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# GUIDELINES FOR HOSPITAL HELICOPTER LANDING SITES IN NSW

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**NSW MINISTRY OF HEALTH**

**AMBULANCE SERVICE OF NSW**

# GUIDELINES FOR HOSPITAL HELICOPTER LANDING SITES IN NSW

During 1993 the Department of Health implemented a policy circular (93/107) detailing the requirements for Helicopter Landing Sites (HLS) at NSW hospitals, titled “Guidelines for Medical Helipads”. The Guidelines were subsequently distributed to Area Health Services, Statutory Health Corporations and Affiliated Health Organisations, Divisions of General Practice, Health Professional Associations and Related Organisations, NSW Ambulance Service and Public Health Units.

Circular 93/97 was subsequently reviewed in January 2005 and was again due to be reviewed in January 2010.

The following updated Guidelines take into account experience gained in helicopter medical retrieval in NSW over more than 20 years and incorporate international experience best practice in the establishment of hospital based HLSs both at ground level and on elevated structures.

The Guidelines for hospital based HLSs have received endorsement from the Perinatal Emergency Transport Coordinating Committee to the NSW Perinatal Services Network and the Medical Retrieval Committee of the NSW Ambulance Service. The guidelines are intended for the use of those hospitals whose role warrants the provision of hospital based HLS facilities.

It is essential that any new public hospital intended to provide critical care services have helicopter access; and that any major refurbishment of existing hospitals which offer critical care services should be preceded by a feasibility study on retrofitting a hospital HLS. While tertiary facilities (as referral centres) have the greatest need for HLSs, any new secondary facilities which would be likely “exporters” of patients should also have helicopter access.

Hospital based HLSs are defined as *helicopter landing areas within easy trolley access (< 100 m.) to and from the hospital’s critical care areas*. All tertiary hospital facilities should be equipped with a hospital HLS. At some locations however a hospital based HLS may not be practical due to existing construction or a lack of space etc. 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 HEMS use which requires the use of a vehicle to convey a patient between the landing area and the hospital*.

Clearly a hospital based HLS is preferable over an “off site” location. The time saved by ready access between a hospital HLS and an Emergency Unit, ICU or Paediatric Unit has been calculated to average 15-20 minutes, in comparison with the use of road ambulance between a nearby landing area and the hospital.

Medical retrievals which involve multiple transfers between vehicles, increases movement and discomfort for patients, who may be particularly susceptible because of the severity or potential instability of their condition.

Hospitals with HLSs within trolley access have trolleys available for the purpose. This minimises unnecessary handling. Every additional patient lift increases the risk of accidental disconnection or disruption of a vital monitor or line.

Well planned hospital HLSs are served by level or near-level smooth pathways leading from the HLS to the hospital building. Where a vehicle is used, the ambulance trolley may traverse unprepared surfaces 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. Deteriorations in patient condition have been observed in these situations.

The importance of maintaining appropriate clinical care and supervision throughout all phases of transport should be considered in hospital HLS planning. Having a HLS accessible by trolley not only saves time, it also reduces manpower requirements and avoids splitting the retrieval team where multiple patients are being transported.

Any decisions to include a new hospital HLS or changes to existing HLSs, are to be made in consultation with the Medical Retrieval Committee via the Director Statewide Services, Sydney Ambulance Centre Eveleigh, at the early stages of planning.

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# 1. INTRODUCTION

## 1.1 Terms of Reference and Applicability

Currently within Australia, there are no set rules or regulations applicable to the design, construction or placement of HLSs. There may however be local council planning, location and movement approvals required. The appropriate legislation at present for the use of HLSs is Civil Aviation Regulation (CAR) 92 which places the onus on the helicopter pilot to determine the suitability of a landing site. The Civil Aviation Safety Authority as the regulator of aviation in Australia, effectively divested itself of direct responsibility in the early 1990s and now 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 is a recent revision of the old CAAP 92-2 (1). CASA has its own legal office established essentially for the protection of CASA and does not provided design or structural information or advice as a matter of policy.

Considerable work has been undertaken internationally in this area, particularly through 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.

The International Civil Aviation Organisation (ICAO) sets out international Standards and Recommended Practices (SARPS) for the safe conduct of civil aviation activities in the Annexes to the *Convention on International Civil Aviation (Chicago, 1944),* with the following Annexes applicable to helicopter operations:

- Annex 6: Operation of Aircraft - Part III: International Operations - Helicopters 6$^{th}$ Edition July 2004
- Annex 14: Aerodromes - Volume II: Heliports 4$^{th}$ Edition 2013

Additional guidance on the design of heliports and Helicopter Landing Sites is provided in ICAO's *Heliport Manual* (Doc. No. 9261-AN/903), although this document is somewhat dated as it was last amended as the 3$^{rd}$. Edition in 1995.

Whereas ICAO Annex 14 Volume II provides SARPS for the planning, design, operation and maintenance of HLS facilities 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 SARPS, except where specific differences have been notified 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 SARPS relating to heliports. This document is now out-of-date, however differences remain. Subject to differences, CASA supported the adoption of Annex 14 SARPS for heliports.

These differences recommended by CASA were notified over 20 years ago and are generally no longer considered by NSW Ambulance or the HEMS contractors as best practice or appropriate.

CASA is presently undertaking a Regulatory Reform Program in the rotary wing area and it is assumed that the ICAO SARPS with the differences removed, will form the basis of the proposed Civil Aviation Safety Regulations (CASR) Part 133 pertaining to Commercial Air Transport Operations and Part 138 pertaining to Aerial Work operations.

Currently HEMS comes under Aerial Work, however it is proposed by CASA that helicopter aeromedical functions come under the Air Transport operations category as Medical Transport within Part 133. Should this eventuate, the highest standards required of Air Transport (the carriage of passengers) will apply to Medical Transport.

Although Australia has not historically been active in this field, many countries have, and in particular the US. Many years of experience operating large numbers of helicopters in a range of roles, have 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 AC is a comprehensive section devoted to hospital based heliports and helicopter landing sites.

The resulting documents on the subject provide excellent advisory material, guidelines and best practice standards. Key current documents are as follows:

- ICAO Annex 14, Vol II, Heliports.
- 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 HLSs in Chapter 4, Hospital Heliports).
- Australian Civil Aviation Safety Authority (CASA) Civil Aviation Advisory Publication (CAAP) 92-2 (2) *Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites*. *(*covers essentially operational specifications only).

## 1.2 Methodology

Criteria from the relevant references have been assessed. The structural design specifications for HLSs, particularly rooftop, have been drawn from the ICAO documents, with size, shape, marking, lighting, safety enhancement and operational features drawn from the guidelines of the US FAA AC pertaining to hospital HLSs. The guidelines of the Australian CAAP are effectively overshadowed by the ICAO and FAA documents.

## 1.3 Overview

Guidelines for the dimensions, marking and lighting for the LLA, TLOF, FATO and the Safety Area for the Design Helicopter, plus the VFR Approach/Departure

Transitional Surfaces, are specified and based upon the FAA document AC 150/5390-2C, Heliport Design.

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

A decision on whether to land on a hospital based HLS rests with the captain of the aircraft and is often based upon the prevailing weather conditions at the time. Turbulence and wind shear are particularly common experiences for helicopter operations to rooftops. On a hospital rooftop HLS, for clinical egress reasons, the pilot will normally try to position the helicopter for a final land on at 90º to the entry doors/walkway to the reception room. This will be dependant on the strength and direction of the wind at the time. The approach and departure direction/s of the helicopter to/from the HLS have no bearing on the final landing position.

## 2. EXPLANATION OF TERMS

**Aircraft.** Refers to both aeroplanes (fixed wing) and helicopters (rotorcraft).

**Approach/Departure Path (VFR).** The flight track helicopters follow when landing at or departing from the FATO of a HLS. Updated standards to align with ICAO recommendations now has the VFR Approach/Departure path extending outwards from the edge of the FATO with an obstacle free gradient of 2.5º or 4.5% or 1:22 vertical to horizontal, measured from the edge of the FATO, to a height initially of 500 feet above the FATO at a distance of ~3,500 m. The previous standard involved an obstacle free gradient of 7.5º or 12.5% or 1:8 vertical to horizontal, measured from the edge of the FATO to a height initially of 500 feet above the FATO at a distance of ~1,200 m.

