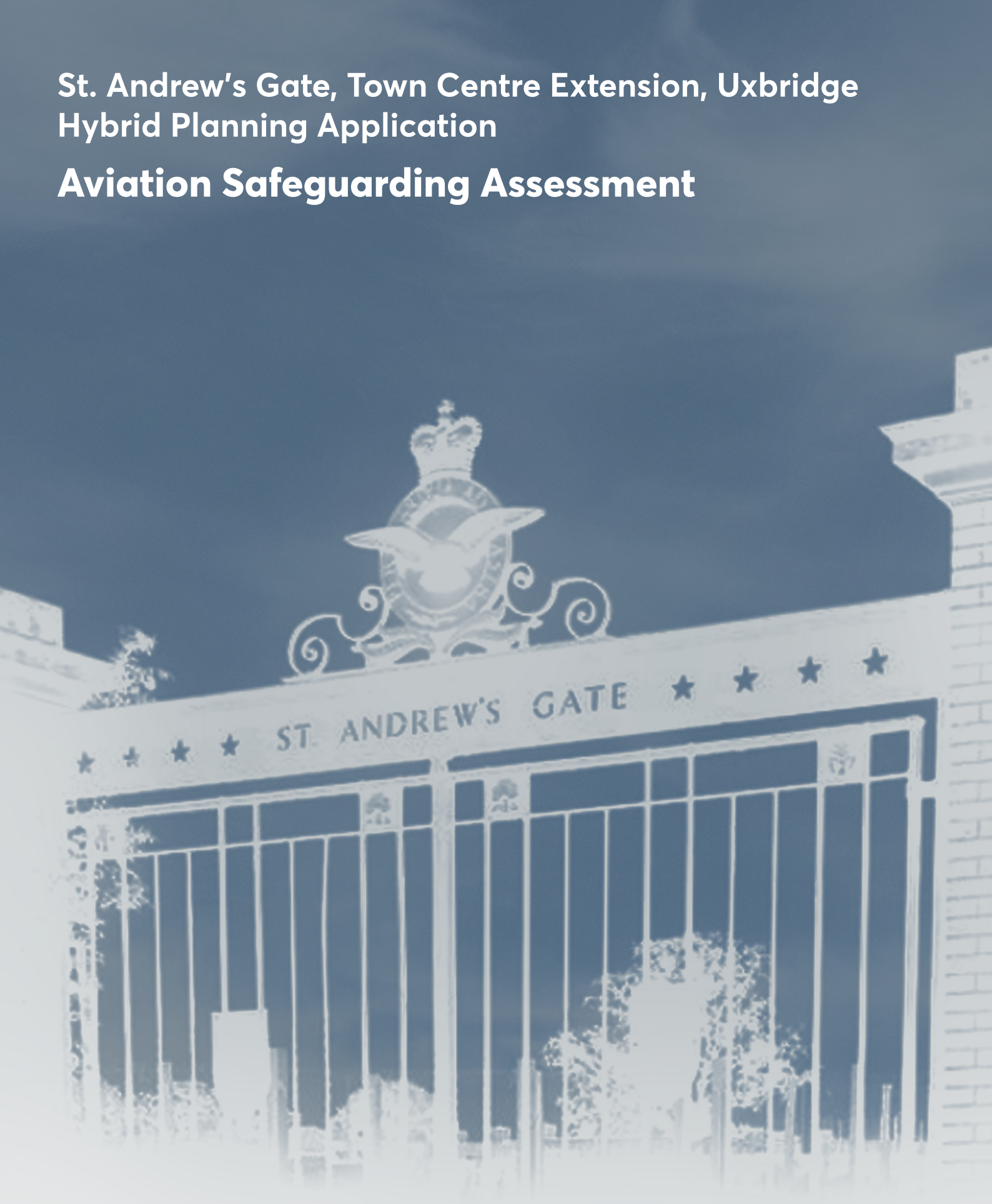
St. Andrew's Gate, Town Centre Extension, Uxbridge
Hybrid Planning Application

Aviation Safeguarding Assessment



ST. ANDREW'S PARK
UXBRIDGE

VINCI PLC | ST. MODWEN

St Andrew's Gate, Town Centre Extension, Uxbridge, Proposed Redevelopment: Aviation Safeguarding Assessment

P1261/R1/Issue 1.1

Report prepared on behalf of Vinci St Modwen

June 2024

Eddowes Aviation Safety Ltd
Specialist Aviation Assessments

Authorisation Sheet

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Summary

Re-development of the St Andrew's Gate Town Centre Extension site (the TCE site), Uxbridge, is being proposed, under a hybrid application comprising the following:

- Outline planning permission (with all matters reserved) for residential development and commercial uses, to be occupied flexibly within Use Classes E(a), E(b), E(c), E(e), E(g)(i), E(g)(ii) and a convenience store (Use Class E(a)); plus car parking, hard and soft landscaping, and all other associated works.
- Full planning permission for reinstatement of gym use (Use Class E(d)) and change of use to provide a café (Use Class E(b)) within the former cinema building; and external alterations; and associated car parking, hard and soft landscaping and all other associated works.

The site is located in the vicinity of Northolt Aerodrome in an area subject to aerodrome safeguarding, the process by which airspace required for safe and efficient take-off and landing at airports is maintained free of new development. Well-defined height limits apply across the site, according to UK and international standards.

To support determination of the application, an aviation safeguarding assessment has been undertaken of the implications for the future safety and efficiency of operations at Northolt Aerodrome of this proposal. Given the requirements for safeguarding, Northolt Aerodrome is a consultee in the planning process for new development in its vicinity. This safeguarding assessment is intended to support consideration of the application by the Aerodrome.

