Standards for Helicopter Landing Areas at Hospitals

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Executive summary

Air Ambulance Helicopters form an essential part of the UK's pre-hospital response to patients suffering life threatening injuries or illnesses. It is estimated that every day about 70 patients are treated using helicopters operating in the air ambulance role to helicopter landing sites (HLSs) located at hospitals in the United Kingdom. HLSs are routinely provided at hospitals for the transfer of critically ill patients by air ambulance helicopters and by helicopters operating in the Helicopter Emergency Medical Services (HEMS) role with facilities varying in complexity from a purpose built structure on a rooftop above the emergency department (ED), with integral aeronautical lighting and fire-fighting systems, to an occasional use recreational / sports field remotely located from the ED perhaps only equipped with an "H" and a windsock present.

The primary purpose of this CAP is to promulgate in detail the design requirements and range of options for new heliports located at hospitals in the United Kingdom that can also be applied for the refurbishment of existing helicopter landing sites. In all cases heliport design guidance is based on the international standards and recommended practices in ICAO Annex 14 Volume II with the supporting Document 9261 "Heliport Manual". However, given the pivotal role of an HLS at a hospital for supporting the (often complex) clinical needs of the patient, it is equally important that the design of the heliport places, at its heart, the needs of the patient who is often critically ill. Consequently, the design of a heliport needs to ensure that it is both 'safe and friendly' for helicopter operations, and, given the clinical needs of the patient, that its proximity to the hospital's Emergency Department (ED) affords rapid patient transfer and avoids the complication of a secondary transfer by land ambulance. Patient transfer from the HLS to the ED should be expedited in a manner that upholds both the dignity and security of the patient and the safety and security of staff tasked to complete the transfer of the patient to ED, potentially in all weather conditions.

A landing area that is remote from the ED, and so entails a lengthy patient transfer from the helicopter, perhaps requiring the transfer to complete using another form of transport and/or protracted exposure to the elements, is then not serving the patient who is in need of the most prompt care, who may be suffering from trauma, cardiac or neurological conditions; all of which are highly time critical. It is therefore strongly recommended that new build designs or refurbishments take these factors fully into consideration, by ensuring early consultation with those people at the hospital who have a direct responsibility for the clinical needs of a patient.

The safety of helicopter operations is clearly paramount to any design for an HLS at a hospital and there can be no alleviations from the regulations due to the emergency nature of an operation. In the interests of most easily assuring the optimum operating environment for helicopters, this CAP promotes the design of elevated (rooftop) heliports, as the ‘package’ most likely to deliver a safe and friendly environment for helicopters operating to a hospital landing site (HLS) in the UK. This focus is chosen because heliports located at a good height above ground level, usually at rooftop level, tend to provide the best long-term operating environment for helicopters, by raising the landing area up above obstacles which might otherwise compromise flight operations. An elevated heliport, in addition to delivering the best safety outcomes for the helicopter and facilitating the complex needs of a critically ill patient, also has the best potential to deliver more effectively on environment performance, by reducing the incidence of helicopter noise and rotor wash (downwash and outwash) at surface level, and delivering a more secure HLS - by creating a landing site that is securely protected from inadvertent or deliberate entry by members of the public.

However, in recognising that a rooftop heliport may not be the preferred solution for every hospital, the CAP also provides supplementary guidance for landing sites at hospitals provided on raised structures which, although above surface level, are less than 3m above the surrounding terrain (and not classed as elevated heliports) and for helicopter landing sites which are at surface level, including mounded. Given the challenges and complexity of designing an HLS able to balance the sometimes competing demands for effective patient care with the need for a safe, efficient and friendly environment in which to operate helicopters, it is recommended that a hospital Trust / Board engages the services of a competent third party heliport consultant, and in addition seeks the advice and guidance of those who have the primary responsibility to deliver effective patient care, including the helicopter operator(s).

In assuming the primary, most frequent, users of a helicopter landing site at a hospital will usually be the local air ambulance and/or HEMS operator, consideration should also be given to other less frequent users, not operating to an HLS in the air ambulance or HEMS role. Other users may include, but may not be limited to, Police helicopters and national intra-hospital specialist Air Ambulances as well as the UK Search and Rescue (SAR) operation, dispatching SAR assets from a network of 10 bases around the UK coastline, and two seasonal inshore mountain rescue bases alongside the potential for overseas or private SAR assets, namely Irish Coastguard and the private North Sea SAR service. Hence for the design of an HLS the critical design helicopter may not be the one that most regularly uses the heliport, but a helicopter, perhaps acting in a lesser seen role, which is the combination of the heaviest helicopter and the one requiring the largest landing area in which to operate. The issue of identifying the design helicopter is sometimes complicated by the fact that all the critical attributes (as defined in the glossary of terms) may not reside in a single helicopter and in this case the designer of an HLS will need to consider two or more types (or type variants) for the basic design. Notwithstanding, most HLSs will need to consider a range of helicopters, from small to medium twins operating in the air ambulance role to larger, heavy category helicopters operating in the SAR role.

It is not the purpose of this civil aviation publication to consider the use of military helicopters at a hospital HLS. As many of the types routinely used by military services are heavy or extra-heavy helicopters, a design to incorporate military types may present particular challenges for the siting of an HLS at a hospital. Given the potentially low usage by military types, it may be prudent to consider a secondary helicopter landing site at or near the hospital which can be used on an occasional basis to accommodate military helicopters. For reference some data has been included in Table 3.1 on military types, but the No.1 AIDU Hospital Helipad Directory or Ministry or Defence should be consulted for further information.

Glossary and abbreviations

AAA	Association of Air Ambulances Ltd
AFM	Aircraft flight manual
ANO	Air Navigation Order
CAP	Civil Aviation Publication
Cd	Candela
Congested area	An area in relation to a city, town or settlement which is substantially used for residential, industrial, commercial or recreational purposes.
DCP	Development Control Plan - a documented arrangement provided by the hospital’s Trust / Board for the control (i.e. limitation) of developments around the heliport which could impact on the operability of the heliport.
DoH	Department of Health (in relation to DoH Health Building Note HBN 15:03 Hospital helipads)
DIFFS	Deck integrated fire-fighting system
D-value	The largest dimension of the helicopter when rotors are turning. This dimension will normally be measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor tip path plan (or the most rearward extension of the fuselage in the case of Fenestron or Notar tails).

Design (critical) helicopter	The following elements are required to be established: MTOM, D-value, RD, UCW including largest containment area, required dimensions for the hover and, if applicable, ground turning, wheel/skid loading, fuselage length and width (for RFFS calculations) and critical obstacle avoidance criteria for obstacle limitation surfaces. These requirements could be contained within one or more types (or type variants).
Design D	The D of the design helicopter
ED	Emergency department
EIA	Environmental impact assessment
Elevated helicopter clearway	A helicopter clearway that has been raised to a level that provides obstacle clearance, where a clearway is a defined area over which a helicopter may accelerate and achieve a specified set of flight conditions.
Elevated heliport	A heliport located on a raised structure at 3m or more above the surrounding terrain. For the purpose of this CAP this is usually supposed to be a purpose-built structure located on a rooftop, ideally at the highest point of the estate.
FATO	Final approach and take-off area
FFS	Fire-fighting service (term does not include rescue arrangements)
FMS	Fixed monitor system
FOI	Flight operations inspector (of the UK CAA)
FOI (H)	Flight operations inspectorate (helicopters)

FOI (GA)	Flight operations inspectorate (general aviation)
Helicopter stand	A defined area intended to accommodate a helicopter for purposes of: loading or unloading passengers, mail or cargo; fuelling, parking or maintenance; and, where air taxiing operations are contemplated, the TLOF.
Helicopter taxiway	A ground taxiway defined path on a heliport intended for the ground movement of wheeled undercarriage helicopters and that may be combined with an air taxi-route to permit both ground and air taxiing.
Helicopter taxi-route	A defined path established for the movement of helicopters from one part of a heliport to another. A taxi-route includes a helicopter air or ground taxiway which is centred on the taxi-route. a) An air taxi-route. A marked taxi-route intended for air taxiing. b) A ground taxi-route. A taxi-route centred on a taxiway.
Heliport	An aerodrome or a defined area of land, water or a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters.
Heliport on a raised structure	A heliport located on a raised structure where the landing surface is less than 3m above the surrounding terrain on a minimum of two sides.
HEMS	Helicopter emergency medical services
HHLS	Hospital Helicopter Landing Site (sometimes abbreviated to HLS)
Hostile environment	An environment in which a safe forced landing cannot be accomplished because the surface is inadequate, or the helicopter occupants cannot be

	adequately protected from the elements or SAR capability is not provided consistent with anticipated exposure or there is an unacceptable risk of endangering persons or property on the ground.
ISO	International Organisation for Standardisation
MTOM	Maximum take-off mass
OM	Operations manual
PC1 / 2 / 3	Performance class 1 / 2 / 3
PinS	Point-in-space
PPE	Personal protective equipment
PPEWR	(HSE) Personal Protective Equipment at Work Regulations
Protection area	A defined area surrounding a stand intended to reduce the risk of damage from helicopters accidentally diverging from the stand.
PUWER	(HSE) Provision and Use of Work Equipment Regulations
RD	Rotor diameter
RFFS	Rescue and fire-fighting service
RFM	Rotorcraft flight manual (also known as Helicopter Flight Manual – HFM)
RTODAH	Rejected take-off distance available (helicopters) - the length of the FATO declared available and suitable for helicopter operated in performance class 1 to complete a rejected take-off.

SAR	Search and rescue
Secondary HLS	A second HLS provided for larger helicopters, including military helicopters, which are not authorised to land at the primary HLS. May also be used for additional capacity when more than one helicopter need to attend the hospital.
SLS	Serviceability limit state
Surface level heliport	A heliport located on the ground which, if specifically prepared and landscaped, may take the form of a mounded heliport.
TDP	Take-off decision point
TD/PM circle	A touchdown positioning marking (TDPM) in the form of a circle used for omnidirectional positioning within a TLOF.
TLOF	Touchdown and lift-off area
‘t’-value	The MTOM of the helicopter expressed in metric tonnes (1000 kg) expressed to the nearest 100 kg.
UCW	Undercarriage width
ULS	Ultimate limit states
UPS	Uninterrupted power supply
Vertical procedures	Take-off and landing procedures that include an initial climb and a final vertical/steep descent profile. The profile may or may not include a lateral component.
VSS	Visual segment surface

Section 1 Heliport Design

Chapter 1
Introduction

Purpose and scope

1.1 The purpose of this CAP is to address the design requirements and options for new heliports located at hospitals in the United Kingdom. The requirements relate to new build facilities or to the refurbishment of landing sites at both existing and new hospitals. As well as setting out in detail the design requirements for hospital heliports, this CAP also provides guidance on their operation and management. This CAP may therefore be assumed to have superseded Department of Health (DoH), Health Building Note 15-03: Hospital Helipads, which was regarded as the principal guidance document for the design and operation of hospital helipads in the UK between 2008 and 2016. The DoH HBN is now withdrawn.

1.2 This CAP should not be considered an exclusive reference source since under the UK Air Navigation Order (ANO), the helicopter operator ultimately has the final responsibility for deciding whether a heliport is safe for use within the constraints of operational requirements laid out in the company Operations Manual (OM) and in the Rotorcraft Flight Manual (RFM). Therefore expert aviation advice should be sought before committing to any final design and expenditure. This advice could be sought from an independent helicopter consultant, or via an aviation consultancy organisation,[1] given in tandem with specific advice from end-users e.g. the local air ambulance, Search and Rescue (SAR) and/or HEMS operators.

1.3 The primary focus of this Civil Aviation Publication is on the interpretation and application of heliport design requirements that are based on the international standards and recommended practices in Annex 14 Volume II. However, it is also important that the design of the heliport at a hospital places, at the heart, the needs of the consumer who is an often critically ill, patient. So the design of the heliport needs not only to ensure it is ‘safe and friendly’ for helicopter operations, but, given the often critical condition of the patient, that the proximity to a hospital’s Emergency Department (ED) affords rapid patient transfer in a manner that upholds their care and dignity. A landing area that is remote from the ED, and so requires a lengthy patient transfer from the helicopter, perhaps involving protracted exposure to the elements, is then not serving the patient in need of the most prompt care, who may be suffering from

[1] For example, CAA International Ltd

trauma, cardiac or neurological conditions which are highly time critical. It is strongly recommended that any new build design should take these elements fully into consideration, by ensuring consultation with those at the hospital who have a direct responsibility for the clinical needs of the patient.

1.4 This CAP provides reference material for the application of a range of specialisations that may have an interest in the design and operation of the heliport including, but not necessarily limited to:

- Trust chief executives and directors considering a business case and options for helicopter access;
- Head clinicians considering pre-hospital care;
- Estates and project managers and private sector partners tasked to approve the design and build of heliports;
- Fire and safety officers considering risk analyses and safety and contingency plans;
- Helicopter operator end-users whether air ambulance helicopters, search and rescue (SAR) or HEMS helicopters, or police helicopters.

Note: The design and operational requirements provided in this CAP intentionally do not seek to address the specific needs of military helicopters. Nonetheless a range of helicopters may need to be considered in an initial heliport feasibility design study which may include a requirement to accommodate heavy or extra- heavy military helicopters.

1.5 In the interests of promoting the optimum operating environment for helicopters, this CAP places the primary focus on elevated (rooftop) heliports, as the preferred option for a hospital landing site (HLS) facility in the UK. This focus is chosen because heliports located at elevation, on a rooftop, tend to provide the best long-term operating environment for helicopters, by raising the landing area up above obstacles which might otherwise compromise flight operations. However, the CAP also provides supplementary guidance for landing sites at hospitals that may be provided on raised structures which, although above surface level, at less than 3m above the surrounding terrain, are not classed as elevated heliports (see Chapter 7). For completeness supplementary guidance for surface level heliports, including heliports on mounded surfaces, are addressed in Chapter 8. Although the guidance is presented in the context of a helicopter landing site at a hospital, much of the good practice can be applied to any unlicensed helicopter landing site facility, whether or not located at a hospital. There are, however, subtle differences for 'non-hospital' helicopter landing sites, such as the characteristics of some markings and, in these cases, it is prudent to consult other reference sources such as CAP 793, Operating Practices at Unlicensed Aerodromes, as well as other sections of Annex 14 Volume II, before embarking on a project not intended to service Air Ambulance / HEMS operations etc (see Appendix B).

1.6 Under the current UK Air Navigation Order (ANO) there is no statutory requirement for an HLS at a hospital to be licensed by the CAA. However, helicopter operators should be satisfied with the operating environment and landing area arrangments including the provision of Rescue and Firefighting Services and, that the adequacy of aeronautical lighting displayed at the heliport is suitable for night operations, where applicable. The heliport operator may accept a third party 'sign off' of the heliport structure and associated systems including RFFS. However, CAA Flight Operations (Helicopters) Flight Operations Inspectors (FOIs) reserve the right to attend an operator's (non-commercial) flight authorisation to allow lighting systems to be assessed from the air before a final sign-off for night operations can occur.

Planning considerations and safeguarding arrangements

1.7 Since helicopter-borne patients are likely to be in a time critical condition (see paragraph 1.3) it is important that the time taken to transfer them between the helicopter and the hospital's Emergency Department (ED) is as short as possible and that the patient is spared a lengthy transfer from the helicopter to a place of medical care which should not involve protracted exposure to the elements i.e. the route for the patient is unprotected from adverse weather conditions. The safest, fastest and most efficient means for a rooftop heliport is likely to be by trolley transfer from the helicopter straight to a dedicated lift at or just below heliport level or, for a purpose-built raised heliport, via a short access ramp connecting the heliport to the surrounding surface level. For a ground level helipad, there will be no need for either a lift or a ramp, but where necessary a covered walkway from the edge of the helipad safety area to the ED should be included in the design, consisting in a concrete or tarmac pathway between the two. Transferring patients from a helicopter to a road ambulance for an additional journey to ED is to be avoided, especially where a patient is critically ill and is in need of prompt care. The best locations for a helicopter landing site are deemed to be on a roof directly above ED or, where practical, in an open area adjacent to it.

1.8 A heliport design requires that a defined area free of obstructions such as buildings and trees be provided to facilitate at least two approach and take-off/ climb 'corridors' rising from the edge of the heliport; an area free of limiting obstructions that will allow helicopters to safely approach to land and, where required by the specific operating technique, to back-up from the heliport before departing, in a forward direction. If new obstructions are built or grow up in defined areas, helicopters may no longer be able to operate or may be severely restricted. It is therefore important that the location of the heliport be considered in the light of the potential future developments around the heliport, whether within or just beyond the boundaries of the hospital estate. If obstructions such as tall buildings or car parks are erected, which may have an associated use of cranes, or if trees are allowed to grow-up within the approach and/or departure corridors, the landing site may become restricted or unusable. NOTAMs should be raised by a hospital for any activity of a temporary nature, such as the requirement to erect cranes for construction, whether occurring within the hospital estate or in proximity to the hospital. All crane activity should be reported directly to the helicopter operator. CAP 738, Safeguarding of Aerodromes, referenced in the bibliography section of this publication, can offer further guidance to NHS Trust Estates Departments to help them assess what impact any proposed development or construction might have on the operation of an HLS. This assessment process is known as safeguarding and should be formally documented in a hospital's Development Control Plan (DCP). The safeguarding process described in CAP 738, and presented in the DCP, should be referenced whenever new buildings or facilities are planned.

1.9 HLS's are likely to attract the need for local authority planning permission - especially where they are anticipated to be used on more than 28 days in any calendar year. In addition they will require the permission of the land owner and the awareness of the local police to operate.

1.10 It is strongly advised that the hospital submits to the local planning authority (LPA) a specific request to safeguard both the heliport and the alternate heliport (if provided). Further information can be found in CAP 738 Chapter 9. Due to the increased performance of helicopters Table 4-1 in this document presents an optimal guide for the areas that should be notified to the hospital when planning permission is received by the LPA.

1.11 All helicopters in flight create a downward flow of air from the rotor system known as rotorwash (rotor downwash and outwash). The severity of downwash and outwash experienced is generally related to the mass of the helicopter, the diameter, and design of the rotor disc and the proximity of the helicopter to the surface. Downwash/outwash causes significant hazards to the public and hospital staff in the vicinity of the heliport, including blowing persons over, dislodging loose hoardings or causing smaller items such as grit and debris to become projectile towards nearby persons and property, the effects of which can cause both significant and fatal injuries.

1.12 Therefore, it is prudent for designers always to plan for the worst- case downwash/outwash profile for the design helicopter. It is strongly recommended a downwash/outwash protection zone be established to include: supervision of vehicular and pedestrian traffic during helicopter movements; robust maintenance and foreign object damage (FOD) prevention processes; and safeguarding from future developments. This link gives some guidance on downwash/outwash effects and although the offshore operating environment is different, there are general principles cited that are common also to hospital HLSs, further guidance can be found in Section 2 Heliport Operations.

1.13 Although currently many air ambulances operate during day light hours only, initiatives are now in place within the industry to provide 24 hour / 'round the clock' services. It is therefore recommended that all new heliports should be equipped with appropriate aeronautical lighting (the latest systems are described in detail in Chapter 4 and Appendix D). For night operations, involving the public transport of helicopters, the Air Navigation Order (ANO) places a duty on the heliport site keeper to provide suitable and effective aeronautical lighting systems for take-off and for approach to land which enables the helicopter operator to identify the landing area from the air at the required ranges (see Appendix D). Discharging this responsibility includes providing at least one Responsible (trained) Person for night operations to ensure that the lights are functioning correctly and that no persons or obstacles have strayed into the operating area, and where authorised to do so, to communicate with the pilot by radio before the helicopter arrives until after the helicopter has departed.

Note: Radio facilities are required to be approved to at least an Air / Ground Communications Service (AGCS) and operators licensed as appropriate – see CAP 452, Aeronautical Radio Station Operator's Guide.

1.14 To address environmental issues including noise nuisance, an assessment may be required under Town and Country Planning guidance in regards to an Envionmental Impact Assessment (EIA). The main impacts to be considered in judging EIA are noise, traffic generation and emissions. New permanent airfields will normally require EIA, whilst operating at a smaller scale hospital heliports should consider an EIA as best practise.

1.15 For a hospital landing site the occasions when helicopters could cause disturbance are likely to be irregular, few in number and short in duration. As a result a formal noise analysis for hospital heliports is unlikely to draw fully objective conclusions and may be of only limited assistance to planning committees; however, checking with the Local Authority at the early stages of the project will help ascertain whether they require an Environmental Impact Assessment to be carried out.

1.16 The environmental impact, balanced against the positive benefit for patients and for the community at large, should be explained to the local population at an early stage of the project and especially during the mandatory consultation phase. The public can appreciate the value of a hospital heliport in life saving situations, especially when fully informed of the purpose and importance, the likely infrequent and short duration of any environmental impact and any mitigation activities proposed which could include:

- Locating the heliport on the highest point of the estate, for example, on top of the tallest building;
- Designing the flight paths to avoid unnecessary low transits over sensitive areas;
- Employing noise abatement flight paths and using approach and departure techniques which minimise noise nuisance;
- Dissipating noise using baffles formed by intervening buildings and trees;
- Insulating buildings and fitting double glazing in vulnerable zones;
- Limiting night operations by transporting only critically ill patients during unsociable hours (2300 to 0700 hours).

1.17 Permitting the use of the heliport by non-emergency helicopters belonging to third parties, whilst it may generate extra revenue, is likely to attract a more antagonistic public reaction to the environmental impact of helicopter movements. In addition permitting these helicopter movements may exceed the hospital's planning permission, incur additional administrative and operational personnel responsibilities and create issues of access and security; especially where passengers have to alight from the heliport through hospital buildings. In addition the situation could arise where non-emergency helicopters are found to block the heliport from receiving emergency helicopters acting in life saving roles.

1.18 This CAP describes the requirements for the provision of a single primary heliport accommodating one helicopter at a time on the premise that this operating arrangement should be sufficient for most hospitals. However, major trauma hospitals and others that might expect to receive mass casualties involving two or more helicopters arriving simultaneously may need to consider a second, alternative, location for helicopters to land at. Preferably, a secondary helicopter landing site should be located close to the ED, but with real estate often at a premium, it is more likely a secondary HLS will have to be located for the transfer of non-critical patients, some distance from the ED perhaps even beyond the hospital boundary (e.g. in a local park). In these cases consideration should be given to ease of transfer by road ambulance and any options identified should be discussed with landowners, local police and fire services. The requirement to activate a secondary site should be included in the hospital's emergency response plan. The responsibility for oversight and site management remains with the hospital trust as described in Section 2 Heliport Operations.

1.19 As an effective alternative to a secondary HLS it may be possible to configure the primary HLS so that it is supported by a simple network of air or ground taxiways capable of servicing one or more parking spots. This option is discussed further, primarily in the context of surface level operations, in Appendix E, but could equally be applied to a rooftop facility.

Heliport site selection (options)

1.20 There are principally three options for siting of an HLS: at surface (ground) level (a variation of this type is a mounded heliport specifically landscaped and constructed for the purpose); at elevated (rooftop) level at a height of more than 3m above the surrounding surface; or a purpose built raised structure that is less than 3m above the level of the surrounding surface. Elevated heliport design is addressed in detail in chapters 3 to 6. Supplementary requirements for heliports provided on a raised structure (less than 3m above the surrounding surface) are addressed in Chapter 7 while supplementary requirements for surface (ground) level heliports, including mounded heliports, are addressed in Chapter 8.

Heliports at surface (ground) level, whether or not mounded

1.21 Heliports built at surface (ground) level are the least expensive to construct and to operate. However, suitable ground level areas are at a premium at most hospitals and are usually being used for buildings, for car parks or for amenity areas (car parking in particular is regarded a good revenue generator at hospitals and the economic case for sacrificing car parking areas to facilitate the considerable space requirements for a ground level heliport will need to be carefully weighed). It should also be borne in mind that HLSs at surface level are the most difficult to secure from the public (whether from inadvertent or deliberate entry) and are most susceptible to noise nuisance and downwash/outwash effects. Moreover unless they can be located in close proximity to the ED, they may not satisfy the clinical needs of a critically ill patient.

1.22 It should be appreciated that ground level sites capable of accommodating helicopters using ‘clear area’ operating techniques will require more space than for helicopter that operate other approved profiles; whether helicopters operate a helipad profile / vertical ‘procedure’ or a ‘short field procedure’. Whatever procedure is utilised, heliports are required to accommodate at least two take-off climb and approach surfaces creating ‘airways’ (generally aligned to take advantage of the prevailing wind conditions) that are free of obstructions which could compromise obstacle limitation surfaces. This is particularly challenging for a ground level facility, likely situated in a densely built up area and so requiring the removal of screening such as trees and shrubs. Providing a mounded heliport may assist to raise-up the level of an HLS to clear ground level obstructions, however, it may be difficult, and is frequently impossible, to find the necessary operating area within an acceptable distance of ED; in which case the option for a raised or elevated heliport should then be considered.

Elevated heliports (more than 3m above ground level) at rooftop level

1.23 From the aviation, environmental and long-term planning perspectives the best position for an HLS is on the roof of the tallest building at the site. Rooftops are generally unused spaces and even if there is air conditioning plant situated on the roof, a purpose-built heliport can usually be constructed above it. Rooftop locations raise the helicopters' approach and departure paths by several storeys and reduce the environmental impact of helicopter operations; in particular noise nuisance and the effects of downwash/outwash at surface level. Rooftop heliports are likely to provide a greater choice of approach path headings (to realise maximum operability this will ideally be 360 degrees allowing the helicopter to take full advantage of a headwind component at all times as well as remaining out of building induced turbulence. However, this 'ideal' situation needs to be weighed against the need to provide lift transfer, at or just below heliport level). In addition elevated rooftop heliports are less likely to influence, or be influenced by, future building plans.

1.24 However, heliports at rooftop level are generally more expensive to build as they require integral fire fighting facilities and, in the past, have always needed dedicated trained crews to operate the fire-fighting equipment (this dictated that the future ongoing operational costs were high). A heliport on the roof of a building housing the ED, with a flat ramp to provide trolley access straight to a dedicated lift to one side beyond the 2D safety area, usually offers the shortest transit and minimises exposure of a patient to the elements. The cost of a rooftop heliport can be controlled by including an HLS provision in the initial design of the building.

Heliports on dedicated raised structures that are less than 3m above the surrounding surface

1.25 An HLS built on a structure that is raised by less than 3m above the surrounding area, when subjected to a thorough risk analysis (see Appendix H), may not be required to provide an integral FFS with the potential associated ongoing operational costs of training and equiping of crews, replenishment of media etc. Therefore a heliport built on a one-storey structure above a car park or other area in close proximity to the ED may afford some economic advantages over an elevated (rooftop) heliport.

1.26 In addition a heliport on a raised structure gives some operational advantages over a surface level heliport as it need not occupy valuable real estate at surface level within the grounds of the hospital. Compared to ground-level sites, raised heliports are more likely to achieve unobstructed approach and take-off flight paths and are to a small degree less likely to impact on future building plans.

1.27 By raising an HLS by one storey this may have some limited beneficial impact on harmful environmental issues (such as noise nuisance, rotor downwash effect etc) created by the helicopter operation; benefits are confined to the case of smaller air ambulance helicopters. However, it is unlikely that raising the HLS by just a single storey will provide much benefit for larger helicopter operations. In particular the severe downwash/outwash effects created by larger types can make operations to heliports on raised structures challenging; due to the risks posed to third parties who may be moving around under final approach and take-off areas and due to the possibility of damage to nearby vehicles and/or property e.g. a raised HLS directly above, and/or surrounded by a public car park. Where operations by very large helicopters are to be facilitated, often the only sure way to reduce the detrimental environmental impact is to locate the HLS above a tall building (preferably the tallest on the estate).

Table 1-1: Comparison of ground level, mounded, raised and rooftop sites

	Ground level	Mounded	Raised structure	Elevated (rooftop)
Aircraft and public security				
Freedom from obstructions at ground level				
Freedom from obstructions in helicopter approach corridors				
Provision of into-wind approaches				
Minimising rotorwash effects / noise nuisance to the public and effects on property				
Reducing the impact of trees and shrubs				
Preservation of trees and shrubs				
Impact on future building plans				
Minimising building costs (CAPEX)				
Minimising running costs (OPEX)				

	Ground level	Mounded	Raised structure	Elevated (rooftop)
Mandatory requirement for integrated fire-fighting equipment				
Mandatory requirement for trained manpower available for each landing				

Key: Colour coding indicates the relative ease or difficulty of meeting certain criterion for each main type of heliport.

Green = easiest, amber = moderate, red = most difficult

Disclaimer: For most aspects the colour coding used is quite subjective and so the Table should be viewed as providing only general comparative guidance between the various heliport options (for example: adopting an aluminium construction means an easy to build, lighter construction and lower-in-maintenance solution than a comparable steel construction).

Refuelling

1.28 It is unusual for a hospital heliport to have a requirement for the installation of a dedicated on-site bulk storage fuelling service and it is not the intention of this CAP to specifically address this option. However, most hospitals will be located within easy reach of a licensed aerodrome where fuelling services will be available, and in many cases offering a refuelling service on a 24/7 basis. However, if for reasons of convenience and economy there is a requirement for an operator to dispense fuel when operating at a hospital landing site then the easiest, and least administratively demanding option for the hospital, will be an arrangement to facilitate a helicopter operator to dispense aviation fuel from barrels via an integrated pump.

1.29 If an operator is to dispense aviation fuel from barrels, it will be necessary to provide a small, secure covered accommodation to typically house up to 4 (200L) drums and a pump. This small secure covered accommodation, provided with an aircraft obstruction light, will need to be located in the vicinity of the helipad and serviced by a hard / firm pathway used to move barrels from store to aircraft. Alternatively, a helicopter operator may elect to bring in their own refuelling bowser or trailer mounted tank which will yield greater mobility and flexibility than do static tanks or drums. A bowser or trailer can be sited nearby and driven, or towed, close to the helipad whenever required.

1.30 By whatever method fuel is provided and dispensed by a helicopter operator, issues of fuel quality control and security and dispensing accountancy all remain the responsibility of the helicopter operator (and not the Board / Trust). If a dedicated bulk storage installation is to be provided on site, then responsibility for the day-to-day operation and fuel quality control passes across to the Board / Trust. Before implementing this option the Board / Trust should be fully appreciative of the scrupulous VAT requirements that will be imposed by HM Revenue Services on a dedicated refuelling service at a hospital, both in initially clearing the facility, and then in the regular and random inspection of the facility and auditing of associated records.

1.31 Further detailed advice on helicopter fuelling conducted in the offshore environment can be found in CAP 437, Standards for Offshore Helicopter Landing Areas – chapters 7 and 8.

Heliport winterisation

1.32 Heliports at which there is an expectation for helicopters to operate regularly in sub zero conditions, may wish to incorporate an electrical heat tracing system to prevent the build-up of snow and ice throughout the entire landing area. Aluminium, widely used in the construction of purpose-built heliports, is known to be a good conductor of heat (having about three times the thermal conductivity of steel), and electrical heating cables can be integrated in the aluminium planking profiles (materials used for cabling should not have a detrimental effect on heliport surface friction and ideally should not protrude above surface level). In consideration of the poor thermal performance of concrete (low conductivity, high inertia), heat tracing electrical cables are not recommended for use with a concrete surface. An efficient electrical heat tracing system incorporated into the heliport design should remove or minimise the labour-intensive need to clear snow and ice manually (see Chapter 6, section 6.4b)

Security

1.33 It is important that the security of the helicopter and the heliport be fully considered to keep malicious persons and straying members of the public from encroaching onto the operating area and/or from tampering with the helicopter. A heliport operation is regarded as “airside” and therefore should be kept secure and free of FOD. Access to the heliport should be restricted to those personnel who have an operational requirement to be there e.g. heliport manager, security staff, fire-fighting teams, porters and clinical teams dispatched to receive a patient etc.

Magnetic field deviation

1.34 Helicopter heading indicators and stabilisation systems cue wholly, or in part, from the earth's magnetic field. Aluminium heliport constructions will not normally produce or interact with a magnetic field however the heliport substructure, where steel is selected, and/or where ancillary services such as electrical cabling and water pipes are incorporated, can generate a significant magnetic field. This field may differ in direction to the natural magnetic field, which in turn will be detected by the helicopter. It is therefore encouraged that magnetic north is initially established to be true for the site, and re-validated before and after key stages of the construction (i.e. "North" is still observed, by compass to be correct). Where possible any deviations should be corrected during construction. Any final magnetic field deviation should be notified to helicopter operators.

Meteorological Information

1.35 Accurate, timely and complete meteorological observations are necessary to support safe and efficient flight operations.

1.36 At a heliport (helicopter operating base or operating site) where there is an Air Navigation Service Provider (ANSP) with certification that includes Meteorological (MET) service provision this provides assurance of the necessary quality of information provided. At a hospital helicopter landing site (HHLS) where there is no certificated MET ANSP the helicopter operator will need to demonstrate to the CAA the reliability and precision of the meteorological information provided and, where necessary, the margins applied to mitigate against the risks of making safety critical weather-related decisions using meteorological information that does not have sufficient quality assurance.

1.37 To enable a helicopter operator to demonstrate the reliability and precision of the meteorological information provided at an HHLS, it is recommended that the HHLS operator installs an automated meteorological observing system in accordance with the applicable requirements for meteorological equipment contained in CAA Publication CAP746 (Requirements for meteorological observations at aerodromes). The system should, as a minimum, be capable of providing the following information:

- Wind speed and direction.
- Height of cloud base above heliport elevation (helideck/helicopter landing surface).
- Barometric Pressure.

- Temperature and dewpoint.

Additional information should be provided if necessary:

- Visibility.
- Present weather.
- Thunderstorm/Cumulonimbus/Towering Cumulus clouds

1.38 Where MET equipment is installed on elevated helidecks alternative arrangements to those detailed in CAP746 may be required. Further details are contained in CAA Publication CAP437 (Standards for offshore helicopter landing areas) Chapter 6 and Appendix E.

1.39 Instrument approach procedures (IAP) enable the continuation of operations in conditions of reduced visibility and lower cloud-base and enhance overall safety by providing accurate navigational information that reduces the risk of Controlled Flight into Terrain. Therefore, at all aerodromes and helicopter landing sites with an approved IAP it is important to ensure that meteorological information used by pilots for weather-related decision making in connection with the IAP is of an appropriate quality. As such, a sponsor applying for approval of an IAP must consider within their safety assessment how they will achieve a suitable level of quality assurance of the meteorological information provided.

1.40 Where helicopter operators sponsor the application for the approval of a Point-in-Space IAP at an unlicensed heliport, such as at a HHLS, to provide the necessary assurance, the helicopter operator will need to provide evidence that the equipment used to provide meteorological information at the HHLS complies with CAP 746. Further details can be found in CAP2520 (Policy and Guidance for the implementation of helicopter Point in Space operations), Chapter 4.

1.41 In all cases, consideration will need to be given as to how weather observations will be transmitted to flight crew. One option would be to make observations available via an internet-based system, but an appropriate solution applicable to each HHLS should be discussed between the HHLS operator and helicopter operator.

Chapter 2
Helicopter performance considerations

General considerations

2.1 The guidance given in this chapter is relevant for UK civil registered helicopter's operating to onshore heliports at hospitals and in particular those operating in accordance with UK Regulation (EU) 965/2012 (Air Operations) Requirements for Air Operators, Operational Requirements Part-OPS, Annex IV Part-CAT or Annex VI Part-SPA. The basic premise in design is that helicopters should be afforded sufficient space to enable them to operate safely at all times to heliports located in an environment that is usually classed as both "congested" and "hostile" (see glossary of terms for a congested and hostile environment).

2.2 For helicopters operating in a congested hostile environment UK Regulation (EU) 965/2012 (Air Operations) Requirements for Air Operators, Part-OPS, Annex IV Part-CAT (Sub Part C Performance and Operating Limitations (POL)) and Annex VI Part-SPA (Sub Part J Helicopter Emergency Medical Service operations (HEMS)) require that these be conducted by helicopters operated in performance class 1 (PC1) (see glossary of terms for performance class 1, 2 and 3 operations). This entails that the design of the heliport should provide a minimum heliport size that incorporates a suitable area for helicopters to land safely back onto the surface in the event of a critical power unit failure occurring early in the take-off manoeuvre. This is assigned the Rejected Take-Off Distance Available for helicopters (RTODA (H)).

2.3 The helicopter's performance requirements and handling techniques are generally contained in Rotorcraft Flight Manual Supplements (RFMS) which includes, where appropriate, performance data and operating techniques applicable for type at an elevated heliport. In considering the minimum elevated heliport size for PC1 operations, the RFMS should publish dimensions that have been established by a manufacturer during flight testing taking into account the visual cueing aspects for the helicopter with All Engines Operating (AEO) and incorporating the Rejected Take-Off Distance (RTOD) for the helicopter in the event of a critical power unit failure occurring before take-off decision point (TDP); in which circumstances the helicopter is required to make a One Engine Inoperative (OEI) landing back to the surface (see glossary of terms). In addition to accommodating an adequate RTOD, the minimum dimensions prescribed in the RFMS establish a minimum elevated heliport size that incorporates suitable visual cues to enable a pilot to perform a normal All-Engines Operating (AEO) landing and a safe OEI landing. These issues are discussed further in Chapter 3 where it is generally concluded that heliport designers need to adopt a cautious approach to determining minimum elevated heliport dimensions by sole reference to those published in the RFMS. In taking account of all considerations, including an assurance of safe surface movement around the helicopter, this should drive designers towards a minimum elevated heliport size that may be larger than the type-specific dimensions published in the RFMS.

2.4 When designing for a suitably sized heliport, hospitals will usually need to consider a range of helicopter types (Air Ambulance, Police and other emergency services, HEMS, SAR etc) and identify the most critical type, which will become the design helicopter (see glossary of terms); every type is required to publish approved profiles for an elevated heliport, and be capable of operating to performance class 1 rules. Therefore at the design concept stage it will usually be necessary to consider performance data for a range of suitable helicopters (including, where possible, future helicopter types that may be under development for similar roles and tasks). Even for the case where a single helicopter type operation is initially envisaged, it is always prudent to consider the future usage aspects of the heliport with the probable introduction of other helicopter types later on.

2.5 The dimensional aspects of the landing area are addressed in more detail in Chapter 3. An illustration of a typical profile for a helicopter operated in performance class 1, which may also include a requirement for obstacle accountability to be considered in the helicopter’s back-up area, are illustrated in Appendix C.

Factors affecting performance capability

2.6 On any given day helicopter performance is a function of many factors including the actual all-up mass; ambient temperature; pressure altitude; effective wind speed component; and operating technique. Other environmental factors, concerning the physical airflow characteristics at the landing area and any associated or adjacent structures which may combine to influence the performance of helicopters. These factors are taken into account in the determination of specific and general limitations which may be imposed in order to assure adequate performance margins are maintained and to ensure any potential exposure period is addressed. These limitations may entail a reduction in the helicopter’s mass (and therefore payload) and in the worse case, an outright suspension of flying operations in certain conditions. It should be noted that, following the rare event of a power unit failure (after TDP), it may be necessary for a helicopter to descend below the level of an elevated heliport to gain sufficient speed to safely fly away.

Chapter 3

Helicopter landing area – physical characteristics

General

3.1 This chapter provides guidance on the physical characteristics, including the obstacle limitation surfaces and sectors necessary for the establishment of a safe and efficient elevated heliport operation. It should be noted that while the overall load bearing capability of the coincident final approach and take-off area (FATO)/ touchdown and lift-off area (TLOF) is usually determined as a function of the maximum take-off mass (MTOM) of the heaviest helicopter intending to operate to the heliport, factors that determine the appropriate heliport dimensions can be less straightforward. It is evident that the minimum elevated heliport size provided in relevant performance sections of type-specific Rotorcraft Flight Manual Supplements (RFMS) does not usually correlate to the D-value (overall length) of the largest helicopter intending to use the heliport. Moreover flight testing to establish the minimum RFMS dimension may not have considered, for example, whether an adequate margin of clearance is assured around the helicopter to facilitate safe and expeditious personnel movements; by considering the particular demands of an air ambulance operation to facilitate safe and efficient patient trolley transfer access to and from the helicopter, with medical staff in attendance.

