Edinburgh Airport
Where Scotland meets the world

Airspace Change Programme departure and arrival procedures.

Second consultation: 30 January – 30 April 2017

Discover how your views have helped Edinburgh Airport develop flight path options and then have your say.

WE'RE ASKING FOR YOUR VIEWS ON OUR OPTIONS FOR NEW FLIGHT PATHS TO AND FROM EDINBURGH AIRPORT.

What is this document about?

This document has been designed to provide the information you may need to understand our second consultation, how we designed our preferred options for new flight paths and the process involved in giving your views.

This document includes information on all arrival and departure flight path options that have been considered. While this document includes all information, there is simplified information available in guides, fact sheets and FAQs. However, we wanted to be able to provide all of the information available in one place for those who require it.

For more information you can visit, letsgofurther.com or write to us at Freepost, LETS GO FURTHER.

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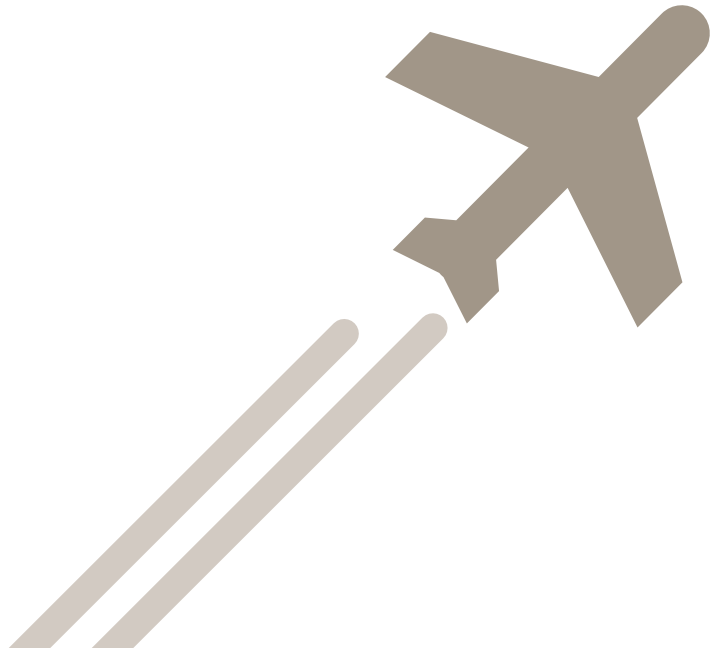
Glossary of terms

This glossary lists key acronyms within the document and their meaning as well as defining some industry terms and what they mean in this context. The glossary will be updated online during the consultation period. Visit letsgofurther.com for more information.



ACP	Airspace change proposal
AGL	Above ground level
AMSL	Above mean sea level
ATC	Air traffic control
ATM	Air traffic movement
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled airspace
CDA	Continuous descent approach
EACC	Edinburgh Airport Consultative Committee
EAL	Edinburgh Airport Limited
Eurocontrol	The European Organisation for the Safety of Air Navigation
Design envelope	The area within which each flight path may be positioned
FAS	Future Airspace Strategy
ICAO	International Civil Aviation Organisation
Knots	Nautical miles (nm) per hour (1nm = 1.15 statute miles, therefore 220Knots = 253 miles per hour)
NATMAC	National Air Traffic Management Committee
NATS	Air Traffic management company providing en-route air traffic control throughout the UK
NDB	Non directional beacon (conventional radio navigation beacon)
NM	Nautical mile
PBN	Performance Based Navigation
RNAV	aRea NAVigation
RNP	Required navigation performance (a navigation specification which includes RNAV)
SARG	Safety and Airspace Regulation Group (Department of the CAA responsible for regulation of airspace)
SESAR	Single European Sky ATM Research
SID	Standard instrument departure
STAR	Standard terminal arrival route
Vector	Tactical routing intervention by ATC, by means of a magnetic heading to be flown by an aircraft
VHF	Very high frequency
VOR	VHF Omni directional range (conventional radio navigation beacon)

02

Welcome

Hello

Over the Summer months, we asked for your opinions on change to the airspace that Edinburgh Airport uses.

We have listened carefully to all that you've had to say.

Your views have helped shape our thinking and have guided us in making our proposals.

We'd now like to share these proposals with you and ask for your feedback on them.

Over the next 3 months we're going to be doing just that. We've worked hard to create the best range of options for all – options that meet our regulatory requirements, minimise the impact on the people who live in our neighbouring communities and accommodate our necessary growth.

This document describes those options. It also describes how we got to them – our decision making process and what we considered.

It's important I think to recognise that any solution will be a compromise between competing interests and as such some may feel that we have not listened.

You'll find all of the information that you need to provide us with your informed views. We've tried to be as clear as we can on the variables that we've used and the weighting we've given to those variables.

This is a complex subject but I believe that we've struck the correct balance between explaining it in a way that the layperson can understand and providing as much technical detail as reasonably required.

We have not decided on specific routes. This is our proposal but we need feedback and opinion on it so we can take the best plan to the CAA.

So please play your part. Look at our options, look at our reasoning and scrutinise our thinking. Tell us what you think, enter into the conversation. Ask us questions, test our options. Let us know if you think we're getting that right or wrong and why.

Thank you for your interest and your opinion. I look forward to continuing this vital conversation over the coming months.

We have listened and where we cannot accommodate what specific groups or areas want we will be clear why we cannot.

These options are, we think, the best for all of the communities below our flight path. They cut the number of people overflown whilst providing safe and efficient flight paths.

If implemented our preferred options will reduce the number of people overflown by aircraft up to 7,000ft by 25,000 people and would reduce our CO_2 emissions by over 8,500 tonnes a year.

We believe that we need to grow and we believe that growth in connectivity is good for our country and its economy. We believe that we are running a good and robust process to ensure that all who wanted to comment on our plans can.

We've also laid out why we need to change and what that change will mean.

Regards

Gordon Dewar
Chief Executive

03

What is this Airspace Change Programme about?

The Airspace Change Programme is about the way in which Edinburgh Airport intends to grow, ensuring that it continues to be able to support Scotland's aspirations in a safe and effective way.

A cornerstone of this is the modernisation of the airport's existing aircraft arrival and departure flight paths.

We know that air travel plays a crucial role in supporting economic growth and prosperity.

Aviation is a part of modern life that we all take for granted; for business, international trade and leisure or for visiting our friends and family. It is central to today's fast-moving lifestyle.

Airlines and airports require the support of efficient airspace, the invisible infrastructure in the skies above us. Today's airspace structure was established over 40 years ago when there were fewer aircraft in the skies and they used basic navigation technology.

We need to enable growth and we must update the technology we use to navigate.

We now have the opportunity to modernise the old airspace structures currently flown to improve efficiency now that our skies are much busier.

The existing routes used by aircraft (termed 'conventional' routes) rely on the 1950s technology of ground-based radio beacons[1]. A well established and much more accurate form of navigation is a**R**ea **NAV**igation (RNAV) which uses a combination of satellite and ground-based navigation technology to permit aircraft to follow a precisely defined path over the ground with far greater accuracy than is possible with conventional routes. This in turn enables pilots to fly pre-determined, predictable arrival and departure profiles.

Aircraft today already use RNAV extensively to fly in our airspace, even though the existing conventional routes have not been specifically designed for its use.

Processes are underway at an international level which requires modernisation of the route system to internationally agreed standards. If the UK is to keep pace with the changes in the surrounding states we need to upgrade our routes to RNAV standards.

It is important then that as we seek to modernise our airspace to accommodate growth that we update all of our routes to RNAV standards.

We are committed to modernising and improving the routes to and from Edinburgh Airport in a way that maximises the benefits across Scotland and minimises the impact on local communities.

This consultation on flight path options is an important element of future development. Edinburgh Airport is committed to undertaking a robust and meaningful consultation process and to give stakeholders confidence, we have commissioned the Consultation Institute to provide independent quality assurance over the consultation process.

For background information on how today's ATC system operates please refer to Ref. 9, found on page 156: the CAA's Description of Today's ATC Route Structure and Operational Techniques.

[1] These ground based radio beacons are technically referred to as "VORs" and "NDBs". VOR stands for **V**HF (**V**ery High Frequency) **O**mni-directional **R**adio Range, and NDB stands for **N**on-**D**irection radio **B**eacon.

3.1 Airspace Change Programme 2016 – 2018

Edinburgh Airport has commissioned a quality assurance of our consultation process by the Consultation Institute (consultationinstitute.org). As part of our commitment to you, we are publishing our programme mandate, as well as the mandate of our initial and second consultation.

Programme mandate

We, Edinburgh Airport, need to understand the views of stakeholders concerning the presentation of an airspace change proposal to the CAA that complies with the relevant regulatory requirements so that Edinburgh Airport can operate flight paths that maximise operational benefits and minimise community impact by 2018 so as to improve Edinburgh Airport's national transportation infrastructure to enable the economic, social and cultural growth of Scotland.

Mandate 1: Initial consultation

We, Edinburgh Airport, need to understand the views of stakeholders concerning issues that may arise from altering arrival and departure flight paths so we can analyse concerns gathered during the initial consultation (June to September 2016) and develop viable options by December 2016 so as to develop a flight path change consultation on options to effectively maximise operational benefits and minimise community impacts.

Mandate 2: Second consultation

We, Edinburgh Airport, need to understand the views of stakeholders' concerning viable options for arrival and departure flight paths so we can alter flight paths to maximise operational benefits and minimise community impacts by Summer 2018 so as to produce an airspace change proposal to the CAA which complies with relevant regulatory requirements and responds to consultee concerns.

3.2 Justification for change – modernising for the future

We seek to upgrade our aircraft arrival and departure routes to take advantage of the improved navigational capabilities of RNAV and improve the efficiency and capacity of the airspace around Edinburgh Airport.

This consultation presents the proposed aircraft arrival and departure routes to Edinburgh Airport below 7,000ft above ground level (ABL). Above 7,000ft aircraft will join the existing en-route network and proceed via flight planned route/tactical ATC instructions.

Modernising our airspace will allow us to:

- help minimise the impact to people on the ground. In particular, by minimising the number of people impacted by overflights below 4,000ft (AGL).
- ensure our airport can meet existing and future demand by increasing the capacity of its runway.
- make improvements to routes to allow more flights to depart with fewer delays.
- make efficiency improvements to the arrival routes based on a newly-positioned hold pattern (to replace the current TWEED hold). Holding will be carried out, as it is today, at or above 7,000ft though the holding pattern itself may be slightly realigned to reduce the impact it has on the ability to ensure continuous climb of departing flights on adjacent routes.
- position aircraft more accurately allowing arrival and departures routes to be flown more accurately.

Our aim is to meet these requirements, maximising benefits to Edinburgh and Scotland whilst minimising any negative impacts. Where we are seeking to change a flight path, we will be seeking to minimise the population impacted under the route and work with those affected to mitigate any negative impacts.

When following RNAV routes, aircraft will follow the routes more consistently than they do today. This is due to the improved track-keeping ability of RNAV. Improved track keeping means that there will be less dispersion of aircraft either side of the route nominal centrelines; this would mean a reduction in the overall area regularly overflown, but an increase in the concentration of over-flights in some areas.

While RNAV routes are flown more accurately they also open up the possibility of designing route configurations to specifically address local environmental issues, such as the provision of respite routes to share noise impacts more equitably (see Ref. 8, on page 156 for more detail about providing feedback on local environmental issues to be considered). This consultation shows all of the route options that have been considered, and explains how the

What do you think of our viable flight path options?

preferred route option has been identified by evaluating all benefits and impacts to provide the best solution for the region as a whole, in line with feedback from the first consultation.

Many aircraft are already equipped with RNAV technology and prefer to use it where they can because it is more accurate. As a result many aircraft currently flying to and from Edinburgh already use RNAV versions of conventional arrival and departure routes, so-called 'RNAV overlays'. This proposal seeks to formalise the use of RNAV by superseding these overlays with officially certified RNAV routes, and introducing new RNAV routes which better meet the objectives stated above.

The new RNAV routes would represent a change to the published routes. For this reason, Edinburgh Airport has a duty, as prescribed by the Civil Aviation Authority, Safety and Airspace Regulation Group (CAA, SARG), to follow the procedure set out in CAP725 and consult on any proposals for new routes.

3.3 The second consultation

In the initial consultation we showed the design envelopes (areas within which each flight path could be positioned)†. Using feedback from the initial consultation, route design options were formulated. This second consultation presents the results of this design process, our preferred options and why these were selected. It also details reasons why other flight path options were considered but are not preferred.

Ultimately the objective of these proposals is for aircraft at low altitude to have less noise impact across the region as a whole. Where possible, routes will be positioned to minimise the number of people overflown. This means that in some areas flight paths will change – and this may mean some areas will be overflown more than today, others less, and some will not be subject to significant change.

We have considered all of the information available including feedback from the initial consultation process.

During that process and the design phase of the project we worked with the Stakeholder Reference Group (SRG) to ensure that our thinking and presentation were clear and resulting outputs useful. The SRG is run through the Consultation Institute and its remit is to contribute to the quality assurance of our project by:

- Analysing our methodology.
- Considering feedback analysis.
- Providing feedback as part of pre consultation.

The group is independent of the airport and is chaired by Dame Sue Bruce.

We have also sought external assistance on the impacts on equalities groups, ensuring our consultation is available to the widest number of people possible. It is important for us to make it as easy as possible for those who wanted to participate to have a voice. We are working on an equalities impact assessment which will sit alongside our submission to CAA. This consultation therefore provides an opportunity to participate in this process by commenting on the impact of the options on such groups.

This document details the design principles used and how we have evaluated the design options to identify preferred flight paths. The purpose of this document is to share this information. This second consultation is asking anyone who wishes to participate including communities, organisations and elected officials for feedback on our flight path options.

If these changes might affect you, we would like to hear your views.

†You can read our Initial Consultation Book and Initial Consultation Findings Report on our website letsgofurther.com.

THE CONSULTATION BEGINS ON 30 JANUARY AND ENDS ON 30 APRIL 2017, A PERIOD OF 13 WEEKS*

(THIS IS AN EXTRA WEEK TO ALLOW FOR EASTER HOLIDAYS).

The principal questions we're asking are:

"To what extent do you agree with our preferred flight path options? And to rate our viable flight path options."

We are asking this question for each of the proposed flight paths, and asking why the responder agrees or disagrees with the preferred flight path option.

Airspace change proposals must follow CAA and government guidance including CAP725 (Ref. 1, 3 and 4). This involves liaising with the CAA to determine the appropriate level and form of consultation.

The CAA is currently reviewing their CAP725 process and have advised that the current guidance still applies to Edinburgh Airport for this Airspace Change Programme. We are aware that the guidance may change in the future, so we have pro-actively maintained constant dialogue with the CAA throughout this Airspace Change Programme to ensure that we exceed what is required by the current guidance requirements, and anticipate future requirements.

Airspace design has an effect on where aircraft fly and can be a highly complex subject area. Matters relating to navigation and airspace arrangements are inevitably technical in nature. For those stakeholders who want a deeper knowledge of Air Traffic Control (ATC), we have provided more in-depth background information on the consultation website. Also, Ref. 9 (CAP1379, found on page 156) is a document produced by the CAA specifically to help stakeholders in airspace consultations, such as this, understand today's ATC route structure and operational techniques.

This consultation information is available at letsgofurther.com and further hard copies are available by contacting the Consultation Coordinator at Freepost, LETS GO FURTHER.

*Best practice guidelines recommend a period of 12 weeks for consultation.

Airspace Change Programme process


DATA ANALYSIS AND ROUTE REFINEMENT
AIRSPACE CHANGE PROPOSAL SUBMISSION TO CAA

04

The second consultation: What is it about, why is it needed and what will it consist of?

We are asking for your views on our flight path options.

4.1 What is this consultation about?

This consultation only concerns aircraft arriving to and departing from Edinburgh Airport and depending on the flight paths implemented, there may be changes to the current holding pattern to the south of Edinburgh (TWEED) to accommodate these. Other holds will remain as today.

The existing routes (termed 'conventional' routes) rely on the 1950s technology of VOR and NDB radio beacons. More modern navigation systems can now provide RNAV which uses a combination of satellite and ground-based navigation technology to permit aircraft to follow a precisely defined path over the ground with far greater accuracy than is possible with conventional routes.

The benefits of RNAV are well documented (Ref. 6 and 7 on page 156), and the replacement of conventional routes with equivalent RNAV routes is in accordance with government and international (ICAO/Eurocontrol) guidelines (Ref. 6).

This proposal seeks to replace the existing conventional routes with RNAV routes.

The positions of the new routes have not yet been finalised.

We have investigated a number of flight path options for each flight path route. For some of the routes we have proposed two preferred options and are keen to gain feedback on these options and how you would like to see them used, for instance, times of days they are used or avoided. We are asking if you agree with our preferred options and why.

Government guidance provides generic objectives for airspace changes, such as the need to overfly the fewest people below 7,000ft above ground level (AGL) and to be as efficient as possible (i.e. minimising or not increasing CO_2 emissions) above 7,000ft.

This consultation concerns changes which affect the profiles of aircraft arriving and departing from Edinburgh Airport below 7,000ft above ground level (AGL). See appendix B for the legal requirements and how different altitude cut-offs apply to this consultation.

These changes are fundamental to Edinburgh Airport's continued development.

A feedback document will be published following the consultation to report on the responses.

After this second consultation, Edinburgh Airport will submit an Airspace Change Proposal to the CAA in which we must demonstrate that the proposed design achieves the best balance between regulatory and operational requirements, and community feedback.

4.2 What is this consultation not about?

This consultation is not related to air traffic growth or the airport's growth in general.

This consultation is not a referendum. We are not seeking to find the most popular routes with the most votes. However, we are seeking feedback on the rationale and design process that we have used to determine our flight path options.

Government policy regarding the change to Performance Based Navigation (PBN) is outside the scope of this consultation.

This consultation is not about RNAV as a future tool, any other or future development, any aspect of government or airspace policy, or the establishment of controlled airspace.

Comments and responses not directly related to this consultation will be recorded and coded as 'out of scope' of consultation.

4.3 Implementation date

If the proposal is approved by the CAA, implementation of the proposal will occur at an appropriate opportunity but, in any event not before March 2018.

4.4 With whom are we consulting?

The consultation is open to everyone who wants to participate and provide their views.

This includes:

(i) Residents, businesses and the general public potentially impacted by the flight path changes.

(ii) The Edinburgh Airport Consultative Committee (EACC) which includes representatives of Local Authorities, community representatives and other organisations that have expressed an interest in the activities of the airport.

(iii) All community councils.

(iv) All councils and unitary authorities.

(v) All Members of the Scottish Parliament.

(vi) All Members of Parliament representing a Scottish constituency.

(vii) Members of the National Air Traffic Management Committee (NATMAC) which includes representatives of all types of airspace users.

(viii) Airlines that operate from Edinburgh Airport, and all users of the airspace around Edinburgh Airport.

(ix) Environmental representative bodies (e.g. National Trust, SEPA, Scottish Natural Heritage).

(x) Passengers who use the airport.

The consultation is also open to any other interested party to respond.

4.5 How long will the consultation period last?

The consultation will begin on 30 January and end on 30 April 2017, a period of 13 weeks to cover the Easter holiday period.

The closing date for replies associated with consultation issues is at 23:59 on 30 April 2017.

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How do I participate?

Public consultations are only as effective as the input from those who participate. We invite you to participate in this initial consultation process. A period of 13 weeks is open for this initial consultation.

The consultation will close at **23:59** on **30 April 2017**.

Responses will be accepted:

- Via web: A dedicated website has been developed to capture your feedback. All respondents need to provide their name, area and postcode. A privacy policy has been developed that meets data protection requirements. All respondents will also be invited to provide details on protected characteristics e.g. age and disability to allow Edinburgh Airport to report on equalities. Visit letsgofurther.com to provide your feedback and read our privacy policy.

- Via postal system: Once you complete and return a response form, we take this as agreement of our privacy policy – please make sure you read this before sending your response. Send your feedback form to Freepost, LETS GO FURTHER.

- Community events: We will be hosting a number of community events during the consultation. These will be listed on letsgofurther.com and we will advertise them on social media and in local community press. We will also work with local community councils to coordinate and promote these sessions locally.

We would welcome your views on how to make this consultation easier to participate in. You can contact us via our website letsgofurther.com or writing to us at Freepost, LETS GO FURTHER.

All respondents will also be invited to provide information about their protected characteristics e.g. age, gender, disability and ethnicity to allow Edinburgh Airport to report on equalities.

5.1 If I have no comment to make on the second consultation, do I need to do anything?

If you have no comment to make on one or more of our flight path options, we would still like to know that you considered the information. Please tick the no comment box on the website or reference this in your postal response.

5.2 What happens to the responses to the consultation?

Following the consultation, Edinburgh Airport will analyse all responses to determine if any local information affecting the preferred options has not previously been considered. Responses to the consultation will be analysed to identify the concerns and comments of respondents.

The final designs will look to address comments and concerns raised during this consultation where this is possible and our final route options will be submitted to the CAA as our Airspace Change Proposal.

5.3 Can I have a copy of the consultation responses?

A report including feedback of responses received in this consultation will be available once the data analysis is complete.

5.4 Who monitors the consultation and where can I go if I have concerns on how the consultation is being carried out?

This consultation is being conducted by Edinburgh Airport. The CAA's SARG will oversee the consultation, to ensure that it adheres to the process laid down in CAP725 and government guidelines.

If you have any complaints about how this consultation has been conducted, these should be referred to:

Airspace Regulator (Coordination)
Airspace, ATM and Aerodromes
Safety and Airspace Regulation Group
CAA House
45-59 Kingsway
London WC2B 6TE

Email: airspace.policy@caa.co.uk

Please note that this address is for concerns and complaints regarding non-adherence to the defined consultation process. The SARG will not engage with consultees regarding details on this consultation.

Response to the nature of this specific consultation should be addressed to Edinburgh Airport. The SARG will receive details of your response as part of the formal Airspace Change Proposal submission.

Edinburgh Airport has also commissioned a quality assurance of our consultation process by the Consultation Institute (consultationinstitute.org).

5.5 Will my query/response be treated as confidential?

The CAA requires all consultation material, which includes copies of responses, to be included in any formal submission.

Edinburgh Airport undertakes that personal details or content of responses or submissions will be treated in line with our privacy policy, see appendix B.

06

Context and background to the proposal

This section describes the strategy and legislation driving the proposed changes, the legal framework that determines how changes should be made, and how these relate to potential benefits and impacts.

6.1 Benefits and impacts

Meeting the UK's FAS (Future Airspace Strategy) requirements will inevitably result in change. Converting a conventional route to a RNAV route will, at the very least, mean that aircraft will fly more accurately along the centre of a route. This will give ATC and airline operators more certainty in planning and managing operations, where previously aircraft would have been dispersed over a wider area.

Given that change to the routes, and consequently their impacts, is inevitable due to future requirements, we are seeking to ensure the change achieves the optimal outcome for Edinburgh and Scotland. We are seeking to redesign the route system and apply new methods of operation that are only possible in a RNAV system, for example, routes that avoid areas with specific noise sensitivity and/or multiple RNAV routes which are designed to share the noise over a wider area (see Ref. 8, on page 156).

There will always be factors that constrain what we can achieve, for example, the proximity of Edinburgh and Glasgow Airport's holding patterns and routes and the limitations of aircraft climb, descent and turn performance. For more information on design consideration please refer to Section 10 of this document. Over conventional routes, RNAV still offers a much greater amount of flexibility in terms of how we design routes and, more importantly, how we can position them.

It is important for us to understand the feedback from individuals, organisations and elected offices, to allow us to strike an optimal balance of benefits and impacts.

6.2 Masterplan 2016

In the period between Airspace Consultation 1 and 2, Edinburgh Airport consulted on its Masterplan. This consultation is now closed and the Airport will is currently analysing its findings.

The Masterplan sets out a framework for the sustainable development and ongoing growth and success of Edinburgh Airport to up to 2040. The draft plan consulted on details how the airport intends to match the growing demand for air travel to and from Edinburgh.

It is focused on our growth on the ground and therefore was not concerned with the Airspace Change Programme (ACP).

Key points of the draft Masterplan, which has been sent to key stakeholders, include:

1. An enlarged terminal building to create space for more passengers and facilities, particular to serve additional international services.

2. An enlarged area for the parking of aircraft.

3. An enlarged cargo storage area.

4. Improved access by creation of a new road linking to the Gogar Roundabout.

5. In order to achieve all of the above, the closure of the existing second runway, the configuration and size of which are not suitable for frequent use.

6. The continued safeguarding of land for a new second runway. Our plan indicates that we will not need this for regular use until around 2050.

07

Overview of current operations at Edinburgh Airport

Edinburgh Airport is serviced by two physical runways, and each can be used in either direction. The main and most commonly used runway is named runway 24/06 as per convention corresponding to the magnetic direction of the runway ends (242° for runway 24 and 062° for runway 06). This runway is used by preference. The direction for take-off and landing on any particular day is dictated by the wind conditions[2].

There is another runway (30/12) which is shorter than runway 24/06 but this is only used if the main runway is undergoing maintenance or if a strong north-westerly or south-easterly wind dictates that it is preferable to use the secondary runway.

In 2015 runway 30/12 was only used on 30 occasions, mostly between the hours of midnight and 6am (less than 0.1% of the time) during maintenance works on the main runway.

[2] It is safest for aircraft to take off and land into a head wind. There are strict limits regarding the strength of crosswinds and tail winds above which aircraft are not permitted to operate for take-off and landing.

Figure 1: Airport runway layout

7.1 Current aircraft flight paths

This following section details the routes and levels which departing and arriving aircraft would take when landing and taking off in each direction.

The main routes which aircraft currently take to and from each runway can be seen as red in the flight path density plots of Figures 2 to 4 as discussed in the following section.

Figures 2 to 4 illustrate the arrival and departure routes to/from runway 24 and 06. These plots are generated from radar data and show the density of flight paths. Red areas indicate the highest concentration of flight paths, with yellow/green less so and grey areas show where there are only occasional flights.

The pattern of traffic on any particular day depends on the direction of the wind, since this determines which runway is used. (Aircraft take-off and land into the wind). The prevailing wind is from the south west, hence on average runway 24 is used, 79% of the time and runway 06, is used 21% of the time. In 2015 runway 30/12 was only used on 30 occasions, (less than 0.1% of the time).

Figure 2 shows traffic patterns over a two-week period including periods when both runway 24 and runway 06 were in use.

Figure 3 shows traffic patterns on days when the wind is predominantly from the west, which results in runway 24 being used.

Figure 4 shows traffic patterns on days when the wind is predominantly from the east, which results in runway 06 being used.

Arrivals to Edinburgh Airport from the south are routed via the TALLA radio beacon (27nm south of the airport) to the TWEED hold[3] (see Figure 3). Currently aircraft are then given instructions by ATC to join the final approach (known as vectoring). Even though there is no formal route it can be seen from Figure 3 and Figure 4 that there is a degree of consistency in the instructions given.

7.2 Current aircraft altitudes

The typical altitudes at points on the current day flight paths are indicated on Figure 3 and Figure 4. ATC will always seek to climb departures to higher altitudes early and not to descend arrivals prematurely; this is better for noise levels, and CO_2 and other emissions reduction. However, ATC has to keep flights safely separated, which sometimes constrains the altitudes they can achieve.

7.3 Existing track concentrations

Figure 2 to Figure 4 are intended to help you understand the current day spread of flight paths.

These figures show the density of flight paths[4] so that the current number of flights over any given location in a typical day can be gauged. These give a good indication of where the main concentrations of flights currently occur.

Where there is a spread of flight paths, this is a result of many factors including:

- the different speeds and performance of the various aircraft types. (In general, slower aircraft [e.g. turbo props and smaller aircraft] will turn with tighter radii, while larger jet aircraft fly faster and turn with wider radii);
- 'vectoring' by Air Traffic Control (i.e. ATC giving instructions to aircraft to fly a certain flight path, order to maintain safe separation, or for sequencing);
- variation due to wind.

For reference the current conventional Standard Instrument Departure (SID) route definitions and Standard Terminal Arrivals (STARs) routes are included in the appendices. The current restrictions are either based on an altitude of 3,000ft or 4,000ft AMSL or a range from the airport (and are detailed in UK AIP AD 2-EGPH).

It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

Once above 4,000ft departing aircraft are often tactically vectored by ATC. This means that they are instructed by ATC to leave the SID. Hence above 4,000ft the departure flight paths may be more dispersed. This can be seen in by the departures beyond the red arrows in Figure 3 and Figure 4.

Likewise, from around 3,000ft-4,000ft arrivals converge on the final approach path that heads straight into the airport. Prior to this they are generally coming from the same direction however they are in a broader swathe. ATC position them this way to keep them separated from one another and to ensure that they have the right spacing when joining final approach and for landing.

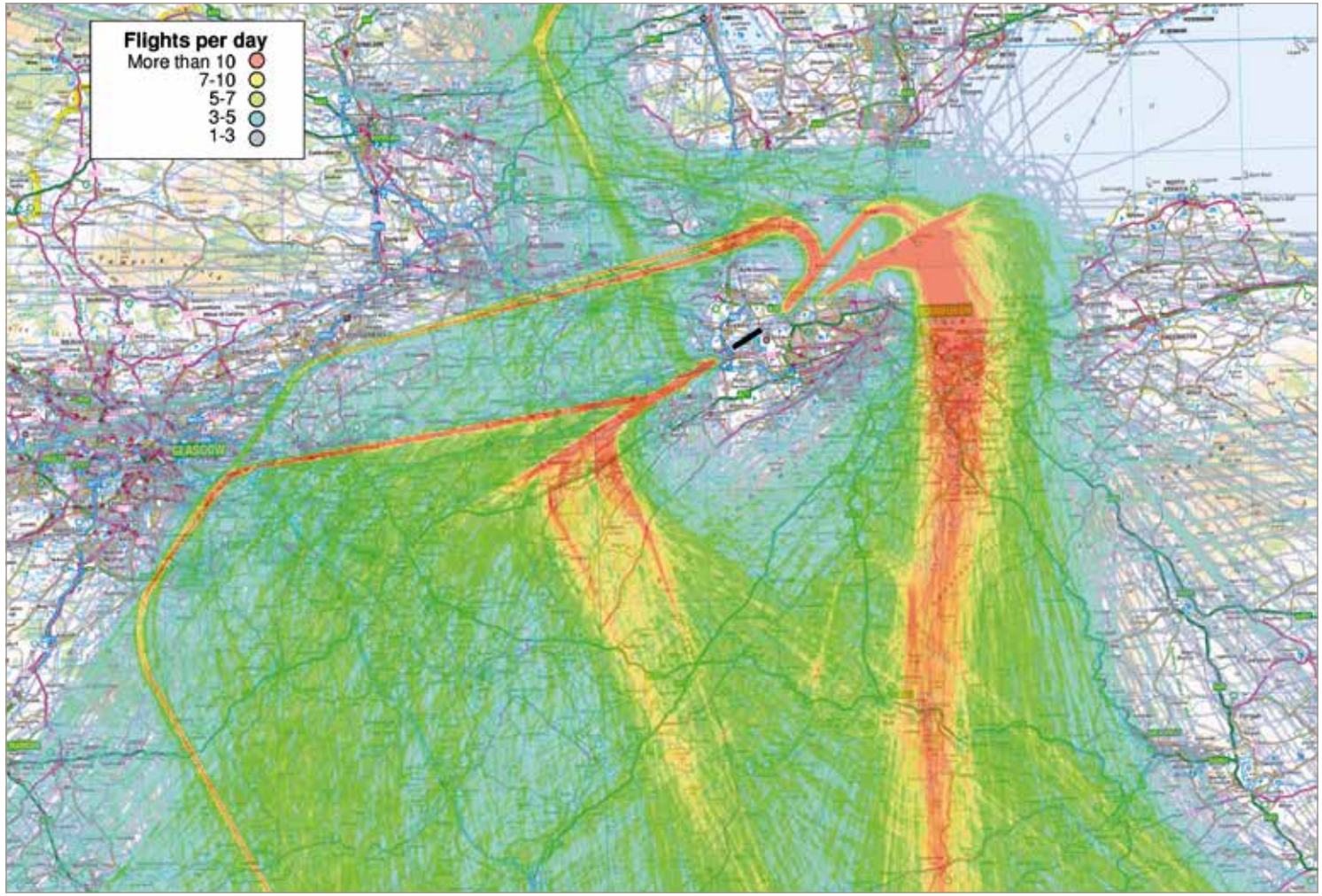
The colour coding on the track pictures show the number of flights that overfly areas and Table 2 shows the total number of flights heading to/coming from each direction.

[3] For background information on ATC operations including holding see Ref. 9, on page 156.

[4] These are derived from radar data taken from June 2015.

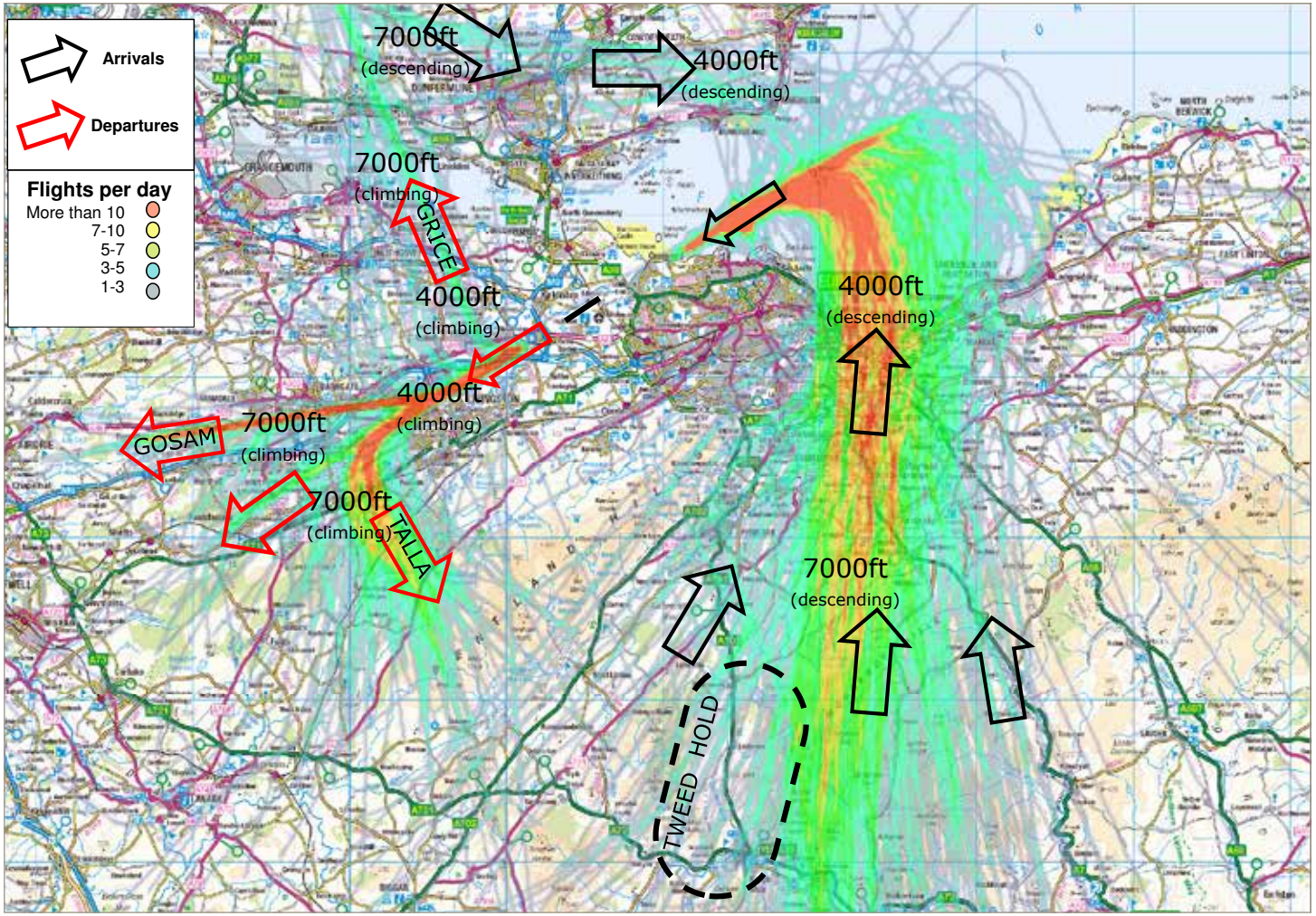
07 Overview of current operations at Edinburgh Airport

Figure 2: Current arrival and departure flight paths



These are derived from a two week traffic sample of radar data taken from June 2015.

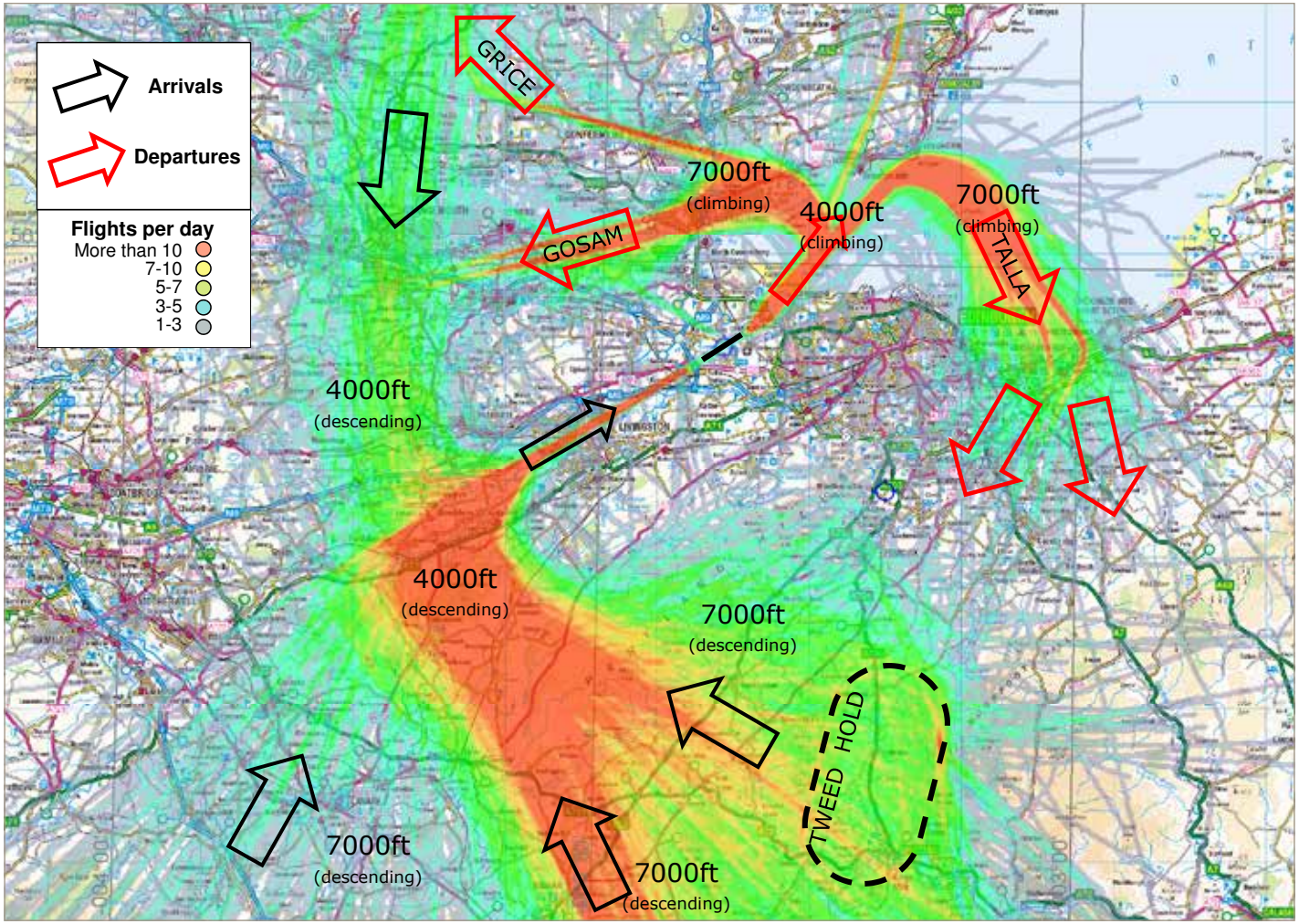
Figure 3: Current flight paths with typical altitudes, runway 24 westerly operations



These are derived from a one week traffic sample of radar taken from June 2014.