The path may be curved left or right to avoid obstacles or to take advantage of a better approach or departure path. Changes in direction by day below 300 feet should be avoided and there should be no changes in direction below 500 feet at night.

**Design Helicopter.** The Agusta AW139 contracted to the ASNSW. 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 (HLS) - multiple HLSs may be referred to as Heliport.** A HLS located on a roof top or some other elevated structure where the Touchdown and Lift-off Area (TLOF) is at least 76 cm. above ground level (FAA). (It is noted that the new CAAP 92-2(2) uses a recommended distance above the ground of 2.5 m.

**Final Approach.** The reduction of height and airspeed to arrive over a predetermined point above the FATO of a HLS.

**Final Approach and Takeoff 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 takeoff is initiated. For the purposes of these guidelines, the US FAA AC specification of 1.5 x Length Overall of the Design Helicopter is used. Area 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).** One or more may also be known as a **Heliport**. The area of land, water or a structure used or intended to be used for the landing and takeoff of helicopters, together with appurtenant buildings and facilities.

**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.

**Hospital Helicopter Landing Site.** A HLS limited to serving helicopters engaged in air ambulance, or other hospital related functions.

***Note:***

*A designated helicopter landing site located at a hospital or medical facility is an emergency services HLS and **not** a medical emergency site.*

**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 Liftoff 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 1 x 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.

**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 1 x 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).** Similar to Category A requirements. For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit, performance is available to enable the rotorcraft 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. PC1 requires a CASA approved surveyed HLS.

**Performance Class 2 (PC2).** For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit, performance is available to enable the rotorcraft to safety continue the flight, except when the failure occurs early during the take-off manoeuvre, in which case a forced landing may be required. PC2 requires a CASA approved surveyed HLS.

**Performance Class 3 (PC3).** For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit at any time during the flight, a forced landing:

a) in the case of multi-engined rotorcraft – may be required; or
b) in the case of single-engined rotorcraft – will be required.

**Pilot Activated Lighting (PAL)**. A PAL system utilises a hospital 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 authorized by the owner, i.e. a hospital based emergency services HLS.

***Note:***

*The HLS owner and operator are to ensure that all pilots are thoroughly knowledgeable with the HLS (including such features as approach/departure path characteristics, preferred heading, facility limitations, lighting, obstacles in the area, size of the facility, etc.).*

**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. Slope should be not more than 3° or 5%.

**Safety Net.** Surrounds the outer edge of a rooftop HLS. Should be a minimum of 1.5 m. wide, not project more than 25 cm. 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 takeoff or arrival directions.

**Touchdown and Lift-off Area (TLOF).** A load bearing, generally paved area, normally 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 1 x main rotor diameter of 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, and extends outwards at a slope of 2:1 (2 units horizontal in 1 unit vertical) for a distance of ~75 m. 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 at 3,500 m.

**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.

## 3. APPLICABLE ABBREVIATIONS

| | |
|---|---|
| AC | US FAA Advisory Circular. |
| AOC | Aeromedical Operations Centre. (HQ Eveleigh). Responsible for control and tasking of HEMS. |
| CAAP | Civil Aviation Advisory Publication (Australia). |
| CASA | Civil Aviation Safety Authority (Australia). |
| CAOs | Civil Aviation Orders (Australia). |
| CARs | Civil Aviation Regulations (Australia). |
| FAA | Federal Aviation Administration, USA. |
| FATO | Final Approach and Take Off Area. (Australian CAAP = 2 x Length) (ICAO and US FAA AC = 1.5 x Length and is used) |
| FARA | Final Approach Reference 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 (also Heliport). |
| 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. |
| LLA | Landing and Lift Off Area. Solid surface with undercarriage contact points + I x metre in all directions. |
| MRI | Magnetic Resonance Imagers. |
| MTOW | Maximum Take Off Weight. |
| NDB | Non Directional Beacon providing a radio signal to an aircraft ADF. |
| PC1 | Performance Class 1. |
| PC2 | Performance Class 2. |
| PC3 | Performance Class 3. |
| RD | Main Rotor Diameter. |
| RMI | Remote Magnetic Indicator (magnetic compass with flux valve system). |
| SARPS | Standards and Recommended Practices developed by ICAO and promulgated in the Annexes to the Convention of International Civil Aviation. |
| 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. |

## 4. LIST OF FIGURES

1: AW139 Dimensions.
2: TLOF and FATO/Safety Area Relationships and Minimum Dimensions.
3: TLOF, FATO, “H” and Weight/Rotor Diameter Markings.
4: Example MRI Direction and Distance Marker in Metres.
5: Standard Hospital HLS Identification and Markings.
6: HLS Markings, including Maximum Weight and Rotor Diameter Limits.
7: Example Roof Top HLS Layout.
8: Approach/Departure Directional Arrow and Lights.
9: Windsock and Lighting.
10: Airspace Where Marking and Lighting are Recommended.
11: VFR HLS Approach/Departure Transitional Surfaces.
12: VFR HLS Lateral Extension of the 1:8 Approach/Departure Surface.

## 5. ROTORCRAFT PERFORMANCE

ICAO Annex 6 Part III defines three performance categories for helicopters and the proposed CASA CASRs Part 133 and Part 138 are proposed to adopt the ICAO Performance Classes.

The definitions for each Performance Class are:

**Performance Class 1 (PC1).** Similar to Category A requirements. For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit, performance is available to enable the rotorcraft 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. PC1 requires a CASA approved surveyed HLS.

**Performance Class 2 (PC2).** Similar to Category B requirements. For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit, performance is available to enable the rotorcraft to safety continue the flight, except when the failure occurs early during the take-off manoeuvre, in which case a forced landing may be required. PC2 requires a CASA approved surveyed HLS.

**Performance Class 3 (PC3).** For a rotorcraft, means the class of rotorcraft operations where, in the event of failure of the critical power unit at any time during the flight, a forced landing:

a) in the case of multi-engined rotorcraft – may be required; or
b) in the case of single-engined rotorcraft – will be required.

By definition, single-engine helicopters can only operate to PC3. Similarly, the PC1 criteria can only be met by multi-engine helicopters. Most multi-engine helicopters are in Transport Category however due to a lower level of complexity, some twin-engine helicopters are in Normal Category. Generally speaking, Normal Category helicopters have limited PC1 capability and would therefore operate primarily under PC2.

There has been considerable discussion by many parties in recent years relating to limiting helicopter operations in urban and built-up areas, to those capable of PC1 operations. There is little doubt that such operations would afford a level of safety exceeding that of PC2 and thus a lower level of risk. However there are other considerations including the likelihood of an accident and cost. ICAO Annex 6 Part III at Chapter 3 states, "*Only Performance Class 1 helicopters shall be permitted to operate from elevated helipads in congested areas*".

Such discussions are on-going and there is certainly future potential for such a requirement via CASA CASRs. Accordingly, consideration is being given to the design of HLS facilities which will allow for PC1 capable helicopters to operate to their capabilities.

These guidelines have replaced the former requirement for a take-off climb gradient requirement of 1:8/12.5%/7.5°, with 1:22/4.5%/2.5°. This former was established primarily to maintain a climb gradient free of obstacles for a helicopter operating at normal power. This climb gradient however did not take into consideration the performance of a twin engine helicopter during take-off and climb one engine inoperative (OEI). It should also be recognised that a number of the older generation twin engine helicopters are unable to achieve 7.5° with both engines operating.

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 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 flight 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.

# 6. ROTORCRAFT DETAILS

## 6.1 Design Helicopter – Agusta AW139

The “Design Helicopter” for the purposes of HLS size and structural design is the Agusta AW139, the larger of the two primary types contracted to the Ambulance Service of NSW. The type reflects the new generation helicopters used in HEMS and reflects the maximum weight, maximum contact load/minimum contact area, and has a similar overall length, rotor diameter, etc. to the older Bell 412 models. The AW139 is Performance Class 1 certified aircraft capable of operating with a working load to PC1 when operating to a MTOW of 6.4 tons. See Figure 1.


