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Urban & Renewables

Technical Aerodrome Safeguarding Assessment

Salboy Central Ltd

Viadux Phase 2

October 2024







PLANNING SOLUTIONS FOR:

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ADMINISTRATION PAGE

Job Reference:	12752E
Author:	Jacob Cunningham
Telephone:	01787 319001
Email:	jacob@pagerpower.com

First Reviewer:	Ayda Yates; Michael Sutton
Email:	ayda@pagerpower.com; michael@pagerpower.com

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1	December 2023	Initial issue
2	January 2024	Consultation with NATS update
3	October 2024	Updated drawings

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Stour Valley Business Centre, Brundon Lane, Sudbury, Suffolk, CO10 7GB

T: 01787 319001 E: info@pagerpower.com W: www.pagerpower.com

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EXECUTIVE SUMMARY

1.1 Report Purpose

Pager Power has been commissioned to investigate the potential impact of a proposed building development (Viadux Plot 2A, a 76-storey tower to comprise hotel and residential use with ground floor commercial space, and Viadux Plot 2B, a 23-storey affordable housing building) located on Albion Street, Manchester city centre, upon aviation infrastructure in the surrounding area, predominantly operations at Manchester Airport.

Building developments have the potential to affect aviation operations in numerous ways. The most common impacts relate to building developments as physical obstructions both to aircraft and wireless signals used for radar and radio systems. This assessment has identified and assessed the relevant aviation constraints for the proposed development.

1.2 The Proposed Development

The Proposed Development includes two residential towers. The tallest of the two residential towers will have a maximum height of 245.6m above ground level (agl) and a maximum altitiude of 281.6m above ordnance datum (AOD), the smaller of the two residential towers will have a maximum height of 69.7m agl and a maximum altitiude of 105.7m AOD.

1.3 Overall Conclusions

The proposed development and any associated cranes would infringe the Outer Horizontal Surface (OHS) at Manchester Airport. Infingement of an OHS can normally be operationally accommodated through appropriate aviation lighting and a crane operations scheme. This is particularly important as it is possible this will be the tallest building in Manchester city centre.

Significant effects on the Secondary Survalence Radar (SSR) at Manchester Airport are not predicted and consultation with NATS has revealed they do not anticipate raising an object to the proposed development.

Whilst no significant impacts are predicted, it is recommended three of the Instrument Approach Procedures are discussed further with Manchester Airport, following consideration of the vertical and horizontal clearance margins.

The Civil Aviation Authority (CAA) should also be notified of the proposed development and any proposed cranes. All cranes and obstacle notifications to the CAA should be made to the ACOMS[1] service. The registration process is via the CAA customer portal to access the ACOMS service to submit notification[2].

[1] Airspace Coordination and Obstacle Management Service.
[2] https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/crane-notification/
https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification/

No significant impacts upon surrounding Helicopter Landing Site (HLS) and Manchester Barton Airport are predicted.

Consultation with Manchester Airport, the CAA, and Manchester Royal Infirmary Hospital is recommended to discuss the results of this report.

1.4 Analysis Results

Manchester Airport's Obstacle Limitation Surfaces

The proposed development infringes the OHS at Manchester Airport by 72.11m.

Crane usage will also need to be considered due to infringement of the OLS. It is likely a Crane Operations Scheme will be required.

Consultation with the safeguarding team at Manchester Airport is recommended to confirm the analysis results.

Manchester Airport SSR

The proposed development is located approximately 15.1km from the SSR at Manchester Airport and is predicted to be visible to the radar considering the existing environment.

The proposed development will be of similar scale to those surrounding it. No significant shadowing effects are anticipated.

The radar has specific features that reduce the radar's susceptibility to interference from buildings. The tower is also orientated such that the likelihood of reflections occurring will be significantly reduced, and will limit the very specific locations in which an aircraft would have to be for reflections to be geometrically possible.

Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance, the potential for some adverse effects on the radar cannot be conclusively ruled out, Manchester Airport are predicted to request mitigation.

Consultation with NATS, who safeguards the Manchester Airport radar, has revealed that mitigation already in place for Phase 1 and other nearby developments is sufficient to mitigate the impacts from the proposed developments, and they do not anticipate raising an objection.

Instrument Flight Procedures (IFPs) at Manchester Airport – High-Level

No impacts upon the published Standard Instrument Departures (SIDs) or Standard Arrival Charts (STARs) are predicted, following consideration of the appropriate vertical and horizontal clearance margins.

Whilst no significant impacts are predicted, it is recommended three of the Instrument Approach Procedures (ILS/DME (I-MM) RWY 05L, ILS/DME (MCT) RWY 05L, and VOR/DME RWY 23R) are discussed further with Manchester Airport, following consideration of the vertical and horizontal clearance margins.

Aviation Lighting Requirement

Plot 2A, as well as any cranes used during construction that are 150m agl or taller, must be lit with red medium intensity aviation lighting. The specific lighting arrangement has not yet been decided but it is likely this would comprise steady red lighting marking the height and shape of the residential tower, along with intermediate lighting on the sides of the tower.

Helicopter Operations and Other Aerodromes – High-Level

Concerns relating to helicopter use are not predicted because the proposed development is located within the city centre where there is already significant urbanisation with many similar types of building development and is in this vicinity to tall building developments such a Beetham Tower and the Owen Street Towers.

It is recommended that the Manchester Royal Infirmary is made aware of the proposed development as it is the closest HLS to the proposed development.

Manchester Barton is a licenced aerodrome located approximately 9km west of the proposed development. None of the published charts cover areas extending over the proposed development or the city centre itself and therefore no significant impacts are predicted.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 59 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 BACKGROUND

1.1 Introduction

Pager Power has been commissioned to investigate the potential impact of a proposed building development (Viadux Plot 2A, a 76-storey tower to comprise hotel and residential use with ground floor commercial space, and Viadux Plot 2B, a 23-storey affordable housing building) located on Albion Street, Manchester city centre, upon aviation infrastructure in the surrounding area, predominantly operations at Manchester Airport.

Building developments have the potential to affect aviation operations in numerous ways. The most common impacts relate to building developments as physical obstructions both to aircraft and wireless signals used for radar and radio systems. This assessment has identified and assessed all of the aviation constraints for the proposed development.

In detail the report includes:

- Proposed development details.
- Radar impact assessment for the Manchester Airport Secondary Surveillance Radar (SSR).
- Obstacle limitation surfaces (OLS) assessment for Manchester Airport.
- High-level assessment of Instrument Flight Procedures (IFPs).
- Commentary on crane usage and lighting requirements.
- High-level assessment of helicopter operations and other aerodromes.
- Overall conclusions and recommendations.

