Airspace Change Proposal: Step 2b

Initial Options Appraisal

Leeds Bradford Airport FASI(N)

03 May 2024

CPJ-5692-RPT-021 V2.0

www.cyrrus.co.uk

info@cyrrus.co.uk

Document Information	
Document title	Airspace Change Proposal: Step 2b
Author	Keeta Butt and Charlotte Mummery
Reviewed by	Val Wilson
Produced by	Cyrrus Projects Limited Cyrrus House Concept Business Court Allendale Road Thirsk North Yorkshire YO7 3NY T: +44 (0) 1845 522 585 F: +44 (0) 8707 622 325 E: info@cyrrus.co.uk W: www.cyrrus.co.uk
Document reference and Version	CPJ-5692-RPT-021 V2.0
Date of release	03 May 2024

Change History Record

Issue	Change Reference	Date	Details
V1.0	Initial Issue	01 Jun 2023	Initial Issue
V2.0	Second Issue	03 May 2024	Second Issue

Executive Summary

Leeds Bradford Airport passed the Civil Aviation Authority Civil Aviation Publication 1616 Stage 1 Gateway in March 2022 and commenced Stage 2 activities. A comprehensive list of design options was subsequently developed through internal workshops and targeted stakeholder engagement in accordance with the CAA's CAP 1616 (V4) process. These options were subsequently evaluated against the Design Principles that were developed during Stage 1.

The comprehensive list of design options, developed for this Airspace Change Proposal, together with the results of the Design Principle Evaluation, was provided in the 'Options Development and Design Principle Evaluation' document which can be found on the Airspace Change Proposal Portal. It served as the submission for the first part of the Stage 2 process (Step 2a).

This document forms the Second part of the Stage 2 submission (Step 2b) and details the Initial Options Appraisal. This Initial Options Appraisal sets out to assess the twenty-four departure swathes and five arrival system design options, put forward following the Design Principle Evaluation, against a set of high-level objectives and assessment criteria. Ultimately, the aim being to refine the list of design options to a shortlist for progression to Stage 3.

The document Is structured in such a way as to remind the reader of the progress made to date and provides an explanation of the methodology and criteria used for the assessment. This is followed by a re-affirmation of the 'Baseline'. The Baseline is critical as it is the bar against which potential changes can be measured. Nevertheless, as explained in the previous document, in the case of the departures, the 'Do Nothing' Baseline is not sustainable. A short-term solution, in the form of an Area Navigation (RNAV) Substitution (CAP1781) replication of the existing departure procedures, is the 'Do Minimum' solution.

It is important to understand that the Initial Options Appraisal that follows has been done as a 'Qualitative Assessment' vice a 'Quantitative Assessment'. This has been done as there is insufficient detail in the design options to assess them mathematically or scientifically; accordingly, the assessment is subjective and based on professional judgement. Every effort has been made to maintain a level and standardised approach to the assessment and the decision-making process of retaining or rejecting Design Options is explained. A 'Quantitative Assessment' will be conducted against the more mature Design Options developed within Step 3a.

Twenty-three Departure Design Option swathes, ten Arrival System Design Options and two Required Navigation Performance (Authorisation Required) Approach Design Options were entered into this Initial Options Appraisal. Seventeen Departure Swathes, five Arrival Systems Design Options and both (RNP(AR)) Design Options have been identified as worthy of further development at Step 3a. These retained Design Options are detailed in the table at the end of the document along with an identification of the 'Preferred Option' for each objective at this stage. It is entirely possible that the preferred option may change as the process continues towards public consultation.

Abbreviations

ACOG	Airspace Change Organising Group
ACP	Airspace Change Proposal
AMS	Airspace Modernisation Strategy
ANSP	Air Navigation Service Provider
AONB	Area of Outstanding Natural Beauty
ATC	Air Traffic Control
ATCO	Air Traffic Controller Officer
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CCO	Continuous Climb Operations
CDO	Continuous Descent Operations
CTR	Control Zones
dB	Decibels
DfT	Department for Transport
DME	Distance Measuring Equipment
DO	Design Option
DP	Design Principle
DPE	Design Principle Evaluation
DVOR	Doppler VHF Omni-Directional Range
EU	European Union
FAS	Future Airspace Strategy
FASI-S	Future Airspace Implementation South
FASI-N	Future Airspace Implementation North
GA	General Aviation
GNSS	Global Navigation Satellite Systems
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
IFP	Instrument Flight Procedure
ICAO	International Civil Aviation Organisation
IOA	Initial Options Appraisal
LPA	Local Planning Authority
METAR	Meteorological Actual Report
NAP	Noise Abatement Procedures

NERL	NATS En Route
NP	National Park
NPR	Noise Preferential Route
NTMS	Noise and Track Monitoring System
PBN	Performance-Based Navigation
PBN IR	Performance-Based Navigation Implementing Regulation
RNAV	Area Navigation
RNP (AR)	Required Navigation Performance (Authorisation Required)
RVR	Runway Visual Range
RW	Runway (when followed by runway designator numbers e.g. RW32)
SID	Standard Instrument Departures
STAR	Standard Arrival
TDZ	Touchdown Zone
UK	United Kingdom

Contents

List of figures

List of tables

1. Introduction

1.1. This document is the second document in support of Leeds Bradford Airport (LBA) Airspace Change Proposal. In the first document, Options Development and Design Principle Evaluation 2a, the Options development process was presented along with the options for consideration. The Design principles are also described and the evaluation of the options against the Design principles is provided in section 6 (2a). The resulting options are brought forward to this step in the process, the Initial Options Appraisal (IOA) 2b.

1.2. In this document, each option is assessed against the Baseline for a range of impact factors. These are presented in section 5 and the outcome of the assessments in section 6.

1.3. The Civil Aviation Publication (CAP) 1616 assessment criteria is explained in Section 2, followed by a description of the methodology used for each design option, including the criteria used for discounting.

1.4. The Baseline is fully described in Options Development and Design Principle Evaluation 2a, however additional information for the IOA is described in section 3 of this document. This document concludes with a Design Options shortlist, this is a list of options proposed to take forward for further assessment in step 3 of the Airspace Change Proposal (ACP) process.

1.5. In this section, the CAA's Airspace Modernisation Strategy (AMS) is explained for context and to provide background on the motivation and objectives for this ACP, followed by an update on the progress of LBA.

1.6. Airspace Modernisation Strategy and the Regulatory Requirement for Change

1.6.1. The Civil Aviation Authority (CAA) published its AMS in December 2018. This Strategy was developed in response to the Department for Transport (DfT), tasking the CAA with preparing and maintaining a co-ordinated plan for the use of the United Kingdom (UK) Airspace up to 2040, including modernisation.

1.6.2. The AMS, which replaced the Future Airspace Strategy (FAS), sets out the ways, the means and ends of modernising airspace through 15 initiatives intended to modernise the Design, Technology and Operations of airspace. Amongst other initiatives, this includes a fundamental redesign of the terminal route network using precise and flexible satellite navigation vice conventional navigation.

1.6.3. The United Kingdoms (UK's) Airspace was originally designed decades ago; it has evolved over time to manage the increasing volumes of climbing and descending aircraft travelling to and from the various airports all within close proximity. This complex evolution has resulted in an environmentally inefficient and overly complicated design that places a burden on Air Traffic Controller Officers (ATCOs) and limits airspace capacity. Whilst COVID-19 has undoubtedly had a significant impact upon the aviation and travel industries, if the airspace is not modernised, the potential benefits of reduced carbon emissions and noise reduction may not be realised.

1.6.4. The Airspace Change Organising Group (ACOG) was established in 2019, as a fully independent organisation within National Air Traffic Services (NATS), under the direction of the DfT and CAA, to coordinate the delivery of key aspects of the AMS.

1.6.5. The requirement for ACOG is to coordinate the delivery of two major national airspace change programmes known as Future Airspace Implementation South (FASI-S) and Future Airspace Implementation North (FASI-N). FASI-N is a complete redesign of the existing airspace structure in Northern England and Scotland. LBA is one of nine airports included within this programme.

1.6.6. ACOG, in collaboration with NATS En-Route Limited (NERL) and each of the Airports, must deliver a Masterplan that provides detailed information on the Airspace Design options. The Masterplan must consider potential areas of overlap between individual Airspace Change Proposals (ACPs), along with the compromises and trade-offs that may need to be made to integrate them effectively.

1.6.7. LBA, just as with all the airports affected, must ensure that their modernisation proposals are aligned with neighbouring airports and connect efficiently with the network above. The FASI(N) airports are responsible for modernising or upgrading their individual arrival and departure routes up to 7000ft. NERL are responsible for redesigning the route network above 7000ft.

1.6.8. For more information, including a brief video, on the importance of modernising UK airspace, see https://www.ourfutureskies.uk/why-modernise/

1.6.9. One of the major aims of the AMS is to optimise future airspace designs to take account of modern aircraft performance and functional capabilities and make them more efficient, saving time, fuel and reducing emissions.

1.6.10. The key to achieving this is through the application of Performance-Based Navigation (PBN)[1]. In parallel, the UK navigation infrastructure can also be optimised to take advantage of the lateral navigation accuracy from Global Navigation Satellite Systems (GNSS), while retaining adequate conventional ground-based navigation aids to ensure both resilience and contingency measures.

1.6.11. PBN is being adopted world-wide. Airspace will be modernised through International, Regional and State level initiatives, including regulations. It impacts both the high-level airways and the lower-level arrival and departure routes into and out of airports and Instrument Approach Procedures (IAPs).

1.6.12. European-wide legislation: Commission Implementing Regulation European Union (EU) 2018/1048, PBN-IR was developed to drive the deployment of PBN in the European region to meet the international vision laid down by the International Civil Aviation Organisation (ICAO).

[1] For more information about PBN visit Performance based navigation | Civil Aviation Authority (caa.co.uk)

1.7. Where is Leeds Bradford Airport in the CAP1616 Process?

1.7.1. CAA regulation CAP1616 defines the ACP process. The ACP is designed to be transparent, comprehensible, and proportionate. It is aligned to the Government's Policy on managing airspace.

1.7.2. The 7-stage process contains 14 'Steps' and 4 'Gateways'. The Change Sponsor must satisfy the CAA at each of these 'Gateways' that it has fully followed the process. Failure to do so results in the need to conduct further work until such time as the CAA is satisfied.

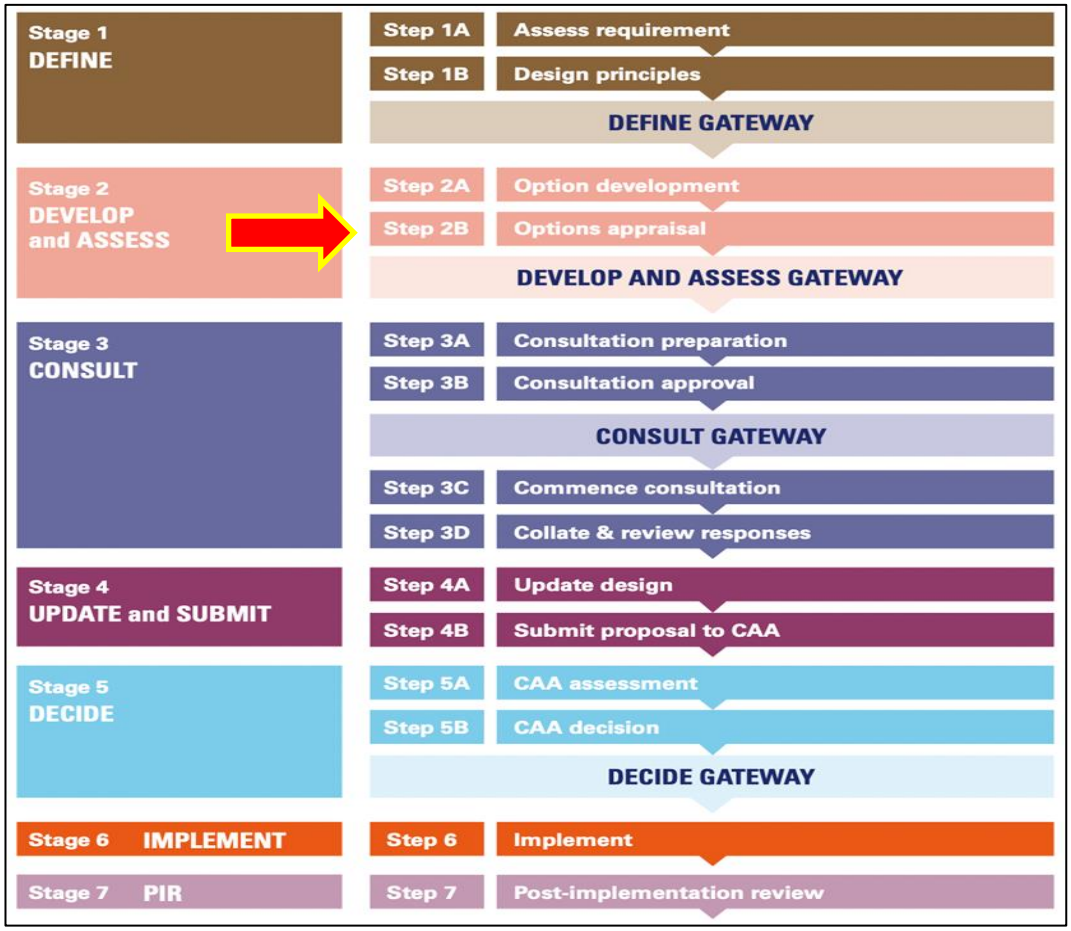


Figure 1: CAP1616 Process

1.7.3. LBA has completed the activities associated with Step 2a of the process having developed a long list of Design Options (DOs) for evaluation against the agreed Design Principles (DPs) in conjunction with key identified stakeholders at a representative level.

1.7.4. This report forms the latter part of the Stage 2 submission (Step 2b) and details the IOA and Initial Safety Assessment (ISA).

1.8. The story so far

1.8.1. LBA passed the CAA CAP 1616 Stage 1 Gateway in March 2022 and commenced Stage 2 activities. A Comprehensive List of DOs were developed through internal workshops and

stakeholder engagement. These DOs were assessed against the Design Principles (DPs) developed during Stage 1 of this ACP process.

1.8.2. Workshops were held in July 2022 which introduced the list of DOs to the Stakeholders and our assessment of the DOs against the design principles they helped us develop. Following these workshops stakeholders were invited to take part in an online survey which ran from mid-July 2022 to late-August 2022. This survey asked whether the Stakeholders felt we had applied the DPs correctly and consistently to each of our DOs. It provided an opportunity to comment on areas they felt this may not have been the case.

1.8.3. Following a period of reflection, and in response to some stakeholder feedback, a series of additional departure DOs were conceived along with a revised array of arrival system DOs. These DOs were shared with the same set of stakeholders throughout April 2023 through a presentation sent out via email. The presentation was accompanied by an online survey and again sought feedback on whether stakeholders felt we had applied the DPs correctly and consistently to each of our DOs.

1.8.4. A submission was made to the CAA, and this was assessed at the June 2023 Develop and Assess Gateway Meeting. The CAA found various failings and it was determined that the DPE conducted previously needed to be reviewed, as did the IOA, to ensure a consistent application of criteria across the DOs. Additionally, based upon meetings between the Airport and the En-Route Air Traffic Service (ATS) provider (NERL), it was deemed necessary to develop some additional Arrival Options. Given the additional time, the opportunity was taken to develop some new Departure Options largely focused on providing communities with respite or night-time noise relief.

1.8.5. These new DOs, and most of the previously aired DOs, were shared with the same set of stakeholders over the period 22 November 2023 to 20 December 2023 through a presentation sent out via email. A briefing was held online on 05 December 2023 allowing stakeholders the opportunity to have concepts explained or have their questions answered. As with the second round, the presentation associated with the third round engagement was accompanied by an online survey seeking feedback on whether stakeholders felt we had applied the DPs correctly and consistently to each of our DOs.

1.8.6. This report forms the latter part of the Stage 2 submission (Step 2b) whilst the accompanying report details the Step 2a activity including a Comprehensive List of DOs that were developed for this ACP and associated the Design Principle Evaluation (DPE).

1.8.7. The IOA is intended to fulfil the requirements of Step 2b and completes the steps within Stage 2 of the process.

2. Options Appraisal Criteria

2.1. CAP1616 Requirements – Step 2b

2.1.1. Change Sponsors are required to complete an Options Appraisal process to assess the potential impacts (positive and negative) of the various DOs as compared to the Baseline scenario (the Do Nothing).

2.1.2. The minimum requirement at Step 2b is to identify the Assessment Criteria and conduct a Qualitative Assessment of each DO against the Baseline scenario. This IOA process facilitates the determination of a 'Shortlist of Options' including the 'Preferred Options' for a more thorough Quantitative Assessment later in the process once DOs have been sufficiently developed.

2.1.3. A Full Options Appraisal (FOA) is conducted at Step 3a followed by a Final Options Appraisal at Step 4a.

2.2. Initial Options Appraisal Assessment Criteria

2.2.1. At Step 2b options are assessed against the criteria contained in Appendix E (Table E2) of CAP1616 with the addition of Tranquillity, Biodiversity, Safety, AMS Realisation and Interdependencies conflicts and trade-offs.

2.2.2. The purpose of this appraisal is to show the positives, negatives, benefits and costs of each option based on high-level qualitative assessment conducted by subject matter experts.

2.2.3. Each option is assessed in isolation. Interdependencies between options will be further explored at Stage 3 in collaboration with neighbouring airports and the enroute network.

2.2.4. These options are assessed based on the present day; external changes are not considered at this stage. Future planned housing and industrial developments will be considered for each option taken forward to Stage 3 at the second options appraisal. These have been collated and are contained within Section 4.8.2.

2.2.5. This qualitative IOA appraisal does not consider traffic forecasts. Future traffic forecasts are provided in Section 4.8.1 and will be utilised during the Stage 3 options appraisal.

2.2.6. The following table (Table 1) details the group impacted, impact category and description of the assessment carried out for this IOA. The tables in section 5 are based on this template and provide assessments against each option for these criteria.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	A qualitative assessment of changes to the noise impact for each option when compared to the Baseline option. This has been done using the geographical area overflown by each option and the analysis from the DPE - DP2 Noise. Each option is assessed over population density maps from 2021 census data available from the Office for National Statistics (ONS), these data are presented as population weighted centroids[2]. Each swathe is assessed over these centroids to provide qualitative analysis on the number of people flown over.
	Air Quality	A qualitative assessment of changes to the local air quality for each option when compared to the Baseline option. This has been done using the geographical area overflown by each option in relation to local air quality, although the requirement is to assess only below 1000ft[3], this assessment identifies Air Quality Management Areas (AQMAs) for each option within a 9nm radius where aircraft are expected to be at 4000ft. AQMA data were retrieved from DEFRAs Air Information Resource AQMA interactive map. AQMAs are highlighted in yellow.
Wider society	Greenhouse gas impact	A qualitative assessment of changes to the greenhouse gas impact for each option when compared to the Baseline. This has been done by considering the difference in track miles to give an indication of the overall impact and using the analysis from the DPE – DP4 Emissions and Air Quality.
	Capacity/ resilience	A qualitative assessment of changes to airspace capacity and resilience for each option when compared to the Baseline option. This includes our analysis from the DPE – DP6 Airspace Complexity and DP8 - Systemisation[4].

[2] Each population weighted centroid was calculated using a median centroid algorithm, the result of which is less influenced by outliers than the result of an algorithm to calculate the mean centroid. For more information visit the Open Geography Portal.

[3] Analysis from DPE 4 has not been referenced in this section, the IOA air quality section assessment relates to local air quality only, whereas DP4 is more generic for the entire swathe and is captured better in other sections of the IOA.

[4] Possible interactions and conflicts between arrival and departure swathes have not been considered at this stage as these will be assessed in Stage 3 when the swathes are refined.

Group	Impact	Qualitative Assessment
	Tranquillity	A qualitative assessment of changes to the tranquillity impact for each option when compared to the Baseline option including analysis from the DPE – DP3 Tranquillity. This has been done paying particular attention to the Nidderdale Area of Outstanding Natural Beauty (AONB) and the Yorkshire Dales and Peak District National Parks. Data for the assessment of tranquillity are sourced from DEFRAs interactive MAGIC map application used to identify AONBs and National Parks (NP), both of which are statutory designations. Options are then assessed over these areas to determine if they will be impacted or not.
	Biodiversity	A qualitative assessment of changes to the biodiversity impact for each option when compared to the Baseline option. Data retrieved from DEFRA's Magic maps is used to identify areas of Biodiversity significance, such as Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) and RAMSAR sites. Additionally potential SACs investigated, of which there were none. Similarly, there are no RAMSAR sites within a 15nm radius of LBA.
General aviation	Access	A qualitative assessment of changes to the General Aviation (GA) access to airspace for each option when compared to the Baseline option. This includes our analysis from the DPE – DP5 Airspace Dimensions.
General aviation/ commercial airlines	Economic impact from increased effective capacity	A qualitative assessment of the economic impact for GA and commercial airlines from changes to capacity for each option when compared to the Baseline option.
	Fuel-burn	A qualitative assessment of changes to the impact to fuel-burn for GA and commercial airlines for each option when compared to the Baseline option. This has been done by considering the difference in track miles to give an indication of the overall impact and uses analysis from the DPE – DP4 Emissions and Air Quality and DP9 Operational Cost[5].

[5] Definition of DP9 Operational Cost - Provided it does not have an adverse impact of community disturbance, procedures should be designed to optimise fuel efficiency.

Group	Impact	Qualitative Assessment
Commercial airlines	Training costs	A qualitative assessment of changes to commercial airline training costs for each option when compared to the Baseline option.
	Other costs	A qualitative assessment of changes to additional commercial airline costs for each option when compared to the Baseline option.
Airport/ Air Navigation Service Provider	Infrastructure costs	A qualitative assessment of changes to infrastructure costs for the Airport and/or Air Navigation Service Provider (ANSP) for each option when compared to the Baseline option.
	Operational costs	A qualitative assessment of changes to operational costs for the Airport and/or ANSP for each option when compared to the Baseline option.
	Deployment costs	A qualitative assessment of deployment costs for the Airport and/or ANSP for each option when compared to the Baseline option.
All	Safety	A qualitative safety assessment for each option when compared to the Baseline option including analysis from DP1 – Safety.
	AMS realisation	A qualitative assessment of whether the option meets the AMS objectives of improved capacity, noise, and fuel/CO2 and reduced CAS and increased airspace integration compared with the do-nothing Baseline.
	Interdependencies, conflicts and trade-offs	A qualitative assessment of interdependencies with neighbouring airports and en-route traffic. Consideration is also given to conflicts and trade-offs between existing and potential LBA traffic.

Table 1 - CAP 1616 Assessment Criteria

3. Methodology

3.1. Options

3.1.1. The development and evolution of the DOs was explained in the 'Options Development & Design Principle Evaluation' document that accompanies this in the Stage 2 Gateway submission. Each of the DOs that were retained following DPE are now further assessed against the criteria listed in Table 1 as compared with the 'Do Nothing' Baseline detailed in Section 4.

3.2. Assessment

3.2.1. As each DO is assessed in turn, a qualitative determination will be made as to whether there is potential for an overall net benefit, no benefit or cost and overall net cost. They are colour coded as below and shown for each option as a whole in Section 6:

Qualitatively assessed as having potential for an overall net benefit.	
Qualitatively assessed as having neither impact nor benefit.	
Qualitatively assessed as having potential for an overall net cost.	

Table 2 – IOA Assessment Key

3.2.2. The outcome of this assessment and associated justification is provided at the end of each DOs individual IOA table. A summary of these results is provided in Section 6 of this report.

3.3. Discounting

3.3.1. Having completed the Qualitative assessment of each option and subsequently scored these according to net benefit (green)/cost(red), we undertook the process of discounting.

3.3.2. Options deemed as having potential for an overall net cost were discounted, this ensures the preferable options are taken forward.

3.4. Preferred Option (P)

3.4.1. The preferred option in each suite of options is indicated at the end of the relevant DOs individual IOA table. A summary of the preferred options is provided in Section 6 of this report.

3.5. Further Options Appraisal - Step 3a and Step 4a

3.5.1. The Further Options Appraisal (FOA) requires Change Sponsors to conduct a quantitative analysis of the DOs shortlisted for consultation and to do this, Change Sponsors must collect quantitative environmental metrics on the Baseline scenario. Additionally, the DOs need to be modelled to facilitate an environmental comparison. LBA will gather the following metrics for the FOA:

- 10-year traffic forecasts (including all the years in between in order to facilitate a comparison between today's operation and 10 years hence, with or without implementation post the intended implementation date);
- CO2 emissions and fuel-burn assessment (using WebTAG);
- Local air quality assessment (using WebTAG);
- Operational diagrams;
- Overflight metrics (as per CAP1498);
- Standard noise metrics:
  - Equivalent Continuous Sound Level (LAeq) noise contours;
  - 100% mode noise contours;
  - Nx contours;
  - Difference contours;
  - Maximum Sound Level (Lmax) spot point levels.

3.5.2. In addition, there will be explicit consideration of any changes to routes and/or traffic patterns that may affect an AONB, such as Nidderdale, or a NP such as The Yorkshire Dales or The Peak District. It should be noted that given the finite amount of airspace available in the UK and the fixed location of airports and NPs or AONBs, it will not always be practical to completely avoid overflying them and there are no legislative requirements to do so, as this would be impractical. Nevertheless, Change Sponsors must show how they have considered and taken account of this impact as part of their option development and final design.

3.5.3. The Government's Transport Analysis Guidance (WebTAG) has not been used within this IOA but will be used alongside the guidance within the Government's 'Green Book'[6] during the FOA.

[6] The Government's green book is guidance on how to appraise and evaluate policies, projects and programmes.

3.6. Altitude-Based Priorities for Environmental Impacts

3.6.1. The Government's priorities for consideration of the environmental impacts arising from ACPs are set out in its Air Navigation Guidance. For the purposes of assessing environmental impacts of ACPs the CAA should apply the following altitude-based priorities:

- In the Airspace from the ground to below 4000 ft, the Government's environmental priority is to limit and, where possible, reduce the total adverse effects on people;
- Where options for route design from the ground to below 4000 ft are similar in terms of the number of people affected by total adverse noise effects, preference should be given to that option which is most consistent with existing published airspace arrangements;
- In the Airspace at or above 4000 ft to below 7000 ft, the environmental priority should continue to be minimising the impact of aviation noise in a manner consistent with the Government's overall policy on aviation noise, unless the CAA is satisfied that the evidence presented by the sponsor demonstrates this would disproportionately increase CO2 emissions;
- In the airspace at or above 7000 ft, the CAA should prioritise the reduction of aircraft CO2 emissions and the minimising of noise is no longer the priority;
- Where practicable, it is desirable that airspace routes below 7000 ft should seek to avoid flying over AONB and NPs; and,
- All changes below 7000 ft should take into account local circumstances in the development of the airspace design, including the actual height of the ground level being overflown, and should not be agreed to by the CAA before appropriate community engagement has been conducted by the sponsor.

3.6.2. This ACP concerns changes being made from the surface to 7000 ft and accordingly, five of the above bullets apply, we have incorporated these in our qualitative assessment of the options throughout this IOA.

4. Baseline Summary

4.1. Overview

4.1.1. The Baseline is fully described in the Options Development and Design Principle Evaluation document (2a) Section 3. It describes the do-nothing and do minimum scenarios, the Airspace surrounding LBA including a description of the arrivals and departure routings and provides the current situation regarding environmental considerations that need to be considered for this ACP, including noise.

4.1.2. This section aims to provide additional information regarding the Baseline relevant to the IOA. This includes a reminder of the departure and arrival Baselines and a description of how the Baselines are assessed and that the options are assessed against the Baselines of each design envelope.

4.1.3. This section also provides a description of noise, potential future noise impact and the noise modelling category for this ACP. There is further information regarding noise in the Options Development and Design Principle Evaluation document (2a) section 3.1.1.

4.1.4. Section 4.7 provides additional information specifically relevant to the Options Appraisals of each Baseline and option impact factor.

4.1.5. In the final section, 4.8 the growth and fleet mix forecast is given in order to understand how the operation may change in terms of numbers of flights and types of aircraft. The proposed local developments have been identified and presented in 4.8.6 to determine if and how communities may change in the future in order to anticipate any future impact of options on these.

4.2. The Departures Baseline

4.2.1. The Departure Baselines are described in the Options Development and Design Principle Evaluation (2a) document. The Noise Preferential Routes (NPR) and runway procedures are described in section 3.10.1 (2a), followed by a description and depiction of the Standard Instrument Departures (SIDs) as published in the Aeronautical Information Publication (AIP). A description of all departures is given for the required 92-day summer period of 16 June to 15 September inclusive followed by a weekly breakdown using representative samples for each runway in order to give a clear and concise picture of departure trends. This enabled Baselines to be established by which to compare the departure options described in this document.

4.2.2. In this document (2b) the Baselines are described at the beginning of each design envelope section. These include a brief description of the Baseline followed by an image over google earth satellite imagery for context. The Baseline are assessed against each impact and the options in each design envelope are then assessed against this Baseline assessment. The Combination options (sections 5.3.3 and 5.4.4) are also assessed against the Baseline presented in each of the preceding design envelopes.

4.3. The Arrivals Baseline

4.3.1. The Arrivals system is fully described in Design Principle Evaluation (2a) document section 3.8. It describes the Gate system, as LBA issues tactical headings for arrivals as there are no published Standard Arrival Routes (STARs) or Arrival Transitions, provides imagery of all arrivals to runway 32 during the period of 16 June to 15 September 2022 to illustrate the arrivals pattern at LBA. Two representative sample weeks were chosen from these data to establish the Baselines for each runway (see figures 13 and 14, section 3.8, 2a).

4.3.2. In this document, 2b, the Baselines are further described in section 5.5.3. It describes the general swathes of aircraft approaching both runways; two to RW32 from the West Southwest and the other straight in from the East Southeast, four to RW14 from the Southwest and three from the South and east southeast.

4.3.3. The Arrivals for this ACP have been developed as systems. The Arrival System Baseline was assessed as red for tranquillity (DP3), AMS realisation (DP10) and PBN (DP11) as the current operation currently flies over an AONB (RW14), does not meet the objectives of the AMS realisation (see section 1.6) or satisfy the requirements for Performance Based Navigation (PBN) (see sections 1.1.10-1.1.12).

4.3.4. As with the Departures assessments, each arrival system option is assessed against the Baselines and considers the same impact factors.

4.4. Noise

4.4.1. The existing noise environment is described in Options Development and Design Principle Evaluation (2a) document, section 3.11. It provides noise contour maps based on the guidance of population thresholds set out in CAP 2091. These maps may be used in conjunction with the population density maps used in this document to give an indication of the numbers of people in any given area.

4.4.2. A more detailed description of the Total Annual Aircraft Movements is given in the Options Development and Design Principle Evaluation (2a) document, 3.12, Table 6. As a recap, the following table shows the total annual aircraft movements at LBA for 2018 and 2022 along with the forecast annual movements for 2030 assuming that there will be no development at the Airport in the intervening period. Note that the 2022 figure is less than 2018 as would be expected in the immediate post-COVID era. These data allow for consideration of any future noise impact.

Year	Total Annual Aircraft Movements
2018	38,680
2022	33,912
2030	45,970

Table 3: Total Annual Aircraft Movements at LBA

4.5. Future Noise Impact (Do-Nothing Scenario)

4.5.1. CAP1616 requires ACP Sponsors to consider the forecast growth of their operation in terms of the forecast number of movements and passengers (affected by the fleet mix owing to the varying passenger capacity). This forecast should not only consider growth between now and implementation of the proposed changes, but it should also consider the potential growth to 10 years beyond the implementation date. If it is assumed that no changes will be made until 2027 at the earliest, then 10 years beyond this is 2037.

4.5.2. Our Noise Consultants have modelled the effect of the forecast growth in the operation at LBA out to 2030 on the assumption that the operation continues to function in the same way as the Baseline described i.e. Do-Nothing. 2030 may be seven years short of the year stated above however, it is not currently considered feasible for the operation to grow beyond handling 7 million passengers per annum with the current planned terminal expansion. By 2030, the Airport is forecasting to handle 6.8 million passengers per annum and the noise modelling was done on this assumption. Note: The noise modelling done for forecast growth out to 2030 was done to satisfy CAP2091[7] Category A requirements.

4.5.3. The following tables and figures show the estimated number of people and dwellings expected to experience average noise levels above 51 decibels (dB) and 45 dB during the average summer day or night respectively in 2030. The associated contours are also shown.

4.5.4. The population and dwellings affected by noise equal to or greater than the 51dB (day) and 45dB (night) contours decreases by 2030 due to a significant change in fleet mix to aircraft with quieter engines. See paragraph 4.8.1 for more detail on Fleet Mix.

Noise Level (dB)	Population	Dwellings
≥ 51 LOAEL	35600	14700
≥ 54	10200	4550
≥ 57	1800	700
≥ 60	100	50
≥ 63	<100	<50
≥ 66	0	0
≥ 69	0	0

Table 4 – Estimated total number of people and dwellings above various noise levels, Laeq 16h in the vicinity of Leeds Bradford Airport, 2030

[7] CAP2091, CAA Policy on Minimum Standards for Noise Modelling, dated Jan 2021

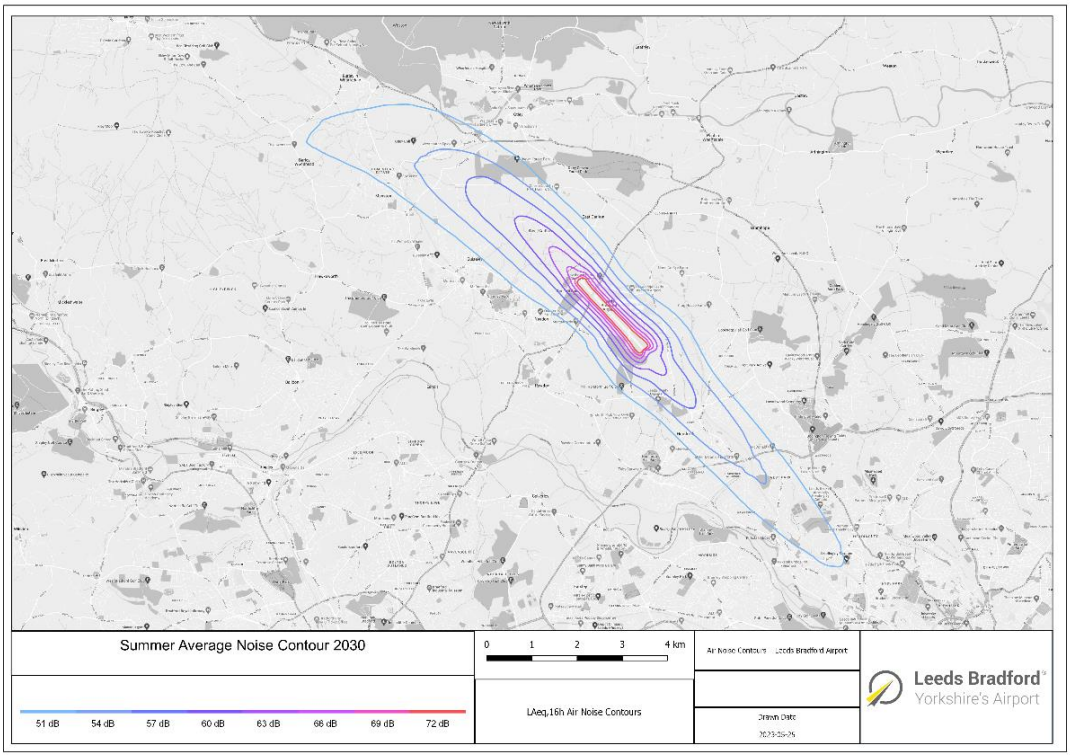


Figure 2: Leeds Bradford Airport Average Summer Day Laeq 16h, 2030

Noise Level (dB)	Population	Dwellings
≥ 45 LOAEL	86300	35000
≥ 48	25200	11000
≥ 51	5200	2250
≥ 54	800	300
≥ 55	300	100
≥ 58	<100	<50
≥ 61	0	0

Table 5: Estimated total number of people and dwellings above various noise levels, Laeq 8h in the vicinity of Leeds Bradford Airport, 2030

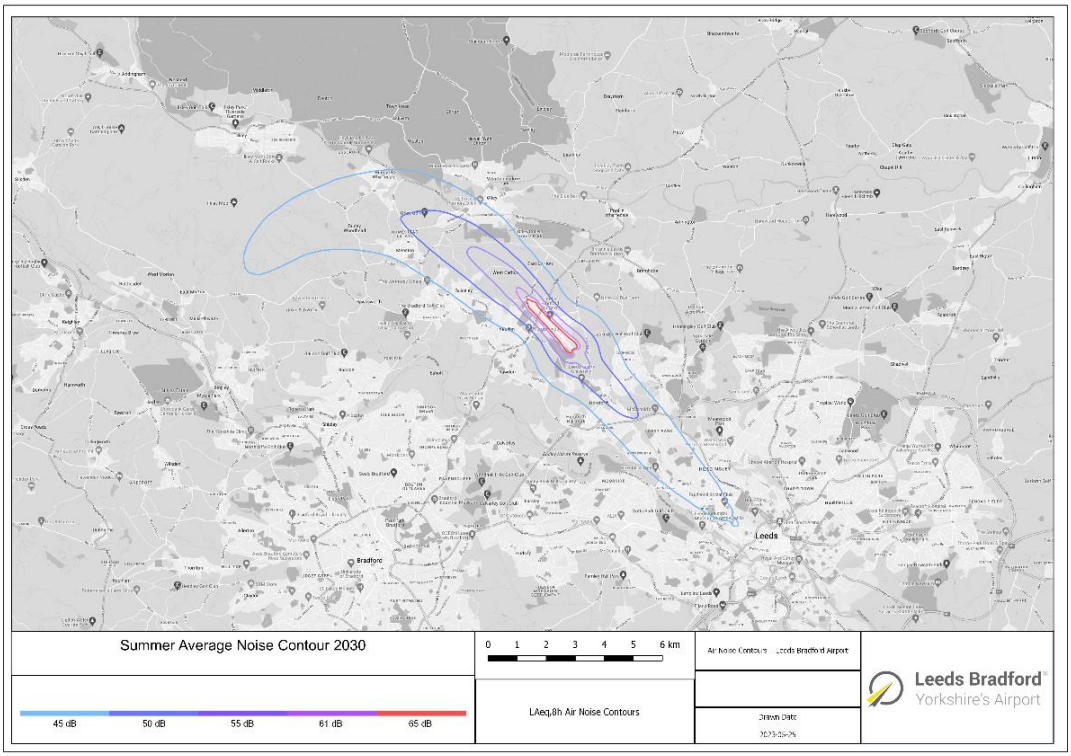


Figure 3: Leeds Bradford Airport Average Summer Night Laeq 8h, 2030

4.6. Noise Modelling Category

4.6.1. The CAA has published its Policy on Minimum Standards of Noise Modelling (CAP 2091). This document defines categories of noise modelling sophistication and describes the different situations where the CAA require noise calculations to be provided. Moreover, it sets out requirements for the minimum category which different stakeholder or sponsor groups should use when providing noise calculations to the CAA for them to carry out their regulatory duties.

4.6.2. CAP2091, CAA Policy on Minimum Standards for Noise Modelling, require Change Sponsors to determine and declare what Noise Modelling Category they consider is appropriate for the ACP consultation. The minimum level of sophistication of the modelling process should depend on the size of the current or proposed noise effect of the airport on its local community. The category of noise modelling required by the CAA is based on the number of residents in the $51dB_{Laeq16h}$ day or $45dB_{Laeq,8h}$ night contours either before or after the proposed change, whichever is greater.

4.6.3. The current situation with regards to noise is described in section 3.11 and draws on data from the Noise Preferential Routes (NPR) published in the Aeronautical Information Publication (AIP), the airport's Noise Action Plan (NAP), and the Section 106 agreement with the Local Authority.

4.6.4. The LBA NAP brings together all noise management activities into one living document. This includes specific actions that will be implemented by LBA to manage the effects of noise arising from airport activities, in order to minimise, as far as reasonably practicable, any adverse impact on the local communities surrounding the Airport.

4.6.5. The NAP is a legal requirement under the Environmental Noise Directive (END) (2002/49/EC), relating to the assessment and management of environmental noise. The END was transposed into English law by the Environmental Noise (England) Regulations 2006 (as amended).

4.6.6. Noise contours have been produced, and presented in this ACP, based on the actual aircraft movements for 16 June to 15 September 2018 and using the Aviation Environmental Design Tool (AEDT) software (version 3d), developed by the Federal Aviation Administration (FAA). A report was produced by Bickerdike Allen Partners LLP (BAP) on behalf of LB A.

4.7. Additional Baseline information relevant to the Initial Options Appraisal

4.7.1. Capacity and Resilience

4.7.1.1. It is likely that in the short-medium term, LBA would maintain current capacity with the existing procedures however, as already stated, with the Doppler VHF Omni-Directional Range (DVOR[8]) rationalisation and the short-term fix of the RNAV substitution there would be insufficient resilience to the operation. Fundamentally, LBA must modernise in accordance with the AMS.

4.7.2. General Aviation Access

4.7.2.1. LBA recognises that GA has a requirement for access to enter/cross CAS. LBA has always facilitated this access, subject to flight safety considerations, and has no intention of changing this going forward. The existing configuration of the Airspace in the vicinity of LBA may need to be changed to accommodate changes to the Airport's procedures however, this will also be consulted on as part of the ACP at Stage 3.

4.7.3. Economic Impact: Commercial Airliners and General Aviation

4.7.3.1. The cost of fuel continues to rise, and the existing suite of procedures results in inefficient climb and descent profiles that burn greater levels of fuel. This additional fuel cost has an economic impact on the airlines and ultimately the passengers who use them.

4.7.4. Fuel-burn: Commercial Airliners and General Aviation

4.7.4.1. In a similar vein to the assessment of emissions, the continued use of the current departure and arrival systems is less predictable than the proposed PBN procedures and likely to result in greater fuel-burn. The lack of predictability results in poor fuel planning for the operators meaning they carry greater fuel than is necessary, which, in turn, increases fuel-burn.

[8] DVOR is a standard International Civil Aviation Organisation (ICAO) ground based radio navigational aid that provides bearing information to aircraft to define air traffic control routes for en-route, terminal and instrument approach/departure procedures

4.7.5. Infrastructure Costs

4.7.5.1. Maintenance of aging navigational facilities such as the LBA non-directional beacon (NDB)[9] is expensive (prohibitively so in some cases) and due to obsolescence can be technologically infeasible. Were the Airport to pay NERL to continue to maintain the service provided by the DVORs that are being rationalised, this would come at a significant cost to the Airport. Repairs may be required as would the flight calibration all at the Airport's expense. Ultimately the continued use of the GAM DVOR, for any longer than necessary is economically unviable.

4.7.6. Operational Costs

4.7.6.1. Other than the costs associated with maintaining infrastructure, it is hard to see any additional costs being associated with continued operation of the extant procedures.

4.7.7. Training Costs

4.7.7.1. There are no training costs identified to maintaining the extant procedures.

4.7.8. Other Costs

4.7.8.1. There are no other costs identified to maintaining the extant procedures.

4.7.9. Deployment Costs

4.7.9.1. There are no deployment costs identified to maintaining the extant procedures.

4.7.10. Safety Assessment

4.7.10.1. It is a key assumption that the Baseline operation is safe and is operated in accordance with extant regulations.

4.8. Forecasts

4.8.1. Growth and Fleet Mix Forecast

4.8.1.1. The Airport expects to handle 4.5 million passengers this financial year. LBA 5-Year Plan forecasts that in the financial year of 2028 the Airport will handle 6.5 million passengers. This is an increase of circa 45% over the next five years. By 2030, this figure is expecting to rise to 6.8 million passengers and the capacity of the current planned terminal extension is assumed to be 7 million.

[9] A non-directional beacon, also known as an NDB, is a navigation aid that provides pilots with a radio signal they can use to determine their position. NDBs are used primarily in non-precision approaches and as en route navigation aids. They are particularly useful in areas where other navigation aids, such as VORs or GPS, may not be available or reliable

4.8.1.2. As for the fleet mix, LBA has a mixture of turbo-prop and jet operators, and the ratio of propulsion types is unlikely to change dramatically over the next 10-15 years. This ratio is currently at 1 turbo-prop to every 10-jet aircraft (1:10). Figure 4 shows the fleet mix during 2022 taken from the Airport's NTMS. The vast majority of aircraft operating at LBA are made up of Boeing 737-800 and 300 variants.

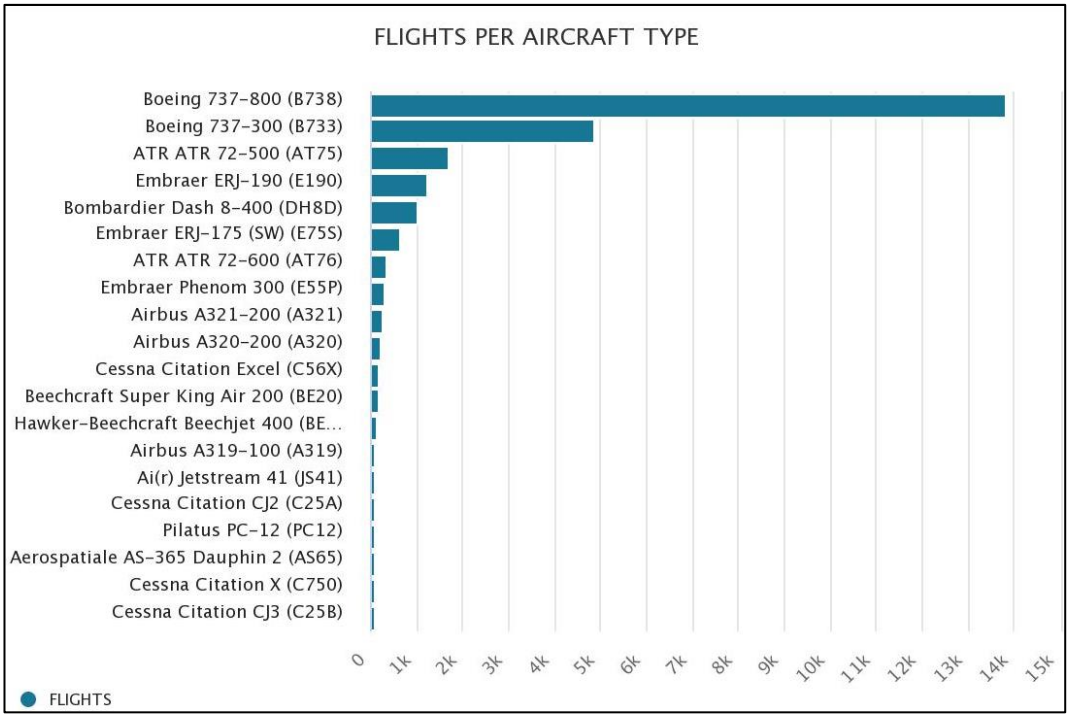


Figure 4: 2022 LBA Fleet Mix

4.8.1.3. The Airport is expecting to see the introduction of more modern, and quieter new generation jet aircraft with Jet2 acquiring A321 Neos and Ryanair recently announcing they are acquiring B737-Max 10's.

4.8.1.4. The following tables detail the Fleet Mix used for the 2018 Noise Contours and the assumed Fleet Mix that was used for the 2030 Noise Contours.

2018 Fleet Mix			
Cessna 525A Citation Jet CJ2	Embraer Phenom 100	Learjet 45	Piaggio P.180 Avanti
Cessna 560 Citation Excel/XLS/XLS+	de Havilland Canada DHC-8-400 Dash 8	Cessna 525B Citation Jet CJ3	Gulfstream G350/400/450 (GIV/GIVSP)
Boeing 737-800	Embraer E175 (short wing)	de Havilland DH.125 Jet Dragon	Gulfstream G550 (C-37B, GVSP)

2018 Fleet Mix			
Learjet 60	Embraer E170	Boeing 737-300	Dassault Falcon 900
Cessna 750 Citation X	Embraer E190	B757-200	Bombardier BD-100 Challenger 300
Embraer EMB-505 Phenom 300	Embraer E195	Boeing 737-400	Pilatus PC-12
Gulfstream G200 (IAI Galaxy)	Saab 2000	Jetstream 41	Cessna F406 Vigilant
Beechcraft Model 90 King Air	Beechcraft Premier I	Hawker 4000	Hawker 750 / 800 / 850 / 900 / XP
Swearingen SA-227 Merlin 4	Airbus A320	Piper PA-31 Navajo	British Aerospace Bae-146-300
Cessna 510 Citation Mustang	Embraer ERJ 145	Cessna 421 Golden Eagle	Airbus A321
ATR-72-500	Beechcraft Super King Air	Bombardier Challenger 600	Fokker 100
ATR-42-500	Dassault Falcon 2000	Cessna 680 Citation Sovereign	Gulfstream G100/150 (IAI Astra)
Boeing 757-200	Beechcraft Model 400 Beechjet	Saab 340	Bombardier Global Express
Boeing 737-500	Airbus A319	Learjet 31	Diamond DA-42 Twin Star
Canadair CRJ200	Cessna 525C Citation Jet CJ4	Cessna 550 Citation II	
Learjet 35/36	Cessna 525 Citation Jet CJ1	Embraer ERJ 135	

Table 6: 2018 Fleet Mix

Assumed 2030 Fleet Mix
Boeing 737 MAX (all series)
Boeing 737-800
Boeing 787-8
Airbus A320 Neo
ATR 72
Embraer E195
Airbus A320
A321 Neo

Table 7: Assumed 2030 Fleet Mix

4.8.2. Proposed Local Developments

4.8.2.1. Local Planning Authorities (LPAs) have 'Development Plans' in which they identify proposed land usage for the future. Figure 5 below has been compiled from data contained within the Leeds City Council Site Allocations Plan that was adopted on 10 July 2019[10]. The main sites identified for housing in the immediate proximity to the LBA runway (in the centre) have been labelled such that they can be identified by the reader and the Number of Units planned on that site can be seen in Table 8. LBA will endeavour, where possible, to take account of these new housing developments during Stage 3 of the CAP1616 process. It should be noted that not all LPA Development Plans are as accessible as the Leeds City Council example and, it is not a simple task to filter out the useful information from the not so useful. LBA will endeavour to engage with the neighbouring LPAs to resolve this and gain a clearer picture on development plans.

[10] Leeds City Council Site Allocations Plan adopted 10 July 2019

Figure 5: Leeds City Council Development Plans against a Google Earth Background

Label	Development Name	Housing Units
A	Otley East	550 Units
B	Mill Lane	245 Units
C	Wharfedale General Hospital	62 Units
D	Rumplecroft	135 Units
E	Bradford Road, High Royds	349 Units
F	Netherfield Road	214 Units
G	Springfield Road	54 Units
H	Green Lane	171 Units
I	Low Hall Road	131 Units
J	Calverley Lane	331 Units
K	Horsforth Campus	72 Units
L	Abbey Road	1385 Units
M	Kirkstall District Cent	55 Units
N	Ring road West Park	485 Units
O	Westbrook Lane	75 Units
P	Cookridge Hospital	326 Units

Label	Development Name	Housing Units
Q	Moseley Wood Gardens	198 Units
R	Church Lane	104 Units
S	Otley Road	256 Units
T	West Park Centre	69 Units
U	Moor Road	68 Units
V	Meanwood Road	54 Units
W	Beckhill Approach	79 Units
X	Victoria House	124 Units
Y	Leeds Girl's High School	105 Units
Z	Canal Wharf	84 Units

Table 8: Leeds City Council Development Plan Housing and Schools

4.8.2.2. It is accepted that not all the sites depicted on the map are labelled and that there will be others associated to other LPAs that are not plotted.