**Figure 1: AW139 Dimensions**

## 6.2 Agusta AW139 Wheels Contact Area

The Agusta AW139 helicopter model certified Maximum Take-Off Weight (MTOW) is 6,400 kg., however with the increased gross weight kit installed the MTOW extends to 6,800 kg. The following data is provided by the aircraft manufacturer Agusta SPA, Construzioni Aeronautiche, Vergiate Italy. Calculations are based at a MTOW of 6,400 kg. On most occasions however the weight of the aircraft would be somewhat below 6,400 kg.[1]

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

The contact area of the nose wheels:

> 2 x 11.2 sq ins = **22.4** sq ins.

The contact area of the aft main wheels:

> 2 x 23.01 sq ins = **46.02** sq ins.

The distribution percentage of gross weight:

> Nose wheels = **22**%, and total of both main wheels = **78**%.

The loading of the respective contact areas:

> Nose wheels = **173** psi, and for each of the two main wheels, **239** psi.

Distance between contact areas:

> The width of the main wheels is **3** m. and the distance from the nose wheels to a line joining the aft main wheels at a right angle, is **4.35** m.

## 6.3 Performance

The current HEMS helicopters under contract in the Sydney Basin area, the Agusta AW139 and the Eurocopter EC145, are capable of operating to Performance Class 1 under the appropriate conditions. Whenever operationally possible HEMS helicopters are to employ Category A procedures and meet Performance Class 1 requirements.

HEMS helicopters under contract outside of the Sydney Basin generally do not currently meet Performance Class 1 requirements, however it is anticipated that future HEMS rotorcraft contracts in NSW will align with the Sydney Basin requirements.

Future CASA regulatory requirements are anticipated to require the use of Performance Class 1 helicopters in particular urban environments and roof tops.

[1] Agusta SPA, Construzioni Aeronautiche, Vergiate Italy

# 7. SITE LOCATION

## 7.1 Considerations

Hospital based HLSs may be either positioned at surface/ground level or on an elevated structure such as a section of hospital roof or a multi-story car park. The decision will depend on existing facilities, planned facilities, available space/land availability and possibly topography.

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 trauma centre. The selected site should also be conveniently positioned for ground transport access and adequate vehicle parking.

To minimize noise disturbance, the ambient noise level should be considered, particularly near noise sensitive buildings such as hospitals, schools and business premises, and especially in relation to areas beneath the potential approach and departure paths of other aircraft.

Hospital HLS design and location should be such that downwind operations are avoided and cross-wind operations are kept to a minimum. HLSs 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 per cent for the helicopters the HLS is intended to serve. These criteria should apply equally to surface level and elevated heliports.

Possible air traffic conflicts between helicopters using a HLS and other air traffic should be avoided if possible, i.e. below an airport approach/departure flight path. Depending on the frequency of hospital HLS helicopter traffic, the need to provide air traffic control services may need to be considered.

For HLSs used by Performance Class 2 and 3 helicopters, the ground beneath the takeoff climb and approach surfaces should where possible permit safe one engine-inoperative landings or forced landings during which injury to persons on the ground and damage to property are minimized. The provision of such areas should also minimize the risk of injury to the helicopter occupants. The main factors in determining the suitability of such areas will be the most critical helicopter type for which the HLS is intended and the ambient conditions.

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 heliport. Equally, the heat generated by large chimneys under or close to the flight paths may adversely affect helicopter performance during approaches to land or climbs after takeoff. 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.

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; and
- if instrument operations are planned, the availability of suitable airspace for instrument approach and departure procedures.

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

Normally a site will have a simple layout which combines those individual areas that have common characteristics.  Such an arrangement will require the smallest area over-all 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 taxiways or air taxiways.

Elevated or roof top HLSs are generally secure sites, however surface level HLSs may not be offered the same level of security.  Surface level HLSs may be within appropriate security 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 at least 1 m. high, be child safe, and be located at least 10 m. beyond the Safety Area perimeter of the HLS.  It is important that the fence does not infringe the VFR Approach/Departure Transitional Surfaces.  Refer to Section 14.

It should be noted that the security fencing described is only an aid to security and does not define any additional public exclusion zone around an operating helicopter.

## 7.2 Planning Approvals

The various legislative requirements relating to HLSs in NSW are complex and no single advice about hospital HLSs can be provided.  Proponents should note however, that current legislation excludes emergency service landing sites from the definition of “designated development” in the Environmental Planning and Assessment Regulation (which otherwise includes most HLSs).  Generally hospital HLSs are considered “ancillary-uses” to hospital purposes and are thus not separate “development”.  The same cannot necessarily be said about off-site medical HLSs.

Where a HLS or major renovation or change to an existing HLS is proposed, a Development Application may be required to be lodged with the local Council. The Council may also require an Environmental Impact Statement. HLSs 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.

Civil Aviation Safety Authority approval is normally not required however the location of local airports and runway approach and departure flight paths must be taken into consideration. Consultation with the local CASA office may be prudent.

# 8. STRUCTURAL DESIGN

The FAA AC 150/5390-2C, Heliport Design states that the minimum design static load is to be equal to the helicopter's maximum takeoff weight applied through the total contact area of the wheels or skids. For dynamic loads, it specifies 150% of the maximum takeoff 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 surface level HLSs and heliports.

The HLS FATO should be designed for the largest or heaviest type of helicopter that it is anticipated will use the HLS, and account taken of other types of loading such as personnel, freight, etc. The heaviest helicopter contracted to the Ambulance Service of NSW for the purpose of HEMS is the Agusta AW139 which has a maximum certified take off weight of 6,400 kg. With the increased gross weight kit installed the MTOW extends to 6,800 kg. The Bell 412 type remains in use but for the most part is unable to meet practical Performance Class 1 requirements. The dimensions of this type are marginally larger but close enough to be considered as the same. The Bell 412 however has a MTOW between 1,000 and 1,400 kg. less than the AW139. The AW139 is therefore to be considered as the Design Helicopter. For HLS design loading, the MTOW is to be considered as 6,800 kg. All references to 6.4 tons marked on HLS diagrams, are to be amended to 6.8 tons.

For the purpose of design, it is to be 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.

## 8.1 Surface Level HLS

For surface level HLSs the advisory information recommends that the dynamic loads will be met with a sealed LLA constructed of 15 cm. thick reinforced Portland cement/concrete. The LLA dimensions for the AW139 are a minimum of 6.35 x 6.35 m.

## 8.2 Elevated HLS

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

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:

a) Dynamic load due to impact on touchdown

This should cover the normal touchdown, with a rate of descent of 6 feet per second, which equates to the serviceability limit state. The impact load is then equal to 1.5 times the maximum takeoff 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:

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

To this should be applied the sympathetic response factor discussed at b). following.

b) Sympathetic response on the FATO

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, i.e. 1.66 x 1.5 x 1.3 = 3.23.

Other design considerations involving the over-all superimposed load from personnel and equipment on the HLS etc. are in this case negligible, however the ICAO Heliport Manual does provide an allowance of 0.5 kilo newtons per square metre.

In essence, the following should be considered in the structural design of an elevated HLS:

- static loads due to the helicopter at rest;
- dynamic loads on particularly the TLOF/GEA and out to the FATO, due to impact of the helicopter on touchdown;
- sympathetic response (resonance) of the HLS structure;
- personnel, freight and equipment loads;
- wind loads;
- lateral loading on supports;
- the dead load of structural members; and
- punching shear.

When all factors are taken into account, the total impact load factor (dynamic loading) is in the vicinity of 3.23, i.e. 3.23 x 6.8. It is recommended that the structural design based on the ICAO Heliport Manual specifications are followed.[2]

[2] Heliport Manual Doc 9261-AN/903

# 9. HLS DIMENSIONS AND SAFETY CRITERIA

A HLS may be surface level or elevated. It may be round or square and incorporate round or square FATO and TLOF markings and lighting. Round is preferred. 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.