Following the results of the analysis, conclusions and recommendations are made.

2 PROPOSED DEVELOPMENT DETAILS

2.1 Description of Development

The description of the development is as follows[3]:

The Site is located in Manchester city centre. It is bounded by the Manchester Central Conference Complex and Great Northern Warehouse to the north, Albion Street to the east, the Deansgate Castlefield Metrolink station and Deansgate Locks to the south, and the Beetham Tower to the west. It extends to 1.49 ha.

The Proposed Development will be delivered across two plots:

- *Viadux Plot 2A: 76-storey tower to comprise hotel and residential use with ground floor commercial space.*
- *Viadux Plot 2B: 23-storey affordable housing building.*

Plot 2a is located immediately east of the recently completed Phase 1 building, on land partially com prising the grade II listed Castlefield Viaduct. This plot will deliver a 76-storey mixed use tower comprising a hotel (Use Class C1) with associated bar and restaurant and residential units above comprising 1, 2 and 3 bed, and penthouse apartments (Use Class C3) with associated residential amenity spaces. Secure cycle spaces, serving this and the Phase 1 building, are provided at the ground floor level. At viaduct level, a redesigned service yard for the conference centre is enclosed by a new podium structure with residents' external amenity space above. A section of the Great Bridgewater Street bridge (deck) is removed to bring light into the street below.

[3] Viadux Phase 2A, Phase 2B and Phase 2c EIA Briefing 4.12.23.

2.2 Proposed Development General Arrangement

The general arrangement plan for the proposed development is shown in Figure 1 below[4], this assessment pertains to Plot 2A and 2B buildings only.

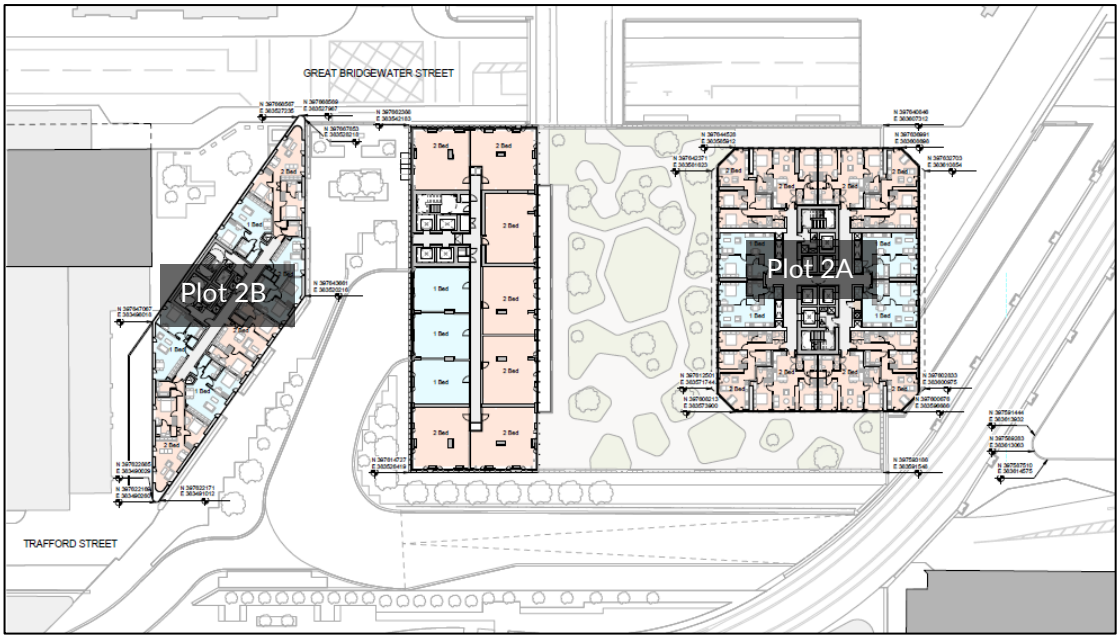


Figure 1 *Proposed development general arrangement plan*

2.3 Assessment Parameters

Plot 2B of the proposed development is in keeping with other low-rise buildings in the area and are therefore not predicted to have a significant impact upon aviation infrastructure. Plot 2B has not been mentioned further within this report.

The residential tower 2A has been considered within this report due to its height and potential to cause a significant impact upon aviation infrastructure.

Figure 2 on the following page[5] shows the building elevations and shapes for Plots 2A and 2B.

The corner coordinates for the 2A tower have been extrapolated from the site drawing and are presented in Appendix A.

[4] 10448-SHP-ZC-A-B5D9-G100-SK-05-001 [cropped]. The landscaping and floorplan shown are indicative only.
[5] 10448-SHP-ZC-A-B5D9-G100-SE-AA-001 [edited].