The outline element of the application covers the following:

- Creation of up to no. 356 residential dwellings (Class C3) within three new build blocks, of up to 10 storeys;
- Up to 1,100sqm GIA of flexible commercial space (Use Classes E(a), E(b), E(c), E(e), E(g)(i) and E(g)(ii)) at ground floor level, which will include a convenience store of up to 440 sqm (GIA) located in Building Zone C and other flexible commercial floorspace at ground floor level in Building Zones B and C.

Given the height restrictions applicable across the site, the focus of this aviation safeguarding assessment has been on the new build blocks, in order to confirm that they comply with the relevant safeguarding requirements and will therefore have no adverse impacts on aircraft operations.

The proposed development has been assessed against relevant physical safeguarding criteria, intended to ensure that airspace required for safe and efficient aircraft operation is kept suitably free of obstacles and technical safeguarding criteria for the protection of navigational aids supporting aircraft operations. The assessment demonstrates that the development will have no adverse impacts on aviation interests and can therefore be considered acceptable from an aviation perspective. The key findings on which that overall conclusion is based may be summarised as follows:

1. The development site is located in the area covered by the Runway 07 approach surface and the Runway 25 take-off climb surface and where the height limits associated with the latter are marginally more restrictive. At an assumed maximum height of 82.8 m AOD, the illustrative scheme complies with the relevant height constraints with a minimum excess vertical clearance margin of just over 10 metres between the finished building height and the surface for the tallest element of the proposed development at its most limiting north-east corner.

2. The development site is also located in the area covered by the inner horizontal surface, a level surface at a height of 79.74 m AOD, which is infringed slightly by the tallest elements of the development. Safeguarding rules allow infringements of this surface where they can be shown not to adversely affect aircraft operations. Further assessment demonstrates that the proposed infringements are not operationally significant.
3. By reference to the available measured height survey data for Northolt Aerodrome that characterise the existing obstacle environment, several obstacles located between the runway end and the development site, comprising mainly trees and lamp posts, are found to be infringements of the Runway 25 take-off climb surface and to be more limiting for westerly departure operations than the proposed development. In addition, a church spire at a height of 93.69 m AOD, immediately to the west of the TCE site, is determined, by virtue of its greater height and close proximity to the site and its closer proximity to the approach path to the south, to be more limiting on easterly approach operations.
4. In summary, the development complies with the relevant regulatory standards and is found to place no potential constraints on operations beyond those associated with the existing obstacle environment. It can therefore be considered acceptable from a physical safeguarding perspective.

The potential for interference with the H10 radar at Heathrow has been identified, though it has not been confirmed whether or not any radar impacts would arise in practice. Where interference is identified, it can normally be addressed by a radar mitigation scheme. NATS, the radar operators, are statutory consultees in the determination of the application and can be expected to screen the application against their standard technical safeguarding criteria and, if necessary, will undertake further detailed assessment to determine if real impacts are to be expected in practice. If NATS conclude that significant impacts may arise they can be expected to request that a condition be attached to any permission arising from the application, requiring the implementation of an agreed radar mitigation. This is an established approach which has previously been adopted to address the impacts of other tall building developments on radar operation and can be addressed in detail the proposed development at the reserved matters stage. Overall, it may be concluded that if there were to be any potential for adverse impacts on the operation of the H10 radar, they can be satisfactorily mitigated by an agreed radar mitigation scheme.

Contents

1 Introduction

Re-development of the St Andrew's Gate Town Centre Extension site (the TCE site), Uxbridge, is being proposed, under a hybrid application comprising the following:

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Given the height restrictions applicable across the site, the focus of this aviation safeguarding assessment has been on the new build blocks, in order to confirm that they comply with the relevant safeguarding requirements and will therefore have no adverse impacts on aircraft operations. The findings are summarised in this report which comprises the following sections:

- An initial summary description of the site and its location relative to Northolt Aerodrome.
- An account of the physical safeguarding constraints at the site associated with operations at Northolt Aerodrome, defining the specifications for the permanent height limits across the site.
- A consideration of other possible safeguarding requirements applicable to development at the site.
- A summary of the assessment findings and associated conclusions.

