Hospital Helicopter Landing Sites in NSW

Summary	The revised Guidelines incorporates international experience and best practice in the establishment of HLS, both at ground level and on elevated structures.
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Audience	All NSW Health Organisations (including the Affiliated Organisations) and NSW Ambulance Ambulance staff

HOSPITAL HELICOPTER LANDING SITES IN NSW

GUIDELINE SUMMARY

Helicopter Landing Sites (HLS) Guideline was first developed in 2005 to establish best practice of hospital-based HLS both at ground level and on elevated structures. The update to the Guideline reflects the opportunities to improve the safeguarding of strategically important helicopter landing sites in all hospital locations.

KEY PRINCIPLES

This Guideline has been developed to:

Support and inform the design or placement of hospital-based HLS to ensure any new strategic HLS are appropriately located.

Identify and incorporate international, national and statewide regulations that affect the planning and design of hospital-based HLS.

Provide a process for use by health services to assess the need for a HLS.

Provide guidance to health services regarding the ongoing management of HLS.

USE OF THE GUIDELINE

This Guideline is intended for hospital-based HLS operations only. For the purposes of this document, when reference is made to a HLS, it is assumed it is a hospital-based HLS. As this is a highly specialised area of health services operations, any works should involve the input of both NSW Ambulance Helicopter Retrieval Services and Health Infrastructure.

REVISION HISTORY

Version	Approved by	Amendment notes
July-2020 (GL2020_014)	Deputy Secretary, Health System Strategy and Planning Division	Replaces GL2018_010 Guidelines for Hospital Helicopter Landing Sites in NSW. Update reflects changes to planning framework aimed at protecting strategically important helicopter landing sites.
April 2018 (GL2018_010)	Deputy Secretary, Strategy and Resources Division	Replaces PD2005_128 Medical Helipads - Guidelines Replacement of fleet with 12 Agusta AW139 helicopters. Revised guideline will ensure refurbished landing sites are designed to accommodate the new fleet.
January 2005 (PD2005_128)	Director General, NSW Health	New Guideline

ATTACHMENTS

Guidelines for Hospital Helicopter Landing Sites in NSW: Guideline

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1 BACKGROUND

1.1 About this document

This Guideline reflects experience gained in the provision of infrastructure to support helicopter emergency medical retrieval in NSW over a 20 year period. The update includes information relating to recently introduced initiatives that seek to protect strategically important helicopter landing sites (HLS) in hospital-based locations.

This Guideline is intended for hospital-based HLS operations only. For the purposes of this document, when reference is made to a HLS, it is assumed it is a hospital-based HLS. It is not intended that existing HLS are upgraded to meet the requirements as detailed in this Guideline. Instead, all sites will be audited to ensure they are safe for continued use. In some cases, this may require some minor upgrades (e.g. lighting or site markings).

In 2017, NSW Ambulance (NSWA) replaced the existing fleet with 12 Leonardo AW139 helicopters. Offsite HLS development, use and operational requirements are the responsibility of the relevant land owner.

The Guidelines are intended for use by:

- health services that may be considering if their clinical role warrants the provision of hospital-based HLS in selected facilities
- hospitals with an identified need for a HLS (either a new build or refurbishment of a HLS where an upgrade is needed as part of a significant site redevelopment) and need information regarding planning, location, design, commissioning and selected operational considerations
- design teams engaged to document requirements.

1.2 Key definitions

Key definitions and explanation of terms are listed at Appendix 1.

1.3 Legal and legislative framework

In Australia, there is currently no established legislation applicable to the design, construction or placement of hospital-based HLS. However, Guideline H of the NASF – Protecting Strategically Important Helicopter Sites (May 2018) was developed in consultation with the Civil Aviation Safety Authority (CASA) to address this issue. The purpose of this guideline is to manage intrusions and activities in the flight paths of strategically important HLS, predominantly those associated with hospitals, and to ensure any new strategic HLS are appropriately located. There may also be other planning, location and movement approvals required.

The legislation describing the use of HLS is the Civil Aviation Regulation (CAR) 92 and places the onus on the helicopter pilot to determine the suitability of a landing site.

CASA as the regulator of aviation in Australia, provides only basic operating guidelines via Civil Aviation Advisory Publication (CAAP) 92-2 (2) Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites. This document replaced CAAP 92-2 (1). CASA does not provide design or structural information or advice.

CASA currently has a Regulatory Reform Program in place to establish new regulations/rules for helicopter operations including HLS.

2 REQUIREMENTS FOR A HELICOPTER LANDING SITE

2.1 Assessing the need for a Helicopter Landing Site

Any hospital which either refers patients to another hospital or receives patients by helicopter should consider how access to their hospital is achieved.

Patients may arrive from non-hospital locations via scene response or be moved from other hospitals (inter-hospital transfer).

The choice of transportation (road, helicopter or fixed wing) is made using pre-determined criteria and based on clinical urgency, distance, accessibility, weather, transport requirements, optimum transport team and vehicle utilisation. Medical Retrieval Selection Guidelines are developed and maintained by the NSWA Helicopter Retrieval Service.

While tertiary hospitals receiving patients from other sites have the greatest need for a HLS, other hospitals may also need helicopter access owing to their location, number of patients transfers and services profile.

When hospitals are first built or redeveloped, it is essential that requirements for a HLS are considered. This may involve:

- inclusion of a HLS where not previously provided, either on-site or nearby
- relocating a HLS from a nearby site or on-site location
- retro-fitting an existing HLS.

When considering if a hospital should have access to a HLS, factors that need to be considered may include:

- the hospital's role in the statewide trauma network
- the hospital's role in statewide critical care network for adults, paediatrics and neonates
- local geography
- proximity to other hospitals.

Any decision to include a new hospital-based HLS, or change an existing HLS, should be made in consultation with the NSWA Helicopter Retrieval Services and a small group of expert clinicians involved in the management and operation of emergency retrieval services. This group will assess emergency medical retrieval requirements for the site and consider recent data and other clinical and situational factors that will impact on the provision of safe clinical care.

2.2 Types of Helicopter Landing Sites

Hospital-based HLS are defined as helicopter landing areas located within the grounds of a hospital with easy trolley access to and from the hospital's critical care areas. These critical care areas are the emergency department, intensive care units (adult and neonatal), operating and selected procedural suites. This access may be facilitated using lifts within the hospital. Ideally this access should be undercover beyond the HLS.

At some locations, a hospital-based HLS may not be practical due to the existing arrangement of buildings on the site, a lack of space or other situational factors. In such cases an off-site HLS may be the only alternative. An **off-site HLS** is defined as a helicopter landing area designed for Helicopter Emergency Medical Service (HEMS) use that requires the use of a vehicle to convey a patient between the landing area and the hospital.

Where a need can be established, a hospital-based HLS is preferable to an off-site location. The time saved by ready access between a hospital-based HLS and critical care services has been calculated to average 15 to 20 minutes. This time can be significantly increased in the off-site scenario.

The importance of maintaining appropriate clinical care and supervision throughout all phases of transport should be considered in HLS planning. An off-site HLS will ideally be accessible by trolley as this will save time and make better use of the retrieval team.

2.3 Operational Roles and Responsibilities

Once a hospital-based HLS has been commissioned and ‘handed-over’ to the health service, the management and maintenance of the HLS and approaches, both air and land, will be the responsibility of the Local Health District/ Specialty Health Networks (LHD/SHN) facilities manager (or equivalent). In practice, the HLS is much like an ambulance parking bay located at an emergency department. The NSWA will park in dedicated ambulance bays to transfer patients but the health service is responsible for the maintenance and upkeep of this area and associated routes into the hospital.

The LHD/ SHN facilities manager (or equivalent) will be responsible for:

- planned and ad-hoc maintenance of the hospital-based HLS including paint and surface condition, lighting, windsocks, fire suppression equipment, spill kits, door access control, signage and painted markings and devices specific to an elevated HLS such as fuel-water separation equipment
- ensuring that approaches to the HLS located on the hospital grounds are maintained (e.g. trimming trees)
- liaison with neighbours to ensure that approach and departure paths to the HLS located nearby the hospital are maintained
- providing written responses to proponents and/ or the relevant approval authority on any proposed encroachments or activities in the approach and departure paths of the HLS. The LHD/SHN should engage an aviation consultant to provide expert advice relating to any potential impacts that may affect the approach and departure paths of the HLS
- currency of the relevant entry in the ERSA through Airservices
- ensuring that any changes to the HLS or risks are communicated immediately to the Office of the Director Helicopter Operations, NSW Ambulance

(AMBULANCE-Helicopters@health.nsw.gov.au).

NSWA will undertake regular safety and compliance audits of hospital-based HLS. A HLS that is identified either by crew or by an audit as unsafe will not be used until issues are rectified.

3 REQUIREMENTS FOR PLANNING AND DESIGN

3.1 Legislation and Regulation

In Australia, there is currently no established legislation applicable to the design, construction or placement of hospital-based HLS. In order to address this issue, Guideline H of the NASF – Protecting Strategically Important Helicopter Sites (May 2018) was developed in consultation with the Civil Aviation Safety Authority (CASA). The purpose of this guideline is to manage intrusions and activities in the approach and departure paths of strategically important HLS, predominantly those associated with hospitals, and to ensure any new strategic HLS are appropriately located. There may also be planning, location and movement approvals required.

The legislation describing the use of HLS is the Civil Aviation Regulation (CAR) 92 and places the onus on the helicopter pilot to determine the suitability of a landing site.

The Civil Aviation Safety Authority (CASA) as the regulator of aviation in Australia, provides only basic operating guidelines via Civil Aviation Advisory Publication (CAAP) 92-2 (2) Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites. This document replaced CAAP 92-2 (1). CASA does not provide design or structural information or advice.

CASA currently has a Regulatory Reform Program in place to establish new regulations/rules for helicopter operations including HLS.

3.2 Design Standards

Considerable design work has been undertaken internationally by the International Civil Aviation Organisation (ICAO) and the US Federal Aviation Administration (FAA). The resulting documents on the subject provide excellent advisory material, guidelines and best practice standards.

ICAO describes international Standards and Recommended Practices (SARP) for the safe conduct of civil aviation activities in the Convention on International Civil Aviation (Chicago, 1944), with the annexes applicable to helicopter operations:

- Annex 6: Operation of Aircraft - Part III: International Operations – Helicopters, 6th Edition, July 2004
- Annex 14: Aerodromes - Volume II: Heliports, 4th Edition, 2013.

Additional guidance on the design of heliports and HLS is provided in ICAO's Heliport Manual (Document No. 9261-AN/903), although this document was last amended in 1995.

Whereas ICAO Annex 14 Volume II provides SARP for the planning, design, operation and maintenance of HLS for use by the providers of these facilities, CAAP 92-2 (2) provides only limited guidance material on the minimum physical parameters required to assist helicopter pilots and operators in meeting their obligations under CAR 92.

As a signatory to the Convention on International Civil Aviation, Australia has undertaken to apply the ICAO SARP, except where specific differences have been identified to ICAO.

The Supplement (Second Edition, Amendment No.1, 18 February 1999) to Annex 14 Volume II, lists seven CASA Australia recommended differences to the ICAO SARP relating to heliports. These differences are that Australia:

- specifies a larger size and overall slope, and different minimum spacing requirements for lighting, the final approach and take-off area (FATO) specifies a different size and overall slope for the TLOF
- refers to the touch down and lift off (TLOF) areas as the landing and lift off area or Landing and Lift Off Area (LLA)
- does not require a safety area
- does not specify the dimensions of an air transit route.

Subject to these differences, CASA supported the adoption of Annex 14 SARP for helicopters.

These differences, as recommended by CASA over 20 years ago, are no longer considered by NSWA or the HEMS contractors as best practice or appropriate.

CASA is currently undertaking a Regulatory Reform Program of rotary wing aircraft and it is assumed that the ICAO SARP, with differences removed, will form the basis of the proposed Civil Aviation Safety Regulations (CASR) Part 133 pertaining to Commercial Air Transport Operations, Part 138 pertaining to aerial work operations which incorporates the winching (hoisting) component of HEMS, and Part 139R (Aerodromes Rotary Wing).

Overseas experience has resulted in the production of comprehensive heliport design and operating procedures. The US Federal Aviation Administration (FAA) has produced an Advisory Circular detailing these requirements. Within the Advisory Circular is a comprehensive section devoted to hospital-based heliports and helicopter landing sites.

While CAAP 92-2 (2) is acknowledged, the relevant key reference and documents underpinning this Policy include:

- ICAO Annex 14, Volume II Heliports, 4th Edition, 2013
- ICAO Heliport Manual Doc 9261-AN/903
- US FAA Advisory Circular AC 150/5390-2C, Heliport Design, (covers both operational and design criteria; particularly for hospital-based HLS in Chapter 4, Hospital Heliports).

Guidelines for the dimensions, marking and lighting for the LLA, TLOF, FATO area and safety area for the Design Helicopter, plus the visual flight rules (VFR) approach/ departure transitional surfaces, are specified and based upon the FAA document AC 150/5390-2C Heliport Design.

Guidelines pertaining to structural requirements for static and dynamic loads to meet the design helicopter limitations are specified and based upon the ICAO Heliport Manual Document 9261-AN/903 recommendations.

3.3 Helicopter Performance

ICAO Annex 6 Part III defines three performance categories for helicopters. It is proposed that the ICAO performance classes are adopted for CASA Part 133 and Part 138. The definitions for each performance class are:

- **Performance Class 1** (PC1) for a Category A certified helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter to land within the rejected take-off distance available or safely continue the flight to an appropriate landing area, depending on when the failure occurs.
- **Performance Class 2** (PC2) for a Category A certified helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter to safely continue the flight except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which case a forced landing may be required.
- **Performance Class 2 with exposure** (PC2 Exp) can be designed to operate with a permitted exposure time for the periods where safe continuation of flight or landing is not assured, or alternatively at all times with a safe forced landing capability. The policy recommendations for PC2 operations include the maximum permitted exposure time concept (see definitions below).
- **Performance Class 3 (PC3)** for a helicopter means the class of operations where, in the event of failure of an engine at any time during the flight, a forced landing:
    - in the case of a multi-engine helicopter - may be required, or
    - in the case of a single-engine helicopter - will be required.

