Aviation Impact Assessment

Bicester Aerodrome - Experience Quarter

Prepared for: Bicester Motion

Date: December 2020

Version: v1.1

Prepared by: Air Motive Limited

Disclaimer

Summary

Bicester Motion has made an application to Cherwell District Council for planning permission for the development of a portion of land at Bicester Aerodrome, known as the 'Experience Quarter'. It will be formed of a cluster of buildings that will house world-leading brands across the Motion sector with each building providing views across the aerodrome, towards the activities taking place in the air and on the tracks, visitors can engage with and partake in automotive and aviation technology.

Under an outline application to provide a location for sustainable transport product launch and demonstrations for both ground and air technology. The development will provide a centre with access to on and off-road driver training and handling tracks, along-with product demonstration zones.

Bicester Motion have asked Air Motive Limited to conduct an Aviation Impact Assessment on the proposed development, with respect to the current flying activities and runway layout at Bicester Aerodrome.

The Aviation Impact Assessment applies the logic of measuring the impact of the proposed development interaction with aviation activities at Bicester Aerodrome against the applicable regulatory guidance provided by the UK regulator – the Civil Aviation Authority. The required output is to determine if there will be any adverse impacts on aviation by the proposed development. The assessment considers the portions of the operation that will be directly affected and the most likely normal and abnormal operational scenarios for aircraft that operate from Bicester. Both public safeguarding and aviation safeguarding are considered in addition to the directly attributable effects the development could have on the Aerodrome and air operations currently undertaken.

It was found, based on analysis of the applicable guidance, to ensure the continuation of safe and sustainable aviation operations at Bicester, prior to commencement of the development that three recommendations are completed:

1. An official aerodrome safeguarding process is applied by the Aerodrome Operator, which, in consultation with the Local Planning Authority (LPA) and within their capability, will protect the environment surrounding the Aerodrome from developments and activities that have the potential to impact on the aerodrome's safe operation.
2. Permanent runway markings need to be applied at the earliest available opportunity, thus allowing the guidance to be specifically applied as a measurable means of assessment.
3. The area on the extended centreline of R34 remains substantially free of obstacles and undulation, and, sufficiently large enough to be reserved as a forced landing area.

In summary, provided these three recommendations are applied, then there is no reason why, from an aviation perspective, that the Experience Quarter would have any adverse impact on the current aviation activities at Bicester Aerodrome.

Contents

Disclaimer....2
Summary....3
Contents....4
1 Introduction....6
1.1 Background....6
1.2 Approach to Aviation Impact Assessment....7
2 Proposed Development – The Experience Quarter....8
2.1 Planning Overview....8
2.2 Buildings and Land-Use....8
2.3 Track and Demonstration zones....10
2.4 Building Heights....11
3 Aviation Operations at Bicester....12
3.1 Air Operations – Operational Principles at Bicester....12
3.2 Bicester Aerodrome Safety Management System....12
3.3 Aerodrome Runway Layout....13
3.4 Aerodrome Circuit Traffic and Joining Procedures....15
3.5 Preferential Runway System....16
3.6 Aerodrome User Responsibilities....17
3.7 Fire and Rescue Services....18
3.8 Aircraft Operations and Aircraft Types at Bicester....18
3.8.1 Aerotow Gliding Operations at Bicester....18
3.8.2 Light Vintage / Training Aircraft Operations at Bicester....19
3.8.3 Light Business Aviation at Bicester....20
3.9 Summary of Air Operations....21
3.10 Safety Considerations for Runway Design at Bicester Aerodrome....22
3.10.1 Protected Aviation Area and Public Safety....22
3.10.2 Runway Strip....22
3.10.3 Transitional Slope Surfaces....23
3.10.4 Inner Horizontal Surface....23
3.10.5 Take-off climb surface....24
3.10.6 Approach Surfaces....26

3.11 Runway Layout Summary ... 28
4 Aviation Impact Assessment ... 29
4.1 Operational Safeguarding Assessment ... 29
4.1.1 Normal Take-off Operations ... 30
4.1.2 Normal Landing Operations ... 30
4.1.3 EFATO and Other Problems during Take-Off ... 31
4.1.4 Runway Excursion ... 33
4.1.5 Turbulence encounters from the development buildings. ... 35
4.2 Assessment of Public and Aviation Safeguarding ... 37
4.2.1 Public Safeguarding ... 37
4.3 Aviation Safeguarding ... 38
4.4 Summary of Assessment Findings ... 39
5 Conclusion ... 41
6 Recommendations ... 42
6.1 Aviation Safeguarding Application to the LPA ... 42
6.2 Runway Markings ... 42
6.3 Runway 34 Forced Landing Area ... 42
7 References ... 43

1 Introduction

1.1 Background

Bicester Airfield has a history of both military and civil aviation, having played a pivotal role in training the country's pioneering aviators, hosting aircraft research & development and technical storage. Gliding has been part of the operations at Bicester with both the RAF and civil operations since the 1950's.

The airfield is now operated by the Bicester Aerodrome Company (a wholly owned subsidiary of Bicester Motion) as an 'unlicensed' airfield. Currently hosting vintage powered flight experiences, private aircraft users, flying training and gliding activity. The stated long-term vision for the aerodrome is 'to host a wide range of aviators who will demonstrate and promote aviation's past present and future bringing the history of the site to life.'

Figure 1.1.1 - View Across Bicester Airfield looking East from the disused Control Tower

Aviation infrastructure making up the airfield is centred around four mown grass runways. Specifically, runway 16/34, which are 790 metres by 50 metres and runway 06/24, which are 650 metres by 50 metres. In addition, grass taxiways and clear areas are provided for ground movements and gliding activities. Operating surfaces are uneven in places across the runway which is impacting on landing surface quality. Aircraft parking, and four hangars are located on the western side of the airfield. Maintenance activities of the airfield are focused on grass cutting in the spring and summer months.

1.2 Approach to Aviation Impact Assessment

This report considers the proposed 'Experience Quarter' development set out in section 2 and assesses the potential impact on aviation operations at Bicester Aerodrome, against the regulatory guidance provided by the UK regulator – the Civil Aviation Authority (CAA). Specifically using the quantifiable means set out in CAA document *CAP 168: licensing of aerodromes* which provides an established framework for safe aerodrome infrastructure.

This report focuses on a set of scenarios that are most likely to be adversely impacted by the Experience Quarter development. These centre around normal aircraft operating conditions: take-off and climbing, approach and landing with the requisite obstacle clearance. A set of abnormal scenarios are also considered, they are Engine Failure After Take-Off (EFATO) and emergency landing area availability immediately after take-off, runway excursion which includes overrun on take-off or landing, undershooting on landing before the runway and lateral deviations from the runway edge.

2 Proposed Development – The Experience Quarter

2.1 Planning Overview

The Experience Quarter proposed by Bicester Motion will be formed of a cluster of buildings that will house world-leading brands across the Motion sector. Each building providing views across the aerodrome, towards the activities taking place in the air and on the tracks, visitors can engage with and partake in automotive and aviation technology. The development is planned to be brought forward in the next 3-5 years. A brief overview of the technical elements of the proposal is provided.

2.2 Buildings and Land-Use

Buildings included within the development will consist of Commercial, Business and Services uses (Class E), Light Industrial (Class B2) and Local Community and Learning Uses (Class F). Building space will total 15,000m^2 for mixed-use business and leisure. Included within the demonstration zones is a 3.1km demonstration circuit, which can be configured into shorter tracks, a low friction training area, E Karting track and 4x4 tracks. Boundaries of the development are shown below:

Figure 2.2.1 The Experience Quarter application boundary, shown in conjunction with the existing runway layout at Bicester Aerodrome.

Figure 2.2.2 shows the land use and boundaries of the application considered:

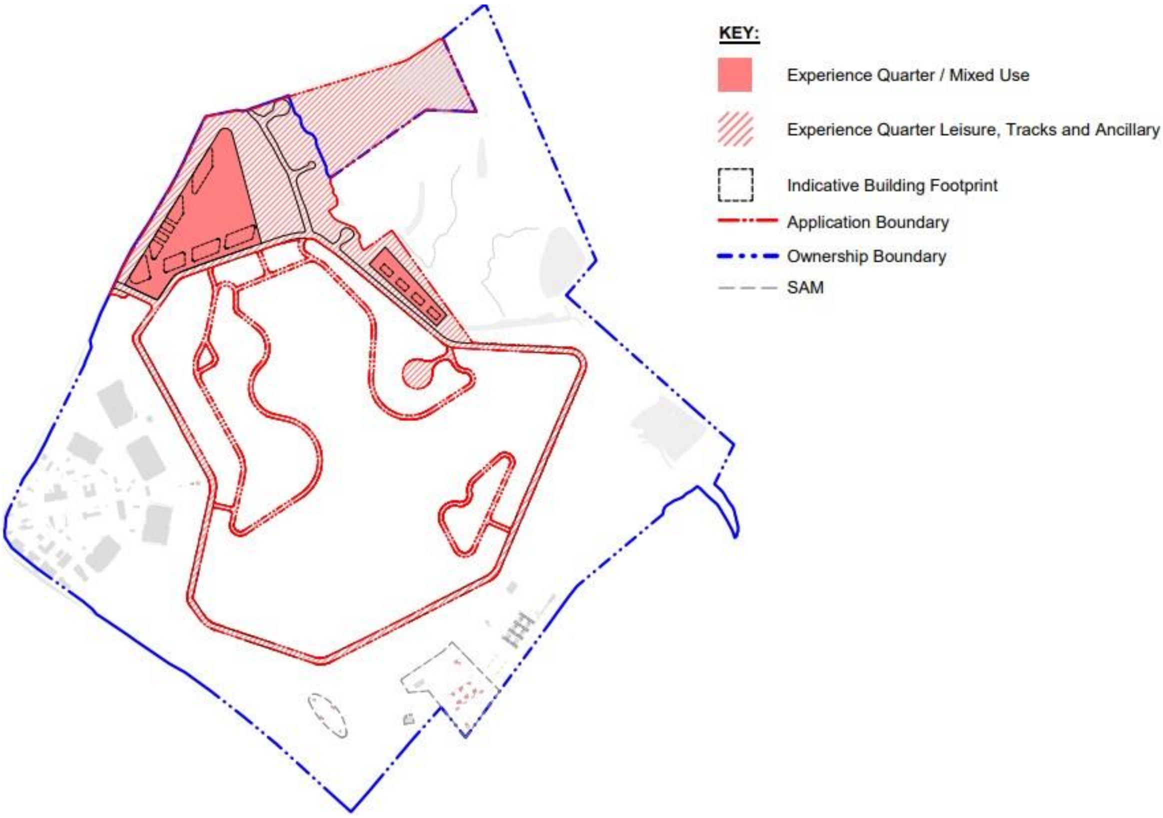


Figure 2.2.2 The Experience Quarter Development; including projected land use and boundaries.