These arrows represent the general flows of traffic (generally vectored).

Figure 4: Current flight paths with typical altitudes, runway 06 easterly operations



These are derived from a two week traffic sample of radar taken from June 2016.

These arrows represent the general flows of traffic (generally vectored).

Table 1: Average daily route usage on existing flight paths

Route (existing flight paths)	Breakdown by route (%)	Average flights per day 2015
Departures		
GOSAM	58%	81
TALLA	38%	53
GRICE	4%	5
Arrivals		
STIRA	8%	13
TWEED	92%	141

Note: Runway 24 is used 79% of the time, and runway 06, 21% of the time. This means that for each route shown in Table 1 the average flights per day would apply to the runway 24 routes for 289 days per year and runway 09 for the remaining 76 days per year. The number of arrivals and departures does not have to be equal. For more information on the current flight paths, refer to appendix A: Current conventional SIDs and STARs.

Table 2: Type of aircraft (by number of departures)

Aircraft type	Number (per year)	Percentage
A319	9360	16.48%
DH8D	8561	15.07%
B738	8395	14.78%
A320	7948	13.99%
E190	4128	7.27%
B733	2801	4.93%
SF3	2280	4.01%
AT76	1748	3.08%
D328	1540	2.71%
E170	1415	2.49%
B752	1230	2.17%
A321	1095	1.93%
B763	814	1.43%
RJ1H	635	1.12%
B737	379	0.67%
B788	344	0.61%
Others (each <0.5%)	4120	7.25%

Note: The flight path that an aircraft will take depends on many factors, including the final destination of the aircraft. The aircraft operated is determined by the airlines, and it is not possible to predict exactly which aircraft will use each route. For explanation of aircraft type, please see FAQs at letsgofurther.com

08

Flight path options within design envelopes

The following pages present design options which have been considered and highlight our preferred flight path option. They also detail the rationale behind the flight path options.

The purpose of this consultation is to ask your opinion on our flight path options and to gain your feedback if you agree, disagree or have no comment. The final designs can be influenced by issues which are brought to light during this consultation.

8.1 The criteria matrix explained

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. Based on feedback provided during the initial consultation the key community concerns raised were around noise, health and environmental impacts on local communities. We engaged an independent noise expert to help us understand how to evaluate the impact on communities and have used population density mapping as a key criterion. The impact on care and education facilities was also raised as a community concern. As well as population density mapping, we also mapped schools and care facilities under the design envelopes. This is a key criterion to understand the impact in these areas, however once a decision has been made, and if the routes are approved by the CAA, we will engage with the local community impacted to assess smaller facilities on a case-by-case basis to mitigate any impact in line with legislation.

We have evaluated the flight path options on an individual basis as well as looking at the airspace as a whole. We have considered how one flight path may affect another and looked overall at benefits and impacts to communities and tried to improve these where possible.

8.2 Noise population overflown

We used population density mapping to determine existing populations that may be overflown below 7,000ft within the design envelope. The population information was taken from the most recent census. Known areas of housing development were also identified and this information was used in conjunction with the current population data. For each proposed flight path we have compared those overflown today to those that may be overflown under the proposed flight path. This has allowed us to determine if the population overflown will be less than, more than or similar to today.

This is shown in red (more than today) amber (similar to today) and green (less than today). For detailed information regarding this criteria see each flight path options matrix and related commentary.

8.3 New population impacted

We used population density mapping to determine existing populations that may be overflown below 7,000ft within the design envelope. The population information was taken from the most recent census. Known areas of housing development were also identified and this information was used in conjunction with the current population data. For each proposed flight path we have compared those overflown today to those who may be overflown under the proposed flight path. This has allowed us to determine if the population may be a new community to be overflown. This is shown in red (new area impacted) amber (already overflown) and green (not overflown). In amber we have also considered population densities of the communities and this is shown as more (larger population overflown than today) and less (fewer population overflown than today). For detailed information regarding this criteria see each flight path options matrix and related commentary.

8.4 How to interpret the flight path options

The options are shown for each flight path over-laid on a map showing the current flight path densities (e.g. Figure 6 for route A). This is so you can assess where the proposed RNAV flight paths will be in relation to the current-day flight paths. It should be assumed that the current day areas of concentration of flight paths in these figures (coloured red), will move to the position shown by the preferred flight path option (bold blue line). It should also be assumed that the amount of dispersal of these flight paths will reduce due to the improved track keeping of aircraft navigating using RNAV.

Once above 4,000ft aircraft will disperse off the proposed flight path; how this dispersal will be manifested is illustrated by the 'possible vectoring' areas shown on the figures showing climb profile for each flight path (e.g. Figure 7 for route A).

8.5 Concentration

Due to the improved accuracy of RNAV, flights will tend to be more concentrated along the route centreline until above 4,000ft. For example Figure 11 for flight path B, the red concentration along the existing flight path shows how aircraft following the existing flight path (B5) are tightly concentrated close to the route centreline. For the proposed flight paths a similar degree of concentration will be seen along the straight segments of the preferred flight paths. Around the first turns there will still be some dispersal as indicated for routes C,D, E and F.

For routes C, D, E and F there will be some dispersal of flight paths in the first turn. This is illustrated by a red swathe in the figures for these routes. These flight paths take advantage of RNAV coding to enable aircraft to turn as early as possible. This results in some dispersion of flight paths in the first turn because different types of aircraft will follow slightly different flight paths. Within the red shaded swathes in the figures for those flight paths:

- Faster jet aircraft will fly towards the outside of the swathe.
- Slower propeller aircraft will fly closer to the inside of the turn.
- If for example faster jets predominate on the route the concentration will be more to the outside of the swathe.

8.6 CO_2 emissions

We know the aviation industry has a significant impact on the environment through CO_2 emissions. We are committed to working to reduce this impact where we can, by reducing taxiing times, reducing on-ground delays and providing flight path options that are as short and efficient as possible to achieve our operational and community objectives. We work with the CAA, ATC and our airline business partners to make reductions in this area. CO_2 is included in our flight path matrix as this is a key consideration when determining our preferred flight path option. For each proposed flight path we have compared the length of the track against the existing flight paths. This has allowed us to determine if the track length will be longer than, shorter than or similar to today. This is shown in dark aqua (longer than today) blue (similar to today) and green (shorter than today). For detailed information regarding this criteria see each flight path options matrix and related commentary.

8.7 Safety and ICAO design criteria

The safety of our passengers, staff and communities is our primary concern. The CAA regulates the UK aviation industry to ensure that airlines and airports operate in a safe manner. There is detailed legislation regarding safe aircraft flying (www.caa.com) and strict design criteria which must be met. As part of our Airspace Change Programme we have conducted tests to ensure that flight path options can be flown in a safe manner and meet the International Civil Aviation Organisation (ICAO) design criteria. A route may be determined as not meeting safety assessment criteria and therefore labelled as non-compliant if the standards required to separate aircraft on that route against other traffic on existing or new routes cannot be assured to a level equal to or greater than today's operation. If a flight path is determined to be unsafe or not meet criteria we have ruled it out as an option for this consultation, however, we have included this as part of our criteria matrix to show the flight path has been considered and why it has been ruled out. This is shown in red (not compliant and discounted) and green (compliant and meets design criteria). For detailed information regarding this criteria see each flight path options matrix and related commentary.

8.8 Community impacts

We used population density mapping to determine the main communities under the design envelopes. The population information was taken from the most recent census. For each proposed flight path we have considered the potential impact on these identified communities compared to existing flight paths. This has allowed us to determine if the flight path option is closer, further away or similar to today's operations. This is shown in dark aqua (flight path option is closer to the community than today or directly overflown) blue (flight path option has a similar impact to the community as today) and green (flight path option is further away from the community than today or not overflow). For detailed information regarding this criteria see each flight path options matrix and related commentary.

8.9 Options outside design envelope

Some of the design options fall outside the design envelopes that were shown in consultation 1. The reason for this is that the design envelopes shown in the first consultation were based upon route design criteria which used a certain RNAV coding method (PANS-OPS fly by waypoint with turn-to-fix coding). However as a result of feedback from consultation 1, and in order to minimise noise exposure at low altitude we explored other coding possibilities which could facilitate a tighter first turn (PANS-OPS fly-over waypoint with direct-to-fix coding). This has resulted in some of the routes being slightly outside the swathes identified in the first consultation. This consultation does constitute full consultation on these route options.

09

Flight path option commentary

The following section provides information for the proposed flight paths.
The first two maps show:

- a consolidated view of the preferred flight path options for Runway 06 and 24
- the current usage applied to the preferred flight path options to give an idea of how they preferred options would be used if in place today
- a table which shows the estimated usage in 2023 based on growth predictions.

It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

Noise information

While we have provided L_{max} information for each proposed flight path, there is more detailed noise information available in an independent report by the Environmental Research and Consultancy Department of the CAA. This report analyses the noise impact of the proposed routes individually and cumulatively.

Three types of analysis have been performed:

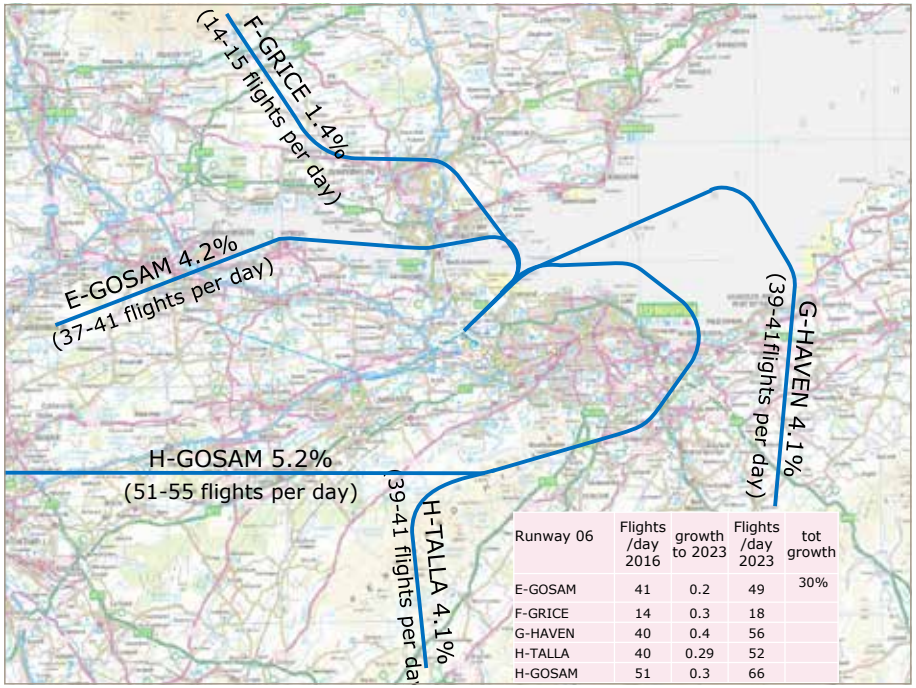
- Leq 16 hours contours – Cumulative measure of the average daily noise impact for locations around the airport. Each contour shows places where people get the same amounts of noise energy.
- L_{max} footprints – show the loudest noise experienced as a result of a single overflight (of the noisiest aircraft type in service). Note of the three types of measure only L_{max} figures can be directly compared to commonly experienced sound levels (e.g. a vacuum cleaner etc).
- SEL footprints – show the noise energy (concentrated into a 1 second interval) of a single overflight (of the noisiest aircraft type in service).

This full report is available on our website at www.letsgofurther.com or by requesting a copy at FREEPOST LETS GO FURTHER.

Community information

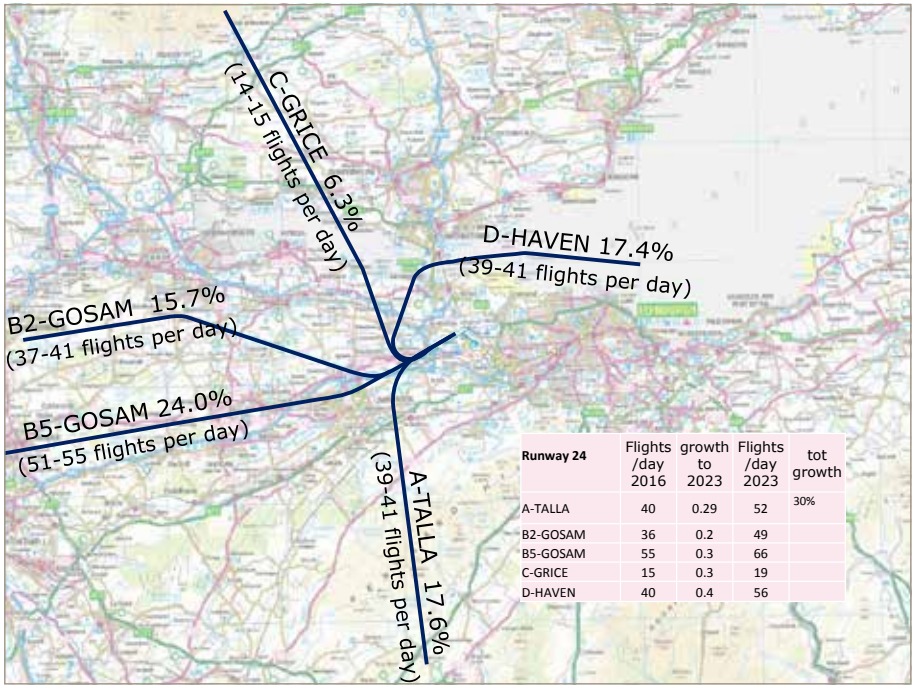
While we have provided community breakdown information for each proposed flight path, there is more detailed community information available in the community fact sheets available on our website at www.letsgofurther.com or by requesting a copy at FREEPOST LETS GO FURTHER.

Runway 06 departures (2016: 19% – 69 days per year)



Runway 06	Flights /day 2016	growth to 2023	Flights /day 2023	tot growth
E-GOSAM	41	0.2	49	30%
F-GRICE	14	0.3	18	
G-HAVEN	40	0.4	56	
H-TALLA	40	0.29	52	
H-GOSAM	51	0.3	66	

Runway 24 departures (2016: 81% – 296 days per year)



Runway 24	Flights /day 2016	growth to 2023	Flights /day 2023	tot growth
A-TALLA	40	0.29	52	30%
B2-GOSAM	36	0.2	49	
B5-GOSAM	55	0.3	66	
C-GRICE	15	0.3	19	
D-HAVEN	40	0.4	56	

FLIGHT PATH A

Runway 24 departures left turn

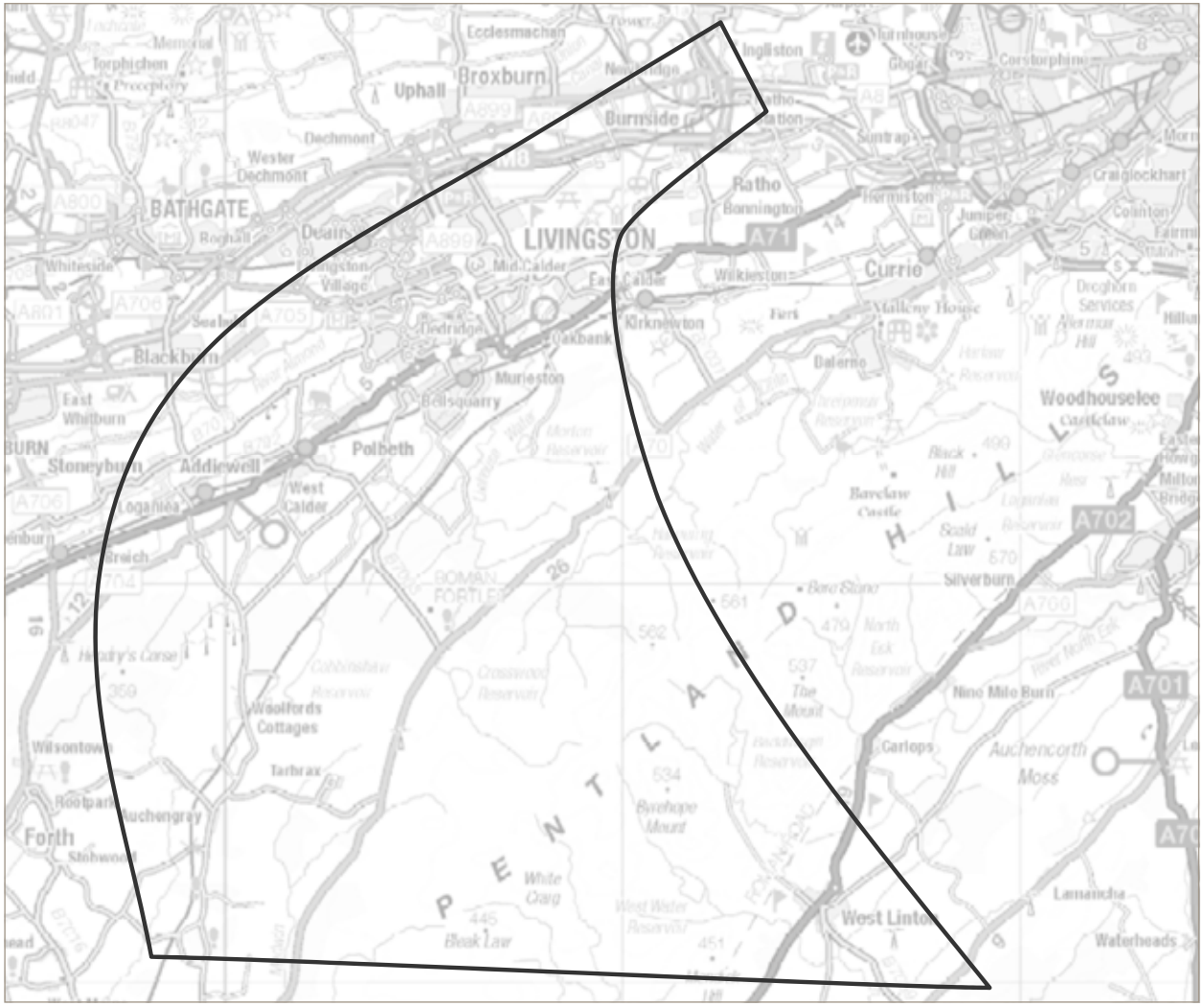


Figure 5: Consultation 1 design envelope

9.1 Flight path A: Runway 24 departures left turn

The Route A design envelope covered areas in West Lothian including Livingston, Kirknewton, Polbeth, Addiewell, Blackburn, East Calder, Mid Calder and West Calder (see Figure 5). Route A will replace the current TALLA SID. The proposed route will only be available for non-jet aircraft (as is the case for the current TALLA route).

9.1.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying, impact on rural areas and adding to an already noisy area (existing flight path).
- Local pollution and environment including air quality and general increase in pollution.
- Health including sleep disturbance and general concerns about the impact of aircraft operations on health.

Specific local issues raised from these communities were concerns for the impact on Five Sisters Zoo, RAF Kirknewton and St John's Hospital.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

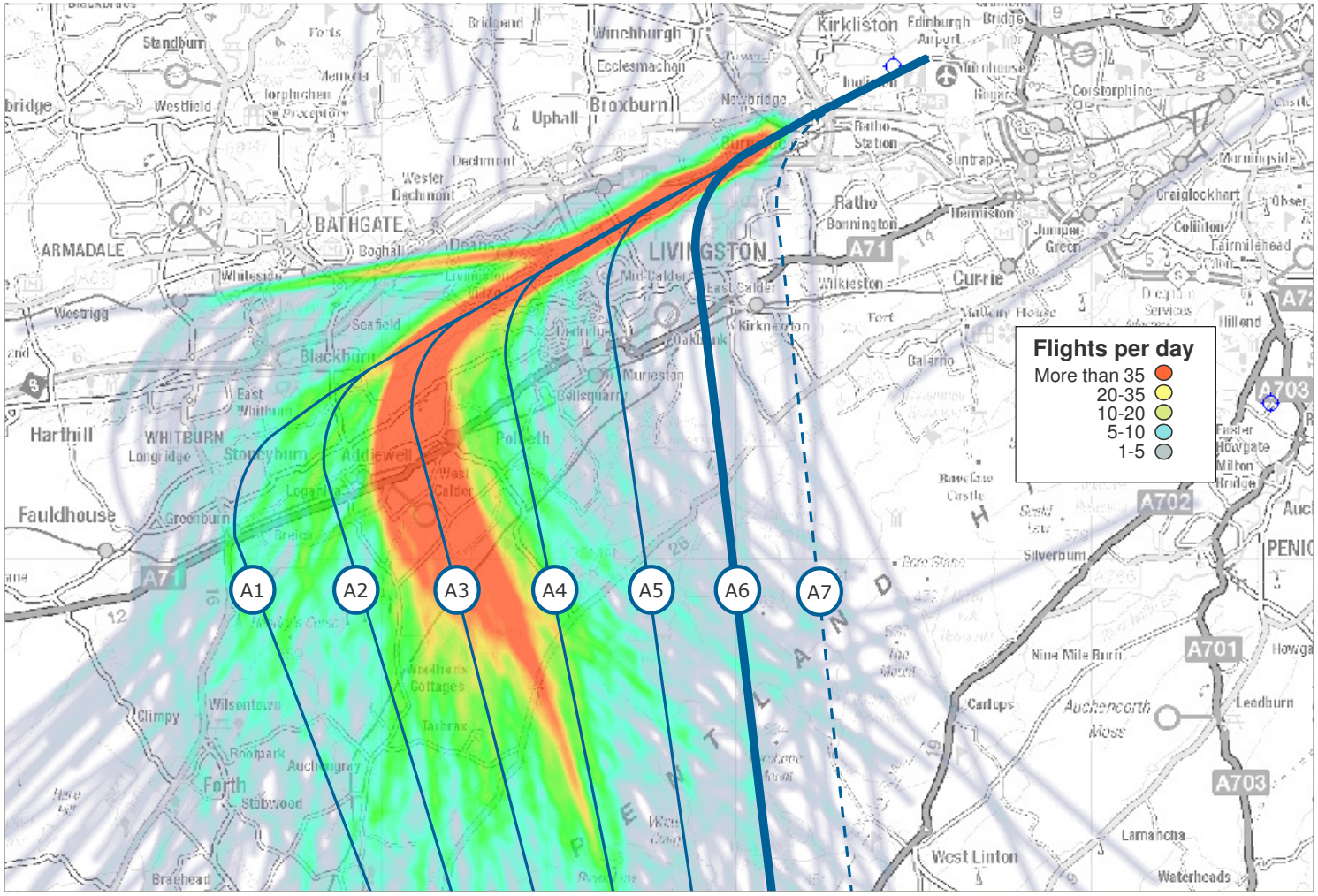
9.1.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements.

Based on the feedback received and the criteria outlined above, we investigated a number of potential Route A options within the design envelope (see Figure 5).

Route A6 is our preferred flight path.

Figure 6: Considered route options for flight path A



This map shows the current flight tracks, overlaid with our considered flight path options (A1-A7).

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.1.3 Preferred option – A6

Our preferred design option is A6. To determine this decision we tabled all of the options against our criteria (see Table 3).

Table 3

		A1	A2	A3	A4	A5	A6	A7
Safety/ICAO design criteria		Compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Non compliant
CO_2		Longer track	Longer track	Similar	Shorter	Shorter	Shorter	Shorter
Noise – population overflown		Similar	Similar	Similar	Similar	Similar	Less	Less
Noise – new population impacted		More	More	No	More	More	Slightly more	Slightly more
Populations impacted								
Broxburn	14,140	Similar	Similar	Similar	Similar	Similar	Further away	Further away
Uphall		Similar	Similar	Similar	Similar	Similar	Further away	Further away
Dechmont		Similar	Similar	Similar	Similar	Similar	Further away	Further away
Livingston – 56,269		Similar	Similar	Similar	Similar	Overflown	Further away	Further away
Kirknewton – 2,267		Similar	Similar	Similar	Similar	Similar	Closer	Overflown
Polbeth	5,370	Further away	Further away	Similar	Overflown	Further away	Further away	Further away
Addiewell		Further away	Overflown	Similar	Further away	Further away	Further away	Further away
Stoneyburn – 3,790		Overflown	Closer	Further away	Further away	Further away	Further away	Further away
Blackburn – 4,970		Overflown	Overflown	Similar	Further away	Further away	Further away	Further away
Bathgate – 20,363		Closer	Closer	Similar	Further away	Further away	Further away	Further away

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.1.4 Optioneering

When considering design options, we needed to balance the impact on communities, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultant to provide expert advice.

Regulatory

All flight path options except A7 meet safety requirements and ICAO design criteria.

Operational

Our preferred option (A6) allows for future growth projections. It meets our need for reduced departure separation times. All flight path options meet our need for reduced separation times. This flight path would typically be used by 17.6% of flights (40 flights per day in 2016, 52 flights per day in 2023).

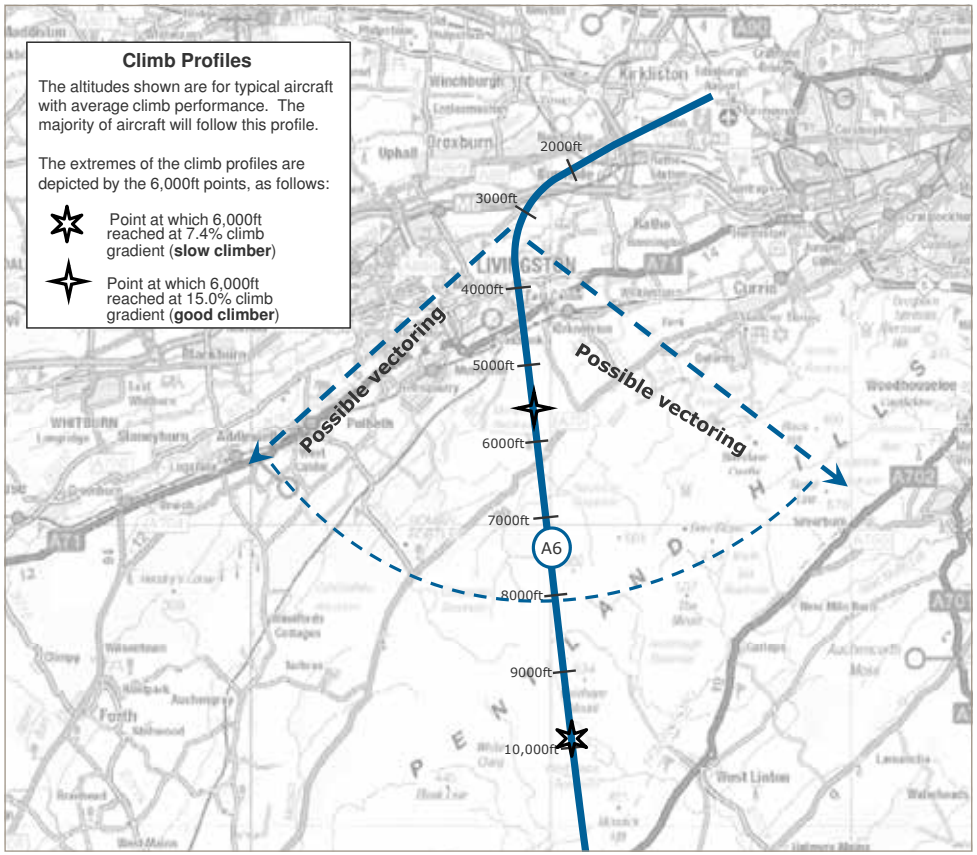
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and positioning the flight paths over less-populated communities. Our Criteria Matrix for Route A lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see, Route A6 overflies the fewest number of communities identified in this area. It moves the existing route away from the centre of Livingston. However, this does move the preferred route closer to Kirknewton.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Already a noisy area with lots of flight paths, it's not fair to raise more.	The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our preferred flight path option (A6) moves the existing route away from the centre of Livingston and reduces the noise impact on this densely populated area.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (A6) is the shortest flight path which reduces CO_2 emissions in comparison to the current flight path.
Air quality.	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 1,0000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to the CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Impact on Five Sisters Zoo.	Five Sisters Zoo is located in West Calder under the existing flight path. Our preferred option (A6) moves the flight path further away from Five Sisters Zoo.
Impact on St John's Hospital.	St John's Hospital is located in Livingston under the existing flight path. Our preferred option (A6) moves the flight path further away from St John's Hospital. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the local community impacted to assess smaller facilities on a case-by-case basis to mitigate any impacts in line with legislation.
Impact on RAF Kirknewton.	The airspace for RAF Kirknewton's gliding facility is located next to this design envelope. We are in conversation with the Ministry of Defence regarding our proposals and working together to ensure the optimal results for both parties.

9.1.5 Preferred option

Our preferred flight path option is A6. To determine this decision we tabled all of the options against our criteria (Refer to Table 3).

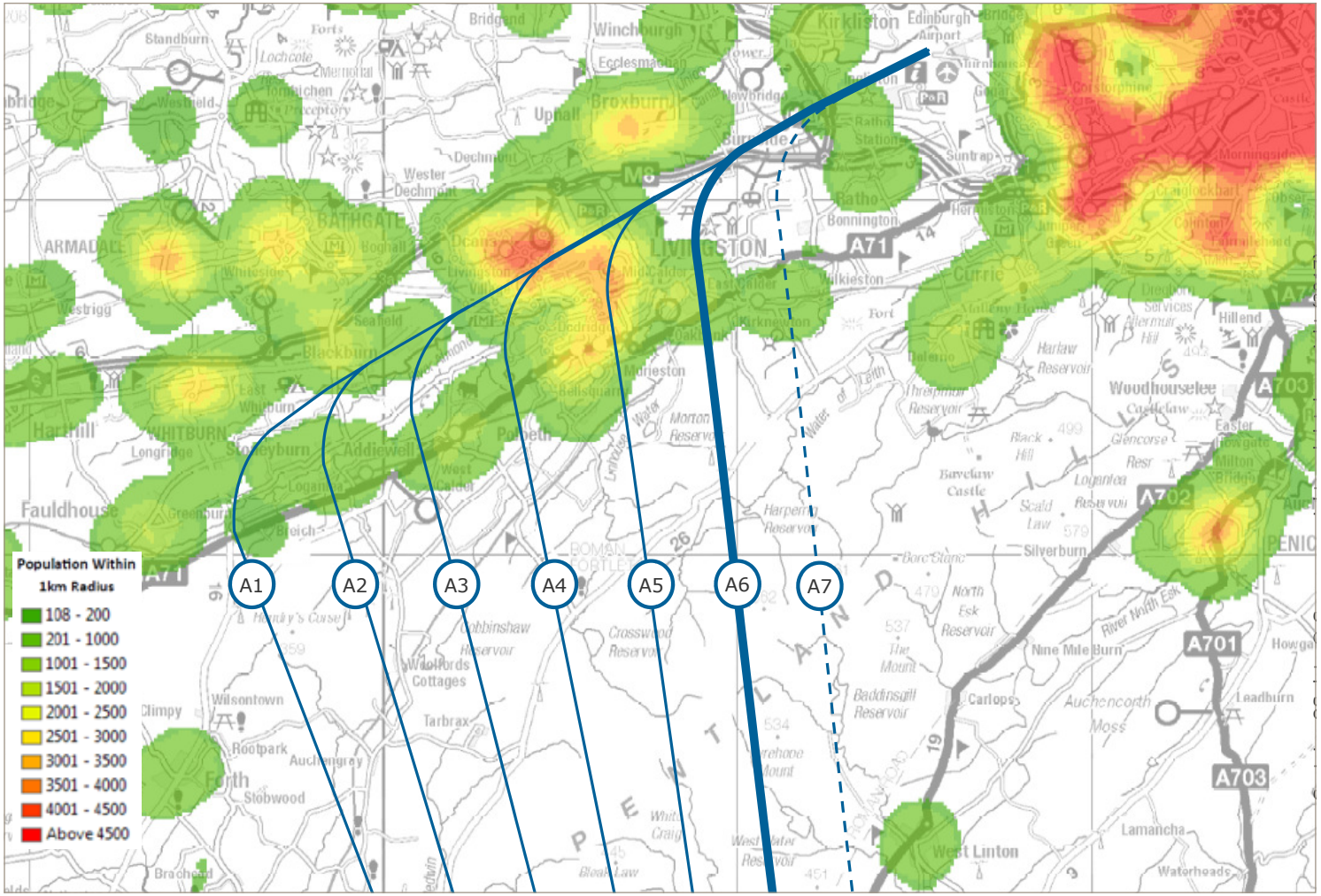
Figure 7: Preferred option for flight path A with typical climb profiles



This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

Figure 8: Considered flight path options against population for flight path A



This map shows population density, overlaid with our flight path options (A1-A7).

Figure 9: Large twin turboprop L_{max} footprint for proposed flight path A

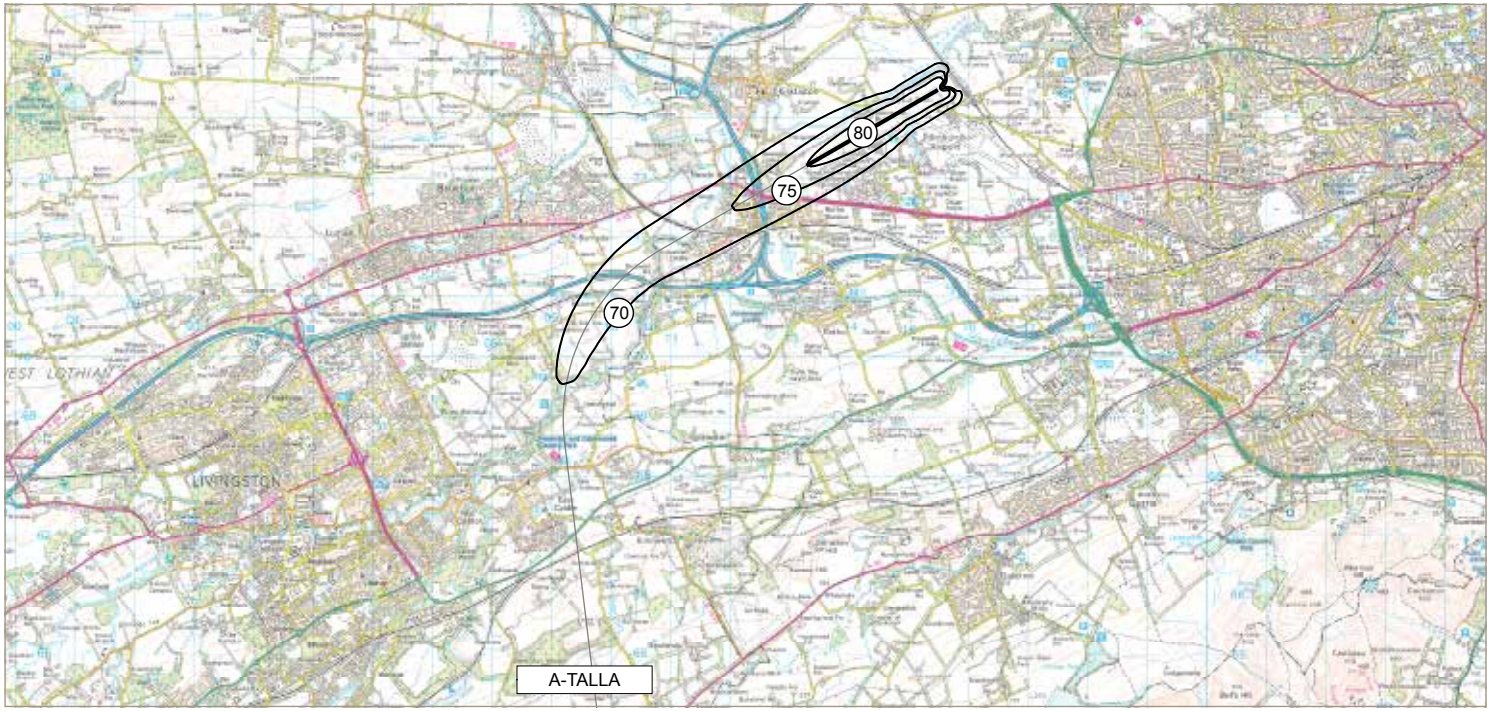


Figure 9 above shows the L_{max} footprint for the proposed flight path A and is based on noise from a large twin turboprop. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.1.6 Other flight path options

Other flight path option	Analysis
A1	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. A1 was not preferred as it was a longer track than A6, resulting in increased CO_2 emissions. A1 would continue to impact the centre of Livingston and impact new areas increasing the population overflown in comparison to the existing flight path.
A2	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. A2 was not preferred as it was a longer track than A6, resulting in increased CO_2 emissions. A2 would continue to impact the centre of Livingston and impact new areas increasing the population overflown in comparison to the existing flight path. A2 does not allow for Edinburgh Airport's future growth plans as it does not meet our need for reduced departure separation times.
A3	A3 replicates the existing flight path. While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community and operations criteria. A3 does not allow for Edinburgh Airport's future growth plans as it does not meet our need for reduced departure separation times. A3 also provides no reduction in noise or environmental impacts as it replicates the existing flight paths, A6 provides improvements in these areas.
A4	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. A4 would continue to impact the centre of Livingston and impact new areas increasing the population overflown in comparison to the existing flight path and the noise benefits to these communities would be less than our preferred option of A6.
A5	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. A5 would continue to impact the centre of Livingston and impact new areas increasing the population overflown in comparison to the existing flight path and the noise benefits to these communities would be less than our preferred option of A6.
A7	This flight path option does not meet ICAO design criteria for the first turn.

FLIGHT PATH B

Runway 24 departures straight ahead

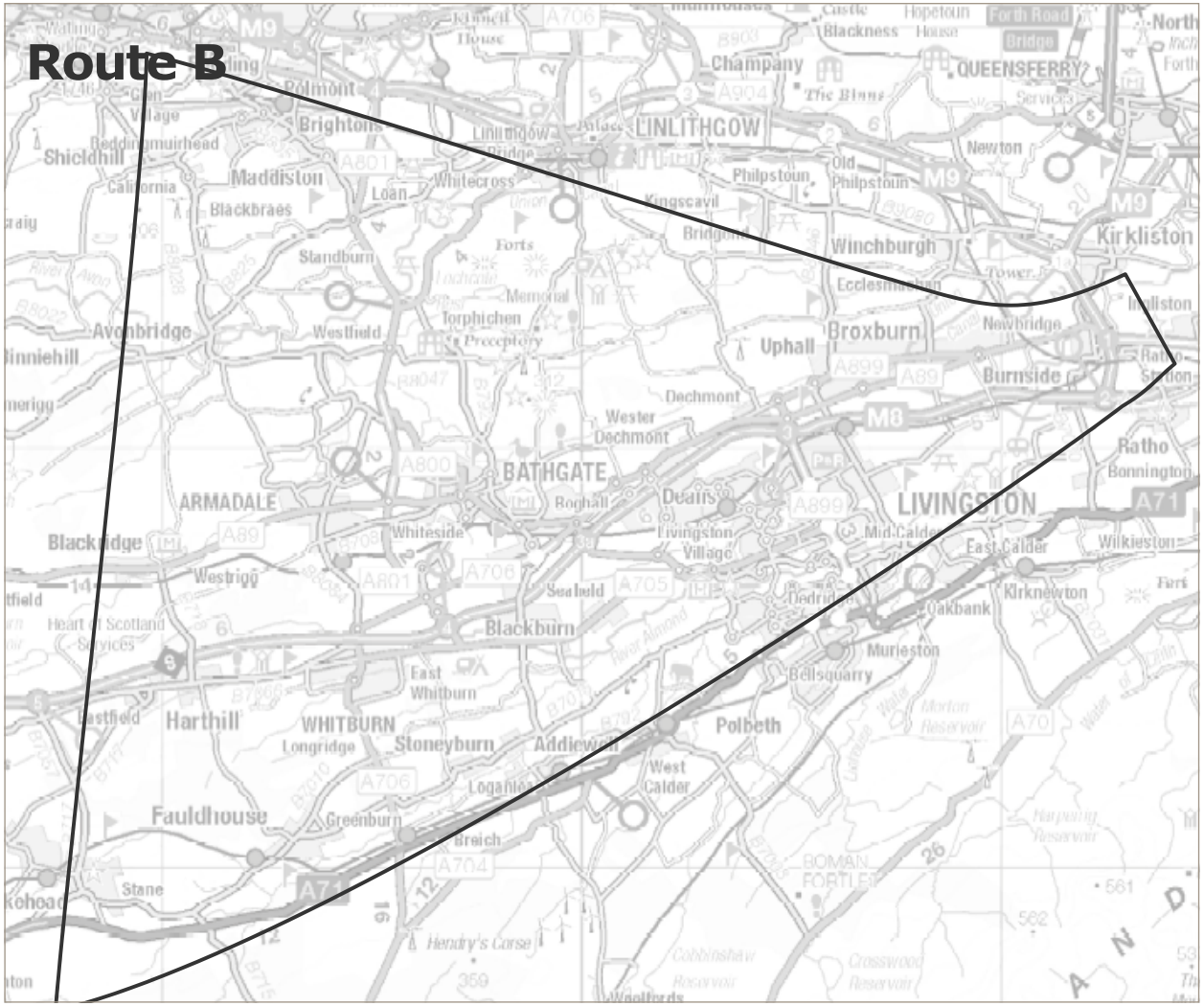


Figure 10: Consultation 1 design envelope

9.2 Flight path B: Runway 24 departures straight ahead

The Route B design envelope covered areas in West Lothian including Livingston, Addiewell, Blackburn, Stoneyburn, Bathgate, Whitburn, Armadale, Torphichan, Broxburn, Uphall, Ecclesmachan and Dechmont (see Figure 10).

