Department of Health

Emergency care

Health Building Note 15-03: Hospital helipads

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Emergency care

Health Building Note 15-03: Hospital helipads

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Preface

About Health Building Notes

Health Building Notes give "best practice" guidance on the design and planning of new healthcare buildings and on the adaptation/extension of existing facilities.

They provide information to support the briefing and design processes for individual projects in the NHS building programme.

Restructuring of the Health Building Note suite

Healthcare delivery is constantly changing, and so too are the boundaries between primary, secondary and tertiary care. The focus now is on delivering healthcare closer to people's homes.

The traditional division of Health Building Notes into discrete books of information based on hospital departments is therefore no longer appropriate.

Instead, the new Health Building Note framework (shown below) is based on the patient's experience across the spectrum of care from home to healthcare setting and back, using the national service frameworks (NSFs) as a model. This structure better reflects current policy and service delivery.

New Health Building Note structure

The Health Building Notes have been organised into a suite of 17 core subjects.

Care-group-based Health Building Notes will provide information about a specific care group or pathway but will cross-refer to Health Building Notes on **generic (clinical) activities** or **support systems** as appropriate.

Core subjects will be subdivided into specific topics and classified by a two-digit suffix (-01, -02 etc), and may be further subdivided into Supplements A, B etc.

All Health Building Notes are supported by the overarching Health Building Note 00 in which the key areas of design and building are dealt with.

Example

The Health Building Note on accommodation for adult in-patients will be represented as follows:

> "Health Building Note 04-01: Adult in-patient facilities"

The supplement to Health Building Note 04-01 on isolation facilities will be represented as follows:

> "Health Building Note 04-01: Supplement A – Isolation facilities in acute settings"

New Health Building Note number and series title	Type of Health Building Note
Health Building Note 00 – Core elements	Support-system-based
Health Building Note 01 – Cardiac care	Care-group-based
Health Building Note 02 – Cancer care	Care-group-based
Health Building Note 03 – Mental health	Care-group-based
Health Building Note 04 – In-patient care	Generic-activity-based
Health Building Note 05 – Older people	Care-group-based
Health Building Note 06 – Diagnostics	Generic-activity-based
Health Building Note 07 – Renal care	Care-group-based
Health Building Note 08 – Long-term conditions/long-stay care	Care-group-based
Health Building Note 09 – Children, young people and maternity services	Care-group-based
Health Building Note 10 – Surgery	Generic-activity-based
Health Building Note 11 – Community care	Generic-activity-based
Health Building Note 12 – Out-patient care	Generic-activity-based
Health Building Note 13 – Decontamination	Support-system-based
Health Building Note 14 – Medicines management	Support-system-based
Health Building Note 15 – Emergency care	Care-group-based
Health Building Note 16 – Pathology	Support-system-based

Other resources in the DH Estates and Facilities knowledge series

Health Technical Memoranda

Health Technical Memoranda give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare (for example medical gas pipeline systems, and ventilation systems).

They are applicable to new and existing sites, and are for use at various stages during the inception, design, construction, refurbishment and maintenance of a building.

All Health Building Notes should be read in conjunction with the relevant parts of the Health Technical Memorandum series.

Health Technical Memorandum Building Component series

All Health Building Notes refer to Health Technical Memorandum Building Component documents for specifications and design guidance on building components for healthcare buildings. All Health Building Notes should therefore be read in conjunction with the relevant parts of the Health Technical Memorandum Building Component series.

Activity DataBase (ADB)

The Activity DataBase (ADB) data and software assists project teams with the briefing and design of the healthcare environment. Data is based on guidance given in the Health Building Notes, Health Technical Memoranda and Health Technical Memorandum Building Component series.

1. Room data sheets provide an activity-based approach to building design and include data on personnel, planning relationships, environmental considerations, design character, space requirements and graphical layouts.
2. Schedules of equipment/components are included for each room, which may be grouped into ergonomically arranged assemblies.
3. Schedules of equipment can also be obtained at department and project level.
4. Fully loaded drawings may be produced from the database.
5. Reference data is supplied with ADB that may be adapted and modified to suit the users' project-specific needs.

For further information please refer to the following DH website: www.adb.dh.gov.uk

How to obtain publications

- To find out about publications that are finalised and currently being published, look under "new publications" on the DH Estates and Facilities Division Knowledge and Information Portal homepage at: www.estatesknowledge.dh.gov.uk. **NOTE that users should also check the Knowledge and Information Portal for latest versions of all publications, including Health Building Notes, and for any amendments to publications.**
- To find out about all DH Estates and Facilities publications, download the publications list from the link on the DH Estates and Facilities Knowledge and Information web page: www.dh.gov.uk/en/Policyandguidance/Organisationpolicy/Estatesandfacilitiesmanagement/DH_4118956
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For further information, contact Jock Graham on 0113 341 3191; email: jock.graham@coi.gsi.gov.uk.

Note

The new Health Building Notes have been progressively rolled out from spring 2007 onwards.

The sequence of numbering within each subject area does not necessarily indicate the order in which the Health Building Notes are published/printed. However, the overall structure/number format will be maintained as described.

To find out how to access information on published documents, see the "How to obtain publications" section above.

Executive summary

Introduction

Since the first helicopter ambulance was established in 1987, the service has expanded to cover most of the United Kingdom, complementing the service provided by military and coastguard search and rescue helicopters. Helicopter ambulance operations are likely to increase further and to extend their operations from day into night, both to meet rising public expectations and to transfer more patients from general to specialist hospitals. Helicopter ambulances are also considered helpful in achieving pre-hospital call-out and care targets in both cities, where congestion affects road ambulances, and in large countryside areas.

Aim of the guidance

This Health Building Note aims to describe the requirements and options for new hospital helipads compliant with regulatory requirements, and provides guidance on their operation and management.

This guidance aims to enable trust executives and staff to become informed customers, when developing a business case and when managing the design, construction and operation of a helipad. It complements and interprets the relevant legislation and standards but cannot provide complete advice on their implementation in all situations; therefore, we would advise that expert aviation advice should be sought before committing to design and expenditure. Advice could be sought from an independent helicopter consultant, or from the Ministry of Defence and the operator of the local ambulance helicopters.

The Health Building Note also describes the planning considerations, the equipment and personnel requirements, and the additional support facilities (including refuelling) which may be necessary at certain helipads. It also quantifies the low level of risk incurred by operating helicopters from a trust site according to the rules for commercial air transport, and indicates how the risk should be managed and mitigated.

This Health Building Note is designed for the guidance of:

- trust chief executives and directors considering a business case and options for helicopter access;
- head clinicians considering pre-hospital patient care;
- estates and project managers and private sector partners tasked to design and build helipads;
- and fire and safety officers considering risk analyses and safety and contingency plans.

There is no cost chapter in this Health Building Note since the cost elements of hospital helipads are project-specific.

The three principal helipad options

There are three principal options for siting a hospital helipad:

- at ground level;
- on a rooftop;
- and on a low structure or mound near to the Accident and Emergency Department.

All options require airways clear of obstacles such as trees and buildings, which helicopters will use when approaching and departing, as well as a clear space for the helipad and its immediate surrounds. These criteria can be difficult to achieve, particularly at ground level in congested areas and on small hospital estates, and may compromise a hospital's future development plans.

Helipads built on rooftops (ideally above the Accident and Emergency department to ensure a short transit for the patient) are the most effective from the aviation and a trust's strategic planning perspectives: they largely remove any constraints on future building plans, they provide the greatest choice of obstacle-free helicopter airways, and they reduce the environmental impact on the hospital and its neighbours.

Ground-level helipads do not have these advantages but are cheaper to build and operate. The third option, building a helipad on a mound or low elevation structure above a car park or other occupied area, has some of the benefits on a roof-top site but costs less to construct and operate.

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Contents

1 Purpose and scope

1.1 The purpose of this Health Building Note is to describe the requirements and options for new helipads compliant with regulatory requirements at both existing and new hospitals, and to provide guidance on their operation and management. This is not a stand-alone document, however, as the helicopter operator has the responsibility of deciding whether a helipad is safe for use. Therefore, expert aviation advice should be sought before committing to design and expenditure. This advice could be from an independent helicopter consultant or from the Ministry of Defence, along with advice from the operator of the local ambulance helicopters. This Health Building Note is intended to provide basic guidance, which complements and interprets the relevant legislation and standards. The guidance covers:

- background information on the requirement for a helipad, the types of helicopters that might use it, and their operating limitations and capabilities;
- planning considerations including access to Accident & Emergency, development planning, public safety, and the principal factors addressed in the planning permission process;
- the relative advantages and detailed design requirements, services and manpower needed for the three principal helipad options (ground-level, rooftop level, and on a low structure or mound);
- the benefits, design criteria and options for providing a refuelling facility;
- additional support facilities needed at the different types of helipad;
- NHS emergency planning guidance;
- a quantification of, and guide to, the management of operational risks;
- engineering requirements.

1.2 This Health Building Note is designed for the guidance of:

- trust chief executives and directors considering a business case and options for helicopter access;
- head clinicians considering pre-hospital patient care;
- estates and project managers and private-sector partners tasked to design and build helipads;
- fire and safety officers considering risk analyses and safety and contingency plans.

1.3 Throughout this document, the following words have particular meanings:

- "must" is used to indicate a legal requirement in the Air Navigation Order (ANO) and for international standards and practices which the UK accepts. The helicopter operator may be able to obtain dispensations from some of the standards and practices if he considers that any additional risk can be mitigated, but this can only be done by assessing the finished helipad after construction is complete. Therefore a new helipad should be designed to meet all the accepted and documented standards and practices, and any potential shortfalls should be identified and discussed with experts at the design stage in order to avoid changes after commissioning;
- "should" is used to indicate where a factor or item is considered beneficial, based on experience.

Background information

1.4 Helicopter ambulances are available over most of the United Kingdom to deliver care to patients rapidly and to transport them to hospital if appropriate. Their usage is likely to increase both with public expectations and if it becomes more necessary to transfer patients from general to specialist hospitals. In addition, NHS ambulance trusts face increasingly demanding targets for responding to call-outs. As a result, hospital helipads have become an integral part of the pre-hospital care service and an important facility at many hospitals.

1.5 Since the introduction of ambulance helicopters and hospital helipads, hospitals have also met increasing demands on the land within their boundaries. Some have lost the use of their helipads through the sale of land or because new buildings have been erected which obstruct the site or its required approaches by air. The loss of these capital assets is avoidable given some knowledge of helicopter requirements and a strategic view of estate planning.

