aircraft. Any agreements should be recorded in the aerodrome manual.

9.40 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 firefighting service, ground handling service providers, security services, aerodrome telephone exchange, police, etc.

9.41 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.

Medical equipment

9.42 The objective is to ensure that sufficient medical services are provided. This objective should have regard to the type and configuration of aircraft, and the facilities should be based on a formal assessment. The assessment should ensure that the available emergency medical services provided are adequate and take into account the largest aircraft using the aerodrome.

9.43 The aerodrome operator shall assess the level of medical supplies to be held on the aerodrome for emergency purposes. The aerodrome operator should seek the advice and co-operation of the local NHS Trust and responding

ambulance services. Consideration should also be given to whether additional supplies should be made available to cater for an accident involving more than one aircraft.

9.44 Additional guidance on the provision of medical equipment and services can be found in the ICAO Airport Services Manual Part 7 Airport Emergency Planning appendix 3 (Airport Medical Services).

9.45 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.

9.46 Portable lighting should be provided for illuminating an accident scene, particularly triage and casualty handling areas.

9.47 Aerodrome Operator should ensure that records appertaining to the medical facilities, covering specification, tests and inspection, and maintenance, are retained and can be made available for CAA inspection if requested. The records should include details of consequential action where an inspection has revealed a defect or deficiency. The records shall be retained for a minimum period of five years.

9.48 Where the journey time for the first local authority ambulance could exceed 15 minutes the provision of an on-site ambulance should be considered, or alternative arrangements agreed with the NHS.

Supporting services, operating companies or agents

9.49 Circumstances at any individual aerodrome may require particular services to be involved in the event of an accident or incident. Appropriate services should be identified within the emergency plan.

9.50 Liaison with the Local Resilience Forum (LRF) should be established to identify appropriate supporting services.

9.51 The roles of supporting services are set out in the guidance to the Civil Contingencies Act 2004.

9.52 It is important that full details of the aircraft are available, i.e., number of persons aboard, details of any dangerous goods or unusual 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.

9.53 The post-accident arrangements for any survivors who are not injured, as well as for 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, is a joint responsibility between the aerodrome, the airline and/or its agents, and category I responders and should be set out in the emergency plan.

9.54 Following an aircraft accident, specialist equipment e.g. additional lighting or heavy lifting gear may be required that may not normally be readily available. 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.

9.55 Incidents involving aircraft will attract the attention of the press and media. Aerodrome operators may wish to appoint a member of staff to liaise with members of the local and national press.

Assembly of assisting services

9.56 An aerodrome emergency plan must consider that category I responders are not likely to be familiar with the aerodrome layout, or the incident may occur in weather conditions that could hamper the ability of emergency services to find the accident site.

9.57 A system may 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.

9.58 Consideration should be given to escort arrangements. Suitable assembly or rendezvous points (RVP) should be established, to which incoming vehicles should report, and from which they can be escorted to the accident or incident site with the minimum of delay. A person should be posted at the aerodrome main gate and the rendezvous point, and a telephone should be made available at both locations.

9.59 Use of GPS technology should be used to ensure that external responders arrive at the correct RVP

9.60 Signs may be considered but any that are placed on a public highway will need to conform to the dimensions and colour scheme as defined by the Department for Transport (DfT) ‘Working drawings for traffic signs’; details are available on the *www.gov.uk* website

Definitions of emergencies and incidents

Aircraft accident/aircraft accident imminent

Aircraft accidents which have occurred or are inevitable on, or in the vicinity of, the aerodrome.

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.

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.

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.

Weather standby

When weather conditions are such as to render a landing difficult or difficult to observe.

Unlawful acts

Action to be taken in the case of any unlawful act will be contained in the aerodrome's contingency plan, which will be drawn up in conjunction with the local police using department for transport guidance.

Off-aerodrome accidents

9.61 Emergency orders should contain details of the action to be taken in the case of aircraft accidents occurring outside the aerodrome boundaries.

Other duties

9.62 The emergency arrangements are generally focused on an aircraft accident or incident. Equipment and techniques recommended are generally directed towards this goal.

9.63 Plans may include other incidents that occur such as domestic fires, road traffic crashes and hazardous materials.

9.64 Emergency orders should include the action to be taken by aerodrome-based responders and, where appropriate, external emergency services, in the event of such calls being received.