3.2 Furthermore it should be borne in mind that in some cases the dimensions published for "Category A" Procedures in RFMS only prescribe an area guaranteed to safely contain the undercarriage of the helicopter based on testing to determine the variation in touchdown location (scatter) during a One Engine Inoperative (OEI) landing; in addition to providing adequate visual references for a normal All- Engines Operating (AEO) landing. So the RFMS may not, in all cases, consider whether the Final Approach and Take-Off Area (FATO) incorporating the Rejected Take-Off Distance (RTOD) is sufficient to ensure the complete containment of the entire helicopter (within a FATO that always encapsulates the rotors in addition to the undercarriage) while allowing for scatter in the actual touchdown position of the helicopter - for the case where it is required to reject back onto the surface following an engine failure before take-off decision point (TDP).

3.3 Taking account of these factors, it is recommended the dimensions for the minimum elevated heliport size provided by the RFMS be treated with caution; assuming, in some cases, it may be insufficient to meet all the elements described above. Therefore it is prudent to base the design of an elevated heliport (the load-bearing FATO and coincidental TLOF size) on that which is

1.5 times the D-value of the design helicopter e.g. a quadrilateral landing area is provided where each side is 1.5 x the largest overall length, dimension (D) of the design helicopter. A quadrilateral or octagonal helideck also provides the pilot with the best possible periphery visual references for manouvering, especialy during final approach and rearwards backup profile.

3.4 Where the criteria in this chapter cannot be met in full, the appropriate authority responsible for the approval of the heliport, in conjunction with the helicopter operator(s), may need to consider the imposition of operational restrictions or limitations to compensate for any deviations from criteria. Appendix A addresses a procedure for authorising elevated heliports. A system for the management of compensating restrictions and/or limitations with the production of a 'Heliport Information Plate' to capture the information may be considered - for further guidance see CAP 437, Appendix A.

3.5 The criteria in the following table provide information on helicopter size (D-value), rotor diameter (RD) and mass (t-value).The overall length of the helicopter on its own does not usually determine the size for a minimum suitable landing area, noting also that the dimensions given below are for information purposes i.e. it is ultimately the heliport designers responsibility to ensure they have available all the latest information by type and by variant).

Table 3-1: D-value, 't' Value and other helicopter type criteria

Type	D-value (m)	Rotor diameter (m)	Max weight (kg)	't' value
Civil Aircraft Types				
Airbus EC 135 T2+	12.20	10.20	2910	2.9t
Airbus H135 (EC 135 T3)	12.20	10.20	2980	3.0t
McDonnell Douglas MD902	12.37	10.34	3250	3.3t
Leonardo AW109	13.05	11.00	2600	2.6t
Bell 429	13.11	10.98	3175	3.2t
Airbus H145 D3	13.54	10.8	3800	3.8t
Airbus H145 D2 (BK117 D2)	13.63	11.00	3650	3.7t
Dauphin AS365 N2	13.68	11.93	4250	4.3t

Type	D-value (m)	Rotor diameter (m)	Max weight (kg)	't' value
Dauphin AS365 N3	13.73	11.94	4300	4.3t
Leonardo AW169	14.65	12.12	4800	4.8t
Leonardo AW139	16.63	13.80	6800	6.8t
Leonardo AW189	17.60	14.60	8600	8.6t
Sikorsky S92A	20.88	17.17	12600	12.6t
Military Aircraft Types				
AW159 Wildcat	15.24	12.8	6000	6.0t
Leonardo AW101 Merlin	22.80	18.60	15600	15.6t
CH-47 Chinook	30.14	18.29	22650	22.7t
V-22 Osprey	25.78	11.6	23900	24.0t

Note: By including helicopter types in this table, it should not be automatically assumed the type (or type variant) has the requisite profiles in its RFM to operate to an elevated heliport. At the time of publication, it is noted that the S92, for example, does not have a profile that would allow it to operate PC1 to an elevated heliport in a congested area.

Heliport design considerations – environmental effects

3.6 The assumption in the following sections is that ideally the elevated heliport design will consist of a separate purpose built structure, usually fabricated from aluminium or steel, rather than a non-purpose built area designed to be an integral part of the building; for example a concrete landing area which forms the top of a roof. Whilst a non-purpose built design is not prohibited, it is clear that this specification for design is incapable of adopting much of the good design practice that follows, such as the recommendation for an air gap or for an overhang of the heliport beyond the edge of the building. Designers should therefore consider the advantages of a purpose built landing area, especially from the perspectives presented in the following sections. Designers of non-purpose built landing areas are encouraged to read the following sections and apply best practice principles where practical and cost-effective to do so.

3.7 The location of an elevated heliport, invariably in a congested hostile environment (see glossary of terms) in a city or town within a hospital complex, even where situated at an elevation that is above all other surrounding buildings, may suffer to some degree from its proximity to tall and bulky structures that may be sited around the heliport. The objective for designers, in examining locations presented in initial feasibility studies, is to create heliport designs that are 'safe and friendly' for helicopter operations and to minimise the environmental effects (mainly aerodynamic, but possibly thermal e.g. chimney structures in proximity to the heliport) which could impact on helicopter operations. Where statutory design parameters cannot be fully achieved it may be necessary for compensating restrictions or limitations to be imposed on helicopter operations which could, in severe cases, for example, lead to a loss of payload when the wind is blowing through a 'turbulent sector'.

3.8 Purpose-built helicopter landing areas will basically consist of flat plates and so are relatively streamlined structures. In isolation they would present little disturbance to the wind flow, and helicopters would be able to operate safely to them in a more or less undisturbed airflow environment. Difficulties can arise however, because the wind has to deviate around the bulk of a building causing areas of flow distortion and turbulent wakes. The effects fall into these main categories:

- The flow around large items of superstructure that can be present on top of a building such as air conditioning cooling units or lift shafts, have potential to generate turbulence that can affect helicopter operations. Like the building itself, these are bluff bodies which encourage turbulent wake flows to form behind the bodies.
- Hot gas flows emanating from exhaust outlets such as chimney stacks.

3.9 For an elevated heliport on a building it should ideally be located at or above the highest point of the main structure. This will minimise the occurrence of turbulence downwind of adjacent structures that may also be present on the building. However, whilst it is a desirable feature for the heliport to be elevated as high as possible it should be appreciated that for a landing area much in excess of 60 m above ground level the regularity of helicopter operations may be adversely affected in high winds and low cloud base conditions. Consequently a trade-off may need to be struck between the height of the heliport above surrounding structures and its absolute height above ground level. It is recommended, where possible that the heliport be located over the corner of a building with as large an overhang as is practicable. In combination with an appropriate elevation and a vital air gap, the overhang will encourage the disturbed airflow to pass under the heliport leaving a relatively clean 'horizontal' airflow above the landing area. It is further recommended that the overhang should be such that the centre of the heliport is vertically above, or outboard, of the profile of the building's superstructure. When determining a preference for which edge of the facility the heliport should overhang, the selection of landing area location should minimise the environmental impact due to turbulence, thermal effects etc. This means that generally the landing area should be located so winds from the prevailing directions carry turbulent wakes, and any exhaust plumes, away from the helicopter approach path. To assess if this is likely to be the case it will usually be necessary for designers to overlay the wind direction sectors over the centre of the helideck to establish prevailing wind directions and wind speeds and to assess the likely impact on helicopter operations for a heliport sited at a particular location.

3.10 The height of the heliport above surface level, and the presence of an air gap between the landing area and the supporting building, are the most important factors in determining wind flow characteristics in the landing area environment. In combination with an appropriate overhang, an air gap separating the heliport from superstructure beneath will promote beneficial wind flow over the landing area. If no air gap is provided then wind conditions immediately above the landing area are likely to be severe particularly if mounted on top of a large multi- storey building – it is the distortion of the wind flow that is the cause. However, by designing in an air gap typically of between 3m and 6m, this will have the effect of 'smoothing out' distortions in the airflow immediately above the landing area. Heliports mounted on very tall accommodation blocks will require the largest clearances, while those on smaller blocks, and with a very large overhang, will tend to require smaller clearances. For shallow superstructures of three storeys or less, a typical 3m air-gap may not be achievable and a smaller air gap may be sufficient in these cases.

3.11 It is important that the air gap is preserved throughout the operational life of the facility, and care should be taken to ensure that the area between the heliport and the superstructure of the building does not become a storage area for bulky items that might hinder the free-flow of air through the gap.

Effects of structure-induced turbulence and temperature rise due to hot exhausts

3.12 It is possible that heliports installed on the roofs of buildings located in congested hostile environments will suffer to some degree from their proximity to tall and bulky structures such as adjacent buildings; it is sometimes impractical to site the heliport above every other tall structure. So any tall structure above, or in the vicinity of, the heliport may generate areas of turbulence or sheared flow downwind of the obstruction and thus potentially pose a hazard to the helicopter. The severity of the disturbance will be greater the bluffer the shape and the broader the obstruction to the flow. The effect reduces with increasing distance downwind from the turbulent source. Ideally a heliport should be located at least 10 structure widths away from any upwind structure which has a potential to generate turbulence. Separations of significantly less than 10 structure widths, may lead to the imposition of operating restrictions in certain wind conditions.

3.13 Exhausts, whether or not operating, may present a further source of structure-induced turbulence by forming a physical blockage to the flow and creating a turbulent wake (as well as the potential hazard due to the hot exhaust). As a rule of thumb, to mitigate physical turbulence effects at the heliport it is recommended that a minimum of 10 structure widths be established between the obstruction and the heliport.

3.14 Increases in ambient temperature are a potential hazard to helicopters as this will mean less rotor lift and less engine power margin. Rapid temperature changes are a significant hazard as the rate of change of temperature in the plume can cause engine compressor surge or stall to occur (often associated with an audible ‘pop’) which can result in loss of engine power, damage to engines and/or helicopter components and, ultimately, engine flame out. It is therefore extremely important that helicopters avoid these conditions, or that occurrence of higher than ambient conditions is for-seen, with steps taken to reduce payload to maintain an appropriate performance margin. The heliport should be located so that winds from the prevailing wind directions carry the plume away from the helicopter approach / departure paths.

Note: Except for a case where multiple stacks are sited in close proximity to the landing area, it is unlikely that emissions from a typical lone source e.g. a chimney stack at a hospital, will have any significant effect on ambient conditions at the heliport. However, guidance is offered in CAA Paper 2008/03 Helideck Design Considerations – Environmental Effects (Section 3.6: Temperature Rise due to Hot Exhausts) for an issue that is more common in the offshore environment. Design teams are encouraged to refer to the relevant section in CAA Paper 2008/03 for more specific guidance. If it is known that a HLS is to be situated in areas where hot exhausts or vented gases may be present it is advised to conduct a micro-climate study to fully understand local environmental effects.

Heliport design – environmental criteria

Note: The principal tools used to predict the flow field around a heliport are wind tunnel testing and Computational Fluid Dynamics (CFD) methods which are highlighted in the following sections. For a more in-depth treatment of these issues, when undertaking detailed flow modelling, design teams are encouraged to refer to relevant sections in CAA Paper 2008/03 Helideck Design Considerations – Environmental Effects (Section 5: Methods of Design Assessment) available on the publications section of the CAA website at www.caa.co.uk/publications. Further guidance on airflow testing at onshore elevated heliports is provided in Appendix G.

3.15 The design criteria given in the following sections represent the current best information available and may be applied to new facilities, and to significant modifications to existing facilities and/or where operational experience has highlighted potential issues. When considering the volume of airspace to which the following criteria apply, designers should consider the airspace up to a height above heliport level which takes into consideration the requirement to accommodate helicopter landing and take-off decision points (LDP/TDP) or committal points. This is considered to be a height above the heliport corresponding to 30 feet (9.14m) plus wheels-to-rotor height plus one rotor diameter.

3.16 As a general rule in respect to turbulence, a limit on the standard deviation of the vertical airflow velocity of 1.75 m/s should ideally not be exceeded. Where these criteria are significantly exceeded (i.e. where the limit exceeds 2.4 m/s), there is the possibility that operational restrictions will be necessary. Facilities where there is a likelihood of exceeding the criteria should be subjected to appropriate testing e.g. a scale model is placed in a wind tunnel, or by CFD analysis, to establish the wind environment in which helicopters will be expected to operate.

3.17 Unless there are no significant heat sources in the vicinity of the heliport, designers should consider commissioning a survey of ambient temperature rise based on a Gaussian Dispersion model and supported by wind tunnel testing or CFD analysis. Where the results of such modelling and/or testing indicate there may be a rise in air temperature of more than 2 degrees Celsius averaged over a 3-second time interval, there is the possibility that operational limitations and/or restrictions may need to be applied .

Heliport structural design

3.18 The helicopter landing area and any parking areas provided should be of sufficient size and strength and laid out so as to accommodate the heaviest and largest helicopter requiring to use the facility (referred to as the design helicopter – see glossary of terms). The structure should incorporate a load bearing area designed to resist dynamic loads without disproportionate consequences from the impact of an emergency landing anywhere within the area bounded by the TLOF perimeter markings (see Chapter 4).

3.19 The helicopter landing area and its supporting structure should be fabricated from steel, aluminium alloy or other suitable materials designed and fabricated to suitable standards. Where differing materials are to be used in near contact, the detailing of the connections should be such as to avoid the incidence of galvanic corrosion.

3.20 Both the ultimate limit states (ULS) and the serviceability limit states (SLS) should be assessed. The structure should be designed for the SLS and ULS conditions appropriate to the structural component being considered as follows:

- For deck plate and stiffeners –
  - ULS under all conditions;
  - SLS for permanent deflection following an emergency landing.
- For helicopter landing area supporting structure –
  - ULS under all conditions;
  - SLS.

3.21 The supporting structure, deck plates and stringers should be designed to resist the effects of local wheel or skid actions acting in combination with other permanent, variable and environmental actions. Helicopters should be assumed to be located within the TLOF perimeter markings in such positions that maximise the internal forces in the component being considered. Deck plates and stiffeners should be designed to limit the permanent deflection (deformation) under helicopter emergency landing actions to no more than 2.5% of the clear width of the plates between supports. Webs of stiffeners should be assessed locally under wheels or skids and at the supports, so as not to fail under landing gear actions due to emergency landings. Tubular structural components forming part of the supporting structure should be checked for vortex-induced vibrations due to wind.

Note: For the purposes of the following sections it may be assumed that single main rotor helicopters will land on the wheel or wheels of two landing gear or on both skids, where skid fitted helicopters are in use. The resulting loads should be distributed between two main undercarriages. Where advantageous, a tyre contact area may be assumed within the manufacturer’s specification.

Case A – helicopter landing situation

A heliport should be designed to withstand all the forces likely to act when a helicopter lands. The load and load combinations to be considered should include:

a) **Dynamic load due to impact landing**

This should cover both a heavy normal landing and an emergency landing. To account for an emergency landing an impact load of 2.5 x MTOM should be applied in any position on the landing area together with the combined effects of b) to g) inclusive. For parking stands an impact load of 1.5 x MTOM of the design helicopter should be used while. The emergency landing case will govern the overall design of the structure.

b) **Sympathetic response of the landing platform**

After considering the design of the heliport structures supporting beams and columns and the heliport structure and the characteristics of the design helicopter, the dynamic load (see a) above) should be increased by a suitable structural response factor (SRF) to take account of the sympathetic response of the helicopter landing area structure. The factor to be applied for the design of the helicopter landing area framing depends on the natural frequency of the deck structure. Unless specific values are available based upon particular undercarriage behaviour and deck frequency, a minimum SRF of 1.3 should be assumed.

c) **Overall superimposed load on the loading platform**

To allow for any appendages that may be present on the deck surface, such as heliport lighting, in addition to the wheel loads, an allowance of 0.5kN/m2 should be applied over the whole area of the heliport.

d) **Lateral load on landing platform supports**

The helicopter landing platform and its supports should be designed to resist concentrated horizontal imposed actions equivalent to 0.5 x maximum take-off mass (MTOM) of the design helicopter, distributed between the undercarriages in proportion to the vertical loading and applied in the horizontal direction that will produce the most severe loading for the structural component being considered.

e) **Dead load of structural members**

This is the normal gravity load on the element being considered.

f) **Environmental actions on the heliport**

Wind actions on the heliport structure should be applied in the direction, which together with the horizontal impact actions produce the most severe load case for the component considered. The wind speed to be considered should be that restricting normal (non-emergency) helicopter operations at the landing area. Any vertical up and down action on the heliport structure due to the passage of wind over and under the heliport should be considered.

g) **Punching shear**

Where helicopters with wheeled undercarriages are operated, a check should be made for the punching shear from a wheel of the landing gear with a contact area of

65 x 10^3 mm^2 acting in any probable location. Particular attention to detailing should be taken at the junction of the supports and the helicopter landing area.

Case B – helicopter at rest situation

In addition to Case A above, a heliport should be designed to withstand all the applied forces that could result from a helicopter at rest; the following loads should be taken into account:

a) **Imposed load from helicopter at rest**

All parts of the heliport should be assumed to be accessible to helicopters, including any parking areas and should be designed to resist an imposed (static) load equal to the MTOM of the design helicopter. This load should be distributed between all the landing gear and applied in any position so as to produce the most severe loading on each element considered.

b) **Overall superimposed load**

To allow for personnel, freight, refuelling equipment and other traffic, snow and ice, and rotor downwash effects etc, a general area-imposed action of 2.0kN/m2 should be added to the whole area of the heliport.

c) **Horizontal actions from a tied down helicopter including wind actions**

Each tie-down should be designed to resist the calculated proportion of the total wind action on the design helicopter imposed by a storm wind with a minimum one-year return period.

d) **Dead load**

This is the normal gravity load on the element being considered and should be regarded to act simultaneously in combination with a) and b). Consideration should also be given to the additional wind loading from any parked or secured helicopter (see also e) (1) below).

e) **Environmental actions**

Wind loading – the 100-year return period wind actions on the helicopter landing area structure should be applied in the direction which, together with the imposed lateral loading, produces the most severe load condition on each structural element being considered.

Size obstacle protected surfaces / environment

3.22 According to UK Regulation (EU) 965/2012 (Air Operations) Requirements for Air Operators, Part-OPS, Annex IV Part-CAT (Sub Part C Performance and Operating Limitations (POL)) and Annex VI Part-SPA (Sub Part J Helicopter

Emergency Medical Service operations (HEMS)), in Europe flights conducted to elevated heliports in congested areas have to be undertaken by helicopters operated in performance class 1 (PC1) (see Chapter 2 for further discussion).

3.23 PC1 operating rules require that the size of the helicopter landing area incorporates a Rejected Take-Off Area (RTOA), into which the helicopter can safely reject (with assurance of full containment including rotors), in the event of an engine failure occurring during the early stages of the take-off procedure. The size of the Final Approach and Take-Off Area (FATO) incorporating the RTOA will vary from type to type (and sometimes even between type variants). Taking into account also the need for safe and efficient ground operations (e.g. allowing effective patient trolley transfers from the helicopter to a dedicated lift), the minimum landing area will rarely, if ever, be as small as for an offshore helideck at 1 times the overall length of the helicopter – D - (note: helicopter's operating to offshore helidecks are not required to meet the same stringent PC1 rules). For the reasons already discussed in Section 1 of this chapter, and in Chapter 2, the dimensions published in the RFMS should be treated with caution when considering the minimum acceptable dimensions for a landing area (the FATO with coincidental TLOF).

3.24 At the earliest design / concept stage designers should consider what type (or types) may be required to operate at a particular heliport throughout the proposed operating life of the facility. Exceptionally, consideration of the size of the heliport may be based on operations by a single type, but much more likely will need to accommodate a range of twin-engine helicopters operating a number of different roles including, but not limited to: Police, HEMS, Air Ambulance, other emergency services and Search and Rescue (SAR). In this event the task of the heliport designer becomes one of identifying the most critical type in respect to the dimensional design aspects of the heliport and to then assume this is the 'design helicopter', in the knowledge that other types, having an approved class 1 profile in the RFMS, should also be able to operate safely and legally to the heliport; provided the other critical design consideration for accommodating the maximum take-off mass (MTOM) of the heaviest helicopter intending to operate to the heliport is also satisfied.

3.25 Chapter 3, Table 1 provides the basic characteristics for a range of small, medium and large civil helicopters known to be capable of operating under specified conditions in performance class 1 to elevated heliports in congested areas (but see additional 'exceptions' note below Table 1). It is re-emphasised that the D-value of the helicopter does not usually define the minimum dimensions of the landing area and it is the responsibility of the heliport designer to collate information from all relevant sources to determine the minimum dimensions for a particular elevated heliport. In general a heliport which is equal to, or is greater than, 1.5 times the D-value of the design helicopter will usually be sufficiently large to accommodate all civil helicopters, including those that are smaller than the design helicopter.

3.26 The helicopter landing area (the FATO with coincidental TLOF) should be surrounded by a safety area (SA) which need not necessarily be a solid surface. The safety area should extend outwards from the periphery of the landing area for a distance of at least 3m or 0.25D for the largest helicopter the heliport is intended to serve, whichever is greater, subject to the FATO plus safety area achieving a minimum overall dimension of 2D for each external side based on a quadrilateral. Where applicable, the surface should be prepared in a manner to prevent any degradation or flying debris caused by rotor downwash/outwash.

3.27 No fixed raised object should be permitted around the periphery of the landing area, in the safety area, except for objects which because of their safety function are required to be located there. In consideration of the above, only the following essential objects may exceed the height of the landing area, but should not do so by more than 25 cm:

- The guttering (associated with the requirements of paragraph 5.2);
- The perimeter lighting required by Chapter 4;
- All handrails, which are incapable of complete retraction or lowering for helicopter operations, including handrails provided for an access ramp;
- Where provided, a Fixed Monitor System (FMS) permitted as an alternative means of compliance to a Deck Integrated Fire-Fighting System (DIFFS).

3.28 The surface of the safety area, when a solid, should not exceed an upward slope of 4 per cent outwards from the edge of the landing area and should be continuous with the edge of the landing area. There should be a protected side slope rising at 45 degrees from the edge of the safety area to a distance of 10m, whose surface should not be penetrated by obstacles, except when obstacles are located to one side of the landing area only, in which case they may be permitted to penetrate the surface of the side slope.

3.29 Objects whose function requires them to be located on the surface of the landing area such as, where provided, the TD/PM Circle and Cross “chevron” marking lighting prescribed by Chapter 4 and detailed in Appendix D, should not exceed the surface of the landing area by more than 2.5 cm. Such objects should only be present if they do not pose a hazard to helicopter operations.

3.30 The assumption is made that an elevated heliport will not usually be designed with a system of helicopter ground or air taxiways feeding to one or more stands for parked helicopters. However, provision for such arrangements is accounted for in ICAO Annex 14 Volume II and may be considered within the overall design of an elevated heliport. The provisions of Annex 14 Volume II, including those relating to the physical characteristics of a surface level heliport and the marking and lighting of taxiways and stands, are reproduced for convenience in a stand- alone Appendix, E. Advice and guidance on the interpretation of these provisions in practice may be sought from CAA Flight Operations (Helicopters).

3.31 An elevated heliport should ideally be provided with approach and take-off climb surfaces that allow for an approach or take-off to always be conducted into wind (i.e. to assure this in all wind conditions, an obstacle protected surface would need to be provided throughout 360 degrees). A 360 degree approach and take- off / departure sector will minimise the likelihood for operational restrictions becoming necessary in particular conditions (combinations of wind speed / direction). However, due to the nature of UK hospitals, invariably situated in congested areas, unless the heliport is situated at the highest point on the estate, it is often not possible to provide obstacle limitation surfaces that are uninfringed throughout 360 degrees given there is also a need to consider obstacles out to a distance of several kilometres from the heliport. In the circumstances, as a minimum, a heliport should be provided with at least two approach and take- off climb surfaces, ideally separated by 180 degrees, but by not less than 135 degrees, to avoid downwind conditions, minimise cross-wind conditions and permit for a baulked landing (see illustrations of obstacle limitation surfaces in figures 1 and 2 below). The slopes for the obstacle limitation surfaces should not be greater than, and the other dimensions not less than, those specified for Slope Design Category A in table 3 (below).

Figure 4-1: Obstacle limitation surfaces - take-off climb & approach surface

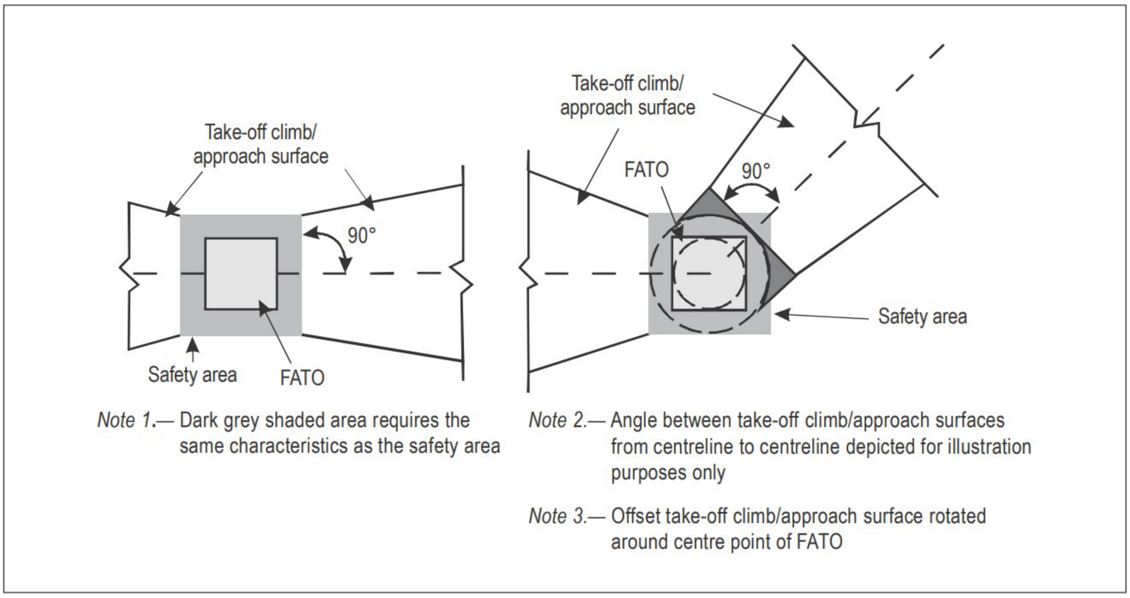


Figure 4-2: Take-off climb / approach surface width

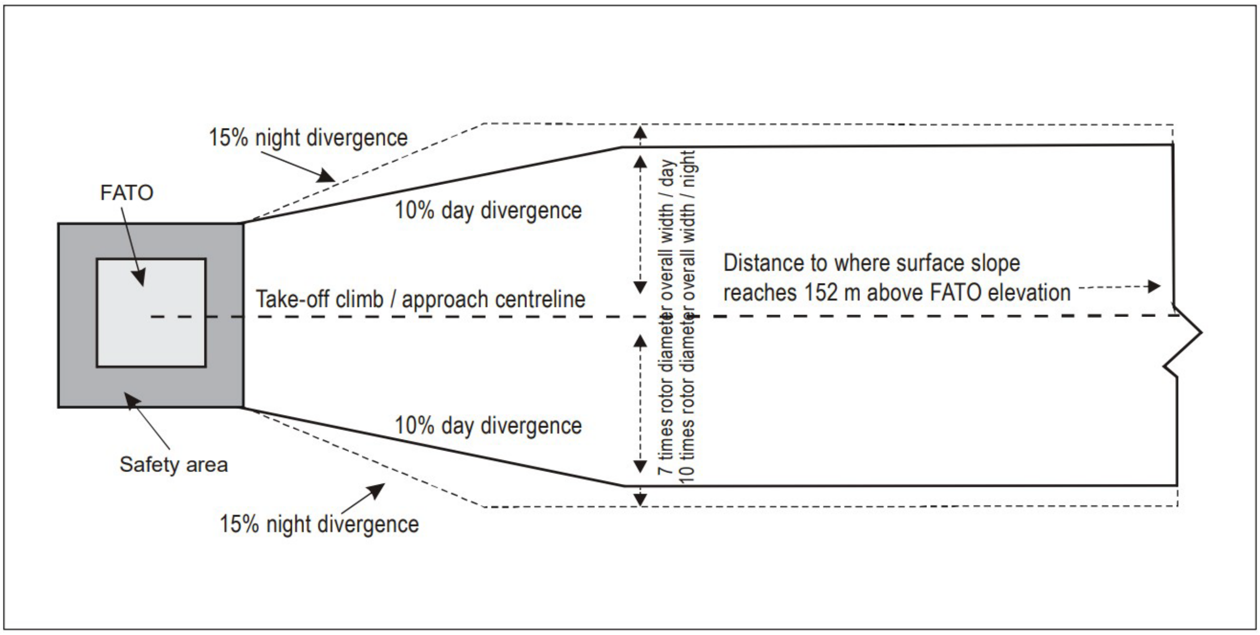


Table 4-1: Dimensions and slopes of obstacle limitation surfaces for all visual FATOs

	Slope design categories		
Surface and dimensions	**A**	**B**	**C**
Approach and take-off climb surface			
Length of inner edge	Width of safety area	Width of safety area	Width of safety area
Location of inner edge	Safety area boundary (clearway boundary if provided)	Safety area boundary	Safety area boundary
Divergence (1st and 2nd section)			
Day use only	10%	10%	10%
Night use	15%	15%	15%
First section			
Length	3386m	245m	1220m
Slope	4.5% (1:22.2)	8% (1:12.5)	12.5% (1:8)
Outer width	b)	N/A	b)
Second section			
Length	N/A	830m	N/A
Slope	N/A	16% (1:6.25)	N/A
Outer width	N/A	b)	N/A
Total length from inner edge a)	3386m	1075m	1220m
Transitional surface (FATOs with a PinS approach procedure with a VSS)			
Slope	50% (1:2)	50% (1:2)	50% (1:2)
Height	45m	45m	45m

a) The approach and take-off climb surface lengths of 3386m (for slope A) and 1075m and 1220m (for slopes B and C respectively) bring the helicopter to 152m (500’) above the elevation of the heliport.
b) 7 rotor diameters overall width for day operations or 10 rotor diameters overall width for night operations.

Note: The slope design categories in Table 4-1 represent minimum design slope angles and not operational slopes. Slope category “A” generally corresponds with helicopters operated in performance class 1; slope category “B” generally corresponds with helicopters operated in performance class 3; and slope category “C” generally corresponds to helicopters operated in performance class 2. For the purpose of this CAP, where helicopters are required to operate in PC1 to elevated heliports in congested areas, the designer need be concerned only with the characteristics of slope category “A”. Slope category “B” and “C” design slopes are not applicable in these cases.

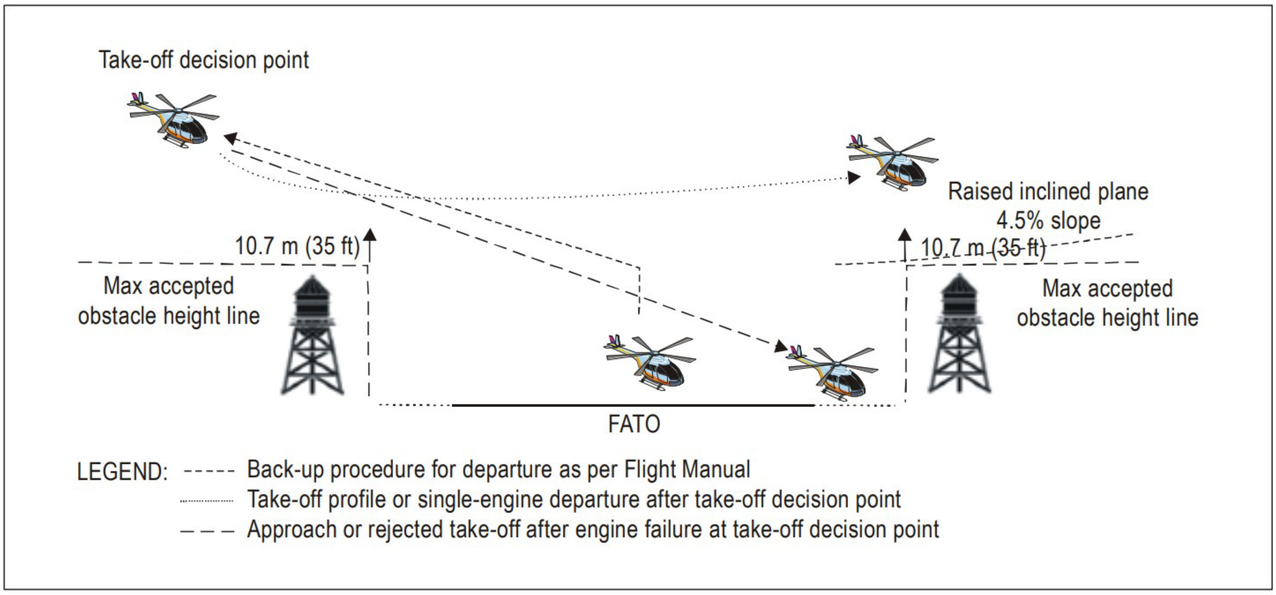
3.32 For helicopter operations conducted in performance class 1 applying the 4.5% slope “A” criteria, the length of the inner edge of the take-off climb and approach surface equates to the width of the safety area, located on the safety area boundary at the elevation of the helicopter landing area. For operations by day, two side edges are provided originating at the ends of the inner edge diverging uniformly at a rate of 10% until they reach an overall width of 7 x rotor diameter (RD) of the largest helicopter authorised to operate to the heliport. From this point the outer edge continues horizontal and perpendicular to the centreline of the approach and take-off climb surface out to a distance from the inner edge where the surface reaches a height of 152m (500’) above the elevation of the inner edge – on level ground this is an overall length of 3386m.

3.33 For operations by night, the two side edges originating at the ends of the inner edge diverge uniformly at a rate of 15% until they reach an overall width of 10 x rotor diameter (RD) of the largest helicopter authorised to operate to the heliport. From this point the outer edge continues horizontal and perpendicular to the centreline of the approach and take-off climb surface out to a distance from the inner edge to a distance where the surface reaches a height of 152m (500’) above the elevation of the inner edge – on level ground this is an overall length of 3386m.

Note: For an elevated heliport without a Point in Space (PinS) approach incorporating a visual segment surface (VSS) there is no requirement to provide transitional (side) surfaces (however, attention is drawn to paragraph 3.52 for restrictions where obstacles are present on both sides of the heliport).

3.34 For operations conducted in PC1 using approved vertical / rearward take-off and landing profiles, there is a facility for heliports to raise the origin of the 4.5% inclined plane for the approach and/or take-off climb surface directly above the landing area. This is depicted in a generic example in Figure 3 (below) and in Appendix C in an illustration of obstacle clearances in the back-up area.

Figure 4-3: Example of raised inclined plane during operations in performance class 1



Note 1: This example diagram does not represent any specific profile, technique or helicopter type and is intended to show a generic example. An approach profile and a back-up procedure for departure profile are depicted. Specific manufacturers operations in performance class 1 may be represented differently in the specific Helicopter Flight Manual. Annex 6, Part 3, Attachment A provides back-up procedures that may be useful for operations in performance class1.

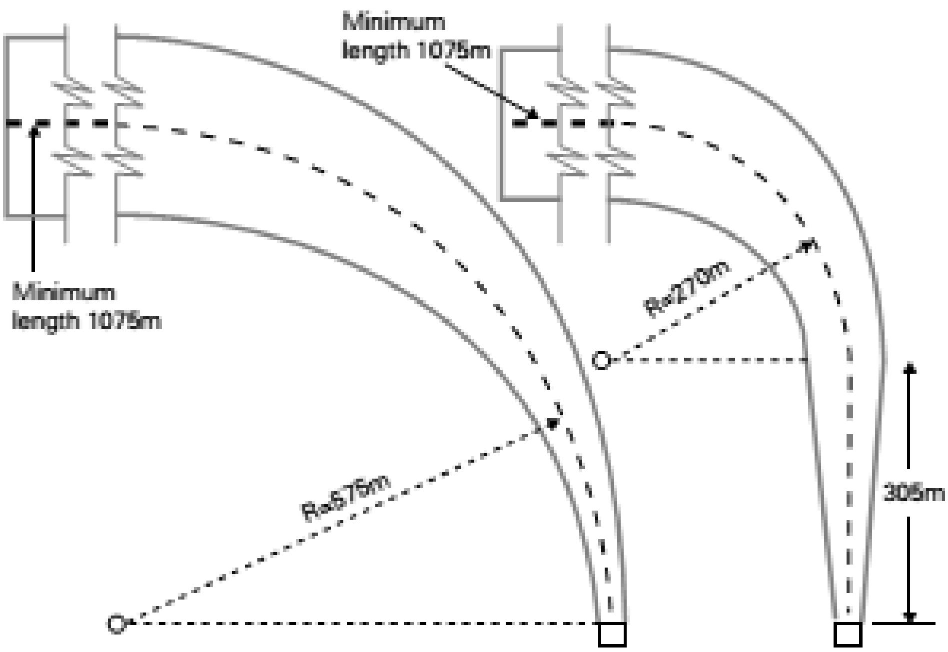
Note 2: The approach / landing profile may not be the reverse of the take-off profile.

Note 3: Additional obstacle assessment might be required in the area where the back-up procedure is intended. Helicopter performance and the Helicopter Flight Manual limitations will determine the extent of the assessment required.

3.35 The characteristics of the take-off climb and approach surfaces are based on a 4.5% slope which provides an obstacle limitation surface that may only be penetrated by objects if the results of an aeronautical study have reviewed the associated risks and mitigation measures. However, any identified objects may limit the operation. Where practicable existing objects above the prescribed surfaces should be removed, except when the object is shielded by an immoveable object or if the results of the aeronautical study determine that the object would not adversely affect the safety or regularity of helicopter operations. New objects, or extensions to existing immoveable objects, should not be permitted above the surfaces except when assessed and approved by an appropriate aeronautical study.

3.36 In the case of an approach or a take-off climb surface involving a turn, the surface should be a complex surface containing the horizontal normal’s to the centreline and the slope of the centreline should be the same as for a straight approach or take-off and climb surface. In the case of an approach or take-off climb surface involving a turn, the surface should not contain more than one curved portion. The curved portion provided should be the sum of the radius of arc defining the centreline and the straight portion originating at the inner edge should not be less than 575m. Additionally any variation in the direction of the centreline should be designed so as not to necessitate a turn radius less than 270m. See Figure 4.

Figure 4-4: Curved approach and take off climb surface for all FATOs



Note 1: Any combination of curve and straight portion may be established using the following formula: S+R>575m and R>270 where S=305m, where S is the length of the straight portion and R is the radius of turn. Any combination > 575m will work.

Note 2: The minimum length of the centre line of the curve and straight portion is 1075m but may be longer depending upon the slope used. See table 4.1 for longer lengths.

Note 3: Helicopter take-off performance is reduced in a curve and as such a straight portion along the take-off surface prior to the start of the curve should be considered to allow for acceleration.

Surface

Note: Where a heliport is constructed in the form of a grating, e.g. where a passive fire-retarding system is selected (see Chapter 5), the design of the landing area surface should ensure that ground effect (promotion of a beneficial ground cushion) is not reduced for any of the types likely to use the heliport.

3.37 The TLOF (landing area), including all markings on the surface of the touchdown area (see Chapter 4, figures 6 & 7), should be provided with a non-slip finish. It is important that adequate friction exists over the entire surface of the heliport (inside the touchdown / positioning marking (TD/PM) circle primarily to benefit the helicopter but also for safe personnel / trolley transfer movements, and outside the TD/PM circle for safe personnel / trolley transfer movements), in all directions and for worst case conditions, i.e. when the deck is wet. Over-painting surfaces with material other than non-slip coatings will likely reduce surface friction. Suitable non-slip surface friction paint is available commercially and should be used.

3.38 Every TLOF should be equipped with adequate surface drainage arrangements and a free-flowing collection system that will quickly and safely direct any rainwater, fire fighting media and/or fuel spillage away from the heliport surface to a safe place. Heliports, with a solid plate surface, should be cambered (or laid to a fall) to approximately, and not less than, 1:100. Any distortion of the heliport surface due to, for example, loads from a helicopter at rest should not modify the landing area drainage system to the extent of allowing spilled fuel to remain on the surface. A system of guttering or a slightly raised kerb should be provided around the perimeter to prevent spilled fuel from falling on to other parts of the installation or the building beneath; any spillage should be conducted to an appropriate drainage system. The capacity of the drainage system should be sufficient to contain the maximum likely spillage of fuel on the heliport and be adequate to cope with the largest foreseeable rainfall rate. The calculation of the amount of spillage to be contained should be based on an analysis of helicopter type, fuel capacity, and typical fuel loads. The design of the drainage system should preclude blockage by debris and/or the drainage system should be regularly inspected or tested to ensure that it remains clear. The landing area should be properly sealed so that all spillages will be collected by the drainage system.