In NSW, the current HEMS fleet is operated to Category A performance requirements when possible and PC1 when approach and departure paths are appropriately surveyed.

ICAO Annex 14 Volume II notes that the minimum Take-Off Climb Surface gradient for PC1 operations of 1:22/4.5%/2.5° is steeper than the minimum achievable one engine inoperative (OEI) gradient for many helicopters. The ICAO OLS criteria define obstacle restriction requirements appropriate for normal helicopter operations, (i.e. with all engines operating). In emergency situations, such as with OEI, consideration must be given to the performance capabilities of the helicopter. Such considerations should include emergency landing areas and the location of objects within likely flight paths. Operational procedures for emergency situations will be determined by individual helicopter operators on a site-specific basis. Where possible, these factors should be considered in determining the nominal alignment of approach and departure paths.

Thus the maximum take-off climb gradient requirement acceptable under these guidelines, is a take-off climb gradient of 2.5° to take account of the limited single engine performance of numerous twin engine helicopters still providing HEMS and to meet the ICAO recommendations.

3.4 Helicopter Details

3.4.1 Design Helicopter – Leonardo AW139

The design helicopter, for the purposes of HLS size and structural design, is the Leonardo AW139, the larger of the two primary types contracted to the NSWA and the only type on contract from 2017. The AW139 is a new generation helicopter increasingly used in HEMS across Australia. The specification for this helicopter will underpin the maximum weight, maximum contact load/minimum contact area for hospital-based HLS developments. The AW139 is a Category A certified aircraft capable of operating with a working load under Category A criteria, to a maximum take-off weight (MTOW) of 6,800kg (refer to Figure 1).

Figure 1: AW139 Dimensions

Source: Leonardo SPA, Construzioni Aeronautiche, Italy

3.4.2 Wheel Contact Area

The AW139 helicopter model certified MTOW is 6,800kg, and for engineering and design purposes, the maximum helicopter gross weight (static weight) is 6,800kg.

The following data, shown in the table below, has been provided by the aircraft manufacturer. Calculations are based at a MTOW of 6,800kg. Under most circumstances, Category A operations from an elevated HLS and a confined area surface level HLS, can be achieved to approximately 6,800kg. On most occasions however the weight of the aircraft would be somewhat below 6,800kg[1] as the helicopter would have burnt fuel before arriving at, or departing from, a hospital-based HLS.

The aircraft has a pair of nose wheels (together) and two single aft main wheels. Undercarriage layout is a triangle.

Table 1: Contact area and related data

Contact area and related data	Calculation
The contact area of the nose wheels	2 x 28.4cm^2 = **56.9cm^2**
The contact area of the aft main wheels	2 x 58.4cm^2 = **116.9cm^2**
The distribution percentage of gross weight	Nose wheels = **22%** Total of both main wheels = **78%**
The loading of the respective contact areas	Nose wheels = **173 psi** Each of the two main wheels = **239 psi**
Distance between contact areas	The width of the main wheels is 3m. The distance from the nose wheels to a line joining the aft main wheels at a right angle, is 4.35m.

Source: Leonardo SPA, Construzioni Aeronautiche, Italy

3.5 Site Location Considerations

3.5.1 Location

Hospital-based HLS may be either positioned on-grade (level or mounded) or as an elevated structure such as a section of hospital roof or a multi-story car park. The decision will depend on existing and planned facilities, available space / land availability and surrounding topography.

[1] Leonardo SPA, Construzioni Aeronautiche, Vergiate Italy

Helicopters offer the advantage of providing an efficient patient transport service from the pick-up point, wherever that may be, to the immediate vicinity of a hospital's critical care areas. These functional relationships should be considered during the design phase for new developments or redeveloped sites.

3.5.2 Management of Wind

Hospital-based HLS design and location should be such that downwind operations are avoided and cross-wind operations are kept to a minimum. HLS should have as a minimum two approach surfaces, separated by at least 150º. Additional approach surfaces may be provided, with the total number and orientation aimed at ensuring that the HLS usability factor will be at least 95% for the helicopters the HLS is intended to serve. These criteria should apply equally to on-grade and elevated helipads.

3.5.3 Management of Noise

To minimise noise disturbance, the ambient noise level should be considered noting that at the majority of hospitals, helicopter movements will be infrequent and landing and take-off procedures seek to minimise the time engines are left running. Typically, elevated/roof top hospital-based HLS provide a reduced noise profile for hospital residents and staff.

3.5.4 Air Traffic Considerations

Possible air traffic conflicts between helicopters using a HLS and other air traffic should be avoided where possible (i.e. below an airport approach/departure path). For HLS currently used by PC2 helicopters, the ground beneath the take-off climb and approach surfaces is required to permit safe one engine-inoperative landings or forced landings during which injury to persons on the ground and damage to property are minimised. The provision of such areas should also minimise the risk of injury to helicopter occupants. The main factors determining the suitability of such areas will be the most critical helicopter type for which the HLS is intended and the ambient conditions. Of critical importance is restricting the use of the hospital-based HLS to only helicopters contracted to NSW Health.

3.5.5 Existing Structures

The presence of large structures close to the proposed site may be the cause in certain wind conditions, of considerable eddies and turbulence that might adversely affect the control or performance of the helicopters operating at the HLS. Equally, the heat generated by large chimneys under or close to the approach and departure paths may adversely affect helicopter performance during approaches to land or climbs after take-off. It may therefore be necessary to conduct wind tunnel or flight tests to establish if such adverse conditions do exist and, if so, to determine possible remedial action.

3.5.6 Limitations to Future Development

Construction of a hospital-based HLS imposes limitations on future building development if approach and departure paths are to be preserved and operations are to be free of the effects of turbulence in all predicted wind conditions. The three-dimensional space represents an opportunity cost to a hospital or health precinct which may influence the choice of HLS location within a hospital campus. Generally, if an elevated HLS is intended, the higher its location amongst hospital buildings the better; consistent with maintaining functional relationships with the key critical care areas of the hospital.

Approach and departure path protection is accomplished via a Design Development Overlay (DDO) Survey in association with a required PC1 survey. Copies of both survey reports are to be forwarded to the relevant planning authorities (local government and the Department of Planning, Industry and Environment). Refer to Section 3.13.5.

In the absence of a survey, approach and departure path protection will still be afforded to hospital HLS using Guideline H of the NASF – Protecting Strategically Important Helicopter Landing Sites. Figure 1 of the Guideline provides a referral trigger for HLS that have not been surveyed or where the survey has not been provided to the relevant planning authority.

3.5.7 Other issues

Other factors to be considered in the selection of a site are:

- high terrain or other obstacles, especially power lines, in the vicinity of the proposed HLS
- impact on existing aviation operations
- impact on culturally, ecologically, environmentally and economically sensitive areas the availability of suitable airspace for instrument approach and departure procedures if instrument operations are planned
- the availability of suitable forced landing areas.

The essential components of a HLS are areas suitable for lift-off, or the take-off manoeuvre, for the approach manoeuvre and for touchdown. If these components are not co-located at a particular site, taxiways to link the areas will be needed.

3.5.8 Layout

Normally a HLS will have a simple layout which combines those individual areas with common characteristics. Such an arrangement will require the smallest area overall where the helicopter will be operating close to the ground and from which it is essential to remove all permanent obstacles and to exclude transient and mobile obstacles when helicopters are operating. When the characteristics or obstacle environment of a particular site do not allow such an arrangement, the component areas may be separated provided they meet their respective individual criteria. Thus a different direction may be used for take-off from that used in the approach and these areas may be served by a separate touchdown and lift-off area, located at the most convenient position on the site and connected to the other manoeuvring areas by helicopter ground or air taxiways.

3.5.9 Security

Elevated / roof top HLS are generally more secure sites than on-grade types.

An on-grade HLS may be located within a secure area with fencing and locked gates. However it may not be possible or practical to fully secure the location and thus the best that can be achieved is suitable perimeter fencing which defines the area, and at best restricts access. Such fencing should be consistent with swimming pool fencing so that it is not easily scalable. This fencing should be located at least 10m beyond the safety area perimeter of the HLS. It is important that the fence does not infringe the visual flight rules (VFR) approach/departure path and transitional surfaces.

Security fencing as described is only an aid to security and does not define any additional public exclusion zone around an operating helicopter. The public exclusion zone will be dependent on terrain and infrastructure. The downforce and lateral winds generated by a 6,800kg helicopter are substantial and require specialist advice to ensure safety of the public and public assets.

3.5.10 Links with the Hospital

An on-grade hospital-based HLS is to be connected to hospital buildings by a smooth sealed pathway at least 1.8m wide, with no cambers, gutters or gaps, and allowing for adequate space for maneuvering around corners. Stretchers or trolleys used to move life-support equipment with or without patients should be able to move along paths with one person required to push them. The maximum slope of the pathway should not exceed 1:20.

Where a vehicle is used, the ambulance trolley may traverse an unprepared surface from the ambulance to the helicopter. Such surfaces may be uneven, boggy, poorly lit or sloping. Ambulance vehicles, even when very carefully driven over gutters or ridges in off-site locations such as sports ovals, can suffer gross movement of their stretchers.

3.6 Planning Approval

Legislative requirements relating to the approval of a HLS in NSW are complex and no single source of information is available. The current legislation excludes emergency service HLS from the definition of a ‘designated development’ in the Environmental Planning and Assessment Regulation (which otherwise includes most HLS). Generally hospital-based HLS are considered ‘ancillary-use’ to the hospital purposes and are thus not a separate ‘development’. The same cannot necessarily be said of off-site emergency service HLS.

Where a new HLS or a major renovation or change to an existing HLS is proposed, a Development Application may need to be lodged with the relevant planning authority. The authority may also require an Environmental Impact Statement. HLS are ‘scheduled premises’ under the Noise Control Act and thus may require a noise licence and pollution control approval. Specialist advice should be sought about the statutory requirements for any particular facility.

Any Development Application for a HLS should also be accompanied by an assessment of any potential encroachments from existing and/or approved development or natural features (for example landscaping) into the approach and departure path(s) of the proposed HLS. The approach and departure path should be identified either through a survey or as identified in Figure 1 of NASF Guideline H – Protecting Strategically Important Helicopter Landing Sites.

Currently, approval from CASA is generally not required, however the location of local airports, runway approaches and departure flight paths and other designated airspace must be taken into consideration. Consultation with the local CASA office is advisable.

Early approval from Air Services (Airport.Developments@AirservicesAustralia.com) should also be sought for sites that may be in or around aerodromes, under the approach and departure paths of existing airports, or at hospital HLS that have an associated instrument approach procedure attached. Notification periods of a minimum of eight weeks apply for gaining approval for obstructions near hospital HLS such as tower cranes or luffing cranes.

3.7 Helicopter Landing Site Design

3.7.1 Structural Design

The FAA Advisory Circular 150/5390-2C Heliport Design states that the minimum design static load is to be equal to the helicopter's maximum take-off weight applied through the total contact area of the wheels or skids. For dynamic loads, it specifies 150% of the maximum take-off weight and assumes a dynamic load of one-fifth of a second or less duration occurring during a hard landing with the weight applied equally through the contact area of the two rear or main wheels or rear of skids. These recommendations however are primarily applied to on-grade HLS and heliports.

The HLS FATO should be designed for the largest and/or heaviest type of helicopter that is anticipated to use the HLS. The design should consider all types of loading such as staff, medical equipment etc. In NSW, the AW139 is considered as the Design Helicopter. For HLS design loading, the MTOW is 6,800kg.

For the purpose of design, it is assumed that the helicopter will land on two main wheels, irrespective of the actual number of wheels in the undercarriage, or on two skids as fitted to other types of helicopter that may use the HLS. The loads imposed on the structure should be taken as point loads at the wheel centres. Refer to Table 1 for detail on load distributions.

The design must allow free movement of hospital trolleys and ambulance stretchers across the HLS. Concrete deck HLS are preferred. The use of aluminium prefabricated HLS is acceptable if it meets all design criteria of this policy. The deck surface of a prefabricated aluminium HLS must not include surface ridging (i.e. it must be smooth but with a non-slip surface).

3.7.2 On-grade Helicopter Landing Site

For an on-grade HLS, the advisory information recommends that the dynamic loads will be met with a sealed FATO area constructed of 150mm thick reinforced concrete slab base.

3.7.3 Elevated Helicopter Landing Site

The structural design advice from the ICAO Heliport Manual is considered to be the most appropriate for the construction of elevated, or roof-top, HLS.

When designing a FATO on an elevated HLS, and in order to cover the bending and shear stresses that result from a helicopter touching down, the following should be taken into account:

Dynamic load due to impact on touchdown

The dynamic load should accommodate a normal touchdown, with a rate of descent of six feet per second, which equates to the serviceability limit state. The impact load is then equal to 1.5 times the maximum take-off mass of the helicopter.

The emergency touchdown should also be covered at a rate of descent 12 feet per second, which equates to the ultimate limit state. The partial safety factor in this case should be taken as 1.66.

Hence, the ultimate design load is:

- 1.66 service load
- (1.66 x 1.5) maximum take-off mass
- 2.5 maximum take-off mass.

To this should be applied the sympathetic response factor discussed at 3.7.5.

Sympathetic response on the Final Approach and Take Off Area

The dynamic load should be increased by a structural response factor dependent upon the natural frequency of the roof top slab when considering the design of supporting beams and columns. This increase in loading will usually apply only to slabs with one or more freely supported edges.

It is recommended that the average structural response factor (R) of 1.3 should be used in determining the ultimate design load.

Other design considerations involving the overall superimposed load from staff and equipment on the HLS are in this case negligible, however the ICAO Heliport Manual does provide an allowance of 0.5 kW/m2.