The current GOSAM flight path from Runway 24 is the most frequently used (58% of runway 24 departures use GOSAM). The design requirement for this route was to keep the current flight path, and introduce an offload route to enable growth while reducing the impact for those on the ground.

How flights are allocated to routes is explained in Table 12. This explains the flights on the B2 flight path go from CUMBO to TRN and then onto specific destinations.

9.2.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying, impact on rural areas and adding to an already noisy area (existing flight path).
- Local pollution and environment including air quality and general increase in pollution.
- Health including sleep disturbance and general concerns about the impact of aircraft operations on health.

Specific local issues raised from these communities were concerns for the impact on St John's Hospital, Union Canal and, rural areas, Oatridge Agricultural College, Scottish National Equestrian Centre and Five Sisters Zoo.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

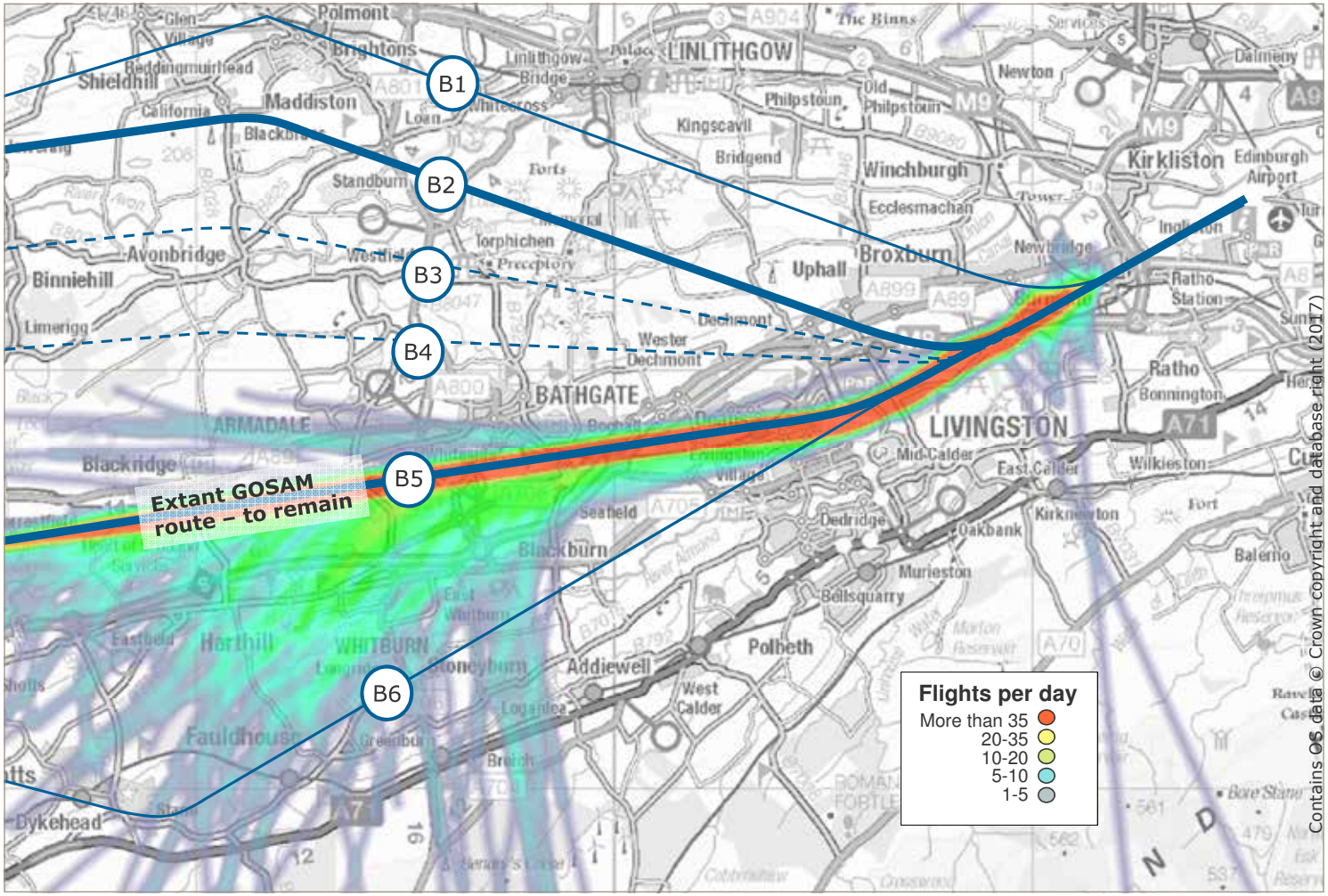
9.2.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements.

Based on the feedback received and the criteria outlined above, we investigated a number of potential Route B options within the design envelope (see Figure 10).

Routes B2 and B5 are our preferred flight paths.

Figure 11: Route options for flight path B



This map shows the current flight tracks, overlaid with our flight path options (B1-B7).

See section 7.3 for explanation of flight path densities. How flights are allocated to routes is explained in Table 12. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.2.3 Preferred option – B5 and B2

Our preferred design option is to keep the existing route B5 and to add parallel route, B2. To determine this decision we tabled all of the options against our criteria (see Table 4).

Table 4

		B1	B2	B3	B4	B5	B6
Safety/ICAO design criteria		Compliant	Compliant	Non compliant	Non compliant	Compliant	Non compliant
CO_2		Longer track	Longer track	Longer track	Similar	Similar	Similar
Noise – population overflown		Less	Less	Less	Less	Similar	Similar
Noise – new population impacted		More	Slightly less	Slightly less	Slightly less	No	No
Operational benefit – reduced delay		Yes	Yes	Yes	Yes	Similar	Yes
Populations impacted							
Broxburn	14,140	Closer	Similar	Similar	Similar	Similar	Similar
Uphall		Overflown	Overflown	Closer	Closer	Similar	Similar
Dechmont		Closer	Overflown	Overflown	Overflown	Similar	Similar
Ecclesmachan		Closer	Closer	Closer	Not overflown	Not overflown	Not overflown
Livingston – 56,269		Further away	Further away	Further away	Further away	Similar	Similar
Torphichen – 570		Not overflown	Closer	Closer	Closer	Not overflown	Not overflown
Bathgate – 20,363		Not overflown	Not overflown	Further away	Further away	Similar	Further away
Blackburn – 4,970		Not overflown	Not overflown	Not overflown	Not overflown	Not overflown	Not overflown
Stoneyburn – 3,790		Not overflown	Not overflown	Not overflown	Not overflown	Not overflown	Not overflown
Linlithgow – 19,000		Not overflown	Not overflown	Not overflown	Not overflown	Not overflown	Not overflown
Polmont/Brightons – 3,790		Not overflown	Not overflown	Not overflown	Not overflown	Not overflown	Not overflown

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.2.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultant to provide expert advice.

Regulatory

All flight path options except B3, B4 and B6 meet safety requirements and ICAO design criteria.

Operational

All flight path options allow for future growth projections, meeting our need for reduced departure separation times. Flight path B2 would typically be used by 15.7% of flights (36 flights per day in 2016, 49 flights per day in 2023). Flight path B5 would typically be used by 24% of flights (55 flights per day in 2016, 66 flights per day in 2023).

For route B5 the track over the ground is the same as for the existing GOSAM SID. However the proposed route has an improved climb profile (without the 6,000ft restriction at D14). Hence aircraft will be able to climb higher with unrestricted climbs. This in turn results in less noise impact and reduced CO_2 emissions.

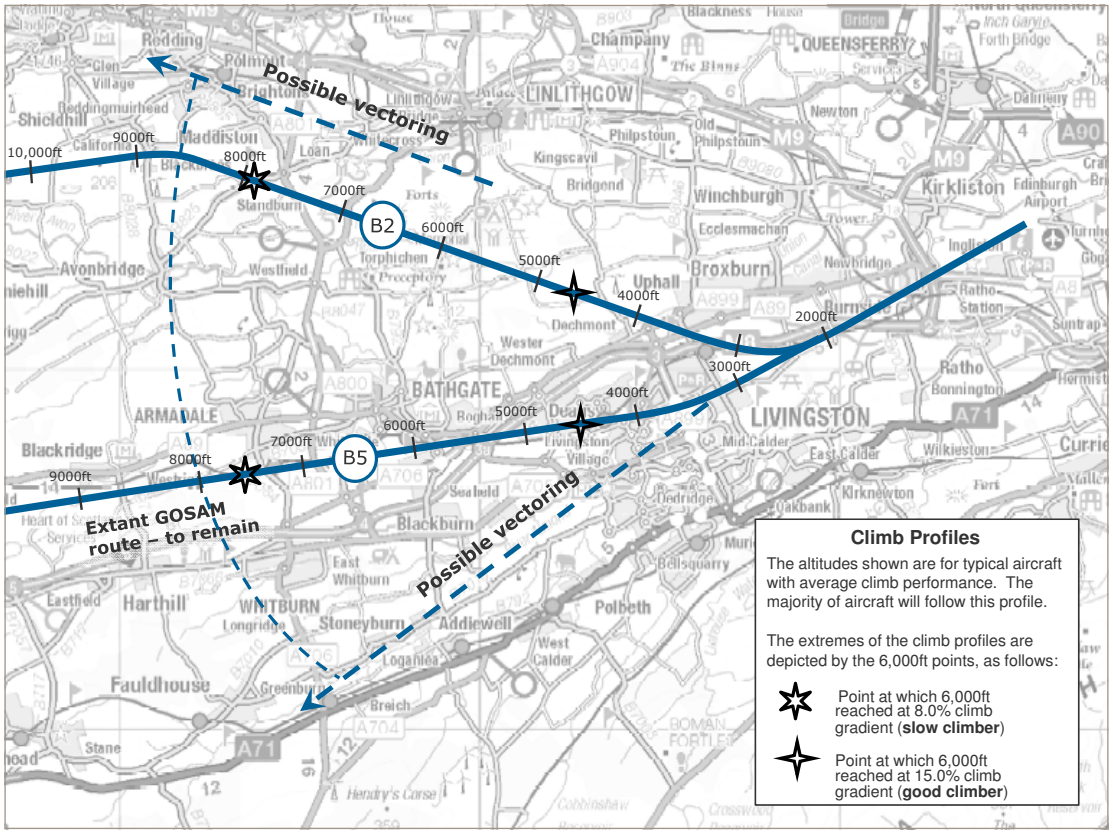
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and positioning the flight paths over less-populated communities. Our Criteria Matrix for Route B lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see, Route B5 replicates the existing flight path, however, we understand the communities' concerns regarding an already busy flight path and propose using Route B5 in conjunction with B2 allowing for less use on the B5 flight path option but allowing for future growth. B2 moves the existing route away from the centre of Livingston. However, this does move the secondary preferred route closer to Uphall, Dechmont, Ecclesmachan and Torphichen. B2 terminates at CUMBO, the onward route would be to TRN.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-spopulated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Already a noisy area with lots of flight paths, it's not fair to raise more.	As you can see Route B5 replicates the existing flight path, however, we understand the communities' concerns regarding an already busy flight path and propose using Route B5 in conjunction with B2 allowing for less use on the B5 flight path option but allowing for future growth. B2 moves the existing route away from the centre of Livingston. However, this does move the secondary preferred route closer to Uphall, Dechmont, Ecclesmachan and Torphichen. Our use of the joint preferred flight path options (B5 and B2) moves some traffic away from the centre of Livingston and reduces the noise impact on this densely-populated area.
Local pollution and environment issues	
General increase in pollution over the local area.	Our use of the joint preferred flight path options (B5 and B2) moves some traffic away from the centre of Livingston and reduces the impact on this densely-populated area.
Air quality.	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Impact on Five Sisters Zoo.	Five Sisters Zoo is located in West Calder under the existing flight path. The use of the offload flight path B2 will reduce the number of flights over Five Sisters Zoo.
Impact on St John's Hospital.	St John's Hospital is located in Livingston under the existing flight path. The use of the offload flight path B2 will reduce the number of flights over St John's Hospital. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the local community impacted to assess smaller facilities on a case-by-case basis to mitigate any impacts in line with legislation.
Impact on Union Canal.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and Scottish Environmental Protection Agency and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Impact on Oatridge Agricultural College.	Oatridge Agricultural College is located in Ecclesmachan. Our preferred option (B5 and B2) continue to not overfly Oatridge Agricultural College.
Impact on Scottish National Equestrian Centre.	The Scottish National Equestrian Centre is located in Ecclesmachan. Our preferred option (B5 and B2) continue to not overfly the Scottish National Equestrian Centre.

9.2.5 Preferred option

Our preferred design options are B5 and B2. To determine this decision we tabled all of the options against our criteria (see Table 4).

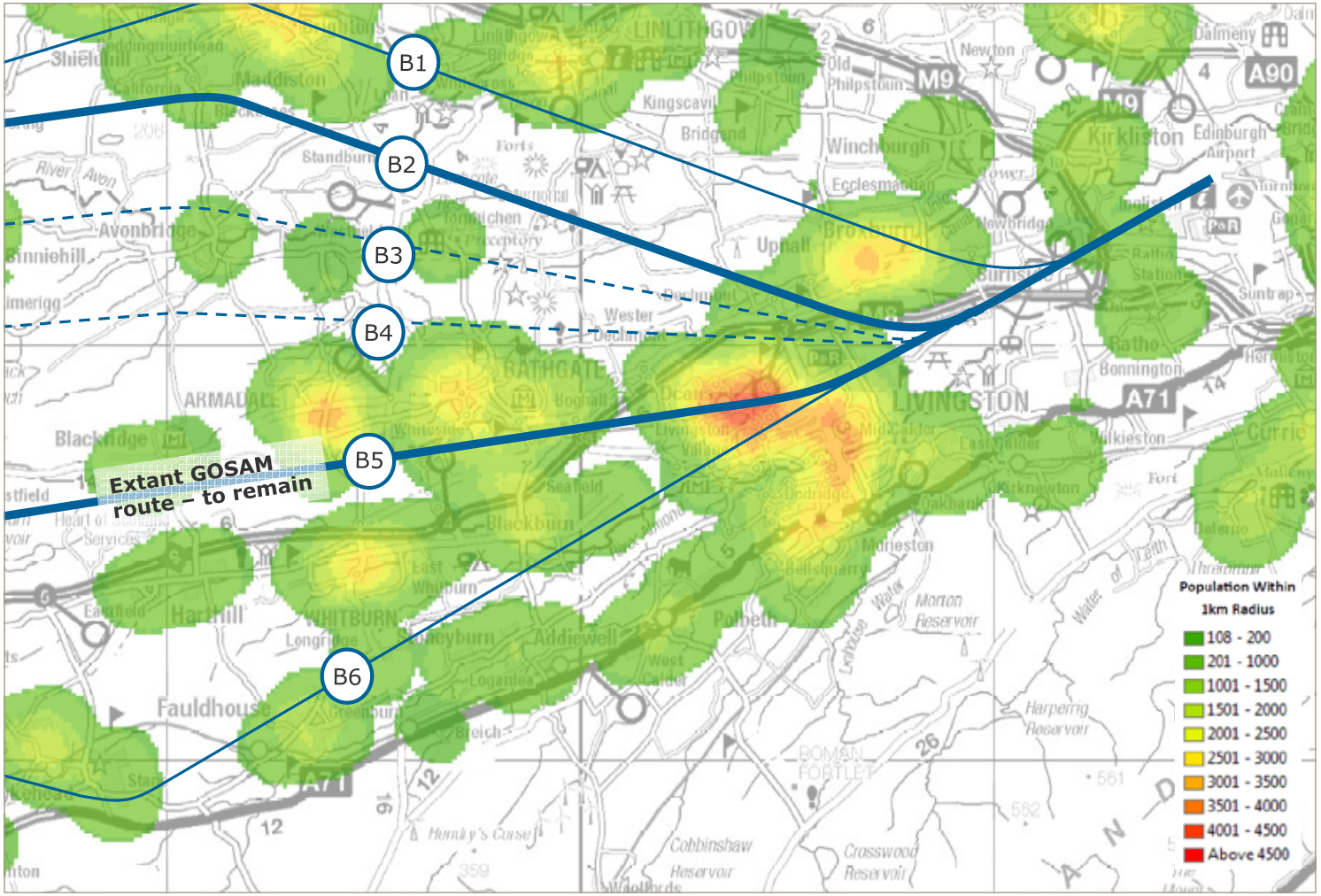
Figure 12: Preferred option for flight path B with typical climb profiles



This map shows our preferred flight path and provides guidance on minimum altitudes along the route. How flights are allocated to routes is explained in Table 12.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

Figure 13: Route options for flight path B



This map shows population density, overlaid with our flight path options (B1-B6).

Figure 14a: Airbus A330 L_{max} footprints for Runway 24 – B5-GOSAM proposed SID

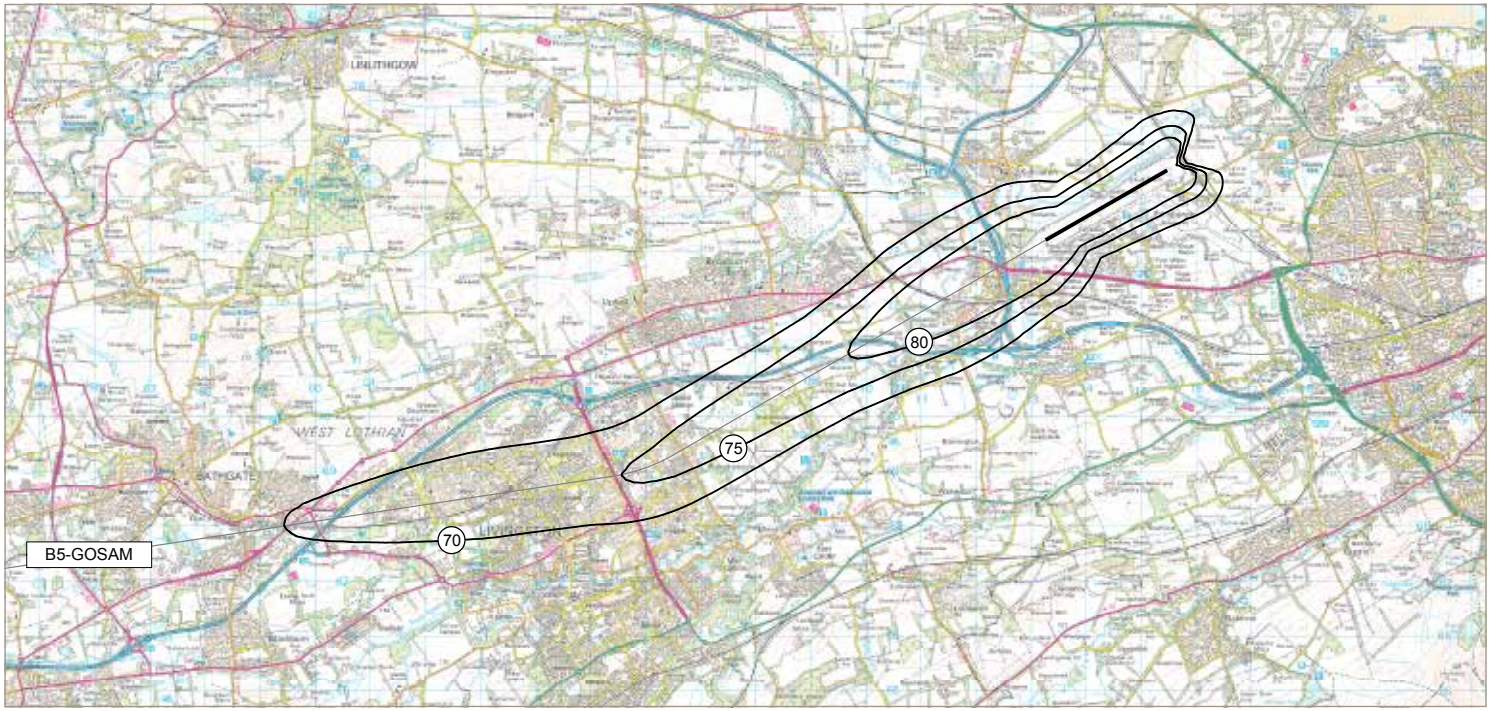
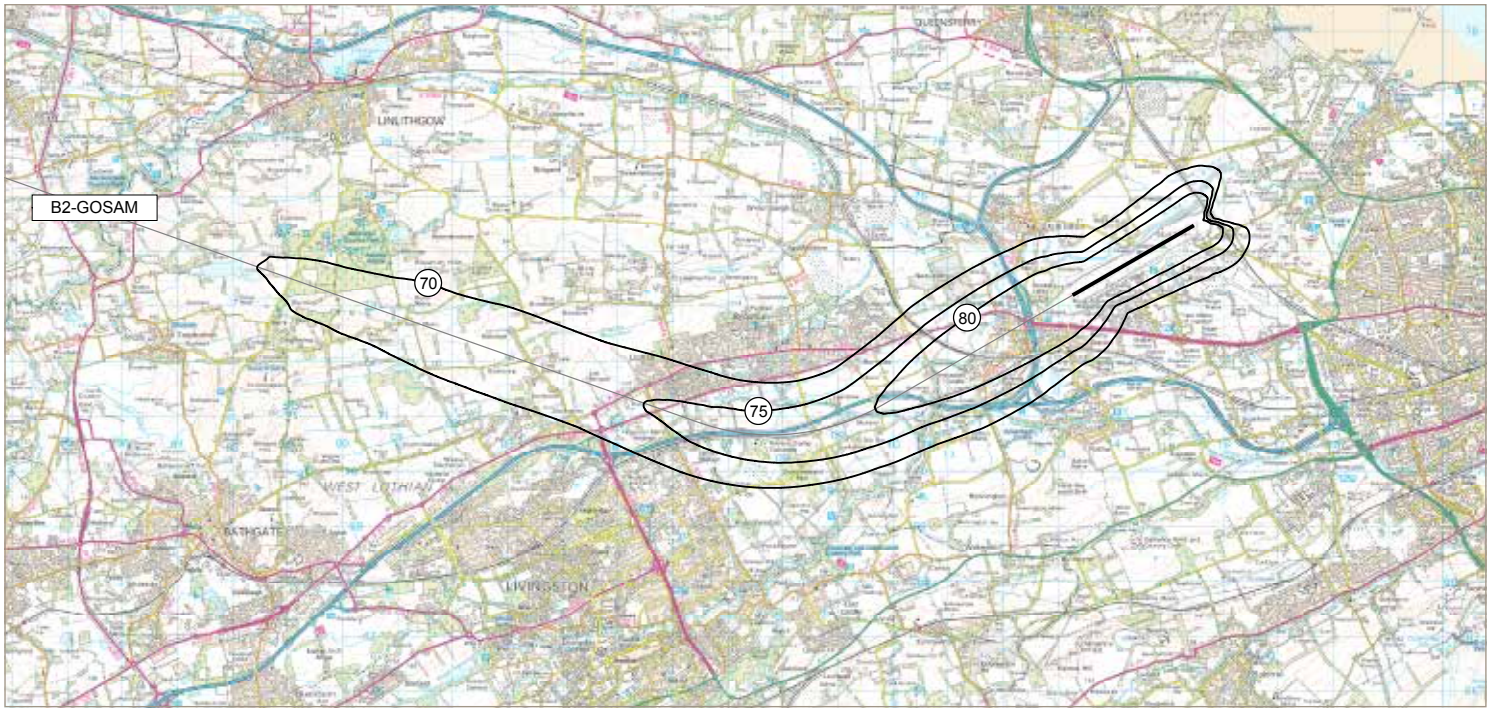


Figure 14a and 14b show the L_{max} footprint for each of our preferred Runway 24 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

Figure 14b: Airbus A330 L_{max} footprints for Runway 24 – B2-GOSAM proposed SID



9.2.6 Other flight path options

Other flight path options	Analysis
B1	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. B1 was not preferred as it was a longer track than B5, resulting in increased CO_2 emissions. B1 would impact new populations within Broxburn, Dechmont, Ecclesmachan and Uphall increasing the population overflown in comparison to the existing flight path.
B3	This flight path option does not meet safety requirements as it does not provide sufficient separation from route B2 or B5 to enable both routes to be used.
B4	This flight path option does not meet safety requirements as it does not provide sufficient separation from route B2 or B5 to enable both routes to be used.
B6	This flight path option does not meet safety and ICAO design criteria as it is too close to arriving/holding traffic patterns for Glasgow Airport and places Edinburgh departures into the Edinburgh arrivals airspace sector, increasing ATC workload.

FLIGHT PATH C

Runway 24 departures right turn to north

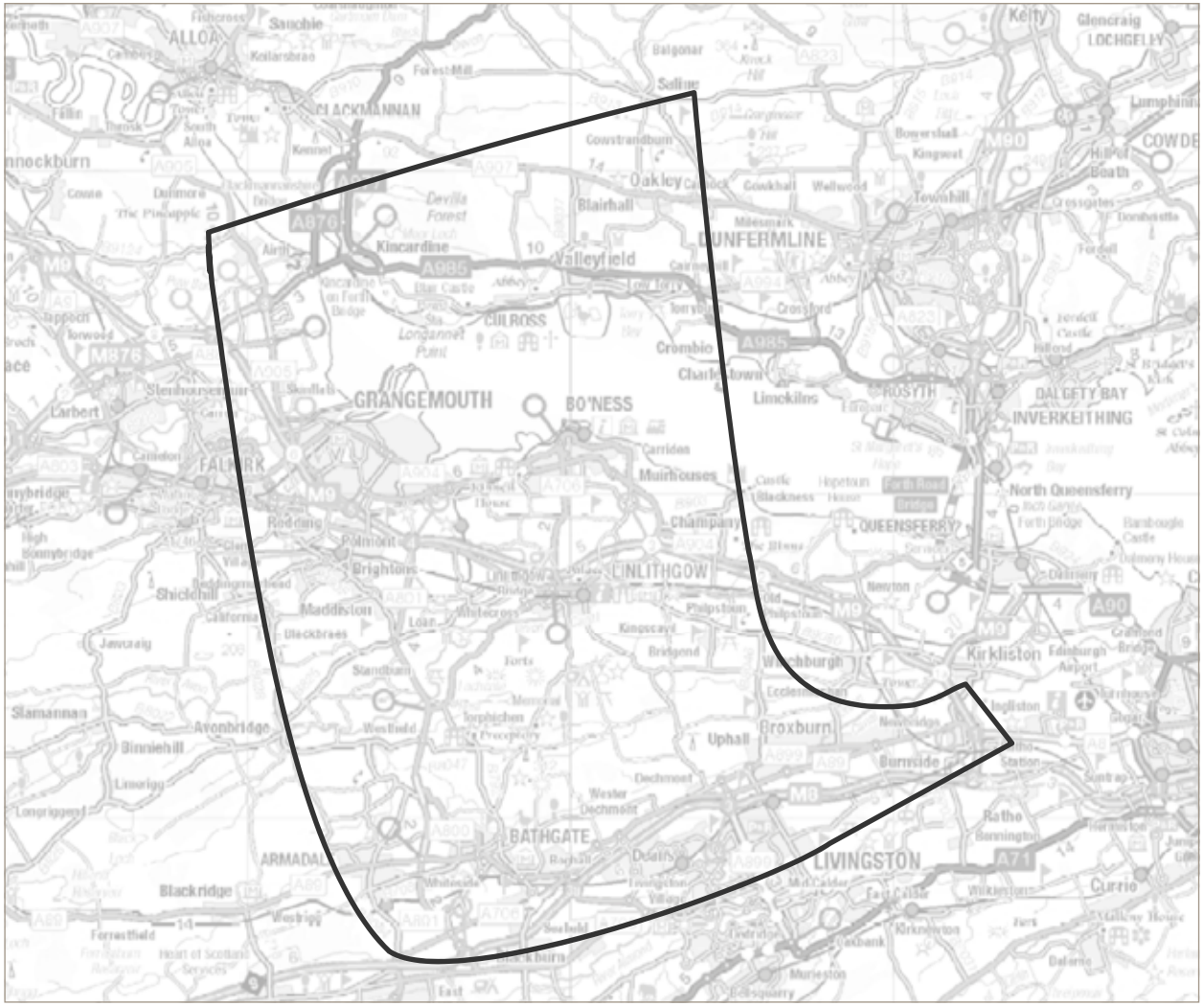


Figure 15: Consultation 1 design envelope

9.3 Flight path C: Runway 24 departures right turn to north

The Route C design envelope covered areas in West Lothian and Falkirk including Broxburn, Uphall,Ecclesmachan, Dechmont, Philpstoun, Linlithgow, Bo'ness, Grangemouth, Bathgate and Polmont (see Figure 15).

9.3.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying, impact on rural areas and adding to an already noisy area (existing flight path).
- Local pollution and environment including air quality and general increase in pollution.
- Health including sleep disturbance and general concerns about impact on health.
- The TUTUR airspace trial which ran between June and October 2015 and primarily impacted on communities in West Lothian, Falkirk and Fife.

Specific local issues raised from these communities were concerns for the safety impact of flying over Grangemouth Petrol Chemical Plant and Oil Refinery, Beecraigs Country Park and Linlithgow Palace.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

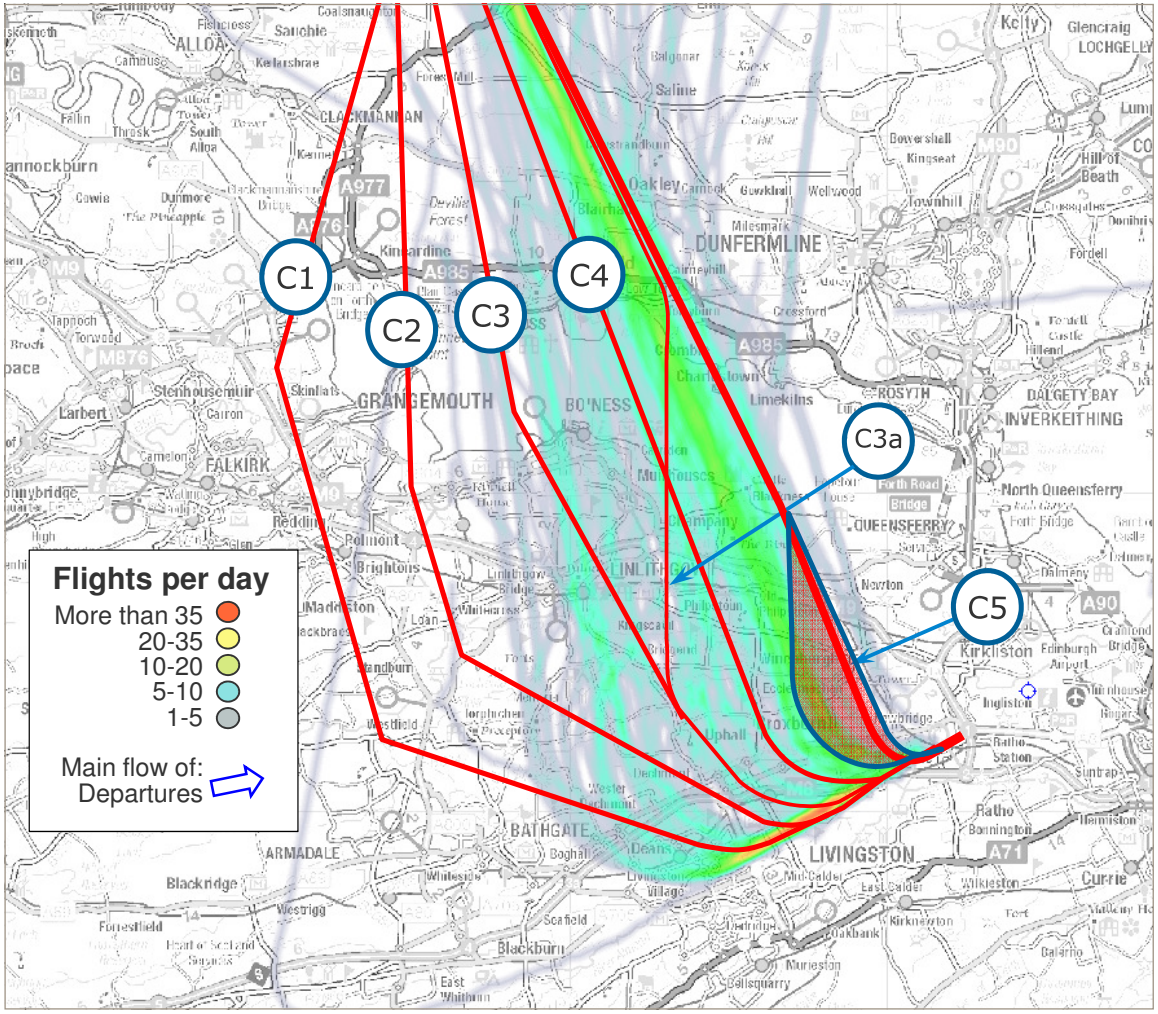
9.3.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. (We explain our criteria breakdown and our approach in the introduction to this in section 8 on page 34.)

Based on the feedback above and the criteria outlined, we investigated a number of potential Route C options within the design envelope (see Figure 15).

Route C5 is our preferred flight path.

Figure 16: Route options for flight path C



This map shows the current flight tracks, overlaid with our flight path options (C1-C5).

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.3.3 Preferred option – C5

Our preferred design option is C5. To determine this decision we tabled all of the options against our criteria (see Table 5).

Table 5

		C1	C2	C3	C3a	C4	C5
Safety/ICAO design criteria		Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
CO_2		Longer track	Longer track	Similar	Similar	Shorter	Shorter
Noise – population overflown		More	Similar	More	Less	Less	Less
Noise – new population impacted		More	More	More	More	Similar	Similar
Operational benefit – reduced delay		Similar	Similar	Similar	Similar	Similar	Similar
Populations impacted	**Broxburn**	14,140	Further away	Further away	Similar	Similar	Closer	Overflown
	Uphall		Further away	Further away	Overflown	Overflown	Overflown	Further away
	Dechmont		Closer	Overflown	Closer	Closer	Similar	Further away
	Ecclesmachan		Not overflown	Further away	Similar	Similar	Overflown	Closer
	Winchburgh – 2,000		Not overflown	Further away	Similar	Similar	Similar	Overflown
	Livingston – 56,269		Similar	Similar	Further away	Further away	Further away	Further away
	South Queensferry – 9,026		Not overflown	Not overflown	Further away	Similar	Similar	Closer
	Torphichen – 570		Overflown	Closer	Not overflown	Not overflown	Not overflown	Not overflown
	Bathgate – 20,363		Closer	Closer	Not overflown	Not overflown	Not overflown	Not overflown
	Linlithgow	19,000	Not overflown	Closer	Overflown	Closer	Similar	Further away
	Philpstoun		Not overflown	Not overflown	Similar	Closer	Overflown	Similar
	Bo'ness – 14,490		Not overflown	Closer	Overflown	Closer	Similar	Further away
	Grangemouth – 17,373		Overflown	Closer	Not overflown	Not overflown	Not overflown	Not overflown
	Falkirk – 32,422		Closer	Closer	Not overflown	Not overflown	Not overflown	Not overflown
	Polmont/Brightons – 9,253		Overflown	Closer	Not overflown	Not overflown	Not overflown	Not overflown
	Blackness – 135		Not overflown	Not overflown	Further away	Similar	Similar	Similar
	Limekilns – 1,430		Not overflown	Not overflown	Further away	Similar	Further away	Closer

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.3.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultation to provide expert advice.

Regulatory

All flight path options meet safety requirements and ICAO design criteria.

Operational

Our preferred option (C5) allows for future growth projections; it meets our need for reduced departure separation times. This flight path would typically be used by 6.3% of flights (15 flights per day in 2016, 19 flights per day in 2023).

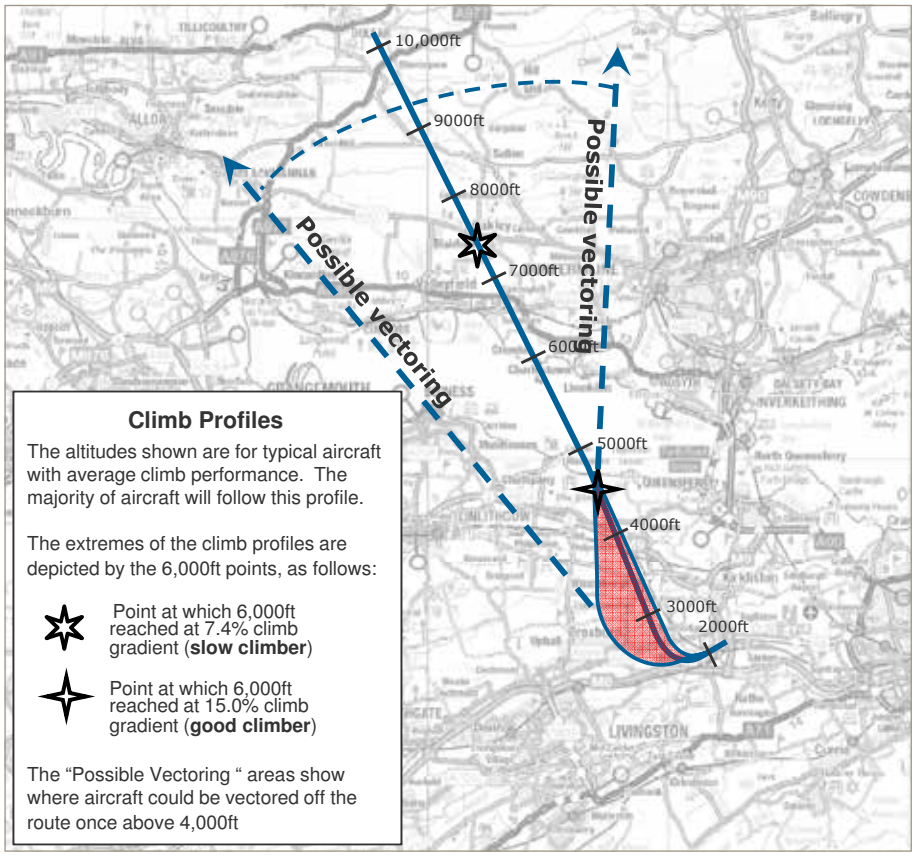
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our Criteria Matrix for Route C lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see Route C5 overflies the fewest number of communities identified in this area. It moves the existing route away from the centre of Livingston, Bo'ness and Linlithgow. It also introduces an earlier turn to move the existing route away from Uphall and Decmont.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". We note the feedback from communities regarding tranquil areas within this design envelope. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (C5) is the shortest flight path which reduces CO_2 emissions in comparison to the current flight path.
Air quality.	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Impact on Beecraig's Country Park.	Beecraig's Country Park is located in Bathgate under the existing flight path. Our preferred option (C5) moves the flight path further away from Beecraig's Country Park.
Grangemouth Petrol Chemical Plant and Oil Refinery.	Grangemouth Petrol Chemical Plant and Oil Refinery is located in Grangemouth under the existing flight path. Our preferred option (C5) moves the flight path further away from Grangemouth Petrol Chemical Plant and Oil Refinery. However, there is no CAA restriction regarding overflying Grangemouth Petrol Chemical Plant and Oil Refinery.
Linlithgow Palace.	Linlithgow Palace is located in Linlithgow under the existing flight path. Our preferred option (C5) moves the flight path further away from Linlithgow Palace.
TUTUR.	C5 has introduced an early turn over the east end of Broxburn which is a more industrial area, moving the traffic away from the residential areas of Broxburn and Uphall. Another area of concern during TUTUR was the noise made during aircraft turning due to the turn on the flight path. C5 is a more direct route with less turn than the existing flight path and that flown during the TUTUR trial in 2015.

