systemsinterface

Member of the Frequentis Group

SAFEGUARDING

STUDY

CNS TECHNICAL SAFEGUARDING

IRISH AIR CORPS

BALDONNEL CASEMENT AERODROME

About Systems Interface
A leading project based aviation systems integrator with many years specialist experience delivering turnkey projects to civil and defence airports and Civil Aviation Authorities worldwide.

Systems Interface manages complex logistical and technical requirements, sourcing and supplying fully integrated bespoke ATC systems, navigational aids and airfield lighting, designed, installed and commissioned to exacting requirements.

Services include system design, upgrading existing Air Traffic Control Systems, completely new turnkey installations, safety cases, training and maintenance and civil works.

A dynamic project based organisation with a proven track record for delivering complex projects on time and in budget.

	Name:	Position:	Company:
Produced for:	Air Corps Contracts Sect		
Prepared By:	Martyn Wills	Specialist Consultant	Systems Interface
Edited By:	Phil Heaney	Technical Director	Systems Interface
Approved By:	Phil Heaney	Technical Director	Systems Interface
Doc Ref:	26-0319-P26087-DOC		
Issue	1.0		
Date:	22/07/2026		

Contents

1. EXECUTIVE SUMMARY 7

2. INTROUCTION 8

2.1 General 8

3. TECHNICAL SAFEGUARDING 8

3.1 Background 8

3.2 Radio Environment 8

3.3 Buildings and Developments 8

3.4 Technical Safeguarding Frames 9

3.5 Technical Assessments 9

4. ICAO EUR DOC 015 10

4.1 Facility Types 10

4.2 Directional Facilities 10

4.3 Omni Directional Facilities 11

5. SAFEGUARDING FRAME CONSTRUCTION 14

5.1 Development 14

5.2 Existing Penetrations 14

6. TECHNICAL SAFEGUARDING FRAMES 15

6.1 ILS Localiser 15

6.2 ILS Glidepath 16

6.3 DVOR 17

6.4 BAL DME 19

6.5 ILS DME 20

6.6 VDF 21

6.7 Transmitters 22

6.8 Receivers 23

6.9 Omni.kmz 24

7. EXISTING PENETRATIONS 26

7.1 General 26

7.2 DVOR Penetrations 28

7.3 BAL DME Penetrations 29

7.4 ILS DME Penetrations 30

7.5 VDF Penetrations 31

7.6 Comms Transmitter Penetrations 32

7.7 Comms Receiver Penetrations 33
7.8 Omni Combined Penetrations 34
8. SAFEGUARDING PROCESS 35
8.1 Technical Safeguarding 35
Attachments 36

Table of Figures

Figure 1 ICAO EUR Doc 015 Directional Facilities Shape ... 10
Figure 2 ICAO EUR Doc 015 Directional Facilities 3D Shape ... 10
Figure 3 ICAO EUR Doc 015 Directional Facilities dimensions ... 11
Figure 4: ICAO EUR Doc 015 Omni Directional Facilities Shape ... 12
Figure 5 ICAO EUR Doc 015 Communication Facilities dimensions ... 12
Figure 6 ICAO EUR Doc 015 Omnidirectional Navigation Facilities dimensions ... 13
Figure 7: Obstacle penetrations of VDF safeguarding frame ... 14
Figure 8: ILS Localiser TSF ... 15
Figure 9: ILS Glidepath TSF ... 16
Figure 10: DVOR TSF ... 17
Figure 11: DVOR wind turbine TSF area ... 18
Figure 12: BAL DME TSF ... 19
Figure 13 ILS DME TSF ... 20
Figure 14: VDF TSF ... 21
Figure 15: Transmitters TSF ... 22
Figure 16: Receivers TSF ... 23
Figure 17: Combined Omni contours ... 24
Figure 18: Combined Omni contours detail ... 25
Figure 19: TSF Obstacle penetrations (GIS) ... 26
Figure 20: Example of obstacle penetrations ... 27
Figure 21: DVOR TSF Penetrations ... 28
Figure 22: BAL DME TSF Penetrations ... 29
Figure 23: ILS DME TSF Penetrations ... 30
Figure 24: VDF TSF Penetrations ... 31
Figure 25: Comms Transmitter TSF Penetrations ... 32
Figure 26: Comms Transmitter TSF Penetrations ... 33
Figure 27: Omni combined TSF Penetrations ... 34
Figure 28: Typical airport safeguarding process ... 35
Figure 29: Google Earth File List ... 36

Change Record

Date	Version	Change Details
16/07/2026	0.1	Initial Draft
22/07/2026	1.0	First Issue

References

Document Description
EIME AD 2.24-1 Aerodrome Chart_301025
EIME-OBST25 Obstacle Survey Data
ICAO Annex 10 – Aeronautical Telecommunications
Airfield Drawing MGS63406_T_ITM_3d_Rev0
ICAO-EUR-Doc-015-3rd Edition Nov 2015 - European Guidance Material on Managing Building Restricted Areas

Glossary

AMSL	Above Mean Sea Level (Malin Head)
BAL	Baldonnel DVOR/DME
CAD	Computer Aided Design
CNS	Communication, Navigation, Surveillance
DME	Distance Measuring Equipment
DVOR	Doppler VOR
GIS	Geographic Information System
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedures
ILS	Instrument Landing System
MLS	Microwave Landing System
OLS	Obstacle Limitation Surfaces
SIL	Systems Interface Limited
TSF[1]	Technical Safeguarding Frame
VDF	VHF Direction Finding
RF	Radio Frequency
ANSP	Air Navigation Service Provider

[1] Also known as Building Restriction Areas or BRA.

1. EXECUTIVE SUMMARY

This report details the development of a technical safeguarding process to protect the performance of the Communication, Navigation, and Surveillance systems at Baldonnel/Casement Aerodrome.

A series of Technical Safeguarding Frames have been produced based on international standards and best practices.

The technical safeguarding frames have been distributed in Google Earth™ format to allow ready access without requiring bespoke tools or paper maps.

Technical Safeguarding Frames do not preclude any development. The Technical Safeguarding Frames are simply a filter to allow the user to determine if a proposed development requires a technical assessment (safeguarding study). The technical assessment informs the acceptability or otherwise of the proposed development. The technical assessment also informs potential modifications to the development to minimise or remove any adverse impact on communication, navigation, and surveillance systems.

Existing surveyed obstacle penetrations of Technical Safeguarding Frames have been assessed as per customer request. The communication, navigation, and surveillance equipment currently operates in the existing environment. Technical Assessments or safeguarding studies are normally carried out before building development and not usually applied retrospectively. The information may prove useful if performance of a facility suffers some degradation.

2. INTROUCTION

2.1 General

2.1.1 Systems Interface Limited (SIL) has been contracted to provide technical safeguarding advice regarding the radio facilities at Baldonnel Casement Aerodrome.

2.1.2 This report describes the process to implement a robust technical safeguarding process in accordance with international standards and industry best practice.

3. TECHNICAL SAFEGUARDING

3.1 Background

3.1.1 The performance of a radio Communication, Navigation or Surveillance (CNS) facility is dependent on the environment in which it operates.

3.1.2 The CNS system installation is designed to operate in the local environment existing at the time. Commissioning / Site Acceptance Testing establishes the acceptability of facility performance (baseline).

3.1.3 Changes to the environment must be monitored to ensure that facility performance is not degraded.

3.2 Radio Environment

3.2.1 Radio Frequency (RF) interference can severely degrade CNS system performance.

3.2.2 Radio Spectrum Management is a process undertaken by the state to ensure that licenced radio systems are protected from mutual radio frequency interference.

3.2.3 The main RF interference threats to aeronautical CNS systems are unlicenced transmissions and spurious radiation from faulty equipment. There is also a possibility of deliberate signal jamming by hostile agents.

3.2.4 Radio frequency safeguarding is generally reactive rather than proactive. The facility operator is reliant on user reports to be made aware of interference. The interference investigation is then handled by specialist agencies.

3.3 Buildings and Developments

3.3.1 The development and construction of buildings and structures in the airfield environment can have adverse effects on the performance of the radio navigation facilities.

3.3.2 Buildings and structures can cause shadowing of the radio navigation system signals, leading to reduced coverage.

3.3.3 Signal reflections from buildings and structures can cause course distortion, in addition to false range and bearing information.

3.3.4 As building development and structures can adversely affect the performance of radio navigation systems, it is essential that such development is controlled to ensure the ongoing safe operation of the navigation systems.

3.3.5 ICAO Annex 10 identifies the requirement to undertake technical safeguarding of CNS facilities but offers no guidance for implementation.

3.4 Technical Safeguarding Frames

3.4.1 It is important that an Air Navigation Services Provider (ANSP) identifies any proposed building developments that could potentially adversely affect the CNS system performance.

3.4.2 Technical Safeguarding Frames (TSF) are a tool used to enable the ANSP to decide whether a potential development could adversely affect the CNS facility.

3.4.3 The TSF is a series of surfaces described around a CNS facility. If the proposed development penetrates the frame, then a technical assessment is required to ensure that the facility performance will not be unduly degraded.

3.4.4 The TSF is a filter, such that only those developments that could cause degradation to a CNS facility are subject to a Technical Assessment.

3.4.5 The TSF must be large enough to capture developments that could adversely affect CNS facility performance. However, excessively large Technical Safeguarding frames will result in many nugatory technical assessments.

3.4.6 Historically, TSF have been derived from various sources such as National Aviation Authorities or from manufacturer's data.

3.4.7 The European and North Atlantic office of ICAO (ICAO-EUR) All-Weather Operations Group became aware that there was a disparate multitude of technical safeguarding area configurations in use. The All-Weather Operations Group set up a Project Team on Building Restricted Areas (PT/BRA) to elaborate respective European Operational Requirements and develop guidance material in order to ensure signal in space requirements are maintained within specification for the respective CNS facilities used in support of All Weather Operations. The results of the project team were the development of Building Restricted Areas (Technical Safeguarding Frames) based on sound scientific principles and evaluation. This guidance was published as EUR DOC 015[2] and has been widely adopted even outside of Europe.

3.4.8 The third edition of EUR DOC 015 was published in 2015 and is the basis of the TSF derived for use at Casement/Baldonnel aerodrome.

3.5 Technical Assessments

3.5.1 Penetration of a TSF only identifies the possibility that the development may degrade a CNS facility and requires confirmation by a technical assessment. Many penetrations will have no measurable effect on CNS facility performance.

3.5.2 A technical assessment can identify suitable mitigation measures to allow the development to proceed whilst minimising any effects on the CNS facility.

[2] European Guidance Material on Managing Building Restricted Areas

4. ICAO EUR DOC 015

4.1 Facility Types

4.1.1 ICAO EUR DOC 015 defines two types of technical safeguarding frames:

- Directional facilities, such as ILS/MLS and directional DME associated with ILS or MLS.
- Omni-directional facilities such as VOR, DME, VDF, radar, communication transmitters and receivers.

