



Manchester Airport – Safeguarding Report – 4x Proposed Buildings Trinity Islands

Assessment of Instrument Flight Procedures

Date: 11/02/2022

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Executive Summary

Osprey Consulting Services Ltd (Osprey) have been commissioned to carry out a check of the published Instrument Flight Procedures (IFPs) for Manchester Airport in relation to 4 proposed buildings approximately 12.7km north the airport, located on two parcels of land known as “Trinity Islands”.

Results

Instrument Flight Procedures (IFPs)

- The published IFPs would be unaffected by the 4 proposed building structures.

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1 Introduction

1.1 Overview

Osprey Consulting Services Ltd (Osprey) have been commissioned to carry out a check of the published Instrument Flight Procedures (IFPs) for Manchester Airport in relation to 4 proposed buildings approximately 12.7km north the airport, located on two parcels of land known as “Trinity Islands”.

1.2 Data Provided by client

Osprey has been sent the proposed building locations and elevations details by Mike Moore on an e-mail dated 4th February 2022.

The overview of the location of the buildings can be seen in the below figure:



Figure 1. Plan View of Proposed Buildings location and elevations.

1.3 Assumptions and Transformations made to data

The elevation data provided by the client had annotations and reference to 'AOD'.

We assumed 'AOD' meant *Above Ordnance Datum*¹ and therefore considered all vertical figures in the drawings as elevation AMSL (Above Mean Sea Level).



Figure 2. Profile View - Proposed Buildings

Also, there were two values of elevation for each building; one for the 'roof' and another one for the 'parapet', as indicated in the table below.

To provide for a level of conservatism, we have always used the highest value out of the two for every building point, rounded up to the next meter value for assessment.

Building ID	Feature	Annotated Elevation AOD (m)	Used Elevation AMSL (m)
Building C1	Roof	146.475	147
	Parapet	146.875	
Building C2	Roof	173.350	174
	Parapet	172.525	
Building D1	Roof	210.400	211
	Parapet	209.575	
Building D2	Roof	196.150	197
	Parapet	195.325	

Table 1. Vertical Information for Proposed Buildings

¹ The term 'Ordnance Datum' refers to the height of mean sea-level, taken from a reference point at Newlyn in Cornwall. This is basis of the national height system for Britain.

The Provided OSGB36 coordinates data was converted using Grid InQuest II to be used in AutoCAD and with PDToolkit software.

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382825.221
Northing:	397884.127
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 38.69800624"
Longitude:	-2° 15' 36.86789316"

Figure 3. Position BuildingC1@Point1 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382851.512
Northing:	397862.744
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 38.00917295"
Longitude:	-2° 15' 35.43758226"

Figure 4. Position BuildingC1@Point2 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382824.644
Northing:	397842.091
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 37.33775667"
Longitude:	-2° 15' 36.89093985"

Figure 5. Position BuildingC1@Point3 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382798.354
Northing:	397863.474
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 38.02658531"
Longitude:	-2° 15' 38.32119678"

Figure 6. Position BuildingC1@Point4 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382806.674
Northing:	397827.539
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 36.86478886"
Longitude:	-2° 15' 37.86282922"

Figure 7. Position BuildingC2@Point1 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382799.376
Northing:	397794.445
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 35.79309320"
Longitude:	-2° 15' 38.25218738"

Figure 8. Position BuildingC2@Point2 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382765.492
Northing:	397793.917
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 35.77203854"
Longitude:	-2° 15' 40.09003745"

Figure 9. Position BuildingC2@Point3 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382772.789
Northing:	397827.011
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 36.84373696"
Longitude:	-2° 15' 39.70074781"

Figure 10. Position BuildingC2@Point4 - Conversion from OSGB36 to ETRS89 Lat/Long

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Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382717.367
Northing:	397786.335
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 35.52105084"
Longitude:	-2° 15' 42.69896037"

Figure 11. Position BuildingD1@Point1 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382694.150
Northing:	397760.417
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 34.67967156"
Longitude:	-2° 15' 43.95317634"

Figure 12. Position BuildingD1@Point2 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382676.455
Northing:	397776.268
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 35.19048820"
Longitude:	-2° 15' 44.91613145"

Figure 13. Position BuildingD1@Point3 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382699.672
Northing:	397802.186
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 36.03187037"
Longitude:	-2° 15' 43.66191672"

Figure 14. Position BuildingD1@Point4 - Conversion from OSGB36 to ETRS89 Lat/Long

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Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382720.365
Northing:	397738.979
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 33.98907356"
Longitude:	-2° 15' 42.52698328"

Figure 15. Position BuildingD2@Point1 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382728.270
Northing:	397716.576
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 33.26509457"
Longitude:	-2° 15' 42.09377677"

Figure 16. Position BuildingD2@Point2 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382695.456
Northing:	397704.999
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 32.88662646"
Longitude:	-2° 15' 43.87136739"

Figure 17. Position BuildingD2@Point3 - Conversion from OSGB36 to ETRS89 Lat/Long

Input System:	OSGB36 / British National Grid (TN15/GM15)
Easting:	382687.552
Northing:	397727.401
Elevation:	
Output System:	ETRS89 Geodetic
Latitude:	+53° 28' 33.61057214"
Longitude:	-2° 15' 44.30452756"

Figure 18. Position BuildingD2@Point4 - Conversion from OSGB36 to ETRS89 Lat/Long

1.4 Final Obstacle and Orientation

The final set of obstacles that are to be used for assessment, after all the required conversions, are as follows:

Obstacle ID	Latitude	Longitude	Elevation AMSL (m)
BuildingC1@Point1	53 28 38.6980N	002 15 36.8679W	147.00
BuildingC1@Point2	53 28 38.0092N	002 15 35.4376W	147.00
BuildingC1@Point3	53 28 37.3378N	002 15 36.8909W	147.00
BuildingC1@Point4	53 28 38.0266N	002 15 38.3212W	147.00
BuildingC2@Point1	53 28 36.8648N	002 15 37.8628W	174.00
BuildingC2@Point2	53 28 35.7931N	002 15 38.2522W	174.00
BuildingC2@Point3	53 28 35.7720N	002 15 40.0900W	174.00
BuildingC2@Point4	53 28 36.8437N	002 15 39.7007W	174.00
BuildingD1@Point1	53 28 35.5211N	002 15 42.6990W	211.00
BuildingD1@Point2	53 28 34.6797N	002 15 43.9532W	211.00
BuildingD1@Point3	53 28 35.1905N	002 15 44.9161W	211.00
BuildingD1@Point4	53 28 36.0319N	002 15 43.6619W	211.00
BuildingD2@Point1	53 28 33.9891N	002 15 42.5270W	197.00
BuildingD2@Point2	53 28 33.2651N	002 15 42.0938W	197.00
BuildingD2@Point3	53 28 32.8866N	002 15 43.8714W	197.00
BuildingD2@Point4	53 28 33.6106N	002 15 44.3045W	197.00

Table 2. Final Set of Obstacles used for assessment.