2 Site and Development Description

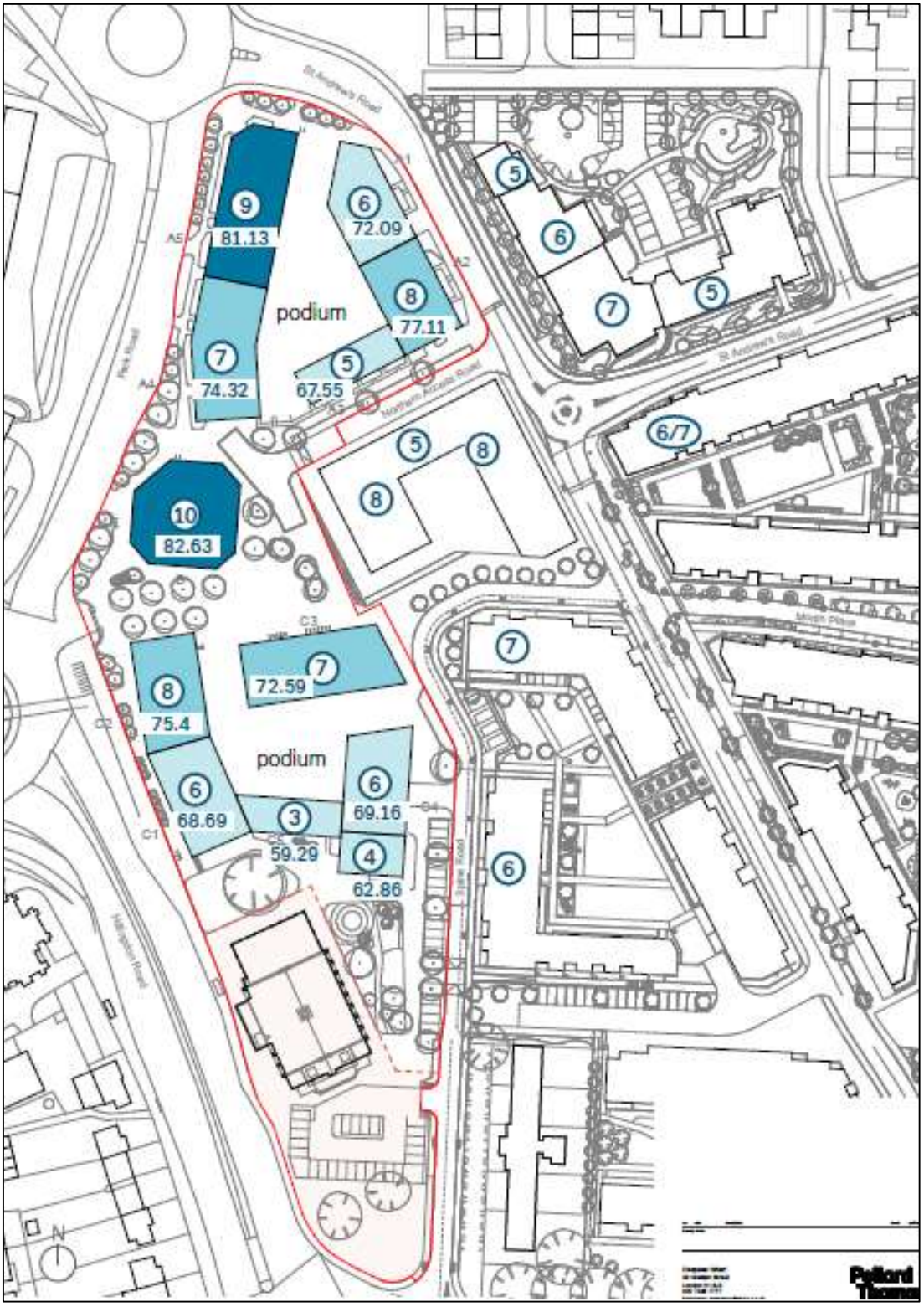
The TCE site is located to the east of Uxbridge town centre, approximately 2.9 km to the west of the western end of the runway at Northolt Aerodrome, as shown by the yellow outline in Figure 1, relative to the runway which is evident to the top right. The site is approximately 7.2 km to the north of the northern runway at London Heathrow Airport. As discussed further in Section 3, the height limits associated with operations at Northolt Aerodrome are more restrictive than those associated with safeguarding requirements at London Heathrow Airport. From the perspective of this assessment, the key characteristics of the development are the block heights and locations, as summarised in Table 1 and Figure 2. This specification covers the heights of the illustrative scheme and of the application maximum parameters where the latter accommodates a vertical deviation of approximately 200 mm.

Figure 1: TCE site location with respect to Northolt Aerodrome

Table 1: Summary of proposed block heights

Block ID	No. of storeys	Height (m AOD)	
		Illustrative scheme	Maximum parameters
A1	6	72.09	72.3
A2	8	77.11	77.3
A3	5	67.55	67.7
A4	7	74.32	74.5
A5	9	81.13	81.3
B	10	82.63	82.8
C1	6	68.69	68.9
C2	8	75.40	75.6
C3	7	72.59	72.8
C4	6	69.16	69.4
C4SB	4	62.86	63.1
C5	3	59.29	59.5

Figure 2: illustrative scheme proposed block footprints and heights



3 Physical Safeguarding Assessment

3.1 OUTLINE OF CONSTRAINTS AND METHOD

The safeguarding of airspace in the vicinity of airports is supported by the specifications of obstacle limitation surfaces (OLS), a set of predominantly planar surfaces arranged about the runway and flight paths to and from it. The requirements at Military Aerodromes are set out in Regulatory Article (RA) 3512 [1] which essentially conforms with the standards and recommended practices [2] of the International Civil Aviation Organisation (ICAO), as implemented for civilian operations in the UK by the Civil Aviation Authority (CAA), according to the specifications in Civil Aviation Publication (CAP) 168 [3]. Infringements of some of the OLS, such as the take-off climb surface and approach surface which protect runway-aligned take-off and landing operations, are generally not permitted. However, infringements of some surfaces further from these essential flight paths may be allowed where it can be shown that these would not adversely affect the safety or regularity of aircraft operations.

This safeguarding assessment therefore begins with an assessment of the proposed development against the specifications for the OLS to determine whether it would lead to any infringements of these surfaces. Further consideration is then given to the nature of operations undertaken at Northolt, in accordance with defined instrument flight procedures to confirm that the development will have no material impact on the safety and efficiency of operations.

The key reference points for the OLS and operational safeguarding criteria are the runway ends at Northolt Aerodrome, primarily the runway thresholds for Runway 07, supporting operations in a north-easterly direction, and Runway 25, supporting operations in a south-westerly direction. The coordinates of these reference points are provided in the Military Aeronautical Information Publication (AIP) [4] and they are summarised in Table 2. A further reference coordinate for some OLS is the Aerodrome Reference Point (ARP), located at the mid-point of the runway, also shown in Table 2. Finally, for south-westerly take-off operations, in the direction of the site, the end of the Runway 25 take-off distance available (TODA) is the key reference point. The coordinates of the Runway 25 end of TODA would normally be accessed from the Type A chart for the aerodrome but, at the time of this assessment, the Northolt Type A chart was not accessible[1]. The coordinates are not specifically identified in the AIP, but the AIP identifies the coordinates of waypoint WUW00 which is understood to correspond with the end of TODA. The coordinates of WUW00, as also summarised in Table 2, have therefore been employed for the Runway 25 end of TODA in this assessment.