5. Initial Options Appraisal Results

5.1. Introduction

5.1.1. This section provides a summary of the DOs carried forward from the DPE, and qualitatively assesses each DO against the criteria detailed in Section 2 as compared against the Baseline IOAs and description in Section 4.

5.1.2. None of the Baseline options were carried forward after the DPE and as such are not being assessed as viable options in this IOA. The individual Baseline IOA tables are provided in each section as a point of reference for the assessment of the other Dos in their group.

5.2. Proposed Options

5.2.1. The following RW32 Departure Dos have been 'Retained' for inclusion in the IOA:

New Combination Options	South-East	South & West
	32SE-Do Minimum	32S&W-Do Minimum
32NEWA	32SEB	32S&WA
32NEWB	32SEC	32S&WC
32NEWC	32SED	32S&WD
32NEWD	32SEF	
32NEWE	32SEG	32S&WF
		32S&WG
		32S&WH

Table 9: RW32 Departure Dos

5.2.2. The following RW14 Departure Dos have been 'Retained' for inclusion in the IOA:

New Combination Options	South-East	South & West
	14SE- Do Minimum	14S&W- Do Minimum
14NEWA	14SEA	14S&WC
14NEWB	14SEB	14S&WD
		14S&WE

Table 10: RW14 Departure Dos

5.2.3. The following Arrival System Dos have been 'Retained' for the IOA:

Arrival Systems
System 1 – Do Minimum – 1 Hold – LBA
System 2 – 2 Holds – NELSA/GOLES
System 3 – 2 Holds – 'AIREY' & 'WORTH'
System 4 – 3 Holds – LBA with 'AIREY' & 'WORTH'
System 5 – 3 Holds – NELSA/'UDDER'/GOLES
System 6 – 2 Holds – LBA/GOLES
System 7 – 3 Holds – NW Hold/LBA/GOLES
System 8 – 2 Arrival Holds – NW Hold/GOLES
System 9 – 2 Holds – 'UDDER'/GOLES
System 10 – 1 Arrival Hold – GOLES & Direct Arrivals

Table 11: Arrival System Dos

5.2.4. The following Approach Dos have been 'Retained' for the IOA:

Approach Options
RNP AR RW14
RNP AR RW32

Table 12 – Approach Dos

5.3. Runway 32 Departures

5.3.1. Runway 32 South-East Design Envelope

5.3.1.1. The following figure shows the Dos as compared to the Baseline against the ENR Chart.

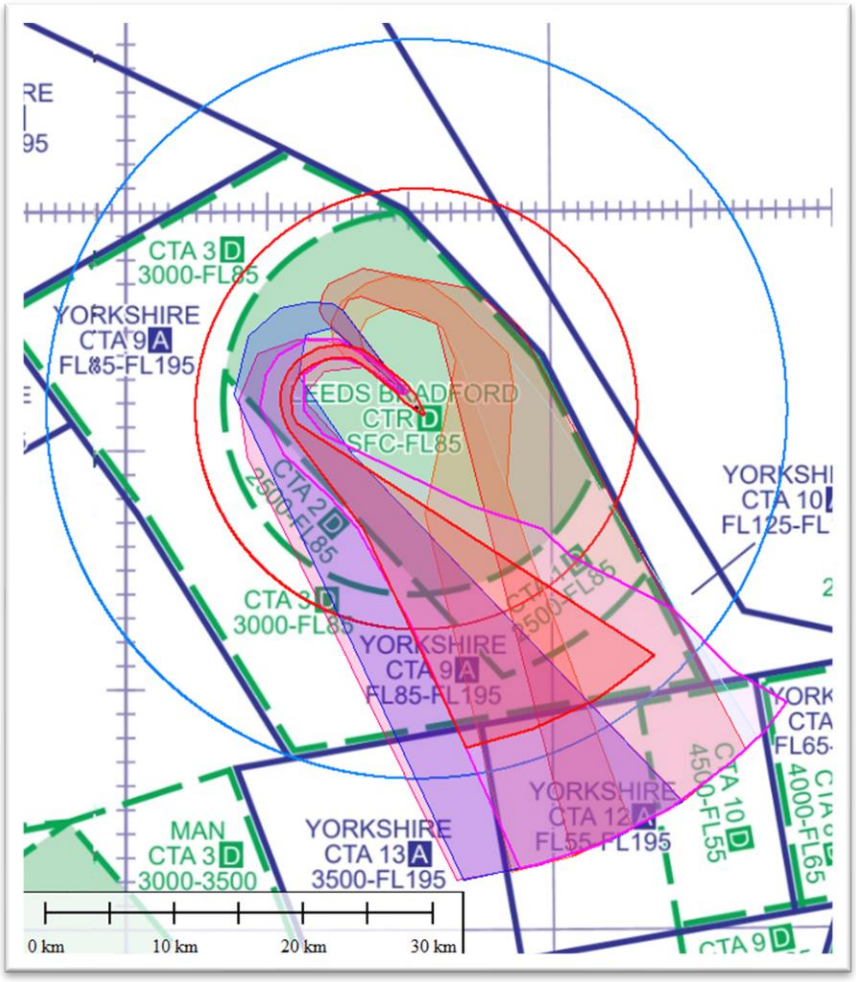


Figure 6: Runway 32 South-East Departure Swathes

5.3.1.2. Runway 32 South-East Baseline

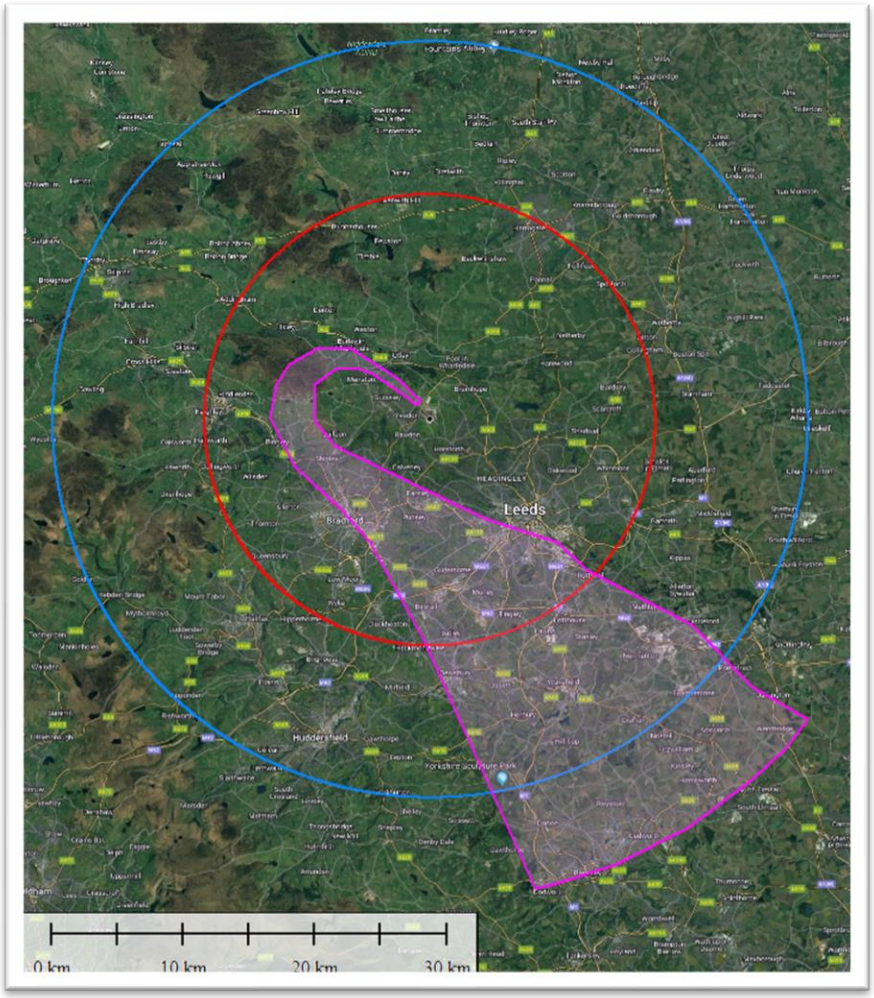
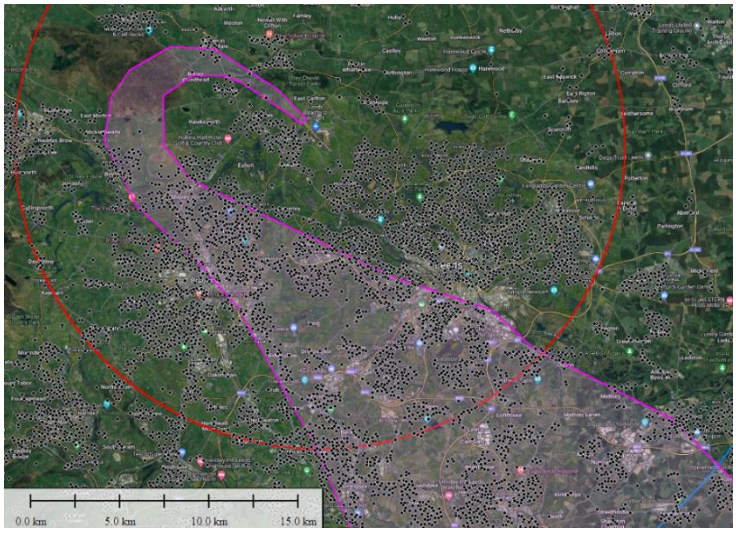
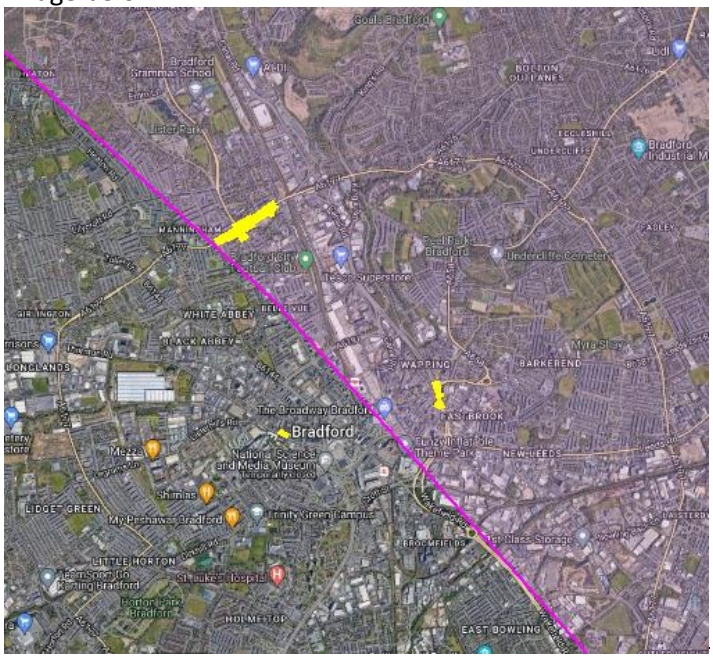


Figure 7: Runway 32 South-East Baseline image over Google Maps Satellite

5.3.1.2.1. The existing departure procedure turns initially left following the NPR. It then overflies central Bradford and then heads towards Wakefield.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would continue to overfly the same communities after take-off with no change to noise impact. Communities currently flown over include Shipley, Bradford, Batley and Pudsey. 
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality. AQMAs around Bradford are highlighted in yellow in the image below. 

Group	Impact	Qualitative Assessment
Wider society	Greenhouse gas impact	There would be no change in track length or altitudes. No change in benefits or impacts to greenhouse gas and CO2 emissions.
	Capacity/ resilience	No opportunity to increase capacity or resilience.
	Tranquillity	No National Parks or AONBs are overflown below 7000ft.
	Biodiversity	There are no additional biodiversity implications associated with retaining the Baseline. The Baseline currently flies over the South Pennines Moors (SSSIO, SAC, SPA).
General aviation	Access	No change in controlled airspace or access to it if the Baseline was to be retained.
General aviation/ commercial airlines	Economic impact from increased effective capacity	No opportunity for increased capacity or benefit to economic impact should the Baseline option be retained.
	Fuel-burn	There would be no change in track length or altitudes. No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	No training costs for airlines as there would be no new procedures if this Baseline option were to be retained. Updates to flight procedures form part of an AIRAC cycle where airlines will update their procedures and utilise training if deemed necessary as standard.
	Other costs	No commercial airline costs are anticipated should the Baseline be retained.
Airport/ Air navigation service provider	Infrastructure costs	No infrastructure costs are anticipated with the initial deployment of this option for either the Airport or ANSP.
	Operational costs	No operational costs are anticipated with the initial deployment of this option for either the Airport or the ANSP.
	Deployment costs	No controller or assistant training will be required should the Baseline be retained as procedures will not be changed.
All	Safety	No safety concerns should this Baseline option be retained.

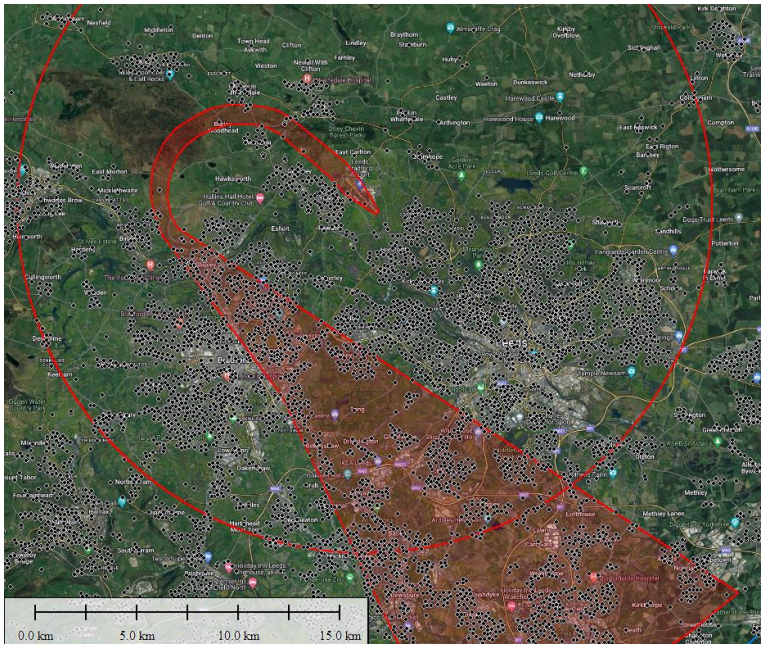
Group	Impact	Qualitative Assessment
	AMS Realisation	No change and therefore no improvements to align with AMS objectives.
	Interdependencies conflicts and trade-offs	The Baseline is not separated from inbound traffic to LBA from the south and west. Tactical vectoring and intermediate phases of level flight would be required in certain traffic conditions.

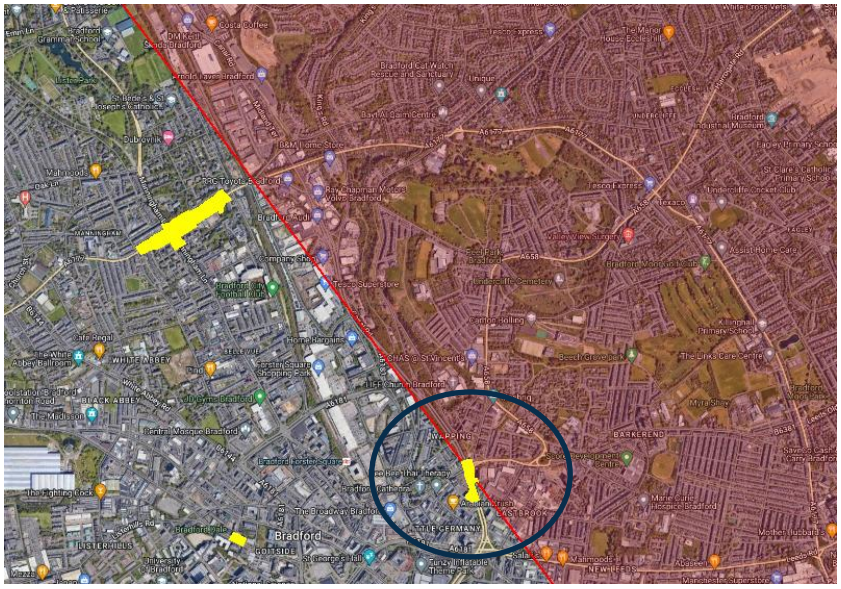
Table 13: Runway 32 South-East Baseline

5.3.1.2.2. None of the Baseline options were carried forward after the DPE and as such are not being assessed as viable options in this IOA. The table above is provided as a point of reference for the assessment of the other Dos in this group.

5.3.1.3. Runway 32 South-East 'Do Minimum' CAP1781

5.3.1.3.1. The RW32 SE 'Do Minimum' DO is the CAP1781 RNAV substitution option. This DO largely mimics the 'Do Nothing' Baseline although traffic will be more concentrated around the nominal track of the published SID in the first 4-5,000ft of climb out.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The 'Do Minimum' option (red swathe) would be relatively close to this line throughout the early stages of flight due to the accuracy of RNAV. The Baseline 'Do Nothing', as defined through track data previously, is represented by the pink swathe. Less people will therefore be routinely affected but those directly under the procedure nominal track will be more regularly overflown. People living in Bingley and areas of North-West Bradford may experience less of these departures directly overflying them.  The existing NPR is contained within the DO swathe. On passing approximately 5,000ft it is assessed that the flightpaths of aircraft will diverge from the SID profile as the en-route control agency (NERL) turns the aircraft on the most expeditious routing towards the next point on the Route Network.

Group	Impact	Qualitative Assessment
	Air Quality	Insignificant change below 1,000ft and therefore it is assessed that there would be little impact on air quality. AQMA at Shipley Airedale Road may be overflown, see image highlighted below in the blue circle. 
Wider society	Greenhouse gas impact	Negligeable difference.
	Capacity/ resilience	No change.
	Tranquillity	No change.
	Biodiversity	There are no additional biodiversity implications associated with the do minimum option. The do minimum option would continue to fly over the South Pennines Moors (SSSI, SAC, SPA).
General aviation	Access	No change.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
	Training costs	Very minimal training, if any.

Group	Impact	Qualitative Assessment
Commercial airlines	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the current operation.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies conflicts and trade-offs	SID is not separated from inbound traffic to LBA from the south and west. Tactical vectoring and intermediate phases of level flight would be required in certain traffic conditions. Alternatively, a waypoint with a "at or above" altitude restriction could be incorporated to provide separation from inbound routes via BARTN.

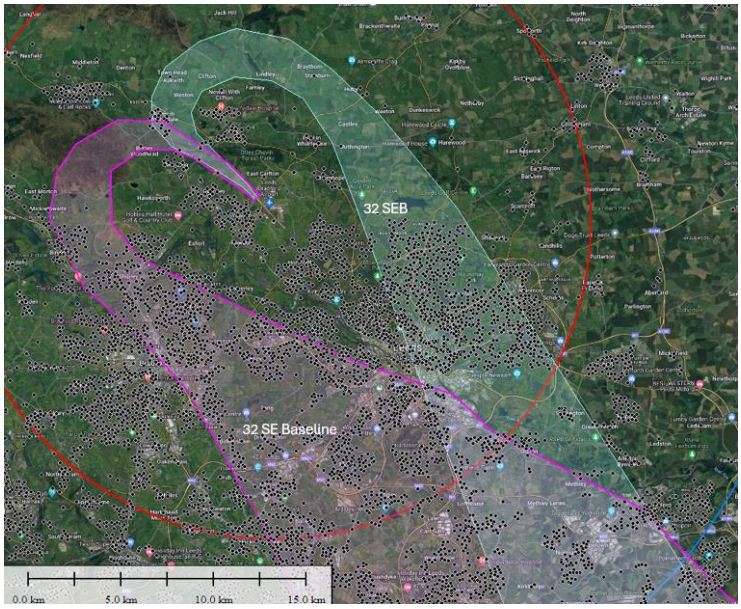
Table 14: Runway 32 South-East 'Do Minimum' CAP1781

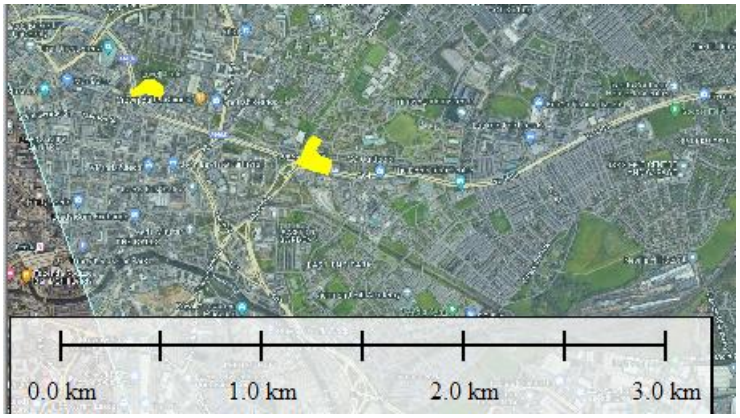
5.3.1.3.2. **Carried forward.**

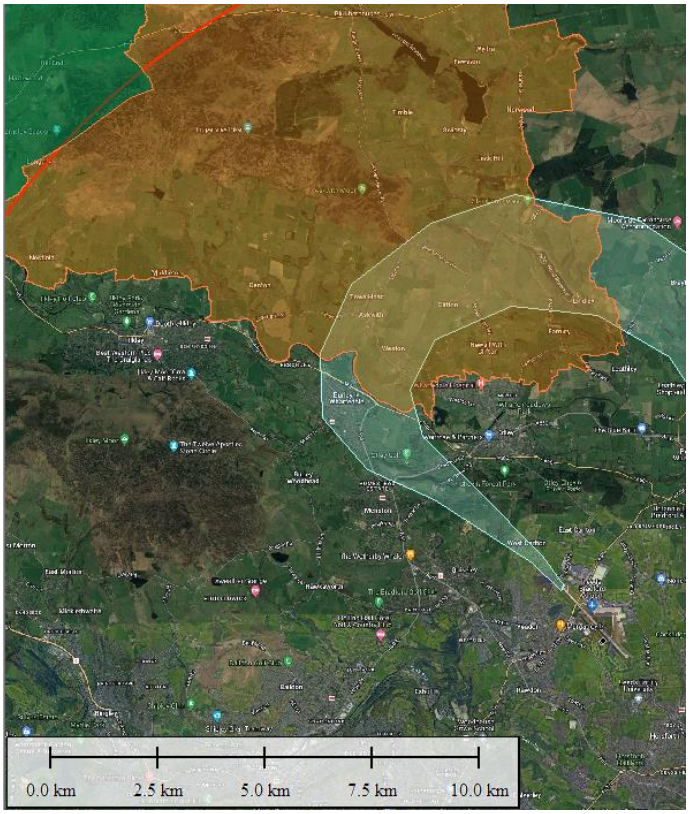
This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN. This option is the option most consistent with existing published procedures.

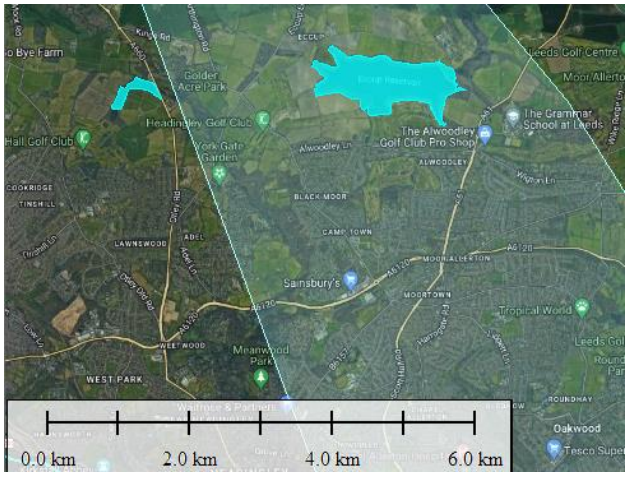
5.3.1.4. Runway 32 South-East Option B

5.3.1.4.1. This DO is similar to Options A (discounted during DPE) and C and flies between the two. It has the potential to fly over more of central Leeds than Option A, but less than Option C. The latter stages of this DO affects various populated areas south-east of Leeds.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The Baseline is the pink swathe. The existing NPR is contained within the DO swathe until it reaches Burley-in-Wharfedale which may be more greatly affected. The 32SEB swathe (green) then turns right to the North of Otley, overflying less densely populated areas. Communities of North-East Leeds may experience some aviation noise from aircraft between 5,000 and 7000ft. 

Group	Impact	Qualitative Assessment
	Air Quality	Two AQMAs near Leeds city centre would be flown over, both on York Road (A64) at the Laylands and Quarry Hill, highlighted in yellow. Fewer AQMAs would be overflown with this option compared to the Baseline and AQMAs, although different, are overflown at higher levels at higher levels. 
Wider society	Greenhouse gas impact	Similar track mileage with either a left or a right turn and therefore negligible difference.
	Capacity/ resilience	An improvement on the Baseline as departures are turned away from busy airspace to the west of LBA. The right turn could be up to 8NM longer than the Baseline left turn. This would take into account that the traffic cannot make the right turn until north of Otley-the initial leg prior to the turn is therefore longer

Group	Impact	Qualitative Assessment
	Tranquillity	The Nidderdale AONB is impacted instead of Ilkley Moor. Eccup Reservoir is also overflown by the swathe, the Baseline does not fly over Nidderdale. 

Group	Impact	Qualitative Assessment
	Biodiversity	This option flies over the Eccup Reservoir SSSI. The Baseline does not fly over either the AONB or the Eccup Reservoir.  
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users. Potentially this route may need RNP1 with RF capability[11] for airspace containment, especially if an extension of CAS to the east is not viable.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.

[11] RNP 1 is used for arrival, initial and intermediate, missed approach and departure navigation applications. Radius-to-Fix (RF) operations are part of RNP 1.

Group	Impact	Qualitative Assessment
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The DPE assessed this DP as Amber due to lack of CAS containment and the potential for conflict with inbounds through the GOLES area. This can be mitigated by a marginal extension of CAS to the East, but the extension may be unpopular.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. This option does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the East of the airport.

Table 15 : Runway 32 South-East Option B

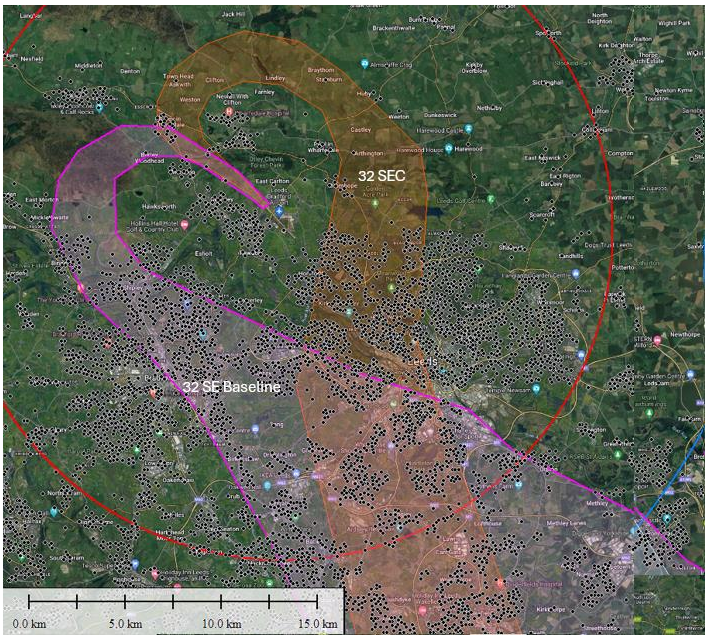
5.3.1.4.2. **Discounted**.

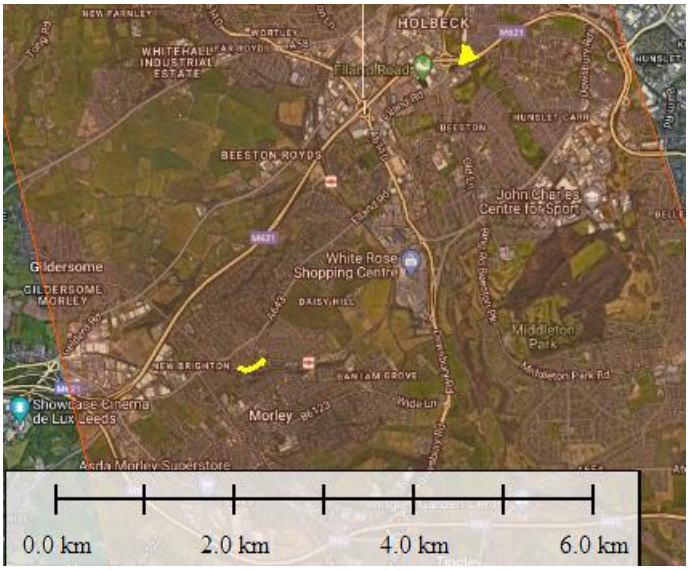
This option is similar to Option C and F and only one of the Options will be carried through to Stage 3. This will ensure the right turn out on departure is captured for the next stage and consultation. Option C was considered the preferable option, and this option has been discounted.

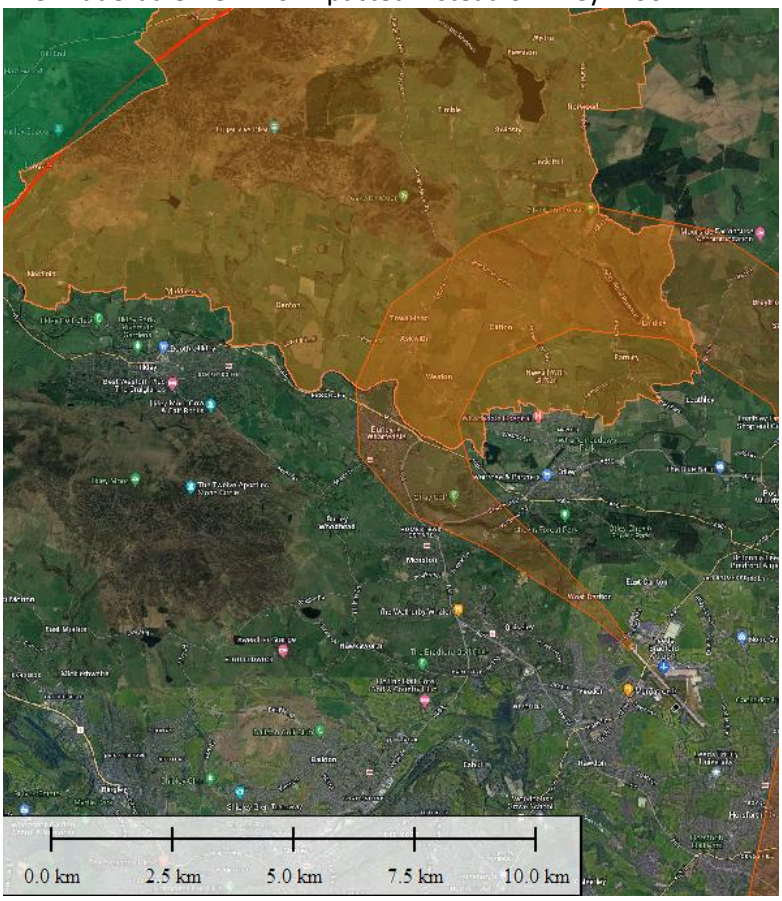
With this option there could be a reduction in noise impact to communities below 4000ft with fewer AQMAs affected, in line with the Government's altitude-based priorities. A right turn out on departure could improve capacity and resilience. Conversely, there would be a requirement for additional CAS which would have a safety impact if not obtained and does not align with the AMS. There would also be an increase in biodiversity and tranquillity impacts, particularly on the Nidderdale AONB at low level which is not currently impacted.

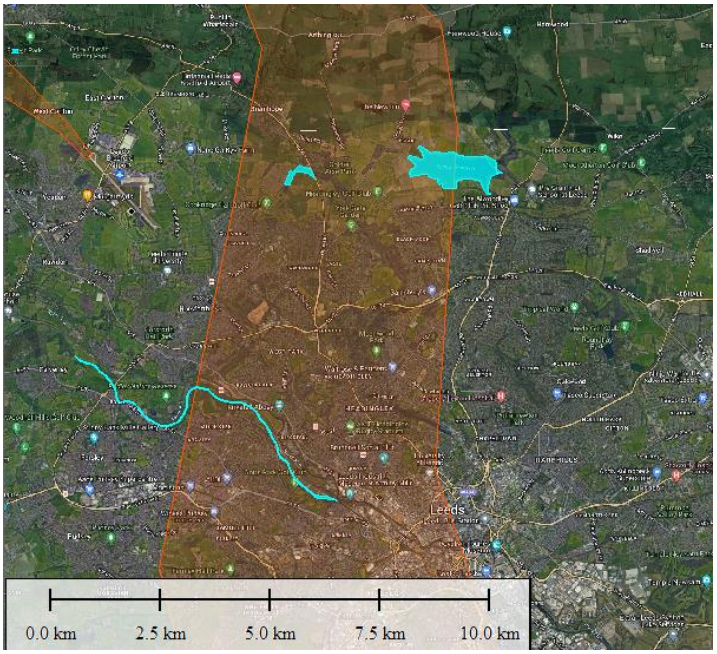
5.3.1.5. Runway 32 South-East Option C

5.3.1.5.1. This DO is initially similar to Option A (discounted during DPE as it would result in climbing head on into arrivals from the East) but flies further to the South. It therefore overflies more of the densely populated areas in central Leeds. The latter stages of this DO overfly various populated areas south of Leeds.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The image above shows the Baseline in pink, and that the existing NPR is contained within the 32SEC swathe (orange). The current NPR routing is used to 2.1 Distance Measuring Equipment (DME). This takes the traffic to the East of Burley. The 32SEC swathe would then take the traffic to the north of Otley thus avoiding all the local noise sensitive areas and overflying less densely populated areas. Communities of North-West Leeds may experience some aviation noise from aircraft between 5,000 and 7000ft. 

Group	Impact	Qualitative Assessment
	Air Quality	Three AQMA's overflown below 4000ft, one at Kirskstall, the other two at Holbeck and Chapel Hill Road, see image below, highlighted in yellow. There is no difference to the Baseline as it also flies over these AQMAs. 
Wider society	Greenhouse gas impact	Similar track mileage with either a left or a right turn and therefore negligible difference.
	Capacity/ resilience	An improvement on the Baseline as departures are turned away from busy airspace to the west of LBA.

Group	Impact	Qualitative Assessment
	Tranquillity	The Nidderdale AONB is impacted instead of Ilkley Moor. 

Group	Impact	Qualitative Assessment
	Biodiversity	Lindley and Eccup Reservoirs, Breary Marsh and Leeds-Liverpool Canal (SSSIs) are also overflown by the swathe. The Baseline flies over fewer, and different areas of concern for biodiversity. 
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.

Group	Impact	Qualitative Assessment
All	Safety	The DPE assessed this DP as Amber due to lack of CAS containment and the potential for conflict with inbound traffic. Upon further assessment there will be no conflictions with BATLI and GOLES arrivals. A waypoint will be inserted to the North of Leeds to cross at FL80 or above, thus de-conflicting the departure from all arrival routes. This option is aligned best with the NERL proposed routing to BARNS.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the East of the airport.

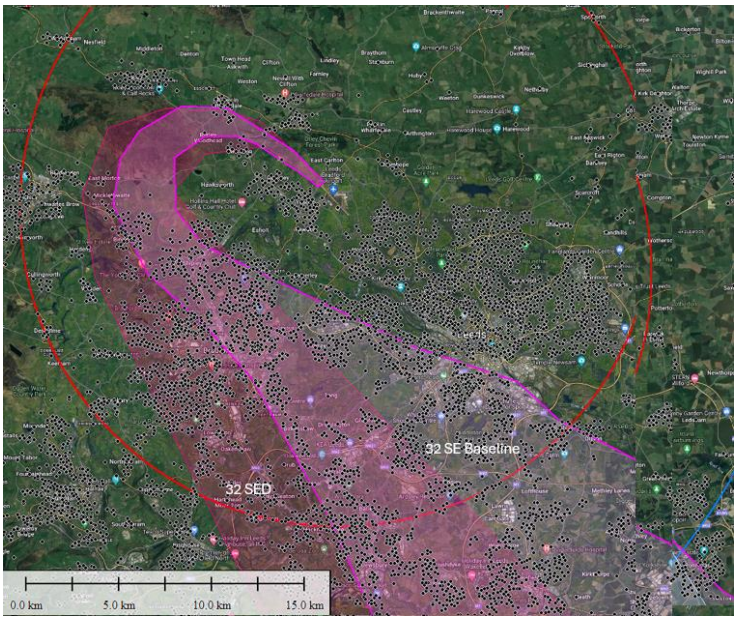
Table 16: Runway 32 South-East Option C

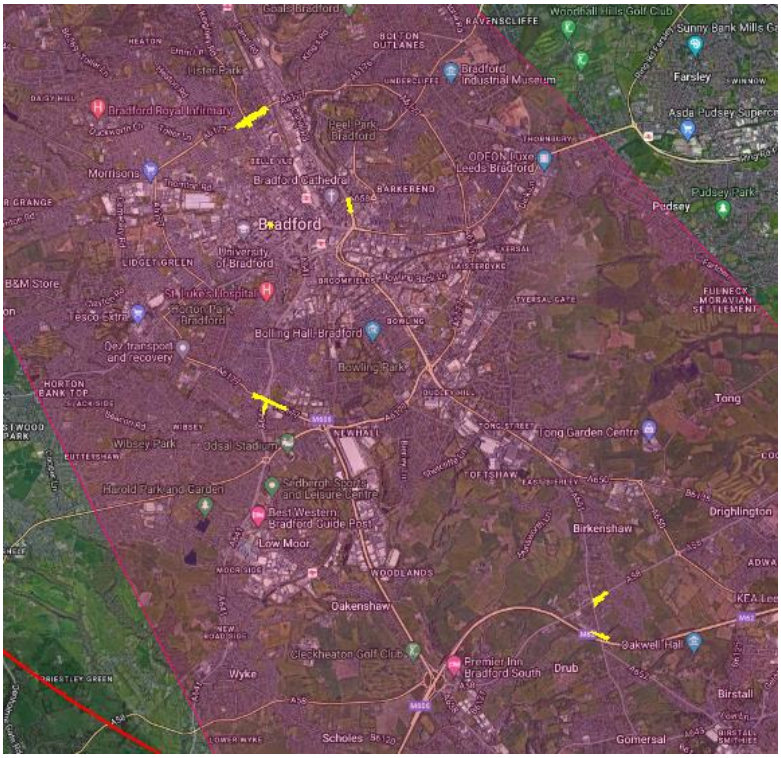
5.3.1.5.2. **Carried Forward.**

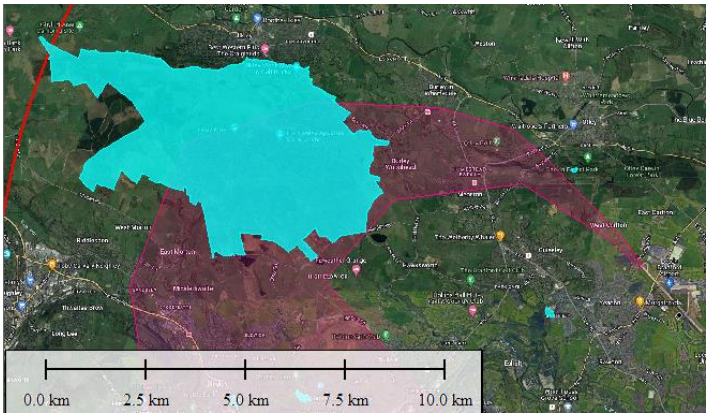
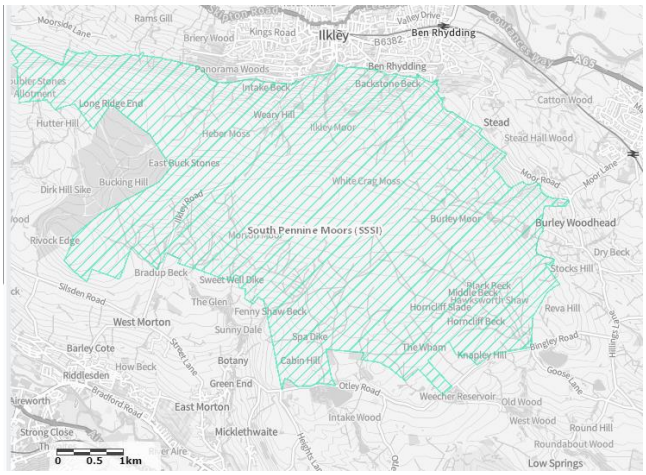
This option is carried forward as it reduces the total adverse effects on people below 4000ft in line with the Governments altitude-based priorities. There are no safety implications and the additional CAS that would be required is minimal. This option provides a right turn out after departure which moves traffic away from the more congested airspace to the west, this helps to future proof the airport and airspace for traffic growth and complexity. As such this option is the preferred option for this direction.

5.3.1.6. Runway 32 South-East Option D

5.3.1.6.1. This DO is initially similar to the Baseline and overflies largely the same areas as the Baseline.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The 32SED swathe (deeper pink swathe) bears closest resemblance to the Baseline of the DOs other than the 'Do Minimum'. The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline. 

Group	Impact	Qualitative Assessment
	Air Quality	Five AQMAs would be flown over. All in or near Bradford, A6177 at Clifton Villas, Sun Street in Eastbrook, Tetley Street and the intersection of Carr Street and A641 at Marshfields. These are the same AQMAs as the Baseline with the exception of Carr Street which would be newly flown over. Two AQMAs are avoided with this option compared to the Baseline, making it marginally preferable in terms of air quality. 
Wider society	Greenhouse gas impact	Similar track mileage to the Baseline so negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	Similar to the Baseline – Ilkley Moor overflown.

Group	Impact	Qualitative Assessment
	Biodiversity	Flies over the South Pennines Moors (SAC, SSSI and SPA), however his is the same as the Baseline.  
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.

Group	Impact	Qualitative Assessment
service provider	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	SID is not separated from inbound traffic to LBA from the South and west. Tactical vectoring and intermediate phases of level flight would be required in certain traffic conditions. Alternatively, a waypoint with a "at or above" altitude restriction could be incorporated to provide separation from inbound routes via BARTN.

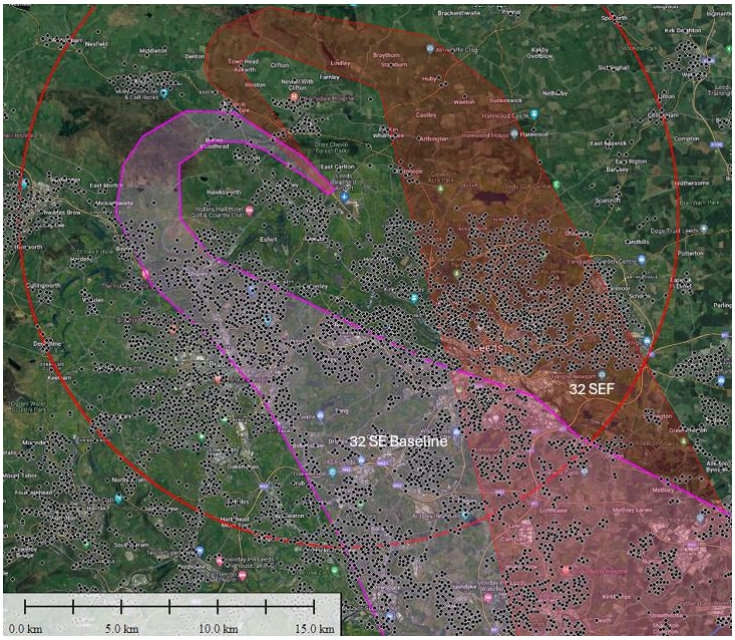
Table 17 : Runway 32 South-East Option D

5.3.1.6.2. **Carried forward**.

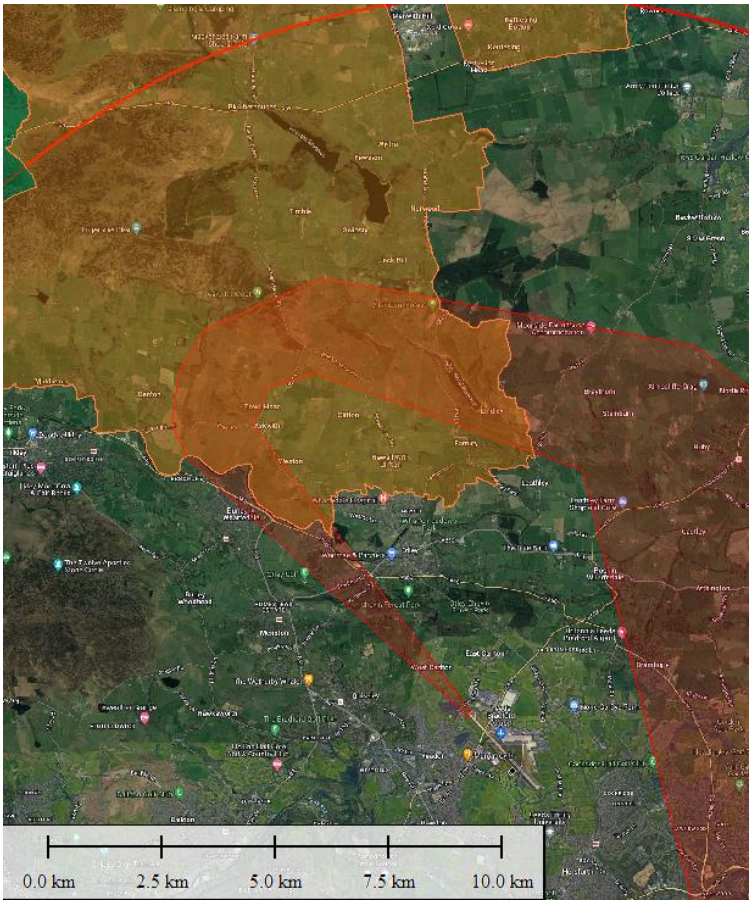
This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

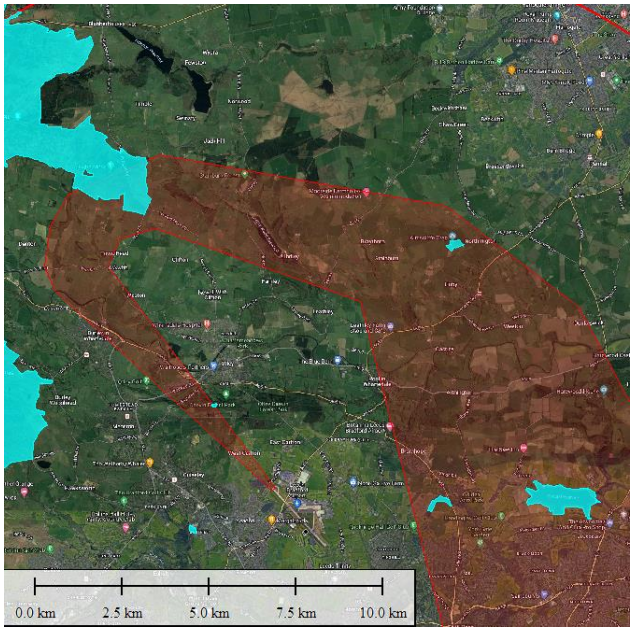
5.3.1.7. Runway 32 South-East Option F

5.3.1.7.1. This DO is similar to Option B, but the initial turn happens slightly later. This would result in aircraft being slightly higher when they overfly Leeds. The latter stages of this DO overfly various populated areas south-east of Leeds.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a slightly lower population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of similar population density would be overflown. The straight-ahead option would have a significant impact on the town of Otley. Otley is also overflown with inbound traffic when RW14 is in use. Under current procedures, the noise impact is shared between Burley and Menston for departures, and Otley for arrivals. 

Group	Impact	Qualitative Assessment
	Air Quality	Three AQMA's overflown below 4000ft, one at Kirskstall, the other two at Holbeck and Chapel Hill Road, see image below. This is different to the Baseline as the Baseline avoids the centre of Leeds, however the Baseline overflies Bradford at a lower altitude. 
Wider society	Greenhouse gas impact	Marginally greater track mileage to the Baseline but still likely to be a negligible difference.
	Capacity/ resilience	Similar to the Baseline. The right turn could be up to 6-8NM longer than the Baseline left turn. This would take into account that the traffic can't make the right turn until north of Otley-the initial leg prior to the turn is therefore longer.

Group	Impact	Qualitative Assessment
	Tranquillity	The Nidderdale AONB is impacted instead of Ilkley Moor. Lindley and Eccup Reservoirs are also overflown by the swathe as is Harewood House. 

Group	Impact	Qualitative Assessment
	Biodiversity	North Pennine Moores SAC and areas with SSSI and SPA status within this SAC. The Eccup Reservoir and Breary Marsh SSSI's also flown over. Compared to the Baseline this option flies over biodiversity sensitive areas. 
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users. Potentially this route may need RNP1 with RF capability for airspace containment, especially if an extension of CAS to the East is not viable.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.

Group	Impact	Qualitative Assessment
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline. Whilst there is the potential for conflict with inbound traffic, it is assessed that the departures could climb well above the arrivals to RW32 coming through GOLES.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, but has the potential to reduce noise impact.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the East of the Airport.

Table 18 : Runway 32 South-East Option F

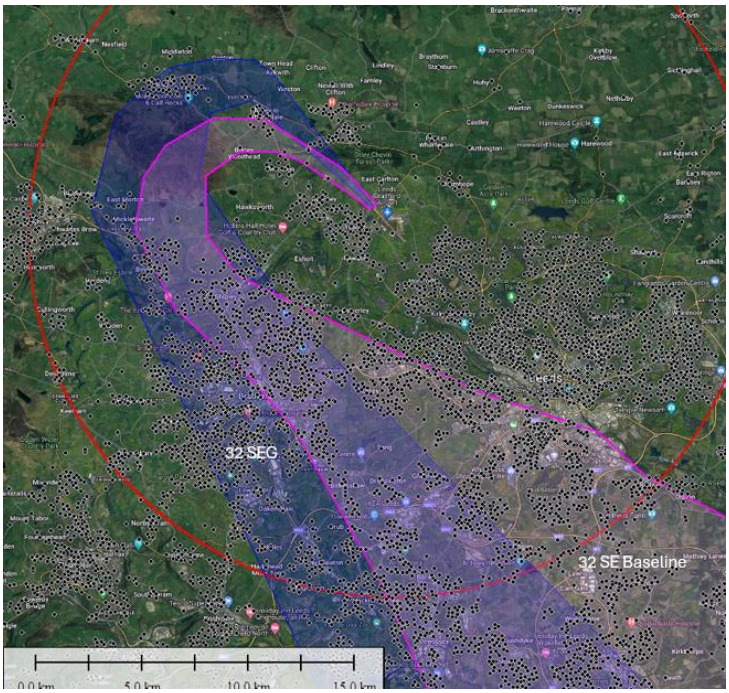
5.3.1.7.2. **Discounted.**

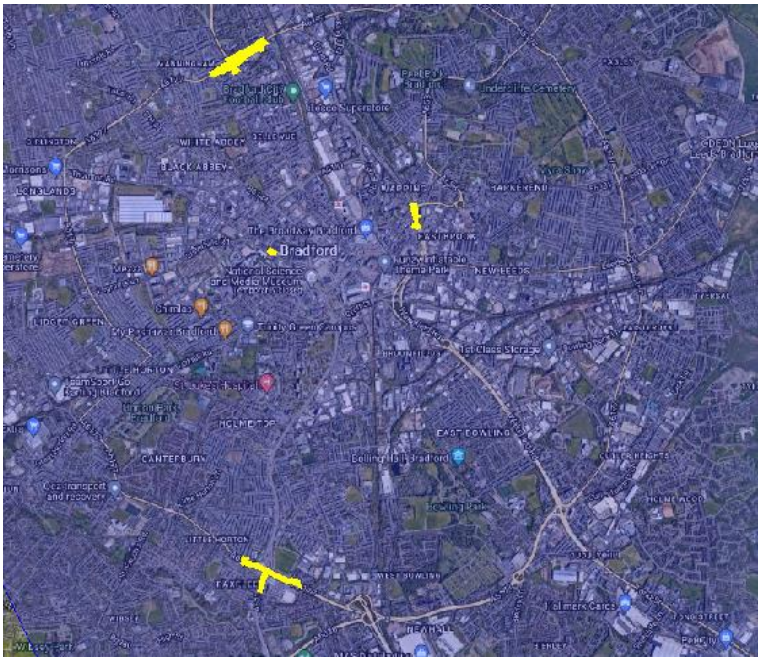
This option is similar to Option B and C and only one of the options will be carried through to Stage 3. This will ensure the right turn out on departure is captured for the next stage and consultation. Option C was considered the preferable option, and this option has been discounted.