9.65 The classification 'domestic' is given to any incident:

1. On the aerodrome not included in definitions of emergencies and incidents;
2. Outside the aerodrome boundary (other than aircraft accidents) which is liable to constitute a danger to flying or aerodrome property;
3. Which the aerodrome rescue and firefighting service might attend where the response is according to an agreement with the local emergency services;
4. Which is in response to calls from the public or police on humanitarian grounds.

Command and control

9.66 The importance of an agreed framework for command and co-ordination 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.

9.67 There is further information on managing the local multiagency emergency response and recovery on the government website. www.gov.uk

9.68 An aerodrome operator should have a clear and coherent policy that sets out the approach for delivering effective aircraft incident command and liaison with external emergency services. The management of incidents should be in line with JESIP principle. JESIP

Control of the incident site

9.69 The UK government has issued guidance on how an incident site should be managed including the use of cordons. This guidance can be found under 'preparation and planning for emergencies' on the www.gov.uk website.

Testing and exercises

9.70 The plan shall contain procedures for periodic testing of the adequacy of the plan and for reviewing the results in order to improve its effectiveness.

9.71 The plan shall be tested by conducting:

1. A full-scale aerodrome emergency exercise at intervals not exceeding two years; and partial emergency exercises in the intervening year to ensure that any deficiencies found during the full-scale aerodrome emergency exercise have been corrected; or

2. A series of modular tests commencing in the first year and concluding in a full-scale aerodrome emergency exercise at intervals not exceeding three years and reviewed thereafter, or after an actual emergency, so as to correct any deficiency found during such exercises or actual emergency.

   Note: The exercises should be set to rotate the time of the year and daylight or darkness.

9.72 Where an aircraft accident occurs to which the response has adequately tested all or part of the plan, a licence holder may use that experience as part of the above exercise process.

9.73 Guidance on exercises is available from the following sources:

1. ICAO Airport Services Manual (Doc.9137) Part 1

2. Airport Emergency Planning, chapter 13 and under 'preparation and planning for emergencies' on the www.gov.uk website

Assessment of the aerodrome emergency plan

9.74 CAA Inspectors will require to be assured of the suitability of the aerodrome operator's emergency plan. Consequently, inspectors will wish to review documentary evidence relating to the arrangements put in place by the Aerodrome Operator.

9.75 Inspectors may attend an exercise pre-briefing, testing, or debriefing, or may choose to attend emergency exercises conducted by the aerodrome.

9.76 Notification of a proposed full-scale exercise must be given to the CAA inspector at least six months in advance.

CHAPTER 10

Aeronautical Information

Information to be made available

10.1 Aeronautical Information Product is the collective term for aeronautical information that a State is required to provide, and which consists of:

1. Aeronautical Information Publication (AIP), including Amendments and Supplements;
2. Aeronautical Information Circulars (AIC);
3. Aeronautical charts;
4. NOTAM; and
5. Digital data sets.

10.2 All UK aeronautical information products published by AIS are made available at; https://www.nats.aero/do-it-online/ais/

10.3 To ensure that aeronautical information services providers obtain information to enable them to provide up-to-date pre-flight information and to meet the need for in-flight information, the aerodrome operator shall make arrangements to report to the relevant aeronautical information service providers, with a minimum of delay, the following:

1. Information on the aerodrome conditions, disabled aircraft removal, rescue and firefighting and visual approach slope indicator systems;
2. The operational status of associated facilities, services, and navigational aids at the aerodrome;
3. Any other information considered to be of operational significance.

10.4 Before introducing changes to the air navigation system, the aerodrome operator shall take due account of the time needed by the relevant aeronautical information services for the preparation, production, and issue of relevant material for promulgation.

Reporting

10.5 The aerodrome operator should report via NOTAM on matters of operational significance or affecting aircraft and aerodrome operations in order to take appropriate action, particularly in respect of the following:

1. Construction or maintenance work;
2. Rough or broken surfaces on a runway, a taxiway, or an apron;
3. Snow, slush ice or frost on a runway, a taxiway, or an apron;
4. Water on a runway, a taxiway, or an apron;
5. Snowbanks or drifts adjacent to a runway, a taxiway, or an apron;
6. Anti-Icing or de-icing liquid chemicals, or other contaminants on a runway, a taxiway, or an apron;
7. Other temporary hazards, including parked aircraft;
8. Failure or irregular operation of part or all of the aerodrome visual aids; and
9. Failure of the normal or secondary power supply.