3.39 The touchdown area should be shown to achieve an overall average surface friction coefficient of not less than 0.60μ and no two adjacent 1m^2 areas should achieve less than 0.60μ as determined by an acceptable test method (see notes below). The use of a landing area net to compensate for insufficient friction is disallowed at hospital landing sites and other sites operated to by skid fitted helicopter types due to the possibility of skids becoming entangled in the net. In addition, patient trolley access right up to the helicopter will be required at all times at a hospital heliport, which would be compromised by the presence of a landing net. The area outside the TD/PM circle should be shown to achieve an overall average surface friction coefficient of not less than 0.5μ and no two adjacent 1m^2 areas should achieve less than 0.5μ as determined by an acceptable test method (see notes below). It is considered that this value of friction coefficient should provide for the safe movement of personnel, including trolley transfers.

3.40 The heliport operator should ensure that the heliport is kept free from oil, grease, ice, snow, excessive surface water or any other contaminant that could degrade the surface friction properties (see also Chapter 6). Assurance should be provided to the helicopter operator that procedures are in place for the removal of contaminants prior to operations. Depending on the type of surface, the average surface friction of the heliport may need to be re-validated at regular intervals to verify a continuing fitness for purpose (a scheme is described in CAP 437).

Note 1: A review of helideck friction measurement techniques has concluded that the test method to be employed for helidecks and heliports, except for those having profiled surfaces, should utilise a friction measuring device that employs the braked wheel technique; is able to control the wetness of the deck during testing; includes electronic data collection, storage and processing; and allows the whole of the deck surface to be covered to a resolution of not less than $1m^2$. An example helideck friction survey test protocol is published in CAP 437, Appendix G.

For heliports with profiled surfaces (whether painted or not), wheeled testers are deemed to be unsuitable as they can only measure friction in the rolling direction of the wheel. In these cases, testing should be conducted in accordance with CAP 437, paragraph 3.43 for heliports commissioned on or after 1 January 2017 and in accordance with CAP 437, paragraph 3.44 for heliports commissioned before 1 January 2017.

Note 2: Friction testing of the yellow TD/PM circle and the area outside the white Cross marking is not required where TD/PC and Cross marking “chevrons” are fitted. The light fittings themselves occupy a significant proportion of the area and are required to be provided with a 0.60 μ (minimum) finish. Testing of the remaining small / narrow areas of the paint markings would be impractical, especially around the TD/PM circle as wheeled testers are normally be maintained on a straight course. In addition, the light fittings have been found to disturb friction tester readings as the test wheel passes over their raised profiles.

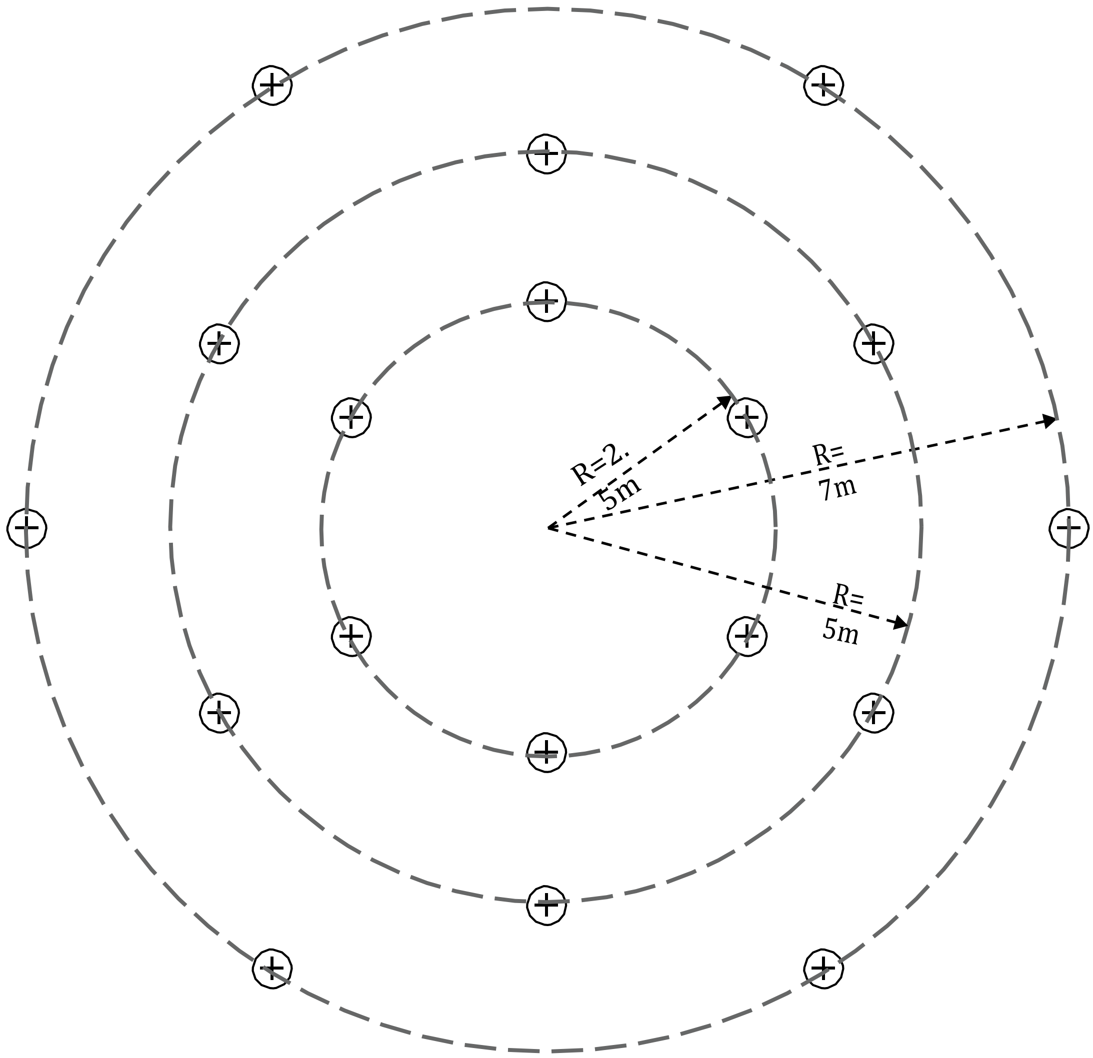
Helicopter tie-down points

3.41 Sufficient flush fitting (when not in use) tie-down points should be provided for securing the maximum sized helicopter for which the heliport is designed. Tie-down points should be located and be of such strength and construction to secure the helicopter when subjected to weather conditions pertinent to the heliport operation.

3.42 Tie-down points should be compatible with the dimensions of tie-down strop attachments. Tie-down points and strops should be of such strength and construction so as to secure the helicopter when subjected to weather conditions pertinent to the heliport design considerations. The maximum bar diameter of a tie-down point should match the strop hook dimension of the tie-down strops carried in most helicopters. Advice on recommended safe working load requirements for strop / ring arrangements for specific helicopter types can be obtained from the helicopter operator(s).

3.43 An example of a suitable tie-down configuration is shown at Figure 5. The helicopter operator can provide guidance on the configuration of the tie-down points for specific helicopter types.

Figure 4-5: Example of suitable tie-down configuration



Note 1: The tie-down configuration should be based on the centre of the TD/PM circle.

Note 2: Additional tie-downs will be required for a parking area.

Note 3: The outer circle is not required for helicopters with D-values of less than 22.2m.

Safety net

3.44 Safety nets for personnel protection should be installed around the landing area, in the safety area, except where adequate structural protection against falls exists. The netting used should be of a flexible nature, with the inboard edge fastened just below the edge of the landing area. The net itself should extend at least 1.5 metres in the horizontal plane and be arranged so that the outboard edge does not exceed the level of the landing area and be angled so that it has an upward and outward slope of approximately 10°.

3.45 A safety net designed to meet these criteria should 'contain' personnel falling into it and should not act as a trampoline. Where lateral or longitudinal centre bars are provided to strengthen the net structure they should be arranged and constructed to avoid causing serious injury to persons falling on to them. The ideal design should produce a 'hammock' effect which should securely contain a body falling, rolling or jumping into it, without serious injury. When considering the securing of the net to the structure and the materials used, care should be taken that each segment is fit for purpose. Polypropylene deteriorates over time; various wire meshes have been shown to be suitable if properly installed.

Note 1: It is not within the scope or purpose of this CAP to provide detailed guidance for the design, fabrication and testing of perimeter nets. These specific issues are addressed for netting systems on offshore helidecks (and are equally applicable for onshore heliports) in the Offshore Energy UK Guidelines for the Management of Aviation Operations' Issue 6 April 2011.

Note 2: Perimeter nets may incorporate a hinge arrangement to facilitate the removal of sacrificial panels for testing.

Access points – ramps and stairs

3.46 For reasons of safety it is necessary to ensure that embarking and disembarking medical teams and patients are not required to pass around the helicopter tail rotor, or around the nose of a helicopter having a low profile main rotor, if a 'rotors-running turn-round' is conducted. Many helicopters have patient access on one side only and the landing orientation of the helicopter in relation to access points is therefore important.

3.47 There should be a minimum of two access / egress routes to and from the heliport preferably diametrically opposite one another. The most efficient, and fail safe, means of moving patients on trolleys to and from an elevated heliport is by use of a short flat ramp linking the heliport to a dedicated lift transfer located outside the minimum 2D safety area, from rooftop level, direct to ED.

3.48 Where a ramp 10m or longer is employed to transfer a patient from heliport level to a lower level lift, the maximum gradient should ideally not exceed 1:20 – or less wherever possible. For short sections of ramps a steeper gradient may be acceptable subject to a risk assessment. The ramp design may need to incorporate a waiting area no less than 2m below the level of the heliport on which specialist personnel can congregate with their equipment to observe the arrival and departure of helicopters. It is preferable for the ramp design to run away from the heliport to put distance between congregating personnel and the potential crash location, and also to provide a walkway around the building below heliport level should the need arise to approach the heliport from the opposite side. Ideally two ramps are preferable, but one ramp and one staircase may be deemed acceptable where both are wide enough for a trolley and/or for a stretcher with attendants. The layout of the ramp / staircase arrangement should be optimised to ensure that, in the event of an accident or incident on the heliport, personnel are able to escape upwind of the helicopter. Adequacy of the emergency escape arrangements from the heliport should be included in any evacuation, escape and rescue analysis for the heliport; the analysis may require that a third escape route be provided.

Note: For discussion on the use of ramps (and the preferred use of dedicated lifts at rooftop level) in the context of the needs of the patient, see Chapter 1.

3.49 If a Fixed Monitor System (FMS) is installed in preference to a Deck Integrated Fire-Fighting System (DIFFS) – see Chapter 5 – and foam monitors are co-located on access platforms, care should be taken to ensure that no monitor is so close to an egress point as to risk causing injury to escaping personnel due to the operation of the monitor in an emergency situation.

3.50 Where handrails associated with heliport access / escape points exceed the height limitations given in paragraph 3.27 they should be made retractable, collapsible or removable. When retracted or collapsed the rails should not impede safe access / egress. Handrails which are retractable or collapsible may need to be painted in a contrasting colour scheme (see Chapter 4). Procedures should be put in place to retract collapse or remove them prior to a helicopter arrival. Once the helicopter has landed, and the air crew have indicated that passenger movement may commence, the handrails should be raised and locked into position. The handrails should be retracted, collapsed or removed again prior to the helicopter taking off.

Lifts

3.51 On a large roof it should be possible to provide a dedicated lift in close proximity for access directly from heliport level to the ED facility. However, if this option is to be realised it is imperative that the lift housing does not compromise the obstacle limitation surfaces established for the heliport by creating a dominant obstacle above the level of the landing area which penetrates an established obstacle limitation surface (a very large structure could also be a source of structure-induced turbulence in addition to compromising helicopter approach and take-off corridors). For this reason the lift-housing should be located outside the 2D safety area, where, provided there are obstructions above heliport level on one side only, there are no formal obstacle limitation surfaces for a visual heliport.

Note: In considering the siting of a lift above heliport level, designers should avoid locations which impact on the preferred approach and/or take-off directions i.e. where the prevailing wind is south-westerly, and airways are separated by 180 degrees, it is inadvisable to site a lift, rising above heliport level, outside the safety area, in the quadrant west through to south or north through to east.

3.52 It is important that any dedicated lift servicing the heliport is immediately available to the heliport 'on demand'. Every effort should be made to install a dedicated lift for heliport use only, but if it is not possible to provide a dedicated lift solely for heliport use, then the next best option will be to commandeer a public lift (prior to the helicopter touching down) and to isolate it for immediate heliport use. In this case an override facility would be required to allow authorised personnel only to take control of the lift when the heliport is in use, prior to the helicopter landing.

Note 1: The public should not be able to use the lift to access the heliport areas. Where lift transfer to ED is the preferred option, the risk of possible lift failure at a critical moment should be considered.

Note 2: Where trolley transfer is used a covered location should be identified close to the heliport where a dedicated patient trolley can be stored securely, so one is always available.

Helicopter base facilities for a helicopter emergency medical services (HEMS) operation

3.53 Air ambulance helicopters are normally based at a location central to the area they cover, and are not likely to be based at a particular hospital. However, some city-centre hospitals may regard a HEMS helicopter as integral to their pre- hospital care system such that they may require a HEMS helicopter to be based at the hospital either permanently or during operational hours only; in which case additional crew facilities should be considered.

3.54 To service a HEMS heliport, helicopter bases require an operations room, a crew room and various support facilities. If the base is to be used for the regular training of paramedics and doctors in the medical and aviation aspects of HEMS operations, additional offices, training rooms and facilities would need to be considered.

3.55 For permanently based helicopters, an aircraft hangar should improve the security and serviceability of the helicopter, and provide an environment for minor technical tasks to be undertaken on site. The effect of any hangar arrangement on obstacle protected surfaces and any associated turbulence issues should be fully assessed before committing to the project.

3.56 Where RFF personnel are permanently based at a HEMS heliport, there should be provided a heated covered area close to the heliport where personnel can store, layout and don their Personal Protective Equipment (PPE).

Chapter 4
Visual aids

General

4.1 A heliport intended for use by day needs only to display appropriate markings, while a heliport intended for use at night will need to display appropriate aeronautical lighting in addition to appropriate markings. The markings described in this chapter are based on specifications included in Annex 14, Volume II (5th Edition, amendment 9 July 2020) and, for heliport lighting, are developed based around the Specification for a helideck lighting scheme published in Appendix C in CAP 437, adapted in Appendix D of CAP 1264 to support onshore heliport operations to hospital HLSs conducted by night in visual meteorological conditions (VMC). This specification is now reproduced in the onshore sections of the ICAO Heliport Manual (doc. 9261).

Wind direction indicator(s)

4.2 The purpose of a wind direction indicator is to display the wind direction and provide an indication of wind speed at the heliport. A facility should be equipped with at least one wind direction indicator to provide a visual indication of the wind conditions prevailing at the heliport during helicopter operations.

4.3 The location of the wind direction indicator(s) should be in an undisturbed air stream avoiding any effects caused by nearby structures (see also Section 2 in Chapter 3), and unaffected by rotor downwash/outwash from helicopters. The location of the wind direction indicator should not compromise the established obstacle protected surfaces (see Chapter 3). Typically, the primary wind direction indicator will consist of a coloured windsock.

4.4 The wind sock should be easy visible to the pilot on the approach (at a height of at least 650ft (200m) on approach to the hover, when landing on the surface of the heliport, and prior to take-off. Where these operational objectives cannot be fully achieved by the use of a single windsock, consideration should be given to siting a second wind sock in the vicinity of the heliport, which may be used to indicate a specific difference between the local wind over the landing area and the free stream wind (which the pilot will need to consider for the approach).

4.5 A windsock should be a truncated cone made of a suitable lightweight fabric with a minimum length of at least 1.2m, a diameter at the larger end of at least

0.3m and a diameter at the smaller end of at least 0.15m. The colour should provide good contrast with the operational background. Ideally a single colour windsock, preferably orange, should be selected. However, where a combination of colours is found to provide better conspicuity against a changeable operating background, orange and white, red and white or black and white colour schemes could be selected, arranged as five alternate bands with the first and last band being the darker colour (see photo below for a typical example).

4.6 If the heliport is intended to be operated at night, the windsock(s) will need to be illuminated. This can be achieved by internal illumination using a floodlight pointing through the wind cone, for example. Alternatively, the windsock can be externally lit using a floodlight. Care should be taken to ensure that any system used to illuminate the windsock highlights the entire cone section while not presenting a source of glare to a pilot operating to the heliport at night.

Figure 4-6: Photograph of windsock

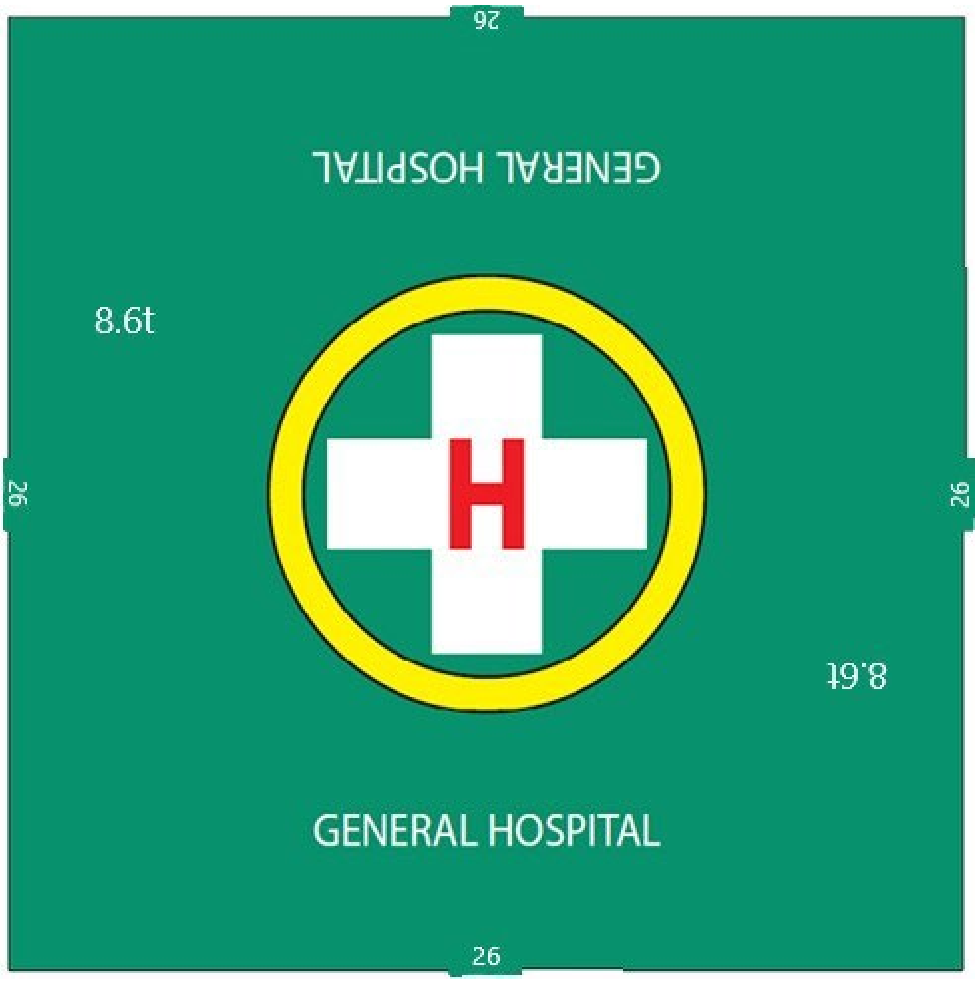
Helicopter landing area markings

Note 1: Aluminium constructions are widely used in the provision of elevated heliports. These tend to be a natural light grey colour and may present painting difficulties. The natural light grey colour of aluminium may be acceptable provided it can be demonstrated that the surface achieves the minimum friction properties specified in Chapter 3, Section 3.39. Where a surface is left unpainted it will normally be necessary to enhance the conspicuity of essential heliport markings by, for example, overlaying markings on a black background or by enhancing the conspicuity of the yellow TD/PM circle, the white cross and the red “H” by outlining them with a thin black line (typically 5-10 cm wide).

Note 2: Guidance on font type, spacing between letters or numerals and between words is given in Annex 14 Volume II, Chapter 5 and the ICAO Heliport Manual.

4.7 Except in the case of note 1 above, the background colour of the heliport should be dark green. The perimeter of the landing area should be clearly marked with a white painted TLOF perimeter line at least 30 cm wide. Non slip finishes should be used throughout (see Chapter 3).

Figure 4-7: Markings for single main rotor helicopters (hospital)



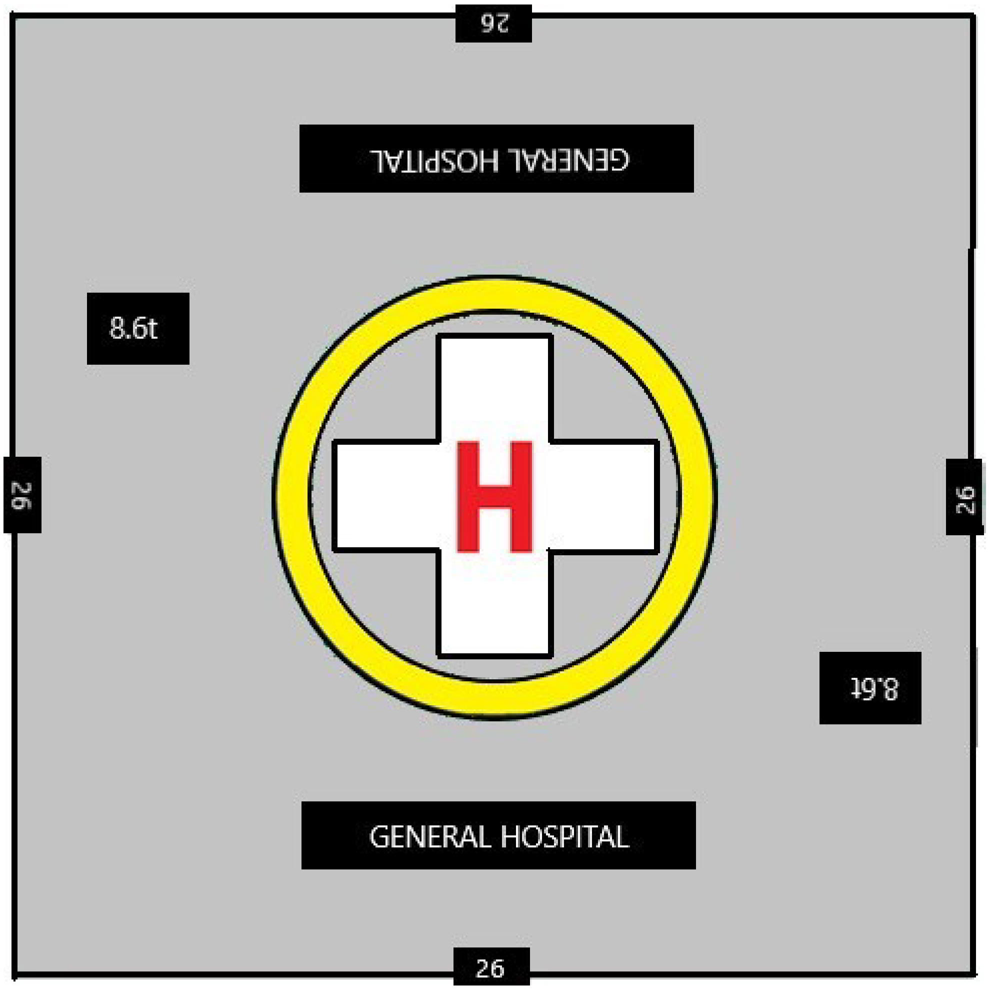


Figure 4-8: Alternate aluminium deck markings for single main rotor helicopters (hospital)

4.8 The dimensions of the heliport should be marked as a two-digit number within the broken perimeter marking so as to be readable from the preferred final approach direction(s) in the manner shown in Figure 4-7 and 4-8 in a contrasting colour (preferably white). The heliports overall dimension should be expressed to the nearest whole number with 0.5 rounded down e.g. a heliport designed for the AW189, having a D-value of 17.60m, assuming the heliport is 1.5D in size should be marked “26”. The characters, to be displayed in two or more locations, should be a minimum height of 90 cm with a line width of approximately 12 cm. However, for large heliports over 30 m, the characters may be increased to a height of not more than 1.5 m with a line width of approximately 20 cm. Where possible the heliport dimension markings should be well separated from other markings such as the heliport identification “H” marking and the maximum allowable mass (t) marking, in order to avoid any confusion with recognition.

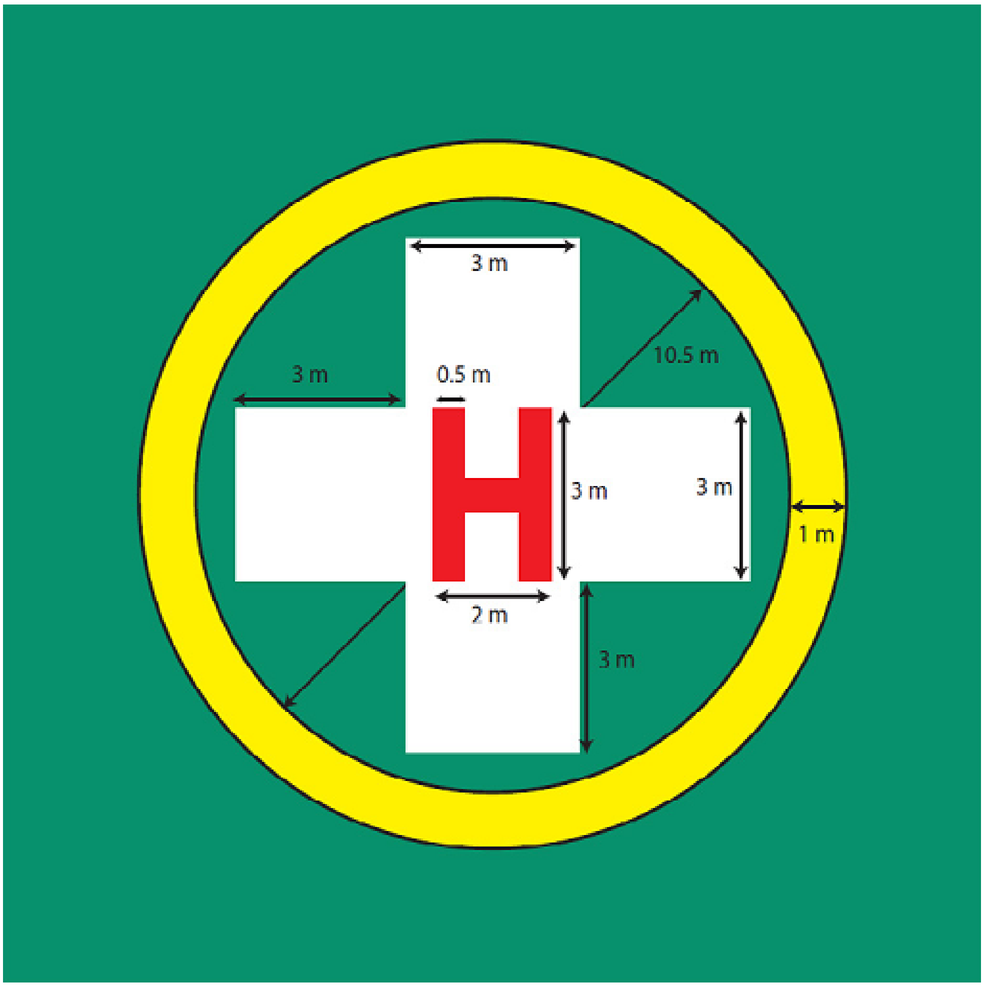
4.9 A maximum allowable mass marking should be marked on the heliport in two positions readable from the preferred final approach direction(s) adjacent to the perimeter of the landing area in the manner shown in figure 4-7 and 4-8. The marking should consist of a two or three-digit number expressed to one decimal place rounded to the nearest 100 kg and suffixed by the letter “t” to indicate the allowable helicopter mass in tonnes (1000 kg) e.g. an AW189 at 8600 kg is expressed as “8.6t”. The height of the figures should be at least 90 cm, and ideally 1.2m, with a line width of 12-15 cm and be in a colour which contrasts with the heliport surface (preferably white). However, for large heliports over 30 m diameter, characters may be increased to a height of not more than 1.5 m with a line width of approximately 20 cm. Where possible the mass markings should be well separated from other markings such as the heliport name marking, the edge of the TD/PM circle and the heliport dimension markings, in order to avoid confusion with recognition.

4.10 A touchdown / positioning marking (TD/PM) circle should be provided and painted in the manner shown in Figure 4-7 and 4-8. In the interests of standardisation of the marking and associated circle and chevron lighting, the TD/PM circle marking, should have a width (thickness) of at least 1.0 m (but not greater than 1.1 m), presented as a yellow circle with an inner diameter of 10.5m. This also ensures that the inner edge of the yellow circle surrounds, but does not overlap, the unique hospital heliport white cross marking, providing a standard picture to a pilot by day and night. The centre of the marking should be located at the centre of the landing area. The location and dimensional characteristics of the TD/PM circle are illustrated in Figure 4-9.

4.11 A heliport identification “H” marking should be provided and located at the centre of the white cross with the cross bar of the “H” lying perpendicular to the preferred direction of approach (which ideally is aligned with the prevailing wind direction). For a heliport at a hospital the “H”, having dimensions of 3.0m x 2.0m x 0.5m, should be painted in red and superimposed on the white cross, as illustrated in Figure 4-9.

4.12 A simple and unique heliport name marking, to facilitate unambiguous communication via an aeronautical radio, should be painted in at-least one, but ideally two locations, aligned with the preferred final approach directions in symbols not less than 1.5 m high with a line width of approximately 20 cm and in a colour (normally white) which contrasts with the heliport surface. Care should be taken to ensure the heliport name markings are distinct and separate from other markings such as the heliport dimension markings and the maximum allowable mass markings; in order to avoid any confusion with recognition. See Figure 4-7 and 4-8.

Figure 4-9: 'H', white cross and touchdown / positioning marking dimensions



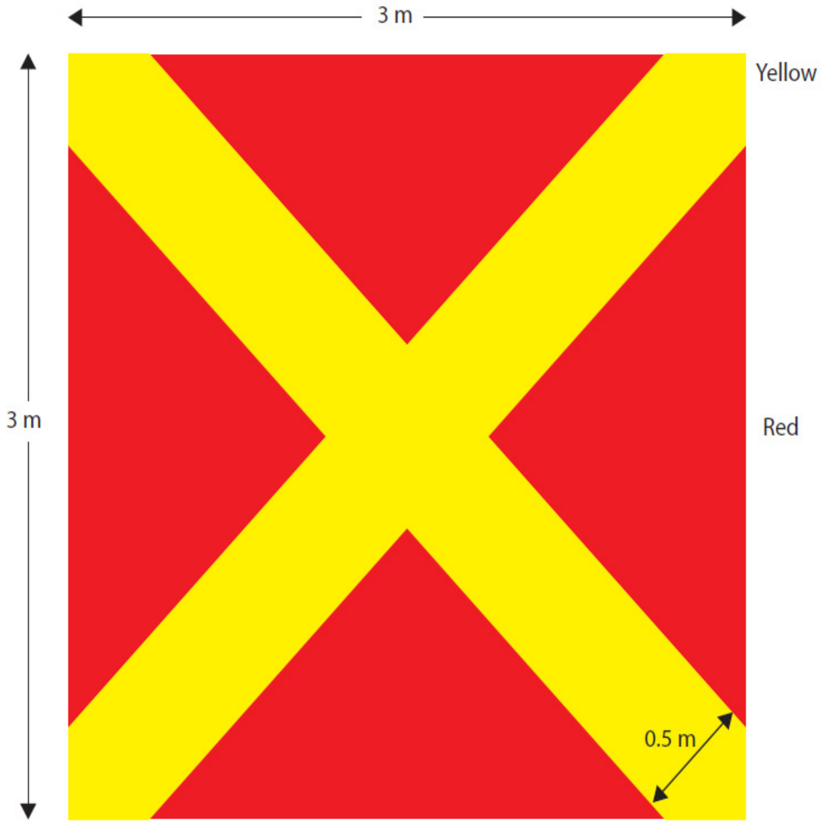
4.13 On rare occasions it may be necessary to protect a helicopter from landing or manoeuvring in close proximity to limiting obstructions, e.g. a marking is applied on the surface to prohibit touchdown in certain directions. Where required a prohibited sector is indicated by applying 0.5m red hatching bands to the TD/PM, with white and red hatching out to the edge of the landing area. The characteristics for the marking, and how it is utilised operationally, are described fully in CAP 437: Standards for Offshore Helicopter Landing Areas, Chapter 4, section 4.16 and Figures 5 and 6.

Figure 4-10: Example of prohibited landing heading marking

Note: The position of the 'H' and the orientation and size of the prohibited landing heading segment will depend on the obstacle.

4.14 For certain operational or technical reasons a heliport may have to prohibit helicopter operations. In such circumstances, the ‘closed’ state of the heliport should be indicated by use of the signal shown in Figure 4-11. This signal is the standard ‘landing prohibited’ signal given in the Rules of the Air and Air Traffic Control Regulations.

Figure 4-11: Landing prohibited signal for a hospital heliport



4.15 Where the FATO and TLOF are not co-located, a Helicopter Aiming Point (HAP) should be provided. This may be used to increase lateral separation of the approach path from fixed obstacles or to distance high power take-off profiles from the public. Consisting of a 9m x 9m triangle, which should be within a solid surface area and marked as shown in Figure 4-12. This surface is to provide ground cushion effect, and to resist the impact of an emergency landing only. Aircraft should come to a hover, and air taxi via a marked and lit route to the TLOF, unless the air taxi route is self evident. However it may be considered acceptable to utilise a HAP within for example a field of suitable load bearing where only a white triangle is used as shown in Figure 4-13. Both types utilise white lighting to clearly demonstrate that they are only designed as a FATO, and a separate TLOF exists to facilitate final touchdown on the surface.

Figure 4-12: Helicopter aiming point surface

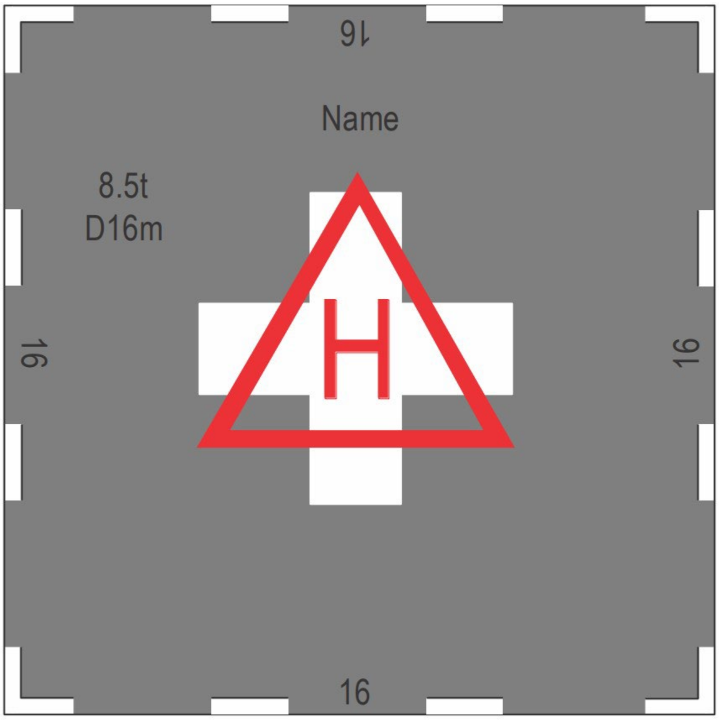
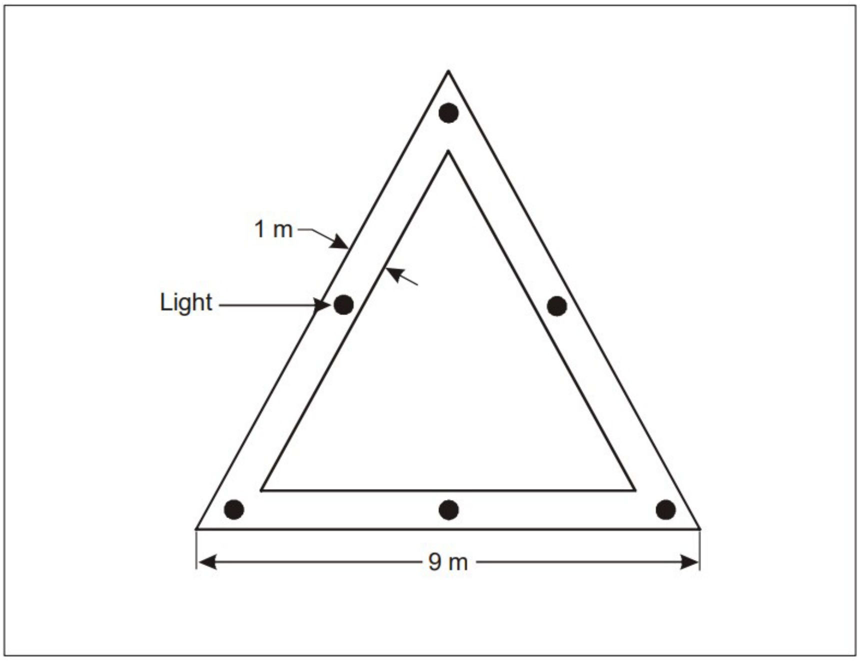


Figure 4-13: Helicopter aiming point



Paint colours should conform to the following BS 381C (1996) standard or equivalent BS 4800 colour. White should conform to RAL charts.

Colour	Standard
Red	BS 381C:537/ RAL 3001 (Signal Red) BS 4800: 04.E.53/ RAL 2002 (Poppy Red)
Yellow	BS 381C:309/ RAL 1018 (Canary Yellow) BS 4800:10.E.53/ RAL 1023 (Sunflower Yellow)
Dark Green	BS 381C:267/ RAL 6020 (Deep Chrome Green) BS 4800: 14.C.39 (Holly Green)
White	RAL 9010 (Pure White) RAL 9003 (Signal White)

Helicopter landing area lighting

All new Hospital Heliports intended to be used at night should be designed with the Heliport Lighting Scheme as described in Appendix D. A reduced scheme may be considered only for ground-based helipads, where either the chevron or TDPM ring may be omitted – but not both. It is recommended in all cases to lay the wiring for the full system to allow for the later addition of the missing lighting component.

On complex terrain, especially where ground slopes downwards and presents a risk of dynamic rollover the perimeter lights may be moved to the edge of the safe operating area usually in a circular pattern, but TDPM markings and hardstanding perimeter markings should also be present.

Note 1: The paragraphs below should be read in conjunction with Appendix D which contains the specification for the full heliport lighting scheme comprising: heliport perimeter lights, lit touchdown / positioning marking and lit green cross (chevron) markings. The specification for each element is fully described in the Appendix with the overall operational requirement detailed in Section 1. The heliport lighting scheme is intended to provide effective visual cues for a pilot throughout the approach and landing manoeuvre at night. No provision is made in the specification for compatibility with night vision enhancing systems e.g. NVIS goggles. Starting with the initial acquisition of the heliport, the lighting should enable a pilot to easily locate the position of the heliport, in an often-well-lit congested area of a city or town, at the required range. The lighting should then guide the helicopter to a point above the landing area and provide visual cues to assist with the touchdown.

Note 2: The specification has an in-built assumption that the performance of the lighting system will not be diminished by the presence of any other lighting due to the relative intensity, configuration or colour of other lighting sources on or adjacent to the heliport. Where other non-aeronautical ground lighting under the control of the facility has the potential to cause confusion or to diminish or prevent the clear interpretation of heliport lighting systems, it will be necessary for the heliport operator to extinguish, screen or otherwise modify these lights to ensure that the effectiveness of the heliport lighting system is not compromised. The CAA recommends that heliport operators give serious consideration to shielding high intensity light sources (e.g. by fitting screens or louvers) from helicopters approaching and landing and maintaining a good colour contrast between the heliport lighting and any surrounding lighting sources. Particular attention should be paid to the areas adjacent to the heliport.