The minimum required dimensions are based upon the Design Helicopter, the AW139. The following information is relevant for a single HLS and thus a single FATO.

## 9.1 FATO

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

## 9.2 TLOF

Diameter minimum 1 x main rotor dia. of 13.8 m., rounded to a diameter of **14** m. or **14** x **14** m. square.

## 9.3 LLA

Diameter minimum of **6.35** m. or **6.35** x **6.35** m. square If a load bearing TLOF is in place the LLA will fall within the TLOF. In such a case, the LLA will not be defined on the HLS deck. In almost all cases, an elevated HLS will have a load bearing TLOF and probably a load bearing FATO.

## 9.4 Safety Area

The FATO shall be surrounded by a Safety Area which is to be free of all obstacles.

The purpose of a Safety Area is to:

a) reduce the risk of damage to a helicopter caused to move off the FATO by the effect of turbulence or cross-wind, mislanding or mishandling; and

b) 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.

A Safety Area surrounding a FATO intended to be used in visual meteorological conditions (VMC) shall 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.

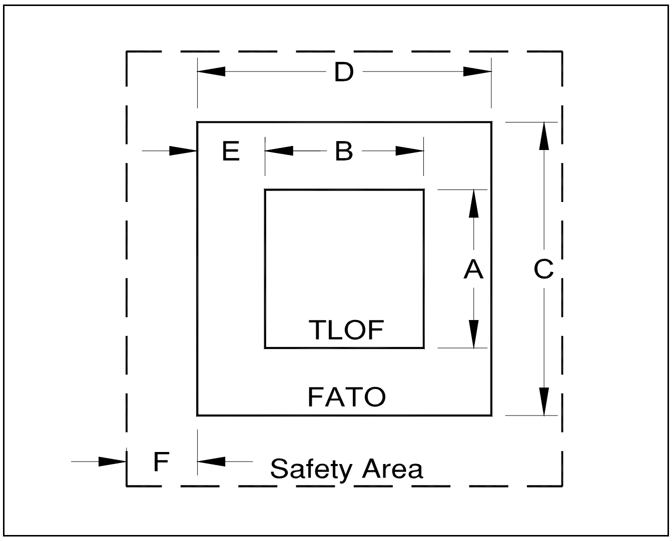
Therefore, 0.3 x RD (13.8 m.) = 4.14 m. The Safety Area width surrounding the FATO is thus rounded to **4** m.

No fixed object shall be permitted on a Safety Area, except for frangibly mounted objects which, because of their function, must be located on the area. No mobile object shall be permitted on a Safety Area during helicopter operations.

Objects whose functions require them to be located on the Safety Area shall not exceed a height of 20-25 cm. when located along the edge of the FATO, nor penetrate a plane originating at a height of 20-25 cm. 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 shall not exceed an upward slope of 4% outwards from the edge of the FATO.

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

The minimum recommended Safety Area surrounding the FATO is dependant 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 to meet night operations requirements, will be installed with the required lighting. With such markings, the Safety Area minimum is to be **4** m. in width and surround the FATO. The total diameter of a round HLS including the Safety Area will therefore be (25 + 8 m.) = **33** m. If square, it will be **33** x **33** m. See Figures 2 and 3.[3]




**Note**: HLS may be square or round. Length and Width dimensions also relate to diameter if round.

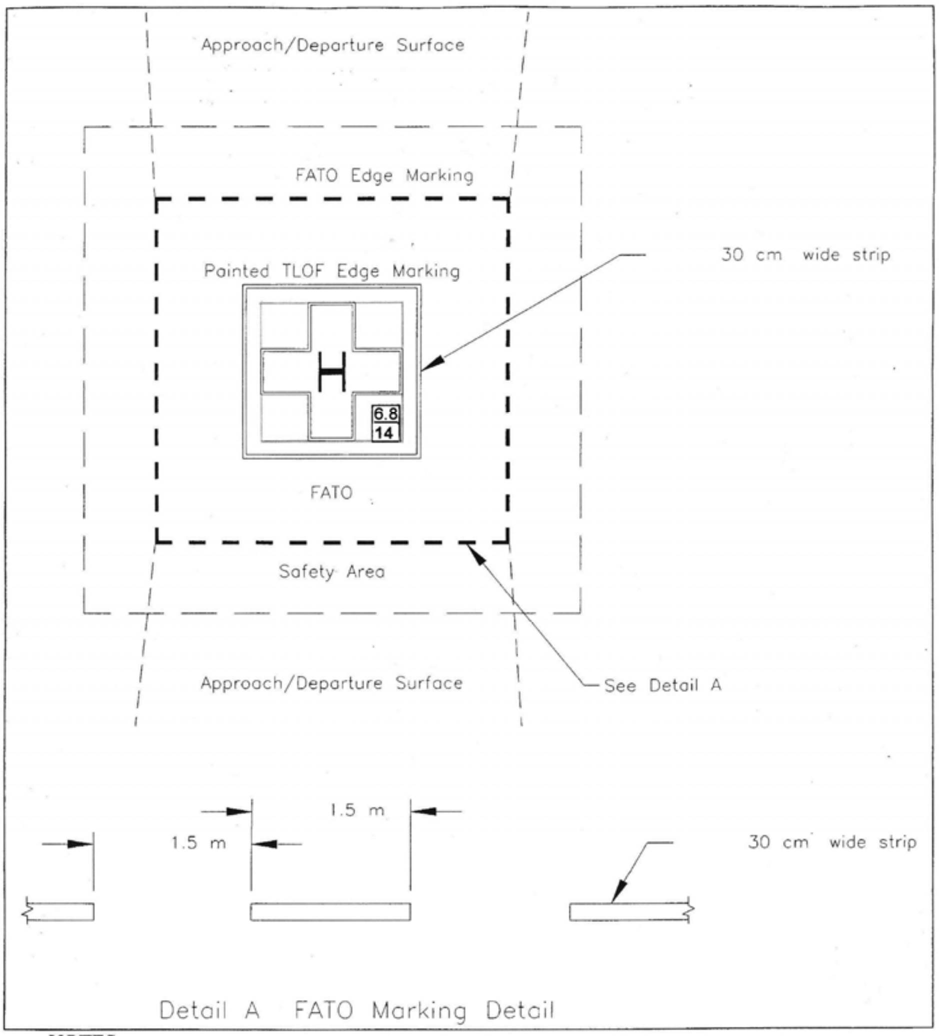
Design Helicopter: **Agusta AW139**

RD: Rotor diameter of the design helicopter
OL: Overall length of the design helicopter

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

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

[3] AC 150/5390-2B




**Note:**

1. The "H" is orientated to Magnetic North.
2. The perimeter of the TLOF defined with a continuous, 30 cm. wide white line.
3. The perimeter of the FATO defined with a 30 cm. dashed white line approximately 1.5 m. in length, and with end-to-end spacing of approximately 1.5 m.
4. The corners of a square FATO to be defined.
5. The positions/directions of the Approach/Departure Surfaces are examples only.
6. HLS deck static weight limit for the AW139 is 6.8 tons.

**Figure 3: TLOF, FATO, "H" and Weight/Rotor Diameter Markings**

## 9.5 Parking Position

Only applicable if the HLS is to be made to such a size that a second helicopter can be accommodated. Refer to the AOC for advice.

## 9.6 Perimeter Safety Net

A perimeter safety net is required to surround the edge of a HLS/rooftop/elevated HLS. It must be not less than 1.5 m. wide, have a minimum load carrying capability of 122 kg/m$^2$, with the outer edge not projecting more than 25 cm. above the HLS deck. It is preferable that the safety net not project above the level of the deck. Both the inside and outside edges of the safety net are to be secured to a solid structure.

## 9.7 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.

## 9.8 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 a surface level HLS. It is however more complex for an elevated or roof top HLS. A suggested solution for a roof top HLS follows.

A gravity operated fuel/water separator of sufficient size (total capacity of ~2,700 litres [static holding capacity of ~1,500 litres and integral storage of 1,200 litres]) should be installed below the rooftop HLS deck or elevated HLS 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. Desirable construction material is stainless steel.