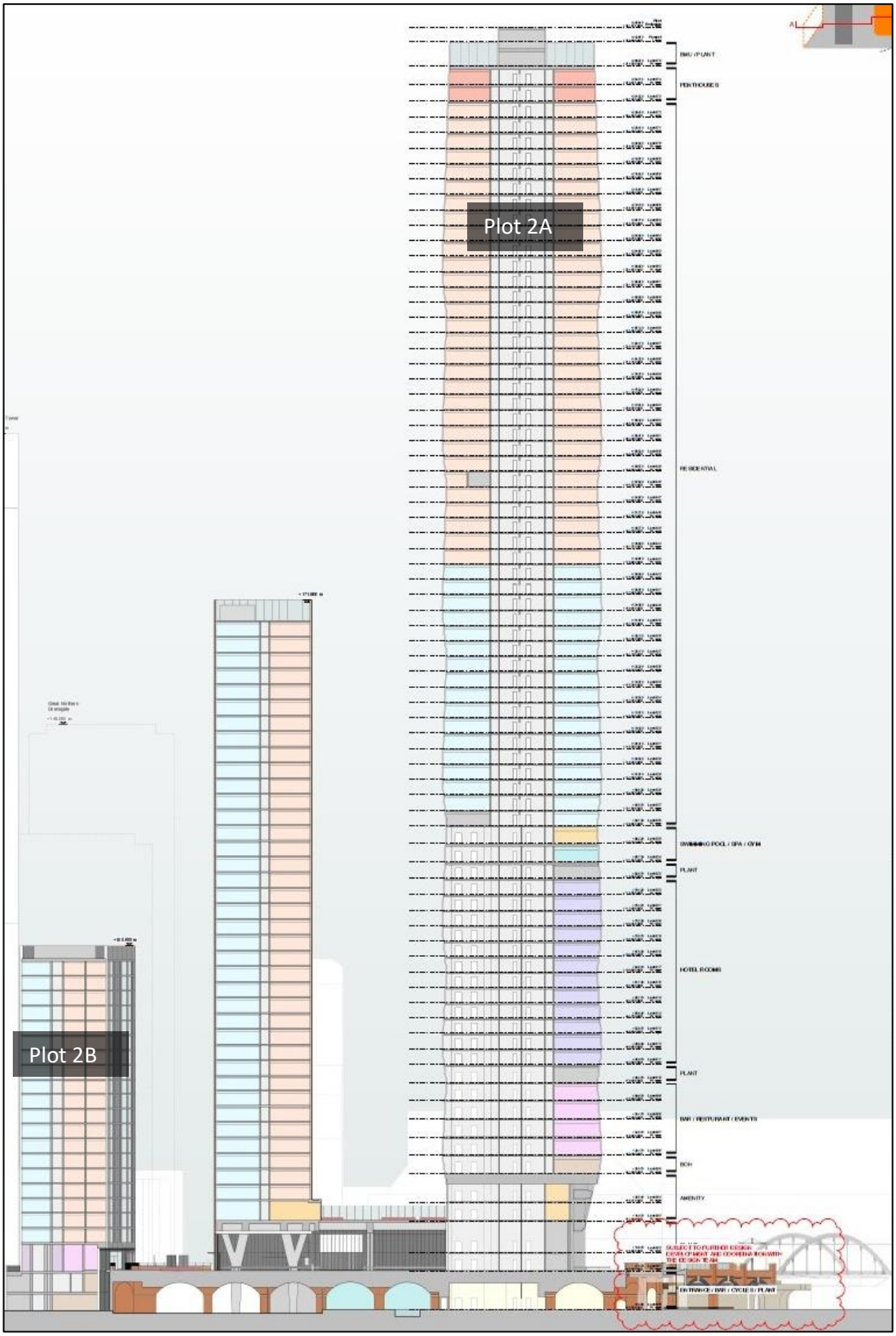


Figure 2 *Proposed development elevation*

The tower heights and altitudes information is presented in Table 1 below.

Plot	Height (m agl)	Altitude (m AOD)
2A	242.9	278.8
2A Elevator Shaft	245.6	281.6
2B	69.7	105.7

Table 1 *Tower heights and altitudes*

2.4 3D Building Representation

A representative 3D aerial image of the proposed development is shown in Figure 3 below.



Figure 3 *3D building representation*

RADAR DATA AND INTERFERENCE MECHANISMS

2.5 Overview

An overview of the radar details and primary interference mechanisms are presented in the following subsections.

2.1 Radar Details

Table 2 below provides the details for the assessed Manchester Airport SSR radar. All data has been provided by NATS.

Radar	Secondary Surveillance Radar (SSR)
Overall radar altitude above mean sea level	97 m
Distance between the proposed development and radar	15.1km
Average grid bearing from radar to proposed development	7.6°

Table 2 *Manchester Airport SSR radar location details*

2.1.1 Radar Types and Usage

SSR broadcast interrogating radio signals that are detected by aircraft with on-board transponders. The transponder responds by broadcasting a radio reply which normally contains identification and altitude information. The SSR determines the aircraft's horizontal position from the direction the antenna is orientated and the time taken to receive a response from the interrogation.

Both radar will be used by air traffic controllers to provide approach services to aircraft landing at and departing Manchester Airport. Both radar will also be used by air traffic controllers at national air traffic control centres to provide services to en-route aircraft.

The radar of significance with respect to the predicted impact is the SSR. The PSR is not expected to be significantly affected.

2.2 Interference Mechanisms

Buildings, structures and terrain can interfere with SSR. The level of interference normally depends on the size of the interfering structure and its distance from the radar. A larger structure closer to the radar is more likely to interfere than a smaller structure which is further away. The two predominant forms of interference are reflections and shadowing.

2.2.1 Reflections

Reflections from a structure can potentially result in genuine aircraft returns being plotted in the wrong place as a result of the structure reflecting signals in a specular (mirror-like) way. This means that an air traffic controller could mis-manage aircraft, leading to safety implications.

Both in-bound and out-bound signals are weakened due to reflections because they are reflected by a structure in both directions.

2.2.2 Shadowing

Radar signals are weakened by physical obstacles. The most significant signal blocking is often caused by terrain. Large obstructions within a radar's area of coverage can have a 'shadowing' effect, reducing the signal strength immediately behind them.

This effect is most pronounced immediately behind the structure and becomes less pronounced with distance. This is important because it means a structure's 'shadow' does not block radar coverage indefinitely, and the areas with the highest losses should be considered in an operational context.

Both in-bound and out-bound signals are weakened by shadowing because signals are attenuated by a structure in both directions.

2.3 SSR Capabilities

The radar is an SSR fitted with a Large Vertical Aperture (LVA) antenna. The radar is located to the south of Manchester Airport. It is a Mode S monopulse SSR supplied by Raytheon Systems Limited as part of a nationwide contract to upgrade NATS' national network of twenty sites.

The radar is understood to be a Condor 300 dual channel system with Mode S capabilities. This radar has a range of advanced built-in capabilities for increasing its reliability and performance. Specific features that reduce the radar's susceptibility to interference from buildings are listed in Table 3 below and on the following pages.

Feature	Form of interference	How feature reduces interference	Additional Information
Integral Tracking Function	Reflections	More likely to determine return is genuine if it moves as an aircraft return is expected to.	Ensures good false target suppression.
Refined Algorithms	Reflections and Shadowing	Experience on many sites used to enhance performance.	Ensures good performance in complex environments.
Identification and rejection of false replies	Reflections	False returns are rejected	If two or more replies are identified from the same source all but the first is rejected.

Feature	Form of interference	How feature reduces interference	Additional Information
Side Lobe Suppression	Reflections	False returns arising from antenna sidelobes are rejected	P1 and P2 pulses are used. This is an encoding system which enables sidelobe signals to be detected by comparing pulse sizes.
Sensitivity Time Control (STC)	Reflections	Removes reflections	Removes relatively low amplitude replies
Minimum Detection Signal Level (MDS)	Shadowing	Maximises radar coverage whilst minimising noise detections	-
Dynamic Threshold	Shadowing	Weak signals stronger than any interference signals are detected.	-
Reply to Reply Correlation	Reflections	Multiple replies required for target processing	Single reply reports are rejected.
FRUIT[6] Rejection	Reflections	Track initiation only allowed if report contains two or more correlating replies in the same SSR mode	e.g. two or more Mode A replies
Track Processing	Reflections and Shadowing	Improvements are made in target location using history of target position.	Improvements made when confidence in location information is low

[6] FRUIT – False Replies Unsynchronized in Time

Feature	Form of interference	How feature reduces interference	Additional Information
False Target Processing	Reflections	Advanced processing that applies a series of tests to identify and reject false returns	Techniques include: 1: Check whether Mode A code is unique 2: Check "known" reflection zones 3: Use geometric analysis for checking reflection zones 4: Self adaptive processing

Table 3 *Radar features for reducing interference*

RADAR LINE OF SIGHT AND INTERFERENCE ANALYSIS

2.4 Methodology

The approach taken within this report is presented in the following section.

