INISTURK DESIGN HELIPORT ASSESSMENT

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3 INTRODUCTION

The assessment is in addition to an assessment conducted on a site within an adjacent field. This draft design heliport is intended for a location adjacent to the community centre South of the Inisturk main harbour at Lat. 53°42'04" Long. 010°05'29" with site magnetic declination of -4°31'. The site is within a field surrounded by a dry-stone wall boundary topped by wooden posts and fencing. The field has a local road to the West and with the uneven terrain sloping down towards the coast to the East.

Mayo County Council are responsible for the development of the heliport. The heliport is likely to be used for the transfer of emergency patients from the island for specialist care. Therefore, day and night heliport operations are expected. The design helicopter is the S92 type operated by the Irish Coast Guard.

The site inspection and topographical assessment was carried out on the 14th March 2020.

4 REGULATORY NOTE

ICAO Annex 14 Vol 2 is recognised by the Irish Aviation Authority as the principle document for the design of heliports in Ireland and internationally. This document and its associated publications are referenced in this assessment.

The assessment of the proposed heliport was conducted by a site visit and survey and by assessment of the draft design completed by Langan Consulting Engineering for Mayo County Council in May 2019.

Although there is no current regulatory requirement for emergency service helicopters to operate to performance class 1(PC1) to and from heliports similar to Inisturk's planned heliport it is Coast Guard policy to do so. As such, the site will be considered to be a HEMS pickup location. This report will consider PC1 specifications as these currently fall in line with best international practice.

Any future commercial operations to and from this helipad may also be obliged to operate to PC1 and therefore it is recommended to construct the heliport to the specifications that would permit it. The application of the recommendations in ICAO Annex 14 Vol 2, particularly in relation to the heliport dimensions and the approach and take-off obstacle limitation surfaces, will ensure this.

5 RESCUE AND FIRE FIGHTING SERVICES

When choosing the level of firefighting services required consideration should be given to the frequency of helicopter movements, the size of the helicopters intended to operate to the site and building regulations. This heliport would be expected to have a low frequency of operations but procedures in the event of an accident should be put in place.

The helipad in the draft design has road access that would allow emergency vehicles to reach the helipad.

Recommendations

- Mayo County Council should develop an Emergency Response Plan for the heliport and coordinate with any local fire services or rescue agencies.

6 WINTER MAINTENANCE

Typical anti-icing and de-icing agents are based on Urea, Glycol or Potassium. These are often used in conjunction with mechanical snow and ice de-icing mechanisms. The criteria for the selection of the most appropriate liquid-form agent will depend on surface type, intended use, effectiveness and environmental impact.

Recommendations

- Mayo County Council should have a maintenance plan in place for the proposed helipad. This plan should invlude wWinter maintenance.

7 METEOROLOGICAL INFORMATION

The wind rose in Figure 7-1 indicates that the prevailing South-Westerly winds strongly influence the wind conditions on Inisturk. A wind direction indicator should be provided at the heliport and sited so as not to be affected by turbulence created by wind over or around prominent ground features. The windsock should also be clear of the main approach and take-off surfaces while giving a clear indication of the wind direction and a general indication of the wind speed.

Recommendations

- A wind sock should be provided at the heliport sited clear of approach and departure paths.