In essence, the structural design of an elevated HLS should consider:

- static loads due to the helicopter at rest
- dynamic loads on particularly the TLOF and out to the FATO, due to impact of the helicopter on touchdown
- sympathetic response (resonance) of the HLS structure
- staff, freight and equipment loads
- wind loads
- lateral loading on supports

- the dead load of structural members
- punching shear.

It is strongly recommended that the structural design based on the ICAO Heliport Manual specifications be considered.[2]

3.8 Helicopter Landing Site Dimensions and Safety Criteria

A HLS may be at ground level or elevated. Preference is for a round HLS, however on occasions design constraints may require a square deck. In all cases however, the markings should represent a circular HLS. If it is elevated it will include a surrounding safety net, and be to the minimum dimensions and structural integrity required to meet the Design Helicopter specifications. It should be noted that elevated HLS generally provide better obstacle clearance, both present and future, particularly in urban areas. The minimum required dimensions are based on the AW139. The following information is relevant for a single HLS and thus a single FATO.

3.8.1 Final Approach and Take-Off Area

Diameter minimum 1.5 x length = 1.5 x 16.62m = 24.93m, rounded to a diameter of **25m** or **25** x **25m**.

3.8.2 Touch Down and Lift Off Area (TLOF)

Diameter minimum is the main rotor diameter of 13.8m, rounded to a diameter of **14m** or **14** x **14m**.

3.8.3 Landing and Lift Off Area (LLA)

Diameter minimum of **6.35m** or **6.35** x **6.35m**. As the FATO area is to be load bearing, it follows the both the TLOF and LLA will also be load bearing. In such cases, the LLA will not be defined on the HLS deck.

3.8.4 Safety Area

The FATO will be surrounded by a safety area which will be free of all obstacles. The safety area may project out into space for an elevated HLS.

The purpose of a safety area is to:

- reduce the risk of damage to a helicopter caused to move off the FATO by the effect of turbulence or cross-wind, missed landing or mishandling
- protect helicopters flying over the area during landing, missed approach or take-off by providing an area which is cleared of all obstacles except small, frangible objects which, because of their function, must be located on the area.

[2] Heliport Manual Doc 9261-AN/903

A safety area surrounding a FATO intended to be used in visual meteorological conditions (VMC) will extend outwards from the periphery of the FATO for a distance of 0.3 times the rotor diameter (RD) of the Design Helicopter. This size assumes that all markings and lighting will be in place.

Therefore, 0.3 x RD (13.8m) = 4.14m. The Safety Area width surrounding the FATO is thus rounded to **4m**.

No fixed objects will be permitted on a safety area, except for frangible mounted objects which, because of their function, must be located on the area. No mobile object will be permitted on a safety area during helicopter operations.

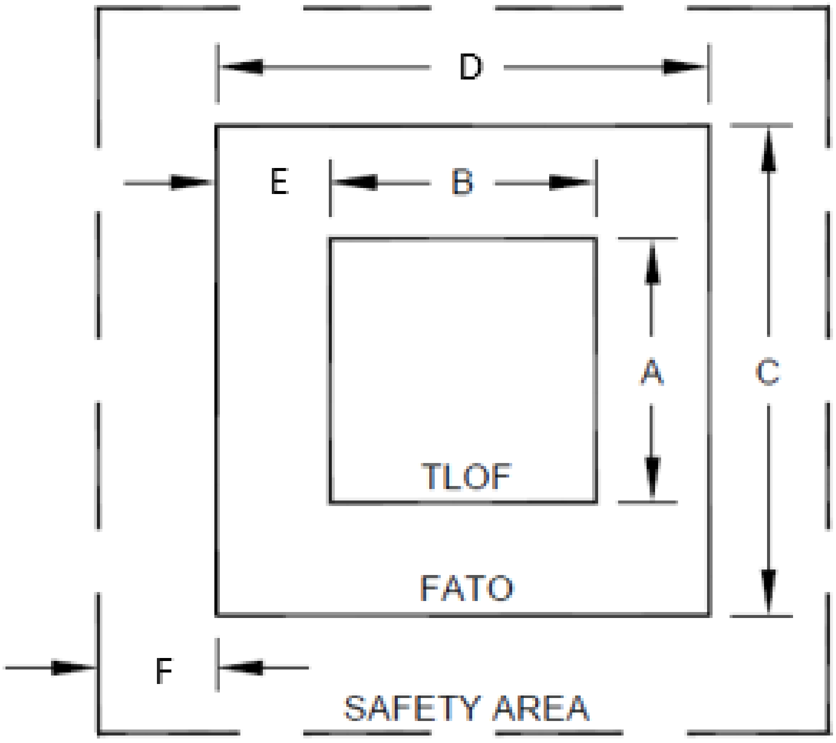
Where possible, no objects are to be located within the safety area. However, objects whose functions require them to be located on the safety area must not exceed a height of 250mm when located along the edge of the FATO, nor penetrate a plane originating at a height of 250mm above the edge of the FATO and sloping upwards and outwards from the edge of the FATO at a gradient of 5%. The surface of the safety area will not exceed an upward slope of 4% outwards from the edge of the FATO.

The surface of the safety area abutting the FATO will be continuous with the FATO and the whole of the safety area will be treated to prevent loose items and any other flying debris caused by rotor downwash.

The minimum recommended safety area surrounding the FATO is dependent upon whether there are suitable markings for the FATO, the TLOF and the central 'H'. The FATO, TLOF and the 'H' are to be appropriately marked with paint, and lighting to support night operations requirements (refer Section 3.8). With such markings, the safety area minimum is to be **4m** in width and surround the FATO. If square, the FATO area will be **33** x **33 m**. If round, the diameter, including the safety area will be (25 + 8 m) = **33 m**. See Figures 2 and 3.[3]

[3] AC 150/5390-2B

Figure 2: TLOF and FATO/Safety Area Relationships and Minimum Dimensions

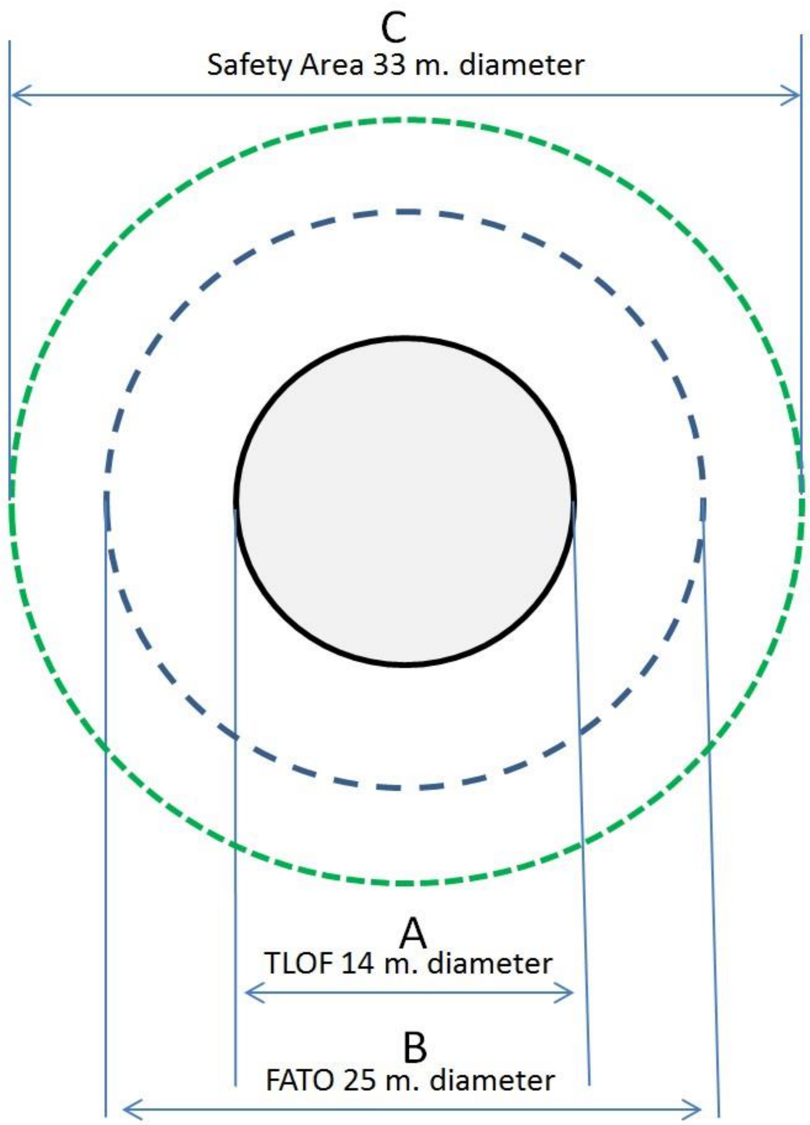


Source: AviPro

Notes:

Design Helicopter: Leonardo AW139
RD: Rotor diameter of the design helicopter
OL: Overall length of the design helicopter
A – Min TLOF Width: 1.0 x RD (14m) (if round, diameter is 14m.)
B – Min TLOF Length: 1.0 x RD (14m)
C – Min FATO Width: 1.5 x L (25m) (if round, diameter is 25m.)
D – Min FATO Length: 1.5 x L (25m)
E – Min separation between perimeters of the TLOF and FATO: 0.5(1.5 x OL – 1.0 x RD) (5.5m)
F – Min Safety Area Width: 0.3 x RD (4m)

Figure 3: TLOF, FATO, Safety Area – Round HLS



Source: AviPro

<u>Notes</u>:

Preference is for a round HLS.

Design Helicopter:	L AW139
RD:	Rotor diameter of the design helicopter
L:	Overall length of the design helicopter
A –TLOF diameter:	1.0 x RD (14m.)
B –FATO diameter:	1.5 x L (25m.). All load bearing.
C –Safety Area width:	0.3 x RD (4m.)

Min separation between perimeters of the TLOF and FATO: 0.5 (1.5 x OL – 1.0 x RD) (5.5m)

3.8.5 Non-Contiguous TLOF and FATO

It is permissible to design a FATO and TLOF that are separated. Such design parameters are highly specialised and require case by case consideration. Refer to the ACC for further advice.

3.8.6 Parking Position

A parking position is recommended where the HLS is to be made to accommodate a second helicopter. Ideally, a parking position will be provided in tertiary trauma centres:

- located in a regional area (e.g. John Hunter Hospital)
- at a few tertiary centres located within the Sydney metropolitan area. This will allow the Helicopter Retrieval Services to have some options should a HLS at a selected location be unavailable.

These types of requirements will be discussed at expert clinical review group meetings and during early Design Development discussions with Health Infrastructure projects.

3.8.7 Perimeter Safety Net

A perimeter safety net is required to surround the edge of an elevated/roof top HLS. It will not be less than 1.5m wide, have a minimum load carrying capability of 122 kg/ m^2 and not project above the HLS deck. Both inside and outside edges of the safety net are to be secured to a solid structure.

3.8.8 Slope and Drainage

Within the FATO, the maximum slope in any direction should not exceed a maximum of 3% and is recommended at 2%. Adequate water/spill drainage is required to account for prolonged heavy rain.

3.8.9 Fuel/Water Separator

Arrangements are required to ensure that any spilt fuel or lubricants do not enter the water drainage system. This is a relatively simple process at an on-grade HLS. It is however more complex for an elevated/roof top HLS and a recommended solution is a gravity-operated fuel/water separator of sufficient size (total capacity of ~2,700 litres (L) static holding capacity of ~1,500L and integral storage of 1,200L). It should be installed below the deck level to ensure that any fuel, oils and greases are appropriately collected in the event of spillage. The separator should have an adjustable oil draw-off, a contents indicator and integral baffle system. Stainless steel is recommended.

3.8.10 Access Points/Dimensions

Two access points are required for elevated HLS. The primary access point is at the same level as the HLS deck and should provide an access-controlled door or doors with a clear opening of at least 1.8m. This would normally lead directly (on-grade HLS) or via a lift to critical care areas of the hospital. The second access point is to be at the opposite side of the HLS to allow for emergency evacuation if required. This access would normally be in the form of stairs leading down from deck level to an emergency egress stairwell.

3.8.11 Windsock

A windsock, rated to 30 knots, is required to show the direction and magnitude of wind. The windsock should provide the best possible colour contrast to its background. To provide maximum contrast, yellow is preferred over white. It should give a clear indication of the direction of the wind and a general indication of the wind speed. The wind direction indicator is to consist of a truncated cone of lightweight fabric, 2.4m long with diameters of 0.6 and 0.3m at respective ends. It is to be located to provide the pilot with valid wind direction and speed information in the vicinity of the HLS under all wind conditions. It must be clearly visible to the pilot on the approach path and understandable from an operating height of not less than 500 feet above the HLS when the helicopter is at a distance of 150m from the HLS, and be clearly visible when on the HLS.

The windsock should also be clearly visible to the pilot from the cockpit when the helicopter is positioned (landed) on the HLS.

The windsock is to be located outside the safety area to avoid presenting an obstruction hazard. It will not penetrate the VFR approach/departure path but may penetrate the transitional surface.

For night operations, refer to Section 3.11.

3.8.12 Fuel

Hospital-based HLS intended for use as a permanent base of operations will require refuelling facilities. Such facilities will normally be bulk storage, either underground or in above ground storage tank. To avoid double handling, it is desirable to locate refuelling facilities on a parking apron sufficiently removed from the FATO as to allow another aircraft to land or take-off. A HLS with refuelling facilities should have a parking position. The anticipated fuel usage will dictate the bulk storage volume necessary. Professional advice will be needed.Where drum stock is used, provision for sufficient secure under cover storage is needed. Dangerous Goods Legislation governs the quantities allowed to be stored within a hangar and in other forms of storage accommodation. Unless an exceptional case is made, a hospital-based HLS will not require refuelling facilities. Refuelling will be conducted at nearby airports.

3.8.13 Magnetic Resonance Imaging Interference

Magnetic resonance imaging (MRI) scanners are located in hospitals for diagnostic purposes. An MRI creates a strong magnetic field when in operation which will cause temporary aberrations in the helicopter's magnetic compass and may interfere with other navigational systems. It is the responsibility of the relevant hospital to provide the helicopter operator/pilot with details of the location of the MRI and similar equipment. This information should be included in the ERSA entry for the HLS. A warning sign is to be placed on the HLS surface alerting pilots to the presence of an MRI, should there be a possibility of interference. A MRI marker is to be painted in black[4]. See the example at Figure 4.