10.6 A change in the level of protection normally available at an aerodrome for rescue and firefighting should be expressed in terms of the new category available at the aerodrome. When such a change has been corrected, the air traffic services provider and the aeronautical information services providers should be advised accordingly.

10.7 The aerodrome operator should observe the predetermined, internationally agreed AIRAC effective dates when submitting the raw information/data to aeronautical information services that affect charts and/or computer-based navigation systems which qualify to be notified by the aeronautical information regulation and control (AIRAC) system. Sponsor deadlines are available on the AIS website: https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/publication-schedule/

Origination of NOTAM

10.8 The aerodrome operator should:

1. Establish and implement procedures in accordance with which it originates a NOTAM issued by the relevant aeronautical information services provider that contains either or both of the following:

a) information on the establishment, condition, or change of any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel involved with flight operations;

b) information of a temporary nature and of short duration or that concerns operationally significant permanent changes or temporary changes of long duration (three months or longer) that are made at short notice, except for extensive text or graphics;

2. Designate aerodrome personnel, who have successfully completed relevant training and demonstrated their competence, to originate NOTAM and provide relevant information to the aeronautical information service providers with which it has arrangements;

3. Ensure that all other aerodrome personnel whose duties involve the use of NOTAM have successfully completed relevant training and demonstrated their competence to do so.

10.9 The aerodrome operator should originate a NOTAM when it is necessary to provide the following information:

1. Establishment of, closure of, or significant changes in the operation of aerodromes, heliports, or runways;

2. Establishment of, withdrawal of, or significant changes in the operation of the aerodrome services;

3. Establishment of, withdrawal of, or significant changes in the operational capability of radio navigation and air-ground communication services for which the aerodrome operator is responsible;

4. Unavailability of backup and secondary systems, having a direct operational impact;

5. Establishment of, withdrawal of, or significant changes to visual aids;

6. Interruption of, or return to operation of, major components of aerodrome lighting systems;

7. Establishment of, withdrawal of, or significant changes to procedures for air navigation services for which the aerodrome operator is responsible;

8. Occurrence or correction of major defects or impediments in the manoeuvring area;

9. Changes to, and limitations on, the availability of fuel, oil, and oxygen;

10. Establishment of, withdrawal of, or return to, operation of hazard beacons marking obstacles to air navigation;
11. Planned laser emissions, laser displays and search lights in the aerodrome surroundings, if pilots' night vision is likely to be impaired;
12. Erecting or removal of, or changes to, obstacles to air navigation in the take-off, climb, missed approach, approach areas, as well as on the runway strip;
13. Changes in aerodrome or heliport rescue and firefighting category;
14. Presence of, removal of, or significant changes in, hazardous conditions due to snow, slush, ice, radioactive material, toxic chemicals, volcanic ash deposition or water on the movement area;
15. Presence of a runway or portion of a runway which is slippery wet;
16. Presence of a runway which is not available due to runway marking works; or information about the time lag required for making the runway available, if the equipment used for such works can be removed, when necessary;
17. Presence of hazards that affect air navigation, including presence of wildlife, obstacles, displays and major events.
18. The aerodrome operator shall ensure that:
    a) A NOTAM is originated with sufficient lead time for the affected parties to take any required action, except in the case of unserviceability, release of radioactive material, toxic chemicals and other events that cannot be foreseen;
    b) A NOTAM notifying unserviceability of associated facilities, services, and navigation aids at the aerodrome, provides an estimate of the unserviceability period or of the time at which restoration of service is expected;
    c) Within three months from the issuance of a permanent NOTAM, the information contained in the NOTAM is included in the aeronautical information products affected;
    d) Within three months from the issuance of a temporary NOTAM of long duration (three months or longer), the information contained in the NOTAM is included in an AIP supplement;

e) When a NOTAM with an estimated end of validity unexpectedly exceeds the three- month period, a replacement NOTAM is originated unless the condition is expected to last for a further period of more than three months; in that case, the aerodrome operator shall ensure that the information is published in an AIP supplement.