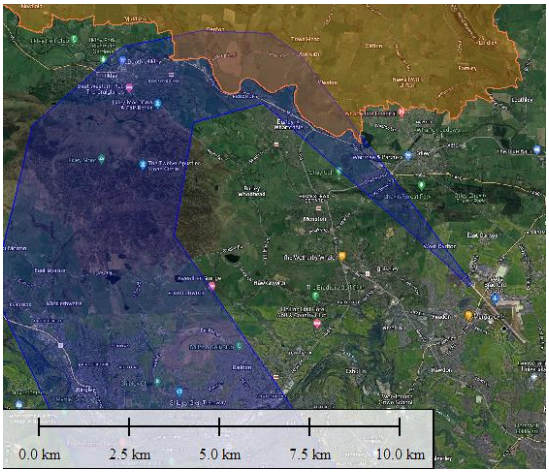
With this option there could be a reduction in noise impact to communities below 4000ft with fewer AQMAs affected, in line with the Government's altitude-based priorities. A right turn out on departure could improve capacity and resilience. Conversely, there would be a requirement for additional CAS which would have a safety impact if not obtained and does not align with the AMS. There would also be an increase in biodiversity and tranquillity impacts, particularly on the Nidderdale AONB at low level which is not currently impacted.

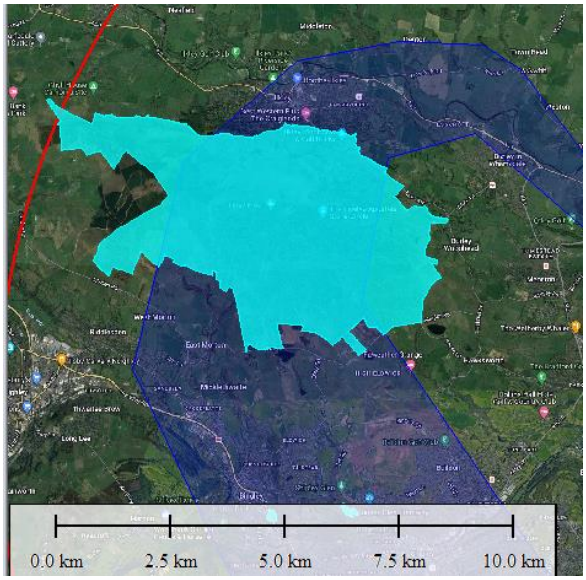
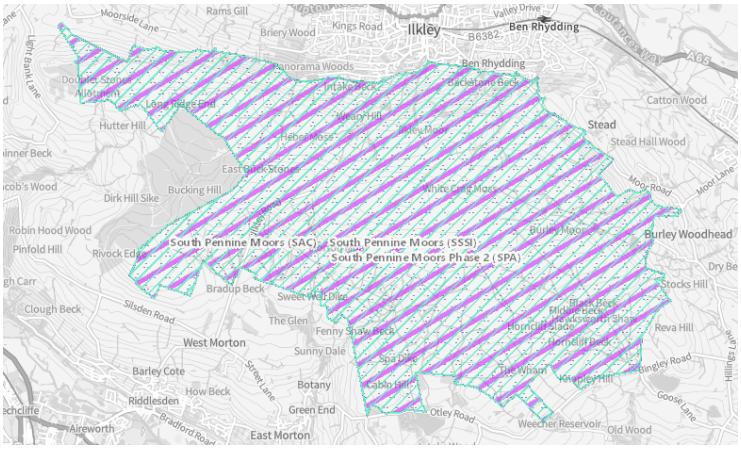
5.3.1.8. Runway 32 South-East Option G

5.3.1.8.1. This DO is similar to Option D, but the initial turn happens slightly later, this results in overflying parts of the area around Ilkley. The latter stages of this DO overfly largely the same areas as the Baseline.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a slightly higher population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of similar population density would be overflown. The 32SEG swathe (blue) routes out on runway track for longer than the Baseline (pink) resulting in a routing to the East of the NPR and over Otley, Burley-in-Wharfedale, Esscroft, Ben Rhydding and Ilkley. 

Group	Impact	Qualitative Assessment
	Air Quality	Five AQMAs would be flown over. All in or near Bradford, A6177 at Clifton Villas, Sun Street in Eastbrook, Tetley Street and the intersection of Carr Street and A641 at Marshfields. This is broadly similar to the Baseline with the exception of Carr lane AQMA being newly flown over. 
Wider society	Greenhouse gas impact	Marginally greater track mileage to the Baseline but still likely to be a negligible difference.
	Capacity/ resilience	Similar to the Baseline.

Group	Impact	Qualitative Assessment
	Tranquillity	Ilkley Moor and Nidderdale AONB overflown, unlike the Baseline which avoids these. 

Group	Impact	Qualitative Assessment
	Biodiversity	South Pennine Moors (SAC, SPA and SSSI) flown over, aircraft are possibly under 4000ft at this point, this is similar to the Baseline.  
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.

Group	Impact	Qualitative Assessment
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the East of the airport. The route would, however, deconflict with any inbound transition from the BARTN area as the additional miles flown would ensure a climb gradient well above what is required to deconflict the two routes.

Table 19: Runway 32 South-East Option G

5.3.1.8.2. **Discounted.**

This option is discounted as it is anticipated that there will be a net increase in noise impact to communities, particularly below 4000ft and the Nidderdale AONB would also be affected at low level this does not align with the Government's altitude-based priorities.

5.3.2. Runway 32 South and West Design Envelope

5.3.2.1. The following figure shows the DOs as compared to the Baseline against the ENR Chart.

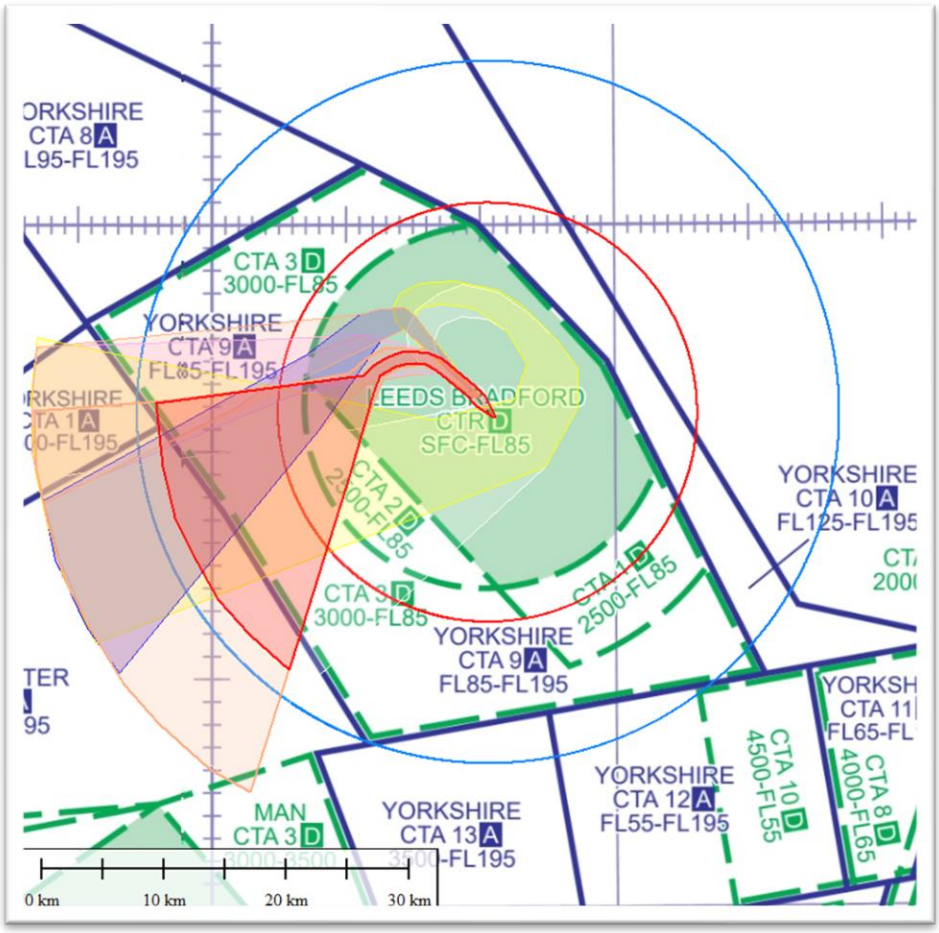


Figure 8: Runway 32 South & West Departure Swathes

5.3.2.2. Runway 32 South and West Baseline

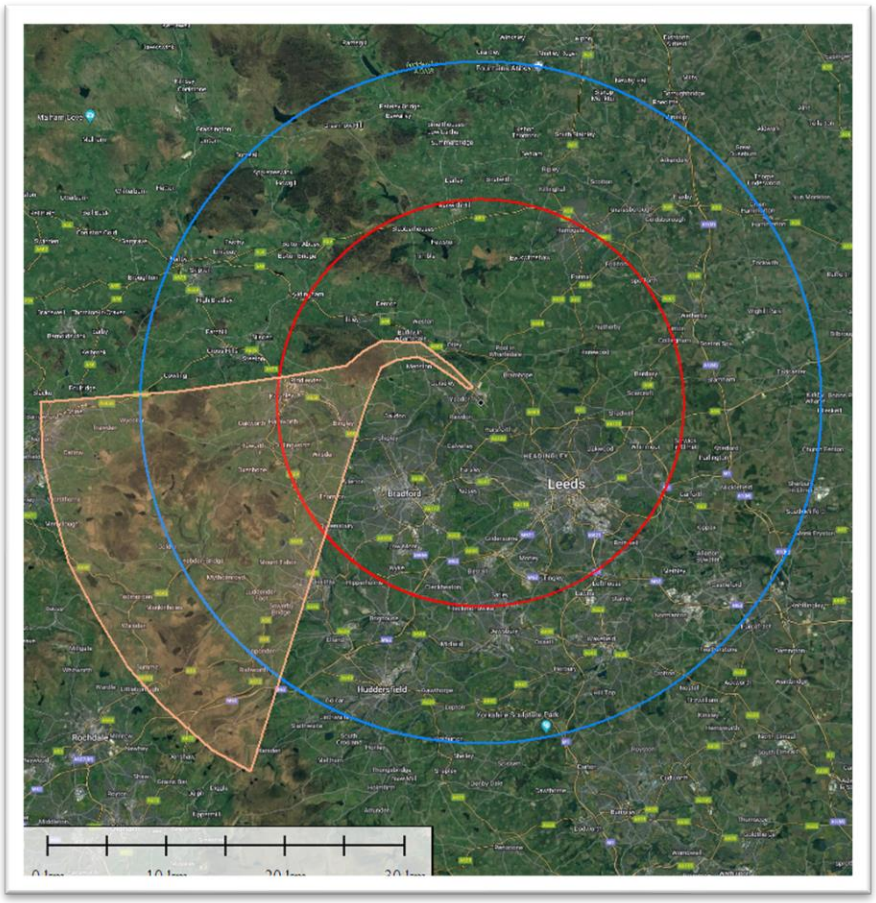
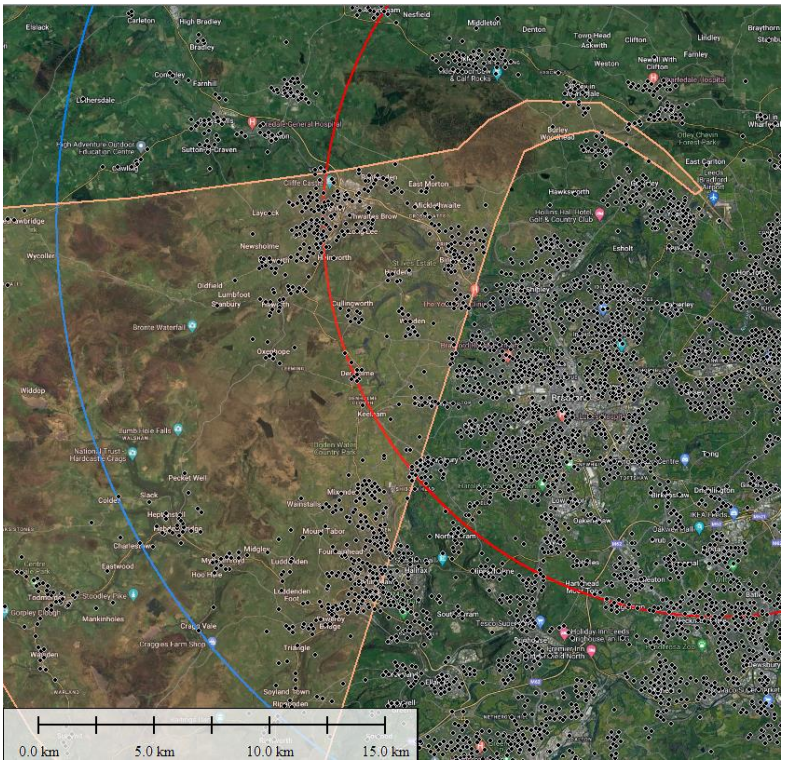


Figure 9: Runway 32 South & West Baseline

5.3.2.2.1. The existing departure procedure turns left following the NPR and avoids overflying Ilkley. Aircraft then continue south-west and overfly Keighley. In the later stages the areas overflown are generally sparsely populated.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would continue to overfly the same communities after take-off with no change to noise impact. Communities currently affected include Keighley and Bingley. 
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality.
Wider society	Greenhouse gas impact	There would be no change in track length or altitudes. No change in benefits or impacts to greenhouse gas and CO2 emissions.
	Capacity/ resilience	No opportunity to increase capacity or resilience.
	Tranquillity	No National Parks or AONBs are overflown below 7000ft.
	Biodiversity	There are no additional biodiversity implications associated with retaining the Baseline. The Baseline currently flies over the South Pennines Moors (SSSIO, SAC, SPA).
General aviation	Access	No change in controlled airspace or access to it if the Baseline was to be retained.

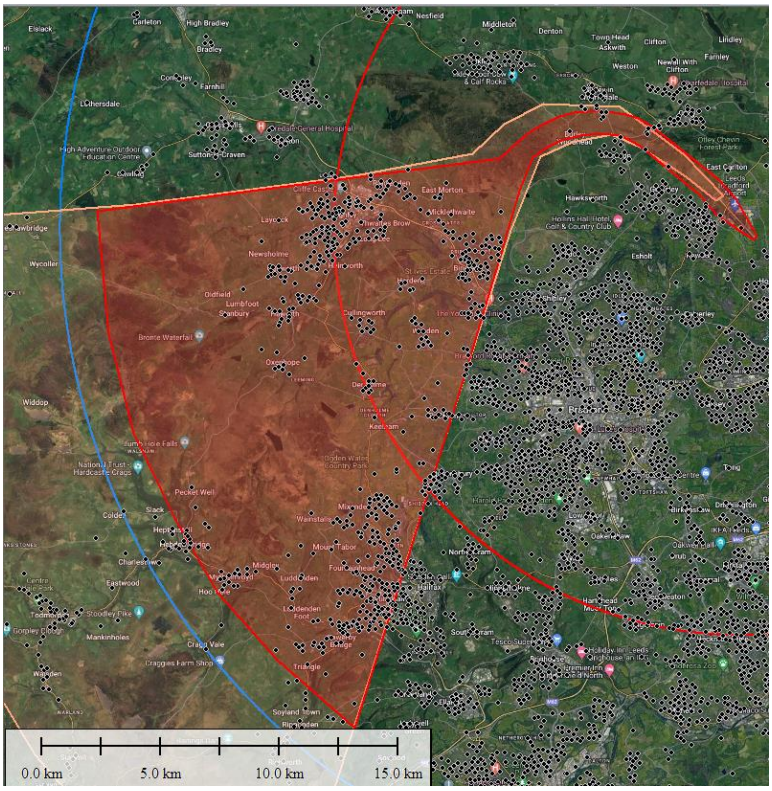
Group	Impact	Qualitative Assessment
General aviation/ commercial airlines	Economic impact from increased effective capacity	No opportunity for increased capacity or benefit to economic impact should the Baseline option be retained.
	Fuel-burn	There would be no change in track length or altitudes. No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	No training costs for airlines as there would be no new procedures if this Baseline option were to be retained. Updates to flight procedures form part of an AIRAC cycle where airlines will update their procedures and utilise training if deemed necessary as standard.
	Other costs	No commercial airline costs are anticipated should the Baseline be retained.
Airport/ Air navigation service provider	Infrastructure costs	No infrastructure costs are anticipated with the initial deployment of this option for either the Airport or ANSP.
	Operational costs	No operational costs are anticipated with the initial deployment of this option for either the Airport or the ANSP.
	Deployment costs	No controller or assistant training will be required should the Baseline be retained as procedures will not be changed.
All	Safety	No safety concerns should this Baseline option be retained.
	AMS Realisation	This option does not contribute to the aims of the AMS as it is today's operation and the Baseline option.
	Interdependencies conflicts and trade-offs	This option does not conflict with any other Leeds inbound routes and gives continuous climb. The route is also used to parallel the inbound Manchester arrival from GOLES to ROSUN, therefore allows the area sector to give continuous climbs to Leeds outbound traffic over the Manchester inbound traffic before turning south westbound towards the MCT.

Table 20: Runway 32 South and West Baseline IOA

5.3.2.2.2. None of the Baseline options were carried forward after the DPE and as such are not being assessed as viable options in this IOA. The table above is provided as a point of reference for the assessment of the other DOs in this group.

5.3.2.3. Runway 32 South and West 'Do Minimum' CAP1781

5.3.2.3.1. The RW32 SW 'Do Minimum' DO is the CAP1781 RNAV substitution option. This DO largely mimics the 'Do Nothing' B although traffic will be more concentrated around the nominal track of the published SID in the first 4-5,000ft of climb out.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The existing NELSA SID is in the centre of this swathe. The 'Do Minimum' option (red swathe) would be relatively close to this line throughout the early stages of flight due to the accuracy of RNAV. The Baseline 'Do Nothing', as defined through track data previously, is represented by the peach swathe. The NPR is contained within both swathes. Keighley and Bingley would continue to be affected.  There will be negligible change experienced by those on the ground. On passing approximately 5,000ft it is assessed that the flightpaths of aircraft will diverge from the SID profile as the en-route control agency (NERL) turns the aircraft on the most expeditious routing towards the next point on the Route Network.
	Air Quality	Insignificant change below 1,000ft and therefore it is assessed that there would be little impact on air quality.

Group	Impact	Qualitative Assessment
Wider society	Greenhouse gas impact	No change.
	Capacity/ resilience	No change.
	Tranquillity	The Nidderdale AONB is impacted instead of Ilkley Moor. Eccup Reservoir is also overflown by the swathe.
	Biodiversity	There are no additional biodiversity implications associated with the do minimum option, and it would continue to fly over the South Pennines Moors (SSSIO, SAC, SPA).
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The DPE assessed this DP as Red due to lack of CAS containment on this wraparound SID. This could be mitigated by a marginal extension of CAS to the East. It is assessed that departures could climb well above inbounds to RW32.

Group	Impact	Qualitative Assessment
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	This option does not conflict with any other Leeds inbound routes and gives continuous climb. The route is also used to parallel the inbound Manchester arrival from GOLES to ROSUN, therefore allows the area sector to give continuous climbs to Leeds outbound traffic over the Manchester inbound traffic before turning south westbound towards the MCT.

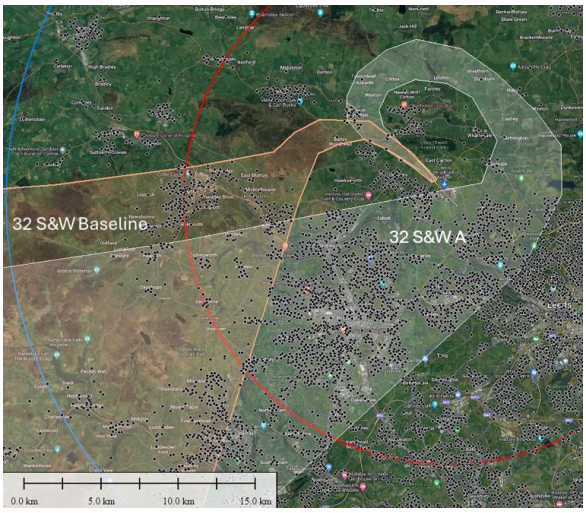
Table 21: Runway 32 South and West 'Do Minimum' CAP 1781

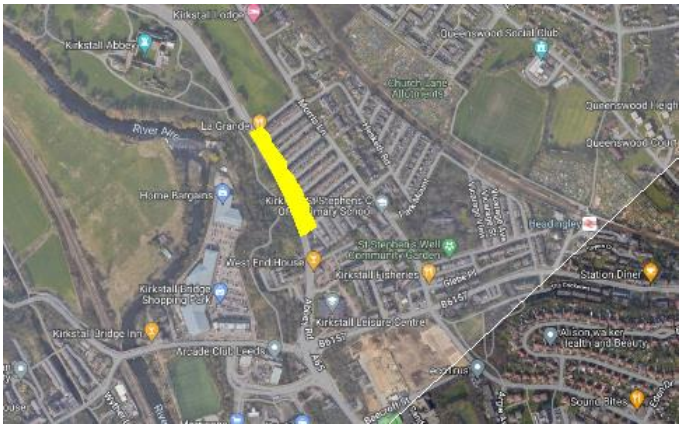
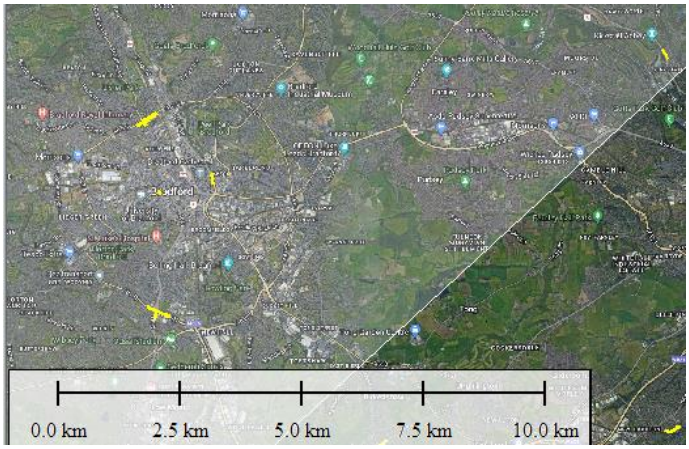
5.3.2.3.2. **Carried forward as the preferred option.**

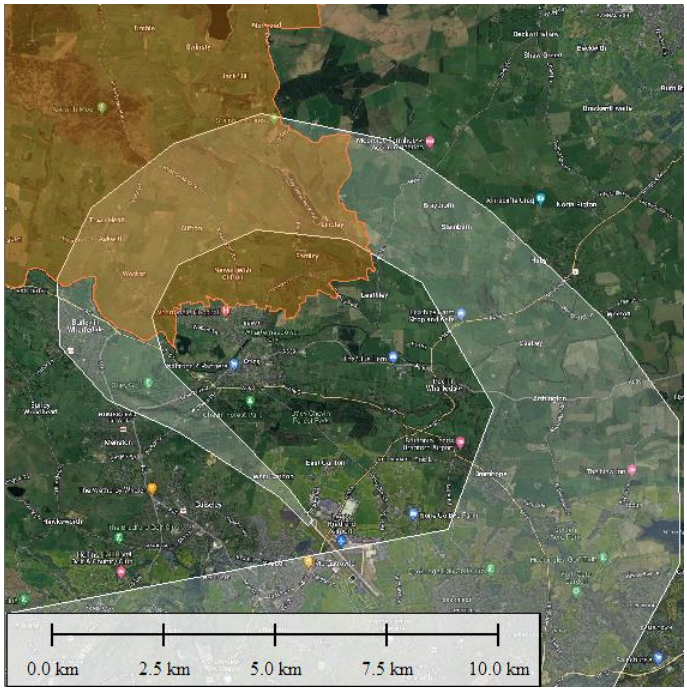
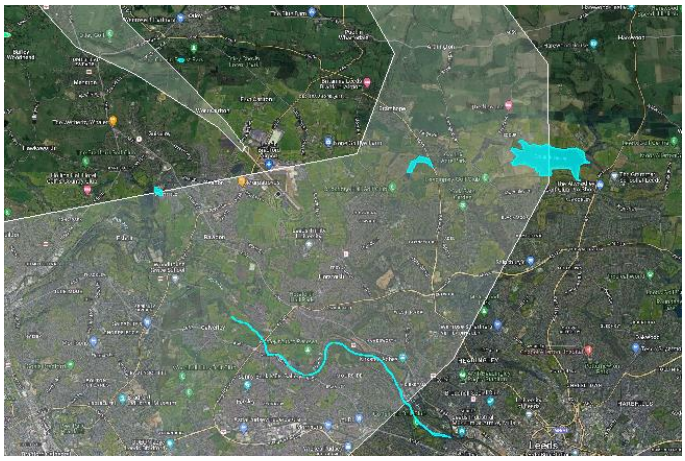
This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN. This option is the option most consistent with existing published procedures.

5.3.2.4. Runway 32 South and West Option A

5.3.2.4.1. This DO would initially turn right and loop around to head south-west. Initially the areas overflown are relatively sparsely populated, however, In the later stages this DO overflies densely populated areas in northern Leeds, Bradford, Keighley and Halifax.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The image shows the Baseline (peach), and that the existing NPR is contained within the 32S&WA swathe (grey) until it reaches Burley-in-Wharfedale. It then turns right to the North of Otley, overflying less densely populated areas. Communities of North-West Leeds may experience some aviation noise from aircraft between 5,000 and 7000ft. 

Group	Impact	Qualitative Assessment
	Air Quality	AQMAs at Kirkstall (top image), Leeds and A6177 at Clifton Villas, Sun Street in Eastbrook, Tetley Street and the intersection of Carr street and A641 at Marshfields. These would be newly overflown compared to the Baseline.  
Wider society	Greenhouse gas impact	Continuous Climb should offset additional track miles from a fuel burn perspective.
	Capacity/ resilience	No change. A Probable use limited to Night Operations. Extra CAS would probably be required to the East of the airport

Group	Impact	Qualitative Assessment
	Tranquillity	Nidderdale AONB now overflown unlike with Baseline. 
	Biodiversity	Flies over Eccup Reservoir, Breary wood and the Leeds-Liverpool canal SSSIs below 4000ft. These are not flown over by the Baseline but avoids the South Pennines Moors (SSSI, SAC, SPA) 
General aviation	Access	Small chance of additional airspace requirement to the East of LBA.

Group	Impact	Qualitative Assessment
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Additional track miles but the continuous climb should offset this.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, but may contribute to improving fuel efficiency, and reducing noise.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the East of the airport. The route would however, de-conflict with any inbound transition from the BARTN area as the additional miles flown would ensure a climb gradient well above what is required to de-conflict the two routes. The South East option would also require a right turn departure, otherwise the interaction between SIDS could be complex.

Table 22: Runway 32 South and West Option A

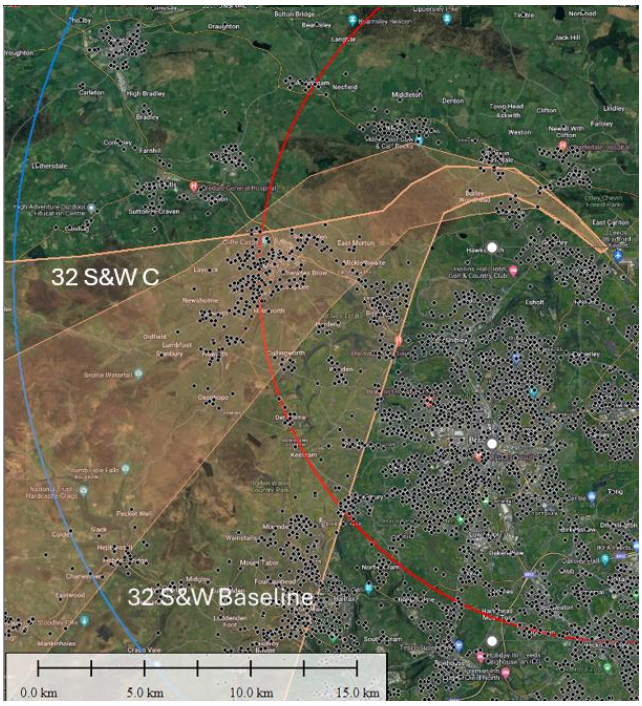
5.3.2.4.2. **Carried forward**.

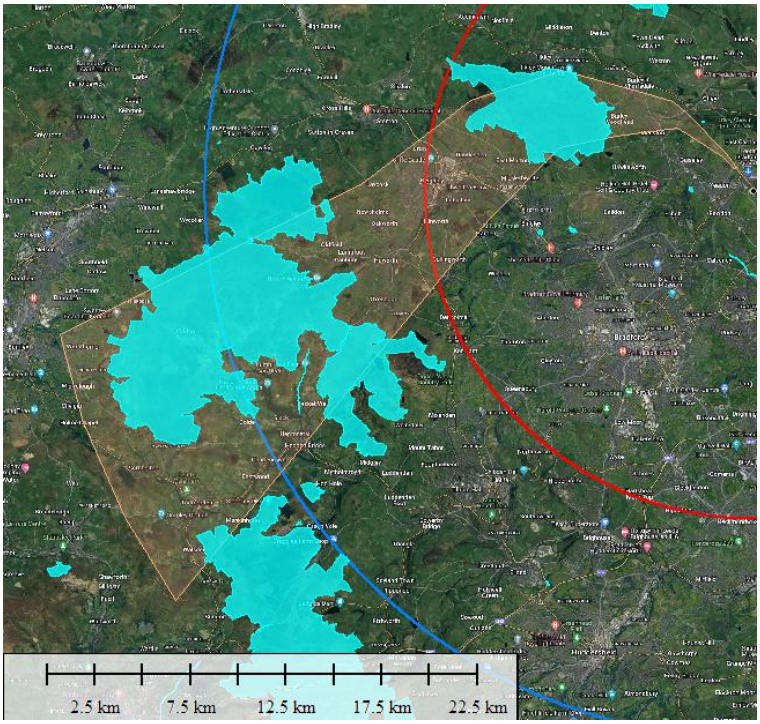
This option is carried forward on the basis there could be a reduction in noise impact to communities below 4000ft with fewer AQMAs affected, in line with the Government's altitude-based priorities. A right turn out on departure could improve capacity and resilience.

Conversely, there would be a requirement for additional CAS which would have a safety impact if not obtained and does not align with the AMS. There would also be an increase in biodiversity and tranquillity impacts, particularly on the Nidderdale AONB at low level which is not currently impacted.

5.3.2.5. Runway 32 South and West Option C

5.3.2.5.1. This DO is initially similar to the Baseline overflies largely the same areas.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline. The 32S&WC swathe (most North-Westerly of the two, the other being the Baseline) contains the NPR but then routes slightly further west over Keighley as opposed to Bingley. 
	Air Quality	Insignificant change below 1,000ft and therefore it is assessed that there would be little impact on air quality. No AQMAs identified.
Wider society	Greenhouse gas impact	Similar track mileage to the Baseline so negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	Similar to the Baseline – Ilkley Moor overflown.

Group	Impact	Qualitative Assessment
	Biodiversity	South Pennine Moors (SAC, SPA and SSSI) flown over, aircraft are possibly under 4000ft at this point, these are sililar to the Baseline. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.

Group	Impact	Qualitative Assessment
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	This option does not conflict with any other Leeds inbound routes and gives continuous climb. The track to POL does however conflict with the inbound GOLES-ROSUN Manchester STAR. This would potentially mean a period of level flight for a number of aircraft as they pass beneath the Manchester inbounds descending to FL80. The distance flown is around 7nm less than the Baseline SID, however there is the possibility that a larger number of aircraft will receive a level period of flight, particularly if traffic levels increase to the predicted numbers in the next decade.

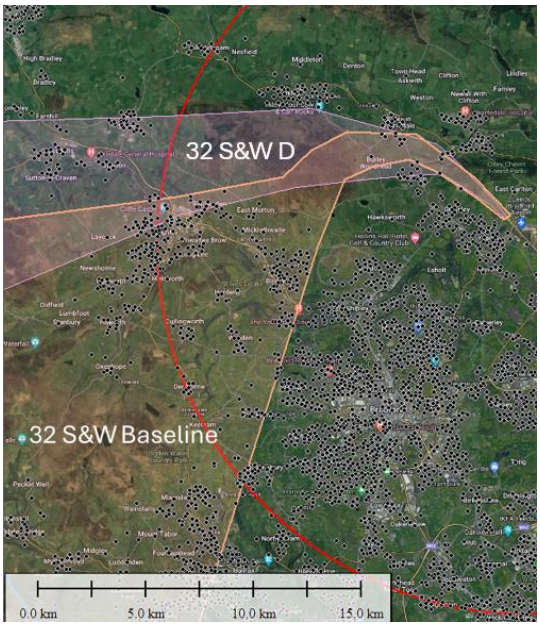
Table 23: Runway 32 South and West Option C

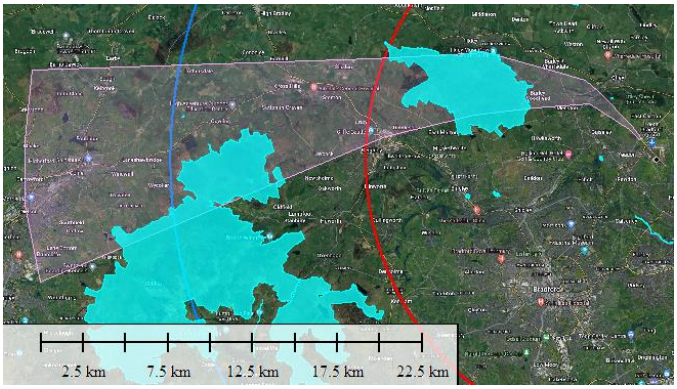
5.3.2.5.2. **Carried forward**.

This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

5.3.2.6. Runway 32 South and West Option D

5.3.2.6.1. This DO is initially similar to the Baseline, but heads further north. This overflies less of Keighley but more of Bradford.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of similar or slightly lower population density would be overflown. The NPR is contained within this swathe but then the swathe diverges from the Baseline to the West and then to the Northern side of Keighley. 
	Air Quality	Insignificant change below 1,000ft and therefore it is assessed that there would be little impact on air quality. No AQMAs identified.
Wider society	Greenhouse gas impact	Similar track mileage to the Baseline so negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	Similar to the Baseline – Ilkley Moor overflown.

Group	Impact	Qualitative Assessment
	Biodiversity	South Pennine Moors (SAC, SPA and SSSI) flown over, aircraft are possibly under 4000ft at this point. Marginal improvement compared to the Baseline, however below 4000ft, the imapct is the same. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	Although this option points departures towards a potential arrival route (via NELSA) which could result in complexities, upon further assessment this is not considered to be an overriding safety factor as there would be procedures put in place to mitigate the safety risk.

Group	Impact	Qualitative Assessment
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	This option would connect to the airways system at NELSA for outbounds routing to the West, North West or Northbound. It should be noted that under current procedures, traffic routing to the common South West airways also take this route. It is therefore forecast that outbound traffic will significantly reduce on this particular route by at least 50%. The only confliction on this route would be caused by traffic routing Northbound, which would cross the track of inbound traffic routing on the transition from the North Western Hold. It is predicated that the northbound segment of this SID would only be used 1-2 times per day therefore the chance of an actual confliction requiring tactical intervention would be low.

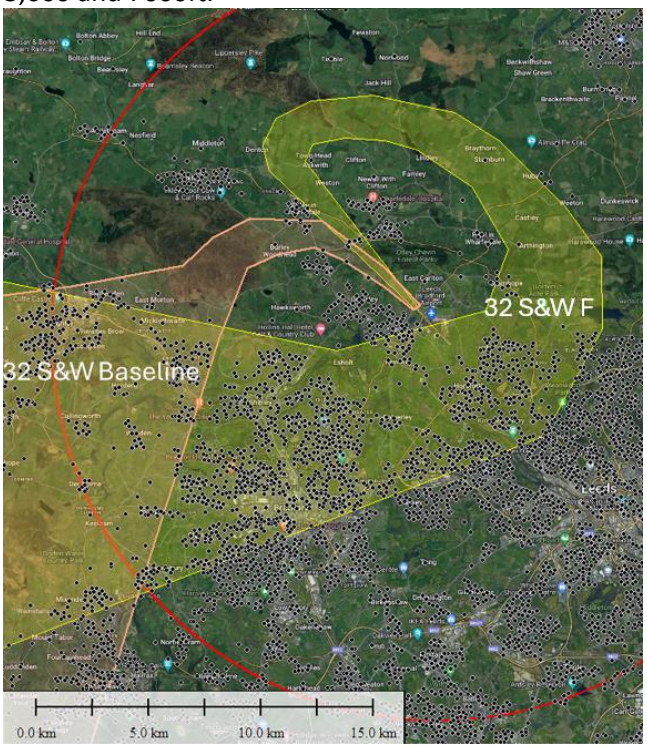
Table 24: Runway 32 South and West Option D

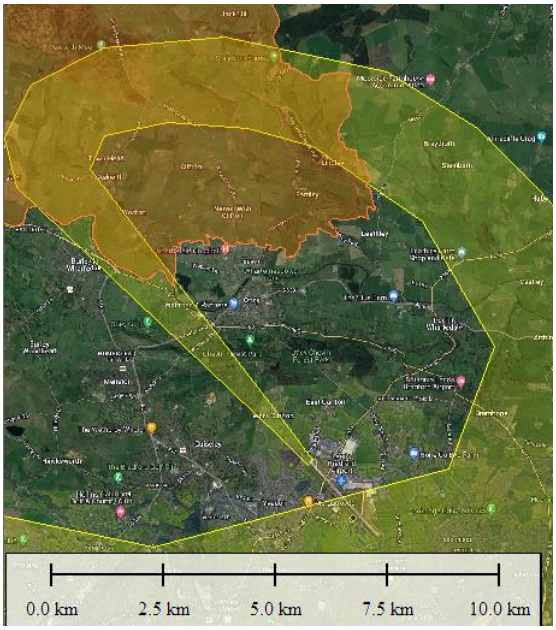
5.3.2.6.2. **Carried forward.**

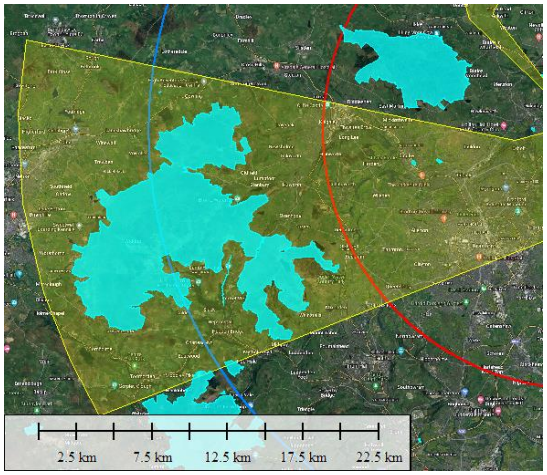
This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

5.3.2.7. Runway 32 South and West Option F

5.3.2.7.1. This DO is similar to Option A, but the initial right turn occurs slightly later. This would result in aircraft being slightly higher when they overfly Leeds. In the latter stages this DO also flies slightly further north than Option A.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The image shows that the existing NPR is only contained within the 32S&WF swathe (yellow) briefly as the NPR veers to the North-West with the Baseline (peach) whilst 32S&WF maintains runway track overflying the western side of Otley. Communities of North-Western Leeds may experience some aviation noise from aircraft between 5,000 and 7000ft. 
	Air Quality	AQMAs at Kirstall, Leeds and A6177 at Clifton Villas, Sun Street in Eastbrook, Tetley Street and the intersection of Carr Street and A641 at Marshfields. These are not flown over by the Baseline.

Group	Impact	Qualitative Assessment
Wider society	Greenhouse gas impact	Additional track mileage as compared to the Baseline resulting in greater fuel-burn however may result in unrestricted climb as it turns away from the congested POL area initially. An unrestricted climb could offset the additional track mileage.
	Capacity/ resilience	An improvement on the Baseline as departures are turned away from busy airspace to the west of LBA.
	Tranquillity	The Nidderdale AONB is impacted instead of Ilkley Moor. Eccup Reservoir is also overflown by the swathe. 

Group	Impact	Qualitative Assessment
	Biodiversity	South Pennine Moors (SAC, SPA and SSSI) flown over, aircraft are likely over 4000ft at this point. The northern section of the South Pennine Moors is avoided with this option. See image below. A greater number of biodiversity sensitive areas are flown over compared to the Baseline. 
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Potentially this route may need RNP1 with RF capability for airspace containment, especially if an extension of CAS to the east is not viable.
	Fuel-burn	Additional track mileage as compared to the Baseline resulting in greater fuel-burn however may result in unrestricted climb as it turns away from the congested POL area initially. An unrestricted climb could offset the additional track mileage.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.

Group	Impact	Qualitative Assessment
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The DPE assessed this DP as Amber due to lack of CAS containment on this wraparound SID. This could be mitigated by a marginal extension of CAS to the East. It is assessed that departures could climb well above inbounds to RW32.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, but has the potential to reduce noise impact. In addition, this option only meets systemisation for N/NW/W routes through NELSA. This option would not offer connectivity through POL for SW and S flights.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the East of the airport. The additional miles generated by the straight-ahead portion of the climb may be beneficial as in many cases outbounds could climb above the Manchester inbound track routing from GOLES into ROSUN.

Table 25: Runway 32 South and West Option F

5.3.2.7.2. **Carried forward**.

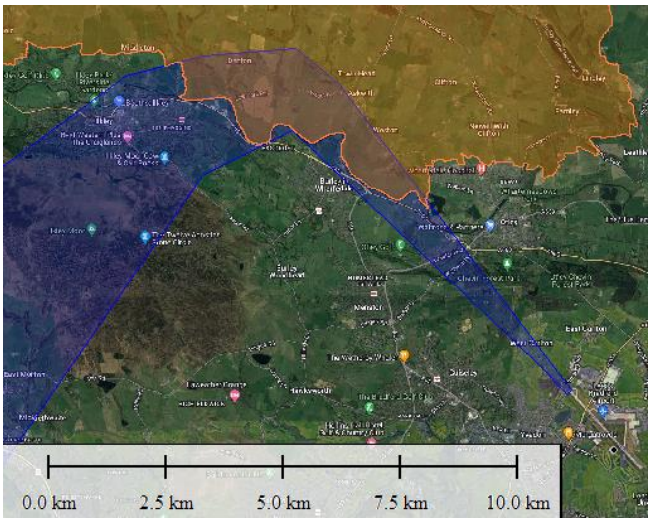
This option is carried forward on the basis there could be a reduction in noise impact to communities below 4000ft, with fewer AQMAs affected, in line with the Government's altitude-based priorities. A right turn out on departure could improve capacity and resilience.

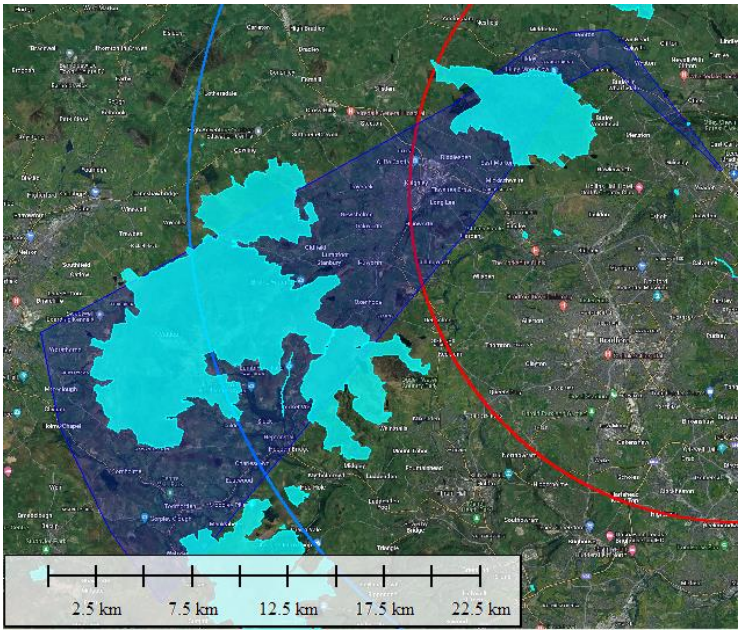
Conversely, there would be a requirement for additional CAS which would have a safety impact if not obtained and does not align with the AMS. There would also be an increase in biodiversity and tranquillity impacts, particularly on the Nidderdale AONB at low level which is not currently impacted.

5.3.2.8. Runway 32 South and West Option G

5.3.2.8.1. This DO is similar to Option C, but the initial left turn occurs slightly later. This results in overflying the area around Ilkley. The latter stages of this design option overfly largely the same areas as the Baseline and Option C.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a slightly higher population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of similar population density would be overflown. The 32S&WG swathe routes out on runway track for longer resulting in a routing to the East of the NPR and over Otley, Burley-in-Wharfedale, Esscroft, Ben Rhydding and Ilkley. It then remains slightly North of the Baseline resulting in overflight of Keighley. Additionally, Otley is also overflown with inbound traffic when 14 is in use. Under current procedures, the noise impact is shared between Burley and Menston for departures, and Otley for arrivals. 

Group	Impact	Qualitative Assessment
	Air Quality	Minor change below 1,000ft and therefore it is assessed that there would still be little impact on air quality. No AQMAs identified below 4000ft.
Wider society	Greenhouse gas impact	Marginally greater track mileage to the Baseline but still likely to be a negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	Ilkley Moor and Nidderdale AONB overflown unlike the Baseline. 

Group	Impact	Qualitative Assessment
	Biodiversity	South Pennine Moors (SAC, SPA and SSSI) flown over as the Baseline however a different section is flown over, farther to the north of the South Pennine Moors. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.

Group	Impact	Qualitative Assessment
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the North and East of the airport. The additional miles generated by the straight-ahead portion of the climb may be beneficial as in many cases outbounds could climb above the Manchester inbound track routing from GOLES into ROSUN.

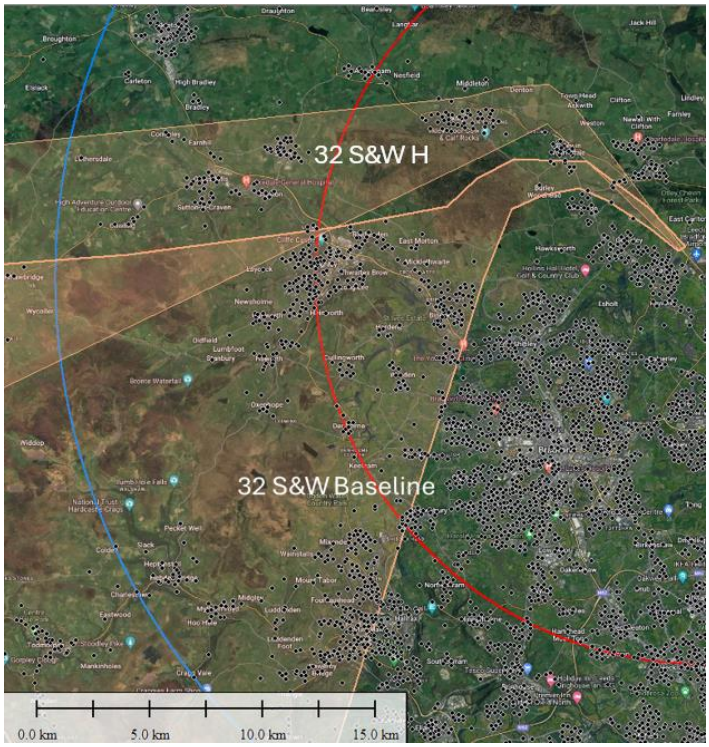
Table 26: Runway 32 South and West Option G

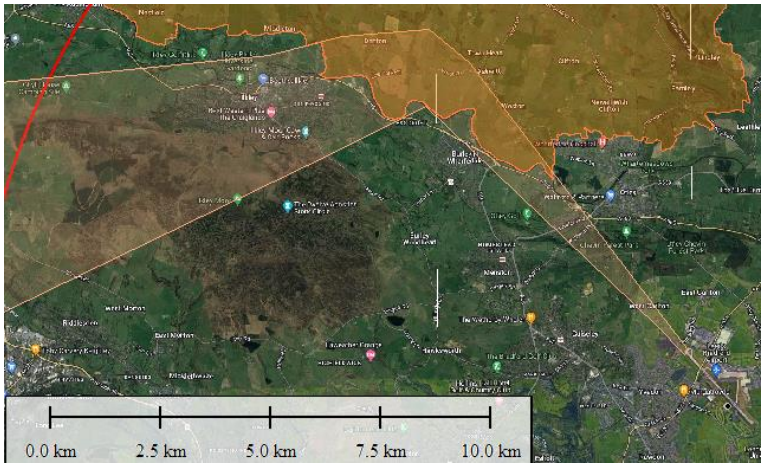
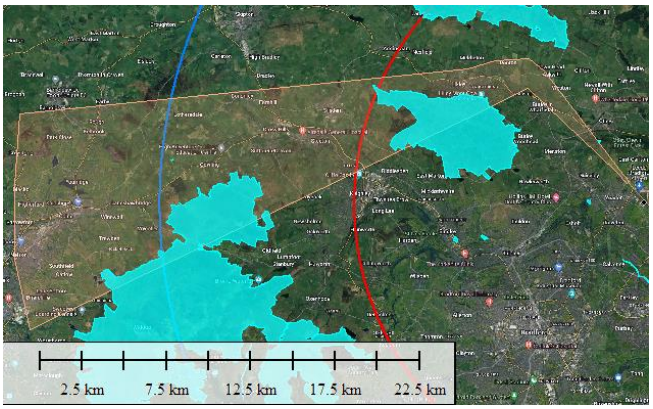
5.3.2.8.2. **Discounted.**

This option is discounted as it is anticipated there will be greater noise impact on communities at lower altitudes, below 4000ft and the Nidderdale AONB is also overflown, these factors do not align with the Government's altitude-based priorities.