2.3 Track and Demonstration zones

Driver training and handling track design has followed a core design principle to avoid the need for crash barriers, the majority of the aerodrome remains open and without obstructions, in some localised areas there is requirement for a 1m high grass bund to be formed to provide safety for driver and viewing safety. These have been sensitively designed in consideration of the aviation and landscape impact.

Figure 2.3.1 Airfield, Tracks Layout and Features

2.4 Building Heights

The survey of existing building height and Experience Quarter proposal is based on an aerodrome reference point at the old RAF Aerodrome control tower. The tallest building proposed is up to 10.5 metres with the tallest existing building on site the Type C hangar in the up to 20metres range. Relevant heights of buildings are shown in the diagram below/

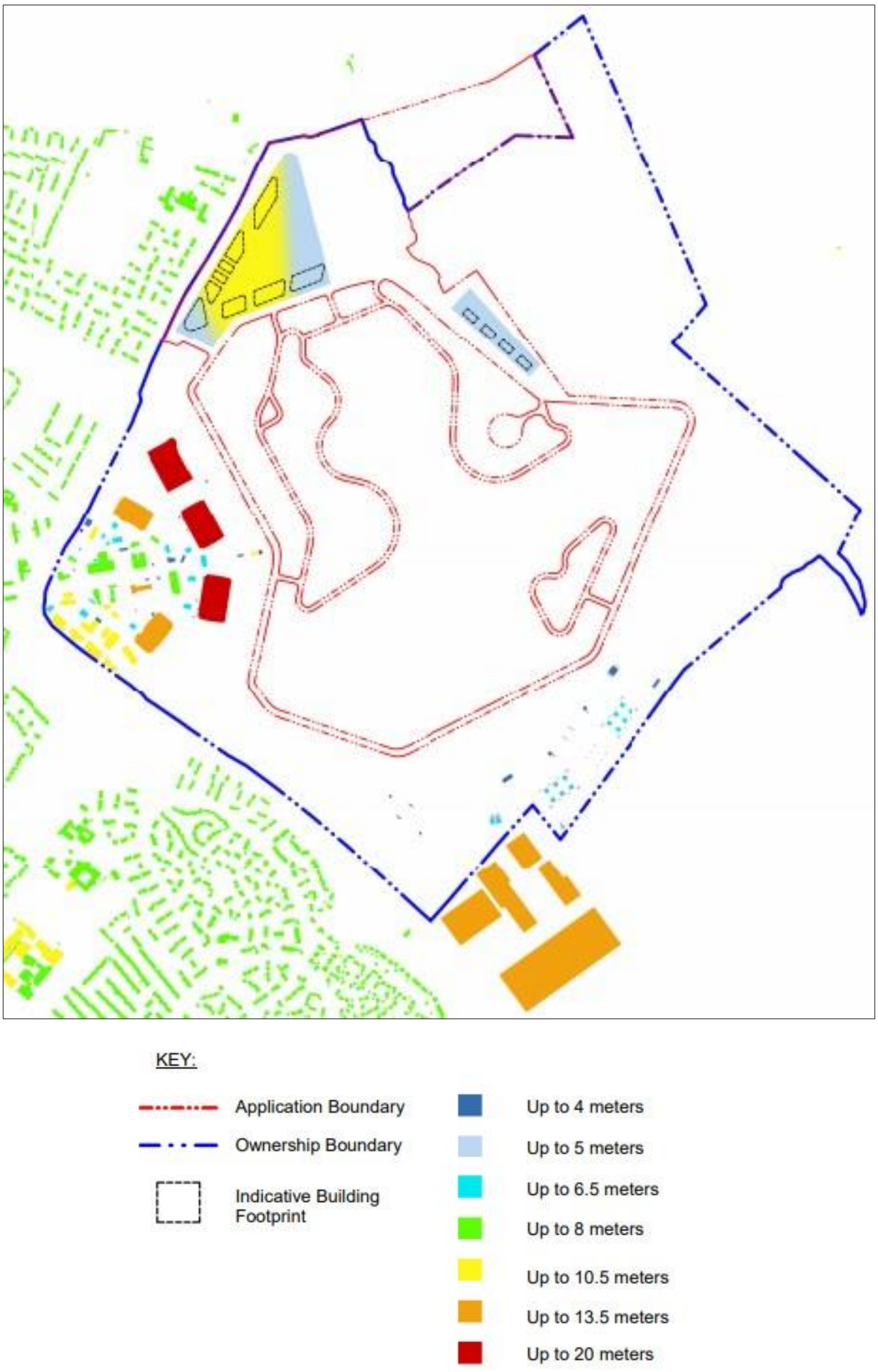


Figure 2.4.1 The Experience Quarter; with the relative height of buildings at Bicester and in the immediate surrounding area.

3 Aviation Operations at Bicester

3.1 Air Operations – Operational Principles at Bicester

The Bicester Aerodrome Company are a wholly owned subsidiary of Bicester Motion and operate Bicester Aerodrome as an unlicensed aerodrome. They operate to the standards and regulatory practices defined by the UK regulator – the Civil Aviation Authority, specifically the guidance UK CAA document *CAP 793: Safe Operating Practices at Unlicensed Aerodromes*. The design of the current runway layout has been aligned to the guidance material in *CAP 168: Licensing of Aerodromes*. This allows the application of a standardised formal approach to layout with clearly defined regulatory guidance.

Bicester operates on a multi-use basis, with defined operational procedures in place to achieve this. From an aviation perspective fixed wing powered, aerotow gliding operations and model aircraft/drone flying take place at the aerodrome. There are also automotive experience activities regularly taking place in the areas outside the designated aviation operations layout. Pilots are advised of this both in aerodrome user agreements supplied to Bicester based aircraft operators, and as a mandatory 'prior permission required' (PPR) briefing before they arrive at the aerodrome.

3.2 Bicester Aerodrome Safety Management System

An effective Safety Management System (SMS) is an organised approach to managing safety, including the necessary organisational structures, accountabilities, policies, and procedures, and forms the primary safety oversight covering the way an aerodrome manages safety. It also provides an identifiable and easily audited systematic control of the management of safety at an aerodrome. By applying lessons learned, a SMS should aim to make measurable improvements to the overall level of safety.

There are four key components to an effective SMS, and theses form the basis of the culture and make for an easy discussion forum, improvement, and promulgation of safety related agenda by the SMG:

1. Safety Policy and Objectives
2. Safety Risk Assessment
3. Safety Assurance
4. Safety Promotion

A key output of the Safety Management Group is to ensure that the aerodrome safety culture is enhanced to meet all the business and safety objectives. Changes to aerodrome procedures and activities are documented by a 'management of change' scheme, and risks are captured and reviewed in the 'Aerodrome Hazard Log', a key component of the safety culture is to mitigate operational risks both to the aerodrome users and the public, to a level considered to be 'as low as reasonably practicable (ALARP)'.

At the core of the aerodrome operation is a safety management system, as defined in the Bicester Aerodrome and Safety Management Manual. The Bicester Aerodrome Company have engaged with aerodrome user groups, aviation stakeholders and aviation advisors to form a Safety Management group (SMG), who meet quarterly.

3.3 Aerodrome Runway Layout

There are four unlicensed grass runway directions available on the aerodrome, demarcated as mown grass areas. All the runways are code 1 (visual) runways of less than 800m in length. There are parallel combined grass taxiway and glider recovery areas, increasing the cut grass width to 100m. Grass taxiways are provided around the southern perimeter and are to be utilised, with grass parking and hangarage in the South West corner. There are two windsocks, one on the Southern edge and another on the North East edge, both outside the perimeter track. The perimeter track is a separate area, and currently has a loose surface and is not suitable for taxiing aircraft.

Runway Designation	Dimensions (m)	Runway Surface	TODA (m)	LDA (m)	Lighting	Markings
06	650 x 50	Grass (cut ≈ 2"-4")	650	650	nil	nil (1)
24	650 x 50	Grass (cut ≈ 2"-4")	650	650	nil	nil (1)
16	790 x 50	Grass (cut ≈ 2"-4")	790	790	nil	nil (1)
34	790 x 50	Grass (cut ≈ 2"-4")	790	790	nil	nil (1)

Table 3.3.1 Runway dimensions, surface and features as defined for Aerodrome users.

(1) Although the runways are currently unmarked, the proposal to mark the runways has been approved by the SMG, with a view to achieving this within the remainder of 2020.

Figure 3.3.1 The aerodrome runway layout and manoeuvring areas

For the purposes of runway elevation, it is noted as being 81 metres (267 ft) above mean sea level (AMSL), based on the original RAF Bicester Aerodrome reference point, which is the centre point within the perimeter track, and is closely aligned to the centre point of R16 / 34, and the intersection of R06 / 24. The elevation varies slightly across the aerodrome with a maximum of 83 metres AMSL at the norther end of R34 /16 to a minimum of 75 metres at the Southern boundary. The distance between these points is 921 metres and the maximum longitudinal slope is calculated at 0.86%.