The obstacles were added to the AutoCAD Model, with a lateral tolerance (radius) of 50m. This should cover any potential inaccuracies on the provided coordinates for each building point:

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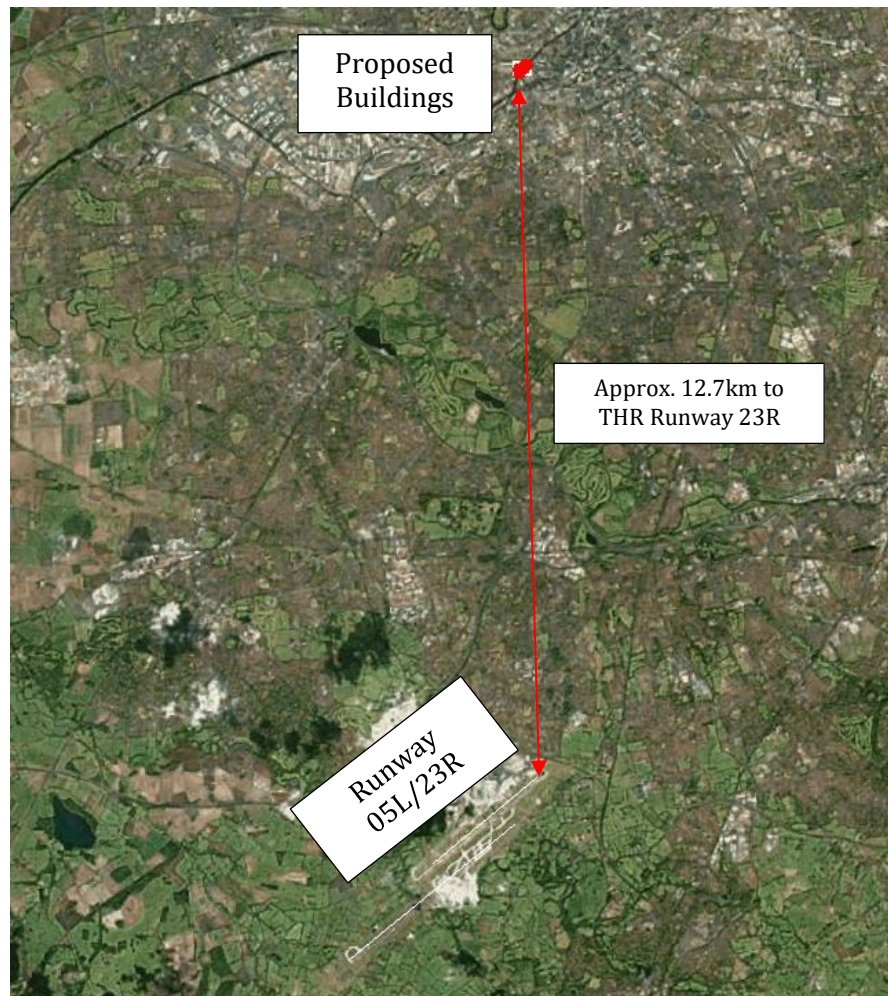


Figure 19. Location of Proposed Buildings in Relation to Airport

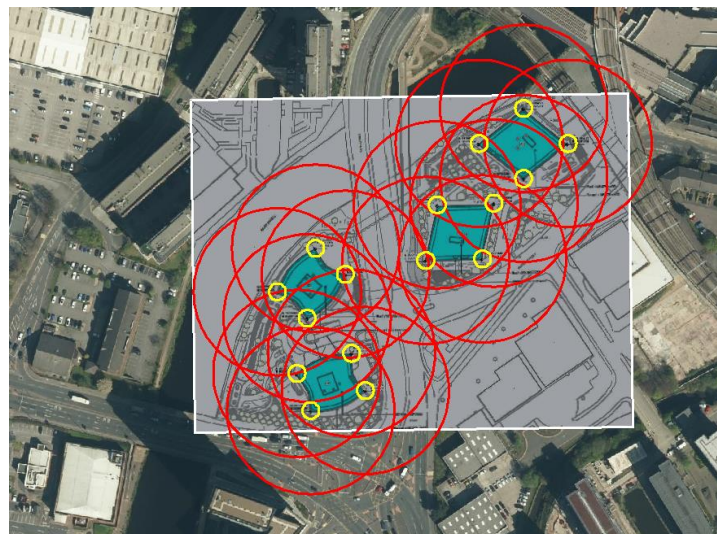


Figure 20. Proposed Buildings Modelled in AutoCAD for IFP Assessment (Centre Points in Yellow and Obstacles with lateral tolerance in red)

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2 IFP Analysis

2.1 General

The IFPs assessed are as follows:

AIRAC 03/2022 - Effective 24th March 2022

- AD 2.EGCC-5-1 ATC SURVEILLANCE MINIMUM ALTITUDE CHART (2 Jan 2020)
- AD 2.EGCC-6-1 STANDARD DEPARTURE CHART - INSTRUMENT (SID) MONTY 1R 1S 1Y 1Z (28 Jan 2021)
- AD 2.EGCC-6-2 STANDARD DEPARTURE CHART - INSTRUMENT (SID) ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y (28 Jan 2021)
- AD 2.EGCC-6-3 STANDARD DEPARTURE CHART - INSTRUMENT (SID) LISTO 2S 2Z (28 Jan 2021)
- AD 2.EGCC-6-4 STANDARD DEPARTURE CHART - INSTRUMENT (SID) (Restricted Use) LISTO 2R 2Y (28 Jan 2021)
- AD 2.EGCC-6-5 STANDARD DEPARTURE CHART - INSTRUMENT (SID) POL 5R 4S 1Y 1Z (28 Jan 2021)
- AD 2.EGCC-6-6 STANDARD DEPARTURE CHART - INSTRUMENT (SID) SONEX 1R 1Y/DESIG 1S 1Z (28 Jan 2021)
- AD 2.EGCC-6-7 STANDARD DEPARTURE CHART - INSTRUMENT (SID) (Jet Aircraft Only) SANBA 1R 1Y (28 Jan 2021)
- AD 2.EGCC-7-1 STANDARD ARRIVAL CHART - INSTRUMENT (STAR) via ROSUN (NORTH) (28 Jan 2021)
- AD 2.EGCC-7-2 STANDARD ARRIVAL CHART - INSTRUMENT (STAR) via DALEY (NORTH) (MCT VOR U/S) (28 Jan 2021)
- AD 2.EGCC-7-3 STANDARD ARRIVAL CHART - INSTRUMENT (STAR) via ROSUN (EAST) (28 Jan 2021)
- AD 2.EGCC-7-4 STANDARD ARRIVAL CHART - INSTRUMENT (STAR) via DALEY (EAST) (MCT VOR U/S) (28 Jan 2021)
- AD 2.EGCC-7-5 STANDARD ARRIVAL CHART - INSTRUMENT (STAR) via MIRSI (4 Nov 2021)
- AD 2.EGCC-7-6 STANDARD ARRIVAL CHART - INSTRUMENT (STAR) via DAYNE (28 Jan 2021)
- AD 2.EGCC-8-1 INSTRUMENT APPROACH CHART ILS/DME (I-MC) RWY 05R (28 Feb 2019)
- AD 2.EGCC-8-2 INSTRUMENT APPROACH CHART ILS/DME (MCT) RWY 05R (28 Feb 2019)
- AD 2.EGCC-8-3 INSTRUMENT APPROACH CHART LOC/DME (I-MC) RWY 05R (28 Feb 2019)
- AD 2.EGCC-8-4 INSTRUMENT APPROACH CHART VOR/DME RWY 05R (28 Feb 2019)
- AD 2.EGCC-8-5 INSTRUMENT APPROACH CHART ILS/DME (I-MM) RWY 05L (28 Feb 2019)
- AD 2.EGCC-8-6 INSTRUMENT APPROACH CHART ILS/DME (MCT) RWY 05L (28 Feb 2019)
- AD 2.EGCC-8-7 INSTRUMENT APPROACH CHART LOC/DME RWY 05L (28 Feb 2019)

- AD 2.EGCC-8-8 INSTRUMENT APPROACH CHART VOR/DME RWY 05L (28 Feb 2019)
- AD 2.EGCC-8-9 INSTRUMENT APPROACH CHART ILS/DME (I-NN) RWY 23R (28 Feb 2019)
- AD 2.EGCC-8-10 INSTRUMENT APPROACH CHART ILS/DME (MCT) RWY 23R (28 Feb 2019)
- AD 2.EGCC-8-11 INSTRUMENT APPROACH CHART LOC/DME RWY 23R (28 Feb 2019)
- AD 2.EGCC-8-12 INSTRUMENT APPROACH CHART VOR/DME RWY 23R (28 Feb 2019)
- AD 2.EGCC-8-13 INSTRUMENT APPROACH CHART VOR/DME RWY 23L (28 Feb 2019)
- AD 2.EGCC-8-14 INSTRUMENT APPROACH CHART RNP RWY 23L (5 Nov 2020)

2.2 Departures

The proposed buildings are located outside the initial departure splays for all departures.