19. In addition, the aerodrome operator shall ensure that:

a) Except as provided for in point 18 d), each NOTAM it originates contains the applicable information in the order shown in the NOTAM format set out in ICAO PANS- AIM (Doc 10066);

b) NOTAM text is composed of the significations or uniform abbreviated phraseology assigned to the ICAO NOTAM Code, complemented by ICAO abbreviations, indicators, identifiers, designators, call signs, frequencies, figures, and plain language;

c) Information concerning snow, slush, ice, frost, standing water or water associated with snow, slush, ice, or frost on the movement area is disseminated by means of SNOWTAM and contains the information in the order shown in the SNOWTAM format in ICAO PANS- AIM (Doc 10066);

d) When an error has occurred in a NOTAM, a NOTAM with a new number is originated to replace the erroneous NOTAM or the erroneous NOTAM is cancelled, and a new NOTAM is originated;

e) When a NOTAM is originated to cancel or replace a previous NOTAM:

i. the series and number/year of the previous NOTAM are indicated;

ii. the Location Indicators and subject of both NOTAM are the same;

f) Only one NOTAM is cancelled or replaced by a new NOTAM;

g) Each originated NOTAM deals with only one subject and one condition of the subject;

h) Each originated NOTAM is as brief as possible and compiled so that its meaning is clear without the need to refer to another document;

i) An originated NOTAM containing permanent or temporary information of long duration (three months or longer) includes appropriate references to the AIP or AIP supplement;

20. The ICAO Location Indicator included in the text of an originated NOTAM for the aerodrome is the one contained in the Location Indicators. A curtailed form of such indicators shall not be used. The aerodrome operator shall, following the publication of a NOTAM that it has originated, review its content to ensure its accuracy, and ensure the dissemination of the information to all relevant aerodrome personnel and organisations at the aerodrome.

21. The aerodrome operator shall maintain records:

a) Of the NOTAM it originated and those that were issued;

b) Regarding the implementation of points in paragraph 10.3 2 and 3.

Presence of wildlife

1. The permanent presence of wildlife is to be contained in the AIP, whereas the notification of hazardous wildlife activity at short notice needs to be promulgated by NOTAM.

2. When originating such a NOTAM, specific bird-related abbreviations should be avoided to facilitate readability and to prevent queries.

Procedures origination of NOTAM

10.10 The procedures should as a minimum:

1. Define the ways and means that the aerodrome operator may use to request the issuance of a NOTAM, in accordance with the arrangements that the aerodrome operator has with the aeronautical information service (AIS) provider(s). The procedures should clearly indicate the names of the aerodrome operator's personnel that have the authority to originate a NOTAM, and which should be included in the arrangements with the AIS provider.

2. Contain instructions regarding the:

a) Cases when a NOTAM should be originated by the aerodrome operator;

b) Cases when a NOTAM should not be originated by the aerodrome operator; and

c) Completion of the NOTAM form (including the use of relevant electronic applications, if applicable) by the personnel designated by the aerodrome operator as NOTAM originators; and

3. Specify the cases in which coordination with the CAA is needed prior to the origination of the NOTAM, and the way to inform the Competent Authority about the issuance of a NOTAM.

Initial training for aerodrome personnel involved in NOTAM origination and other aerodrome personnel

10.11 The theoretical part of the training of a person to be designated as a NOTAM originator should, as a minimum, cover the following areas:

1. Regulatory framework governing NOTAM origination and issuance, and its relationship with other aeronautical data products, including:

a) Cases when the origination of a NOTAM is required;

b) Cases when a NOTAM should not be originated.

10.12 NOTAM form completion, including word abbreviations and phrase contractions applicable to NOTAMs;

10.13 NOTAM types and understanding of NOTAM;

a) Use of electronic applications for initiating a NOTAM (if applicable); and

b) Aerodrome procedures for origination and internal dissemination of a NOTAM.

10.14 The theoretical training should be followed by an assessment of the trainees

10.15 Following the successful completion of the theoretical training, the practical part of the training should, as a minimum, include familiarisation with the origination of NOTAM and implementation of the relevant aerodrome operating procedures for the persons to be designated as NOTAM originators. Upon completion of the practical training, and the successful competency assessment of the trainee in practical terms, the person may be designated as a NOTAM originator.

10.16 For other aerodrome personnel, whose duties require only the understanding of a NOTAM, the theoretical part of the training should be adjusted to their needs and need not include (a)(4) and (a)(5) above, while the practical training should include practical examples to assess the level of their

understanding. Both the theoretical and the practical training should be followed by an assessment of the person concerned (see CAP2174)

Recurrent, refresher and continuation training CAP 2174

10.17 Training and proficiency check programmes provides guidance on the provision of training following the completion of the initial training, as part of the aerodrome operator's training programme. For the process that needs to be followed to ensure the continued competence of the personnel involved in NOTAM origination and use.