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[4] U.S. Department of Transportation SAFO 06-007. DATE: 7/20/06, Federal Aviation Flight Standards Service, Administration Washington, DC

Figure 4: Example MRI Direction and Distance Marker in Metres

Source: AviPro

3.8.14 Radio Communication

Good communications between the helicopter, the hospital and the NSWA Aeromedical Control Centre (ACC) is essential. This may be via cell phone, radio or both. It has become common hospital practice for the local security department to be responsible for HLS security, access, safety, lighting and communications.

Radio communications between the hospital HLS. This communication is facilitated by the hospital switch/ control room.

3.8.15 Fire Fighting Appliances

There are currently no regulatory standards in NSW for fire-fighting appliances at a HLS. The most appropriate fire protection involves foam making equipment such as a Fixed Monitor System (FMS) / oscillating monitor nozzle/s for a concrete HLS, or a foam Deck Integrated Fire Fighting System (DIFFS) for a prefabricated steel or aluminium HLS deck. The offshore resources industry requires foam DIFFS on manned HLS decks and the less effective and cheaper water-only DIFFS for unmanned HLS decks. Both on-grade and elevated hospital HLS decks are considered as manned HLS. A foam system (Fixed Monitoring System – FMS) is more important on an elevated HLS deck due to the potential collateral damage following a deck fire. Excellent reference material is contained within the US National Fire Protection Association publication NFPA 418 Standards for Helipads. This publication is called up by CASA in CAAP 92-2 (2). In all situations the advice of the local fire authorities is to be sought for the latest information. It is likely that future CASA Part 139R rules will detail specific firefighting equipment limits for both on-grade and elevated HLS.

The **minimum** standards currently are as follows:

- a fire water point with fire hose located adjacent to the primary HLS deck access point.
- firefighting appliances suitable for liquid and electrical fires located in the vicinity of the primary access point, including:
    - 1 x CO_2 3.5kg
    - 1 x dry powder, 9.0kg
    - 1 x foam, 90L
    - 1 x fire blanket.

Hospitals should note the weight and manoeuvre capability of the 90Lfoam extinguisher. In some cases, these are difficult to move and a four-wheel cart base could assist in the versatility of the extinguisher.

Similar appliances may be located within the emergency egress stair well on elevated HLS.

3.8.16 Instrument Approach Aids and Visual Glideslope Indicators

The use of satellite-based GPS approaches to the HLS should be considered when siting a hospital-based HLS. This requires consideration of the approach/departure path obstacles and their impact on future instrument approach minimum altitudes and also the reservation of space to install instrument approach lighting arrays which may be required for precision approach procedures.

There are also several glide slope indicator systems available, with details available through the office of the Deputy Director Helicopter Retrieval Services at NSWA.

3.8.17 Exhaust Gas Ingestion

Hospital air-conditioning air intake systems must not be positioned in the vicinity of an elevated HLS. The design helicopter burns almost 500L of kerosene per hour and presents a noticeable odour. In the event of the duct being in the vicinity to ingest exhaust gases a closure or redirection facility will be required for the relatively short period the aircraft turbines are exhausting. Under particular wind conditions the exhaust gases emitted from the helicopter engines exhausts can travel for some distance and if ingested into hospital ventilation systems, can cause considerable consternation; even if the gases involved are below noxious levels.

3.9 HLS Surface and Markings

All paint used on a HLS surface is to be hard wearing gloss, hydrocarbon resistant, UV resistant and non-slip. The HLS is to be painted neutral grey, out to at least the perimeter of the FATO. On a concrete surface, an appropriate sealer is required. Surface markings are to identify the facility as a HLS. Lines/markings for the FATO and TLOF are to be 30cm wide and painted in a white to make them conspicuous.

Colours required as based upon AS 2700 Colour Standards for General Purposes, and are as follows:

- Neutral Grey N23
- White N14
- Waratah Red R14
- Black N61
- Golden Yellow Y14

3.10 TLOF and FATO Perimeter Marking

3.10.1 Overview

The perimeter of the TLOF and the FATO is to be defined with markers and/or lines.

The perimeter of the TLOF is to be defined with a continuous white line 30cm wide.

The perimeter of the FATO is to be defined with a 30cm wide dashed white line. The corners of a square FATO should be defined, and the perimeter marking segments are to be 30cm in width, approximately 1.5m in length, and with end-to-end spacing of approximately 1.5m. Refer to Figure 5 Standard Hospital HLS Identification, Markings, Dimensions and Colours.

The identification marking is intended to identify the location as a hospital-based HLS, clearly identify the TLOF and FATO, and therefore provide visual cues to the pilot

The standard marking is a red ‘H’ in a white cross over a red square background, defined by the TLOF continuous white line. The ‘H’ is to be oriented to magnetic north. Yellow arrows and landing direction lights (refer Section 3.11.4 and Figure 9) are also to be used to indicate two preferred and PC1 surveyed approach/departure directions. Figure 5 illustrates the requirements of the standard hospital HLS marking, dimensions and paint colours.

3.10.2 Hospital Identifier

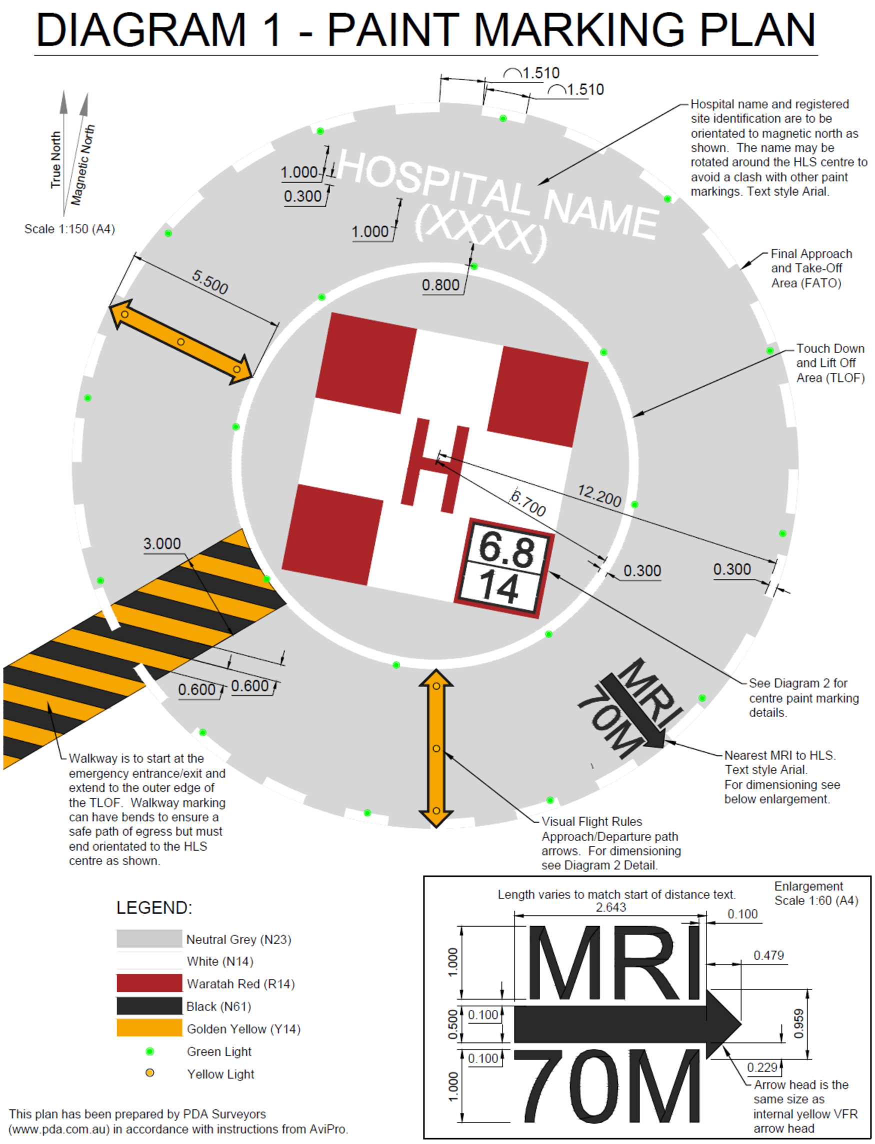
Each HLS will have the name of the hospital and a designated and unique four letter Airservices Location Code identifier painted on the HLS surface orientated to magnetic north, and normally positioned between the TLOF and FATO boundaries. If sufficient space exists beyond the FATO boundary, they may be placed on the outside of the FATO boundary. The letters if possible should be one metre high, in white and marked as shown in Figure 6.

3.10.3 Weight and Rotor Diameter Size Limitation Markings

Within the TLOF and at the lower right-hand side of the 9 x 9m red square beneath the white cross, is a white box surrounded by a black edge, containing in its upper half the Maximum static Take-Off Weight limit marking of the Design Helicopter in metric units.

The lower half is to contain the main rotor diameter of the Design Helicopter, i.e. above, a marking of “**6.8**” equating to 6,800kg, and below, “**14**”, equating to a rotor diameter the Design Helicopter. The numbers should be 0.9m high and black on a white background. Figure 6 following depict typical ground level HLS markings in colour.

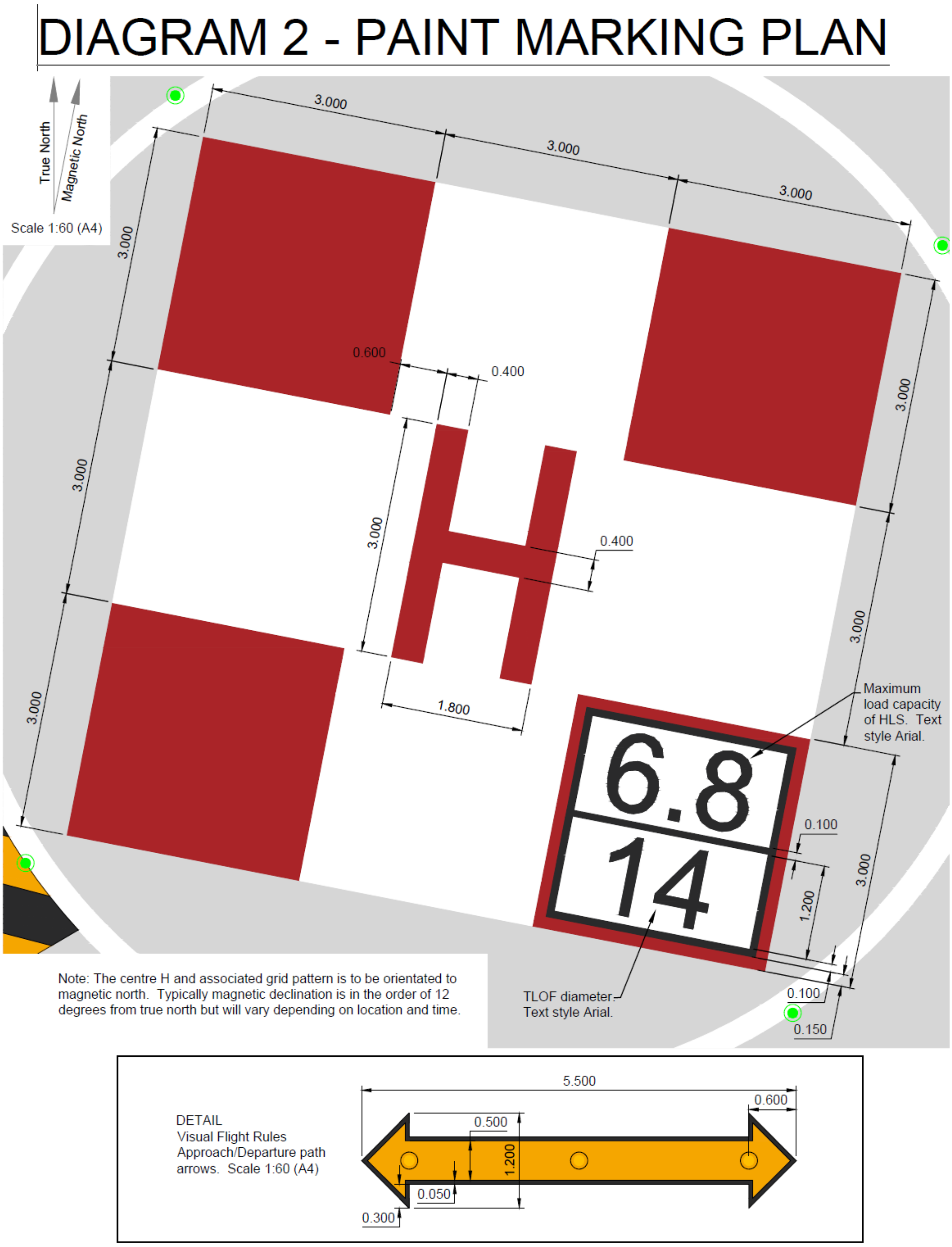
Figure 5: Standard Hospital HLS Identification, Markings, Dimensions and Colours



Source: AviPro

Note: The standard hospital identification is a red ‘H’ surrounded by a white cross over a red square, orientated to Magnetic North.

Figure 6: TLOF Colour Scheme, Maximum Weight and Rotor Diameter Limits



Source: AviPro

3.10.4 Helicopter Landing Site Deck Walkways

Painted walkway markings are to be positioned on the decks of HLS. They are to be direct from the primary deck access point entry doors on elevated HLS, and from at least the edge of the safety area on surface level HLS, to the edge of the TLOF. Walkways must be a minimum of 1.8m wide and be painted in hard wearing (road type), hydrocarbon resistant, UV resistant and non-slip yellow and black diagonal lines.

The pavement is to be designed so that spilled fuel or lubricants do not drain onto passenger walkways or toward a parked helicopter.