Table 2: Aerodrome reference coordinates

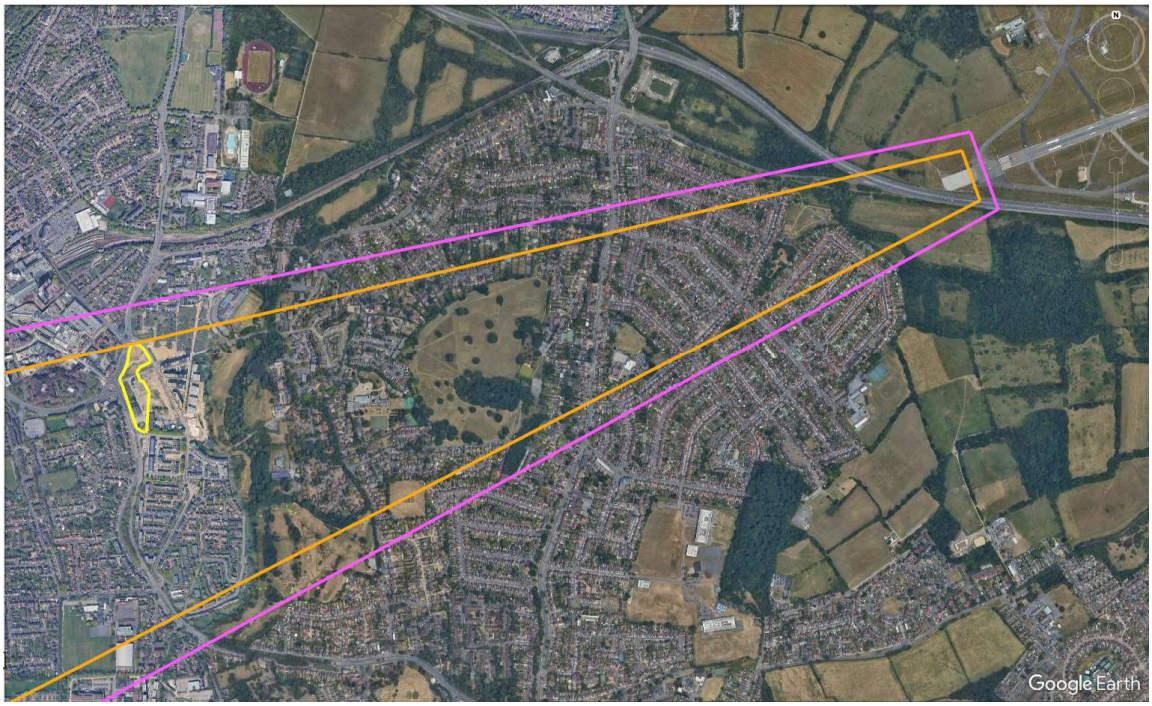
Location	Latitude	Longitude	OS Grid coordinates		Elevation (m AMSL)
			Easting	Northing	
Northolt 07 THR	51° 33' 01.43"N	0° 25' 46.99"W	508972.57	184668.82	34.74
Northolt 25 THR	51° 33' 19.16"N	0° 24' 29.53"W	510452.44	185248.77	37.88
Northolt ARP	51° 33' 09.77”N	0° 25' 10.55" W	509668.79	184941.57	38.40
Waypoint WUW00	51° 33' 00.22"N	0° 25' 52.28"W	508871.48	184629.25	34.74

[1] The Military AIP website returned the following error message: The requested URL /aip/pdf/typea/Northolt_TYPEA_FEB2024.pdf was not found on this server.

3.2 OBSTACLE LIMITATION SURFACE ASSESSMENT

The obstacle limitation surfaces are defined according to the runway code, based on the runway length, and the nature of operations. Based on the declared distances identified in the Military AIP, the runway at Northolt is determined to be a code 3 runway. An ILS precision approach operation is available at Runway 25 and non-precision approach operations are defined for both runway directions. Northolt Aerodrome has therefore been assessed as a code 3 precision instrument runway. Based on the OLS specifications for that runway classification, the TCE site is identified as being located within the area covered by the Runway 25 take-off climb surface (TOCS) and the Runway 07 approach surface (APPS), as shown in Figure 3.

Figure 3: OLS limits in relation to the Site



Site boundary, yellow line; Runway 07 APPS, magenta line; Runway 25 TOCS, orange line

The Runway 07 APPS and Runway 25 TOCS both rise in height with a slope of 2% from the reference coordinates and elevations shown in Table 1. Since the Runway 25 TOCS is located slightly further to the south-west than the Runway 07 APPS, it is evidently the more limiting surface in terms of the building height restrictions it imposes on development at the site. The height restrictions associated with the Runway 25 TOCS are therefore of primary interest in the current assessment and have been determined in detail.

As summarised earlier in Table 1, indicative building heights for an illustrative masterplan have been identified by Pollard Thomas Edwards architects who have also provided a more detailed specification for the coordinates of each of the proposed blocks, as summarised in Appendix 1. Each of the limiting corners of all the proposed blocks have been systematically assessed against the heights of the Runway 25 TOCS at those locations. The surface heights and excess vertical clearance margins with respect to this surface at each of the block corners are summarised in Appendix 2, which shows that all the blocks are below the Runway 25 TOCS across the whole of their footprints. A minimum excess vertical clearance margin of 10.32 m is determined for the highest block, Block B, at an assumed maximum height of 82.8 m AOD, at its north-east corner, compared to the estimated TOCS height at

that point of 93.12 m AOD. The assessment therefore demonstrates that the proposed development will comply with the height limits associated with the Runway 25 TOCS and Runway 07 APPS.