2.4.1 Technical Assessment

- Radar line of sight assessment based on the tower co-ordinates assessed at their relative height above ground level;
- Screening assessment to determine whether existing buildings and/or landscape features would hide/shield the proposed development from the SSR;
- Consideration of the distance from the SSR.

2.4.2 Cumulative Assessment

Assessment of the predicted impact in the context of the existing environment has been undertaken.

2.5 Line of Sight Analysis

A radar line of sight assessment was completed for the proposed development – considering the footprint coordinates of the tower presented in Appendix A. Figure 4 on the following page show the line of sight chart from Manchester Airport SSR to the closest corner of the proposed development.

The box labelled 'certainty' in Figure 4 on the following page provides the distance (in metres) by which tower is within line of sight to the assessed radar (rounded to one decimal place).

The chart shows that the proposed development will be significantly visible to the radar, based on bare-earth terrain.

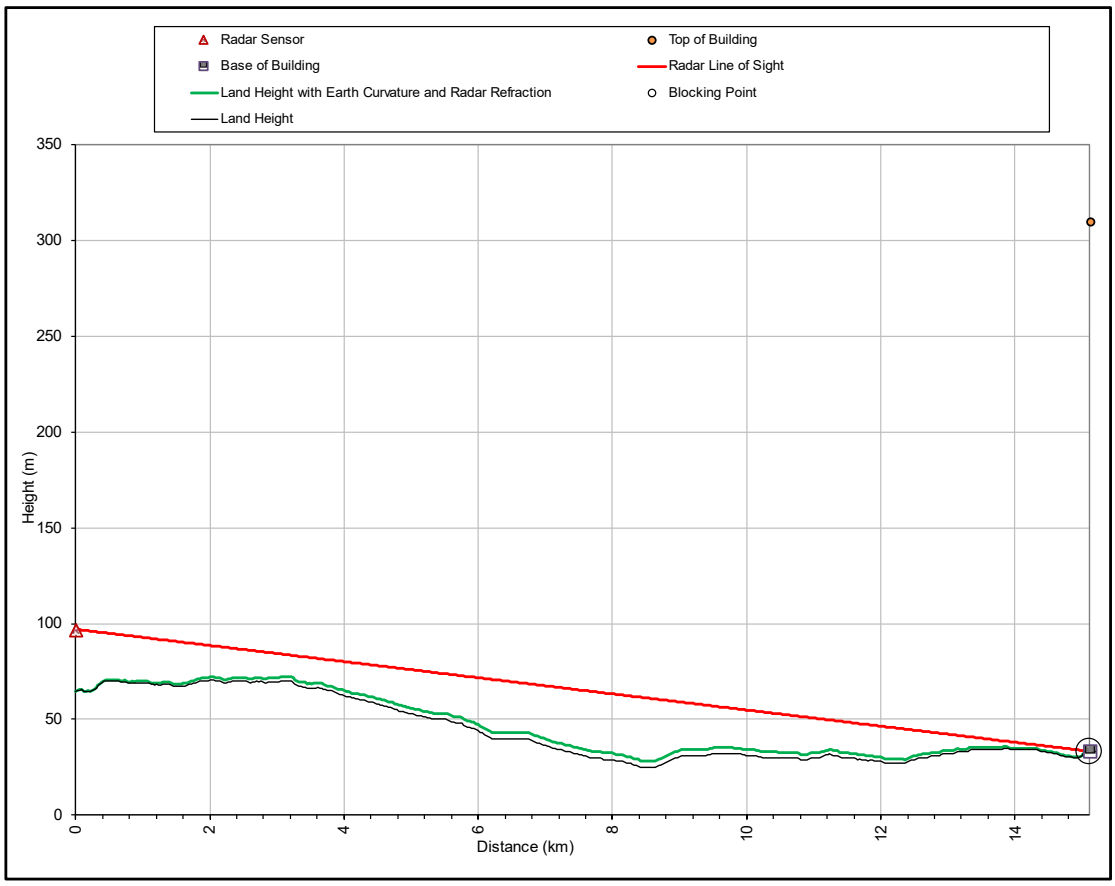


Figure 4 *Manchester Airport SSR visibility*

2.5.1 Additional Screening

A review of the line of sight profiles was undertaken to identify any potential additional screening that may significantly reduce the visibility of the towers to the SSR.

Plot 2A only benefits from screening by other existing, under construction or consented developments for approximately the bottom nine stories. There is therefore no further significant additional screening that warrants incorporation to the line of sight profiles.

2.5.2 Radar Line of Sight Conclusions

The results show that the tower would be significantly visible to the SSR at Manchester Airport and therefore technical and subsequent operational impacts upon the radar are possible. These are discussed further in the following subsection.

2.6 Interference Assessment

SSR radar broadcast interrogating radio signals that are detected by aircraft with on-board transponders. The transponder responds by broadcasting a radio reply which normally contains identification and altitude information. The SSR determines the aircraft's horizontal position from the orientation of the antenna and the time taken to receive a response from the interrogation.

Buildings, structures and terrain can interfere with SSR. The level of interference normally depends on the size of the interfering structure and its distance from the radar. A larger structure closer to the radar is more likely to interfere than a smaller structure which is further away. Two forms of interference have been considered. These are:

1. Reflections – Either in-bound or out-bound signals are reflected off a structure;
2. Shadowing – Either in-bound or out-bound signals are weakened because they are attenuated by a structure.

The proposed development's location, height and orientation has been reviewed and the reflection and shadow zones considered at a high level.

2.6.1 Reflection Effects

The proposed development can be considered a flat façade acting as a uniform reflector. Reflection effects caused by static structures have the potential to create false targets, azimuth errors and target fading issues. These could occur when an obstruction reflects the outgoing and/or incoming radar signals between the SSR and an aircraft. To be received by the radar the signals also have to be strong enough to be detected. A radar return that is reflected via a building will be significantly weaker than a return received directly from an aircraft. Furthermore, a radar antenna is also designed to have reduced gain at very low angles to reduce ground clutter returns. Overall, radar returns that are reflected via buildings are significantly weaker than those that are received directly from aircraft.