Types of helicopter that may need to use hospital helipads

Ambulance helicopters

1.6 Hospital helipads are used predominantly by ambulance helicopters. Presently these are small to medium-sized aircraft with an overall length not exceeding 15 m and a maximum weight of 3.5 t. In future, if funding becomes more available, larger machines with an overall length of more than 15 m and weighing up to 7 t are likely to be used to supplement the smaller helicopters. All have two engines to reduce the risk of an accident if one fails, and approved operating procedures to stay airborne or to land safely in that unlikely event. Ambulance helicopters will probably land less than once per day on average, but several times on busy days.

Bond Air Services

A typical ambulance helicopter

Search and Rescue helicopters

1.7 Casualties of leisure and major industrial accidents and natural disasters may be rescued by Search and Rescue (SAR) helicopters. Therefore it is important for pre-hospital care that these helicopters can land at hospitals with Level 1 A&E, and at those hospitals near the coast, mountains and the possible sites of large accidents such as major railway junctions and airports. SAR helicopters can be up to 23 m in length and 15 t maximum weight. The design criteria for a helipad at relevant hospitals should include access for these larger rescue helicopters. In many situations, this will not increase the size or cost; where it does, the increase can be minimised if the requirement is included from the outset in the design of the helipad.

SAR Sea King, Crown copyright

A Search and Rescue helicopter

Police helicopters

1.8 Many police forces operate helicopters, which can function in the ambulance role and would then require access to hospital helipads.

Secondary landing sites

1.9 This Health Building Note describes the requirements for a single primary helipad accommodating one helicopter at a time; this will be sufficient to meet most hospitals' requirements. However, it is possible that two helicopters will arrive simultaneously, or that a mass casualty incident could generate a considerable increase in the number of helicopter movements. Ambulance, SAR and other helicopters might be mobilised to assist. Major trauma hospitals and others that might expect to receive mass casualties should consider a second location for helicopters to land. It should be close to A&E, but this criterion may have to be compromised if open areas are scarce. The only likely position will be at ground level, and may be outside the hospital boundary on a sports field or public park; it is desirable to select a location with a firm area or tracks which will allow

road ambulances to make repeated journeys when the ground is wet. Options should be identified and agreed with landowners, and the local police and fire services should be informed. The requirements to activate the site should be included in the hospital's emergency response plan.

Helicopter Emergency Medical Service flight rules

1.10 A flight is termed a Helicopter Emergency Medical Service (HEMS) flight when it is undertaken to facilitate emergency medical assistance where immediate and rapid transportation is required. This may be to carry medical attendants, supplies, ill or injured persons, and others directly involved. If medical opinion is that HEMS conditions apply, the pilot is permitted certain dispensations from normal commercial air transport regulations. For example, a helicopter with Civil Aviation Authority (CAA) HEMS approvals can land in unprepared confined areas by accident sites which would be unsuitable for commercial air transport. However, these dispensations do not apply to the design and management of hospital landing sites because they are used frequently and the risks are predictable and can therefore be mitigated.

Helicopter operating limitations

1.11 Several different criteria affect whether a helicopter can land or take off from a particular area, including its power, the size of the landing area, and the range and payload required to be flown. Some helicopters, particularly older models, are unable to operate at their maximum weight into confined and elevated helipads because of performance limitations. However, a headwind component on approach and take-off is always important; the optimum helipad will therefore offer approach and departure paths into the prevailing southwest wind, and also in other directions to allow flight into the wind in most situations.

Principal guidance and legislation

1.12 The principal guidance and legislation referred to in this Health Building Note is as follows:

- International Civil Aviation Organisation (ICAO) Annex 14 to the Convention on International Civil Aviation, Volume II, Heliports, and the associated Heliport Manual, abbreviated to "ICAO Annex 14";
- Statutory Instrument 2005 No 2005/1970, The Air Navigation Order;
- Joint Aviation Requirements JAR-OPS 3, Commercial Air Transportation (Helicopters), abbreviated to "JAR-OPS 3".

2 Planning considerations

Access to Accident & Emergency

2.1 Since helicopter-borne patients are likely to be in a time-critical condition, it is important that the time taken to transfer them between the helicopter and hospital A&E department is short (ideally less than 2 minutes) and that the patient is protected as far as possible from adverse weather conditions. The safest, fastest and most efficient means of transfer is by trolley from the helicopter. Transferring patients from a helicopter to a road ambulance for the journey to A&E is always undesirable and often impractical, especially if they are connected to fluid, gas and electrical life-support systems. The best locations for a helipad are therefore in an open area immediately adjacent to A&E or on the roof above it, with trolley access.

Development planning

2.2 A helipad requires a defined area free of all obstructions such as buildings and trees at ground level. Also, there must be at least two corridors rising from the helipad into the air which are free of such obstructions to allow helicopters a clear airway to approach and depart. If any new obstructions are built or grow in the defined areas, helicopters may no longer be able to operate. It is therefore essential that the location of the helipad is considered in the light of potential future developments within and beyond the boundaries of the hospital estate. If obstructions such as tall buildings or radio masts are erected in the airways, the landing site may become unusable.

Development Control Plan

2.3 The site should be located by reference to the Hospital's Development Control Plan (DCP), and the helipad requirements should then be included in the DCP and considered when new buildings and facilities are planned.

Public safety

2.4 All helicopters in flight create a downward flow of air known as downwash. The severity depends on the weight of the helicopter, the dissipating effect of wind, and disruption by screening in the form of buildings, trees, hedges and walls. The downwash in a small area underneath large SAR and military helicopters can be intense, displacing loose hoardings and blowing grit and debris at people, cars and buildings in the immediate vicinity. The loose objects can then be a risk to the helicopter if they are carried into the rotor blades or engines by re-circulating airflows. Old and infirm people are particularly susceptible to the wind strength of downwash. For small, light ambulance helicopters, the effect is greatly reduced but should still be considered; a 30 m downwash zone around the helipad should be kept clear of people, parked cars and buildings. However, the most effective mitigation is to raise the helipad above areas used by the public and NHS employees. Raised sites reduce the downwash effects considerably, and high elevated or rooftop sites remove the risk.

Licensing

2.5 There is no requirement for the CAA to license hospital helipads, and there is no benefit to the hospital from licensing. The CAA will be required to inspect the Rescue and Fire Fighting Services (RFFS) and the lighting at elevated helipads.

Planning permission

2.6 Hospital landing sites require planning permission because they will be used on more than 28 days per year. The sites also require the permission of the landowner and the awareness of the local police.

Night flying

2.7 Currently, ambulance helicopters mostly operate during daylight hours only, but the funding and the requirement to provide a 24-hour service are

increasing. Also, SAR helicopters provide a 24-hour service. It is therefore recommended that all new helipads should be equipped with approved lighting to permit night operations. The lights are not only essential for night work but are also highly desirable for use on short, dark winter days. At the very least, new helipads should incorporate the trunking for cables so that lighting can be added cost-effectively at a later date.

Night flying responsibilities

2.8 Flight safety by day is the responsibility of the operator. However, the Air Navigation Order makes an additional stipulation that, for night operations involving public transport, "the person in charge of an area intended for taking off and landing must cause to be in operation such lighting as will enable the pilot to identify the landing area and direction, and to make a safe landing and take-off". The NHS trust will bear this responsibility for sites on NHS land, and should take formal acceptance of the responsibility for hospital landing sites built on neighbouring land by permission of the landowner. Discharging the responsibility includes providing at least one trained person for night operations to ensure that the lights are functioning correctly, and that no people or obstacles have strayed into the area, and to communicate with the pilot by radio or light signals before the helicopter arrives until after it has departed.

Flight limitations due to cloud and visibility

2.9 Cloud cover and visibility can affect an ambulance helicopter's ability to operate. This is because helicopter pilots fly by reference to what they can see of the terrain when they approach hospital helipads, termed "visual flight". The alternative is to fly using only the cockpit instruments for references, but the equipment and procedures needed to approach a helipad are complex and expensive, and are not yet approved by the CAA. Consequently, this Health Building Note covers only the requirements for visual flight by day and night. By day, this requires the cloud cover to be at least 500 ft above the helipad and the horizontal visibility to be at least 1000 m, with minor variations. At night, visual flight requires a cloud base at least 1000 ft above the helipad and a horizontal visibility of 3000 m or better, again with minor variations.

Environmental assessment

2.10 Planning Policy Guidance 24, 'Planning and Noise' (issued by the Department for Communities and Local Government), states that an environmental assessment is required of a new "aerodrome" (any area of land or rooftop commonly used for the landing and departure of aircraft) if the proposal is likely to have significant environmental effects.

Helicopter noise

Certification

2.11 It has been a mandatory requirement for every civilian helicopter certified since 1985 to hold a noise certificate as part of its Certificate of Airworthiness. This certifies that the helicopter is quieter than the noise limits established by ICAO and subsequently introduced into UK legislation.

Planning control

2.12 Helicopter noise is likely to be an important part of the planning approval process. The principal guide is Planning Policy Guidance 24. This urges caution in measuring and applying noise exposure categories when the absolute levels of the noise are balanced by an infrequent occurrence and a short duration of such noise. The occasions when ambulance helicopters cause disturbance are likely to be irregular, few in number and short in duration. As a result, a formal noise analysis for hospital helipads is unlikely to draw useful or objective conclusions and will be of limited assistance to planning committees.

Public reaction

2.13 The environmental impact, balanced by the positive benefit for patients and the community at large, should be explained to the local population at an early stage, and especially during the mandatory consultation phase (see the Cabinet Office Code of Practice on Consultation, reference 270621/0805/D8, dated January 2004). The public can appreciate the usefulness of a hospital helipad in life-saving situations, especially when fully informed of the purpose and importance, the infrequency and short duration of the environmental impact, and any mitigation activities proposed, which could include:

- locating the helipad on the highest point in the estate;

- planning the flight paths to avoid unnecessarily low transits over sensitive areas, including transiting for as long as possible at or above a height of 1000 ft as required by law;
- employing noise abatement flight paths and using special approach and departure techniques which minimise noise; operators are required to include these techniques in the training of their pilots;
- dissipating noise using baffles formed by intervening buildings and trees;
- insulating buildings and fitting double glazing in vulnerable zones;
- transporting only critically ill patients during unsocial hours (2300 to 0700 hrs).

Third-party use

2.14 Use of the helipad by non-emergency helicopters belonging to third parties is likely to attract a more antagonistic public reaction to the environmental impact of all helicopter movements. It may exceed the hospital's planning permission, will incur additional administrative responsibilities, and may not be appropriate if passengers have to gain access to the helipad through the hospital buildings. However, it can be achieved if there is sufficient space to create an aircraft parking area separate from the A&E pad, which should always be kept clear for ambulance helicopters. The guidance in this Health Building Note is sufficient to meet the aviation requirements of private and corporate helicopter owners and commercial operators.