9.3.5 Preferred option

Our preferred design option is C5. To determine this decision we tabled all of the options against our criteria (see table 5).

Figure 17: Preferred option for flight path C with typical climb profiles

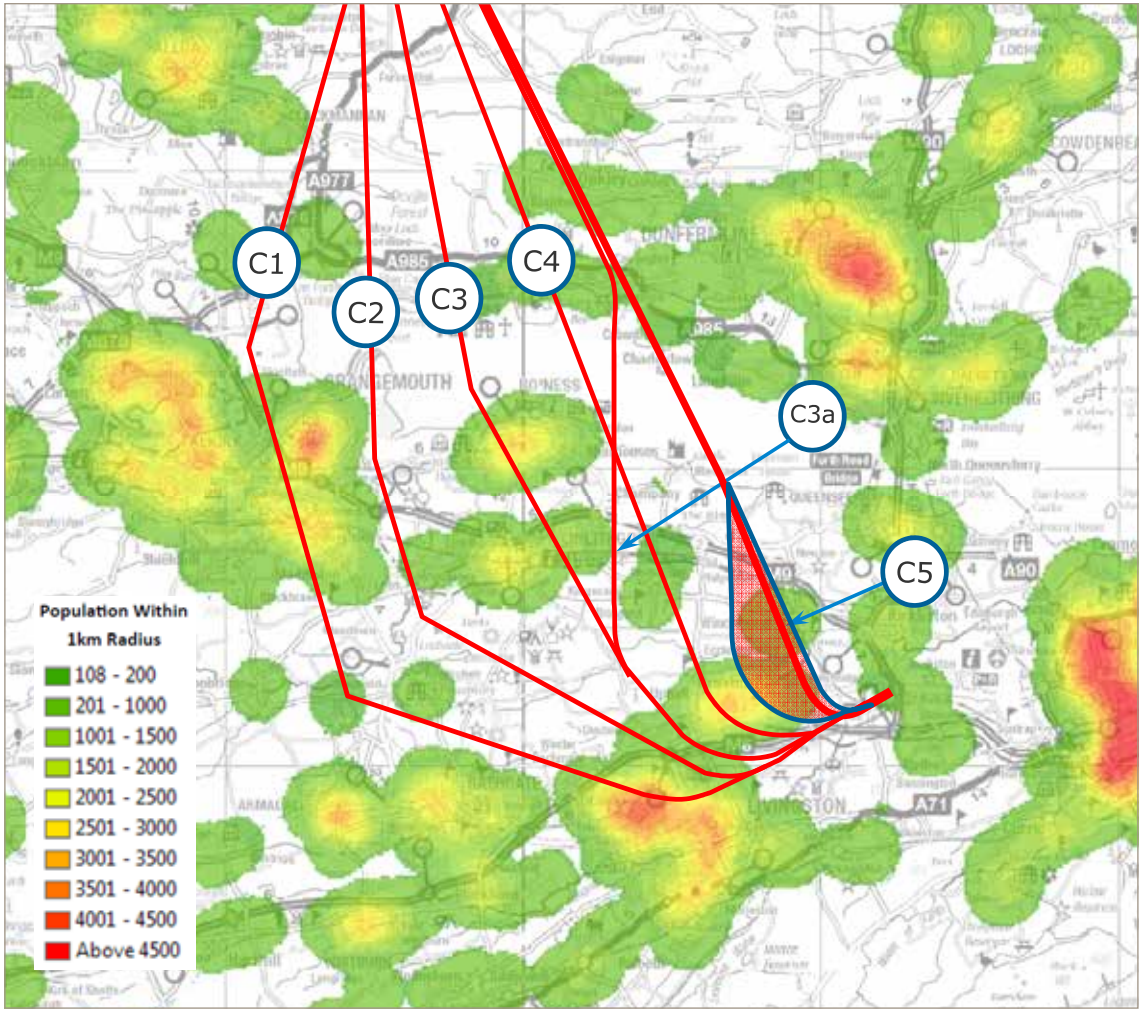


This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

The proposed route takes advantage of RNAV coding to enable aircraft to turn as early as possible. This results in some dispersion of flight paths in the first turn. This is illustrated by a red shaded swathe in the Figure 17. Faster jet aircraft will fly towards the outside of this swathe while slower propeller aircraft will fly closer to the inside of the turn.

Figure 18: Route options for flight path C



This map shows popularity density, overlaid with our flight path options (C1-C5).

Figure 19: Airbus A330 L_{max} footprints for Runway 24 – proposed SIDs

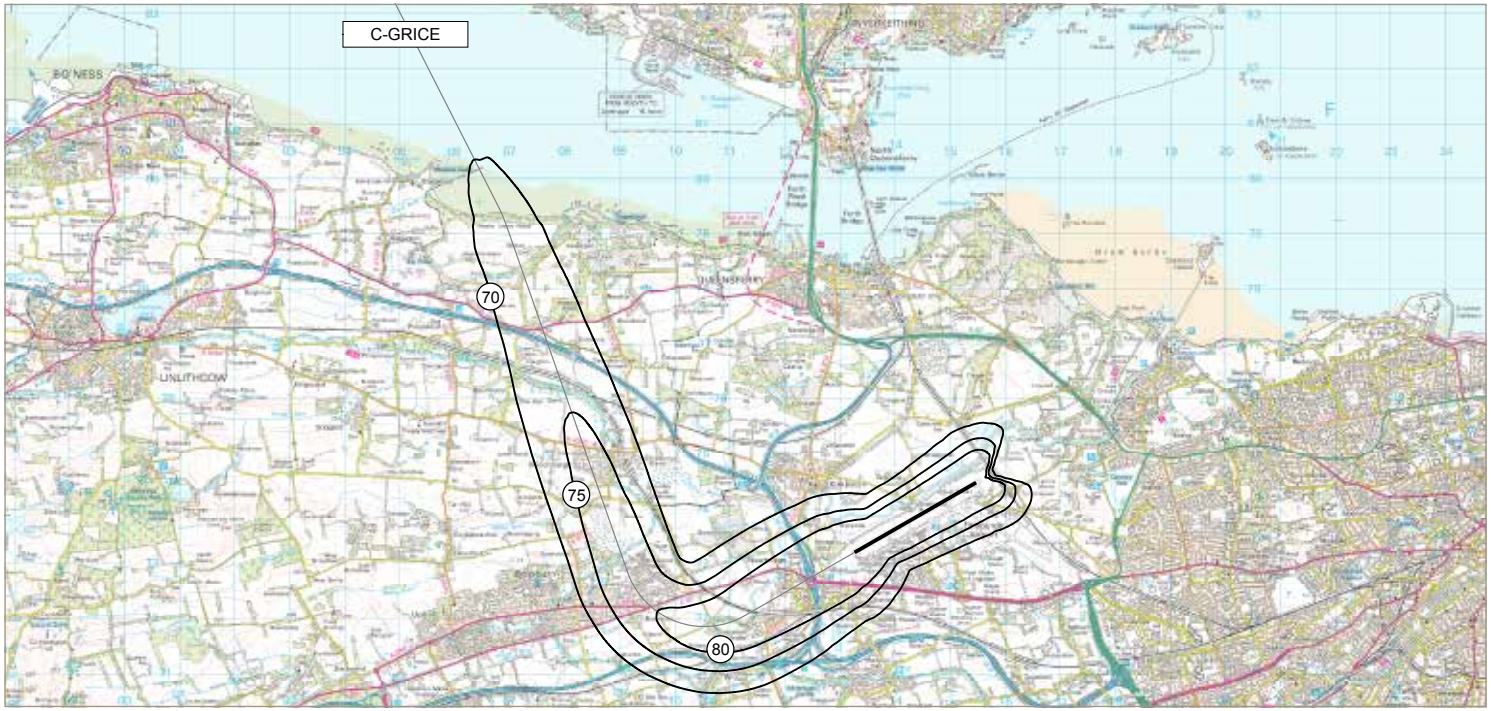


Figure 19 above shows the L_{max} footprint for each of our preferred Runway 24 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.3.6 Other flight path options

Other flight path options	Analysis
C1	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community and regulatory criteria. C1 was not preferred as it was a longer track than C5, resulting in increased CO_2 emissions. C1 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Grangemouth, Falkirk and Polmont.
C2	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. C1 was not preferred as it was a longer track than C5, resulting in increased CO_2 emissions. C1 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Grangemouth, Falkirk, Bo'ness, Linlithgow and Polmont.
C3	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community and operations criteria. C3 provides no reductions in noise or an environmental impact as it doesn't provide any savings in track miles or CO_2 emissions, C5 provides improvements in these areas. C3 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Bo'ness and Linlithgow.
C4	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. C4 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Broxburn, Uphall, Ecclesmachan and Philpstoun.

FLIGHT PATH D

Runway 24 departures right turn to south

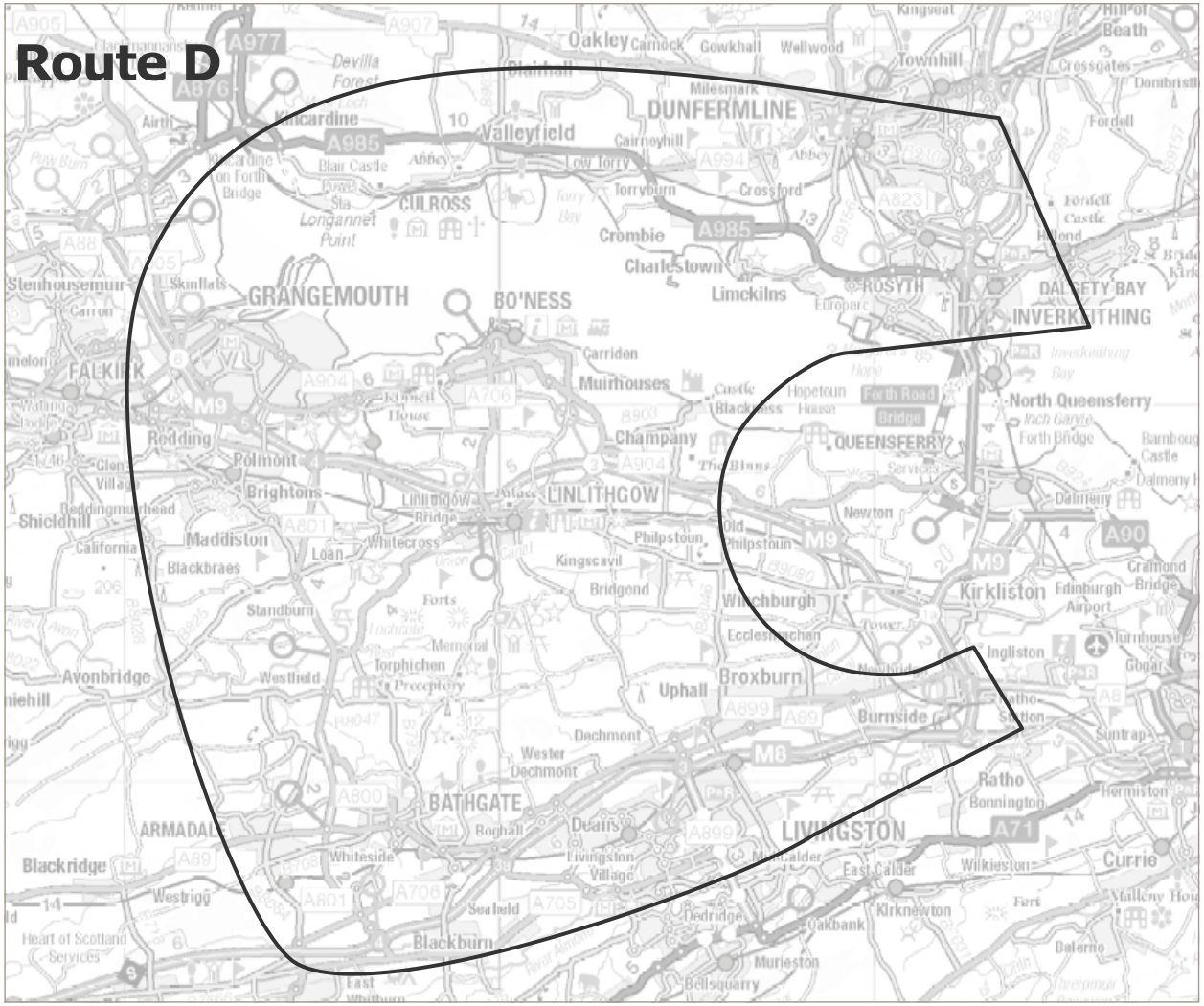


Figure 20: Consultation 1 design envelope

9.4 Flight path D: Runway 24 departures right turn to south

The Route D design envelope covered areas in West Lothian, Falkirk and Fife including Broxburn, Uphall, Ecclesmachan, Dechmont, Philpstoun, Linlithgow, Bo'ness, Grangemouth, Bathgate, Polmont, Dunfermline, Rosyth, Inverkeithing, Dalgety Bay and Limekilns (see Figure 20).

9.4.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying, impact on rural areas and adding to an already noisy area (existing flight path).
- Local pollution and environment including air quality and general increase in pollution.
- Health including sleep disturbance and general concerns about impact on health.
- The TUTUR airspace trial which ran between June and October 2015 and primarily impacted on communities in West Lothian, Falkirk and Fife.
- Proposed alternative flight paths over the Firth of Forth to avoid towns and centres.

Specific local issues raised from these communities were concerns for the safety impact of flying over Grangemouth Petrol Chemical Plant and Oil Refinery, Beecraigs Country Park, Linlithgow Palace and regarding local wildlife.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

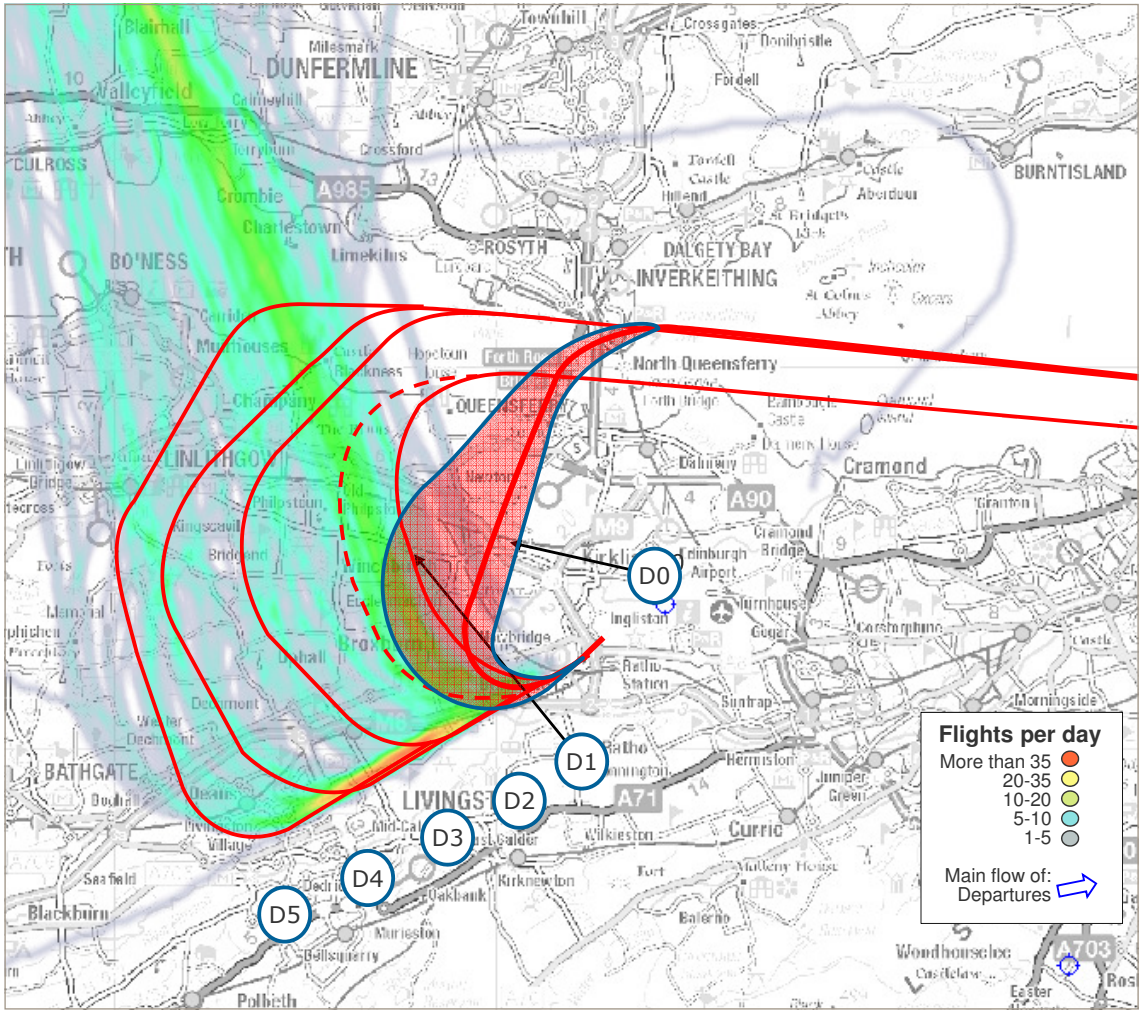
9.4.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. (We explain our criteria breakdown and our approach in the introduction to this in section 8 on page 34.)

Based on the feedback above and the criteria outlined, we investigated a number of potential Route D options within the design envelope (see Figure 20).

Route D0 is our preferred flight path.

Figure 21: Route options for flight path D



The proposed route takes advantage of RNAV coding to enable aircraft to turn as early as possible. This results in some dispersion of flight paths in the first turn. This is illustrated by a red shaded swathe in Figure 21, 22 and 23. Faster jet aircraft will fly towards the outside of this swathe while slower propeller aircraft will fly closer to the inside of the turn.

This map shows the current flight tracks, overlaid with our flight path options (D0-D5).

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.4.3 Preferred option – D0

Our preferred design option is D0. To determine this decision we tabled all of the options against our criteria (see Table 6).

Table 6

		D0	D1	D2	D3	D4	D5
Safety/ICAO design criteria		Compliant	Compliant	Non compliant	Compliant	Compliant	Compliant
CO_2		Better climb	Better climb	Better climb	Better climb	Better climb	Better climb
Noise – population overflown		Less	Similar	Similar	Similar	Similar	Similar
Noise – new population impacted		Slightly more	Slightly more	Slightly more	Slightly more	More	More
Operational benefit – reduced delay		Yes	Yes	Yes	Yes	Yes	Yes
Populations impacted	**Broxburn**	Further away	Overflown	Overflown	Similar	Similar	Similar
	Uphall	Further away	Closer	Closer	Overflown	Similar	Similar
	Dechmont – 14,140	Further away	Further away	Similar	Closer	Overflown	Overflown
	Ecclesmachan	Further away	Closer	Overflown	Closer	Similar	Similar
	South Queensferry – 9,026	Overflown	Closer	Closer	Similar	Similar	Similar
	Winchburgh – 2,000	Overflown	Overflown	Closer	Similar	Similar	Similar
	Livingston – 56,269	Further away	Further away	Further away	Further away	Similar	Overflown
	Linlithgow	Not overflown	Not overflown	Not overflown	Closer	Closer	Overflown
	Philpstoun – 19,000	Further away	Closer	Overflown	Overflown	Closer	Not overflown
	Bo'ness – 14,490	Not overflown	Not overflown	Not overflown	Not overflown	Closer	Closer
	Blackness – 135	Further away	Closer	Closer	Closer	Overflown	Closer
	Limekilns – 1,430	Further away	Closer	Closer	Closer	Closer	Closer
	Rosyth – 12,850	Closer	Closer	Closer	Closer	Closer	Closer
	Inverkeithing/Dalgety Bay – 15,295	Closer	Closer	Closer	Closer	Closer	Closer

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.4.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultation to provide expert advice.

Regulatory

All flight path options except D2 meet safety requirements and ICAO design criteria.

Operational

Our preferred option (D0) allows for future growth projects; it meets our need for reduced departure separation times. This flight path would typically be used by 17.4% of flights (40 flights per day in 2016, 56 flights per day in 2023).

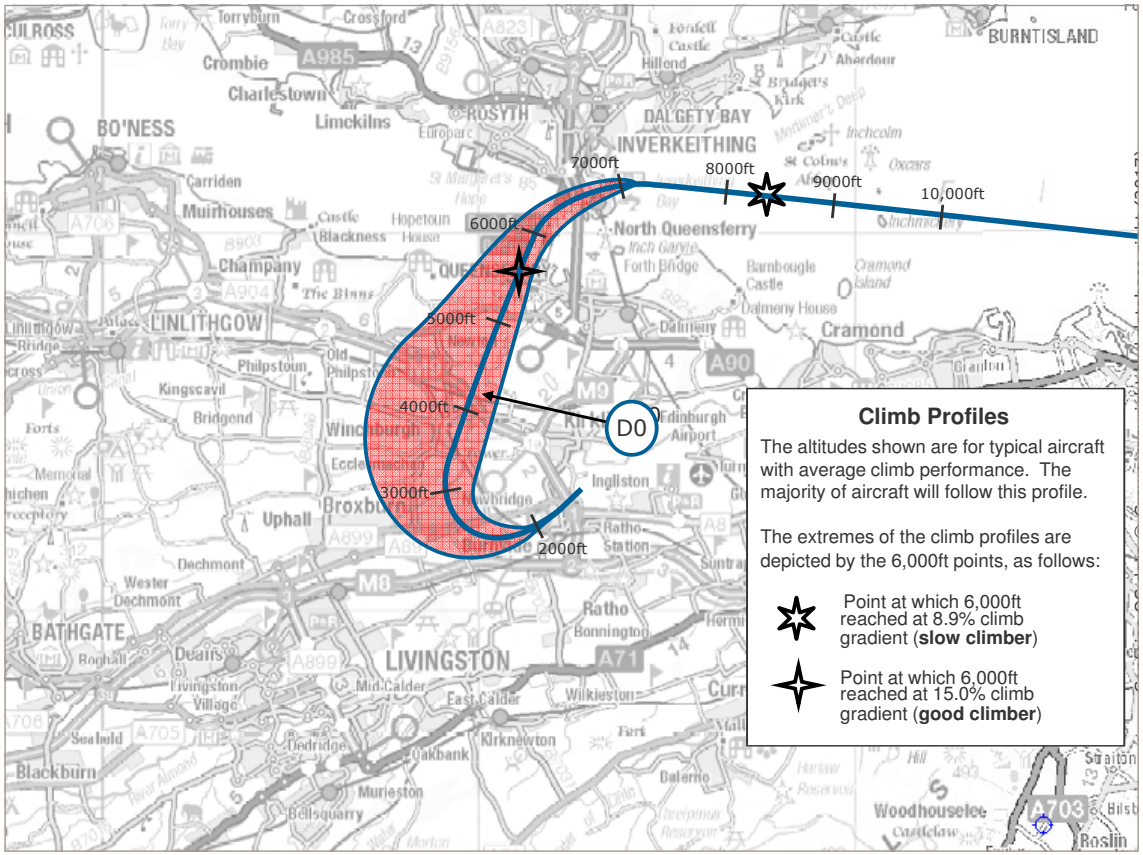
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our Criteria Matrix for Route D lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see Route D0 overflies the fewest number of communities identified in this area. It moves the existing route away from the centre of Livingston, Bo'ness and Linlithgow. It also introduces an earlier turn to move the existing route away from Uphall and Dechmont.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". We note the feedback communities regarding tranquil areas within this design envelope. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (D0) is the shortest flight path which reduces CO_2 emissions in comparison to the current flight path.
Air quality.	The CAA considers air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Impact on Beecraig's Country Park.	Impact on Beecraig's Country Park is located in Bathgate under the existing flight path. Our preferred option (D0) positions the flight path away from Beecraig's Country Park.
Grangemouth Petrol Chemical Plant and Oil Refinery.	Grangemouth Petrol Chemical Plant and Oil Refinery is located in Grangemouth under the existing flight path. Our preferred option (D0) positions the flight path away from Grangemouth Petrol Chemical Plant and Oil Refinery. However, there is no CAA restrictions regarding overflying Grangemouth Petrol Chemical Plant and Oil Refinery.
Linlithgow Palace.	Linlithgow Palace is located in Linlithgow under the existing flight path. Our preferred option (D0) positions the flight path away from Linlithgow Palace.
TUTUR.	On initial review of the flight path options, D3 was considered the preferred flight path option. Based on community feedback raised during consultation 1, D0 was designed to introduce an early turn over the east end of Broxburn which is a more industrial area, moving the traffic away from the residential areas of Broxburn and Uphall. Due to the RNAV coding required to achieve this early turn, aircraft with differing performance will fly slightly different trajectories. Hence this will create a dispersal effect on the turn due to variations in aircraft performance.

9.4.5 Preferred option

Our preferred design option is D0. To determine this decision we tabled all of the options against our criteria (see Table 6).

Figure 22: Preferred option for flight path D with typical climb profiles



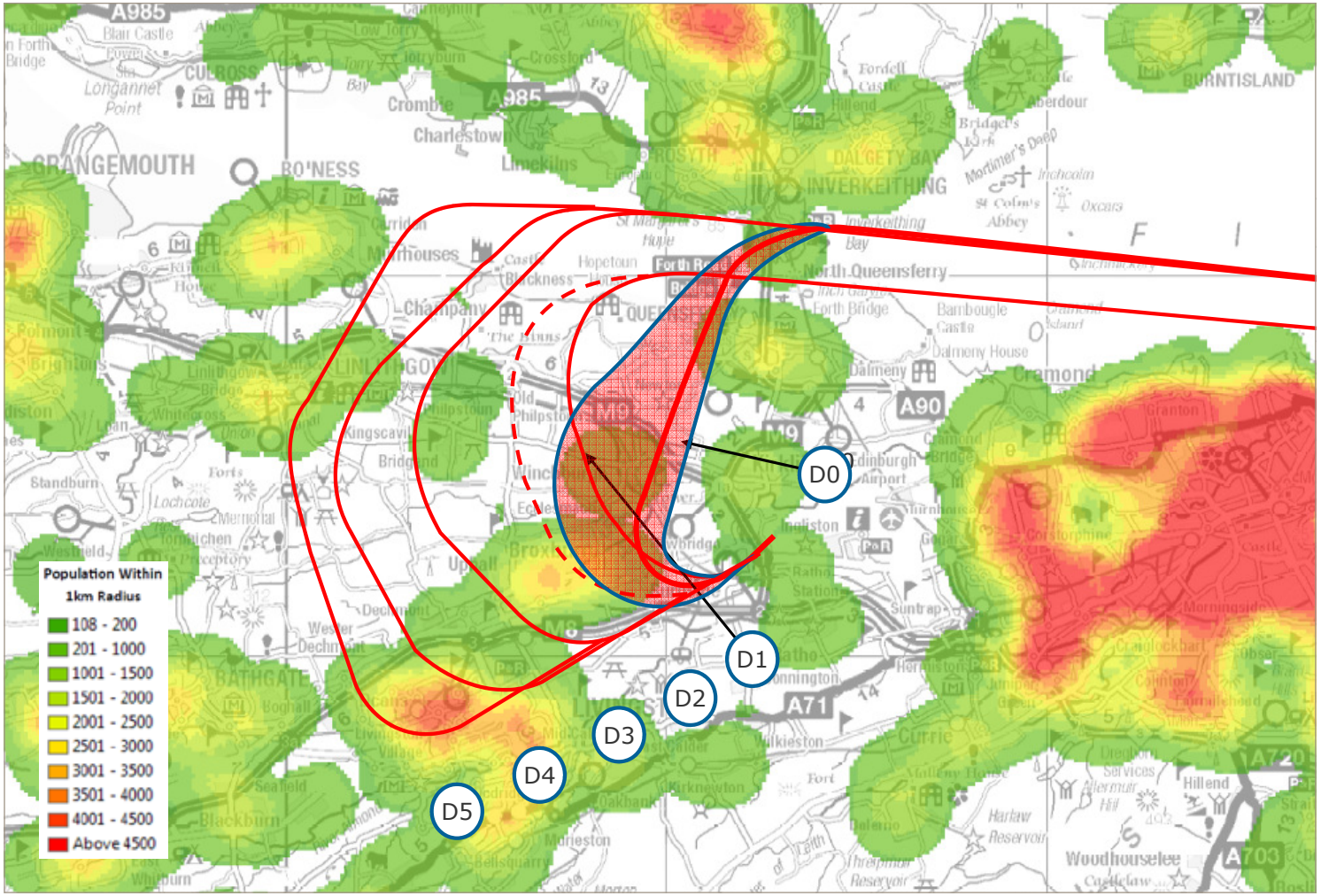
This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. For flight path D it is intended that the flights will be kept on the route until over the water.

It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC. Flight path goes to HAVEN where it joins the en-route network. Flights will be kept over the Firth of Forth until above 10,000ft and will not overfly the City of Edinburgh.

The proposed route takes advantage of RNAV coding to enable aircraft to turn as early as possible. This results in some dispersion of flight paths in the first turn. This is illustrated by a red shaded swathe in Figure 21, 22 and 23. Faster jet aircraft will fly towards the outside of this swathe while slower propeller aircraft will fly closer to the inside of the turn.

Figure 23: Route options for flight path D



This map shows population density, overlaid with our flight path options (D0-D5).

Figure 24: Airbus A330 L_{max} footprints for Runway 24 – proposed SIDs

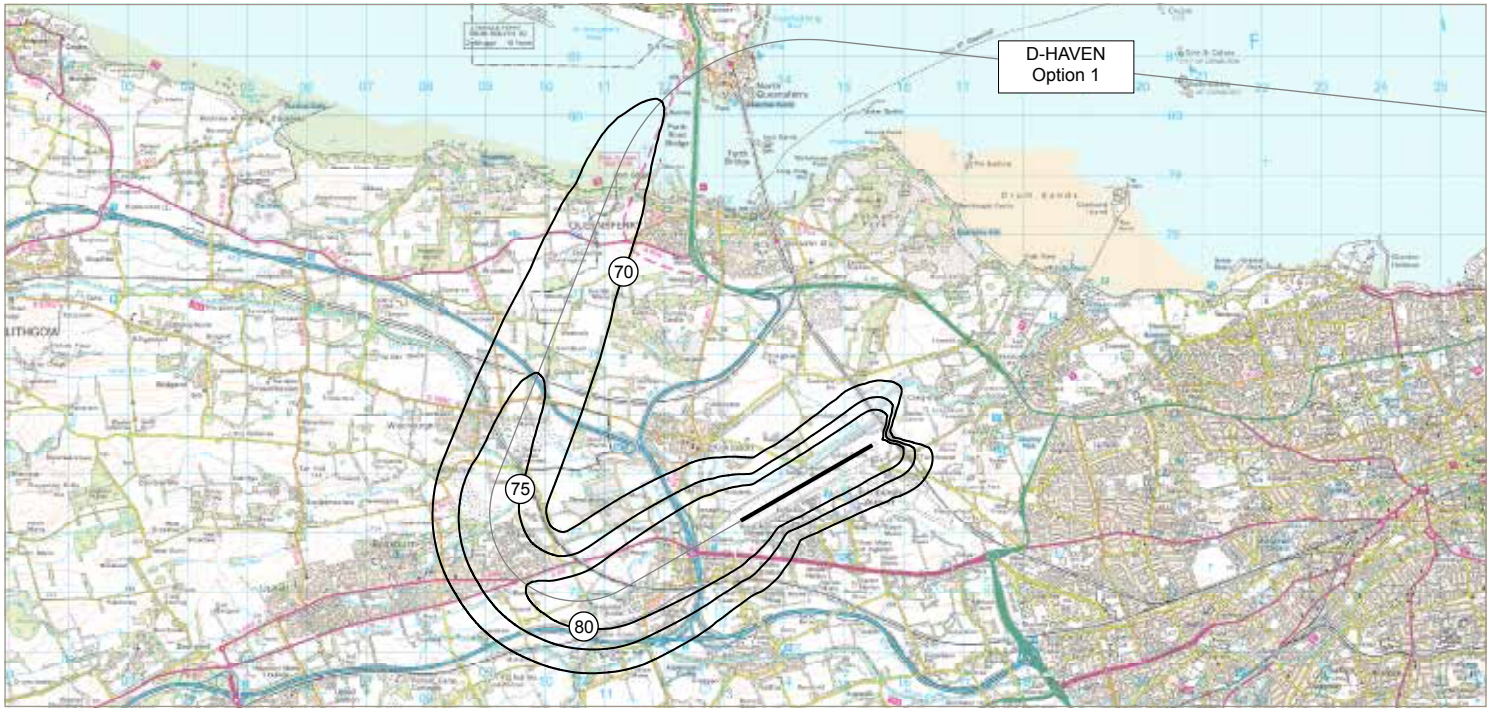


Figure 24 above shows the L_{max} footprint for each of our preferred Runway 24 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.4.6 Other flight path options

Other flight path options	Analysis
D1	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. D1 was not preferred as it was a longer track than D0, resulting in increased CO_2 emissions. D1 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Broxburn, Uphall, Ecclesmachan, Winchburgh, Philpstoun, Blackness, Rosyth, Inverkeithing and Dalgety Bay.
D2	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria.
D3	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. D3 is a close representation of the TUTUR trial path and is therefore not a preferred option. Based on community concerns raised during consultation 1 regarding the TUTUR flight path, D0 was designed to introduce an early turn over the east end of Broxburn which is a more industrial area, moving the traffic away from the residential areas of Broxburn and Uphall.
D4	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. D4 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Dechmont, Linlithgow, Blackness and Philpstoun.
D5	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. D5 would increase the population overflown in comparison to the existing flight path and fly over densely-populated areas of Dechmont, Linlithgow, Blackness, Bo'ness and Livingston.

FLIGHT PATH E

Runway 06 Departures left turn west

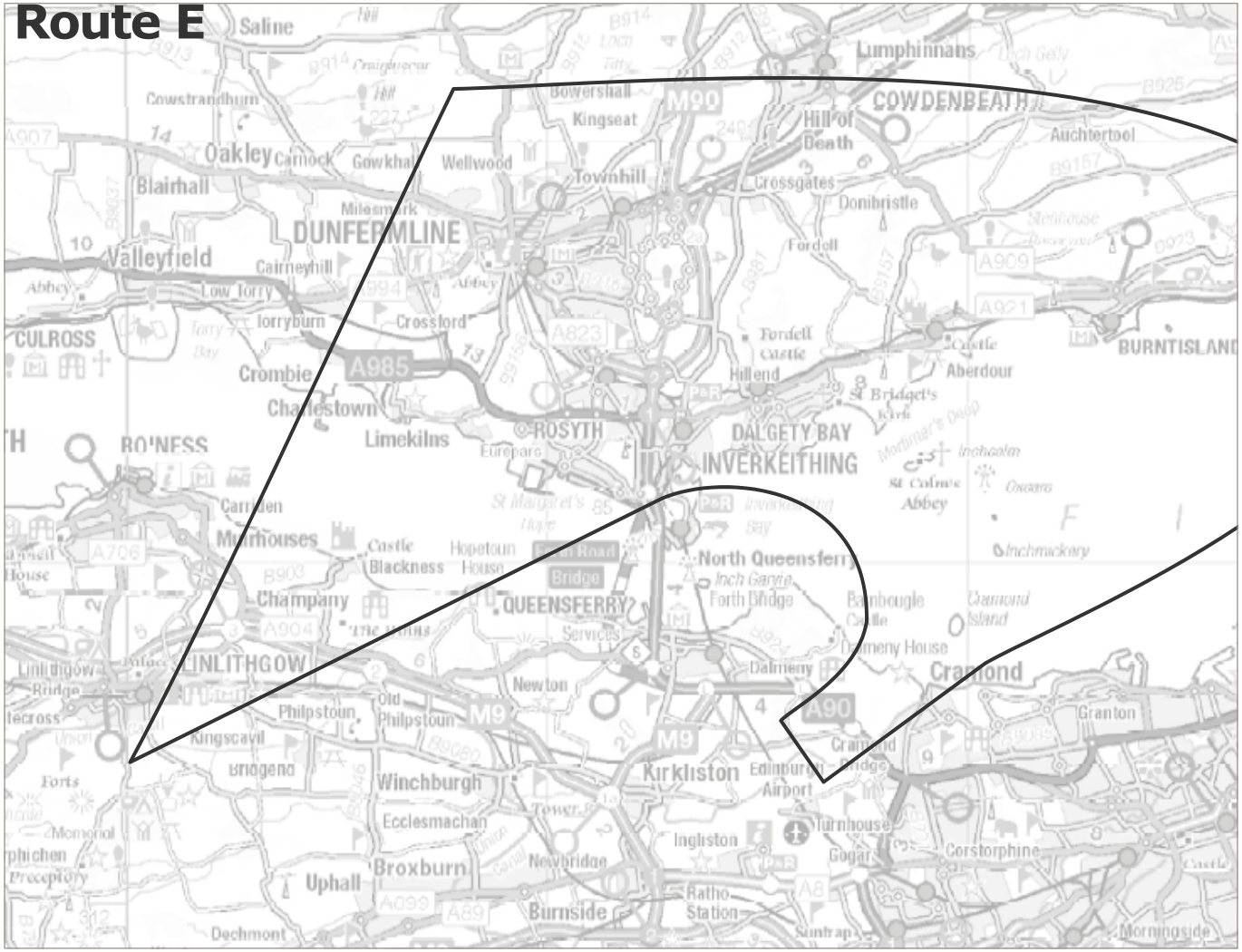


Figure 25: Consultation 1 design envelope

9.5 Flight path E: Runway 06 departures left turn west

The Route E design envelope covered areas in Edinburgh, Fife and West Lothian including Cramond, Livingston, Kinghorn, Burntisland, Aberdour, Dalgety Bay, Inverkeithing, Rosyth, Dunfermline, Blackness and Linlithgow (see Figure 25). This SID would replace the GOSAM 1D SID.

9.5.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying, low flying aircraft and rural areas.
- Local pollution and environment including air quality and general increase in pollution.
- Impact on natural areas and local coastal towns.