## 9.9 HLS Capacity and Load Limitations

Refer to Section 8, Structural Design for maximum load limits.

## 9.10 Access Points/Dimensions

For elevated HLSs, two access points are required. The primary access point is at the same level as the HLS deck and should involve security controlled double doors with an entry width of at least 1.8 m. This would normally lead directly into the Emergency Department or a lift.

The second access point should where possible be on the opposite side of the deck, and allow for emergency evacuation of the HLS if necessary. This access would normally be in the form of stairs leading down from deck level to an emergency egress stair well.

Refer to Sub-section 10.7 regarding surface level or on-grade HLS access paths.

## 9.11 Windsock

A 30 knot windsock is required to show the direction and magnitude of the wind. The windsock should provide the best possible colour contrast to its background. It may be either white or yellow, with a preference for yellow. It should give a clear indication of the direction of the wind and a general indication of the wind speed. It is recommended that a wind direction indicator consist of a truncated cone of lightweight fabric, 2.4 metres long with diameters of 0.6 and 0.3 metres at respective ends. It is to be located so it provides 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 150 m. from the HLS, and be clearly visible when on the HLS.

To avoid presenting an obstruction hazard, the windsock is to be located outside the Safety Area and it is not to penetrate the approach/departure or transitional approach/departure surfaces. For night operations, refer to Sub-section 11.6 and Figure 9.

## 9.12 Fuel

Hospital HLSs intended to be used as permanent bases for operations will require refuelling facilities. Such facilities would normally be bulk storage, either underground or in above ground storage tank. To avoid double handling, it is desirable to locate refuelling facilities immediately adjacent to the HLS or parking apron. The anticipated fuel usage will dictate the bulk storage volume necessary. Professional advice is required.

Where drum stock is used, provision for sufficient secure storage under cover is necessary. Dangerous Goods Legislation governs the quantities allowed to be stored within a hangar and in other forms of storage accommodation.

## 9.13 Magnetic Resonance Imagers Interference

Magnetic Resonance Imagers (MRI) are located in hospitals and used in diagnostic work. A MRI can create a strong magnetic field that 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. 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. See the example at Figure 4.


**Figure 4: Example MRI Direction and Distance Marker in Metres**

## 9.14 Radio Communication

Good communications between the helicopter, the hospital and the AOC is essential. This may be via cell phone, radio or both. It has become common hospital practice for the Security Department to be responsible for HLS security, access, safety, lighting and communications.

Appropriate radio equipment and protocols for use are thus required. Hospital procedures must therefore be prepared. Advice from the Ambulance Service of NSW

Medical Retrieval Unit should be sought to confirm the frequencies and call signs in use.

## 9.15 Fire Fighting Appliances

There are currently no regulatory standards in NSW for fire fighting appliances. 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 ground level and elevated hospital HLS decks are considered as manned HLSs. A foam system 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. In all situations the advice of the local fire authorities is to be sought for the latest information. Ultimately the decision rests with the MoH.

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

- a fire water point with fire hose located adjacent to the primary HLS deck access point.
- fire fighting appliances suitable for liquid and electrical fires located in the vicinity of the primary access point, including:
    - 1 x $CO_2$ 3.5 kg.
    - 1 x Dry Powder 9.0 kg.
    - 1 x Foam 90 litres.
    - 1 x Fire Blanket.

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

## 9.16 Instrument Approach Aids and Visual Glideslope Indicators

The use of satellite-based GPS approaches to the hospital 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, of which the HAPI-PLASI is one and the type used at the Westmead NETS roof top HLS.

Refer to the AOC for advice.

## 9.17 Exhaust Gas Ingestion

Hospital air conditioning air intake systems should not be positioned in the vicinity of a rooftop HLS deck. Under particular wind conditions the exhaust gases emitted from the helicopter engines exhausts can travel for some distance.

# 10 HLS MARKINGS

## 10.1 HLS Surface Covering and Marking

All paint used on a HLS surface is to be hard wearing (road type), hydro carbons resistant, UV resistant and non-slip. HLS is to be painted neutral grey, out to at least the perimeter of the FATO. Surface markings are to identify the facility as a HLS. Lines/markings for the FATO and TLOF are to be 30 cm. wide and of a contrasting colour (white) to enhance conspicuity.

There are a number of manufacturers of paint and primer/sealer to meet the requirements. An example of a product that meets the requirements is as follows:

- Ennis Waterborne Roadmarking Paint
- Ennis Waterborne Primer/Sealer
- Ennis Crushed Quartz (a non-slip additive)
- Ennis High Performance Glass Beads Type B (reflective)

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

## 10.2 TLOF and FATO Perimeter Marking

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

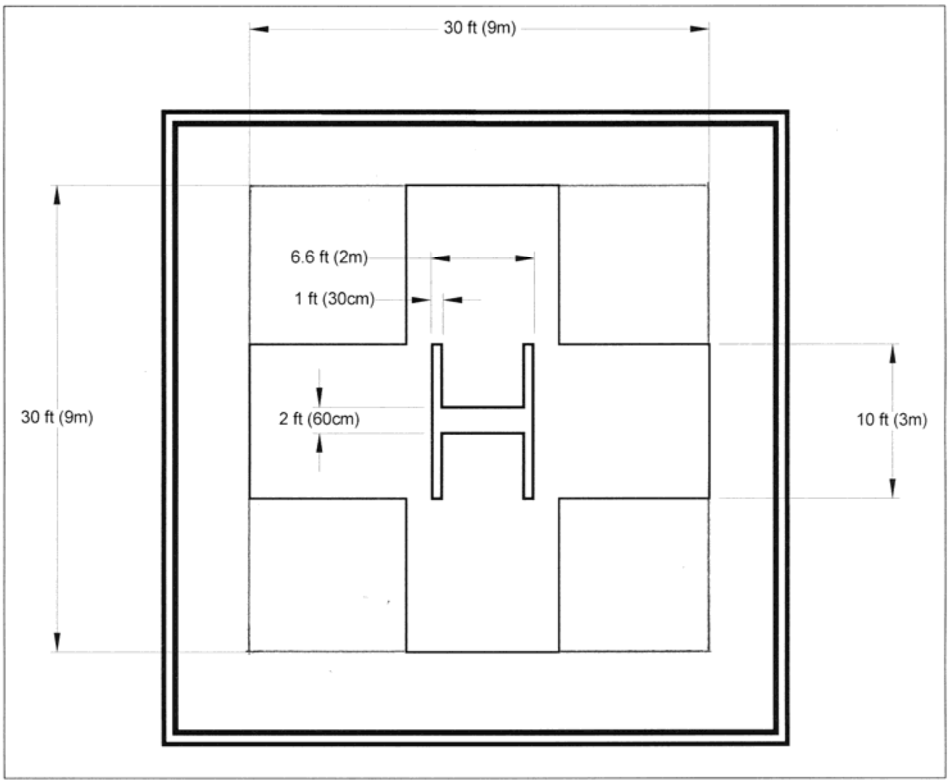
a) TLOF. The perimeter of the TLOF is to be defined with a continuous white line 30 cm. wide. Refer to Figure 3.

b) FATO. The perimeter of the FATO is to be defined with a 30 cm. wide dashed white line. The corners of a square FATO should be defined, and the perimeter marking segments are to be 30 cm. in width, approximately 1.5 m. in length, and with end-to-end spacing of approximately 1.5 m. Refer to Figure 3.

## 10.3 Hospital HLS Identification Marking

The identification marking is intended to identify the location as a hospital HLS, mark the TLOF, and provide visual cues to the pilot.

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 (see Sub-section 11.4 and Figure 8) are also to be used to indicate two preferred approach/departure directions. Figure 5 illustrates the requirements of the standard hospital marking.




**Note: (Example is for a square HLS)**

1. The standard hospital identification is a red "H" surrounded by a white cross over a red square.
2. A white cross 9 x 9 m.is overlaid on a red background 9 x 9 m.
3. The surrounding box is a continuous 30 cm. wide white TLOF perimeter marking.
4. The TLOF surrounding the "H" markings is 14 x 14 .m.