5.3.2.9. Runway 32 South and West Option H

5.3.2.9.1. This DO is similar to Option D, but the initial left turn occurs slightly later. This results in overflying the area around Ilkley. The latter stages of this design option overfly largely the same areas as Option D.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a slightly higher population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of similar or slightly lower population density would be overflown. The NPR is not contained within this swathe as it maintains runway track over Western Otley and Burley-in-Wharfedale before turning overhead Ilkley and then to the North of Keighley. Additionally, Otley is also overflown with inbound traffic when 14 is in use. Under current procedures, the noise impact is shared between Burley and Menston for departures, and Otley for arrivals. 
	Air Quality	Minor change below 1,000ft and therefore it is assessed that there would be no significant impact on air quality. NO AQMAs identified.

Group	Impact	Qualitative Assessment
Wider society	Greenhouse gas impact	Greater track mileage to the Baseline but still likely to be a negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	Ilkley Moor and Nidderdale AONB overflown unlike the Baseline. 
	Biodiversity	South Pennine Moors (SAC, SPA and SSSI) flown over, aircraft are possibly under 4000ft at this point, this is similar to the Baseline however a different section of South Pennine Moors would be flown over. 
General aviation	Access	No impact.

Group	Impact	Qualitative Assessment
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Additional track miles will result in greater fuel-burn.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	This points a departure towards a potential arrival route (via NELSA) and could result in complexities.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Potential to conflict with the proposed transition from the North Western STAR which initially routes to the North and East of the airport.

Table 27: Runway 32 South and West Option H

5.3.2.9.2. **Discounted.**

This option is discounted as there would be an increase in disturbance to communities below 4000ft, the Nidderdale AONB would be overflown at low level and the more northerly track placement on departure would point traffic towards arrival routes which could have safety implications.

5.3.3. Runway 32 South and West Combination Options

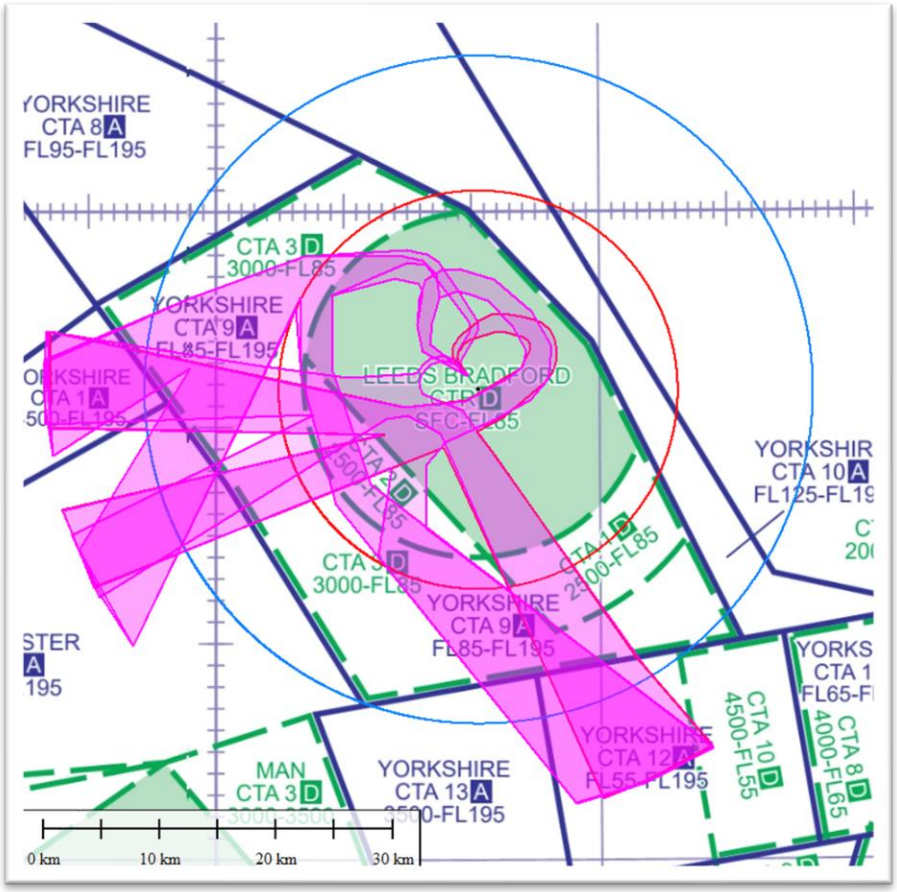


Figure 10: Runway 32 South and West Combination Options

5.3.3.1. Runway 32 Combination Option A

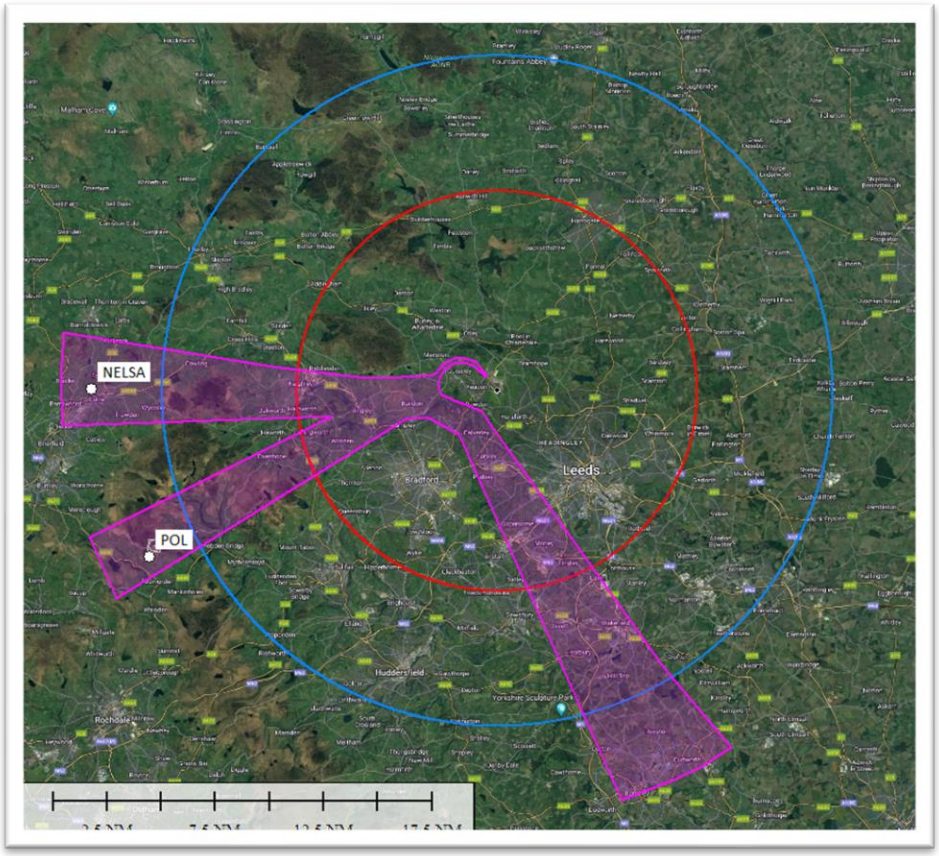


Figure 11: Runway 32 Combination Option A over Google Maps Satellite

5.3.3.1.1. 32NEWA was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

5.3.3.1.2. This option uses modern navigational techniques (Radius-to-Fix turns[12]) to navigate over the fields between North Guiseley (Wetherby Whaler Restaurant area) and South Menston. The objective is to reduce the noise nuisance from the existing route over North Menston/South Burley by sharing the load between the two routes. Flight paths could be altered on a daily basis to share the noise between the two areas. As satellite navigational techniques are used, the flight tracks over the ground will have greater accuracy.

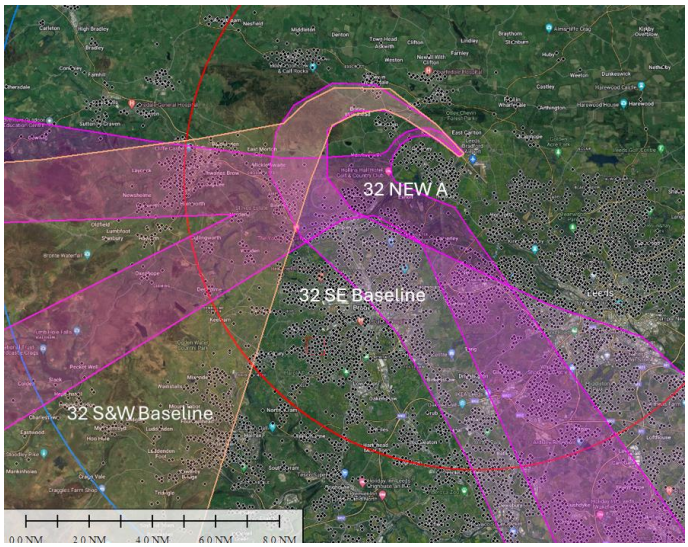
[12] A Radius to Fix (RF) leg is defined as a constant radius circular path around a defined turn centre that terminates at a fix. Like putting a pin in a board with a piece of string and drawing a circle using a pen attached to that piece of string. These turns, encoded into the navigation database, allow aircraft to avoid critical areas of terrain or conflicting airspace while maintaining positional accuracy by maintaining precise, positive course guidance along the curved track.

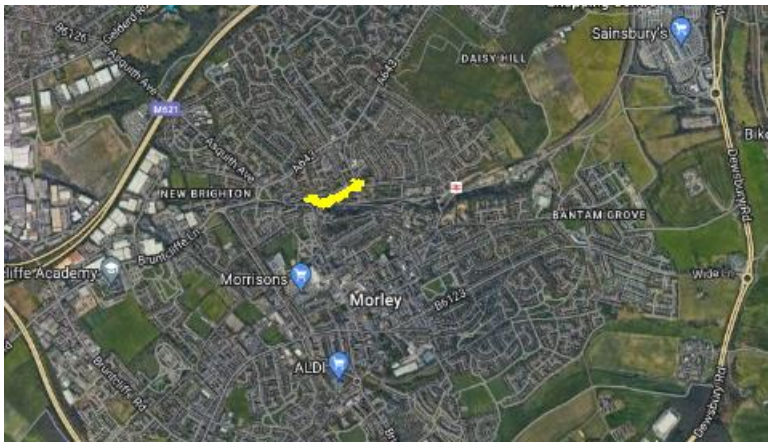
5.3.3.1.3. This proposed route uses the latest Satellite Navigational technology of modern aircraft to fly a RNP1 SID with RF turns. On departure, the traffic takes an early left hand turn on the Northern outskirts of Guiseley to track over open land in the gap between Guiseley and Menston. Note that this departure illustrates the basic concept of early RF turns on departure but would require further assessment from Instrument Flight Procedure (IFP) designers to assess viability for what is a marginal turn on departure.

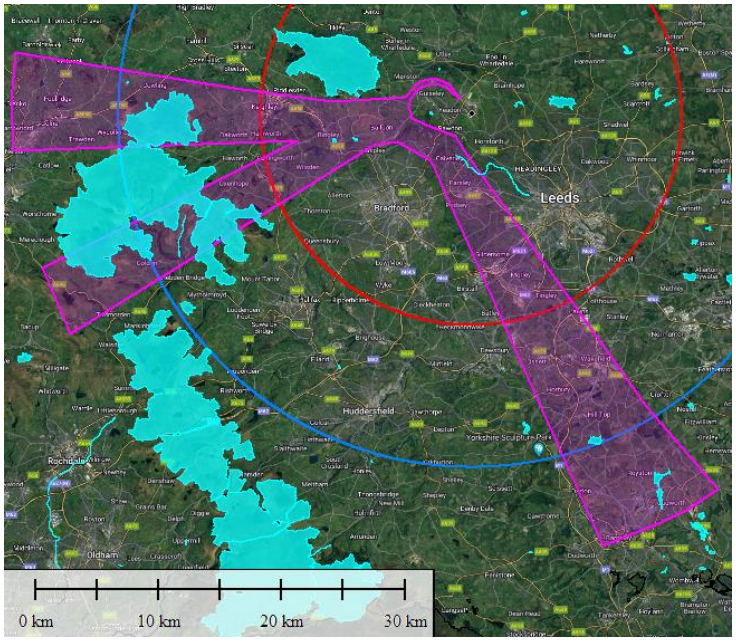
5.3.3.1.4. The initial track is designed to reduce the noise impact on the Western Otley, North Menston and Burley in Wharefdale communities. Small parts of Northern Guiseley and South Menston would however encounter more noise than on the Baseline routes.

5.3.3.1.5. Due to the earlier departure turn, Bingley (3500 ft or above) and Keighley (4000 ft and above) would be overflown at lower heights than the Baseline. This could be potentially mitigated by RNP1 designs to avoid the centre of these population areas.

5.3.3.1.6. Whilst there are limitations to this route, it could possibly have potential to be used as a respite option in conjunction with other routes.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This combination option was developed as a potential respite route. It would provide respite to communities north of the airport, such as Burley Woodhead, West and East Morton and Burley in Warfdale. Newly overflown communities would include Baildon, Thackley End and Calverly. 

Group	Impact	Qualitative Assessment
	Air Quality	AQMA at Morely, however aircraft are expected to be between 5000ft or above at this point (on a 7% climb gradient), this is no different from the Baseline. 
Wider society	Greenhouse gas impact	Around 4-5 miles saved from the early turn on track after departure. This, however, may be penalised by periods of level flights caused by conflictions with other routes.
	Capacity/ resilience	If all departures follow this track, capacity remains identical to Baseline. If, however, this route is followed by South and westbound flights, and the SE flights were to take a right turn option, runway capacity could be increased with RW32 intersection departures utilising a 1-minute departure interval, rather than 2 minutes.
	Tranquillity	No AONBs or National Parks are flown over with this option as with the Baseline.

Group	Impact	Qualitative Assessment
	Biodiversity	Leeds-Liverpool canal SSSI may be flown over below 4000ft unlike the Baseline and South Pennine Moors (SAC, SPA and SSSI) flown over above 4000ft, this is similar to the Baseline. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	NELSA Route: SID require RNP1 with ability to fly RF fixes which may preclude some aircraft types. POL Route: SID require RNP1 with ability to fly RF fixes which may preclude some aircraft types. Southeast Route to MAMUL/LAMIX: SID require RNP1 with ability to fly RF fixes which may preclude some aircraft types. Early turn has impact on traffic routing from and to the Salt Mills VRP which may cause delays to VFR movements. If used only as a night time, respite route this would not be an issue. Many GA aircraft departing IFR may not have the onboard equipment to fly the RNP1 RF departure.
	Fuel-burn	Around 4-5 miles saved from the early turn on track after departure. This, however, may be penalised by periods of level flights caused by conflictions with other routes. Therefore, possible fuel savings.

Group	Impact	Qualitative Assessment
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	There may be a requirement for fleet upgrades with this option which could incur extra costs for the airlines. Requires RNP 1 with RF turns. The vast majority of operators should be equipped to fly this SID, however a small amount of older aircraft not equipped would be required to fly on a non-standard departure.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	This proposed route has yet to be assessed by an authorised IFP designer. There may be a number of factors which make the route unviable, including radius of turn and associated bank angle and speeds required to accurately fly the turn between Guiseley and Menston. Terrain clearance margins also need to be assessed on the initial departure turn against the Chevin, along with the track towards the high ground of Baildon Moor.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.

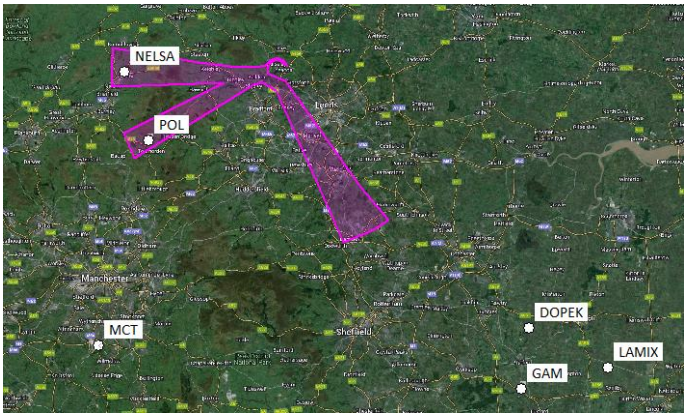
Group	Impact	Qualitative Assessment
	Interdependencies, conflicts and trade-offs	NELSA Route: The SID is separated from all arrival transitions except for the rarely used north bound turn which would conflict with the North Western Hold. The POL SID would not conflict with any inbound transition. Due to the early turn, traffic would be presented to the area sector at a lower altitude than current Baseline operations. It is likely that a restriction of FL80 will be imposed by NERL at POL for departures out of Leeds. There is potential that due to the shortened track miles due to the early turn, that outbound traffic from Leeds may not make the required POL level restriction. The route also conflicts with the Manchester inbound GOLES-ROSUN track which will result in periods of level flight for a number of departures on this route. Route to MAMUL/LAMIX: The early turn will in many cases cause a confliction with the proposed inbound transition from BARTN to runway 32. The proposed standard outbound SID would include a waypoint associated with a 7% climb gradient to ensure that the outbound track was at least 1000 ft above the BARTN inbound transition. Due to the early turn on this SID, it is unlikely that the outbound traffic could make a level to clear the inbound BARTN track. This could result in around a 10nm period of level flight at 4000 ft unless tactical vectoring was used to solve the conflict. 

Table 28 :Runway 32 Combination Option A

5.3.3.1.7. **Carried forward** as a potential respite route, this would be our preferred respite/night time option.

5.3.3.1.8. This option is carried forward on the basis there would be a reduction in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

5.3.3.2. Runway 32 Combination Option B

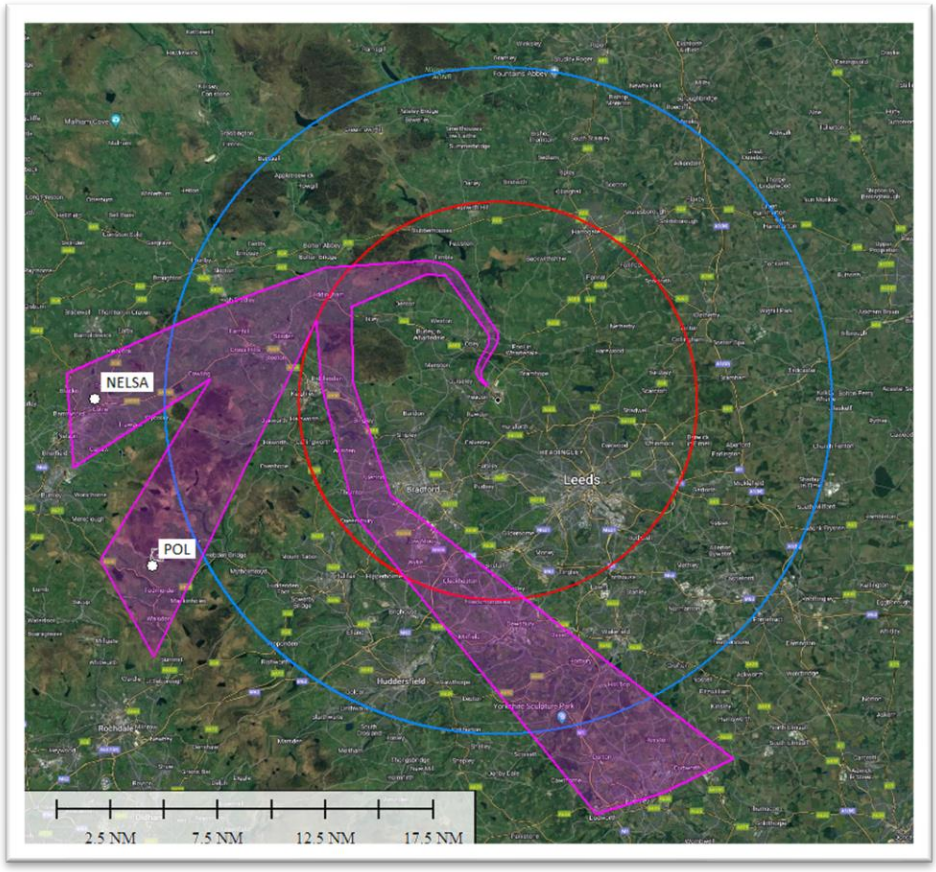


Figure 12: Runway 32 Combination Option B over Google Maps Satellite

5.3.3.2.1. 32NEWB was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

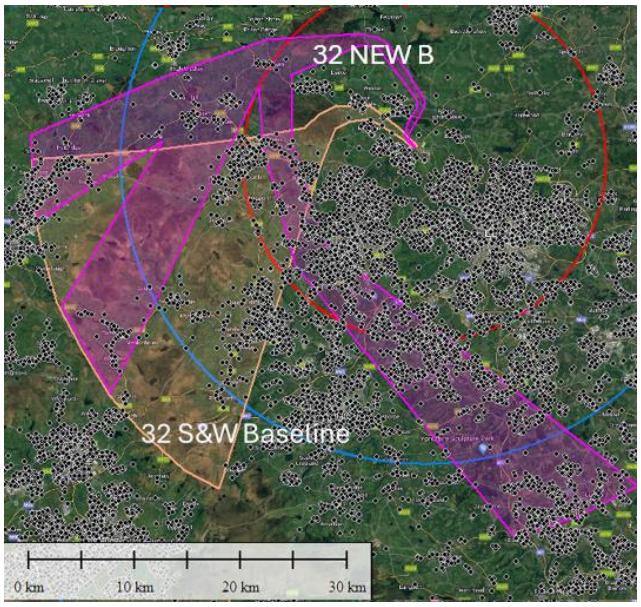
5.3.3.2.2. This option involves an early right turn over the Chevin followed by a left turn intended to route around the back of Otley and in so doing, reduce the populated areas overflown. The initial climb-out is then split in the three most in demand departure directions. The extra track distance makes less likely for regular use but instead as a night-time noise abatement route.

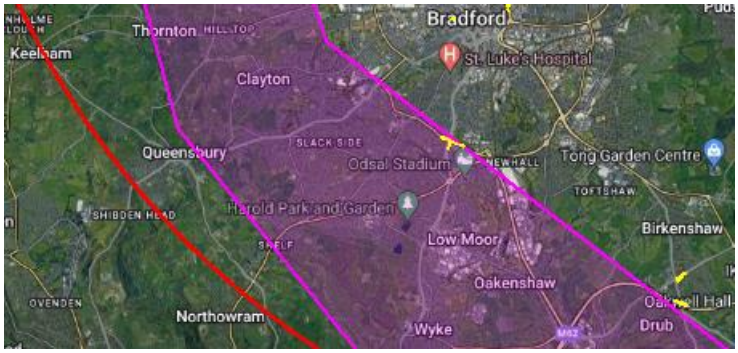
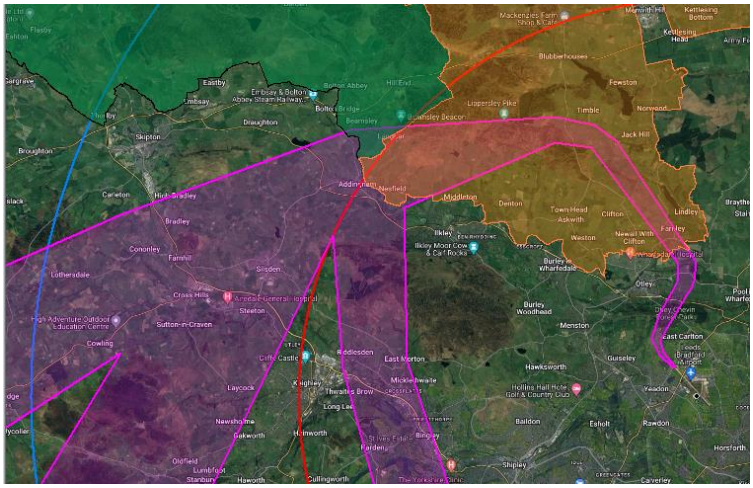
5.3.3.2.3. The objective of this SID is to create an early right turn after departure in order to avoid overflying the town of Otley. Burley In Wharfedale and Menston would no longer be overflown.

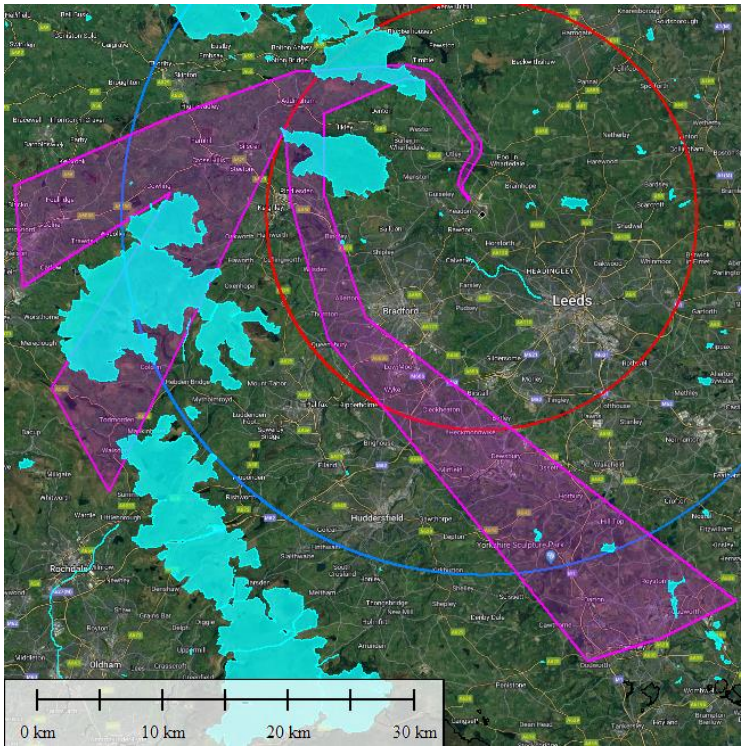
5.3.3.2.4. There are two potential options that can be explored to achieve this early right turn.

a. By using the latest Satellite Navigational technology of modern aircraft to fly a RNP1 SID with RF turns. The placing of the first turn waypoint however may be problematic as it would need to be around 0.7nm from the runway end. This could potentially cause aircraft to overfly southern Otley in the turn. This option would require validation from an IFP designer and most likely trials in flight simulators to assess if the turn is viable.

b. A right turn commenced at 500 ft towards a Waypoint to the North East. This could potentially give the possibility of an earlier turn than option a as a number of aircraft would cross 500 ft earlier than 0.7nm. The disadvantage to this method is that predictability of track is not possible, any slow climbers could potentially overfly Otley in the turn, thus defeating the object of the SID.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option was introduced as a potential night time route. Newly flown over communities include Addingham, Silsden and Cross hills to the North and Clawton to Oakenshaw in the south section of the swathe. The populations densities overflown are anticipated to be slightly less with this option. 

Group	Impact	Qualitative Assessment
	Air Quality	The AQMA at the intersection of Carr street and A641 at Marshfields could be newly overflown, see image below. The Baseline does not currently fly over this AQMA but does fly over more AQMAs at a lower altitude. 
Wider society	Greenhouse gas impact	Extra track miles mean this option would have a negative impact on greenhouse gas, however these extra miles could facilitate a continuous climb departure. Estimated 8nm additional miles flown compared to the Baseline.
	Capacity/ resilience	Insignificant difference from the Baseline.
	Tranquillity	Overflies Nidderdale AONB and a small section of the Yorkshire Dales National Park unlike the Baseline. 

Group	Impact	Qualitative Assessment
	Biodiversity	Possible impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Currently only the South Pennine Moors are affteced. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Confliction with any VFR flights to/from Harrogate. The early right turn also potentially conflicts with helicopters operations out of Coney Park. Delays could be caused to training flights on these routes which would require holding off for outbound traffic.
	Fuel-burn	Extra track miles mean this option would have a negative impact on fuel burn, however these extra miles would facilitate a continuous climb departure.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.

Group	Impact	Qualitative Assessment
	Other costs	Requires RNP 1 with RF turns. The vast majority of operators should be equipped to fly this SID, however a small amount of older aircraft not equipped would be required to fly on a non-standard departure.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The SID length and design would need to ensure that the outbound track is separated from any proposed missed approach procedure at the point when the departure turns westbound towards the runway 32 climb out.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It also contributes to the AMS objective of reducing noise. It does not contribute to the AMS objective of reducing CAS or improving fuel efficiency.

Group	Impact	Qualitative Assessment
	Interdependencies, conflicts and trade-offs	NELSA Route: The initial right turn would conflict with the inbound transition from the North West Hold which may result in a level period of flight at 6000 ft, POL Route: Potential to conflict with the proposed transition from the North Western STAR which initially routes to the North and East of the airport. The additional miles generated by the extended track could be advantageous as it would allow outbound traffic to be well above the Manchester inbound routing from GOLES into ROSUN. MAMUL/LAMIX Route: Potential to conflict with the proposed transition from the North Western STAR which initially routes to the North and East of the airport. Separated from all routes other than the inbound transition from the North Western Hold. This could potentially mean a period of level flight for outbounds until clear of the inbound transition track. 

Table 29: Runway 32 Combination Option B

5.3.3.2.5. **Carried forward** as a potential night time route.

This option is carried forward on the basis there would be a reduction in noise impact below 4000ft, although new communities would be impacted, aligning with the Government's altitude-based priorities. The Nidderdale AONB would be impacted at low level and impacts on biodiversity could increase. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

5.3.3.3. Runway 32 Combination Option C

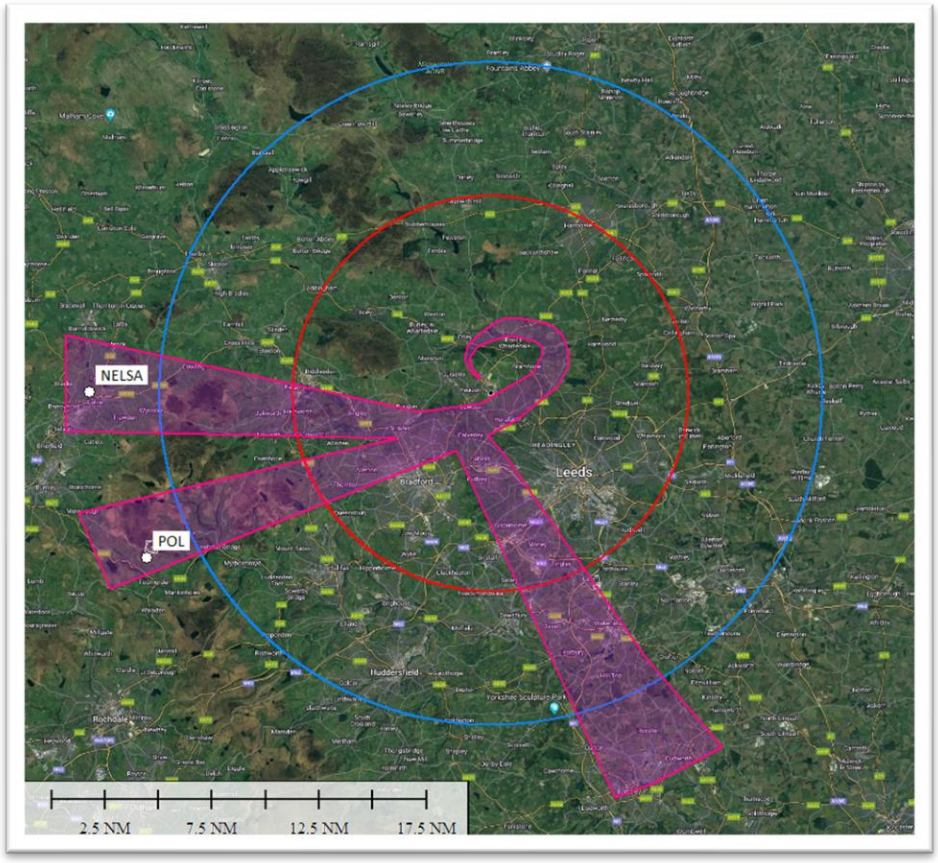


Figure 13: Runway 32 Combination Option over Google Maps Satellite

5.3.3.3.1. 32NEWC was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

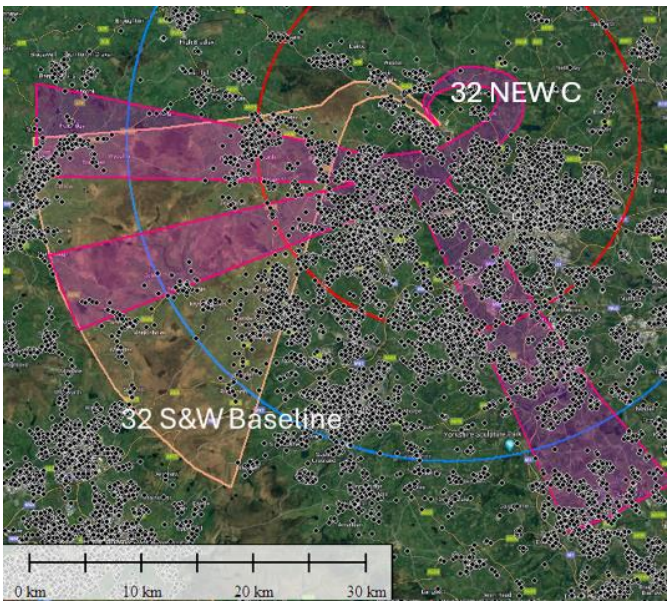
5.3.3.3.2. This option uses advanced navigational techniques to fly an early right turn after departure to avoid Otley. It is intended as a respite option to share the noise loading with the traditional route over Menston and Burley-In-Wharfedale. The aircraft would climb out looping mainly over countryside to then cross Cookridge (approximately ¾ of a mile East South East of the Airport) at realistically 5000 ft or above.

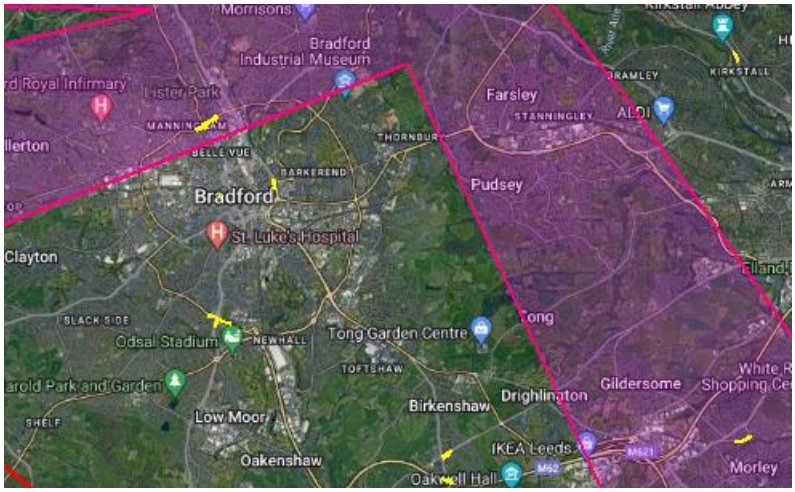
5.3.3.3.3. The objective of this SID is to create an early right turn looping departure in order to avoid overflying the town of Otley. Burley In Wharfedale and Menston would no longer be overflown. The tight looping turn is intended to track the outbound back towards a point 2 miles south of the airport prior to turning on course to the SID endpoints.

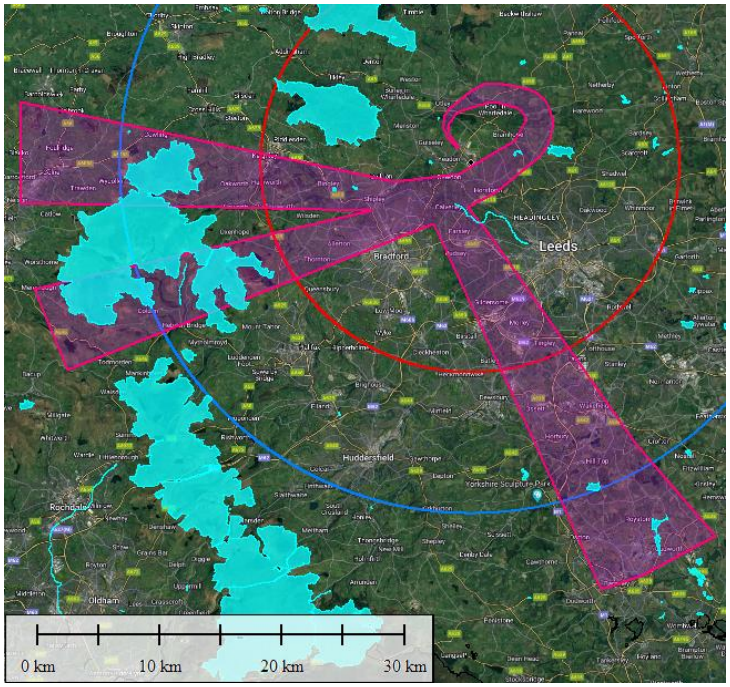
5.3.3.3.4. There are two potential options that can be explored to achieve this early right turn.

a. By using the latest Satellite Navigational technology of modern aircraft to fly a RNP1 SID with RF turns. The placing of the first turn waypoint however may be problematic as it would need to be around 0.7nm from the runway end. This could potentially cause aircraft to overfly southern Otley in the turn. This option would require validation from an IFP designer and most likely trials in flight simulators to assess if the turn is viable.

b. A right turn commenced at 500 ft towards a Waypoint to the North East. This could potentially give the possibility of an earlier turn than option a as a number of aircraft would cross 500 ft earlier than 0.7nm. The disadvantage to this method is that predictability of track is not possible, any slow climbers could potentially overfly Otley in the turn, thus defeating the object of the SID.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option was introduced as potential respite or night route. Newly overflown communities compared to the Baselines are Horsforth, Esholt and Calvery. This option avoids Bradford. Overall, slightly fewer communities would be overflown with this option compared to the Baselines. For the SID to be viable, the track length and climb gradient would need to ensure that the outbound is through 4000 ft prior to turning westbound towards the approach in order to provide separation against the runway 32 missed approach. Horsforth, Calverley and Esholt would therefore be crossed above 4000 ft. 

Group	Impact	Qualitative Assessment
	Air Quality	Two AQMAs would be overrflown at Morley and the north ring road of Bradford. See image below. This is the same as the Baseline. 
Wider society	Greenhouse gas impact	Extra track miles mean this option would have a negative impact on greenhouse gas, however these extra miles could facilitate a continuous climb departure. Estimated 10-12 nm additional miles flown compared to the Baseline.
	Capacity/ resilience	Insignificant difference from the Baseline.
	Tranquillity	No AONBs or National Parks are flown over, the same as the Baseline.

Group	Impact	Qualitative Assessment
	Biodiversity	Flies over, Eccup Reservoir, the Leeds-Liverpool canal SSSIs below 4000ft, and South Pennine Moors (SSSI, SAC and SPA) above 4000ft. The Baseline flies over the South Pennine Moors below 4000ft, this option avoides more biodiversity sensitive areas, with the exception of a small section on the Leeds-Liverpool canal. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Confliction with any VFR flights to/from Harrogate and Eccup. The early right turn also potentially conflicts with helicopters operations out of Coney Park. Delays could be caused to training flights on these routes which would require holding off for outbound traffic.
	Fuel-burn	Extra track miles mean this option would have a negative impact on fuel burn, however these extra miles could facilitate a continuous climb departure.
	Training costs	Very minimal training adapting to an amended departure profile.

Group	Impact	Qualitative Assessment
Commercial airlines	Other costs	There may be a requirement for fleet upgrades with this option which could incur extra costs for the airlines. Option a requires RNP 1 with RF turns. The vast majority of operators should be equipped to fly this SID, however a small amount of older aircraft not equipped would be required to fly on a nonstandard departure.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The SID length and design would need to ensure that the outbound track is separated from any proposed missed approach procedure at the point when the departure turns westbound towards the runway 32 approach.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts, and trade-offs	Separated from all routes other than the inbound transition from the North Western Hold. This could potentially mean a period of level flight for outbounds until clear of the inbound transition track. 

Table 30: Runway 32 Combination Option C

5.3.3.3.5. **Carried forward** as a potential respite route.

This option is carried forward on the basis there would be a reduction in noise impact below 4000ft, although new communities would be impacted, aligning with the Government's altitude-based priorities. There would be a significant increase in track miles but no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

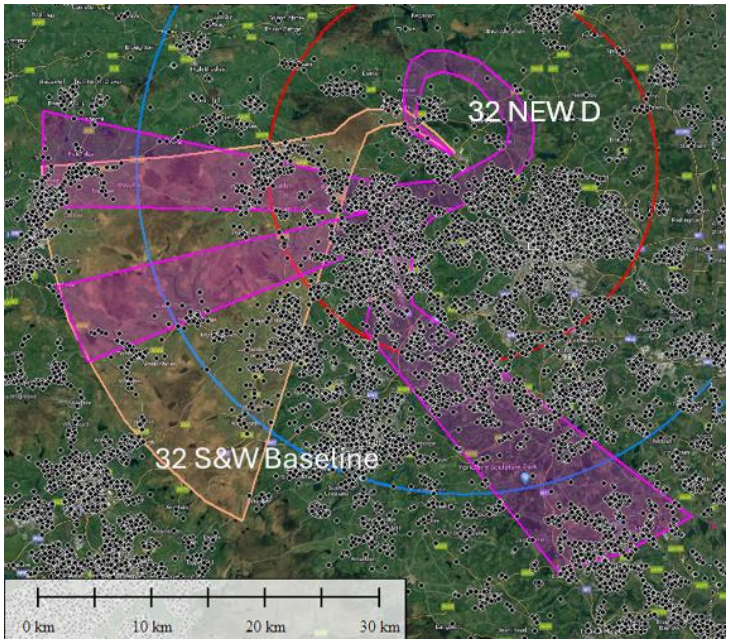
5.3.3.4. Runway 32 Combination Option D

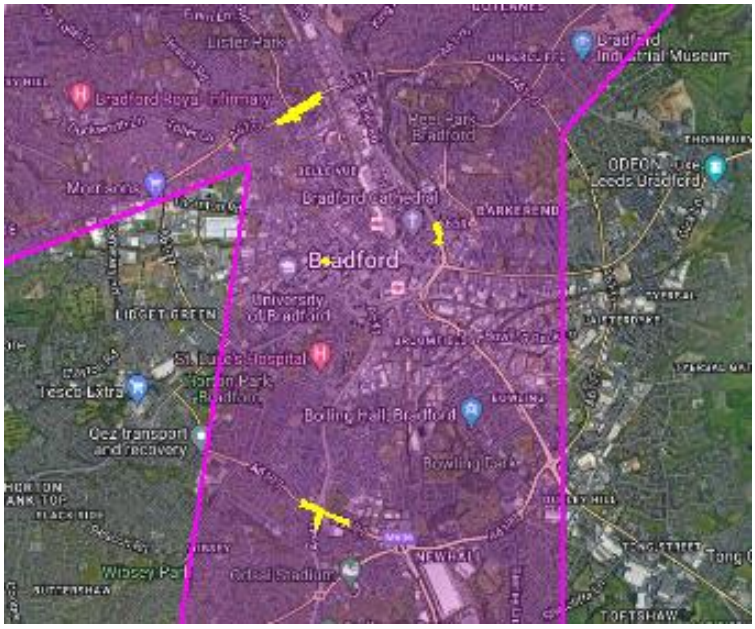
Figure 14 Runway 32 Combination Option D over Google Maps Satellite

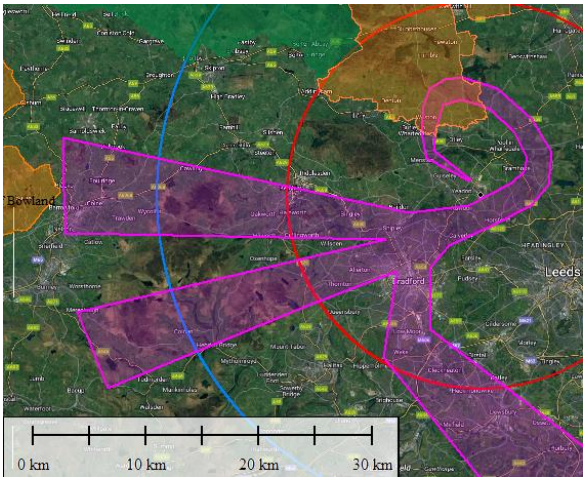
5.3.3.4.1. 32NEWD was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

5.3.3.4.2. This route generally follows the initial track of the existing flightpath for 2 miles to deviate West of Otley. Rather than turning west over Menston, the flightpath makes a wide right turn to the north of Otley to gain height over open countryside prior to turning back westbound. The route is designed to minimise noise to local communities during the night. Due to the excessive miles flown and excess CO_2 produced, this route is not considered viable for continuous operations and is more suited for use at night for purposes of noise nuisance reduction.

5.3.3.4.3. This objective of this SID is to fly the initial track of the Baseline noise abatement to 2.1 DME, prior to turning northbound to avoid Burley In Wharfedale and Menston. Once north of Otley the track takes a looping right turn to cross through the runway 32 approach at 2 miles prior to turning on track to the SID exit points. RF turns are proposed in the looping turn in order to achieve control airspace confinement.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option was introduced as a potential night time route. Newly overflown communities compared to the Baselines are Horsforth, Esholt and Calvery. This option flies over more Bradford communities than the Baselines however avoids Morley, Pudsey and Farsley. Overall fewer people would be flown over below 4000ft than the Baseline as it avoids Leeds. 

Group	Impact	Qualitative Assessment
	Air Quality	The two AQMAs on the northern part and southern parts of the Bradford ring road (A6177) in addition to the two city centre AQMAs, see image below. Although the AQMA at Marshfield (bottom of image below) would be newly over flown over, this option flies over fewer AQMAs than the Baseline. 
Wider society	Greenhouse gas impact	Extra track miles mean this option would have a negative impact on greenhouse gas, however these extra miles could facilitate a continuous climb departure. Estimated 10-12 nm additional miles flown compared to the Baseline. Due to this additional fuel burn, this option may only be viable for night time noise abatement use.
	Capacity/ resilience	Insignificant difference from the Baseline.

Group	Impact	Qualitative Assessment
	Tranquillity	Flies over Nidderdale AONB unlike the Baseline. 
	Biodiversity	Flies over Breary wood and the Leeds-Liverpool canal SSSIs however this would be above 4000ft similaly to the Baseline, however avoids the South Peninne Moors. 
General aviation	Access	There may be a requirement for more controlled airspace as the right turn may not keep aircraft inside the current airspace boundaries.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Extra track miles mean this option would have a negative impact on fuel burn, however these extra miles would facilitate a continuous climb departure.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.

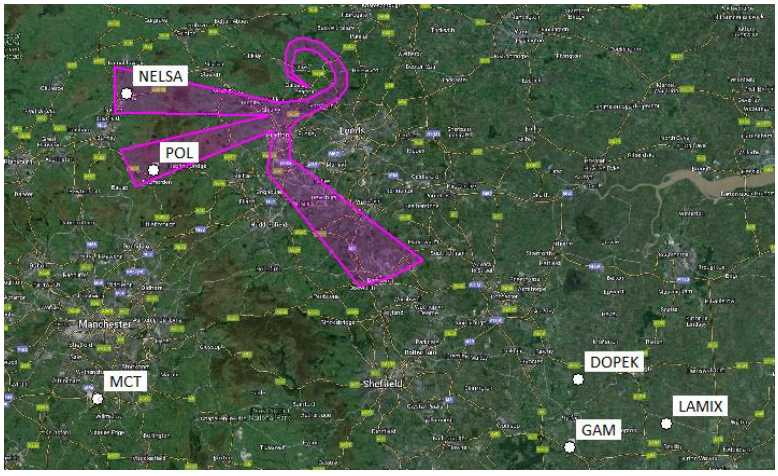
Group	Impact	Qualitative Assessment
	Other costs	Requires RNP 1 with RF turns. The vast majority of operators should be equipped to fly this SID, however a small amount of older aircraft not equipped would be required to fly on a nonstandard departure.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The SID length and design would need to ensure that the outbound track is separated from any proposed missed approach procedure at the point when the departure turns westbound towards the runway 32 approach. The additional miles flown to the North of Otley prior to the turn should give ample distance for the departure to reach this altitude.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It also contributes to the AMS objective of reducing noise. It does not contribute to the AMS objective of reducing CAS or improving fuel efficiency.
	Interdependencies, conflicts and trade-offs	Separated from all routes other than the inbound transition from the North Western Hold. This could potentially mean a period of level flight for outbounds until clear of the inbound transition track. 

Table 31: Runway 32 Combination Option D

5.3.3.4.4. **Carried forward** as a potential night time route.

This option is carried forward on the basis there would be a reduction in noise impact below 4000ft, although new communities would be impacted. The Nidderdale AONB would be impacted at low level and impacts on biodiversity could increase as well as an increase in track miles. This option contributes towards the AMS by introducing PBN.