Figure 21. Initial Departure Splays

Aircraft in a turn would have to be at a minimum altitude of 757ft.

The shortest distance from the most restrictive TIA edge (RW 05R) to the closest obstacle (BuildingD2@Point2) is 7466m.

Aircraft would be at $757\text{ft} + 0.033 \cdot d$ at that point:

$$230.7336\text{m} + 0.033 \times 7466 = 477.11\text{m}$$

MOC is the highest between 75m and $0.008 \times d$:

$$\text{Max}[75, 0.008 \times (11187.3254 + 7466)]$$

$$\text{Max}[75, 149.23] = 149.23\text{m}$$

So the maximum permissible building elevation at that point would be:

$$\text{Aircraft Elevation} - \text{MOC} = 477.11 - 149.23 = 327.88\text{m}$$

As the maximum proposed building elevation is 211m, there is no effect on the Departures.

2.3 Arrivals

All Arrivals terminate at or above 6000ft.

The maximum possible elevation of the buildings, before affecting the Minimum Initial Altitude of 6000ft, has been calculated.

$$6000\text{ft} = 1828.8\text{m}$$

$$1828.8\text{m} - 300\text{m Minimum Obstacle Clearance (MOC)} = 1528.8\text{m AMSL.}$$

The maximum elevation of the proposed buildings is below this altitude; therefore, the procedure would be unaffected in this instance.

The proposed buildings will have no impact on any of published Arrival Procedures.

2.4 Approaches

2.4.1 ILS/DME (I-MC) RWY 05R (28 Feb 2019)

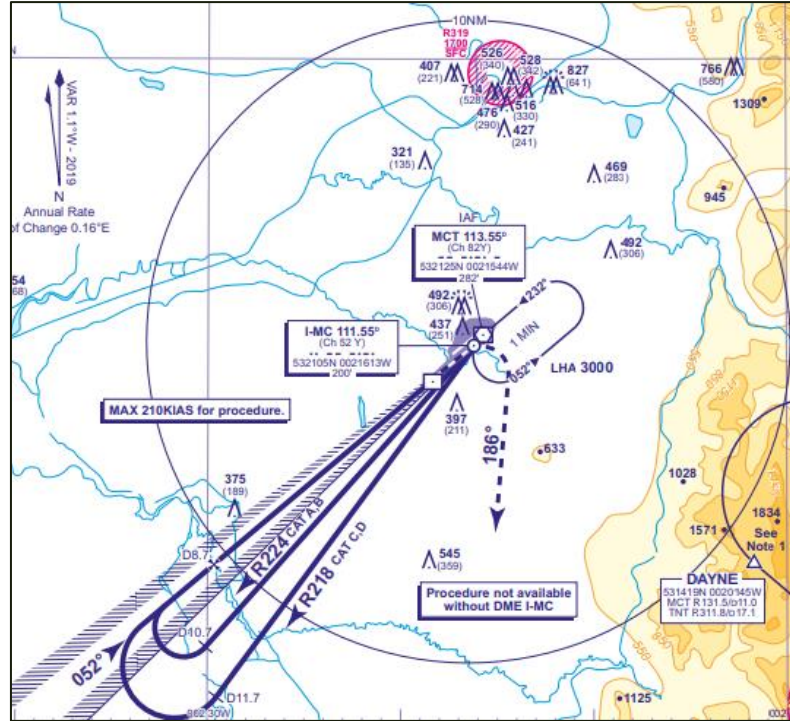
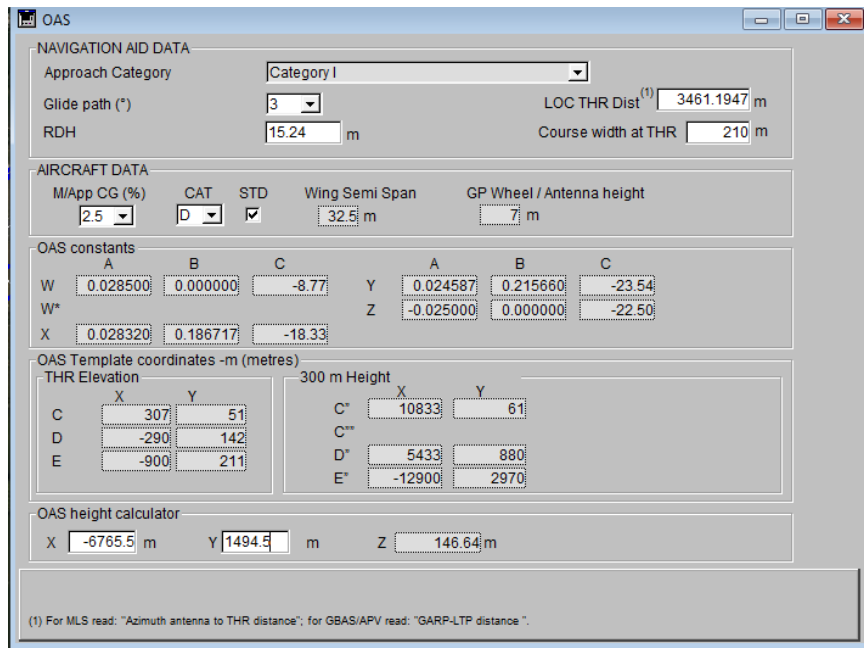


Figure 22. ILS/DME (I-MC) RWY 05R Procedure

The CAT I ILS Obstacle Assessment Surface (OAS) was constructed in CAD:



Figure 23. ILS/DME (I-MC) RWY 05R OAS



OAS

NAVIGATION AID DATA

Approach Category:

Glide path (°): LOC THR Dist ⁽¹⁾: m

RDH: m Course width at THR: m

AIRCRAFT DATA

M/App CG (%): CAT: STD: ☒ Wing Semi Span: m GP Wheel / Antenna height: m

OAS constants

A			B			C		
W	0.028500	0.000000	-8.77	Y	0.024587	0.215660	-23.54	
W*				Z	-0.025000	0.000000	-22.50	
X	0.028320	0.186717	-18.33					

OAS Template coordinates -m (metres)

THR Elevation

	X	Y
C	307	51
D	-290	142
E	-900	211

300 m Height

	X	Y
C*	10833	61
C**		
D*	5433	880
E*	-12900	2970

OAS height calculator

X: m Y: m Z: m

(1) For MLS read: "Azimuth antenna to THR distance"; for GBAS/APV read: "GARP-LTP distance".

Figure 24. Results – PANS-OPS OAS Tool

The proposed buildings are outside the lateral limits of the OAS CAT I so do not need to be considered towards ILS OCA.

It is unlikely that the proposed buildings would be within the protection area of the final missed approach, as this turns right away from the obstacles. However, the lowest altitude for the turn is 700ft. Aircraft would be at a minimum of $700\text{ft} + 0.025 * 9701.36\text{m} = 455.894\text{m}$ at the position of the closest building point. With an MOC of 50m this will result in a maximum permissible elevation for obstacles of 405.894m. As the proposed buildings have an elevation lower than that, there is no impact on the missed approach turn.

The proposed buildings would have no impact on the published minima.

The proposed buildings might be within the protection area of the initial approach base turns. The lowest altitude for the base turn is 3000ft. With an MOC of 300m this will result in a maximum permissible elevation for obstacles of 614.4m. As the proposed buildings have an elevation lower than that, there is no impact on the base turn.

The proposed buildings would have no impact on the published procedure.

2.4.2 ILS/DME (MCT) RWY 05R (28 Feb 2019)

See Section 2.4.1.