4.2 Directional Facilities

4.2.1 The shape of the TSF for directional facilities is shown at Figure 1below.

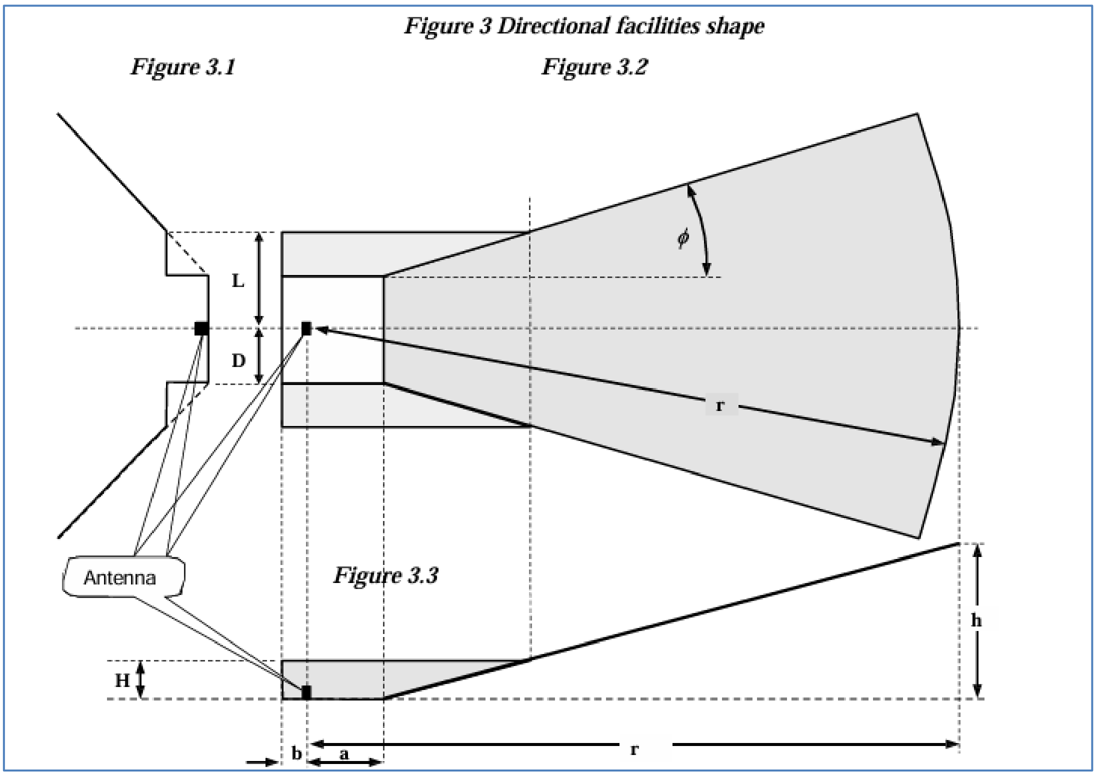

Figure 1 ICAO EUR Doc 015 Directional Facilities Shape

4.2.2 A 3D representation of the shape is shown at Figure 2

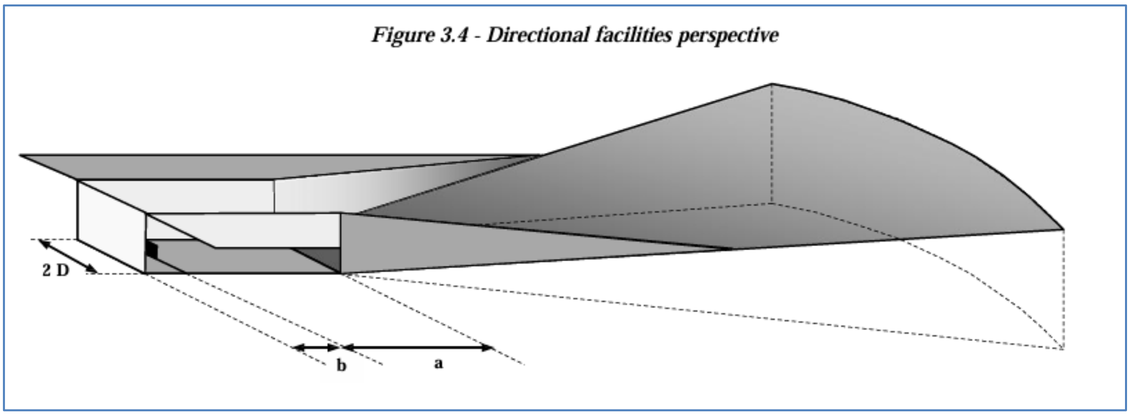

Figure 2 ICAO EUR Doc 015 Directional Facilities 3D Shape

4.2.3 The dimensions of the shape are detailed at Figure 3.

Table 2: Harmonised guidance figures for the directional navigational facilities in accordance with Figure 3

*Type of **navigation** facilities*	***A*** *(m)*	***b*** *(m)*	***h****(m)*	***r*** *(m)*	***D*** *(m)*	***H*** *(m)*	***L*** *(m)*	***ϕ*** *(°)*
ILS LLZ (medium aperture single frequency)	Distance to threshold	500	70	a+6000	500	10	2300	30
ILS LLZ (medium aperture dual frequency)	Distance to threshold	500	70	a+6000	500	20	1500	20
ILS GP M–Type (dual frequency)	800	50	70	6000	250	5	325	10
MLS AZ	Distance to threshold	20	70	a+6000	600	20	1500	40
MLS EL	300	20	70	6000	200	20	1500	40
DME (directional antennas)	Distance to threshold	20	70	a+6000	600	20	1500	40

Figure 3 ICAO EUR Doc 015 Directional Facilities dimensions

4.2.4 **NOTE**: Due to the interference mechanisms for ILS and MLS, the TSF defines the maximum building height above ground level irrespective of terrain elevation.

4.3 Omni Directional Facilities

4.3.1 The TSF for omni directional facilities comprises a cylinder around the facility encompassing all development.

4.3.2 A cone extends from the cylinder at a stated angle to a specified distance.

4.3.3 A second cylinder extends from the extents of the cone to define an area where wind turbines must be assessed. Not all facilities have a second cylinder.

4.3.4 The TSF shapes are shown at Figure 4

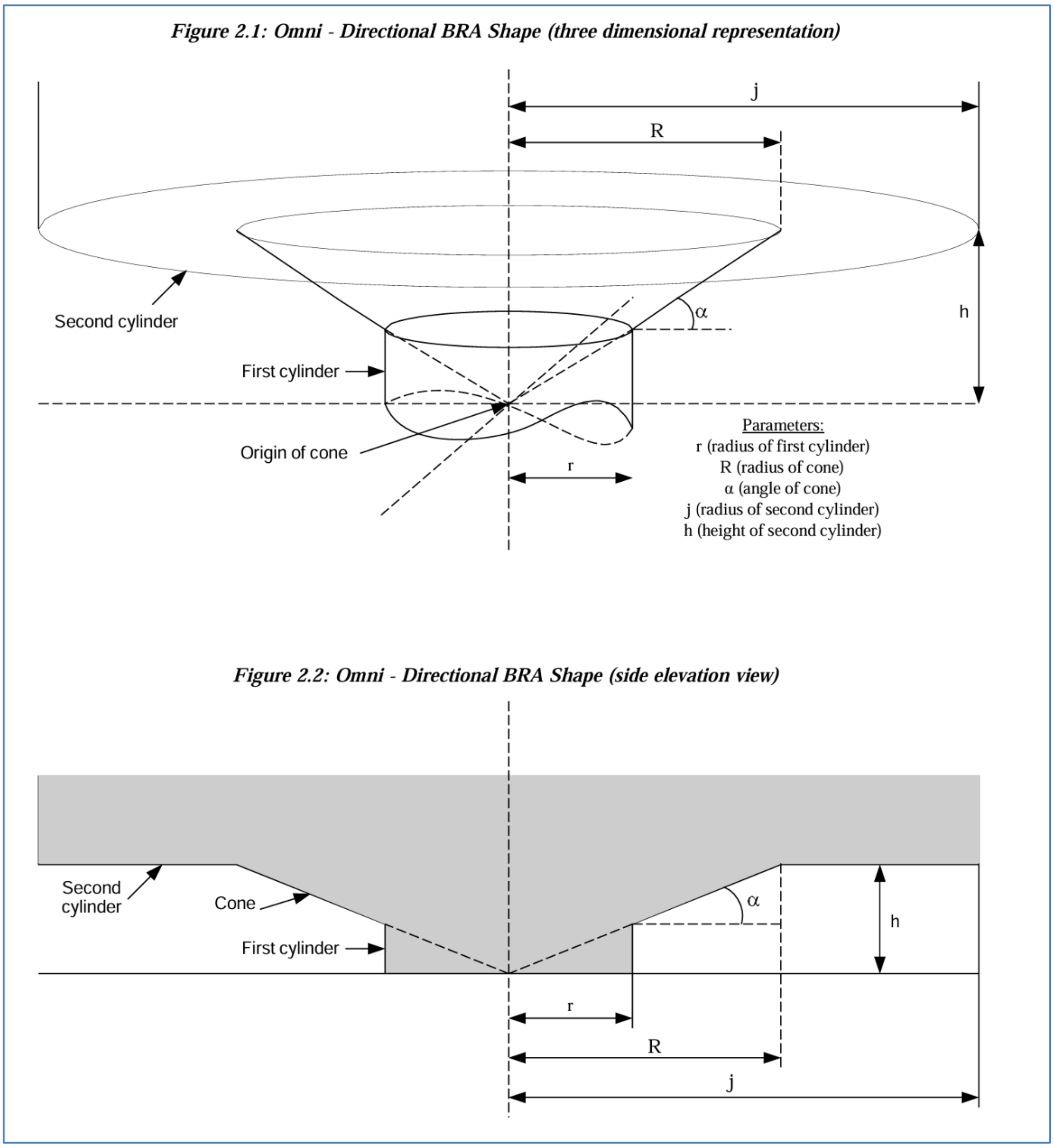

Figure 4: ICAO EUR Doc 015 Omni Directional Facilities Shape

4.3.5 The dimensions of the omni directional technical safeguarding shape for various facilities are shown in the following figures.

Type of ***communication*** *facilities*	*Alpha (a – cone) (°)*	*Radius (R- cone) (m)*	*Radius (r – cylinder) (m)*	*Origin of cone*
VHF Communication Tx	1.0	2000	300	Base of antenna at ground level
VHF Communication Rx	1.0	2000	300	Base of antenna at ground level

Figure 5 ICAO EUR Doc 015 Communication Facilities dimensions

Table 1: Harmonised guidance figures for the omni-directional navigational facilities in accordance with Figures 2.1 and 2.2

*Type of **navigation** facilities*	*Radius (r – Cylinder) (m)*	*Alpha (a – cone) (°)*	*Radius (R- Cone) (m)*	*Radius (j – Cylinder) (m) Wind turbine(s) only*	*Height of cylinder j (h -height) (m) Wind turbine(s) only*	*Origin of cone and axis of cylinders*
DME N	300	1.0	3000	N/A	N/A	Base of antenna at ground level
CVOR	600	1.0	3000	15000	52	Centre of antenna system at ground level
DVOR	600	1.0	3000	10000	52	Centre of antenna system at ground level
Direction Finder (DF)	500	1.0	3000	10000	52	Base of antenna at ground level
Markers	50	20.0	200	N/A	N/A	Base of antenna at ground level
NDB	200	5.0	1000	N/A	N/A	Base of antenna at ground level
GBAS ground Reference receiver	400	3.0	3000	N/A	N/A	Base of antenna at ground level
GBAS VDB station	300	0.9	3000	N/A	N/A	Base of antenna at ground level
VDB station monitoring station	400	3.0	3000	N/A	N/A	Base of antenna at ground level

Figure 6 ICAO EUR Doc 015 Omnidirectional Navigation Facilities dimensions

4.3.6 **NOTE**: Omnidirectional safeguarding frames originate at ground level at the facility. The safeguarding frame defines the maximum building/structure elevation.

5. SAFEGUARDING FRAME CONSTRUCTION

5.1 Development

5.1.1 The TSF are drawn in 3D CAD, geo-referenced to the facility.

5.1.2 The drawings are imported into a Geographic Information System (GIS) tool. The GIS tool is used to construct a 3D representation of the TSF.

5.1.3 Height or elevation contours are added to the TSF.

5.1.4 Relevant areas are colour coded for ease of identification.

5.1.5 The TSF are exported as Google Earth KMZ files to allow ready access by the end user.

5.2 Existing Penetrations

5.2.1 The documenting of existing penetrations is a customer requirement.

5.2.2 The GIS tool is used to compare existing penetrations of the technical safeguarding frames using data from the airfield obstacle survey.