3 Helipad site options

3.1 There are three principal options for siting a helipad: at ground level, at rooftop level, and on a low structure or mound. The three options are described in outline in this chapter (and summarised in Table 1), and their requirements are covered in detail in Chapters 4, 5 and 6 (summarised in Table 2).

Ground-level helipads

3.2 Helipads built at ground level are the least expensive to construct and operate. However, they take up much more space than raised and elevated pads. Ground-level helipads require a clear, firm, level landing area free of all obstructions such as buildings, shrubs, trees, and fences down to ground level. In common with all helipads, they also require at least two corridors rising from the edge of the helipad into the air that are free of all obstructions, to allow helicopters a clear space in which to fly during their approaches and departures. This is usually the most difficult criterion to achieve at ground-level pads in densely built-up areas, and may require the removal of screening such as trees and shrubs, a sensitive subject for the environment. The corridors should be aligned approximately northeast/southwest to make use of the prevailing wind; crosswinds may limit the weight that a helicopter can carry, and a strong crosswind would prevent some helicopters from making an approach.

3.3 It may be difficult and is frequently impossible to find the necessary clear area within an acceptable distance of A&E, in which case a limited availability ground-level helipad or a raised, mounded or elevated pad should then be considered.

Elevated (rooftop) helipads

3.4 From both the aviation and the long-term planning perspectives, the best position for a hospital helipad is on the roof of the tallest building on the site. The considerations affecting rooftop helipads are as set out in the following paragraphs.

3.5 Rooftops are generally unused space; even if there is air-conditioning plant on the roof, a helipad can be built above it. By comparison, ground-level areas in most hospitals are at a premium and may need to be used for other buildings, car parks and amenity areas.

3.6 They raise the helicopters' approach and departure paths by several storeys, reducing the

Photographer: Lisa Payne

A ground-level helipad at Queen's Hospital, Romford

environmental impact, particularly noise and the effects of downwash at ground level. This is not only valuable for hospital activities but is also significantly likely to reduce complaints from neighbours.

3.7 They provide the greatest choice of unobstructed approach paths, allowing the helicopter to approach with a headwind component. The general lack of obstructions at rooftop level also allows the helicopter to fly in smoother air compared with the turbulence that can be experienced when landing between buildings; this reduces patient discomfort and helicopter power requirements. Consideration should be given to:

- hot air from exhaust vents and flues which might disrupt the airflows around the helicopter;
- roof-level ventilation intakes; any fumes from the helicopter are likely to be dispersed, but could be mistaken for the smell of fire by hospital staff, who might then sound the alarm;
- poisonous gas vents; the gas should be dissipated by the wind but must not affect the helicopter crew.

3.8 Rooftop helipads, especially if on high buildings, are unlikely to influence future building plans; their approach paths are less likely to be affected. A lower-level helipad could prevent the construction of new facilities if they would block the approaches or intrude into the obstacle-free area needed for landing.

3.9 Helipads on rooftops are more expensive to build and to operate than those at ground level. They require integral fire-fighting facilities and trained RFFS manpower. However, the additional expense is reduced if the helipad can be included in the initial design of the building.

3.10 A helipad on the roof of the building housing A&E, with a ramp to provide trolley access, usually offers the shortest transit with the patient exposed to the elements.

Helipads on raised structures and mounds

3.11 A helipad built on a structure that is raised not more than 3 m above the surrounding area, or on a mound, does not always require RFFS trained personnel and equipment. The main options are as set out in the following paragraphs.

Bond Air Services

An elevated (rooftop) helipad at Leeds General Infirmary

3.12 A helipad can be built on a one-storey structure above a car park or other area near to A&E. Such raised sites are cheaper to build than those on existing rooftops, and achieve some of the advantages of a rooftop pad: they do not occupy valuable ground, and they raise the helicopters' approach and departure paths (and environmental impact) by one storey. In addition, compared with ground-level sites, they are more likely to provide unobstructed approach paths and smooth air, and are less likely to impact on future buildings or to be affected by exhaust flues.

3.13 A helipad built on a mound has similar advantages to one on a raised structure, except that it is less expensive to construct and the area under the helipad cannot be used. The pad can be approached up a path which spirals around the mound and is suitable for pushing a trolley or driving a fire engine. Such sites require little maintenance beyond landscaping.

ADAC, Germany

A helipad on a raised structure over a car park

Peter Rover

A mounded helipad

Table 1 Comparison of ground level, raised (and mounded) and rooftop sites

	Ground-level sites	Raised structures and mounds	Elevated (rooftop) sites
Aircraft and public security			
Freedom from obstructions at ground level			
Freedom from obstructions in the helicopter approach corridors			
Provision of into-wind approaches			
Preventing air turbulence affecting helicopters and patients			
Reducing the impact of noise and downwash			
Preservation of trees and shrubs			
Impact on future building plans			
Minimal building cost			
Minimal running costs		See paragraph 3.11	
Requirement for fire and rescue equipment	None mandated	Possibly required	Required
Requirement for trained manpower available for each landing	None mandated	Possibly fire and rescue	Fire and rescue

Key: Colour coding indicates the ease or difficulty of meeting each criterion at each type of helipad.
Green = easiest, amber = moderate, red = most difficult

4 Ground-level landing sites

4.1 The dimensions, marking and lighting of helipads are specified in the ICAO Annex 14 and the associated Heliport Manual. Lighting requirements are amplified by the CAA Safety Regulation Group in its letter reference 10A/254/24 dated 16 February 2007.

Large areas

4.2 A ground-level area at least 200 m long and at least 30 m wide, aligned with the prevailing wind, with clear areas at either end such as agricultural or parkland, will allow access by most helicopters in most wind conditions. The surface must be firm enough to allow a car to be driven across it, the overall slope must not exceed 3% (1.8º), and local slopes must not exceed 5% (3º).

Boundaries

4.3 NHS trusts should check with their local helicopter operator or an aviation consultant whether the extent of the landing area will be evident to pilots. If the boundary is deemed to be unclear, the perimeter of a rectangular area must be delineated by white boundary markers or stripes 1 m wide by 9 m long (or one-fifth of the side of the rectangle if shorter) at 50 m intervals, with at least three markings to each side and one at each corner. For areas that are not rectangular, there must be a minimum of five boundary markers at intervals of less than 10 m.

Aiming point

4.4 Helicopters would approach such an area to an aiming point near the centre of the area. The aiming point is a 9 m-sided equilateral triangle comprising three 1 m-wide lines either constructed from paving or consisting of a shallow trench filled with heavy crushed-stone ballast, and painted white. The bisector of one of the angles should be aligned with the preferred approach direction, probably to the northeast or where the helicopters are most likely to approach into the prevailing wind. At the end of its approach, the helicopter will hover near the aiming point and then taxi across the area at a low height and speed to a landing point near the A&E to discharge patients.

Landing point

4.5 The landing point can be firm ground, but an 18 m paved circle should be laid to allow easy access for a patient on a small-wheeled trolley in wet weather. The 18 m dimension is necessary to allow large helicopters to position the doors at both ends of the cabin over the pad with adequate space to manoeuvre the trolley. The landing point must be able to support 1.5 times the maximum weight of the heaviest likely helicopter; 23 t will satisfy all potential future needs. Also, the slope must be sufficient to drain off standing water (a high point at the centre is preferred) but must not exceed 2% (1.2º) in any direction. The surface must be skid-resistant, and resistant to the eroding effect of downwash; tarmac should not be used because it is dissolved by spilt aviation fuel. See Figure 1, which shows boundary markings and an aiming and landing point.

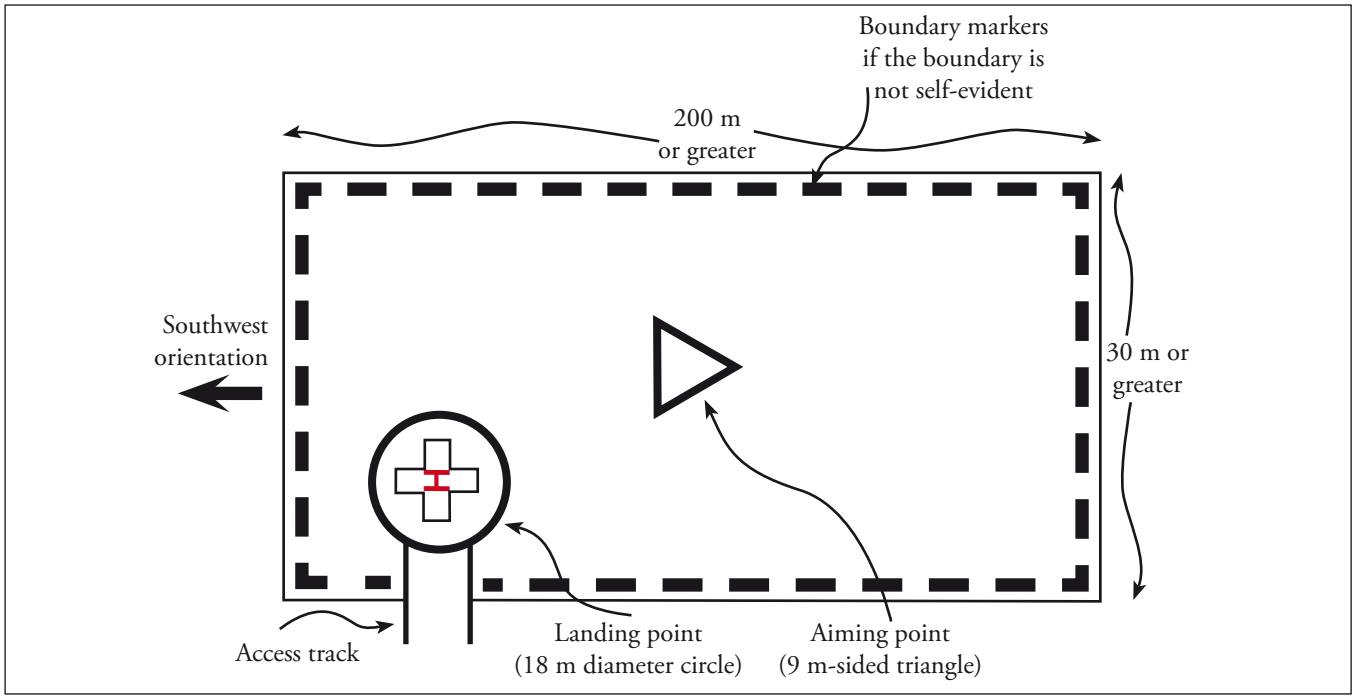
Access

4.6 The access track from the landing point to A&E should not include any kerbs or bumps to disturb the smooth movement of the trolley. It should not slope laterally except for drainage. Any slope in the direction of travel should comply with Building Regulations Part M; the maximum slope for 2 m ramps should be 1:12, for 5 m ramps should be 1:15, and for 10 m or longer ramps should be 1:20. However, all slopes should be 1:20 or flatter wherever possible to prevent the patient from sliding along the trolley.