Note 3: All lighting should be fed from a UPS system. See CAP 437.

4.16 The periphery of the landing area should be delineated by Omni-directional green perimeter lights visible from on and above the landing area. The pattern formed by the lights should not be visible to the pilot from below the elevation of the landing area. Perimeter lights should be mounted above the level of the heliport but should not exceed the height limitations specified in Appendix D, paragraph D13. The lights should be equally spaced at intervals of not more than three metres around the perimeter of the landing area, coincident with the white perimeter marking (see Chapter 4, paragraph 4.7). In the case of square or rectangular landing areas there should be a minimum of four lights along each side including a light at each corner of the landing area. Flush fitting lights may exceptionally be used at locations along the edge of the landing area where an operational need exists to move items of equipment to and from the landing area, e.g. at the access locations on the periphery where it is necessary for a stretcher trolley to exit the landing area onto a ramp. Care should be taken to select flush fitting lights that will meet the minimum intensity requirements stated in Appendix D, Table D-2.

4.17 In order to aid the visual task of final approach and hover and landing it is important that the heliport is adequately illuminated for use at night. In the past compliance has been sought by providing a system of (typically) 8 deck level floodlights mounted around the perimeter of the landing area. Experience has shown, however, that deck level floodlighting systems can adversely affect the visual cueing environment by reducing the conspicuity of green heliport perimeter lights during the approach, and by causing glare and loss of pilots' night vision during the hover and landing. Furthermore, floodlighting systems often fail to provide adequate illumination of the centre of the landing area leading to the so called 'black-hole effect'. Even well designed and maintained floodlighting systems do not provide effective visual cueing until within relatively close range of the heliport due to the scale of the visual cues involved.

4.18 In view of the well documented weaknesses of heliport floodlighting, the CAA has been seeking to identify better methods for meeting the top-level requirement to provide effective visual cues for night operations, with a particular focus on finding technologies to more adequately highlight the touchdown markings. Through research programmes initiated in the offshore environment during the 1990's it was demonstrated by a series of dedicated and in-service trials that effective visual cues could be provided by means of a lit touchdown / positioning marking circle and a lit heliport identification "H" marking. This scheme, modified for the onshore environment and described in detail in Appendix D, is demonstated to provide equivalency in the onshore operating environment, usually in a congested area, and has been shown to provide the visual cues required by the pilot earlier on in the approach, and much more effectively than floodlighting, and without the disadvantages associated with floodlights such as glare. The CAA believes that the new lighting scheme, first introduced as the offshore variant in CAP 437 Standards for Offshore Helicopter Landing Areas, represents a significant safety enhancement over traditional floodlighting and is strongly recommending that the onshore industry deploys the new lighting scheme in preference to floodlighting. In addition, all operators of existing onshore elevated heliports should consider the safety benefits of upgrading their facilities to meet the final specification for a Heliport Lighting System described in detail in Appendix D.

Note: The offshore lighting scheme was developed to be compatible with helicopters having wheeled undercarriages, this being the prevailing configuration on the (offshore) United Kingdom Continental Shelf during the development of the specification. Although compliant with the ICAO maximum obstacle height of 2.5cm, and likely to be able to withstand the point loading presented by (typically) lighter skidded aircraft, compatibility when operating skidded helicopters to elevated and raised heliports fitted with the offshore configuration of the lighting cannot be assured. Due to the potential for raised fittings to induce dynamic rollover and/or ground resonance with helicopters equipped with skids, it has been determined that the onshore version of the scheme, often being installed at heliports used by skid-fitted helicopters, should avoid a lit "H" altogether and instead should present green cross markers, which are sufficiently spaced to mitigate any incidence of interaction with skid fitted helicopters. The detail is described in Appendix D, where the height of the system, including any mounting arrangements, should not exceed 2.5 cm above surface level.

4.19 The new system described in paragraph 4.18 above, assures that effective visual cueing is provided for the acquisition, approach, hover and landing tasks. In view of the weaknesses described in paragraph 4.17, it is considered that floodlighting systems have proven to be relatively ineffective for these tasks. Their continued use for the provision of primary visual cueing on new build raised and elevated heliports is therefore not supported. However, CAA recognises that in the past, in the absence of any viable alternative, the industry has invested, in good faith, in deck-mounted heliport floodlighting systems. CAA has no objection to these systems being retained for the purpose of providing a source of illumination for on-deck operations, such as patient handling and, where required, for lighting the heliport name marking on the surface. Where the improved lighting system described in Appendix D is retro-fitted at an existing heliport, unless otherwise instructed by aircrew, any floodlights present should be switched off for the entire approach, landing and take-off phases. In addition, particular care should be taken to maintain correct alignment to ensure that floodlights do not cause dazzle or glare to pilots seated in helicopters landed on the heliport. All floodlights should be capable of being switched on and off at the pilot’s request independantly of the main lighting system.

Obstacles – marking and lighting

4.20 Fixed obstacles such as hospital chimneys which present a hazard to helicopters should be readily visible from the air. If a paint scheme is necessary to enhance identification by day, alternate black and white, black and yellow, or red and white bands are recommended, not less than 0.5 metres, or more than six metres wide. The colour scheme should be chosen to contrast with the background to the maximum extent. Paint colours should conform to the references at paragraph 4.15 above.

4.21 Omni-directional low intensity steady red obstruction lights conforming to the specifications for low intensity obstacle (Group A) lights described in CAP 168 Licensing of Aerodromes, Chapter 6, Appendix 6D and Table 6A.1, having a minimum intensity of 10 candelas for angles of elevation between 0 degrees and 30 degrees should be fitted at suitable locations to provide the helicopter pilot with visual information on the proximity and height of objects which are higher than the landing area and which are close to it. Objects which are more than 15 metres higher than the landing area should be fitted with intermediate low intensity steady red obstruction lights of the same intensity spaced at 10 metre intervals down to the level of the landing area (except where such lights would be obscured by other objects).

4.22 Omni-directional low intensity steady red obstruction lights should be fitted to the highest point of dominant obstacles that are above the landing area. The light should conform to the specifications for a low intensity obstacle (Group B) light described in CAP 168 Licensing of Aerodromes, Chapter 6, Appendix 6D and Table 6A.1, having a minimum intensity of 50 candelas for angles of elevation between 0 and 15 degrees, and a minimum intensity of 200 candelas between 5 and 8 degrees. Where it is not practicable to fit a light to the highest point of a dominant obstacle the light should be fitted as near to the extremity as possible.

4.23 Red lights should be arranged so that the locations of the objects which they delineate are visible from all directions of approach above the landing area. Any failures or outages should be reported immediately to the helicopter operator.

4.24 For certain obstacles it may be more effective to use floodlighting to illuminate the obstruction rather than fixed red lights. One example could be where it is necessary to highlight trees. The use of floodlighting is permitted provided care is exercised to ensure that lighting used does not present a source of glare to pilots operating to the heliport.

4.25 A number of supplementary heliport visual aids are specified by Annex 14 volume II and are commercially available to assist helicopters operating to a heliport located in a congested area by day and/or by night. Additional aids may be provided including a heliport beacon, a visual alignment guidance system and visual approach slope indicator, a lit helicopter aiming point marker, a flight path alignment guidance marking / lighting system and an approach lighting system. These systems are summarised in the table below. Full system specifications are presented in Annex 14 Volume II. See also CAP 637, Visual Aids handbook which provides examples of some visual aids peculiar to onshore helicopter operations.

System name and function (objective)	Rationale for recommendation	System description
Heliport beacon (for heliport acquisition to make it more conspicuous to assist the pilot to locate and identify the heliport at night and by day in reduced visibility)	Where long range visual guidance is considered necessary and is not provided by other visual means or where identification of the heliport is difficult due to surrounding lights.	A beacon is located on, or adjacent to the heliport preferably at an elevated position. ICAO Heliport Manual Part 2, reference: Section 5.3.2
Visual alignment guidance system (to provide conspicuous and discrete cues to assist a helicopter pilot to attain and maintain an 'on track' approach based on the centreline of the FATO)	Provided to serve an approach to a heliport where one or more of the following conditions exist especially at night: a) obstacle clearance, noise abatement or ATC procedures require a particular track to be flown; b) the environment of the heliport provides few visual surface cues and; c) it is physically impractical to install an approach lighting system.	Two units located equidistant on either side of the centreline of the FATO at the downwind edge of the FATO, in the safety area and aligned along the preferred approach direction. ICAO Heliport Manual Part 2 reference: Section 5.3.5.

System name and function (objective)	Rationale for recommendation	System description
Visual approach slope indicator (to provide conspicuous and discrete colour cues, within a specified elevation and azimuth, to assist a helicopter to attain and maintain an approach slope which will guide them down to a desired position within the FATO)	Provided to serve an approach to a heliport where one or more of the following conditions exist especially at night: a) obstacle clearance, noise abatement or ATC procedures require a particular slope to be flown; b) the environment of the heliport provides few visual surface cues and; c) the characteristics of the helicopter required a stabilised approach.	A unit should be located in the safety area adjacent to the nominal aiming point and aligned in azimuth with the preferred approach direction. ICAO Heliport Manual Part 2 reference: Section 5.3.6.
Approach lighting system (to allow the helicopter by day and night to visually identify the heliport and align the helicopter on the centreline of the FATO to provide for a straight-in approach in the preferred direction of approach)	An approach lighting system should be provided at a heliport where it is desirable and practicable to indicate a preferred approach direction.	A row of three lights spaced uniformly at 30m intervals in a straight line with a cross bar of 5 lights (18m width) located 90m from the end of the FATO. ICAO Heliport Manual Part 2 reference: Section 5.3.3.

System name and function (objective)	Rationale for recommendation	System description
Flight path alignment guidance marking and lighting system (to provide flight path alignment guidance in the direction of approach and/or departure, by day and night and in reduced visibility)	Where it is desirable and practicable to indicate available approach and/or departure path directions, but where there is insufficient area to provide a full approach lighting system (see above).	Marking and lighting may be located in the TLOF, FATO or safety area or on any suitable surface in the vicinity. Markings consist of one or more arrows containing three or more lights with 1.5m to 3.0m spacing. ICAO Annex 14 Volume II references: Section 5.2.18 and 5.3.4 and Heliport Manual Part 2 5.3.4.
Helicopter aiming point marker lighting (to assist a pilot at night to approach to a hover over a desired position within the FATO)	Applies to a surface level heliport where it is necessary for a pilot to make an approach to a particular point within the FATO before proceeding to a remote TLOF to touchdown.	A 9m x 9m triangle with six lights placed equidistantly within the triangle. ICAO Annex 14 Volume II reference: Section 5.2.7 and 5.3.8 and Heliport Manual Part 2 5.3.8.

System name and function (objective)	Rationale for recommendation	System description
Helicopter stand floodlighting	The objective of helicopter stand floodlighting is to provide illumination of the surface of a stand and the associated markings to assist the manoeuvring and positioning of a helicopter and facilitation of essential operations around the helicopter.	Helicopter stand floodlights should be located so as to provide adequate illumination, with a minimum of glare to the pilot of a helicopter in flight and on the ground, and to personnel on the stand. The arrangement and aiming of floodlights should be such that a helicopter stand receives light from two or more directions to minimize shadows. ICAO Annex 14 Volume II and Heliport Manual Part 2 reference: Section 5.3.10.

Chapter 5

Heliport fire-fighting services

Introduction

5.1 This chapter presents standards for the appropriate level of fire protection for elevated heliports located within the UK at or above 3m above the surface of the surrounding terrain.

5.2 The consequences resulting from post-crash fire following an accident or serious incident on an elevated heliport have been assessed to be potentially catastrophic, while the likelihood of post-crash fire based on an analysis of accidents and incidents for operations to elevated heliports in the UK, has been assessed as improbable. All flights for which Rules of the Air Rule 5 Permissions are necessary will attract a condition that recommended levels of fire fighting protection and response for operations to elevated heliports are in accordance with this chapter (or that an acceptable alternative means of compliance has been applied instead), this would be required for each ROTA exemption air operator applicant. This condition will be applied to all Rule 5 Permissions whether issued for public transport operations by Flight Operations Department or for private operations by General Aviation Department. The minimum levels of extinguishing agents are listed below in Sections 5.6 to 5.28.

5.3 It is foreseeable that an accident could result in a fuel spill with a helicopter post-crash fire situation which could quickly cut off or reduce the already limited routes of escape to a place of safety for helicopter occupants. The purpose for providing integrated fire fighting services (FFS) at an elevated heliport is to rapidly suppress any fire that occurs within the confines of the heliport response area (see note 1 in Appendix F) to allow occupants of a helicopter, with assistance from the helideck fire crew, to evacuate to safety and to protect persons in the building beneath the heliport from the effects of a helicopter fire situation.

5.4 Local fire and rescue authorities should be consulted at the earliest stages of the planning and provision of an elevated heliport to ensure that proper consideration is given to the effect that an accident could have on the structure below, above which the heliport is located. An aviation-related fire and/or fuel spillage poses a risk to the structure below the heliport, which may have consequences for fire fighting and for the means of escape both from the heliport and from within the building. To protect the occupants of the building, fire and rescue services may require provisions in addition to those , provided for the initial suppression and control of a fire arising anywhere on the heliport response area.

5.5 Furthermore the local fire and rescue service will need to consider its response to the heliport and its tactics. The local fire and rescue service should be informed immediately of any incident or accident on the heliport to allow post-initial fire and specialist rescue assistance to be provided. Local fire and rescue services familiarisation and exercises should include access routes to the heliport and the capabilities of integral on-site FFS, as well as locations of dry-risers assessed. Consequently, taking into account the secure area access arrangements to an elevated (rooftop) heliport, the requirement for the amount of extinguishing agent at elevated heliports is based on a fire fighting action which, depending on the design of the surface, may be required to last longer than at a surface level heliport (see Chapter 8). In addition, to achieve a rapid ‘knock-down’ response the system employed should be capable of providing immediate intervention on the heliport response area while helicopter operations are taking place.

Key design characteristics for the effective application of the principal agent for an elevated heliport.

5.6 A key aspect in the successful design for providing an efficient, integrated heliport fire fighting facility is a complete understanding of the circumstances in which it may be expected to operate. A helicopter accident, which results in a fuel spillage with wreckage and/or fire and smoke, has the capability to render some of the equipment unusable or preclude the use of some escape routes.

5.7 Delivery of the principal agent to the whole of the landing area at the appropriate application rate should be achieved in the quickest possible time. The ICAO Heliport Manual recommends a delay of not more than 15 seconds, measured from the time the system is activated to actual delivery of fire extinguishing media at the required application rate, should be the objective. This objective can be achieved by use of an automatic detection system but, preferably by a single action undertaken by a Responsible Person (RP) trained for the task. The operational objective then is to sufficiently suppress, so as to bring under control the fire, within 30 seconds of initial application.

5.8 RFFS provision at elevated heliports should take into consideration the difficulties that may be encountered should an incident or accident occur during operations. One such difficulty may be the confined and restricted space available on an elevated heliport. Foam-making equipment and the capability of the fire pump(s) should be of adequate performance in terms of application rate, and discharge area and duration, and be suitably located to ensure an effective application of foam to any part of the critical area, irrespective of the wind strength / direction or accident / incident location. All equipment should be regularly inspected and tested to ensure it operates in accordance with its design specifications

5.9 To achieve the objectives of 5.8 in an efficient and effective manner, heliport operators are strongly encouraged to consider the provision of a deck integrated fire-fighting system (DIFFS), whether capable of foam discharge on a standard solid plate deck impervious to liquids, or by providing a water-only DIFFS capability when used in tandem with a passive fire-retarding surface where there is an expectation that liquids will rapidly drain away through the perforated surface (see paragraph 5.12). A DIFFS typically consist of a series of ‘pop-up’ nozzles, with both a horizontal and vertical component, designed to provide an effective dispersed-pattern spray distribution of foam, or water, to the whole of the landing area and therefore provide protection to the helicopter throughout the range of weather conditions prevalent at the heliport. A DIFFS provision on a standard purpose-built (solid plate) heliport should be capable of supplying ICAO Performance Level B or Level C foam solution. Sufficient fire fighting should be provided to effect control of a fire in all weather conditions, It is necessary to achieve an average (theoretical) application rate over the entire landing area of 5.5 litres per square metre per minute for Level B foams and 3.75 litres per square metre per minute for Level C foams or, when applicable, water, for a duration, which at least meets the minimum requirements stated in paragraph 5.17 below.

Note: Some DIFF systems employ fixed nozzles (typically referred to as ‘non-pop up’) which sit very slightly proud of the surrounding deck surface prior to activation. In these cases it is unnecessary for them to physically ‘pop-up’ upon activation of the system.

5.10 The precise number and lay out of pop-up nozzles will be dependent on the specific heliport design, particularly the shape and overall dimensions of the landing area – the objective is to ensure that the pattern of pop-up nozzles will allow foam (or water) to be distributed to all parts of the response area. However, foam delivery nozzles should not be located in close proximity of heliport access / egress points as this may hamper quick access to the heliport by trained local authority fire and rescue service crews and responsible person(s) and/or impede occupants of the helicopter when escaping to a safe place beyond the heliport response area - Notwithstanding this, the number and lay out of nozzles should be sufficient to provide an effective spray distribution of firefighting media over the entire FATO/TLOF with a suitable overlap of the horizontal spray component from each nozzle assuming calm wind conditions. It is recognised, in seeking to meet the objective for an average (theoretical) application rate specified for Performance Level B or C foams (or water) to all parts of a potentially large heliport, there will be areas of the FATO/TLOF where the application rate in practice may fall below the average (theoretical) application rate specified in 5.9. This is acceptable provided that the actual application rate achieved for any portion of the FATO/TLOF does not fall below two-thirds of the rate specified for the critical area calculation.

5.11 To provide responding local authority fire fighters with a fire fighting capability at heliport level, a hand controlled branch pipe with a minimum discharge rate of 225 L/min should be provided alongside dry risers at heliport level. Where agreed with the local authority fire and rescue service, a hand controlled branch pipe should be sited in an easily accessible upwind location close to the primary access points and, for standard solid plate heliports, a branch pipe should have the capability of delivering aspirated foam. When utilised with a passive fire-retarding surface the delivery of water-only is permitted.

5.12 Where a DIFFS is used in tandem with a passive fire-retarding system, consisting in a perforated / grated surface, which, in the event of a fuel spill from a ruptured aircraft tank, has been demonstrated to be capable of quickly removing significant quantities of unburned fuel from the surface of the heliport, a water-only DIFFS to deal with any residual fuel burn may be considered in lieu of a foam system. A water-only DIFFS, removing the need for periodic foam quality testing, should meet the same average (theoretical) application rate and duration as specified in paragraph 5.11 and 5.15 for a performance Level C foam DIFFS.

Note: When considering the option for a passive fire retarding system typically constructed in the form of a perforated surface or grating, it is important to fully evaluate the surface design (i.e. the size and shape of the holes) to ensure it does not promote a reduction in beneficial ground ‘cushion’ effect, and so adversely affect the performance of any helicopter types that are likely to use the heliport.

5.13 The required minimum capacity of the foam production (or water-only) system will therefore be predicated on the overall ‘critical’ area of the heliport, the required foam (or water-only) application rate, discharge rates of installed equipment and the required duration of application. It is important that the capacity of the main heliport fire pump is sufficient to ensure that foam solution, can be applied at the appropriate induction ratio and application rate, for the minimum duration, to the whole of the critical area, the FATO/TLOF, when all components of the DIFFS are operating in accordance with the manufacturer’s technical specifications for the equipment. Formulae for the calculation of critical area, application rate, discharge duration and minimum operational stocks, based on the assumption that a Performance Level C foam is used, are presented in the following paragraphs using a worked example which assumes the application of a Level C foam applied to a typical 25 m x 25 m elevated heliport laid out as a square.

5.14 Level C foams should be applied at a minimum application rate of 3.75 litres per square metre per minute based on the overall critical area, which for the purposes of the following illustration, is assumed to be a 25 m x 25 m FATO/TLOF, which according to the RFM is suitable for operation of the AW 189.

5.15 A 25 m x 25 m FATO/TLOF assumes a total area of required coverage of 625 m^2. Based on an application rate of 3.75 litres per square metre per minute the application rate per minute is 625 x 3.75 = 2344 litres.

5.16 Given the difficulties in quickly accessing an elevated heliport from ground level it is necessary to assume that no assistance will be available from external trained sources during the initial suppression, control and evacuation phases. Therefore, the overall capacity of the foam system should comfortably exceed that necessary for initial control and suppression of a fire plus a quantity available, held-back for a second ‘attack’ should the original foam blanket, when applied on a solid plate heliport, subsequently break down, giving potential for a previously suppressed fire to re-ignite. A three minutes discharge capability on a solid plate surface is regarded by the ICAO Heliport Manual to be sufficient.

5.17 Calculation of total foam discharge and minimum operational stocks:

5.18 Using the 25 m x 25 m worked example shown in paragraph 5.15 above, the total required discharge for Level C foam, assuming three minutes’ discharge duration, is 2344 x 3 = 7,032 litres.

5.19 A 3% performance Level C foam solution discharged over three minutes at the minimum application rate will require the following stock of foam concentrate (based on a standard 3% solution):

5.20 2,344 x 3% x 3 = 211 litres of foam concentrate.

Note 1: Sufficient reserve foam stocks to allow for replenishment should also be considered.

Note 2: From time-to-time new technologies will come to market which, providing they are demonstrated by rigorous testing to be at least as effective as solutions described elsewhere in this chapter, may be considered as an acceptable alternative means of compliance (AltMoC) for the provision of heliport fire-fighting at new build installations. For example, a further reduction in foam capacity requirements may be considered with the use of compressed air foam systems (CAFS) with foam distributed through a DIFFS. CAFS can inject compressed air into foam to generate an effective solution to attack and suppress a heliport fire. This type of foam has a tighter, denser bubble structure than standard foams which in theory allows it to penetrate deeper into the fire before the bubbles are broken down. CAFS has added potential to address all sides of the fire triangle by smothering the fire (preventing oxygen from combining with the fuel), diminishing the heat using trapped air within the bubble structure, and disrupting the chemical reaction required for a fire to continue. Hence the provision of a DIFFS using an ICAO performance level B compressed air foam (B-CAFS) has potential to reduce the application rate still further. Consistent with Chapter 5 of CAP 437, the application rate for an ICAO Performance Level B compressed air foam is three litres per square metre per minute.

Any CAFS solution considered will need to take full account of the (windy) weather conditions usually prevalent on rooftop elevated heliports.

5.21 As previously stated, for a solid plate heliport, a three (3) minute foam discharge capability is considered to be reasonable. In the case of a passive fire-retarding surface with a water-only DIFFS, the discharge duration may be reduced to no less than two (2) minutes, with the calculations above in paragraphs 5.18 to 5.20, adjusted accordingly.

Complementary media

5.22 While foam is considered the principal medium for dealing with fires involving fuel spillages, other fire incidents that may be encountered during helicopter operations – e.g., engine, avionic bays, fuel system, transmission areas, hydraulics – may require the provision of complementary agent. Dry powder and gaseous agents are generally considered acceptable for this task. The complementary agents selected should comply with the appropriate specifications of the International Organisation for Standardisation (ISO). Extinguishers should be capable of delivering the agents through equipment which will ensure its effective application.

5.23 For all but the largest helicopters the minimum total capacity of Dry Powder should be 45 kg of dry chemical powder, delivered from one, or preferably two, extinguishers. The dry powder system should have the capability to deliver the agent anywhere on the landing area and the discharge rate of the agent used should be selected for optimum effectiveness. For helicopters with a fuselage length greater than 16m and/or a fuselage width greater than 3m it is necessary to provide 90 kg of dry chemical powder dispensed from two to four extinguishers.

5.24 The CAA recommends that the heliport operator considers the use of a gaseous agent, in addition to the use of dry powder, as a secondary complementary agent. Therefore, in addition to dry powder specified at paragraph 5.23 operators should consider a quantity of gaseous agent provided with a suitable applicator for use on engine fires. For all but the largest helicopters the appropriate minimum quantity delivered from one, or preferably two, extinguishers is 18 kg. The discharge rate of the agent should be selected for optimum effectiveness of the agent. Due regard should be paid to the requirement to deliver gaseous agent to the seat of the fire at the recommended discharge rate. Because of the weather conditions prevalent on rooftop elevated heliports, complementary agents can be adversely affected during application and training evolutions, and this should be taken into account. For helicopters with a fuselage length greater than 16m and/or a fuselage width greater than 3m it is necessary to provide 36 kg of gaseous agent dispensed from two to four extinguishers.

5.25 All helicopters have integral engine fire protection systems (predominantly Halon) and it is therefore considered, for a solid plate heliport, that provision of foam as the principal agent plus sufficient levels of dry powder will form the core of the fire extinguishing system.

5.26 Dry powder should be of the ‘foam compatible’ type (not essential where a water-only DIFFS is used).

5.27 The dry powder and gaseous agents should be sited so that they are always readily available and capable of being transported by one or two responsible persons.

5.28 Reserve stocks of complementary agents to allow for replenishment as a result of system activation during an incident, or following training or testing, should be considered .

5.29 Complementary agents should be subject to annual visual inspection by a competent person and pressure testing in accordance with manufacturers’ recommendations. Records of such inspections and tests should be kept by the responsible person.

Note: Halon extinguishing agents are no longer specified for new installations. Gaseous agents, including CO2, have replaced them. The effectiveness of CO2 is accepted as being half that of Halon.

The management and maintenance of media stocks

5.30 Consignments of extinguishing media should be used in date order to prevent deterioration in quality by prolonged storage.

5.31 The mixing of different types of foam concentrate may cause serious sludging and possible malfunctioning of foam production systems. Unless evidence to the contrary is available, it should be assumed that different types are incompatible. In these circumstances it is essential that the tank(s), pipe work and pump (if fitted) are thoroughly cleaned and flushed prior to the new concentrate being introduced.

5.32 It is important to ensure that foam containers and tanks are correctly labelled.

5.33 Induction equipment ensures that water and foam concentrate are mixed in the correct proportions. Settings of adjustable inductors, if installed, should correspond with the strength of foam concentrate in use as per the manufacturers' instructions.

5.34 All parts of the foam production system, including the finished foam, where applicable, should be tested by a competent person on commissioning and periodically thereafter, often annually or as per manufacturers' recommendations. The duration of tests should be long enough to assess the performance of the system against original design expectations while ensuring compliance with any relevant pollution regulations.

Equipment

5.35 Consideration should be given to the effects of the weather on static equipment such as FMS, extinguishers, foam branch pipes etc. All equipment forming part of the facility should be designed to withstand protracted exposure to the elements or be protected from them. Where protection is the chosen option, it should be securely fitted but not prevent the equipment being brought into use quickly and effectively. The effects of condensation on stored equipment should be considered.

5.36 For night operations sufficient illumination of an incident should be provided.

Life-saving equipment

5.37 A first aid kit together with a seat belt cutter should be available in the vicinity of the landing area and signposted if necessary.

Emergency planning arrangements

5.38 The objective of the emergency plan is to anticipate the affects that a helicopter emergency might have on life, property, and operations, and to prepare a course, or courses, of action to minimise those effects, particularly in respect of preserving lives.

5.39 The emergency plan should provide for the co-ordination of the actions to be taken in an emergency occurring at the heliport or in its vicinity.

5.40 Emergency instructions should provide details to individuals, or to departments, of the actions required to initiate the emergency plan.

5.41 The plan should co-ordinate the response or participation of all existing agencies, which, in the opinion of the Trust / Board and the appropriate local fire authority, could be of assistance in responding to an emergency.

5.42 The plan should consider the likely delay of responding emergency services arriving at the heliport response area, and the arrangements to ensure fire suppression, the resources needed for casualty extraction and the administering of first aid to casualties.

5.43 The emergency plan should include procedures for assisting passengers escaping the helicopter, leading them to secure areas away from the scene of an incident.

5.44 Equipment should be available to ensure that all agencies can effectively communicate with each other during an emergency, the provision of a control centre within the building should be considered to coordinate the plan.

5.45 The emergency plan should be tested prior to the initial operation of the heliport and biennially thereafter.

Further advice

5.46 Advice is available from the CAA's Aerodromes Department regarding the choice and specification of fire extinguishing agents and the development of an emergency plan.

5.47 In certain circumstances (see also Appendix F) alternative firefighting equipment, such as fixed monitors, may be appropriate, however this will always involve the provision of trained staff to operate the equipment. A ring-main system (RMS) may be considered for a heliport with a diameter of less than 20.00 m. At a minimum, dry risers in the local vicinity of the helideck would be expected to assist the Local Authority Fire and Rescue Service.

5.48 As fixed monitor systems deliver primary media in a solid stream, rather than a dispersed pattern as for DIFFS, the calculation for the amount of primary media (i.e. level B or C foam) for a solid plate surface is predicated on a critical area which considers the fusleage dimensions for a range of helicopters, categorised between H0 and H3. It assumes a minimum discharge duration, in all cases, of 5 minutes. These assumptions, and the resultant usuable amounts of extinguishing agents, are summarised in the following tables:

Note: A given helicopter has to be within the limits for both parameters, fuselage length and fuselage width, to take advantage of a particular RFFS category. If either dimension is exceeded, that type should apply assumptions for the higher RFFS category. A 10% allowance can be made, should an aircraft exceed a firefighting category by a small margin however the higher category should be aimed for when possible. Guidance on fuselage dimensions and categorisation of common helicopter types is provided in Appendix I.

Table 5-1: Heliport firefighting category

Heliport firefighting category	Maximum fuselage length	Maximum fuselage width
H0	up to but not including 8 m	1.5 m
H1	from 8 m up to but not including 12 m	2 m
H2	from 12 m up to but not including 16 m	2.5 m
H3	from 16 m up to 20 m	3 m

Table 5-2: Minimum usable amounts of extinguishing agents for elevated heliports

	Foam meeting performance level B		Foam meeting performance level C		Complementary agents	
Category	**Water (L)**	**Discharge rate foam solution/ minute (L)**	**Water (L)**	**Discharge rate foam solution/minute (L)**	**Dry chemical powder (kg)**	**Gaseous media (kg)**
(1)	(2)	(3)	(4)	(5)	(6)	(7)
H 0	1 250	250	825	165	23	9
H 1	2 000	400	1 350	270	45	18
H 2	3 000	600	2 000	400	45	18
H 3	4 000	800	2 750	550	90	36

5.49 For further guidance on Initial emergency response requirements for elevated heliports, refer to Appendix F. For guidance on risk assessments for surface level, mounded and raised heliports above unoccupied structures refer to Appendix H. Additional standards for RFFS at surface level and mounded heliports are addressed at Appendix I.

Chapter 6

Miscellaneous operational standards

General precautions

6.1 Whenever a helicopter is stationary on an elevated heliport with its rotors turning, except in cases of emergency, no person should enter upon or move about the helicopter landing area otherwise than within the view,and with the permission of, a helicopter flight crew member, and at a safe distance from the engine exhausts and tail rotor of the helicopter. It may also be dangerous to pass under the main rotor disc in front of a helicopter which has a low main rotor profile.

6.2 The practical implementation of paragraph 6.1 is best served through consultation with the helicopter operator for a clear understanding of the approach paths approved for personnel and danger areas associated with a rotors-running helicopter. These areas are type specific, but in general, the approved routes to and from the helicopter are at the 2-4 o'clock and 8-10 o'clock positions. Avoidance of the 12 o'clock (low main rotor profile helicopters) and the 6 o'clock (tail rotor) danger area positions should be maintained at all times.

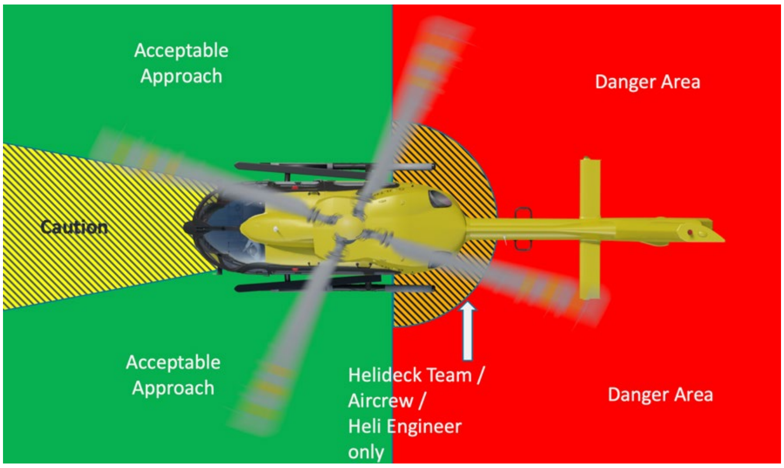


Figure 6-1 Example of common approach zones on Air Ambulance type aircraft

6.3 Personnel should not approach the helicopter while the helicopter anti-collision (rotating / flashing) beacons are operating.

Helicopter operations support equipment

6.4 Provision should be made for equipment needed for use in connection with helicopter operations including:

a) Chocks and tie-down strops and;

b) Equipment for clearing the helicopter landing area of snow and ice and of other contaminants

Note: Anti-icing and de-icing agents for heliports may be sourced from products that are commercially available for use at aerodromes. Typically, these products are based on Urea, Glycol or Potassium, and the criteria for the selection of the most appropriate liquid, or granule form agent, will depend on surface type, intended use, effectiveness and environmental impact. The requirement for clearance of snow or ice may be minimised by equipping a purpose-built heliport with a heat tracing system - see Chapter 1, Section 1.32.

Note: Salt or grit is never to be used for ice and snow decontamination on a landing surface due to the damage it can cause due to the effects of downwash and outwash on personnel and the helicopter.

6.5 Provision of a suitable power source for starting helicopters should be considered if helicopter shut-down is seen to be an operational requirement

6.6 Chocks should be compatible with helicopter undercarriage / wheel configurations. Several types are commonly available: the ‘NATO sandbag’ type, a ‘rubber triangular’ or ‘single piece fore and aft’ type chock may be used as long as they are suited to all helicopters likely to operate to the heliport.

6.7 For securing helicopters to tie-down points on the heliport surface it is recommended that adjustable aircraft compatible tie-down strops are used in preference to ropes. Specifications for tie-downs should be agreed with helicopter operator(s).

Chapter 7

Heliports located on raised structures

Concept and definition

7.1 For new build installations at UK hospitals there is an increasing demand to specify heliports located on raised structures which due of their elevation above surface (ground) level (by definition where the heliport surface is less than 3m above the surrounding terrain on at least two sides) are categorised neither as elevated heliports nor as heliports at surface (ground) level. It becomes necessary therefore to provide both a stand-alone definition and additional good practice guidance for heliports located on low level raised structures. The guidance set out in the following chapter should be read, where appropriate, in conjunction with chapters 1 through to 6.

7.2 In the glossary of terms and abbreviations a Heliport on a raised structure is defined as a heliport located on a raised structure which is less than 3m above the surrounding terrain. Typically such arrangements consist in a purpose built helicopter landing area located on top of a single storey building or structure, which invariably will make use of the area beneath the heliport for non-aviation purposes, such as for hospital car parking. See Figure 1 below.

Figure 1: A heliport on a raised structure over a car park

Introduction

7.3 According to Table 1 in Chapter 1 which provides a subjective comparison of heliport facilities based at ground level, mounded, raised structure and elevated (rooftop) sites, for most aspects of the design and operation of a heliport located on a raised structure the ease or difficulty of meeting each of the listed criterion is comparatively determined as “amber” i.e. moderate. However, when it comes to building costs, especially if addressing a case for a deck integrated fire fighting service (DIFFS) the colour coded ‘rating’ would advance to “red”. In practice the case for an integrated FFS, when not located above an occupied structure, will be dependent on the outcome of a risk assessment conducted by the heliport operator – see Appendix H for guidance. A raised heliport above a fully occupied carpark may be classed as an occupied space. Where the outcome of the risk assessment determines that an integrated FFS is deemed necessary, it is expected the assumptions used to determine the key design characteristics / performance of the DIFFS will be the same as for an elevated heliport. For a heliport on a raised structure, the FFS provision is further discussed in Section 6 of this chapter (and in detail in Chapter 5 for elevated heliports).

7.4 Although the building costs are likely to be in a similar ballpark to those where the specification is for a rooftop structure, depending on the fire fighting strategy / philosophy, the overall costs of a raised heliport may be lower than for a rooftop facility. However, when it comes to the preservation of unobstructed flight paths to and from the heliport, and the mitigation of rotor downwash/outwash effects, a raised heliport has more in common with a surface (ground) level heliport than with a rooftop heliport, particularly if the latter is located multiple storeys above the level of the surrounding surface. Therefore, for a raised heliport care needs to be exercised to ensure unobstructed flight paths are not encroached upon / compromised by other developments, which may grow up in the vicinity of the heliport, especially if siting a new structure more than a single storey above the surface. Unless future developments at the hospital is strictly controlled and limited, with the growth of obstacles it is possible in time that an operation to a raised heliport will be compromised and become restricted, or in the worst case, the heliport may become unusable due to obstructions around the heliport. Further guidance on safeguarding an HHLS is provided in CAP 738.

7.5 In addition to the impact of obstacles, designers need to be aware of the effects caused by helicopter rotor downwash/outwash and blade tip vortices on persons and property (particularly loose objects) that may be present in the vicinity of, and below, the heliport. As with a surface level heliport, it is strongly recommended to establish a downwash/outwash zone around the touchdown and lift-off area which during helicopter operations is kept clear of people and loose articles (e.g. light and insecure objects) to avoid injuries and damage from any debris that might be disturbed as a result of downwash/outwash or blade tip vortices. For small to medium air ambulance helicopters a 30m downwash zone is recommended. For larger helicopters such as are operated in the SAR role, and for military helicopters, an extended downwash/outwash zone should be provided which is typically 50m – 65m beyond the centre of the touchdown and lift-off area.

Note: Downwash zones may move in a dynamic manner below an aircraft that is required to perform a rearwards departure. This may cover a larger area than the figures in 7.5 and can be partially mitigated by using a larger helideck to allow the aircraft to be at a higher altitude when reaching deck edge.

Note: Due to the location of raised helidecks on a structure, often over a carpark additional risks may be present and a combination of staffing, signage and audible alerts may be required to protect uninvolved persons.

Helicopter performance considerations

7.6 Consistent with the concept and definition for a raised heliport (see Section 1) unless specifically stated otherwise by the Rotorcraft Flight Manual (RFM), the dimensional requirements published in the RFM applicable for the ground level (PC1) helipad procedure may be assumed for operations to a raised heliport.

7.7 An approved ‘helipad’ take-off profile for a surface level heliport often entails an upwards and rearwards (or sideways) manoeuvre or a vertical lift, all to a pre-determined point above the surface called the take-off decision point (TDP), whereupon if all is well, the helicopter will transition into forward flight. Should the engine fail while the helicopter is climbing initially to TDP, using the available visual references provided at the heliport, a pilot is able to land safely back on the surface (hence a need for dimensions that incorporate a rejected take-off area and for load bearing capabilities of the surface that will accommodate a ‘one-engine-inoperative’ (OEI) emergency landing). For the take-off manoeuvre, if an engine should fail after the initiation of transition into forward flight, at or beyond TDP, the pilot is able to swap height for speed and continue his departure manoeuvre from the heliport avoiding all obstacles on the surface by a vertical margin of not less than 35’. For the landing manoeuvre, if an engine should fail at any point at, or before, the landing decision point (LDP), it is possible either to land and stop within the available landing area or to perform a baulked landing and clear all obstacles in the flight path by a vertical margin of 35’.

7.8 Where an upwards and rearwards profile is flown according to approved techniques in the RFM, it will be necessary to consider and account for obstacles that may be present underneath the flight path during a helicopter’s back-up manoeuvre to take-off decision point. An illustration of this concept is shown in Appendix C for a helicopter that utilises an upwards and backwards manoeuvre (e.g. EC 135); and illustrates the prescribed limitation surfaces imposed for the restriction of obstacles permitted to be present on the surface beneath the back-up portion of the profile flown. This basic generic illustration is extracted from UK Regulation (EU) 965/2012 (Air Operations) Acceptable Means of Compliance and Guidance Material to Part-CAT (AMC1 CAT.POL.H.205 (e)). CAT.POL.H.205 (e) which requires that for a take-off using a backup or lateral transition procedure, with the critical engine failure recognition at or before the TDP, all obstacles in the back-up or lateral transition area should be cleared by an adequate margin.