Nominally, the site also lies in the area covered by the inner horizontal surface at Northolt Aerodrome. The inner horizontal surface extends from the aerodrome reference point at a height of 45 m above a reference elevation normally defined as the height of the lowest runway threshold, in this case 34.74 m AOD, i.e. at a height of 79.74 m AOD, out to a radial distance of 4 km. The two tallest blocks are therefore determined to be minor infringements of this surface. In practice, the height limits of the Runway 07 APPS and Runway 25 TOCS are better representative of operational requirements. According to CAP 168, the inner horizontal surface *represents the level above which consideration needs to be given to the control of new obstructions and the removal or marking of existing obstructions so as to ensure safe visual manoeuvring in the vicinity of an aerodrome.* In accordance with those principles, the UK military standards state more succinctly that *the inner horizontal surface should protect airspace for visual circling prior to landing*. However, visual manoeuvring is not required in the vicinity of the TCE site in order to facilitate safe and efficient operations at Northolt Aerodrome; neither are any other operations at low altitudes that might be compromised by the development. CAP 168 further states that *"New objects or extensions of existing objects should not be permitted above the conical surface and the inner horizontal surface except when an object would be shielded by an existing immovable object, or if after a safety assessment, it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes."* Further operational safety assessment is presented in Section 3.3 to formally demonstrate that these minor infringements will have no adverse impact on aircraft operations and can therefore be considered acceptable.

The site lies approximately 7.5 km from the ARP at London Heathrow Airport. The safeguarded zone at Heathrow extends to 15 km from the ARP. The TCE site is therefore within the Heathrow safeguarded zone. Assessment against the relevant OLS specifications demonstrates that the site lies in an area covered by the outer horizontal surface at a height of 150 m above reference elevation of 22.95 m AOD. It is readily seen that the proposed development complies with the physical safeguarding requirements associated with London Heathrow Airport.

3.3 OPERATIONAL ASSESSMENT

The extent to which the proposed minor infringement of the inner horizontal surface may have a material impact on operations has been assessed by reference to the existing obstacle environment and the nature of operations at Northolt Aerodrome. Separate consideration has been given to take-off and approach operations.

For departures, the key requirement is that aircraft climb performance is sufficient to ensure a safe vertical clearance margin with respect to all obstacles along the departure flight path. For example, for civilian operations, the IR-OPS Implementing Rules of the European Aviation Safety Agency (EASA) apply, as follows:

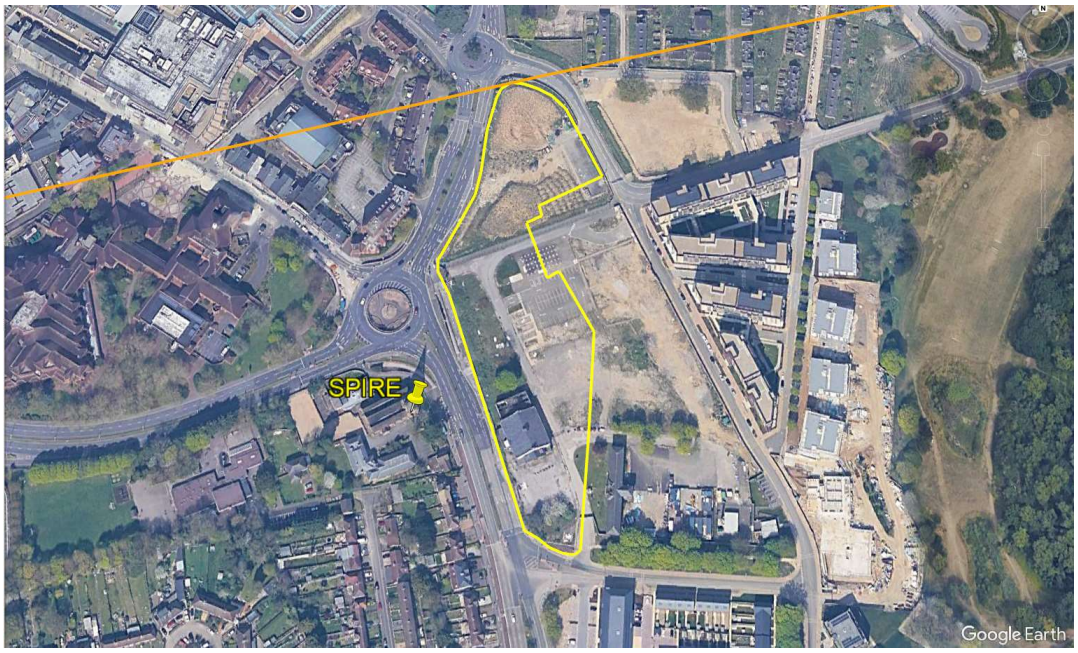
'The net take-off flight path shall be determined in such a way that the aeroplane clears all obstacles by a vertical distance of at least 35 ft or by a horizontal distance of at least 90 m plus 0.125 × D, where D is the horizontal distance the aeroplane has travelled from the end of the take-off distance available (TODA) or the end of the take-off distance if a turn is scheduled before the end of the TODA. For aeroplanes with a wingspan of less than 60 m, a horizontal obstacle clearance of half the aeroplane wingspan plus 60 m, plus 0.125 × D may be used.'