Fire precautions

4.7 The track should be wide enough to accommodate a fire engine; no other fire precautions are mandated.

Figure 1 Diagram of a large site and markings



Small areas

Landing pad

4.8 Helipads on areas less than 200 m long require a square pad with 25 m sides or a circular pad containing a 25 m-sided square (35.4 m in diameter). The pad must be able to withstand 38 t (2.5 times the greatest anticipated helicopter weight). The surface should be non-tarmac and must be skid-resistant, resistant to the eroding effect of downwash, and sloped by less than 2% (1.2°) to disperse rainwater.

Downwash zone

4.9 An area of 30 m around the pad should be kept clear of people, structures and hard obstacles to avoid injuries and damage from debris blown by the downwash. Large helicopters require a larger downwash zone than ambulance helicopters.

Helicopter approach and departure corridors

4.10 The helipad must have at least two corridors of clear airspace rising from the pad which are free of all obstructions. If only the minimum of two corridors is possible, they should be orientated approximately northeast/southwest (aligned with the prevailing wind) and separated by at least 150° in azimuth. Some helicopters require the wind to be within 30° of their approach heading, so the greater the number and width of corridors, the greater the utility of the helipad. The inner ends of the corridors start at the outer edge of the landing pad and are not less than 30 m wide. Both sides of the corridors diverge laterally by 15% (9°) out to a distance of up to 500 m; thereafter they continue with parallel sides to a total distance from the helipad of 1875 m, in which length a turn of up to 120° is permitted. The base of the corridors slopes upwards at 8% (4.8°). To increase safety and utility, it is desirable to have a 30 m-wide area under each corridor cleared of hard obstacles for the first 200 m in the direction of the corridor and in the opposite direction. Figure 2 depicts the specifications in this paragraph.

Access

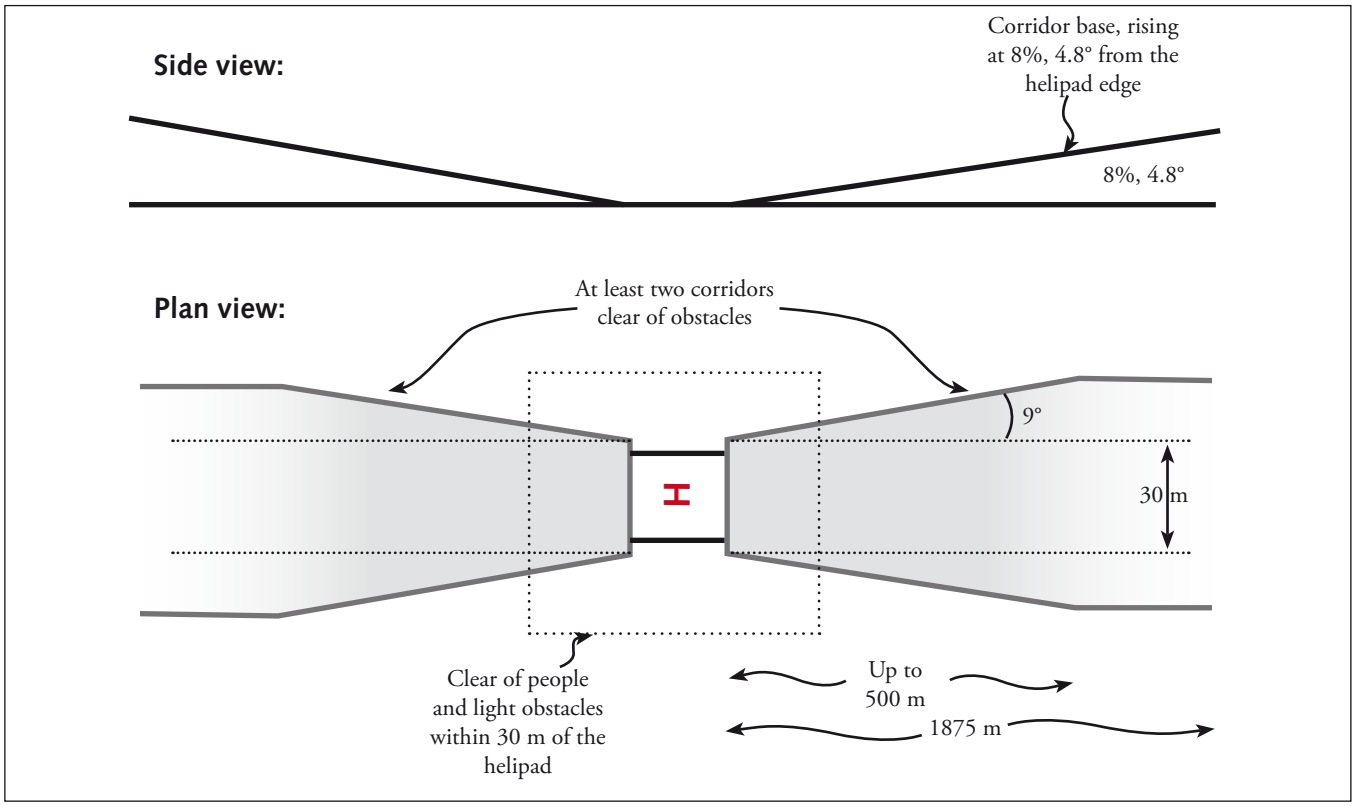
4.11 The trolley access track requirements for sites in small areas are the same as those for large areas (paragraph 4.6).

Visual aids

Paint markings

4.12 A white cross must be painted in the centre of the landing point in large areas and the helipad in small areas. The cross must comprise two overlapping stripes, each 3 m by 9 m, with one of the stripes aligned with the centre of the helicopter approach corridor closest to a southwest/northeast orientation. There must be a red H at the centre of

Figure 2 Obstacle-free corridors for helicopter approaches and departures



the cross, 3 m high and 1.8 m wide with 0.4 m line widths; the uprights of the H must be parallel to the line of the white cross which is nearest to a southwest/northeast orientation. A white perimeter line, 30 cm in width, must be painted just inside the outer edge of the pad. For helipads in small areas, a yellow circle with a 0.5 m line width must be painted with its inner circumference just abutting the tips of the white cross. All these markings must be applied in non-slip paint. The whole surface must be kept free of loose items such as gravel, soil, twigs and litter, and contaminants that might reduce the non-skid qualities.

Wind indication

4.13 A windsock must be erected to indicate the surface wind in the area of the touchdown point; this may need to be small and carefully positioned so that it does not intrude into the obstacle-free areas. For a large site, a second windsock to one side of the open area is valuable for indicating the area wind.

Lighting for night operations

Lighting to guide approaching helicopters

4.14 A locating beacon, approach lights, and visual alignment and approach slope indicators may be necessary in certain circumstances, such as where a pilot might have difficulty identifying the helipad due to surrounding lights, where a preferred approach direction or approach slope needs to be indicated, or where there is a lack of visual surface clues.

Boundary lights

4.15 At sites in large areas (which exceed 200 m in length) where the extent of the area is not self-evident, CAA-approved white omnidirectional lights must be placed by each white boundary marker (paragraph 4.3).

Aiming point lights

4.16 The white aiming point triangle (paragraph 4.4) must include six low-level omni-directional lights, one at each corner and one at the centre of each side of the triangle (see Figure 3).

Helipad lights

4.17 At large sites, an 18 m circular landing point requires 18 green blister lights laid in a hexagon fitted tightly around the pad. There must be a light at each of the six corners and two others equally spaced (at about 3.4 m) along each straight line (see Figure 4).