5.2.3 The obstacle survey data is filtered to only show those obstacles higher than the technical safeguarding frame and the extent of the penetration.

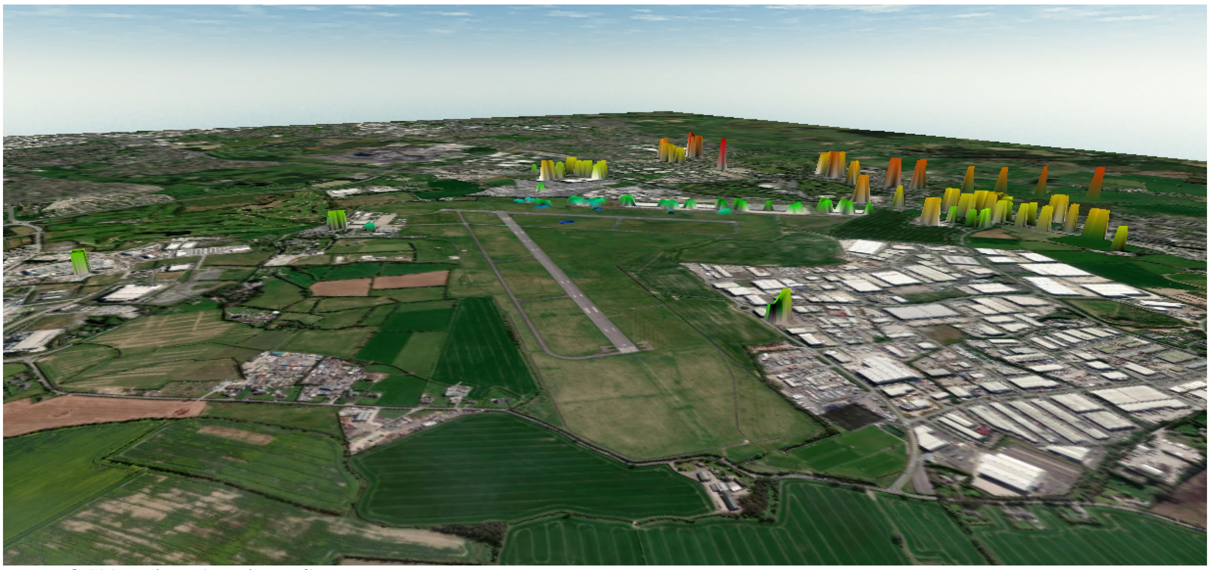

Figure 7: Obstacle penetrations of VDF safeguarding frame

5.2.4 Unfortunately, it has not been possible to export this data directly from GIS to Google Earth™.

5.2.5 An alternative method of presentation has been developed compatible with Google Earth™. This is described later.

6. TECHNICAL SAFEGUARDING FRAMES

6.1 ILS Localiser

6.1.1 The ILS Localiser TSF for Casement/Baldonnel is shown at Figure 8

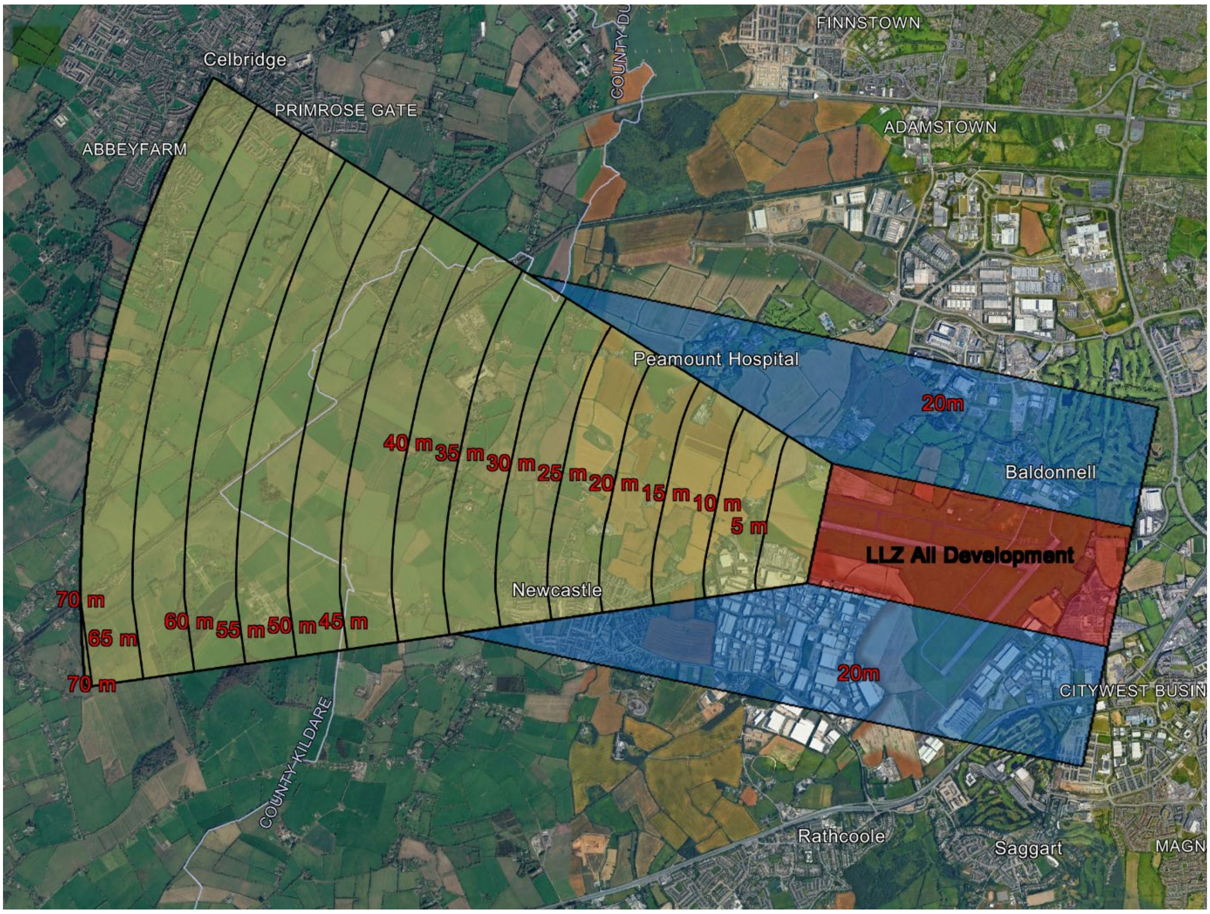

Image © 2026 Google Airbus

Figure 8: ILS Localiser TSF

6.1.2 The red shaded area is where all development should be subject to a technical assessment. The blue shaded areas are where all buildings or structures exceeding a height of 20m should be assessed.

6.1.3 The yellow shaded area is a slope annotated with contours showing the limiting building/structure height. Existing penetrations are not shown as no accurate terrain elevation data is available outside of the airfield boundary.

6.1.4 The ICAO EUR DOC 015 TSF is based on a typical medium aperture localiser operating at Cat III. The area is very conservative and physically larger than absolutely necessary. A bespoke TSF derived from computer simulation and modelling of the actual localiser installation, as allowed in DOC 015, would result in a smaller TSF and reduced nugatory assessments. Conversely, this would need to be re-assessed in the event of ILS equipment change.

6.2 ILS Glidepath

6.2.1 The ILS Glidepath TSF for Casement/Baldonnel is shown at Figure 9

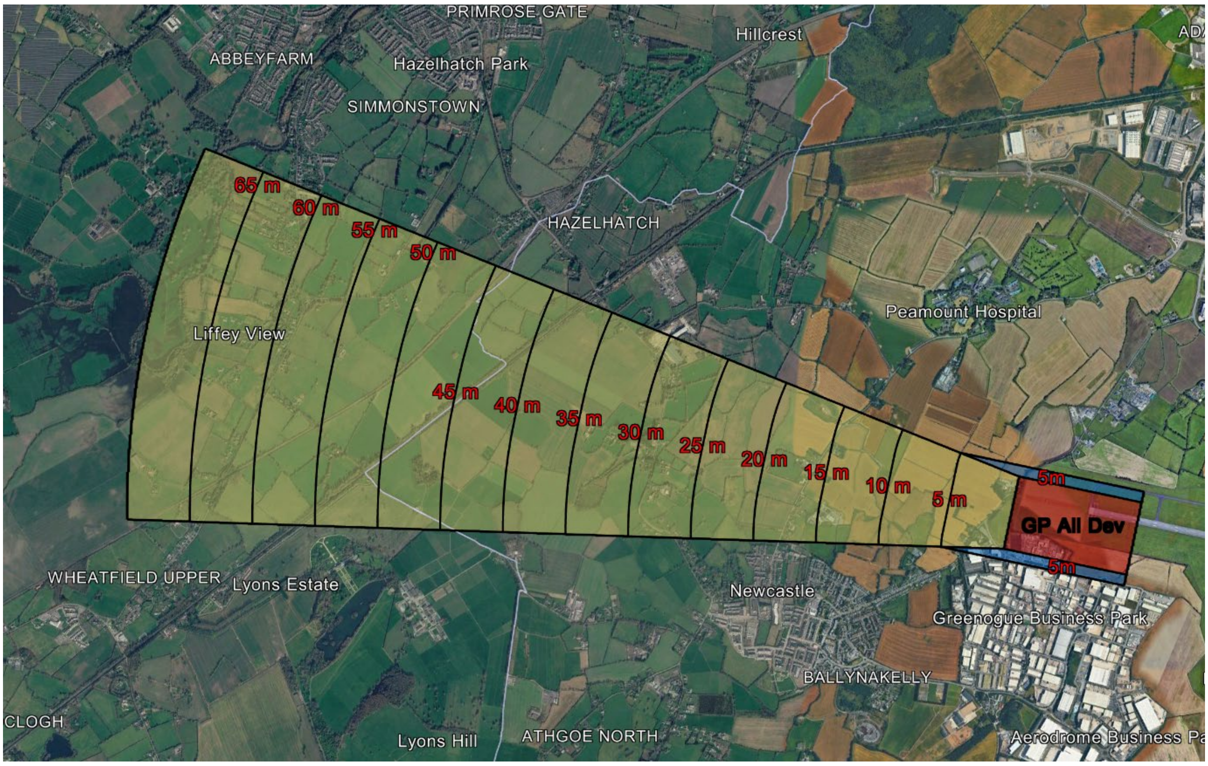

Image © 2026 Google Airbus

Figure 9: ILS Glidepath TSF

6.2.2 The red shaded area is where all development should be subject to a technical assessment. The blue shaded areas are where all buildings or structures exceeding a height of 5m should be assessed.

6.2.3 The yellow shaded area is a slope annotated with contours showing the limiting building/structure height. Existing penetrations are not shown as no accurate terrain elevation data is available outside of the airfield boundary.