2.4.3 LOC/DME (I-MC) RWY 05R (28 Feb 2019)

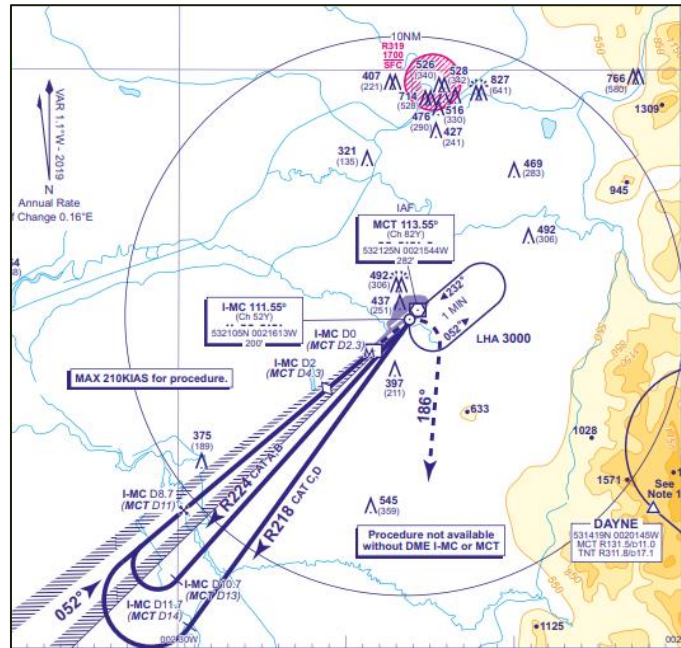


Figure 25. LOC/DME (I-MC) RWY 05R Procedure

See Section 2.4.1.

The proposed buildings would be outside the OAS of the RWY 05R ILS CAT I OAS; therefore, the proposed buildings do not need assessing for the LOC only procedure.

It is unlikely that the proposed buildings would be within the protection area of the final missed approach, as this turns right away from the obstacles. However, the lowest altitude for the turn is 700ft. Aircraft would be at a minimum of $700\text{ft} + 0.025 * 11544\text{m} = 501.96\text{m}$ at the position of the closest building point. With an MOC of 50m this will result in a maximum permissible elevation for obstacles of 451.96m. As the proposed buildings have an elevation lower than that, there is no impact on the missed approach turn.

The proposed buildings would have no impact on the published minima.

2.4.4 VOR/DME RWY 05R (28 Feb 2019)

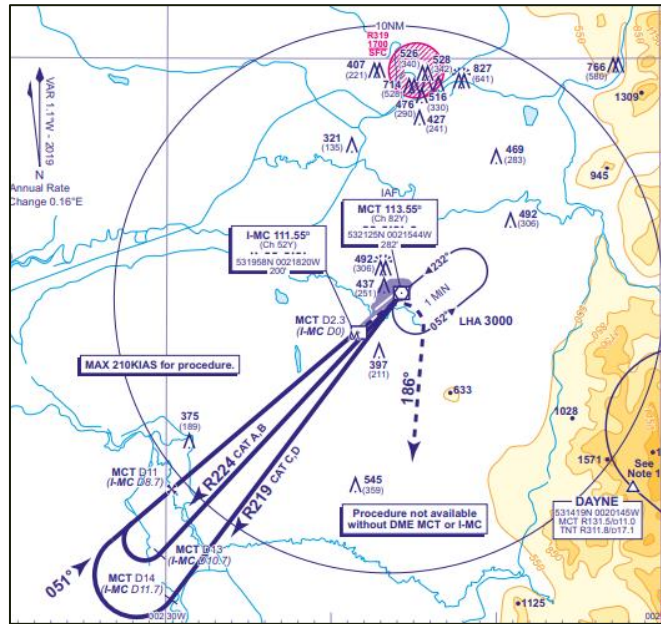


Figure 26. VOR/DME RWY 05R Procedure



Figure 27. VOR/DME RWY 05R Protection Area

The proposed buildings are outside the final and missed approach protection areas.
The proposed buildings would have no impact on the published minima.

2.4.5 ILS/DME (I-MM) RWY 05L (28 Feb 2019)

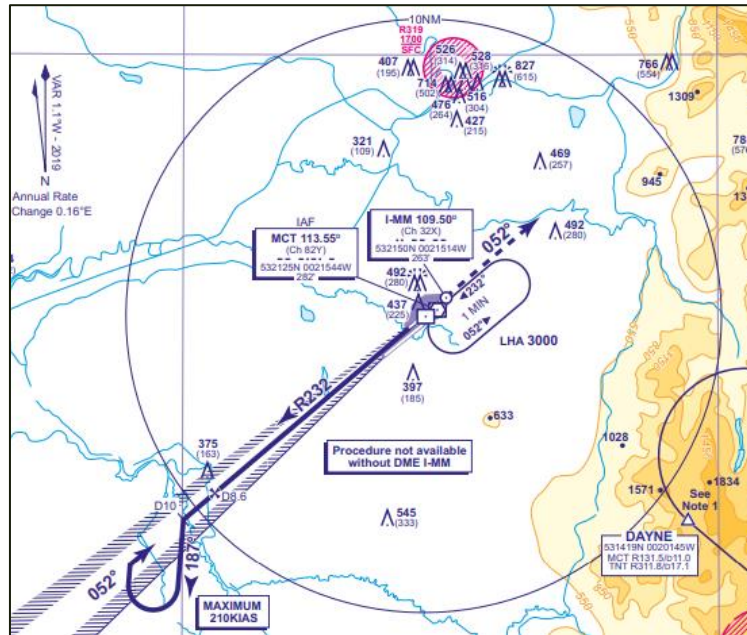


Figure 28. ILS/DME (I-MM) RWY 05L

OAS

NAVIGATION AID DATA

Approach Category:

Glide path (°):

RDH: m

LOC THR Dist⁽¹⁾: m

Course width at THR: m

AIRCRAFT DATA

M/App CG (%):

CAT:

STD: ☒

Wing Semi Span: m

GP Wheel / Antenna height: m

OAS constants

	A	B	C		A	B	C
W	0.028500	0.000000	-6.63	Y	0.023758	0.208388	-20.63
W*				Z	-0.025000	0.000000	-22.50
X	0.027490	0.181241	-15.68				

OAS Template coordinates -m (metres)

THR Elevation

	X	Y
C	232	51
D	-331	136
E	-900	201

300 m Height

	X	Y
C*	10759	109
C**		
D*	5393	923
E*	-12900	3009

OAS height calculator

X: m

Y: m

Z: m

(1) For MLS read: "Azimuth antenna to THR distance"; for GBAS/APV read: "GARP-LTP distance".