Figure 3 The aiming triangle with lights

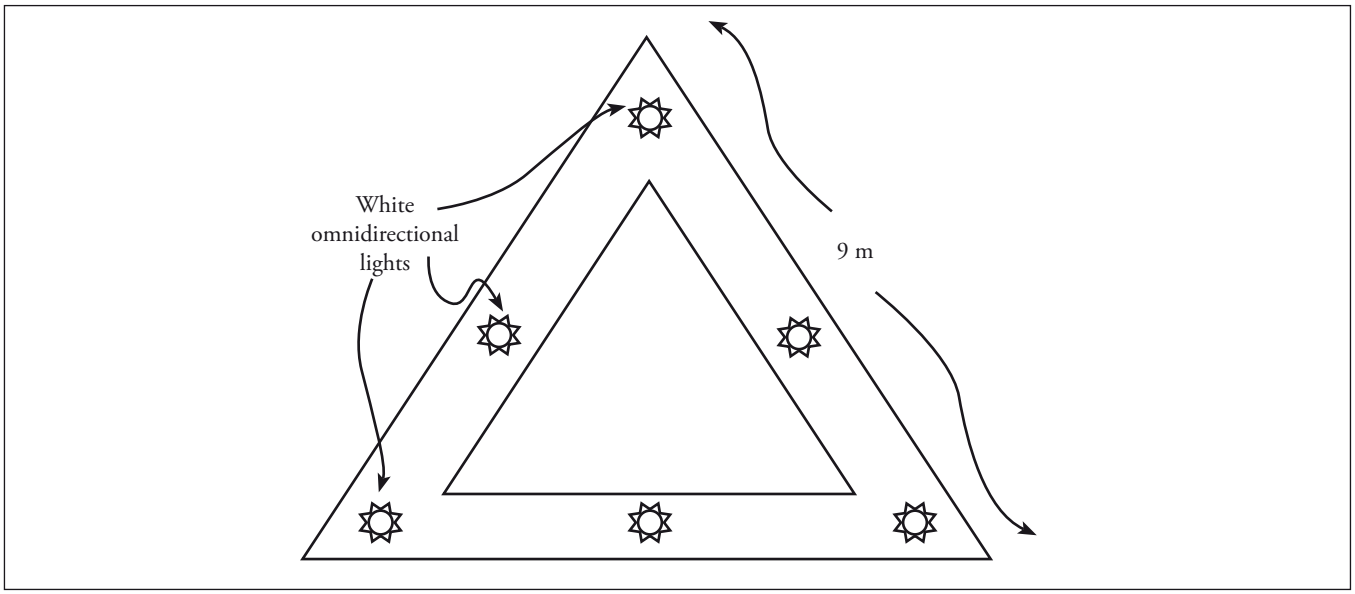
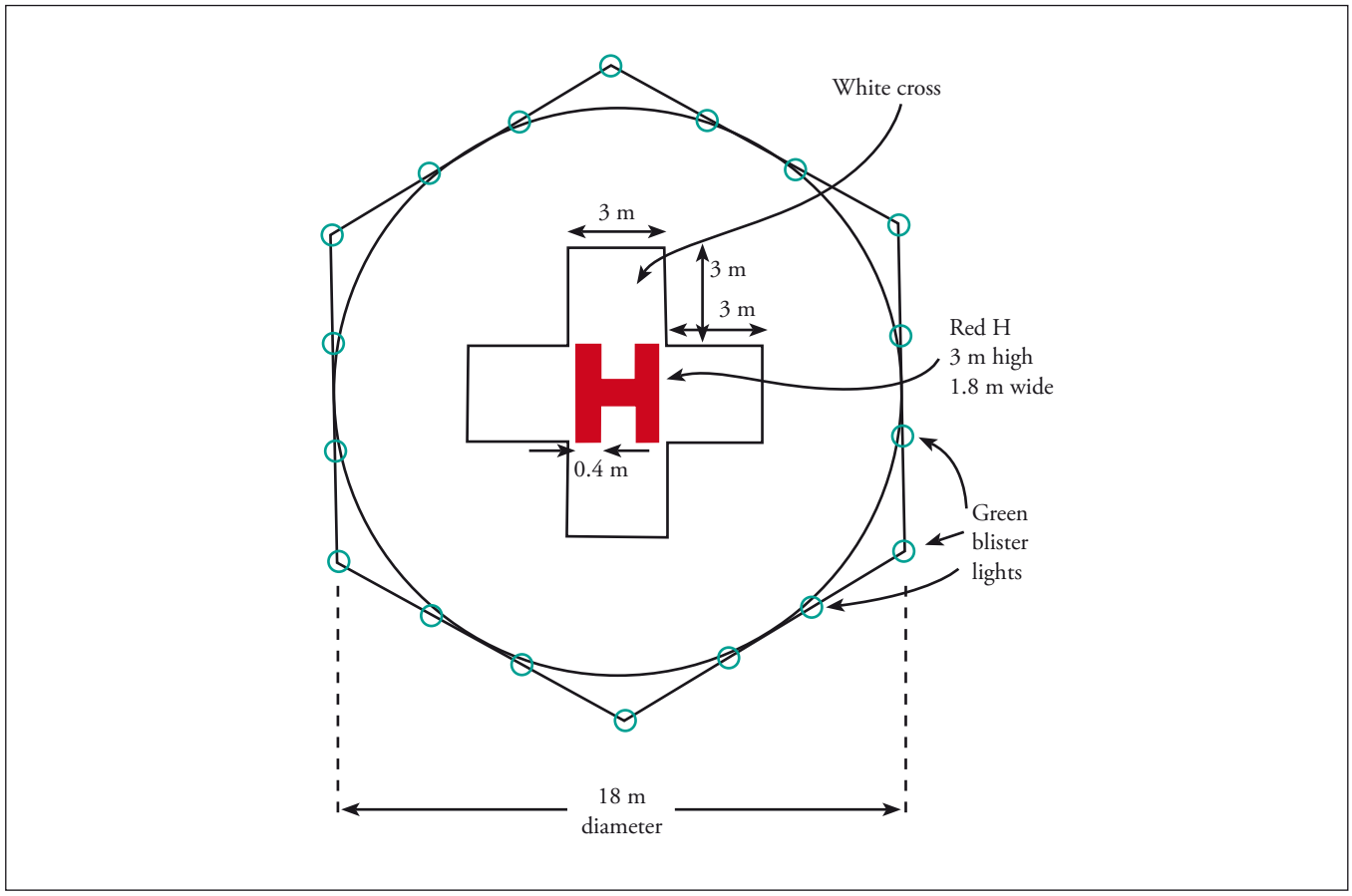
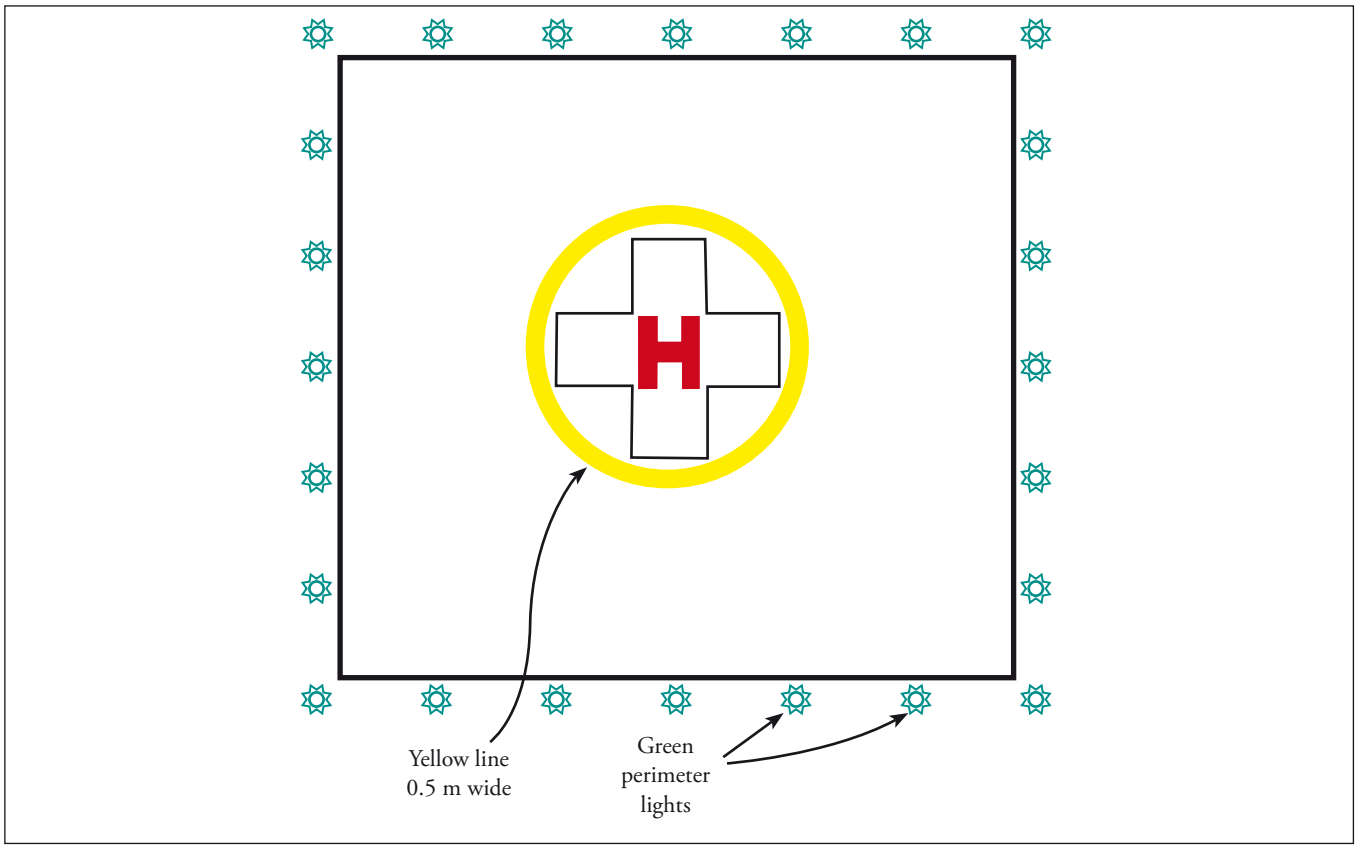


Figure 4 The landing point in a large area with lights



4.18 For a 25 m-sided square pad (or a 35.4 m circle containing it) in small areas, there must be 24 green blister lights laid in four straight lines around and within 1.5 m of the edge of the square; there must be a light at each corner and five others equally spaced (at less than 5 m intervals) along each side (see Figure 5). All helipad lighting structures must be kept low, preferably inset, and certainly less than 25 cm in height, both to prevent creating obstacles to aircraft and tripping hazards, and because flush-mounted lights are more difficult to vandalise. Following CAA studies, existing lit helipads must change to green perimeter lights by 1 January 2009.

Figure 5 The landing pad in a small area with lights



Windsock illumination

4.19 The windsock must be illuminated either by an internal light or by downward-facing floodlighting, which is more conspicuous but must not dazzle pilots on approach or on the helipad.

Obstacle illumination

4.20 Obstacles such as trees, buildings, masts and chimneys (that present a danger to the helicopter) must carry a light or be floodlit, but this lighting must not dazzle pilots.

Access track lighting

4.21 Any lighting for the trolley access track should be at ground level or should be less than 25 cm high and point downwards within 30 m of the pad.

Switching

4.22 All lighting should be operated by a single switch near the helipad so that no component can be forgotten by ground staff.

Security

4.23 It is important that the security and safety of the helicopter and the pad be considered in order to avoid air and ground accidents. The 30 m downwash zone should be marked by fencing where it does not constitute an obstacle to the helicopter, and by signs elsewhere, to stop people encroaching. It may be necessary to stop traffic on roads which cross the zone, and the hospital risk assessment might require one or more members of staff to be present to police all movements.

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A windsock illuminated by downward-facing floodlights

5 Elevated (rooftop) landing sites

5.1 ICAO Annex 14 defines an elevated (rooftop) helipad as one built on a raised structure on land, and JAR-OPS 3 further defines it as being at least 3 m above the surrounding surface. Helicopters taking off from elevated helipads must have two engines. If one fails at a critical moment, the helicopter must be able either to land back on the helipad or to continue the take-off on one engine and fly away, clearing the helipad structure and thereafter clearing obstacles under the flightpath by a vertical margin of at least 35 ft.

Similarities to a ground-level site

5.2 In common with ground-level sites in small areas, elevated sites should contain a rectangle with sides at least 25 m long (or a circle at least 35.4 m in diameter) to accommodate all helicopter types likely to make use of the facility. They also require:

- a skid- and erosion-resistant non-tarmac surface with a maximum 2% (1.2°) slope from the centre to disperse rainwater;
- at least two obstacle-free corridors with the same separation, dimensions and orientation as a ground-level site (paragraph 4.10);
- visual aids with the dimensions, location, quality and orientation specified for small area helipads in paragraphs 4.12–4.13;
- a locating beacon, approach lights, and visual alignment and/or approach slope guidance systems if the criteria for them on ground-level sites apply (paragraph 4.14). A lit aiming point is not required, and perimeter and helipad lights are described below (paragraph 5.16);
- warning lights or floodlighting of the windsock and all obstacles which present a danger to the helicopter, and lighting for the trolley access track (paragraphs 4.19–4.21).