6.2.4 Where the Localiser and Glidepath areas overlap, the lowest building height restriction is the determining factor.

6.3 DVOR

6.3.1 The DVOR TSF for Casement/Baldonnel is shown at Figure 10

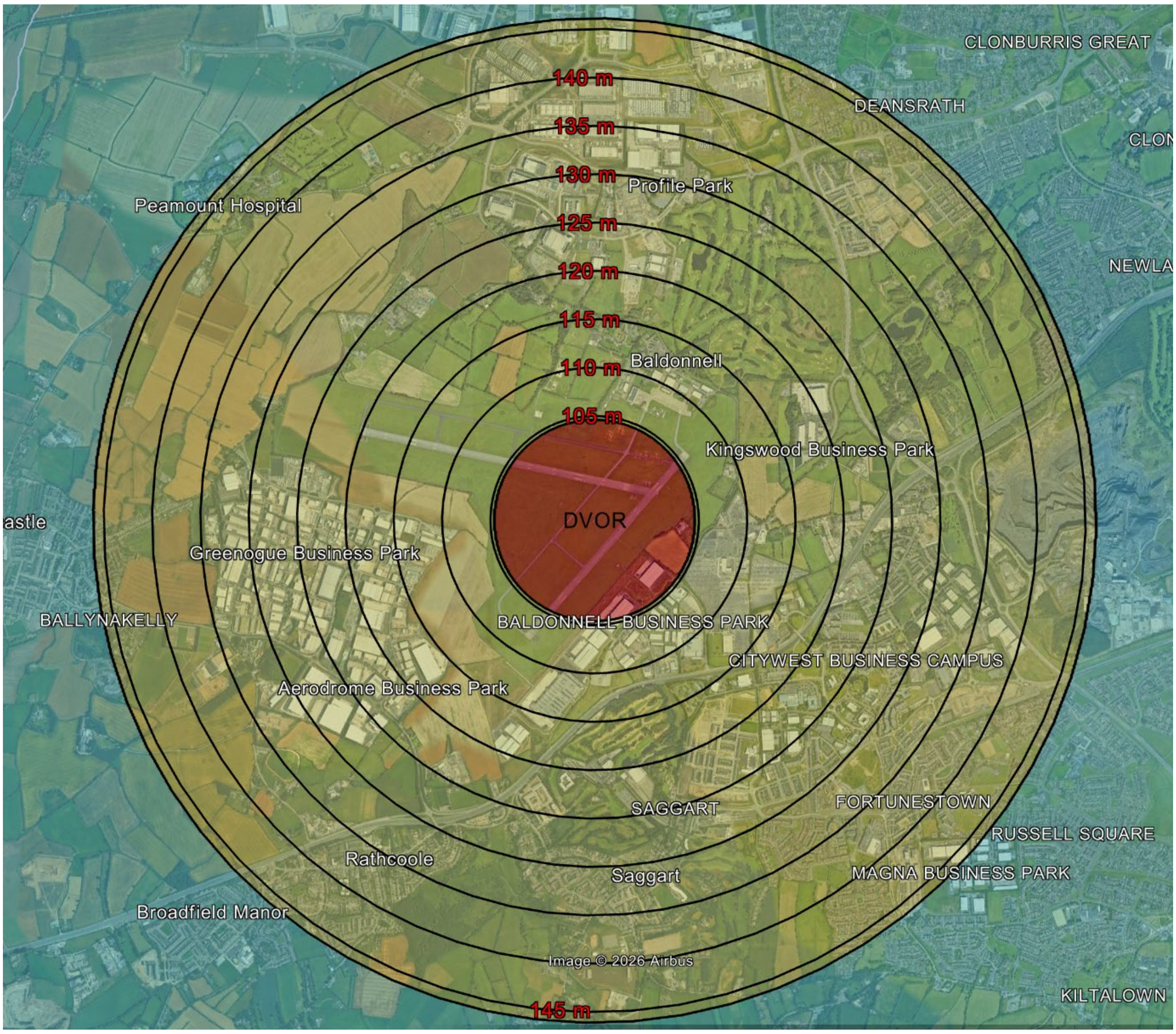

Image © 2026 Google Airbus

Figure 10: DVOR TSF

6.3.2 The red area is a cylinder of radius 600m where all potential development should be subject to a technical assessment.

6.3.3 The yellow shaded area is an inverted cone annotated with maximum building elevations Above Mean Sea Level (AMSL[3]). The blue shaded area is where wind turbines exceeding a tip elevation of 146.1m AMSL should be subject to a technical assessment. This area is shown in more detail at Figure 11

[3] Malin Head datum.

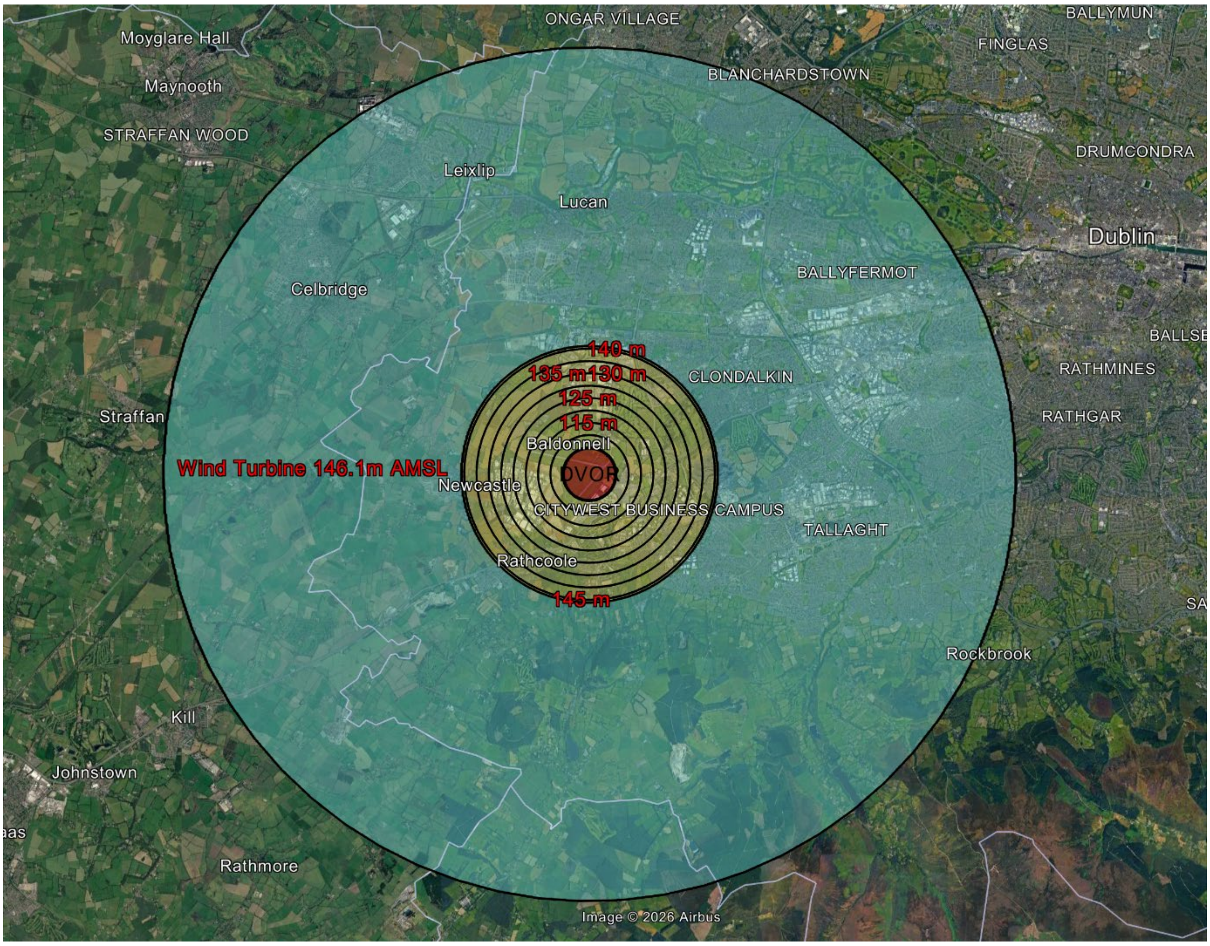

Image © 2026 Google Airbus

Figure 11: DVOR wind turbine TSF area

6.4 BAL DME

6.4.1 The BAL DME TSF for Casement/Baldonnel is shown at Figure 12

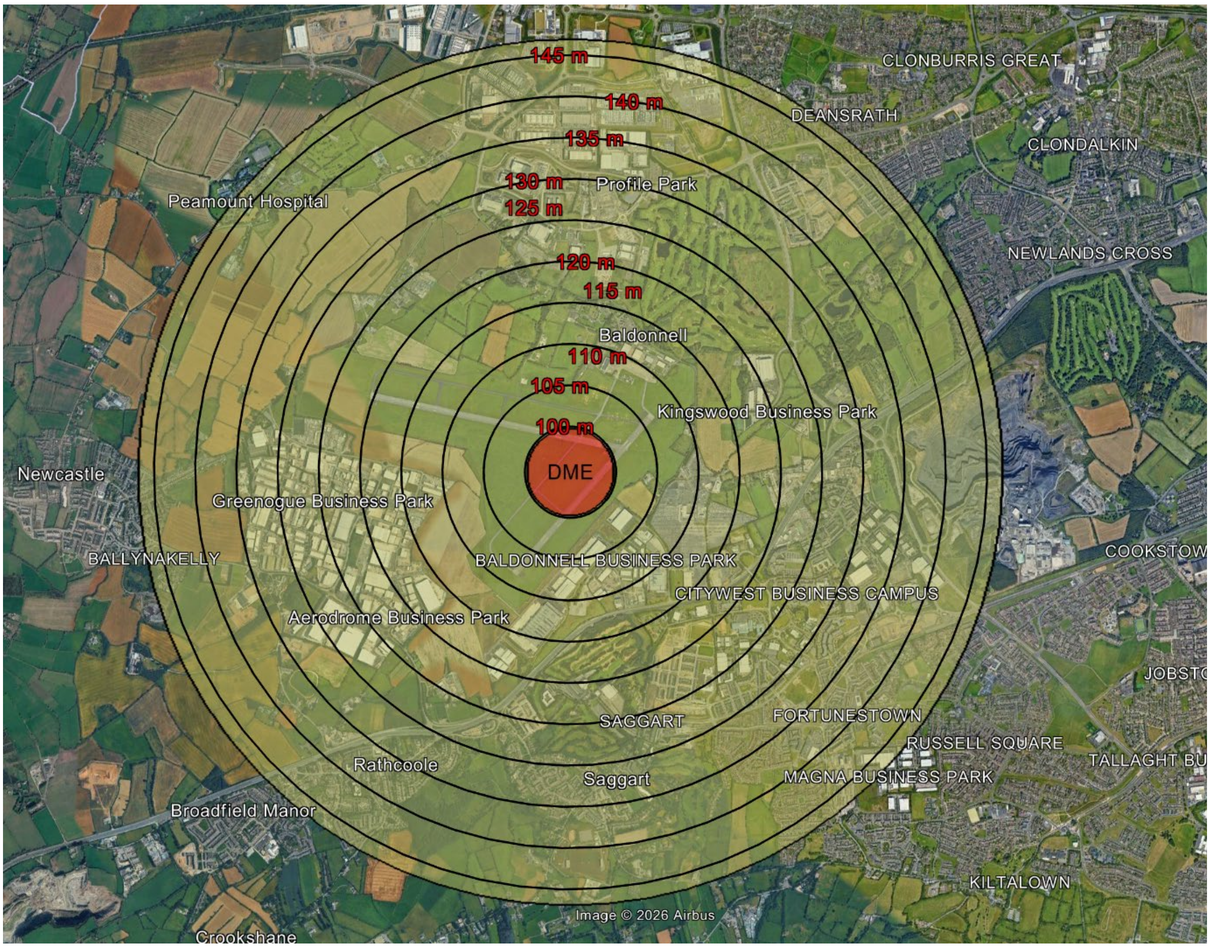

Image © 2026 Google Airbus

Figure 12: BAL DME TSF

6.4.2 The red area is a cylinder of radius 300m where all potential development should be subject to a technical assessment.