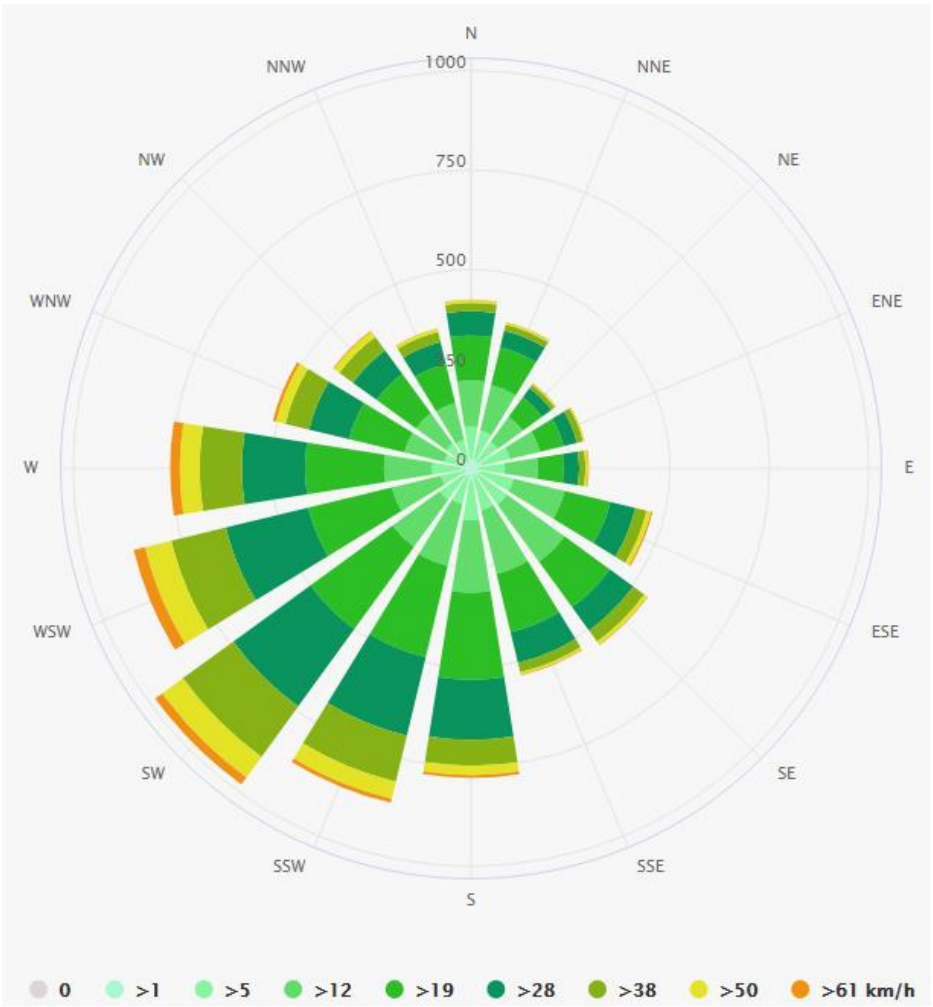


Figure 7-1 Wind Rose for nearby Belmullet indicating the hours per year the wind blows in each direction. (source: meteoblue)

8 HELIPORT DESIGN DATA

8.1 Type

The helipad draft design will consist of a circular surface level structure made of reinforced concrete built onto the sloped terrain. The helipad is accessed by a road leading down from the main road and meeting the helipad on its western side. The site is adjacent to the community centre. 8.68m

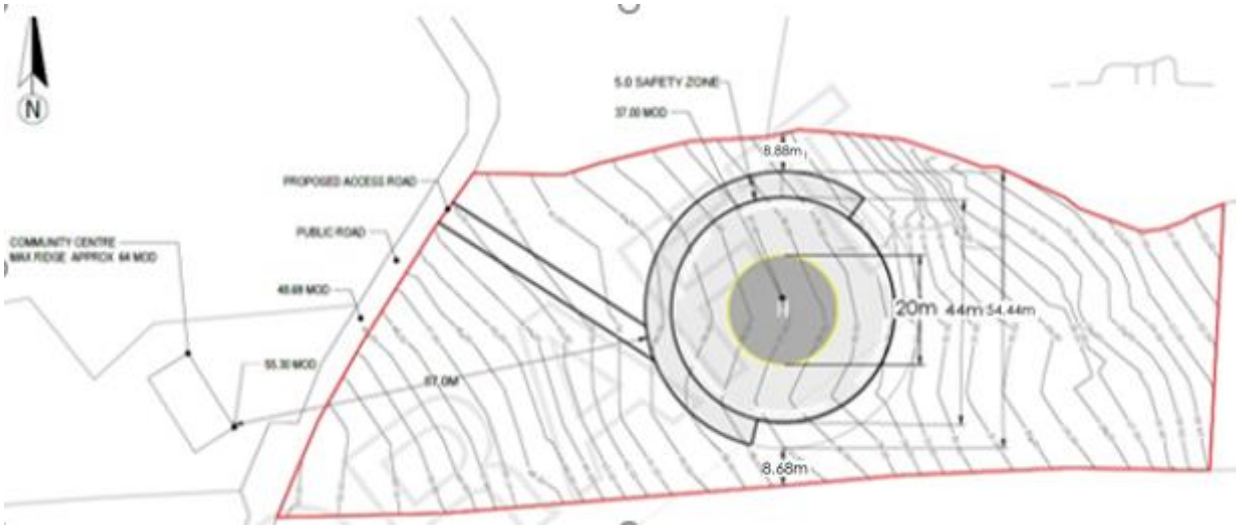


Figure 8-1 Langan Consulting draft section drawing of heliport amended to show correct dimensions for Helipad elements

8.2 Design Aircraft

The helipad design aircraft is the S92. The table below represent the minimum dimensions applicable to the design of the helipad.

Aircraft	Diameter or Square Distance (m)					
		A	B (greater of)		C	
	D-Value	TLOF (ICAO 0.83D)	RFM FATO Dimension	ICAO FATO	ICAO SA	RFM SA
S92	20.88m	17.33m	31.1m	20.88m	41.76	54.44