Structural design

5.3 The structural design criteria are given in detail in the ICAO Heliport Manual that accompanies ICAO Annex 14. In summary, the pad must be designed for the maximum weight of the heaviest type of helicopter anticipated to use the pad in the worse of two conditions: when the helicopter is landing and when it is at rest.

Design criteria – helicopter landing

5.4 The design load for landing helicopters must take account of:

- **the dynamic load due to impact at touchdown:** the most severe case is an emergency touchdown, with a partial safety factor of 1.66 applied to the normal impact load of 1.5 times the maximum weight of the helicopter;
- **sympathetic response:** the average structural response factor of 1.3 must be used in determining the ultimate design load;
- **overall superimposed load:** an allowance of 0.5 kN per m^2 must be included for other causes of loading, including the fire crew and other people, snow, freight and any equipment used on the helipad;
- **lateral load on the platform supports:** the supports of the platform must be designed to resist a horizontal point load equivalent to 0.5 times the maximum weight of the helicopter together with a specified wind loading, applied in the direction which will provide the greater bending moments;
- **dead load of the structure:** the partial safety factor for the dead load must be 1.4;
- **punching shear:** the pad must withstand the punching shear of the helicopter's weight spread between two contact areas, each 64.5 mm × 1000 mm.

Design criteria – helicopter at rest

5.5 The design load for helicopters at rest must take account of:

- **the dead load of the helicopter:** each structural element must be designed to carry a point load of 45.0 kN for helicopters up to 9 t and 67 kN for helicopters up to 13.5 t from two main wheels or skids a specified distance apart, applied simultaneously on any position within the landing area;
- **overall superimposed load and dead load:** in addition to wheel loads, the allowance for overall superimposed and dead loads given for landing helicopters must be included in the design.

Summary of structural design criteria

5.6 For helicopters up to 9 t in maximum weight, the point load would be 45 kN for each of two wheels separated by 2.5 m, the superimposed load of landing would be 0.5 kN/m^2, and the superimposed load of a helicopter at rest would be 2.5 kN/m^2. For helicopters up to 13.5 t in maximum weight, the point load would be 67 kN for each of two wheels separated by 3 m, the superimposed load of landing would be 0.5 kN/m^2, and the superimposed load of a helicopter at rest would be 3.0 kN/m^2.

Surface structure

5.7 The surface of the pad can be an integral part of the roof of the building, but in the unlikely event that structural alterations are required (such as the addition or repair of inset lighting), the work may affect the building's waterproofing. As an alternative, the helipad can be built as a metal deck above the roof level. This may be necessary on tall, slab-sided buildings where the wind can produce severe turbulence as it rises over the building; a pad built at least 3 m above the roof on a metal raft supported by steel framing allows the turbulent air to flow under the pad, leaving the helicopter to land in relatively smooth air on the helipad. This requires less power, reduces risk, and causes less distress to patients in the helicopter. The landing area must be sealed so that any fluids can run only into the drains, and the 2% (1.2°) slope for drainage must be retained under the weight of the helicopter.

Drainage

5.8 Fire-resistant guttering is required around the perimeter of the helipad to carry rainwater, spilt (and possibly burning) fuel and fire-fighting media into the drainage system and prevent it falling onto the building below. Under normal conditions, precipitation and domestic water deposited on the helipad should be directed into the foul water sewage system. In the event of a fire, a valve should divert aircraft fuel, fire-fighting media, and all other fluids to an oil/water separator. The capacity of the separator should be 3300 L for helicopters up to 15 m in overall length (ambulance helicopters), to accept 700 L of fuel, 2500 L of fire extinguishant, and rain or melted snow. The capacity of the separator for larger helicopters should be 8100 L (3000 L of fuel, 5000 L of extinguishant, and rain or melted snow). The down-pipes must be fire-resistant and should include a system to exclude air (sufficient to extinguish burning fuel).

Landing area requirements

5.9 An elevated landing site also requires the following items.

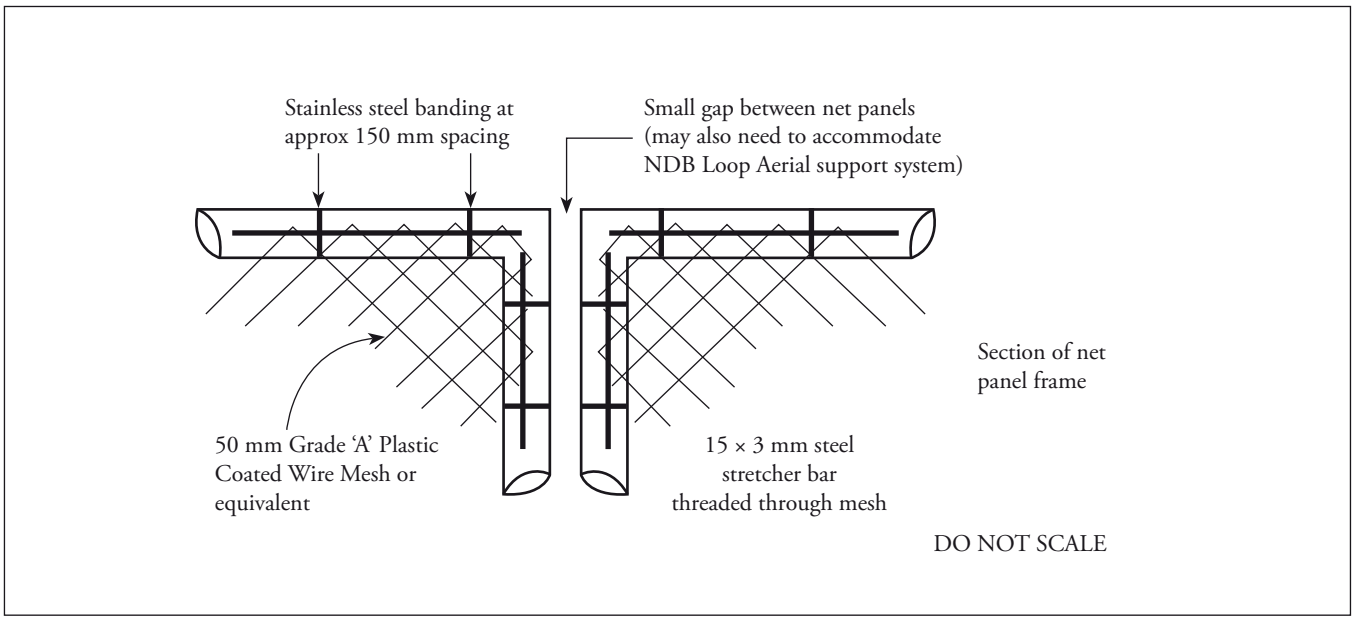
Tie-down points

5.10 Tie-down points should be recessed into the surface of the helipad to secure a helicopter against strong winds in the event that it must remain on the pad for an extended period, for example if it becomes unserviceable and requires repair before flying off. Each point should withstand the pull of a strong wind acting on the slab side of a helicopter. It should comprise a metal bar mounted across a cup and let into the surface, and should be of a size to accept standard ratchet strops. Six tie-down points should be arranged equidistantly around the inner circumference of the yellow circle which surrounds the white cross.

Safety netting

5.11 Deck edge safety netting must be installed to catch and retain a falling person, and must therefore produce a "hammock" rather than a "trampoline" effect. It must extend outwards to 1.5 m around all areas where there is a sheer drop from the edge of the helipad and its access stairs and ramps. The netting must be of a non-flammable material, typically either polypropylene rope or plastic-coated wire; wire corrodes but polypropylene

Figure 6 Typical details of preferred fixings for wire mesh (or equivalent) deck-edge safety net panels



weakens in UV light. Wire mesh should be secured as shown in Figure 6, with the wire "tails" turned back to ensure mesh integrity is fully maintained. Polypropylene netting should be supported on all sides of each panel, with a substantial stainless steel wire threaded through the net mesh.

5.12 The netting should either be wrapped or tied to the support wire at approximately 100 mm intervals. On new helipads, the inboard edge of the netting must be mounted below the level of the helipad edge and the net angled up not more than 10o; the outer edge must not be above the level of the pad. Until 2008 on existing helipads, the inboard edge of the netting can be mounted level with or just below the level of the helipad edge and the net can be angled up at not more than 10º; the outer edge must not be higher than a line rising at 5º from a point 25 cm high at the edge of the helipad. Supporting bars must be below the netting to reduce injury to a falling person. All netting deteriorates and requires routine inspection and replacement as specified in CAA Safety Regulation Group letter 10A/253/5 dated 16 February 2006 (to be incorporated in Civil Aviation Publication 437, 'Offshore Helicopter Landing Areas – Guidance on Standards' (CAP437)).

Additional visual aids

5.13 In addition to the windsock and the markings listed for helipads in small areas at paragraphs 4.12–4.13, the following markings must also be painted on the helipad in non-slip paint of a contrasting colour to that of the pad surface.

Hospital name

5.14 The name of the hospital must appear in letters at least 1.2 m high.

Allowable weight

5.15 The maximum allowable mass in tonnes must be written as two digits and a small "t" (for example "5.5 t"), preferably orientated to be legible by a helicopter approaching on a heading of southwest. The inscription should describe the strength of the helipad, not the weight of the local ambulance helicopter. The inscription must be in letters 1.5 m high with 20 cm line widths; additional dimensions are available in ICAO Annex 14.

Helipad lighting

5.16 The helipad must be lit by:

- omni-directional green lights in straight lines off each side of the helipad but within 1.5 m of the perimeter. The lights must not project more than 25 cm above the helipad, and the light sources must not be visible from below the helipad level. There must be one light at each corner and others evenly spaced in between at intervals of not more than 3 m. Existing lit helipads shall display green perimeter lights by 1 January 2009;

Robert Davey, Estates Project Manger, Heart of England NHS Foundation Trust

Green perimeter and xenon floodlights on an elevated helipad at Birmingham Heartlands Hospital

- four low-level (25 cm) Xenon floodlights to illuminate the landing surface, well-shielded so as not to dazzle pilots.

Access to and from the landing area

Ramps and stairs

5.17 The helipad must have a minimum of two access points at opposite sides or corners. The most efficient and fail-safe means of moving patients on trolleys to and from an elevated site is by a ramp descending to a level where the trolley can enter the building. The slope of the ramp should be 1:20 or flatter wherever possible (paragraph 4.6). The ramp should include a landing 1 m below the level of the helipad on which the RFFS personnel can stand with their fire-fighting equipment to observe the arrival and departure of helicopters. It is preferable if the ramp runs away from the building to distance the RFFS personnel from a crash, and also to provide a walkway around the building below helipad height in case they need to approach the fire from the opposite side. Two ramps are preferred, but one ramp and one staircase, both wide enough for a trolley or stretcher and attendants, are acceptable.

