ROSE AVIATION
Aviation Consultancy

Baldonnel Visual Aviation Safeguarding Report



Rathcoole Park

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Acronyms

Acronym	Title
‘	feet
AMSL	Above Mean Sea Level
AS	Approach Surface
EASA	European union Aviation Safety Agency
EIME	Casement Aerodrome Baldonnel
IAA	Irish Aviation Authority
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface
ILS	Instrument Landing System
LPA	Local Planning Authority
LPV	Localiser Performance with Vertical navigation
M	metres
OHS	Outer Horizontal Surface
OLS	Obstacle Limitation Surfaces
RA	Rose Aviation
RFF	Rescue and Fire Fighting
RNP	Required Navigation Performance
SRA	Surveillance Radar Approach
TOCS	Take Off Climb Surface
VFR	Visual Flight Rules
VOR	VHF Omnidirectional Range

Introduction

1. The management of MDB and South Dublin County Council contracted Rose Aviation (RA) to act as their aviation consultant to carry out a safeguarding analysis concerning the impact their construction project at Rathcoole hereafter known as the development, will have on aviation operations at Casement Aerodrome Baldonnel (EIME).

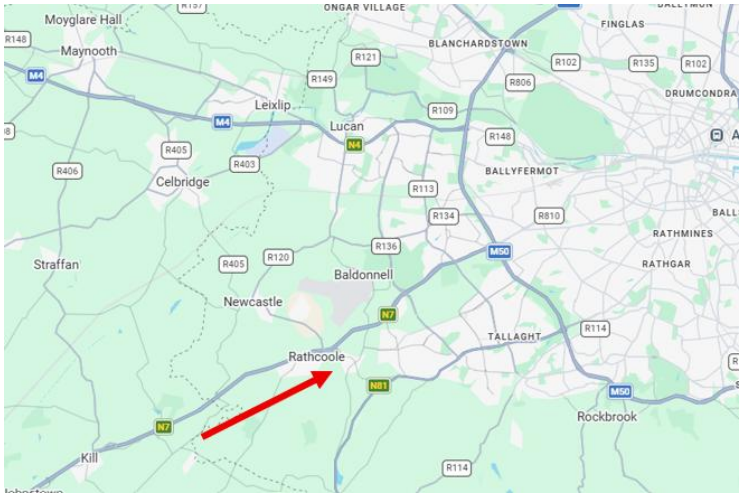


Figure 1 Location of proposed construction project

2. The proposed construction is an accommodation project. The most relevant section of the development is the highest accommodation as this is the highest section of the development at an elevation of 142.6m Above mean sea level (AMSL).

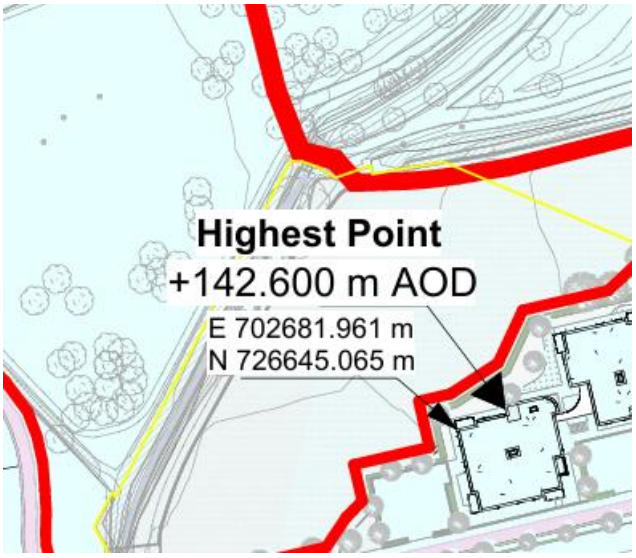


Figure 2 Highest part of the development

3. Safeguarding is the process by which the Aerodrome Operator can protect the environment surrounding an aerodrome from developments and activities that have the potential to impact on the aerodrome's safe operation.

4. All drawings shown here are for demonstrative purposes only. In the event of a potential conflict, accurate architectural drawings will be required to determine if an Obstacle Limitation Surface (OLS) is compromised.

5. The purpose of aerodrome safeguarding at EIME is to protect:

    a. The airspace around the location to ensure no buildings or structures may cause danger to aircraft either in the air or on the ground. This is achieved through the OLS.

    b. Aeronautical lighting, such as runway end and edge lighting, by ensuring that they are not obscured by any proposed development and that any proposed lighting, either temporary or permanent, could not be confused for aeronautical ground lighting.

    c. Aerodrome operations from interference by any construction processes through the production of dust/smoke, temporary lighting or construction equipment impacting on radar and other navigational aids.

    d. Aircraft from the risk of collision with obstacles through appropriate lighting.

    e. Aircraft from the risk of building induced turbulence.

    f. Aircraft from the risk from glint and glare, e.g. solar panels.

6. The European union Aviation Safety Agency (EASA) under EU Regulation no 139/2014 state that:

    "Member States shall ensure that consultations are conducted with regard to safety impacts of constructions proposed to be built within the limits of the obstacle limitation and protection surfaces as well as other surfaces associated with the aerodrome."

7. They also state:

    Member States shall ensure that consultations are conducted with regard to human activities and land use such as:

    - any development or change in land use in the aerodrome area;
    - any development which may create obstacle-induced turbulence that could be hazardous to aircraft operations;
    - the use of hazardous, confusing and misleading lights;
    - the use of highly reflective surfaces which may cause dazzling;
    - the creation of areas that might encourage wildlife activity harmful to aircraft operations;
    - sources of non-visible radiation or the presence of moving or fixed objects which may interfere with, or adversely affect, the performance of aeronautical communications, navigation and surveillance systems.