Note: Where large or very large helicopters are required to operate to a heliport it is important to consider the third-party risk posed to persons and property on the ground, in particular as a result of the downwash/outwash generated. Where effects are pronounced the provision of a raised heliport, being only within 3m of the surrounding surface, may not provide an effective mitigation ; in this case a better option could be to provide an elevated heliport located above the tallest building within the hospital complex, or, to cater for large or very large helicopters, a surface level HLS located well away from the environment of the congested hospital (e.g. in a near-by playing field). In the case of a surface level heliport the provision of downwash fencing may assist in dissipating the effects of downwash/outwash.

Physical characteristics

7.9 Designers of heliports on raised structures when considering the physical characteristics of the facility should pay careful attention to Chapter 3 of this CAP. In particular, wherever practical, the heliport design considerations in relation to environmental effects, including mitigation of turbulence and thermal effects, should make use of the same good design practices applied for purpose-built elevated (roof top) heliports; and the environmental criteria within Section 2 of Chapter 3 should be adopted. The heliport structural design requirements of Section 3 are also pertinent to a purpose-built raised structure. The basic size and obstacle requirements for the heliport, the characteristics of the surface, the tie-down arrangement, the safety netting and access / egress arrangements will be very similar, if not identical, to best practice applied for a rooftop elevated heliport. Even the provision of a lift or a dedicated ramp may be an important design feature for a raised heliport.

Visual aids

7.10 The marking and lighting requirements for a raised heliport are considered identical to those specified in Chapter 4 and Appendix D for a rooftop (elevated) heliport. The process for assessment of obstacle markings and, in particular, for obstacle lighting may be more demanding for a raised heliport due to the relatively lower elevation of the landing area in relation to dominant obstructions; generally much lower in elevation than for a rooftop heliport. Consequently there could be more dominant obstacles (buildings etc) in the vicinity of a raised heliport for which full consideration of obstacle lighting and marking needs to be given.

7.11 In respect to wind direction indicator(s), it is recommended that at least one wind sock be located in clean air at heliport level. Consideration should be given to increasing the dimensions of the windsock to be compatible with the ‘sock specified for a surface level heliport i.e. 2.4m in length with a 0.6m diameter cone at the larger end and a 0.3m diameter cone at the smaller end. For other marking requirements follow Chapter 4, Section 1.

7.12 For advice and guidance on the specifications for helicopter ground and air taxiways and helicopter stands in support of a raised heliport refer to Appendix E.

Heliport Rescue and Fire Fighting Services (RFFS)

7.13 For heliports located less than 3m above the surrounding terrain that are not arranged over an occupied area , the provision of integral on-site Rescue and Fire Fighting Services (RFFS) is not considered mandatory provided it can be demonstrated through a risk analysis that any additional risks that arise due to the location and/or elevation of the heliport are fully mitigated (see Appendix H). However, if the opportunities for saving lives is to be maximised an essential element of a risk analysis is the requirement to ensure an effective fire-fighting intervention (e.g. by Local Authority Fire and Rescue Service Appliances) that guarantees rapid, unimpeded access to any location on the landing area to address all reasonably foreseeable helicopter fire scenarios that may occur on the heliport. Where the level of risk is deemed to support an immediate dedicated response capability (see Appendix H), guidance to select an appropriate standard is provided in Chapter 5 of CAP 1264. For the design and provision of a deck integrated fire fighting system, to provide a rapid knock down and suppression of a heliport fire (e.g. worse case helicopter crash and burn), Chapter 5 of this CAP should be similarly applied to a raised heliport.

Miscellaneous operational standards

7.14 Operators of heliports on raised structures should follow the best practice in Chapter 6, General Precautions (Sections 6.1 to 6.3) and Helicopter Operations Support Equipment (Sections 6.4 to 6.6).

Chapter 8

Surface level and mounded heliports

Concept and definition

8.1 For new build installations at UK hospitals, often the most cost efficient and simplest solution for the siting of a heliport is to provide a dedicated facility at surface (ground) level. On occasions, to achieve adequate clearance from obstacles that may be situated on the ground around a heliport, but protrude above protected surfaces, it may be possible to improve the obstacle environment by providing a mounded heliport suitably landscaped to rise above obstacles on the adjacent surrounding surface. Philosophically this is still regarded as a surface level heliport but is somewhat different from a heliport that is provided on flat ground at surface level. The two arrangements are illustrated at Figure 1 (surface level heliport) and Figure 2 (mounded heliport) below. Since each variation is distinct from a heliport on a raised structure (see Chapter 7) or an elevated heliport on a rooftop (see Chapter 1-6), it is necessary to provide both a definition and some additional good practice guidance for heliports designed at surface level; whether or not forming a mounded arrangement. Supplementary guidance is set out in the following chapter which should be read, as appropriate, in conjunction with chapters 1 through to 6.

8.2 According to the glossary of terms and abbreviations a Surface Level heliport includes a heliport located on the ground which when specifically prepared and landscaped, may exist as a mounded heliport. See Figures 1 and 2 below.

Figure 8-1: Hospital heliports at surface (ground) level

Figure 8-2: A mounded heliport at surface level (Ospedale Negrar)

Introduction

8.3 According to Table 1 in Chapter 1 comparing the design and construction of heliport facilities at ground level, mounded, raised and elevated (rooftop) sites, for the cost element of the design, and for the operation of a ground level heliport, the ease or difficulty of meeting each criterion is comparatively gauged as “green” i.e. easiest. However, while a facility located at ground level is likely to be least expensive to construct and to operate, it is also the most difficult to provide (and to maintain) clear and unobstructed flight paths to and from the heliport and is also much more prone to the adverse effects of rotor downwash/outwash in the vicinity of the heliport. Given also the general scarcity of available real estate at hospitals, it is likely to be a significant challenge to locate a surface level heliport that is both within easy access of ED but sufficiently remote to ensure rotor downwash/outwash effects do not have a detrimental impact on persons and property around the heliport. To mitigate the potential adverse effects of rotor downwash/outwash, for small-medium air ambulance helicopters, it is recommended that a 30m downwash/outwash zone be established all around the touchdown and lift-off area and measured from the edge of the TLOF which, during helicopter operations, is kept clear of people and loose articles and light or insecure objects, to avoid injuries and damage from debris that might be disturbed by the downwash/outwash effect and/or by vortices generated at the blade tips. For large and very large helicopters, where the effects of rotor downwash/outwash are likely to be even more pronounced, an appreciably larger downwash/outwash zone should be considered; typically a 50m – 65m zone should be provided and measured from the edge of the TLOF.

8.4 Also unless future development at the hospital is strictly controlled and limited, it is possible, in time, that the operation of a ground level site will become restricted or even unusable where the environment around the heliport is compromised due to other developments (this has been the experience at several surface level heliports in the UK where uncontrolled development around the heliport has forced helicopter operations to cease). For all HLSs, and especially those located at surface level, safeguarding of the site is very important. Further guidance on safeguarding an HLS is provided in CAP 738.

8.5 The overall cost of providing a surface level heliport, whether or not on a mound, will be significantly impacted by the decision whether or not to provide an integral (i.e. dedicated) Fire Fighting Service (FFS) at the heliport (effectively mandated for an elevated heliport – see Chapter 5). For heliports at surface level this is further discussed in section 8.19 of this chapter.

8.6 The use of matting in construction of the surface of the TLOF is only considered to be a temporary solution and is not recommended to be installed at a permenent installation. CAA is aware of atleast one instance at a UK hospital where matting was dislodged by the combination of downwash and jet blast from a military aircraft. If matting is to be used then a metal structure with intermediate (regular) ground anchors should be used, and consideration should be given about limiting the size of the helicopter permitted to use the matting as a TLOF.

Helicopter performance considerations

8.7 For heliports that are specifically located on the surface (i.e. at ground level) in accordance with the Rotorcraft Flight Manual (RFM), the performance requirements and handling techniques may involve either a ‘clear area’ procedure, a ‘short- field’ procedure or similar ‘helipad’ profiles and techniques as are typically utilised for an elevated or raised heliport (see Chapters 3 and 7 and Appendix C).

8.8 A helicopter performing a clear area procedure at a surface level site such as in a large field is optimised for take-off by accelerating from a low hover, and remaining close to the surface until the helicopter achieves a safe single engine climb-out speed; typically about 30 to 40 kts. If an engine fails during the acceleration phase the take-off can be aborted and a safe forced landing performed in an obstacle free area having a surface capable of accommodating the loads generated by a rejected take-off. The amount of clear area required for a typical air ambulance helicopter is in the order of 250 to 300 metres. A clear area procedure will generate the best pay-load but requires the most ground space to complete the manoeuvre safely.

8.9 A compromise between a clear area procedure and a vertical take-off and landing profile is a short field procedure. This profile applies some characteristics from both the clear area and the vertical procedure, generating reasonable pay loads by utilising a technique that requires less ground space than for a clear area procedure.

8.10 Another approved take-off profile for a surface heliport entails an upwards and rearwards manoeuvre or a vertical lift, to a pre-determined point called the take- off decision point (TDP), whereupon if all is well the helicopter will transition into forward flight. Should the engine fail while the helicopter is climbing initially to TDP, the pilot is able to land safely back on the heliport (hence the need for added dimensions which incorporate a rejected take-off area and for load bearing characteristics on the surface which accommodate a 'one-engine-inoperative' emergency landing). If an engine should fail after initiating the transition into forward flight, at or beyond TDP, the pilot is able to swap height for speed and, in accordance with performance class one procedures, continue his take-off and departure manoeuvre from the heliport avoiding all obstacles on the ground by a vertical margin of not less than 35 feet. (The surfaces prescribed for heliports designed for helicopters operated in performance class one are addressed in Chapter 3, Table 4-1).

8.11 Where an upwards and rearwards profile is flown according to approved techniques in the RFM, it will be necessary to consider, and account for, obstacles that may be present underneath the flight path during a helicopter's rearward manoeuvre up to the take-off decision point. An illustration of concept is shown in Appendix C which illustrates typical prescribed limitation surfaces imposed for the restriction of obstacles permitted to be on the surface beneath the back-up portion of the profile flown. Designers of heliports should be aware that Appendix C is for illustration of concept purposes only and where profiles are to be operated using these techniques, reference to up-to-date type-specific RFM data will need to be applied. The illustration in Appendix C is extracted from UK Regulation (EU) 965/2012 (Air Operations) Acceptable

Means of Compliance and Guidance Material to Part-CAT (AMC1 CAT.POL.H.205 (e)).

Note: Where large or very large helicopters are required to operate to a hospital it is important to consider the third-party risk posed to persons and property on the ground, in particular as a result of the significant downwash/outwash generated by large and very large helicopters (see section 8.3 above regarding the provision of a minimum 50m – 65m downwash/outwash zone). In the case of a surface level heliport the provision of downwash fencing may assist in dissipating the effects of downwash / outwash. Without adequate mitigation the provision of a dedicated surface level or mounded heliport within the hospital complex may not be an appropriate option; in which case a better option could be to identify an additional secondary HLS well away from the congested hospital environment which may be operated by large or very large helicopters (e.g. in near-by playing fields away from persons and property).

Physical characteristics

8.12 Designers of heliports at surface level, when considering the physical characteristics of the FATO, should pay careful attention to Chapter 3 of this CAP. In particular, wherever practical, the heliport design considerations in relation to environmental effects, including mitigation of turbulence and temperature effects, should make use of the good design practices applied to purpose-built structures and the relevant 'environmental' criteria within section 2 of Chapter 3. The heliport structural design requirements of the ICAO Heliport Manual are applied for a surface level heliport noting that as designs have to accommodate helicopters operating in performance class 1, the surface of the FATO, when colocated with the TLOF, should be capable of withstanding a rejected take-off, which may well equate to an emergency landing. Therefore, in accordance with the ICAO Heliport Manual, the bearing strength of the FATO, colocated with the TLOF and incorporating the rejected take-off area, should be designed to meet the ultimate limit state covering an emergency landing with a touchdown impact velocity of 3.6 m/s. The design load in this case should be taken as 1.66 times the maximum take-off mass of the heaviest helicopter for which the FATO is intended.

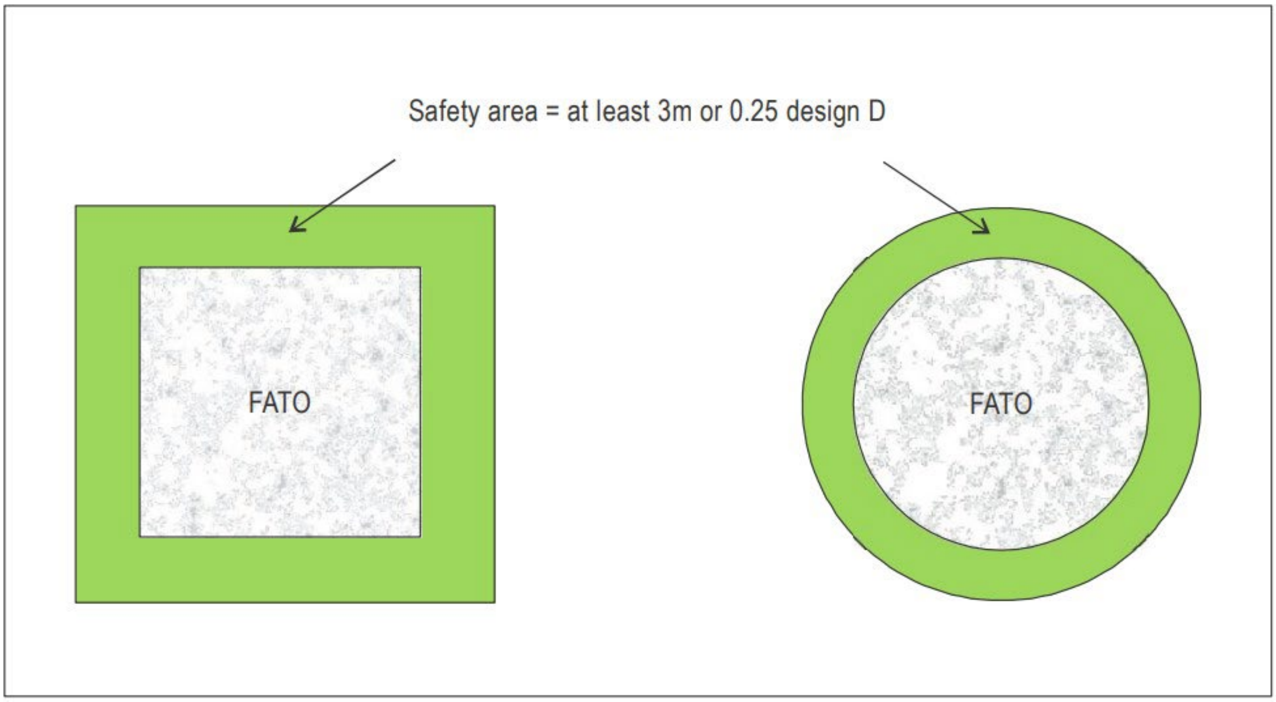
8.13 In accordance with Annex 14 Volume II the FATO should provide rapid drainage with a mean slope in any direction not exceeding 3%. No portion of the FATO should have a local slope exceeding 5%. In addition the surface of the FATO should be resistant to the effects of rotor downwash/outwash and be free of irregularities that would adversely affect the take-off or landing of helicopters operated in performance class 1.

8.14 The touchdown and lift-off area (the TLOF) will normally be colocated within the FATO. The TLOF should be a minimum of 1D, and be dynamic load bearing (see 8.11), with a mean slope not exceeding 2%; but sufficient slope to prevent the accumulation of water.

8.15 Surrounding the colocated TLOF and FATO will be a safety area out to an overall dimension of at-least 2D. (See Figure 3 below) The surface of the safety area abutting the FATO should be continuous with the FATO, and when solid should not exceed an upward slope of 4% outwards from the edge of the FATO. Objects located around the edge of the FATO, such as perimeter lighting, should be located in the safety area and should not penetrate a plane originating at a height of 25 cm above the plane of the FATO (minimum distance of essential objects from the centre of the FATO should be 0.75D). The surface of the safety area should be treated to prevent flying debris caused by rotor downwash.

Note: There should be at least one protected side slope rising at 45 degrees from the edge of the safety area to a distance of 10m whose surface should not be penetrated by obstacles, except that when obstacles are located to one side of the FATO only, they may be permitted to penetrate the side slope surface. Illustrations of FATO simple/complex safety area and side slope protection are given at Figure 3.1b.

Figure 3 FATO and associated safety area



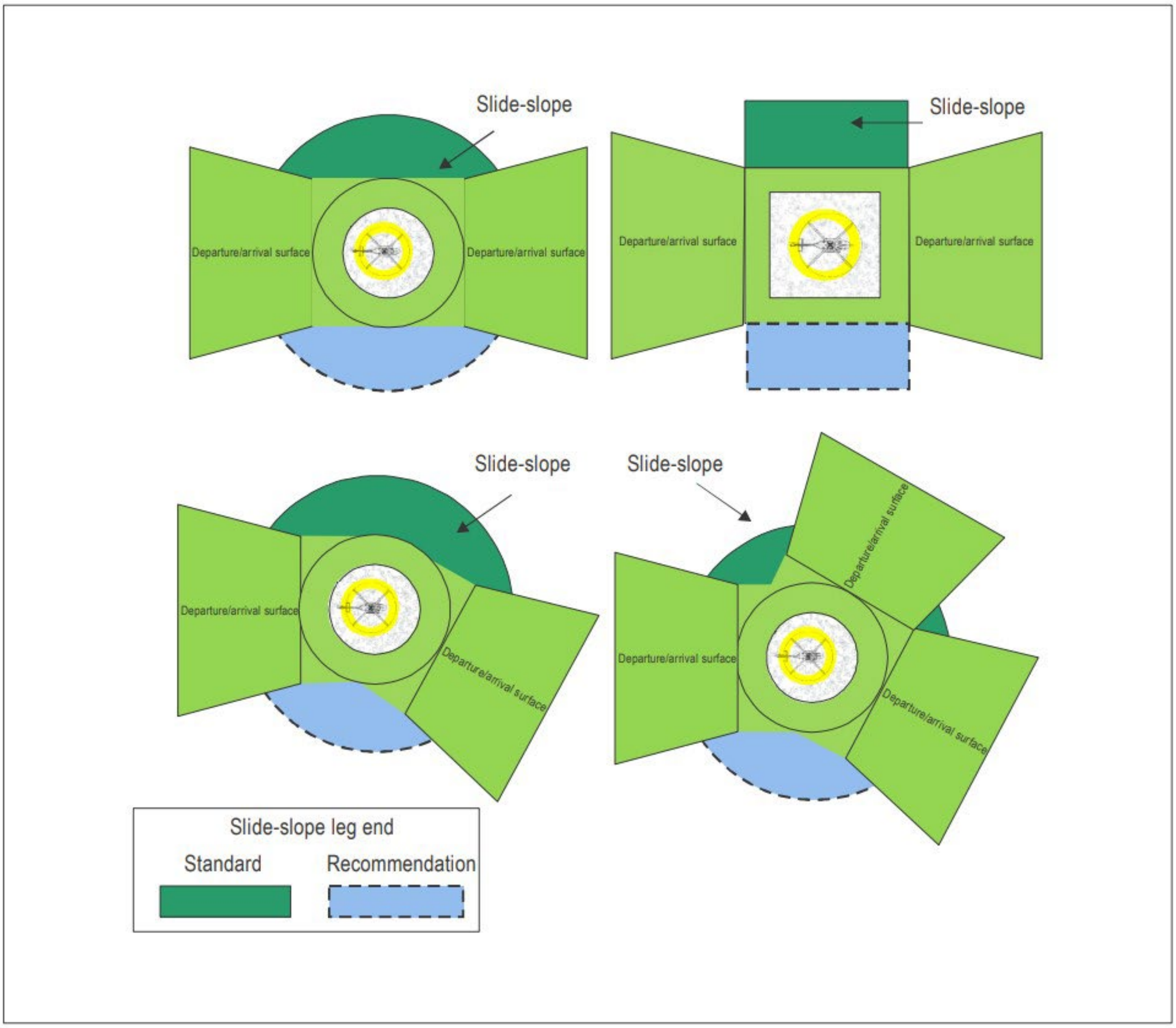


Figure 3.1b FATO simple/complex safety area and side slope protection

Note.— These diagrams show a number of configurations of FATO/Safety Areas/Side slopes. For a more complex arrival/departure arrangement which consists of: two surfaces that are not diametrically opposed; more than two surfaces; or an extensive obstacle free sector (OFS) which abuts directly to the FATO, it can be seen that appropriate provisions are necessary to ensure that there are no obstacles between the FATO and/or safety area and the arrival/departure surfaces.

8.16 For helicopter operations in PC1 a helicopter clearway would need to be considered and, where provided, located beyond the end of the FATO. The width of the clearway should not be less than that of the associated FATO plus safety area and the ground should not project above a plane having an upward slope of 3% (the lower limit of this plane is located on the periphery of the FATO). Any objects situated within the helicopter clearway, which may endanger helicopters in the air, should be regarded as obstacles and therefore removed. The definition for a helicopter clearway is provided in the glossary of terms and abbreviations.

8.17 The design requirements for helicopter taxiways, taxi-routes and helicopter stands provided in support of surface level heliports are addressed in detail in Appendix E.

Visual aids

8.18 The marking requirements for a surface level or mounded heliport are considered identical to those specified in Chapter 4 for a rooftop (elevated) heliport except that the background colour of the heliport may be left unpainted, provided that good conspicuity with the immediate surrounding terrain is achieved (note: it would be unhelpful to paint the background dark green if the adjacent area is grass – See Figure 8.1).

In respect to wind direction indicator(s), it is recommended that at least one windsock is located in clean air above surface level. The dimensions of the 'sock should be compatible with that provided in Annex 14 Volume II for surface level heliports i.e. 2.4m in length with a 0.6m diameter cone at the larger end and a 0.3m diameter cone at the smaller end. For heliport marking requirements surface level heliports should follow Chapter 4.

8.19 TLOF lighting system at a surface level heliport

8.19.1 General

8.19.1.1 The objective of a touchdown and lift-off area lighting system is to provide illumination of the TLOF and required elements within. The necessary elements of the lighting system are dependent on the siting of the TLOF and context in which it is being used.

8.19.1.2 For a TLOF in any location, the lighting system should provide sufficient illumination of the surface to enable a pilot, when in close proximity to the TLOF, to identify and use the TD/PM circle to accurately place the helicopter.

8.19.1.3 For a TLOF collocated in a FATO the lighting system should provide sufficient illumination to allow the pilot, when on the final approach, to distinguish the TLOF from other defined areas on the heliport.

8.19.2 TLOF perimeter lighting

8.19.2.1 TLOF perimeter lights should be placed along the boundary of the TLOF within a distance of 1.5 m from the edge and should be evenly spaced at intervals of not more than 5 m showing green with the intensity and beam spread characteristics shown in Appendix D, Table D-2. Solid state lights should conform to the chromaticity of Annex 14, Volume 1, Appendix 1, Paragraph

2.3.1 (c), and filament light sources Paragraph 2.1.1 (c) – see Appendix D, paragraph D-16.

8.19.3 TLOF floodlighting

8.19.3.1 Floodlighting, where incorporated, should ideally be arranged to provide an average horizontal illuminance of at least 10 lux with a uniformity ratio of 8 to 1 (average to minimum) on the surface of the touchdown and lift-off area.

8.19.3.2 For most heliports, it will not be possible to achieve the uniformity ratio of 8 to 1 over the entire surface, given the fixture height and typical beam spread limitations. In addition, experience has shown that floodlighting systems, even when properly aligned, can adversely affect the visual cueing environment by reducing the conspicuity of TLOF perimeter lights during the approach, and by causing glare during the hover and landing – these undesirable effects are exacerbated when the surface is wet. When provided floodlighting should be adequately shielded e.g. fitted with louvres, to ensure that the source of light is not directly visible to a pilot at any stage of landing.

8.19.4 TD/PM circle and cross marking lighting

8.19.4.1 Depending upon the distance and angle of projection of floodlighting, the centre portion of the TLOF may have a darkened appearance (the black hole effect). In this circumstance, a combination of TD/PM circle and chevron marking lighting will prove more effective in providing adequate surface texture cues including an indication to the pilot of where the helicopter needs to touchdown. The TDPM circle and cross (chevron) marking lighting, where provided, should be in accordance with the relevant sections of Appendix D.

8.19 The marking and lighting requirements for helicopter taxiways, taxi-routes and helicopter stands provided in support of surface level heliports are addressed in detail in Appendix E.

Heliport Rescue and Fire Fighting Services (RFFS)

8.20 For heliports located at surface level or mounded sites that are assumed to have expeditious access to Local Authority Fire and Rescue Service Appliances, the provision of on-site Rescue and Fire Fighting Services (RFFS) is not considered mandatory provided it can be demonstrated through a risk analysis that any additional risks that arise due to the location and/or elevation of the heliport are fully mitigated (see sample Risk Assessment in Appendix H) . However, if the opportunities for saving lives are to be maximised an essential component of any risk analysis is a requirement to ensure an effective fire-fighting intervention (e.g. by Local Authority Fire and Rescue Service Appliances) that guarantees rapid, unimpeded access to any location on the heliport to address all reasonably foreseeable helicopter fire scenarios that may occur on the heliport.

8.21 Where the level of risk is deemed to support an immediate dedicated response capability (see Appendix H), guidance on the selection of an appropriate standard is provided in Chapter 5 of CAP 1264, where a heliport has a lay out that will allow a fixed foam application system (FFAS) to service every part of the response area e.g. a limited size heliport consists of confined area FATO/TLOF. Where a surface level or mounded heliport is laid out so that it requires the physical movement of rescue and fire-fighting equipment and services to an accident scene which is remote from where equipment is normally located, it will be necessary to provide a portable foam application system (PFAS) located on a rescue vehicle. In this case, subject to the risk assessment in Appendix H, the minimum provisions are set out in Appendix I of CAP 1264. .

8.22 If, due in particular to a low number of movements, it is determined not to be necessary to provide a dedicated RFFS at a surface level heliport, there should be a specified method for immediately invoking the heliport emergency plan. See Emergency Planning arrangements in Chapter 5 and Appendix I.

Miscellaneous operational standards

8.23 Operators of surface level heliports should follow the best practice in Chapter 6, section 1 ‘General Precautions’ and section 2 ‘Helicopter Operations Support Equipment’.

Section 2 Heliport Operations

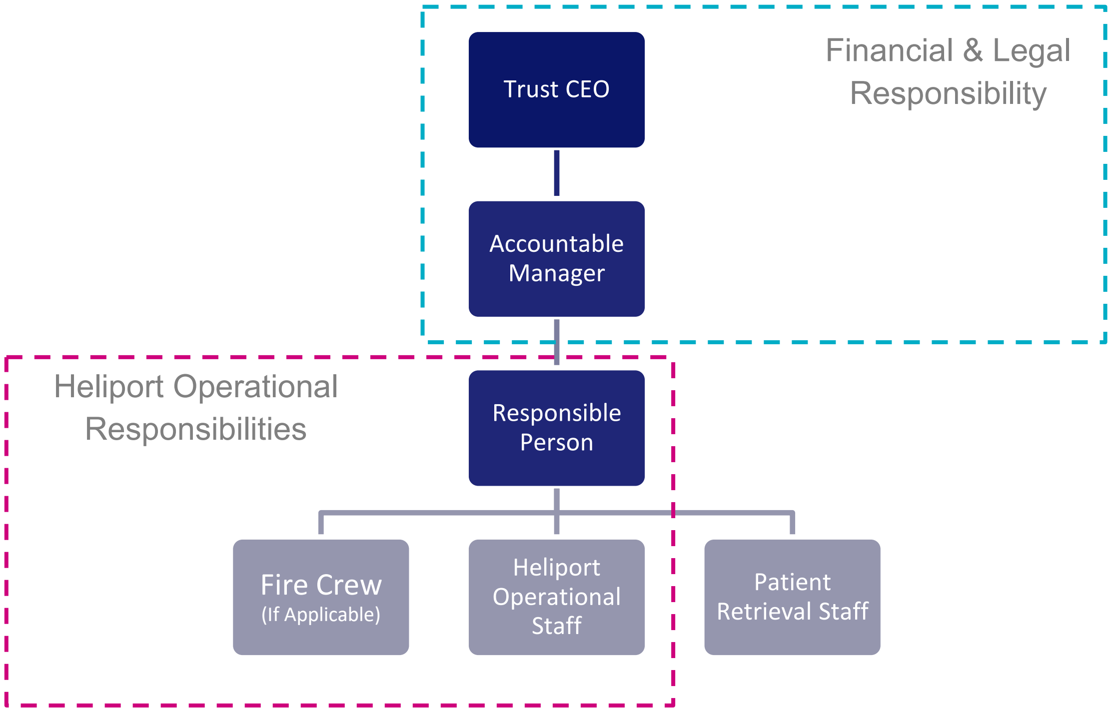
Chapter 1
Operational Management

Overview

CAP1264 is primarily a heliport design document, however this section will describe some elements that need to be considered for the ongoing operation of a heliport. These requirements are site specific and should be determined by a risk based assessment of the heliport, type of operation and surrounding environment.

Operational Management

The CEO of the Hospital Trust has overall responsibility and accountability for safe and effective operation and use of the heliport within their control, and should appoint a Heliport Accountable Manager[2] (AM) to oversee the Heliport operation on their behalf. The AM may delegate some of these actions to a Responsible Person[3] (RP), whilst assuring



[2] In line with the overarching requirements and systems of control (as described in HTM-00 and CAP168) the Accountable Manager should be of sufficient seniority and have autonomy to control and apply resources as required to assure the Trust's board of the correct and safe operation of the heliport and it users/operators and other relevant persons.

[3] The RP is more likely to be working within an operational role such as Helideck Manager, Security Manager or Facilities Manager and is closely linked to the daily operation of the Heliport.

that there is a controls and assurance process in place so they are fully aware of all activities and can exercise their overall control and responsibility.

The Accountable Manager should regularly report to the CEO and the Heliport should be a regular reporting item on the Board Assurance Framework (BAF). The Accountable Manager should be appointed by the CEO in writing, and acknowledge, in writing, that they are aware of and understand their role and responsibilities and feel capable of demonstrating the knowledge, skills and behaviours needed to discharge the role effectively. If deficiencies are identified additional training requirements should be agreed, and mitigations put in place until the Accountable Manager feels confident to perform the role. The Accountable Manager should have a reporting line directly to the Heliport Responsible Person, although they may not directly manage them on a day-to-day basis.

It is the duty of the Accountable Manager to oversee the ongoing management of the heliport, and these duties extend to third party locations that host aircraft movements on a hospital's behalf such as schools and public parks[4]. Whilst a daily presence may not be necessary, overall responsibility for the operation, production of documentation and ongoing safety reviews should be managed by the Responsible Person under the direction of the Accountable Manager. Ultimately both persons are responsible to, and should be known to, all likely aircraft operators[5] whose usage of the heliport is regulated by the Civil Aviation Authority. The Accountable Manager also holds responsibility for upholding the standards and intentions of aviation regulation and safety principles contained therein, also forming the focal point of contact for investigators should an incident occur at the heliport.

Further best practice guidance can be found in CAP168 Appendix 2C, note – applied to an unlicensed heliport CAP168 does not act as a statutory document and is considered best practise.

Heliport Operations Manual

The Heliport Operations Manual is the all-encompassing document for a hospital heliport operation, owned by the AM it sets the standards, procedures and best practise of the Heliport's Operation and Maintenance.

Note – It is the legal responsibility of the Air Operator to determine initial and ongoing suitability of a HHLS and its compliance with the Performance Class 1 (PC1).

As part of the work of the Onshore Safety Leadership Group (OnSLG), a template Heliport Operations Manual (HOM) can be found at Annex A.

[4] In the context of third party locations the AM's responsibilities

[5] Including but not limited to regional HEMS services, Intra-Hospital Air Ambulance Services, Police Air Support Units, HM Coastguard, Irish Coastguard, Ministry of Defence.

It can be expected that an Air Operator may choose to form a contract or terms of service with the heliport, which may be generic or site specific. This may impose additional management requirements or aircraft specific requirements, in which case the Heliport Operations Manual should be updated to reflect the requests, noting that some requests from the Air Operator may be due to statutory requirements placed upon them by the CAA, and they may be duty bound to refuse to operate to the heliport if these requirements are not adequately met.

Additional Documentation

The Accountable Manager is to ensure that documentation is provided to both ensure adequate monitoring of safety based documents, and to provide accountability to authorities as required. The air operators, or other bodies should be offered access to, and provided upon request, the latest revisions of applicable documents. It is suggested that the following documentation is provided upon request:

- Staff Training Log
- Maintenance and Inspection Plan
- Maintenance and Inspection Log
- Rescue Fire Fighting Service Plan (If Applicable)
- Rescue Fire Fighting Service Media, Equipment and Training Logs (If Applicable)
- Memorandum of Understanding with Emergency Services (or hospital fire plan)

Many elements of this should be contained within the Heliport Operations Manual. It is accepted that some items may be held within restricted NHS systems such as staff training logs and emergency response plans and may contain sensitive information. In this instance the information is not required to be made publicly available to air operators but the Accountable Manager may be required to make a written declaration in lieu of access to original documentation by the air operator.

Heliport Maintenance

The responsible person is to oversee the ongoing maintenance of the heliport, this should include a mixture of periodical checks, and scheduled maintenance as well as be a primary contact for air operators to report problems. As part of the maintenance plan, as a minimum, the following should be considered:

- Surface condition
  The heliport surface[6], including all markings, provides suitable surface friction (as

[6] Including heliport access routes, nearby roads, ambulance bays, public footpaths

described in section 3.37), and if ground based is free from cracking or breakups which may cause FOD[7].

- Paint condition
  The paint is clear, visible and not breaking up in a manner which may cause FOD.
- Wider site condition
  The local area including; grass cutting, tree management, public footpaths are managed suitably. Including presence of vehicles and construction works.
- Safeguarding
  No changes to the Obstacle Environment are present, or planned, that may need to be discussed with air operators.
- Windsock condition
  The wind indicator should be free from tears, lights for night time illumination are working and colour of the 'sock is clear and not faded or sun-bleached.
- Visual Aids
  All lights are functional and any aviation safety markings such as obstacle markings are clear and present.
- Winterisation
  Ensuring preventative and reactive work is carried out to prevent icing or snow build up on the heliport and surrounding area.
- Safety Equipment
  When fitted, safety systems such as helideck perimeter nets are checked to be in good condition and tested.
- Weather Monitoring
  When fitted, weather monitoring equipment should be checked, serviced, and calibrated as per manufacturer recommendation.

The Accountable Manager should be regularly appraised by the Responsible Person of the overall condition of the heliport, it's operability and serviceability.

Safety Management

The Responsible Person is to lead on the Heliport's Safety Management System (SMS). It may be assumed that the air operator will have completed either a generic or site-specific Risk Based Assessment for the operation of the helicopter itself, so the heliport only requires to consider matters regarding the operational viability of the site, as well as the safety of involved and uninvolved persons. Further guidance on SMS can be found in CAP795 "Safety Management Systems – Guidance to Organisations" and further in depth guidance within CAP168 "Licensing of Aerodromes" and CAP1059 "Safety Management Systems: Guidance for Small, Non Complex Operations".

[7] Foreign Objects and Debris

Involved persons are people who have willingly agreed to a Heliport's SMS and agree to work within the vicinity of a helicopter operation. They should also be trained and equipped for their role during all helicopter movements to the standards expected in the SMS. They need not be directly involved with an aircraft, but this could extend to persons who secure roads or oversee an ED department beside the heliport. All involved persons come under the direct management and responsibility of the AM and RP during helicopter operations regardless of their conventional NHS employee management structure.

Uninvolved persons can be considered as people who have not been given the opportunity to understand or agree to the heliport's SMS. The act of passing the heliport or associated general information signage does not constitute a person's agreement.

The uninvolved persons category will include all members of the public, but also could include members of hospital staff or Ambulance Service employees routinely working in the vicinity of the Heliport. It is the primary focus of the SMS to protect uninvolved persons to avoid injury and reduce the risk of fatal incidents.

Heliport Signage & Markings

As described in the SMS introduction, signage does not change the status of persons in vicinity of the heliport but can be used to assist the heliport operator in instructing 'uninvolved' members of the public on what is expected of them during helicopter operations. It also helps to assist the hospitals protection of staff under Health & Safety at Work Act 1974. Signs should be procured and maintained in compliance with The Health and Safety (Signs and Signals) Regulations 1996 and designed in accordance with BS EN ISO 7010.

Signage should be clear, uncluttered, distinct, and understandable from a distance. If required further additional information can be added in a sub sign below the primary sign. It is not recommended to add excessive information for public use, however staff orientated signs can contain more information, for example to act as a reminder of key elements of the Hospital's SOP document before entering the Heliport area.

Within the vicinity of the heliport additional road markings to deter stationary traffic should be considered. Within the immediate heliport area markings such as Red Routes, No Waiting Zones and Hatched Areas should be used to prevent vehicles parking or waiting in areas where the vehicle may either become an aviation obstacle (especially on bus routes, or Ambulance parking areas) or where the occupants may enter or exit the vehicle and be subject to downwash/outwash.

If ambulances are to be parked and operated in the near vicinity of the heliport then designated marked bays should be used, any non-marked, and therefore not risk assessed areas, should be prohibited from use. It would not be considered acceptable to have bays which require an ambulance to be physically moved prior to an aviation movement to adhere to the helicopters PC1 obstacle environment requirements.

Crane Operations

Cranes pose a heightened risk to aviation, especially at Heliports operated at night. Due to this additional risk, whilst CAP738 “Safeguarding of Aerodromes” provides crane operators information on aviation safeguarding, further measures should be taken. It is recommended that any crane operations on the hospital estate or in the near vicinity of the hospital is notified to air operators with urgency, as suspension of heliport operations may be required. A deconfliction plan may be required, such as the lowering or stowing of a crane prior to aviation movements. The Responsible Person should manage this plan and ensure it is followed by all parties.

Where possible additional lighting and markings should be requested from the crane operator, this includes yellow and black aviation markings described in CAP738 as well as additional lighting on the jib and tower (such as low intensity floodlighting and fixed steady red beacons) to assist helicopters operating in the near vicinity to gain a visual orientation on the jibs position at night.

All capital estate projects onsite should be monitored for the likely use of cranes, and the impact this may cause. Local planning submissions should be monitored for construction projects likely to utilise cranes and should, where possible, be raised with the planning authority so a deconfliction plan can be made with the developer.

Communications

There are many benefits to having communications with the aircraft crew, aircraft operator and control desk. It should be assured that as a minimum the hospital updates its communications Standard Operating Procedure regularly and notifies all regional HEMS

Desks (Ambulance Control), HM Coastguards ARCC[8] and the Ministry of Defence[9] of this contact point that initiates the heliport activation procedure.

In any communication loop it is important that feedback is received in a standardised format to assure aircrew that the heliport is ready for use. Often this is signalled to aircrew by the activation of the heliport lights at locations without pilot controlled lighting, but note that especially older designs of heliport lighting can be difficult to see in the day [10]so alternate methods can be considered such as using a heliport strobe light.

Radios provide the most effective communication method, but only certified personnel may transmit on a radio frequency. This often means that air to ground communications are possible but not the reciprocal. If a hospital wishes to utilise ground to air radio communications as an AGCS[11] they should read the guidance contained in CAP413.

Usage of Unmanned Aircraft

There are many benefits of utilising UAVs within the hospital estate for inspections and survey work, and likewise with cargo drone RPAS systems intra-hospital. It is imperative that the responsible person oversees any movements of aerial vehicles, regardless of category, within the hospital estate and surrounding area.

On-Site UAV Operation

All on site UAV[12] operations should be notified to the Heliport Responsible Person. It is recommended to reduce workload that an internal heliport safeguarding document is produced based on the shape of the hospital estate. This should consider the location of buildings, flight paths and the height of buildings above heliport elevation.

This could be marked on a map with coloured overlays in the described manner, but equally should be made site specific and in consultation with the local air operators:

- Red Overlay – All UAV movements must be authorised by the air operator.
- Yellow/Orange Overlay – All UAV movements should be notified to the air operator for situation awareness.