Lifts

5.18 It may be possible to provide a dedicated lift for access directly from the helipad on a very large roof, but the lift housing will constitute an obstacle. It should not be near to the helipad and must not compromise the required helicopter approach corridors. Where it is not possible to have a

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Ramp access to an elevated helipad

dedicated lift, there should be an override facility to allow RFFS staff to take control of the lift. The public should not be able to use the lift to access the helipad area. The presence of a lift will not remove the requirement for two access points by stairs and ramps. Also, the risk of possible lift failure at a critical moment should be addressed.

Personnel safety

5.19 Handrails must not protrude more than 25 cm above the helipad when the helicopter is approaching and departing. It may therefore be necessary to protect all edges by extending the safety netting around the ramps and staircases until their level is sufficiently below the helipad to allow the provision of fixed handrails.

RFFS facilities

5.20 The general RFFS requirements are listed in ICAO Annex 14, and the specific CAA requirements are in CAA FODCOM 24/2005. These specify the standards for helicopters with an overall length up to 15 m (termed H1, which includes all current ambulance helicopters) and for those which are 15 to 24 m (H2, which covers SAR helicopters). The FODCOM also requires the operator to undertake a risk analysis to justify the scale of RFFS facilities and standards, but this is unlikely to increase the specification above the following.

Foam

5.21 For H1 helicopters landing at elevated sites, the minimum requirement is a single, manned hose line with nozzle/branch pipe, capable of delivering foam in a jet spray/aspirated pattern at 250 L/min for 10 min. However, a second system is usually needed for several reasons: inevitable delays will be incurred when evacuating an immobile patient in the event of a fire; the single foam spray could be destroyed in the crash; and the system must cover the whole area of the helipad in foam in any wind condition. Therefore the recommended minimum is two foam jets located at opposite sides or corners of the pad, each capable of delivering foam in a jet spray/aspirated pattern at 250 L/min for 10 min. One could be an automatic foam monitor, a device which sprays foam in an oscillating pattern once activated. For H2 helicopters, two foam sprays at diametrically opposite positions on the pad perimeter are mandated, each capable of a discharge rate of 500 L/min for 10 min.

Water

5.22 The water for extinguishing and for making foam can come from a pressurised main supply provided that the delivery pipe is not on the outside of the building where it could be destroyed in a helicopter crash. Alternatively it can be supplied from tanks immediately below the helipad level (2500 L for H1, 5000 L for H2), pressurised by an inert gas to propel the water to the nozzles when activated. The system will also require small tanks for the foam concentrate. A manned hose is important for washing the helipad surface to remove routine dirt and bird droppings in order to retain the friction characteristics of the surface.

Complementary fire-fighting agents

5.23 In addition to the foam, 45 kg of dry powder (compatible with the foam) or halon or 90 kg of CO_2 must also be available and portable for conveying up the access stairs or ramp to the helipad. Where the main complementary agent is dry powder, an additional 9 kg of halon or 18 kg of CO_2 must be available to fight engine fires. Where the main complementary agent is gaseous, an additional 9 kg dry powder must be available for running fuel fires. These amounts are the same for both H1 and H2.

Rescue personnel

5.24 The minimum of two trained RFFS personnel for H1 sites (three for H2) must wear full protective equipment (helmet with flash hood, tunic, trousers, gloves and boots). They must respond to an accident in considerably less than two minutes, wearing their personal protective equipment; the initial response will include warning the hospital, so a telephone should be readily available. Respiratory protective equipment must also be available to protect from the fumes from modern helicopters, which are constructed using composite materials. At many hospitals, the RFFS personnel will be required on average less than once per day for less than 30 minutes. They could be employed specifically for the duty, drawn from a roster of hospital staff who can leave their normal jobs for the required periods, or provided by the main helicopter operator under contract or by a third party which provides specialist aviation-trained manpower. The physical fitness of RFFS staff will need to be considered when selecting personnel to carry out this role. Hospitals could consider asking

existing staff who have current or previous experience as retained fire-fighters.

Rescue equipment

5.25 For both H1 and H2, each RFSS crew member must have one harness knife and sheath and a pair of fire-resistant gloves. One of each of the following items of rescue equipment must also be available:

- adjustable wrench;
- large rescue axe;
- 60 cm bolt cutters;
- 105 cm crowbar;
- grab hook;
- heavy-duty hacksaw with six spare blades;
- 1.2 m-sided square fire-resistant blanket;
- 3 m ladder;
- 15 m life-line of 50 mm circumference;
- side-cutting pliers;
- set of assorted screwdrivers;
- general purpose eclipse-type saw;
- power saw.

Medical equipment

5.26 The following medical equipment must also be available:

Equipment:	H1 sites	H2 sites
Medical pack with specified contents	1	2
Foil blankets	6	12
Stretchers	2	4
Resuscitation pocket mask	1	1

Additional storage

5.27 The rescue and medical equipment, and complementary fire-fighting agents should be kept in a weather-proof store near the helipad.

6 Helipads on raised structures and mounds

6.1 Where space is not available for a ground-level helipad and it is either not feasible or too expensive to build a rooftop helipad on an existing building, there are two other options. A helipad can be sited on a mound or on a purpose-built structure of one or more storeys, bridging a car park or other occupied area.

Similarities to a ground-level site

6.2 In common with ground-level sites in small areas, raised structures and mounded sites require:

- a rectangular pad with sides at least 25 m long, or a 35.4 m diameter circle;
- a skid- and erosion-resistant non-tarmac surface with a maximum 2% (1.2º) slope from the centre to disperse rainwater;
- at least two obstacle-free corridors with the same separation, dimensions and orientation as a ground-level site (paragraph 4.10);
- visual aids of the dimensions, location, quality and orientation specified for helipads in small areas in paragraphs 4.12–4.13;
- a locating beacon, approach lights, and visual alignment and/or approach slope guidance systems if the criteria for them on ground-level sites apply (paragraph 4.14);
- helipad lighting as described in paragraph 4.18 for the 25 m-sided square pad (or 35.4 m diameter circle) if the pad is 3 m or less above the surrounding area or is on a mound;
- warning lights or floodlighting of the windsock and all obstacles, which present a danger to the helicopter, and lighting for the trolley access track as described in paragraphs 4.19–4.21;
- all lighting to be operated by a single switch so that no component can be forgotten;
- access to a mounded site via a single spiral path winding around the mound and sloping at 1:20 in the direction of travel wherever possible (paragraph 4.6); the path should be suitable for access by a fire engine.

Similarities of raised structures to elevated (rooftop) sites

6.3 A site built on a raised structure requires:

- the same structural design, drainage, deck-edge safety netting, and access requirements as an elevated (rooftop) site (paragraphs 5.3–5.7, 5.8, 5.11 and 5.17–5.19);
- tie-down points as described at paragraph 5.10 only if the site is exposed to very strong winds;
- the additional visual aids and the helipad lighting described for elevated (rooftop) sites (paragraphs 5.14–5.15 and 5.16) if the site is higher than 3 m above the surrounding terrain.

RFFS facilities

6.4 The RFFS requirements are the same as elevated (rooftop) sites for an elevated structure at least 3 m higher than the surrounding terrain. However, raised structures 3 m or less in height and mounded sites are considered as ground-level sites (where no RFFS is mandated) if the full surface area can be covered with foam by a fire engine with access to a fire hydrant.

Table 2 Summary of the requirements of ground-level, raised and elevated (rooftop) helipads

	Large ground-level sites, at least 200 m long	Small ground-level sites	Raised structures less than 3 m above the surrounds, and mounds	Low elevated structures more than 3 m above the surrounds	Elevated (rooftop) sites
Boundary markers	Required if the boundary is not self-evident	Not required			
Aiming point	Required	Not required			
Pad size	18 m circle	25 m sided square or 35.4 m diameter circle			
Pad strength	23 t (1.5 × max weight of largest helicopter)	38 t (2.5 × max weight of largest helicopter)	Structures: paragraph 5.3. Mounds: 38 t (2.5 × max weight of largest helicopter)	See paragraph 5.3	
Surface	Paved (not tarmac), skid- and erosion-resistant				
Slope of pad	<2% (1.2°)				
Access track/ ramp slope	1:20 preferred; see paragraph 4.6				
Access track/ ramp width	Fire engine		Trolley width; fire engine width if it cannot cover pad from ground level	Trolley and attendants	
Clear area around pad	30 m		30 m at pad level	Not applicable	Not applicable
Helicopter approach corridors	Yes; see paragraph 4.10				
White cross, red H, white perimeter line	Required				
Yellow circle around H	Not required	Required			
Windsock	Required				
Guidance lighting	Possibly. See paragraph 4.14				
Boundary lights	Possibly		Not required		
Aiming point lights	Required	Not required			
Helipad lights	Paragraph 4.17	Paragraph 4.18		Paragraph 5.16	
Windsock and obstacle illumination	Required				
Drainage	Not required		Structures: Required. Mounds: Not required	Required	
Tie-down points	Not required		Unlikely		Required

Table 2 (contd)

	Large ground-level sites, at least 200 m long	Small ground-level sites	Raised structures less than 3 m above the surrounds, and mounds	Low elevated structures more than 3 m above the surrounds	Elevated (rooftop) sites
Deck edge safety netting	Not required		Possibly on structures, unlikely on mounds	Required	
Hospital name and max weight markings	Not required			Required	
RFFS	If required by trust risk assessment		Not if a fire engine could cover the pad area	Required	

7 Refuelling

Requirement

7.1 At present, it is not usual for hospital helipads to have their own fuelling service. The service is important only if the helipad is the normal operating base for the helicopter, or the helicopter is routinely used to transfer patients to hospitals over 100 miles away at night when the opportunities for refuelling at airfields are limited. A refuelling facility is not necessary for visiting HEMS helicopters, although it could reduce flying hours (by saving the time required to fly off to another location to refuel before undertaking the next task), thereby cutting the flying costs.

Safety and security

7.2 The helicopter operator bears the responsibility for the quality and quantity of fuel taken on by its helicopters, and will specify procedures for implementation by a trained refuelling system operator. The training includes safety, handling, testing, and delivering fuel and the maintenance of fuel samples and records. The refuelling system operator could be drawn from the same sources as RFFS personnel (paragraph 5.24). The principal safety considerations for a refuelling facility are set out in the following paragraphs.

Fuel quality

7.3 The aviation fuel used by air ambulances has a flashpoint greater than 38°C. Ignition by sparking is most unlikely, and the fumes are not noxious, but it must be stored and handled in accordance with instructions for hazardous goods and the relevant Material Safety Data Sheet. It has a shelf life, so storage capacity and rate of use should be matched to prevent the need to dispose of old stock. Keeping a stock for emergency use only is an expensive option.