Runway orientation has been checked for conformity of alignment by the architectural supplier – Ridge LLP. The runway tracks are orientated to true North, and magnetic variation at Bicester is currently running at approximately 1°West. The runway orientations used are Magnetic tracks, that are within +/- 5° magnetic track of the nominated runway orientation. This aligns with standard aviation practice, giving the pilot the same view as depicted on an aeronautical chart, and that the aircraft magnetic orientated compass aligns with the runway.

3.4 Aerodrome Circuit Traffic and Joining Procedures

The aerodrome joining procedures are defined for all users and for visiting pilots, the information is also promulgated by third party aviation guides. Pilots are requested to join overhead at 2000' above airfield level (AAL). This reduces noise to the local area and allows the pilots time to orient and integrate with the existing circuit traffic, as well as having height in hand above the aerodrome to afford them the most opportunity to safely effect an emergency landing in the event of an engine failure.

Runway	Circuit Direction	Circuit Height	Notes
06	Left Hand Pattern	800' AAL	240m Clearway with a Displaced Threshold. Curved final approach to avoid Bicester Town & Caversfield village.
24	Right Hand Pattern	800' AAL	Engine failure after take-off emergency landing options are severely limited. Early right turn to avoid Bicester Town.
16	Left Hand Pattern	800' AAL	**Preferential Runway.** Avoid Stratton Audley & Launton Village.
34	Right Hand Pattern	800' AAL	**Preferential Runway.** Avoid Stratton Audley & Launton Village.

Table 3.4.1. Fixed Wing Operations – fixed wing aircraft circuit procedures.

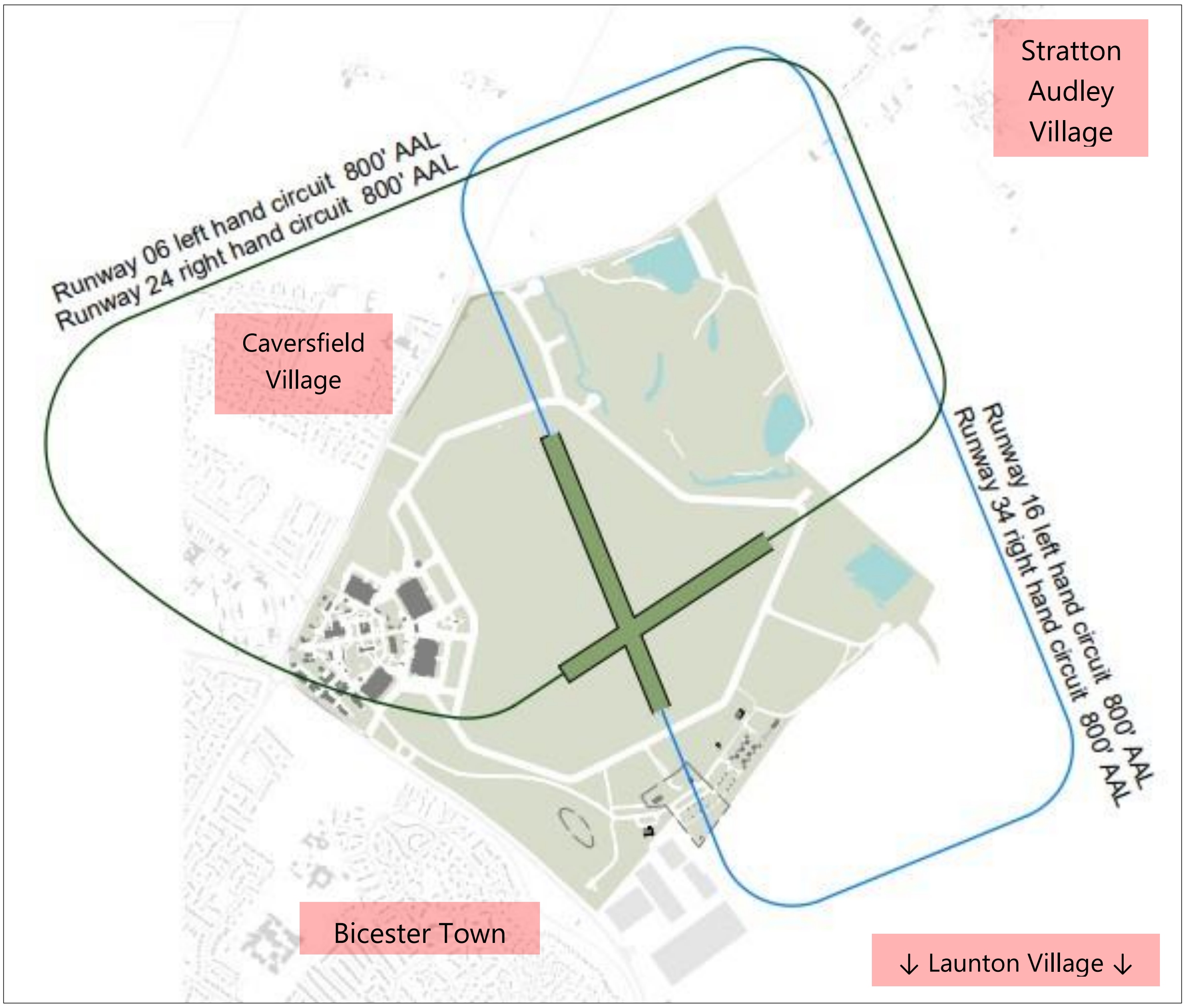


Figure 3.4.1 Aerodrome Circuit Patterns with Noise Sensitive Areas Highlighted.

3.5 Preferential Runway System

The purpose of using a preferential runway system is to allow most of the aerodrome traffic to operate in areas that offer to optimise the noise abatement routes and keep the overflight of the local urban habitation to a minimum. Thus, in doing so the risks posed to pilots in the event of an emergency landing following an engine failure are reduced to a minimum.

Runways 16 & 34 are preferential for utilisation, at the discretion of the aircraft commander, for most aircraft types in weather conditions up to 10 knots (18.5 km/h) of crosswind. At any greater wind speed Runway 06 & 24 become favourable, with improved into wind take-off and climb gradients being achievable. The majority of aircraft movements take place on R16/34, including aerotow gliding and training flights. The most likely users of R06/24 are the vintage aircraft users whose machinery is generally less manageable in crosswind conditions.

Wind speed and direction has been analysed and taken into consideration as it often predicates the runway direction. The majority of UK general aviation happens in the summer months between March and October, which best suits most of the machinery and licencing privileges of most general aviation pilots. During this period, the wind speed has an average of 18.5 km/h (10 knots) or less.

Wind speed at Bicester is based on an hourly average wind vector (speed and direction) at *10 metres* above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

The average hourly wind speed in Bicester experiences significant seasonal variation over the course of the year. The windier part of the year lasts for 5.6 months, from 11 October to 30 March, with average wind speeds of more than 18.5 kilometres per hour. The windiest day of the year is 3 January, with an average hourly wind speed of 21.3 kilometres per hour.

The calmer time of year lasts for 6.4 months, from 30 March to 11 October. The calmest day of the year is 26 July, with an average hourly wind speed of 15.6 kilometres per hour.

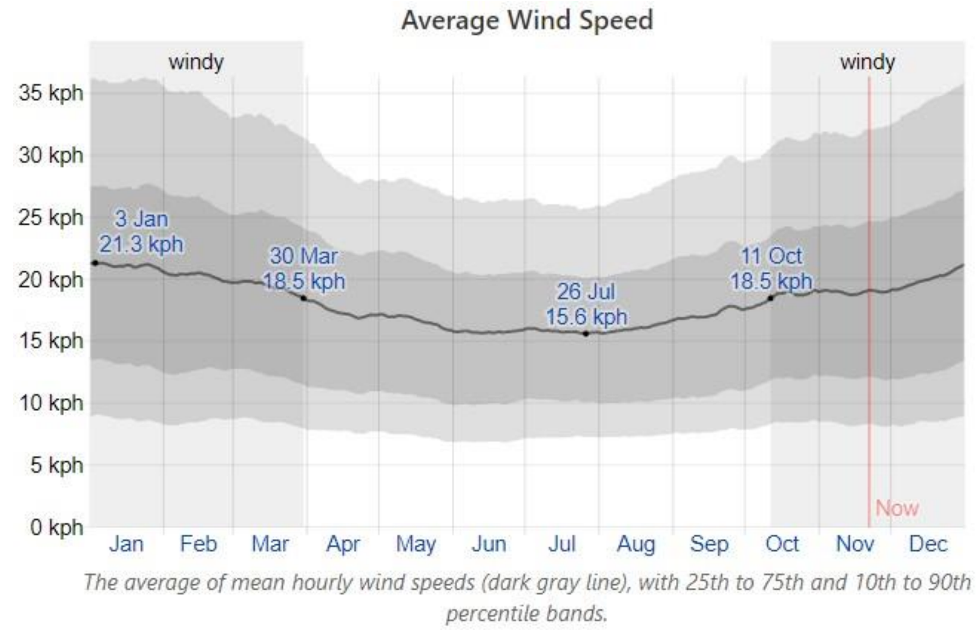
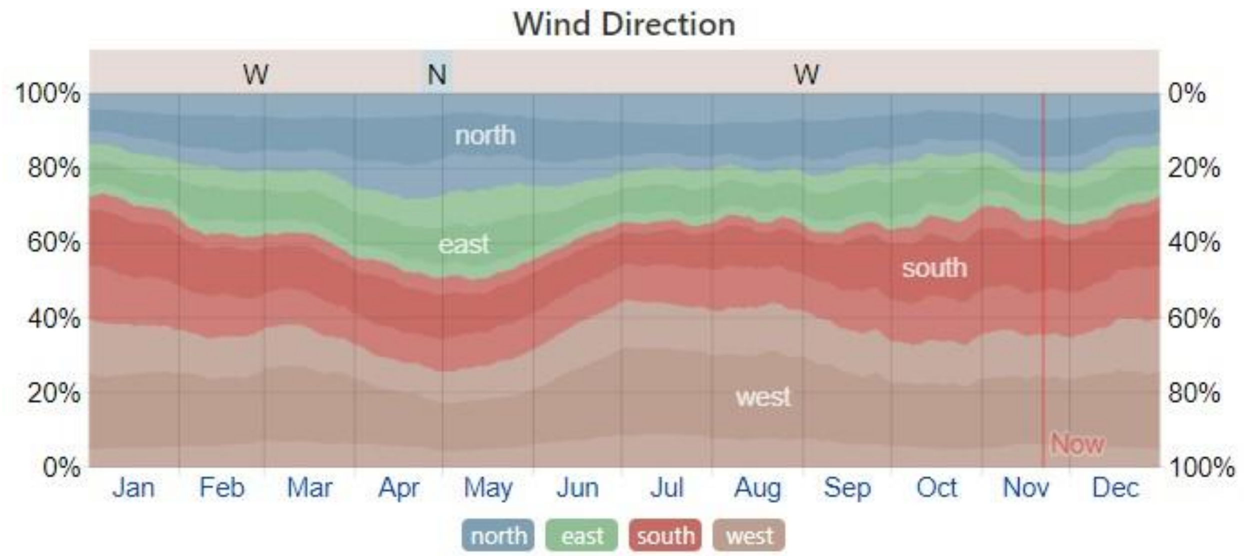