[8] Aeronautical Rescue Coordination Centre part of the Joint Rescue Coordination Centre
[9] Contact Us (mod.uk)
[10] ICAO Guidance currently requires TLOF lighting only to be visible at night however many modern LED lights far surpass this standard and may be visible in the day.
[11] Air Ground Communications Service
[12] Unmanned Aerial Vehicle – As defined in CAP722 and UK Regulation (EU) 2019/945

- Green Overlay – UAV movements may proceed in these areas within the altitude parameters of the procedure.

It should be noted that even in green marked areas UAVs should be grounded for the duration of the helicopter operation, and may be reported to the Civil Aviation Authority if the aircrew perceive a risk to the aircraft or its operation.

Intra-Hospital Cargo RPAS

Cargo drones (RPAS[13]) that land or take-off from a hospital will by default come under the duty of the Heliport Responsible Person. RPAS should not be allowed to operate without authorisation of the RP, who should consult air operators prior to their decision.

Factors to consider:

- The heliport should remain available for helicopter movements at all times with minimal notice.
- Provision of RPAS parking stands or an on-site team need to be available to allow vacation of the primary heliport. This stand should be adjacent to, but not below the primary approach paths.
- Public source flight following such as phone apps must not be relied upon for tracking of local helicopter activity.
- Downwash of helicopters is strong enough that a nearby cargo drone could become unintentionally airborne.

Other Operation Types

Other types of operations may be permissible at the hospital heliport, and may include helicopter training, filming, emergency exercises or demonstrations of novel aircraft types.

Helicopter training for the purposes of pilot initial, line and local area training should be encouraged when the risk to uninvolved persons can be contained to a reasonable level as determined by the Accountable Manager.

Any operations by a non-emergency aircraft should be mitigated with an action plan for when use of the heliport is required by an emergency service aircraft. If an aircraft is required to be stationary for a period of time on the ground and is not able to be moved for a period of time, a dedicated stand should be provided. For example, if a novel aircraft type requires ground-based functions such as electric charging.

[13] Remotely Piloted Aircraft System – As defined in CAP722 and UK Regulation (EU) 2019/945

Chapter 2

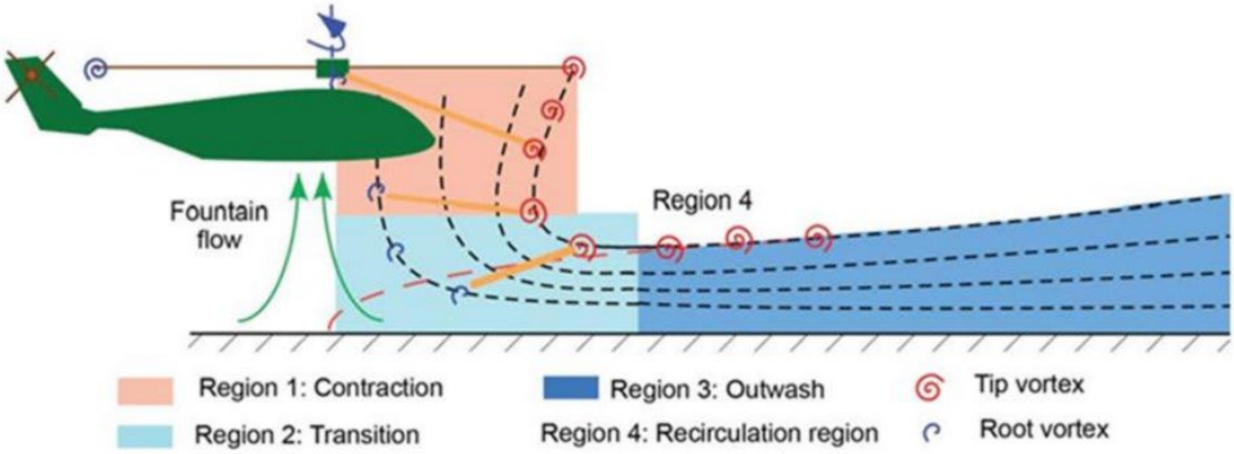
Mitigation of Downwash / Outwash

Introduction

Downwash and Outwash mitigation is a key component of the risk based assessment allowing the safe usage of a hospital heliport. It is imperative that Downwash/Outwash is considered due to the risk to aircraft, uninvolved persons and private property such as parked cars if not managed correctly, the effects of which can severely injure (including fatally) or cause significant property damage.

Whilst the aircraft commander is responsible for the assessment of the heliport at the time of use, it is the Accountable Managers responsibility to risk assess and work with the air operator/s in advance to mitigate fixed risks that may be present[14]. Legal responsibility[15] for incidents incurred may reside with the site Accountable Manager if the heliport is ineffectively managed. Any ground obstacles that may direct or accelerate air in the vicinity of the heliport, including vehicles and structures need to be seen as an individual risk factor.

Factors to consider about downwash and outwash at a hospital heliport, further guidance can be found in the ICAO Doc9261 “Heliports Manual”:



[14] As low as is reasonably practicable.
[15] As regulated and determined by the Health and Safety Executive.

Downwash Characteristics

When manoeuvring at slow speeds, especially during take-off and landing rotorwash can be significant producing effects, comparable in the most extreme cases, to a violent storm (Beaufort Scale 11) which may cause light or insecure cladding and other light objects to become detached. Added to this, the effects of rotorwash can be unpredictable given it is influenced by ambient wind and temperature conditions at the time of operation. The characteristics of the downwash from some helicopters are known to exhibit a localised hard jet, as opposed to a disturbance that occurs over a larger area. Although more localised in its impact, a hard jet can nevertheless be intense and disruptive on the surface. The intensity of any downwash/outwash may be affected by the dissipating action of any wind present or by the screening effect caused by local features on the surface such as buildings, trees, hedges etc.

The downwash/outwash in an area beneath large and very large helicopters, and beneath even a small helicopter operating at high power settings (such as are used during the upwards and rearwards portion of the take-off manoeuvre by most air ambulance types) can be intense, displacing loose hoardings and blowing grit and debris at persons, property or vehicles in the vicinity of the heliport. Loose objects can pose a risk to the helicopter itself if sucked up by re-circulating air flows into the rotor blades or engines. All feasible helicopter profiles need to be considered from the perspective of rotor wash including any manoeuvres to and from the touchdown and lift-off area to a stand which may require a helicopter in transit to hover taxi close to the ground.

For a surface level heliport operating exclusively light-medium air ambulance helicopters it is recommended that a minimum 30m downwash/outwash zone, measured from the edge of the heliport, be established around the heliport which is kept clear of people, property, or parked vehicles (typically 2 to 3 rotor diameters of the helicopter). If heavy or extra heavy helicopters are to be utilised at surface level, the downwash/outwash zone established around the heliport should be considerably larger; typically between 50m and 65m measured from the edge of the heliport for the largest helicopters. In the case of a surface level heliport the provision of downwash fencing may assist in dissipating the effects of downwash/outwash.

The downwash zone, to account for the approach to land and take-off manoeuvres, may need to be extended in the portion below the common helicopter flight paths to account for operating techniques which promote local disturbances, such as when a helicopter pilot applies full power during the rearward portion of the take-off. With consultation from local air operators the area overflown by the take-off manoeuvre should host downwash mitigations including, but not limited to, removal of the public from these areas during flight operations. This area may extend up to 150m from the FATO to suitably separate uninvolved persons from a helicopter situated overhead at TDP (Take-off Decision Point) described in Appendix C.

Caution should be taken when factoring in the as-built environment around the heliport, as certain types of structure locations may make narrow channels in which, through the venturi effect, the speed of outwash may be increased and present a higher risk to persons in that area. Note that moveable objects such as parked cars and ambulances can cause the venturi effect, especially for persons stood between them.

Downwash Mitigation

The primary way to mitigate the risks of downwash to uninvolved persons is to physically remove them from the aviation environment. Either in the context of the public by the means of temporary restrictions, such as barriers or re-routing of primary pathways but also in reviewing the requirement for non-aviation required staff to be present in the aviation environment.

Downwash / Outwash protective walling or other kinds of deflection can be considered, however primarily it has to be assured that the protective measures do not in themselves become obstacles, or due to their design, promote the undesired venturi effect which may increase risk to uninvolved persons. This can be either of a wall type – ideally with an upwards deflective curve on the inside to allow outwash to dissipate rather than recirculate back to the helicopter, or alternative methods such as slat structures / blast screens may be used, especially helpful for walkways in the vicinity of the heliport. Any screening within the immediate heliport vicinity should be marked with alternating red and white bands, on any side the pilot could view the obstacle from – this may mean both sides for objects overflown on approach and departure, these markings are described in Section 1, 4.20.

Downwash Studies and Reports

There are several documents which highlight the risks and characteristics of downwash, a selection are listed here:

International Civil Aviation Organisation - Document 9261 Heliports Manual

Air Accidents Investigation Branch – Investigation into G-MCGY

Australian Transport Safety Bureau - Safety risks from rotor wash at hospital landing sites

DGAC / DSAC - Helicopter Rotor Downwash Safety Guidebook

Chapter 3
Risk Assessments

Risk assessments should be carried out annually or sooner if a reportable incident or near miss occurs.

The assessment should be completed by a competent person[16] alongside the RP / AM, and should in consultation with the air operator factor in risks related to, but not necessarily limited to:

- Risks to the public
- Risks to hospital staff (including ambulance service)
- Risks to patients (walking or stretchered)
- Heliport staffing shortages
- Infrastructure failures or unserviceability

All of these factors should be considered across a range of conditions not just normal operations. For example members of public or staff ignoring a safety cordon, or during an aviation incident. Wider area and longer term impacts to the hospital itself should be considered when factoring in aviation incidents and the emergency response that may be generated.

The ability for emergency services to respond to an aviation incident should be considered, this may require additional Rendezvous Point signage, planning with Fire Service and regular exercises both tabletop and live. Consideration should also be taken for where Fire Service vehicles can park, and the impacts on an ED area or other hospital operations during this response.

[16] Qualified to undertake NHS Risk Assessments.

Annexes

Annex A – Heliport Operations Manual

Introduction

This Annex provides a template for the Heliport Operations Manual (HOM) and should be seen as the all encompassing document for Hospital Helicopter Landing Site (HHLS) operations. It is owned by the Accountable Manager (AM) and can be delegated to the HHLS Responsible Person (RP) where required and sets the standards, procedures and best practise of the Heliports Operation and Maintenance.

Ownership

Each NHS Trust Hospital that operates a HHLS requires a HOM. The HOM can cover one or more HHLS within the Hospital grounds and ideally, any alternative HHLS that is either used by or operated by that same Hospital but may be located outside Hospital property.

Part A - General

1. Administration and Control of the Helicopter Operations Manual

1.1 Introduction

This manual contains operational instructions that should be complied with by the relevant personnel.

All text in **RED** describes how each NHS Trust must complete and/or action its responsibilities within this manual

The manual consists of the following Sections:

Part A: General

1. Administration and Control of Manual
2. Organisation and Responsibilities
3. Safety Management Systems
4. Qualification Requirements
5. Dangerous Goods
6. Handling and Notification of Accidents / Incidents

Part B: Site Specific Procedures

1. Normal HHLS Procedures
2. Emergency HHLS Procedures
3. HHLS Maintenance

Part C: Change Management

1. HHLS Change Notification
2. HHLS Safeguarding Procedures
3. HHS Operations Contact Details

Part D: Training

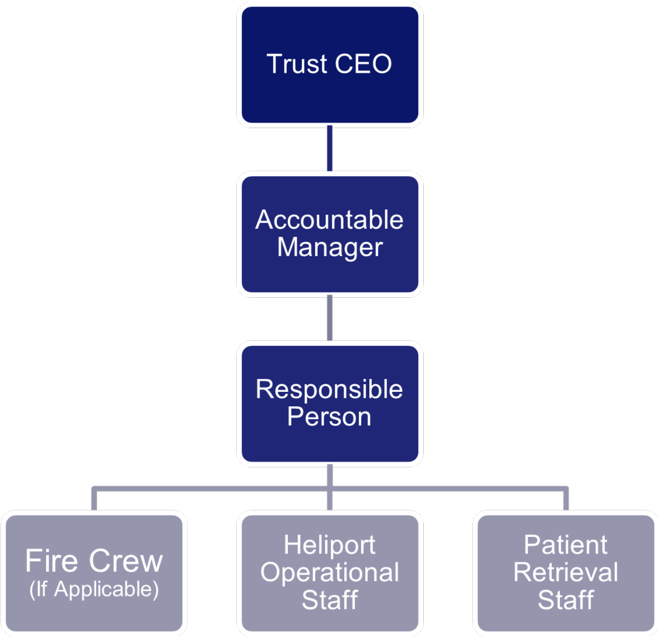
1. HHLS Awareness Courses
2. Other HHLS Courses
3. Training Records

Amendment and distribution of this manual is the responsibility of the AM, usually delegated to the RP.

2. Organisation and Responsibilities

2.1 Organisational Structure

This diagram is reproduced from Part 2 – Heliport Operations of CAP1264



2.2 Responsibilities and Duties

Accountable Manager (AM)

NAME

POSITION

CONTACT DETAILS

TERMS OF REFERENCE AND DUTIES – Listed and defined per NHS Trust

HHLS Responsible Person (RP)

NAME

POSITION

CONTACT DETAILS

TERMS OF REFERENCE AND DUTIES – Listed and defined per NHS Trust

Other HHLS staff

Names and Responsibilities listed as required.

Deputies

Where required some roles, for example the AM and RP, may deputise for each other and such procedures should be detailed here.

3. Safety Management Systems

3.1 Introduction

A Safety Management System (SMS) is a systematic and proactive approach to managing safety risks. Risk management activities are at the heart of SMS, including the identification of safety issues, risk assessments and risk mitigation. It is supported by a strong assurance function that monitors compliance and performance as well as managing changes.

To be effective, the SMS needs the right policies, processes and procedures in place, in addition to the safety leadership to enable it to perform.

Training also plays a key role in implementing effective safety management systems. Training maintains personnel competencies, the sharing of safety information across the organisation, and with external organisations where there is a safety interface.

An effective safety management system is woven into the fabric of an organisation and its culture.

CAP1264 Section 2 Chapter 1 contains further information on Safety Management.

3.2 Safety Policy and Objectives

The NHS Trust responsible for the safe operation of HHLS has a commitment to:

- Improve HHLS Operations towards the highest safety standards;
- Meet all applicable standards and consider best practices;
- Provide appropriate resources to uphold safety;
- Encourage safety as a primary responsibility of all HHLS personnel; and
- Not to blame someone for reporting something which would not have been otherwise detected and encourage a 'Just Culture.'

NHS Trusts should develop their own Safety Policies and Objectives based on the above and detail them in this section.

3.3 Risk Management and Risk Assessments

The safety risk management component of a SMS can be divided into three areas:

- Hazard identification processes;
- Risk assessment and mitigation processes;
- Internal safety investigation.

Safety risk management is the heart of the SMS. The process starts with identifying hazards affecting safety and then assessing the risks associated with the hazards in terms of severity and likelihood. Once the level of risk is identified, appropriate remedial action or mitigation measures can be implemented to reduce the level of risk to an acceptable level. Mitigation measures should then be monitored to ensure that they have had the desired effect.

It should be noted that any safety risk management process should include collaboration with the HEMS Operators to ensure a joint approach and best practice.

Risk assessments should be carried out annually or sooner if a reportable incident or near miss occurs. The assessment should be completed by a competent person alongside the RP / AM and should, in consultation with the air operator, factor in risks related to, but not necessarily limited to:

- Risks to the public
- Risks to hospital staff (including ambulance service)
- Risks to patients (walking or stretchered)

- Heliport staffing shortages
- Infrastructure failures or unserviceability

CAP1264 Section 2 Chapter 3 contains further information on Risk Assessments.

Helicopter downwash is perhaps the major risk to be considered when assessing the safety of HHLS. CAP1264 Section 2 Chapter 2 contains further information and should be consulted during the Risk Assessment phase.

NHS Trusts should develop their own Risk Assessments based on the above and detail them in this section.

3.4 Safety Assurance

Safety Assurance assesses the safety performance of the organisation and enables continuous improvement.

A key function of the SMS is assurance that the system is working and is effective. This should involve:

- The setting and monitoring of Safety Performance Indicators (SPIs) to measure the organisation's HHLS safety performance;
- Assessing the effectiveness of the SMS by confirming that the mitigations, controls and defences put in place are working and effective to ensure safe operational practices;
- Monitoring compliance with the appropriate regulations, standards and best practice.
- Collaboration with HEMS Operators.

SPIs require the monitoring of data from various sources and as such could include:

- Occurrences and events;
- Safety reports;
- Safety studies;
- Safety reviews including trend analysis;
- Audits (see below);
- Surveys;
- Internal safety investigations.

NHS Trusts should develop their own SPIs based on the above and detail them in this section.

Safety Audits are used to ensure that the structure of the SMS is sound in terms of:

- Adequate HHLS staff levels;
- Compliance with approved procedures and instructions;
- Levels of competency and training to carry out specific roles;
- Maintaining required levels of performance;
- Achievement of the safety policy and objectives;
- Effectiveness of interventions and risk mitigations

NHS Trusts should develop their own Safety Audits based on the above and detail them in this section.

3.5 Safety Communication

Safety communication is an essential foundation for the development and maintenance of an adequate safety culture.

Types of communication may include:

- Safety policies and procedures;
- Newsletters, safety bulletins and notices;
- Presentations;
- Websites and e-mails;
- Informal workplace meetings between HHLS staff and the AM or RP.
- Sharing of information between NHS Trusts.

Safety communication should:

- Ensure that all staff are fully aware of the SMS and the organisation's safety culture;
- Disseminate safety critical information internally and externally;
- Explain why certain actions are taken;
- Explain why safety procedures are introduced or changed;
- Compliment and enhance the organisation's safety culture;
- Contain a process for assessing the suitability of safety communication and its effect on the organisation.
- Include the HEMS Operators to establish a two way flow of information.

NHS Trusts should develop their own Safety Communication methods based on the above and detail them in this section.

4. Qualification Requirements

The Accountable Manager and Responsible Person should complete HHLS Awareness Training, as detailed in Part D – Training, as soon as they are nominated.

Other staff who have roles associated with the HHLS are also encouraged to complete HHLS Awareness Training as detailed in Part D - Training.

5. Dangerous Goods

An approval from the CAA is not required for the carriage of dangerous goods on a flight for the purpose of providing medical aid to a patient.

Notwithstanding the above, HHLS operators should be aware of the potential for such dangerous goods to be used and therefore carried on helicopters. Examples might be, but are not limited to, oxygen bottles, lithium batteries, flares and blood products.

6. Handling and Notification of HHLS Incidents / Accidents

6.1 Internal Processes

The NHS has a number of mature reporting processes in place and as such, these should still be used for reporting HHLS incidents.

However, to ensure full cooperation and a sharing of information, the local Helicopter Operators should also be informed of any incident raised by the hospital which concerns the HHLS. This will usually result in the Helicopter Operators producing their own incident report (see below) and therefore ensuring any investigation is conducted jointly between the NHS Trust and the Operator.

NHS Trusts should ensure their methods of reporting for any HHLS incidents are robust and should detail a system of coordination with local Helicopter Operators to ensure full cooperation with any incident or investigation.

6.2 External (Helicopter Operator) Processes

Aviation incident reporting is normally competed using a Helicopter Operators own internal reporting system, for example an Air Safety Report (ASR) and/or the Mandatory Occurrence Report (MOR) scheme coordinated by the CAA.

MORs help improve aviation safety by ensuring that relevant safety information is reported, collected, stored, protected, exchanged, disseminated, and analysed. They are not used to attribute blame or liability, but support continued learning to make flying safer.

Where an incident involving a HHLS has been reported, it is extremely important that the NHS Trust involved is both made aware and works with the Helicopter Operators to complete any investigation.

6.3 Accidents and Serious Incidents

In the UK, aircraft accidents and serious incidents are investigated by the Air Accidents Investigation Branch (AAIB) under the Department of Transport (DfT) and all accidents and serious incidents should be reported to them directly.

With respect to HHLS operations, the definitions can be shown as follows:

- An **accident** means an occurrence associated with the operation of an aircraft which: (a) a person is fatally or seriously injured or (b) the aircraft sustains damage or structural failure.
- A **serious incident** means an incident involving circumstances indicating that there was a high probability of an accident.

Guidance to Emergency Procedures can be found below in Part B – Site Specific

Part B – Site Specific

1. Normal HHLS Procedures

When a helicopter arrives at, or departs from an HHLS, the sudden change in activity, interest and potential risk cannot be underestimated. There are a number of important stages which need to happen in order for any HHLS operation to remain safe and the importance of robust procedures and trained personnel, each fully conversant with their roles, is of paramount importance.

The following personnel / teams should all form a part of any Normal Procedures for HHLS operations, from oversight, to control and supervision:

- Accountable Manager (AM)
- Responsible Person (RP)
- Emergency Department
- HHLS collection / receiving team
- NHS Trust Estates
- NHS Trust Security
- NHS Trust Rescue and Firefighting

Each NHS Trust should consider the following basic timeline when forming their Normal HHLS Procedures:

- Initial activation / notification of a helicopter inbound
- Acceptance of the helicopter to land.
- Security of the HHLS
- Collection / receiving team dispatch
- Actions during helicopter approach and landing
- Unloading of patient
- Keeping the HHLS safe and sterile post unload
- Actions for the departure of Helicopter
- Resetting of HHLS for the next helicopter arrival

NHS Trusts should develop their own Normal HHLS Procedures and detail them in this section.

2. Emergency HHLS Procedures

Emergency HHLS Procedures aim to anticipate the effects that a helicopter emergency might have on life, property and operations and provide guidance to minimise those effects.

These procedures must, as a minimum, detail how each NHS Trust:

- Co-ordinate the actions to be taken in an emergency occurring at the heliport or in its vicinity.
- Provide detailed instructions to individuals, or to departments, of the actions required in an emergency occurring at the heliport or in its vicinity.
- Co-ordinate the response or participation of all existing agencies, which should include the appropriate local agencies such as police and fire.
- Consider fire suppression, the resources needed for casualty extraction (normally LFS) and the administering of first aid to casualties (if trained).
- Include procedures for assisting crew / patients escaping the helicopter, leading them to secure areas away from the scene of an incident.
- Detail the equipment available to ensure all agencies can effectively communicate with each other during an emergency.

CAP1264 Section 1 Chapter 5 contains further information on Emergency Planning, as well as the following Appendixes:

Appendix F: Initial Emergency Response Requirements for elevated heliports – duties of Responsible Persons

Appendix H: Risk assessment to determine the need for a dedicated heliport rescue and fire-fighting service (RFFS) at a surface level, mounded or raised HLS.

Appendix I: Rescue and fire-fighting services for surface level and mounded heliports

NHS Trusts should develop their own Emergency HHLS Procedures and detail them in this section.

3. HHLS Maintenance

The Responsible Person should oversee the ongoing maintenance of the heliport, by using periodical checks as well as scheduled maintenance. Liaison with the local Helicopter Operators is also essential to ensure any reported defects can be dealt with in an effective and timely manner.

Consideration should be given in any Maintenance Plan for:

- HHLS Surface condition
- HHLS Paint condition
- Adequate surface friction
- Surrounding area
- Windsock condition
- Lighting condition
- Signage condition
- Seasonal changes
- Safety equipment

NHS Trusts should develop their own HHLS Maintenance Plan and provide details in this section.

Part C – Change Management

1. HHLS Change Notification

In its purest form, an HHLS is either open or closed and as such, all invested parties need to be aware of its status. An HHLS might be closed, either temporarily or permanently, due to a number of reasons, some being:

- The HHLS is considered unsafe.
- The HHLS is in use (a Helicopter is currently occupying the only landing area.)
- Hazards in the local area (cranes.)
- Hours of darkness and the HHLS is not authorised for night operations.
- Fire suppression team not in place at an Elevated Helipad (EHP).

The notification procedure for the closure of an HHLS must be robust and all parties made aware in a timely manner. A helicopter arriving with a patient onboard to a closed HHLS would be a very unwelcome outcome. Change Notification Procedures therefore should cover everything deemed operationally important, for example, from the HHLS been closed, to a damaged windsock or failed light.

There are a number of projects in the development stage whereby this Change Notification might be better enabled across all parties, such as the use of Electronic Flight Bag (EFB) software (currently used by all Emergency Helicopter Operators) being incorporated into the NHS Trust's own HHLS systems and procedures.

NHS Trusts should develop their own Change Notification Procedures and provide details in this section.

2. HHLS Safeguarding Procedures

For licensed or certified aerodromes, the process of safeguarding ensures the continued safety of aircraft operations by assessing any developments proposed in the vicinity.

CAP 738 – The Safeguarding of Aerodromes, offers guidance to those responsible for the safe operation of an aerodromes to help them assess what impact a proposed development or construction might have on that operation. This guidance can also be used for unlicensed aerodromes or heliports.

Under the current UK Air Navigation Order (ANO) there is no statutory requirement for an HHLS to be licensed and therefore HHLS safeguarding is wholly reliant upon the NHS Trusts relationship with the Local Planning Authority (LPA.)

CAP1264 Section 1 Chapter 1.6 to 1.10 and CAP738 Chapter 9 details further guidance.

Within this section, NHS Trusts should detail the procedure in place with their LPA to ensure the safeguarding of its HHLS.

3. HHLS Operations Contact Details

This section should be the primary reference for all contact details in connection with the HHLS. It should provide, where possible, multiple means of contact and be treated as a 'live' document i.e. accurate and kept up to date.

For the NHS Trust, contact details should include as a minimum:

- Accountable Manager (AM)
- Responsible Person (RP)
- Emergency Department
- HHLS collection / receiving team
- NHS Trust Estates
- NHS Trust Security
- NHS Trust Firefighting

For the Helicopter Operators and Airdesk, contact details for:

- All local Helicopter Operators (HEMS, Police, SAR, Military.)
- All local Airdesks (Trusts, Ambulance Services, Operator/Charities.)
- Coast Guard / SAR

For the Local Area:

- Police and Fire
- Local Planning Authority

Other useful contact details for:

- AAIB
- CAA

NHS Trusts should provide a list of Contact Details for HHLS Operations in this section.

Part D - Training

1. HHLS Awareness Training

HHLS Awareness Training should be given for all personnel involved in HHLS Operations, however for both the AM and the RP it should be treated as a mandatory requirement.

Any such training should as a minimum cover:

- Relevant CAA Regulations and Guidance
- Basic Principles of Helicopter Flight
- Working Safely Around Aircraft
- Performance Class 1 / Category A operations
- Downwash and Outwash
- Protection of Third Parties from Helicopter Operations
- Initial Emergency Response
- Rescue & Firefighting Risk Management

Site specific training should be considered advantageous.

2. Training Records

Training records should be kept securely for all personnel involved in HHLS Operations, for example by digital storage within the NHS's own secure systems. Access to these records should be controlled and access permissions stated within this section.

Typical training records to be kept might be:

- HHLS Awareness Training
- Safety Training
- Safety Audit Training
- Dangerous Goods Training
- Incident Report Training
- Normal and Emergency HHLS Procedures Training
- Personal Protective Equipment (PPE) And Safety Equipment Training
- Fire Suppression Training

NHS Trusts should provide a list of Training Records for HHLS Operations, storage methods and access permissions within this section.

Appendices

Appendix A
Heliport checklists

Example of Initial Hospital Heliport Validation Checklist

Note - This checklist provides an example of an inspection profile for an elevated helideck, this does not include operator approvals with reference to the Performance Class 1 profiles to be utilised. This also does not capture obligations for staff and visitor safety under the guidance of the Health & Safety Executive.

AERODROME: <Insert Name> Hospital Helicopter Landing Site

Core items	
1	Helideck dimensions
2	Surface landing area (elevated helipad)
3	Helideck lighting
4	Helideck environment
5	Visual aids
6	Obstacle protected surfaces
7	Rescue and fire service provisions
8	Extinguishing media
9	Platform facility
10	Personal protective equipment
11	Media discharge test
12	Fire-fighter accommodation
13	Personal protective equipment
14	Fire fighter staffing and competency

Inspection of <Insert Name> Hospital Helicopter Landing Site Following satisfactory review of final helipad drawings and feasibility study report by XXXXX and XXXXX, a site visit and inspection was undertaken on <insert date>, in accordance with International Civil Aviation Organisation International Standards and Recommended Practices (Annex 14 Volume II), UK Air Navigation Order and Rules of Air Regulations, European Aviation Safety Agency (Air Operations Regulations), operational, maintenance and training regulations which may affect the future operation of the heliport. The following persons were present during the site visit and inspection: <List names and organisations of those present> This document forms the outcome of the site visit and inspection including detail of actions required.
Report produced by: XXXX and XXXX For <Insert Name> Date: <insert date>

1	**Helideck Dimensions**		**Action**
1.1	Helideck dimensions (length and width, or diameter) in metres		
1.2	Deck shape (circular, square, octagonal, other)		
1.3	Load bearing category (limit in metric tonnes to 1 decimal place)		
1.4	Scale drawings of helipad arrangements including helipad as marked drawing		

2	Surface Landing Area Conditions (Elevated Helipad)		Action
2.1	Type of Surface, condition, friction characteristics (aggregate added to paint for markings, friction test to validate), markings contaminant free		
2.2	Perimeter safety netting (not less than 1.5m wide and not more than 2.0m wide (drop test certificate by supplier. No hazardous gaps in all round defence).		
2.3	Tie-down points (recessed into surface, for pattern see CAP 437, Chapter 3, Figure 3)		
2.4	Helideck – Leak test		
2.5	Bolting Control Report		

3	Helideck Lighting		Action
3.1	Helideck lighting design		
3.2	Night Lighting Test		
3.3	Conditions and security of ramp, safety netting, handrails, surface and operational and associated domestic lighting (that it does not present a glare issue for the pilot)		
3.4	Standby generator		

4	Environment		Action

4.1	Has the heliport been subjected to appropriate wind tunnel testing or CFD analysis		
4.2	Minimum 3m air-gap beneath the helipad		
4.3	Turbulence generators, Flues and other exhausts		
4.4	Adjacent fixed, mobile, structures and turbulence generators		
4.5	Choice of preferred approach departure flight paths to optimise wind and noise, nuisance considerations (at least two approach and take-off climb surfaces present)		

5	**Obstacle Protected Surfaces (minima)**		**Action**
5.1	Obstacle-free sectors, 2 flight paths ideally separated by 180 degrees		

5.2	No obstacles on the operational surface of the helipad (within the perimeter white lines) exceeding 25mm and no essential obstacles around the landing area surface or in the surrounding Safety Area higher than 250mm. (includes helipad lighting, foam monitors, any handrails)		

6	**Visual Aids**		**Action**
6.1	Markings, friction characteristics when dry and wet; (brushed concrete, metal ribbed, sand blasted or epoxy resin painted finish)		
6.2	General condition, good contrasting colour and dimensions of painted markings; (non slip paint, not thermoplastic types)		
6.3	Location / colour of H (red, 3m x 1.8m x 0.4m minimum, set over a white cross)		
6.4	Touchdown and lift-off circle, width and diameter (surrounding white cross)		

6.5	D-value marked in two locations within perimeter line (elevated helipads only)		
6.6	Maximum allowable mass marking to one decimal place e.g. 9.3t (elevated helipads only)		
6.7	Illuminated wind indicator, size / colour of wind sleeve, location, lighting and access for servicing		
6.8	Perimeter lighting (colour- green, condition and operational spaced every 3m)		
6.9	Floodlighting (type, numbers, condition, adjustment and operation)		
6.10	Obstruction lighting (location, accessibility, condition and operation)		
6.11	Marking of dominant obstacles close to heliport / helipad, prohibited landing approach sectors (as required)		
6.12	CCTV		
6.12	Anemometer / wind speed		
6.13	Helideck de-icing facility		

6.14	Shielding of ambient / domestic lighting sources from helipad operations		
6.15	Glide slope indicator (HAPI) if provided		
6.16	Heliport Beacon, if provided		
6.17	Other lighting aids (e.g. flight path alignment guidance lighting) , if provided		

RFFS Provisions			
7	**Minimum Scale of Service**		**Action**
7.1	RFFS Protection (H1 or H2) Elevated		
7.2	Day or Night or both		
7.3	Refuelling		

8	**Extinguishing Equipment & Media**		**Action**
8.1	Fire Protection and Completion Certificate		
8.2	Principal Fire fighting agent Type and Certificate of Conformity		
8.3	• Location		
8.4	• Quantity		
8.5	• Shelf life		
8.6	Foam Monitor		

9	**Extinguishing Media (Water)**		**Action**
9.1	Water supply (500ltr/1min)		

10	**Platform**		**Action**
10.1	• Access		
10.2	• Fire fighting platform		
10.3	• Emergency egress		
10.4	• Waterproof storage cabinets		
10.5	• Rescue equipment as per CAP 437 (branch pipe, hose, rescue equipment)		
10.6	Drainage		

11	Discharge test		Action
11.1	Water & foam discharge output test.		
11.2	Isolate each monitor		
	Full coverage of the helipad in moderate wind conditions (15knts) should be demonstrated by each monitor or by 1 monitor and hand line prepositioned upwind. • Jet range • Spray pattern		
11.3	Operate the hose line to reach all parts of the deck		
11.4	Refill Test		
11.5	Foam Sample Test		
a	• Induction		
b	• Expansion		
c	• Drainage		
11.6	Flush system		
11.7	Replenish		

12	RFFS Domestic Accommodation Facility		Action
12.1	Accommodation facility		

13	Fire-fighters PPE		Action
13.1	Helmet, flashood, tunic, leggings, boots, gloves, RPE		

14	**Staffing Levels and Emergency Procedures**		**Action**
14.1	Normal and emergency access / egress points to and from helipad and fire fighting platforms		
14.2	Building / LAFRS alert system and access to helipad through building fire core or external RFFS staircase		
14.3	Helipad, normal and emergency communication system		
14.4	Check warning notice on access approach routes to helipad		
14.5	Check availability of helipad operational / no fly flag (yellow cross on red background)		
14.6	Provision of a Helipad operating manual		
14.7	RFFS crewing level		
14.8	RFFS training, competence, qualification		
14.9	RFFS Rescue equipment		
14.10	Medical equipment		
14.11	Emergency planning arrangements		
14.12	Arrangements for LAFRS to familiarise with the location and access routes		

14.13	Off helipad incident response capability		
14.14	Bird scaring mechanism		

Notes
Issue of Certificate: Yes / No Items detailed with actions will need to be addressed satisfactorily to meet the relevant criteria.

Appendix B
Bibliography

Civil Aviation Authority – CAPs and research papers

CAP 168	Licensing of Aerodromes
CAP 437	Standards for Offshore Helicopter Landing Areas
CAP 452	Aeronautical Radio Station Operator's Guide
CAP 637	Visual Aids Handbook
CAP 738	Safeguarding of Aerodromes
CAP1484	CAA/HSE/HSENI Memorandum of Understanding
CAP 3043	Helicopter Off Airfield Landing Sites
CAP 3075	Trials and Simulation of Downwash and Outwash for Helicopters and Powered Lift Aircraft

CAA Paper 2007/02	Visualisation of Offshore Gas Turbine Exhaust Plumes
CAA Paper 2008/03	Helideck Design Considerations: Environmental Effects

International Civil Aviation Organisation (ICAO) and European Aviation Safety Agency (EASA)

ICAO Annex 14 Volume II	Heliports (5th Edition, amendment 9 July 2020)
ICAO Doc 9261/AN 903	Heliport Manual (Onshore Part 2) ICAO Annex 6 Part III International Operations – Helicopters

EASA Requirements for Air Operators, Operational Requirements Part-OPS, Annex IV Part-CAT or Annex VI Part-SPA

Other publications

The Health and Safety at Work etc Act 1974 HMSO 1974

Oil and Gas UK Guidelines for the Management of Aviation Operations Issue 6 April 2011

Appendix C

An illustration of obstacle clearances in the backup area

Obstacle clearances in the backup area

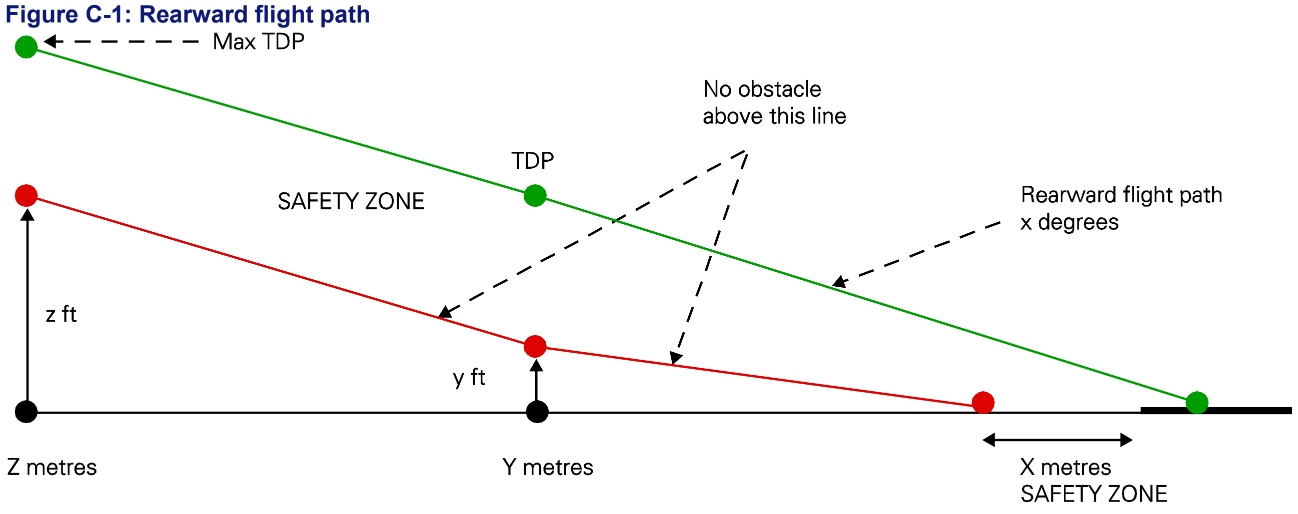
C1 The requirements in CAT.POL.H.205(e) has been established in order to take into account the following factors:

1. in the backup: the pilot has few visual cues and has only to rely on the altimeter and sight picture through the front window (if flight path guidance is not provided) to achieve an accurate rearward flight path;
2. in the rejected take-off: the pilot has to be able to manage the descent against a varying forward speed whilst still ensuring an adequate clearance from obstacles until the helicopter gets in close proximity for landing on the FATO; and
3. in the continued take-off: the pilot has to be able to accelerate to V_{TOSS} (take- off safety speed for Category A helicopters) whilst ensuring an adequate clearance from obstacles

C2 The requirements of CAT.POL.H.205(e) may be achieved by establishing that:

1. in the backup area no obstacles are located within the safety zone below the rearward flight path when described in the RFM (see Figure 1, in the absence of such data in the RFM, the operator should contact the manufacturer in order to define a safety zone); or
2. during the backup, the rejected take-off and the continued take-off manoeuvres, obstacles clearance is demonstrated to the competent authority.

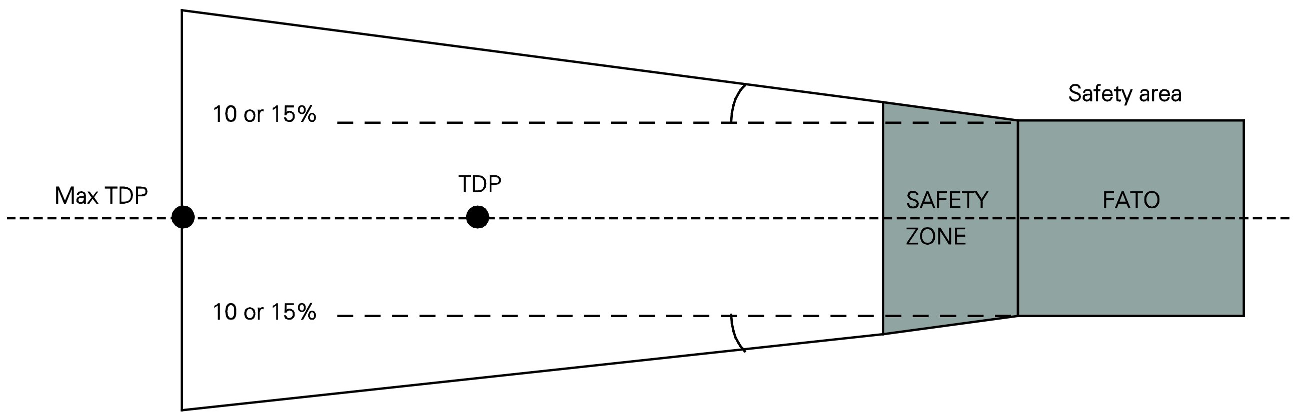
Figure C-1: Rearward flight path



C3 An obstacle, in the backup area, is considered if its lateral distance from the nearest point on the surface below the intended flight path is not further than:

1. half of the minimum FATO (or the equivalent term used in the AFM) width defined in the RFM (or, when no width is defined 0.75 D, where D is the largest dimension of the helicopter when the rotors are turning); plus
2. 0.25 times D (or 3m, whichever is greater); plus
3. 0.10 for VFR day, or 0.15 for VFR night, of the distance travelled from the back of the FATO (see Figure C-2).