Other than these issues, there were no specific local issues raised from these communities. However, the local communities proposed a number of alternative flight paths specifically using waterways more than flying over populated areas.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

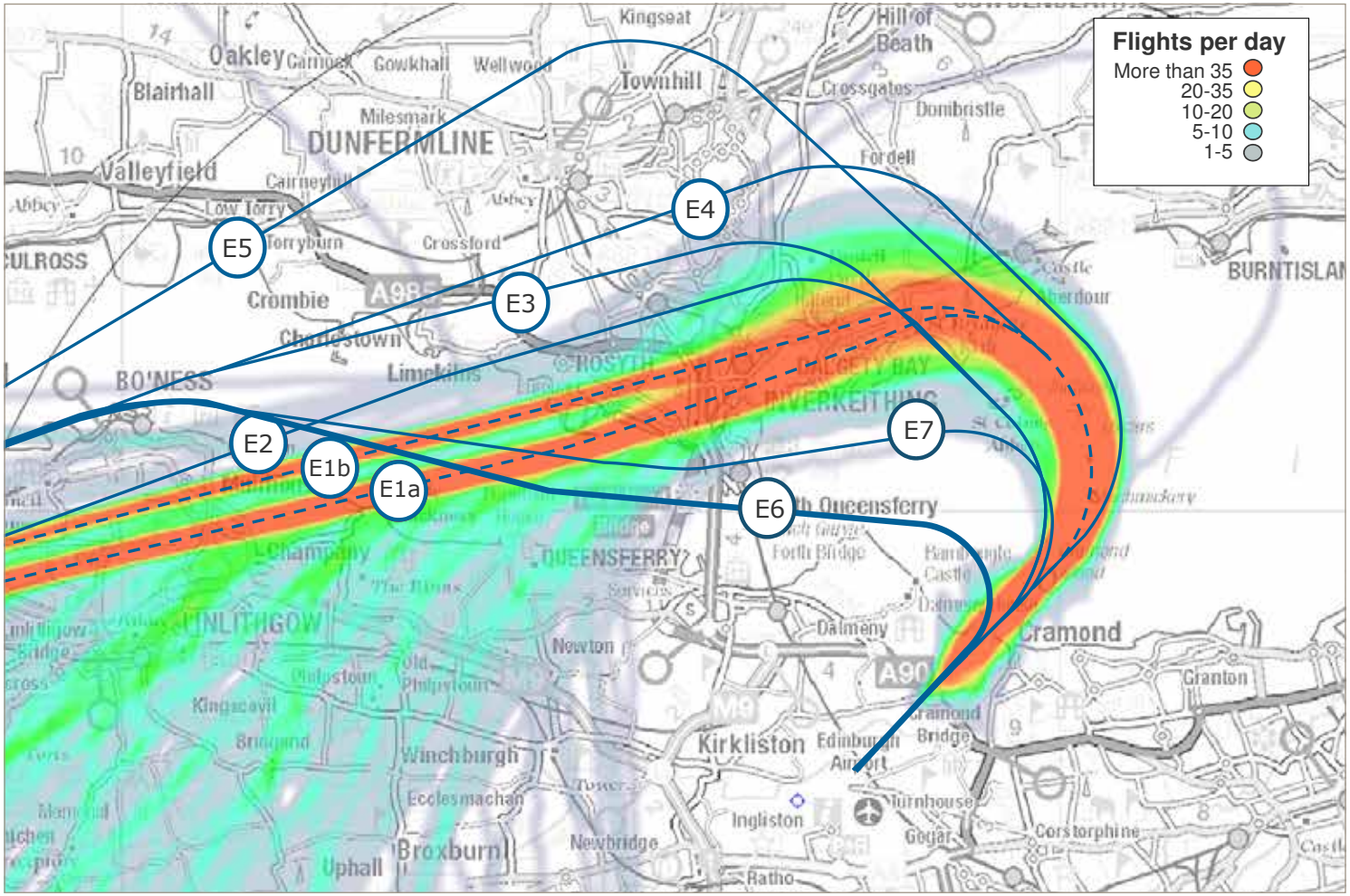
9.5.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. (We explain our criteria breakdown and our approach in the introduction to this in section 8 on page 34.)

Based on the feedback above and the criteria outlined, we investigated a number of potential Route E options within the design envelope (see Figure 25).

Route E6 is our preferred flight path. This SID would replace the GOSAM 1D SID.

Figure 26: Route options for flight path E



This map shows the current flight tracks, overlaid with our flight path options (E1a-E7). The expected track dispersion is shown by the shaded swathe in Figure 27 and Figure 28.

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.5.3 Preferred option – E6

Our preferred design option is E6. To determine this decision we tabled all of the options against our criteria (see Table 7).

Table 7

	E1a	E1b	E2	E3	E4	E5	E6	E7
Safety/ICAO design criteria	Non compliant	Non compliant	Compliant	Compliant	Compliant	Compliant	Compliant	Compliant
CO_2	Similar	Similar	Similar	Similar	Longer	Longer	Similar	Similar
Noise – population overflown	Similar	Similar	Similar	Similar	More	Less	Less	Less
Noise – new population impacted	None	None	More	Slightly more	More	Slightly more	None	None
Operational benefit – reduced delay	Similar	Similar	Yes	Yes	No	Similar	Yes	Yes
Populations impacted								
Cramond – 7,502	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
Rosyth – 12,850	Overflown	Overflown	Overflown	Further away	Further away	Not overflown	Further away	Further away
Inverkeithing/Dalgety Bay – 15,295	Overflown	Overflown	Overflown	Overflown	Further away	Further away	Further away	Similar
Aberdour – 1,633	Overflown	Overflown	Further away	Further away	Overflown	Overflown	Further away	Further away
Burntisland – 6,269	Similar	Similar	Not overflown	Not overflown	Closer	Similar	Not overflown	Not overflown
South Queensferry – 9,026	Similar	Similar	Further away	Further away	Further away	Further away	Closer	Closer
Cowdenbeath – 14,081	Similar	Similar	Further away	Further away	Closer	Closer	Not overflown	Not overflown
Dunfermline – 50,380	Similar	Similar	Closer	Overflown	Overflown	Similar	Not overflown	Not overflown
Blackness – 135	Similar	Similar	Further away	Further away	Further away	Further away	Further away	Further away
Bo'ness – 14,490	Similar	Similar	Similar	Similar	Similar	Further away	Similar	Similar
Linlithgow – 19,000	Similar	Similar	Similar	Further away	Further away	Further away	Further away	Further away

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.5.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultation to provide expert advice.

Regulatory

All flight path options except E1a and E1b meet safety requirements and ICAO design criteria.

Operational

Our preferred option (E6) allows for future growth projections; it meets our need for reduced departure separation times. This flight path would typically be used by 4.2% of flights (41 flights per day in 2016, 49 flights per day in 2023).

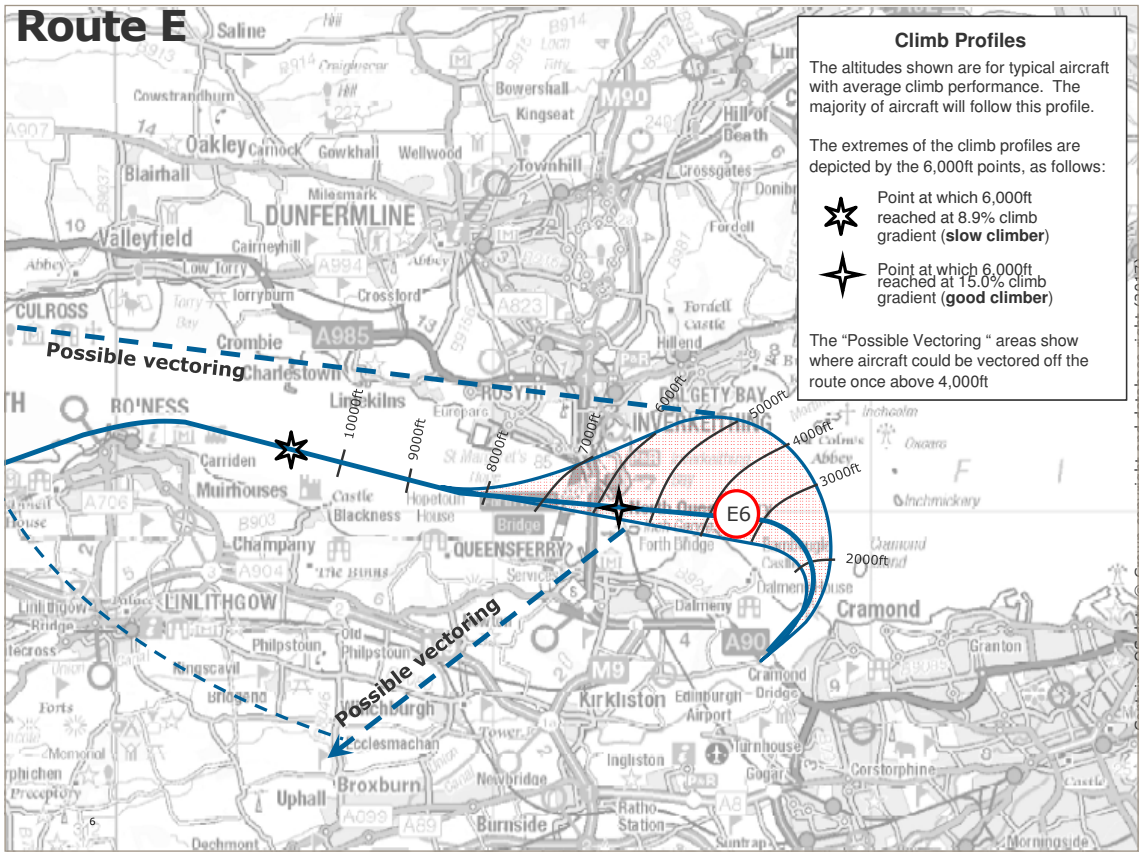
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our Criteria Matrix for Route E lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see Route E6 overflies the fewest number of communities identified in this area. It moves the existing flight path along the Firth of Forth as much as possible, and pushes it further away from the Fife coastal towns.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (E6) is a similar track length to the existing flight path and therefore doesn't increase CO_2 emissions in comparison to the current flight path.
Air quality.	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Use waterways, specifically the Firth of Forth, more than flying over populated areas.	You can see our preferred flight path option E6 maximises flying over the Firth of Forth as much as possible to avoid populated areas and coastal towns. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage regarding any wildlife impacted to ensure Edinburgh Airport meets legislative requirements in this area.

9.5.5 Preferred option

Our preferred design option is E6. To determine this decision we tabled all of the options against our criteria (see Table 7).

Figure 27: Preferred option for flight path E with typical climb profiles

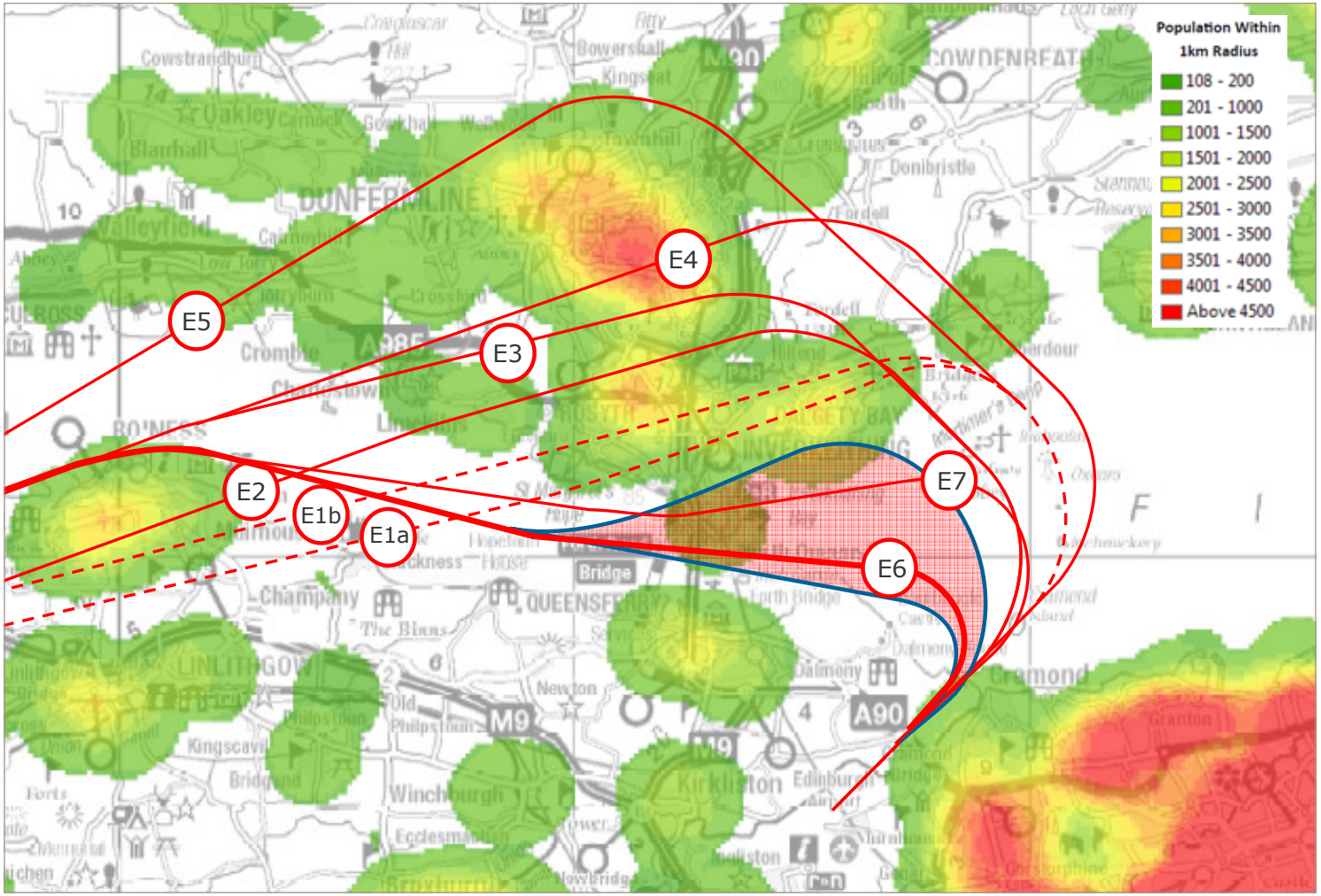


This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

The proposed route takes advantage of RNAV coding to enable aircraft to turn as early as possible. This results in some dispersion of flight paths in the first turn. This is illustrated by a red shaded swathe in Figure 27 and Figure 28. Faster jet aircraft will fly towards the outside of this swathe while slower propeller aircraft will fly closer to the inside of the turn.

Figure 28: Route options for flight path E



This map shows population density, overlaid with our flight path options (E1a-E7).

Figure 29: Airbus A330 L_{max} footprints for Runway 06 – proposed SIDs

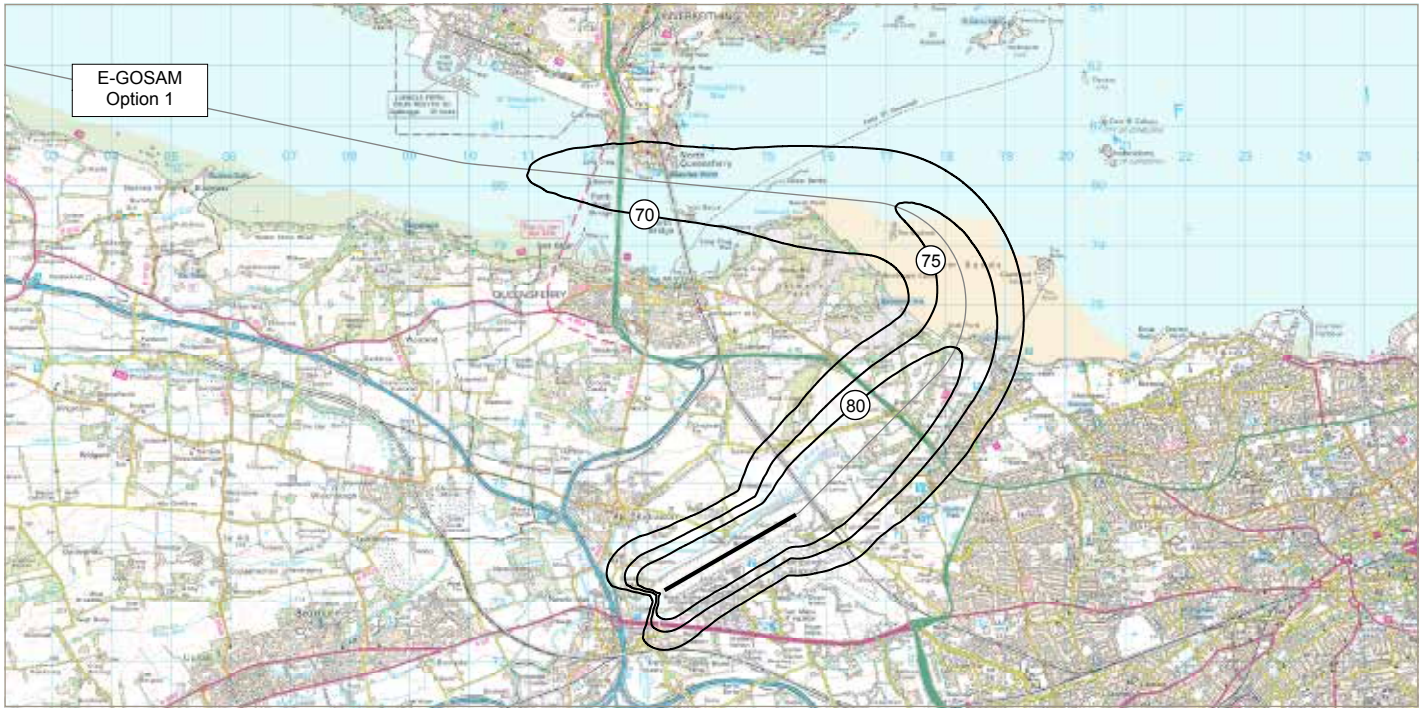


Figure 29 above shows the L_{max} footprint for each of our preferred Runway 06 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.5.6 Other flight path options

Other flight path options	Analysis
E1a and E1b	This flight path option does not meet ICAO design criteria due to stabilisation distances.
E2	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. E2 was not preferred as it is a similar track length to the existing flight path and would not provide any noise or CO_2 reductions. E2 would impact Dalgety Bay, Rosyth, Inverkeithing and Dunfermline increasing the population overflown in comparison to our preferred flight path option (E6).
E3	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. E3 was not preferred as it is a similar track length to the existing flight path and would not provide any noise or CO_2 reductions. E3 would impact Dalgety Bay, Inverkeithing and Dunfermline increasing the population overflown in comparison to our preferred flight path option (E6).
E4	While this flight path option meets safety criteria, this option is not preferred based on it not meeting a number of operational or community criteria. E4 would impact Aberdour, Burntisland and Dunfermline increasing the population overflown in comparison to our preferred flight path option (E6). E4 does not allow for Edinburgh Airport's future growth plans as it does not meet our need for reduced departure separation times.
E5	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. E5 was not preferred as it is a longer track compared to the existing flight path and would not provide any noise or CO_2 reductions. E5 does not allow for Edinburgh Airport's future growth plans as it does not meet our need for reduced departure separation times.
E7	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community, regulatory and operations criteria. E7 is similar to E6, that it provides a reduction in noise and CO_2 emissions, however, it moves the existing flight path closer to Inverkeithing and Dalgety Bay increasing the population overflown in comparison to our existing flight path.

FLIGHT PATH F

Runway 06 departures left turn to north

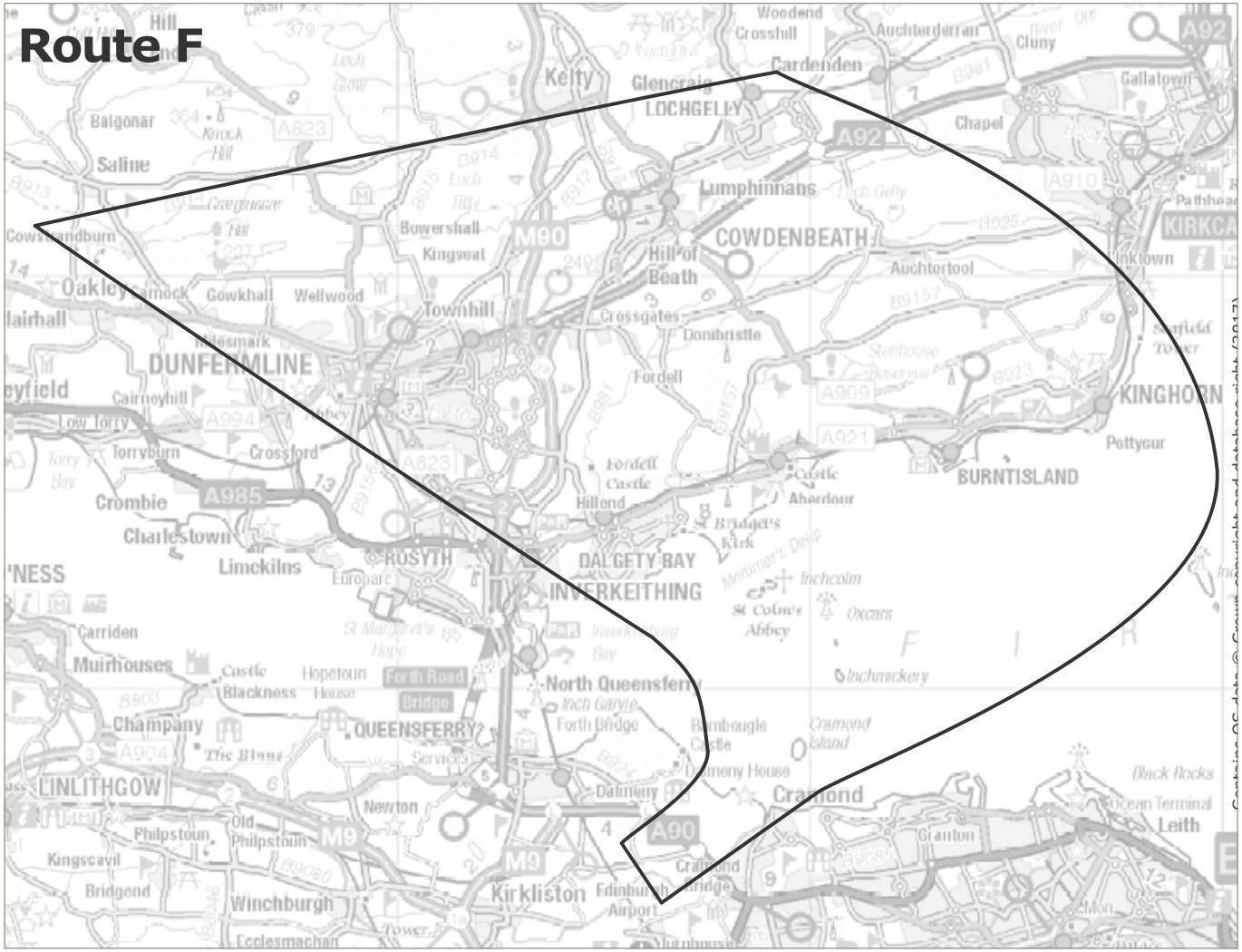


Figure 30: Consultation 1 design envelope

9.6 Flight path F: Runway 06 departures left turn to north

The Route F design envelope covered areas in Edinburgh and Fife including Cramond, Burntisland, Aberdour, Inverkeithing, Dalgety Bay, Rosyth, Cowdenbeath and Dunfermline (see Figure 30).

9.6.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying, low flying aircraft and rural areas.
- Local pollution and environment including air quality and general increase in pollution.
- Impact on natural areas and local coastal towns.

Other than these issues, there were no specific local issues raised from these communities. However, the local communities proposed a number of alternative flight paths specifically using waterways more than flying over populated areas.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

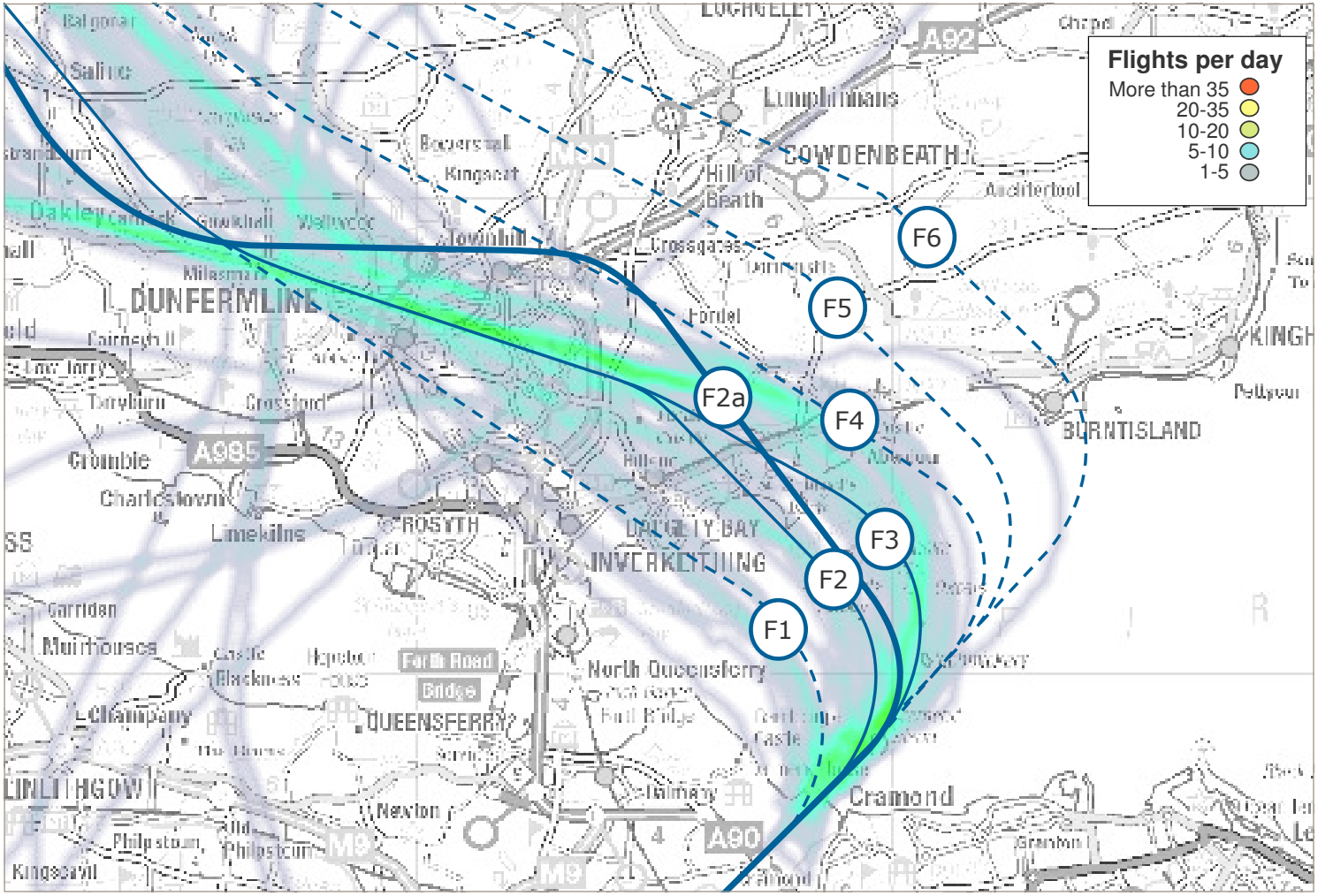
9.6.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. (We explain our criteria breakdown and our approach in the introduction to this in section 8 on page 34.)

Based on the feedback above and the criteria outlined, we investigated a number of potential Route F options within the design envelope (see Figure 30).

Route F2a is our preferred flight path.

Figure 31: Route options for flight path F



This map shows the current flight tracks, overlaid with our flight path options (F1-F6).

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.6.3 Preferred option – F2a

Our preferred design option is F2a. To determine this decision we tabled all of the options against our criteria (see Table 8).

Table 8

	F1	F2	F2a	F3	F4	F5	F6
Safety/ICAO design criteria	Non compliant	Compliant	Compliant	Compliant	Non compliant	Non compliant	Non compliant
CO_2	Shorter	Shorter	Longer	Similar	Similar	Longer	Longer
Noise – population overflown	More	Similar	Similar	Similar	Less	Less	Less
Noise – new population impacted	More	Slightly more	Slightly more	Slightly more	Slightly more	Slightly more	Slightly more
Operational benefit – reduced delay	Yes	Yes	Yes	Similar	No	No	No
Populations impacted							
Cramond – 7,502	Similar	Similar	Similar	Similar	Similar	Similar	Similar
Rosyth – 12,850	Closer	Similar	Similar	Similar	Not overflown	Not overflown	Not overflown
Inverkeithing/Dalgety Bay – 15,295	Overflown	Similar	Similar	Similar	Further away	Not overflown	Not overflown
South Queensferry – 9,026	Closer	Similar	Similar	Similar	Further away	Further away	Further away
Aberdour – 1,633	Further away	Similar	Overflown	Overflown	Overflown	Further away	Further away
Burntisland – 6,269	Not overflown	Not overflown	Similar	Similar	Closer	Overflown	Overflown
Cowdenbeath – 14,081	Not overflown	Similar	Closer	Similar	Closer	Overflown	Overflown
Dunfermline – 50,380	Overflown	Overflown	Further away	Overflown	Further away	Further away	Not overflown

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.6.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultation to provide expert advice.

Regulatory

All flight path options except F1, F4, F5 and F6 meet safety requirements and ICAO design criteria.

Operational

Our preferred option (F2a) allows for future growth projects; it meets our need for reduced departure separation times. This flight path would typically be used by 1.4% of flights (14 flights per day in 2016, 18 flights per day in 2023).

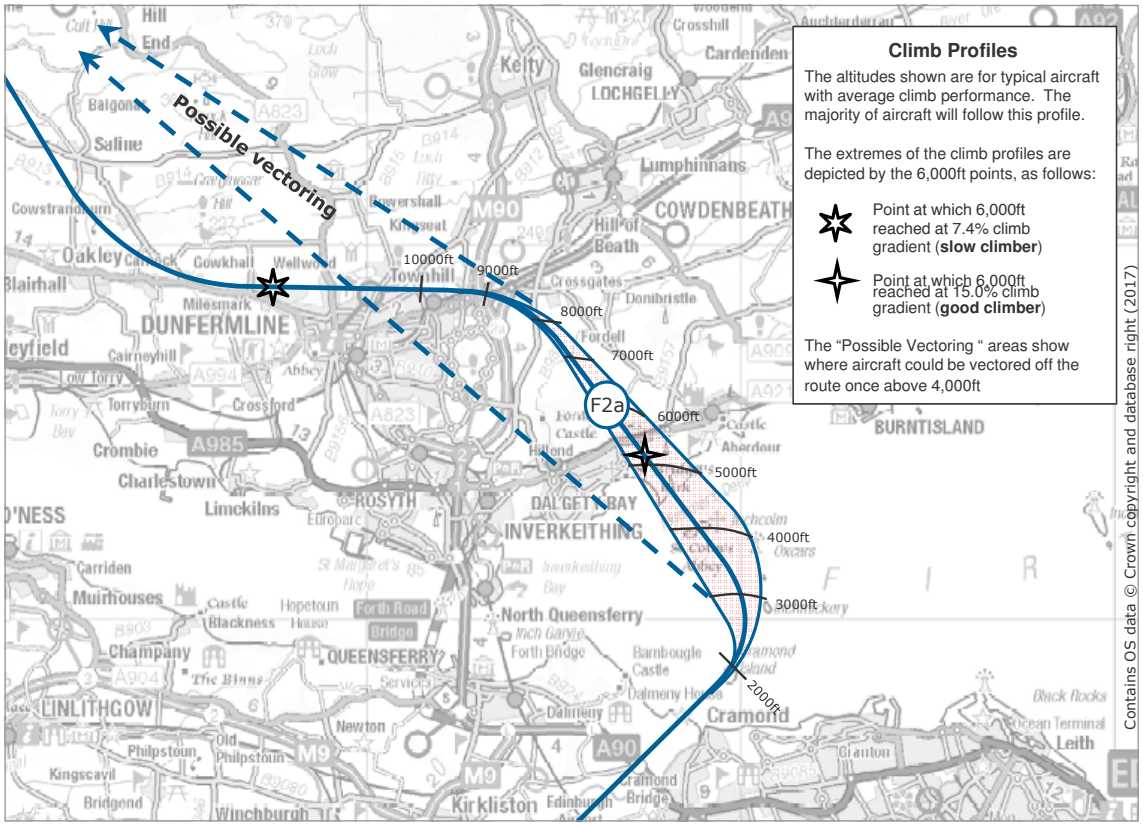
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our Criteria Matrix for Route F lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see Route F2a overflies the fewest number of communities identified in this area. It moves the existing flight path out to miss Inverkeithing, Aberdour and Dunfermline.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (F2a) is a slightly longer track length compared to the existing flight path as reducing the community impact on Dunfermline, Inverkeithing and Aberdour were prioritised.
Air quality.	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Use waterways, specifically the Firth of Forth, more than flying over populated areas.	Our preferred option (F2a) is a slightly longer track length compared to the existing flight path, reducing the community impact on Dunfermline, Inverkeithing and Aberdour was prioritised.

9.6.5 Preferred option

Our preferred design option is F2a. To determine this decision we tabled all of the options against our criteria (see Table 8).

Figure 32: Preferred option for flight path F with typical climb profiles

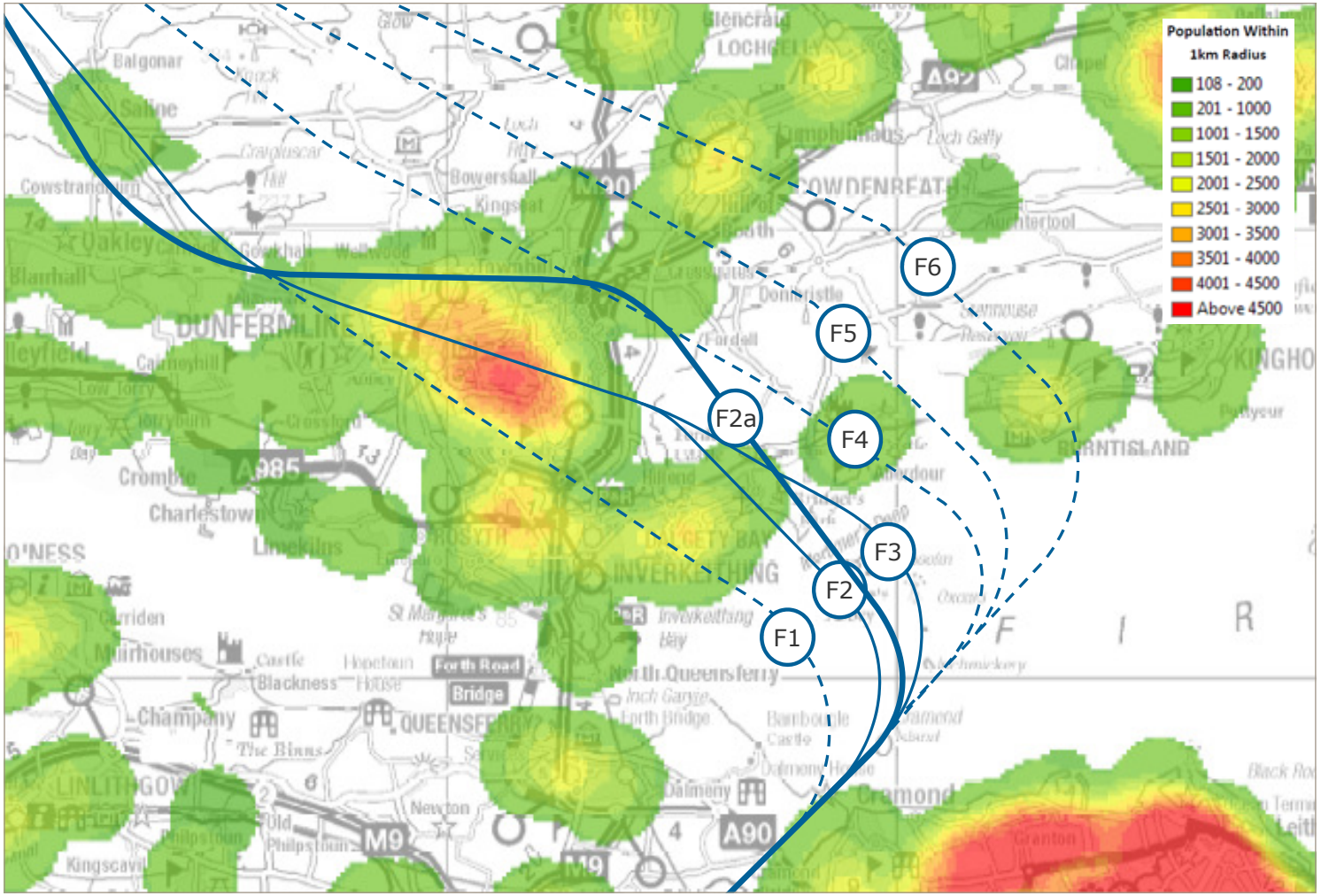


This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The proposed route takes advantage of RNAV coding to enable aircraft to turn as early as possible. This results in some dispersion of flight paths in the first turn. This is illustrated by a red shaded swathe in the Figure 32. Faster jet aircraft will fly towards the outside of this swathe while slower propeller aircraft will fly closer to the inside of the turn.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

Figure 33: Route options for flight path F



This map shows population density, overlaid with our flight path options (F1-F6).

Figure 34: Airbus A330 L_{max} footprints for Runway 06 – proposed SIDs

Figure 34 above shows the L_{max} footprint for each of our preferred Runway 06 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.6.6 Other flight path options

Other flight path options	Analysis
F1	This flight path option does not meet ICAO design criteria following initial track adjustment needed to avoid Cramond.
F2	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. F2 was not preferred as it is a shorter track length to the existing flight path. However, F2 would impact Dunfermline increasing the population overflown in comparison to our preferred flight path option (F2a).
F3	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. F3 was not preferred as it is a similar track length to the existing flight path and would not provide any noise or CO_2 reductions. F3 does not allow for Edinburgh Airport's future growth plans as it does not meet our need for reduced departure separation times.
F4	This flight path option does not meet safety criteria for ensuring sufficient departure separation standards from Routes G and H when applying a 1 minute departure interval between successive departures on these routes, which is a design requirement.
F5	This flight path option does not meet safety criteria for ensuring sufficient departure separation standards from Routes G and H when applying a 1 minute departure interval between successive departures on these routes, which is a design requirement.
F6	This flight path option does not meet safety criteria for ensuring sufficient departure separation standards from Routes G and H when applying a 1 minute departure interval between successive departures on these routes, which is a design requirement.

FLIGHT PATH G

Runway 06 departures right turn to south

Figure 35: Consultation 1 design envelope

9.7 Flight path G: Runway 06 departures left turn to south

The Route G design envelope covered areas in Edinburgh and East Lothian including Cramond, Musselburgh, Prestonpans, Cockenzie and Port Seton, and Longniddry (see Figure 35). This flight path will be used by jet traffic routing to the south which previously would have been routed on the TALLA 6D SID. This flight path goes to HAVEN where it joins the en-route network.

9.7.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying and rural areas.
- Local pollution and environment including air quality and general increase in pollution.
- Health including sleep disturbance and general concerns about impact on health.

Other than these issues, there were no specific local issues raised from these communities. However, the local communities proposed a number of alternative flight paths specifically using waterways more than flying over populated areas.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

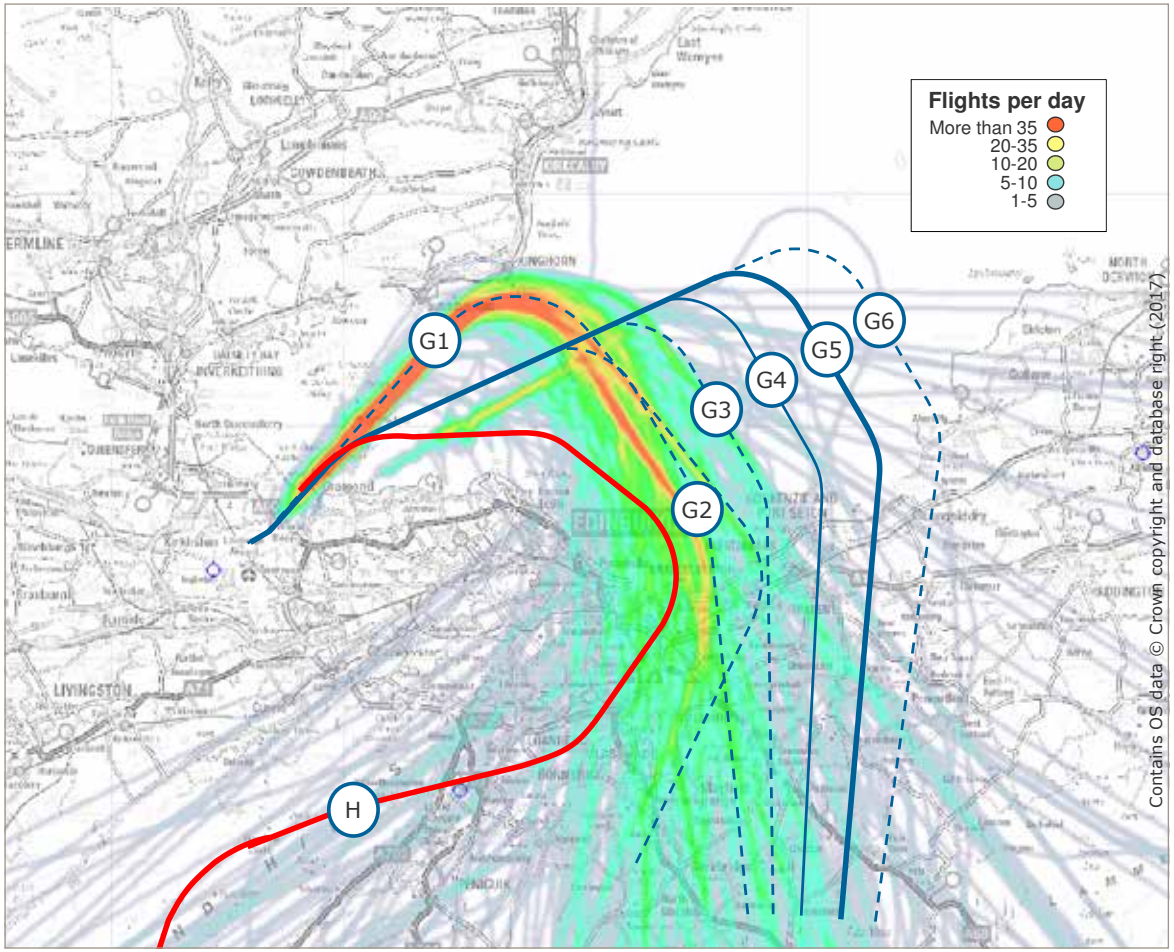
9.7.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. (We explain our criteria breakdown and our approach in the introduction to this in section 8 on page 34.)