8. There are two runways at EIME that need to be assessed regarding the impact of construction at the development. These are designated Runway 22/04 and 28/10. In this analysis, RA will examine the OLS for each runway separately to determine if the proposed construction will penetrate these surfaces.

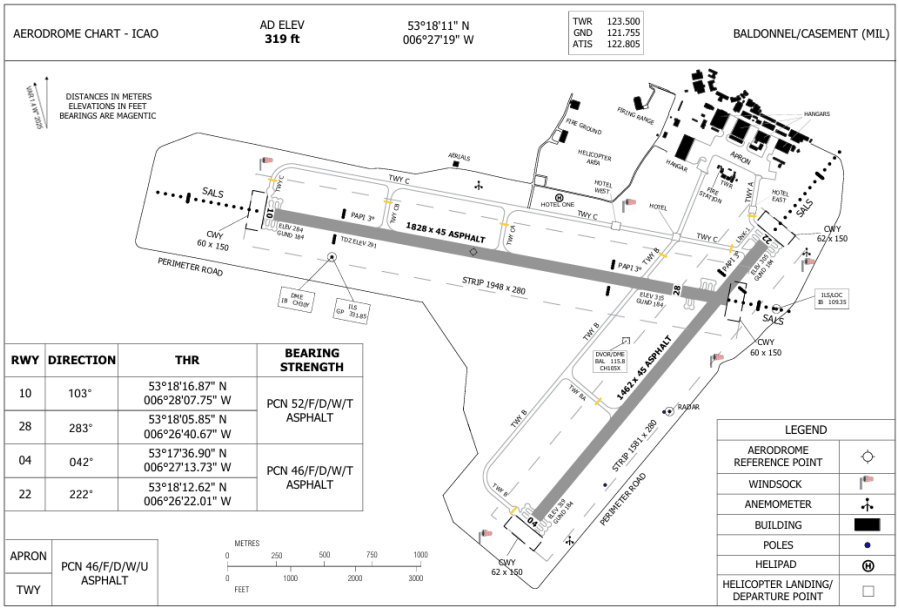


Figure 3 Layout of runways at EIME

9. Runway 22/04 is a paved surface runway 1462m(metres) long. It caters for both Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) aircraft with a VHF Omnidirectional Range (VOR) approach to runway 22. There is no IFR approach for runway 04. The threshold of runway 22 is at 306'(ft) above mean sea level (AMSL) while the threshold of 04 is at 319' AMSL. For calculations, the elevation of 306' will be used as this is more constrictive

10. Runway 28/10 is a paved surface runway 1828m long. It caters for both VFR and IFR aircraft with a combination of precision and non-precision approaches for both thresholds. Runway 28 has Required Navigation Performance (RNP) and VOR approaches while 10 has Instrument Landing System (ILS), VOR and Surveillance Radar Approach (SRA) approaches. The threshold of runway 28 is at 315' AMSL while 10 is at 284' AMSL. We will use 284' as this is more constrictive.

11. EIME is a military aerodrome and is the base of the Irish Air Corps. The aerodrome is the operating base for a wide range of aircraft including:

    a. Single engine turbo-prop aircraft

    b. Multiengine turbo-prop aircraft

    c. Multi engine jet aircraft

    d. Multi engine rotary wing helicopters.

12. The objectives of the specifications of ICAO Annex 14 volume 1 section 4 are to describe the airspace around aerodromes so as to permit intended aircraft operations to be conducted safely and to prevent aerodromes from becoming unusable by the growth of obstacles around them. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.

13. There is no published VFR Chart showing the VFR reporting points for EIME. Instead, the military authorities have published a table of their reporting points as shown below. None of these are close to the development.

PALMERSTOWN ROUNDABOUT	RED COW ROUNDABOUT	SQUARE TALLAGHT	BRITTAS
MARLEY PARK HOUSE	KILTEEL	NAAS RACECOURSE	KILL
CLANE	DONDEA WOOD	KILCOCK	STRAFFAN
MAYNOOTH		CELBRIDGE	

Figure 4 EIME VFR reporting points

Obstacle Limitation Surfaces runway 22/04

14. There are numerous defined areas surrounding a runway that need to be kept free of obstacles. In the paragraphs below, RA have cited each of these, their explanation and the requirements for each. These are known as the OLS.

15. The closest point of the centreline of runway 22/04 to the development at the development is the threshold of runway 04. This is at a distance of 1550m.



Figure 5 Distance from the development to runway 22

Runway Code 22/04

16. In order to determine the OLS requirements, the first thing that must be established is the code of the runway. Runway 22/04 is 1462m which makes it a code 3 runway. The dimensions of the OLS often depend on the runway code. The runway is 45m wide.

Code number	Aeroplane reference field length
1	Less than 800 m
2	800 m up to but not including 1 200 m
3	1 200 m up to but not including 1 800 m
4	1 800 m and over

Figure 6 Runway Codes

Runway Strip

17. A runway strip is required to reduce the risk of damage to an aircraft accidentally running off the runway, to protect aircraft flying over it when taking-off or landing, and to enable safe use by rescue and firefighting (RFF) vehicles. For a code 3 runway as at runway 22/04, the strip extends 60m beyond each runway threshold and 150 m to either side from the runway centreline.
18. No fixed object, other than visual aids required for air navigation or those required for aircraft safety purposes should be permitted on a runway strip.
19. The extent of the runway strip lies entirely within the land owned by EIME and as such there are no safeguarding requirement here for consideration.



Figure 7 Location of runway strip

Transitional Surface

20. The purpose of the transitional surface is to safeguard against development between the edge of the runway, the approach surface and the inner horizontal surface. No obstacles should penetrate the transitional surface.

21. The slope of the Transitional Surface is measured in the vertical plane above the horizontal, and normal to the centreline of each runway. The slope is 20% (1:5) for Code 1 and 2 non-instrument and non-precision instrument runways. For all other runways the slope is 14.3% (1:7). EIME runway 22/04 is a code 3 non-precision instrument runway and as such the 14.3% slope will apply here.