Figure 29. Results – PANS-OPS OAS Tool – CAT I

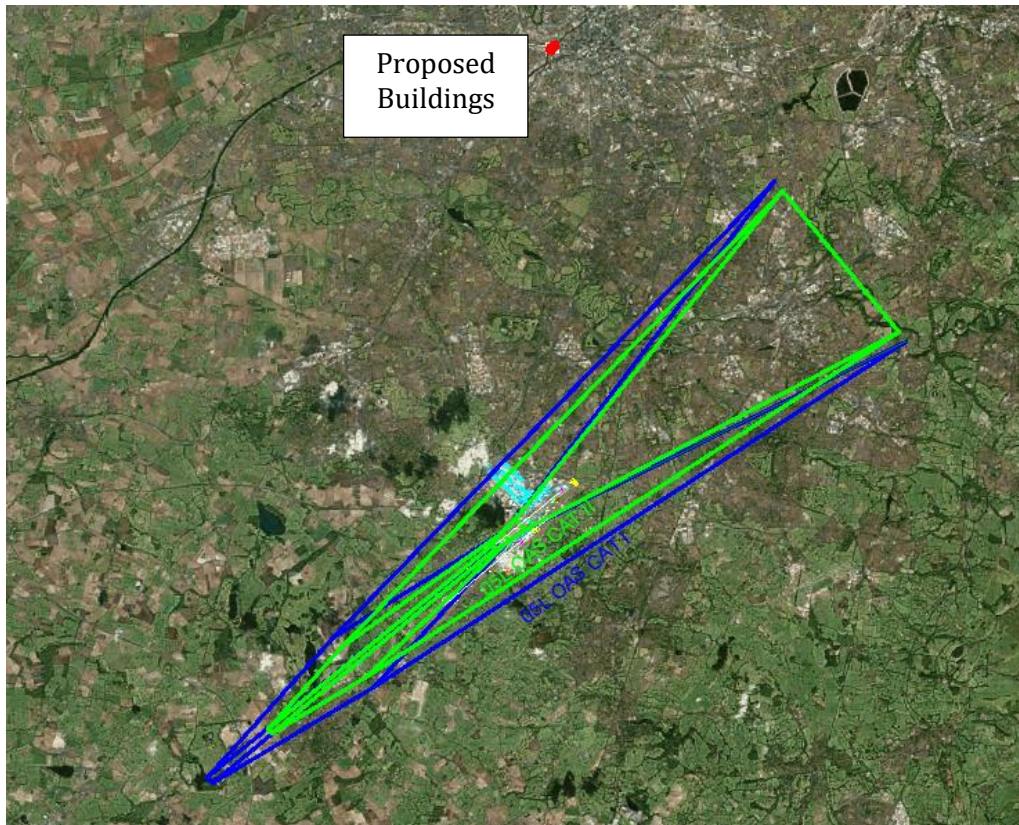


Figure 30. Extent of Runway 05L ILS OAS CAT II

The proposed buildings are outside the lateral limits of the OAS CAT I and OAS CAT II so do not need to be considered towards ILS OCA.

The proposed buildings would have no impact on the published minima.

2.4.6 ILS/DME (MCT) RWY 05L (28 Feb 2019)

See Section 2.4.5.

2.4.7 LOC/DME RWY 05L (28 Feb 2019)

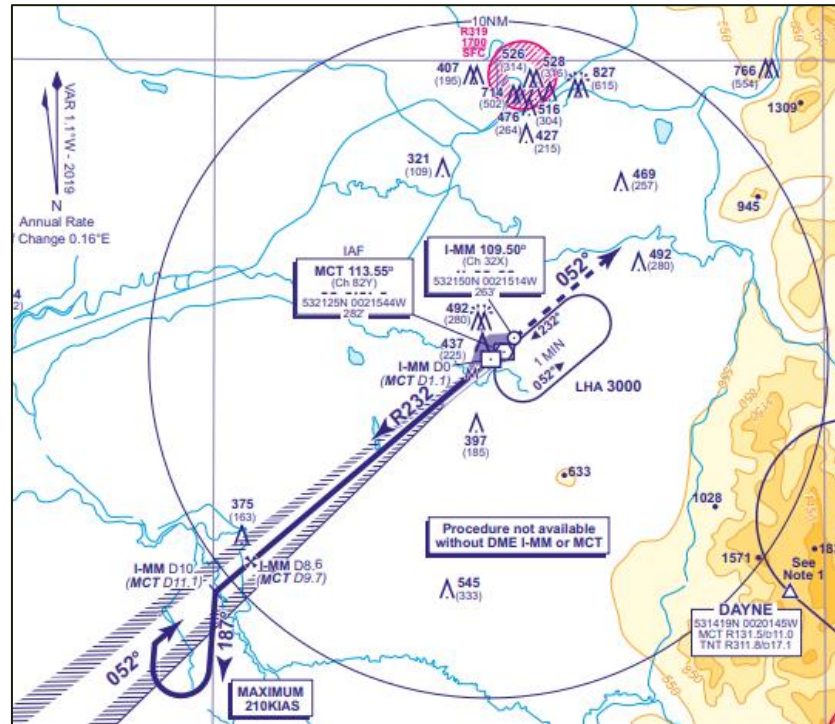


Figure 31. LOC/DME RWY 05L Procedure

See Section 2.4.5.

The proposed buildings would be outside the OAS of the RWY 05L ILS CAT I OAS; therefore, the proposed buildings do not need assessing for the LOC only procedure.

The proposed buildings would have no impact on the published minima.

2.4.8 VOR/DME RWY 05L (28 Feb 2019)

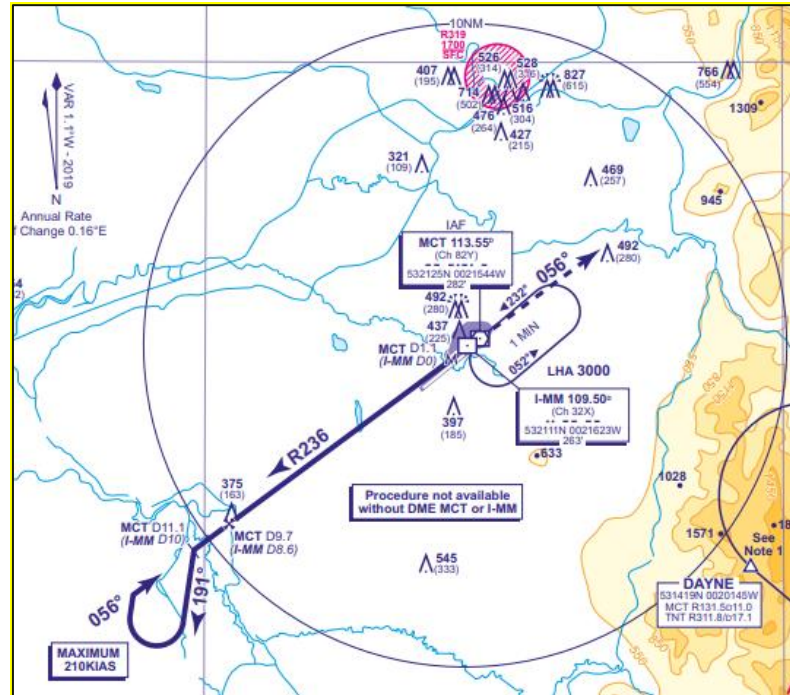


Figure 32. VOR/DME RWY 05L Procedure



Figure 33. VOR/DME RWY 05L Protection Area

The proposed buildings are outside the final and missed approach protection areas.
The proposed buildings would have no impact on the published minima.