The façades of Plot 2A will be exposed to the radar, where reflections would be geometrically possible, and therefore concerns due to reflections are possible.

In practice, the effects from the proposed development are likely to be small. The radar is understood to be a Condor 300 dual channel system with Mode S capabilities. This radar has a range of specific features that reduce the radar's susceptibility to interference from buildings are shown in Section 3.3.

Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance, the potential for some adverse effects on the radar cannot be conclusively ruled out.

2.6.2 Shadowing Effects

Shadowing effects will be extremely limited. This is because the development is already within a built-up area of Manchester city centre, including the Owen Street Development that consists of four towers. These towers have a similar bearing as the proposed development relative to the SSR.

2.7 Assessment Conclusions

The modelling has revealed that the proposed development will be significantly visible to the SSR at Manchester Airport.

Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance (see Section 3.3), the potential for some adverse effects on the radar cannot be conclusively ruled out.

Consultation with NATS, who safeguards the radar, is recommended. Mitigation is expected to be requested at the cost of the developer.

OBSTACLE LIMITATION SURFACES

2.8 Obstacle Limitation Surfaces

Obstacle Limitation Surfaces (OLS) are imaginary planes defined in three dimensions for physical safeguarding purposes (i.e. ensuring that physical structures do not present a safety hazard at an airfield) and are defined around licensed aerodromes.

The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the UK Civil Aviation Authority's Civil Aviation Publication 168. The size of the surfaces is dependent on the number of runways, their dimensions and the procedures carried out at the aerodrome.

2.8.1 Obstacle Limitation Surfaces at Manchester Airport

The OLS for Manchester Airport have been modelled with respect to the representative tower corner points. The OLS chart is shown in Figure 5 below. The assessed points are shown by the red crosses – due to the scale they appear as a single icon.

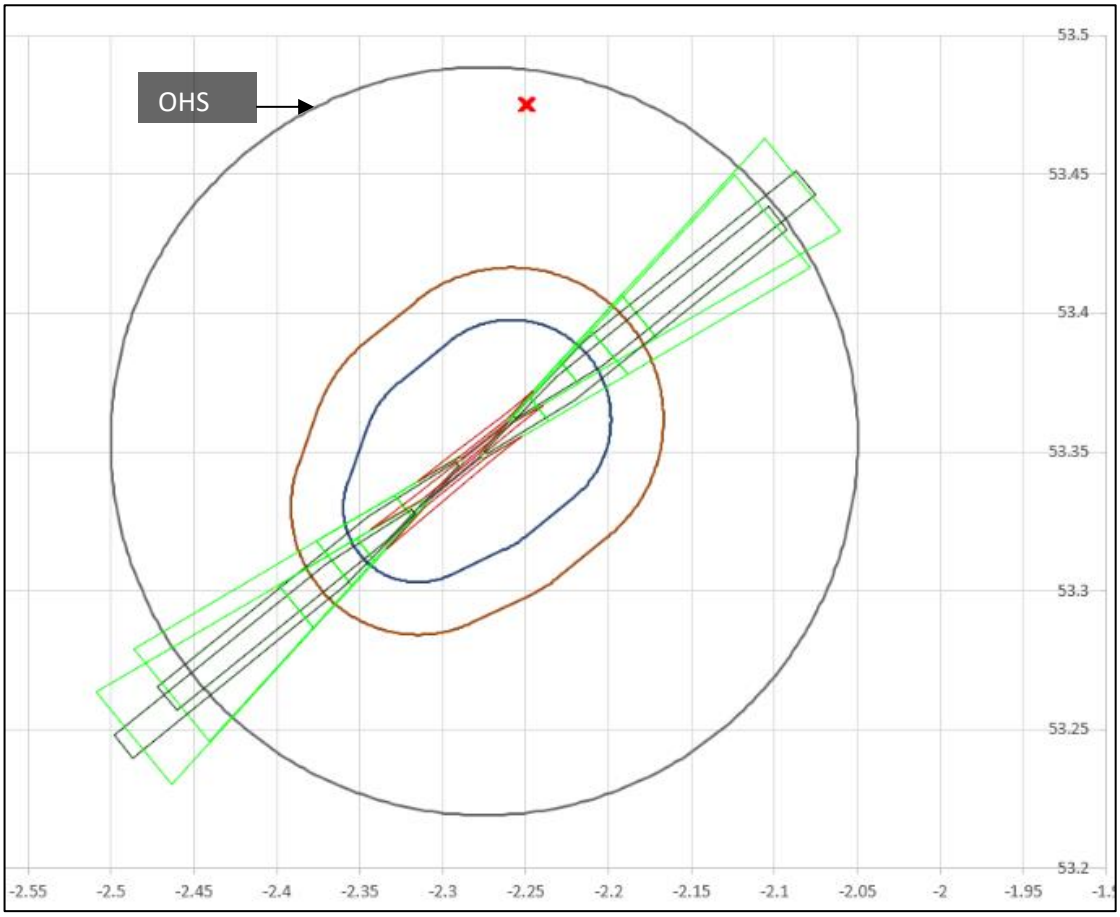


Figure 5 *OLS chart*

Table 4 below presents a summary of the OLS assessment results.

Surface	2A	2A Elevator Shaft
Outer Horizontal Surface[7]	Infringes by 66.89 metres	Infringes by 72.11 metres

Table 4 *OLS assessment results*

2.9 Breaching an Obstacle Limitation Surface

CAP 168 states that:

"In ideal circumstances all the surfaces will be free from obstacles but when a surface is infringed, any safety measures required by the CAA will have regard to:

1. the nature of the obstacle and its location relative to the surface origin, to the extended centreline of the runway or normal approach and departure paths and to existing obstructions;

2. the amount by which the surface is infringed;

3. the gradient presented by the obstacle to the surface origin;

4. the type of air traffic at the aerodrome; and

5. the instrument approach procedures published for the aerodrome.

...

Safety measures could be as follows:

1. promulgation in the UK AIP of appropriate information

2. marking and/or lighting of the obstacle

3. variation of the runway distances declared as available

4. limitation of the use of the runway to visual approaches only

5. restrictions on the type of traffic"

There are examples in the UK of tall developments breaching an OLS. These include Heathrow Airport, where the ATC tower itself causes a breach, and the other tall buildings in Manchester City Centre which breach the Manchester Airport OHS. Its acceptability may depend on crane heights and relative distance to the published Instrument Flight Procedures (IFPs) - discussed in the following section.

In practice, the airport must be satisfied that any surface breach can be safely accommodated, as the CAA would likely support the airport's position in almost any case.