6.4.3 The yellow shaded area is an inverted cone annotated with maximum building elevations AMSL.

6.5 ILS DME

6.5.1 The ILS DME TSF for Casement/Baldonnel is shown at Figure 13

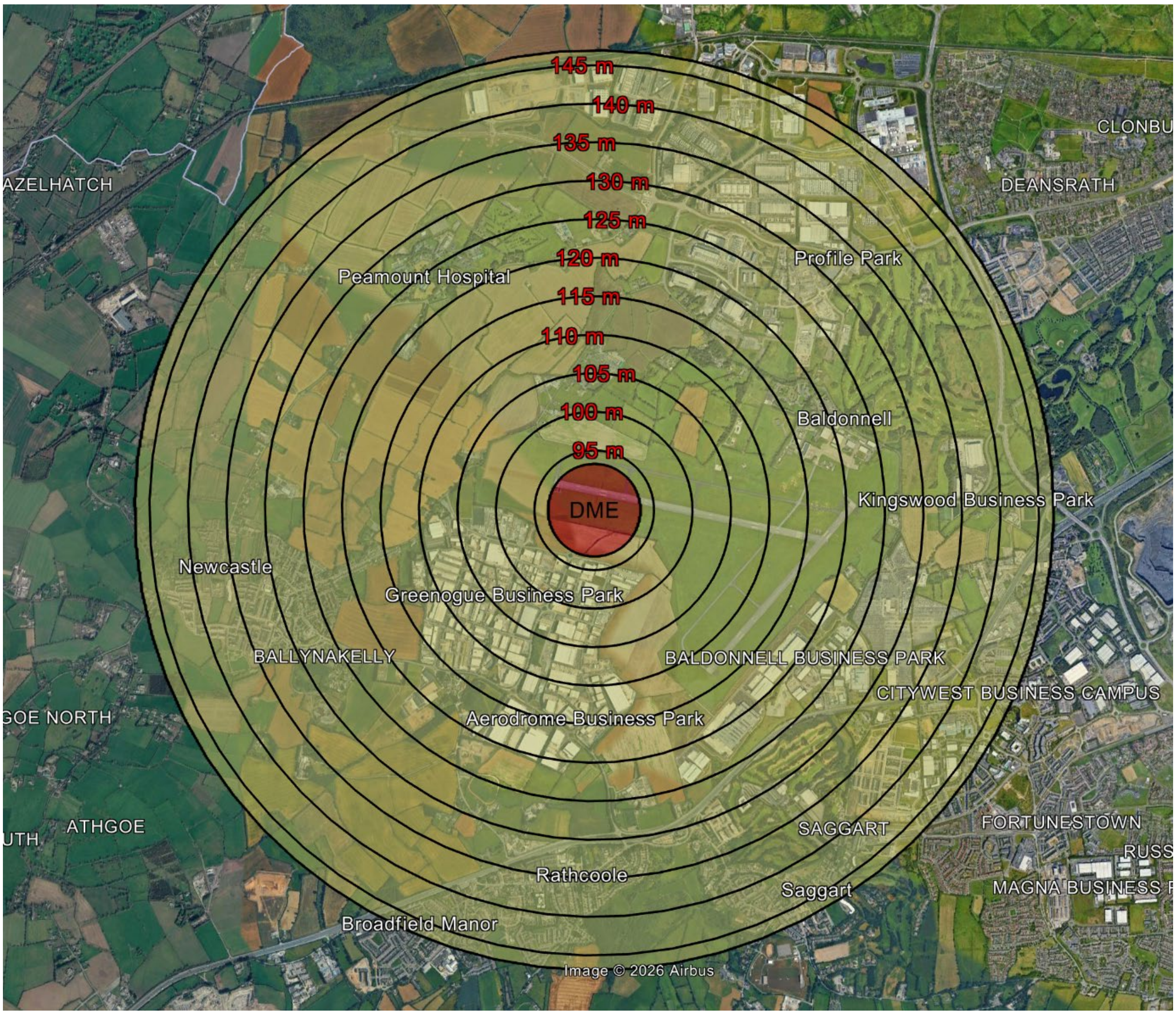

Image © 2026 Google Airbus

Figure 13 ILS DME TSF

6.5.2 The red area is a cylinder of radius 300m where all potential development should be subject to a technical assessment.

6.5.3 The yellow shaded area is an inverted cone annotated with maximum building elevations AMSL.

6.5.4 Note that if the ILS DME were to have a directional antenna, then the TSF would be similar to the ILS glidepath and therefore much smaller.

6.6 VDF

6.6.1 The VDF TSF for Casement/Baldonnel is shown at Figure 14

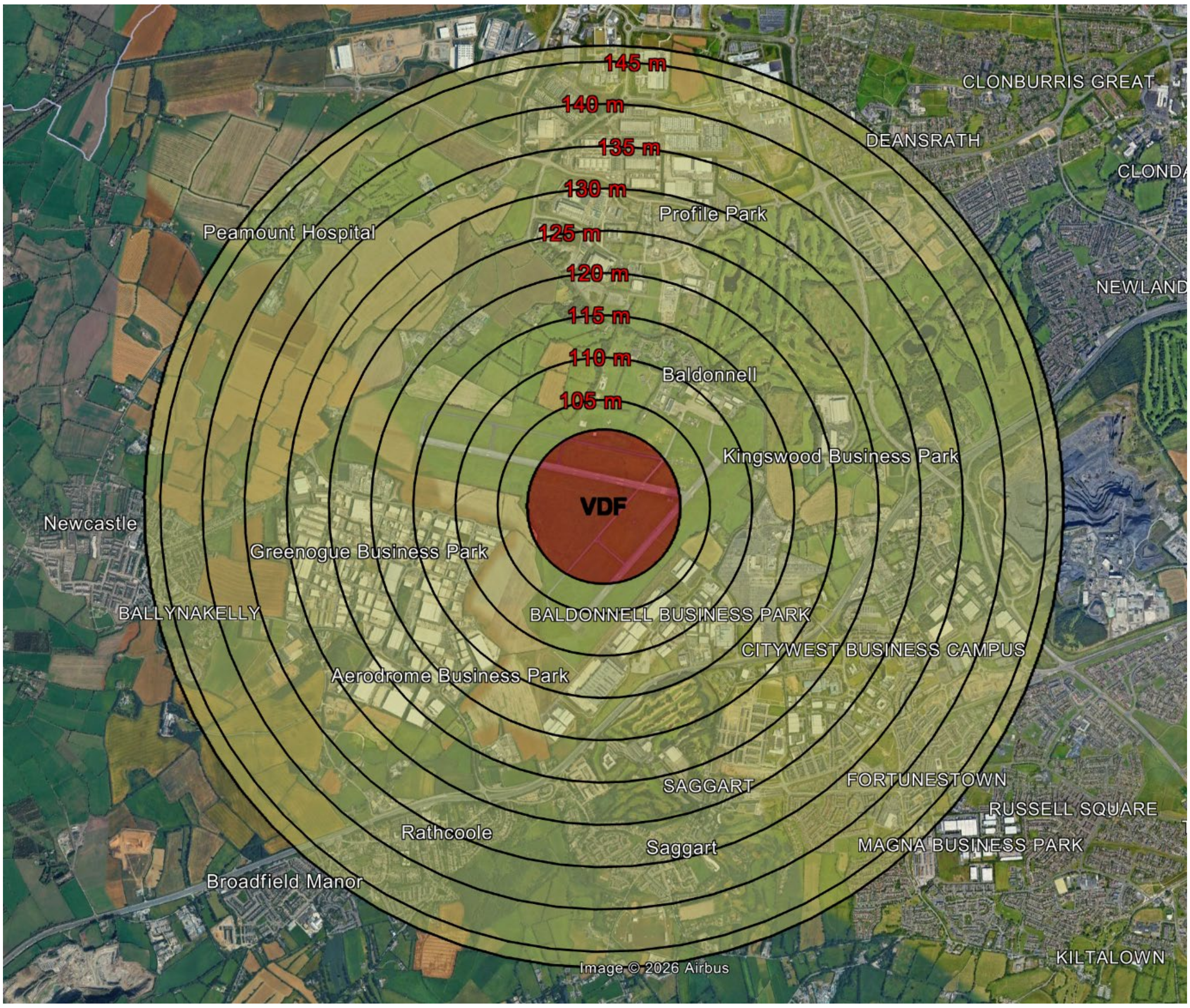

Image © 2026 Google Airbus

Figure 14: VDF TSF

6.6.2 The red area is a cylinder of radius 500m where all potential development should be subject to a technical assessment.

6.6.3 The yellow shaded area is an inverted cone annotated with maximum building elevations AMSL.

6.7 Transmitters

6.7.1 The communication transmitters TSF for Casement/Baldonnel is shown at Figure 15

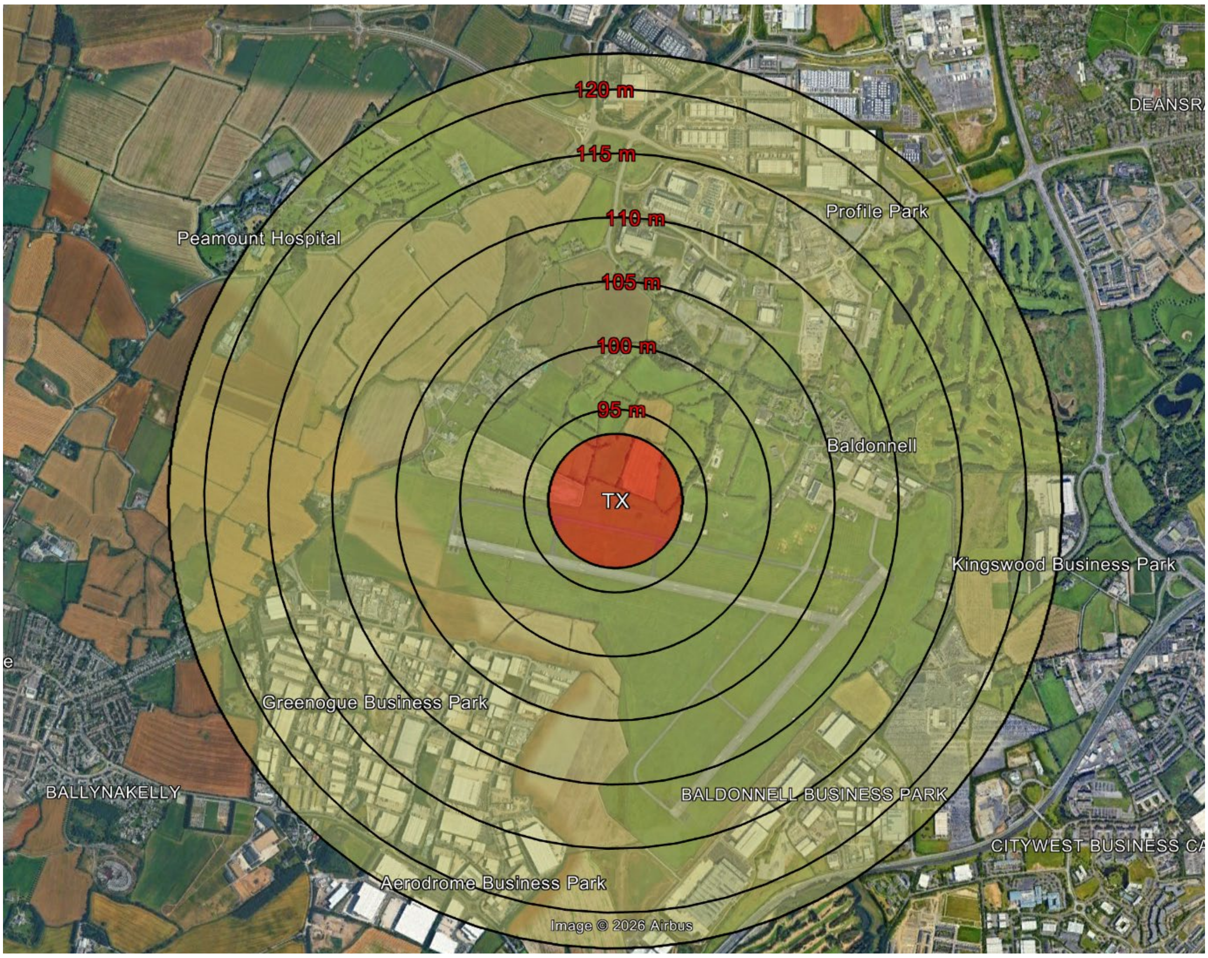

Image © 2026 Google Airbus

Figure 15: Transmitters TSF

6.7.2 The red area is a cylinder of radius 300m where all potential development should be subject to a technical assessment.