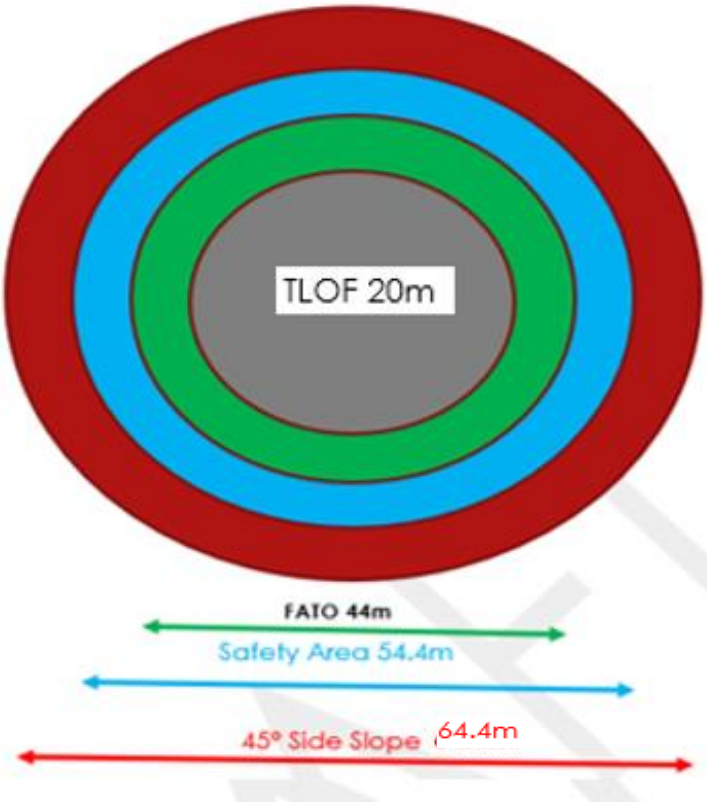


Table 8-1 Design aircraft overall dimensions and helipad dimensional requirements

8.3 TLOF

The Touchdown and lift-off area is centred within the Final Approach and Take-Off area of the helipad in the draft design. 64.4m

ICAO Annex 14 Vol 2 states that a "TLOF shall be sufficient size to contain a circle of diameter of at least 0.83 D of the largest helicopter the area is intended to serve". The helipad TLOFdesign, at 20m, satisfies the greater dimensional requirements of 17.33m for the S92 helicopter type. The S92 has a rear access ramp which needs to be considered when deciding on the TLOF dimension. Therefore, the TLOF dimension of 20m is recommended.

The slope of the TLOF should not exceed 2% but be sufficient to prevent the accumulation of water.

Recommendations

- A "wire brushed" surface finish on the TLOF can provide adequate friction and grip for helicopter landing gear and underfoot.

8.4 FATO

ICAO Annex 14 Vol 2 states that for a FATO "the width shall be not less than the greatest overall dimension (D) of the largest helicopter the FATO is intended to serve" or as prescribed in the helicopter flight manual (RFM). The S92 RFM calls for a FATO size of at least 31.1m. This

requires a circular design of a 44m diameter FATO in order to encompass a 31.1m square.

The design slope of the FATO surface is approximately 1% which provides adequate drainage from the surface and is compliant with the requirements of ICAO Annex 14 Vol 2. During the design phase of the helipad, Mayo CoCo and Rose Aviation will agree on exact dimensions and surface composition.

8.5 Markings

A heliport identification "H" marking should be provided located at the centre of the helipad with the cross bar of the "H" lying perpendicular to the preferred direction of approach.

The FATO perimeter markers should be 30cm in width, 1.5 m in length, and with end-to-end spacing of not less than 1.5 m and not more than 2 m.

The TLOF perimeter marking should be located along the edge of the TLOF and should consist of a continuous white line with a width of at least 30cm.

All markings should have good contrasting colour comprising of non-slip and non-thermoplastic paint.

8.6 Bearing Strength

The FATO should have a dynamic load-bearing capacity for 1.66 times the maximum take-off mass of the heaviest helicopter for which the FATO is intended. The S92 has a maximum take-off mass of 12,837kg equating to a requirement for a dynamic load bearing strength of approximately 21,310kg.

8.7 Downwash Zone

A recommended distance of 50-65m downwash zone should be established around the helipad for aircraft like the S92 which is kept clear of people, property or parked vehicles. This downwash zone is focused primarily underneath the intended approach and departure paths.

8.8 Safety Area

ICAO Annex 14 Vol 2 requires that the FATO be surrounded by a safety area whereby the outer diameter shall be at least 2 D and the width of the safety area surrounding the FATO be the greater of 3m or 0.25 D.

Table 8-2 indicates the required safety area dimensions as per the ICAO requirements. The S92 RFM requires a FATO dimension of 44m. The 0.25D value is 5.22 and as this is the greater than 3m, it is this 5.22 m value that must be used. This results in a dimension of 54.44m diameter. To satisfy the requirements of a safety area the surface, when solid, should not exceed an upward slope of 4% outwards from the edge of the FATO. However, Mayo CoCo should abide by Rose Aviations recommendation of no upward slope at all.

	0.25 D	2 D	RFM FATO with 0.25D
S92	5.22m	41.76m	54.44m

Table 8-2 Safety Area dimensions for S92

The requirement of a protected side slope rising outwards at 45° to a distance of 10m from the edge of the safety area must also be satisfied except on one side of the FATO only. The 45° protected side slope may be penetrated by obstacles on the uphill side only of the draft design.