NON-origination of NOTAM

10.18 Promulgation of information through NOTAM is required under certain circumstances. In such cases, the responsible organisation (e.g. CAA, aerodrome operator, air traffic services provider, etc.) originates a NOTAM, which is finally issued by the AIS provider. 10.3 defines the responsibilities of the aerodrome operator with respect to the NOTAM origination process, while paragraph 10.4 requires the origination of a NOTAM by the aerodrome operator in the cases prescribed in it. On the other hand, for a variety of reasons (e.g. prevention of information overflow), not all kinds of information are eligible for promulgation through NOTAM. To this end UK Reg (EU) 2017/373, which applies to AIS providers, prescribes in AIS.TR.330 the cases where the AIS provider shall (or shall not) issue a NOTAM. This means that there are cases in which, even if an aerodrome operator originates a NOTAM to promulgate information, the NOTAM will not be finally issued by the AIS provider if this information is not allowed to be promulgated by NOTAM as per AIS.TR.330. To avoid such situations, the aerodrome operator needs to:

1. Ensure that the relevant aerodrome operator's personnel are adequately trained in the relevant regulatory framework regarding both the origination and issuance of NOTAM;
2. Develop robust procedures regarding NOTAM origination by its personnel; and
3. Maintain close cooperation with the relevant AIS provider. The following are example cases where the aerodrome operator will not originate a NOTAM:
4. Routine maintenance work on aprons and taxiways that does not affect the safe movement of aircraft;

5. Temporary obstructions in the vicinity of aerodromes/heliports that do not affect the safe operation of aircraft;
6. Partial failure of aerodrome/heliport lighting facilities where such a failure does not directly affect aircraft operations;
7. Partial temporary failure of air-ground communications when suitable alternative frequencies are available and are operative;
8. Lack of apron marshalling services, road traffic closures, limitations, and control;
9. Unserviceability of location, destination, or other instruction signs on the aerodrome movement area;
10. Training activities performed by ground units;
11. Unavailability of backup and secondary systems if these systems do not have an operational impact;
12. Limitations to aerodrome facilities or general services with no operational impact;
13. Announcements or warnings about possible/potential limitations with no operational impact;
14. General reminders on already published information;
15. Availability of equipment for ground units, without information on the operational impact on airspace and facility users;
16. Information about laser emissions with no operational impact and about fireworks below the minimum flying heights;
17. Closure of parts of the movement area in connection with locally coordinated, planned work of duration of less than 1 hour;
18. Closure, changes, unavailability in the operation of aerodrome(s)/heliport(s) other than in the aerodrome(s)/heliport(s) operation hours; and
19. Other non-operational information of a similar temporary nature. Information which relates to an aerodrome and its vicinity, and which does not affect its operational status may be distributed locally during pre-flight or in-flight briefing or other local contact with flight crews. Thus, in case of need, the aerodrome operator may disseminate such type of information through the AIS provider it has arrangements with.

NOTAM format

10.19 Information on the completion of a NOTAM format may be found in Chapter 6 of ICAO Doc 8126 'Aeronautical Information Services Manual'. Information on the ICAO NOTAM code and abbreviations to be used may be found in ICAO Doc 8400 'Procedures for Air Navigation Services - ICAO Abbreviations and Codes' (PANS ABC). The following is a link to the guidance material: https://nats-uk.ead-it.com/cms_nats/opencms/en/NOTAM/

10.20 The aerodrome operator is responsible for providing data relevant to the aerodrome and available services to the users, the relevant air traffic services, and aeronautical information services providers.

Provision of information

10.21 The aerodrome operator must have formal arrangements with the organisations with which it exchanges aeronautical data or aeronautical information and shall ensure that all data relevant to the aerodrome and available services is provided to UK AIS with the required quality, in terms of accuracy, integrity, resolution, traceability, timeliness, completeness and format, as described in CAP1054.

10.22 AIP Amendments, AIP Supplements, AICs, and Permanent NOTAM can be submitted by Authorised Sources via Aurora Data Originators Portal (www.aurora.nats.co.uk). Only Authorised Sources have access to the Portal and can submit changes to aeronautical information products. More information about UK AIP, Aurora Data Originators Portal, Formal Arrangements, Authorised Sources and data can be found in CAP1054.