Figure 3.5.1. Wind speed at Bicester. Data supplied by www.weatherspark.com

The predominant average hourly wind direction in Bicester varies throughout the year.

The wind is most often from the north for 1.6 weeks, from 23 April to 4 May, with a peak percentage of 28% on 24 April. The wind is most often from the west for 12 months, from 4 May to 23 April, with a peak percentage of 40% on 1 January.



The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 1.6 kph*. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).*

Figure 3.5.2. Wind direction at Bicester. Data supplied by www.weatherspark.com

3.6 Aerodrome User Responsibilities

The policy is for all flying operations at Bicester Aerodrome to comply with the rules of the air. It is the responsibility of the aircraft commander to ensure that they are conversant with, and conform to, the rules of the air within the airspace, and aerodromes, that they operate. For reference pilots are advised to check and comply with the *UK CAA CAP 393 - Air Navigation: The Order and Regulations* and *EASA Standardised European Rules of the Air (EC No. 923/2012) (SERA).*

Pilots should be aware of the performance characteristics of their aircraft and ensure the aerodrome dimensions and operating practices are appropriate and proportionate for their proposed activity.

3.7 Fire and Rescue Services

There are no fire or rescue services available on site. Fire and rescue services are provided by the local emergency response services, and they have been briefed on access and operational procedures at Bicester by the Aerodrome Manager.

Training can only take place if adequate risk assessments have been carried out, and training organisations provide the additional requisite ground support as defined in *CAP 793: Safe operating Practices at Unlicensed Aerodromes*. The aerodrome operates a basic 'Emergency Response Plan' as defined in the Aerodrome Operations and Safety Management Manual, which is initiated in the event of an emergency, with a formalised process for safety and incident reporting.

3.8 Aircraft Operations and Aircraft Types at Bicester

All the current types of operation at Bicester are considered when considering the regulatory guidance to the runway layout. For each distinctly different type of operation we have considered some of the most common aircraft types in operation at Bicester, and their relative performance characteristics. This allows a case-by-case analysis to ensure that the safety margins afforded by the runway layout and safeguarding areas give practicable use, and that wherever possible the risks associated with a given type of operation are reduced.

When considering the scope of air operations, the relative performance of the powered flight options currently available, in terms of take-off distance required (TODR) and landing distance required (LDR) performance is considered. Please note that the operating weight and atmospheric conditions have a significant effect on the performance of any aeroplane.

3.8.1 Aerotow Gliding Operations at Bicester

The aerodrome gliding operations are aerotow only, whereby a glider is towed to height by a tug aircraft. Where possible the gliding operations will utilise the additional mown grass taxiway/glider recovery area. These are parallel to the runways, as shown on the aerodrome layout. There is a resident glider stakeholder group at Bicester which operate a single tug aircraft and around eight high performance gliders, with a likelihood of this increasing to twenty gliders in 2021.

Figure 3.8.1.1 High performance glider

Recommended minimum TODR/LDR (dry level grass) for Glider Tug (Aerotow) Aircraft. Data supplied by British Gliding Association for typical two seat aerotow tug aircraft towing glider:

Aerotow tug glider aircraft TODR on tarmac = 150m, x wet grass factor (1.3) = 195m, x 2% uphill factor (1.2) = 234m, x ASK21 factor (2.0) = 468m, x Safety Factor (1.33) = **622m TODR**
Landing distance required without glider is **LDA ≤ 400m**
Typical climb gradient during aerotow operations 1:20 (5%) and a typical high-performance glider such as used at Bicester can achieve a glide ratio of between 25:1 (4%) and 60:1 (2%), or 6:1 (17%) with speed brakes deployed for approach and landing.

3.8.2 Light Vintage / Training Aircraft Operations at Bicester

There are a good number of privately owned vintage aircraft operating at Bicester, and the Tiger Moth is typical of this genre. There is also an aviation stakeholder that has been operating at Bicester for several years with several Tiger Moth aircraft, principally delivering air experience flights and flight training. Other operators conduct more advanced tailwheel training and aerobatic training in more modern certificated aircraft types with better performance characteristics.

Performance at maximum operating weights:
DeHavilland 82 Tiger Moth TODR **400m** / LDR **320m**
Typical climb gradient 1:15 (7%) with a typical glide ratio 8:1 (12%)
Conditions: ISA day, 50’, dry grass (factored 1.15 take-off/1.2 landing), no wind, no slope.

Figure 3.8.2.1. DH 82B – Vintage experience flights / vintage training Aircraft

Cessna 152 Texan Tailwheel TODR **532m** / LDR **365m** (Performance at maximum operating weights)
Typical climb gradient 1:11 (9%) with a typical glide ratio of 10:1 (10%)
Conditions: ISA day, 50’, dry grass (factored 1.15 take-off/1.2 landing), no wind, no slope.

Figure 3.8.2.2. Cessna 152 Texan Tailwheel – ab initio / tailwheel training aircraft

Avions Mudry CAP10B TODR **457m** / LDR **486m (**Performance at maximum operating weight)
Typical climb gradient 1:6 (16%) with a typical glide ratio of 10:1 (10%)
Conditions: ISA day, 50’,dry grass (factored 1.15 take-off/1.2 landing), no wind, no slope.

Figure 3.8.2.3. Avions Mudry CAP10B – Aerobatic training aircraft

3.8.3 Light Business Aviation at Bicester

There have been a number of movements in certificated light (private category) business aircraft at Bicester in recent years, and the current runway dimensions cater for the operational considerations typical of these types, and the activity they are engaged with. It should be noted that this type of operation would be strictly limited to runways 16 / 34, whereby the maximum runway length and improved safeguarding associated with the take-off climb and approach obstacle limitation surfaces provide the greatest safety margin.

Pilatus PC12 NG (-800lbs payload) TODR **748m** / LDR **756m** (Performance at typical operating Weights and without reverse thrust)
Typical climb gradient 1:7 (15%) with a typical glide ratio of 15:1 (7%)
Conditions: ISA day, 50', dry grass (factored 1.15 take-off/1.2 landing), no wind, no slope.
Certificated for grass field operations with typical operational weights considered.

Figure 3.8.3.1. Pilatus PC-12 Light Business Aircraft – European range / 6 seats

Cessna 421C Golden Eagle (-600lbs payload) TODR **778m** / LDR **766m** (Performance at typical operating weights)
Typical climb gradient is 1:7 (15%) all engines operating, and glide ratio is negligible due twin engine performance.
Conditions: ISA day, 50', dry grass (factored 1.15 take-off/1.2 landing), no wind, no slope.
Certificated for grass field operations with typical operational weights considered.

Figure 3.8.3.2 Cessna 421C Golden Eagle light business aircraft – European range / 6 seats

3.9 Summary of Air Operations

All the types of aircraft flown at Bicester offer a suitable amount of performance to operate within the described runway layout, and the TODA and LDA are adequate to meet their needs. The climb gradients achievable are all ≥5%, which satisfies the climb requirements expected of an Obstacle Limitation Surfaces (OLS) at a code 1 runway, as described in *CAP 168*.

3.10 Safety Considerations for Runway Design at Bicester Aerodrome

3.10.1 Protected Aviation Area and Public Safety

It is good practice that the area around the runways have protected surfaces within which no obstacles are permitted. This is principally to safeguard the Bicester Airfield community, local community, and the public. The further necessity is to give the pilot a reasonable margin of safety in terms of known obstacle clearance to ensure their aircraft has adequate performance to operate at a given aerodrome. These areas are referred to as protected areas and protected slopes.

A form of pedestrian barrier will be introduced in order to segregate the public / pedestrians from accessing airside operations on the aerodrome.

In the design of the runway layout The Bicester Aerodrome Company have considered the following items, as defined in the *UK CAA CAP 168, 738 & 793* regulatory guidance material.