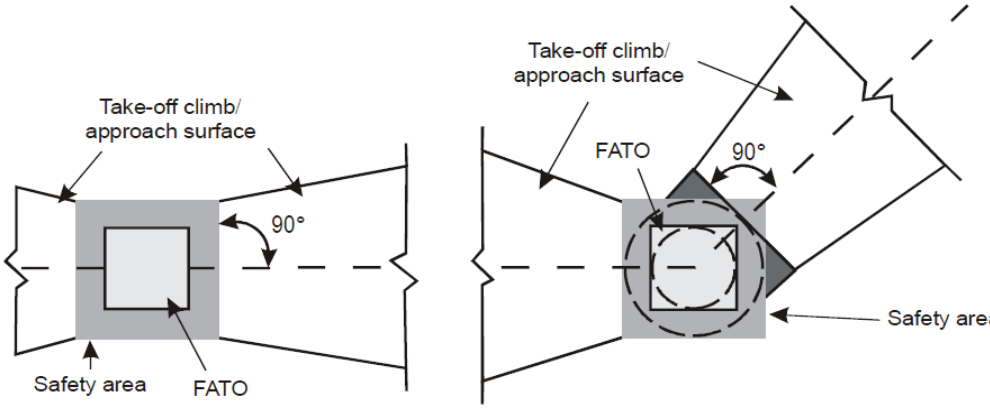
In the draft design the access road routes directly to the helipad on the Western side. This access road avoids routing below approach and/or take-off paths.

8.9 Obstacles with reference to protection surfaces

A heliport should be provided with approach and take-off climb surfaces that ideally allow for an approach and take-off to be conducted into wind with a usability factor of 95%. Approaches and departures in certain directions are not possible if wind conditions exceed the crosswind or tailwind limitations. An obstacle limitation or protection surface is an inclined plane sloping upwards from the edge of the safety area and centred on a line passing through the centre of the FATO.

A surface level heliport shall have at least one approach and take-off climb surface accounting for area/terrain, obstacles surrounding the heliport, performance and operating limitations of the helicopter intended for use and local meteorological conditions, including the prevailing winds.

The angle between the take-off/approach surface centrelines should not be less than 150° or greater than 210°, i.e. a course change not greater than 30°.



Note 1.— Dark grey shaded area requires the same characteristics as the safety area

Note 2.— Angle between take-off climb/approaches surfaces from centreline to centreline depicted for illustration purposes only

Note 3.— Offset take-off climb/approach surface rotated around centre point of FATO

Figure 8-2 Obstacle limitation surfaces — Take-off climb and approach surface

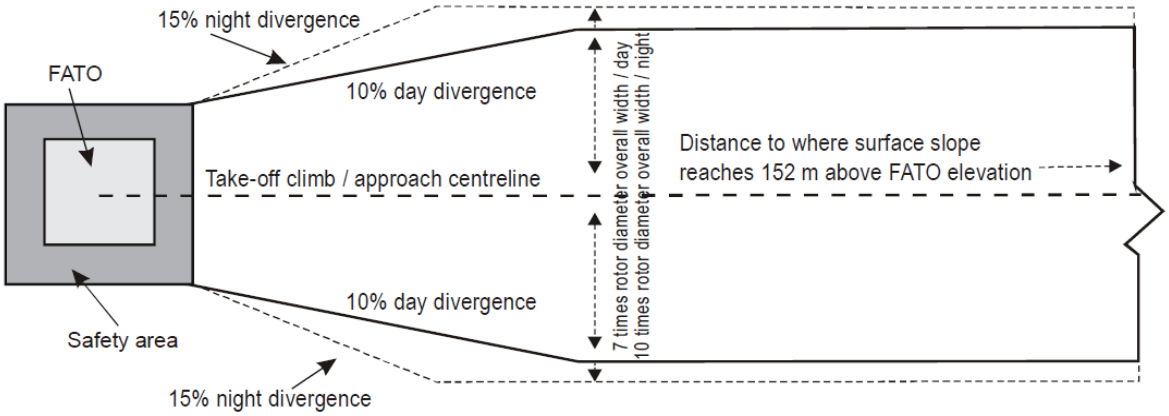


Figure 8-3 Take-off climb/Approach surface width

SURFACE and DIMENSIONS	*SLOPE DESIGN CATEGORIES*		
	A	B	C
APPROACH and TAKE-OFF CLIMB SURFACE:			
Length of inner edge	Width of safety area	Width of safety area	Width of safety area
Location of inner edge	Safety area boundary (Clearway boundary if provided)	Safety area boundary	Safety area boundary
Divergence: (1st and 2nd section)			
Day use only	10%	10%	10%
Night use	15%	15%	15%
First Section:			
Length	3 386 m	245 m	1 220 m
Slope	4.5% (1:22.2)	8% (1:12.5)	12.5% (1:8)
Outer Width	(b)	N/A	(b)

Table 8-3 Dimensions and slopes of obstacle limitation surfaces for all visual FATOs

(a) The approach and take-off climb surface lengths of 3386 m, 1 075 m and 1 220 m associated with the respective slopes, brings the helicopter to 152 m (500 ft) above FATO elevation.

(b) Seven rotor diameters overall width for day operations or 10 rotor diameters overall width for night operations.

The slope design categories in Table 8-3 may not be restricted to a specific performance class of operation and may be applicable to more than one performance class of operation. The slope design categories depicted in Table 8-3 represent minimum design slope angles and not operational slopes. Slope category "B" generally corresponds with helicopters operated in performance class 3. Slope category "C" generally corresponds with helicopters operated in performance class 2.

Although the S92 RFM provides a region exempt from obstacle clearance close to the helipad for a CAT A vertical take-off profile from surface level helipads it is not taken into consideration in this assessment as it effects compliance with ICAO Annex 14 Vol 2 for the reciprocal approach surface.