22. The transitional surface at EIME is parallel to the runway strip and runway centreline. It runs from the edge of the strip to the bottom of the Inner Horizontal Surface (IHS) at 45m as shown in figure 4 below. From basic principles of trigonometry, this means the lateral distance from the edge of the strip is 314.17m. This equates to a distance of 464.7m from the centreline of runway 22/04. The development does not penetrate the transitional surface.

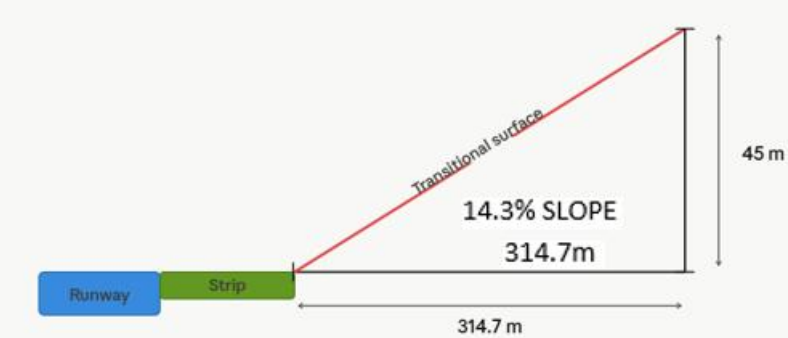


Figure 8 Transitional Surface Dimensions



Figure 9 Transitional Surface Location from centreline

Inner Horizontal Surface (IHS)

23. The purpose of the IHS is to protect airspace for aircrafts visual manoeuvring prior to landing. The radius or outer limits of the inner horizontal surface shall be measured from a reference point or points established for such purpose by using circular arcs centred on the runway ends and joined tangentially by straight lines, thus producing a racetrack pattern. The radii of the circular arcs vary with the runway code number and the type of approach and are specified in figure 8 below. For EIME runway 22/04, the radius is 4000m as it is a code 3 non-precision instrument runway.

Runway Code Number	Non-Instrument	Non-Precision Approach	Precision Approach Category I	Precision Approach Category II or III
1	2000m	3500m	3500m	-
2	2500m	3500m	3500m	-
3	4000m	4000m	4000m	4000m
4	4000m	4000m	4000m	4000m

Figure 10 Radii of IHS Threshold Arcs

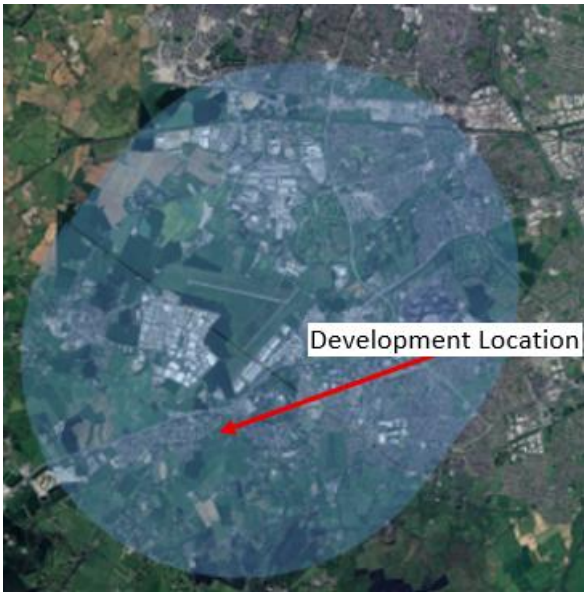


Figure 11 Indicative Location of Inner Horizontal Surface runway 22/04

24. As can be seen, the development lies within the IHS. The height of the IHS shall be 45m (148') above the elevation datum established for that purpose. The agreed elevation to be used for runway 22/04 is 306'. Therefore, the IHS shall begin at an elevation of 454ft (138.3m) AMSL.

25. This means that any obstacle above this height will penetrate the IHS area outside the transitional surface. The height of the Inner Horizontal Surface (IHS) is based on the lowest threshold if there is a difference between the two thresholds as is the case at EIME. The height of the highest building is 142.6m AMSL. This means that the highest part of the development will penetrate the IHS by 4.3m.

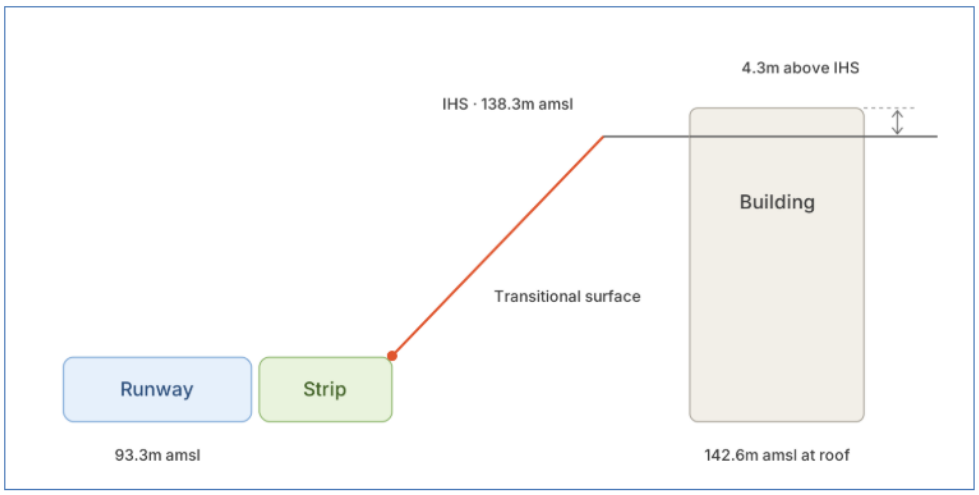


Figure 12 Development penetrates HIS

Conical Surface

26. The purpose of the conical surface is to facilitate safe visual manoeuvring in the vicinity of the aerodrome. The conical surface slopes upwards and outwards from the periphery of the IHS for 75m as runway 22/04 is a code 3 non-precision approach runway as detailed below.