If the development is to progress at its proposed height, it would require an aviation lighting scheme in accordance with CAA policy. It is likely this would comprise steady red lighting marking the height and shape of the residential tower, along with intermediate lighting on the sides of the tower.

[7] The OHS is a flat surface with an altitude of 206.78m AOD.

The first step to progress the development from an aviation perspective should be to engage with Manchester Airport based on the findings within this report.

2.10 Crane Usage Overview

During the construction phase, cranes will be present at the site that will reach elevations greater than the final building height. In principle, safeguarding concerns for cranes are the same as for building developments.

The proposed development will beach the OLS and therefore cranes will further breach the OLS. If the building is to proceed, it is likely that a crane operation scheme will need to be agreed with Manchester Airport and steady red medium intensity aviation lighting will be required for cranes. Lighting will be a mandatory requirement for any crane breaching the OLS.

2.11 CAA Notification

The Civil Aviation Authority (CAA) should also be notified of the proposed development and any proposed cranes. All cranes and obstacle notifications to the CAA should be made to the ACOMS[8] service. The registration process is via the CAA customer portal to access the ACOMS service to submit notification[9].

[8] Airspace Coordination and Obstacle Management Service.
[9] https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/crane-notification/
https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification/

HIGH-LEVEL INSTRUMENT FLIGHT ANALYSIS

2.12 Overview

Aircraft flying Instrument Flight Rules (IFR) have been assessed at a high-level by considering:

- Impact on Maximum Elevation Figures (MEF) shown on national aeronautical charts;
- Impact on Manchester Airport Surveillance Minimum Altitude Chart (SMAC);
- Impact on current Manchester Airport Standard Instrument Departures (SIDs);
- Impact on current Manchester Airport Standard Arrival Charts (STARs);
- Impact on current Manchester Airport Instrument Approach Charts.

This has been undertaken to determine whether an impact upon Instrument Flight Procedures (IFP) is likely or whether further, more detailed, analysis is required.

2.13 Maximum Elevation Threshold

The Maximum Elevation Threshold provides the minimum obstacle clearance above all obstacles (terrain and structures) in a particular quadrangle of an aeronautical chart. The Maximum Elevation Threshold shown for the quadrangle in which the development is located is 2,200 feet amsl. The proposed development has a maximum altitude of 914.7 feet which is 1,285.3 feet below the Maximum Elevation Threshold.

The proposed development will therefore not affect the published Maximum Elevation Threshold.

2.14 Surveillance Minimum Altitude Chart (SMAC)

Surveillance Minimum Altitude Charts (SMAC)[10] are published to show the lowest altitude a pilot will be instructed to fly whilst receiving an air traffic control service. The Manchester Airport SMAC shows that the minimum altitude for the sector above is 2,400 feet amsl. The proposed development has a maximum altitude of 914.7 feet. The vertical clearance between aircraft subject to a radar control service and the residential tower will be at least 1,485.3 feet. This is 501.3 feet greater than the specified clearance of 984 feet[11] in the CAA publication (CAP 777) for designing SMACs. This means that published SMAC will not be impacted by the proposed development.

Figure 6 on the following page shows the ATC Surveillance Minimum Altitude Chart for Manchester Airport. It presents the approximate location of the proposed development (blue outlined dot) as well as the area of tall buildings present in the surrounding city centre.

[10] AD 2.EGCC-5-1.
[11] 300 metres

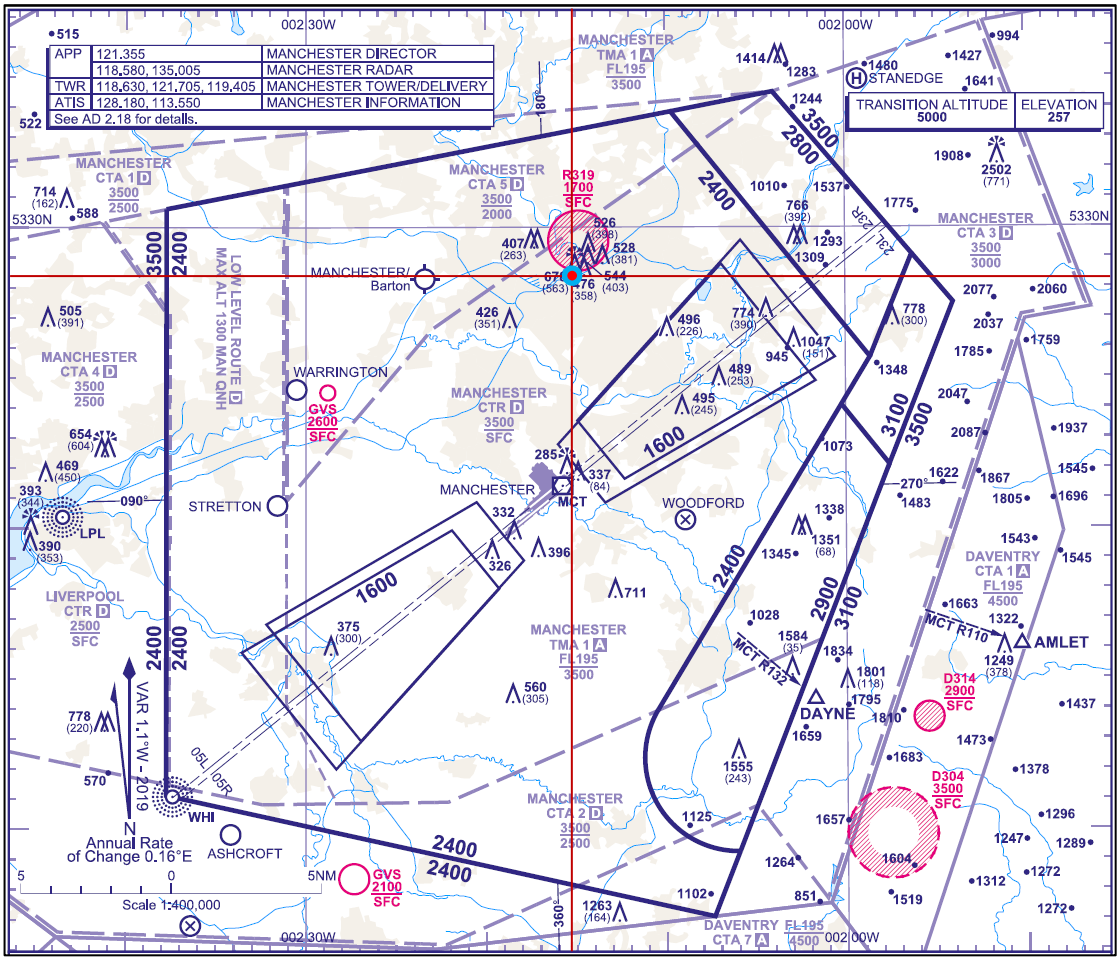


Figure 6 *Manchester Airport ATC Surveillance Minimum Altitude Chart*

2.15 High-level IFP Assessment – Obstacle Clearance Margins

As a general rule Instrument Flight Procedures (IFPs) are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles. These margins vary depending on the phase of flight and whether UK, European or International rules are being considered. Nevertheless, the vertical margins are always 1,000 feet or less (except in particularly mountainous regions which Manchester is not). This means that if the vertical clearance between an IFP route and the top of the proposed development exceeds 1,000 feet then it will not have a significant safety impact on aircraft flying the route. The maximum altitude of the proposed development is 914.7 feet.