Based on the feedback above and the criteria outlined, we investigated a number of potential Route G options within the design envelope (see Figure 35).

Route G5 is our preferred flight path.

Figure 36: Route options for flight path G



This map shows the current flight tracks, overlaid with our flight path options (G1-G6). Flight path option 'H' is in red to show the relationship between the two flight paths.

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

9.7.3 Preferred option – G5

Our preferred design option is G5. To determine this decision we tabled all of the options against our criteria (see Table 9).

Table 9

	G1	G2	G3	G4	G5	G6
Safety/ICAO design criteria	Non compliant	Non compliant	Non compliant	Compliant	Compliant	Non compliant
CO_2	Similar	Shorter	Similar	Similar	Longer	Longer
Noise – population overflown	Similar	Similar	Similar	Less	Less	Less
Noise – new population impacted	None	Slightly more	None	Slightly more	Slightly more	Slightly more
Operational benefit – reduced delay	No	Yes	Yes	Yes	Yes	Yes
Populations impacted						
Cramond – 7,502	Similar	Similar	Similar	Similar	Similar	Similar
Burntisland – 6,269	Similar	Further away	Further away	Further away	Further away	Further away
Kinghorn – 15,295	Similar	Further away	Further away	Further away	Further away	Further away
Edinburgh – 464,990	Similar	Similar	Further away	Further away	Further away	Further away
Musselburgh – 21,900	Similar	Similar	Similar	Further away	Further away	Not overflown
Cockenzie and Port Seton – 5,460	Similar	Similar	Overflown	Overflown	Overflown	Similar
Longniddry and Aberlady – 3,486	Not overflown	Not overflown	Not overflown	Closer	Overflown	Overflown

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.7.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultation to provide expert advice.

Regulatory

All flight path options except G1, G2, G3 and G6 meet safety requirements and ICAO design criteria.

Operational

Our preferred option (G5) allows for future growth projects; it meets our need for reduced departure separation times. This flight path would typically be used by 4.1% of flights (40 flights per day in 2016, 56 flights per day in 2023).

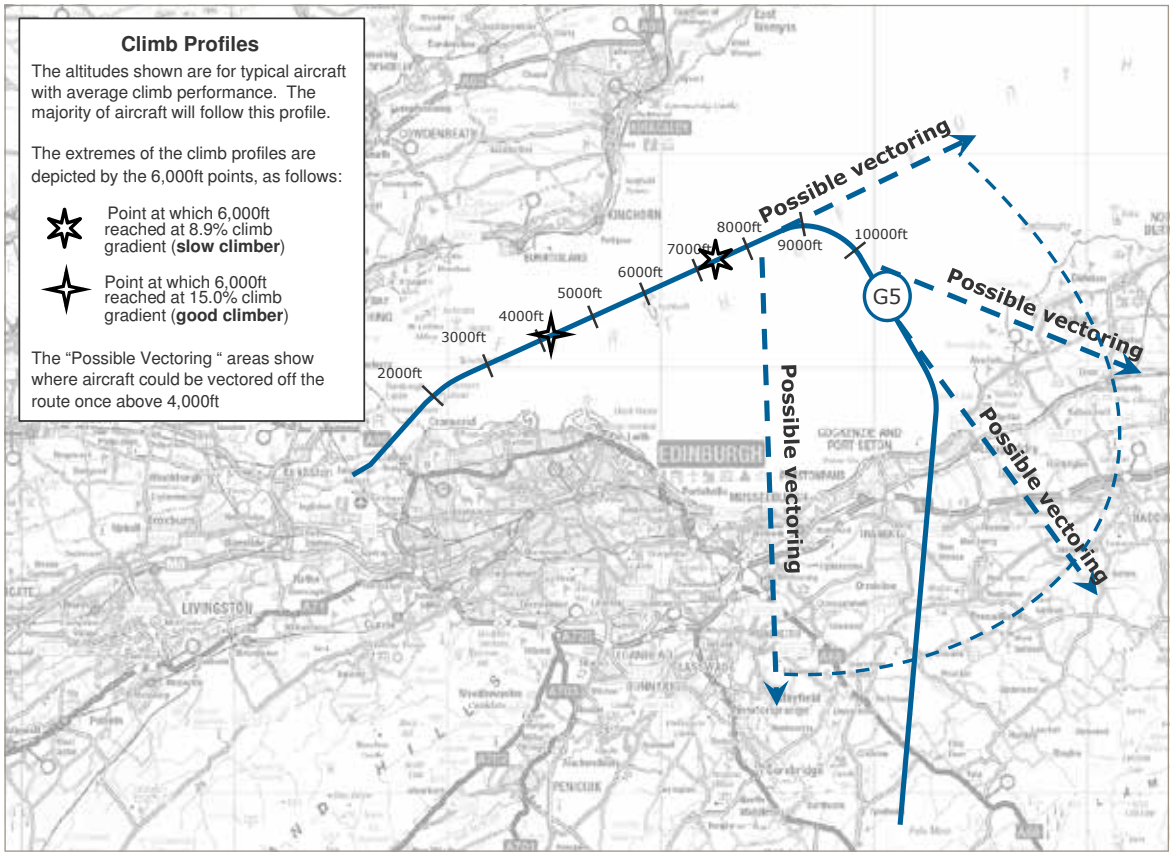
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our Criteria Matrix for Route G lists the populations under the design envelope; this was calculated based on a population density mapping exercise. As you can see Route G5 overflies the fewest number of communities identified in this area. G5 moves the existing flight path further out over the Firth of Forth so that aircraft reach a higher altitude before turning over land reducing the noise impact.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, “The DfT’s guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to ‘pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas’”. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (G5) is a slightly longer track length compared to the existing flight path as reducing the community impact on Burntisland, Kinghorn, Edinburgh and Musselburgh were prioritised.
Air quality	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to the CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Use waterways, specifically the Firth of Forth, more than flying over populated areas.	Our preferred option (G5) is a slightly longer track length compared to the existing flight path, reducing the community impact on Edinburgh, Burntisland, Kinghorn and Musselburgh was prioritised.

9.7.5 Preferred option

Our preferred design option is G5. To determine this decision we tabled all of the options against our criteria (see Table 9).

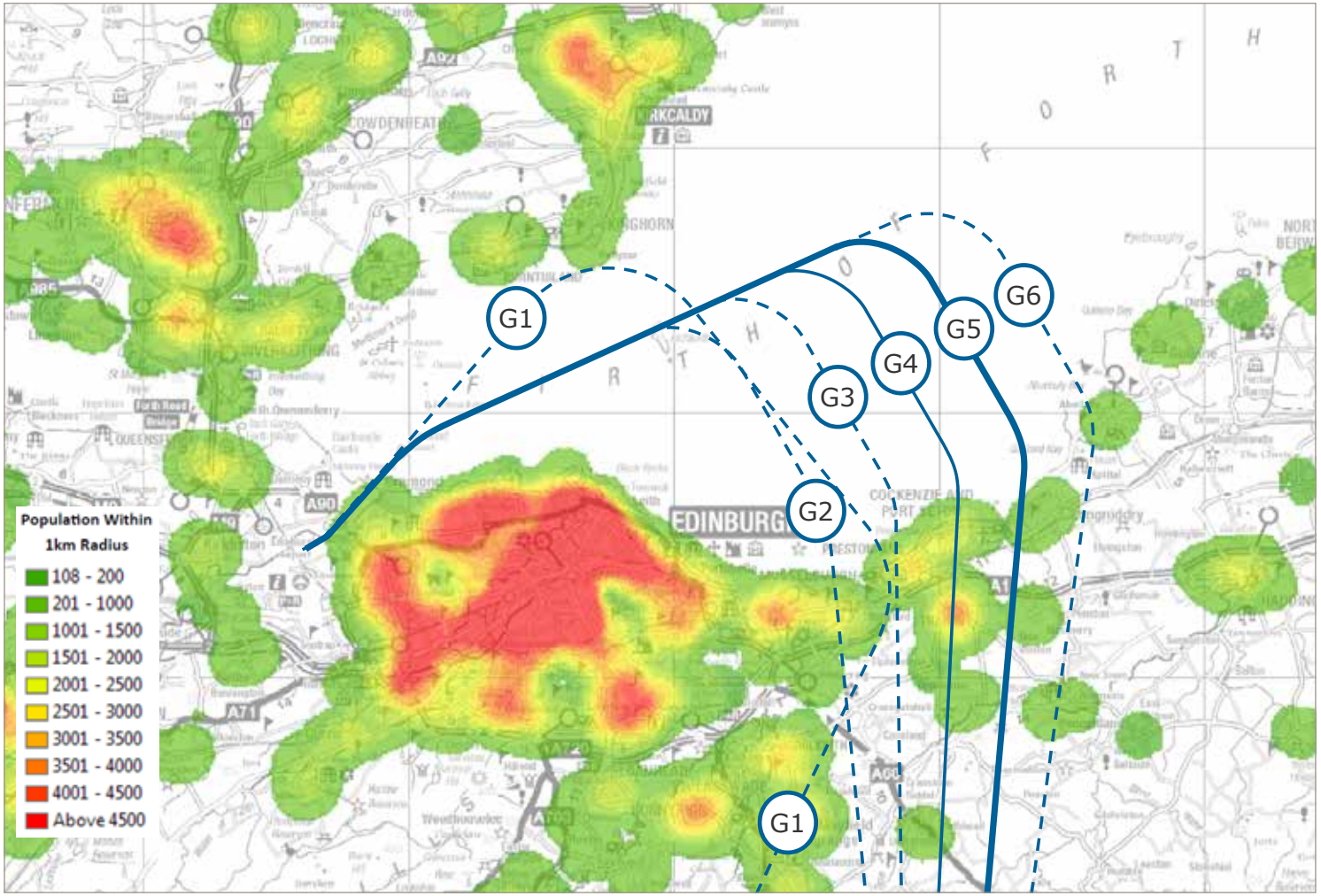
Figure 37: Preferred option for flight path G with typical climb profiles



This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC.

Figure 38: Route options for flight path G



This map shows population density, overlaid with our flight path options (G1-G6).

Figure 39: Airbus A330 L_{max} footprints for Runway 06 – proposed SIDs

Figure 39 above shows the L_{max} footprint for each of our preferred Runway 06 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.7.6 Other flight path options

Other flight path options	Analysis
G1	This flight path option does not meet safety criteria as it is not sufficiently separated from Route H options.
G2	This flight path option does not meet safety criteria as it is not sufficiently separated from Route H options.
G3	This flight path option does not meet safety criteria as it does not allow sufficient separation from Route H option.
G4	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. G4 was not preferred as it is a similar track length to the existing flight path and would not provide any noise or CO_2 reductions.
G6	This flight path option does not meet safety and ICAO design criteria as it places aircraft too close to the existing controlled airspace boundary to ensure safe operation from general aviation and military traffic outside.

FLIGHT PATH H

Runway 06 departures right turn to south west

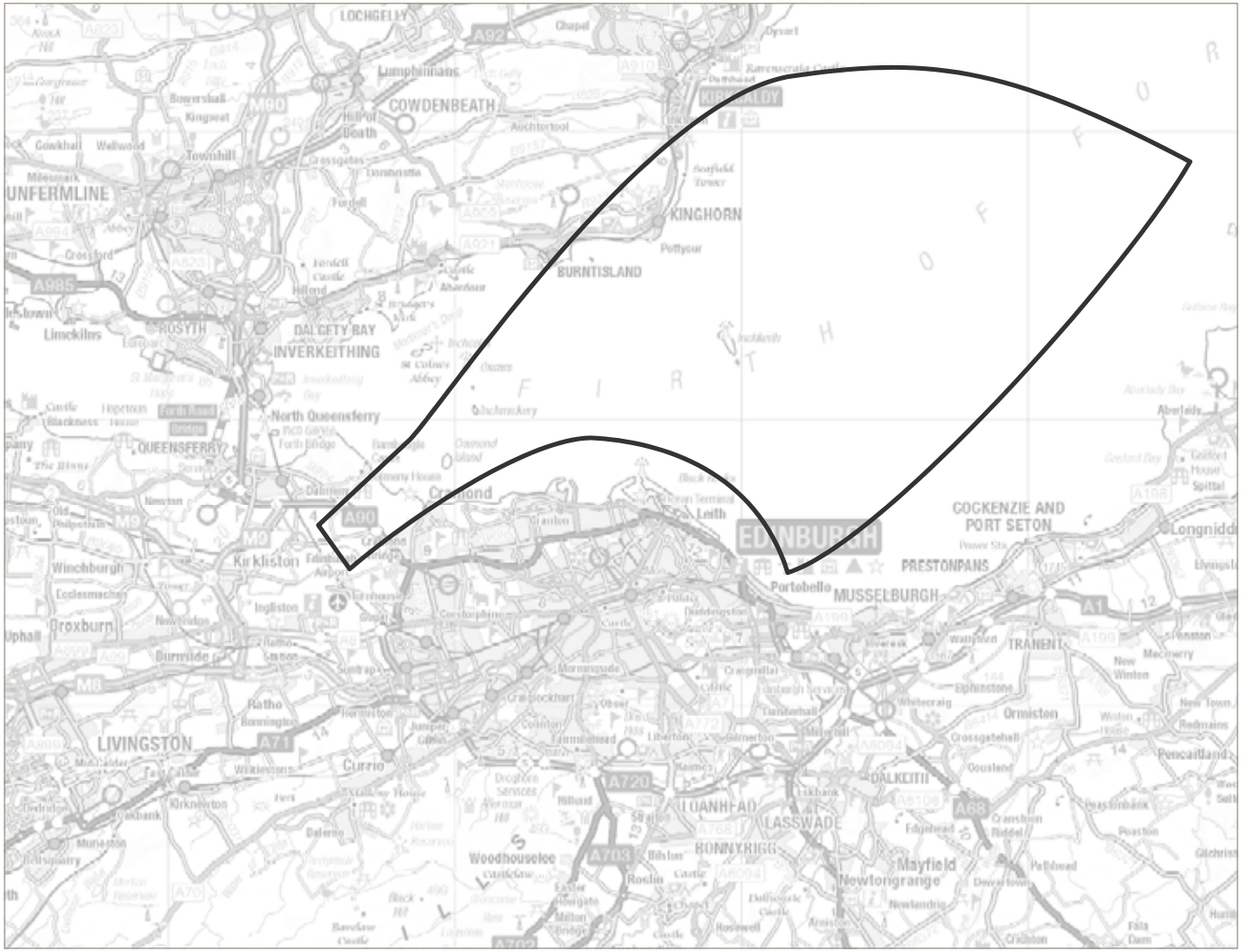


Figure 40: Consultation 1 design envelope

9.8 Flight path H: Runway 06 departures right turn to south west

The Route H design envelope covered areas in Edinburgh and East Lothian including Cramond, Musselburgh, Prestonpans, Cockenzie and Port Seton (see Figure 40).

9.8.1 Issues raised

The feedback we received from respondents under this design envelope identified top themes covering:

- Noise including general noise concerns, night flying and rural areas.
- Local pollution and environment including air quality and general increase in pollution.
- Health including sleep disturbance and general concerns about impact on health.

Other than these issues, there were no specific local issues raised from these communities. However, the local communities proposed a number of alternative flight paths specifically using waterways more than flying over populated areas.

While we have considered all of your feedback, determining the flight path options is a balancing act to try to accommodate issues from different communities and reducing the impact overall. This means that while 'you said, we did', in some instances there is also 'you said, we didn't'. Where possible and appropriate we have adopted your feedback in designing the flight path options. Where it has not been possible or appropriate to do so, we have sought to explain why.

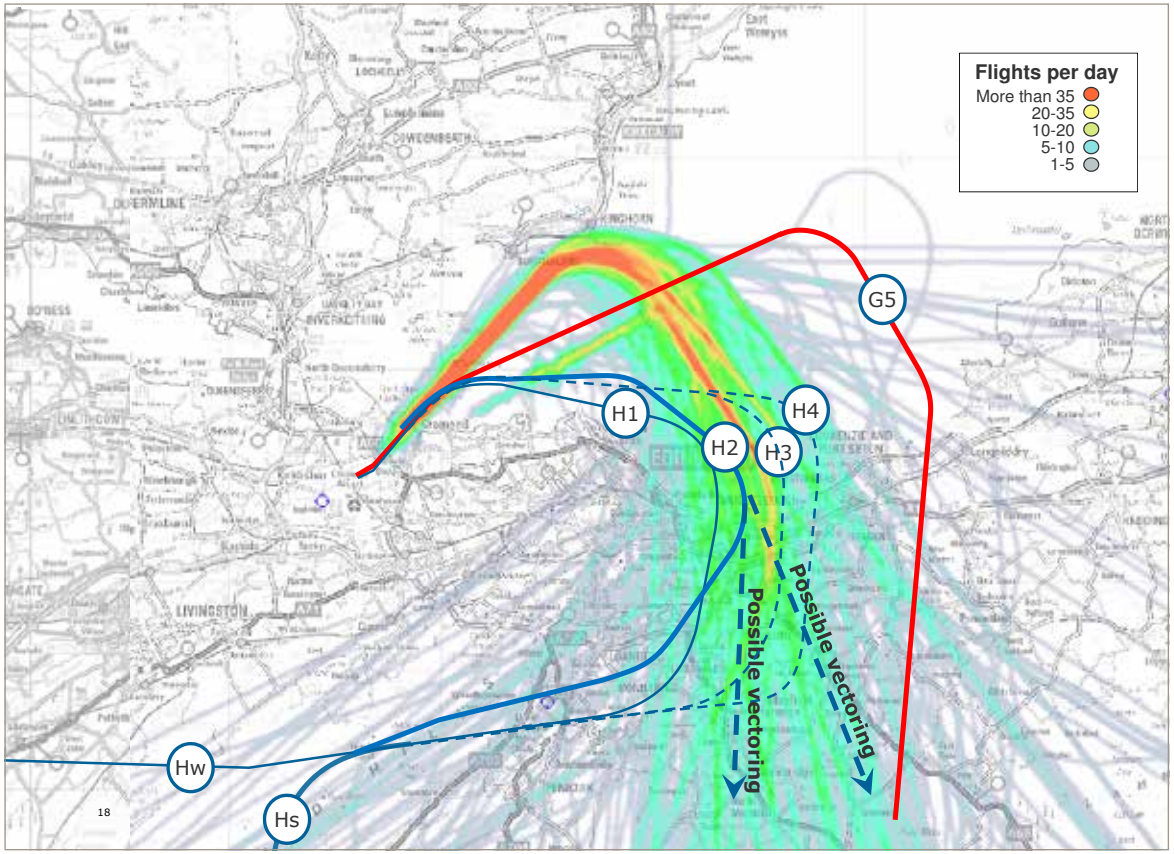
9.8.2 Determining flight path options

When considering design options, we needed to balance the impact on the community, regulatory requirements and our operational requirements. (We explain our criteria breakdown and our approach in the introduction to this in section 8 on page 34.)

Based on the feedback above and the criteria outlined, we investigated a number of potential Route H options within the design envelope (see Figure 40).

Route H2 is our preferred flight path.

Figure 41: Route options for flight path H



This map shows the current flight tracks, overlaid with our flight path options (H1-H4). Flight path option 'G' is in red to show the relationship between the two flight paths.

See section 7.3 for explanation of flight path densities. Visit letsgofurther.com to view current and proposed flight paths on Google maps.

This route will be used by jet and non-jet traffic routing to the south and west. For route allocation see section 8 and 12. The extended part of Route H2 (Hw) goes to MAVIX, while Hs goes to TALLA.

9.8.3 Preferred option – H2

Our preferred design option is H2. To determine this decision we tabled all of the options against our criteria (see Table 10).

Table 10

	H1	H2	H3	H4
Safety/ICAO design criteria	Compliant	Compliant	Non compliant	Non compliant
CO_2	Longer	Longer	Longer	Longer
Noise – population overflown	More	Similar	Similar	Similar
Noise – new population impacted	More	Slightly more	Slightly more	No
Operational benefit – reduced delay	Yes	Yes	Yes	Yes
Populations impacted				
Cramond – 7,502	Similar	Similar	Similar	Similar
Burntisland – 6,269	Further away	Further away	Further away	Further away
Kinghorn – 15,295	Further away	Further away	Further away	Further away
Edinburgh – 464,990	Closer	Closer	Closer	Closer
Musselburgh – 21,900	Overflown	Overflown	Overflown	Overflown
Cockenzie and Port Seton – 5,460	Similar	Further away	Further away	Further away
Longniddry and Aberlady – 3,486	Not overflown	Not overflown	Not overflown	Not overflown

Positive impact **No change/neutral** **Negative impact**

Note: Difference relative to today's impact.
Not overflown = route centreline more than 2nm away from community.

9.7.4 Optioneering

When considering design options, we needed to balance the impact on community, regulatory requirements and our operational requirements.

Community

Noise was the primary issue raised by communities within this design envelope. To help us better understand the noise concerns in this area, we engaged a noise consultation to provide expert advice.

Regulatory

All flight path options except H3 and H4 meet safety requirements and ICAO design criteria.

Operational

Our preferred option (H2) allows for future growth projections; it meets our need for reduced departure separation times. The initial portion of this flight path would typically be used by 9.3% of flights (91 flights per day in 2016, 118 flights per day in 2023). 5.2% (51 per day) route to GOSAM while 4.1% (40 per day) route to TALLA.

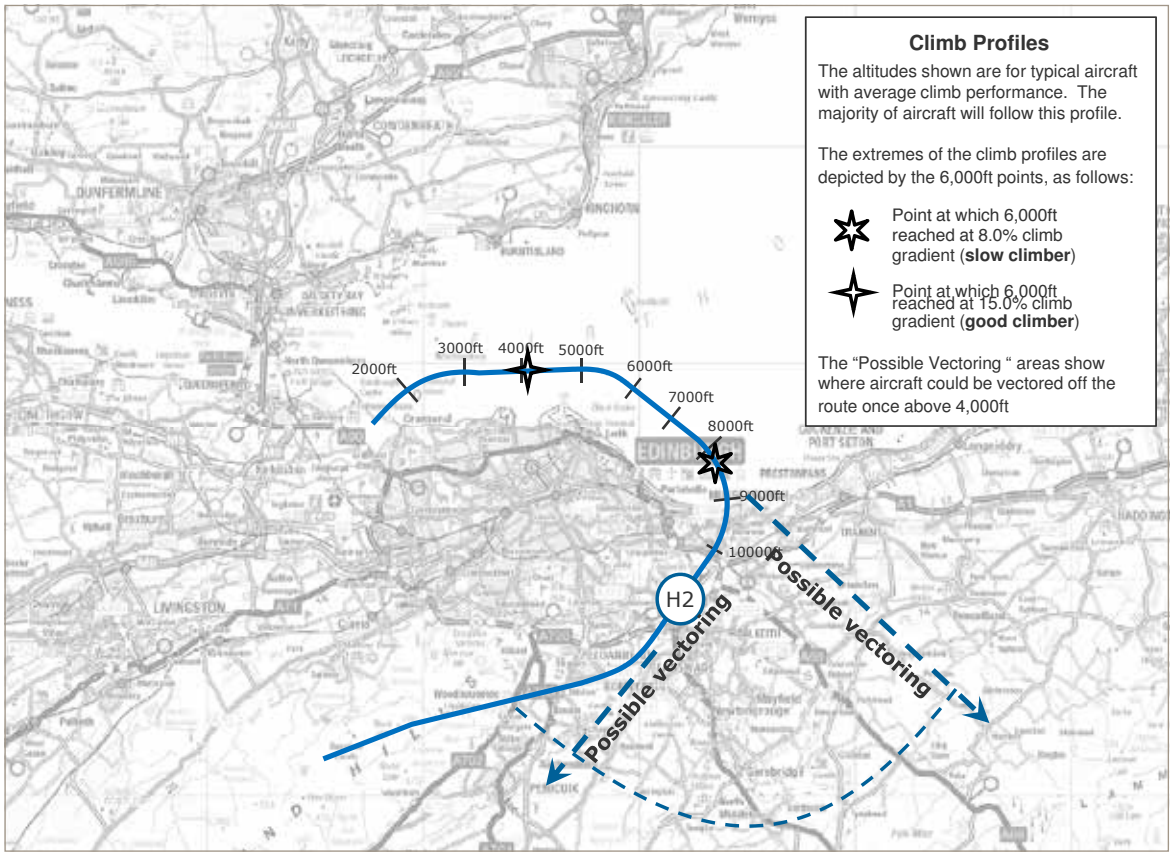
Concern: Noise	Response
General noise disturbance – concerns about changes or increases to existing noise within their community.	Noise impacts different people in different ways, and we have noted the concerns raised regarding the impact on younger people and the older generation in particular. The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Our Criteria Matrix for Route H lists the populations under the design envelope; this was calculated based on a population density mapping exercise. H2 allows a split between G and H, allowing Edinburgh Airport the space for future growth and capacity.
Concerns around sleep disturbance.	The World Health Organisation (WHO) provide guidelines on night time noise levels (42dB LAmax [inside]). Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.
Noise impact on quieter rural areas.	CAP725 states, "The DfT's guidance to the CAA (DTLR, 2002 – paragraph 46) requires DAP to 'pursue policies that will help to preserve the tranquillity where this does not increase significantly the environmental burdens on congested areas'". The advice from our consultant in response to this concern was to minimise residential exposure through population density mapping and fly over less-populated communities. Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will engage with the communities impacted regarding an update to our Noise Action Plan and Noise Insulation Scheme.

Local pollution and environment issues	
General increase in pollution over the local area.	Our preferred option (H2) is a slightly longer track length compared to the existing flight path as H2 allows a split between G and H, allowing Edinburgh Airport the space for future growth and capacity.
Air quality.	The CAA consider air quality a priority below 1,000ft. The preferred option provides no change to existing air quality under 1,000ft.
Concerns regarding the smell of fuel and dumping of fuel.	The dumping of aviation fuel is not a routine activity and is strictly controlled by the CAA. Regulation states that fuel dumping, unless it's an emergency, is an offence liable to a statutory fine. However, not all aircraft have the facility to dump fuel. Those that are equipped with this facility and according to CAA guidelines should dump fuel out to sea or if unavoidable above 10,000ft over land to allow the fuel to evaporate before reaching the ground. All such incidents must be reported to the CAA. Airports are often associated with kerosene odours which can cause concern. The odour of aviation fuel is difficult to control, however the majority of odours are blown away in the wind. In some cases, such as warm and still days, the smell may be more noticeable but should be short lived.
Concerns regarding the impact on the natural environment.	Once a decision has been made and approved by the CAA regarding a preferred route to be implemented, we will continue to work with Scottish Natural Heritage and with the communities impacted to ensure Edinburgh Airport meets legislative requirements in this area.
Specific community issues	
Use waterways, specifically the Firth of Forth, more than flying over populated areas.	Our preferred option (H2) is a slightly longer track length compared to the existing flight path as H2 allows a split between G and H, allowing Edinburgh Airport the space for future growth and capacity.

9.8.5 Preferred option

Our preferred design option is H2. To determine this decision we tabled all of the options against our criteria (see Table 10).

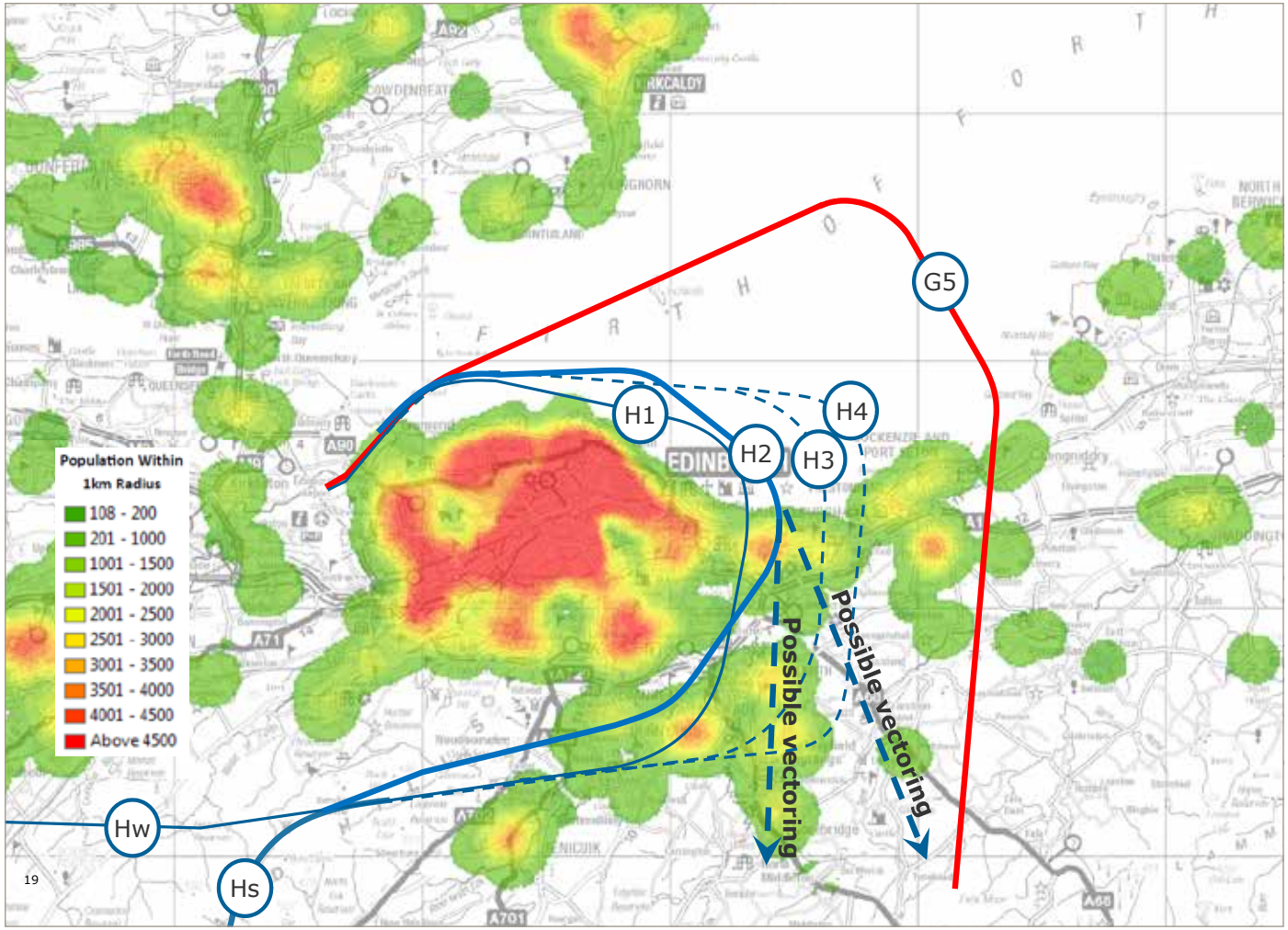
Figure 42: Preferred option for flight path H with typical climb profiles



This map shows our preferred flight path and provides guidance on minimum altitudes along the route.

The centreline of the route is shown in blue. Once above 4,000ft aircraft will be able to be directed off the route. This will result in traffic dispersing away from the route as it climbs above 4,000ft. The dotted 'possible vectoring' area either side of the route indicates where this dispersal is most likely. It is proposed that aircraft will be kept on the SID route until reaching 4,000ft altitude (4,000ft for SIDs that turn and approximately 8 miles geographical point for the straight-ahead routes), at which point they may be vectored by ATC. Traffic will not be vectored over Edinburgh city centre.

Figure 43: Route options for flight path H



This map shows population density, overlaid with our flight path options (H1-H5).

Figure 44: Airbus A330 L_{max} footprints for Runway 06 – proposed SIDs

Figure 44 above shows the L_{max} footprint for each of our preferred Runway 06 flight paths, based on noise from an Airbus A330. For further detailed noise analysis please refer to Ref. 10 on page 156 and our noise factsheet. The measurement of noise is very complex. There are a number of different ways of measuring noise from aircraft, with the measurement used dependent on what the measurement will be used for. L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one departure movement.

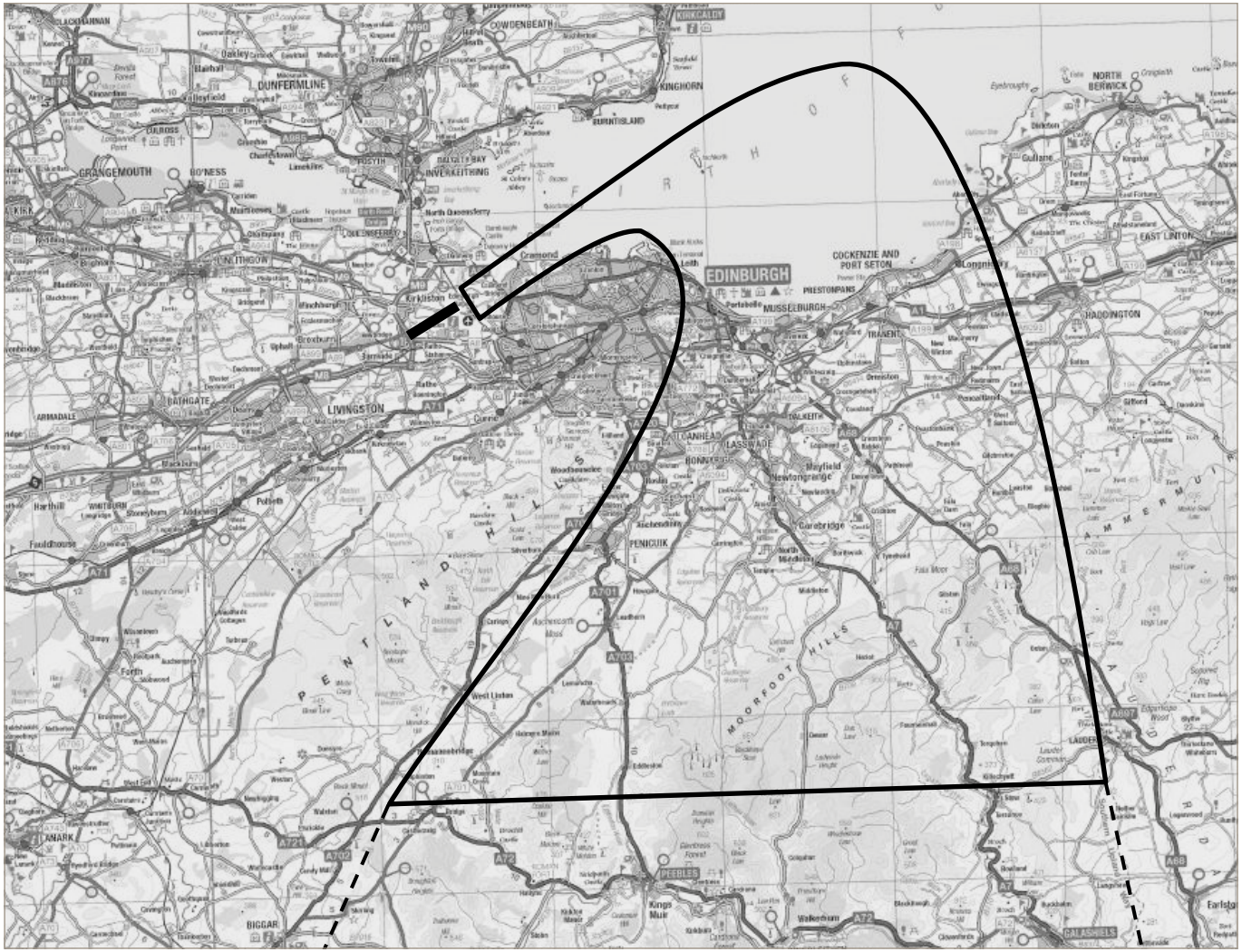
As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases. The above footprint shows areas that are predicted to lie within the 70dB and 80dB L_{max} noise level.

9.8.6 Other flight path options

Other flight path options	Analysis
H1	While this flight path option meets safety and ICAO design criteria, this option is not preferred based on it not meeting a number of community criteria. H1 was not preferred as it was a longer track than H2, resulting in increased CO_2 emissions. H1 would impact Edinburgh city increasing the population affected in comparison to the existing flight path.
H3	This flight path option does not meet safety criteria as it is not sufficiently separated from Route G options.
H4	This flight path option does not meet safety criteria as it is not sufficiently separated from Route G options.

RUNWAY 24 ARRIVALS

Figure 45: Consultation one design envelope



9.9 Runway 24 arrivals from the north

There is no change proposed for Runway 24 arrivals from the north. Arrivals from the north represent a relatively small proportion of the overall number of flights (approximately 8% of arrivals). Figure 46 shows the flight path tracks for current Runway 24 arrivals from the north below 7,000ft.