10.23 NOTAM and SNOWTAM proposals shall be submitted by AFS to EUECYIYP.

10.24 Email submissions will only be accepted to notam.proposals@nats.co.uk using the online form where there is an outage to your AFS connection.

10.25 The aeronautical information published in the AIP for which aerodrome operators are responsible for is shown in CAP 1054, Annex A.

10.26 Detailed specifications concerning the AIP and other Aeronautical Information Products are contained in ICAO Annex 15 and PANS-AIM (Doc 10066) - that includes the scope of each of the aeronautical information products (i.e. what information requires publication in aeronautical information products and which product is the most appropriate) and aeronautical data and information maintenance requirements (when

submission should be made to UK AIS to publish or amend aeronautical information product(s)).

UK AIS contact details

10.27 Contact details and service hours for principal UK AIS sections are detailed below and also available in the UK AIP.

10.28 The UK AIS information line is a voice recorded message system, designed to supplement the information available on the UK AIS website. It is not designed to replace the need to obtain a full pre-flight briefing. The message provides information on temporary restricted areas, airspace upgrades and emergency restrictions of flying.

UK AIS section	Service Hours	Contact details
UK AIS Publications Section (AIP/SUP/AIC/etc.) General enquiries	Monday to Friday (0800-1600)	01489-887462 aissupervisor@nats.co.uk
UK NOTAM Office (NOF/INO)	H24	01489-612488 01489-612489
UK AIS Charting Section	Monday to Friday (0800-1600	01489-887463
Email (NOTAM Proposals)	Email (NOTAM Proposals)	notam.proposals@nats.co.uk
AIS Information Line UK	H24	08085-354802 / +44(0)1489-887515 (International)

CHAPTER 11

Water Aerodromes

11.1 ICAO annex 14 does not differentiate between land and water as a surface from which aircraft can operate; nor, since Schedule 1 defines that an ‘aerodrome’ can be an area of water, does the ANO.

11.2 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.

11.3 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 licence holder 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.

11.4 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.

11.5 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 byelaws that are not addressed in this document.

11.6 Where appropriate, licence holders 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;

1. The Maritime Coastguard Agency;
2. The Ports Authorities;
3. The Health and Safety Executive;
4. The Environmental Agency;
5. Local government and national parks authorities; and
6. 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, 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.

Aerodrome manual and notification in the UK aeronautical information publication

11.7 ANO Article 212(7) requires the inclusion in the aerodrome manual of information and instructions relating to the matters listed under Schedule 12. Items (11), (12), (13) and (14) of Schedule 12 do not directly apply to water aerodromes.

11.8 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, and;

1. The aerodrome reference point (ARP) co-ordinates and the Aerodrome Reference Elevation (ARE);
2. The shape of the manoeuvring area(s); the lengths and bearings of the edges (in degrees magnetic); and the means of identification.
3. 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.

Physical characteristics

Reference Point and Elevation

11.9 The aerodrome reference point (ARP) should be located at the planned geometric centre of the manoeuvring area, or at the main one if more than one is provided.

11.10 The aerodrome reference point should be measured and reported to the aeronautical information services in degrees, minutes, and seconds.

11.11 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.

Movement Area

11.12 Aerodrome operators 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.

11.13 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.

11.14 Operational procedures should be developed for safe seaplane taxying 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 like those applicable to land aerodrome operations, are not reproduced in CAP 393, Air Navigation: The Order and the Regulations.

11.15 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. Procedures should be established for the regular inspection of the manoeuvring area(s) to remove FOD.

Manoeuvring Area

11.16 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 ‘omni-directional’. 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 'bi-directional'. Unless specified otherwise, the licensing criteria apply to both types of manoeuvring area.

11.17 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.

11.18 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.

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.

Note: Aerodrome operators should consult the CAA for code W3 criteria not specified below.

Maneuvering 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

Table 11.1 Water aerodrome manoeuvring area coding

Obstacle Limitation Surfaces (OLS)

Take-off climb and approach surface.

11.19 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.

11.20 The take-off climb surface and an approach surface for a code W1, W2 and W3 omni-directional 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.

11.21 The dimensions of the take-off climb surface and an approach surface relating to a code W1, W2 and W3 bi-directional manoeuvring area should correspond to the dimensions for land-based runway code numbers 1, 2 and 3 respectively; see chapter 4.