Runway Code number	Non-instrument approach	Non-precision approach	Precision approach category I	Precision approach category II and III
1	35 m	60 m	60 m	-
2	55 m	60 m	60 m	-
3	75 m	75 m	100 m	100 m
4	100 m	100 m	100 m	100 m

Figure 13 Conical Surface requirements

27. The slope of the conical surface is measured in the vertical plane above the IHS, and normal to the centreline of each runway. The slope is 5% for all runways regardless of code or types of approach.

28. From basic principles of trigonometry, this means the lateral distance from the edge of the IHS is 1500m. This equates to a distance of 6720m from the proposed development. As such, it can be seen that the proposed development site does not penetrate the conical zone.

29. The conical zone commences at 138.3m AMSL and finishes at 213.3m AMSL This is derived from AMSL elevation of threshold runway 22 (93.3m)+height of Transitional zone/IHS (45m)+ height of conical surface (75m)= 93.3+45+75= 213.3m.

30. As the development site lies within the IHS, it is apparent that the conical zone is not affected.

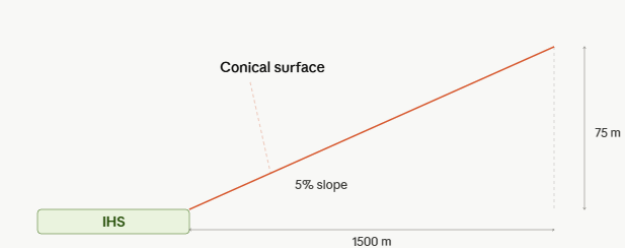


Figure 14 Conical Surface Dimensions

Outer Horizontal Surface (OHS)

31. The OHS extends outwards from the conical surface. Aviation regulations do not state definitively that an OHS is required for all runways. As a broad specification, the IAA suggest that the OHS should extend from the periphery of the conical surface to a lateral distance of 15000m for a code 3 runway.

32. It is quite evident that the development location lies within the IHS and does not interfere with the OHS. lateral extent of the OHS.

Approach Surface (AS)

33. An approach surface is an inclined plane or combination of planes preceding the threshold and is established for each runway direction intended to be used for the landing of aircraft.

APPROACH RUNWAYS

Surface and dimensions[a]	RUNWAY CLASSIFICATION: Non-instrument, Code number 1	Non-instrument, Code number 2	Non-instrument, Code number 3	Non-instrument, Code number 4	Non-precision approach, Code number 1,2	Non-precision approach, Code number 3	Non-precision approach, Code number 4	Precision approach category I, Code number 1,2	Precision approach category I, Code number 3,4	Precision approach category II or III, Code number 3,4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
INNER APPROACH										
Width	—	—	—	—	—	—	—	90 m	120 m[e]	120 m[e]
Distance from threshold	—	—	—	—	—	—	—	60 m	60 m	60 m
Length	—	—	—	—	—	—	—	900 m	900 m	900 m
Slope								2.5%	2%	2%
APPROACH										
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second section										
Length	—	—	—	—	—	3 600 m[b]	3 600 m[b]	12 000 m	3 600 m[b]	3 600 m[b]
Slope	—	—	—	—	—	2.5%	2.5%	3%	2.5%	2.5%
Horizontal section										
Length	—	—	—	—	—	8 400 m[b]	8 400 m[b]	—	8 400 m[b]	8 400 m[b]
Total length	—	—	—	—	—	15 000 m	15 000 m	15 000 m	15 000 m	15 000 m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope	—	—	—	—	—	—	—	40%	33.3%	33.3%
BALKED LANDING SURFACE										
Length of inner edge	—	—	—	—	—	—	—	90 m	120 m[e]	120 m[e]
Distance from threshold	—	—	—	—	—	—	—	c	1 800 m[d]	1 800 m[d]
Divergence (each side)	—	—	—	—	—	—	—	10%	10%	10%
Slope	—	—	—	—	—	—	—	4%	3.33%	3.33%

a. All dimensions are measured horizontally unless specified otherwise.
b. Variable length (see 4.2.9 or 4.2.17).
c. Distance to the end of strip.
d. Or end of runway whichever is less.
e. Where the code letter is F (Table 1-1), the width is increased to 140 m except for those aerodromes that accommodate a code letter F aeroplane equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

Note — See Circulars 301 and 345 (forthcoming), and Chapter 4 of the PANS-Aerodromes, Part I (Doc 9981) for further information.

Figure 15 Approach surface requirements

34. The AS consists of an inner edge. For EIME this edge is perpendicular to the centreline of the runway located at a distance of 60 m before the landing threshold. The inner edge is 280m long for EIME. There are two sides originating at the ends of the inner edge and diverging uniformly at a rate of 15% from a line drawn parallel to the extended centreline of the runway. The AS for runway 04 is slightly smaller; the inner edge is still 60m from the threshold but it is 150m long and the edge of the AS diverges at a gradient of 10% rather than 15% as it is a non-instrument runway.

35. In aviation, an AIP is the Aeronautical Information Publication. This is the official state-published manual containing the aeronautical information essential to air navigation in that country. It's defined by ICAO Annex 15, and every ICAO member state is required to publish one. The chart EIME AD 2.12 from AIP Ireland shows the exact location of the threshold and bearing for runway 04.