5.3.3.5. Runway 32 Combination Option E

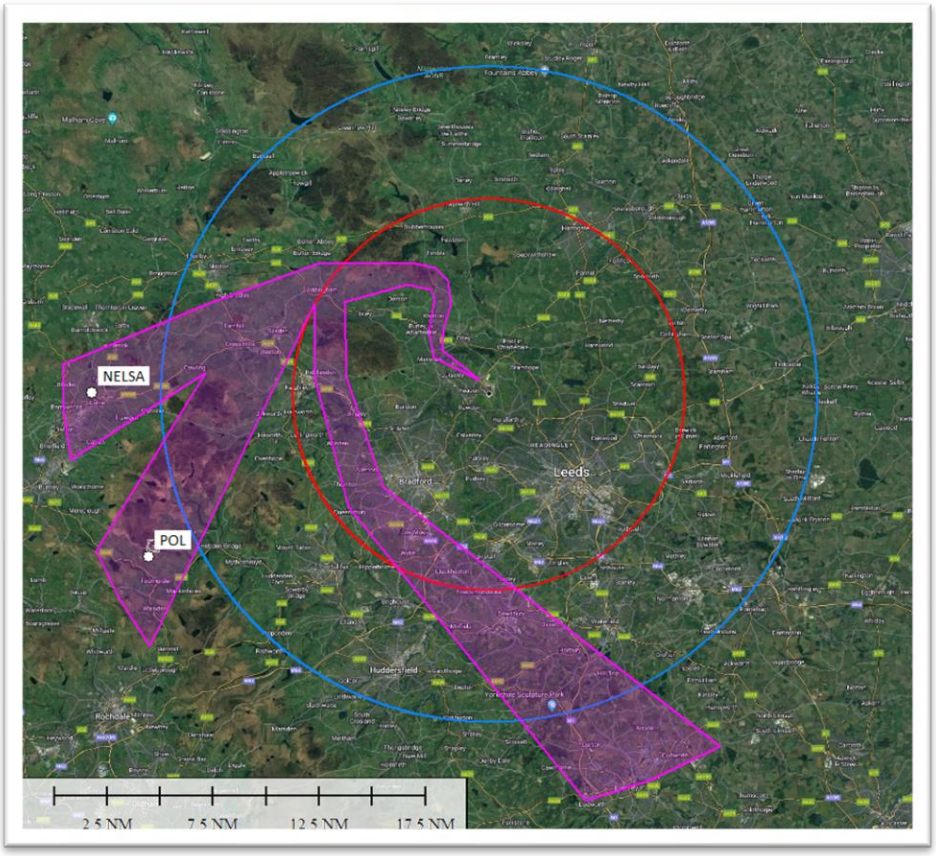
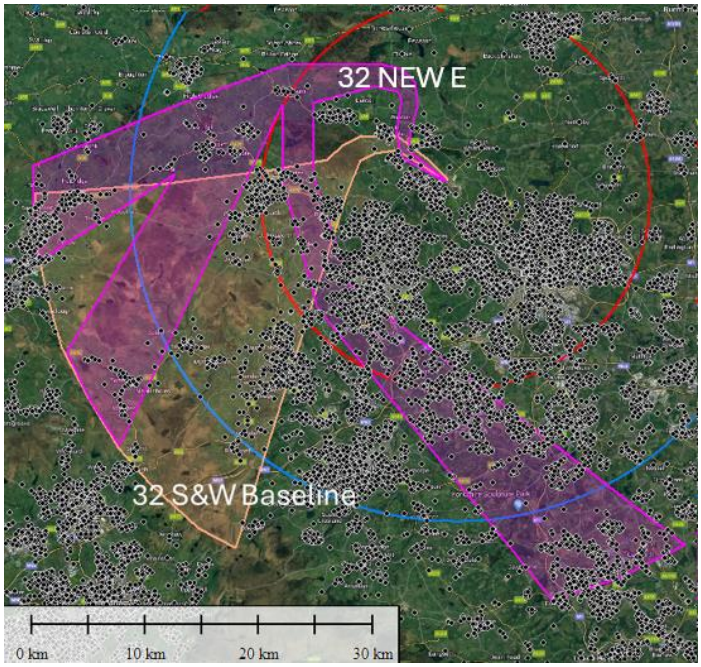
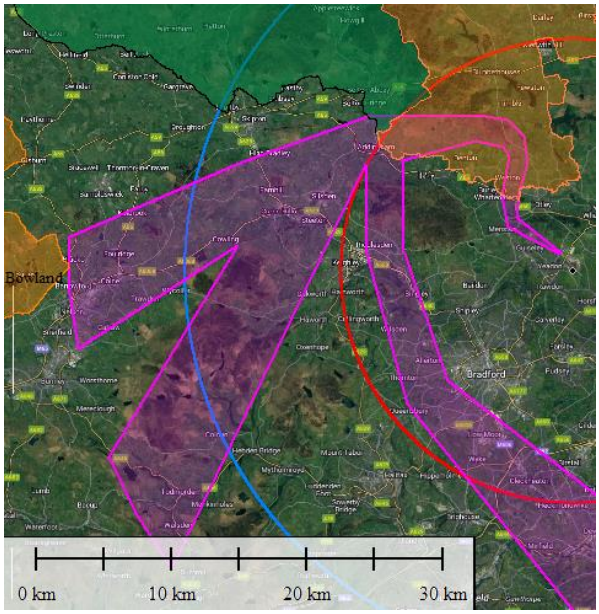


Figure 15: Runway 32 Combination Option E over Google Maps Satellite

5.3.3.5.1. 32NEWE was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

5.3.3.5.2. This route generally follows the initial track of the existing flightpath for circa 2 miles to deviate West of Otley. After this point, the route flies north and then westbound to avoid all major settlements whilst gaining height over open countryside. The route is designed to minimise noise to local communities during the night. Due to the excessive number of additional miles flown and excess CO_2 produced, this route is not considered viable for continuous operations and is more suited for use at night for purposes of noise nuisance reduction.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option was introduced as a potential night time route. Newly flown over communities include Silsden, Addingham and Steeton at the northern section of the swathe. Allerton, Clayton and Lower grange would be newly overflown on the southern section. This option avoids Bradford and would fly over slightly fewer people than the Baselines. 
	Air Quality	The AQMA at the intersection of Carr street and A641 at Marshfields could be overflown, see image in option B. However, this option flies over significantly fewer AQMAs than the Baseline.
Wider society	Greenhouse gas impact	Extra track miles mean this option would have a negative impact on greenhouse gas, however these extra miles could facilitate a continuous climb departure.
	Capacity/ resilience	Insignificant difference from the Baseline.

Group	Impact	Qualitative Assessment
	Tranquillity	Overflies Nidderdale AONB and a small portion of the Yorkshire Dales National Park unlike the Baseline. 
	Biodiversity	Possible impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. The Baseline only overflies the South Pennine Moors. 
General aviation	Access	No impact.

Group	Impact	Qualitative Assessment
General aviation/ commercial airline	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Extra track miles mean this option would have a negative impact on fuel burn, however these extra miles could facilitate a continuous climb departure.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It also contributes to the AMS objective of reducing noise. It does not contribute to the AMS objective of reducing CAS or improving fuel efficiency.

Group	Impact	Qualitative Assessment
	Interdependencies, conflicts and trade-offs	Separated from all routes other than the inbound transition from the North Western Hold. This could potentially mean a period of level flight for outbounds until clear of the inbound transition track. 

Figure 16: Runway 32 Combination Option E

5.3.3.5.3. **Discounted.**

This option is discounted as the reduction in impacts below 4000ft is negligible, the Nidderdale AONB would be overflown, there is a large increase in extra track miles and more CAS could be required. This option does not align with the AMS or Government's altitude-based priorities.

5.4. Runway 14 Departures

5.4.1. Under current operations all S, SW, W, NW,N departures route via POL. To meet the NERL systemisation requirements, W, NW and N flights will route to NELSA off 14. Two SIDS will therefore be required rather than the 1 SID which serves all of these routes at the present time.

5.4.2. Runway 14 South-East Design Envelope

5.4.2.1. The following figure shows the DOs as compared to the Baseline against the ENR Chart. Purple swathe is the Baseline, Red the Do-Minimum, blue is option A and brown is option B.

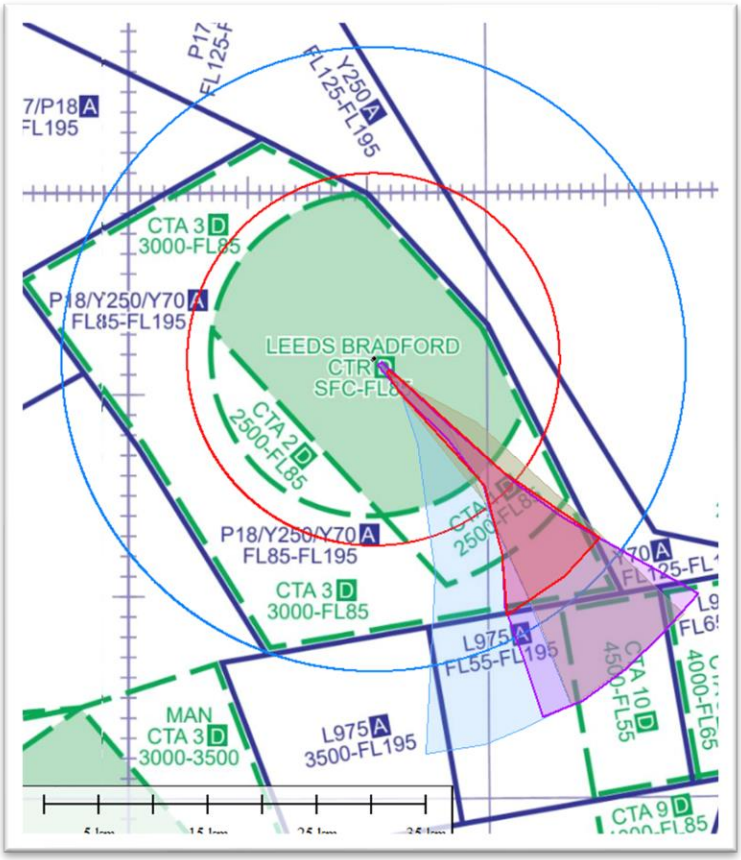


Figure 17: Runway 14 South-East Departure Swathes over ENR chart

5.4.2.2. Runway 14 South-East Baseline

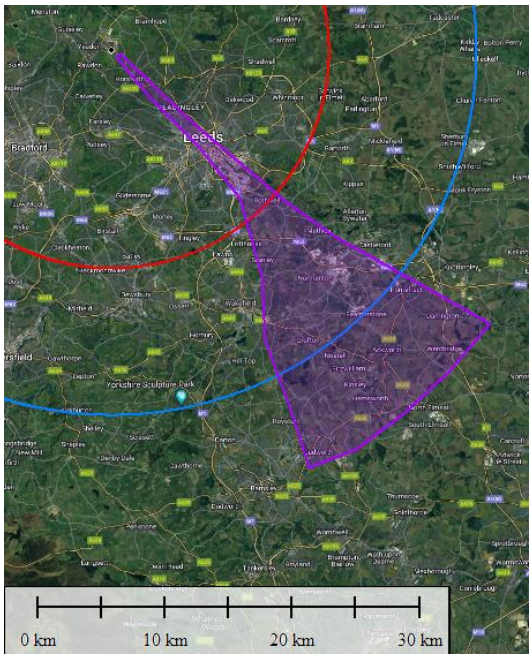
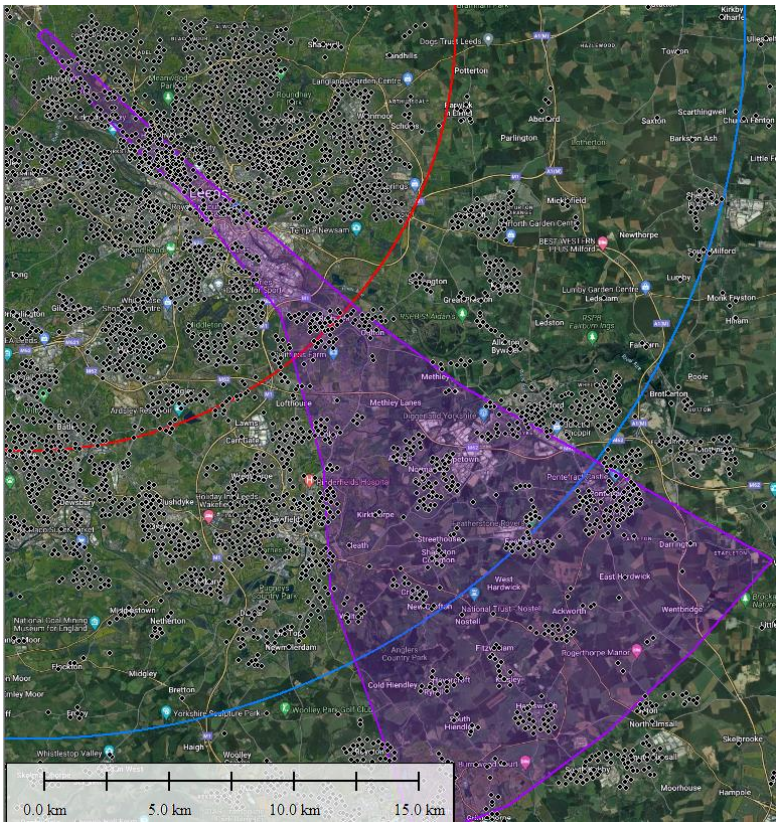


Figure 18 - Runway 14 South-East Departure Swathes over Google Maps Satellite

5.4.2.2.1. The existing departure procedure flies largely straight following the NPR initially. This overflies central Leeds and continues to the South-East towards Doncaster.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would continue to overfly the same communities after take-off with no change to noise impact. Communities in parts of Headingly, Central Leeds and Rothwell are over flown by the Baseline. 
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality.
Wider society	Greenhouse gas impact	There would be no change in track length or altitudes. No change in benefits or impacts to greenhouse gas and CO2 emissions.
	Capacity/ resilience	No opportunity to increase capacity or resilience.
	Tranquillity	No National Parks or AONBs are overflown below 7000ft.
	Biodiversity	There are no additional biodiversity implications associated with retaining the Baseline. The Baseline does not currently fly over any SSSIs, SPAs SACs or other designated conservation areas.

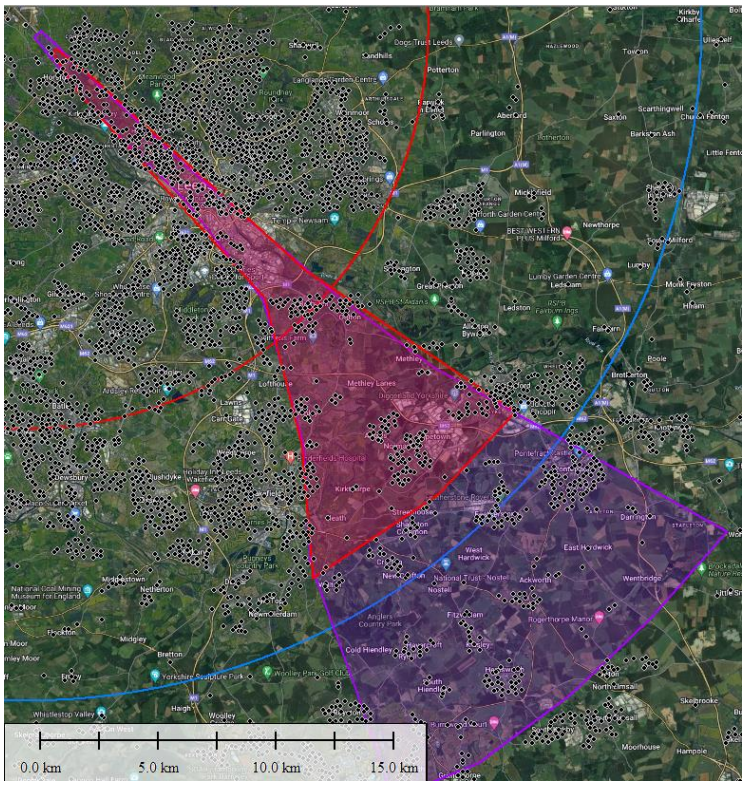
Group	Impact	Qualitative Assessment
General aviation	Access	No change in controlled airspace or access to it if the Baseline was to be retained.
General aviation/ commercial airline	Economic impact from increased effective capacity	No opportunity for increased capacity or benefit to economic impact should the Baseline option be retained.
	Fuel-burn	There would be no change in track length or altitudes. No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	No training costs for airlines as there would be no new procedures if this Baseline option were to be retained. Updates to flight procedures form part of an AIRAC cycle where airlines will update their procedures and utilise training if deemed necessary as standard.
	Other costs	No commercial airline costs are anticipated should the Baseline be retained.
Airport/ Air navigation service provider	Infrastructure costs	No infrastructure costs are anticipated with the initial deployment of this option for either the Airport or ANSP.
	Operational costs	No operational costs are anticipated with the initial deployment of this option for either the Airport or the ANSP.
	Deployment costs	No controller or assistant training will be required should the Baseline be retained as procedures will not be changed.
All	Safety	No safety concerns should this Baseline option be retained.
	AMS Realisation	No change and therefore no improvements to align with AMS objectives. Further, this option fails to offer connectivity to the NERL proposed SID end point at Barnsley
	Interdependencies conflicts and trade-offs	Current Operations. Conflicts with inbound route from GOLES-LBA resulting in a period of level flight or tactical vectoring. Future Operations- Interaction with proposed inbound transition from BARTN which would often result in a stepped climb with initial stop altitude of 5000 ft. The Baseline would also conflict with the proposed inbound transition from GOLES causing a long period of level flight at 5000 ft until the tracks diverged.

Table 32: Runway 14 South-East Baseline

5.4.2.2.2. None of the Baseline options were carried forward after the DPE and as such are not being assessed as viable options in this IOA. The table above is provided as a point of reference for the assessment of the other DOs in this group.

5.4.2.3. Runway 14 Southeast 'Do Minimum' CAP1781

5.4.2.3.1. The RW14 SE 'Do Minimum' DO is the CAP1781 RNAV substitution option. This DO largely mimics the 'Do Nothing' Baseline although traffic will be more concentrated around the nominal track of the published SID in the first 4-5,000ft of climb out.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The do-minimum option would overfly the same communities and number of people as the Baseline. Communities in parts of Headingly, Central Leeds and Rothwell will continue to be affected. 
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality.
Wider society	Greenhouse gas impact	No change is anticipated.
	Capacity/ resilience	No change
	Tranquillity	No National Parks or AONBs are overflown below 7000ft as with the Baseline.

Group	Impact	Qualitative Assessment
	Biodiversity	There are no additional biodiversity implications associated with the do minimum option. This option, as with the Baseline, does not fly over any SSSIs, SPAs SACs or other designated conservation areas.
General aviation	Access	No change.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training, if any.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the current operation.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Outbound traffic conflicts with opposite direction inbound arrivals from GOLES which can result in a period of level flight for the outbound aircraft.

Table 33: Runway 14 South-East 'Do Minimum' CAP1781

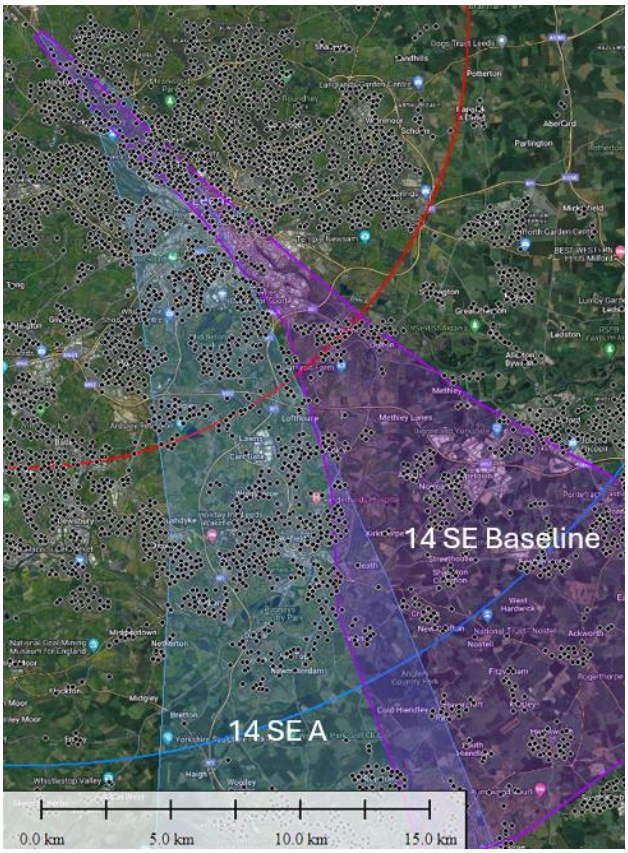
5.4.2.3.2. **Carried forward as the preferred option.**

This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and

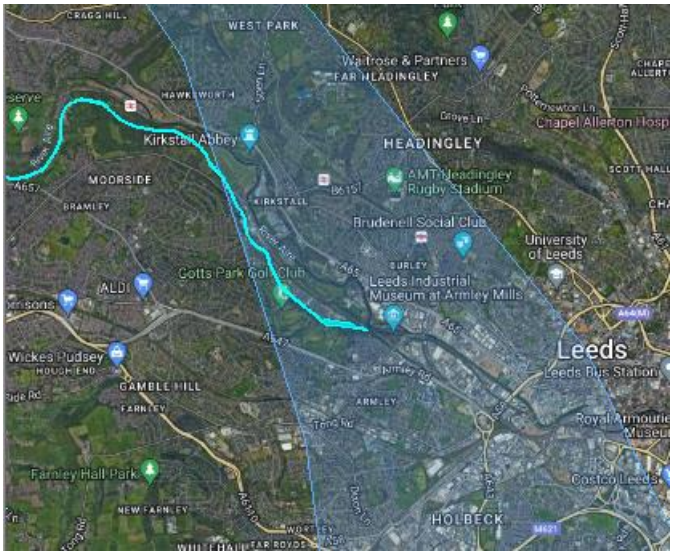
tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN. This option is the option most consistent with existing published procedures.

5.4.2.4. Runway 14 South-East Option A

5.4.2.4.1. This DO would initially turn right, overflying central and southern Leeds. The latter stages of this DO overfly several densely populated areas such as Wakefield and Barnsley.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of higher population density would be overflown. The NPR is contained within this swathe but after this, the 14SEA swathe (blue) diverts more directly south than the Baseline (purple) potentially impacting a great number of people as it routes towards Wakefield. 

Group	Impact	Qualitative Assessment
	Air Quality	The AQMAs at Kirkstall to the north of Leeds and at Islington to the southwest will be overflown. These areas are not currently flown over with the Baseline. 
Wider society	Greenhouse gas impact	Similar track mileage to the Baseline so negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	No AONBs or National Parks flown over below 7000ft as with the Baseline.

Group	Impact	Qualitative Assessment
	Biodiversity	Flys over Leeds-Liverpool Canal (SSSIs) unlike the Baseline. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.

Group	Impact	Qualitative Assessment
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Interaction with proposed inbound transition from BARTN which would often result in a stepped climb with initial stop altitude of 6000 ft. Potential to also conflict with inbound transition from GOLES which could also cause a period of level flight at 6000 ft.

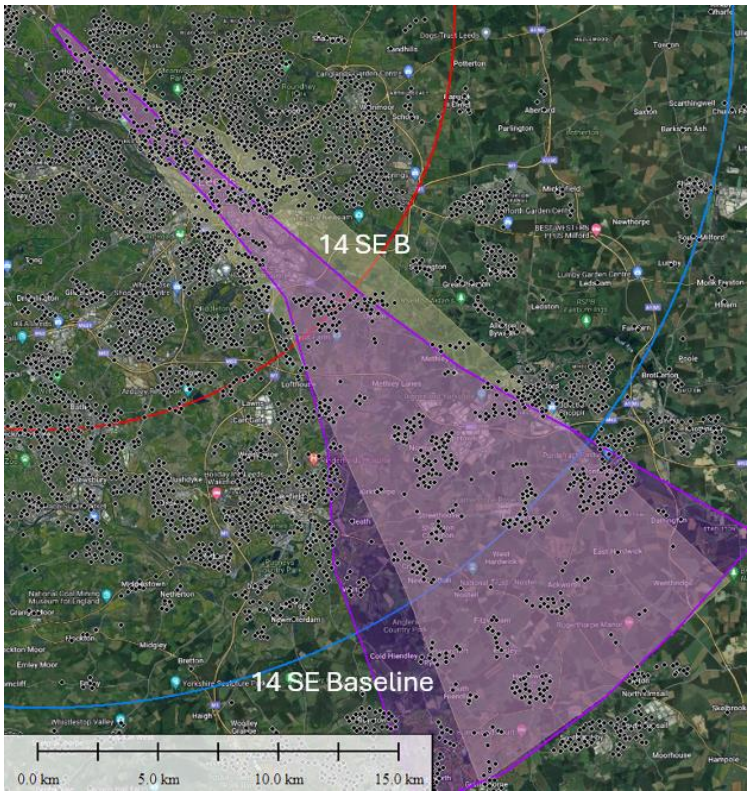
Table 34: Runway 14 Southeast Option A

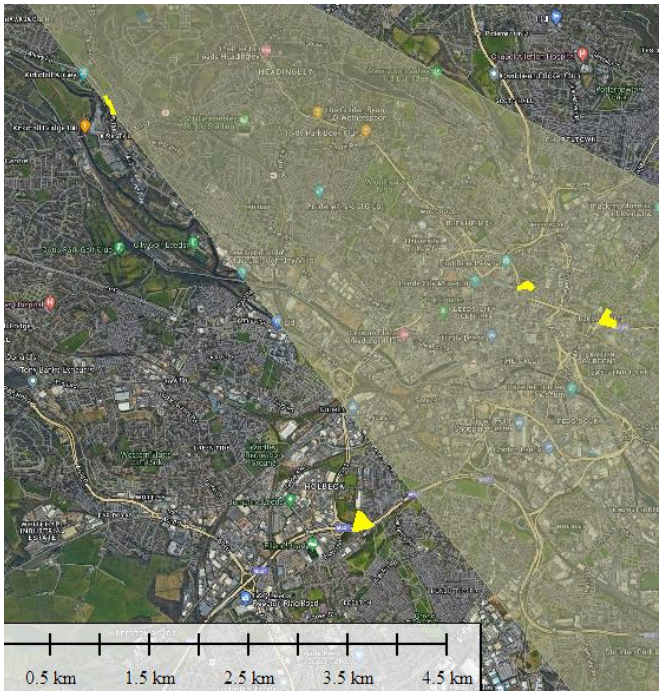
5.4.2.4.2. **Carried forward.**

This option is carried forward as there is a minimal difference to the Baseline although new AQMAs could be overflown below 1000ft depending on final track placement. This option is less preferable than the Do-Minimum option but has been retained.

5.4.2.5. Runway 14 South-East Option B

5.4.2.5.1. This DO is very similar to the Baseline and therefore overflies largely the same areas.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline. Overflies Central Leeds just as the Baseline track (purple) but once beyond Leeds it has the potential to affect less people than the alternate options. It is the DO most similar to the Baseline. 

Group	Impact	Qualitative Assessment
	Air Quality	Three AQMAs at Kirkstall, The Laylands and York Road (A64) near Quarry Hill would be overflown. The Baseline does not currently fly over these AQMAs. 
Wider societ	Greenhouse gas impact	Similar track mileage to the Baseline so negligible difference.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	No AONBs or National Parks flown over as with the Baseline.
	Biodiversity	No conservation areas or SSSIs flown over in this option as with the Baseline.
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.

Group	Impact	Qualitative Assessment
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	Potential conflicts with arrivals via GOLES however, given similarity with the operation today, it is likely that this is risk is overstated.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Interaction with proposed inbound transition from BARTN and the transition from GOLES which would often result in a stepped climb with initial stop altitude of 6000 ft.

Table 35: Runway 14 South-East Option B

5.4.2.5.2. **Carried forward.**

This option is carried forward as there is a minimal difference to the Baseline although new AQMAs could be overflown below 1000ft depending on final track placement. The previous safety concerns are no longer considered to be viable as there is minimal difference to today's operation, so this factor has been discounted. This option is less preferable than the Do-Minimum option but has been retained.

5.4.3. Runway 14 South and West Design Envelope

5.4.3.1. The following figure shows the DOs as compared to the Baseline against the ENR Chart.

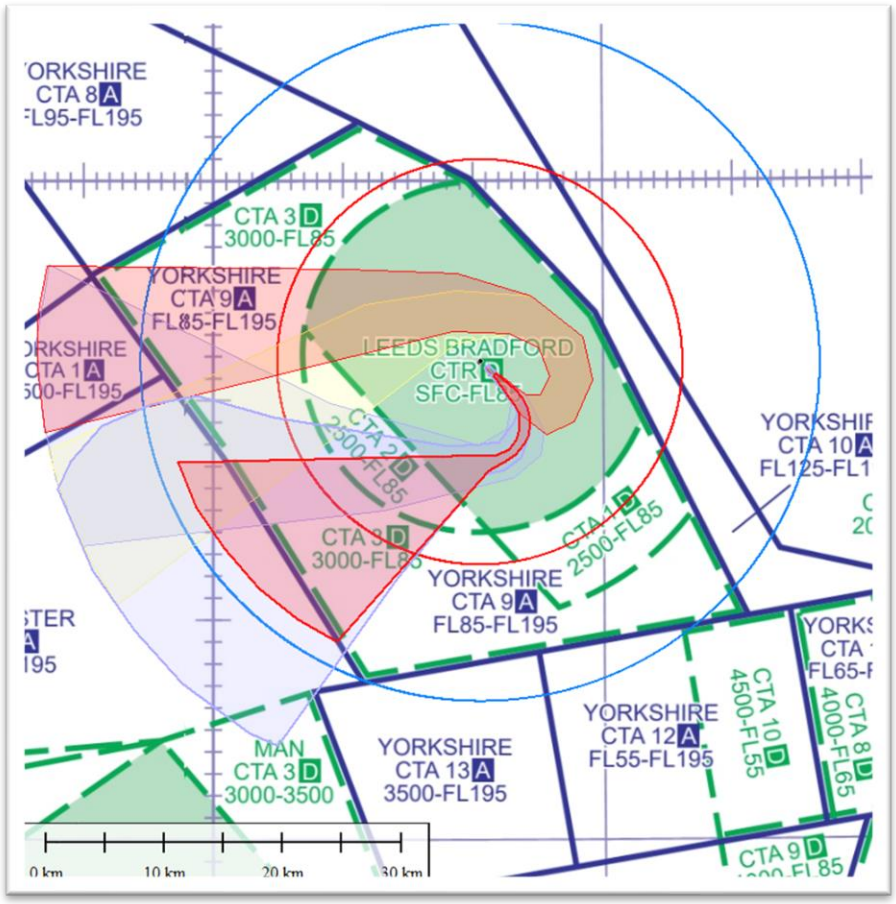


Figure 19: Runway 14 South & West Departure Swathes over ENR chart

5.4.3.2. Runway 14 South and West Baseline

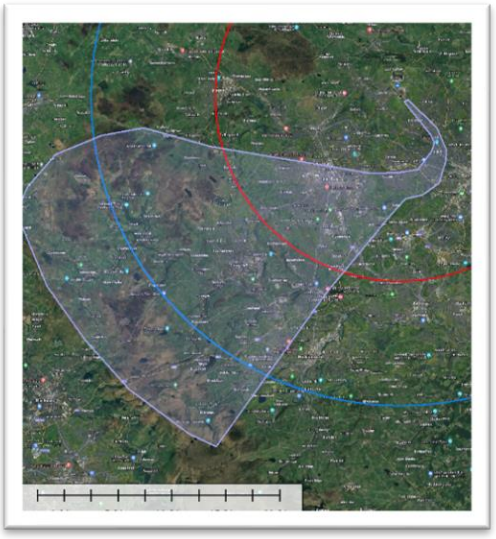
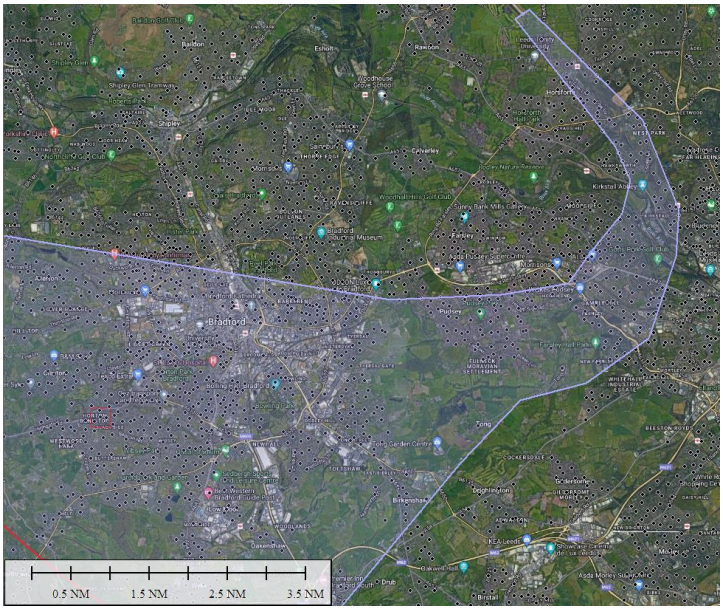
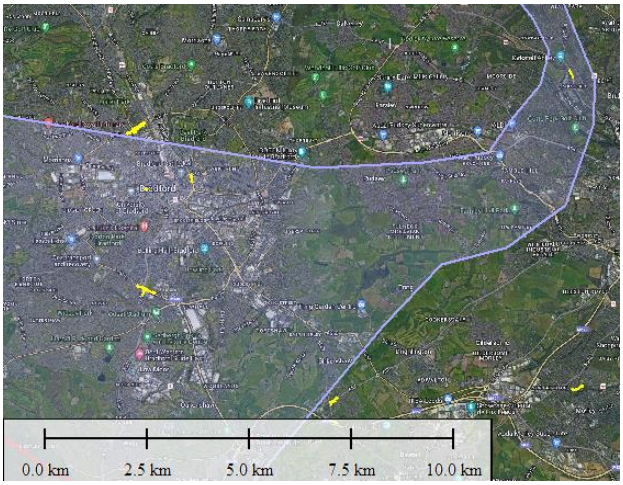


Figure 20 : Runway 14 South & West Departure Swathes over Google Maps Satellite

5.4.3.2.1. After following the NPR, the existing departure procedure turns initially right overflying western Leeds and Bradford before veering left to the South-West over Halifax towards Manchester.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would continue to overfly the same communities after take-off with no change to noise impact. Communities such as Kirkstall, Gamble Hill, Pusey, Bradford and Westwood park are currently affected by the Baseline. 

Group	Impact	Qualitative Assessment
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality. The Baseline currently flies over the AQMA at Kirkstall Norh of Leeds and Marshfields, south of Bradford. 
Wider society	Greenhouse gas impact	There would be no change in track length or altitudes. No change in benefits or impacts to greenhouse gas and CO2 emissions.
	Capacity/ resilience	No opportunity to increase capacity or resilience.
	Tranquillity	No National Parks or AONBs are overflown below 7000ft.
	Biodiversity	There are no additional biodiversity implications associated with retaining the Baseline. The Baseline currently flies over Leeds-Liverpool Canal (SSSI).
General aviation	Access	No change in controlled airspace or access to it if the Baseline was to be retained.
General aviation/ commercial airlines	Economic impact from increased effective capacity	No opportunity for increased capacity or benefit to economic impact should the Baseline option be retained.
	Fuel-burn	There would be no change in track length or altitudes. No change in benefits or impacts to fuel burn.

Group	Impact	Qualitative Assessment
Commercial airlines	Training costs	No training costs for airlines as there would be no new procedures if this Baseline option were to be retained. Updates to flight procedures form part of an AIRAC cycle where airlines will update their procedures and utilise training if deemed necessary as standard.
	Other costs	No commercial airline costs are anticipated should the Baseline be retained.
Airport/ Air navigation service provider	Infrastructure costs	No infrastructure costs are anticipated with the initial deployment of this option for either the Airport or ANSP.
	Operational costs	No operational costs are anticipated with the initial deployment of this option for either the Airport or the ANSP.
	Deployment costs	No controller or assistant training will be required should the Baseline be retained as procedures will not be changed.
All	Safety	No safety concerns should this Baseline option be retained. Fails to offer connectivity to the NERL proposed SID end point at NELSA for W/NW/N flights
	AMS Realisation	This option does not contribute to the aims of the AMS as it is today's operation and our Baseline option.

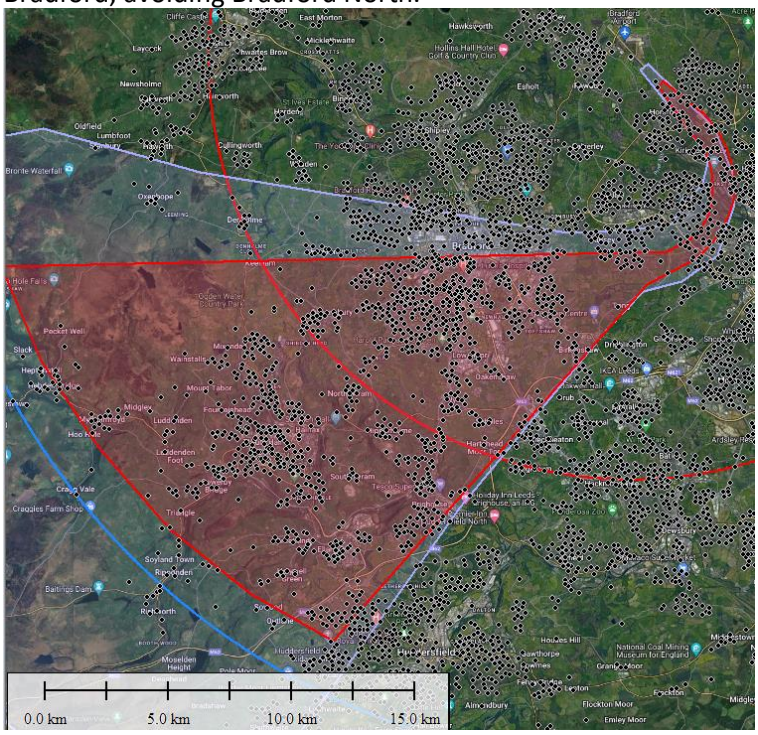
Group	Impact	Qualitative Assessment
	Interdependencies conflicts and trade-offs	Current Operations: Conflicts with inbound route from GOLES-LBA resulting in a period of level flight or tactical vectoring. Also conflicts with inbounds from DENBY which often requires a period of level flight or tactical vectoring. The SID conflicts with the Manchester inbound track from GOLES to ROSUN which could potentially result in a level period of flight at FL80 for a number of flights. It should be noted that under existing procedures, the area sector would place the Leeds traffic on a heading or give a short cut to MCT in order to facilitate continuous climb. Whilst this methodology may not be considered ideal under a systemised network, it does allow for the most efficient resolution to the conflict with Manchester inbound traffic. Future Operations: Would conflict with the proposed inbound transition from GOLES resulting in a potential leg of level flight at 5000 ft. The SID conflicts with the Manchester inbound track from GOLES to ROSUN which could potentially result in a level period of flight at FL80 for a number of flights.

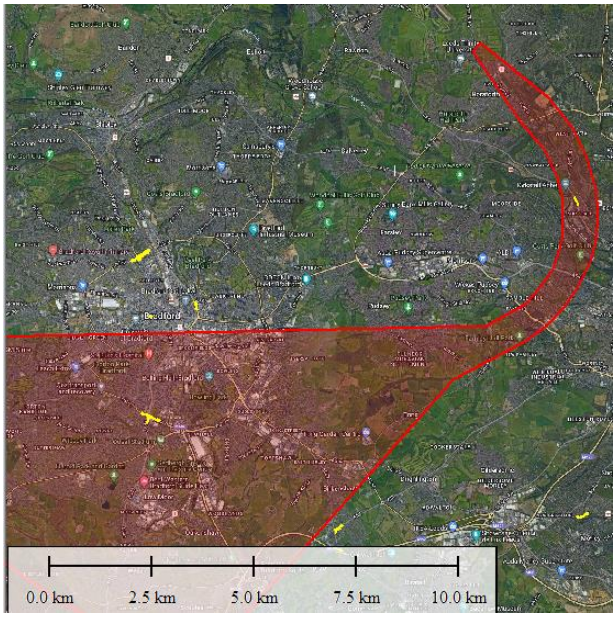
Table 36: Runway 14 South and West Baseline

5.4.3.2.2. None of the Baseline options were carried forward after the DPE and as such are not being assessed as viable options in this IOA. The table above is provided as a point of reference for the assessment of the other DOs in this group.

5.4.3.3. Runway 14 South and West 'Do Minimum' CAP1781

5.4.3.3.1. The RW14 SW 'Do Minimum' DO is the CAP1781 RNAV substitution option. This DO largely mimics the 'Do Nothing' Baseline although traffic will be more concentrated around the nominal track of the published SID in the first 4-5,000ft of climb out.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The do-minimum option would overfly the fewer communities and fewer people than the Baseline. Kirkstall and Westwood park would continue to be flown over, however Gamble Hill and Pusey would be avoided. This option would fly over less of Bradford, avoiding Bradford North. 

Group	Impact	Qualitative Assessment
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality. The Baseline currently flies over the AQMA at Marshfields, south of Bradford. 
Wider society	Greenhouse gas impact	Similar to the Baseline.
	Capacity/ resilience	Similar to the Baseline.
	Tranquillity	No AONBs or National Parks flown over below 7000ft.
	Biodiversity	There are no additional biodiversity implications associated with the do minimum option.
General aviation	Access	No change.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
	Training costs	Very minimal training, if any.

Group	Impact	Qualitative Assessment
Commercial airline	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the current operation.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Would conflict with the proposed inbound transition from GOLES resulting in a potential leg of level flight at 5000 ft. The SID conflicts with the Manchester inbound track from GOLES to ROSUN which could potentially result in a level period of flight at FL80 for a number of flights.

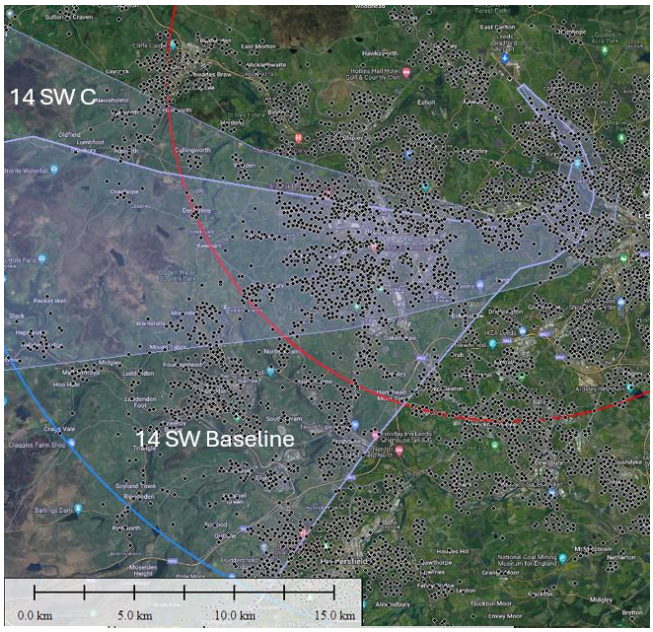
Table 37: Runway 14 South and West 'Do Minimum' CAP1781

5.4.3.3.2. **Carried forward as the preferred option.**

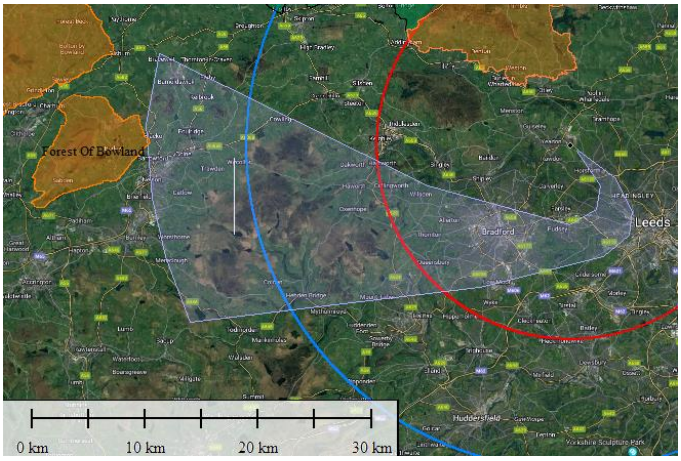
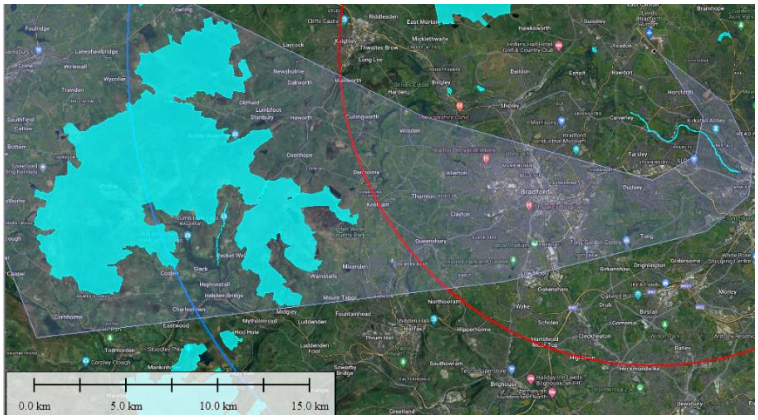
This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN. This option is the option most consistent with existing published procedures.

5.4.3.4. Runway 14 South and West Option C

5.4.3.4.1. This DO is initially similar to the Baseline, but flies further North overflying more of Bradford. In the latter stages of this DO it overflies generally less densely populated areas.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a slightly higher population density compared to those overflown in the Baseline at lower altitudes. At higher altitudes areas of lower population density would be overflown. The NPR is contained within the swathe but thereafter, 14S&WC turns harder to the West and overflies large areas of Bradford than the Baseline which continues South-West. 

Group	Impact	Qualitative Assessment
	Air Quality	This option would continue to overfly the same communities after take-off with no change in impact to local air quality. This option would continue to fly over the AQMA at Kirkstall, same as the Baseline. It would also fly over the four Bradford AQMAs, as the Baseline does with the addition of the AQMA on the North ring road. 
Wider society	Greenhouse gas impact	Additional track mileage to the Baseline if routing to the South-West but less if routing West and this probably balances this out.
	Capacity/ resilience	Similar to the Baseline.

Group	Impact	Qualitative Assessment
	Tranquillity	Although similar to the Baseline, the northern part of this option heads over the AONB of the Forest of Bowland, however aircraft are likely to be over 7000ft at this point and so no significant issues identified. 
	Biodiversity	Flies over the Leeds-Liverpool canal SSSIs below 4000ft. South Pennine Moors (SAC, SPA and SSSI) flown over, aircraft are possibly over 4000ft at this point, this is similar to the Baseline. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Additional track mileage to the Baseline if routing to the South-West but less if routing West and this probably balances this out.

Group	Impact	Qualitative Assessment
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	This SID swathe covers the SID to POL, as well as giving the option to turn northwest bound to NELSA. The POL option does not conflict with any inbound Leeds routes. It does however, conflict with the Manchester inbound track from GOLES to ROSUN which could potentially result in a level period of flight at FL80 for a number of flights. It should be noted that under existing procedures, the area sector would place the Leeds traffic on a heading or give a short cut to MCT in order to facilitate continuous climb. Whilst this methodology may not be considered ideal under a systemised network, it does allow for the most efficient resolution to the conflict with Manchester inbound traffic. The swathe that covers the NELSA SID is fully systemised and does not conflict with any inbound transition.

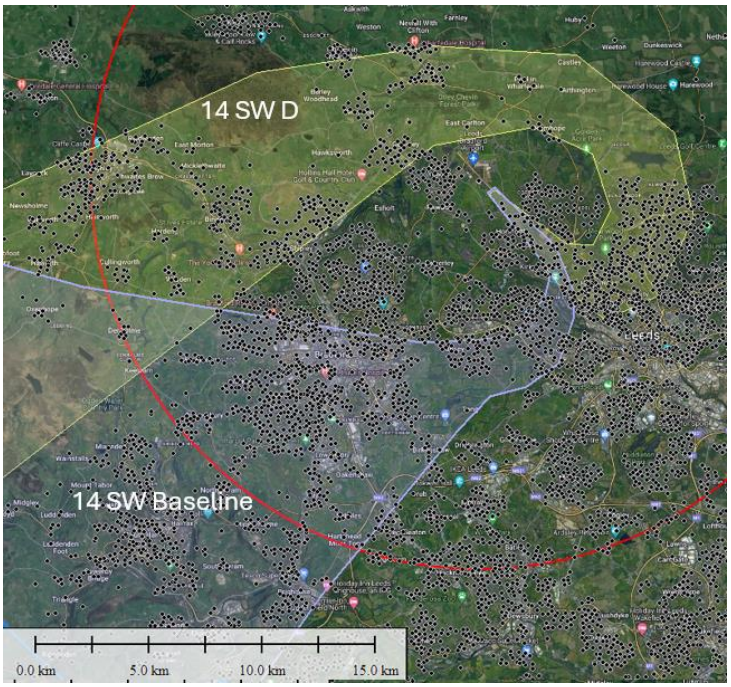
Table 38: Runway 14 South and West Option C

5.4.3.4.2. **Discounted.**

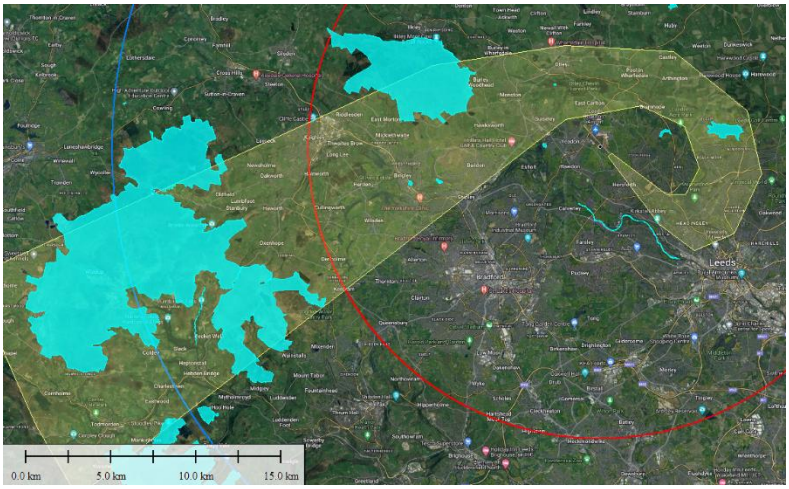
This option is discounted on the basis there would be a greater impact to communities below 4000ft and the Forest of Bowland AONB could be affected below 7000ft meaning this option does not align with the Government's altitude-based priorities.

5.4.3.5. Runway 14 South and West Option D

5.4.3.5.1. This DO would initially turn left, overflying north-eastern Leeds. The latter stages of this DO overfly generally more sparsely populated areas than the Baseline.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline at lower altitudes. The NPR is contained within the 14S&WD swathe (yellow) before it then turns left and loops around to the North of the Airport impacting the communities of North-West Leeds but of similar population density to the Baseline (purple). 

Group	Impact	Qualitative Assessment
	Air Quality	This option would fly over the Mill Lane AQMA at Pool-in-Wharfdale situated north northeast of the airport. This is a similar distance from the airport as the AQMA overflown by the Baseline, although a different AQMA. 
Wider society	Greenhouse gas impact	Additional track mileage to the Baseline however, the ability to climb in an unrestricted fashion may offset this.
	Capacity/ resilience	Potential improvement as the climb is achieved earlier before turning towards the busy POL area.
	Tranquillity	No National Parks flown over below 7000ft. Possibly a very small section of Nidderdale AONB may be flown over at its southern tip. The Baseline does not fly over either.

Group	Impact	Qualitative Assessment
	Biodiversity	This option flies over The Eccup Reservoir and South Pennine Moors (SAC, SPA and SSSI). The Baseline flies over the Leeds-Liverpool Canal and the same section of the South Pennine Moors with the omission of the north section. 
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Potentially this route may need RNP1 with RF capability for airspace containment, especially if an extension of CAS to the east is not viable.
	Fuel-burn	Additional track mileage to the Baseline however, the ability to climb in an unrestricted fashion may offset this.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline. Outbounds will climb well above the inbounds to RW14. Additional CAS may be required.

Group	Impact	Qualitative Assessment
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	The long direction turn to the East conflicts with the arrival from GOLES and BARTN resulting in a long period of flight at 4000 ft until completing the loop and to the West of the runway 14 approach. This would result in level flight over built up areas causing the route to be unviable unless used in periods of light inbound traffic. It is likely that this route would be therefore limited to night time, or respite operations in off peak inbound periods. Down-route, if given continuous climb, there is potential for outbounds to climb above the Manchester inbound GOLES-ROSUN track.