2.4.9 ILS/DME (I-NN) RWY 23R (28 Feb 2019)

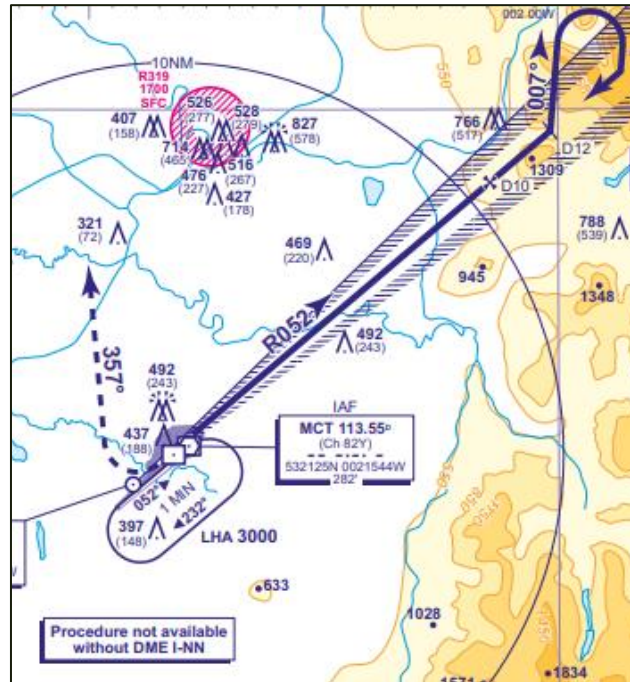


Figure 34. ILS/DME (I-NN) RWY 23R

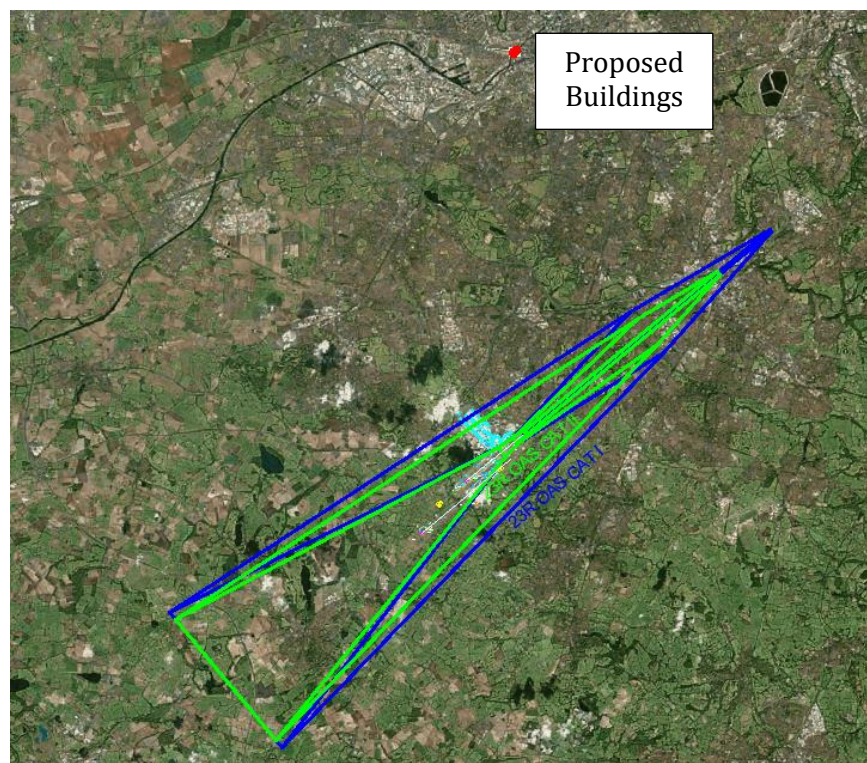


Figure 35. Extent of Runway 23R ILS OAS CAT I / II

The proposed buildings are outside the lateral limits of the OAS CAT I & CAT II so do not need to be considered towards ILS OCA.

The proposed buildings might be within the protection area of the final missed approach, as this turns right in the direction to the obstacles. However, the lowest altitude for the turn is 750ft. Aircraft would be at a minimum of $750\text{ft} + 0.025 \times 11274\text{m} = 510.45\text{m}$ at the position of the closest building point. With an MOC of 50m this will result in a maximum permissible elevation for obstacles of 460.45m. As the proposed buildings have an elevation lower than that, there is no impact on the missed approach turn.

The proposed buildings would have no impact on the published minima.

The proposed buildings might be within the protection area of the initial approach reversal turn. The lowest altitude for the reversal turn is 3500ft. With an MOC of 300m this will result in a maximum permissible elevation for obstacles of 766.8m. As the proposed buildings have an elevation lower than that, there is no impact on the base turn.

The proposed buildings would have no impact on the published procedure.

2.4.10 ILS/DME (MCT) RWY 23R (28 Feb 2019)

See Section 2.4.9.

2.4.11 LOC/DME RWY 23R (28 Feb 2019)

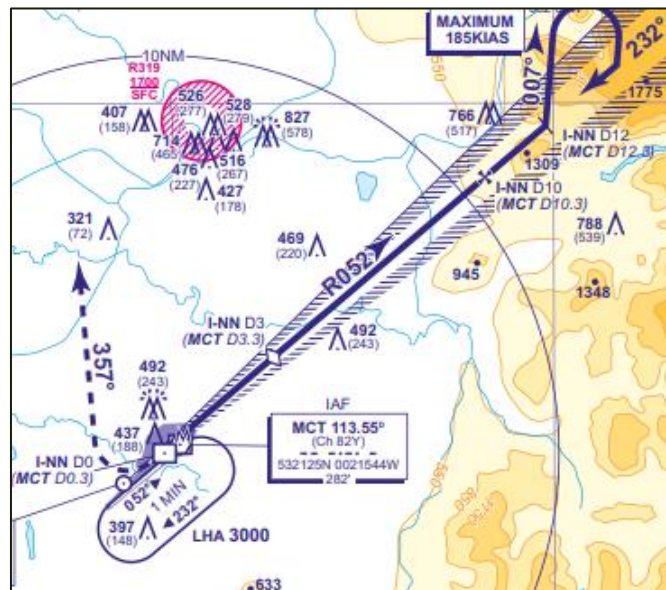


Figure 36. LOC/DME RWY 23R

See Section 2.4.9.

The proposed buildings would be outside the OAS of the RWY 23R ILS CAT I OAS; therefore, the proposed buildings do not need assessing for the LOC only procedure. Also, as the missed approach has been proven cleared for the ILS, it will be cleared for the LOC (Same earliest turning point and common minimum turn altitude of 750ft).

The proposed buildings would have no impact on the published minima.

2.4.12 VOR/DME RWY 23R (28 Feb 2019)

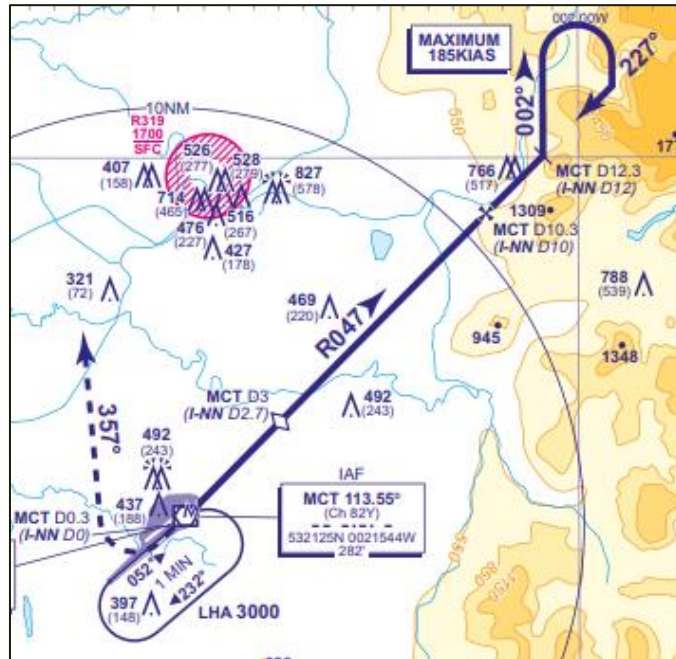


Figure 37. VOR/DME RWY 23R



Figure 38. VOR/DME RWY 23R Protection Area

The proposed buildings are outside the lateral limits of the final approach protection area therefore do not need to be considered towards OCA.

The proposed buildings might be within the protection area of the final missed approach, as this turns right in the direction to the obstacles. However, the lowest altitude for the turn is 750ft. Aircraft would be at a minimum of $750\text{ft} + 0.025 * 11874\text{m} = 525.45\text{m}$ at the position of the closest building point. With an MOC of 50m this will result in a maximum permissible elevation for obstacles of 475.45m. As the proposed buildings have an elevation lower than that, there is no impact on the missed approach turn.

The proposed buildings would have no impact on the published minima.

The proposed buildings might be within the protection area of the initial approach reversal turn. The lowest altitude for the reversal turn is 3500ft. With an MOC of 300m this will result in a maximum permissible elevation for obstacles of 766.8m. As the proposed buildings have an elevation lower than that, there is no impact on the base turn.

The proposed buildings would have no impact on the published procedure.