In the case of an approach surface involving a turn a curved portion can be provided. The sum of the radius of arc and the length of the straight portion of the centreline of the approach surface shall not be less than 575m. The slope of the centreline shall be the same as that for a straight approach.

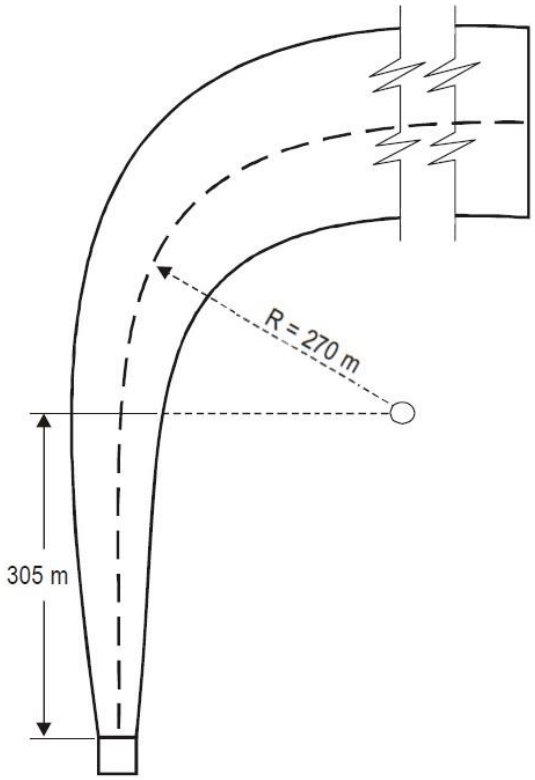


Figure 8-4 Curved Approach Surface

8.10 Obstacles

Image 8-1 View to the West

Image 8-2 View to the North

Image 8-3 View to the South

The heliport in the draft design is surrounded by obstacles or terrain in most directions which prohibit its compliance with ICAO Annex 14 Vol 2 minimum design obstacle limitation surface slope angle of 4.5% for helicopters operating to performance class 1 and the minimum design slope of 12.5% for helicopters operating in performance class 2. Figure 8-5 represents the origin of these slopes at the edge of the required safety area, 20.88m from the centre of the draft design helipad. The obstacles within the figure are relative to the level and position of the centre of the draft helipad design.

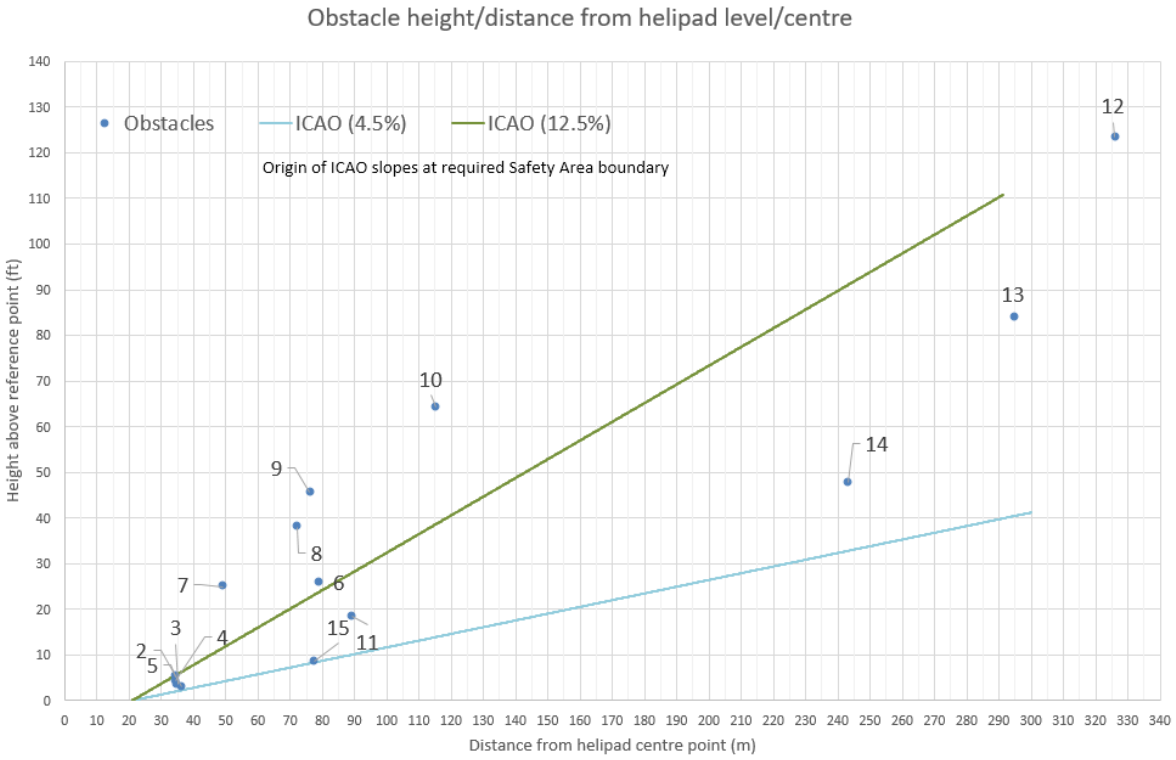


Figure 8-5 Obstacle height/distance

Figure 8-5 above indicates that all measured obstacles are above the 4.5% limitation surface extending from the edge of the required safety area originating at 20.88m (S92 Safety area requirements) from the centre of the helipad. This will limit the S92's ability to operate to and from the heliport while satisfying the requirements of performance class 1.