EIME AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	TRUE BRG	Dimensions of RWY	Strength (PCN) and surface of RWY and SWY	THR coordinates RWY end coordinates THR Geoid undulation	THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
10	101.917°	1828M x 45M	PCN 52/F/D/W/T ASPHALT -	THR: 531816.87N 0062807.75W END: 531805.85N 0062640.67W GEOID: 184ft	THR 283ft TDZ 291ft
28	281.937°	1828M X 45M	PCN 52/F/D/W/T ASPHALT -	THR: 531805.85N 0062640.67W END: 531816.87N 0062807.75W GEOID: 184ft	THR 315ft
04	040.926°	1462M X 45M	PCN 46/F/D/W/T ASPHALT -	THR: 531736.90N 0062713.73W END: 531812.62N 0062622.01W GEOID: 184ft	THR 319ft
22	220.937°	1462M X 45M	PCN 46/F/D/W/T ASPHALT -	THR: 531812.62N 0062622.01W END: 531736.90N 0062713.73W GEOID: 184ft	THR 305ft

Figure 16 Coordinated and bearing of runway 04

36. From this we can derive the edges of the AS for runway 04. The AS consists of a first and second section. The first section slopes upward at 2% to a distance of 3000m. From here the second section slopes upwards at 2.5% for a distance of 3600m. No obstacle can penetrate the AS. Any obstacles that are proposed within the area of the AS will need to be examined to see if they penetrate the AS. The coordinates are shown below.

Parameters (instrument approach runway, code 3/4, CS-ADR-DSN Issue 6 / ICAO Annex 14 Table 4-1): inner edge 280 m at 60 m before threshold; divergence 15% per side; first section 3 000 m at 2.0% slope; second section 3 600 m at 2.5% slope.

Station	Side	Half-width (m)	Latitude (WGS84)	Longitude (WGS84)
Inner edge (60 m from THR)	L	140	53°17'32.47"N	006°27'10.14"W
	R	140	53°17'38.40"N	006°27'21.56"W
End of 1st section (3 000 m)	L	590	53°16'09.60"N	006°28'37.85"W
	R	590	53°16'34.60"N	006°29'25.96"W
End of 2nd section (6 600 m)	L	1,130	53°14'30.11"N	006°30'22.99"W
	R	1,130	53°15'18.01"N	006°31'55.08"W

Surface elevation: inner edge at threshold elevation; +60 m at 3 000 m; +150 m.

Figure 17 Coordinates of runway 04 approach surface

37. From the image of the first section of the AS below, it is evident that the development does not penetrate the AS for runway 04 and obviously it doesn't penetrate the AS for runway 22 either.



Figure 18 Location of approach surface and relative position of the development

Take Off Climb Surface (TOCS)

38. A TOCS is an inclined plane located beyond the end of the take-off run available and is established for each runway direction intended to be used for take-off.

39. The TOCS consists of a horizontal inner edge. For EIME this edge is perpendicular to the centreline of the runway located at a distance of 60 m beyond the runway end in the direction of take-off. The inner edge is 180m long for EIME. There are two sides originating at the ends of the inner edge and diverging uniformly at a rate of 12.5% from a line drawn parallel to the extended centreline of the runway.

RUNWAYS MEANT FOR TAKE-OFF

Surface and dimensions[a] (1)	Code number 1 (2)	2 (3)	3 or 4 (4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end[b]	30 m	60 m	60 m
Divergence (each side)	10%	10%	12.5%
Final width	380 m	580 m	1 200 m 1 800 m[c]
Length	1 600 m	2 500 m	15 000 m
Slope	5%	4%	2%[d]

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d. See 4.2.24 and 4.2.26.

Figure 19 TOCS requirements

40. The diverging lines continue until a width of 1200m is achieved. This width occurs at a distance of 4080m from the inner edge of the TOCS. The slope for the TOCS is 2% for a code 3 runway. No obstacle can penetrate the TOCS. Any obstacles that is proposed within the area of the TOCS will need to be examined to see if it penetrates the TOCS. The coordinates are shown below.

Parameters (code 3/4): inner edge 180 m at 60 m from the runway end; divergence 12.5% per side; final width 1 200 m (reached 4 080 m from the inner edge); total length 15 000 m; slope 2.0%. Sides run parallel at ±600 m from the full width point to the outer edge.

Station	Side	Half-width (m)	Latitude (WGS84)	Longitude (WGS84)
Inner edge (60 m from runway end)	L	90	53°17'33.53"N	006°27'12.18"W
	R	90	53°17'37.34"N	006°27'19.52"W
Full width reached (4 080 m)	L	600	53°15'42.98"N	006°29'15.60"W
	R	600	53°16'08.41"N	006°30'04.51"W
Outer edge (15 000 m)	L	600	53°11'15.78"N	006°35'40.67"W
	R	600	53°11'41.21"N	006°36'29.51"W

Surface elevation: inner edge at the elevation of the highest point on the extended centreline between the runway end and the inner edge; rising at 2.0% thereafter (+299 m at 15 000 m).

Figure 20 Coordinates of runway 22 Take off climb surface

41. From the image of the first section of the TOCS below, it is evident that the development does not penetrate the TOCS for runway 22 and obviously it doesn't penetrate the TOCS for runway 04 either.



Figure 21 Location of the TOCS and relative position of the development

Obstacle Limitation Surfaces runway 28/10

42. The closest point of the centreline of runway 28/10 to the development is shown below at a distance of 2550m.

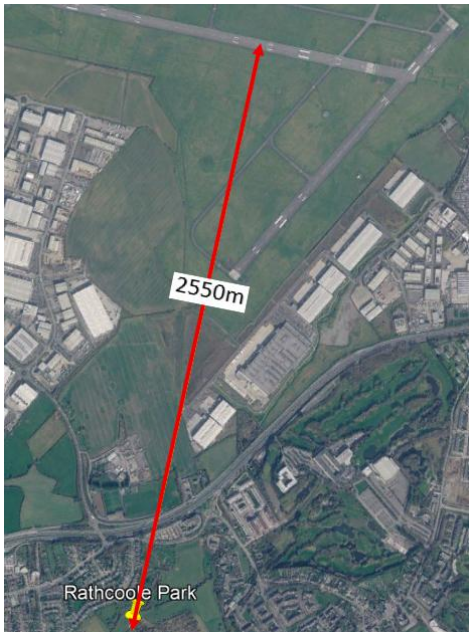


Figure 22 Distance of the development from runway 28

Runway Code 28/10

43. In order to determine the OLS requirements, the first thing that must be established is the code of the runway. Runway 28/10 is 1828m which makes it a code 4 runway. The dimensions of the OLS often depend on the runway code. The runway is 45m wide.