6.7.3 The yellow shaded area is an inverted cone annotated with maximum building elevations AMSL.

6.8 Receivers

6.8.1 The communication receivers TSF for Casement/Baldonnel is shown at Figure 16

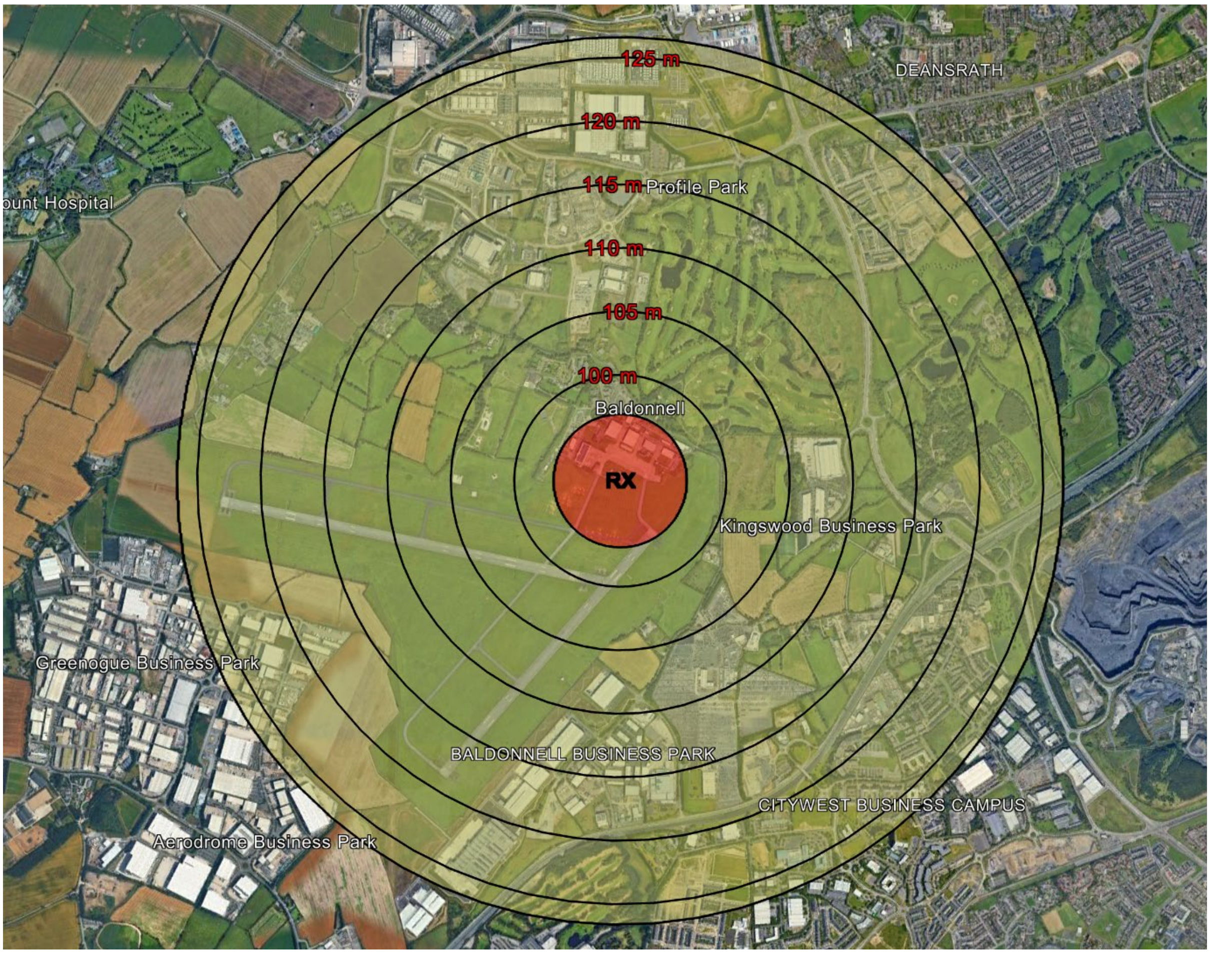

Image © 2026 Google Airbus

Figure 16: Receivers TSF

6.8.2 The red area is a cylinder of radius 300m where all potential development should be subject to a technical assessment.

6.8.3 The yellow shaded area is an inverted cone annotated with maximum building elevations AMSL.

6.9 Omni.kmz

6.9.1 To make initial assessments easier, all of the cones of the omni-directional facilities have been combined into one set of contours depicting the most limiting elevation as shown at Figure 17

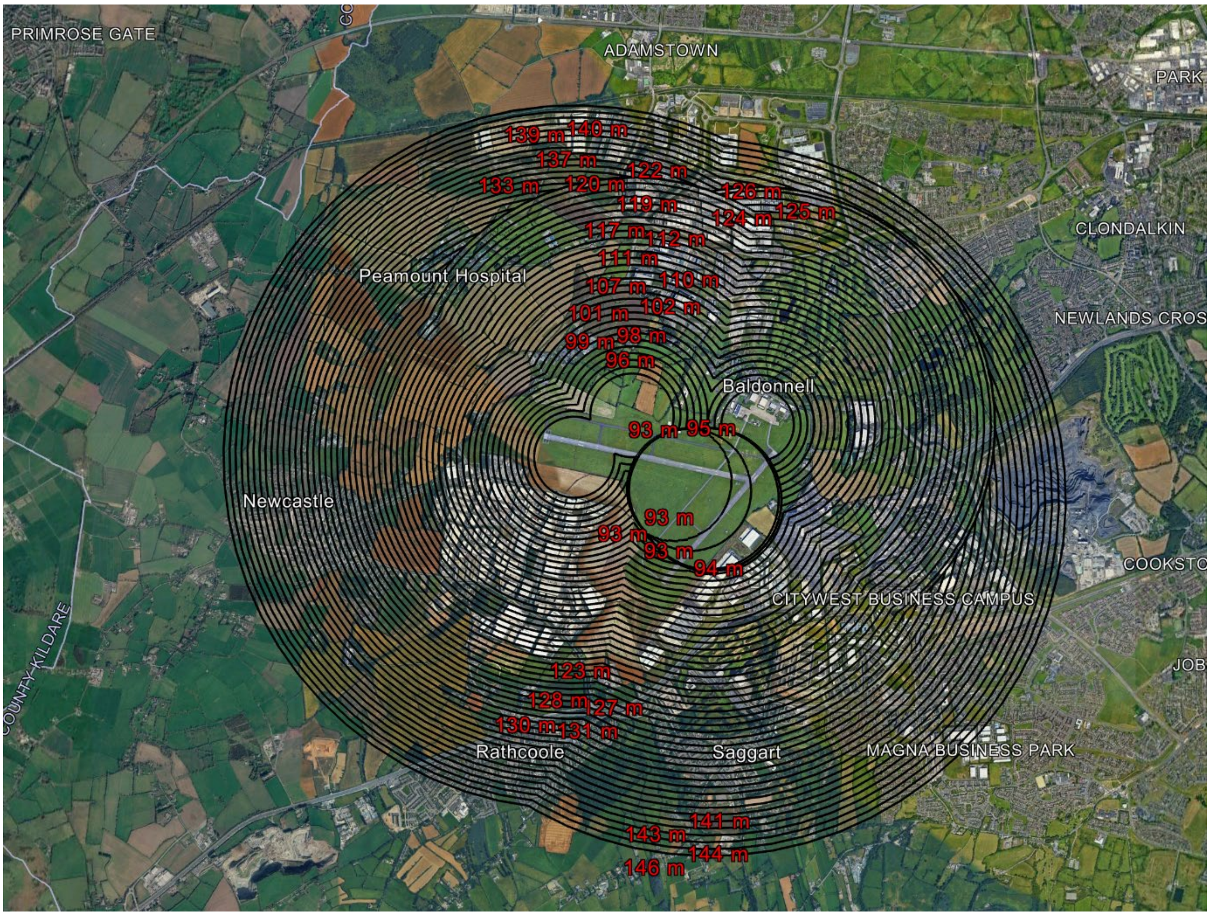

Image © 2026 Google Airbus

Figure 17: Combined Omni contours

6.9.2 A zoomed in section of Omni.kmz is shown at Figure 18

Image © 2026 Google Airbus

Figure 18: Combined Omni contours detail

6.9.3 Clicking on a contour line will bring up a label showing the contour line elevation as shown at Figure 18

7. EXISTING PENETRATIONS

7.1 General

7.1.1 As mentioned earlier, penetrations of the TSF by surveyed obstacles were assessed in the GIS model.

Image © 2026 Esri Vantor Microsoft

Figure 19: TSF Obstacle penetrations (GIS)

7.1.2 Unfortunately, the penetration data is not readily exported from GIS to Google Earth.

7.1.3 A work-around to export the location and identification of the penetrations has been established that works with Google Earth.

Image © 2026 Google Airbus

Figure 20: Example of obstacle penetrations

7.1.4 Each obstacle penetration KMZ places a red obstacle identification number next to the associated penetration.

7.1.5 By enabling the obstacle survey file[4] in Google Earth, the user can click on the red 'X' next to the penetration to view the penetration details.

7.1.6 The penetration quoted in the details is the Obstacle Limitation Surface penetration. Determination of the TSG penetration is made by comparing the obstacle elevation with the TSF contours.

7.1.7 NOTE: Due to the limitations of manual filtering to convert to KMZ, small obstacles that do not penetrate the TSF may be included if they are located immediately adjacent to a penetrating object.