Horizontal margins are always 5 nautical miles (NM) or less, reducing the closer the route is to the aerodrome. This means that if the horizontal clearance between the IFP route and the closest

point of the proposed development exceeds 5NM then it will not have a significant safety impact on aircraft flying this route.

This means that aircraft subject to any IFP route or limit which is more than 1,914.7 feet will not be impacted by the proposed development[12].

2.16 Standard Instrument Departures (SIDs)

Manchester Airport has seven published Standard Instrument Departure procedures (SIDs). Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 5 below.

SID Name	Observations	Assessed Impact	Recommendation
MONTY 1R 1S 1Y 1Z	The proposed development is approximately 2.8 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 1,963 feet at this point	No impact due to vertical clearance	No further action
ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y			
LISTO 2S 2Z	The proposed development is approximately 6.0 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action
LISTO 2R 2Y	The proposed development is approximately 7.8 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action

[12] This is a worst-case vertical clearance – the required vertical clearance also reduces the closer the aircraft is to the aerodrome.

SID Name	Observations	Assessed Impact	Recommendation
POL 5R 4S 1Y 1Z	The proposed development is approximately 5.3 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action
SONEX 1R 1Y/DESIG 1S 1Z	The proposed development is approximately 0.9 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 4,762 feet at this point	No impact due to vertical clearance	No further action
SANBA 1R 1Y	The proposed development is approximately 7.8 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action

Table 5 *Standard Instrument Departure (SID) Charts assessment results*

The proposed development and any associated crane are likely to present an acceptably low collision risk to aircraft flying all Standard Instrument Departure routes.

2.17 Standard Arrival Charts (STARs)

Manchester Airport has four published Standard Arrival (STARs) Charts. Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 6 below.

STAR Name	Observations	Assessed Impact	Recommendation
LAKEY 1M SETEL 1M TILNI 1M	Minimum Altitude FL70	No impact due to vertical clearance	No further action
LIBSO 1M OTBED 1M			
MAKUX 1M MALUD 1M OKTEM 1M PENIL 1M	Minimum Altitude FL60	No impact due to vertical clearance	No further action

STAR Name	Observations	Assessed Impact	Recommendation
ELVOS 1M LESTA 1M	Minimum Altitude FL70	No impact due to vertical clearance	No further action

Table 6 *Standard Arrival Charts (STARs) assessment results*

Aircraft flying Manchester Airport's Standard Arrival Routes will be at least 5,085 feet vertically clear of the towers. This means that such aircraft will have an acceptably low collision risk.

2.18 Instrument Approach Charts

Manchester Airport has fourteen published Instrument Approach Charts. Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 7 below.

Name	Observations	Assessed Impact	Recommended Action
ILS/DME (I-MC) RWY 05R	The proposed development is approximately 5.7 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action
ILS/DME (MCT) RWY 05R			
LOC/DME (I-MC) RWY 05R			
VOR/DME RWY 05R			

Name	Observations	Assessed Impact	Recommended Action
ILS/DME (I-MM) RWY 05L	The proposed development is approximately 5.0 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 1,653 feet at this point	No impact due to vertical clearance	No further action
ILS/DME (MCT) RWY 05L			
LOC/DME RWY 05L	The proposed development is approximately 5.0 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 1,980 feet at this point	No impact due to vertical clearance	No further action
VOR/DME RWY 05L	The proposed development is approximately 5.4 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action
ILS/DME (I-NN) RWY 23R	The proposed development is approximately 4.4 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 1,956 feet at this point	No impact due to vertical clearance	No further action
ILS/DME (MCT) RWY 23R			
LOC/DME RWY 23R	The proposed development is	No impact due to vertical clearance	No further action

Name	Observations	Assessed Impact	Recommended Action
	approximately 4.4 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 1,948 feet at this point		
VOR/DME RWY 23R	The proposed development is approximately 4.6 nautical miles from the nearest section of the procedure An aircraft will be at an altitude of approx. 1,718 feet at this point	No impact due to vertical clearance	No further action
VOR/DME RWY 23L	The proposed development is approximately 5.0 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action
RNP RWY 23L	The proposed development is approximately 5.2 nautical miles from the nearest section of the procedure	No impact due to horizontal clearance	No further action

Table 7 *Instrument Approach Chart assessment results*

The proposed development is likely to present an acceptably low collision risk to aircraft flying all Instrument Approach Procedures. No further assessment is recommended.

2.19 High-level IFP Assessment – Obstacle Clearance Margins Conclusions

As a general rule, IFPs are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles.

No significant impacts upon the published SIDs or STARs and Instrument Approach Procedures are predicted, following consideration of the appropriate vertical and horizontal clearance margins. Whilst no detailed IFP assessment is recommended, it is recommended three of the

Instrument Approach Procedures (ILS/DME (I-MM) RWY 05L, ILS/DME (MCT) RWY 05L, and VOR/DME RWY 23R) are discussed further with Manchester Airport, following consideration of the vertical and horizontal clearance margins.

HELICOPTER OPERATIONS AND OTHER AERODROMES (HIGH-LEVEL COMMENTARY)

2.20 Helicopter Operations

Helicopter use in and around the city centre is most likely to be associated with the emergency services. Any tall building in principle has the potential to present a hazard to helicopters, particularly if they were to be operating at low-level. There are several helicopter landing site (HLS) surrounding Manchester.

Manchester Royal Infirmary Hospital is the closest HLS to the proposed development, which is located approximately 1.8km to the southeast.

The development is unlikely to present a significant risk to helicopter operations because:

- The proposed development is located within the city centre where there is already significant urbanisation with many similar types of building development.
- The proposed development is in this vicinity to tall building developments such a Beetham Tower and the Owen Street Towers.

The greatest risk to helicopters related to the proposed development is likely to be the use of cranes, because they will be at a greater altitude and are in general harder to see from the air than buildings are. Cranes have been discussed in Section 5.2.