Code number	Aeroplane reference field length
1	Less than 800 m
2	800 m up to but not including 1 200 m
3	1 200 m up to but not including 1 800 m
4	1 800 m and over

Figure 23 Runway Codes

Runway Strip

44. A runway strip is required to reduce the risk of damage to an aircraft accidentally running off the runway, to protect aircraft flying over it when taking off or landing, and to enable safe use by rescue and firefighting (RFF) vehicles. For a code 4 runway as at runway 28/10, the strip extends 60m beyond each runway threshold and 150 m to either side from the runway centreline.

45. No fixed object, other than visual aids required for air navigation or those required for aircraft safety purposes should be permitted on a runway strip.

46. The extent of the runway strip lies entirely within the land owned by EIME and as such there are no safeguarding requirement here for consideration.

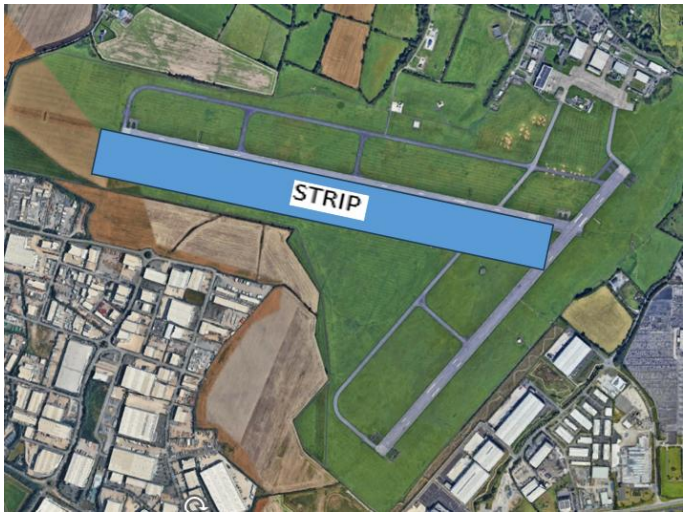


Figure 24 Location of runway strip

Transitional Surface

47. The purpose of the transitional surface is to safeguard against development between the edge of the runway, the approach surface and the inner horizontal surface. No obstacles should penetrate the transitional surface.

48. The slope of the Transitional Surface is measured in the vertical plane above the horizontal, and normal to the centreline of each runway. The slope is 20% (1:5) for Code 1 and 2 non-instrument and non-precision instrument runways. For all other runways the slope is 14.3% (1:7). EIME runway 28/10 is a code 4 precision instrument runway and as such the 14.3% slope will apply here.

49. The transitional surface at EIME is parallel to the runway strip and runway centreline. It runs from the edge of the strip to the bottom of the IHS at 45m as shown in figure 4 below. From basic principles of trigonometry, this means the lateral distance from the edge of the strip is 314.17m. This equates to a distance of 464.7m from the centreline of runway 28/10.

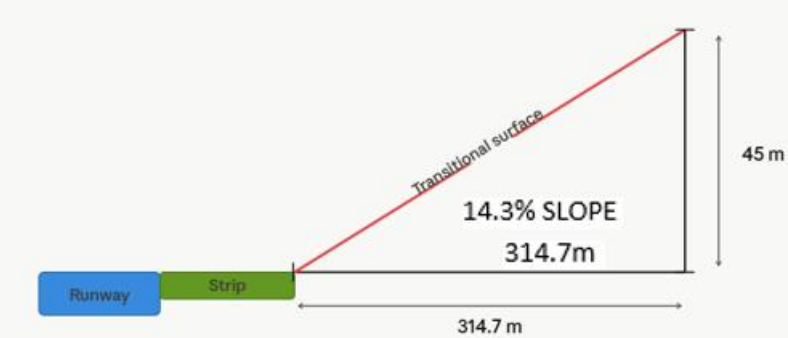


Figure 25 Transitional Surface Dimensions

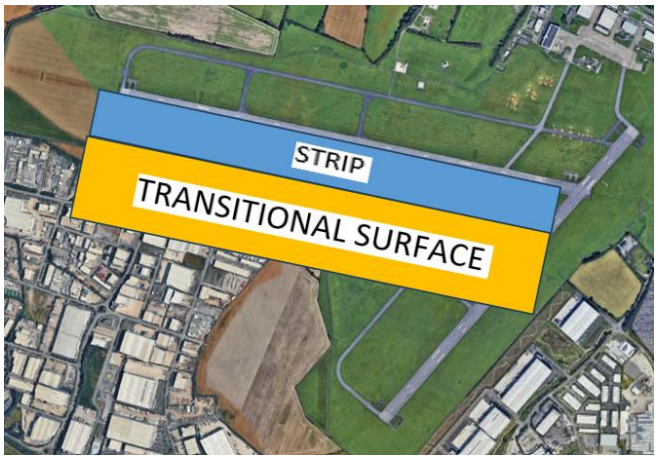


Figure 26 Transitional Surface Location from centreline

Inner Horizontal Surface (IHS)

50. The purpose of the IHS is to protect airspace for aircrafts visual manoeuvring prior to landing. The radius or outer limits of the inner horizontal surface shall be measured from a reference point or points established for such purpose by using circular arcs centred on the runway ends and joined tangentially by straight lines, thus producing a racetrack pattern. The radii of the circular arcs vary with the runway code number and the type of approach and are specified in the figure below. For EIME runway 28/10, the radius is 4000m as it is a code 4 precision instrument runway.