To satisfy the requirements of ICAO Annex 14 Vol 2 in relation to the obstacle limitation surfaces the level of the heliport in the draft design would need to be raised by 1m (to 38m MOD) from its current level for obstacles marked 2-5 not to penetrate the limitation surface. These obstacles are associated with the boundary wall and fencing which shall be retained.

The high ground to the west and associated obstacles prohibit approach surfaces to the heliport.

Recommendations

- Helipad level should be raised to ensure no obstacles penetrate the obstacle limitation surface (4.5%) along the approach and departure paths.

8.11 Approach and Take-off Paths

Topography, prevailing winds and obstacle environment dictate which surface directions, if any, are available at the intended heliport site.

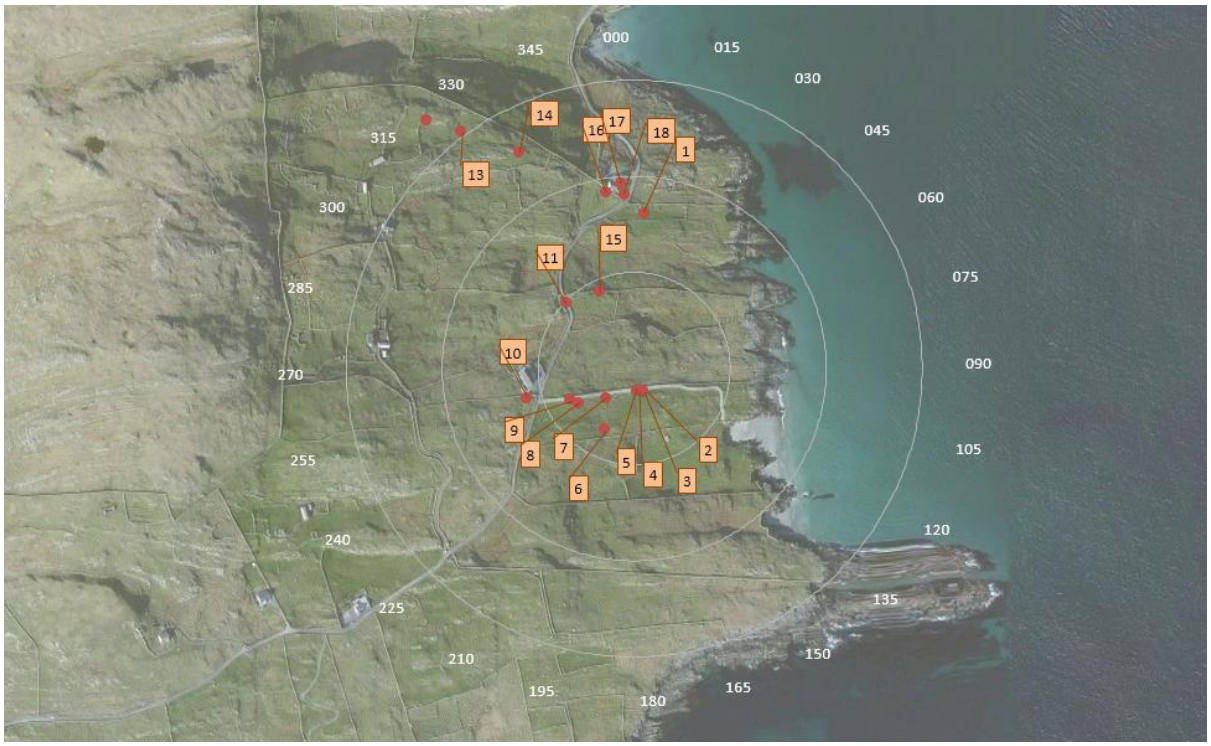


Figure 8-6 Obstacle bearing and distance from helipad centre

The 4.5% gradient associated with slope design category A extends to 3386m from the heliport. A hill on the northern side of the island penetrates this slope. (See Image 8-4). The high ground is approximately 950m from the heliport which is sufficient to allow for a curved approach surface do be used as detailed in paragraph 8.9. The approach and departure path on the northern side of the heliport can incorporate this curved approach to avoid the high ground to the North and West of the heliport.

Image 8-4 High ground on the northern side of the island

After accounting for the topography and obstacles shown in Figure 8-6 and assuming a helipad elevation level at 38m MOD the suggested approach and take-off sectors are shown in Figure 8-7.