Transitional, inner horizontal and conical surface

11.22 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.

11.23 A transitional surface is not required for an omni-directional manoeuvring area.

11.24 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.

11.25 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.

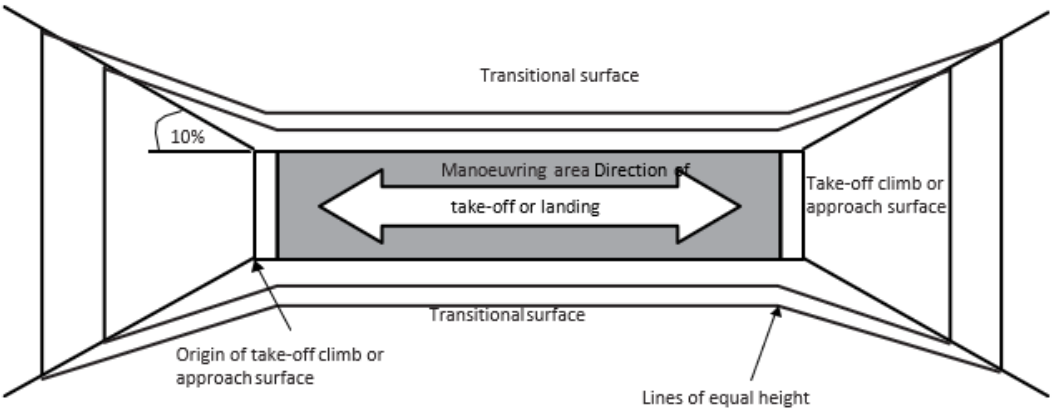


Figure 11.1 Take-off climb, approach and transitional surfaces for a bi-directional manoeuvring area

Wildlife strike hazard

11.26 Aerodrome operators should provide a wildlife hazard management plan that includes the identification of the risk and hazards that may exist, and suitable mitigation measures.

11.27 All reasonable measures should be taken to discourage wildlife from gathering in the movement area, and under anticipated departure and arrival flight paths.

Note: Procedures on the management of wildlife hazards on and within the vicinity of aerodromes, including the establishment of a wildlife hazard management programme (WHMP), wildlife risk assessment, land-use management, and personnel training, are specified in the PANS-Aerodromes (Doc 9981).

Further guidance is given in the Airport Services Manual (Doc 9137), Part 3.

Visual aids

11.28 The edges of each manoeuvring area should be easily identifiable by pilots departing from, or arriving at, the water aerodrome.

11.29 Floating visual aids should be conspicuous and conform to maritime regulations or,

11.30 Where such regulations and requirements do not exist or are not applicable, the intended use of shapes, colours and lights specified in chapters 4, 6 and 7 should be considered.

Signals

11.31 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, unless the same guidance and information can be provided to pilots by an alternative means of compliance.

Rescue and Fire Fighting Services (RFFS)

11.32 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.

11.33 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.

11.34 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.

11.35 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.

11.36 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.

Emergency planning

11.37 The objectives of emergency planning outlined in chapter 9 apply equally to a water aerodrome.

11.38 The emergency plan should consider the hazards associated with seaplane operations, including:

1. Passenger evacuation into a further life-threatening environment, e.g. deep water.
2. The onset of hypothermia, and its associated effects, during and following prolonged immersion in cold water; and
3. 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.

Additional guidance on seaplane accidents in the water is outlined in appendix 6 to the ICAO Airport Services manual (Doc 9137) Part 7.

OFFICIAL - Public. This information has been cleared for unrestricted distribution.

CHAPTER 12

Heliports

12.1 This chapter applies to land-based heliports that wish to be licensed.

12.2 ANO Articles 207 to 209 indicate what helicopter operations are required to be conducted at, from or to a licensed facility.

12.3 The licensing process for a heliport is the same as that required for fixed-wing aerodromes, and is laid out in CAP 168, chapters 1 and 2.

12.4 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 2.

12.5 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.

12.6 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.

12.7 Guidance on the standards for the operation of heliports that do not require a licence can be obtained from CAP793 “Safe Operating Practices at Unlicensed Aerodromes” Appendix D. Best practice guidance should be drawn both from licensed heliport Guidance within this document, and other documents referred to within CAP168.

OFFICIAL - Public