Figure 46: Current Runway 24 arrivals from the north (1-14th June 2014)

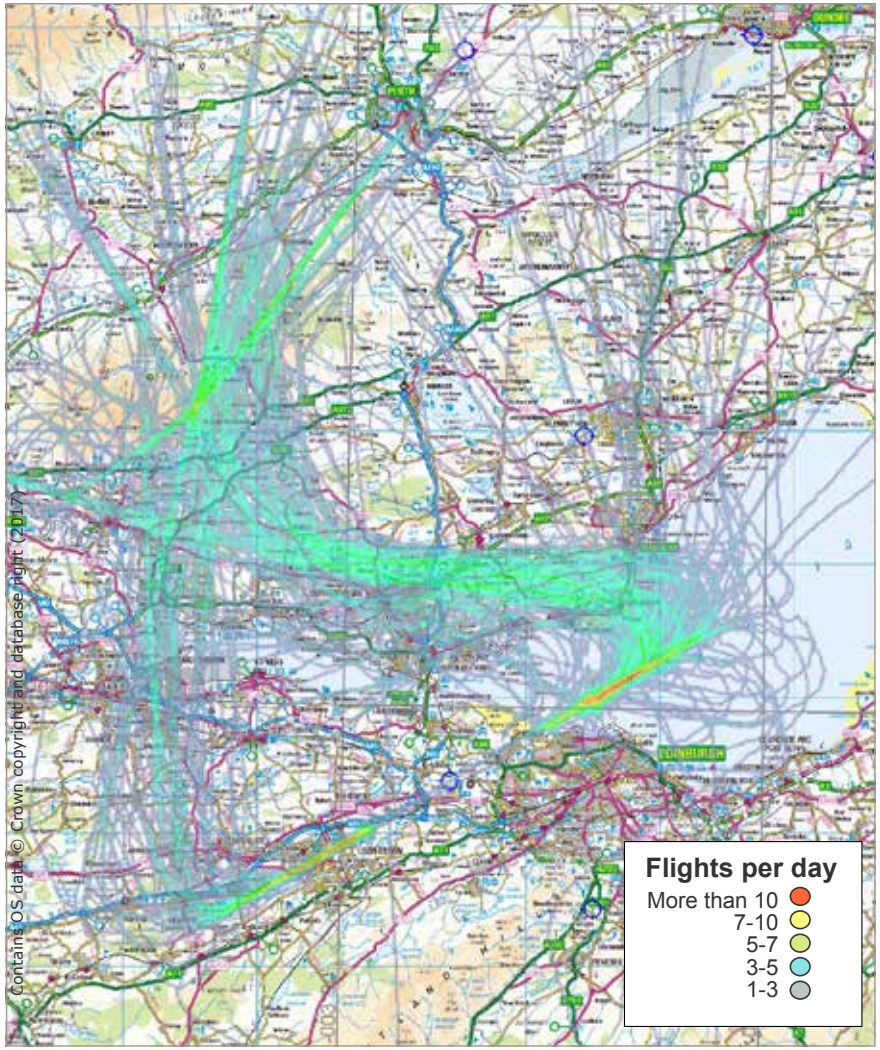
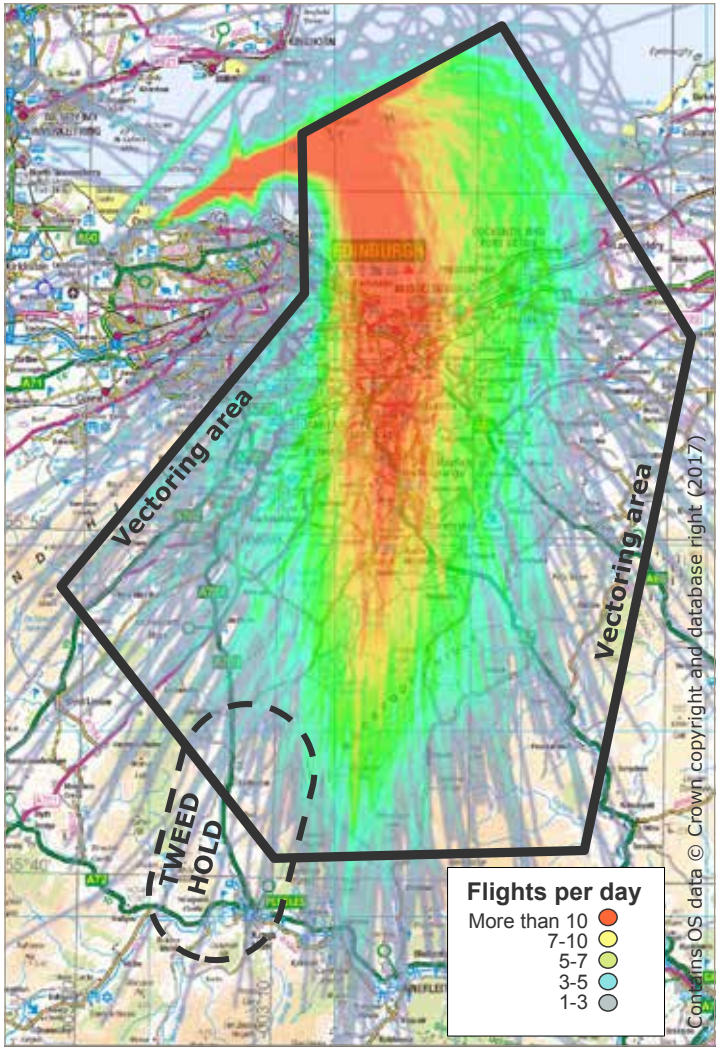


Figure 47: Current Runway 24 arrivals from the south (1-14th June 2014)



9.10 Runway 24 arrivals from the south

There is currently no published flight path for aircraft arriving from the south. Arrivals to Edinburgh Airport from the south are routed to the TWEED hold (a point 17nm south of the airport) via the TALLA radio beacon. Aircraft are then given directions by Air Traffic Control until joining the final approach (this is known as vectoring). Even though there is no formal flight path it can be seen from Figure 47 left that there is a degree of consistency in the instructions given. Flexibility is required so that ATC can maintain a safe and orderly flow of arriving aircraft.

Currently there is no published arrival transition (route from the current TWEED hold, direct to the runway final approach track); all aircraft are vectored to final approach.

We are proposing to introduce a published flight path for aircraft arriving from the south. This flight path will be used for aircraft flight planning purposes as aircraft arriving from the south will enter this flight path into their pre-flight planning system, however as described above ATC will have the flexibility to vector aircraft to ensure a safe and orderly flow of arriving aircraft. Despite introducing this flight path for arriving aircraft the general pattern of traffic is expected to be very similar to current operations. There may be some concentration of flight tracks along the transition route however the requirement by ATC to vector aircraft to achieve safe and orderly arrival sequence will still remain.

By introducing a published flight path, aircraft will have a better understanding of the planned flight route which will enable aircraft to perform continuous descent approaches, these smoother approaches at reduced power settings require less fuel and reduce CO_2 emissions.

The use of RNAV technology enables aircraft to fly routes more accurately and does mean that over time, as an increasing number of aircraft use the RNAV routes there will be an increased concentration of aircraft over certain core tracks. This concentration will be focused in the airspace between 4,000ft and 7,000ft and should be offset by the increased use of continuous descent approaches which will bring improvements in noise and emissions. Above 7,000ft the impact of noise due to over-flying aircraft is less significant to those on the ground. Concentration of traffic reduces the extent of areas overflown, and has the potential to reduce the number of people exposed to noise from aircraft flying below 7,000ft.

The flight paths selected for the RNAV transitions replicate the procedural flight-planned route. Different options for the arrival transitions are not being consulted upon since the normal practice will remain as today with the majority of flights being radar vectored by ATC and not following the exact published route. The proposed arrival transitions require the TWEED hold to be realigned and the holding fix moved 3nm to the east. See Section 12, Figure 55 for more information.

Figure 48: Proposed flight path and vectoring area

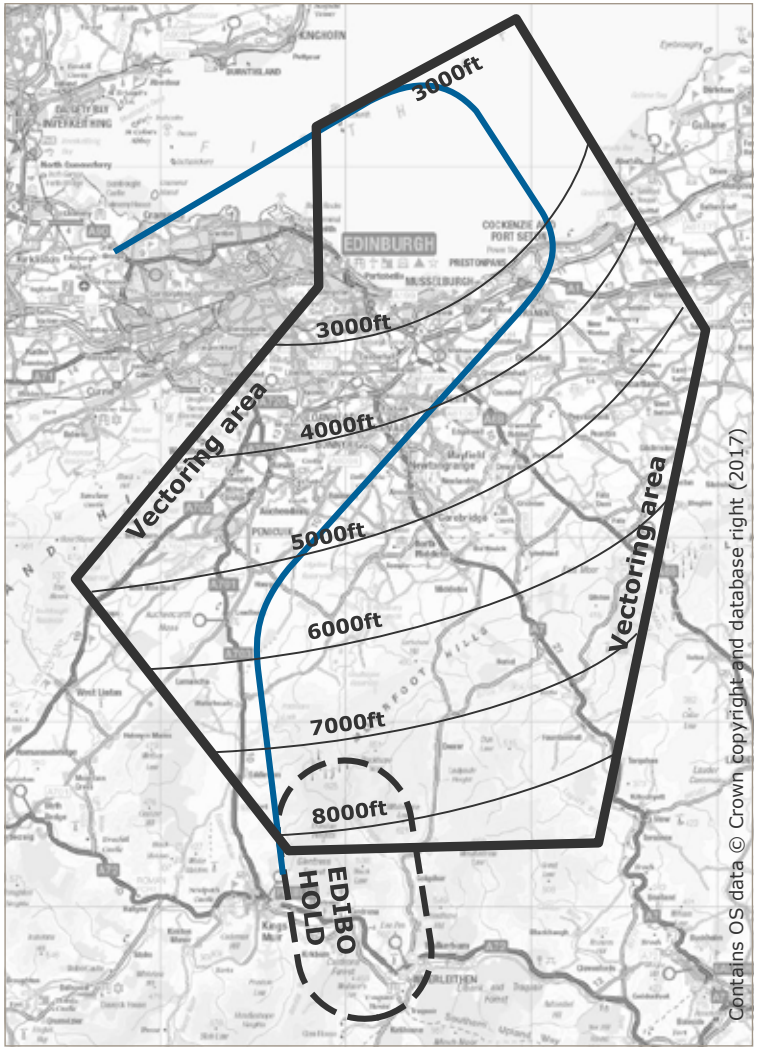
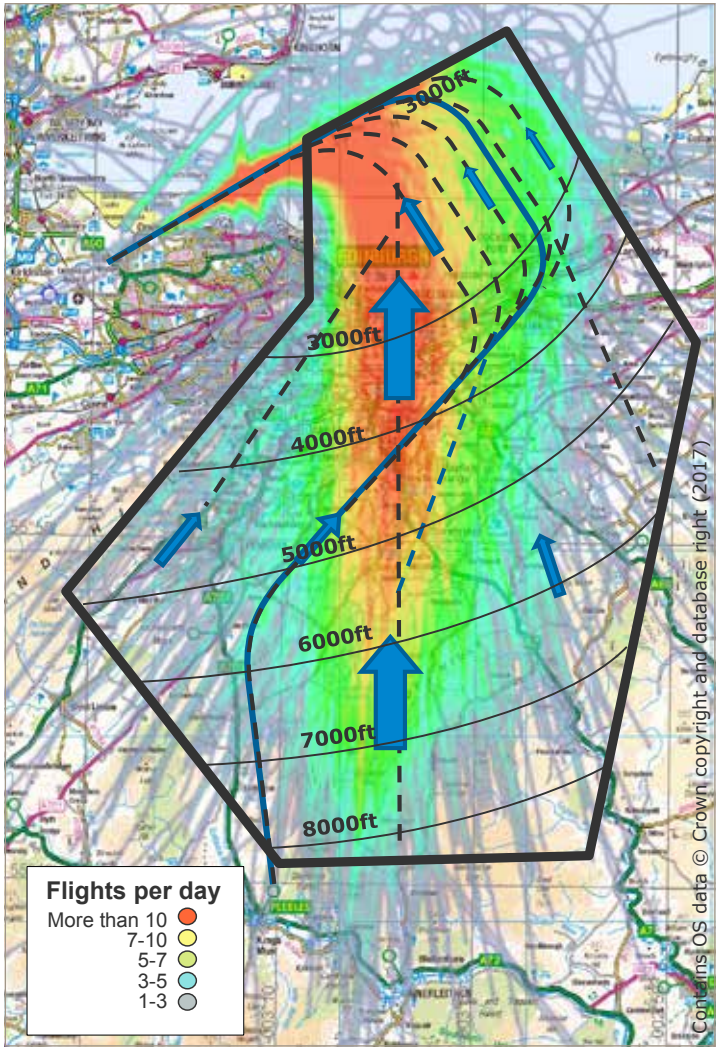


Figure 48 shows the proposed RNAV flight path (shown in blue) and associated vectoring area for arrivals to runway 24 and gives an indication of approximate altitudes of aircraft within the arrivals envelope.

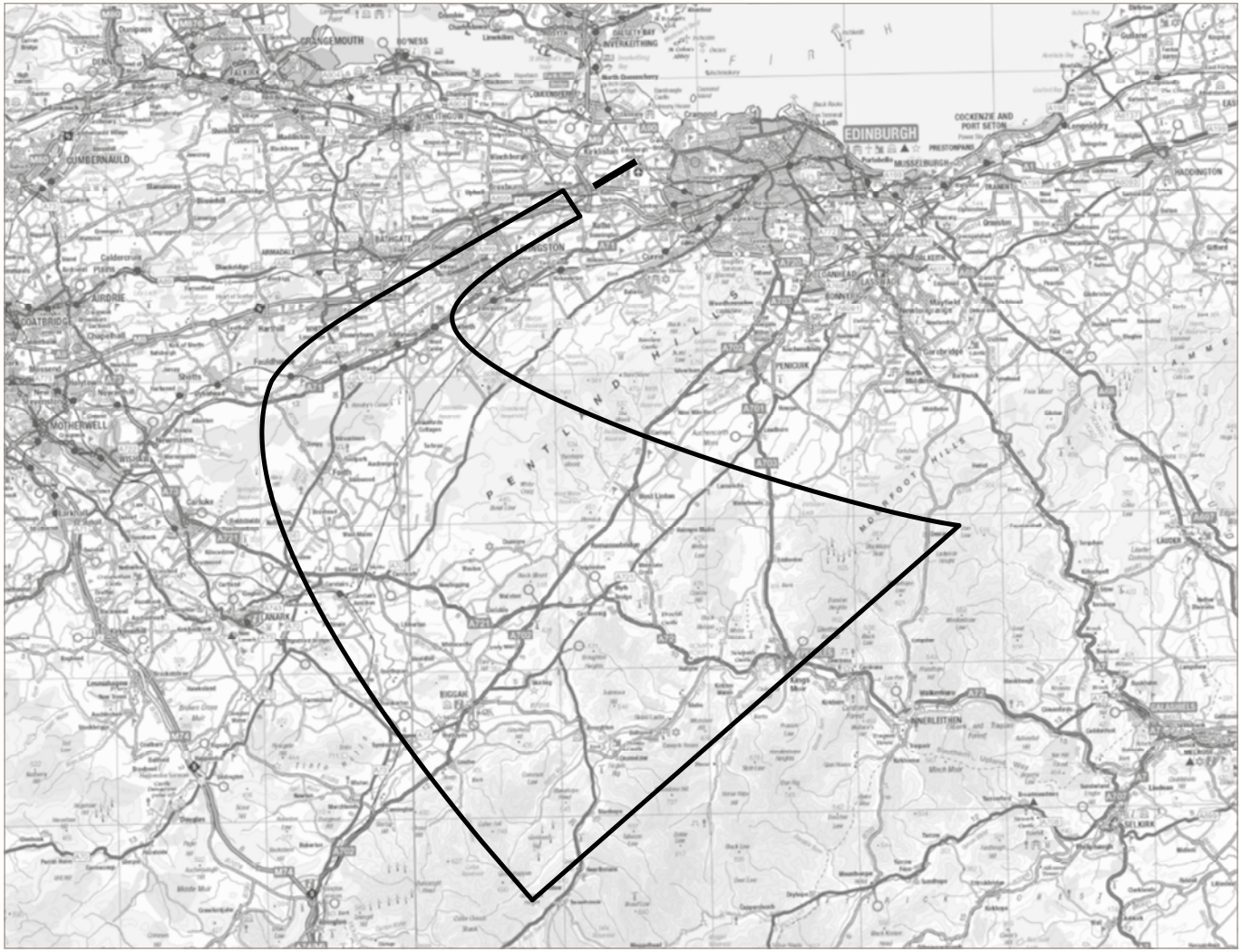
Figure 49 shows the proposed RNAV flight path (shown in blue) and associated vectoring area for arrivals to runway 24 and gives an indication of approximate altitudes of aircraft within the arrivals envelope. The dotted blue lines and arrows represent how actual flight paths may vary from the published flight path.

Figure 49: Current Runway 24 arrivals from the south and proposed flight path



RUNWAY 06 ARRIVALS

Figure 50: Consultation one design envelope



9.11 Runway 06 arrivals from the north

There is no change proposed for Runway 06 arrivals from the north. Arrivals from the north represent a relatively small proportion of the overall number of flights (approximately 8% of arrivals). Figure 51 shows the flight path tracks for current Runway 06 arrivals from the north below 7,000ft.

Figure 51: Current Runway 06 arrivals from the north (1-14 June 2016)

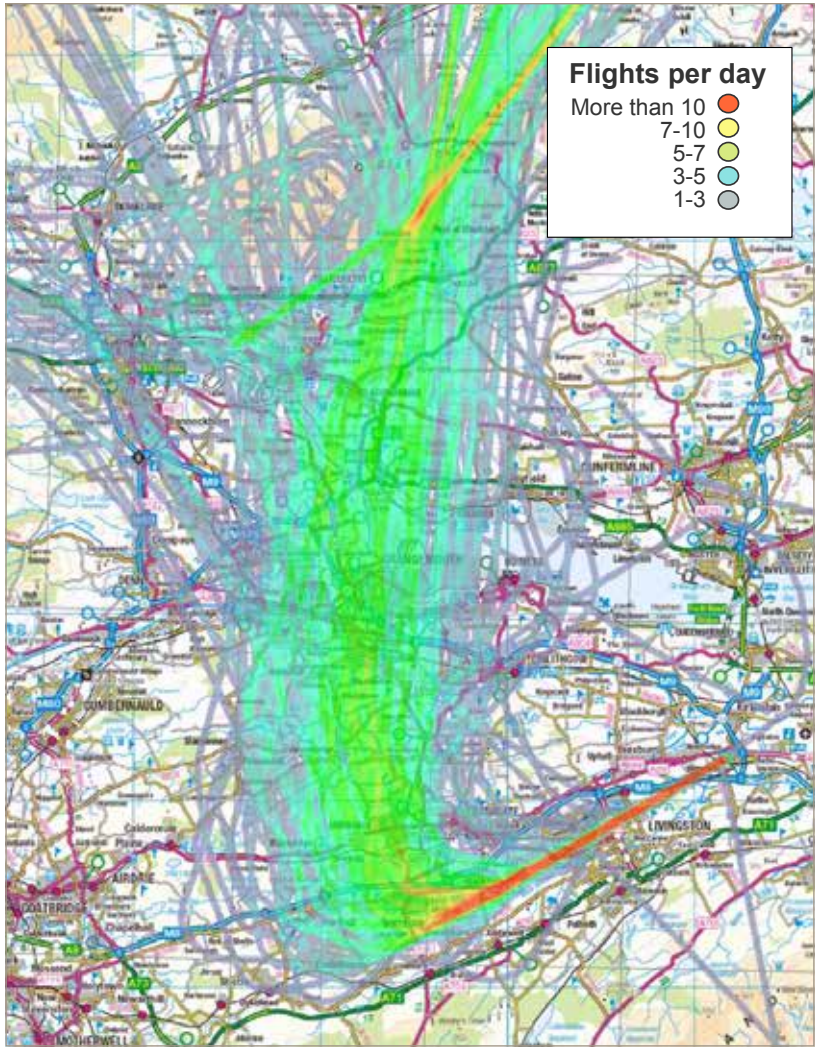
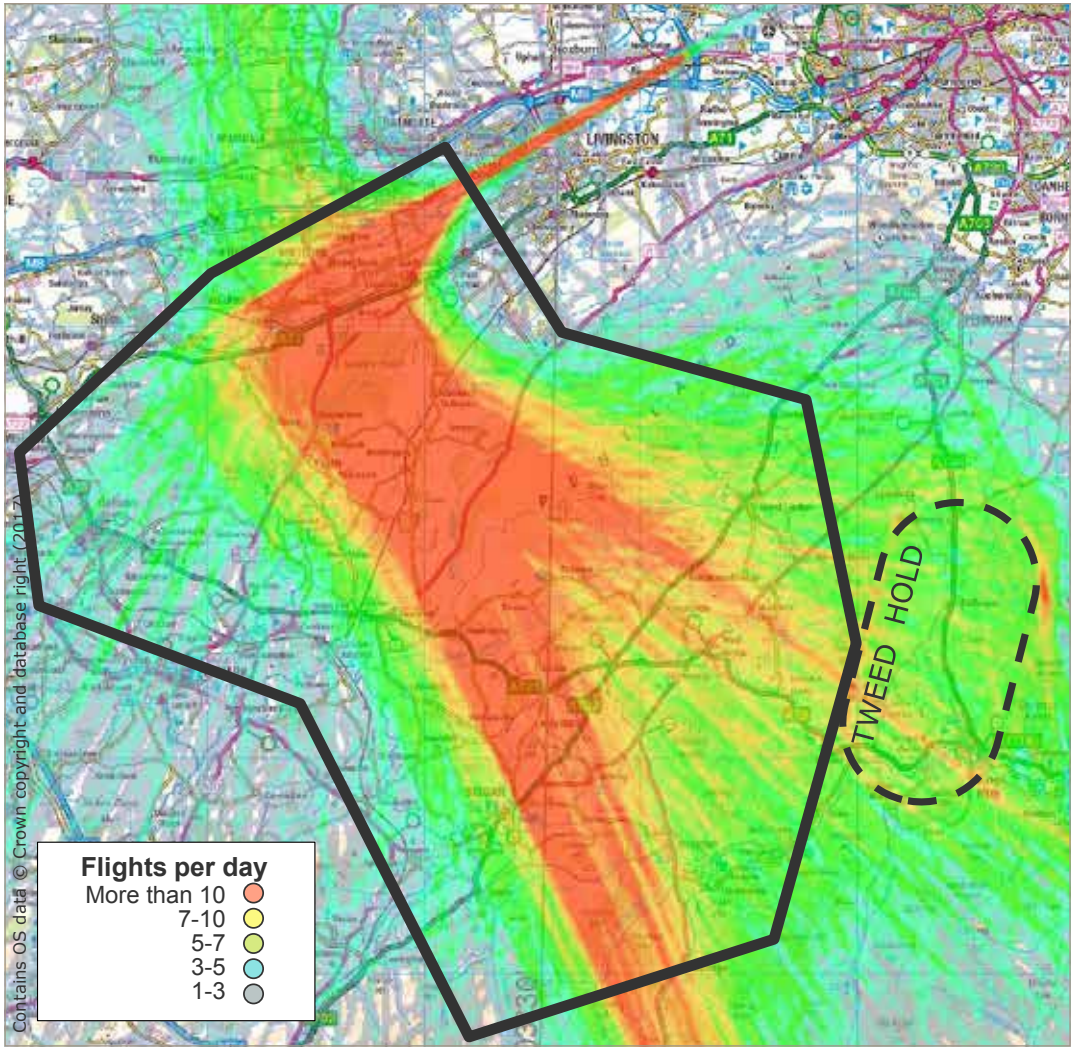


Figure 52: Current Runway 06 arrivals from the south (1-14 June 2016)



9.12 Runway 06 arrivals from the south

There is currently no published flight path for aircraft arriving from the south. Arrivals to Edinburgh Airport from the south are routed to the TWEED hold (a point 17nm south of the airport) via the TALLA radio beacon. Aircraft are then instructed by Air Traffic Control at what point to join the final approach, this is known as vectoring. Even though there is no formal flight path it can be seen from Figure 52 left that there is a degree of consistency in the instructions given. Flexibility is required so that ATC can maintain a safe and orderly flow of arriving aircraft.

Currently there is no published arrival transition (route from the current TWEED hold, direct to the runway final approach track); all aircraft are vectored to final approach.

We are proposing to introduce a published flight path for aircraft arriving from the south. This flight path will be used for aircraft flight planning purposes as aircraft arriving from the south will enter this flight path into their pre-flight planning system, however as described above ATC will have the flexibility to vector aircraft to ensure a safe and orderly flow of arriving aircraft. Despite introducing this flight path for arriving aircraft the general pattern of traffic is expected to be very similar to current operations. There may be some concentration of flight tracks along the transition route however the requirement by ATC to vector aircraft to achieve safe and orderly arrival sequence will still remain.

By introducing a published flight path, aircraft will have a better understanding of the planned flight route which will enable aircraft to perform continuous descent approaches, these smoother approaches at reduced power settings require less fuel and reduce CO_2 emissions.

The use of RNAV technology enables aircraft to fly routes more accurately and does mean that over time, as an increasing number of aircraft use the RNAV routes there will be an increased concentration of aircraft over certain core tracks. This concentration will be focused in the airspace between 4,000ft and 7,000ft and should be offset by the increased use of continuous descent approaches which will bring improvements in noise and emissions. Above 7,000ft the impact of noise due to over-flying aircraft is less significant to those on the ground. Concentration of traffic reduces the extent of areas overflown, and has the potential to reduce the number of people exposed to noise from aircraft flying below 7,000ft.

The flight paths selected for the RNAV transitions replicate the procedural flight-planned route. Different options for the arrival transitions are not being consulted upon since the normal practice will remain as today with the majority of flights being radar vectored by ATC and not following the exact published route. The proposed arrival transitions require the TWEED hold to be realigned and the holding fix moved 3nm to the east. See Section 12, Figure 55 for more information.

Figure 53: Proposed flight path and vectoring area

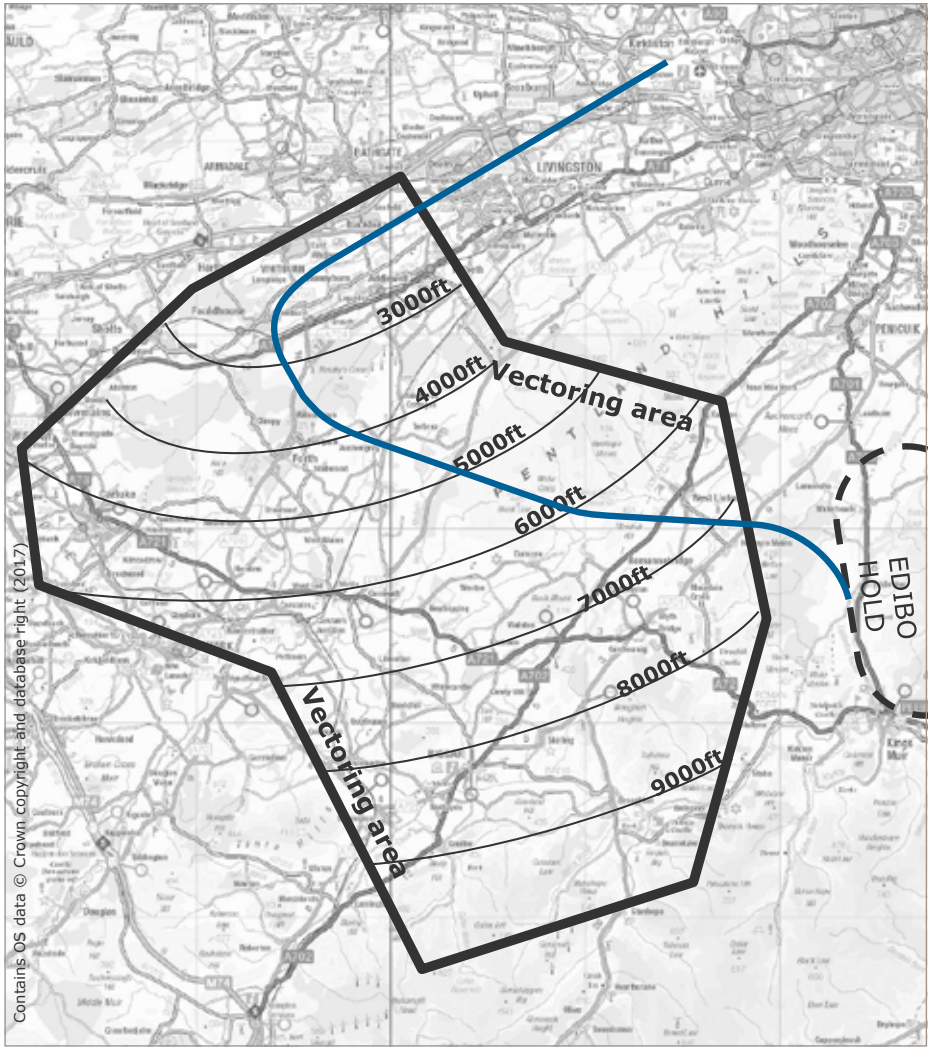
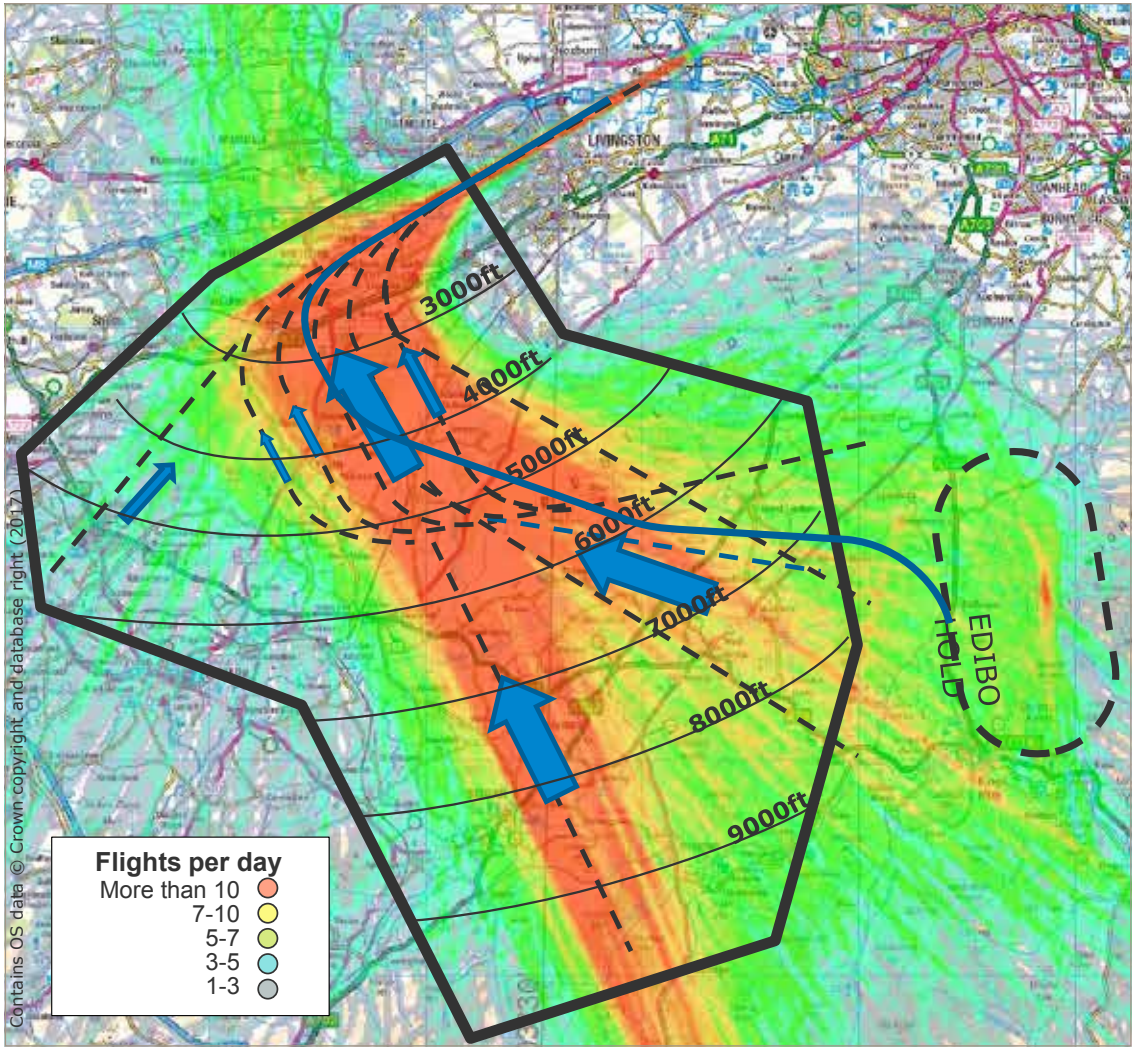


Figure 53 shows the proposed RNAV flight path (shown in blue) and associated vectoring area for arrivals to runway 06 and gives an indication of approximate altitudes of aircraft within the arrivals envelope.

Figure 54 shows the proposed RNAV flight path (shown in blue) and associated vectoring area for arrivals to runway 06 and gives an indication of approximate altitudes of aircraft within the arrivals envelope. The dotted blue lines and arrows represent how actual flight paths may vary from the published flight path.

Figure 54: Current Runway 06 arrivals from the south and proposed flight path



9.13 Non-conventional approach procedures

We initiated two studies into the use of innovative or non-conventional final approach procedures with the aim of reducing the noise impact on our local communities, these were:

- Steeper approaches.
- Offset arrivals.

We drew on experience from other international airports, including Ben Gurion, Göteborg, Ronald Reagan Washington 'Metro' and JFK, as well as current national, European and international guidance and regulations.

We discovered that these non-conventional final approaches cannot be used by the majority of the airline and aircraft types using our airport due to:

- National and international regulatory approval limitations.
- Increased training requirements.
- Inability of the approaches to be used in poor weather conditions increasing the risk of aircraft diversion and passenger inconvenience.

Additionally, the operational effects and variations incurred by the airport and its airline operators, some of which can be counterproductive to the goal of noise reduction, would not necessarily gain approval from the CAA. It was also unclear as to what noise reduction might be gained within three miles of the runway threshold as there were complex competing operational effects including pilot throttle adjustment, selection of landing-enhancement devices, undercarriage, and imprecision in the final stages of the approach that could disproportionally negate any potential gain in the goal of reducing noise.

In summary, technologies and regulatory guidance, are not consistently available across different aircraft and non-conventional final approach procedures would likely lead to the need to have mixed mode operations alongside existing conventional procedures thus increasing pilot and air traffic controller workload at a critical stage of flight. This would therefore be unlikely to receive the necessary CAA approval. The negative consequences for operational safety, particularly the increased likelihood of unstable approaches and increased go-arounds or diversion, the impact on other airport procedures, and the operational complication and resource penalties for airline and airport operator alike were considered too great in comparison to any possible gains that may be made.

10

Design considerations

When deciding where a route will be positioned, there are numerous factors which must be considered. They include:

10.1 Safety

Safety is always the number one priority.

Many of the factors below are motivated by ensuring the utmost safety. A change to airspace will only be approved by the CAA if it is as least as safe as current operations. Where possible we will always strive to improve safety.

10.2 Environmental

Noise impact to those on the ground

In low altitude airspace (below 4,000ft AGL) the priority should be to minimise aviation noise impact and the number of people on the ground significantly affected by it. In intermediate airspace from 4,000ft to 7,000ft the focus should continue to be on minimising the impact of aviation noise, but this should be balanced with the need for an efficient flow of traffic that minimises emissions.

Visual impact

Usually considered only with respect to designated areas such as National Parks.

CO_2 emissions

This is prioritised where aircraft will be above 7,000ft AGL. For emissions at altitude, government guidelines dictate that the emphasis is on CO_2 rather than NO_x and particulates. Between 4,000ft and 7,000ft CO_2 emissions remain a priority to be considered in conjunction with noise impacts at these altitudes.

Local air quality

All emissions are considered, but are only applicable where changes are made to flight paths which are below 1,000ft AGL. Our proposals do not include changes below 1,000ft.

10.3 Physical

Procedure design limitations

Internationally agreed parameters for design of flight procedures are governed by the International Civil Aviation Organisation (ICAO), and adopted by the UK CAA. These are limits for parameters including terrain/ obstacle clearance, maximum climb and descent angles, minimum distances between waypoints, stabilisation distances.

Avoidance of other airspace

Restricted areas, military danger areas.

Minimum turn radii

Determined by aircraft speed and maximum bank angle.

Speed

Maximum speed e.g. 220 knots can be specified for procedures. Below 10,000ft the maximum speed for aircraft is 250 knots unless otherwise notified.

10.4 Efficiency

Air traffic controller workload

Each air traffic controller is responsible for a specific sector of airspace. For safety, limits are set on the number of aircraft that can enter each sector thus ensuring that the controller can safely manage the workload. Hence workload can be a limiting factor for how many aircraft can be handled.

Pilot workload

For safety, pilot workload must be kept to a manageable level e.g. complex routings can cause an unacceptable increase in pilot workload.

Airspace capacity

Systemisation, based upon published routes with better navigational accuracy, such that less tactical intervention is required by ATC to maintain optimal climb and descents of aircraft, can result in efficiencies such that the number of aircraft able to be handled in a sector can be increased.

Runway capacity

Runway capacity is often a limiting factor determining how many aircraft can use each route in a given time.

11

Environmental considerations

The full environmental considerations required when undertaking airspace changes are described in detail in Ref. 1, 4 and 8. The purpose of this consultation is to gather information which will help finalise the proposed route positions. Environmental analysis of noise impact and CO_2 production has been conducted on the considered flight path options.

11.1 Accurate track keeping

Aircraft using RNAV can follow a defined flight path accurately and repeatedly (this can however still result in some dispersal of flight paths around turns).

The use of RNAV technology enabling aircraft to fly routes more accurately does mean that there will be an increased concentration of aircraft over core tracks, replacing the spread that is seen today.

This increased track conformity, is in line with Department for Transport guidance on environmental objectives (Ref. 5: Aviation Policy Framework, Section 3.31) which embodies the government guidance that it is desirable to concentrate aircraft along the fewest possible number of specified routes in the vicinity of airports. This may, however, represent a change in noise and visual intrusion impact. Typically locations either side of the routes will be overflown less and will be exposed to less aircraft noise, while locations close to the route centreline will be overflown more, and may be exposed to more aircraft noise.

11.2 Improved descent planning

When flying RNAV arrival routes, pilots have more certainty regarding the distance left to run before reaching key points in the approach. This enables them to plan their descent such that they are able to stay higher longer and to execute smooth continuous descents. This can save fuel, reduce CO_2 emissions, and reduce noise impact[5].

11.3 Noise

We have produced noise contour maps which illustrate the change in noise exposure and provide detailed information around noise for the preferred flight path options.

[5] Aircraft flying higher are quieter. Aircraft descending smoothly with reduced power settings are quieter than those having to descend then level off, which require changes to the power settings which produce tonal changes in engine noise which are particularly noticeable to those on the ground. Smooth descents at reduced power settings requires less fuel/CO_2 emissions.

The target date for the RNAV routes to come into operation is **Summer 2018.**

12

Aviation Stakeholders

The information in this section is aimed at aviation stakeholders and addresses issues that may be of concern to them. This information may also be of interest to some members of the public, however knowledge of aviation technical terms is assumed.

12.1 Departure delays

The current, conventional TLA SID route, particularly from Runway 24, causes ground queuing and departure congestion as they are coincident with the track of the most heavily loaded GOSAM route; which itself has 72% of traffic allocated to it (meaning that 91% of traffic currently follows the same track for over 7nm from Edinburgh when departing runway 24; which is utilised approximately 80% of the time due to prevailing wind conditions).

The intent is to both reduce the overall loading on the GOSAM route by allocating the high traffic demand across the new SIDs and to reduce queuing and delay, through reduced departure intervals enabled by increased number of diverging routes. This would allow the use of 1 minute (minimum) departure intervals, as used at other airports. The current conventional SID route structure requires a minimum of 2 minutes between successive departures and 3 minutes between a TLA routed non-jet aircraft followed by a GOSAM jet departure.

SID route allocation and loading for both current conventional SID routes, and proposed new RNAV1 SID route structure is shown in the table below opposite:

Table 11: Aircraft type, jet/non jet

Departure runway	Current conventional SID allocation	Flight planned route	Typical % of traffic allocated to SID by runway
24	GOSAM (jet only)	Southbound via P600, UL612	72%
	TLA	P600, Y96 (non jet aircraft) and jet aircraft routing via Y96 or leaving controlled airspace via TLA VOR Jet aircraft via N57/L612/N684 between hours of 23:00–06:00 (one hour earlier in summer)	21%
	GRICE		7%
			100%
06	GOSAM (jet only)	Southbound via P600, UL612	72%
	TLA	P600, Y96 (non jet aircraft) and jet aircraft routing via Y96 or leaving controlled airspace via TLA VOR Jet aircraft via N57/L612/N684 between hours of 23:00–06:00 (one hour earlier in summer)	21%
	GRICE	P600 eastbound and for aircraft leaving controlled airspace north of GRICE	7%
			100%

Table 12: Flight plan route/destination

Departure runway	Proposed new RNAV1 SID allocation	Flight planned route	Typical % of traffic allocated to SID by runway
24	A (non jet only)	P600, Y96	22%
	B2 (jet only)	Via TRN and destination Northern Ireland, Republic of Ireland, Canaries and Azores	20%
	B5 (jet only)	Southbound via P600, UL612	30%
	C	P600 eastbound and for aircraft leaving controlled airspace north of GRICE	7%
	D (jet only)	Via L602, HAVEN	21%
			100%
06	E (jet only)	Via TRN and destination Northern Ireland, Republic of Ireland, Canaries and Azores	20%
	F	P600 eastbound and for aircraft leaving controlled airspace north of GRICE	7%
	G (jet only)	Via L602, HAVEN	21%
	H	Southbound jet aircraft via P600, UL612 P600, Y96 (non jet aircraft)	52%
			100%

12.2 Fuel burn & CO_2 emissions

The fuel burn and CO_2 emissions for the current routes versus the proposed routes are presented in Table 13 below.