[4] EIME-OBST25.kmz

7.2 DVOR Penetrations

7.2.1 Existing penetrations of the DVOR TSF are depicted by the red obstacle identification numbers.

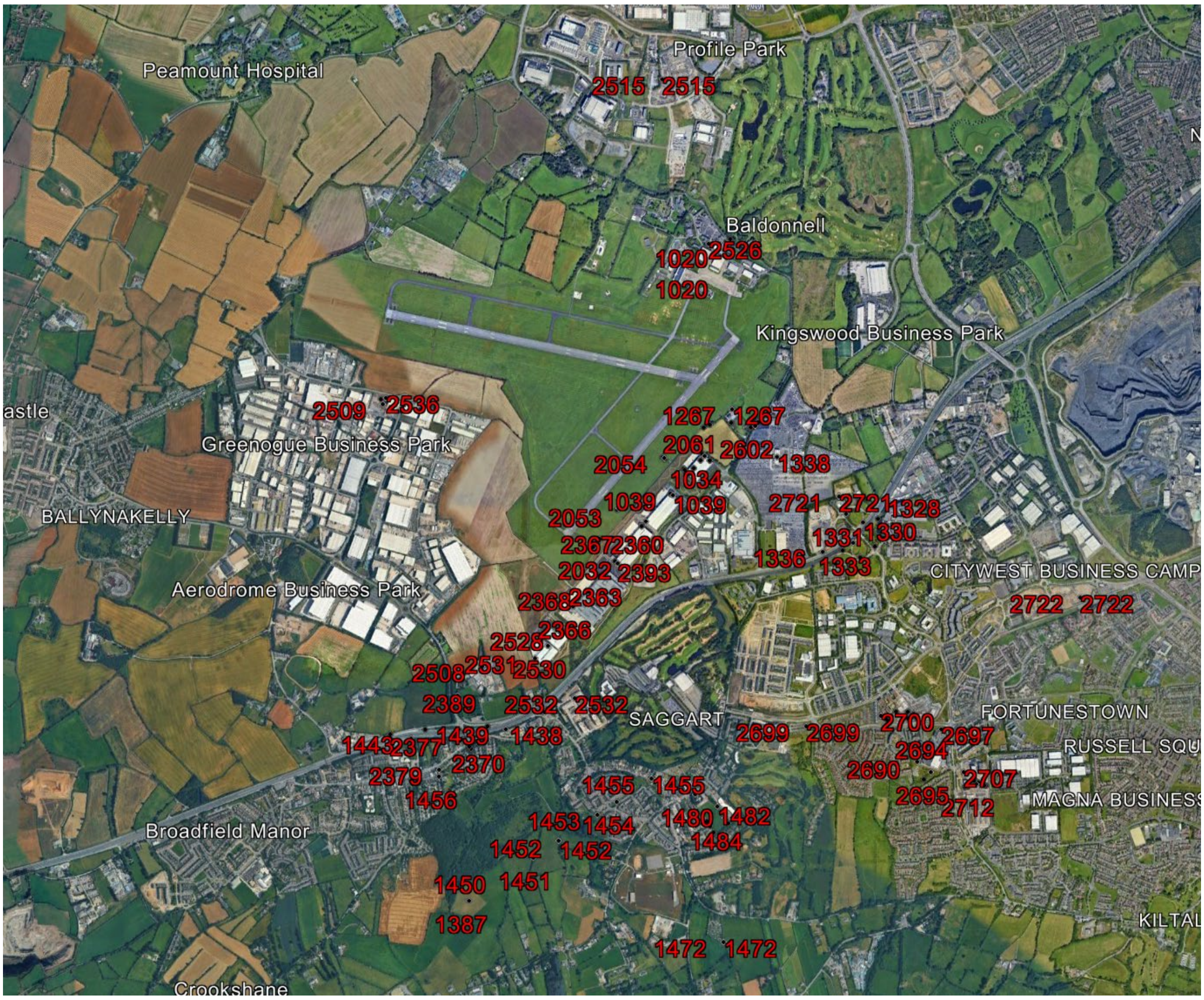

Image © 2026 Google Airbus

Figure 21: DVOR TSF Penetrations

7.3 BAL DME Penetrations

7.3.1 Existing penetrations of the BAL DME TSF are depicted by the red obstacle identification numbers.

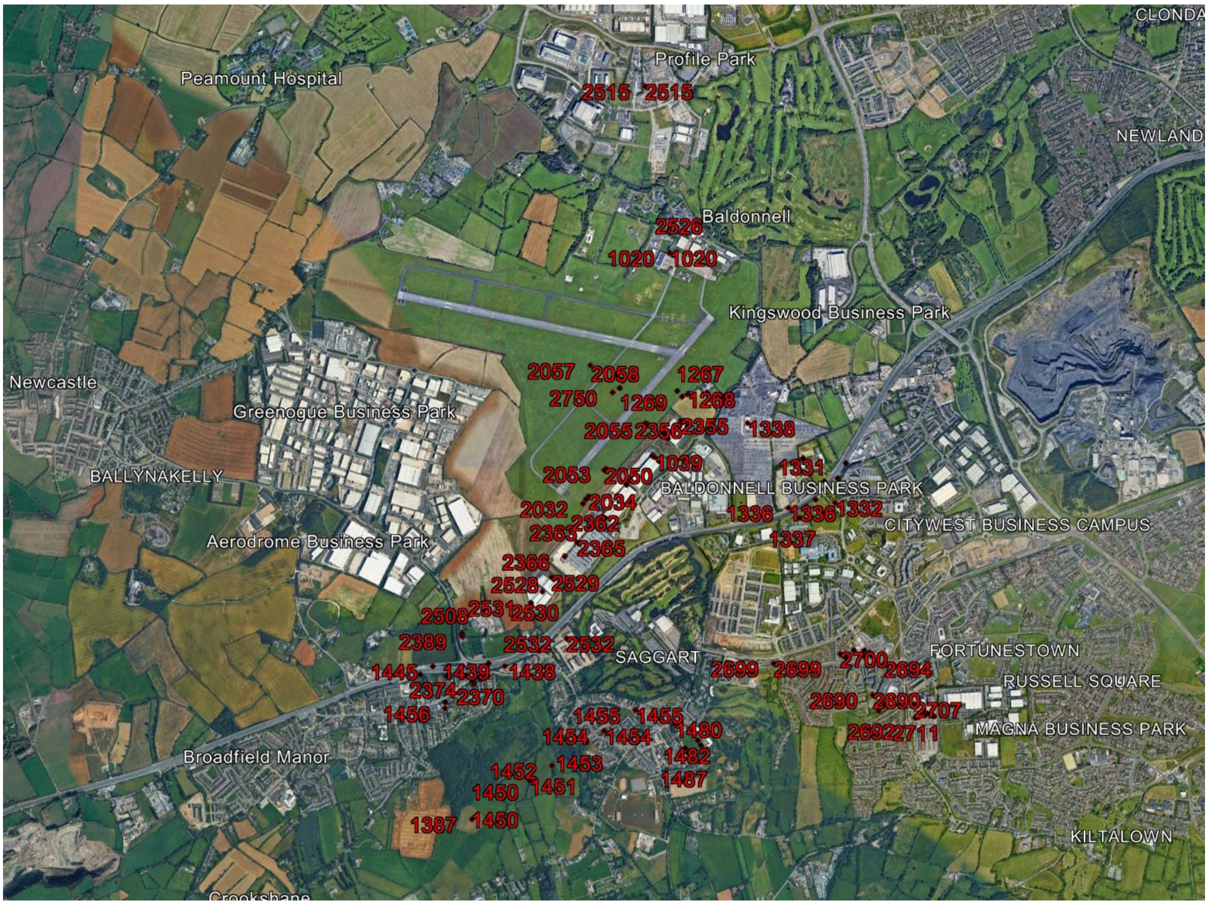

Image © 2026 Google Airbus

Figure 22: BAL DME TSF Penetrations

7.4 ILS DME Penetrations

7.4.1 Existing penetrations of the ILS DME TSF are depicted by the red obstacle identification numbers.

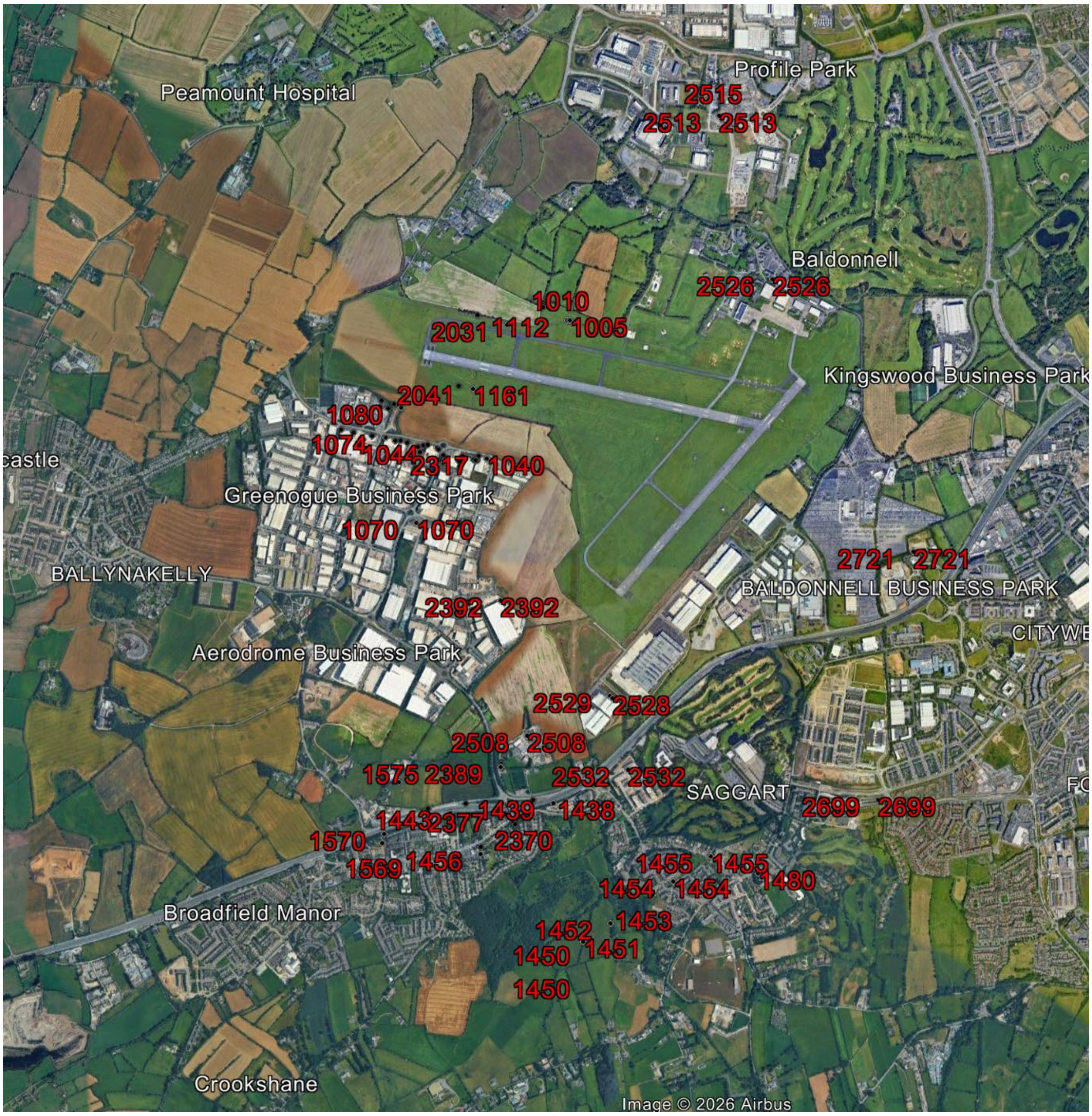

Image © 2026 Google Airbus

Figure 23: ILS DME TSF Penetrations

7.5 VDF Penetrations

7.5.1 Existing penetrations of the VDF TSF are depicted by the red obstacle identification numbers.

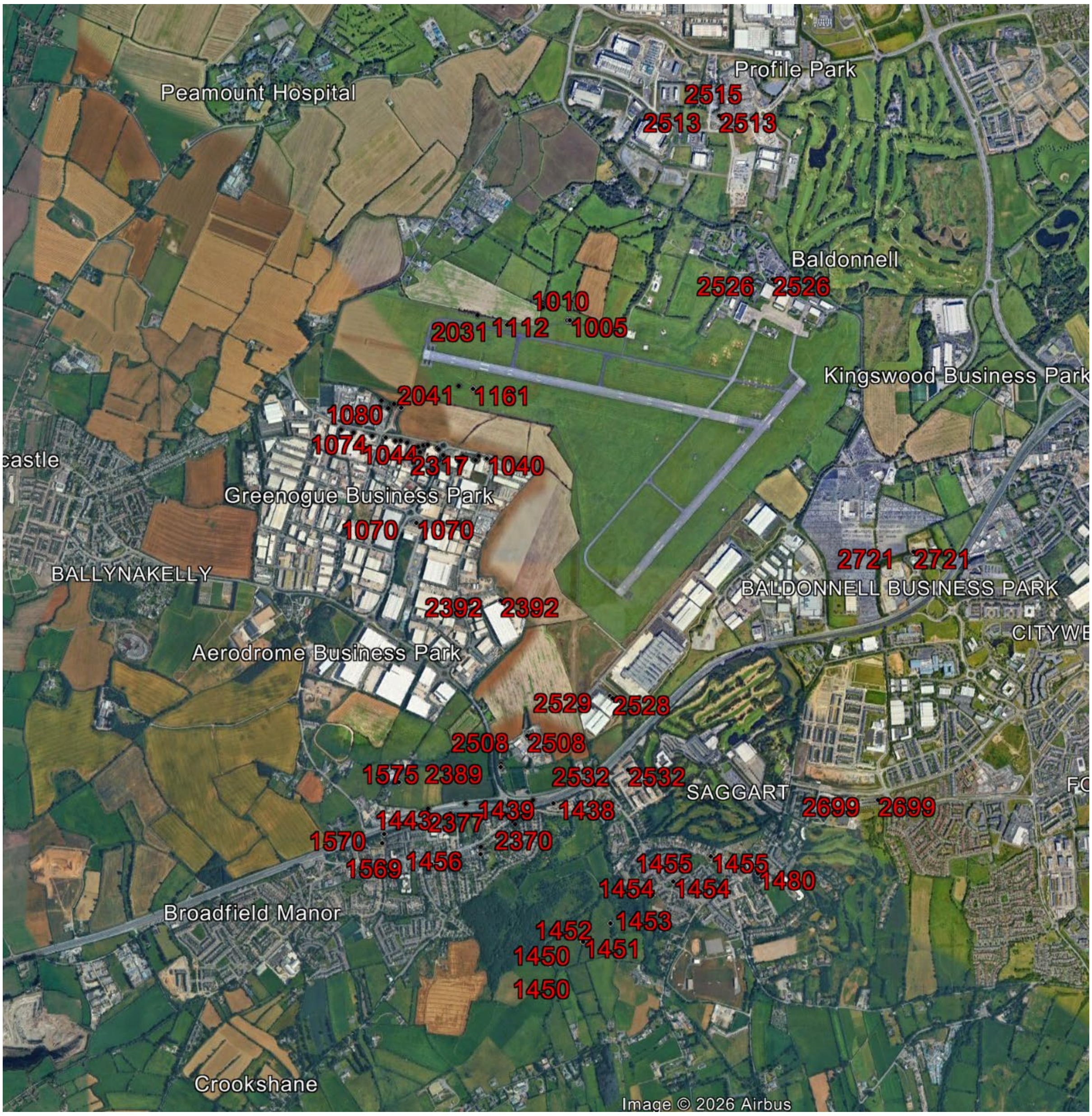

Image © 2026 Google Airbus

Figure 24: VDF TSF Penetrations

7.6 Comms Transmitter Penetrations

7.6.1 Existing penetrations of the communications transmitter TSF are depicted by the red obstacle identification numbers.

Image © 2026 Google Airbus

Figure 25: Comms Transmitter TSF Penetrations

7.7 Comms Receiver Penetrations

7.7.1 Existing penetrations of the communications receiver TSF are depicted by the red obstacle identification numbers.

Image © 2026 Google Airbus