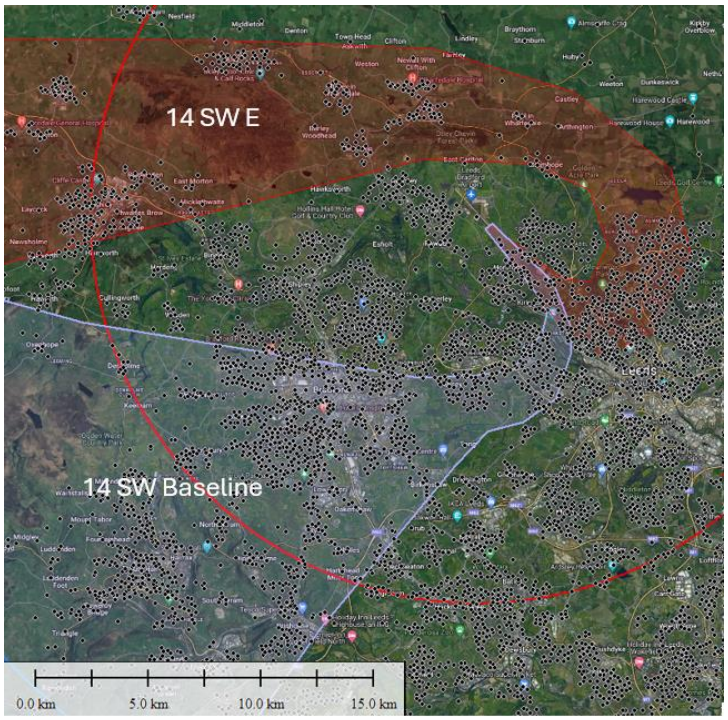
Table 39: Runway 14 South and West Option D

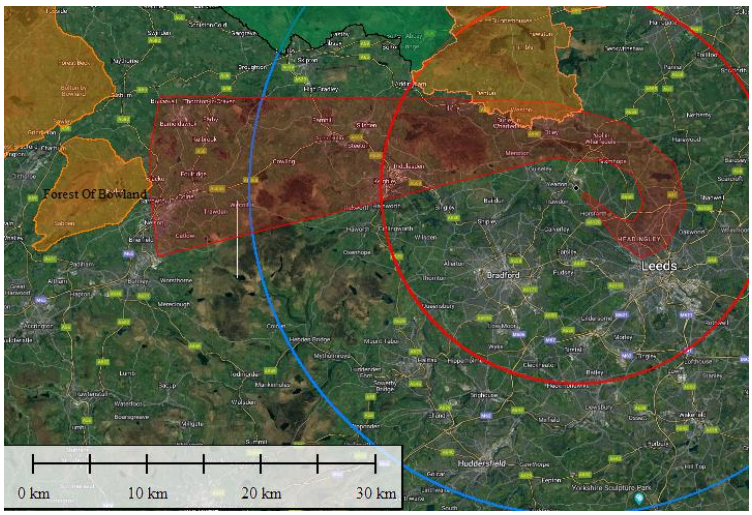
5.4.3.5.2. **Carried forward.**

This option is carried forward as there could be a slight decrease in noise impact below 4000ft owing to the left turn out on departure, although it would be different communities that would be affected. Capacity and resilience could also be increased, however additional CAS may be required. This option is less preferable than the Do-Minimum option but has been retained as an alternative.

5.4.3.6. Runway 14 South and West Option E

5.4.3.6.1. This DO is initially the same as Option D but flies further North. The latter stages of this DO overfly generally more sparsely populated areas than the Baseline or Option D.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline at lower altitudes. The NPR is contained within the 14S&WE swathe (red) before this DO turns left and wraps around to the North of the Airport affecting the communities of North-West Leeds. The Baseline is the purple swathe. 
	Air Quality	This option would fly over the Mill Lane AQMA at Pool-in-Wharfdale situated north northeast of the airport. See image in option D. The Baseline flies over the Marshfields Bradford AQMA at approximatley the same distance after takeoff as the option. Therefore no net benefit or loss.
Wider society	Greenhouse gas impact	Additional track mileage to the Baseline and the ability to climb in an unrestricted fashion may offset this however, it also doesn't point towards POL such that additional track miles are flown to go South-West.

Group	Impact	Qualitative Assessment
	Capacity/ resilience	Potential improvement as the climb is achieved earlier before turning towards the busy POL area.
	Tranquillity	Overflight of Nidderdale AONB, Meanwood Park, Eccup Reservoir and Otley Chevin Forest Park unlike the Baseline. 
	Biodiversity	Flies over , Eccup Reservoir and South Pennine Moors (SSSI, SAC and SPA), Crimsworth Dean SSSI and Otley Chevin Forest Park SSSI, unlike the Baseline. 
General aviation	Access	It is possible that additional CAS would be required to the East of LBA at the detriment of Class G and other airspace users.
General aviation/	Economic impact from increased effective capacity	Potentially this route may need RNP1 with RF capability for airspace containment, especially if an extension of CAS to the east is not viable.

Group	Impact	Qualitative Assessment
commercial airlines	Fuel-burn	Additional track mileage to the Baseline and the ability to climb in an unrestricted fashion may offset this however, it also doesn't point towards POL such that additional track miles are flown to go South-West.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	Whilst the outbounds will climb well above the RW14 approach, this swathe potentially climbs departures towards arrivals via NELSA adding a layer of complexity. There may also be the requirement for additional CAS.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	The long direction turn to the East conflicts with the arrival from GOLES and BARTN resulting in a long period of flight at 4000 ft until completing the loop and to the West of the runway 14 approach. This would result in level flight over built up areas causing the route to be unviable unless used in periods of light inbound traffic. It is likely that this route would be therefore limited to night time, or respite operations in off peak inbound periods. Once to the west of the airport, the only route confliction would be for northbound traffic which would conflict with the inbound route from the North Western Hold.

Table 40: Runway 14 South and West Option E

5.4.3.6.2. **Discounted.**

This option is discounted on the basis that more densely populated areas of Leeds would be affected, the Nidderdale AONB could also be impacted, and additional CAS may also be required. The more northerly track placement on departure would point traffic towards arrival routes which could have safety implications. These factors do not align with the Government's altitude-based priorities or contribute towards the AMS.

5.4.4. Runway 14 South and West Combination Options

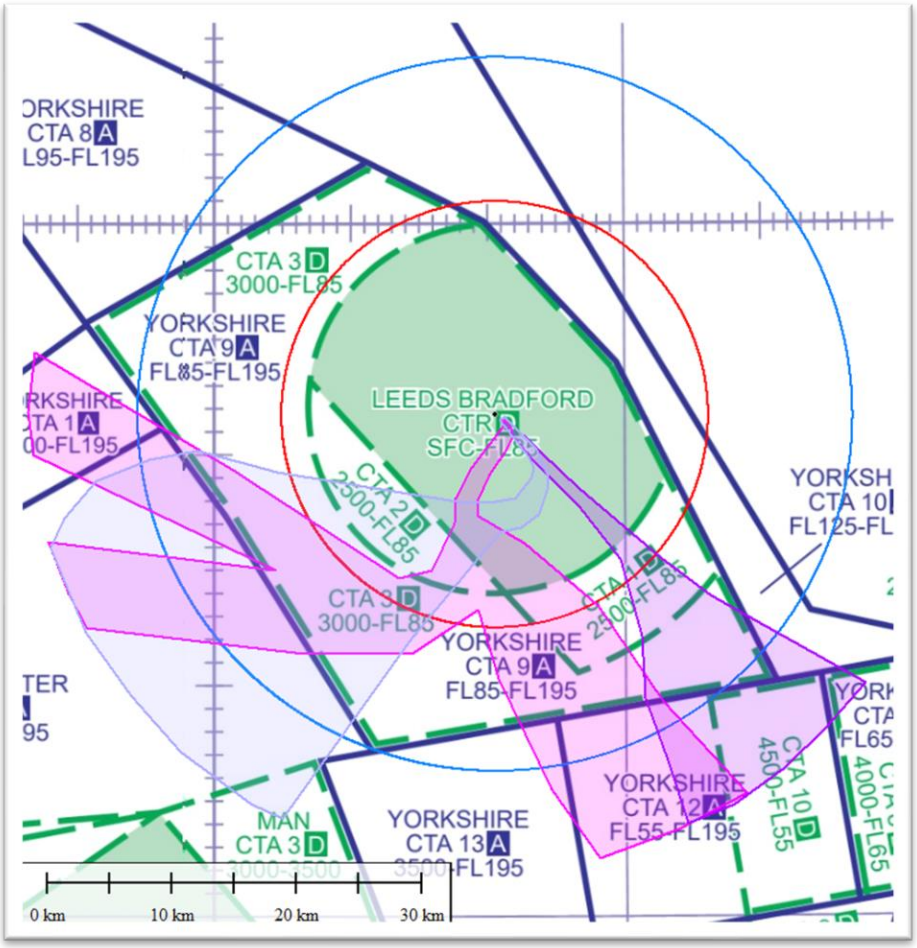


Figure 21: Runway 14 South and West Combination Options over ENR chart

5.4.4.1. Runway 14 Combination Option A

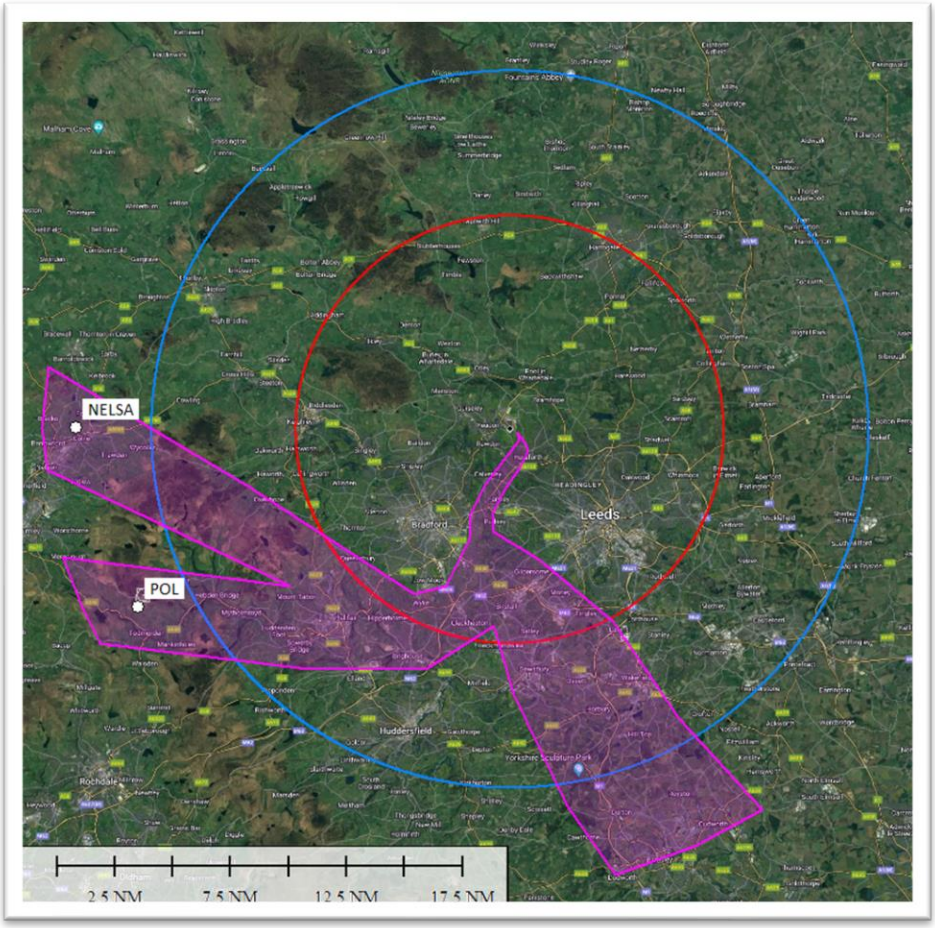
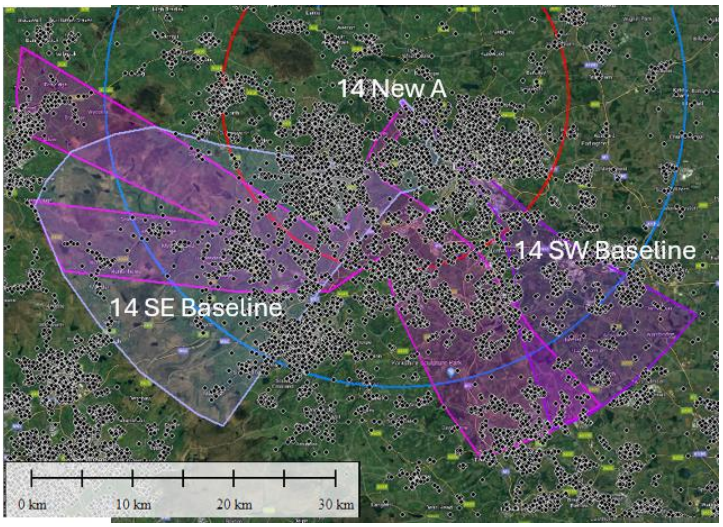
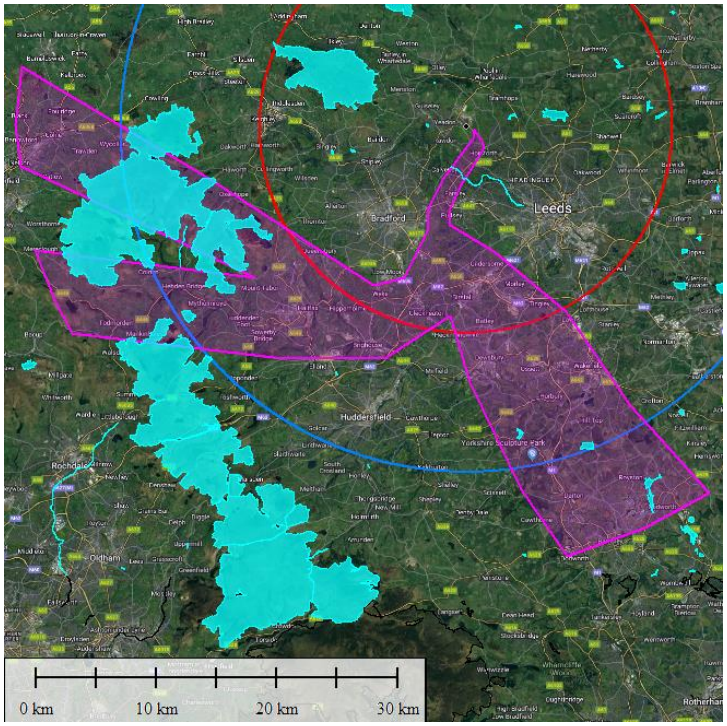


Figure 22: Runway 14 Combination Option A over Google Maps Satellite

5.4.4.1.1. 14NEWA was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

5.4.4.1.2. This option turns right on passing 500 ft to avoid overflying the suburbs North-West of Leeds. The route seeks to weave through an area of countryside dividing Leeds and Bradford prior to turning on a direct track. It intends to offer some respite to the North-West Leeds area whilst accepting that new areas such as Eastern Calverley and Farsley may be overflown. This route also offers an element of dispersion; as aircraft climbs rates differ, the point at which the turn is made (500 ft) will vary on each departure, resulting in varied tracks. Currently, due to its proximity to the Airport, the area of North-Western Leeds is regularly directly overflown regardless of the runway in use; departures over this area when on RW14 and arrivals when on RW32. This option may provide an opportunity to remove some noise nuisance from this area when RW14 is in use.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option was introduced as a potential respite or night route. This option avoids Leeds and Bradford and flies over significantly fewer people below 4000ft than the Baselines. Newly overflown communities would include Birstall, Drighlington and Gildersome. 
	Air Quality	This option would overfly the AQMAs at Morley, Birkenshaw Bottoms (at the intersection of the A58 and A651) and at Swincliffe on the intersection of the M62 and A651. The Baseline currently avoids these areas.
Wider society	Greenhouse gas impact	Assessed as negligible difference.
	Capacity/ resilience	Assessed as negligible difference.
	Tranquillity	Does not fly over any AONBs or National Parks below 7000ft similar to the Baseline.

Group	Impact	Qualitative Assessment
	Biodiversity	Flies over South Pennine Moors SAC, this contains several SSSIs and SPAs. Aircraft are expected to be between 4000-7000ft similar to the Baseline. 
General aviation	Access	No impact.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Assessed as negligible difference.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.

Group	Impact	Qualitative Assessment
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, but has the potential to reduce noise impact.
	Interdependencies, conflicts and trade-offs	

Table 41: Runway 14 Combination Option A

5.4.4.1.3. **Carried forward** as a potential respite route, this would be our preferred respite/night time option.

This option is carried forward on the basis there would be a reduction in noise impact below 4000ft with no new communities affected, no change in impacts to biodiversity and tranquillity (with no AONBs overflown below 7000ft) aligning with the Government's altitude-based priorities. There would be no requirement for additional CAS and this option contributes towards the AMS by introducing PBN.

5.4.4.2. Runway 14 Combination Option B

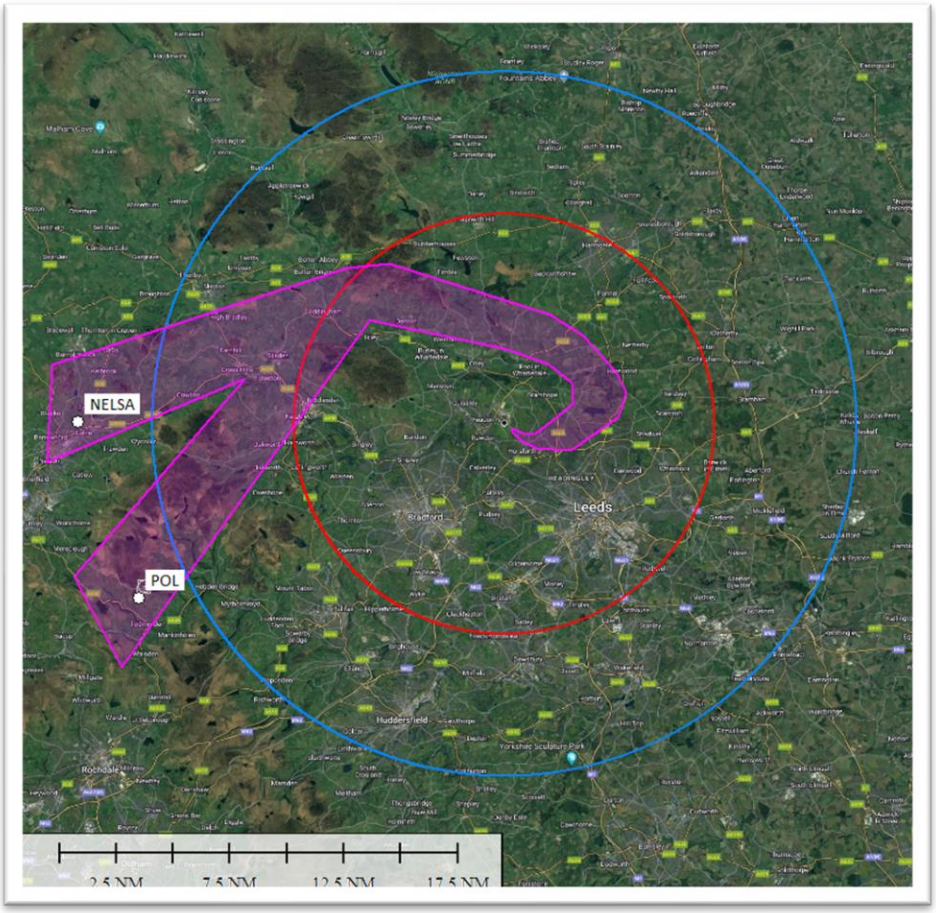
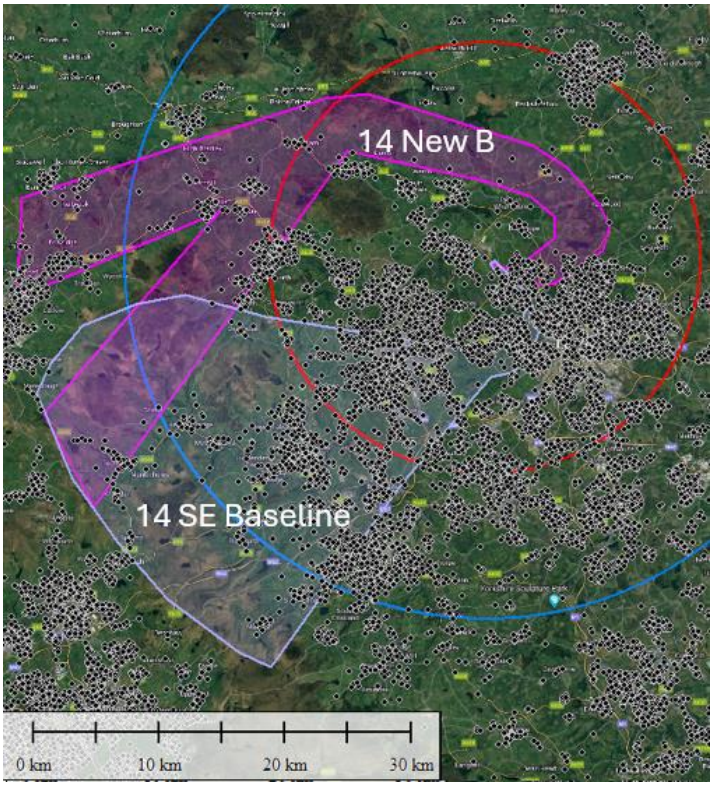
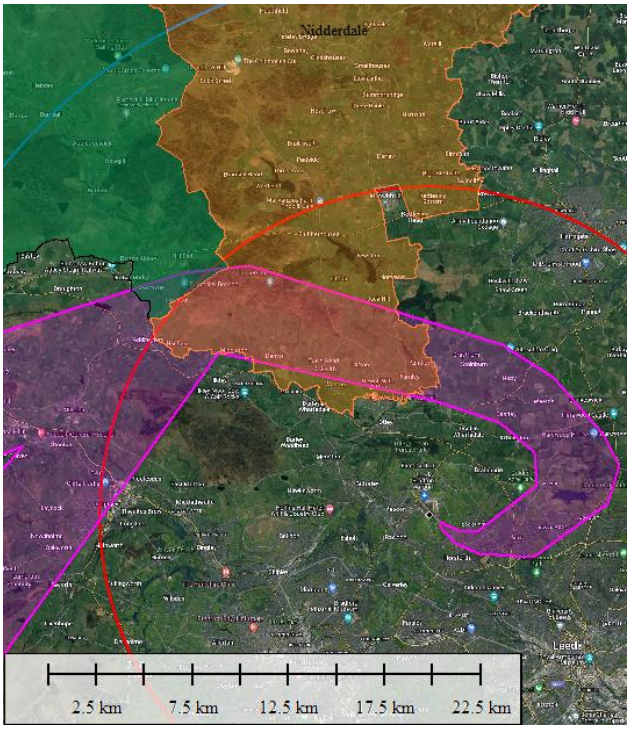
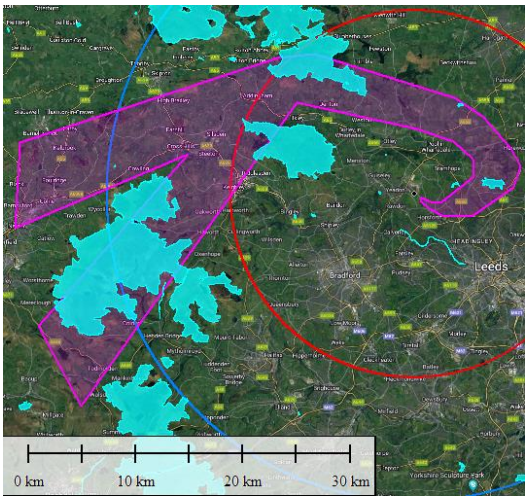


Figure 23: Runway 14 Combination Option B over Google Maps Satellite

5.4.4.2.1. 14NEWB was introduced after the second round of engagement and was shared with stakeholders in the third round of engagement.

5.4.4.2.2. This option utilises an early left turn off RW14 to offer respite to both the suburbs of North-Eastern Leeds and the towns of Pudsey and Bramley. It does however overfly new communities in North-East Leeds such as Weetwood and Adel before continuing to climb out over the countryside. Due to the length of route flown, this route would only be viable as a night noise mitigation route in a combined respite rotation with other noise routes. It would not be viable for departures routing out towards LAMIX (to the South-East).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option was introduced as a potential night time route. Pink 14NEWB, Lilac Baseline S&W, No Baseline SE as this DO does not support departures in that direction. This option Avoids Bradford and overflies significantly fewer people than the Baseline, one newly overflown community is Keighly close to the range ring indicating aircraft would be at or over 4000ft at this point. 
	Air Quality	No AQMAs identified under 4000ft with this option unlike the Baseline which flies over several.
Wider society	Greenhouse gas impact	Extra track miles mean this option would have a negative impact on greenhouse gas.
	Capacity/ resilience	Potential for a reduction in capacity and resilience when compared to the Baseline as there could be additional complexity with inbound traffic.

Group	Impact	Qualitative Assessment
	Tranquillity	This option overflies Nidderdale AONB and a small portion of the Yorkshire Dales National Park unlike the Baseline. 
	Biodiversity	Flies over North and South Pennine Moors SACs, these contains several SSSIs and SPAs. A portion of which may be flown over potentially below 4000ft however most of the South Pennine Moors Aircraft are expected to be between 4000-7000ft. The Baseline flies over different, and fewer below 4000ft, than this option. 

Group	Impact	Qualitative Assessment
General aviation	Access	There may be a requirement for more controlled airspace.
General aviation/ commercial airlines	Economic impact from increased effective capacity	Assessed as negligible difference.
	Fuel-burn	Extra track miles mean this option would have a negative impact on fuel burn.
Commercial airlines	Training costs	Very minimal training adapting to an amended departure profile.
	Other costs	No other costs have been identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	Potential for complexity with inbound traffic and a requirement for additional CAS
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, but has the potential to reduce noise impact.

Group	Impact	Qualitative Assessment
	Interdependencies, conflicts and trade-offs	

Table 42: Runway 14 Combination Option B

5.4.4.2.3. **Discounted.**

This option is discounted as the reduction in impacts below 4000ft is negligible, the Nidderdale AONB would be overflown, there is a large increase in extra track miles and more CAS could be required. This option does not align with the AMS or Government's altitude-based priorities.

5.5. Arrivals

5.5.1. Leeds Bradford Airport are exploring methods to utilise advancements in Satellite based navigation in order to meet the objectives of the Governments FAS. Satellite based navigation routes (termed RNAV or RNP routes) can be followed by the majority of today's airline fleet with great accuracy. This enables routes to be designed which can often avoid densely populated areas, offering noise relief to local communities.

5.5.2. The only negative aspect of these approaches are that because aircraft follow them so accurately, the exact same communities under the flight path will be overflown by every arrival. Under existing arrival procedures, inbounds are radar vectored. As vectoring does not follow an exact track, the routes followed over the ground tend to differ slightly for each aircraft. This means that the exact same communities are not affected by each flight, the noise is shared over a larger area.

5.5.3. A combination of methods are proposed in order to meet the differing traffic demands during the operational hours of the airport. The methodology can be broken down into the following categories.

5.5.4. Off Peak Periods

5.5.4.1. Short RNP approaches avoiding densely populated areas for modern, suitably equipped aircraft. These approaches are much shorter than traditional approaches thus reducing distance travelled, subsequently reducing fuel used and associated emissions. This is emerging technology with little adoption in the UK. Use of this type of technology is forecast to significantly increase in the next 2-3 years, placing Leeds Bradford in a position to be one of the UK's first airports to introduce these procedures as a form of emission reducing procedure.

5.5.4.2. Night Time RNP Approaches. Offset approaches to runway 32 available for suitably equipped aircraft. These approaches avoid central Leeds and certain northern suburbs before turning onto the existing final approach track at around 3 miles from touchdown. This is emerging technology with little adoption in the UK. Use of this type of technology is forecast to significantly increase in the next 2-3 years, placing Leeds Bradford in a position to be one of the UK's first airports to introduce these procedures as a form of noise mitigating procedure.

5.5.4.3. Standard RNAV/RNP Transitions: During light to moderate traffic, inbounds fly a defined track to a standard 8–10-mile final approach. The transitions are designed to allow continuous descents to assist in reducing fuel burn and emissions. The transitions will be designed to avoid as many built up areas as possible. Theses transitions will concentrate aircraft on accurate, specific routes. The overall area impacted by noise will be reduced, however noise would be concentrated into small corridors, with the same settlements overflown by each approach.

5.5.5. Busy Periods

5.5.5.1. During busy spells, there may be a requirement to vector inbound aircraft in the latter stages of the approach to achieve safe spacing between multiple inbound aircraft. This use of vectors does however provide an element of track dispersion and noise relief to those communities which under the promulgated RNAV routes. It is indented that the areas available for use for radar vectoring are located away from the major conurbations, mostly overlying countryside to the South East and North West of the Airport.

5.5.5.2. This assessment concentrates on those aircraft not directed by Air Traffic Control (ATC) and is based on aircraft flying from the Initial Approach Fix or Holding Fix to the final approach (i.e. those that follow the Arrival Transitions). This assessment does not consider the final approach track (the straight-line approach to the runway from approximately 10 nautical miles out) as this will be the same for the Baseline and all DOs.

5.5.6. Arrival System Baseline

5.5.6.1. The are two general swathes of aircraft approaching RW32 that have been identified based on existing operations. One of these approaches from the south-west and overflies Huddersfield and then Wakefield before turning to join the final approach, which is labelled A on the figure. The second route (B) flies straight in over Featherston and Normanton. Both the Baseline swathes converge on Rothwell where they join the final approach, which overflies central Leeds.

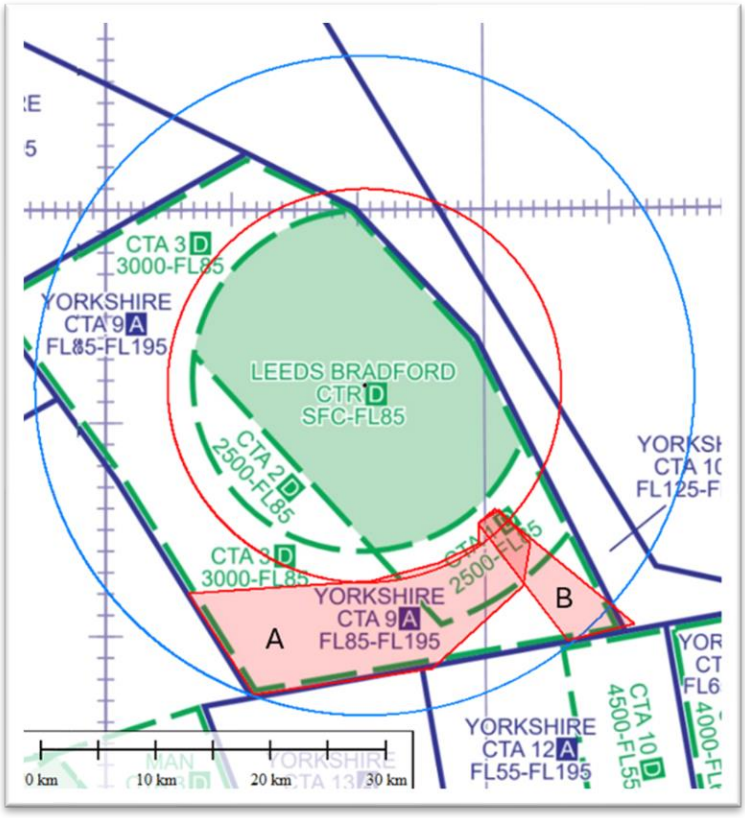


Figure 24: RW32 Arrival Swathes Baseline over ENR chart.

5.5.6.2. The are four general swathes of aircraft approaching RW14 that have been identified based on existing operations. One of these approaches from the south-west, which is labelled A on the figure. The remaining three swathes approach from the south or south-east. The first of these overflies Huddersfield and Halifax and then passes to the west of Bradford and is labelled B. This track conflicts with the outbound SIDS to POL and NELSA. Traffic often requires vectors, or a period of level flight to solve the confliction. The second overflies Normanton and parts of Wakefield before flying between Leeds and Bradford and is labelled C. This track conflicts with all outbound SIDS. Traffic often requires vectors, or a period of level flight to solve the confliction. The third overflies Pontefract and Castleford before flying to the west of Leeds and is labelled D. This track conflicts with the outbound SID to LAMIX. Traffic often requires vectors, or a period of level flight to solve the confliction. All four of the Baseline swathes converge on Bolton Abbey where they join the final approach.

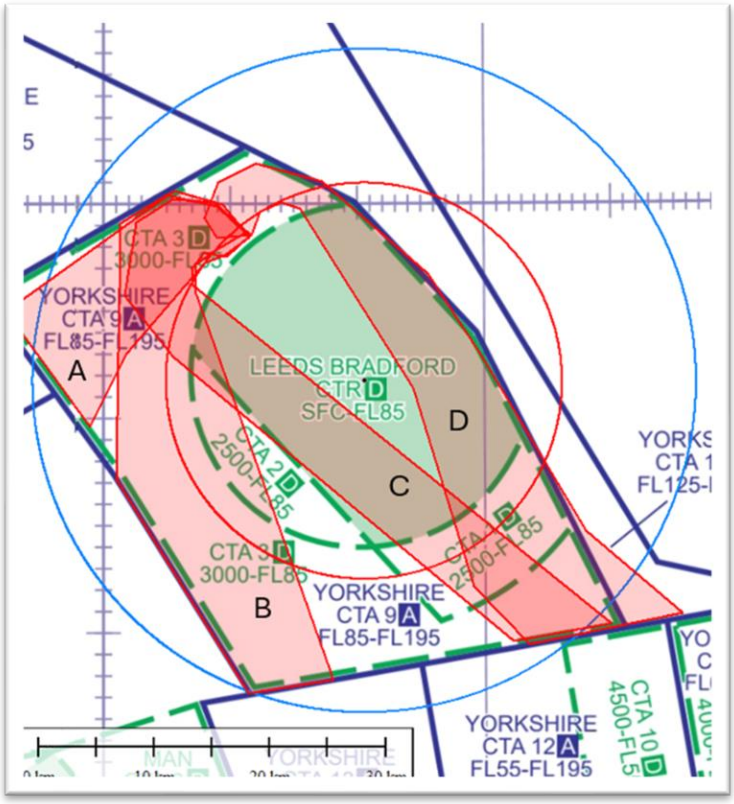


Figure 25: RW14 Arrival Swathes Baseline over ENR chart

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would continue to overfly the same communities after take-off with no change to noise impact.
	Air Quality	No changes expected to Air Quality.
Wider society	Greenhouse gas impact	There would be no change in track length or altitudes. No change in benefits or impacts to greenhouse gas and CO2 emissions.
	Capacity/ resilience	No opportunity to increase capacity or resilience.
	Tranquillity	The Baseline flies over Nidderdale AONB.
	Biodiversity	There are no additional biodiversity implications associated with retaining the Baseline. RW 14 Baseline currently flies over biodiversity sensitive areas in the southern part of Nidderdale AONB, such as South Pennine Moors and West Nidderdale Barden and Blubberhouses Moors and the North Pennine Moors. RW 32 does not currently fly over any areas of concern regarding biodiversity.
General aviation	Access	No change in controlled airspace or access to it if the Baseline was to be retained.
General aviation/ commercial airlines	Economic impact from increased effective capacity	No opportunity for increased capacity or benefit to economic impact should the Baseline option be retained.
	Fuel-burn	There would be no change in track length or altitudes. No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	No training costs for airlines as there would be no new procedures if this Baseline option were to be retained. Updates to flight procedures form part of an AIRAC cycle where airlines will update their procedures and utilise training if deemed necessary as standard.
	Other costs	No commercial airline costs are anticipated should the Baseline be retained.

Group	Impact	Qualitative Assessment
Airport/ Air navigation service provider	Infrastructure costs	No infrastructure costs are anticipated with the initial deployment of this option for either the Airport or ANSP.
	Operational costs	No operational costs are anticipated with the initial deployment of this option for either the Airport or the ANSP.
	Deployment costs	No controller or assistant training will be required should the Baseline be retained as procedures will not be changed.
All	Safety	No safety concerns should this Baseline option be retained.
	AMS Realisation	No change and therefore no improvements to align with AMS objectives.
	Interdependencies conflicts and trade-offs	Arrivals from the SW (labelled A) conflict with departures to LAMIX as tracks cross. This can often result in aircraft requiring radar vectors, or a period a level flight.

Table 43: Arrival System Baseline

5.5.6.2.1. None of the Baseline options were carried forward after the DPE and as such are not being assessed as viable options in this IOA. The table above is provided as a point of reference for the assessment of the other DOs in this group.

5.5.7. Arrival System 1 – LBA (Do Minimum)

5.5.7.1. Note this 'Do Minimum' option is not a 'Do Minimum' in the same way as the departure 'Do Minimum' options. There is no CAP1781 RNAV substitution equivalent for arrivals. The reason this is a 'Do Minimum' is because it keeps the arrival gate system as it exists today but adds PBN approaches and Arrival Transitions. The largest change from the Baseline is the addition of an eastern T-Bar to RW14.

5.5.7.2. RW32 Option 1 approaches from the north (having left the LBA Hold/Initial Approach Fix (IAF) flying between the centres of Leeds and Bradford before turning to broadly follow the later stages of RW32 Baseline approach swathe A.

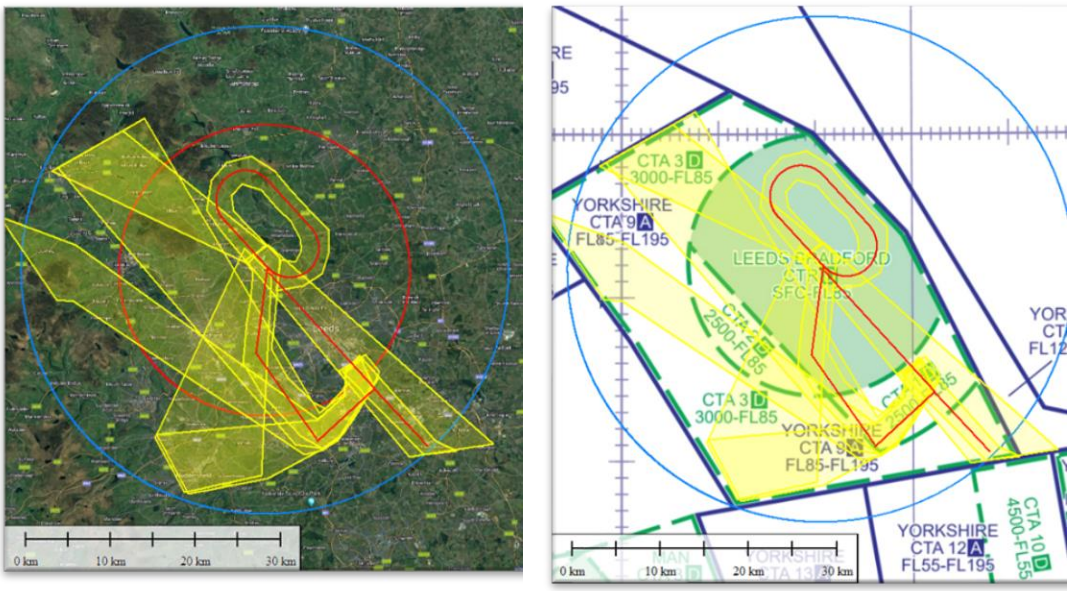
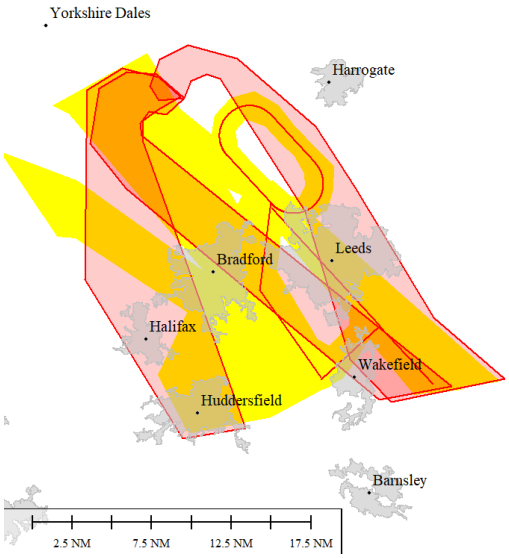
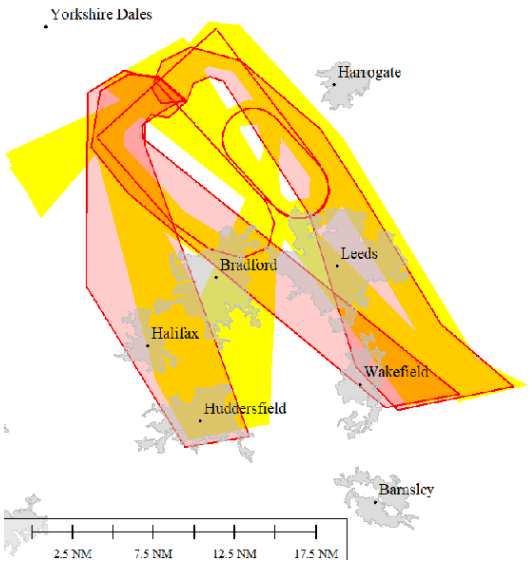


Figure 26: RW32 Arrival System 1 Google Maps Satellite (left) over ENR chart (right)

5.5.7.3. RW14 Option 1 includes two approach routes which begin at the LBA Hold over the Airport before circling either left or right respectively. The left turn route overflies generally sparsely populated areas. The right turn route overflies northern Bradford and Keighley. Both routes then converge on Bolton Abbey and are similar to RW14 Baseline swathes C and D.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 - The newly overflown areas would generally be of a slightly lower population density compared to those overflown in the Baseline at higher altitudes. At lower altitudes areas of similar population density would be overflown. A greater portion of Bradford would be flown over.  RW14 - The newly overflown areas would generally be of a slightly lower population density compared to those overflown in the Baseline at higher altitudes. At lower altitudes areas of similar population density would be overflown. A greater portion of Leeds would be flown over. 

Group	Impact	Qualitative Assessment
	Air Quality	The final approach will remain unaffected and therefore no change to air quality because there is no change to procedures below 1,000ft.
Wider society	Greenhouse gas impact	Insignificant difference from the Baseline.
	Capacity/ resilience	Insignificant difference from the Baseline however it not as efficient as other available options due to the Hold being in the overhead of the Airport.
	Tranquillity	Nidderdale AONB continues to be affected, and potentially further by the introduction of the Eastern T-Bar to RW14.
	Biodiversity	Biodiversity implications include those in the southern part of Nidderdale AONB, such as South Pennine Moors and West Nidderdale Barden and Blubberhouses Moors and the North Pennine Moors.
General aviation	Access	It is likely that additional CAS would be required to contain the Eastern T-Bar for RW14 at the detriment of Class G and other airspace users.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This DO does not increase effective capacity.
	Fuel-burn	Not as efficient as other available options but no less efficient than the Baseline.
Commercial airlines	Training costs	Minimal.
	Other costs	Airlines must file and fuel plan to route via the LBA.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	The airspace is not systemised-certain inbound and outbound routes require the use of vectors to de-conflict traffic. This results in higher workload. If the airport increases capacity as per predictions, additional sectors would be required to maintain safety levels due to the un-systemised network. This would result in higher staffing costs.

Group	Impact	Qualitative Assessment
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise. Routes are also not systemised (the TMA sectors have a different entry point depending on the runway in use)
	Interdependencies, conflicts and trade-offs	Runway 32: LAMIX departure conflicts with inbound routes from the South Western Gate, requiring tactical intervention. Runway 14: GOLES arrivals conflict with all outbound routes, often resulting in a period of level flight for departing traffic.

Table 44 - Arrival System 1 - LBA (Do Minimum)

5.5.7.4. **Carried forward.**

This option is carried forward on the basis there would be minimal change in noise impact below 4000ft with no new communities affected aligning with the Government's altitude-based priorities. The Eastern T-Bar for RW14 would mean the Nidderdale AONB would be affected, and additional CAS may be required. The RW32 option is not fully systemised as arrivals from the North West Hold would conflict with POL and NELSA departures. This option is the option most consistent with existing published procedures.

The runway 32 transition from the LBA could be beneficial in the event that additional airspace to the East is approved. LAMIX departures could potentially take a right turn from runway 32. The transition from the North West Hold could then leave the LBA on the above RNAV procedure, thus deconflicting all SIDS from the north western arrivals.

5.5.8. Arrival System 2 – NELSA/GOLES

5.5.8.1. RW32 Option 2 includes two routes. The first approaches from the west (from NELSA) flying over southern Bradford before turning to broadly follow the later stages of RW32 Baseline approach swathe A. The second is similar to RW32 approach Baseline swathe B, but with the initial fix points located further from the Airport.at GOLES.

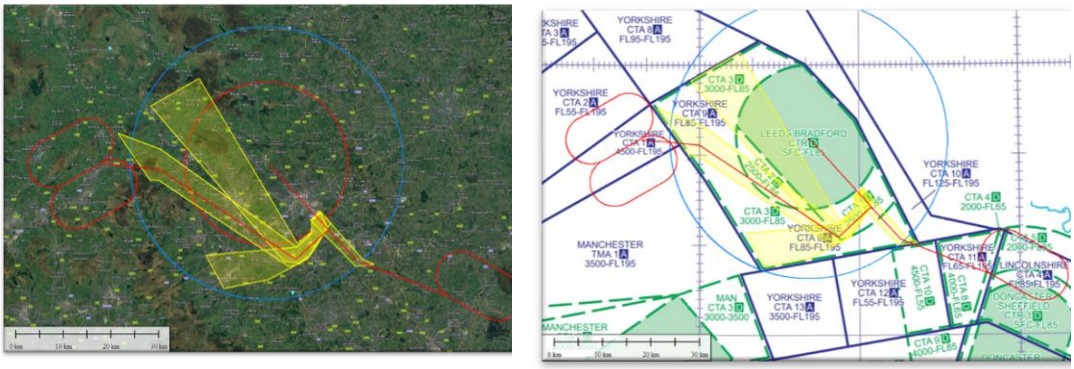


Figure 27: RW32 Arrival System 2 – NELSA/GOLES over Google Maps Satellite (left) over ENR chart (right).

5.5.8.2. RW14 Option 2 includes two approach routes which are similar to RW14 Baseline swathes A and D, but with the initial fix points located further from the airport at NELSA and GOLES.

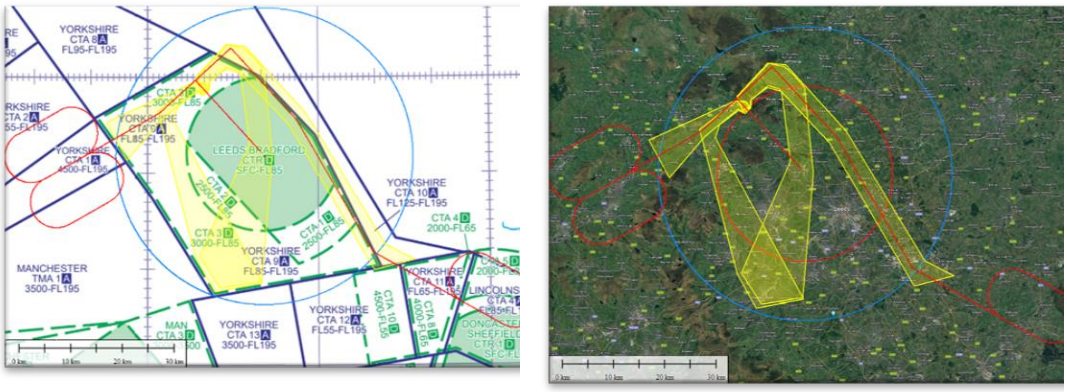
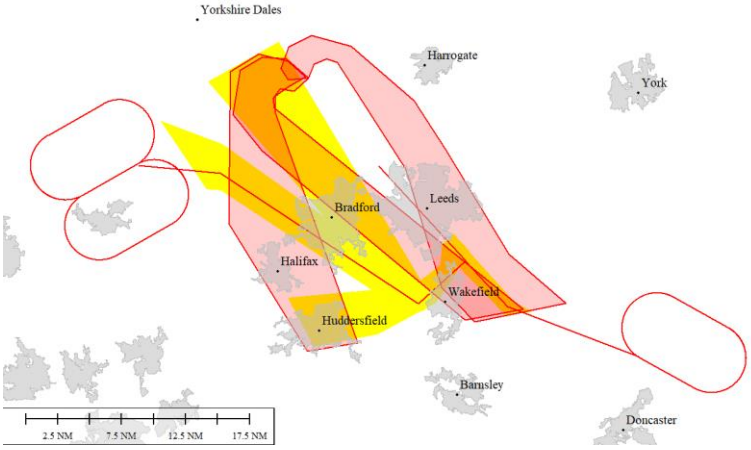
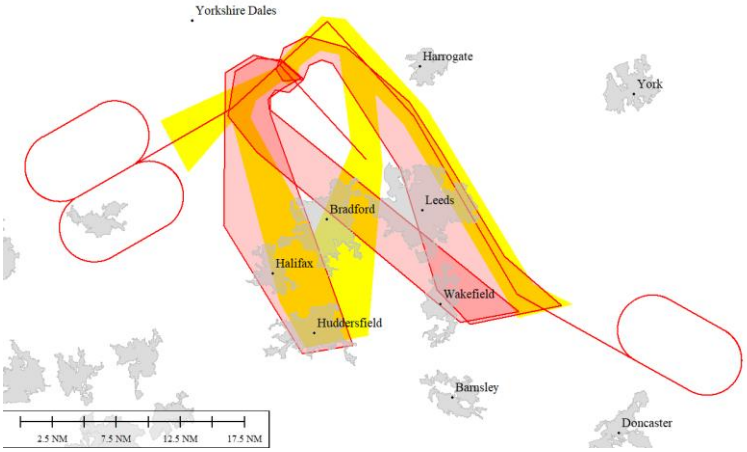
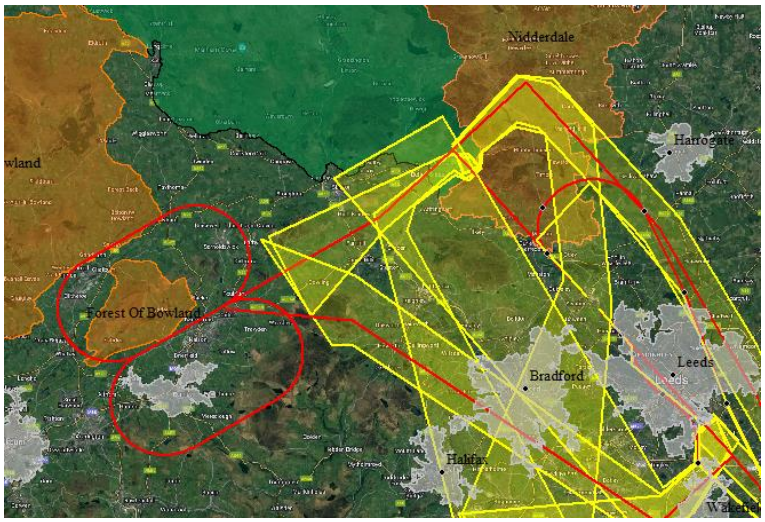


Figure 28: RW14 Arrival System 2 – NELSA/GOLES over Google Maps Satellite (left) over ENR chart (right).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 - The newly overflown areas would generally be of a similar or slightly higher population density compared to those overflown in the Baseline at higher altitudes. At lower altitudes areas of similar population density would be overflown.  RW14 - The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline. 
	Air Quality	The final approach will remain unaffected and therefore no change to air quality as no change to procedures below 1,000ft.
Wider society	Greenhouse gas impact	If it can be assumed that much of the inbound traffic from the South will be re-routed via the GOLES area by NERL with traffic from the North-West and West being routed via NELSA, then this DO is efficient as the track miles are no more than necessary and the systemised approach should result in continuous descent.