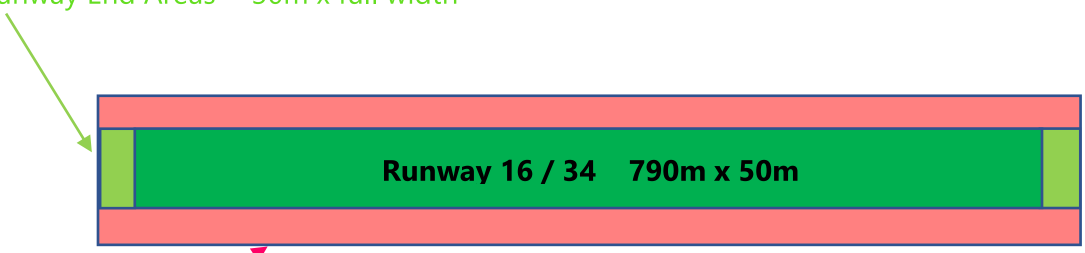
3.10.2 Runway Strip

The runway strip is the area enclosing the runway, the purpose of which is to provide a graded area clear of all obstacles except permitted aids to navigation, to protect aircraft inadvertently running off the runway, or flying over during landing or take off.

The runway strip at Bicester are Code 1 runway (visual) runways, and they extend 30m beyond each end of the runway, in addition to a minimum clear and graded area (CGA) width from each runway edge, of 30m. The minimum requirement for a code 1 runway being 21m from the runway edge. These required areas are there to reduce the risk of damage to an aeroplane running off the runway.

At Bicester Aerodrome the whole of the runway area is clear of obstacles. The runways are demarcated by the mown grass areas, and provision is in place to lay down runway markings, Bicester Aerodrome Company have scheduled this for completion by the end of 2020. The chalk markings will conform to the sizing guidance in *UK CAA CAP 168: Licensing of Aerodromes*. The chalk markings are to be recessed into the surface, which remains flush, thus, minimising the risk of collision with a fixed obstacle, particularly important given the regular use of Aerotow Gliding and vintage tailwheel aircraft that operate at Bicester.

Runway End Areas = 30m x full width



Clear and graded areas = 30m width x full length (incl. end areas)

Figure 3.10.2.1 Runway 16 / 34 at Bicester is shown, with the requisite end areas and CGA applied.

3.10.3 Transitional Slope Surfaces

The purpose of the transitional surface is to define the limit of the area available for buildings, other structures or natural obstructions, such as trees.

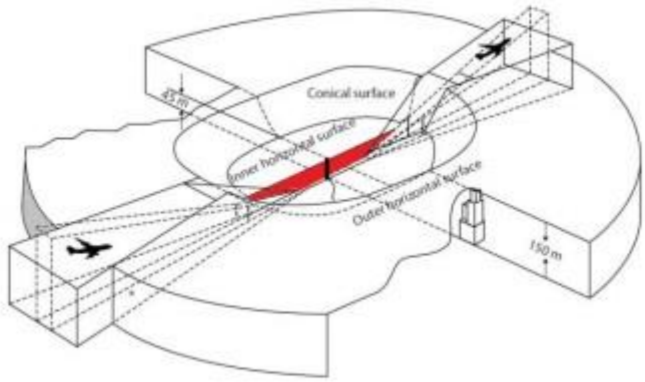


Figure 3.10.3.1 Transitional slope surface illustration (UK CAA CAP 168/738)

These surfaces consist of a plane beginning at ground level along the edges of the runway strip and increasing in height with increasing distance away from the strip edge and at right angles to the runway centreline until it reaches a height of 45m. The gradient slope is 1:5 (20%). All buildings, structures and parked aircraft must remain below this gradient. The clearance given by the gliding runway width ensure this is enough. The runways are positioned more than 150m from the highest building (existing C type hangar at ≤20m), which are adequate.

3.10.4 Inner Horizontal Surface

The purpose of the inner horizontal surface is to protect airspace for visual manoeuvring prior to landing.

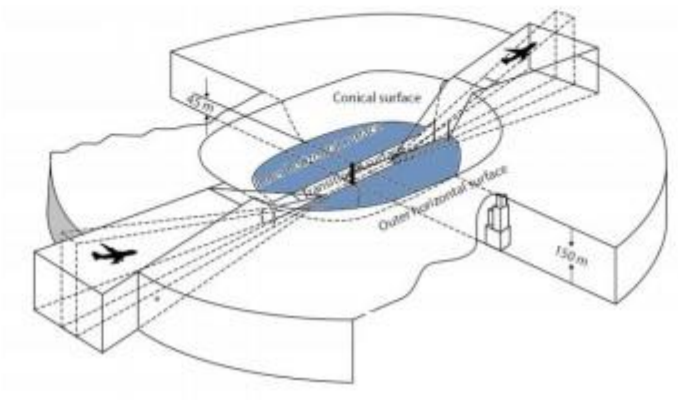


Figure 3.10.4.1 Inner horizontal surface illustration (UK CAA CAP 168/738)

The inner horizontal surface is a horizontal plane located 45m above the lowest runway threshold elevation and extends (for Code 1 Visual runway) to 2,000m radius of the mid-point of the main runway. It represents the level above which consideration needs to be given to the control of new obstacles and the removal or marking of existing obstacles and its purpose is to ensure safe visual manoeuvring of aeroplanes in the vicinity of the aerodrome. The aerodrome survey and aeronautical charts of the local areas shows it to be compliant with no buildings higher than 45m.

Figure 3.10.4.2. The inner horizontal surface has been surveyed by Ridge to a radii of at least 1000m. The highest noted obstacles are the 'C type' hangars on the aerodrome at a maximum of ≤20m.

The UK CAA 1:250000 scale Aeronautical Chart denotes there are no significant obstacles to present a significant hazard to aviation within a radii of at least 2000m. This is the primary source of navigational data for pilots, operating under visual flight rules within UK airspace.

3.10.5 Take-off climb surface

A take-off climb surface is an inclined plane located beyond the end of the take-off run available or the end of the clearway where one is provided and is established for each runway direction intended to be used for take-off.

These surfaces begin at the end of the runway strip and extend away along the centreline for a distance of 1600m, diverging by 10% each side of the extended centreline. The gradient slope of the surfaces is 1:20 for a code 1 runway. No obstacles are permitted to penetrate these surfaces, plus, an additional 60m beyond the end of the runway. This is the most significant factor in runway layout at Bicester. For example, a building positioned at within the take-off climb surface, at 10m in height, requires the runway end to be at least 260m distant.

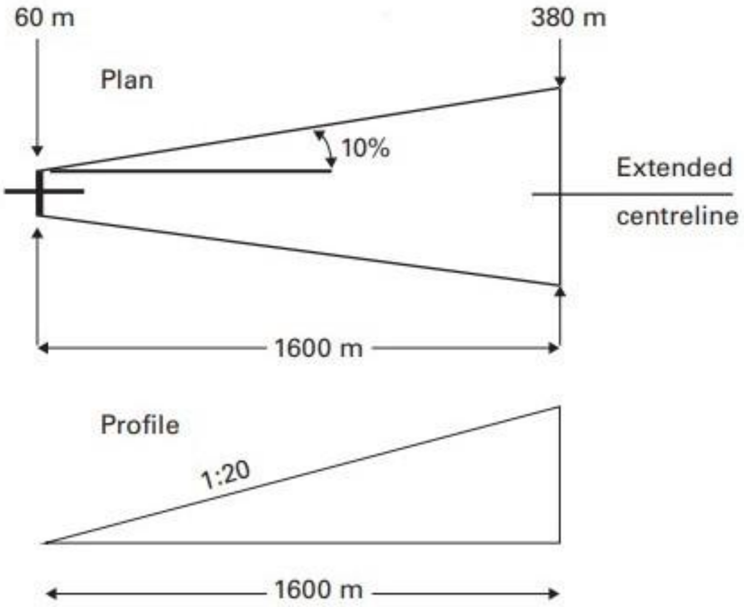


Figure 3.10.5.1 The take-off climb surface plan view dimensions, and applicable profile gradient for a code 1 (visual) runway. (UK CAA CAP 168)

Code number	3 or 4	2	1
Length of inner edge	180 m	80 m (1)	60 m (2)
Distance of inner edge from end of take-off run (TORA) (3)	60 m	60 m	30 m
Divergence (each side)	12.5%	10%	10%
Final width	1200 m (4)	580 m	380 m
Length	15000 m	2500 m	1600 m
Slope	2% (1:50)	4% (1:25)	5% (1:20)

1 & 2. Where clearway is provided, the length of the inner edge should be 150 m.

3. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.

4. When the intended track includes changes of heading greater than 15°, the final width of the take-off climb surface for runways where the code number is 3 or 4 is increased to 1800 m.

Table 3.10.5.1 Take-off climb surface requirements (highlighted) table detailing a code 1 (visual) runway. (UK CAA CAP 168)

3.10.6 Approach Surfaces

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

These surfaces begin at the end of the runway strip and extend away along the centreline for a distance of 1600m, diverging by 10% each side of the extended centreline. The gradient slope of the surfaces is 1:20 for a code 1 runway. No obstacles are permitted to penetrate these surfaces, plus, an additional 60m beyond the end of the runway.

This is the most significant factor in runway layout at Bicester, and the runways are arranged to negate this, by not being directed so the extended centrelines, and thus take off and approach flight paths would pass over/through them. For example, if the runways were directly aligned with an existing building, some of which are 10m in height, then the runway end would need to be at least 260m distant.

Table 3.10.6.1 Code 1 (visual) runway requisite approach surface dimensions. Data from CAP168.

	Precision instrument approach runways		**Non-precision instrument approach runways**		**Non-instrument runways**			
	Code number		**Code number**		**Code number**			
	3 or 4	**1 or 2**	**3 or 4**	**1 or 2**	**4**	**3**	**2**	**1**
Length of inner edge	280 m*	150 m	280 m*	150 m	150 m	150 m	80 m	60 m
Distance before threshold	60 m	60 m	60 m	60 m	60 m	60 m	60 m	30 m
Divergence each side	15%	15%	15%	15%	10%	10%	10%	10%
Length of first section	3000 m	3000 m	3000 m	2500 m	3000 m	3000 m	2500 m	1600 m
Slope of first section	2% (1:50)	2.5% (1:40)	2% (1:50)	3.33% (1:30)	2.5% (1:40)	3.33% (1:30)	4% (1:25)	5% (1:20)
Length of second section	3600 m	2500 m	3600 m					
Slope of second section	2.5% (1:40)	3% (1:33.3)	2.5% (1:40)					
Length of horizontal section	8400 m	9500 m	8400 m					

* The length of the inner edge may be reduced to 210 m for a runway where the LDA falls into the lower third of code number 3, and where, in the opinion of the CAA, such a reduction is compatible with the use made of the runway.