Spillage protection

7.4 Fuel tanks and bowsers must be either double-skinned or parked in a bunded area to prevent leaking fuel from entering local water-courses.

Contamination and theft

7.5 Security measures should be implemented to prevent the accidental or malicious contamination of the fuel; its quality is vital to the safety of the helicopter. It should also be protected from theft and misappropriation for use as diesel or central heating oil.

Equipment options

7.6 A fuel facility includes storage and pumping equipment; for raised and elevated sites, the storage can be at ground level provided that the pump is able to deliver fuel to the height of the helipad. The storage options are set out in the following paragraphs.

Drums

7.7 Fuel is available in 205 L drums; small helicopters burn about 1¼ drums per flight hour, and large ones about three. Stocking fuel in drums is not recommended because of the problems of storage, movement, cost (it is much more expensive than bulk fuel and part-used drums must be rejected), and the difficulty of guaranteeing the quality.

Palletted tanks

7.8 Fuel is available in plastic tanks mounted on pallets. Individually, these contain larger quantities than drums but suffer similar drawbacks, except that fuel in a part-used tank can be issued subsequently.

Road bowser or trailer-mounted tank

7.9 A dedicated aviation fuel bowser fit to travel on public roads (a clearance which may not be necessary if it is refilled and maintained on site) or

a fuel trailer offer greater mobility and flexibility than tanks and drums. They can be housed nearby and driven/towed close to the helipad when required.

Dedicated tank

7.10 The most expensive option to install is a dedicated tank with a fuel delivery hose that can reach the helipad. However, it offers the lowest running costs and is the best option if fuel is required frequently. A bulk storage facility has VAT implications: it must be cleared for use by HM Revenue and Customs and would be subject to random inspection; the fuel should be accounted for scrupulously.

8 Support facilities

Elevated sites and raised sites above 3 m

8.1 Male and female RFFS personnel will each need heated covered spaces close to the helipad to store, lay out and put on their protective equipment quickly. There should also be a toilet, shower and kitchenette if they are expected to spend long periods on the helipad. The kitchenette could be doubled up as an area that could contain flight records. A space should also be identified near the helipad where a dedicated patient trolley can be stored securely so that one is always available.

Helicopter base facilities

8.2 Air ambulance helicopters are normally based at a location central to the area they cover, and are not likely to be based at a hospital. However, some city-centre hospitals, where the recovery of accident victims may be severely delayed by local traffic conditions, may regard a HEMS helicopter as integral to their pre-hospital care system. They may require a helicopter to be based at the hospital, either permanently or more likely during daylight hours, in which case additional facilities will be necessary. Basing a helicopter at a main trauma hospital in an area should also reduce flying times (and therefore cost) because most flights will follow a direct path out to the incident and back to the hospital.

8.3 In addition to the helipad, helicopter bases require an operations room with telephones and internet access for flight planning, a crew room/staff room with kitchenette, changing rooms, toilets, a medical store, and a sluice room. 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 and training rooms and facilities would be required.

8.4 For permanently-based helicopters, a small aircraft hangar will improve the security and serviceability of the helicopter, and provide the conditions for minor technical tasks to be undertaken on site. Small ambulance helicopters require a hangar with doors that provide an opening at least 12 m wide and 4 m high, and with an interior length of about 15 m.

9 NHS emergency planning guidance

9.1 NHS Emergency Planning Guidance is available at www.dh.gov.uk/emergencyplanning. The Guidance describes a set of general principles for all NHS organisations in developing their ability to respond to a major incident or incidents and to manage recovery whether the incident or incidents has/have effects locally, regionally, or nationally, within the context of the requirements of the Civil Contingencies Act 2004. This includes guidance on the command, control and coordination of emergencies at local, regional and national levels. All processes and systems developed by NHS organisations regarding the triaging, transport, reception, and/or transfer of patients including the deployment of air assets and the use of hospital helipads should be made in the context of the prevailing Guidance. Health Building Note 00-07 – 'Resilience planning for the healthcare estate' may also be relevant. This publication gives guidance on developing NHS facilities that are resilient to a range of threats and hazards.

10 Operational risk management

Aviation risk assessment

10.1 Trusts should include specific risks created by helicopters using the hospital helipad in their overall site risk assessments. An independent consultant or the operator of the ambulance helicopter could provide analysis of general aviation and site-specific risks.

10.2 Overall, the acceptable quantitative probability of a safety occurrence for helicopters is less than 5×10^{-8} per flight hour (defined as "extremely remote"). This is achieved by addressing safety at all stages including the design and airworthiness of the helicopter, its maintenance and operation, the training of all personnel involved, and internal and external auditing of safety processes.

10.3 All safety-critical helicopter systems except the rotor and power transmission systems are duplicated. The occurrence of a rotor or transmission failure is classified as hazardous to catastrophic, but the probability is remote (10^{-5} to 10^{-7}). In addition, the probability of an event affecting a trust is further reduced because of the small proportion of each flight hour spent over the trust's estate. The possibility of an engine failure is accounted for at every stage of flight. Approved take-off and landing profiles are mandated which, in the event of failure of one of the engines, enable the helicopter to land safely or fly away safely to a larger landing area where single-engine (low-power) techniques can be used to land safely.

10.4 In summary, while the effect of a helicopter accident would be significant, the likelihood is extremely remote.

Risk management

10.5 A trust with a helipad should manage the facility and its risks by means of a Helipad Operations Manual written specifically for the local conditions and criteria, and should audit the helipad routinely for compliance with the Manual. It should include sections covering the following matters.

Introduction

10.6 This should include the purpose, control and distribution of the Manual.

Technical administration

10.7 The following technical administration is recommended:

- the names, status, contact details and responsibilities of the Helipad Quality Managers and their deputies, and the helipad operating staff;
- the Safety Management Policy;
- the location and status of architectural, mechanical and electrical drawings;
- the procedures for the periodic maintenance (and auditing) of the structure and systems.

Helipad characteristics

10.8 This section should include the location, elevation, and description of the facility including illustrations showing the windsock, markings, obstacle-free corridors, and all local obstacles to flight, with details.

Operational procedures

10.9 Relevant operational procedures include:

- security from vandals, straying members of the public, and unauthorised landings;
- flight booking, authorisation and reception procedures;
- the nature and frequency of pre-landing and routine helipad and equipment inspections and surface cleaning;
- the removal of snow and ice;
- radio communications;
- night flying procedures if applicable.

Lighting

10.10 Lighting considerations include:

- the specification and method of operation of the systems;
- the inspection and maintenance regime;
- stand-by power arrangements;
- the locations and responsibilities for obstacle lighting on neighbouring buildings and obstacles.

Rescue and Fire-Fighting Services

10.11 Rescue and fire-fighting considerations include:

- a statement of the RFFS category (H1 or H2);
- the safety accountabilities of chief and line fire officers and their procedures;
- details of the fire-fighting media (including replenishment and shelf-life procedures) and delivery systems;
- personnel manning, supervision and training (including records);
- procedures for Emergency Response and Contingency Plans and their routine exercising.

Anthony Morgan, Fire Officer (CAA Low Category Airport Supervisor), Heart of England NHS Foundation Trust

Fire-fighters under training

Personnel safety

10.12 To help ensure the safety of personnel, the following should be covered:

- the safety of people in the vicinity during operations;
- rules concerning restricted access to the helipad area, no smoking, the storage and use of protective clothing including ear defenders, the dangers of rotors and jet blast, how to approach and depart from a helicopter with rotors turning and stationary, and the danger of loose objects and clothing;
- training requirements for RFFS and medical teams on specific aircraft types and on the procedures for receiving and despatching patients safely.

Hospital procedures

10.13 The following procedures and information should be included:

- procedures for receiving and reacting to warnings of incoming helicopters;
- the responsibilities and individual actions of the switchboard, porters, medical and security teams;
- patient assessment and handover procedures, including the routes from the helipad, the operation of dedicated lifts and key procedures;
- contact details for hospital staff and departments and air ambulance, police, coastguard and military helicopters likely to use the helipad.

Quality assurance auditing

10.14 If the hospital has a Quality Department, the helipad should be included in its responsibilities and audit programme, or external, independent specialist helipad auditors should be employed. Audits should be planned annually to assess compliance with the local Helipad Operations Manual, and should include observation of day and night operations. Any nonconformances identified should be prioritised, and the Quality Manager or Helipad Manager should formulate a timely corrective-action plan to eradicate the root causes. The audit should remain open until agreed corrective actions have been completed and signed off by the Quality Manager or Helipad Manager, with a copy sent to the auditor if external auditing is used.

11 Engineering requirements

Introduction

11.1 The generic HBN engineering guidance for hospital facilities is not considered to be appropriate for air ambulance landing sites. Specific issues relating to these facilities are raised below.

Space requirements for services and plant

11.2 Adequate space should be made available for critical engineering services such as fire fighting, helipad access and helipad lighting for night landings. These services are often duplex or with adjacent standby plant. Electrical equipment must be supported by an uninterrupted power supply (UPS).

Ventilation

11.3 Special consideration should be given to the position of adjacent intake or exhaust vents, which may be influenced by the location of the helipad. See also paragraph 3.7.

Hot and cold water systems

11.4 The requirements for water to extinguish fires and to wash the helipad are given in paragraph 5.22.

Internal drainage

11.5 The specific requirements for helipad drainage to remove potentially burning fuel and fire-fighting media, as well as rain and melted snow, are given in paragraph 5.8.

Acoustics

11.6 Consideration should be given at the earliest opportunity to the impact of the noise of helicopters, which may otherwise affect the function of the healthcare facility. See also Health Technical Memorandum 08-01 – 'Acoustics' and paragraphs 2.11–2.14.

Fire safety

11.7 Fire-fighting requirements for elevated helipads are given in paragraphs 5.20–5.27.

Lighting

11.8 Helipad lighting has to provide reliable illumination in exposed conditions, including the strong winds caused by helicopter downwash; failure or disintegration could cause a fatal accident. Also, the lighting must meet the chromaticity and illumination levels specified in ICAO Annex 14. The lighting fitments should therefore be supplied by accredited aviation suppliers, not by domestic or normal industrial suppliers. All helipad guidance and obstacle lighting should be operated by a single switch in the vicinity of the helipad. On elevated or other pads with fire-fighting facilities, the switch should be located beside the position where the fire appliances are placed prior to a helicopter landing. The specific requirements for helipad lighting are given in paragraphs 4.14–4.22, 5.16, 6.2 and 6.3.

Commissioning and maintenance

11.9 A helipad with lighting and fire-fighting facilities should be inspected by the aviation specialist designer, the CCA Landing Site Specialist and the helicopter operator, as well as the installer.

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