2.4.13 VOR/DME RWY 23L (28 Feb 2019)

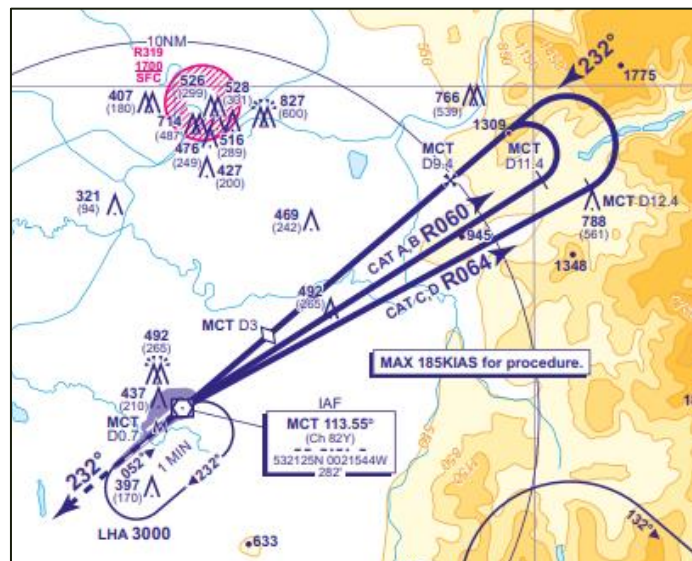


Figure 39. VOR/DME RWY 23L

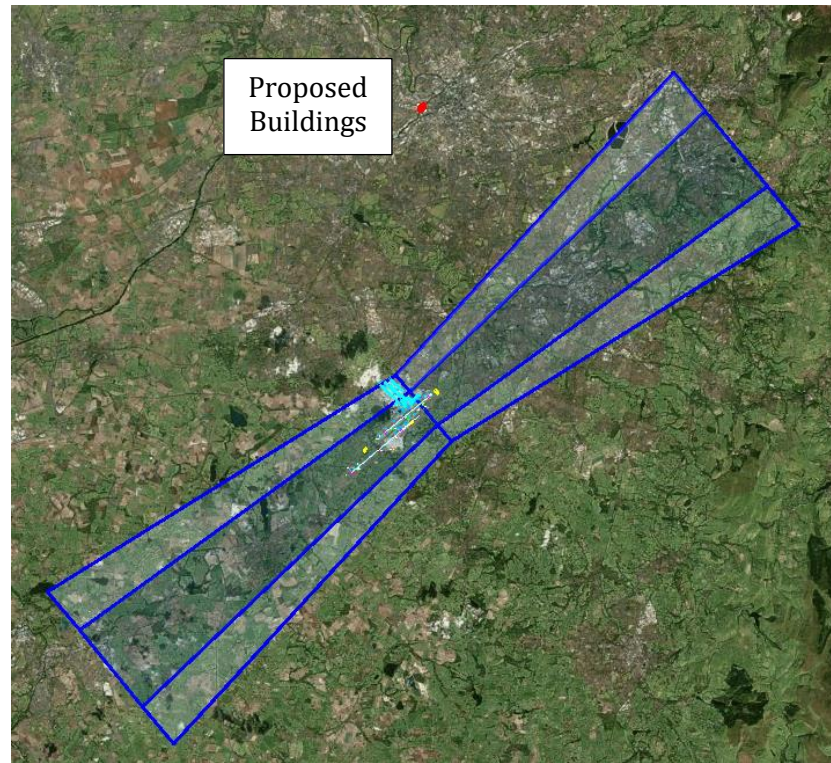


Figure 40. VOR/DME RWY 23L Protection Area

The proposed buildings are outside the lateral limits of the final approach and missed approach protection area therefore do not need to be considered towards OCA.

The proposed buildings would have no impact on the published minima.

The proposed buildings might be within the protection area of the initial approach base turn. The lowest altitude for the base turn is 3500ft. With an MOC of 300m this will result in a maximum permissible elevation for obstacles of 766.8m. As the proposed buildings have an elevation lower than that, there is no impact on the base turn.

The proposed buildings would have no impact on the published procedure.

2.4.14 RNP RWY 23L (5 Nov 2020)

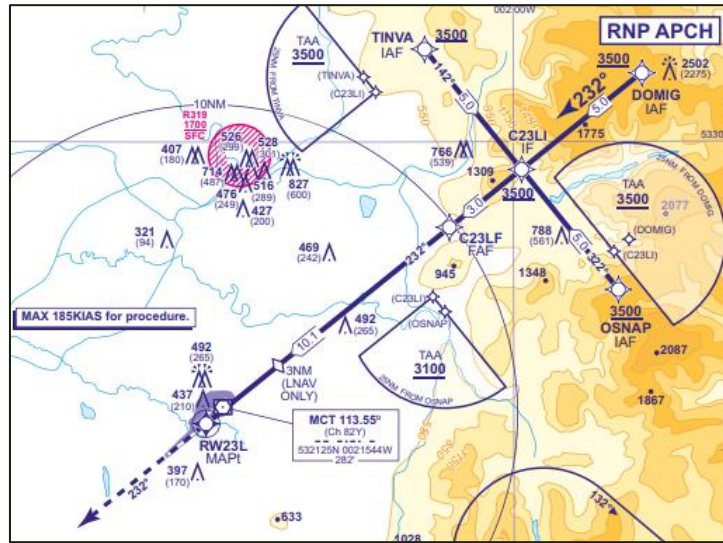


Figure 41. RNP RWY 23L

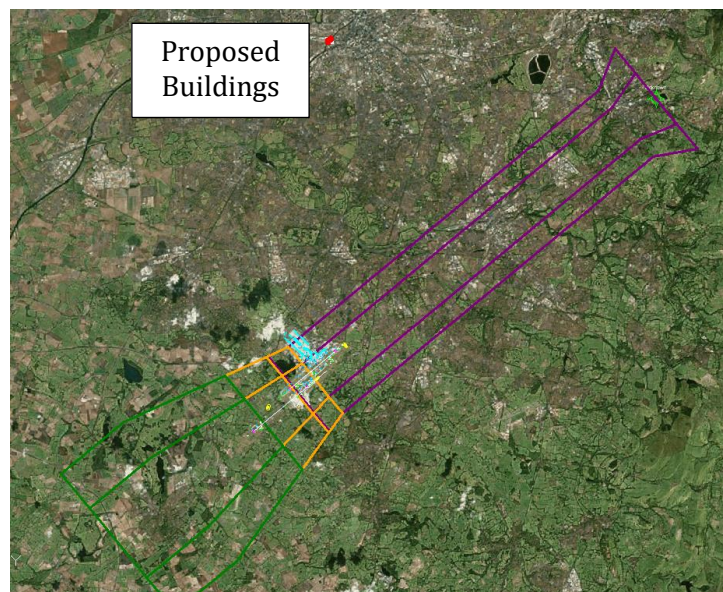


Figure 42. RNP RWY 23L Protection Area

The proposed buildings are outside the lateral limits of the final approach and missed approach protection area therefore do not need to be considered towards OCA.

The proposed buildings would have no impact on the published minima.

The proposed buildings might be within the protection area of the TAA. The lowest altitude for the TAAs is 3100ft. With an MOC of 300m this will result in a maximum permissible elevation for obstacles of 644.88m. As the proposed buildings have an elevation lower than that, there is no impact on the TAA.

The proposed buildings would have no impact on the published procedure.

2.5 Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC)

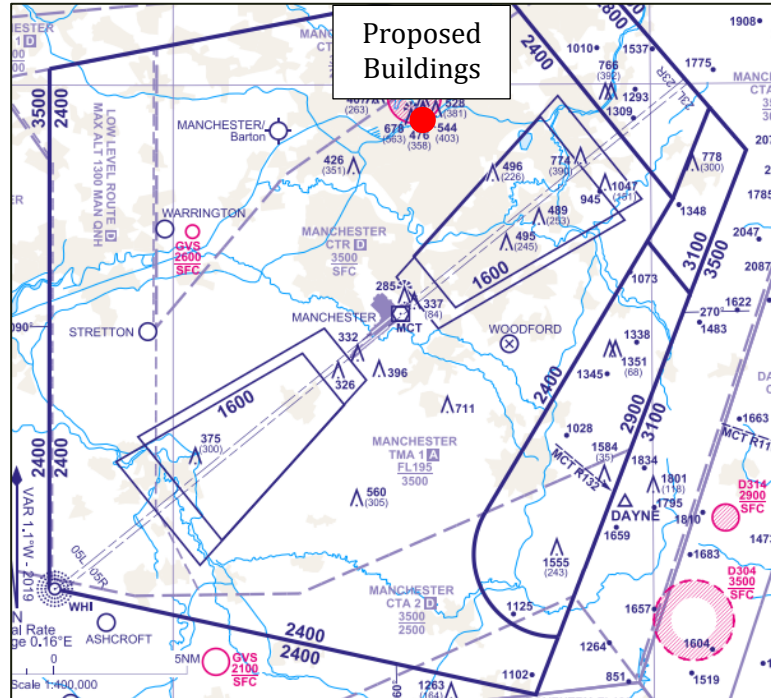


Figure 43. ATCSMAC

The proposed buildings lie within the 2400ft SAA.