3.10.5 Surface Level Walkways and Paths

Surface level or on-grade walkways and paths will be sealed, not exceed a slope of 1:12, have no steps, and not less than 1.8m wide. If possible, they should be covered to within 20 metres of the HLS Safety Area boundary.

Surface level or on-grade walkways and paths are to be sealed with gentle sweeping turns, have no steps, and not less than 1.8m wide. If possible, they should be covered to within 20m of the HLS Safety Area boundary. A slope of 1:12 is considered the absolute maximum for a short distance i.e. < 10m If the path is longer than 10m, 1:20 or less is to be sought.

3.10.6 Magnetic North Orientation

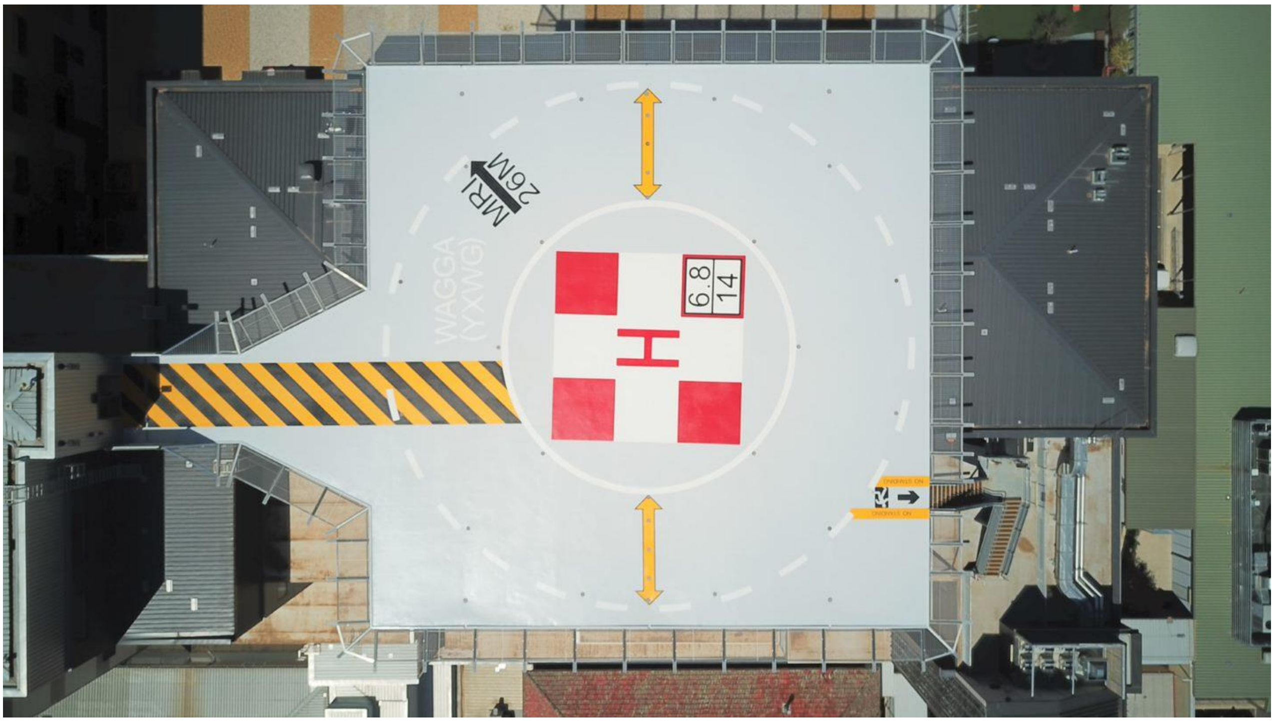
The ‘H’ marker and thus its white cross background are to be orientated towards magnetic north.

3.10.7 Roof Top Helicopter Landing Site Layout

Figure 7 provides an example of an elevated HLS layout incorporating:

- TLOF perimeter markings and lighting
- safety net and safety area
- maximum weight and rotor size limitation markings
- HLS deck walkway
- hospital identifier
- HLS identification ‘H’ oriented to magnetic north
- MRI direction
- preferred approach and departure direction
- secondary HLS deck emergency exit.

Figure 7: Example Roof Top HLS Layout



Source: AviPro

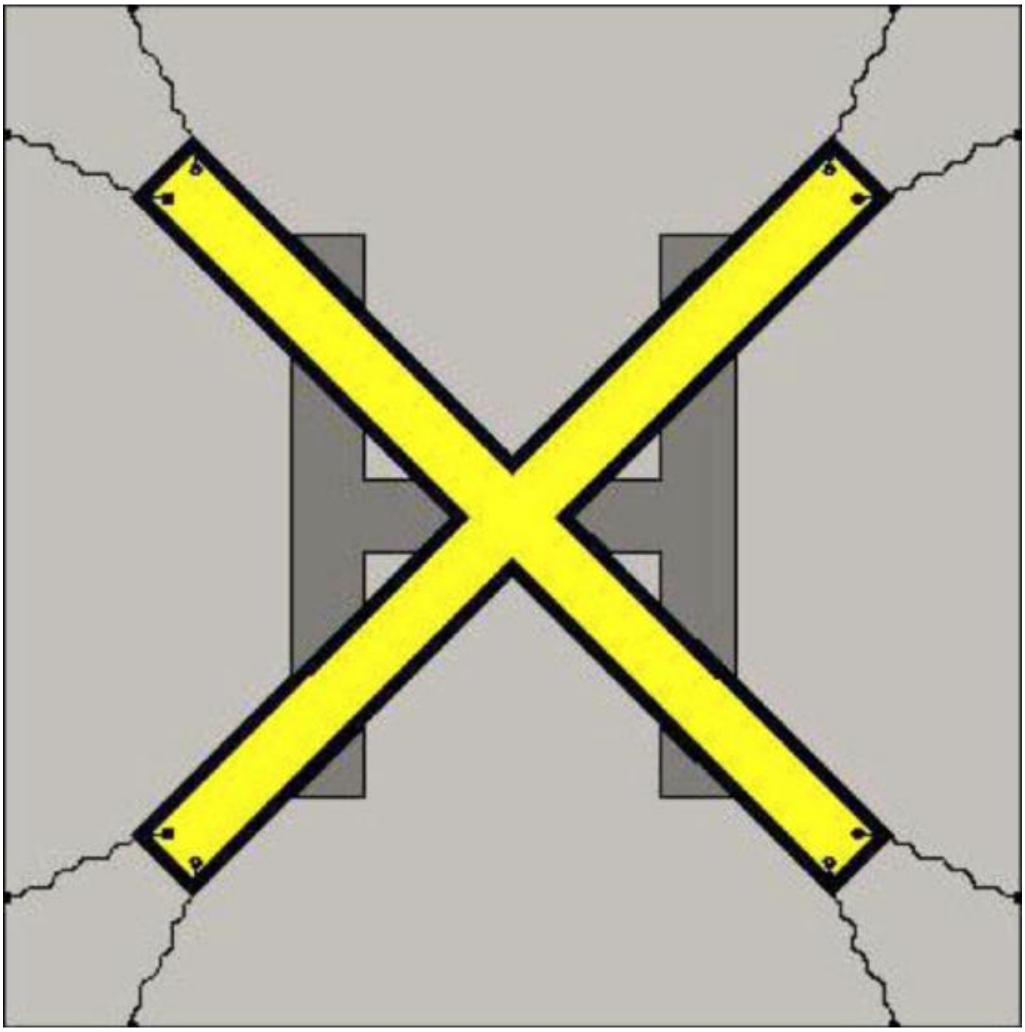
Notes

- HLS deck in light grey.
- The perimeter of the FATO is defined with a dashed white 30cm wide circle at 25m diameter, and with 12 flush mounted NVG Compliant green lights.
- The perimeter of the TLOF is defined with a continuous, white 30cm wide circle at 14 m diameter, and with eight flush mounted NVG Compliant green lights.
- The direction arrows are yellow, with a minimum of three flush mounted yellow lights.
- HLS identification marking is a red “H” on a white cross orientated to magnetic north.
- Walkway is in yellow and black stripes (chevrons).

3.10.8 HLS Unserviceability

A HLS which is unserviceable must be notified immediately to the ACC by phone and completing the (via online helipad notification form. Non-urgency matters will be communicated using the online helipad notification form. For extended periods of unserviceability, the HLS is to be appropriately marked by a yellow “X”. See Figure 8.

Figure 8: HLS Unserviceability marker



3.11 Lighting

3.11.1 Helicopter Landing Site Lighting

For night operations, the TLOF, the FATO, approach/ departure directions, and the windsock are to be illuminated. Additionally, there are to be appropriately positioned obstruction lights. To accommodate night vision goggles (NVG) operations, all HLS lighting other than the flood lights, must be NVG compatible/compliant/friendly and must be visible from a distance of at least 3km at the prevailing Lowest Safe Altitude (LSALT) in clear conditions. That is, all lighting must be visible both with and without the use of NVG under these conditions.

To meet NVG requirements, all lights must operate within the wavelength range of 600 and 900 nanometre (nm). Current generation LED lights have been found noncompliant, unless they are equipped with additional IR LEDs providing a wavelength of approximately 850nm. Only NVG compliant lights are acceptable.

A statement acknowledging NVG compliance is required from the lighting contractor.

3.11.2 TLOF Perimeter Lights

The TLOF perimeter is to be lit with green lights. Flush mounted lights are to be used, and they are to be located within 30cm of the outside edge of the TLOF perimeter (14m diameter). If lights cannot be aligned with the TLOF painted marking, positioning on the outside edge provides better visual cues to pilots when at a distance from the HLS, since they outline a larger area. A minimum of eight uniformly spaced lights is required.

3.11.3 Load Bearing FATO Perimeter Lights

The FATO perimeter is to be lit with flush mounted green NVG compliant lights. They are to be located within 30cm of the outside edge of the FATO perimeter (25 m diameter). It lights cannot be aligned with the FATO painted marking, positioning on the outside edge provides better visual cues to pilots when at a distance from the HLS, since they outline a larger area. A minimum of 12 uniformly spaced lights is required.

3.11.4 Landing and Take-Off Direction Lights

Landing and take-off direction lights are required for both surface and elevated HLSs. They are to be installed on the deck to provide landing and take-off directional guidance at night. Landing direction lights are a configuration of three yellow, flush mounted omni-directional lights on the centreline of a yellow two headed arrow with black borders painted on the deck. The arrows show the preferred VFR approach/departure path/s, which ultimately will all be surveyed to meet PC1 requirements. The arrows are to be positioned on the deck between the TLOF and FATO markings. An example of a correctly positioned VFR approach/departure path arrow with NVG compliant yellow lights follows at Figure 9.

Figure 9: Approach/Departure Directional Arrow and Lights

Source: AviPro

3.11.5 Taxi Route and Taxiway Lighting

Taxiways may be required in some situations such as where the FATO and TLOF are not contiguous. Refer to the ACC for advice.

3.11.6 Windsock Lighting

The windsock is to be illuminated by four closely mounted white lights to ensure that it is seen clearly from all directions. A red obstruction light is also to be positioned on the top of the mast. Refer to Figure 10.

Figure 10: Windsock and Lighting

3.11.7 Flood Lights

Flood lights are to be positioned to illuminate the TLOF and the FATO for the purposes of aiding in helicopter patient loading and unloading. To eliminate the need for tall poles, these flood lights may be mounted on a co-located building wall if it is high enough. The flood lights are to be clear of the TLOF, the FATO, the Safety Area, and the approach/departure surfaces and any required transitional surfaces. Care should be taken to ensure that flood lights and their associated hardware do not constitute an obstruction hazard. Flood lights should be aimed down and provide a minimum of 3-foot candles (32 lux) of illumination on the HLS surface. Flood lights can interfere with pilot vision during take-off and landings and are therefore to be capable of being independently manually turned off. They are to be on a separate circuit to that of all other lights. Low level (deck level) low intensity flood lights do not meet the purpose and present unacceptable obstacles and are not to be used.

3.11.8 Walkway and Pathway Lighting

Lighting will be required to illuminate walkways and pathways and must be directional so as not to create a hazard for NVG operations.

3.11.9 HLS Identification Beacon

A HLS identification beacon is to be located as close as is practical to the HLS and on the highest point of the hospital reasonably available. The beacon is to be capable of flashing white/green/yellow at the rate of 30 to 45 flashes per minute. Recommended candelas range is 600 to 1,000 to provide a low intensity beacon visible between 10 and 12nm by night. When pilot activated lighting (PAL) is in use, the beacon is to be on the PAL circuit. Beacon systems utilising three independent lights must position each light at 12-15° above the horizontal. There are currently only two manufacturers with approved beacon lights. Refer to NSW Ambulance for advice.

All HLS lighting must be capable of manual activation and deactivation. Flood lighting must be on a separate circuit to that of the FATO, TLOF, approach/departure directional lighting, beacon, windsock, local obstruction lighting and any visual glideslope indicator installed. These latter lights may be on a common circuit.

All but flood lighting may also be activated via a PAL system. This utilises a hospital based VHF radio and a timed switching device. The pilot is able when within range (~20 nm), to activate via a VHF radio transmission from the aircraft, on a pre-set frequency. The PAL system will operate for a period of 45 minutes. Lights may be manually turned on and may be manually turned off within the 45 minutes, or they automatically turn off at 45 minutes after a 10 minute flashing warning. The installation of PAL equipment is recommended.

The manual activation switching must be readily accessible to the HLS attendant staff, and on an elevated HLS, is normally located within the lift lobby/ HLS deck reception room adjacent to the PAL controller.

3.11.10 Stand-by Power Supply

HLS lighting requires a stand-by electrical power supply. An uninterrupted power source is not required. Helicopter Landing Site Lighting Suppliers

There are a number of aerodrome and HLS lighting equipment suppliers. Advice can be sought from the NSW Ambulance Deputy Director Helicopter Retrieval Services.

3.12 Obstructions

3.12.1 Object Marking

HLS maintenance and servicing equipment, as well as other objects used in the airside operational areas, should be made conspicuous with paint, reflective paint, reflective tape, or other reflective markings.