Group	Impact	Qualitative Assessment
	Capacity/ resilience	The runway 14 option works well, assuming GOLES and the North West Hold routes are used. The runway 32 system however will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb)
	Tranquillity	May have some impact on the Nidderdale AONB and Yorkshire Dales National Park. The Hold is over Forest of Bowland AONB however aircraft are typically at approximately 4000ft here. This is similar to the Baseline. 
	Biodiversity	Possible impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted. This is similar to the Baseline.
General aviation	Access	It is likely that additional CAS would be required, to contain the Eastern T-Bar for RW14, the Holds and for the Arrival Transition routing to the East of the Airport, at the detriment of Class G and other airspace users.
General aviation/	Economic impact from increased effective capacity	This DO may increase effective capacity and therefore may be of economic benefit.

Group	Impact	Qualitative Assessment
commercial airlines	Fuel-burn	If it can be assumed that much of the inbound traffic from the South will be re-routed via the GOLES area by NERL with traffic from the North-West and West being routed via NELSA, then this DO is efficient as the track miles are no more than necessary and the systemised approach should result in continuous descent.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline. Transition swathes from Worth do not connect with the proposed NERL Hold at MARIA.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS and reducing noise but may contribute to improving fuel efficiency.
	Interdependencies, conflicts and trade-offs	The runway 14 option is free from confliction, assuming that the Eastern transition from GOLES is used along with the North West transition. The runway 32 system however will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point to the West of the airport (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). RW 32 option is not fully systemised as arrivals from the North West Hold would conflict with POL and NELSA departures.

Table 45 – Arrival System 2 – NELSA/GOLES

5.5.8.3. **Carried forward**.

This option should have benefits to fuel burn, capacity and greenhouse gas, there would be minimal change in noise impact below 4000ft with no new communities affected and is carried forward on these grounds. However, the Eastern T-Bar for RW14 would mean the Nidderdale AONB would be affected, and additional CAS may be required, the Hold is also over the Forest of Bowland AONB at approximately 4000ft which does not align with the Government's altitude-based priorities.

5.5.9. Arrival System 3 – AIREY/WORTH

5.5.9.1. RW32 Option 3 includes two routes. The first approaches from the north-west from the Hold/IAF at WORTH flying over eastern Bradford before turning to broadly follow the later stages of RW32 Baseline approach swathe A. The second is similar to RW32 approach Baseline swathe B, but with the initial fix points located further from the airport and slightly further east at AIREY. This route would overfly Pontefract instead of Normanton.

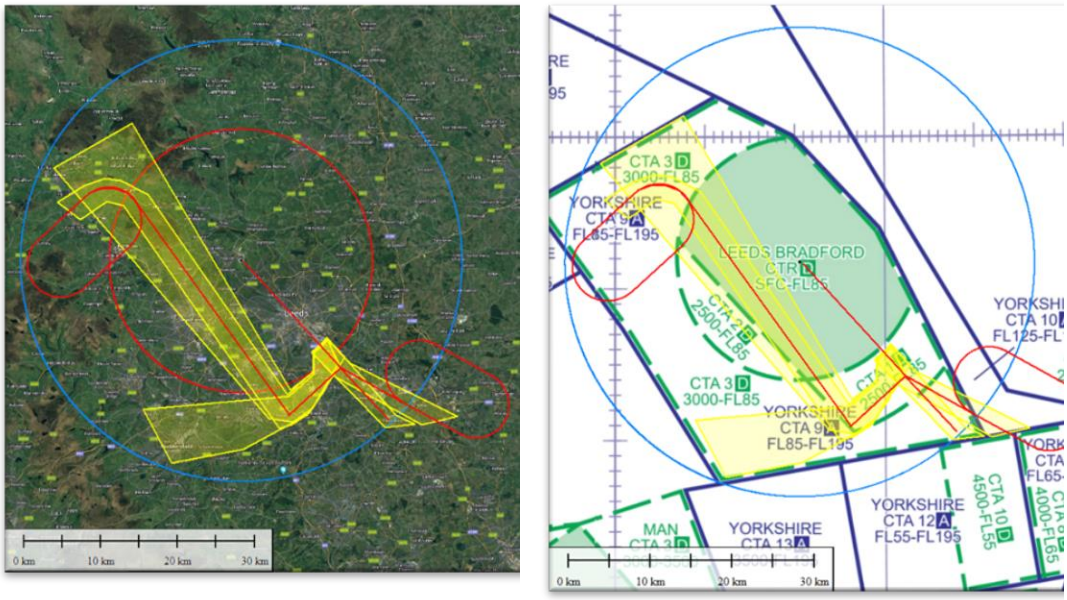


Figure 29: RW32 Arrival System Option 3 Google Maps Satellite (left) over ENR chart (right).

5.5.9.2. RW14 Option 3 is similar to RW14 Option 2, but with the initial fix points located closer to the airport at WORTH and AIREY.

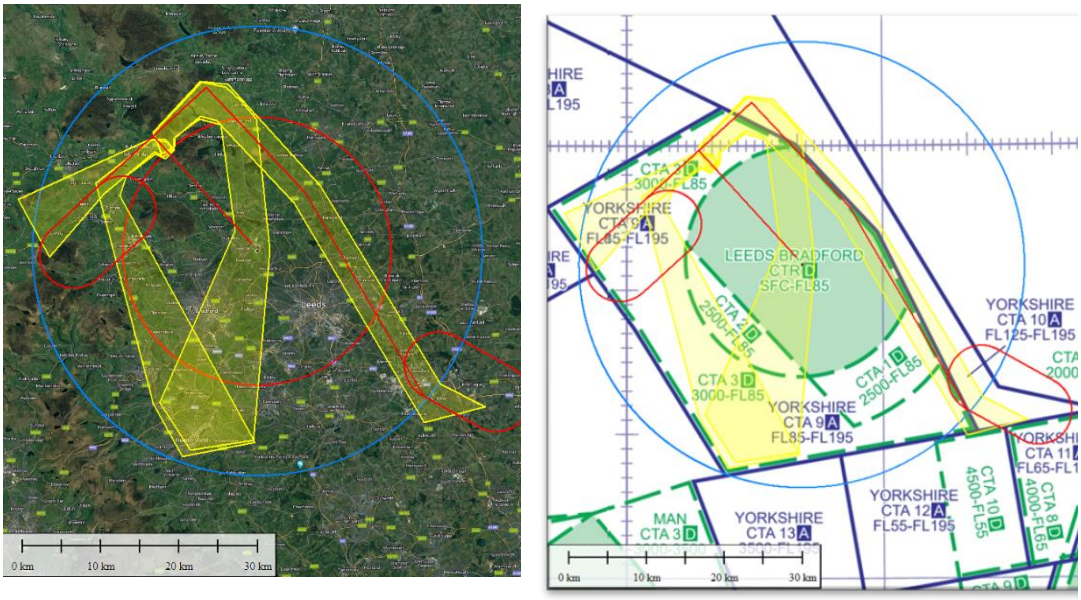
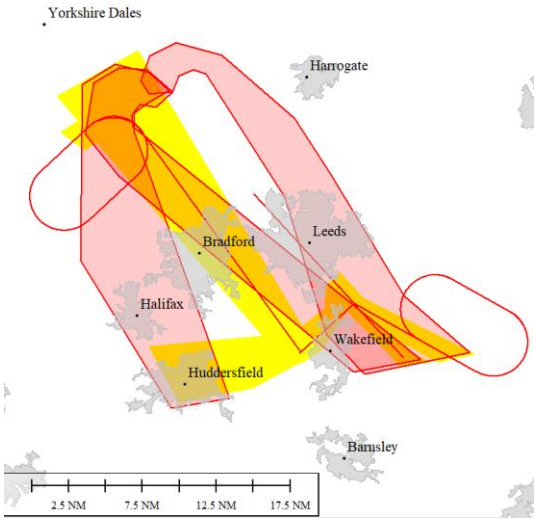
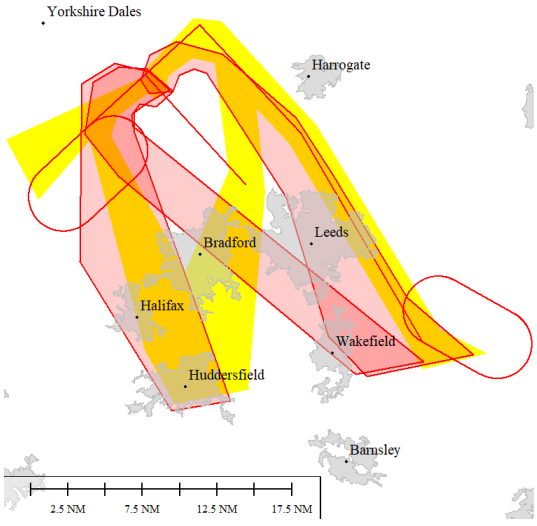


Figure 30: RW14 Arrival System Option 3 Google Maps Satellite (left) over ENR chart (right).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 - The newly overflown areas would generally be of a similar or slightly higher population density compared to those overflown in the Baseline at higher altitudes. At lower altitudes areas of similar population density would be overflown.  RW14 - The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline.  Yellow swathes represent the option and red the Baseline. Red lines represent the Hold for the option.

Group	Impact	Qualitative Assessment
	Air Quality	The final approach will remain unaffected and therefore no change to air quality as no change to procedures below 1,000ft.
Wider society	Greenhouse gas impact	If it can be assumed that much of the inbound traffic from the South will be re-routed via the AIREY area by NERL with traffic from the North-West and West being routed via NELSA to WORTH, then this DO is efficient as the track miles are no more than necessary. However, the position of the Hold at WORTH may impact upon continuous climbs.
	Capacity/ resilience	The IAF/Hold at WORTH is most likely to reduce the likelihood of CCOs off RW32 and add unnecessary congestion close to the Airport. The runway 32 system will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The runway 14 option from the South West would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks.
	Tranquillity	May have some impact on the Nidderdale AONB and Yorkshire Dales National Park.
	Biodiversity	Possible impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted. These are similar to the Baseline.
General aviation	Access	It is likely that additional CAS would be required, to contain the Eastern T-Bar for RW14, the Holds and for the Arrival Transition routing to the East of the Airport, at the detriment of Class G and other airspace users. The airspace required for the AIREY Hold is disproportionate.
General aviation/ Commercial airlines	Economic impact from increased effective capacity	This DO is unlikely to increase capacity.

Group	Impact	Qualitative Assessment
	Fuel-burn	If it can be assumed that much of the inbound traffic from the South will be re-routed via the AIREY area by NERL with traffic from the North-West and West being routed via NELSA to WORTH, then this DO is efficient in terms of expeditious routing however, Continuous Climb Operations (CCOs)/ Continuous Descent Operations (CDOs) may be impacted.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	Tactical coordination required to deconflict WORTH and RW32 departures. Proximity of AIREY Hold to Sherburn and Leeds East and Burn Gliders is problematic.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS and reducing noise but may contribute to improving fuel efficiency.
	Interdependencies, conflicts and trade-offs	The runway 32 system will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The runway 14 option from the South West would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks.

Table 46 – Arrival System 3 – AIREY/WORTH

5.5.9.2.1. **Discounted.**

This option is discounted as it provides no improvements on the Baseline and do minimum option. Safety is of concern along with the requirement for more CAS, impacts on tranquillity and fuel burn.

5.5.10. Arrival System 4 – AIREY/WORTH/LBA

5.5.10.1. RW32 Option 4 is a combination of Options 1 and 3.

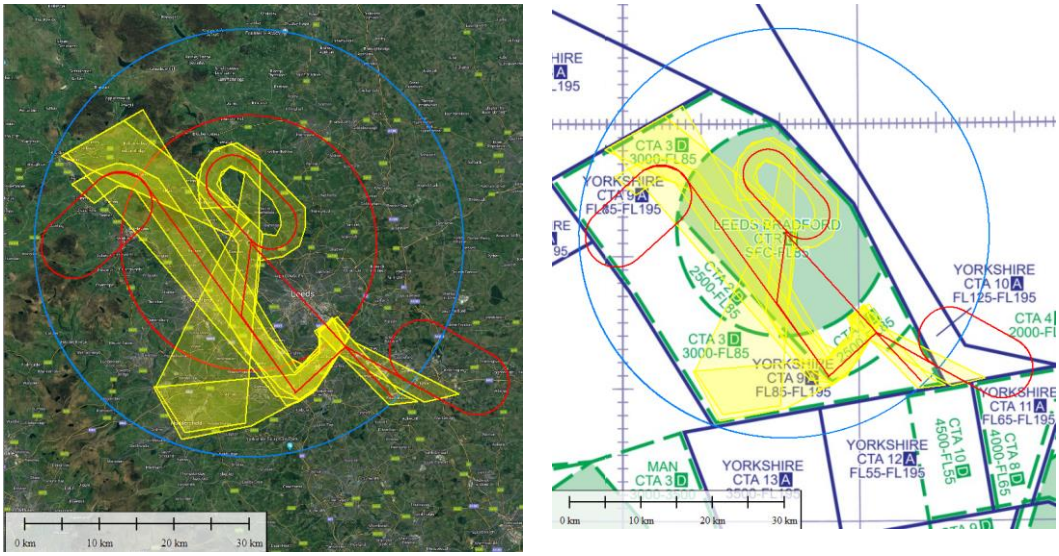


Figure 31: RW32 Arrival System Option 4 AIREY/WORTH/LBA over Google Maps Satellite (left) over ENR chart (right).

5.5.10.2. RW14 Option 4 is a combination of Option 1 and Option 3.

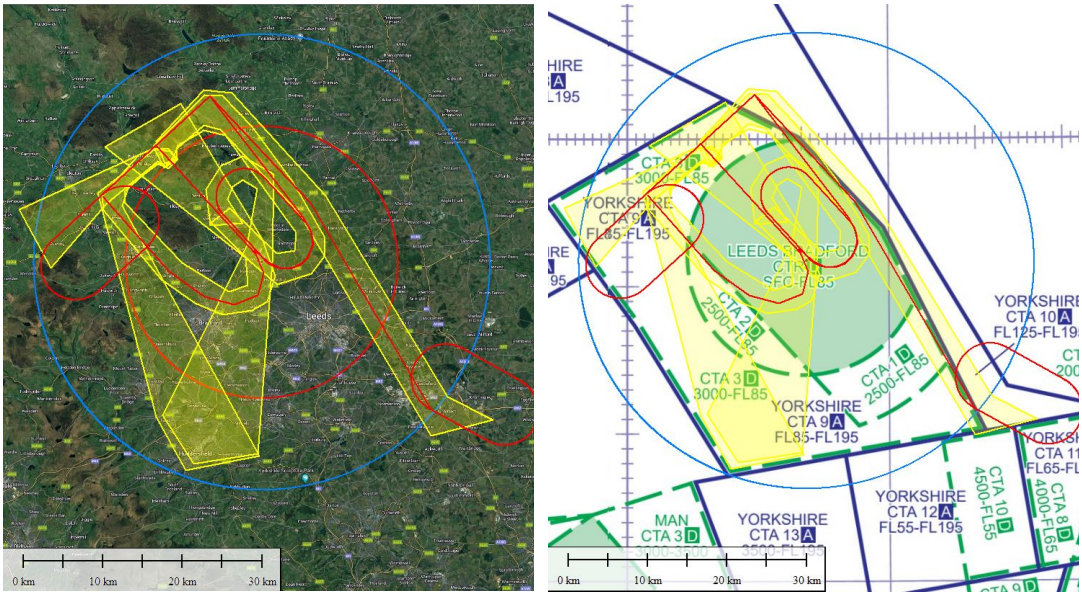
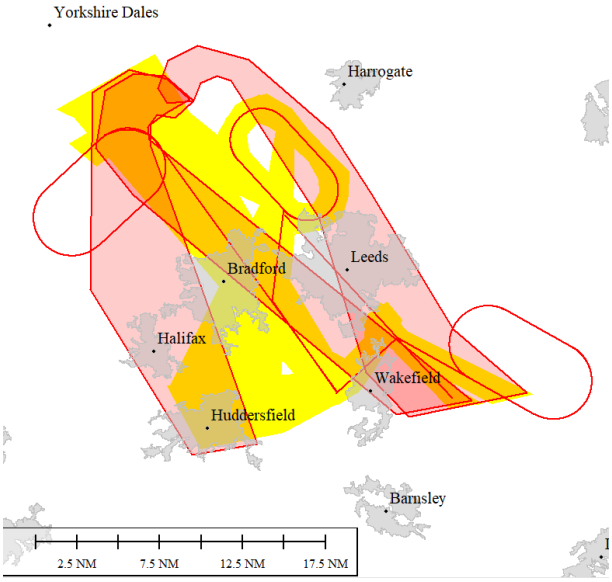
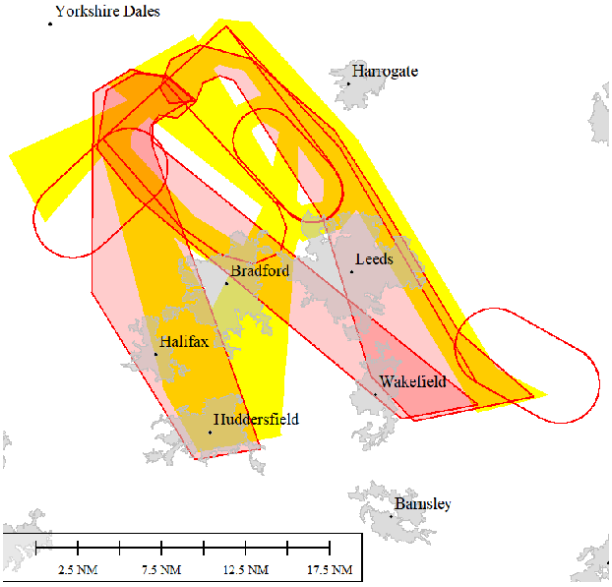
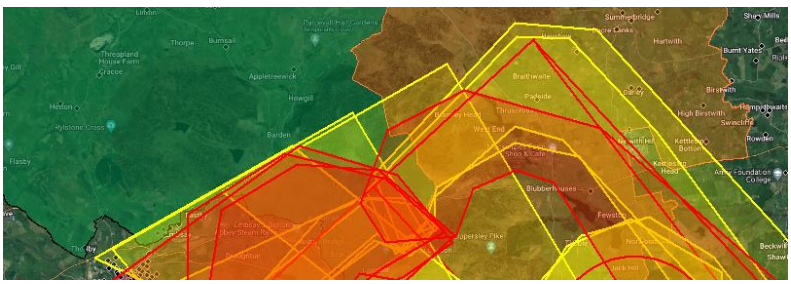
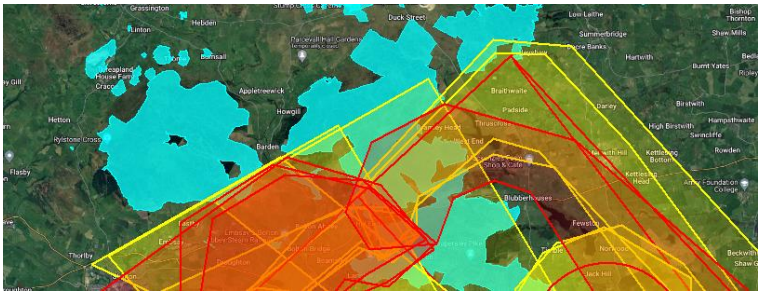


Figure 32: RW14 Arrival Option 4 AIREY/WORTH/LBA over Google Maps Satellite (left) over ENR chart (right).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW 32 -The newly overflown areas would generally be of a similar or slightly higher population density compared to those overflown in the Baseline at higher altitudes. At lower altitudes areas of similar population density would be overflown.  RW14 - The newly overflown areas would generally be of a similar population density compared to those overflown in the Baseline.  Yellow swathes represent the option and red the Baseline. Red lines represent the Hold for the option.

Group	Impact	Qualitative Assessment
	Air Quality	The final approach will remain unaffected and therefore no change to air quality as no change to procedures below 1,000ft.
Wider society	Greenhouse gas impact	Routing via the LBA assessed as negligible difference compared with the Baseline as very similar. If it can be assumed that much of the inbound traffic from the South will be re-routed via the AIREY area by NERL with traffic from the North-West and West being routed via NELSA to WORTH, then this DO is efficient as the track miles are no more than necessary. However, the position of the Hold at WORTH may impact upon continuous climbs.
	Capacity/ resilience	The IAF/Hold at WORTH is most likely to reduce the likelihood of CCOs off RW32 and add unnecessary congestion close to the Airport. The runway 32 system will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The runway 14 option from the South West would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks.
	Tranquillity	May have some additional impact on the Nidderdale AONB and Yorkshire Dales National Park. 

Group	Impact	Qualitative Assessment
	Biodiversity	Possible additional impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted. 
General aviation	Access	It is likely that additional CAS would be required, to contain the Eastern T-Bar for RW14, the Holds and for the Arrival Transition routing to the East of the Airport, at the detriment of Class G and other airspace users. The airspace required for the AIREY Hold is disproportionate.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This DO is unlikely to increase capacity.
	Fuel-burn	If it can be assumed that much of the inbound traffic from the South will be re-routed via the AIREY area by NERL with traffic from the North-West and West being routed via NELSA to WORTH, then this DO is efficient in terms of expeditious routing however, CCOs/CDOs may be impacted.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified,
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.

Group	Impact	Qualitative Assessment
All	Safety	Tactical coordination required to deconflict WORTH and RW32 departures. Proximity of AIREY Hold to Sherburn and Leeds East and Burn Gliders is problematic.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS and reducing noise but may contribute to improving fuel efficiency.
	Interdependencies, conflicts and trade-offs	The runway 32 system will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The runway 14 option from the South West would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks. Transition swathes from NELSA do not connect with the proposed NERL Hold at MARIA.

Table 47 – Arrival System 4 - AIREY/WORTH/LBA

5.5.10.2.1. **Discounted.**

This option is discounted as it provides no improvements on the Baseline and do minimum option. Safety is of concern along with the requirement for more CAS, impacts on tranquillity and fuel burn.

5.5.11. Arrival System 5 – NELSA/GOLES/UDDER

5.5.11.1. RW32 Option 5 includes both routes from Option 2 as well as an additional approach route from the Hold/IAF at UDDER. The additional approach route also approaches from the west, but flies further south than that from Option 2.

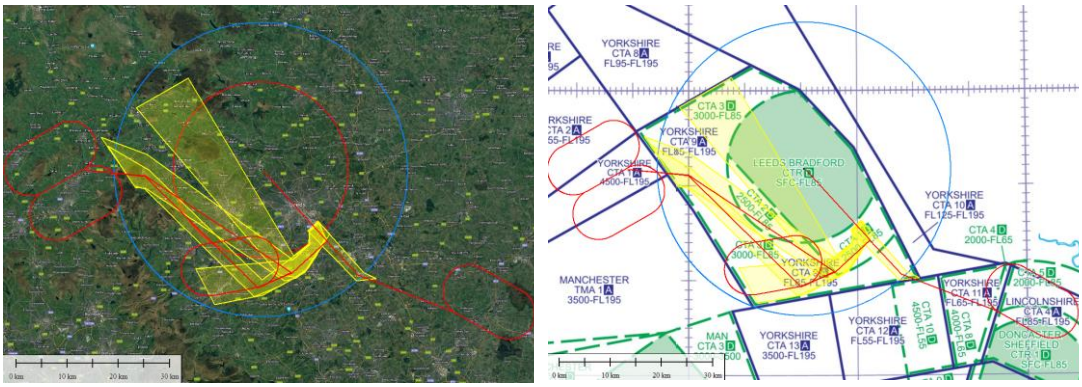


Figure 33: RW32 Arrival System Option 5 NELSA/GOLES/UDDER over Google Maps Satellite (left) over ENR chart (right).

5.5.11.2. RW14 Option 5 includes both routes from Option 2 as well as an additional approach route from the Hold/IAF at UDDER. The additional approach route overflies central Bradford.

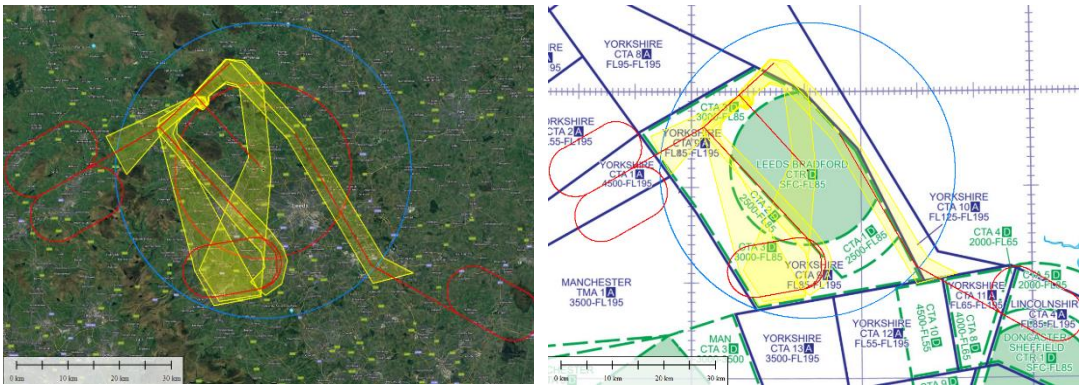
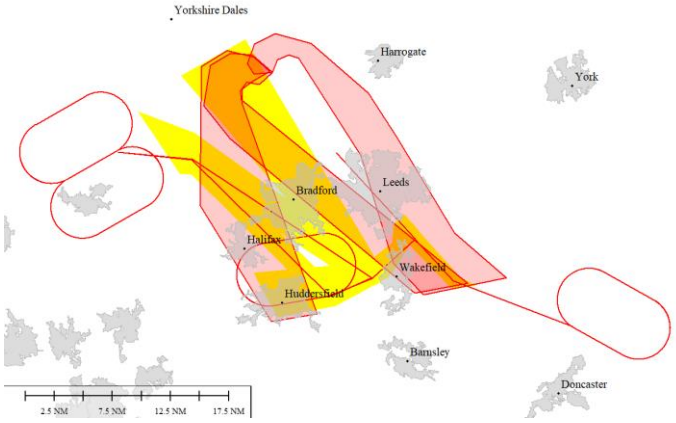
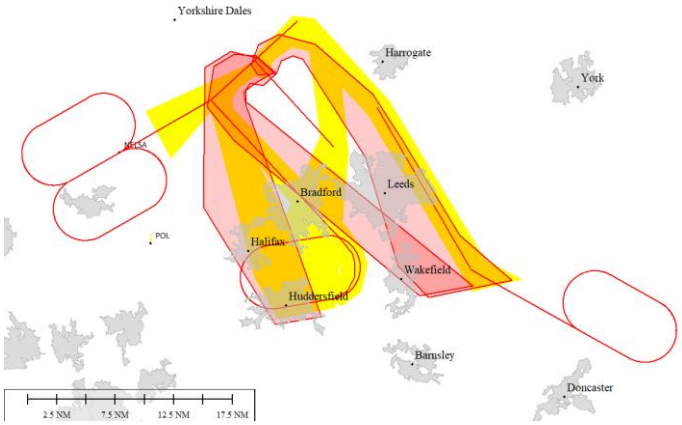
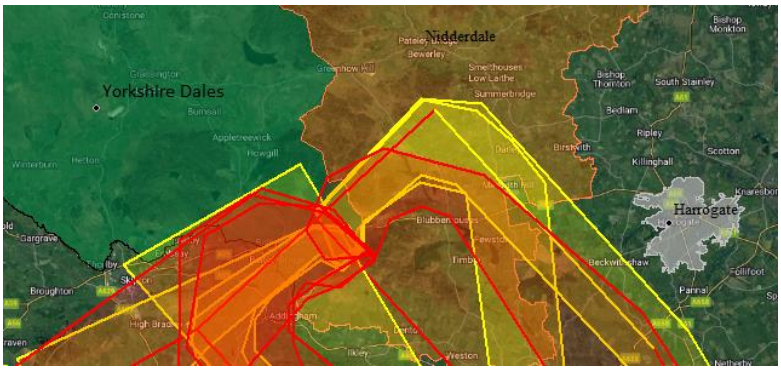


Figure 34: RW14 Arrival System Option 5 over Google Maps Satellite (left) over ENR chart (right).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 - This route would overfly areas with a slightly lower population density compared to those overflown in the Baseline at higher altitudes. However, the Option 2 routes overfly areas with a similar or slightly higher population density compared to those overflown in the Baseline at higher altitudes. At lower altitudes Option 5 is similar to the Baseline so areas of similar population density would be overflown.  RW14 – The additional route from UDDER would overfly areas with a slightly higher population density compared to those overflown in the Baseline. 
	Air Quality	The final approach will remain unaffected and therefore no change to air quality as no change to procedures below 1,000ft.
Wider society	Greenhouse gas impact	If it can be assumed that much of the inbound traffic from the South will be re-routed via the GOLES area by NERL with traffic from the North-West and West being routed via NELSA, then this DO is efficient as the track miles are no more than necessary and the systemised approach should result in continuous descent.

Group	Impact	Qualitative Assessment
	Capacity/ resilience	The runway 32 system will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The runway 14 option from the South West would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks.
	Tranquillity	May have some additional impact on the Nidderdale AONB and Yorkshire Dales National Park. 
	Biodiversity	Possible impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted however this is similar to the Baseline.
General aviation	Access	It is likely that additional CAS would be required, to contain the Eastern T-Bar for RW14, the Holds and for the Arrival Transition routing to the East of the Airport, at the detriment of Class G and other airspace users.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This DO may increase effective capacity but the economic value of this is impossible to state in qualitative terms.
	Fuel-burn	If it can be assumed that much of the inbound traffic from the South will be re-routed via the GOLES area by NERL with traffic from the North-West and West being routed via NELSA, then this DO is efficient as the track miles are no more than necessary and the systemised approach should result in continuous descent. UDDER Hold may result in departures off RW14 being held down lower than necessary.

Group	Impact	Qualitative Assessment
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified; however, Coordination and associated workload would be higher than Baseline if the Udder Hold was active.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	The proposed Hold at UDDER has potential to conflict with inbound routes to Manchester routing from GOLES towards the ROSUN arrival. The Hold is also not separated from POL and potentially NELSA departures from runway 14, and the POL departure from runway 32.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS and reducing noise but may contribute to improving fuel efficiency.
	Interdependencies, conflicts and trade-offs	The runway 32 system will result in level periods of flights for both POL and NELSA departures as the transition crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The runway 14 option from the South West would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks.

Table 48 – Arrival System 5 – NELSA/GOLES/UDDER

5.5.11.2.1. **Carried forward.**

This option should have benefits to fuel burn, capacity and greenhouse gas. This option is carried forward on the basis there would be minimal change in noise impact below 4000ft aligning with the Government's altitude-based priorities. The Eastern T-Bar for RW14 would mean the Nidderdale AONB would be affected, and additional CAS may be required. The Hold at Udder may make this option unviable due to the numerous conflictions with other routes and potentially Manchester inbounds.

5.5.12. Arrival System 6

5.5.12.1. Arrival System 6 is a two arrival Hold system in which aircraft arriving from all directions other than the East have a STAR that ends with a holding fix at the LBA (or route directly through the existing arrival gates). Arrival Transitions then take aircraft from the LBA to a downwind left IAF for RW32 and to a downwind right IAF for RW14 unless aircraft are released on own navigation prior to reaching the LBA. Each runway has the potential to add a 'Trombone' for sequencing of traffic by extension of the downwind leg albeit this would result in the need to extend the LBA CAS. T1raffic from the East would route via a STAR to a holding fix at GOLES and for RW14, an Arrival Transition would route initially to the East of the climb-out lane before turning through the overhead to a downwind right IAF (possibly utilising the Trombone for sequencing). For RW32, traffic would use an Arrival Transition to at 15nm final on the extended centreline, or via an extension (for sequencing) to the western IAF. The LBA Hold would also serve as the MAP Hold in this configuration.

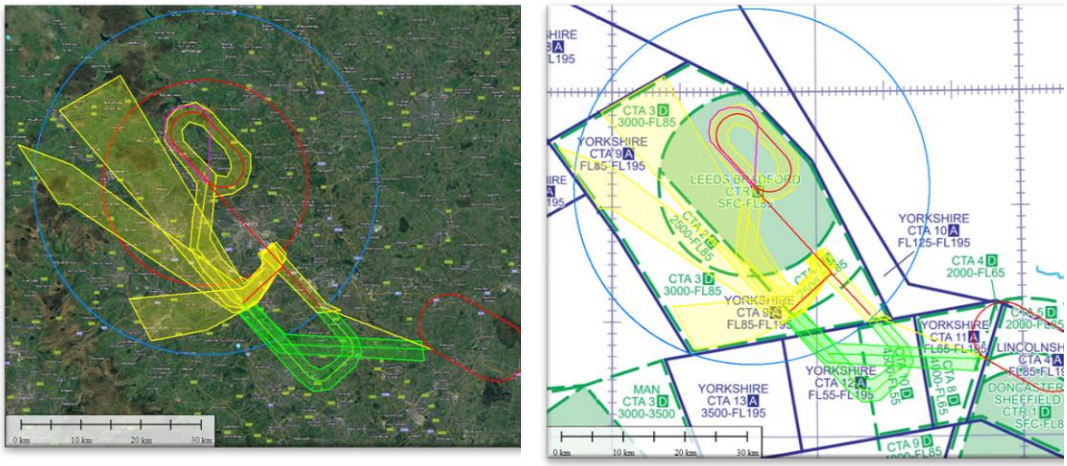


Figure 35: RW 32 Arrival System 6 over Google Maps Satellite (left) over ENR chart (right).

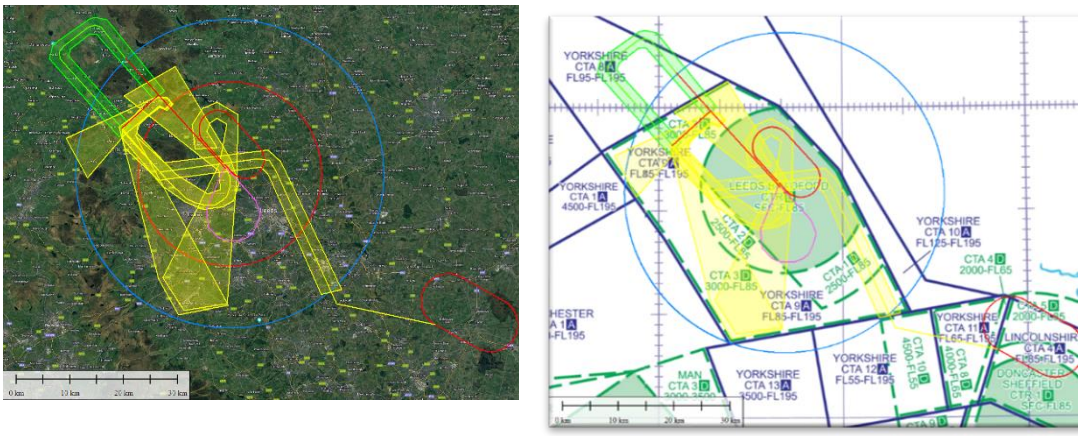
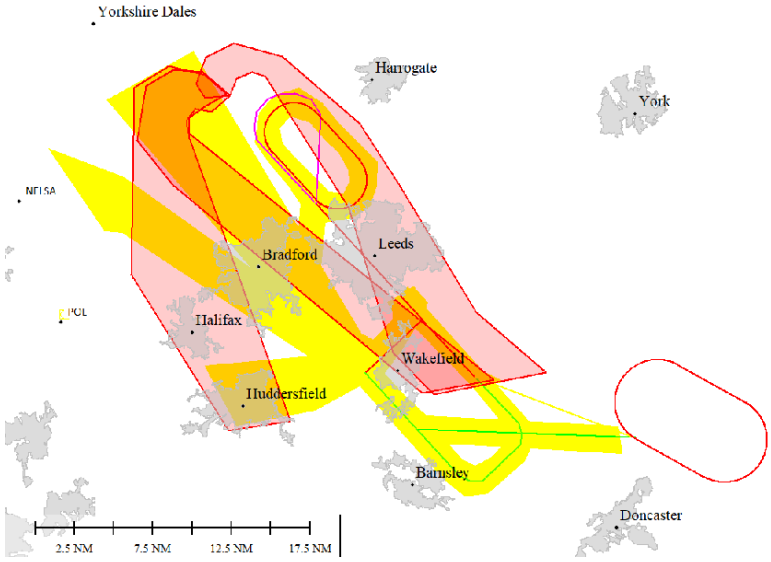
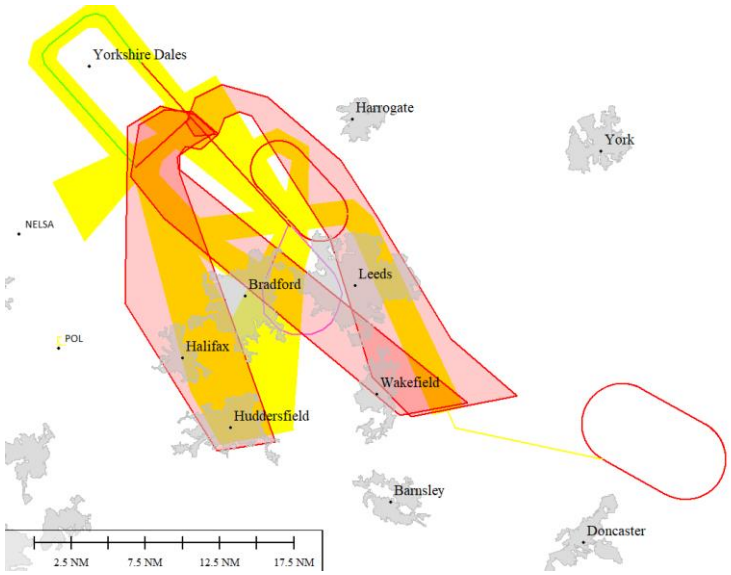
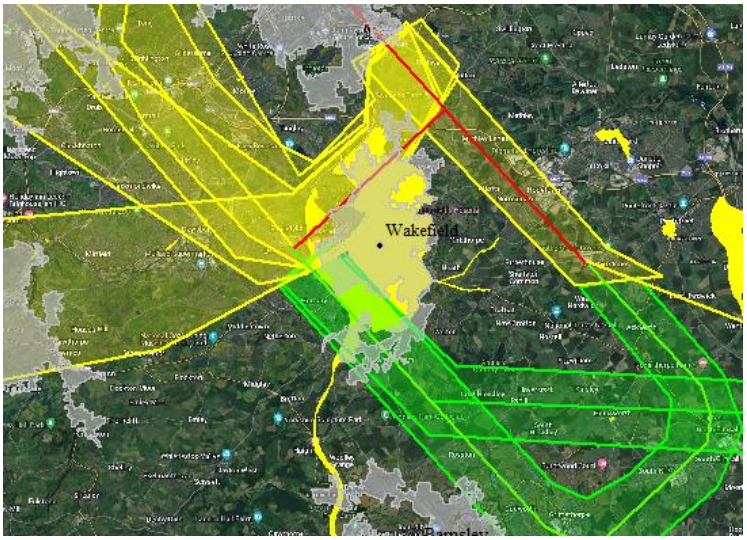
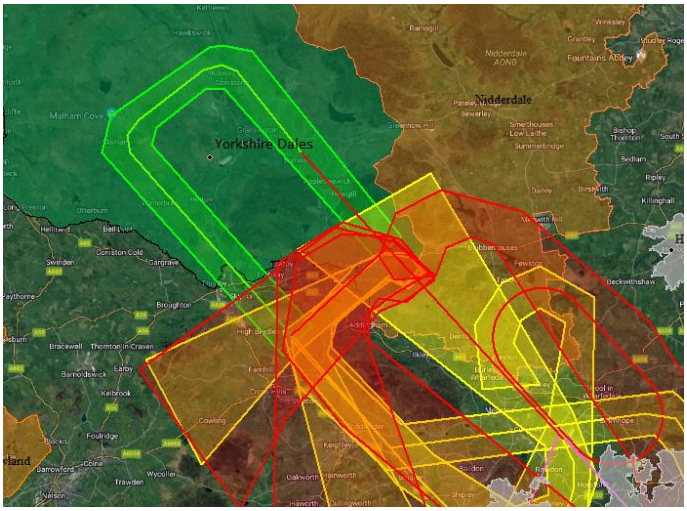


Figure 36 - RW14 Arrival System 6 over Google Maps Satellite (left) over ENR chart (right).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 – Significantly greater numbers of the population would be flown over for RW32 with this option. Newly flown over areas include Bradford.  RW14 – A similar amount of people would be flown over for however different communities in Leeds and Bradford would be flown over compared to the Baseline. 

Group	Impact	Qualitative Assessment
	Air Quality	AQMA at Wakefield and M1 corridor will be flown over for arrivals to RW32, see image. AQMAs at Brighouse and Huddersfield would be overflown for arrivals to RW14, however this is similar to the Baseline. 
Wider society	Greenhouse gas impact	Greenhouse gas impact would be increased for routing via LBA.
	Capacity/ resilience	The GOLES element of this option would increase capacity and resilience, however the LBA and trombone airspace could have the opposite effect[13]. There would also be a heavy requirement for tactical vectoring and level restrictions, particularly on RW32.

[13] The trombones are actually designed to increase the capacity of the airspace. They allow more aircraft to be handled in the airspace than simply delaying aircraft at the holds which may have a capped upper limit.

Group	Impact	Qualitative Assessment
	Tranquillity	May impact Nidderdale AONB and the south portion of the Yorkshire Dales National Park. RW 14 may significantly impact the Yorkshire Dales National Park. See image below. 
	Biodiversity	Possible additional impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted.
General aviation	Access	It is likely that additional CAS would be required, for the 15nm final and trombone.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This option may increase effective capacity but the economic value of this is impossible to state in qualitative terms.
	Fuel-burn	Fuel burn would be increase for routing via LBA.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.

Group	Impact	Qualitative Assessment
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Runway 32. Direct routings from the N and NW to the LBA would conflict with all SIDS. A direct to the downwind from the NW Hold would conflict with the POL and NELSA SIDS (but not the LAMIX SID if it was to turn right off runway 32). The direct approach from the SW should potentially not conflict with any SID (a left turn LAMIX departure off runway 32 could contain an "at or above" waypoint to ensure separation from this approach" Runway 14. The arrival from GOLES could conflict the NELSA SID off runway 14. The LBA option from the SW would conflict with all SIDS. The "direct to base leg" option for runway 14 would conflict with the POL and NELSA SIDS. A routing from the NW Hold to the LBA followed by a downwind right-hand transition would conflict with the POL and NELSA SIDS. A transition from MARIA direct to final approach would not conflict with any SID. Any holding traffic at the LBA at FL80 or below would result in a level period of flight for any right turn LAMIX SID off runway 32. The trombone to the South for runway 32 would require either a change of controlling authority, or delegation from Scottish control. It should be noted that this segment of airway is rarely used by any traffic working Scottish at 6000 ft (the requested level for this particular transition).

Table 49 – Arrival System 6

5.5.12.2. **Discounted.**

This option is discounted based on the increase in disturbance to communities below 4000ft, potential increase in CAS and greenhouse gas/fuel burn with minimal foreseen benefits.

5.5.13. Arrival System 7

5.5.13.1. Arrival System 7 is a three arrival Hold system with the LBA additionally serving as the MAP Hold. Aircraft from the South-West and South-East would route through the existing arrival gates or via a STAR terminating at the LBA. Arrival Transitions then take aircraft from the LBA to a downwind left IAF for RW32 and to a downwind right IAF for RW14 unless aircraft are released on own navigation prior to reaching the LBA. Traffic from the East would route via a STAR to a holding fix at GOLES and for RW14, an Arrival Transition would route initially to the East of the climb-out lane before turning through the overhead to a downwind right IAF (possibly utilising the Trombone for sequencing). For RW32, traffic would use an Arrival Transition to at 15nm final on the extended centreline, or via an extension (for sequencing) to the western IAF. Traffic from the North-West or North-East would route via a STAR to a NW Hold before transitioning via the overhead for downwind left for RW32 or a 15nm final for RW14.

Figure 37: RW 32 Option 7

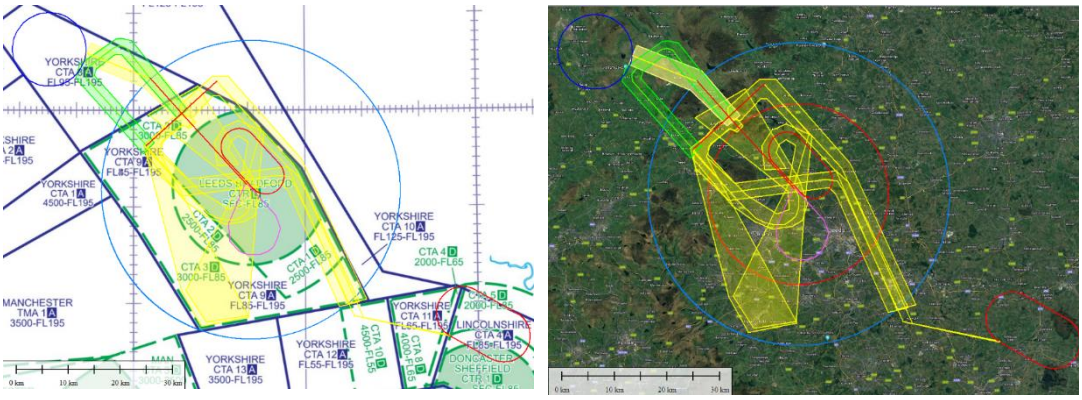
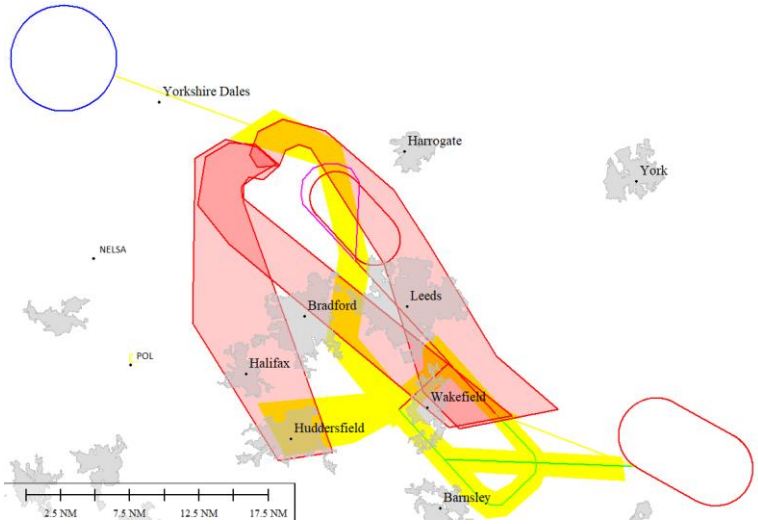
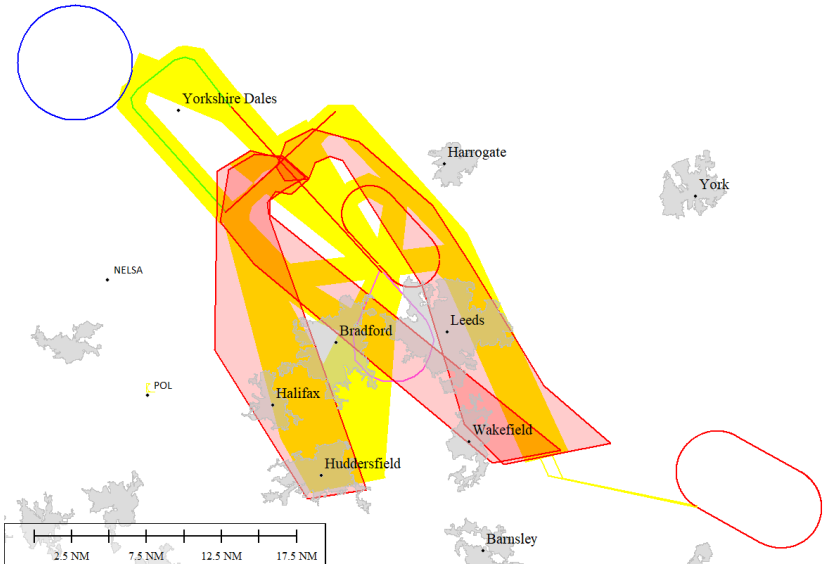
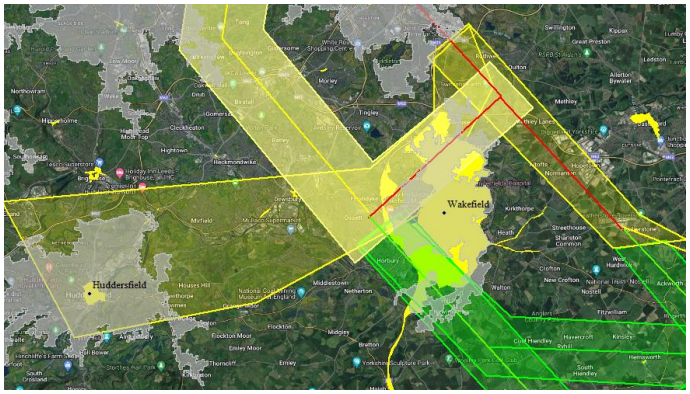
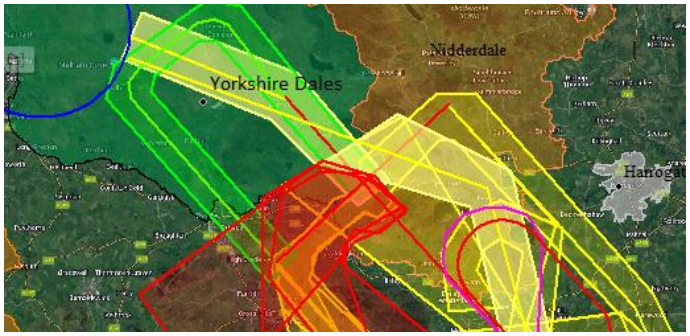
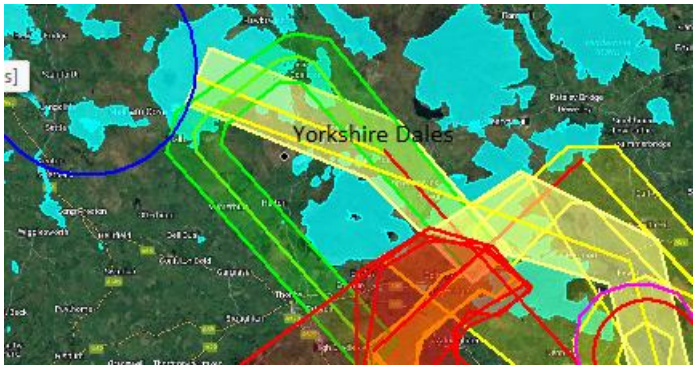


Figure 38: RW14 Option 7

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 – Similar impact on communities in Huddersfield and Wakefield, additional impact on communities in Bradford and West Leeds with this option compared to the Baseline.  RW14 – Similar impact on Bradford, Halifax and Huddersfield and greater impact on East Leeds communities. 

Group	Impact	Qualitative Assessment
	Air Quality	AQMA at Wakefield and M1 corridor will be flown over for arrivals to RW32, see image. AQMAs at Huddersfield and Wakefield would be overflown for arrivals to RW14, see image, however this is similar to the Baseline. 
Wider society	Greenhouse gas impact	Greenhouse gas impact would be increased with this option.
	Capacity/ resilience	The GOLES element of this option would increase capacity and resilience, however the LBA and trombone airspace has the opposite effect. There would also be a heavy requirement for tactical vectoring and level restrictions, particularly on RW32.
	Tranquillity	May have some additional impact on the Nidderdale AONB and Yorkshire Dales National Park. 