Runway Code Number	Non-Instrument	Non-Precision Approach	Precision Approach Category I	Precision Approach Category II or III
1	2000m	3500m	3500m	-
2	2500m	3500m	3500m	-
3	4000m	4000m	4000m	4000m
4	4000m	4000m	4000m	4000m

Figure 27 Radii of IHS Threshold Arcs

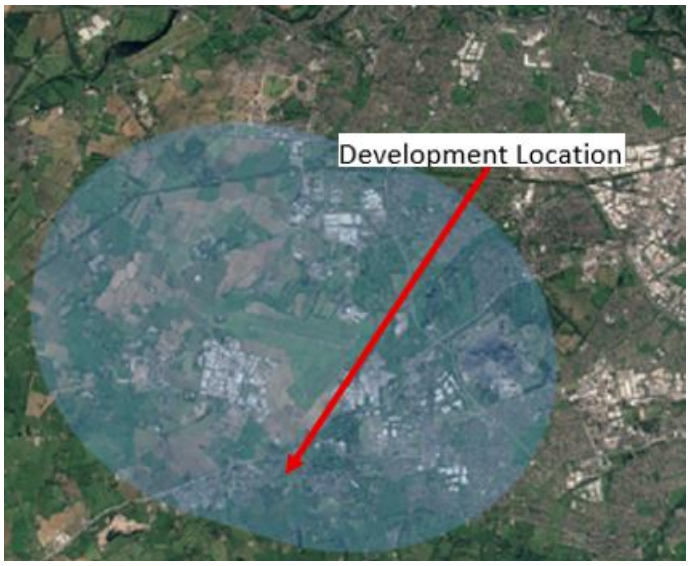


Figure 28 Location of Inner Horizontal Surface

51. As can be seen, the development lies within the IHS. The height of the IHS shall be 45m (148') above the elevation datum established for that purpose. The agreed elevation to be used for runway 28/10 is 284'. Therefore, the IHS shall begin at an elevation of 432ft (131.6m) AMSL.

52. This means that any obstacle above this height will penetrate the IHS area outside the transitional surface. The height of the IHS is based on the lowest threshold if there is a difference between the two thresholds as is the case at EIME. The height of the highest building is 142.6m AMSL. This means that the highest part of the development will penetrate the IHS by 11m.

Conical Surface

53. The purpose of the conical surface is to facilitate safe visual manoeuvring in the vicinity of the aerodrome. The conical surface slopes upwards and outwards from the periphery of the IHS for 100m as runway 28/10 is a code 4 precision approach runway as detailed below.

Runway Code number	Non-instrument approach	Non-precision approach	Precision approach category I	Precision approach category II and III
1	35 m	60 m	60 m	-
2	55 m	60 m	60 m	-
3	75 m	75 m	100 m	100 m
4	100 m	100 m	100 m	100 m

Figure 29 Conical Surface requirements

54. The slope of the conical surface is measured in the vertical plane above the IHS, and normal to the centreline of each runway. The slope is 5% for all runways regardless of code or types of approach.

55. From basic principles of trigonometry, this means the lateral outer distance from the edge of the IHS is 2000m. This equates to a distance of 6600m from the proposed construction site. As such, it can be seen that the proposed construction site does not penetrate the conical zone.

56. The conical zone commences at 131.6m AMSL and finishes at 231.6m AMSL. This is derived from AMSL elevation of threshold runway 10 (86.6m) +height of Transitional zone/IHS (45m)+ height of conical surface (100m)= 86.6+45+100= 231.6m.

57. As the development site lies within the IHS, it is apparent that the conical zone is not affected.

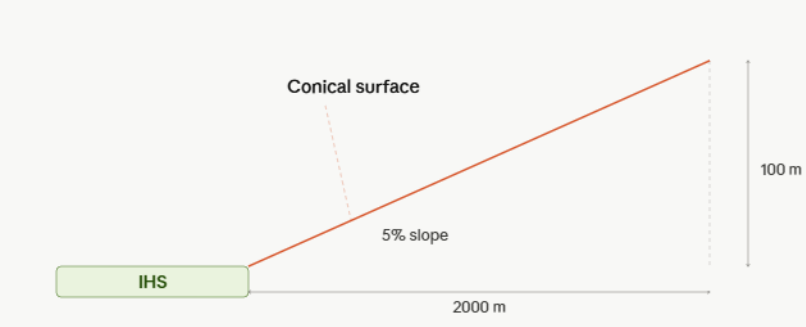


Figure 30 Conical Surface Dimensions

75m

Outer Horizontal Surface(OHS)

58. The OHS extends outwards from the conical surface. Aviation regulations do not state definitively that an OHS is required for all runways. As a broad specification, the IAA suggest that the OHS should extend from the periphery of the conical surface to a lateral distance of 15000m for a code 4 runway.

59. It is quite evident that the development location lies within the IHS and does not interfere with the OHS. lateral extent of the OHS.

Approach Surface (AS)

60. An approach surface is an inclined plane or combination of planes preceding the threshold and is established for each runway direction intended to be used for the landing of aircraft.

    The AS consists of a horizontal inner edge. For EIME runway 28 as a code 4 precision approach runway, this edge is perpendicular to the centreline of the runway located at a distance of 60 m before the landing threshold. The inner edge is 280m long for EIME. There are two sides originating at the ends of the inner edge and diverging uniformly at a rate of 15% from a line drawn parallel to the extended centreline of the runway.