Figure 26: Comms Transmitter TSF Penetrations

7.8 Omni Combined Penetrations

7.8.1 Existing penetrations of the combined omni-directional TSF are depicted by the red obstacle identification numbers.

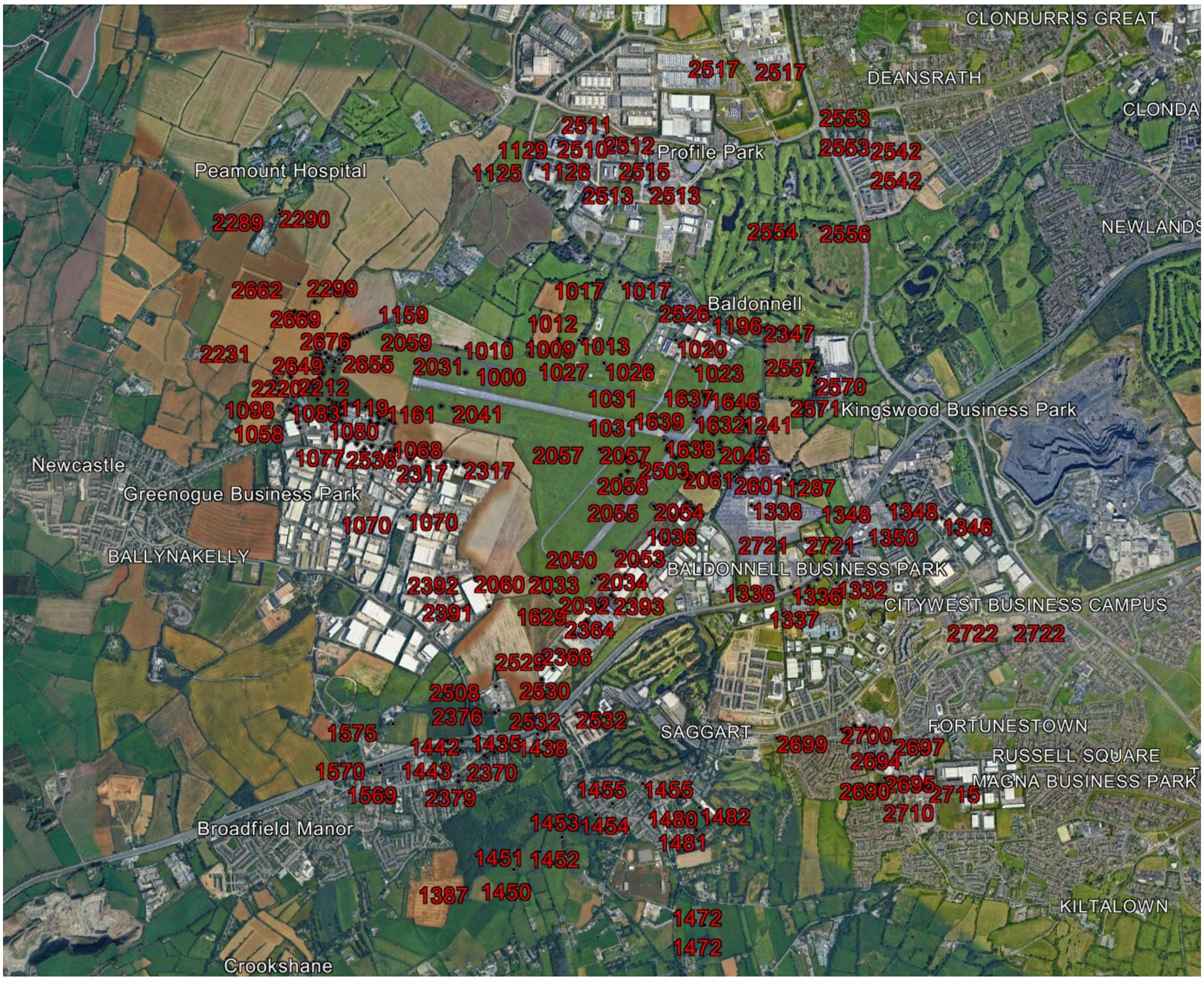

Image © 2026 Google Airbus

Figure 27: Omni combined TSF Penetrations

8. SAFEGUARDING PROCESS

8.1 Technical Safeguarding

8.1.1 The outline steps for technical safeguarding are as follows:

- ANSP receives a planning/development application.
- Proposal record is logged.
- Development details are checked against the TSF using Google Earth™.
- If no penetration of the TSF, then a letter of no objection is issued.
- If penetration of TSF occurs, request a safeguarding study by a company acceptable to the ANSP (Responsibility of developer).
- Review findings of technical safeguarding study.
- Make a decision based on technical safeguarding study.

8.1.2 The technical safeguarding process is identical to OLS and Instrument Flight Procedure (IFP) safeguarding and should follow a similar process to those outlined in the ANSP quality procedures and work instructions.

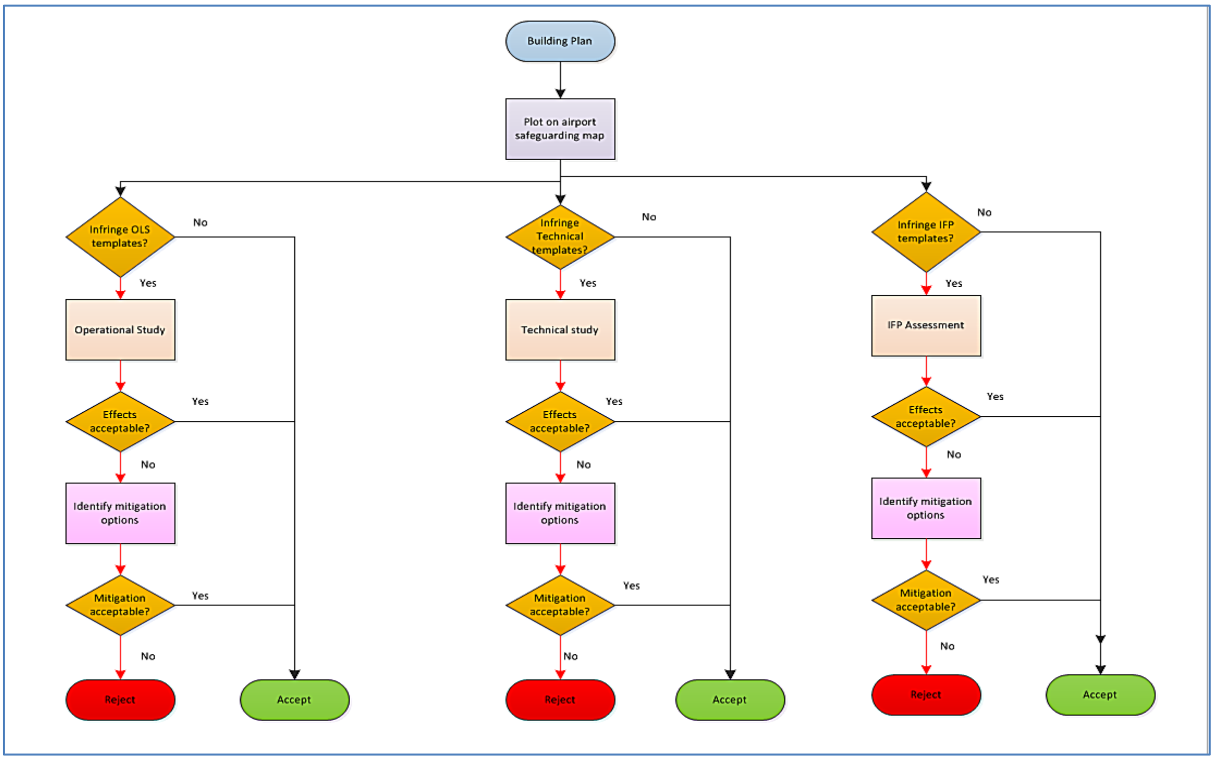

Figure 28: Typical airport safeguarding process

Attachments

A Google Earth KMZ folder containing the following files forms part of this document.

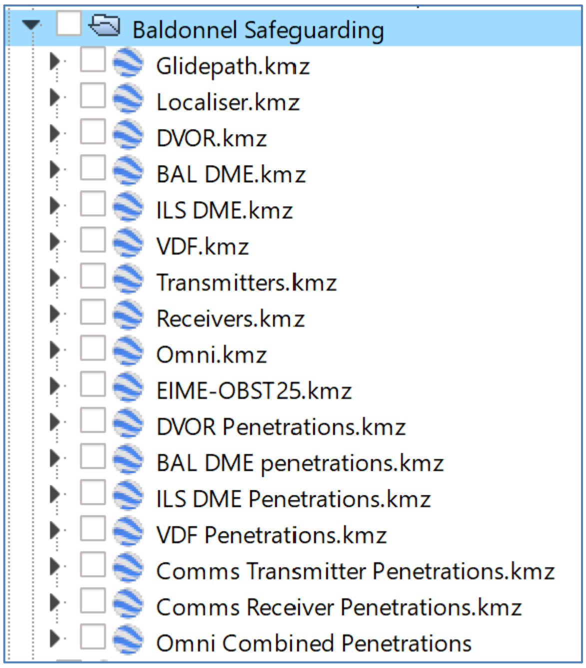

Figure 29: Google Earth File List

---- End of Document ---