Ensuring a sufficient climb performance to guarantee aircraft safety may impact on operational efficiency as it may lead to a limitation on take-off weight. Provided that a new structure is no more limiting than the existing obstacle environment in that respect, it is evident that it can be accommodated without placing any additional restriction on take-off weights. From a review of the measured height survey data for Northolt Aerodrome, available from the Military AIP, several existing infringements of the Runway 25 TOCS located in areas to the east of the TCE site are identified. The obstacles concerned are primarily trees and lamp posts which represent infringements of the Runway 25 TOCS by up to around 10 m. Given that these obstacles are located closer to the runway end and are infringements of the Runway 25 TOCS, it is evident that they must be more limiting from the perspective of the required climb performance than the proposed development.

It is noted further that instrument flight procedures published for use at Northolt Aerodrome identify a minimum climb gradient of 3.% to 390 ft (119 m) for Runway 25 departure operations, in excess of the 2% slope of the Runway TOCS. This requirement will ensure that aircraft will have gained a safe height with respect to the site before reaching it. Overall, it can be concluded from this operational assessment that the proposed development will have no adverse impact on Runway 25 departures.

Instrument flight procedures for approach operations must also comply with defined vertical and lateral clearance margin requirements that are not precisely matched by the OLS specifications. Current and any future Runway 07 approach operations must comply with those clearance margin requirements with respect to the existing obstacle environment. Provided that the proposed development places no additional restrictions on operations, beyond those already associated with the existing obstacle environment, it can have no adverse impact on operations. Detailed review of the current and future instrument approach procedures and the constraints associated with the existing obstacle environment are beyond the scope of this assessment. However, it may be noted first that, in general, compliance with the OLS, will normally be sufficient to safeguard instrument approach procedures. Second, review of the measured height survey data for Northolt Aerodrome, available from the Military AIP, reveals a church spire at a height of 93.69 m AOD, immediately to the west of the TCE site, as shown in Figure 4. Taking account of its greater height and close proximity to the site and its closer proximity to the approach path to the south, it may be concluded that this existing obstacle will be more limiting on approach procedures, including visual circling, and that the proposed development will have no adverse impact on current or future operations.

Figure 4: Existing church spire in relation to the Site



3.4 PHYSICAL SAFEGUARDING SUMMARY

The physical safeguarding assessment findings may be summarised as follows:

1. The development site is located in the area covered by the Runway 07 approach surface and the Runway 25 take-off climb surface and where the height limits associated with the latter are marginally more restrictive. At an assumed maximum height of 82.8 m AOD, the illustrative scheme complies with the relevant height constraints with a minimum excess vertical clearance margin of just over 10 metres between the finished building height and the surface for the tallest element of the proposed development at its most limiting north-east corner.
2. The development site is also located in the area covered by the inner horizontal surface, a level surface at a height of 79.74 m AOD, which is infringed slightly by the tallest elements of the development. Safeguarding rules allow infringements of this surface where they can be shown not to adversely affect aircraft operations. Further assessment demonstrates that the proposed infringements are not operationally significant.
3. By reference to the available measured height survey data for Northolt Aerodrome that characterise the existing obstacle environment, several obstacles located between the runway end and the development site, comprising mainly trees and lamp posts, are found to be infringements of the Runway 25 take-off climb surface and to be more limiting for westerly departure operations than the proposed development. In addition, a church spire at a height of 93.69 m AOD, immediately to the west of the TCE site, is determined, by virtue of its greater height and close proximity to the site and its closer proximity to the approach path to the south, to be more limiting on easterly approach operations.
4. In summary, the development complies with the relevant regulatory standards and is found to place no potential constraints on operations beyond those associated with the existing obstacle environment. It can therefore be considered acceptable from a physical safeguarding perspective.

4 Technical Safeguarding

In addition to the physical safeguarding of flight paths, there is a requirement for the technical safeguarding of airport and wider en-route operations to ensure that there are no adverse impacts on navigational aids. Navigational aids requiring protection include various instruments that provide direct guidance to aircraft and radar systems that support air traffic control. The technical safeguarding criteria for the protection of navigational aids at the aerodrome are conceptually similar to those for physical safeguarding according to the OLS. A series of "frames" of defined geometry arranged about the different types of navigational aid are identified [5] in which it is considered that new structures may potentially lead to adverse impacts on these facilities. A proposal to locate a new structure inside the frame of a navigational aid would trigger a more detailed assessment to determine whether or not the proposed new structure would, in practice, adversely affect the signals concerned.

The Aeronautical Information Publication identifies navigational aids located on the airfield at Northolt Aerodrome, a DME (distance measuring equipment) and ILS (instrument landing system). Given the distance between the site and these navigational aids, it can readily be shown that the development lies well outside the geometrical frames within which any potential for adverse impacts might be identified on the various navigational aids located at the aerodrome that provide direct guidance to aircraft.

There is also potential for interference with the effective operation of radar systems by tall buildings through the interruption of coverage and the generation of reflections that give rise to "false targets". In the current context, impacts on the H10 radar at London Heathrow Airport are a potential consideration. New buildings of a broadly similar height but closer to the radar to those currently being proposed have previously been identified by NATS, the operators of the radar, to be of potential concern. The assessment of potential radar impacts is a complex technical matter that is beyond the scope of this assessment and would need to be undertaken by the NATS if considered necessary.

However, previous experience also indicates that these impacts can generally be mitigated through software changes to the radar system, as part of a radar mitigation scheme. NATS are statutory consultees in the determination of the application and can be expected to screen the application against their standard technical safeguarding criteria and, if necessary, will undertake further detailed assessment to determine if real impacts are to be expected in practice. If NATS conclude that significant impacts may arise they can be expected to request that a condition be attached to any permission arising from the application, requiring that a radar mitigation scheme is agreed by the developer with NATS prior to commencement of construction and subsequently implemented according to an agreed timetable. This is an established approach which has previously been adopted to address the impacts of other tall building developments on radar operation and can be addressed in detail the proposed development at the reserved matters stage.