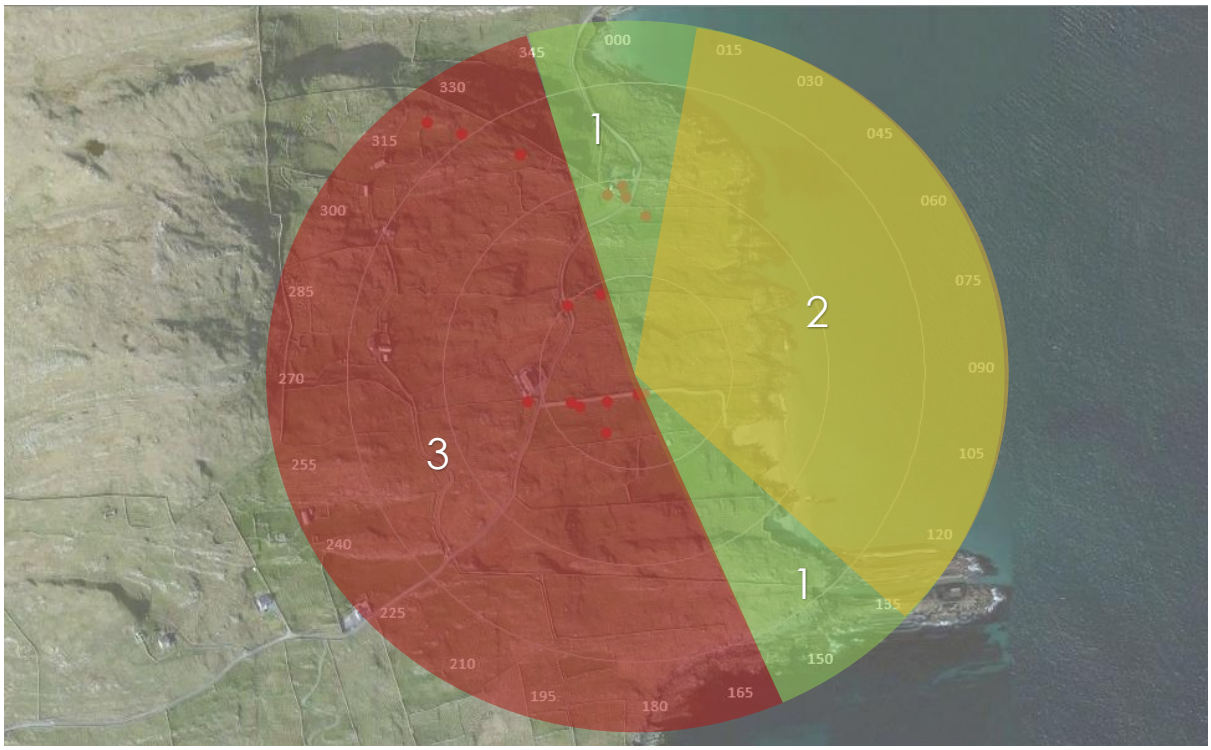


Figure 8-7 Various sectors to and from the heliport (38m MOD level)

Sector	Description
1	Unrestricted take-offs and approaches. (135-160) Curved approach and departure. (345-010)
2	Take-offs possible (excluding some back-up departure profiles) Approach limited by high terrain and obstacles in the go-around path.
3	No approach or take-offs due to obstacles and terrain.

The North to S-S-East approach and departure sectors are perpendicular to the prevailing S-W winds. This wind direction will likely reduce the usability of the heliport for performance class 1 operations. The relevant aircraft flight manual defines the crosswind limitations for PC1 operations.

9 LIGHTING

The access road should be provided with low set lights or floodlit in a manner that would not produce glare or dazzle aircrew. Account should be taken of the heliport obstacle limitation surfaces and the protected side slope when siting lights.

FATO lights are required for surface-level heliports intended for use at night and should be NVE compatible. Uniformly spaced lights shall be

Recommendations

- The access road from the main road to the helipad should be illuminated.

placed along the edge of the FATO, at intervals of not more than 5m with a minimum of 10 lights. FATO lights shall be fixed, omnidirectional, showing white and inset where extending above the surface would endanger helicopter operations. FATO lights should not exceed a height of 25cm.

A TLOF must contain a perimeter or floodlighting showing green and should be located as to avoid glare and shadows. TLOF perimeter lights shall be placed along the edge of the area designated for use as the TLOF or within a distance of 1.5m from the edge, at intervals not greater than 5m. They shall be evenly spaced evenly spaced around the perimeter of the TLOF at the appropriate interval, except that over a sector of 45 degrees the lights shall be spaced at half spacing. A minimum of 14 lights is recommended.

The topography surrounding the Inisturk heliport would make it desirable to provide a flight path alignment guidance lighting system to indicate available approach and/or departure path directions. The lighting system should consist of a row of three or more lights uniformly spaced with a total minimum distance of 6m. Intervals between lights should not be less than 1.5m and should not exceed 3m. The lights should be steady omnidirectional inset white lights with a suitable control incorporated to allow for adjustment of light intensity. Flight path alignment arrows as detailed in Figure 9-1 can be incorporated with the lights.