Figure 3.10.6.2 Runway layout with 1:20 gradient take off climb surfaces, and the approach surfaces, highlighted in red, diverging by 10%, with a minimum inner end width of 60m.

Runway 06 incorporates a 240m clearway at the Western end. Thus, as mandated in CAP 168, the inner end of the surface is increased to 150m width at the end runway 06.

3.11 Runway Layout Summary

Since its inception in the early 20th century, the build-up of urban habitation in the local area has severely compromised the runway orientation options available. The aerodrome can no longer be considered 'omni-directional', with only a limited number of uncompromised runway orientations remaining available. These are the ones currently utilised at Bicester, as described.

The physical characteristics and operating standards should provide a safe operational environment with long term capability in terms of accessibility to different aircraft types able to access, and the spectrum of both existing and future air operations available.

The take off and approach surfaces have been applied and checked for conformity of the OLS by the architectural supplier – Ridge LLP. When the current runway layout was integrated with a parametric mode l of the site, including the proposed 'Experience Quarter' development, the requisite take-off climb and approach surfaces were confirmed as obstacle free.

When all safety factors are fully considered, both in terms of the regulations, and as the safest operating practice with the primary runway R16/34, positioned as far to the East as possible. This also significantly enhances safety considerations; reduced aircraft noise within the local habited areas, enabling the maximum distance from the hangar buildings which would likely produce turbulent air that could affect the otherwise smooth airflow expected over a runway surface and enabling a significantly longer TODA/LDA for R16 / 34 with uncompromised OLS, thus facilitating the compliment of aircraft currently operating at Bicester.

4 Aviation Impact Assessment

4.1 Operational Safeguarding Assessment

This safeguarding assessment has sought to determine the extent to which the proposed Experience Quarter development may adversely impact operations at Bicester Aerodrome by consideration of normal take-off and landing operations and a set of reasonably foreseeable non-standard operations and fault conditions.

The following desirable operational states have been considered in detail, along with the undesirable operational states which cover the reasonably foreseeable non-standard operations and fault conditions:

1. Normal take-off and normal landing.
2. Engine failure after take-off (EFATO) and other problems during take-off.
3. Runway excursion:
    - Undershoot on landing.
    - Overrun during either take-off or landing.
    - Lateral deviation from the runway edges.
4. Turbulence encounters from the development buildings.

Runway excursions are the most common type of accident for aircraft, both private and commercial, worldwide. Runway excursions account for 23% of all aviation accident/incidents *(ICAO – runway excursion statistics*). As such, with these being the most common reasonably foreseeable incidents, the need to be mitigate in the environment around an aerodrome requires attention.

There are a wide variety of other incident and accident scenarios could be identified, but, they are generally not likely to occur in the immediate vicinity of an aerodrome or be associated with take-off and departure or approach and landing, thus it may not be practicable to seek to accommodate all of them. The focus in this assessment has therefore been on these more common scenarios, together with normal operations. In practice, impacts associated with runway excursion scenarios are not expected to be significant but given their propensity it has been considered. Finally, turbulence caused by new development is identified as a potential impact that may merit some consideration.

To identify relevant operations that might potentially be adversely impacted by the proposed development, reference has been made to figure 3.10.6.2 to identify flight paths closest to the Experience Quarter site. Specific operations that require assessment have been identified:

- Take-off in the Runway 34 direction
- Landing in the Runway 16 direction

4.1.1 Normal Take-off Operations

When considering the scope of air operations at Bicester, it is reasonable to assume and is expected of Bicester Aerodrome users, that the aircraft commander will ensure the performance available is suitable, given the conditions on the day. They will have established that the aircraft take-off distance required (TODR) is less than the take-off distance available (TODA). For Runway 34 take-offs this is 790m. Thus, once airborne, and safely accomplishing a safe flying speed (known as the Take-Off safety Speed) they can climb away at a relatively constant angle and accelerate to the best rate of climb speed (Vy). Wherever possible the flight path to at least 500'AAL will be straight ahead, and in normal practice no track change >30° is recommended as this is detrimental to the aircraft climb performance.

The climb gradient is assumed to be at least a 1:20, or a 5% climb percentage. The operational suitability of aircraft described in section 3.8 shows this is clearly achievable by all types operating at Bicester.

The optimal take-off flight path will be clear of obstacles, and also ensure any obstacles are below the 1:20 (5%) take off climb surface defined in the *UK CAA CAP168* guidance, and applied at Bicester as per section 3.10.5 of this document. The runway orientations, and their extended centrelines are straight, and clear of the proposed Experience Quarter developments, as depicted in figure 3.10.6.2. Even in the unlikely event an aircraft significantly deviated from the take-off flight path in a left climbing turn, then the top height of the closest roof to the departure track/extended centreline of the development is 5 metres in height, with the take-off climb surface passing overhead at 5.8 metres.

4.1.2 Normal Landing Operations

Safe landing technique requires a stabilised approach to be flown. Stabilised is described as descending at a relatively constant rate of descent with a constant angle toward the landing runway, with a clearly identifiable aiming point. The required angle of approach must have sufficient vertical clearance margin between the approach path and obstacles along it for the risk of collision to be entirely negligible and an adequate length of runway in which the aircraft can come to a complete stop. Again, this descent gradient is assumed to be a minimum of 1:20, or 5%, which is approximately a 3° approach angle. This is the absolute minimum angle used in practice. Typically, light aircraft approach at between 4° and 5° angle.

Once again, it is reasonable to assume, and is expected of Bicester Aerodrome users, that the aircraft commander will ensure the performance available is suitable, given the conditions on the day. They will have established that the aircraft landing distance required (TODR) is less than the take-off distance available (TODA). For Runway 16 landings this is 790m.

Safe landing distance requirements for specific, certificated aircraft, are typically defined in aircraft operating manuals in terms of both the distance required from a height of 50 ft and the length of the landing roll after aircraft have touched down. These are quoted for the majority of Bicester based aircraft in section 3.8 of this document.

The optimal approach path will be clear of obstacles, and ensure any obstacles are below the 1:20 (5%) approach surface defined in the *UK CAA CAP168* guidance and applied at Bicester as per section 3.10.6 of this document. The runway orientations, and their extended centrelines are clear of the proposed Experience Quarter developments, as depicted in figure 3.10.6.2. Even in the unlikely event an aircraft significantly deviated from the approach flight path to the right on landing, once again the top height of the closest roof to the departure track/extended centreline of the development is 5 metres in height, with the approach surface passing overhead at 5.8 metres.

A consideration which requires discussion is the aerotow glider operations. When the aerotow tug aircraft lands it is trailing a dyneema® or steel rope tow line, to a length of up to 50 metres. With this tow line dangling it is important that the approach remain clear of obstacles. In this instance the 5% gradient may not be sufficient based on the R16 marked threshold. The aerotow pilot could well 'land long', meaning they aim to touch down at an imaginary threshold, or prominent abeam feature or additional marking, at 200-300 metres beyond the marked runway threshold aiming point. Another technique that could prevent compromising the approach surface would be to land on another runway, any of R06, R24 and R34 are within controlled areas and available without any buildings or likelihood of the public being in the immediate vicinity.

Mitigation of this form would require briefing and training by the aerotow operation, with discussion and risk assessment by the safety management group. Where required the risk would be added to the 'Aerodrome Hazard Log' by the aerodrome manager, with mitigation procedures detailed and promulgated to the aerodrome user group and visiting PPR aircraft.

4.1.3 EFATO and Other Problems during Take-Off

Engine failure after take-off (EFATO) is an undesirable, but relatively common fault on light aircraft with reciprocating piston engines. Most of the aircraft types used at Bicester are single engine piston types, and engine failure will lead to a forced landing.

Considerable attention is paid to this during pilot training, ensuring piloting technique is optimised to aid the best possible outcome – which is to effect an emergency landing without injury and minimal damage to the aircraft or any third party. Ideally the pilot must glide and land in the area directly ahead, without having to initiate a turn through a track change of greater than 30°. Historical incident and accident record indicate that crashes into light vegetation and open land with only mild undulation are often easily survivable from the pilot's perspective. Survivability in the event of collision with buildings and significant obstacles and undulation can generally be expected to be lower.

Other problems on take-off during glider aerotow launch, for example tow rope failure or other problems with tow rope management, may also lead to a requirement for a forced landing by the glider. Again, the same predicament requires the pilot must glide and land in the available area ahead.

For pilots undertaking multiple take-off operations per year, the probability of involvement in a forced landing incident must be considered tolerable, but only if the risk can be mitigated be ensuring reasonably suitable areas exist to conduct an emergency landing following EFATO. Provided these open areas exist then the risk is manageable.

To mitigate this risk, the most important requirement for the operating environment at Bicester Aerodrome is to provide opportunities for safe forced landing in the form of open and substantially obstacle free areas along the take-off flight path. It is therefore important to demonstrate that the proposed Experience Quarter development would not lead to a substantial loss of open land directly ahead of R34 that currently serves as a potential safe forced landing area, recognising that a substantial proportion of take-off operations make use of the R34 direction.

Figure 4.1.3.1. Runway 34 take-off flight path, with a suitable emergency landing area highlighted in red.