	RUNWAY CLASSIFICATION									
	Non-instrument Code number				Non-precision approach Code number			Precision approach category I Code number		II or III Code number
Surface and dimensions[a]	1	2	3	4	1,2	3	4	1,2	3,4	3,4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height	35 m	55 m	75 m	100 m	60 m	75 m	100 m	60 m	100 m	100 m
INNER HORIZONTAL										
Height	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m	45 m
Radius	2 000 m	2 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m	3 500 m	4 000 m	4 000 m
INNER APPROACH										
Width	—	—	—	—	—	—	—	90 m	120 m[c]	120 m[c]
Distance from threshold	—	—	—	—	—	—	—	60 m	60 m	60 m
Length	—	—	—	—	—	—	—	900 m	900 m	900 m
Slope								2.5%	2%	2%
APPROACH										
Length of inner edge	60 m	80 m	150 m	150 m	140 m	280 m	280 m	140 m	280 m	280 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1 600 m	2 500 m	3 000 m	3 000 m	2 500 m	3 000 m	3 000 m	3 000 m	3 000 m	3 000 m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second section										
Length	—	—	—	—	—	3 600 m[b]	3 600 m[b]	12 000 m	3 600 m[b]	3 600 m[b]
Slope	—	—	—	—	—	2.5%	2.5%	3%	2.5%	2.5%

Figure 31 Approach Surface requirements

61. The AS slopes upwards in two sections.:
    a. The first section has a slope of 2% to a distance of 3000m
    b. The second section slopes from the end of the first section at 2.5% to a distance of 3600 (variable). No new obstacle should penetrate the AS.
62. The first section concludes at an elevation of 156m (60m above threshold). The second section starts at an elevation of 156m and finishes at 246m (150m above threshold). The coordinates of the edges of the AS are shown below.

Station (from THR)	Width	North edge	South edge
Inner edge (60 m)	280 m	531809.88N 0062635.93W	531801.02N 0062639.07W
End 1st section (3,060 m)	1,180 m	531804.02N 0062352.44W	531726.68N 0062405.62W
End 2nd section (6,660 m)	2,260 m	531756.91N 0062036.30W	531645.38N 0062101.53W
Outer edge (15,060 m)	4,780 m	531739.99N 0061258.87W	531508.72N 0061352.22W

Figure 32 AS coordinates runway 28

63. From the image of the AS below, it is evident that the development does not penetrate the AS for runway 28 and obviously it doesn't penetrate the AS for runway 10 either.



Figure 33 Indicative Approach Surface Runway 28

Take Off Climb Surface(TOCS)

64. A TOCS is an inclined plane located beyond the end of the take-off run available and is established for each runway direction intended to be used for take-off.

65. The TOCS consists of a horizontal inner edge. For EIME runway 10 this edge is perpendicular to the centreline of the runway located at a distance of 60 m beyond the runway end in the direction of take-off. The inner edge is 180m long for EIME. There are two sides originating at the ends of the inner edge and diverging uniformly at a rate of 12.5% from a line drawn parallel to the extended centreline of the runway.

RUNWAYS MEANT FOR TAKE-OFF

Surface and dimensions[a] (1)	Code number 1 (2)	2 (3)	3 or 4 (4)
TAKE-OFF CLIMB			
Length of inner edge	60 m	80 m	180 m
Distance from runway end[b]	30 m	60 m	60 m
Divergence (each side)	10%	10%	12.5%
Final width	380 m	580 m	1 200 m 1 800 m[c]
Length	1 600 m	2 500 m	15 000 m
Slope	5%	4%	2%[d]

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d. See 4.2.24 and 4.2.26.

Figure 34 TOCS requirements

66. The diverging lines continue until a width of 1200m is achieved. This width occurs at a distance of 4080m from the inner edge of the TOCS. The slope for the TOCS is 2% for a code 4 runway. No obstacle can penetrate the TOCS. Any obstacles that is proposed within the area of the TOCS will need to be examined to see if it penetrates the TOCS.

67. For EIME, both ends of the runway can be used for take off and landing. As the Approach Surface covers more area that the Take Off Climb Surface, there is no need to map out the dimensions of the TOCS as it is quite apparent that the development construction does not penetrate the TOCS.

Conclusion

68. The objective of this report is to investigate the impact that the new construction project at the development, might have on aviation at Casement Aerodrome in Baldonnel. Specifically, Rose Aviation were tasked with investigating whether or not any element of the proposed construction will penetrate any of the obstacle limitation surfaces associated with the runways at EIME.

69. As detailed in this report, RA have demonstrated that the proposed structures will penetrate the IHS OLS at EIME. RA can also state that the proposed building will not interfere in any other aspect of safeguarding as outlined in paragraph 5 of this report.

70. The military authorities may request an aeronautical study to demonstrate that the development would not adversely affect the safety, or significantly affect the regularity, of operations. Given the IHS protects the visual manoeuvring/circling airspace at 45 m above aerodrome elevation, a 3.605m intrusion has a reasonable prospect of surviving a study, but it depends entirely on *where* it sits relative to circling areas and the existing obstacle picture a small penetration in a benign location is very different from a small penetration under a circling track.

71. The development may have to be surveyed and recorded as an obstacle which will feed into obstacle data and, where relevant, into military aeronautical data and any applicable AIP or obstacle records. Marking and lighting may be required in line with Annex 14 Chapter 6 principles, since in absolute terms the top of the development sits at 48.6m above aerodrome elevation (a penetration of 3.605 m into the IHS) for runway 22-04. Whether the development can be omitted from the obstacle data for EIME is one of the things the aeronautical study addresses if required by the IAC. The IAC may want the study to make the determination, with the planning authority consulted through the safeguarding process.

72. Therefore, RA conclude that the proposed construction may have a minor impact on aviation safety or efficiency in this regard depending on the outcome of engagement with the IAC. It is therefore proposed that further liaison is required with the Air Traffic Services management at Casement Aerodrome and also with Department of Defence officials.



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