Group	Impact	Qualitative Assessment
	Biodiversity	Possible additional impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be significantly impacted. 
General aviation	Access	It is likely that additional CAS would be required, for the 15nm final, eastern T bar on RW14 and trombone to the north.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This option may increase effective capacity but the economic value of this is impossible to state in qualitative terms.
	Fuel-burn	Fuel burn would be increased with this option.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	There could be safety implications with this option as the LBA STAR via the SW Arrival Gate system conflicts with outbounds off RW14.

Group	Impact	Qualitative Assessment
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Runway 32. The transition from the NW Hold could conflict with a Right turn LAMIX SID. The direct approach from the SW should not conflict with any SID (a left turn LAMIX departure off runway 32 could contain an "at or above" waypoint to ensure separation from this approach" Runway 14. The arrival from GOLES through the overhead into a right hand downwind could conflict the NELSA SID off runway 14. The transition from GOLES to the east of the airport into a downwind left will not conflict with any SIDS. The LBA option from the SW would conflict with all SIDS. The "direct to base leg" option for runway 14 would conflict with the POL and NELSA SIDS. A routing from MARIA to the LBA followed by a downwind right-hand transition would conflict with the POL and NELSA SIDS. A transition from MARIA direct to final approach would not conflict with any SID. Any holding traffic at the LBA at FL80 or below would result in a level period of flight for any right turn LAMIX SID off runway 32. The trombone to the South for runway 32 would require either a change of controlling authority, or delegation from Scottish control. It should be noted that this segment of airway is rarely used by any traffic working Scottish at 6000 ft (the requested level for this particular transition).

Table 50 – Arrival System 7

5.5.13.2. **Carried forward.**

This option is carried forwards as it would offer connectivity. The trombones would only be used for track extension in busy periods. Without flow and sequencing tools there would be the requirement for some form of track extension in order to achieve the required spacing. In light and moderate traffic, the design offers full systemisation. There is, however, potential increases in CAS, greenhouse gas and fuel burn.

Carrying this option forward gives the option of a direct routing from the BARTN area in the event that a transition without a Hold is not a viable option and avoids routing all BARTN inbounds to GOLES. Keeping this option allows us to cover all outcomes for the BARTN arrivals.

5.5.14. Arrival System 8

5.5.14.1. Arrival System 8 is a two arrival Hold system with the LBA purely serving as a MAP Hold. All traffic would be sent via a STAR to either a holding fix to the North-West or via the holding fix at GOLES (depending on the direction the traffic had come from). There would be no arrival gates. Aircraft would then transition to the IAFs.

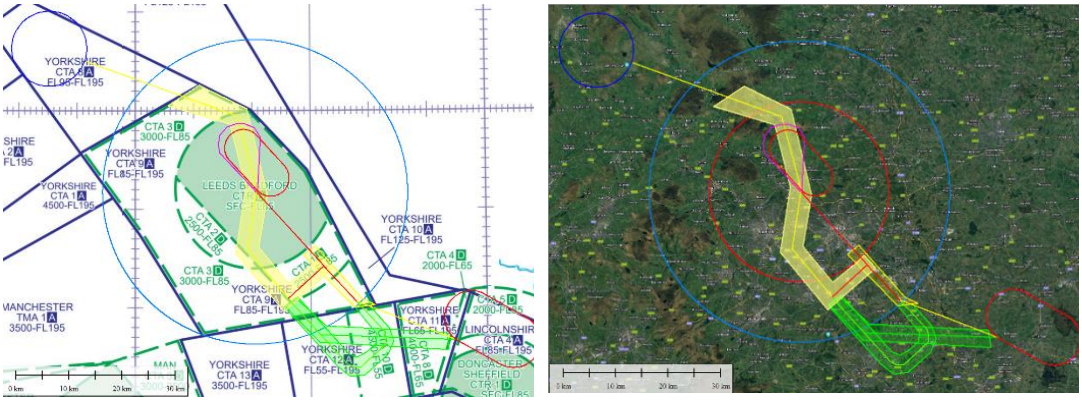


Figure 39: RW32 Option 8

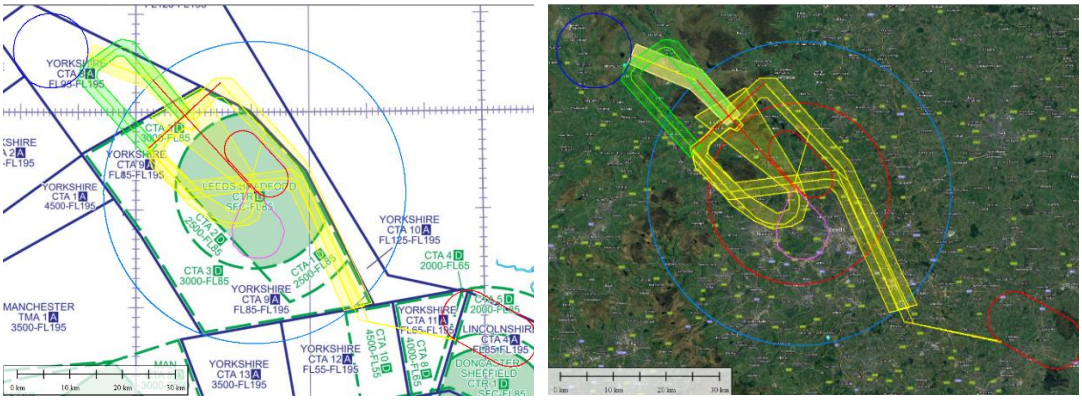
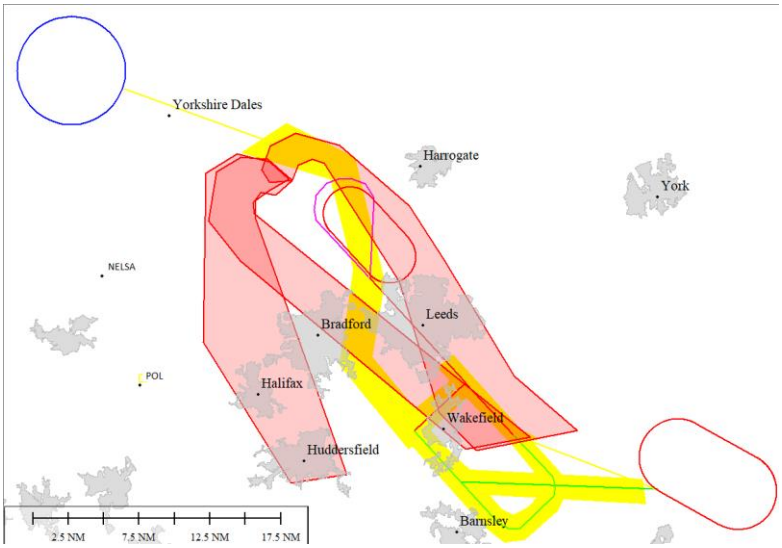
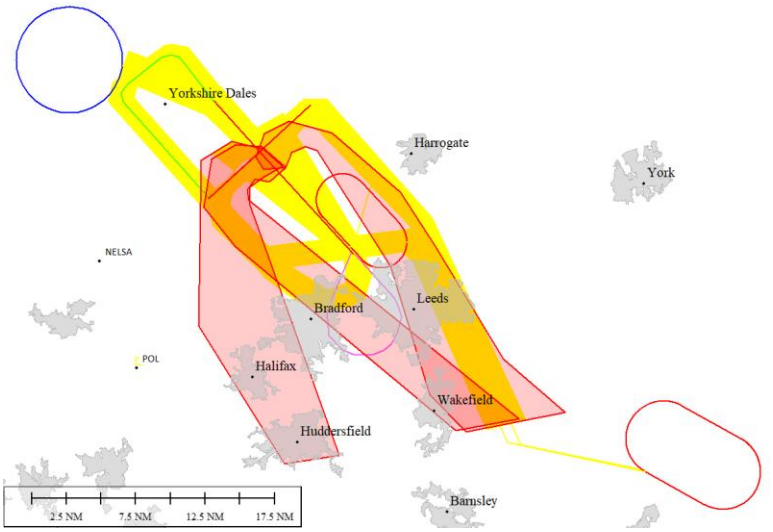
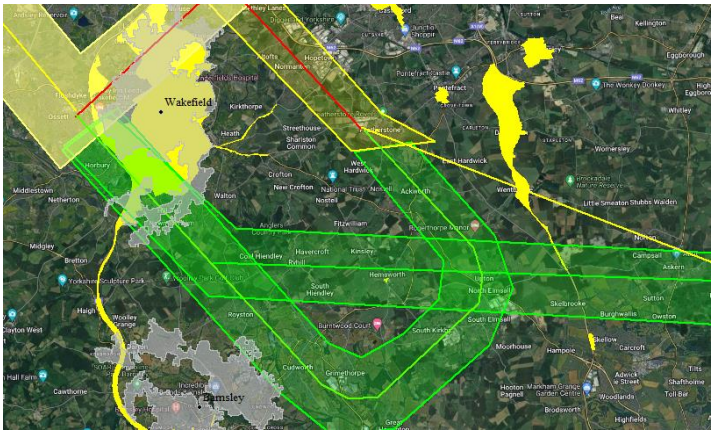
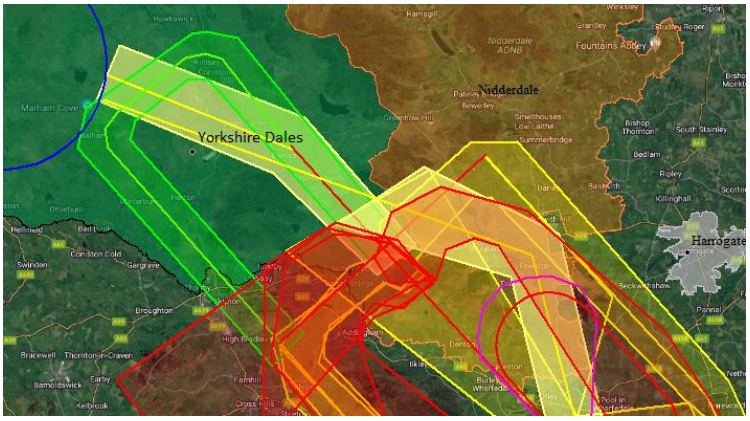


Figure 40: RW14 Option 8

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 – Wakefield communities would experience no change; Huddersfield would no longer be flown over however communities between Bradford and Leeds would be newly flown over. A greater number of people would be flown over with this option compared to the Baseline.  RW14 – Fewer people would be flown over with this option as it no longer flies over Halifax, Huddersfield or Wakefield. 

Group	Impact	Qualitative Assessment
	Air Quality	No AQMAs identified foe RW14. AQMAs at Wakefield would be flown over and possibly the A1 south of Pontefract at Wentbridge, see image. This is similar to the Baseline. 
Wider society	Greenhouse gas impact	No change in benefits or impacts to greenhouse gas.
	Capacity/ resilience	The GOLES element of this option would increase capacity and resilience, however the LBA and trombone airspace has the opposite effect. There would also be a heavy requirement for tactical vectoring and level restrictions, particularly on RW32.
	Tranquillity	May have some additional impact on the Nidderdale AONB and Yorkshire Dales National Park. 
	Biodiversity	Possible additional impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted.

Group	Impact	Qualitative Assessment
General aviation	Access	It is likely that additional CAS would be required, for the 15nm final, eastern T bar on RW14 and trombone to the north.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This option may increase effective capacity but the economic value of this is impossible to state in qualitative terms.
	Fuel-burn	No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.

	Interdependencies, conflicts and trade-offs	Runway 32. The transition from the NW Hold could conflict with a Right turn LAMIX SID. This could be solved if the transition was amended slightly from the North West Hold, down the 32 extended climb out to the LBA, rather than transitioning to the east of the climb out then back into the overhead (arrival yellow, outbound blue)  With this amendment, all SIDS would be separated from the arrival track regardless of turn direction. (The arrivals would be at FL80 until crossing the LBA, the departures would be well below FL80 at the time that the tracks were separated). The direct approach from the SW should not conflict with any SID, a left turn LAMIX departure off 32 could contain an “at or above” waypoint to ensure separation from this approach”. Runway 14. The arrival from GOLES through the overhead into a right hand downwind could conflict the NELSA SID off runway 14. The transition from GOLES to the east of the airport into a downwind left will not conflict with any SIDS. Both of these options would be required for traffic sequencing. The routing from the NW Hold to the straight in approach does not conflict with any outbound SID. A routing from the North West Hold to the LBA would conflict with the NELSA SID. It is recommended that the option from the NW to the LBA is dismissed. A delay of 3 mins or more could be absorbed in the NW

Group	Impact	Qualitative Assessment
		Hold. A delay of 1-2 mins could be absorbed by a tactical vector to the final approach (only one dog leg vector would be required) The trombone to the South for runway 32 would require either a change of controlling authority, or delegation from Scottish control. It should be noted that this segment of airway is rarely used by any traffic working Scottish at 6000 ft (the requested level for this particular transition).

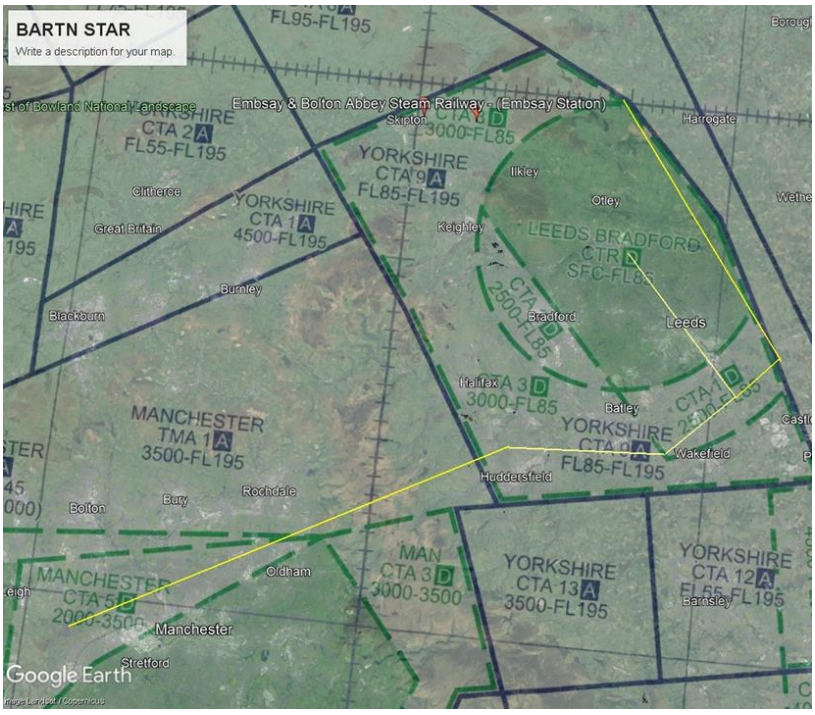
Table 51 – Arrival System 8

5.5.14.2. **Carried forward as preferred option**.

This option is carried forward on the basis there could be a reduction in noise impacts aligning with the Government's altitude-based priorities. There is no impact to safety or fuel burn/greenhouse gas. The Eastern T-Bar for RW14 and trombone to the north would mean the Nidderdale AONB would be affected, and additional CAS may be required. This option is the preferred arrival option.

Note: Arrivals from the West and southwest

NERL are exploring the potential to add a transition for arrivals from the BARTN direction as shown in the diagram below. Arrivals for RW32 would take an inbound track towards the southern border of the CTR, before tracking direct to the Base leg IAF for RW32. The RW14 transition would also follow the same initial track, before crossing through the RW14 climb out and joining the downwind to the east of the airport in effect merging with the GOLES arrival.



5.5.15. Arrival System 9

5.5.15.1. Arrival system 9 is a two arrival Hold system and again the LBA is purely used for the MAP Hold. Traffic from the North-West and North-East would be tactically managed largely due to the small volumes associated with these arrival directions. Traffic from the South West and West would be routed via a STAR terminating at UDDER and the traffic from the South-East and East would utilise a STAR ending at GOLES.

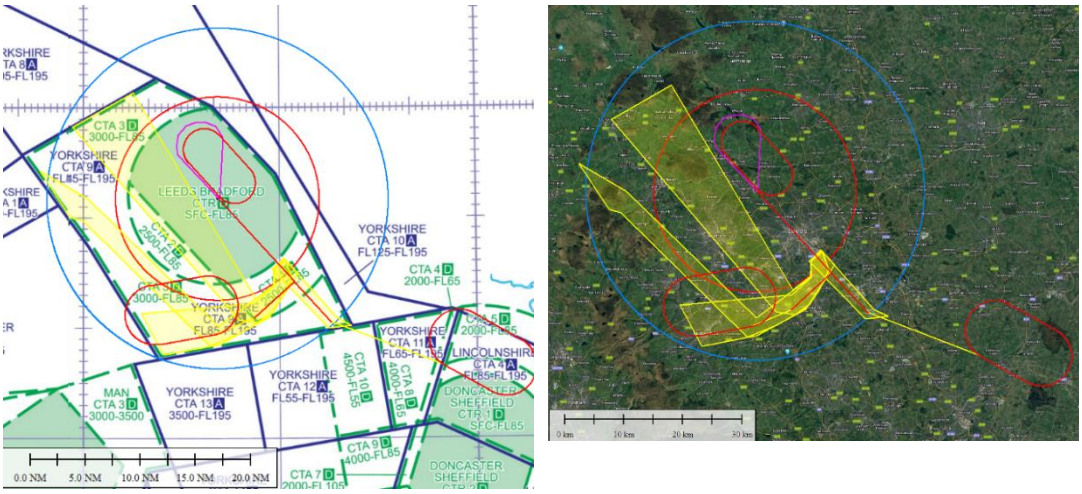


Figure 41: RW32 Option 9

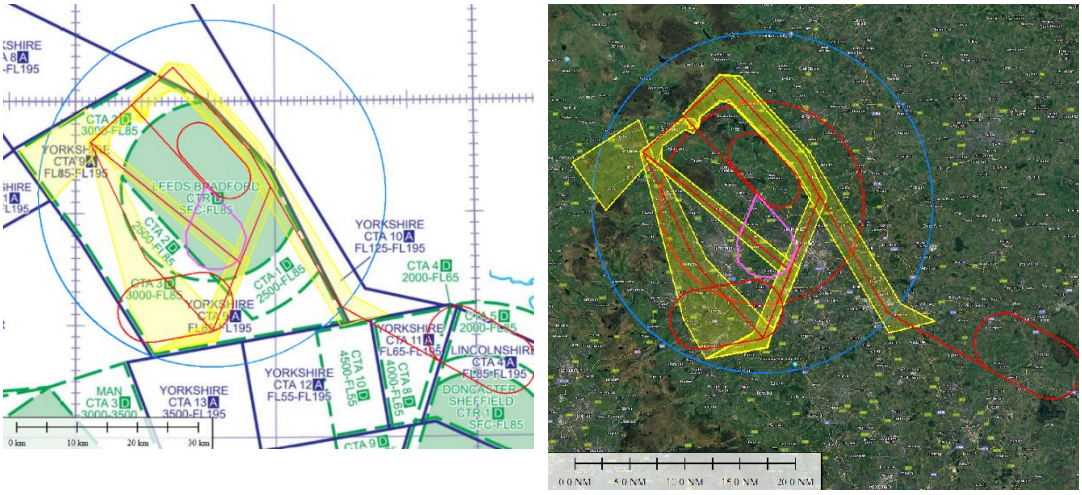
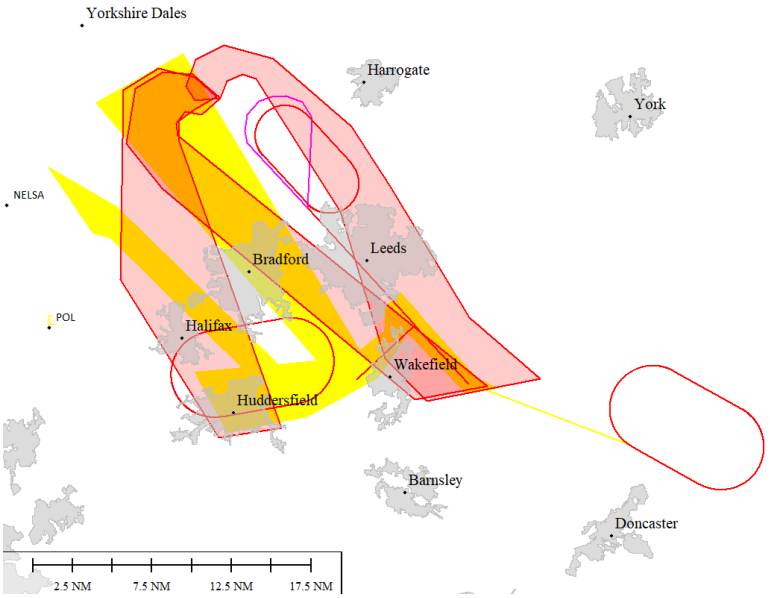
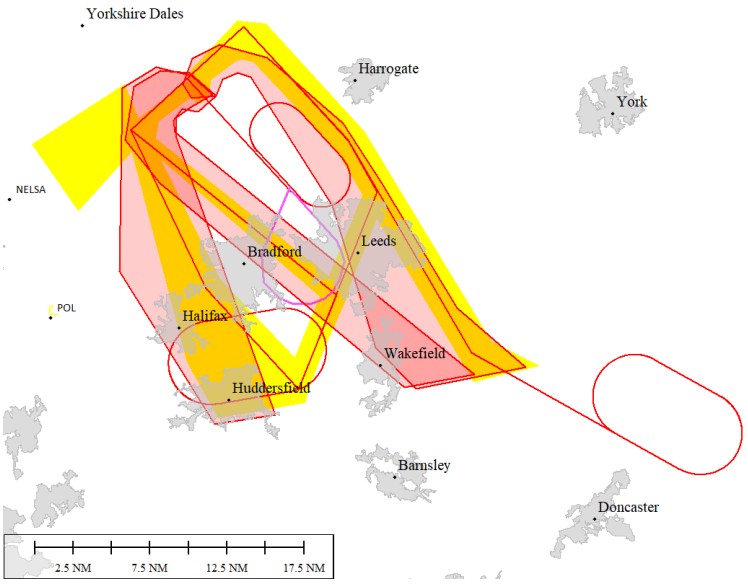
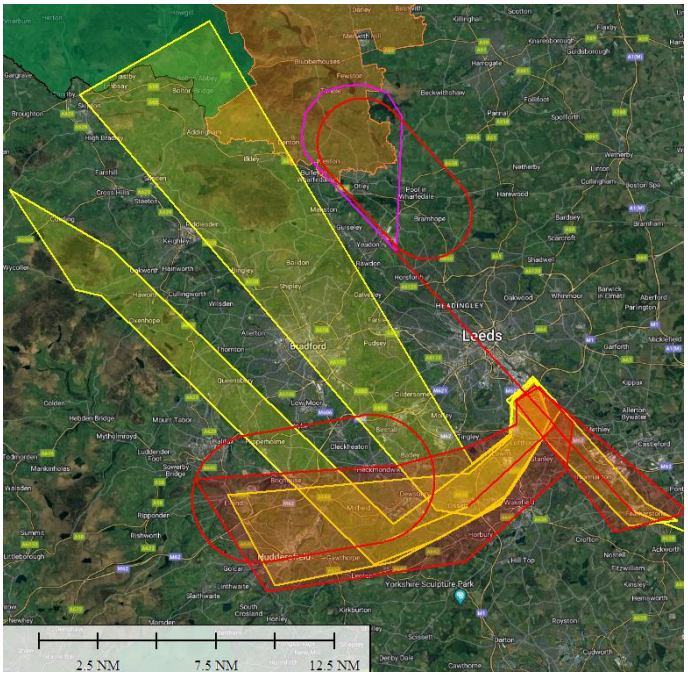


Figure 42: RW14 Option 9

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 – Leeds would no longer be flown over with this option. Bradford would be similar to the Baseline as would Huddersfield. Halifax would still be flown over but to a lesser extent.  RW14 – This option would fly over fewer communities of Leeds and Bradford, in addition considerably less of Halifax and Wakefield would be flown over compared to the Baseline. Huddersfield would remain the same. 

Group	Impact	Qualitative Assessment
	Air Quality	AQMAs at Huddersfield, Brighouse and Dewsbury, in addition to the A1 near Pontefract for arrivals to RW14. Wakefield and Huddersfield AQMAs potentially overflown for RW32.
Wider society	Greenhouse gas impact	No change in benefits or impacts to greenhouse gas.
	Capacity/ resilience	Potential increase in CAS could contribute to increased capacity, however the UDDER Hold may impact RW14 departures, causing a reduction in capacity.
	Tranquillity	May have some impact on the Nidderdale AONB and Yorkshire Dales National Park. This is worse than the Baseline for both runways, see RW 32 below (red swathe is the Baseline). 
	Biodiversity	Possible impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted, no worse or any improvement on the Baseline
General aviation	Access	It is likely that additional CAS would be required, for GOLES/UDDER Holds.

Group	Impact	Qualitative Assessment
General aviation/ commercial airlines	Economic impact from increased effective capacity	This option may increase effective capacity but the economic value of this is impossible to state in qualitative terms.
	Fuel-burn	No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	The runway 32 system will result in level periods of flights for both POL and NELSA departures as the arrival swathe from the NW crosses the outbound SID tracks at an un-optimised point (The crossing point needs to be much nearer to the airport in order to have a chance of continuous climb). The Hold at UDDER would almost certainly conflict with the POL SID from runway 32. A left turn LAMIX SID would also conflict with both the arrival swathes from the NW and also the UDDER Hold. The runway 14 option from UDDER direct to left base IAF would result in level periods of flight for both POL and NELSA departures due to the crossing points of these tracks. The UDDER arrival routing through the 14 climb out to join the Eastern downwind would conflict with all SIDS. The UDDER Hold has the potential to conflict with all SIDS. The UDDER Hold could also potentially conflict with Manchester inbound traffic routing GOLES-POL for the ROSUN Hold.

Table 52 – Arrival System 9

5.5.15.2. **Carried forward.**

This option is carried forward as there would be minimal change in noise impact below 4000ft aligning with the Government's altitude-based priorities. However, there may be a requirement for more CAS due to the GOLES/UDDER Holds. The Hold at Udder may make this option unviable due to the numerous conflictions with other routes and potentially Manchester inbounds.

5.5.16. Arrival System 10

5.5.16.1. Arrival system 10 is an attempt to systemise the LBA operation without having STARs (that have holding fixes and Holds) for every arrival direction. Instead, only traffic from the South and East would have a STAR ending at a holding fix (GOLES). Traffic from all other arrival directions would have direct arrivals to the respective IAFs contained within the swathes. In this configuration, the LBA is intended as a MAP and weather Hold with GOLES intended as an arrival and weather Hold (with transitions to the approach).

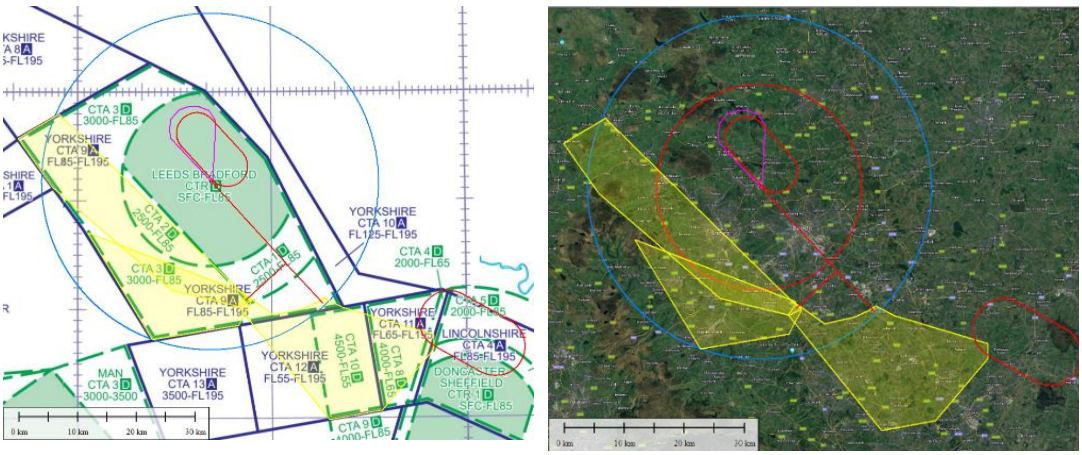


Figure 43: RW32 Option 10

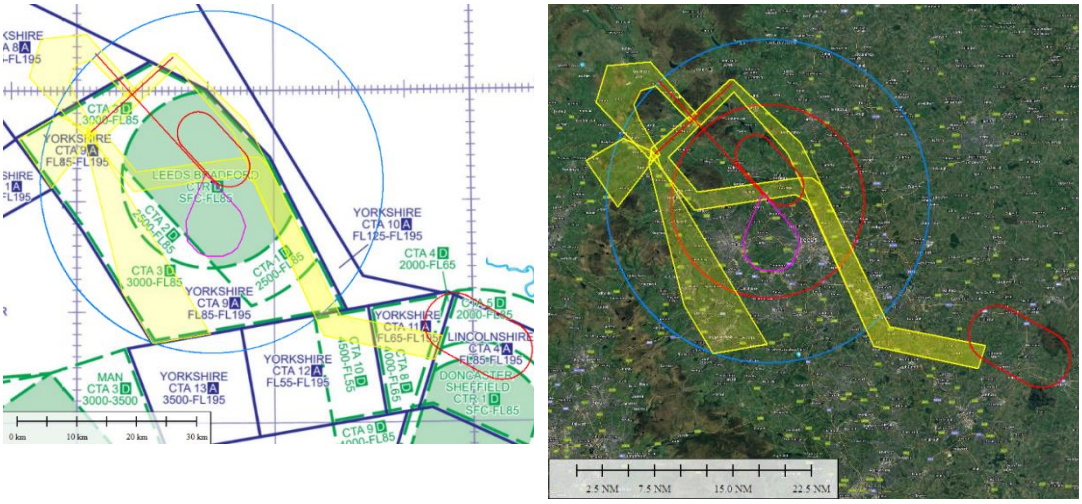
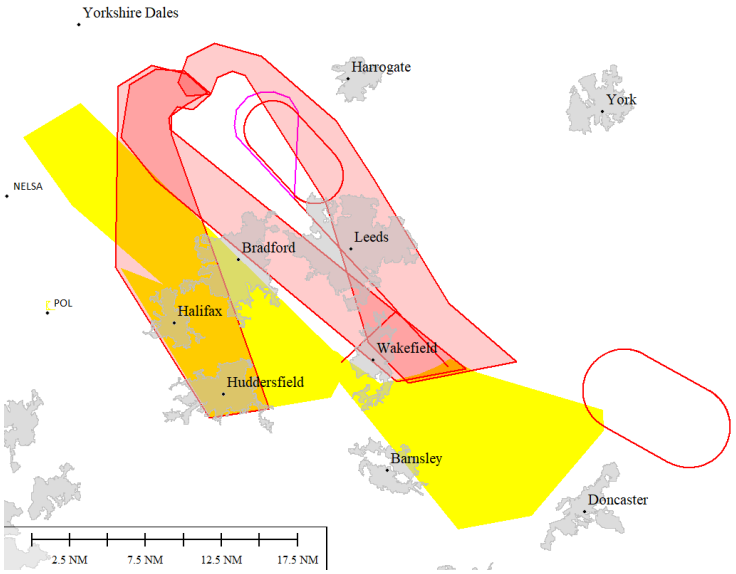
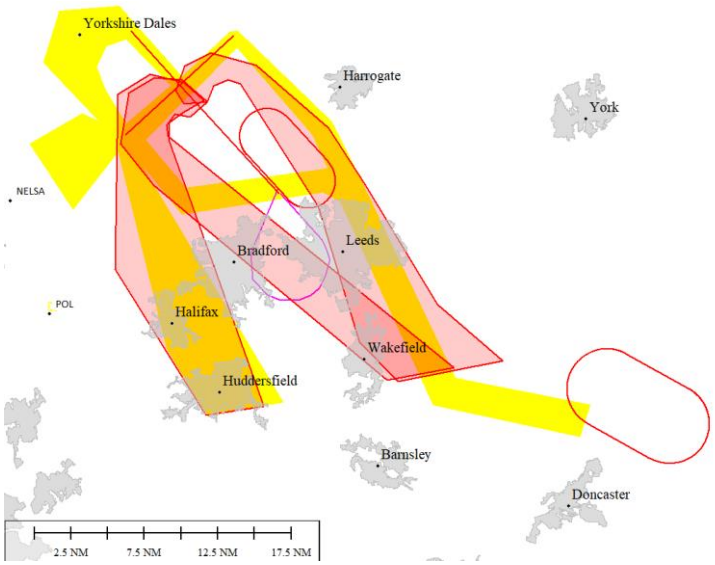
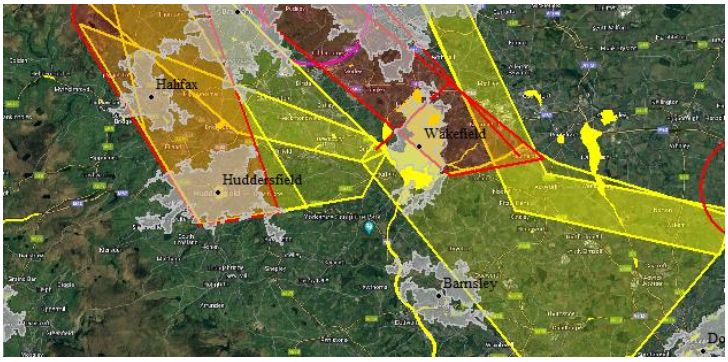
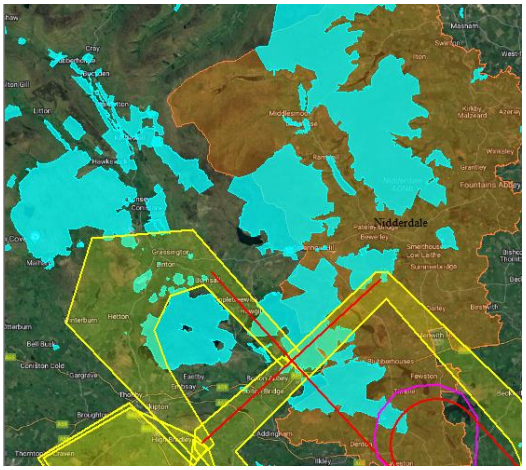


Figure 44: RW14 Option 10

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	RW32 – Greater impact on more communities expected and will include Bradford, Halifax and Barnsley and those already flown over by the Baseline, such as Huddersfield and Wakefield.  RW14 – Approximately the same number of people flown over, however there would be additional communities in Leeds and fewer in Bradford compared to the Baseline. 

Group	Impact	Qualitative Assessment
	Air Quality	For arrivals to both RW14 and RW32, Huddersfield and Halifax AQMAs will be overflown. Additional AQMAs south of Pontefract on the A1 for RW32. 
Wider society	Greenhouse gas impact	No change in benefits or impacts to greenhouse gas.
	Capacity/ resilience	Potential increase in CAS could contribute to increased capacity, however there is potential for inbounds from the west/south west to still conflict with departures.
	Tranquillity	May have some additional impact on the Nidderdale AONB and Yorkshire Dales National Park compared with the Baseline.
	Biodiversity	Possible additional impact on the North and South Pennine Moor SAC and associated SPAs, SSSIs and SACs. Additionally, West Nidderdale Barden and Blubberhouses Moors (SSSI, SAC and SPA) may be impacted. 

Group	Impact	Qualitative Assessment
General aviation	Access	It is likely that additional CAS would be required, for GOLES Hold.
General aviation/ commercial airlines	Economic impact from increased effective capacity	This option may increase effective capacity but the economic value of this is impossible to state in qualitative terms.
	Fuel-burn	No change in benefits or impacts to fuel burn.
Commercial airlines	Training costs	Minimal.
	Other costs	No other costs identified.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	Runway 32 Arrival from the NW conflicts with POL,NELSA and LAMIX SIDS. Arrival from SW conflicts with LAMIX SID. Runway 14 Arrival from S and SW conflicts with POL and NELSA SID.

Table 53: Arrival System 10

5.5.16.2. **Discounted.**

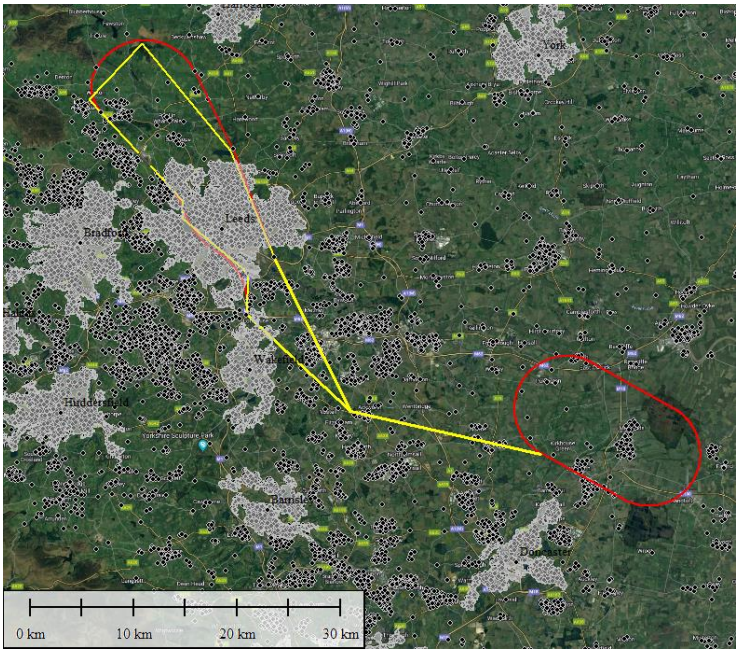
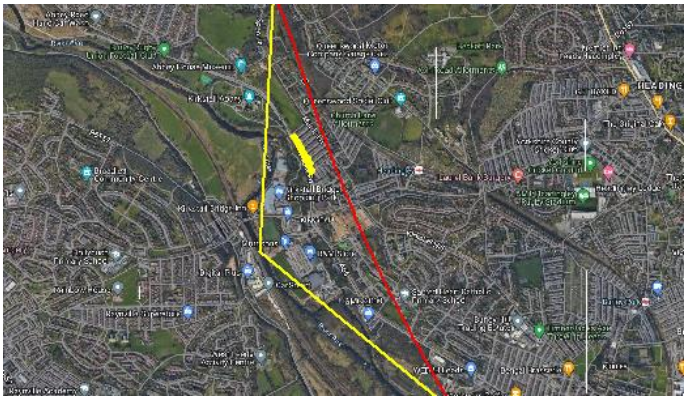
This option is discounted based on the increase in disturbance to communities and new communities which does not align with the Government's altitude-based priorities. There is potential for an increase in CAS with minimal foreseen benefits in other areas.

5.5.17. RNP AR RW32

Figure 45 : RW32 RNP AR

5.5.17.1. Approach offset intended to avoid overflying central Leeds Residential district, Headingley and Hyde Park Districts. Potential respite option that could be alternated with standard approach on rotation. Potential for arrival transitions to the IAF from other arrival directions, not just GOLES.

Important Note: Concept Only - Track is only an indication of what might be possible. It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation in Stage 3 of this ACP.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option offset intended to avoid overflying central Leeds, Headingley and Hyde Park s. Potential respite option that could be alternated with standard approach on rotation. This option would fly over considerably fewer communities than the Baseline. 
	Air Quality	This option would overfly the AQMA at Kirkstall unlike the Baseline. However, this option flies over considerably fewer AQMAs than the Baseline in total offering a net benefit to Air Quality. 
Wider society	Greenhouse gas impact	It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.

Group	Impact	Qualitative Assessment
	Capacity/ resilience	RNP approaches have the potential to improve capacity and resilience.
	Tranquillity	No AONBs or National parks are impacted with arrivals to RW32 as with the Baseline.
	Biodiversity	Possibly a small section of the Leeds Liverpool Canal (SSSI), similarly to the Baseline. 
General aviation	Access	The offset approach may conflict with VFR traffic routing from and to Dewsbury. During night time operations there would be sparse use of the VFR route. If the RNP arrival was used as a respite during weekend daytime hours there may however be a confliction between the approach and the Dewsbury VFR route.
General aviation/ commercial airlines	Economic impact from increased effective capacity	The approach would not increase capacity, this option is more focussed on noise reduction. A potential solution would be to also promulgate the approach as a VPT procedure (Visual Prescribed Track). This would allow non AR crews to fly the procedure in VMC however, this procedure not currently used in the UK.
	Fuel-burn	It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.
Commercial airlines	Training costs	There would be training costs associated with this option as currently certified to fly these approaches. Some airlines would be required to train and certify their crews for RNP AR approaches at considerable cost.
	Other costs	There may be a requirement for fleet upgrades with this option which could incur extra costs for the airlines.

Group	Impact	Qualitative Assessment
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	There are no further interdependencies with this route.

Table 54 – RNP AR RW32

5.5.17.2. Both RNP Arrival options have been carried forward to Stage 3 as they are concept options only at this stage. The track is only an indication of what might be possible. It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.

5.5.18. RNP AR RW14

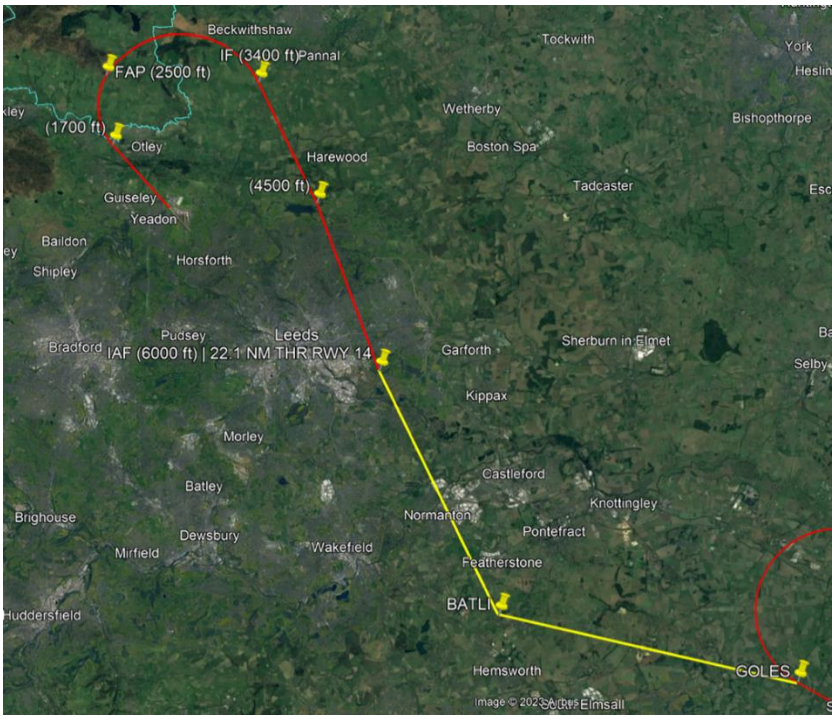
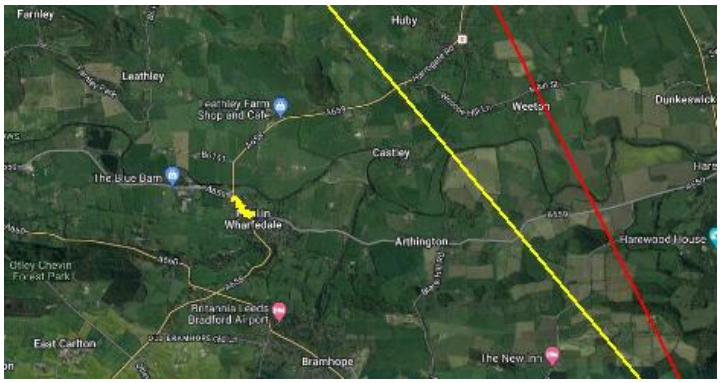
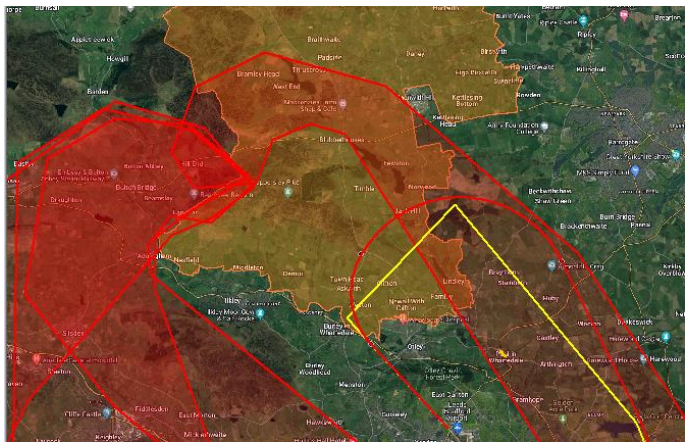


Figure 46: RNP AR RW14

5.5.18.1. This option is a more environmentally friendly approach providing a shorter route to RW14 from the SE. Significantly shorter than the standard arrival and, as a result, significant fuel and CO_2 saved on each arrival. Eastern suburbs of Leeds overflown not below 5,000 ft at continuous descent on idle power, further descent over open countryside until final approach.

Important Note: Concept Only - Track only an indication of what might be possible. It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is intended to avoid overflying central Leeds and avoid eastern parts of Leeds under 5000ft. This option would fly over considerably fewer communities than the Baseline.
	Air Quality	This option would fly close to, but not over, the Mill Lane AQMA at Pool-in-Wharfdale situated north northeast of the airport. 
Wider society	Greenhouse gas impact	It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.
	Capacity/ resilience	RNP approaches have the potential to improve capacity and resilience. Additional airspace may be required to the East to ensure that a 2nm buffer is provided between the route and control zone (CTR) boundary.
	Tranquillity	Nidderdale AONB may be impacted, however considerably less than the Baseline. 

Group	Impact	Qualitative Assessment
	Biodiversity	Eccup Reservoir (SSSI) may be impacted as with the Baseline, however considerably fewer conservation areas would be impacted compared with the Baseline. 
General aviation	Access	No changes to the current airspace are anticipated.
General aviation/ commercial airlines	Economic impact from increased effective capacity	The approach would not increase capacity, this option is more focussed on noise reduction. A potential solution would be to also promulgate the approach as a VPT procedure (Visual Prescribed Track). This would allow non-AR crews to fly the procedure in VMC however, this procedure not currently used in the UK.
	Fuel-burn	It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.
Commercial airlines	Training costs	There would be training costs associated with this option as currently certified to fly these approaches. Some airlines would be required to train and certify their crews for RNP AR approaches at considerable cost.
	Other costs	There may be a requirement for fleet upgrades with this option which could incur extra costs for the airlines.
Airport/ Air navigation service provider	Infrastructure costs	Removal of reliance on ground-based navigational aids reduces cost as compared to the Baseline.
	Operational costs	No operational costs have been identified.

Group	Impact	Qualitative Assessment
	Deployment costs	Other than the cost of conducting the ACP there are minimal deployment costs.
All	Safety	No less safe than the Baseline.
	AMS Realisation	This option contributes to the VOR rationalisation currently ongoing within the UK as it removes reliance on ground based navigational aids with the implementation of PBN. It does not contribute to the AMS objective of reducing CAS, improving fuel efficiency, or reducing noise.
	Interdependencies, conflicts and trade-offs	There are no further interdependencies with this route.

Table 55 – RNP AR RW14

5.5.18.2. Both RNP Arrival options have been carried forward to Stage 3 as they are concept options only at this stage. The track is only an indication of what might be possible. It would be optimised for noise, fuel and emissions reduction before final proposals are developed for consultation.

6. Results Summary

6.1. The following table summarises the outcome of the IOA for the departure swathes and details the Preferred Options (P). The crossed squares indicate there is no option in that group with that letter.

Departure Option	Do-Min	A	B	C	D	E	F	G	H
32 - SE				P					
32 - S&W	P								
32NEW		P							
14 - SE	P								
14 - S&W	P								
14NEW		P							

Table 56: IOA - Departure Options Summary

6.2. The following table summarises the outcome of the IOA for the arrival systems and details the Preferred Option (P).

Arrival Option	Outcome
Option 1 - LBA	
Option 2 – NELSA/GOLES	

Arrival Option	Outcome
Option 3 – AIREY/WORTH	
Option 4 – AIREY/WORTH/LBA	
Option 5 – NELSA/GOLES/UDDER	
Option 6 – LBA/GOLES	
Option 7 – NW Hold/LBA/GOLES	
Option 8 – NW Hold/GOLES	Preferred Option
Option 9 – UDDER/GOLES	
Option 10 – GOLES & Direct Arrivals	
RNP AR RW14	
RNP AR RW32	

Table 57: IOA - Arrival Options Summary

7. Safety Assurance Plan

7.1. CAP1616 Safety Assessments

7.1.1. CAP1616 requires Change Sponsors to conduct a qualitative Safety Assessment at Step 2b of the process. This Assessment has been included in the appraisal tables for each DO in the previous section of this document.

7.1.2. A seven-step CAP760 compliant Safety Assessment will be conducted prior to Step 4b. This activity will include Hazard Identifications, Risk Assessment, and the production of the required Safety Case(s) for the proposed change(s).

7.2. Safety Assurance Team

7.2.1. The Safety Assurance Team involved in this process will consist of the following suitably qualified and empowered individuals:

- Representative of the ANSP conversant with the Safety Management System (SMS);
- Airspace Change Consultant and Safety Manager;
- Representatives from neighbouring MTMA ACP Sponsors (including NERL); and
- At least one representative pilot from an airline routinely operating at LBA.

8. Design Options Shortlist

8.1. Shortlist of Options Taken Forward

8.1.1. It is proposed that the following DOs are taken forward to Stage 3 of the ACP process for further investigation and development (the preferred highlighted bold):

- RW32 Departures (12 DOs);
  - 32SE Do-Min**, 32SEC (P)** and 32SED;
  - **32S&W Do-Min (P),** 32S&WA, 32S&WC, 32S&WD and 32S&WF;
  - **32NEWA (P),** 32NEWB, 32NEWC, 32NEWD;
- RW14 Departures (5 DOs);
  - **14SE Do-Min (P),** 14SEA and 14SEB;
  - **14S&W Do-Min (P)** and 14S&WD;
  - **14NEWA (P);**
- Arrival System Options (5 DOs);
  - Option 1;
  - Option 2;
  - Option 5;
  - Option 7;
  - **Option 8 (P);**
  - Option 9.

8.2. Impacted Audiences

8.2.1. The swathes devised for the options progressed to Stage 3 will be the starting point to determine the 'Impacted Audiences' for the Consultation Strategy. These will include populations on the ground (communities and environmental groups) and communities in the air or with a vested interest in airspace (airspace users). Clearly not everyone under these swathes will be 'impacted' as ultimately the options will be fine-tuned with the aim of being the optimal operational procedures with the least impact possible.

8.3. Next Step – Full Options Appraisal

8.3.1. Step 3a of the process requires that the options are developed to the point that a rigorous quantitative options appraisal can be conducted. Whilst this is being done, LBA will be preparing documentation for a public consultation to give the impacted audiences the opportunity to influence the outcome of this ACP.

This Page Is Intentionally Blank