Overall, whilst it has not been confirmed whether or not any radar impacts would arise from the development proposal, it may be concluded that if there were to be any potential for adverse impacts on the operation of the H10 radar, they can be satisfactorily mitigated by an agreed radar mitigation scheme.

5 Summary and Conclusions

The proposed development has been assessed against relevant physical safeguarding criteria, intended to ensure that airspace required for safe and efficient aircraft operation is kept suitably free of obstacles and technical safeguarding criteria for the protection of navigational aids supporting aircraft operations. The assessment demonstrates that the development will have no adverse impacts on aviation interests and can therefore be considered acceptable from an aviation perspective. The key findings on which that overall conclusion is based may be summarised as follows:

1. The development site is located in the area covered by the Runway 07 approach surface and the Runway 25 take-off climb surface and where the height limits associated with the latter are marginally more restrictive. At an assumed maximum height of 82.8 m AOD, the maximum building height shown on the parameter plans supporting the application, the proposed development complies with the relevant height constraints with a minimum excess vertical clearance margin of just over 10 metres between the finished building height and the surface for the tallest element of the proposed development at its most limiting north-east corner.
2. The development site is also located in the area covered by the inner horizontal surface, a level surface at a height of 79.74 m AOD, which is infringed slightly by the tallest elements of the development. Safeguarding rules allow infringements of this surface where they can be shown not to adversely affect aircraft operations. Further assessment demonstrates that the proposed infringements are not operationally significant.
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The potential for interference with the H10 radar at Heathrow has been identified, though it has not been confirmed whether or not any radar impacts would arise in practice. Where interference is identified, it can normally be addressed by a radar mitigation scheme. NATS, the radar operators, are statutory consultees in the determination of the application and can be expected to screen the application against their standard technical safeguarding criteria and, if necessary, will undertake further detailed assessment to determine if real impacts are to be expected in practice. If NATS conclude that significant impacts may arise they can be expected to request that a condition be attached to any permission arising from the application, requiring the implementation of an agreed radar mitigation. This is an established approach which has previously been adopted to address the impacts of other tall building developments on radar operation and can be addressed in detail the proposed development at the reserved matters stage. Overall, it may be concluded that if there were to be any potential for adverse impacts on the operation of the H10 radar, they can be satisfactorily mitigated by an agreed radar mitigation scheme.

References

1 RA 3512 - Permanent Fixed Wing Aerodrome - Obstacle Environment Issue 3 https://www.gov.uk/government/publications/regulatory-article-ra-3512-permanent-fixed-wing-aerodrome-obstacle-environment
2 Annex 14 to the Convention on International Civil Aviation: Aerodromes Volume 1, Aerodrome Design and Operations, International Civil Aviation Organisation, 9th Edition, July 2022
3 CAP 168: Licensing of Aerodromes Edition 12, Civil Aviation Authority, 14 January 2022
4 UK Military AIP https://www.aidu.mod.uk/aip/aipVolumes.html
5 Civil Aviation Authority (2014) CAP 670 Air Traffic Services Safety Requirements, Version 3, including amendment 1/2014.

Appendix 1: Coordinates and maximum parameter heights for block corners

Corner location	OS coordinates		Runway aligned coordinates		Building Height (m AOD)
	Easting	Northing	X (m)	Y (m)	
A1a	506049.84	183987.88	2969.69	-432.43	72.3
A1b	506058.08	183986.21	2962.62	-427.87	72.3
A1c	506069.58	183964.01	2960.02	-403.01	72.3
A1d	506054.96	183956.66	2976.31	-401.50	72.3
A1e	506046.82	183971.88	2978.33	-418.64	72.3
A2a	506069.58	183964.01	2960.02	-403.01	77.3
A2b	506081.57	183941.27	2957.15	-377.46	77.3
A2c	506066.88	183933.62	2973.62	-375.70	77.3
A2d	506054.96	183956.66	2976.31	-401.50	77.3
A3a	506062.55	183941.91	2974.62	-385.00	67.7
A3b	506066.88	183933.62	2973.62	-375.70	67.7
A3c	506037.27	183918.09	3006.85	-372.04	67.7
A3d	506029.8	183917.66	3013.97	-374.37	67.7
A3e	506029.09	183927.18	3011.15	-383.49	67.7
A3f	506035.31	183927.49	3005.25	-381.51	67.7
A4a	506015.38	183953.97	3014.14	-413.44	74.5
A4b	506031.52	183950.9	3000.24	-404.69	74.5
A4c	506028.43	183935.97	3008.56	-391.92	74.5
A4d	506029.8	183917.66	3013.97	-374.37	74.5
A4e	506013.23	183916.58	3029.79	-379.41	74.5
A4f	506011.89	183937.07	3023.56	-398.97	74.5
A5a	506022.61	183993.11	2993.13	-447.24	81.3
A5b	506039.07	183989.97	2978.95	-438.31	81.3
A5c	506031.52	183950.9	3000.24	-404.69	81.3
A5d	506015.38	183953.97	3014.14	-413.44	81.3
B1	506009.42	183903.9	3037.96	-368.99	82.8
B2	506021.76	183901.29	3027.42	-362.06	82.8
B3	506023.11	183877.62	3034.80	-339.53	82.8
B4	505996.91	183875.98	3059.80	-347.56	82.8
B5	505995.91	183892.11	3054.84	-362.95	82.8
C1a	506016.87	183835.81	3055.87	-302.88	68.9
C1b	506027.69	183811.35	3054.72	-276.16	68.9
C1c	506012.44	183804.8	3071.31	-275.62	68.9
C1d	506000.76	183831.18	3072.56	-304.45	68.9
C2a	506013.09	183862.18	3049.77	-328.81	75.6
C2b	506016.87	183835.81	3055.87	-302.88	75.6
C2c	506000.76	183831.18	3072.56	-304.45	75.6
C2d	505996.36	183859.69	3066.25	-332.60	75.6
C3a	506059.43	183864.56	3005.75	-314.12	72.8
C3b	506067.42	183849.47	3003.82	-297.15	72.8
C3c	506026.81	183843.16	3043.93	-306.10	72.8
C3d	506024.43	183859.25	3040.28	-321.94	72.8