**Figure 5: Standard Hospital HLS Identification and Markings**

## 10.4 Hospital Identifier

The name of the hospital and its identifier are to be painted on the HLS surface orientated to Magnetic North, and normally 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 1 m. high, in white and marked as per the example for Tamworth Hospital following: "**TRRH (YXTW)**".

## 10.5 Weight and Rotor Diameter Size Limitation Markings

Within the TLOF and at the lower RH side of the 9 x 9 m. 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 6,800 kg., and below, "**14**", equating to a rotor diameter the Design Helicopter. The numbers should be 0.9 m. high and black on a white background. Figure 6 following depicts typical ground level HLS markings.

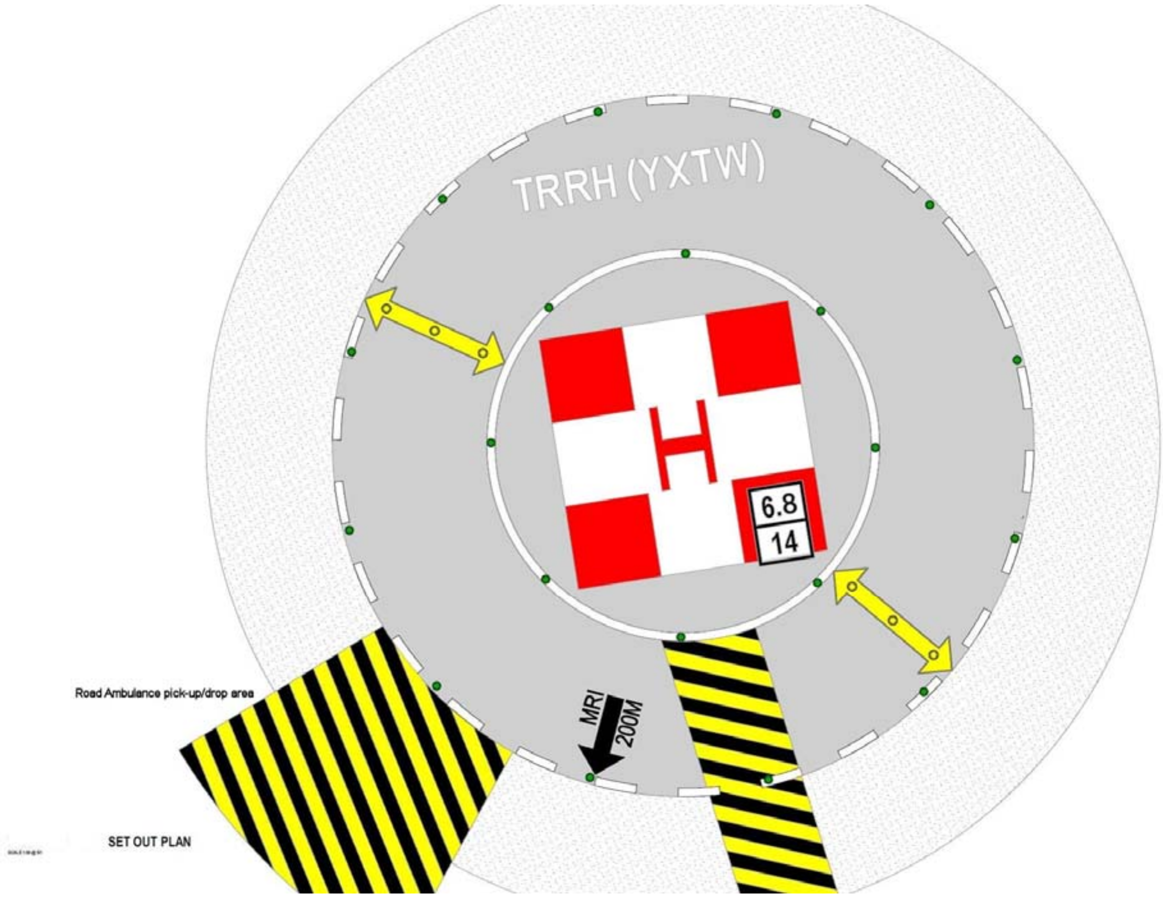



**Figure 6: HLS Markings, including Maximum Weight and Rotor Diameter Limits**

## 10.6 HLS Deck Walkways

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

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

## 10.7 Surface Level Walkways and Paths

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

Maximum distance of the HLS from the Emergency Department should not be more than 100 m.

## 10.8 Magnetic North Orientation

The red “H” marker and thus its white cross on the red background, is to be orientated towards Magnetic North.

## 10.9 Example Roof Top HLS Layout

The following photograph at Figure 7 provides an example of a roof top HLS layout incorporating:

- TLOF perimeter markings and lighting,
- safety net and safety area beyond the safety net,
- maximum weight and rotor size limitation markings,
- HLS deck walkway,
- hospital identifier,
- hospital HLS identification marking with magnetic north orientation,
- MRI direction,
- surveyed approach and departure paths, and
- secondary HLS deck emergency exit.

**Note:**

1. HLS deck in light grey.
2. The perimeter of the FATO is defined with a dashed white line at 25 m. diameter, and with 12 flush mounted green lights.
3. The perimeter of the TLOF is defined with a continuous, 30 cm. wide white line at 14 m. diameter, and with 8 flush mounted green lights.
4. The direction arrows are yellow, with a minimum of three flush mounted yellow lights.
5. HLS identification marking is a red “H” on a white cross orientated to magnetic north.
6. Walkway is in yellow and black stripes (chevrons).

**Figure 7: Example Roof Top HLS Layout**

# 11 LIGHTING

## 11.1 HLS Lighting

For night operations, the TLOF, the FATO, approach/departure direction, 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 3 km at the prevailing Lowest Safe Altitude (LSALT) in clear conditions. That is, all lighting must be visible both with and without the use of NVGs under these conditions.

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

A statement relating to NVG compliance is required from the lighting contractor.

## 11.2 TLOF-Perimeter Lights

The TLOF perimeter is to be lit with green lights. Flush mounted lights are to be used, and they should be located within 30 cm. of the outside edge of the TLOF perimeter (14 m. diameter). Lighting 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 lights is required.

## 11.3 Load Bearing FATO-Perimeter Lights

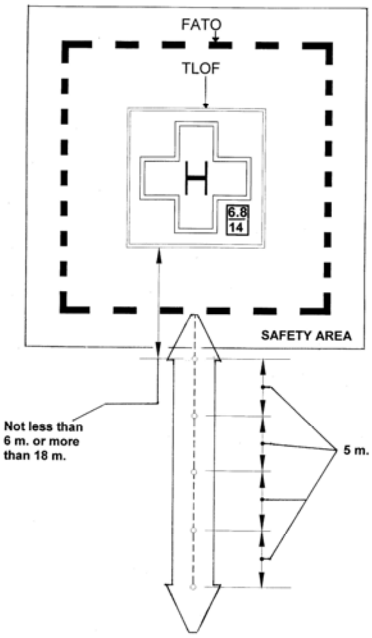
Green lights are to define the perimeter of a load-bearing FATO. A round FATO is preferred, however if square, a minimum of four flush light fixtures per side is recommended. If square, a light should be located at each corner with additional lights uniformly spaced between the corner lights. Whether square or round, not less than 12 lights uniformly spaced are required.

***Note:***

*Flush lights are required, and they should preferably be located within 30 cm. of the outside of the FATO perimeter and within the safety net area.*

## 11.4 Landing and Take-Off Direction Lights

Landing and Take-Off direction lights are required for both surface and elevated HLSs. On elevated HLSs, they should be installed on the deck to provide landing and take off directional guidance at night. At ground level HLSs, landing direction lights are ideally a configuration of three to five yellow, flush mounted omni-directional lights on the centreline of a yellow two headed arrow with black borders painted on the deck, and showing the preferred approach/departure path/s. The number of lights will depend on the arrow lengths. Such lights may be spaced at up to 5 m. intervals beginning at a point not less than 6 m. and not more than 8 m from the TLOF perimeter and extending outward in the direction of the preferred approach/departure path. More commonly however, the area is insufficient and the arrow/s may be proportionally reduced in size and fewer lights used. Commonly, the arrows are positioned between the TLOF and FATO with not less than three lights per arrow.