Figure C-2: Obstacle accountability



Appendix D

Specification for Heliport Lighting Scheme: Comprising Perimeter Lights, Lit Touchdown/Positioning Marking and Lit Cross Marking

Overall Operational Requirement

D1 The whole lighting configuration should be visible over a range of 360° in azimuth.

D2 The visibility of the lighting configuration should be compatible with operations in a meteorological visibility of 3000 m.

D3 The purpose of the lighting configuration is to aid the helicopter pilot perform the necessary visual tasks during approach and landing as detailed in Table D-1.

Table D-1: Visual Tasks During Approach and Landing

Phase of Approach	Visual Task	Visual Cues/ Aids	Desired Range (NM)
			3000m met. vis.
Heliport Location and Identification	Search for heliport within the hospital complex.	Shape of heliport, colour of heliport, luminance of heliport, perimeter lighting.	1.1 (2km)
Final Approach	Detect helicopter position in three axes. Detect rate of change of position.	Apparent size / shape and change of size / shape of heliport. Orientation and change of orientation of known features/ markings/ lights.	0.75 (1.4 km)

Hover and Landing	Detect helicopter attitude position and rate of change of position in three axes (six degrees of freedom).	Known features/ markings/ lights. Heliport texture.	0.03 (50 m)

D4 The minimum intensities of the lighting configuration should be adequate to ensure that, for a minimum Meteorological Visibility (Met. Vis.) of 3000 m and an illuminance threshold of $10^{-6.1}$ lux, each feature of the system is visible and useable at night from ranges in accordance with D5, D6 and D7 (below).

D5 The Perimeter Lights are to be visible and usable at night from a minimum range of 1.1 NM.

D6 The Touchdown/Positioning Marking (TD/PM) circle on the heliport is to be visible and usable at night from a range of 0.75 NM.

D7 The cross marking is to be visible and usable at night from a range of 0.375 NM.

D8 The design of the Perimeter Lights, TD/PM circle and cross marking should be such that the luminance of the Perimeter Lights is equal to or greater than that of the TD/PM circle segments, and the luminance of the TD/PM circle segments equal to or greater than that of the cross marking.

Definitions

The following definitions should apply.

Lighting element

D9 A lighting element is a light source within a segment or sub-section and may be discrete (e.g. a Light Emitting Diode (LED)) or continuous (e.g. fibre optic cable, electro luminescent panel). An individual lighting element may consist of a single light source or multiple light sources arranged in a group or cluster and may include a lens/diffuser.

Segment

D10 A segment is a section of the TD/PM circle lighting. For the purposes of this specification, the dimensions of a segment are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses/diffusers.

Sub-section

D11 A sub-section is an individual section of the cross marking lighting. For the purposes of this specification, the dimensions of a sub-section are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses/diffusers.

The perimeter light requirement

Configuration

D12 Perimeter lights, spaced at intervals of not more than 3 m, should be fitted around the perimeter of the landing area of the heliport as described in Section 3 of Chapter 4.

Mechanical constraints

D13 The perimeter lights should not exceed a height of 25 cm above the surface of the heliport.

Light intensity

D14 The minimum light intensity profile is given in Table D-2 below:

Table D-2: Minimum Light Intensity Profile for Perimeter Lights

Elevation	Azimuth	Intensity (min)
0° to 10°	-180° to +180°	30 cd
>10° to 20°	-180° to +180°	15 cd
> 20° to 90°	-180° to +180°	3 cd

D15 No perimeter light should have an intensity of greater than 60 cd at any angle of elevation. Note that the design of the perimeter lights should be such that the luminance of the perimeter lights is equal to or greater than that of the TD/PM circle segments.

Colour

D16 The colour of the light emitted by the perimeter lights should be green, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.3.1(c), whose chromaticity lies within the following boundaries:

Yellow boundary $x = 0.310$

White boundary $x = 0.625y – 0.041$

Blue boundary $y = 0.400$

Note: The above assumes that solid state light sources are used. ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.1.1(c) should be applied if filament light sources are used.

Serviceability

D17 The perimeter lighting is considered serviceable provided that at least 90% of the lights are serviceable, and providing that no two adjacent lights are unserviceable.

The touchdown / positioning marking circle requirement

Configuration

D18 The lit TD/PM circle should be superimposed on the yellow painted marking such that it is concentric with the painted circle and contained within it. It should comprise one or more concentric circles of at least 16 discrete lighting segments, of at least 40 mm minimum width. A single circle should be positioned such that the radius of the circle formed by the centreline of the lighting segments is within 10 cm of the mean radius of the painted circle. For an onshore hospital which has to display a 9 m x 9 m white cross, the inner diameter of the TD/PM circle is fixed at 10.5 m. Therefore, the centreline of the circle should always be at a radius of 5.75 m. Four gaps of between 1.5 m and 2.0 m, aligned with the ‘arms’ of the white cross should be provided to permit stretcher trolley access. The lighting segments should be of such a length as to provide coverage of between 50% and 75% of the circumference populated by lighting segments (i.e. the four 1.5 to 2 m access gaps are to be excluded from this calculation), and be equidistantly placed with the gaps between them not less than 0.5 m. The mechanical housing should be coloured yellow - see Chapter 4 paragraph 4.15.

Mechanical constraints

D19 The height of the lit TD/PM circle fixtures (e.g. segments) and any associated cabling should be as low as possible and should not exceed 25 mm above the surface of the heliport when fitted. So as not to present a trip hazard, the segments should not present any vertical outside edge greater than 6 mm without chamfering at an angle not exceeding 30° from the horizontal.

The overall effect of the lighting segments and cabling on deck friction should be minimised. Wherever practical, the surfaces of the lighting segments should meet the minimum deck friction limit coefficient (μ) of 0.6, e.g. on non-illuminated surfaces.

The TD/PM circle lighting components, fitments and cabling should be able to withstand a pressure of at least 2,280 kPa (331 lbs/in2), without damage.

Intensity

D20 The light intensity for each of the lighting segments, when viewed at angles of azimuth over the range + 80° to -80° from the normal to the longitudinal axis of the strip (see Figure D-1), should be as defined in Table D-3.

For the remaining angles of azimuth on either side of the longitudinal axis of the segment, the maximum intensity should be as defined in Table D-3; the minimum intensity values are not applicable.

Note that the intensity of each lighting segment should be nominally symmetrical about its longitudinal axis.

Note also that the design of the TD/PM circle should be such that the luminance of the TD/PM circle segments is equal to or greater than those of the cross chevrons.

Table D-3: Light Intensity for TD/PM Circle Lighting Segments

Elevation	Intensity	
	Min	Max
0° to 10°	As a function of segment length as defined in Figure 2	60 cd
>10° to 20°	25% of min intensity >0° to 10°	45 cd
>20° to 90°	5% of min intensity >0° to 10°	15 cd

Figure D-1: TD/PM Segment Measurement Axis System

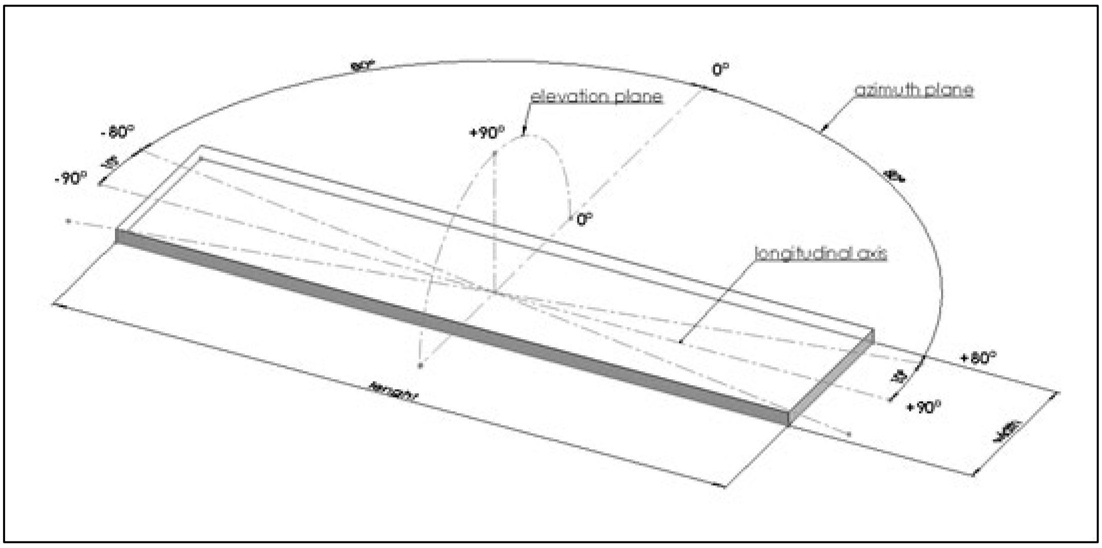
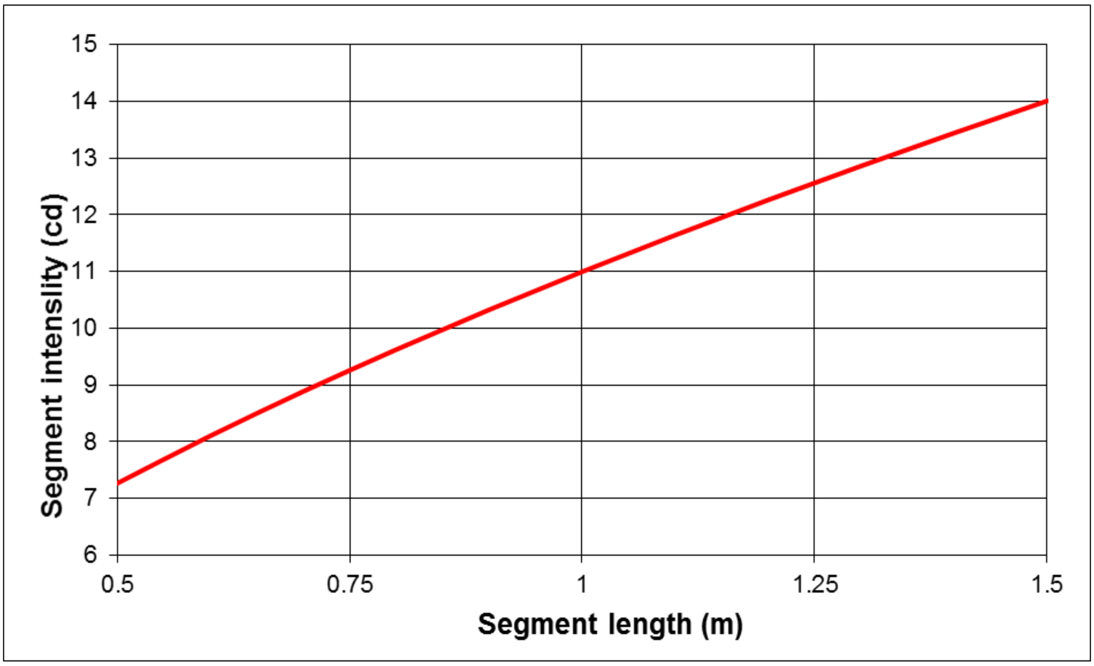


Figure D-2: TD/PM segment intensity versus segment length



Note: Given the minimum gap size of 0.5 m and the minimum coverage of 50%, the minimum segment length is 0.5 m. The maximum segment length is given by selecting the minimum number of segments (16), the minimum access gap size (1.5 m) and the maximum coverage (75%), resulting in a maximum segment length of 1.5 m for the 11.5 m standard TD/PM circle diameter.

D21 If a segment is made up of a number of individual lighting elements (e.g. LED's) then they should be of the same nominal performance (i.e. within manufacturing tolerances) and be equidistantly spaced throughout the segment to aid textural cueing. Minimum spacing between the illuminated areas of the lighting elements should be 3 cm and maximum spacing 10 cm.

On the assumption that the intensities of the lighting elements will add linearly at longer viewing ranges where intensity is important the minimum intensity of each lighting element (i) should be given by the formula:

i = I / n

where: I = required minimum intensity of segment at the 'look down' (elevation) angle (see Table D-3).

n = the number of lighting elements within the segment.

Note: The maximum intensity of a lighting element at each angle of elevation should also be divided by the number of lighting elements within the segment.

D22 If the segment comprises a continuous lighting element (e.g. fibre optic cable, electro luminescent panel), then to achieve textural cueing at short range, the element should be masked at 3.0 cm intervals on a 1:1 mark-space ratio.

Colour

D23 The colour of the light emitted by the TD/PM circle should be yellow, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.3.1(b), whose chromaticity is within the following boundaries:

Red boundary y = 0.387

White boundary y = 0.980 – x

Green boundary y = 0.727x + 0.054

Note: The above assumes that solid state light sources are used. ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.1.1(b) should be applied if filament light sources are used.

Serviceability

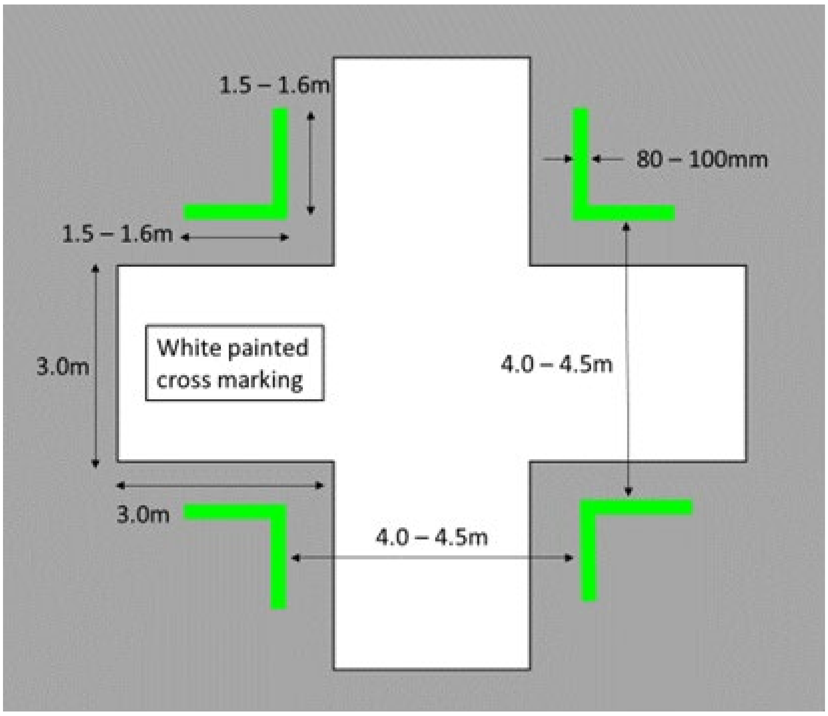
D24 At least 90% of the lighting elements should be operating for the TD/PM circle to be considered serviceable.

The cross marking requirement

Configuration

D25 The white cross marking should be lit using green right-angled lit chevron markings located adjacent to each of the four internal corners of the 9 m x 9 m white cross. Each chevron should be 1.5 to 1.6 m x 1.5 to 1.6 m in size and be spaced by 4.0 m to 4.5 m as shown in Figure D-3.

Figure D-3: Configuration and dimensions of heliport cross marking



The chevron markings should comprise sub-sections of between 80 mm and 100 mm wide. There are no restrictions on the length of the sub-sections, up to a maximum of 1.6 m but, where applicable, the gaps between them should not be greater than 10 cm. The mechanical housings should be coloured white (see Chapter 4 paragraph 4.15) and should be mounted onto white paint markings between 15cm and 45cm wide. To ensure the white chevron markings are conspicuous to a pilot operating by day, they should be outlined with a thin black line (typically 5 to 10 cm wide - see Note 1 to Helicopter landing area markings).

Mechanical Constraints

D26 The height of the chevron fixtures (e.g. sub-sections) and any associated cabling should be as low as possible and should not exceed 25 mm above the surface of the heliport when fitted. So as not to present a trip hazard, the lighting equipment should not present any vertical outside edge greater than 6 mm without chamfering at an angle not exceeding 30° from the horizontal.

D27 The overall effect of the lighting sub-sections and cabling on deck friction should be minimised. Wherever practical, e.g. on non-illuminated surfaces, the surfaces of the lighting sub-sections should meet the minimum deck friction limit coefficient (μ) of 0.6.

D28 The cross lighting components, fitments and cabling should be able to withstand a pressure of 2,280 kPa (331 lb/in2), without damage.

Light Intensity

D29 The intensity of the lighting for each 1.5 m limb of each chevron over all angles of azimuth is given in Table D-4 below.

Note that, for the purposes of demonstrating compliance with this specification, a sub-section of the lighting forming the cross chevrons may be used. The minimum length of the sub-section should be 0.5 m.

Table D-4 Light intensity of the 1.5 m limb of each cross chevron

Elevation	Intensity	
	Min	Max
2° to 12°	2 cd	30 cd
>12° to 20°	0.25 cd	15 cd
>20° to 90°	0.1 cd	5 cd

D30 The cross chevrons should consist of the same sub-sections throughout.

D31 If a sub-section of the cross chevrons is made up of individual lighting elements (e.g. LEDs) then they should be of nominally identical performance (i.e. within manufacturing tolerances) and be equidistantly spaced within the sub-section to aid textural cueing. Minimum spacing between the illuminated areas of the lighting elements should be 3 cm and maximum spacing 10 cm.

D32 Due to the shorter viewing ranges for the cross and the lower intensities involved the minimum intensity of each lighting element (i) for all angles of elevation (0° to 90°) should be given by the formula:

i = I / n

where I = required minimum intensity of the sub-section at the 'look down' (elevation) angle between 2° and 12° (see Table D-4).

n = the number of lighting elements within the sub-section.

Note: The maximum intensity of each lighting element at any angle of elevation should be the maximum between 2° and 12° (see Table D-4) divided by the number of lighting elements within the sub-section.

D33 If the cross chevrons are constructed from a continuous light element (e.g. ELP panels or fibre optic cables or panels), the luminance (B) of the 1.5 m arms of the chevrons should be given by the formula:

B= I / A

where I = intensity of the limb (see Table D-4).

A = the projected lit area at the 'look down' (elevation) angle.

D34 If the sub-section comprises a continuous lighting element (e.g. ELP, fibre-optic cable), then to achieve textual cueing at short range, the element should be masked at 3.0 cm intervals on a 1:1 mark-space ratio.

Colour

D35 The colour of the cross chevrons should be green, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.3.1(c), whose chromaticity is within the following boundaries:

Yellow boundary x = 0.310

White boundary x = 0.625y – 0.041

Blue boundary y = 0.400

Note: The above assumes that solid state light sources are used. ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.1.1(c) should be applied if filament light sources are used.

Serviceability

D36 At least 90% of the lighting elements in each of the four chevron markings should be operating for the cross marking to be considered serviceable.

General characteristics

Requirements

The following items are fully defined and form firm requirements.

D37 All lighting components should be tested by an independent test house. The photometrical and colour measurements performed in the optical department of this test house should be accredited according to the version of EN ISO/IEC 17025 current at the time of testing. The angular sampling intervals should be: every 10° in azimuth; every 1° from 0° to 10°, every 2° from 10° to 20° and every 5° from 20° to 90° in elevation.

D38 As regards the attachment of the TD/PM Circle and cross chevrons to the heliport, the failure mode requiring consideration is detachment of elements of the TD/PM circle and cross lighting due to shear loads generated during helicopter landings. The maximum horizontal load may be assumed to be that defined in Chapter 3, Case A, paragraph d i.e. the maximum take-off mass (MTOM) of the largest helicopter for which the heliport is designed multiplied by 0.5, distributed equally between the main undercarriage legs. The requirement applies to components of the circle and cross lighting having an installed height greater than 6mm and a plan view area greater than, or equal to, 200cm^2. Recessed fittings should be used wherever possible. Use of raised fittings (e.g. domed nuts) should be minimised and, in any event, should not protrude by more than 6mm above the surrounding surface without chamfering at an angle not exceeding 30° from the horizontal.

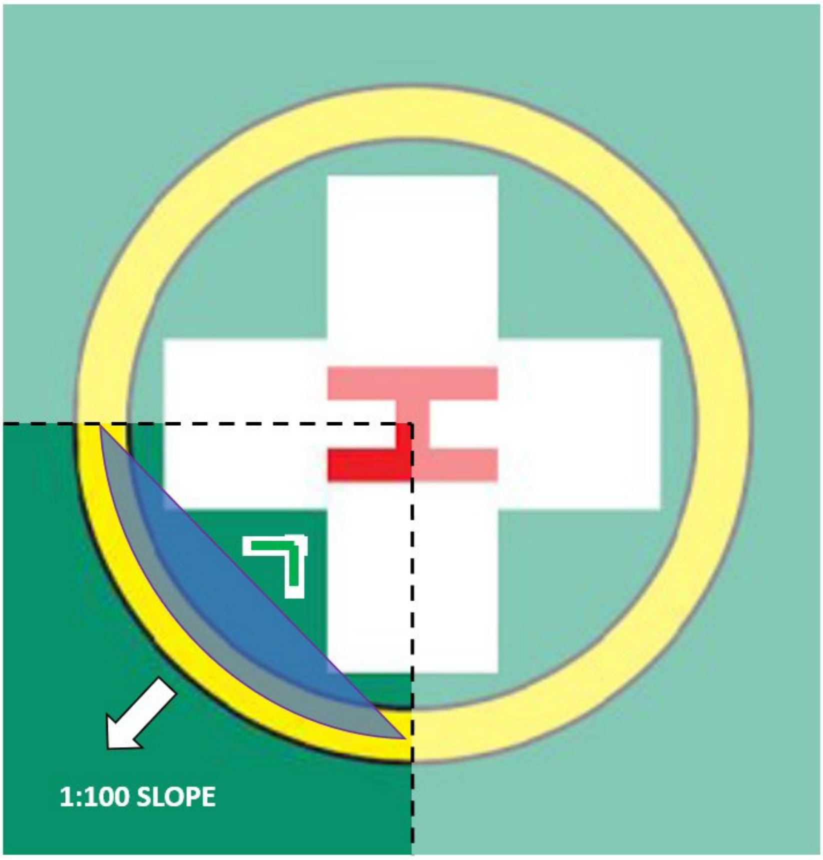
Note 1: Example – for a helicopter MTOM of 14,600kg, a horizontal load of 35.8kN should be assumed.

Note 2: For components having plan areas up to and including 1,000 cm^2, the horizontal load may be assumed to be shared equally by all fasteners provided that they are approximately equally spaced. For larger components, the distribution of the horizontal loads should be considered.

D39 Provision should be included in the design and installation of the system to allow for the effective drainage of the heliport areas inside the TD/PM circle and the cross lighting (see Chapter 3 paragraph 3.38). The design of the lighting and its installation should be such that the residual fluid retained by the circle and cross lighting when mounted on a smooth flat plate with a slope of 1:100, a fluid spill of 200 litres at the centre of the helipad will drain from the circle within 2 minutes. The maximum drainage time applies primarily to aviation fuel, but water may be used for test purposes. The maximum drainage time does not apply to fire-fighting agents.

Note: Drainage may be demonstrated using a mock-up of a one quarter segment of a helipad of D-value of at least 20m, configured as shown in Figure D-4, and a fluid quantity of 100 litres. The surface of the test helipad should have a white or light-coloured finish and the water (or other fluid used for the test) should be of a contrasting colour (e.g. by use of a suitable dye) to assist the detection of fluid remaining after 2 minutes.

Figure D-4: Configuration of quarter segment drainage test mock up



Other considerations

The considerations detailed in this section are presented to make equipment designers aware of the operating environment and customer expectations during the design of products /systems. They do not constitute formal requirements but are desirable design considerations of a good lighting system.

D40 All lighting components and fitments should meet safety regulations relevant to a heliport environment such as flammability and be tested by a notified body in accordance with applicable directives.

D41 All lighting components and fitments installed on the surface of the heliport should be resistant to attack by fluids such as: fuel, hydraulic fluid, helicopter engine and gearbox oils; those used for de-icing, cleaning and fire-fighting; any fluids used in the assembly or installation of the lighting, e.g. thread locking fluid. In addition, they should be resistant to UV light, rain, snow and ice. Components should be immersed in each of the fluids individually for a period representative of the likely exposure in-service and then checked to ensure no degradation of mechanical properties (i.e. surface friction and resistance to contact pressure), any discolouration or any clouding of lenses / diffusers. Any other substances that may come into contact with the system that may cause damage should be identified in installation and maintenance documentation.

D42 All lighting components and fitments that are mounted on the surface of the heliport should be able to operate within a temperature range appropriate for the local ambient conditions.

D43 All cabling should utilise low smoke/toxicity, flame retardant cable. Any through-the-deck cable routing and connections should use sealed glands, type approved for heliport use.

D44 All lighting components and fitments should meet IEC International Protection (IP) standards according to IEC 60529 appropriate to their location, use and recommended cleaning procedures. The intent is that the equipment should be compatible with deck cleaning activities using pressure washers and local flooding (i.e. puddling) on the surface of the heliport. It is expected that this will entail meeting at least IP66 (dust tight and resistant to powerful water jetting). IP67 (dust tight and temporary submersion in water) and/or IP69 (dust tight and resistant to close -range high pressure, high temperature jetting) should also be considered and applied where appropriate.

Note: Except where flush mounted (e.g. where used to delineate the landing area from an adjacent parking area), perimeter lights need only meet IP66. Lighting equipment mounted on the surface of the heliport (e.g. circle and cross lighting) should also meet IP67. Any lighting equipment that is to be subject to high pressure cleaning (i.e. lighting mounted on the surface of the heliport such as the circle and cross lighting) should also meet IP69.

D45 Control panels that may be required for heliport lighting systems are not covered in this document. It is the responsibility of the Duty Holder / engineering contractor to select and integrate control panels into the installation safety and control systems, and to ensure that all such equipment complies with the relevant engineering standards for design and operation.

Appendix E

Specifications for helicopter taxiways, taxi-routes and stands at surface level heliports

The following requirements for taxiways / taxi-routes and helicopter stands for provision at surface level heliports are based on amendment 9 of the 4th Edition Annex 14 Volume II (Heliports). The numbering system has been amended to provide sequential references for Appendix E. Future Safety Policy section should be contacted for advice on specifications relating to taxiways / taxi- routes and helicopter stands at elevated heliports:

Helicopter taxiways and helicopter taxi-routes

Note: A helicopter taxiway is intended to permit the surface movement of a wheeled helicopter under its own power. A helicopter taxiway can be used by a wheeled helicopter for air taxi manoeuvres, if associated with a helicopter air taxi route.

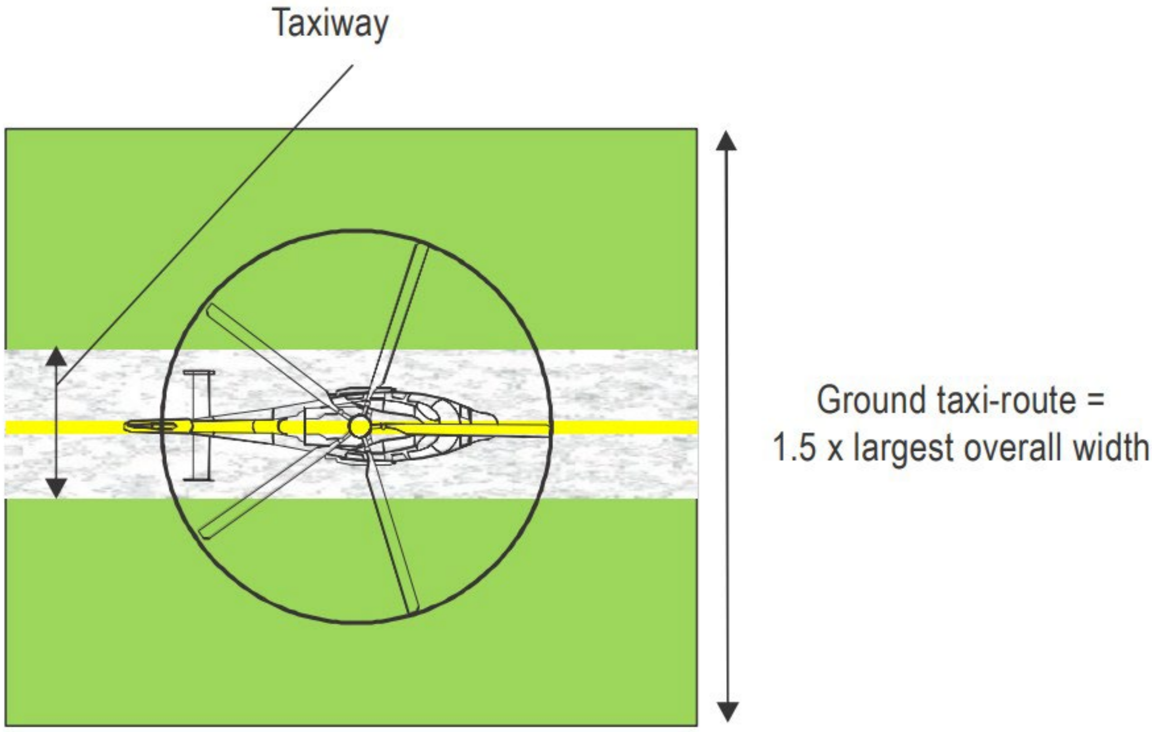
E1 The minimum width of a helicopter taxiway should not be less than 2.0 times the largest width of the undercarriage (UCW) of the most demanding helicopter the helicopter taxiway is intended to serve.

E2 The longitudinal slope of a helicopter taxiway should not exceed 3 per cent and the transverse slope should not exceed 2 per cent.

E3 A helicopter taxiway should be capable of withstanding the taxiing loads of the helicopters the helicopter taxiway is intended to serve and be free of irregularities that would adversely affect the ground taxiing of helicopters.

E4 A helicopter taxiway should be centred on a ground taxi-route extending symmetrically on each side of the centre line for at least 0.75 times the largest overall width of the helicopters it is intended to serve. (See Figure E-1).

Figure E-1: Helicopter ground taxi-route / taxiway



E5 No fixed object should be permitted above the surface of the ground in a helicopter ground taxi-route, except for objects, which, because of their function, must be located thereon. No mobile object should be permitted on a ground taxi-route during helicopter movements.

E6 Objects whose function requires them to be located in a helicopter ground taxi-route should not be located at a distance of less than 50 cm from the edge of the helicopter ground taxiway; whereupon objects should not penetrate a plane originating at a height of 25 cm above the surface of the helicopter ground taxiway, at a distance of 50 cm from the edge of the helicopter taxiway and sloping upwards and outwards at a gradient of 5 per cent.

E7 The helicopter taxiway and ground taxi-route should provide rapid drainage. The surface of a helicopter ground taxi-route should be resistant to the effect of rotor downwash.

E8 For simultaneous operations, helicopter ground taxi-routes should not overlap.

Helicopter air taxi-routes

Note: A helicopter air taxi-route is intended to permit the movement of a helicopter above the surface at a height normally associated with ground effect and at ground speed less of than 37km/h (20 kt).

E9 The width of a helicopter air taxi-route should be at least two times the largest overall width of the helicopters that it is intended to serve.

E10 When not collocated with a taxiway the slopes of the surface of an air taxi-route should not exceed the slope landing limitations of the helicopters the air taxi-route is intended to serve. In any event the transverse slope should not exceed 10 per cent and the longitudinal slope should not exceed 7 per cent.

E11 A helicopter taxiway, where provided, should be centred on an air taxi-route, extending symmetrically on each side of the centre line for a distance at least equal to the largest overall width of the helicopters it is intended to serve. (See Figure E-2)

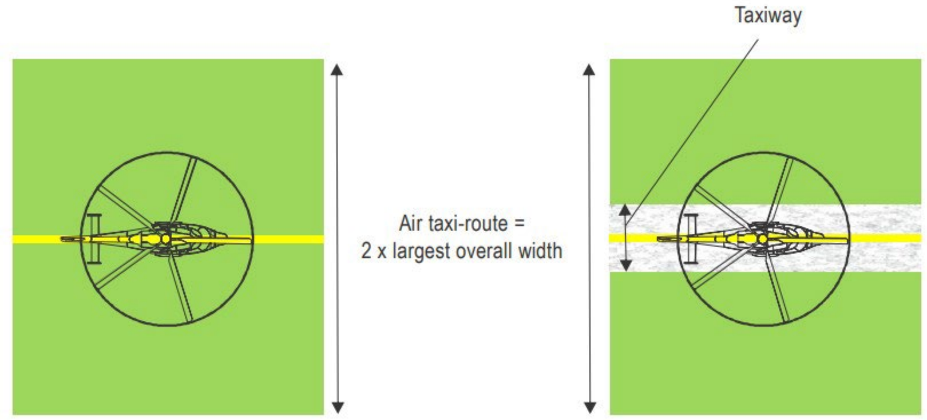
E12 No fixed object should be permitted above the surface of the ground on an air taxi-route, except for objects, which, because of their function, must be located thereon. No mobile object should be permitted on an air taxi-route during helicopter movements.

E13 If collocated with a taxiway for the purpose of permitting both ground and air taxi operations, the helicopter air taxi-route should be centred on the taxiway and essential objects in the helicopter air taxi-route should not be located less than 50cm outwards from the edge of the helicopter taxiway and penetrate a surface originating 50cm outwards from the edge of the helicopter taxiway and a height of 25 cm above the surface of the helicopter taxiway and sloping upwards and outwards at a gradient of 5 per cent.

E14 The surface of a helicopter taxi-route should be resistant to the effect of rotor downwash and provide ground effect.

E15 For simultaneous operations, the helicopter taxi-routes should not overlap.

Figure E-2: Helicopter air taxi-route / taxiway



Helicopter stands

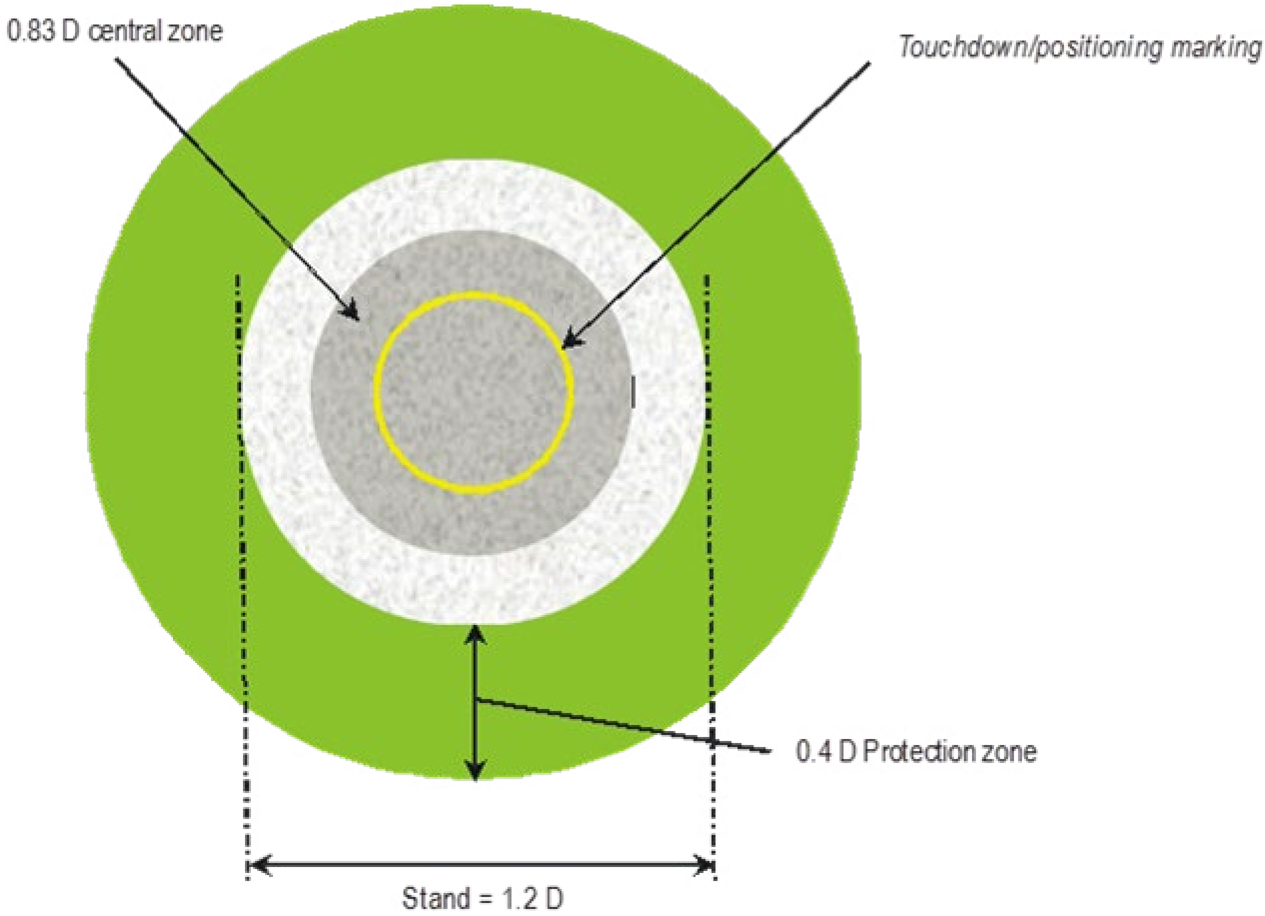
Note 1: The provisions of this section do not specify the location for helicopter stands but allow a high degree of flexibility in the overall design of the heliport. However, it is not considered good practice to locate helicopter stands under a flight path, where helicopters are required to perform a rearwards departure it would be advised that no overflight of parked aircraft is permitted.

Note 2: The requirements on the dimensions of helicopter stands assume the helicopter will turn in a hover when operating over a stand. For a helicopter stand intended to be used for turning on the ground by wheeled helicopters, the dimension of the helicopter stand, including the dimension of the central zone, wiil be influenced by the turning circle of the type in use and may need to be significantly increased. Data should be available from the helicopter manufacturer.

E16 A helicopter stand intended to be used by helicopters turning in a hover should be of sufficient size to contain a circle of diameter of at least 1.2 D of the largest helicopter the stand is intended to serve. (See Figure E-3).

E17 Where a helicopter stand is intended to be used for turning in a hover, it should be surrounded by a protection area which, need not necessarily be a solid surface, but should extend for a distance of 0.4 D from the edge of the helicopter stand. Therefore, the minimum dimension of the stand and protection area should not be less than 2 D and, to the extent that it is a solid surface, should be resistant to the effects of rotor downwash and ensure effective drainage.

Figure E-3: Helicopter stand and associated protection area for a stand designed for turning



E18 Where a helicopter stand is intended to be used for taxi-through where the helicopter using the stand is not required to turn, the minimum width of the stand should be not less than 1.2 times the width of the largest helicopter the stand is intended to serve.

E19 The helicopter stand should provide rapid drainage but the mean slope of the stand should not exceed 2 per cent in any direction. A helicopter stand and associated protection area intended to be used for air taxiing should provide ground effect. The upward slope of the protection area, where solid, should not exceed 4 per cent.

E20 No fixed object should be permitted above the surface of the ground on a helicopter stand. No fixed object should be permitted above the surface of the ground in the protection area around a helicopter stand except for objects, which because of their function, must be located there. No mobile object should be permitted on a helicopter stand and the associated protection area during helicopter movements.

E21 Objects whose function requires them to be located in the protection area should not:

a) if located at a distance of less than 0.75 D from the centre of the helicopter stand, penetrate a plane at a height of 5 cm above the plane of the central zone; and

b) if located at a distance of 0.75 D or more from the centre of the helicopter stand, penetrate a plane at a height of 25 cm above the plane of the central zone and sloping upwards and outwards at a gradient of 5 per cent.