An effective safe forced landing area which is substantially free of obstacles and sufficiently without undulation to accommodate an emergency aircraft and the glider under tow is ideally required along the take-off path. Figure 3.10.6.2 showing the OSL take-off climb surface, and the Experience Quarter buildings are to remain to the west of the highlighted area, thus mitigating the risk. The area shown above in figure 4.1.3.1 gives an indication as to the area , within which portions would be required for an emergency landing to be effected following EFATO.

4.1.4 Runway Excursion

Overrun

Overrun is a reference to runway operations in which aircraft runs off the end of the runway on the ground. Overrun may occur on take-off following an aborted take-off or landing and failing to slow sufficiently be the far end. This is as a relatively common type of runway excursion scenario, for which the associated risks can be effectively mitigated by ensuring that a safety buffer of obstacle free space is available beyond the runway.

The Runway 34 take-off overrun incorporates a 30m runway end area for this reason. Beyond the 30 metres runway end area there is approximately 70 metres of clear and graded area before the perimeter track.

Runway 16 landing overrun incorporates a 30m runway end area. Beyond the 30 metres runway end area there is approximately 30 metres of taxiway, clear and graded, before the perimeter track.

The take-off distance and landing distance requirements for aircraft operating at Bicester Aerodrome indicate the TODA and LDA should be more than adequate during normal take-off and landing operations. The distances available will typically exceed the requirements by a sufficient margin to provide an adequate buffer to contain reasonably foreseeable overruns within the operational area of the airfield.

Undershoot

Undershoot is a reference to incidents whereby an aircraft fails to reach the runway or other intended landing area during approach and touchdown before the intended location. In terms of runway excursion this is a relatively common incident scenario and is of particular concern for glider operations – while there is the ability to increase the rate of descent and approach angle with speed brakes, there is no power available to correct for circumstances in which pilots have inadvertently found themselves too low in the approach to reach the airfield.

It is standard practice at runways with markings for aircraft to aim to cross the landing threshold at an appropriate safe height (nominally 50 ft, at recommended and calculated using the aircraft Pilot Operator Handbook) and to touchdown some distance beyond the threshold. Aiming for a touchdown point some distance beyond the threshold provides a safety margin in respect of landing short or undershoot.

A further safety margin is provided by locating the threshold some distance into the airfield such that there is an obstacle free area along the approach path for some distance before the runway threshold. The Runway 16 landing threshold incorporates a 30m runway end area for this very reason. Beyond the 30 metres runway end area there is approximately 70 metres of clear and graded area before the perimeter track. The area under the R 16 approach surface is relatively clear of man-made obstacles, with the planned Experience Quarter buildings positioned to the West of the final approach track and clear of the approach OLS surface.

The approach path to a suitable landing area would avoid flight over the site. It can therefore be concluded that safety in the event of undershoot would not be compromised by the development under these circumstances.

Lateral deviation from the runway edge

The possibility exists of an aircraft losing directional control on either the take-off or landing roll, with the result being a lateral departure from the runway strip. To cater for this eventuality and minimise the risk of a collision with another aircraft or vehicle, the runways are significantly wider than the minimum required. The runway width has been increased from a minimum requirement of 18m width to 50m. The multi-use nature of the runways at Bicester requires the use of both glider and vintage tailwheel aircraft, known to have reduced directional control, and for this reason the SMG determined that an acceptable width, for all air operations considered was to be 50m. The CGA are also increased beyond the minimum dimension of 21m from the runway edge, to 30m, providing additional buffer space.

Figure 4.1.4.1 Proposed driver experience tracks

The proposed driver experience tracks area, shown on the right, are entirely positioned outside the existing clear and graded areas, shown left, which are already factored into existing aviation activities. The 600m loop track in the South Eastern corner is also greater than 30 metres from the runway surfaces, and thus compliant with the regulatory guidance.

Given the additional space, beyond the minimum derived by the UK CAA regulatory guidance material and considering the multi-use functions at Bicester, the mitigation to cope with lateral runway edge excursion are greater than the mandated minimum requirement. The current runway allows for 25m of deviation from the runway centreline, plus and additional 30m of CGA in which to bring the aircraft to a halt or regain directional control to recover to the centreline. Thus, the chances of an aircraft penetrating beyond the runway edge and further through the CGA are low.

With regard to the driver experience vehicle run off area requirement, there is insufficient information to conduct a thorough analysis, and the likelihood of the aviation CGA being penetrated in such an event as has not been considered.

4.1.5 Turbulence encounters from the development buildings.

The potential impacts on operations arising from turbulence caused by buildings of the proposed development have been identified as a generic potential concern at aerodromes. A new building in a generally open environment such as an aerodrome can be expected to alter wind flows across the runway strips if they are close enough. Air flows must move upwards to pass over the building, then as the laminar flow passes the downwind edge of the building it becomes turbulent and can cause an upset for nearby manoeuvring or low flying aircraft.

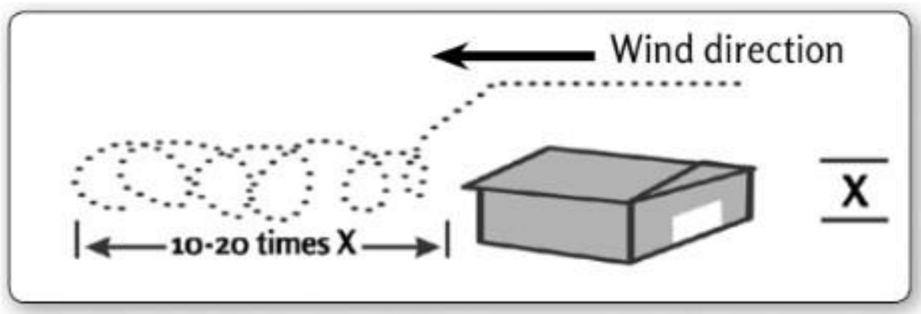


Figure 4.1.5.1: Description of the airflow effect over a building and the turbulence generated. Data supplied by the Federal Aviation Administration www.faa.gov

A detailed assessment of potential turbulence impacts is technically complex task involving fluid dynamics and outside the scope of this assessment. However, a rough guideline as to the extent of the effect can be achieved using the techniques described in figure 4.1.5.1 above, based on the information available in the design proposal, as shown in figure 2.4.1. The buildings of the proposed Experience Quarter development have a maximum height determined as up to 10m, with the nearest buildings in the vicinity of the runways at 5m, both the Northern Experience Quarter buildings and the Trackside Pavilions are up to 5m.

The maximum effect is plotted whereby the wind arrows representative horizontal distance is 20 times the building heights of 10 and 5 metres, thus, 200 and 100 metres, respectively. They are drawn to represent a worse case wind scenario whereby it prevails to cover the shortest distance available from the building to the runway surface.

Figure 4.1.5.2 Shows the wind vector arrows, whereby a metre of height is multiplied by 20 to achieve the maximum turbulence penetration into the runway strips.

Based on the comparative heights of the proposed development and having further regard to their relative proximities to flight paths, it is judged that any additional building wake turbulence impacts on runway 34 approaches and runway 16 departures that might arise from the proposal are unlikely to be significant.

4.2 Assessment of Public and Aviation Safeguarding

The design of the runway layout and the useable runway length has been carefully considered with regard to noise abatement, aircraft traffic patterns and protected surfaces. This is of important to safeguard the Bicester Airfield community, local community and the public. The next two sections consider public and aviation safeguarding.

4.2.1 Public Safeguarding

The aerial view of Bicester Aerodrome in Figure 4.2.1.1 highlights the urban habitation development on the North West and South West sides that severely restrict many runway directions available on the aerodrome. These areas leave emergency landing options in the event of an engine failure after take-off severely limited. Public safeguarding areas, which reduce the risks to the public areas and urban habitation, by avoiding low overflight during take-off and approach-to-land phases of flight, are highlighted in red. All the nominal runway directions at Bicester are considered.

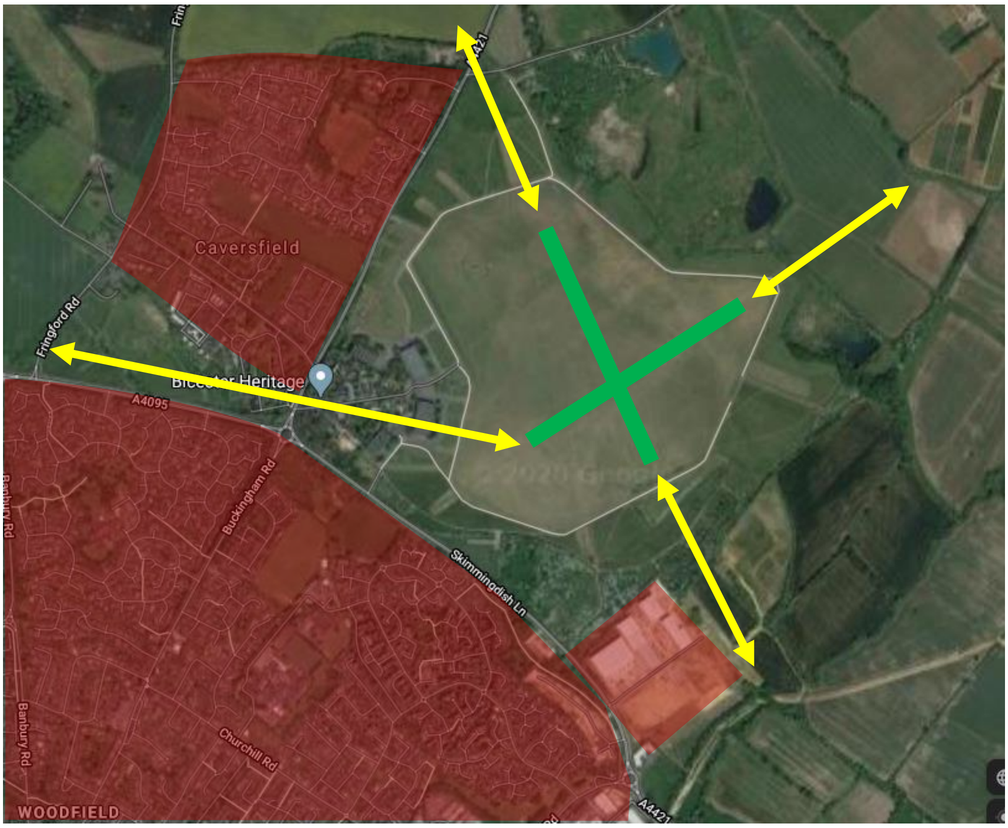


Figure 4.2.1.1 Areas of urban habitation beyond the aerodrome boundary, that any low-level overflight should be avoided, and which do not allow any reasonable opportunity for a pilot to complete an emergency landing.