***Note*:**

1. The direction of arrow and lights are an example only and not to scale. The size may dictate the number of lights, which should not be less than three.
2. This size and positioning of the arrow is unlikely to be achieved on an elevated HLS deck due to size. In such a situation it is common that the arrows are located between the TLOF and FATO markings and each installed with three evenly spaced yellow lights.
3. Lights are flush mounted NVG compatible yellow omni-directional.
4. Arrow is yellow with a black border.
5. FATO and TLOF lights not shown.


**Figure 8: Approach/Departure Directional Arrow and Lights**

## 11.5 Taxi Route and Taxiway Lighting

Refer to the AOC for advice.

## 11.6 Windsock Lighting

The windsock is to be illuminated by four closely mounted white lights to ensure that it may be seen clearly from all directions. A red obstruction light is also to be positioned on the top of the mast. See Figure 9.

**Figure 9: Windsock and Lighting**

## 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 takeoff 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 low intensity flood lights do not meet the purpose and present unacceptable obstacles and are not to be used.

## 11.8 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 12 nm. by night. Such a beacon may be activated via a PAL system, which is recommended. Refer to Sub-section 11.10 for suppliers.

### 11.9 Lighting Activation

All HLS lighting must be capable of manual activation and deactivation. Flood lighting is to be on a separate circuit to that of the FATO, TLOF, approach/departure directional lighting, 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 Pilot Activated Lighting (PAL) system. This utilises a hospital based VHF radio and 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 allows for 45 minutes duration. 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 is normally located within the lift lobby/HLS deck reception room adjacent to the PAL controller.

### 11.10 HLS Lighting Suppliers

There are a number of aerodrome and HLS lighting equipment suppliers. Ensure that the supplier provides NVG compliant lights and issues a certification to that effect.

At present there are only two confirmed and acceptable suppliers of NVG compliant flush mounted HLS deck lighting (green and yellow):

**Point Lighting Corporation**
P.O. Box 686
Simsbury Connecticut
USA 06070
P: +1 860 243 0600
F: +1 860 243 0665
Info@PointLighting.com.

Agent: Stan Glaser
Stan.glaser@sgsolutions.com.sg
&
**FEC Heliports**
5298 River Road
Cincinnati, Ohio
USA 45233
P: +1 513 864 8014
M: +1 513 378 5915
www.fecheliports.com

Agent: Tom Schuman
tom@fecheliports.com

Following are three local organisations currently providing HLS lighting and windsock services, but not necessarily NVG compliant lighting:

**Airport Lighting Specialists**
18 Simms Road
Greensborough Vic. 3088

P: 03 9432 0511
F: 03 9720 8233
Email: sales@airportlighting.com.au
www.airportlighting.com.au

**Thorn Airfield Lighting**
Lot 7-9 Newcastle Road
Bayswater Vic. 3153

P: 03 9720 3233
F: 03 9720 8233
Email: Australia@safegate.com
www.thornairfieldlighting.com

**Avlite Systems**
11 Industrial Drive
Somerville Vic. 3912
P: 03 5977 6128
F: 03 5977 6124
Email: info@avlite.com
www.avlite.com

# 12 OBSTRUCTIONS

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

## 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.

## 12.3 Obstructions on or in the Vicinity of the HLS

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

a) Removing the object.

b) Altering the object, e.g. reducing its height.

c) 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 9. Other obstacles in close proximity to the HLS deck may include radio aerials or exhaust stacks etc. attached to the main building or other buildings in the vicinity. All such obstacles are required to have red obstacle lights fitted.

## 12.4 Obstructions in close Proximity but Outside and Below the Approach/Departure Surface

Unmarked wires, antennas, 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. Usually 12” marker balls are sufficient in size.

If difficult-to-see objects penetrate the object identification surfaces as illustrated in Figure 10 following in Section 13, these objects should be marked to make them more conspicuous.

## 12.5 Shielding of Objects

If there are a number of obstacles in close proximity, 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.

## 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 between the FATO and 200 m. from the HLS.

# 13 OBJECT IDENTIFICATION SURFACES

## 13.1 Description

The object identification surfaces can be described as follows:

a) 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 ~30 m.

b) Under the approach/departure surface, the object identification surface starts from the outside edge of the FATO and extends horizontally out for a distance of ~700 m. From this point, the object identification surface extends out for an additional distance ~2,800 m. while rising on a 2.5º or 22:1 slope (22 units horizontal in 1 unit vertical). From the point ~700 m. from the FATO perimeter, the object identification surface is ~30 m. beneath the approach/departure surface.

c) 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 ~30 m. outside the Safety Area perimeter. At the upper end of the surface, the object identification surface extends laterally ~60 m. on either side of the approach/departure path.

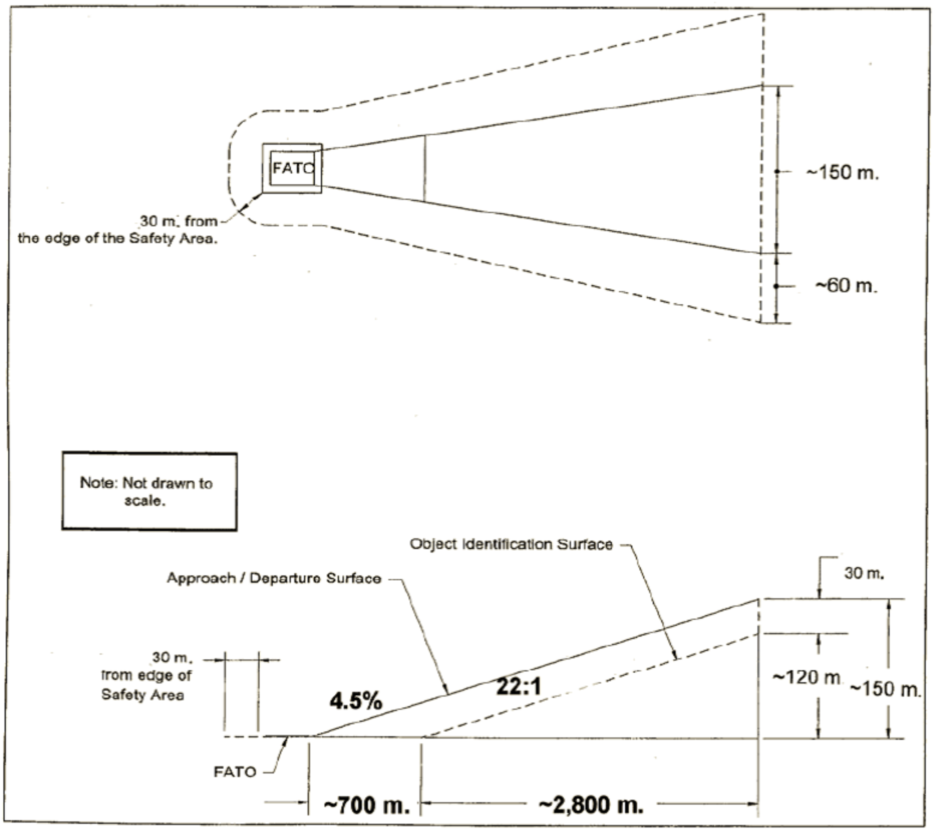



**Figure 10: Airspace Where Marking and Lighting are Recommended**

# 14 OPERATIONAL REQUIREMENTS

## 14.1 VFR Approach and Departure Paths

The purpose of approach/departure airspace is to provide sufficient airspace clear of hazards to allow safe approaches to and departures from landing sites.

Approach/departure paths should be such that downwind operations are avoided and crosswind operations are kept to a minimum. To accomplish this, a HLS should have more than one approach/departure path which provides an additional safety margin and operational flexibility. The preferred flight 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 flight paths should not be less than 150 degrees, and preferably 180 degrees.

## 14.2 VFR Approach/Departure and Transitional Surfaces

An approach/departure surface is centred on each approach/departure path. Figure 11 illustrates the approach/departure (primary and transitional) surfaces.