Table 13: CO_2 and fuel burn analysis for current vs proposed routes

RWY	Current SID	Proposed SID	Track Mileage Difference (nm)	2016 flight count†	Avg fuel diff per flight (kg)	Annual fuel difference (T)	Annual CO_2 difference (T)	Option pref'ed
24	TLA	Route A	-2.8	9005	-11.9	-107	-340.2	X
24	GOSAM	Route B5	0.0	15304	-104.5	-1599.8	-5087.4	X
24	GOSAM	Route B2	2.8	5047	-82.1	-414.4	-1317.7	X
24	GRICE	Route C	-10.7	2874	-76.2	-218.9	-696.2	X
24	TLA	Route D Option 1	22.9	7907	191.4	1513.1	4811.5	X
24	TLA	Route D Option 2	29.3	7907	272.6	2155.4	6854.2	
6	GOSAM	Route E Option 1	-1.9	9664	-125.3	-1210.6	-3849.7	X
6	GOSAM	Route E Option 2	0.1	9664	-92.5	-893.9	-2842.6	
6	GRICE	Route F Option 1	-18.0	1092	-155.4	-169.7	-539.7	X
6	GRICE	Route F Option 2	-17.3	1092	-146.8	-160.3	-509.6	
6	TLA	Route G	3.5	4228	-120.2	-508.1	-1615.8	X
6	TLA	Route H Option 1	2.8	3931	9.3	36.5	116.0	X
					Sum of preferred options	**-2678.9**	**-8519.2**	

†The '2016 flight count' column shows the number of flights at 2016 traffic level, that would be apportioned to each proposed new route.

The preferred options are marked with an X on Table 13, on page 141. (Note for route B it is proposed to use both B2 and B5, with B2 being an offload route to reduce the traffic on B5).

A change in track mileage and/or climb profile will result in a change in fuel burn & CO_2 emissions. Improvements in climb profile often have a more significant effect than expected. For example for route B5 the track over the ground is the same as the existing GOSAM SID, however a reduction in fuel burn & CO_2 emissions is achieved due to an improved climb profile.

12.3 Controlled airspace

The proposed new routes will be contained within existing controlled airspace. There is no proposal to change the extent of the Edinburgh CTA/CTR or any other controlled airspace.

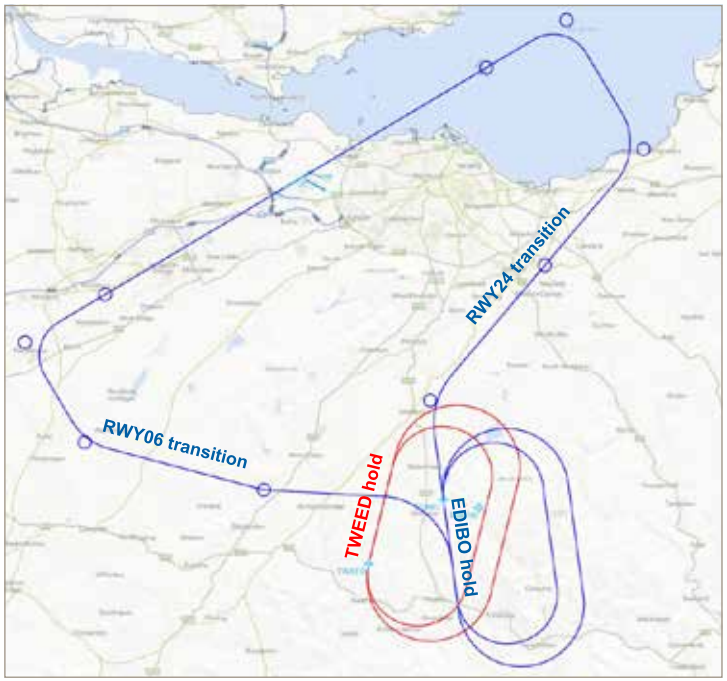
Holding

Currently the following holds are used for arrivals to Edinburgh:

- TWEED (for arrivals from the south).
- STIRA (for arrivals from the north).
- EDN (on final approach to RWY24, procedural approaches to RWY24, contingency in case of blocked runway, missed approach etc).
- UW (on final approach to RWY06, procedural approaches to RWY06, contingency in case of blocked runway, missed approach etc).

The TWEED hold is the only one of these which requires to be changed. The proposed new arrival transitions require TWEED to be realigned and the holding fix moved 3nm to the east as shown in Figure 55 below.

Figure 55: TWEED hold (existing) vs EDIBO (proposed)



12.4 Letters of agreement with other airspace users

Table 14 below details organisations which have Letters of Agreement (LOAs) with Edinburgh Airport ATC, and whether the proposed changes require any change to the LOA.

Table 14: Letters of agreement between Edinburgh ATC and local flying clubs

LOA number/organisation	Impact of proposed new routes
No. 02 RAF Leuchars	No change
No. 03 Cumbernauld Airport	No change
No. 04 Latch Farm Flyers	No change
No. 05 Skydive St Andrews	No change
No. 07 British Gliding Association/Scottish Gliding Centre, Portmoak	No change. (At weekends, if gliding at Portmoak is active a restriction is placed on the use of P600 at lower levels (GOW-PTH) (up to FL195) and N864 is activated accordingly. When this happens arrival and departures from the north route via PIPAR. This arrangement will remain in place and routing via PIPAR will continue if the proposed new routes are implemented.)
No. 08 Broomhill	No change
No. 09 Scottish Mountain Paragliding	No change
No. 10 Latch Farm, 661, KFG	No change
No. 11a RAF Kirknewton Gliding (RAF 661 Volunteer Gliding Squadron)	LOA requires review in line with impact on proposed Route A. Current gliding activity would prevent the use of this route during hours of gliding operation and require tactical re-routing via route B (increasing track mileage and population overflown to today's levels during the gliding activity)
No. 14 Model Flying Penicuik	No change
No. 15 Livingston Model Aircraft Group	No change
No. 17 Kirknewton Flying Group	No change
No. 20 SCATCC (mil) 121.5	No change
No. 22 Exclusive Ballooning Ltd.	No change

12.5 PBN specification

The proposed routes have been designed to the RNAV1 specification. The current RNAV1 equipage rate for aircraft operating from Edinburgh is 91.3%.

Table 15: PBN equipage of aircraft operating from Edinburgh

Airport	RNAV5	RNAV1	RNAV1 GNSS	RNP1	RNP1 GNSS	RNP APCH	with RF
EDINBURGH	99.8%	91.3%	78.3%	70.1%	36.3%	69.7%	5.9%

As can be seen above, there is a high percentage of RNAV1 capable aircraft currently operating from Edinburgh Airport. The stated aims of the proposed changes are to improve efficiency of the management of flights, while reducing the population affected by overflight, via replacement of the current conventional routes with new RNAV1 routes. If the proposed RNAV1 procedures are approved, the current conventional SIDs and STARs would be removed from service when the new routes are introduced. Departing aircraft which are not equipped for RNAV1 navigation would be handled using omni-directional departures (ODD) from runways 24/06. These are a simple procedure to ensure safe terrain clearance is achieved by non-RNAV1 equipped aircraft, before onward routing by ATC into the flight planned airway route network.

The track of these ODDs will match the current initial section of conventional SID routes from Runways 24 and 06 (including the initial track adjustment from Runway 06 to avoid the village of Cramond).

Non-RNAV1 arrivals will be vectored from the holding fix to final approach as today.

Note, typically the aircraft operators which do not yet have RNAV navigation capability, tend to operate the smaller aircraft types e.g. servicing the highlands & islands.

12.6 Runway 30/12

No new routes are proposed to/from Runway 30/12. The existing conventional TLA5G departure from Runway 12 will remain, though this is very rarely used.

13

What happens next?

This consultation has been circulated to individuals, organisations and elected officials who may have an interest in the Airspace Change Programme.

Following the government best practice guidelines for consultation (Ref. 3), consultees will be provided with 13 weeks to consider and respond to the proposal. The recommended 12-week consultation duration has been extended by one week to account for the Easter holidays.

A feedback report will be published on the Edinburgh Airport website (letsgofurther.com) once all the consultation responses have been analysed. This will include details of the main issues that have been raised by respondents during the consultation period informed by environment, health, community and equality impact assessments.

Once this consultation has ended Edinburgh Airport will submit an Airspace Change Proposal to the CAA in which we must demonstrate that the proposed design changes achieve the best balance possible.

It is a requirement of the airspace change process that Edinburgh Airport provide the CAA with full details of the consultation (including copies of responses and correspondence) together with all documentation necessary for the promulgation of the proposed RNAV routes.

The CAA will then review the proposal (which can take up to 17 weeks) and reach a Regulatory Decision. If the proposal is approved, the implementation process could take a further twelve weeks. If approved the RNAV routes will come into operation not before March 2018.

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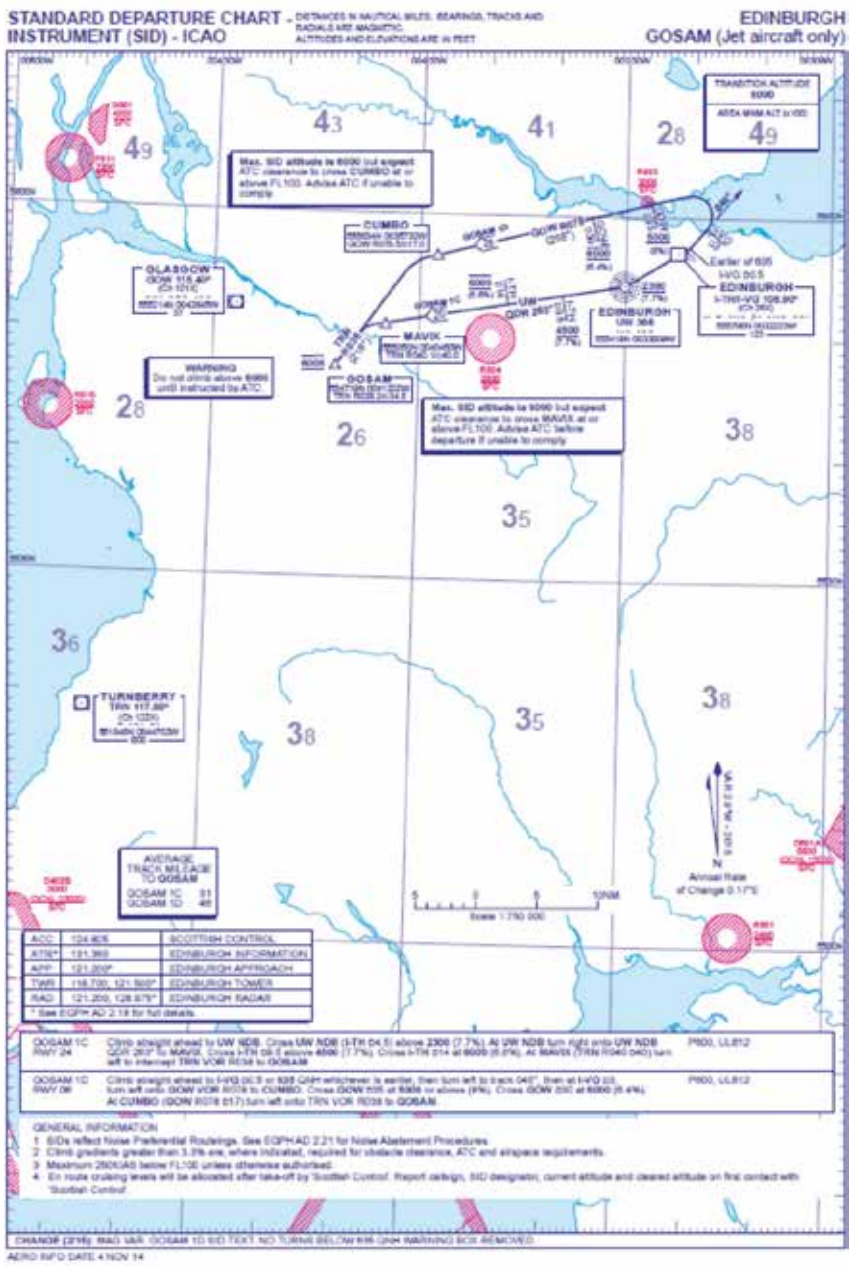
Appendices

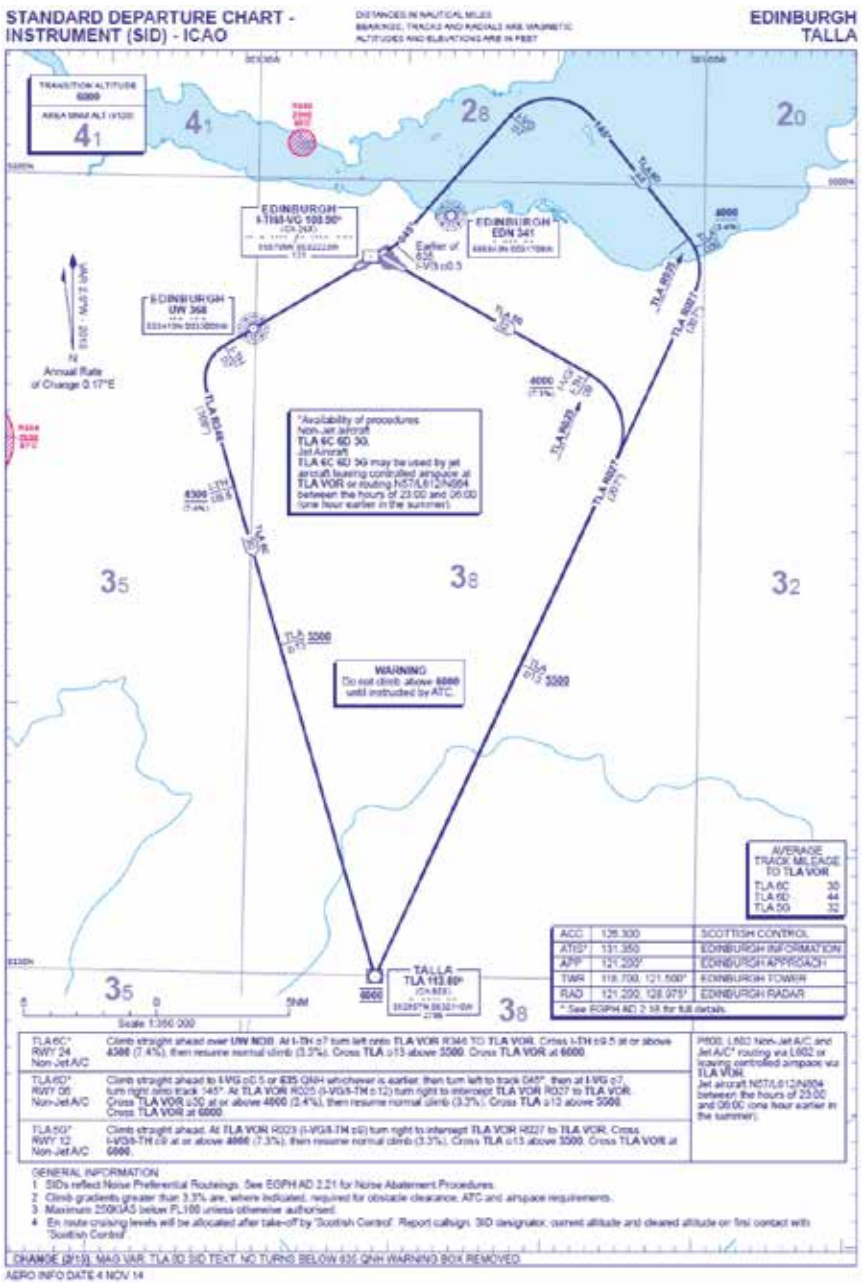
Appendix A: Current conventional SIDs and STARs

The conventional SID charts currently in use are shown in the following pages and can be found at nats-uk.ead-it.com

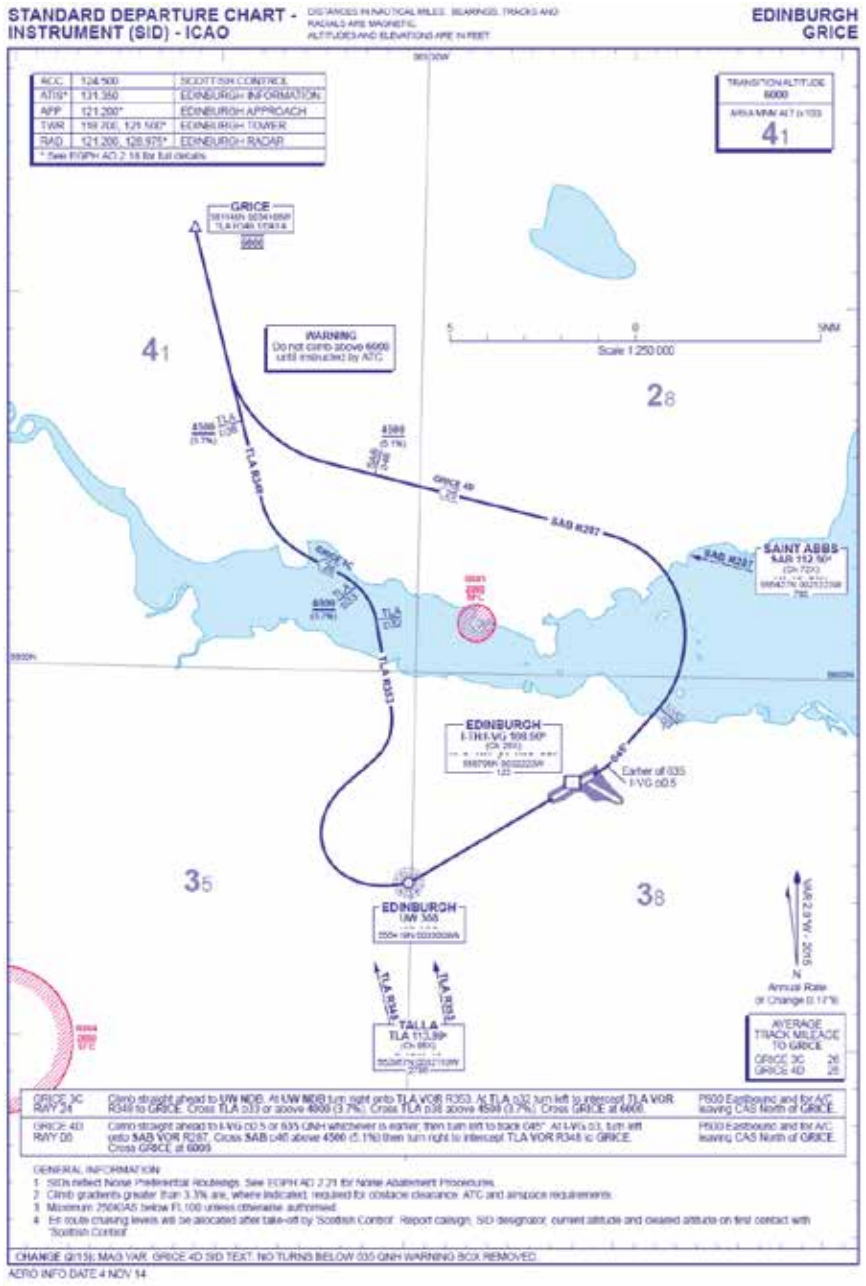
Current SID – GOSAM (departure)



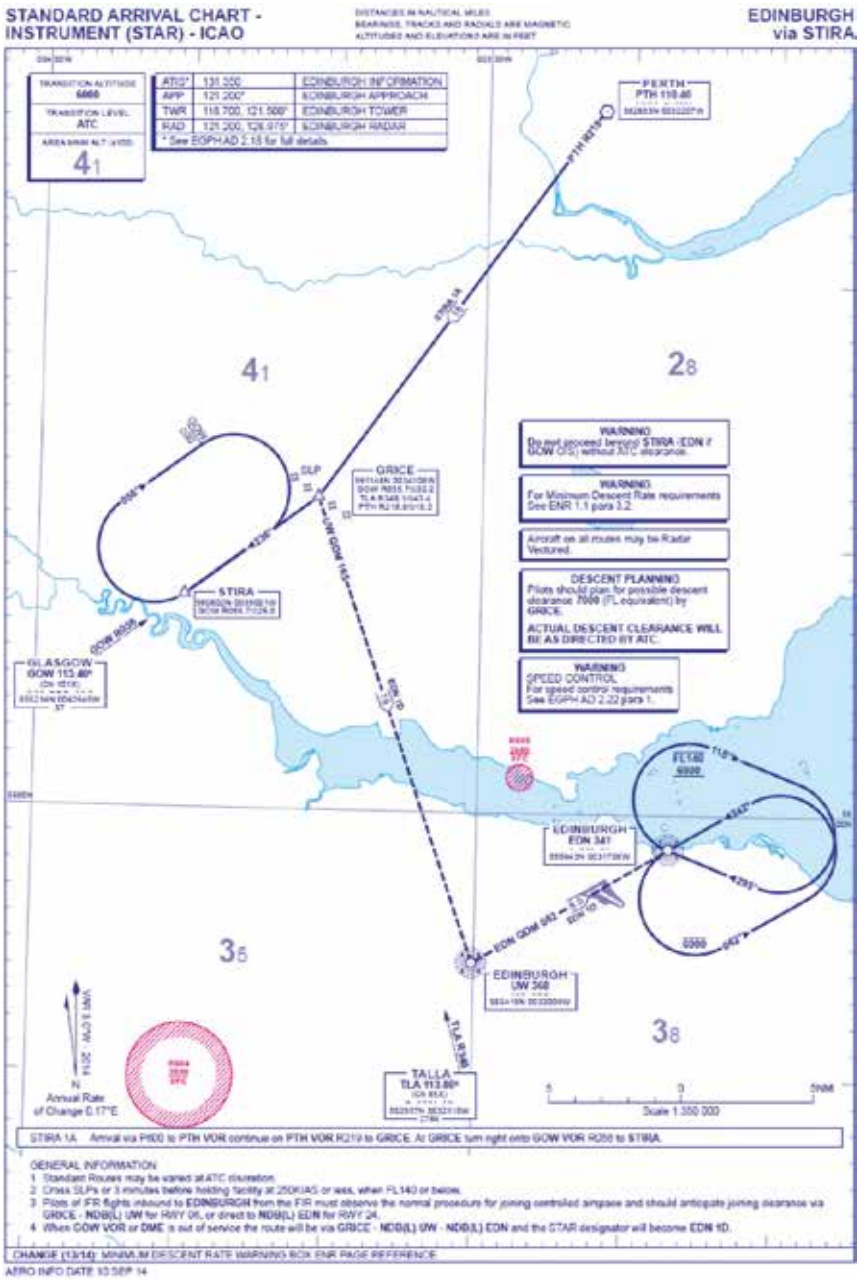
Current SID – TALLA (departure)



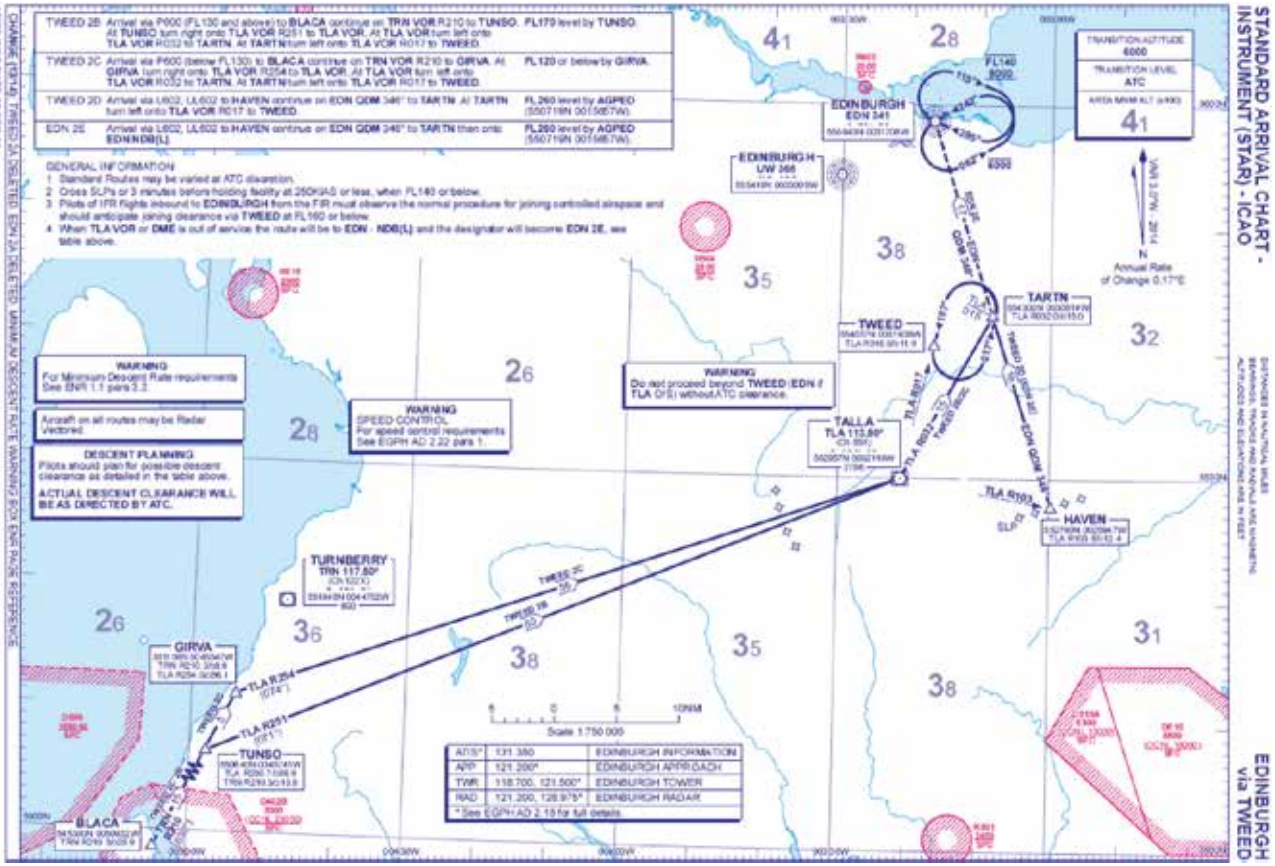
Current SID – GRICE (departure)



Current STAR – STIRA (arrival)



Current STAR – TWEED (arrival)



Appendix B: Technical supporting information

What is RNAV?

RNAV is a highly accurate method of aircraft navigation. RNAV is not new, it has been in use since the 1970s, however the accuracy achievable has improved over the years and as a result there are several different specifications which determine the accuracy that can be achieved. For example RNAV5 has accuracy to ±5nm, RNAV1 has accuracy to ±1nm (note: these are minimum standards, in practice the performance is typically much better, i.e. most aircraft are able to follow the defined centreline of a straight segment to within ±0.1nm although more variation is seen around turns). RNAV1 utilises existing ground based infrastructure and satellite navigation to enable aircraft to navigate from point to point with a high degree of accuracy. The routes proposed herein are all designed to the RNAV1 specification.

When RNAV equipped aircraft fly known routes, the on-board flight management computers can assist the pilots by predicting accurate arrival times, and create optimised descent profiles from the top of the descent to the runway.

Predictable aircraft behaviour benefits both pilots and air traffic control, and helps deliver improved operational and environmental efficiency, safety, and resilience through the systemisation of operations.

The proposal to improve Edinburgh Airport's routes is a small part of the change to RNAV across the whole country and internationally. For the most efficient air transport network all routes need to be modernised to the same RNAV1 standard. This interdependency is the reason behind the international legislation that requires modernisation throughout the system, as the full benefit can only be realised by ensuring that all key parts of the system are modernised.

What does an RNAV route design consist of?

RNAV routes are made up of waypoints which are precisely defined points in space. These waypoints are given certain attributes which determine how the aircraft interpret the route. Different aircraft will fly routes in different ways; along a straight segment all aircraft will follow the same 'centreline' closely (the centreline is a term describing the track that the route follows). However where routes turn, there is greater variation. For instance, slower aircraft tend to turn in a tighter radius than faster ones; hence they will follow different flight paths around the turn.

The RNAV-routes have an associated 'nominal track'. This is the track flown by the least manoeuvrable aircraft likely to fly the route, leading to the widest turns. It is necessary to calculate this as it is the performance of the least manoeuvrable aircraft that tend to limit what can be achieved in the design of a route, for example waypoints around a turn must be positioned such that the least manoeuvrable aircraft can fly between them, which may not be possible if they are too close together.

Waypoints are defined as either 'fly-over' whereby the aircraft flies directly over the top of the point and then turns to intercept a new course, or they are 'fly-by' waypoints in which case the aircraft anticipates the turn and the flight management system calculates the turn, (inside of the waypoint) to smoothly intercept the outbound course.

The aim of RNAV is to give consistency and commonality to the routes. This allows pilots to plan their descent profiles to best effect by knowing, ahead of schedule, the distance to touchdown and any level or speed restrictions that are in place.

CAA Future Airspace Strategy and legislation

Achieving operational and environmental efficiency means, importantly, taking advantage of the very latest technology. To ensure the UK takes full advantage of this, the CAA has been working with the aviation industry to develop the Future Airspace Strategy (FAS[6]), a blueprint for modernising the UK's airspace.

Modernisation of the airspace system is essential for the UK and continental Europe to remain competitive in the global market. For this reason processes are underway at a European level to make modernisation a legal requirement for the UK and other European states[7]. Doing nothing is therefore not an option.

The UK's airspace infrastructure is currently predicated on 'conventional' navigation, using ground based beacons. This system has been in place for many decades and does not exploit the modern navigational capabilities with which most commercial aircraft are already equipped (e.g. satellite technology). It is therefore relatively inefficient, both operationally and environmentally.

Modernisation will enable UK aviation to reap the benefits of the latest technologies such as Performance Based Navigation (PBN)[8]. A route system using PBN standards allows more flexible positioning of routes and enables aircraft to fly them more accurately. This helps improve operational performance in terms of safety and capacity, and also offers environmental benefits.

The environmental benefits of route flexibility include noise management by positioning some routes away from population centres or other sensitive areas, and more scope to minimise fuel burn and CO_2 emissions[9] by shortening and/or raising flight paths.

Modernising the system can also help improve resilience by enabling a quicker recovery from events that close runways and generate delay (such as emergencies and bad weather).

Given FAS and the upcoming European legislation, the change to a PBN environment is inevitable and beyond the scope of this consultation; our focus is instead on how best to apply the change. Stakeholders wishing to discuss the overall PBN strategy should contact the CAA.

Our focus is therefore to meet medium to long term demands by providing an airspace system to help the UK meet the FAS and European requirements.

This consultation is not on growth in air traffic demand itself. Regulation of the UK aviation sector is the responsibility of the CAA.

6 The CAA explains the background to FAS here: www.caa.co.uk/default.aspx?catid=2408

7 Eurocontrol explains the requirement and planned timescales for modernisation here: www.eurocontrol.int/articles/performance-based-navigation-pbn-mandate

8 PBN is a generic term for modern navigation standards.

9 Burning fossil fuel means that CO_2 is produced; for aviation fuel, 1kg of fuel burnt means 3.18kg of CO_2 is emitted.

Legal framework

Once airspace change sponsors have submitted their airspace change proposal, the CAA decides whether the proposal should be approved. To do this, they are required to consider a framework of legislation and guidance which set out the CAA's obligations, and the factors that it must take into account in assessing the merits of an airspace change proposal.

The CAA's primary obligation is to exercise its air navigation functions so as to maintain a high standard of safety in the provision of air traffic service. This duty, which is imposed on the CAA by the Transport Act 2000 (the 'Transport Act'), takes priority over all of the CAA's other duties.

The Transport Act also directs the CAA to exercise its air navigation functions in the manner it thinks best calculated to:

- secure the most efficient use of airspace consistent with the safe operation of aircraft and the expeditious flow of air traffic.
- satisfy the requirements of all airspace users.
- take account of government guidance on environmental objectives.

In addition to the duties imposed by the Transport Act, the CAA is obliged, by the Civil Aviation Authority (Air Navigation) Directions 2001, to take into account the need to reduce, control and mitigate as far as possible the environmental impacts of civil aircraft operations, and the need for environmental impacts to be considered at the earliest possible stages of planning, designing, and revising, airspace procedures and arrangements.

Edinburgh Airport has sought to reflect these duties and objectives, and the framework as a whole, in our development of these airspace change proposals and the consultation on them. We also take into account government guidance on environmental objectives set out in the Department for Transport's document 'Guidance to the Civil Aviation Authority on Environmental Objectives Relating to the Exercise of its Air Navigation Functions' (Ref. 4, on page 156). This sets out a number of environmental objectives, in relation to:

- greenhouse gas emissions and ozone depleting substances.
- local air pollution.
- noise (in particular in relation to aircraft below 7,000ft).
- tranquillity.

In our judgement, the way in which these objectives are best balanced is heavily dependent on the local area. For example, in some places, it may be better to fly aircraft along a longer route (using more fuel, causing an increase in CO_2 emissions) in order to avoid increasing noise in a sensitive area. In other cases, the opposite may be true. However, in general, our view is that:

a. in low altitude airspace below 4,000ft, the priority should be to minimise aviation noise impact, and the number of people on the ground significantly affected by it.

b. in intermediate airspace from 4,000ft to 7,000ft, the focus should continue to be minimising the impact of aviation noise, but this should be balanced with the need for an efficient flow of traffic that minimises emissions.

c. in network airspace above 7,000ft, the priority is efficiency, and to minimise the global environmental impact of aviation (i.e. CO_2 emissions).

d. where practicable, and without a significant detrimental effect on efficiency or noise impact on populated areas, air routes below 7,000ft should be avoided over National Parks.

e. where two options are similar in terms of their effect on densely populated areas, the value of maintaining legacy arrangements should be taken into consideration.

Airspace change sponsors must also take into account the guidance published by the CAA entitled 'CAP725 CAA Guidance on the Application of the Airspace Change Process' (Ref. 1, on page 156). This guidance states that the environmental impact of an airspace change must be considered from the outset, which we have done and continue to do.

In considering the design of airspace we take account of the environmental effects in the current system, and the effects we would expect after implementation, should our proposal be accepted. These are represented in the consultation document by the density plots showing the location of current traffic, and the consultation design envelopes showing where routes may be positioned in the future. We consider these effects for populated areas, National Parks and any other area in which there is potential impact that may be highlighted to us through the consultation process.

We seek to mitigate the local environmental impact on these areas as best we can, referring to the legal framework set out above. This consultation forms part of that mitigation strategy as it will collect information on local significance for route positioning. We will use the feedback from consultation to inform flight path design alongside guidance from the Government and CAA.

Referenced documents

List of documents referenced in this publication:

(1) CAP 725, CAA Guidance On The Application Of The Airspace Change Process[10], Fourth Edition March 2016, CAA Safety and Airspace Regulation Group.

(2) CAP 724, CAA Airspace Charter which defines the authorities, responsibilities and principles by which the CAA Director of Airspace policy conducts the planning or airspace and related arrangements in the UK.

(3) Cabinet Office Code of Practice on Consultation.

(4) Guidance to the Civil Aviation Authority on Environmental Objectives Relating to the Exercise of its Air Navigation Functions[11], January 2014.

(5) HM Government – Aviation Policy Framework, 2013.

(6) Civil Aviation Authority, Future Airspace Strategy for the United Kingdom 2011 to 2030.

(7) Policy for the Application of Performance Based Navigation in UK/Irish Airspace 2011.

(8) CAP1378 Airspace Design Guidance: Noise mitigation considerations when designing PBN departure and arrival procedures, March 2016.

(9) CAP1379 Description of Today's ATC Route Structure and Operational Techniques, March 2016.

(10) Edinburgh Airport – new SIDs ACP noise assessment.

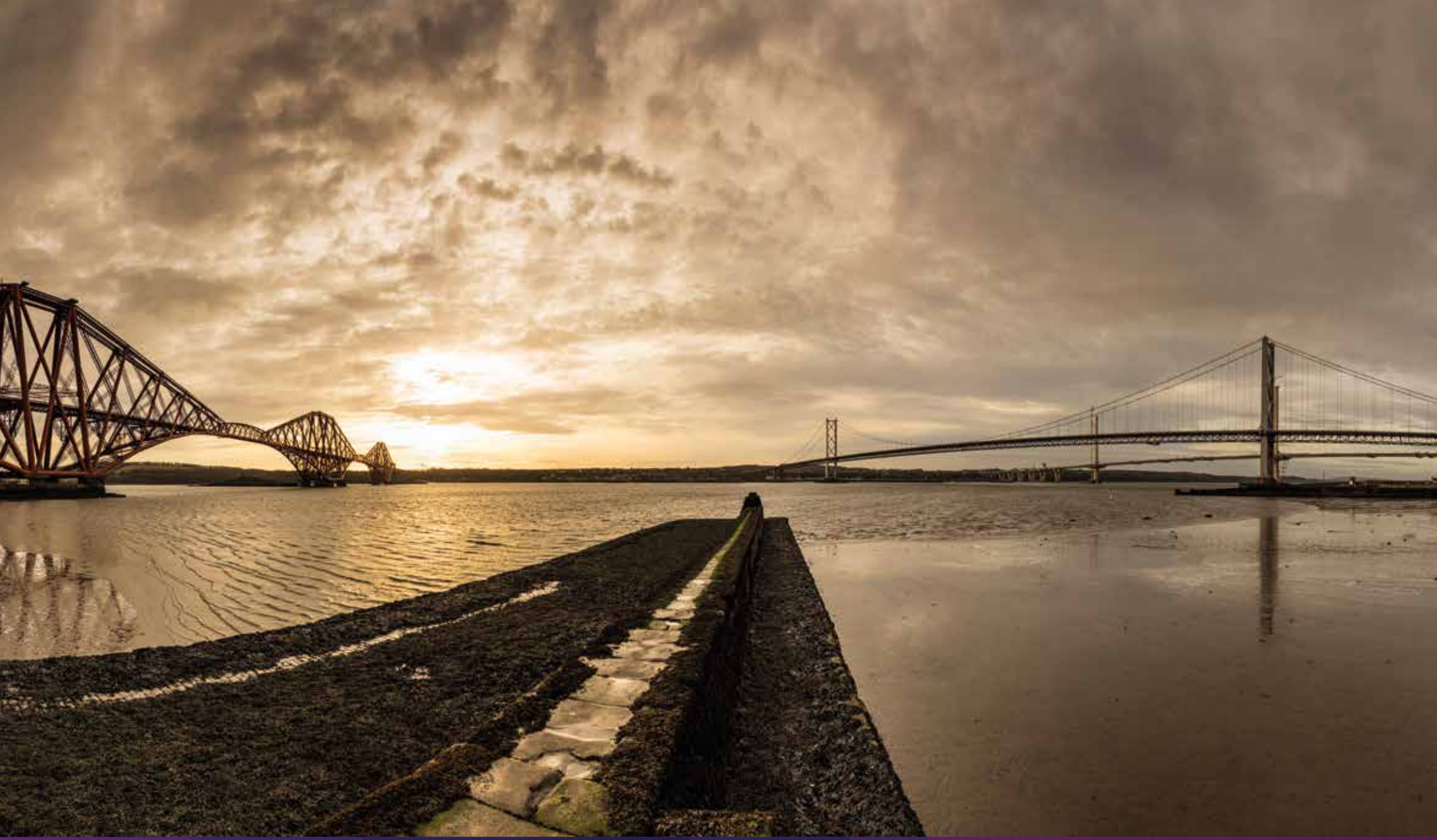
If you require larger scale maps or additional details relating to the summary tables of our viable flight path options, please contact us at letsgofurther@edinburghairport.com

[10] At the time of writing a new version of CAP725 is being consulted on by the Civil Aviation Authority; however any resultant change to the guidance is not expected to be published until 2017; therefore in our consultation we refer to the extant guidance dated March 2016.

[11] At the time of writing a new version of this guidance is being considered by the Department for Transport; however any resultant change to the guidance is not expected to be published until 2017; therefore in our consultation we refer to the extant guidance dated January 2014.

THANK YOU

If you need this document in a different format, please contact us at letsgofurther@edinburghairport.com or call us on 0131 348 4141



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January 2017

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