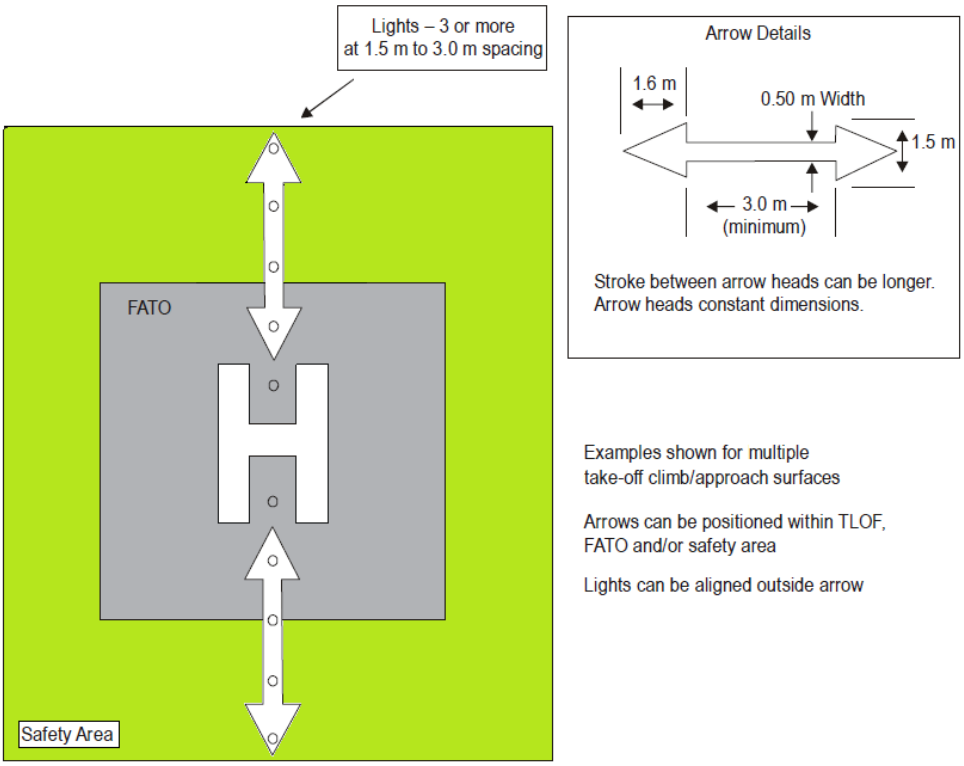


Figure 9-1 Flight path alignment markings and lighting

The marking or lighting of obstacles is intended to reduce hazard to aircraft, by indicating the presence of obstacles. Objects which are more than 15 metres higher than the landing area should be fitted with intermediate low intensity steady red obstruction lights, with the

minimum intensity of 10 candelas for angles of elevation between 0 and 30 degrees. The majority of the obstacles greater than 15m above helipad elevation are associated with the terrain to the west of the helipad. If street lighting along the main road is included in the final design obstacle lights may be fitted. Obstacle lights on top of tall objects should be viewable from all directions. Mayo CoCo and Rose Aviation will confirm lighting design and operational procedures during the design phase.

10 CONCLUSION

The location identified in this report can be used to accommodate an operational helipad that will fulfil all the requirements of ICAO Annex 14 Volume 2, providing the recommendations as laid out in this report are complied with.

It is always very difficult to select a feasible helipad location that fulfils the aviation regulatory requirements as well as satisfying the needs of the helicopter operators and client end user(Mayo CoCo). The proposed location does provide adequate safe approach paths although they will be limited as shown in fig 8.7. This means that while the helipad will be compliant with international aviation requirements, it will offer little flexibility to helicopter crews. This may result in aircraft being unable to land on Inisturk on any given day depending on the wind velocity conditions on that day. This is the same situation that exists in the vast majority of operational helipads in Ireland today and as such Rose Aviation does not consider this to be a major impediment.

The dimensions cited here are current values for a PC1 compliant helipad. The proposed helipad on Inisturk does not strictly have to comply with PC1 criteria, but it should be designed to comply as much as possible. The exact details of the design requirements will be discussed during the helipad design phase.

The purpose of this report was to identify the feasibility of constructing a helipad at the given location. It has been demonstrated in this report that a PC1 helipad compliant with international aviation regulations and with the S92 as the design helicopter is possible.

Shane Bonner

Operations Director

Rose Aviation

087 2461413

Definitions

Category A (Cat 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.

D - The largest overall dimension of the helicopter when rotor(s) are turning measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor tip path plane or helicopter structure.

Final approach and take-off area (FATO) - A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. Where the FATO is to be used by helicopters operated in performance class 1, the defined area includes the rejected take-off area available.

Landing decision point (LDP) - The point used in determining landing performance from which, a power-unit failure occurring at this point, the landing may be safely continued or a balked landing initiated.

MOD – Malin Ordnance Datum

NVE – Night Vision Equipment

Performance Class 1 (PC1) - A helicopter with performance such that, in case of critical power-unit failure, it is able to land on the rejected take-off area or safely continue the flight to an appropriate landing area, depending on when the failure occurs.

Performance Class 2 (PC2) - A helicopter with performance such that, in case of critical power-unit failure, it is able to safely continue the flight, except when the failure occurs prior to a defined point after take-off or after a defined point before landing, in which cases a forced landing may be required.

RFM – Rotorcraft Flight Manual

Safety area - A defined area on a heliport surrounding the FATO which is free of obstacles, other than those required for air navigation purposes, and intended to reduce the risk of damage to helicopters accidentally diverging from the FATO.

Take-off decision point (TDP) - The point used in determining take-off performance from which, a power-unit failure occurring at this point, either a rejected take-off may be made or a take-off safely continued.

Touchdown and lift-off area (TLOF) - An area on which a helicopter may touch down or lift off.

VTOL – Vertical Take-off and landing