The approach/departure path starts at the 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 ~3,500 m. where the width is ~150 m. at a height of 500 feet above the elevation of TLOF surface. For PC1 survey purposes, the survey commences from the forward edge of the FATO in the flight path direction, from a datum point 1.5 m. above the FATO edge.

The transitional surfaces start from the edges of the FATO parallel to the flight path centre line, and from the outer edges of approach/departure surface, and extend outwards at a slope of 2:1 (2 units horizontal in 1 unit vertical) for a distance of ~75 m. 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. See Figure 11.

***Note:***

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

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

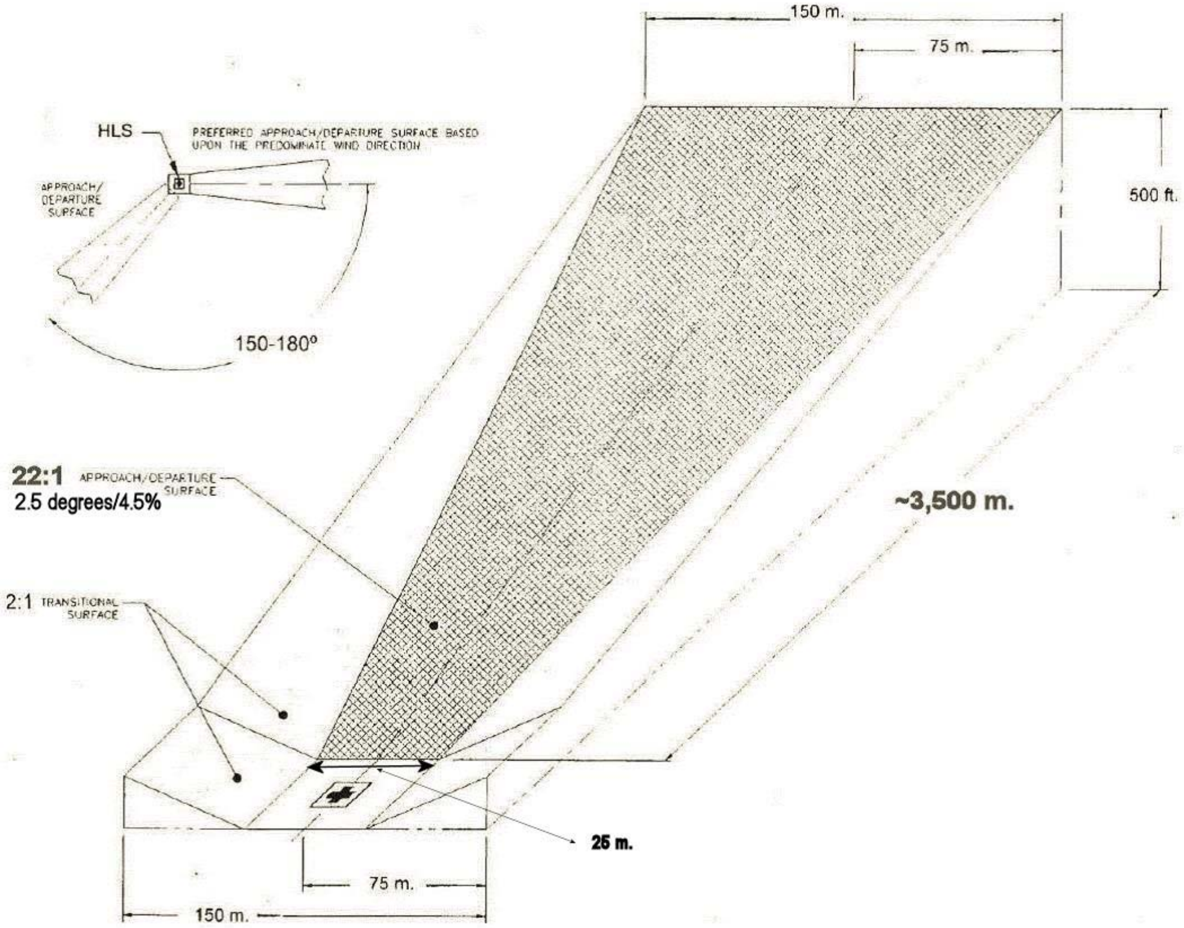



**Figure 11: VFR HLS Approach/Departure Transitional Surfaces**

## 14.3 HLS Approach Plans

During the HLS planning phase, potential HLS approach paths should be studied and applied to paper to confirm that 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.

## 14.4 VFR Approach and Departure Path and Transitional Surface Survey

NSW Ambulance currently requires HEMS contractors meet Category A performance requirements when circumstances allow. The introduction of a new fleet of AW139 helicopters will allow for Category A operations to be undertaken at all times. The vast majority of urban hospital based HLSs 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 flight path.

To date CASA has not provided guidance in relation to the survey requirements. The following however is considered adequate when prepared by a licensed surveyor:

1. A survey covering the entire VFR approach and departure path and transitional surface area for each flight path. The entire area is a rectangle 150 m. x 150 m., commencing from the forward edge of the FATO at eye height (1.5 m.) extending out at 2.5º for 3.5 km. At 3.5 km., the flight path is approximately 500 feet above the HLS elevation. The width of the flight path at the commencement (FATO edge) is 25 m., expanding uniformly to 150 m. at a distance of 3.5 km. The transitional surface extends laterally from the outer edges of the flight paths at 2:1.

2. A written report. Refer to ASNSW for advice on content.

3. A plan drawing out to the limit of any obstruction along the flight path/s accompanied by a statement to the effect that no obstructions exist beyond the relevant distance.

4. A side elevation drawing out to the extent of the obstructions along the flight 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.

5. 3D modelling along the flight paths is a very effective method of showing obstacles and their relative position etc., and if possible should be provided.

### 14.5 Flight 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 HLSs. In Victoria there is legislation through Planning, requiring a Design Development Overlay (DDO) to be prepared to protect the area below hospital HLS flight paths. This is normally completed in association with the PC1 survey. In Victoria, any Development Application to the local Council that could have an effect on a hospital HLS flight path must be passed via the DoH for a determination. The Council are then required to follow the direction of the DoH.

In the absence of formal legislation, it is recommended that a DDO be prepared at the time of the PC1 VFR approach and departure paths and the transitional surface survey. Subsequently, the survey report is to be passed to the local Council with advice that the flight paths require protection and that any proposed development in the vicinity be referred to MoH.

Refer to ASNSW for advice on the DDO format.

### 14.6 Curved VFR 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 feet should be avoided, and there should be no changes in direction below 500 feet at night.

### 14.7 Periodic Review of Obstructions

The relevant hospital in association with the Ambulance Service of NSW 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 AOC as soon as there is knowledge of any potential local obstructions such as cranes etc.

The Ambulance Service of NSW shall at its discretion, undertake periodic HLS Safety Audits at periods normally not exceeding 24 months.

### 14.8 Turbulence

Air flowing around and over buildings, stands of trees, terrain irregularities, etc. 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 a roof top HLS, when compared with a HLS which is elevated 1.8 m. 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 updrafting on the windward side of a building supporting a rooftop HLS.

### 14.9 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). In the Sydney area, consideration of the CASA Building Control Regulations and the Sydney Kingsford Smith Airport OLS are required, particularly the inner horizontal OLS. Refer to the MOS Part 139 - Aerodromes, Chapter 7. If infringements are likely, a submission is required and is submitted to and coordinated by the Airport Design section at Sydney Airport Corporation Limited (SACL). Assessment will require a number of parties, including

SACL, CASA, Airservices and the major airlines. Final determination is provided by the Federal Department of Infrastructure in Canberra.

Additional information may be found within the current Airservices En Route Supplement Australia (ERSA), including advice on special helicopter routes in the Sydney area.

### 14.10 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.

On-site hospital HLSs 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, council officers and/or local fire brigade. Such measures are unnecessary for a well planned hospital HLS. Elevated or roof top HLSs are more easily secured and have the added advantage of decreasing the noise impact of helicopter movements.