The maximum possible elevation of the building, before affecting the MOCA of 2400ft, has been calculated.

$$2400\text{ft} = 731.52\text{m}$$

$$731.52\text{m} - 300\text{m MOC} = 431.52\text{m AMSL.}$$

The maximum elevation of the proposed buildings is below this altitude; therefore, the ATCSMAC would be unaffected in this instance.

The proposed buildings would have no impact on the published ATCSMAC.

2.6 Visual Manoeuvring (Circling)

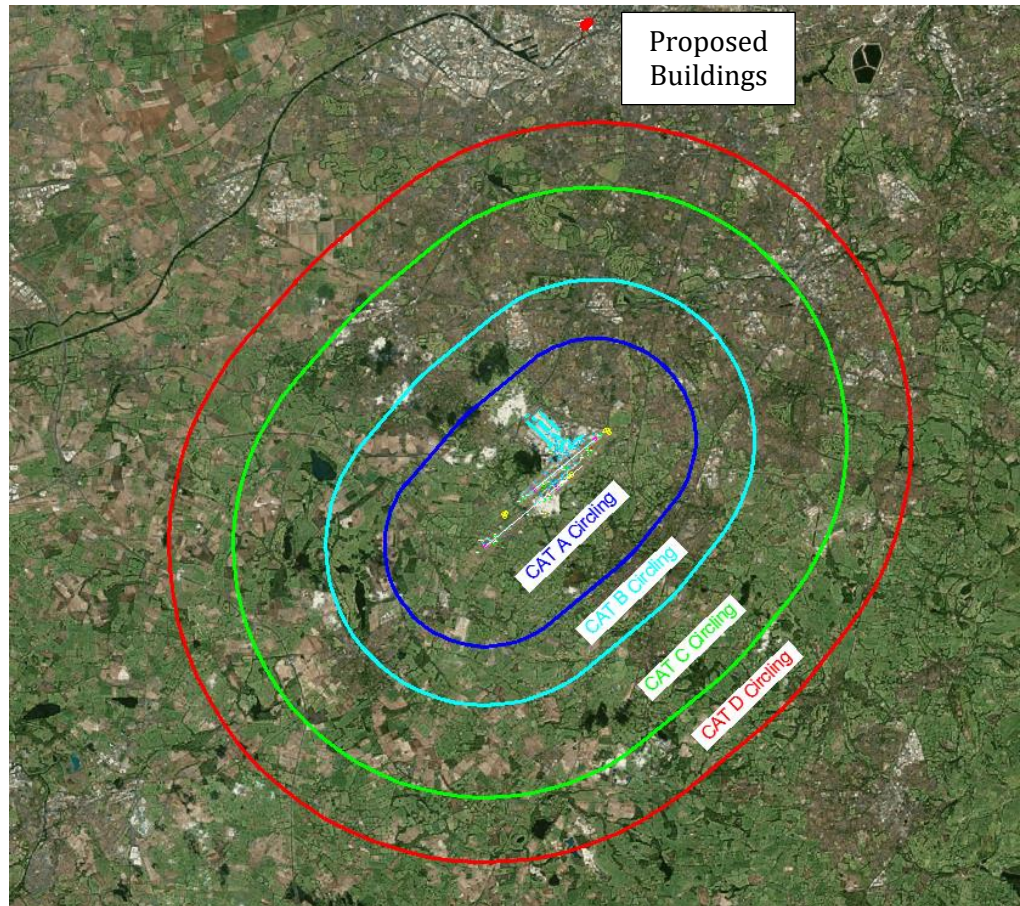


Figure 44. Circling Protection Area

The proposed buildings lie outside the Visual Circling Obstacle Protection Areas for all Categories and therefore do not require further assessment.

The proposed buildings will have no effect on the Visual Circling.

2.7 Visual Segment Surface (VSS)

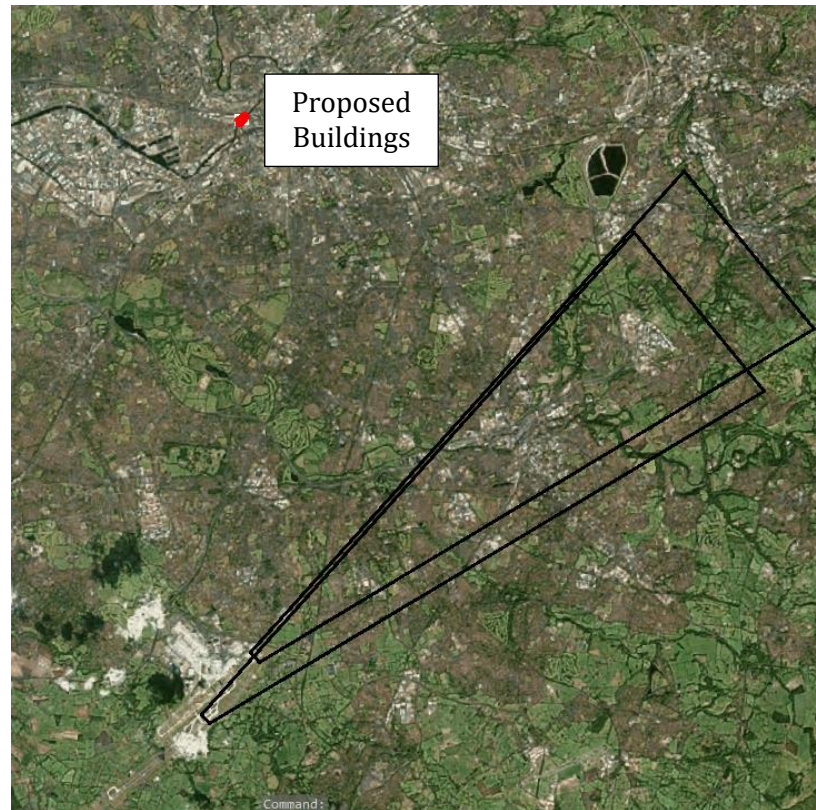


Figure 45. Visual Segment Surfaces (VSS)

The proposed buildings lie outside of the protection area for the VSS to all Runways.

2.8 Holding

The Lowest Holding Altitude (LHA) for any of the Holds is 3000ft.

The maximum possible elevation of the buildings, before affecting a LHA of 3000ft, has been calculated.

- 3000ft = 914.4m
- $914.4\text{m} - 300\text{m MOC} = 614.4\text{m AMSL}$. The maximum proposed building elevation is below this altitude.

The proposed buildings will have no effect on the Holdings.

2.9 Minimum Sector Altitude (MSA)

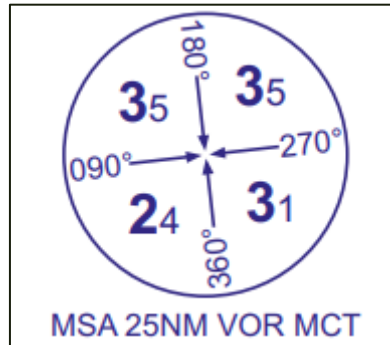


Figure 46. MSA

The lowest MSA value is 2400ft.

The maximum possible elevation of the buildings, before affecting 2400ft, has been calculated.

- 2400ft = 731.5m
- 731.5m – 300m MOC = 431.5m AMSL. The maximum building elevation is below this altitude.

The proposed buildings will have no effect on the MSA.

3 Conclusion

Instrument Flight Procedures (IFPs)

- The published IFPs would be unaffected by the 4 proposed building structures.