Particular attention must be given to marking objects that are hard to see in marginal visibility, such as at night, in heavy rain, or in fog.

3.12.2 Obstruction Lighting

Marking and lighting of obstructions relates to those objects considered an obstruction on or in the vicinity of the HLS and within the approach/ departure airspace, and obstructions in close proximity but outside and below the approach/ departure surface. Obstruction lights are red. Low intensity steady red lights are suitable.

Obstruction lights should be linked with photo-electric (PE) cells and illuminate in poor/low light conditions regardless of the use of the HLS. They should be placed on the highest obstruction associated with the HLS and on corners of adjacent buildings. Advice needs to be sought from an appropriate aviation advisor for safety compliance requirements of obstruction lights.

3.12.3 Obstructions on or in the vicinity of the Helicopter Landing Site

The adverse effect of an object presumed or determined to be a hazard to air navigation may be mitigated by:

- removing the object
- altering the object (e.g. reducing its height)
- marking and/or lighting the object, provided that the object would not be a hazard to air navigation if it were marked and lit.

An example of an obstruction light required close to the HLS would be that required to be positioned on the top of the windsock. Refer to Figure 10. Other obstacles in close proximity to the HLS deck may include radio aerials, cell towers, lightning arrestors or exhaust stacks attached to the main building or other buildings in the vicinity. All such obstacles are required to have red obstacle lights fitted.

3.12.4 Obstructions in close proximity but outside and below the Approach/Departure surface

Unmarked wires, antennae, poles, cell towers, and similar objects are often difficult to see even in the best daylight weather, and in time for a pilot to successfully take evasive action. While pilots can avoid such objects during en-route operations by flying well above them, approaches and departures require operations near the ground where obstacles may be in close proximity. Where power lines or wires present a potential obstacle threat to a HLS, the positioning of power line hazard markers (balls) may be necessary. Reflective marker flags are recommended.

If difficult-to-see objects penetrate the object identification surfaces as illustrated in Figure 11 (Section 3.11.1), these objects should be marked to make them more conspicuous.

3.12.5 Shielding of Objects

If there is a number of obstacles in close proximity to the HLS, it may not be necessary to mark/light all of them if they are shielded. To meet the shielding guidelines an object would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation.

3.12.6 Positioning of Hospital Gas Storage Cylinders/Containers

Inflammable hospital gasses such as bulk storage LPG and oxygen cylinders/containers are not to be positioned below the VFR approach/departure paths and are to be at least 30m beyond the approach and departure paths and safety area boundary.

3.12.7 Cranes in the vicinity of the Helicopter Landing Site

Most sites will experience the requirement for a crane within the vicinity of the HLS during a hospital or adjacent development. The significance of this, on service delivery impact cannot be understated and there will be positioning and lighting requirements that need to be addressed in addition to the Civil Aviation Safety Authority (CASA) Manual of Standards (MOS) Part 139 requirements.

The illumination requirements for cranes in the vicinity of a Hospital HLS are detailed below.

As a minimum for all tower cranes:

- top of crane A frame or cabin: medium intensity flashing red obstruction light.
- both ends of Jib: medium intensity flashing red obstruction light
- along Jib: line of white LED fluoro on a PE cell along the full length of the jib, and
- tower section: stairway lights or spot lights attached to the top of the tower pointing down and onto the tower (not up into pilot eyes).

As a minimum for all luffing cranes:

- top of crane A-frame or cabin: medium intensity red obstruction light
- end of Jib: medium intensity red obstruction light
- along Jib: line of white LED fluoro on a PE cell along the full length of the jib
- tower section: stairway lights or spot lights attached to the top of the tower pointing down and onto the tower (not up into pilot eyes)
- the LED jib fluoro lights are to be LED weather proof emergency fluoros controlled via a PE cell with a minimum 90 minute battery back-up.

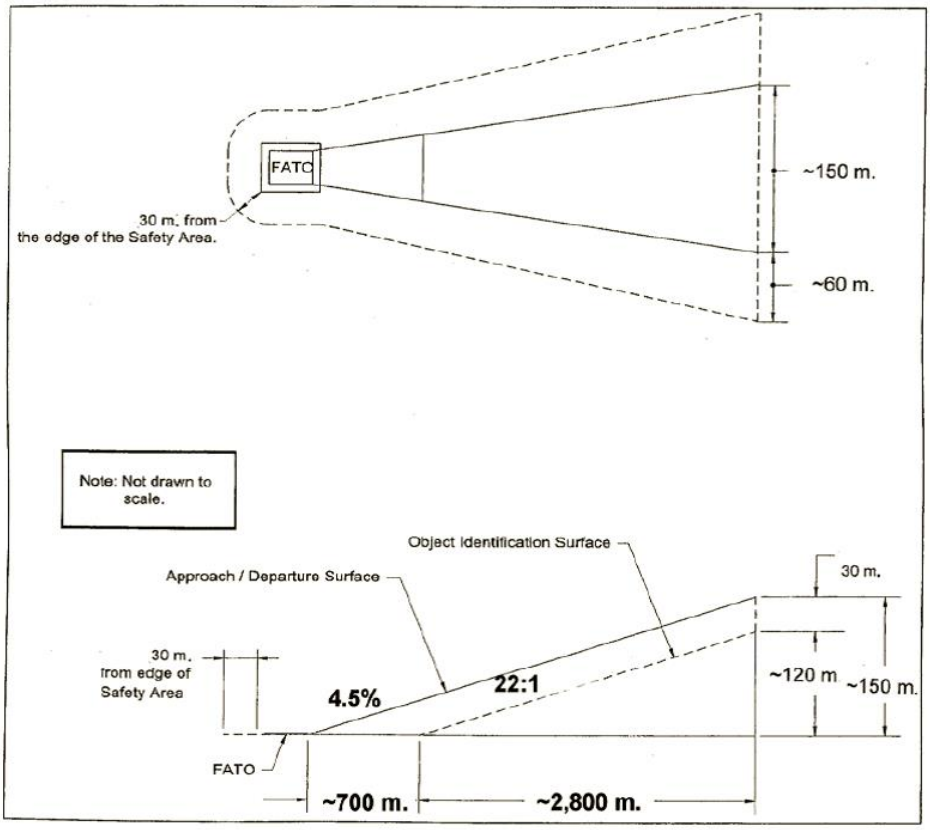
3.13 Object Identification Surfaces

The object identification surfaces (OIS) can be described as:

- in all directions from the safety area, except under the approach/departure paths, the object identification surface starts at the safety area perimeter and extends out horizontally for a distance of ~30m
- under the approach/departure surface, the object identification surface starts from the FATO outside edge and extends horizontally out for a distance of ~700. From this point, the object identification surface extends out for an additional distance ~2,800m while rising on a 2.5º or 22:1 slope (22 units horizontal in one unit vertical). From the point ~700m from the FATO perimeter, the object identification surface is ~30m beneath the approach/ departure surface
- the width of the safety surface increases as a function of distance from the Safety Area. From the safety area perimeter, the object identification surface extends laterally to a point ~30m outside the safety area perimeter. At the upper

end of the surface, the object identification surface extends laterally ~60m on either side of the approach/departure path.

Figure 11: Airspace Where Marking and Lighting are recommended



Source: AviPro

For the purpose of the Design Development Overlay (DDO), the OIS below the VFR approach and departure paths are the limit for the penetration of obstructions. That is, there should be no future development penetrating the OIS, which extends out to 3.5km from the forward edge of the FATO.

3.14 Operational Requirements

3.14.1 Visual Flight Rules Approach and Departure Paths

The purpose of approach and departure path airspace is to provide sufficient airspace clear of hazards to allow safe approaches to and departures from landing sites. Refer to Guideline H of the NASF – Protecting Strategically Important Helicopter Sites (May 2018)

VFR approach and departure paths should be such that there are no downwind operations and crosswind operations are kept to a minimum. To accomplish this, a HLS must have more than one approach/ departure path which provides an additional safety margin and operational flexibility. The preferred approach/departure path should, where possible, be aligned with the predominate wind when taking account of potential obstacles. Other approach/departure paths should also be based on an assessment of the prevailing winds and potential obstacles. The separation between such approach and departure paths should not be less than 150°, and preferably 180°.

3.14.2 Visual Flight Rules Approach/Departure and Transitional Surfaces

An approach/ departure surface is centred on each approach/departure path. Figure 12 illustrates the approach/departure (primary and transitional) surfaces.

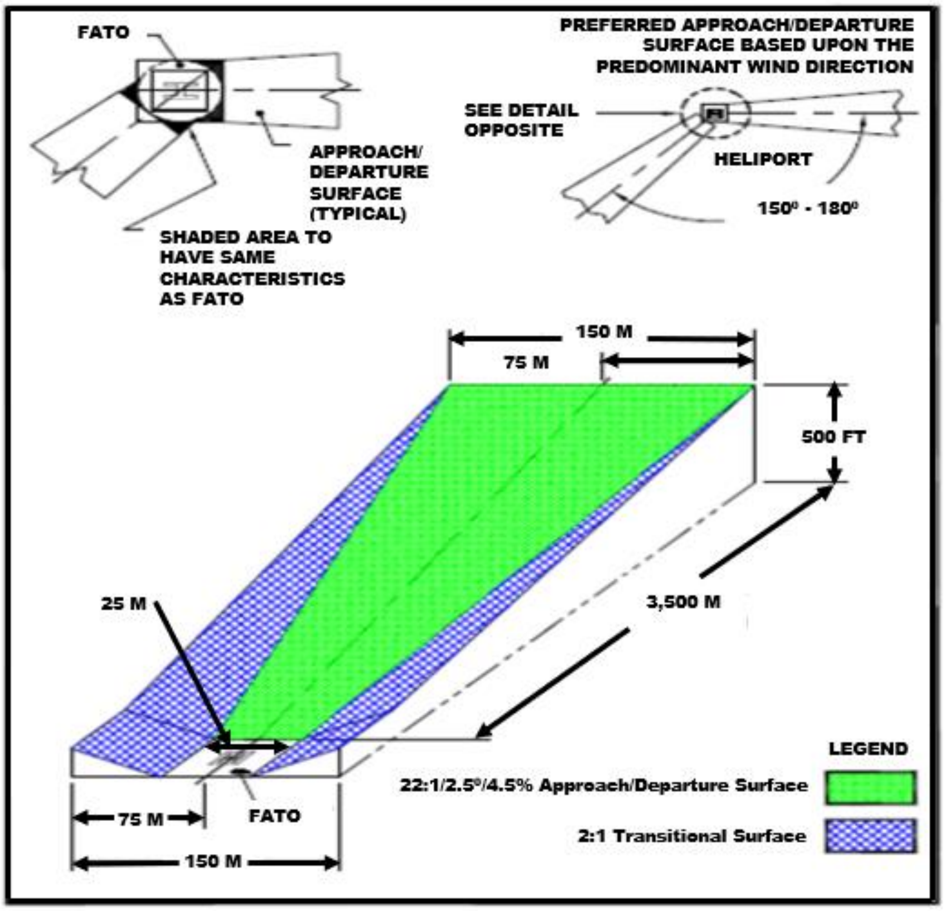
The approach/departure path starts at the forward edge of the FATO and slopes upward at 2.5º/ 4.5%/ 22:1 (22 units horizontal in 1 unit vertical) for a distance of ~3,500m where the width is ~150m at a height of 500 ft above the elevation of TLOF surface. For PC1 survey purposes, the survey commences from the forward edge of the FATO in the approach and departure path direction, from a datum point 1.5m above the FATO edge.

The transitional surfaces start from the edges of the FATO parallel to the approach and departure path centre line, and from the outer edges of approach/departure surface, and extend outwards at a slope of 2:1 for a distance of ~75m from the centreline. The transitional surfaces start at the edge of the FATO opposite the approach/departure surfaces and extend to the end of the approach/ departure surface. Refer to Figure 12.

The transitional surface is not applied on the FATO edge opposite the approach departure surface.

The approach/departure surface is to be free of penetrations. Any penetration of the transitional surface is considered a hazard.

Figure 12: VFR HLS Approach/Departure Transitional Surfaces



Source: AviPro

3.14.3 Helicopter Landing Site Approach Plans

During the planning phase, potential HLS approach paths are to be studied and applied to paper to confirm there are no buildings or other projections forming obstructions with the VFR approach/departure and transitional surfaces, and that there is no or limited potential for future obstructions within this area. It is strongly recommended that the required three-dimensional space is fully documented; preferably with three dimensional models to show current and future planners the restrictions imposed on future building construction.

3.14.4 VFR Approach and Departure Path and Transitional Surface Survey

NSWA requires HEMS contractors to meet Category A performance requirements when circumstances allow. The AW139 helicopter allows for Category A operations to be undertaken at almost all times. The vast majority of urban hospital based HLS do not have ‘suitable forced landing areas’ within the first segment (path 1) and thus the use of Category A operations becomes an imperative.

Under proposed changes to CASA Rules, HEMS operations will fall under Medical Transport, an extension of a new Air Transport category. Operations are proposed to be undertaken to Performance Class 1 or 2 (PC1/2). Both PC 1 and PC2 require a Category

A certified helicopter meeting the relevant Category A requirements, approaching and departing a PC1 accredited HLS along VFR approach and departure paths which have been surveyed for obstacles. The survey must be ‘current’ and be provided to the operator so that appropriate Category A procedures may be planned.

To meet PC1 requirements, VFR approach and departure paths are to have no obstacles penetrating 2.5º/ 4.5%/ 22:1. Likewise obstacles should not be penetrating the adjacent transitional surface; however some penetration may be accepted depending on the amount of penetration and the proximity to the relative approach and departure path.