4.3 Aviation Safeguarding

It is important that the areas around the runways which are overflown during the take-off-climb and approach-to-land phases of flight are protected from further urban habitation and industrial development, and, are areas within which no obstacles are permitted to penetrate the obstacle limitation surfaces. This is principally to safeguard the Bicester Aerodrome community, local community, and the public.
The areas close to the runway end areas where the aircraft climb through the first 500'AAL need to have reasonable area reserved, clear of substantial obstacles and undulation. Thus, facilitating the important necessity, which is to give the pilot a reasonable margin of safety in terms of ensuring their aircraft has adequate performance to glide clear of urban habitation in the event of an engine failure after take-off.

Figure 4.2.1.1 An aerial view of Bicester Aerodrome with appropriate aviation safeguarding areas highlighted in blue. These would allow for relatively low overflight during the take-off-climb and approach-to-land phases of flight, enhancing safety and reducing noise complaints.

4.4 Summary of Assessment Findings

The safeguarding assessment has referred to the recommended operational procedures and the current runway layout at Bicester Aerodrome. To determine this the likely impacts on normal take-off and landing operations and the reasonably foreseeable incidents scenarios of engine failure on take-off, or other precursors leading to forced landing, runway excursions including lateral deviation and undershoot on landing and overrun – have all been considered. Some consideration has also been given to possible building wake turbulence impacts.

The findings of the assessment may be summarised as follows:

1. No significant impacts on normal take-off operations are expected. Preferred flight paths for take-off can generally be expected to avoid direct flight over the development site buildings and a safe lateral clearance margin is therefore expected to be maintained with respect to the proposed Experience Quarter buildings. In the event of an undesired deviation from the flight path shortly after take-off, then the take-off and climb performance of the aircraft using the airfield is expected to be sufficient to ensure a safe vertical margin with respect to the proposed buildings.

2. No significant impacts on normal landing operations are expected. Aircraft approach operations are not expected to involve direct flight over the proposed buildings due to existing operational considerations, specifically the approach path does not pass overhead the proposed development buildings. Aircraft can be expected to maintain a safe lateral and vertical clearance margin with respect to the proposed buildings of the development. In the case of an undesired deviation from the normal approach path, with an approach directly over the site then it is expected that a safe vertical margin with respect to the proposed buildings could be maintained.

3. Whilst there are no buildings planned in the area directly beyond runway 34 the proposed development does reduce the options available to a pilot in the event of EFATO. The area is currently flat grassland with hawthorn scrub and hedging to both east and west of the extended centreline. The land directly on the extended centre line is clear of the proposed buildings. The area is marked in figure 2.2.2 as 'Leisure, Tracks and Ancillary' becomes more important to flight safety as an emergency landing area. To retain this essential function the area should remain substantially free of obstacles and undulation, and sufficiently large to be an effective forced landing area.

4. No significant impact is expected on the safety of runway excursion. The margin afforded by the runway end area and CGA will allow for moderate deviation from the aiming point. The same is expected for overrun incidents, whereby the additional runway end area and CGA allow for moderate overrun incidents. In terms of lateral deviation then the significantly increased runway width and CGA provided along the runway edges allow a significant buffer zone to absorb any reasonable lateral deviation

by aircraft. The allowance for vehicle excursion from the driver experience has not been considered in this assessment.

5. It could be seen there could be some building wake turbulence might be generated across approach paths by the proposal under some wind conditions, however, any impacts on the safety of approach operations are expected to be minor as they are at the very limit of area likely to be effected. With comparison to the comparative heights of some existing hangars that are currently identified, then any turbulence impacts produced from the proposed development would be on a smaller scale than those experienced at Bicester with previous runway layout variations.

6. The risk to the public in terms of safeguarding remains unchanged by the proposed development site. The public safeguarding areas highlighted, which are imperative to reduce low overflight to reduce the risk of a forced landing into urban habitation, and to optimise the noise abatement routes. In terms of aviation safeguarding then the proposed development does not impact the areas that are required to be set aside to allow aviation activities at Bicester, and thus, the longevity of flying activities at the Aerodrome are not compromised.

5 Conclusion

It was found, that providing the three recommendations are applied, then there is no reason why, from an aviation standpoint, that the Experience Quarter would have any adverse impact on the current aviation activities at Bicester Aerodrome.

The assessment has made reference to operational practices and determines the likely impacts on normal take-off and landing operations and the reasonable foreseeable incident scenarios of engine failure on take-off or other associated forced landing, runway excursions including lateral deviations, undershoot on landing and overrun. In all these scenarios there is no expected impact associated with runway safety. It is also based on the expectation that pilots will generally follow established good practice and aim sufficiently far into the aerodrome for there to be an adequate vertical and lateral safety margin with respect to the buildings of the proposed development.

The operational safeguarding assessment undertaken as part of this overall review indicates that the proposed Experience Quarter development appears to be unlikely to have any significant adverse impacts on air operations or any other reasonably foreseeable future aircraft operations at Bicester Airfield. The assessment does, however, primarily deal with areas inside the Aerodrome boundary. To validate the findings in the longer term it would be prudent to conduct an official aerodrome safeguarding process, that specifically caters for single engine aircraft. This is imperative in ensuring the clear areas required for utilisation in the event of an emergency situations and foreseeable failure scenarios including an engine failure after take-off remain available. This element is fundamental in protecting the longevity of air operations at Bicester Aerodrome.

In order to maintain operational efficiency it is necessary to ensure that the aircraft Bicester Aerodrome wishes to serve can clear all obstacles directly along the take-off path by an appropriate vertical margin, having regard to the length of take-off runway available. To achieve this the length of runway available must be clearly visible by markings so that aircraft commanders will be able to make use of the full take-off run available and achieve an appropriate safe height at the airfield boundary.

Further consideration has also been given to possible building wake turbulence impacts, it is unlikely to have any significant adverse effect, due to the distance provided between the buildings and the runway surface. The validity of these findings will be dependent, to some extent, upon the interpretation of the publicly available information applied concerning its effect on aviation.

Predicting the future is a perennial problem, and it is reasonable to assume the operational procedures on site are likely to develop in an iterative manner, commensurate with updated safety guidance. The promotion of ongoing aerodrome safety management will be necessary during the construction phases, and during the commencement of operations on the driver experience circuits. Throughout these phases it would be prudent to incorporate the various Experience Quarter management elements into the SMG group, so that thorough risk analysis and mitigation is carried out in a timely and concurrent manner. The updating of operational procedures for all stakeholders, and the required safety assurance and promotion will be an ongoing process.

Unless additional information is provided by those responsible for operations at Bicester Airfield showing that the assumptions are not appropriate and that operations are significantly different from those assumed, it will be reasonable to conclude that the Experience Quarter development will not have any adverse impact on the safety and efficiency of aircraft operations at Bicester Aerodrome.

6 Recommendations

6.1 Aviation Safeguarding Application to the LPA

An official aerodrome safeguarding process should be applied by the Aerodrome Operator, which, in consultation with the Local Planning Authority (LPA) and within their capability, will protect the environment surrounding the Aerodrome from developments and activities that have the potential to impact on the aerodrome's safe operation. This is imperative in ensuring the highlighted clear areas required for utilisation in the event of an emergency or forced landing after take-off remain available. This element is essential in protecting the longevity of air operations at Bicester Aerodrome.

To be delivered as per the *CAP 738*: *Aerodrome Safeguarding* guidance and submission is recommended at the earliest possible juncture.

6.2 Runway Markings

Runway markings need to be applied, at the earliest available opportunity, thus allowing the guidance to be specifically applied as a measurable means of assessment to the pilot in establishing a clearly marked aiming point and runway threshold.

Runway markings laid out as per the regulatory guidance in *CAP 168: Licensing of Aerodromes*. Specifically: with the size, style, and format as per the guidance, which requires the markings to be visible aloft from 2000m. While it has been established that planning for this has been started by the Bicester Aerodrome Company, working around current weather conditions, the preference is to have it permanently completed as soon as practicable.

6.3 Runway 34 Forced Landing Area

The area on the extended centreline of R34 remains substantially free of obstacles and undulation, and, sufficiently large enough to be reserved as an emergency forced landing area.

7 References

The following material are appliable as regulatory guidance, as defined by the UK Civil Aviation Authority, within the relevant Civil Aviation Publications (CAP):

CAP 168: Licencing of Aerodromes. Version 11, 13th March 2019.

CAP 738: Safeguarding of Aerodromes. Version 3, 29th October 2020.

CAP 793: Safe Operating Practices at Unlicensed Aerodromes. Version 1, 1st July 2010.

CAP 1059: Safety Management: Guidance for small non-complex organisations. Version 1, June 2013.

The following aircraft flight manuals were referred to calculate the required performance characteristics applicable to this document:

DH82 Tiger Moth - Pilot Operator Handbook

Cessna 152 - Pilot Operator Handbook

Avions Mudry CAP10B/C - Pilot Operator Handbook

Pilatus PC12 NG - Pilot Operator Handbook

Cessna 421C Golden Eagle - Pilot Operator Handbook

British Gliding Association: 'Aerotow Performance' and 'Safe Aerotowing' online leaflets.

This page is intentionally blank