E22 For simultaneous helicopter operations on turning stands, the protection areas of stands and their associated taxi-routes should not overlap. (See Figure E-4) Where only non- simultaneous operations are envisaged on turning stands, the protection areas of helicopter stands, and their associated taxi-routes, may overlap. (See Figure E-5)

Note: When a TLOF is collocated with a helicopter stand, the protection area of the stand should not overlap the protection area of any other helicopter stand or associated taxi route.

E23 The central zone of a helicopter stand should be capable of withstanding the traffic of helicopters it is intended to serve and have a static load-bearing area: a) of diameter not less than 0.83 D of the largest helicopter it is intended to serve; or b) for a helicopter stand intended to be used for taxi-through, and where the helicopter using the stand is not required to turn, the same width as the helicopter ground taxiway.

Figure E-4: Helicopter stands for hover turns with air taxi-routes / taxiways - non-simultaneous operations

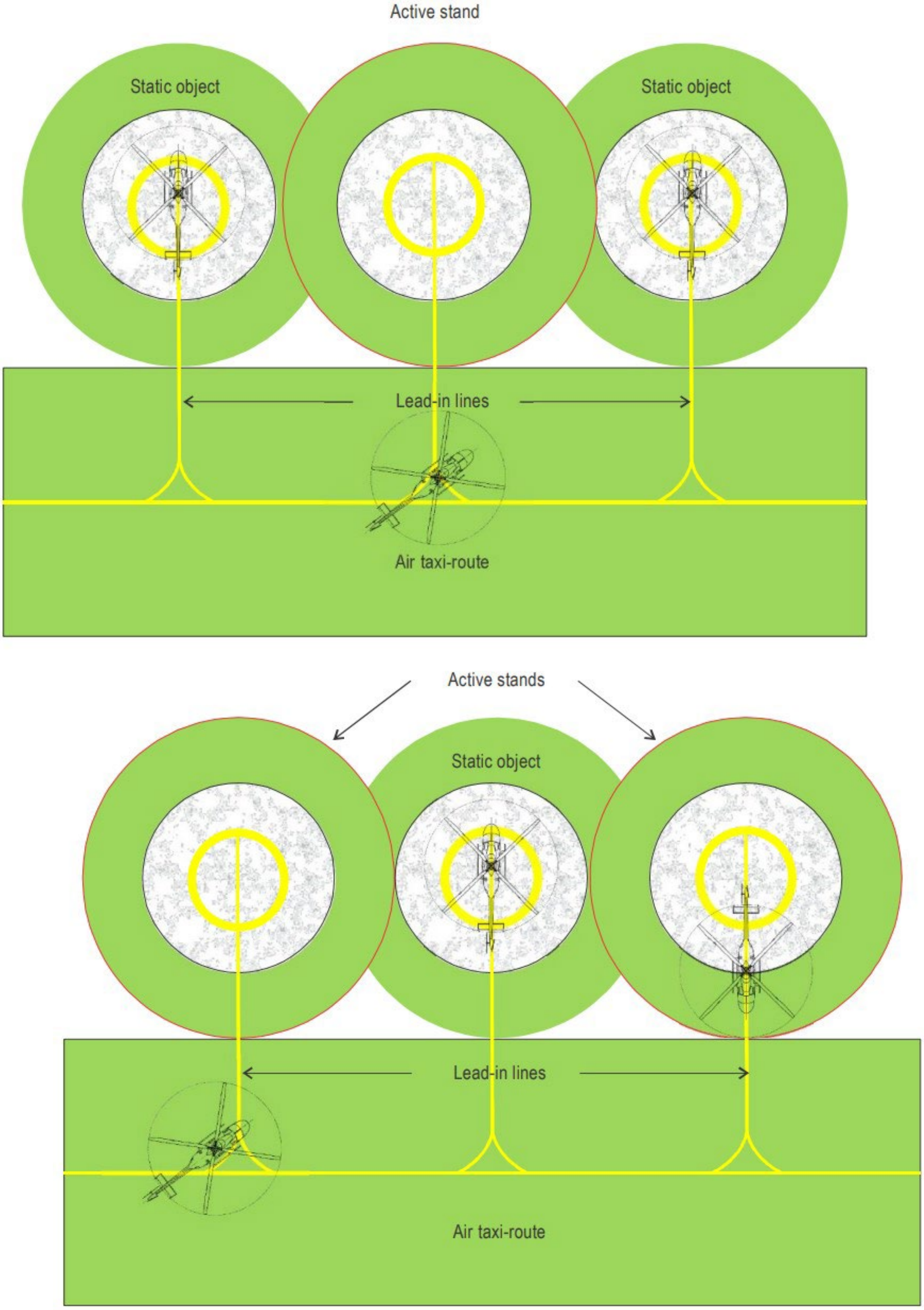
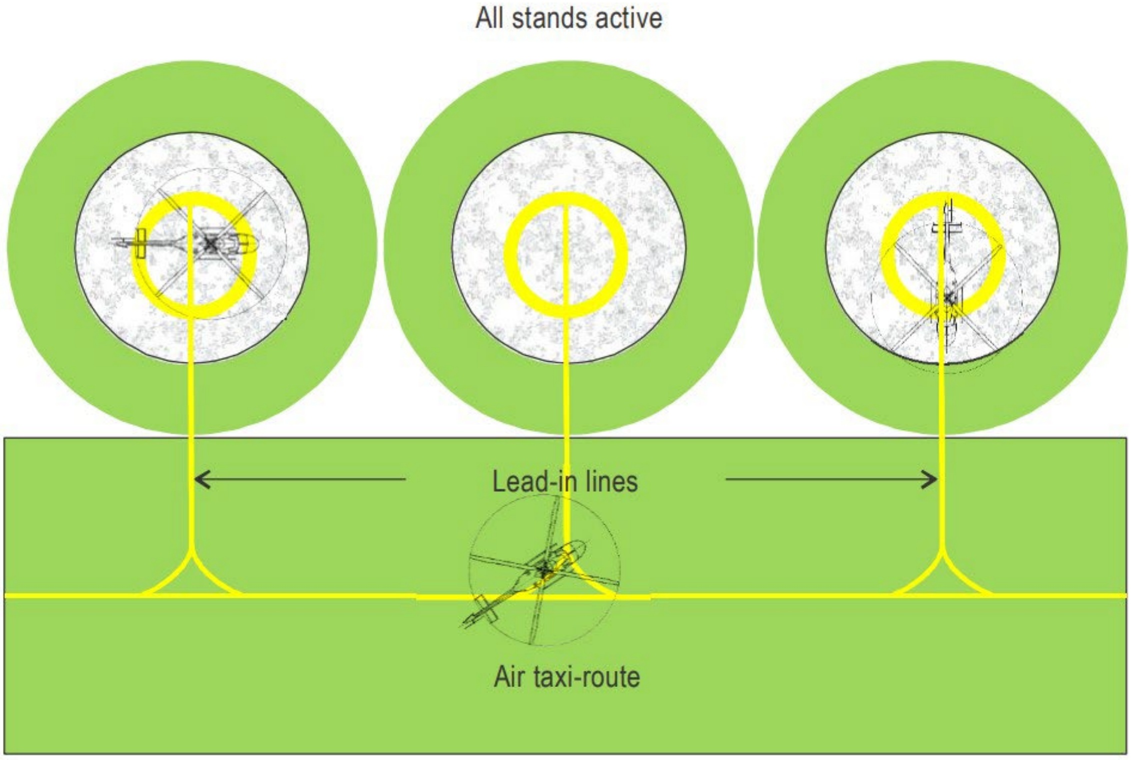


Figure E-5: Helicopter stands for hover turns with air taxi-routes / taxiways - simultaneous operations



Helicopter taxiway markings and markers

Note: Ground taxi-routes and air taxi-routes over a taxiway are not required to be marked. Unless otherwise indicated it may be assumed that a helicopter taxiway is suitable for both ground taxiing and air taxiing.

E24 The centre line of a helicopter taxiway should be identified with a marking, and the edges of a helicopter taxiway, if not self-evident, should be identified with markers or markings. Helicopter taxiway markings should be along the centre line and, if required, along the edges of a helicopter ground taxiway.

E25 A helicopter taxiway centre line marking should be a continuous yellow line 15 cm in width. Helicopter taxiway edge markings should be a continuous double yellow line, each 15 cm in width, and spaced 15 cm apart (nearest edge to nearest edge).

E26 Helicopter taxiway edge markers, where provided, should be frangible to the wheeled undercarriage of a helicopter and located at a distance of 1 m to 3 m beyond the edge of the helicopter ground taxiway and spaced at intervals of not more than 15 m on each side of straight sections and 7.5 m on each side of curved sections with a minimum of four equally spaced markers per section. A helicopter taxiway edge marker should be blue.

E27 A helicopter taxiway edge marker should not exceed a plane originating at a height of 25 cm above the plane of the helicopter taxiway, at a distance of 0.5 m from the edge of the helicopter taxiway and sloping upwards and outwards at a gradient of 5 per cent to a distance of 3 m beyond the edge of the helicopter taxiway.

E28 If the helicopter taxiway is to be used at night, the edge markers should be internally illuminated or retro-reflective.

Helicopter air taxi-route markings and markers

E29 The centre line of a helicopter air taxi-route should be identified with markers or markings.

E30 A helicopter air taxi-route centre line marking or flush in-ground centre line markers should be located along the centre line of the helicopter air taxi-route.

E31 A helicopter air taxi-route centre line, when on a paved surface, should be marked with a continuous yellow line 15 cm in width.

E32 A helicopter air taxi-route centre line, when on an unpaved surface that will not accommodate painted markings, should be marked with flush in-ground 15 cm wide and approximately 1.5 m in length yellow markers, spaced at intervals of not more than 30 m on straight sections and not more than 15 m on curves, with a minimum of four equally spaced markers per section.

E33 If the helicopter air taxi-route is to be used at night, centreline markers should be either internally illuminated or retro-reflective.

Helicopter stand markings

Note: Helicopter stand identification markings may be provided where there is a need to identify individual stands. Additional markings relating to stand size may be provided. Alignment lines and lead-in / lead-out lines and TD/PM circle may be provided on a helicopter stand and should be located such that every part of the helicopter can be contained within the helicopter stand during positioning and permitted manoeuvring.

E34 A helicopter stand perimeter marking should be provided on a helicopter stand designed for turning. If a helicopter stand perimeter marking is not practicable, a central zone perimeter marking should be provided instead.

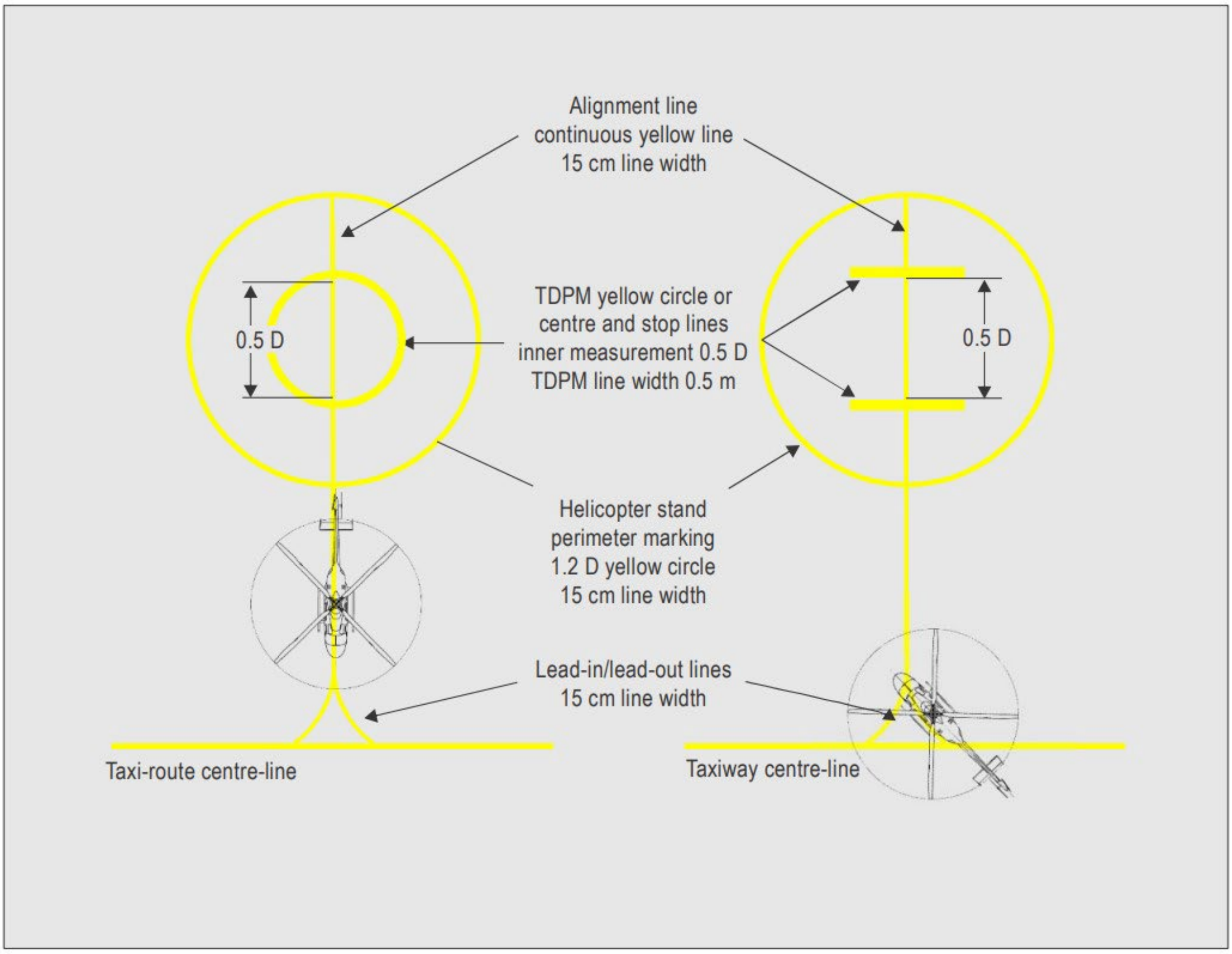
E35 For a helicopter stand intended to be used for taxi-through and which does not allow the helicopter to turn, a stop line should be provided.

E36 A helicopter stand perimeter marking on a helicopter stand designed for turning or, a central zone perimeter marking, should be concentric with the central zone of the stand.

E37 For a helicopter stand intended to be used for taxi-through and which does not allow the helicopter to turn, a stop line should be located on the helicopter ground taxiway axis at right angles to the centre line.

E38 A TD/PM circle, for turning stands, should be marked in yellow in the centre of the stand having an inner diameter of 0.5D and a line width of 0.5m Alignment lines and lead-in / lead-out lines, where provided, should be located as shown in Figure E-6.

Figure E-6: Helicopter stand markings



E39 A helicopter stand perimeter marking or a central zone perimeter marking should be a yellow circle and have a line width of 15 cm.

E40 For a helicopter stand intended to be used for taxi-through and which does not allow the helicopter to turn, a yellow stop line should not be less than the width of the helicopter ground taxiway and have a line thickness of 50 cm.

E41 Alignment lines and lead-in / lead-out lines, where provided, should be continuous yellow lines and have a width of 15 cm. Curved portions of alignment lines and lead-in / lead-out lines should have radii appropriate to the most demanding helicopter type the helicopter stand is intended to serve.

E42 Stand identification markings, where provided, should be marked in a contrasting colour so as to be easily readable to the pilot.

Appendix F

Initial Emergency Response Requirements for elevated heliports – duties of Responsible Persons

Introduction

F1 The consequence from fire following an accident or serious incident on an elevated heliport has been assessed as being potentially catastrophic and although the likelihood of a post-crash fire, based on available accident and incident data for operations to elevated (rooftop) heliports in the UK, is assessed as “improbable” (i.e. very unlikely to occur (not known to have occurred)), the overall risk tolerability rating (based on both the likelihood and the consequence) requires that operators of elevated heliports put in place appropriate measures to mitigate the reasonably foreseeable risk of a crash and burn.

F2 CAA considers that the rescue and fire-fighting service (RFFS) arrangements described in Chapter 5 of this document provides an adequate mitigation for the improbable, but potentially catastrophic worst-case event; a helicopter accident resulting in post-crash fire. Therefore, the objective for providing integral rescue and fire-fighting services (RFFS) at an elevated heliport is to rapidly suppress, and bring under control, any fire that occurs within the confines of the heliport response area[17] to allow occupants of a helicopter an opportunity to escape to safety and to protect people in the building beneath the heliport from the catastrophic consequences of a fire; by ensuring, for a post-crash fire occurring within the response area, that the fire is contained on the heliport and is rapidly suppressed, so it doesn’t spread to other parts of the building.

F3 In the past it was effectively a mandated requirement for an elevated heliport to provide a team of dedicated appropriately trained and equipped fire fighters to ensure an assisted rescue takes place immediately after a post-crash fire has been brought under control– through operating a system of fixed foam monitors and/or of hand-lines provided. This model (see Note below), which invariably requires a significant number of appropriately trained and equipped fire fighters to be ‘on staff’ (whether or not employed by the hospital), when assessed against the risk tolerability rating cannot be automatically justified going forward; based on a full appreciation of the overall risk picture (where robust threat controls[18] are

[17]The ICAO onshore Heliport Manual defines the response area as all areas used for manoeuvring, landing, take-off, rejected take-off, (ground) taxiing, air taxiing and parking of helicopters.
[18] Threat controls include, but may not be limited to, helicopter operations always conducted to the highest performance standards (PC1), heliport lighting systems installed which provide air crew with the most

introduced to further reduce the likelihood of an accident leading to post-crash fire occurring in the first place).

Note: In the past personnel requirements for an assisted rescue have dictated that a minimum of two trained fire fighters be in attendance for an H1 helicopter movement (previously defined as a helicopter with an overall length of up to 15.0m) and three trained fire fighters be in attendance for an H2 helicopter movement (previously defined as a helicopter with an overall length above 15.0m but not exceeding an overall length of 24.0m), and given the expectation on dedicated trained personnel to fully engage in the rescue of the occupants from a crashed helicopter, which may, or may not, have been on fire, trained fire fighters were required to be appropriately equipped to undertake the task through the provision of rescue equipment and personal protective equipment (PPE) and by the completion of regular periodic (initial and recurrent) training and testing.

F4 By specifying the use of more effective, higher performing systems and mindful that any response strategy employed has to be proportionate to the overall risk analysis, except for cases where a helicopter is based on the rooftop (e.g. a HEMS operation), or where more than one helicopter is operating to the helipad at the same time, there is a justifiable shift in philosophy away from a purely "assisted rescue" model, so that in the improbable event of a crash and burn incident or accident occurring on an elevated (rooftop) heliport, an expectation is placed upon occupants of the helicopter to escape clear; without having initial assistance from dedicated heliport personnel. Once clear of the immediate incident area there is the possibility for Responsible Persons (RP) to assist casualties and to administer basic first aid and/or for waiting medical teams to remove casualties to a safe place offering immediate medical assistance, which, at a hospital is likely to involve a transfer straight down to the emergency department (ED).

F5 Through the activation of the Emergency Response Plan (ERP) the local fire and rescue service should be immediately informed by a Responsible Person of an incident or accident occurring on the heliport, to allow as necessary, post-initial fire and specialist rescue assistance to be provided by them. To this end local fire and rescue services should be familiarised with access routes to the heliport and with the capabilities of the integral on-site primary fire-fighting system. As a consequence of the expectation that the Responsible Persons present will not of necessity be trained or equipped to engage directly in the rescue of casualties following an accident, it will be for local fire and rescue services, following the activation of the heliport's Emergency Response Plan, to attend the incident and to provide any specialist back-up equipment required for an extricated rescue and/or

effective visual cues and a requirement introduced in CAP 1264 v1 to predict the flow field around a heliport by conducting wind tunnel testing or CFD methods, thereby controlling the incidence of unwanted environmental (turbulence) effects at the heliport.

for the release and removal of the fatally injured of casualties. To assist local authority fire and rescue service personnel to perform these tasks, it is prudent for the heliport to consider providing a fully equipped crash equipment box at, or near, rooftop level with an inventory of rescue equipment that is appropriate to helicopter operations (see CAP 437, Chapter 5, Table 1). This inventory is in addition to the requirement in Chapter 5 that hand-controlled water branch pipes be provided for local authority fire fighters at both accesses.

F6 In determining a policy that is an appropriately risk-based and proportionate response to rescue and fire-fighting arrangements applied at an elevated heliport, it is important to also consider the scope and complexity of the operation at a helicopter landing site and to take account of additional risks that may be present; such as where an elevated heliport is capable of accommodating more than one helicopter (in the case where there are one or more parking spots servicing the landing area) and/or where a helicopter is based on a rooftop heliport during operating hours – an example of this is a HEMS operating base. In the event of having helicopters parked and/or a helicopter based at a heliport, now on the basis of the higher exposure to an accident with post-crash fire occurring, there is a stronger case for maintaining a dedicated and appropriately trained rescue and fire-fighting capability during operating hours. Guidance on the provision of rescue and medical equipment, personnel protective equipment, a task resource analysis, and training and manning are provided in the ICAO onshore Heliport Manual (Doc 9261).

Responsible person(s) – duties to perform including following an incident or accident

F7 A minimum of one, but preferably two, competent persons should be in attendance during each helicopter movement. For guidance on daily checks and duties see Appendix A.

F8 In addition to the daily checks and duties highlighted in Appendix A material (and promulgated in a Heliport Operations Manual), tasks for Responsible Person(s) will include the following responsibilities in respect to the heliport emergency procedures:

1. An RP should be assigned to promulgate and publish a set of clear and concise emergency procedures as part of an Emergency Response Plan (see Chapter 5).
2. The Emergency Response Plan (Orders), which may form part of the Heliport Operations Manual, should include arrangements for alerting personnel and for summoning externally-based emergency services. These orders should detail procedures for anticipated emergency situations including accidents

and incidents that occur anywhere on the roof of the building where the heliport is located – including the heliport structure.

3. Responsible Person(s) (RP) should be competent in at least the following:

- have a detailed knowledge of the heliport and the immediate surrounding environment at rooftop level;
- Instigating procedures to invoke the heliport emergency response plan to deal with the types of emergencies appropriate to the operation, hazards and risks;
- The procedure and action for activating and de-activating the primary Fixed Foam Application System (i.e. DIFFS) achieving a response as expediently as possible;
- Be periodically trained in the use of complementary media from hand-held dispensers;
- Initial Emergency Medical Aid (IEMA) and casualty handling;
- Maintenance of equipment (usually arranged through the maintenance department)
- For HEMS operating bases and/or for elevated heliports designed to accommodate more than one helicopter, personnel will need to be fully trained and equipped to operate all the additional equipment provided for a dedicated Rescue and Fire-fighting response at the heliport. Guidance on minimum trained personnel levels is given in the ICAO onshore Heliport Manual (doc 9261).

Addressing a helicopter crash which does not result in post-crash fire

F9 The primary purpose of Chapter 5 is to provide specifications for an effective integrated heliport fire-fighting system capable of addressing a range of fire situations that may occur on the heliport including a worst-case helicopter crash and burn. However, for modern helicopters designed to meet all the latest certification specifications (in CS29), the likelihood of a fire following a crash landing is somewhat reduced, with the prospects of occupants surviving the crash increased, by adopting the latest certification specifications which ensure the following:

- a method to minimize fuel egress from helicopter vents;
- crash resistant fuel tanks;
- self-sealing couplings;
- and energy attenuating seats.

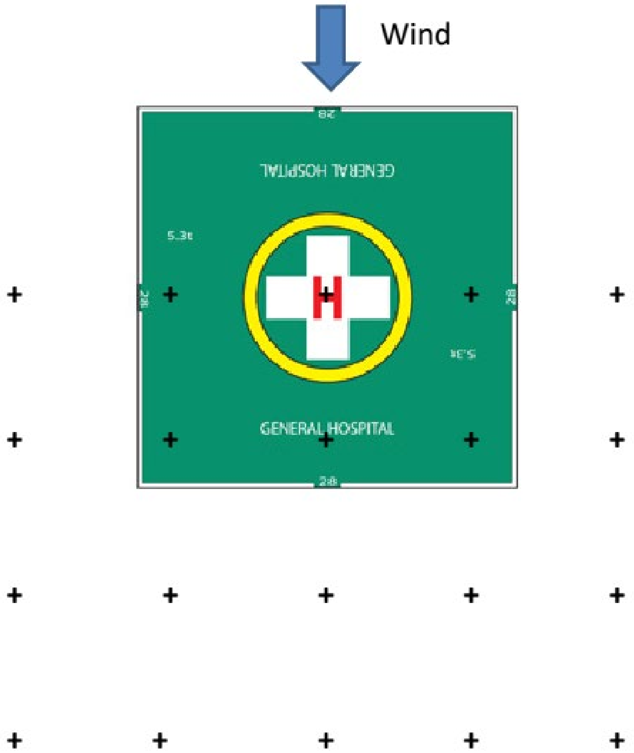
Moreover, occupant survivability is further improved by adopting the latest certification standards for structural crashworthiness and for seat / occupant restraints.

As many of the newer types operating in the HEMS / air ambulance roles have been (or are being) certificated to meet the latest CS-29 standards, it is reasonable to conclude that for a survivable incident or accident occurring anywhere on the heliport response area, the likelihood of a post-crash fire developing following an emergency or crash landing has, to some extent, receded. Section F10, therefore, addresses the incidence of a helicopter crash with no subsequent burn.

F10 Following a helicopter crash on a rooftop heliport, involving no subsequent fire, competent person(s) in attendance may be in a position to render some assistance to occupants of the crashed helicopter to allow them to escape clear of the aircraft, and to dispense any immediate first aid, before occupants are transferred to the emergency department utilising the resources of attending medical teams. In the event of a crash but with no burn, the Emergency Response Plan should be immediately initiated. Seat belt cutters should be provided for the use of first responders.

Appendix G

Guidance on airflow testing of onshore elevated helipads



Notes:

1. Horizontal spacing (along-wind and cross-wind) between measurement points = 10m.
2. Measurements to be made at all points at 5, 10, 20 and 30m above helipad height.
3. Measurement pattern shown to be repeated for wind speeds and directions commensurate with the ambient wind environment.
4. Wind sector widths should be no greater than 30deg; untested wind sectors should be clearly defined and stated.
5. Wind speed increments should be no greater than 5m/s; the maximum wind speed tested for each wind direction should be clearly stated.
6. Operations should not be conducted in any wind direction more than 15deg. from a tested direction.
7. Operations should not take place at any wind speed greater than the maximum tested wind speed for the corresponding sector.

Appendix H
Risk assessment to determine the need for a dedicated heliport rescue and fire-fighting service (RFFS) at a surface level, mounded or raised HLS

The following factors need to be considered in any risk assessment.:

- The number of movements planned / unplanned.
- The frequency of movements.
- The total number of helicopters in use at the site during peak periods.
- Type of movements i.e. whether conducting commercial air transport passenger operations (CATPO) and/or general aviation (GA).
- The number of passengers.
- The types of helicopters in use, their certification status with respect to crashworthiness, and their performance characteristics.
- The size and complexity of the response area e.g. other helicopters' present in apron area?
- The nature of the terrain e.g. located near water or swampy areas.
- Whether the heliport is 'elevated' or at surface level.
- Whether the heliport is in a congested or non-congested environment.
- The availability of the local authority fire and rescue services i.e. how rapidly can they respond to an incident on the heliport?
- The types of helicopters and specific hazards e.g. construction materials used in airframes such as composite materials.
- Whether or not an emergency plan has been established.
- Whether or not, for a raised heliport, the structure beneath is occupied or unoccupied (in the former case RFFS is effectively mandated).

There are a number of systems and features, linked to the certification standards of a helicopter that, if provided, can potentially limit the likelihood of a post-crash fire (PCF) and influence the outcome of a heavy impact or emergency landing e.g. by increasing occupant safety and survivability.

- Seat design to ensure slower deceleration loads on occupants i.e. energy attenuation seats CS29.562 (b)
- Occupant restraints
- Crash Resistant Fuel Systems (CRFS) e.g. compliant with CS29.952 (a).
- Methods to minimise fuel egress through fuel tank vent e.g. seal-sealing fuel lines CS29.952 (c) and CS29.975 (a).
- Fuel lines that are designed, installed and constructed to be crash resistant CS29.952 (f).

Where the population of helicopters is limited, or can be limited, to those which have crashworthy features, this may be considered in the assessment for the required level of the services and personnel in the establishment of the RFFS policy.

Appendix I

Rescue and fire-fighting services for surface level and mounded heliports

Level and method of protection, primary foam media: Helicopter characteristics/parameters to be considered

1.1 For the defined areas on a heliport, overall length and maximum take-off mass of the design helicopter are the critical parameters for a designer. For a dedicated rescue and firefighting service (RFFS) to determine primary media at a surface level, including mounded heliport, the critical parameters are fuselage length and fuselage width. These dimensions are usually available in the helicopter's Type Certificate and in the Helicopter Flight Manual but are presented for ease of reference for common types in Table I-3.

1.2 In general terms, the fuselage consists of the central portion of the helicopter designed to accommodate the aircrew and the passengers and/or cargo. Fuselage length is often presented (conservatively) in Flight Manuals as the distance between the nose of the helicopter and the end of the tail boom, and fuselage width as the overall width of the occupied portion of the helicopter excluding the undercarriage.

1.3 To assist operators Table I-3 presents the fuselage dimensions of common helicopter types. This table is not exhaustive and for types not listed in the table a designer will have to source the information from official documentation (i.e. the helicopter's Type Certificate or Flight Manual). Notwithstanding this, the right-hand column specifies a broad firefighting category from H0 to H3, which reads back to Table I-1 below and includes a discretionary 10% tolerance applied to the upper limits quoted for fuselage length and fuselage width in Table I-3.

1.4 Therefore, for a given operation there is the option either to apply a type-specific critical area calculation using the formula:

$L \times (W + W_1)$ where:

L = fuselage length

W = fuselage width

W_1 = additional width factor of 4m

or alternatively, to adopt the broader 'default' figures in Table I-3 and Table I-2, which reconcile to the right hand column of Table I-3, either H0, H1, H2 or H3 as appropriate (with the 10% tolerances factored in).

Table I-1: Heliport firefighting category

Heliport firefighting category	Maximum fuselage length	Maximum fuselage width
H0	up to but not including 8 m	1.5 m
H1	from 8 m up to but not including 12 m	2 m
H2	from 12 m up to but not including 16 m	2.5 m
H3	from 16 m up to 20 m	3 m

Table I-2 Minimum usable amounts of extinguishing agents for surface level heliports

	Foam meeting performance level B		Foam meeting performance level C		Complementary agents	
Category	Water (L)	Discharge rate foam solution/ minute (L)	Water (L)	Discharge rate foam solution/minute (L)	Dry chemical powder (kg)	Gaseous media (kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
H 0	500	250	330	165	23	9
H 1	800	400	540	270	23	9
H 2	1200	600	800	400	45	18
H 3	1600	800	1100	550	90	36

Table I-3 – Firefighting category based on fuselage dimensions for common UK helicopter types

Type	D-value (metres)	Fuselage length	Fuselage width*	FFS category H0 to H3
Robinson R22	8.76	6.30	1.12	H0
Robinson R44	11.70	9.10	1.30	H1
Robinson R66	11.66	9.00	1.47	H1
H120	11.52	9.60	1.50	H1

Type	D-value (metres)	Fuselage length	Fuselage width*	FFS category H0 to H3
H125 (AS350 B3)	12.94	10.93	1.87	H1
H130	12.60	10.68	2.03	H1
MD902	12.37	10.39	1.32	H1
Bell 206B III	11.95	9.51	1.40	H1
Bölkow Bo 105	12.00	8.81	1.58	H1
EC 135 T2+	12.20	10.20	1.56	H1
H135	12.26	10.20	1.56	H1
Bell 407	12.70	10.57	1.47	H1
Bell 429	13.00	11.73	1.63	H1
Bell 206L IV	12.96	10.56	1.40	H1
Eurocopter AS355	12.94	10.93	1.87	H1
BK 117	13.00	9.98	1.60	H1
Bell 427	13.00	11.13	1.60	H1
Leonardo A109	13.05	11.45	1.62	H1
Leonardo A119	13.02	11.14	1.67	H1
Eurocopter EC145C-2e	13.03	10.20	1.73	H1
H145	13.64	11.69	1.73	H1
Dauphin AS365 N2	13.68	11.63	2.03	H1+
Dauphin AS365 N3	13.73	11.63	2.03	H1+
H155 (EC 155B1)	14.30	12.71	2.05	H1+
Leonardo AW169	14.65	12.19	2.15	H1+
Bell 222	15.33	12.50	1.62	H1+
Bell 230	15.38	12.97	1.65	H1+
Sikorsky S76C	16.00	13.20	2.13	H1+
Bell 430	15.29	13.44	1.70	H2
Leonardo AW139	16.63	13.77	2.26	H2
Bell 412	17.13	12.91	2.44	H2

Type	D-value (metres)	Fuselage length	Fuselage width*	FFS category H0 to H3
Bell 212	17.46	14.00	2.64	H2+
Leonardo AW189	17.60	14.60	2.55	H2+
H175	18.06	15.68	2.25	H2
H215 (AS332L1-e)	18.70	15.58	2.00	H2
Super Puma AS332L2	19.50	16.79	2.00	H2+
H225 (EC 225 LP)	19.50	16.79	2.00	H2+
Bell 214ST	18.95	14.97	3.11	H3
Sikorsky S92A	20.88	17.10	2.50	H3
Sikorsky S61N	22.20	18.72	2.16	H3
AW101	22.80	19.51	2.80	H3

*An additional width factor of 4m (W_1) is applied in all cases as part of the practical critical area calculation.

+Some helicopter types may be operated under a lower FFS category due to being within the 10% discretionary tolerance. These have been marked with a + however should where possible be operated in the above category than the category stated.

Note: A given helicopter is required to be within the limits, including tolerances, for both parameters, fuselage length and fuselage width, to take advantage of a given FFS category. If either dimension, when factoring-in tolerances, is exceeded, that type should be recorded against the next higher FFS category. For the S92 fuselage width sponsons are not included.

Note: The dimensions above have been taken from “The Official Helicopter Blue Book®”. Actual dimensions should be verified against the RFM for the type(s) being used.

Complementary agents

2.1 Complementary agents should ideally be dispensed from one or two extinguishers, although more containers may be permitted where high volumes of the agent are specified e.g. for H3 operations.

2.2 The discharge rate of complementary agents should be selected for optimum effectiveness of the agent used. When selecting dry chemical powder for use with foam, care should be taken to ensure compatibility. Complimentary agents should comply with the appropriate specifications of the International Organization for Standardization (ISO).

2.3 The amounts of complementary agents required are specified in columns 6 and 7 of Table I-2. Dry chemical powder should be of a foam-compatible type.

2.4 The dry chemical powder and gaseous agents should be sited so that extinguishers are readily available at all times and are capable of being transported by one or two personnel trained in their use.

Heliport Emergency Plan

3.1 The degree of complexity of the heliport, and the emergency planning arrangements in place, will help to inform resourcing of heliport staff to execute the plan effectively.

3.2 The heliport emergency plan exists to identify agencies which could be of assistance in responding to an emergency at the heliport, or in its vicinity. This could include, but may not be limited to, a helicopter crash, whether, or not, resulting in a post-crash fire, a medical emergency or a dangerous goods occurrence.

3.3 Where present, designated personnel should invoke the heliport emergency plan. If the heliport is unattended the heliport emergency plan should be activated remotely.

Meeting the response time objective and defining response area

4.1 The most important factors bearing on effective escape in a survivable helicopter accident at a heliport are the speed of initiating a response and the effectiveness of that response. Except for limited size heliports, the objective for surface level heliports is to achieve response times not exceeding two minutes in optimum conditions of visibility and surface conditions measured from the initial call to the RFFS to the time when the first responding vehicle(s) is (are) in place to apply foam at a rate of at least 50% of the required discharge rate specified in Table I-2.

4.2 In considering the response area at a surface level heliport, account should be taken of all areas used for the manoeuvring, landing, take-off, rejected take-off, ground taxiing, air-taxiing and parking of helicopters that are in the direct control of the heliport operator.

4.3 At a limited-size surface level heliport, the response area will usually only be the TLOF, and when load bearing, the FATO. However, if a heliport is served by one or more taxiways linking to stands, the heliport operator will have to consider rescue and firefighting arrangements for each additional element of the response area that is under their control. The response time objective for a limited size heliport is in accordance with Chapter 5, paragraph 5.7.

RFFS Personnel

5.1 The determination of the number of personnel provided, and the training given, is a decision for the heliport management and should be fully documented. The provision of rescue and firefighting personnel may be informed by use of a task/resource analysis (see ICAO onshore Heliport Manual Appendix A for further guidance). Dedicated heliport rescue and firefighting personnel should be provided with appropriate training to enable them to perform their duties effectively.

Rescue equipment

6.1 Rescue arrangements commensurate with the overall risk of the helicopter operation should be provided at a heliport. Guidance on a minimum equipment inventory required to ensure effective rescue arrangements are in place at the heliport are listed in Table I-1.

6.2 Equipment should only be used by personnel who have received adequate information, instruction and training.

Table I-1 - Rescue Equipment

Adjustable wrench	1
Rescue axe, large (non-wedge or aircraft type)	1
Cutters, bolt	1
Crowbar, large	1
Hook, grab or salving	1
Hacksaw (heavy duty) and six spare blades	1
Blanket, fire resistant	1
Ladder (two-piece) *	1
Lifeline (5 mm circumference x 15 m in length) plus rescue harness	1
Pliers, side cutting (tin snips)	1

Set of assorted screwdrivers	1
Harness knife and sheath or harness cutters	**
Man-Made Mineral Fibre (MMMF) Filter masks	**
Gloves, fire resistant	**
Power cutting tool***	1
* For access to casualties in an aircraft that may be on its side, the ladder should be of an appropriate length. ** This equipment is required for each heliport crew member. *** Requires additional approved training by competent personnel. Equipment only specified for helicopters with a D-value above 24m.	

Personal Protective Equipment (PPE)

7.1 Heliport rescue and firefighting personnel should be provided with appropriate personal protective equipment (PPE) to enable them to perform their duties effectively.

7.2. When determined by the task-resource analysis, all responding RFF personnel should be provided with appropriate personal protective equipment (PPE) and respiratory protective equipment (RPE) to allow them to carry out their duties in an effective manner.

7.3. Sufficient personnel to operate the RFF equipment effectively should be dressed in protective clothing prior to helicopter movements taking place.

7.4 In addition, equipment should only be used by personnel who have received adequate information, instruction and training. PPE should be accompanied by suitable safety measures e.g. protective devices, markings and warnings.

The specifications for PPE should meet one of the international standards shown in

Table I-2.

Table I-2 - Standards for PPE

Item	NFPA	EN	BS
Helmet with visor	NFPA 1971	EN443	BS EN 443
Gloves	NFPA 1971	EN659	BS EN 659

Boots (footwear)	NFPA 1971	EN ISO 20345	EN ISO 20345
Tunic and trousers	NFPA 1971	EN469	BS EN ISO 14116
Flash-hood	NFPA 1971	EN 13911	BS EN 13911

7.5 Appropriate personnel should be appointed to ensure that all PPE is installed, stored, used, checked and maintained in accordance with the manufacturer's instructions. Facilities should be provided for the cleaning, drying and storage of PPE when crews are off duty. Facilities should be well-ventilated and secure.

Communication and alerting system

8.1 At large complex surface level heliports a discrete communication system should be provided linking the rescue and firefighting service with central control and RFF vehicles (when provided). The mobilisation of all parties and agencies required to respond to an aircraft emergency on a large heliport will require the provision and management of a complex communications system. The requirement is examined in the Airport Services Manual (Doc 9137) Part 7 – Airport Emergency Planning, Chapter 12.

8.2 An alerting system for RFF personnel should be provided at their base facility, and be capable of being operated from that location, at any other areas where RFF personnel congregate, and in the Control Tower (when provided). Examples could include:

- direct telephone line to the rescue control centre or service room of the rescue personnel;
- alarm button for direct alarm of the fire brigade;
- heat sensor for alarm and/or automatic switching of the extinguishing system; or
- monitored video surveillance.