The following however is considered adequate when prepared by a licensed surveyor:

- a survey covering the entire VFR approach and departure path and transitional surface area for each chosen direction. The entire area is a rectangle 150m x 150m, commencing from the forward edge of the FATO at eye height (1.5m) extending out at 2.5º for 3.5km. At 3.5km, the approach and departure path is approximately 500ft above HLS elevation. The width of the approach and departure path at the commencement (FATO edge) is 25m, expanding uniformly to 150m at a distance of 3.5km. The transitional surface extends laterally from the outer edges of the approach and departure paths at 2:1.
- a written report. Refer to NSWA for advice on content.
- a plan drawing out to the limit of any obstruction along the approach and departure path/s accompanied by a statement to the effect that no obstructions exist beyond the relevant distance.
- a side elevation drawing out to the extent of the obstructions along the approach and departure path/s. Drawings are to clearly show the horizontal distance to obstructions, the height of the obstruction above the HLS elevation and the height of the penetration above 2.5º.
- 3D modelling along the paths is a very effective method of showing obstacles and their relative position etc., and if possible this should be provided.

3.14.5 Approach and Departure Path Protection/Design Development Overlay

Currently no Federal or NSW State legislation is in place to protect VFR approach and departure paths and the transitional surfaces associated with hospital HLS. In Victoria there is legislation through Planning, requiring a DDO to be prepared to protect the area below hospital HLS approach and departure paths. This is completed in association with a required PC1 survey. In Victoria, any Development Application to planning authorities that could have an effect on a hospital HLS approach and departure path must be reviewed the Department of Health & Human Services (DHHS) for a determination. The planning authority are then required to follow the direction of the DHHS.

In the absence of formal legislation, it is recommended that a DDO be prepared at the time of the PC1 VFR approach and departure path and the transitional surface survey. Subsequently, the survey report is to be passed to the local government authority with advice that the approach and departure paths require protection and that any proposed development in the vicinity be referred to NSW Health Ministry of Health (Ministry). In essence, the DDO provides for a 30 m buffer below the approach and departure path and transitional surface, through which no obstructions are to penetrate. Refer to OIS.

Refer to NSWA for advice on the DDO format.

3.14.6 Curved Visual Flight Rules Approach/Departure Paths

VFR approach/departure paths may curve in order to avoid objects or noise-sensitive areas. More than one curve in the path is not recommended. Changes in direction by day below 300 ft should be avoided, and there should be no changes in direction below 500 ft at night.

3.14.7 Periodic Review of Obstructions

The relevant hospital, in association with NSWA should re-examine obstacles in the vicinity of approach/departure paths on at least an annual basis. This re-examination should include an appraisal of the growth of trees and new building constructions in close proximity to approach and departure paths. Hospitals must advise the ACC as soon as there is knowledge of any potential local obstructions such as cranes etc.

The NSWA will at its discretion, undertake periodic HLS safety audits at periods normally not exceeding 24 months.

3.14.8 Turbulence

Air flowing around and over buildings, stands of trees, terrain irregularities can create turbulence that may affect helicopter operations. Rotor downwash coming up against a close wall can also produce considerable turbulence and recirculation.

Turbulence from wind effect is usually more pronounced on aa elevated/roof top HLS, when compared with a HLS which is elevated 1.8m or more above the level of the roof top. The reason is that the turbulent effect of air flowing over the roof edge is minimised if the HLS is elevated.

Strong winds however can cause considerable up-drafting on the windward side of a building supporting an elevated HLS.

3.15 Airspace

Airspace above and around the relevant hospital is to be considered as it may be either within an aerodrome Control Zone and/or under a flight path involving airport Obstacle Limitation Surfaces (OLS) (also Known as Object Identification Surfaces). In the Sydney area, consideration of the CASA Building Control Regulations and the Sydney Kingsford Smith Airport OLS, Bankstown OLS, Camden OLS, Western Sydney Airport OLS and Richmond OLS are required. Further information on OLS for Sydney basin aerodromes may be found at: https://www.planningportal.nsw.gov.au/opendata/dataset/epi-obstacle-limitation-surface.Refer also to the MOS Part 139 - Aerodromes, Chapter 7. If infringements are likely, a submission is required and should be submitted to, and coordinated by, the Airport Design section at Sydney Airport Corporation Limited (SACL). Assessment will require input from a number of parties, including SACL, CASA, Airservices and the major airlines. Final determination is provided by the Federal Department of Infrastructure, Transport, Cities and Regional Development in Canberra.

Additional information may be found within the current Airservices ERSA, including advice on special helicopter routes in the Sydney area.

3.16 Security

Appropriate security measures are required to restrict access to the HLS, to manage the HLS on a day-to-day basis, to manually activate lighting and to coordinate maintenance.

Hospital-based HLS can be made more secure from the general public than landing areas in a nearby park or sports ground. Control of the public for HEMS activities can often involve not only ambulance but police, local government officers and/or local fire brigade. Such measures are unnecessary for a well-planned hospital-based HLS. Elevated HLS are more easily secured and have the added advantage of decreasing the noise impact of helicopter movements.

The design helicopter generates considerable rotor downwash that can easily topple people who are unsteady on their feet; and move substantial, unsecured objects. The responsible, attending hospital personnel are to ensure the safety of the HLS and to the greatest degree possible, nearby areas.

4 COMMISSIONING THE HLS

4.1 Design and Construction Advice

Hospital HLS are to be designed to meet the requirements of this policy document. It will be necessary for the design architects for each HLS project, to work closely with an aviation advisor with a sound knowledge of helicopter operations, in particular HEMS and helicopter landing site requirements. Close contact with the aviation advisor throughout the project will ensure that costly mistakes do not occur.

4.2 Building Commissioning

Throughout the design and construction phase, the design architect and construction engineer, are to liaise with NSWA. This may involve reviewing drawings, specifications and approach and departure path details prepared during the design phase. At an appropriate time, the nominated project director is to organise a meeting with the engineering project manager, the Deputy Director Helicopter Retrieval Service and the project's nominated aviation consultant. The overarching purpose is to test that the HLS is being delivered as specified.

As the project nears completion, the project director is to liaise with NSWA via the Deputy Director Helicopter Retrieval Service, to arrange for the HLS Safety and Compliance Acceptance Audit inspection. This inspection will be for the purpose of operational commissioning.

4.3 Operational Commissioning

The hospital HLS will be operationally commissioned via a HLS Safety and Compliance Acceptance Audit inspection. This inspection will include a review of specifications, and detailed testing of major systems including dimensions, surface coverings, markings, lighting, electrical equipment testing, emergency facilities, firefighting equipment, navigational aids, compliance certificates, and the HLS Operations Manual. A generic template for an Operations Manual is available from the Deputy Director Helicopter Retrieval Services. This template will be further developed to outline site specific requirements. A go-live checklist is provided at Appendix 2.

Each hospital HLS is required to hold a **HLS Operation Manual**. Under proposed incoming CASA legislation for HLS, CASA refer to this document as a HLS Exposition. The purpose of the HLS Operations Manual, is to document the personnel responsibilities, activities and procedures necessary for the efficient and safe operation of the Hospital HLS. The contents will include:

- relevant staff contact list including the hospital HLS officer and Airservices HLS reporting officer
- access to the HLS
- design criteria
- helicopter types in use and performance requirements

- HLS location information including coordinates and elevation
- HLS specifications including dimensions, weight limits, markings, lighting, and wind direction indicator advice
- HLS identification, orientation, and VFR approach and departure path information
- operation of HLS lighting system include PAL operations
- notification procedures of impending HEMS arrival
- clinical actions prior to arrival of the helicopter, on the HLS deck during loading/unloading of patients and within the hospital after a patient arrival
- HLS safety, firefighting and specialist equipment
- VFR approach and departure path PC1 survey information and biannual requirements
- any adjacent airspace restrictions
- daily HLS inspection Requirements
- aircraft pre-arrival HLS inspection requirements
- management of lighting, access to the deck and deck control during operations
- HLS weekly inspection
- HLS quarterly maintenance inspection requirements
- training of relevant staff in the use of and procedures associated with the use of the HLS
- HLS emergency procedures including emergency exits

The HLS will not be approved for operations until the Operations Manual has been signed off by the hospital and the staff appropriately trained and approved for their respective activities.

NSWA will provide a template to the relevant hospital to be used for the preparation of the HLS Operations Manual. It will be necessary for the hospital to liaise with the Deputy Director Helicopter Retrieval Service during the preparation period, to ensure that procedures are acceptable.

During the latter stages of the HLS construction, the health service using the template, should begin to document procedures relating to:

- the transfer in and out of patients using the HLS including security and clinical management issues
- arrangements for ‘overflow’ should the HLS not be available
- a schedule for the ongoing inspection and maintenance of the HLS.

Once the HLS has been accepted operationally by NSWA and ‘handed over’ to the health service, a series of test flights will be conducted by day and night. The health service will also implement staff training to ensure that local staff are equipped to manage their roles.

4.4 Operational Check Flights

Where possible during the HLS Safety and Compliance Acceptance Audit inspection process, helicopter check flights will be undertaken by both day and night, to test the functioning of the HLS lighting, test the PAL activation, familiarise the HEMS crew with the hospital and the HLS deck, and familiarise the hospital staff with the requires deck activities, and check the safety and firefighting equipment.

5 MONITORING AND MAINTAINING THE HLS

5.1 General

Hospital HLS are to be designed to meet the requirements of this policy document. It is essential that the facility is monitored and maintained to ensure that the safety of patients, staff and hospital assets is not compromised.

5.2 Schedules for monitoring and maintenance

The following tasks are only required where a HLS is located on a healthcare site. Three suggested checklists are included to assist LHDs to plan routine monitoring and maintenance of the HLS. LHD/ SHN facilities may choose to tailor the checklist their local needs

LHD/ SHN facilities manager (or equivalent) are designated as HLS Officers and are responsible for the three activities, which include:

- HLS Daily Inspection (refer Appendix 3)
- HLS Arrival and Departure Inspection Checklist (refer Appendix 4)
- HLS Three Monthly Maintenance Checklist (refer Appendix 5).

Should issues be detected, maintenance staff should raise the issue in the maintenance system and apply a criticality rating to the task.

6 APPENDIX LIST

Appendix 1: Abbreviations and Explanation of Terms

Abbreviations	
AC	United States of America Federal Aviation Administration Advisory Circular
ACC	Aeromedical Control Centre. (HQ Eveleigh). Responsible for control and tasking of the Helicopter Emergency Medical Service in NSW
ARO	Airport Reporting Officer
ADF	Automatic direction finder
AW139	Leonardo AW139 (the helicopter on which the design requirements are based)
AWIS	Automatic Weather Information Service
CAAP	Civil Aviation Advisory Publication (Australia)
CASA	Civil Aviation Safety Authority (Australia)
CAOs	Civil Aviation Orders (Australia)
CARs	Civil Aviation Regulations (Australia)
CASR	Civil Aviation Safety Regulations
DIFFS	Deck Integrated Fire Fighting System
DDO	Design Development Overlay
EC	Eurocopter (now Airbus)
ERSA	En Route Supplement Australia
FAA	Federal Aviation Administration, USA.
FATO	Final Approach and Take-Off Area = 1.5 x Length
FARA	Final Approach Reference Area
FMS	Fixed Monitor System
TLOF	Touchdown and Lift-off Area
GPS	Global Positioning System taking its data from orbiting satellites
HAPI-PLASI	Pulse Light Approach Slope Indicator (see VGI)
HEMS	Helicopter Emergency Medical Service
HLS	Helicopter Landing Site
HLSRO	HLS Reporting Officer
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions - requiring flight under IFR
L	Length (overall), in relation to a helicopter, the total distance between the main rotor and tail rotor tip plane paths when rotating
LEP	Local Environment Plan

LLA	Landing and Lift Off Area. Solid surface with undercarriage contact points + I x metre in all directions
LED	Light emitting diode
LPG	Liquid petroleum gas (in Bulk Storage Tank)
LSALT	Lowest safe altitude
LUX	The SI unit of illumination and luminous emittance, measuring luminous flux per unit area
MRI	Magnetic resonance imaging
MTOW	Maximum Take-off Weight
NASF	National Airports Safeguarding Framework
NDB	Non directional beacon providing a radio signal to an aircraft ADF
NETS	Newborn and paediatric Emergency Transport Service
nm	Nautical miles
NSWA	New South Wales Ambulance
NVG	Night vision goggles
OEI	One engine inoperative
OIS	Object identification surfaces
OLS	Obstacle Limitation Surface
PAL	Pilot activated lighting
PC1	Performance Class 1
PC2	Performance Class 2.
PC3	Performance Class 3
PAL (system)	Pilot activated lighting
RD	Main rotor diameter
RMI	Remote magnetic indicator (magnetic compass with flux valve system)
SARP	Standards and Recommended Practices developed by ICAO and promulgated in the Annexes to the Convention of International Civil Aviation
SACL	Sydney Airport Corporation Limited
TLOF	Touch Down and Lift Off Area (US FAA), also (Australia GEA) - min. 1 x main rotor diameter. Load bearing
VFR	Visual Flight Rules
VHF	Very high frequency radio
VGI	Visual glideslope indicator
VMC	Visual meteorological conditions - allowing flight under VFR
VOR	VHF Omni-directional Radio - a ground radio transmitter for aircraft navigation purposes

Explanation of Terms	
Aircraft	Refers to both aeroplanes (fixed wing) and helicopters (helicopter).
HLS (Aerodrome) Reporting Officer	A health service nominated single point of contact for all non-clinical related hospital-based HLS matters, reporting to Airservices. Airservices us Australia's air navigation service provider.
Approach/Departure Path (VFR)	The flight track helicopters follow when landing at or departing from the FATO of a HLS. The VFR Approach/Departure path extends outwards from the edge of the FATO with an obstacle free gradient of 2.5º or 4.5% or 1:22 measured from the forward edge of the FATO (25m) , extending uniformly to a width of 150m , and to a height of 500 feet above the FATO at a distance of ~3,500m.
Category A	Category A with respect to helicopters means a multi-engined helicopter designed with engine and system isolation features specified in the applicable airworthiness codes and capable of operations using take-off and landing data scheduled under a critical engine failure concept that assures adequate designated surface area and adequate performance capability for continued safe flight or safe rejected take-off in the event of engine failure.
Design Helicopter	The Leonardo AW139 contracted to the NSWA. The type reflects the new generation Performance Class 1 helicopters used in HEMS and reflects the maximum weight and maximum contact load/minimum contact area. The overall length and rotor diameter are similar to the Bell 412 models.
Elevated Helicopter Landing Site (Heliport)	A HLS on a raised structure on land with a FATO and a TLOF surface 2.5m or higher above the ground in the immediate vicinity.
Exposure time	The actual period during which the performance of the helicopter with an engine inoperative in still air does not guarantee a safe forced landing or the safe continuation of the flight.
Final Approach	The reduction of height and airspeed to arrive over a predetermined point above the FATO of a HLS.
Final Approach and Take-off Area (FATO)	A defined area over which the final phase of the approach to a hover, or a landing is completed and from which the take-off is initiated. FATO size is determined by the specification of the Design Helicopter and is set at 1.5 x length overall. The area of the FATO is to be load bearing.
Ground Taxi	The surface movement of a wheeled helicopter under its own power with wheels touching the ground.
Hazard to Air Navigation	Any object having a substantial adverse effect upon the safe and efficient use of the navigable airspace by aircraft, upon the operation of air navigation facilities, or upon existing or planned airport/heliport capacity.
Helicopter Landing Site (HLS)	An area of land or water, or an area on a structure on land, intended for use wholly or partly for the arrival or departure: (a) helicopters; or (b) a helideck; or (c) a heliport. For the purposes of this Policy the HLS refers to a hospital location. HLSs not located on hospital property are outside the scope of this Guideline.