Corner location	OS coordinates		Runway aligned coordinates		Building Height (m AOD)
	Easting	Northing	X (m)	Y (m)	
C4a	506069.1	183838.6	3006.22	-286.42	69.4
C4b	506067.05	183810.04	3018.55	-260.58	69.4
C4c	506050.74	183811.06	3033.36	-267.48	69.4
C4d	506052.21	183836.11	3022.86	-290.26	69.4
C4SBa	506050.71	183811.06	3033.39	-267.49	63.1
C4SBb	506067.05	183810.04	3018.55	-260.58	63.1
C4SBc	506066.59	183800	3022.64	-251.40	63.1
C4SBd	506050.09	183800.97	3037.65	-258.32	63.1
C5a	506023.56	183820.81	3055.11	-286.47	59.5
C5b	506051.2	183819.23	3029.95	-274.92	59.5
C5c	506050.69	183810.1	3033.76	-266.60	59.5
C5d	506027.69	183811.35	3054.72	-276.16	59.5

Appendix 2: TOCS 25 heights and building clearance margins

Corner location	X (m)	Y (m)	Building Height (m AOD)	TOCS Height (m AOD)	Vertical margin (m)
A1a	2969.69	-432.43	72.3	91.97	19.67
A1b	2962.62	-427.87	72.3	91.83	19.53
A1c	2960.02	-403.01	72.3	91.77	19.47
A1d	2976.31	-401.50	72.3	92.10	19.80
A1e	2978.33	-418.64	72.3	92.14	19.84
A2a	2960.02	-403.01	72.3	91.77	14.47
A2b	2957.15	-377.46	72.3	91.72	14.42
A2c	2973.62	-375.70	72.3	92.05	14.75
A2d	2976.31	-401.50	72.3	92.10	14.80
A3a	2974.62	-385.00	67.7	92.07	24.37
A3b	2973.62	-375.70	67.7	92.05	24.35
A3c	3006.85	-372.04	67.7	92.71	25.01
A3d	3013.97	-374.37	67.7	92.85	25.15
A3e	3011.15	-383.49	67.7	92.80	25.10
A3f	3005.25	-381.51	67.7	92.68	24.98
A4a	3014.14	-413.44	74.5	92.86	18.36
A4b	3000.24	-404.69	74.5	92.58	18.08
A4c	3008.56	-391.92	74.5	92.74	18.24
A4d	3013.97	-374.37	74.5	92.85	18.35
A4e	3029.79	-379.41	74.5	93.17	18.67
A4f	3023.56	-398.97	74.5	93.04	18.54
A5a	2993.13	-447.24	81.3	92.44	11.14
A5b	2978.95	-438.31	81.3	92.15	10.85
A5c	3000.24	-404.69	81.3	92.58	11.28
A5d	3014.14	-413.44	81.3	92.86	11.56
B1	3037.96	-368.99	82.8	93.33	10.53
B2	3027.42	-362.06	82.8	93.12	10.32
B3	3034.80	-339.53	82.8	93.27	10.47
B4	3059.80	-347.56	82.8	93.77	10.97
B5	3054.84	-362.95	82.8	93.67	10.87
C1a	3055.87	-302.88	68.9	93.69	24.79
C1b	3054.72	-276.16	68.9	93.67	24.77
C1c	3071.31	-275.62	68.9	94.00	25.10
C1d	3072.56	-304.45	68.9	94.02	25.12
C2a	3049.77	-328.81	75.6	93.57	17.97
C2b	3055.87	-302.88	75.6	93.69	18.09
C2c	3072.56	-304.45	75.6	94.02	18.42
C2d	3066.25	-332.60	75.6	93.90	18.30
C3a	3005.75	-314.12	72.8	92.69	19.89
C3b	3003.82	-297.15	72.8	92.65	19.85
C3c	3043.93	-306.10	72.8	93.45	20.65
C3d	3040.28	-321.94	72.8	93.38	20.58

Corner location	X (m)	Y (m)	Building Height (m AOD)	TOCS Height (m AOD)	Vertical margin (m)
C4a	3006.22	-286.42	69.4	92.70	23.30
C4b	3018.55	-260.58	69.4	92.94	23.54
C4c	3033.36	-267.48	69.4	93.24	23.84
C4d	3022.86	-290.26	69.4	93.03	23.63
C4SBa	3033.39	-267.49	63.1	93.24	30.14
C4SBb	3018.55	-260.58	63.1	92.94	29.84
C4SBc	3022.64	-251.40	63.1	93.03	29.93
C4SBd	3037.65	-258.32	63.1	93.33	30.23
C5a	3055.11	-286.47	59.5	93.68	34.18
C5b	3029.95	-274.92	59.5	93.17	33.67
C5c	3033.76	-266.60	59.5	93.25	33.75
C5d	3054.72	-276.16	59.5	93.67	34.17