Helicopter pilots are likely to be used to flying in a built up environment such as that surrounding the proposed development. Additionally, the proposed developments will be marked on the aeronautical charts and lit with appropriate aviation lighting.

Concerns relating to helicopter use are not predicted. It is recommended that the Manchester Royal Infirmary is made aware of the proposed development.

2.21 Other Aerodromes

Generally speaking, Manchester Airport is the aerodrome that presents the most significant restrictions with regard to building developments in Manchester's city centre.

Manchester Barton is a licenced aerodrome located approximately 9km west of the proposed development.

The aerodrome has multiple grass runways. Published charts associated with the aerodrome include an 'aerodrome chart' and an 'ATZ, Helicopter Entry/Exit Points and Circuits'.

These charts do not cover areas extending over the proposed development or the city centre itself. Furthermore, existing buildings at a greater altitude than the proposed development that are located closer to Manchester Barton Aerodrome.

Significant impacts on Manchester Barton Aerodrome are not predicted.

HIGH-LEVEL AVIATION LIGHTING AND MARKING CONSIDERATIONS

2.22 Overview

Aviation lighting is required where an object becomes a collision risk. This is most likely where there is an infringement of the OLS. It also becomes mandatory to have lighting where an object extends to 150m above ground level or more[13]. The following section explores the requirement for aviation lighting at a high-level.

2.23 Lighting Requirements

Plot 2A extends to 245.7m agl, on this basis aviation lighting is mandatory for Plot 2A, as per the associated CAA guidance and will be requested by Manchester Airport.

The following lighting arrangements are therefore recommended:

- Plot 2A will be lit with medium intensity lights.
- Intermediate lights on Plot 2A will be included, as appropriate.
- The top of any associated crane that breaches the OHS or is 150m or taller will be lit with medium intensity lights.

The specific aviation lighting scheme for each tower is to be decided.

2.24 Marking Requirements

MIt is recommended that the following arrangements are followed, as per the associated CAA guidance and will be requested by Manchester Airport:

- The tower will be marked on CAA Aeronautical Charts.
- Any associated crane will be marked on CAA Aeronautical charts or a Notice to Airmen (NOTAM) will have been issued advising of the crane's height and location.

[13] CAP 168 Licensing of Aerodromes, Edition 12, January 2022. Last accessed 07.03.23.

CONCLUSIONS

2.25 Analysis Results

The results of the analysis for the key identified aviation risks are presented below.

2.25.1 Manchester Airport's Obstacle Limitation Surfaces

The proposed development infringes the OHS at Manchester Airport by 72.11m.

Crane usage will also need to be considered due to infringement of the OLS. It is likely a Crane Operations Scheme will be required.

Consultation with the safeguarding team at Manchester Airport is recommended to confirm the analysis results.

2.25.2 Manchester Airport SSR

The proposed development is located approximately 15.1km from the SSR at Manchester Airport and is predicted to be visible to the radar considering the existing environment.

The proposed development will be of similar scale to those surrounding it. No significant shadowing effects are anticipated.

The radar has specific features that reduce the radar's susceptibility to interference from buildings. The tower is also orientated such that the likelihood of reflections occurring will be significantly reduced, and will limit the very specific locations in which an aircraft would have to be for reflections to be geometrically possible.

Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance, the potential for some adverse effects on the radar cannot be conclusively ruled out, Manchester Airport are predicted to request mitigation.

Consultation with NATS, who safeguards the Manchester Airport radar, has revealed that mitigation already in place for Phase 1 and other nearby developments is sufficient to mitigate the impacts from the proposed developments, and they do not anticipate raising an objection.

2.25.3 Instrument Flight Procedures at Manchester Airport – High-Level

No impacts upon the published Standard Instrument Departures (SIDs) or Standard Arrival Charts (STARs) are predicted, following consideration of the appropriate vertical and horizontal clearance margins.

Whilst no significant impacts are predicted, it is recommended three of the Instrument Approach Procedures (ILS/DME (I-MM) RWY 05L, ILS/DME (MCT) RWY 05L, and VOR/DME RWY 23R) are discussed further with Manchester Airport, following consideration of the vertical and horizontal clearance margins.

2.25.4 Aviation Lighting Requirement

Plot 2A, as well as any cranes used during construction that are 150m agl or taller, must be lit with red medium intensity aviation lighting. The specific lighting arrangement has not yet been decided but it is likely this would comprise steady red lighting marking the height and shape of the residential tower, along with intermediate lighting on the sides of the tower.

2.25.5 Helicopter Operations and Other Aerodromes – High-Level

Concerns relating to helicopter use are not predicted because the proposed development is located within the city centre where there is already significant urbanisation with many similar types of building development and is in this vicinity to tall building developments such a Beetham Tower and the Owen Street Towers.

It is recommended that the Manchester Royal Infirmary is made aware of the proposed development as it is the closest HLS to the proposed development.

Manchester Barton is a licenced aerodrome located approximately 9km west of the proposed development. None of the published charts cover areas extending over the proposed development or the city centre itself and therefore no significant impacts are predicted.

2.26 Overall Conclusions

The proposed development and any associated cranes would infringe the Outer Horizontal Surface (OHS) at Manchester Airport. Infingement of an OHS can normally be operationally accommodated through appropriate aviation lighting and a crane operations scheme. This is particularly important as it is possible this will be the tallest building in Manchester city centre.

Significant effects on the Secondary Survalence Radar (SSR) at Manchester Airport are not predicted and consultation with NATS has revealed they do not anticipate raising an object to the proposed development.

Whilst no significant impacts are predicted, it is recommended three of the Instrument Approach Procedures are discussed further with Manchester Airport, following consideration of the vertical and horizontal clearance margins.

The Civil Aviation Authority (CAA) should also be notified of the proposed development and any proposed cranes. All cranes and obstacle notifications to the CAA should be made to the ACOMS[14] service. The registration process is via the CAA customer portal to access the ACOMS service to submit notification[15].

No significant impacts upon surrounding Helicopter Landing Site (HLS) and Manchester Barton Airport are predicted.

[14] Airspace Coordination and Obstacle Management Service.
[15] https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/crane-notification/
https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification/

APPENDIX A - TOWER FOOTPRINT COORDINATES

2.27 Plot 2A

Easting	Northing
383574	397611
383597	397603
383601	397604
383610	397634
383608	397637
383585	397644
383582	397643
383572	397614

Plot 2A footprint coordinates

PAGERPOWER

Urban & Renewables

Pager Power Limited
Stour Valley Business Centre
Sudbury
Suffolk
CO10 7GB

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com