Helicopter Landing Site Elevation	At a HLS without a precision approach, the HLS elevation is the highest point of the FATO expressed as the distance above mean sea level.
Helicopter Landing Site Imaginary Surfaces	The imaginary planes, centred about the FATO and the approach/departure paths, which identify the objects to be evaluated to determine whether the objects should be removed, lowered, and/or marked and lit – or the approach/departure paths realigned.
Helicopter Landing Site Reference Point (HRP)	The geographic position of the HLS expressed as the latitude and longitude at the centre of the FATO.
Heliport	HLS with associated infrastructure such as aircraft hangar, refuelling facilities etc.
Hospital Helicopter Landing Site (HHLS)	A HLS limited to serving helicopters contracted to NSW Health. Hospital-based HLS are located within the grounds of a hospital with easy trolley access to and from the hospital's critical care areas.
Hover Taxi	The movement of a wheeled or skid-equipped helicopter above the surface, generally at a wheel/skid height of approximately one metre. For facility design purposes, a skid-equipped helicopter is assumed to hover-taxi.
Landing Position	Also known as the **Landing and Lift-off Area** (**LLA**). A load-bearing, nominally paved area, normally located in the centre of the TLOF, on which helicopters land and lift off. Minimum dimensions are based upon a one metre clearance around the undercarriage contact points of the Design Helicopter.
Length (Overall) (L)	The distance from the tip of the main rotor tip plane path to the tip of the tail rotor tip plane path or the fin if further aft, of the Design Helicopter. ICAO reference to overall length is "D".
Landing and Lift Off Area (LLA)	Also known as the **Landing Position**. A load-bearing, nominally paved area, normally located in the centre of the TLOF, on which helicopters land and lift off. Minimum dimensions are based upon a one metre clearance around the undercarriage contact points of the Design Helicopter.
Lift Off	To raise the helicopter into the air.
Movement	A landing or a lift off of a helicopter.
Obstruction to Air Navigation	Any fixed or mobile object, including a parked helicopter, which impinges the approach/departure surface or the transitional surfaces.
Parking Pad	The paved centre portion of a parking position, normally adjacent to a HLS.
Performance Class 1 (PC1)	Performance Class 1 for a helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter to land within the rejected take-off distance available or safely continue the flight to an appropriate landing area, depending on when the failure occurs
Performance Class 2 (PC2)	Performance Class 2 for a helicopter means the class of operations where, in the event of failure of an engine, performance is available to enable the helicopter to safely continue the flight except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which case a forced landing may be required.
Performance Class 2 with	Performance Class 2 operations can be designed to operate with a permitted exposure time for the periods where safe continuation of flight

exposure. (PC2 Exp)	or landing is not assured, or alternatively at all times with a safe forced landing capability. The policy recommendations for PC2 operations include the maximum permitted exposure time concept. See definitions below.
Performance Class 3 (PC3)	Performance Class 3 for a helicopter means the class of operations where, in the event of failure of an engine at any time during the flight, a forced landing: - in the case of a multi-engine helicopter, may be required; or - in the case of a single-engine helicopter, will be required.
Pilot Activated Lighting (PAL)	A PAL system utilises a ground-based VHF radio and timed switching device, activated by the pilot via a VHF radio transmission on a pre-set frequency, to turn on the HLS lighting.
Prior Permission Required (PPR) HLS	A HLS developed for exclusive use of the owner and persons authorised by the owner (i.e. a hospital-based emergency services HLS). To ensure the safety of the hospital as critical infrastructure, only helicopter contracted to Health and managed by NSW Ambulance may use the Hospital Helicopter Landing Site. In the event of uncertainty any requests from other users are to be forwarded to the Deputy Director Helicopter Retrieval Services for advice.
Rotor Downwash	The volume of air moved downward by the action of the rotating main rotor blades. When this air strikes the ground or some other surface, it causes a turbulent outflow of air from beneath the helicopter.
Safety Area	A defined area on a HLS surrounding the FATO intended to reduce the risk of damage to helicopters accidentally diverging from the FATO (0.3 x RD of the Design Helicopter). This area should be free of objects, other than those frangible mounted objects required for air navigation purposes.
Safety Net	Surrounds the outer edge of a rooftop or elevated HLS. It is to be a minimum of 1.5 metres wide, not project above the HLS outer edge, have a load carrying capacity of not less than 122 kg/m^2 and be fastened to a solid structure.
Shielded Obstruction	A proposed or existing obstruction that does **not** need to be marked or lit due to its close proximity to another obstruction whose highest point is at the same or higher elevation.
Standard HLS	A place that may be used as an aerodrome for helicopter operations by day and night.
Take-off	To accelerate and commence climb at the relevant climb speed.
Take-off Position	A load bearing, generally paved area, normally located on the centreline and at the edge of the TLOF, from which the helicopter takes off. Typically, there are two such positions at the edge of the TLOF, one for each of two take-off or arrival directions.
Touchdown and Lift-off Area (TLOF)	A load bearing, generally paved area, centred in the FATO, on which the helicopter lands or takes off, and that provides ground effect for a helicopter rotor system. Size is based on one main rotor diameter of the Design Helicopter.
Transitional Surfaces	Starts from the edges of the FATO parallel to the flight path centre line, and from the outer edges of approach/departure surface, extends outwards at a slope of 2:1 (two units horizontal in one unit vertical) for a distance of ~75m from the centreline. The transitional surfaces start at

	the edge of the FATO opposite the approach/departure surfaces and extend to the end of the approach/departure surface.
Unshielded Obstruction	A proposed or existing obstruction that may need to be marked or lit since it is **not** in close proximity to another marked and lit obstruction whose highest point is at the same or higher elevation.

Appendix 2: New or Re-opened HLS – Go live Checklist

Insert hospital name: ________________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

New or Re-opened HLS – Go live Checklist		
All approach and departure flight paths have been reviewed and are appropriate with all relevant documentation updated and available.		
Name and Position	**Signature**	**Date**
Local Health District representative endorsement Name: Position:		
Independent Aviation Safety Auditor endorsement Name: Position:		
NSW Ambulance (Southern) Chief Pilot approval Name: Position:		
NSW Ambulance (Northern) Chief Pilot approval Name: Position:		
NSW Ambulance endorsement Name: Position:		

Appendix 3: HLS Daily Inspection Template

HLS Daily Inspection Checklist

Insert hospital name: ______________________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Date/Time: **Completed By:** **Position: Facilities Manager (or equivalent)**

HLS Daily Inspection Checklist	Yes	No
Keys		
Lift priority swipe card present		
HLS access key present		
HLS Deck / Landing Area		
HLS clear of any loose items		
Safety Net serviceable		
HLS lights functional check		
• FATO (final approach and take-off area)		
• TLOF (Touch down and lift-off area		
• Approach and departure paths		
• Windsock		
• Obstruction lights		
• Hospital HLS beacon		
• Flood lights (separate circuit)		
Functional manual check of pilot activated lighting (PAL) and flood lights circuit		
Windsock present and in good condition		
HLS Lift Lobby/Foyer		
All lifts serviceable		
Sliding doors serviceable		
Foyer is clean and equipment is stored correctly		
Motion sensor lights turn **ON** when entering foyer		
Trolley present and operational		
1 x full D portable oxygen cylinders present, and if NETS arriving 1x DAir		
PPE:		
• Disposable gloves present (small, medium, large)		
• Eye protection x 5 sets		
• Hand hygiene present		
• High visibility vest x 3		
Lobby lighting		
Air isolation button if present		

Fire Suppression Systems		
Fire extinguishers (lift lobby):		
• 1 x 90L Foam		
• 1 x CO_2 3.5kg		
• 1 x Dry Powder 9.0 g		
Fire extinguishers (lift lobby):		
• 1 x 90 Foam		
• 1 x CO_2 3,5kg		
• 1 x Dry Powder 9.0kg		
Fire blanket (lobby)		
Deck drains		
Deck integrated fire-fighting system (DIFFS) spray head x 19 (Lismore and Westmead Children's Hospitals only)		
Fire hose (lobby)		
Fire hydrant		

The results from the Daily Checklist are to be checked and recorded in the maintenance system with a criticality rating applied. Any issues identified are to be reported to the PFC or After Hours Nurse Manager for action. If any issues present a potential or actual risk to the helicopter operations, notify the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Add Comments:

Appendix 4: HLS Arrival/Departure Inspection Template

HLS Arrival and Departure Inspection Checklist

Insert hospital name: ______________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Date/Time: **Completed By:** **Position: Facilities Manager (or equivalent)**

HLS Arrival and Departure Checklist	Yes	No
Keys		
Lift priority swipe card present		
HLS access key present		
HLS Deck / Landing Area		
HLS clear of any loose items		
Safety Net serviceable		
HLS lights functional check		
• FATO (final approach and take-off area)		
• TLOF (Touch down and lift-off area		
• Approach and departure paths		
• Windsock		
• Obstruction lights		
• Hospital HLS beacon		
• Flood lights (separate circuit)		
Functional manual check of pilot activated lighting (PAL) and flood lights circuit		
Windsock present and in good condition		
HLS Lift Lobby/Foyer		
Check lifts serviceable		
Sliding doors serviceable		
Foyer is clean and equipment is stored correctly		
Motion sensor lights turn **ON** when entering foyer		
Trolley present and operational		
1 x full D portable oxygen cylinders present, and if NETS arriving 1 x DX Air		
PPE:		
• Disposable gloves present (small, medium, large)		
• Eye protection x 5 sets		
• Hand hygiene present		
• High visibility vest x 3		
Lobby lighting **OFF**		
Air isolation button		

The results from the HLS Arrival/Departure Checklist are to be checked and recorded in the maintenance system with a criticality rating applied. Any issues identified are to be reported to the ED Clinical NUM. If any issues present a potential or actual risk to helicopter operations, notify the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Add Comments:

Appendix 5: HLS Three Monthly Maintenance Inspection Template

Three Monthly Maintenance Checklist

Insert hospital name: ________________

Note: NSW Hospital Landing Sites cover a range of facilities and environments. Not all items apply to all hospitals. If uncertain Contact the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

Date/Time: **Completed By:** **Position: Facilities Manager (or equivalent)**

HLS Three Monthly Maintenance Checklist	Yes	No
Keys		
Lift priority swipe card present		
HLS access key present		
HLS Deck		
Surface undamaged		
Painted marking serviceable (check for peeling or loose paint)		
Tie down serviceable if present		
Safety net and attachments serviceable		
HLS lights functional check		
• FATO (final approach and take-off area)		
• TLOF (Touch down and lift-off area		
• Approach and departure paths		
• Windsock		
• Obstruction lights		
• Hospital HLS beacon		
• Flood lights (separate circuit)		
Functional manual check of pilot activated lighted (PAL) and flood lights circuit		
Lower windsock and inspect for condition		
Windsock swivel bearing lubricate		
Windsock illumination lights serviceable		
Windsock obstruction light serviceable		
Hospital HLS beacon service as necessary		
HLS Lift Lobby/Foyer		
Check lifts serviceable		
Sliding doors serviceable		
Motion sensor lights turn **ON** when entering foyer		
PAL controller serviceable		
Manual PAL override serviceable		
Flood light serviceable		
Lobby lighting serviceable		
Carbon filter bypass switch serviceable		

Fire Suppression Systems (all to be confirmed in-date and serviceable)		
Fire extinguishers (lift lobby):		
• 1 x 90L Foam		
• 1 x CO_2 3.5kg		
• 1 x Dry Powder 9.0kg		
Fire extinguishers (emergency stairs):		
• 1 x 90L Foam		
• 1 x CO_2 3.5kg		
• 1 x Dry Powder 9.0kg		
Fire blanket		
Fire hose (lobby)		
Fire hydrant		
Deck drains		
Deck integrated fire-fighting system (DIFFS) spray heads x 19 confirm serviceable (Lismore and Westmead Children's Hospitals only)		
DIFF storage tank, pump and plumbing functional check and confirm 20,000L. water tank full (Lismore and Westmead Children's Hospitals only)		
DIFFs diesel pump engine serviceable, with lubricants and fuel satisfactory		
Fuel/water separator and plumbing serviceable		

The results from the Three Monthly Maintenance Inspection are to be checked and recorded in the maintenance system with a criticality rating applied. Any issues identified are to be reported to the ED Clinical NUM. If any issues present a potential or actual risk to the helicopter operations, notify the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au).

A copy of the completed Three Monthly Maintenance Checks should be sent to the Office of the Director Helicopter Operations, NSW Ambulance (AMBULANCE-Helicopters@health.nsw.gov.au)

Add Comments: