Design Options Report - V2

Stage 2 Develop and Assess

MAG
London Stansted Airport

Document Details

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Amendments	1. Addition of a reference to the Summary Document Appendix A - Design Options Evolution, a new report provided to show the evolution of the design options: • Section 2.2, page 19 2. The DOR has been amended to clarify the approach to CAS requirements. • Section 4.5, page 29

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1 Glossary

Term	Definition
ACOG	Airspace Change Organisation Group
'Listening to Stakeholders – Our Proposed Design Principles for Airspace Change'	A document that formed part of London Stansted Airport's Stage 1 submission to the CAA https://airspacechange.caa.co.uk/documents/download/2156
ABBOT	One of two existing hold stacks used at London Stansted Airport.
ACP	The Airspace Change Proposal at London Stansted Airport.
Agl	Above ground level
AIP	Aeronautical Information Publication. A document published by the UK CAA which contains information essential to air navigation. eAIS Package United Kingdom (nats.co.uk)
AMS	Airspace Modernisation Strategy (CAP1711). This is the Government's strategy and plan for the use of UK airspace, including the modernisation of airspace. www.caa.co.uk/cap1711
Amsl	Above mean sea level
ANSP	Air Navigation Service Provider: An organisation which operates the technical system, infrastructure, procedures, and rules of an air navigation service system, which includes air traffic control.
AONB	Area of Outstanding Natural Beauty: An area of countryside which has been designated for conservation because of its significant landscape value, recognising its national importance.
AQMA	Air Quality Management Area: Designated by a local authority and subject to a Local Air Quality Management Plan
ATC	Air Traffic Control: Service from an air navigation service provider providing guidance to aircraft through controlled airspace.
ATM	Air Transport Movement: An aircraft operation for commercial purposes, as opposed to flight for recreational or personal reasons.
ATS	Air Traffic Services
Biodiversity	The variability among living things from all ecosystems (including terrestrial, marine, and other aquatic among others) and the ecological complexes of which they are part; including diversity within species, between species and of ecosystems.
BKY	Abbreviation for the Barkway navigation beacon and routes that use that as a navigation point.

CAA	Civil Aviation Authority: the aviation industry's regulator.
CAP	Civil Aviation Publication: A document published by the UK CAA which can provide information, guidance or policy depending on the subject covered. The list of all CAPs is published on the CAA website at www.caa.co.uk
CAP1616	The CAA's Airspace Change guidance document. It sets out the regulatory process which all airspace change proposals must follow.www.caa.co.uk/cap1616
CCO	Continuous Climb Operations: Allows departing aircraft to climb continuously, which reduces the level of noise heard on the ground and also reduces fuel burn and emissions.
CDA	Continuous Descent Approach: Allows arriving aircraft to descend continuously which reduces the level of noise heard on the ground and also reduce fuel burn and emissions.
Change sponsor	An organisation that proposes, or sponsors, a change to the airspace design in accordance with the CAA's airspace change process.
CLN	Abbreviation for the Clacton navigation beacon and routes that use that as a navigation point.
Comprehensive List	The full list of design options that are viable designs as required by Stage 2 of the CAP1616 process and which are detailed in the Design Options Report.
CONOPS	Concept of Operations: A document that outlines how we want the airspace system to work in the future and the standards that we will use.
Controlled airspace	Controlled airspace is airspace within which air traffic control services are provided. There are different classifications which define the air traffic control service provided and the requirements of aircraft flying within it. All commercial (passenger) flights fly within controlled airspace.
COVID-19	A disease caused by a new strain of Coronavirus.
CP	Country Park: Areas of land designated and protected by local authorities to provide access to the countryside.
dB	Decibels: a unit used to measure noise levels.
DEFRA	Department for the Environment, Food and Rural Affairs (UK Government)
DER	Departure End of Runway. A term that, when used in PANS-OPS 8168, determines the start point for the design of a departure procedure.
Design option	An output from the route design process that responds to the design principles and the Statement of Need (SoN). Design options are a requirement of the CAP1616 process. During the engagement carried out at Stage 2, design options were also referred to as "route options".
Design principles	The principles encompassing the safety, environmental and operational criteria, and the strategic policy objectives that the change sponsor seeks to achieve in developing the airspace change proposal. They are an opportunity to combine local context with technical considerations and are therefore drawn up through discussion with affected stakeholders and – in Stansted's case – members of the public. The design principles at London Stansted Airport were established during Stage 1 of the CAP1616 process.

DET	Abbreviation for the Detling navigation beacon and routes that use that as a navigation point.
DfT	Department for Transport
DME	Distance Measuring Equipment
DOR	Design Options Report: This responds to the requirements of CAP1616 to develop a comprehensive list of options that address the Statement of Need (SoN) and that align with the design principles. It details the design process and the output of that process in the form of design options for both departures and arrivals.
DPE	Design Principles Evaluation: The document that undertakes an evaluation of the Viable and Good fit options described in this report against the Design Principles.
FAF	Final Approach Fix: The point at which an aircraft starts its final approach to land.
FASI-S	Future Airspace Strategy Implementation - South: The programme of airspace changes across the southern part of the UK, including London, that is implementing the Governments Airspace Modernisation Strategy.
FIR	Flight Information Region: Airspace delegated to a country by ICAO. In the UK there are two FIRs, London and Scottish.
Flight path	The routes taken by aircraft within airspace.
FOA	Full Options Appraisal: The options appraisal carried out at Stage 3 of the CAP1616 process.
Focus group	Group of representative stakeholders brought together to discuss proposals and offer feedback.
Ft.	Feet
GA	General Aviation
GDPR	The General Data Protection Regulations
GIS	Geographic Information System
GNSS	Global Navigation Satellite System: A term used to describe a system that uses satellites for position fixing.
IAF	Initial Approach Fix: The start of the approach phase of flight. For the Stansted arrival design options, the IAF is at 7,000ft unless stated otherwise.
ICAO	International Civil Aviation Organisation: an agency of the United Nations
IFP	Instrument Flight Procedures.
ILS	Instrument Landing System: A radio navigation system that provides vertical and horizontal guidance to arriving aircraft to help them land safely, especially in bad weather.
IOA	Initial Options Appraisal: The document that is the first iteration of the three option appraisals required by CAP1616 - the design options appraised within the IOA are the outputs from the Design Principles Evaluation (DPE).
LAM	Abbreviation for the Lambourn navigation beacon and routes that use that as a navigation point.
LNAV	Lateral Navigation: A term for lateral navigation used within Performance Based

	Navigation
LOREL	One of two existing hold stacks used at London Stansted Airport.
LTMA	London Terminal Manoeuvring Area: The designated area of controlled airspace surrounding the London airports.
m	Metres
MAGIC Map	Interactive map managed by DEFRA containing authoritative geographic information about the natural and built environment from across Government.
MAP	Missed Approach Procedure: A documented procedure for an aircraft to follow if a safe landing cannot be completed.
Masterplan	The strategic plan for the coordinated national programme of airspace change, created by the Airspace Change Organising Group (ACOG) under the direction of the CAA and DfT.
MSD	Minimum Stabilisation Distance: A design criteria within PANS-OPS 8168 that ensures aircraft stability when flying a procedure.
NATS	The air navigation service provider for the UK, formerly National Air Traffic Services. NATS 'en-route' manage the traffic in the upper airspace and also climbing and descending to land in the London area.
NERL	NATS En-Route Ltd: The part of NATS that delivers en-route air traffic control.
Nm	Nautical Miles
NNR	National Nature Reserves: Designated under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 to protect important habitats, species, or geology.
Noise-sensitive receptors	Specific locations identified as likely to be adversely affected by noise from or due to aircraft operations. Individual locations will have varying degrees of sensitivity (measured noise exposure levels) depending upon their use.
NP	National Park: Designated areas under the National Parks and Access to the Countryside Act 1949 to protect landscapes because of their special qualities
NUGBO	A navigation fix to the NW of Stansted used by STN departures that exit UK to the south west.
PANS-OPS 8168	An ICAO document that stands for Procedures for Air Navigation Services. This outlines the rules and criteria for designing instrument flight procedures for aircraft.
PBN	Performance Based Navigation: Which is a range of specifications that requires aircraft to navigate to specific accuracy standards, mainly by using satellite-based navigation systems. It is designed to improve track-keeping accuracy for departing and arriving aircraft. The transition to PBN is a foundation to the Airspace Modernisation Strategy and this ACP.
RAG	Red, Amber, Green
Ramsar	Wetlands of international importance designated under the Ramsar Convention 1976.
RNAV1	Area Navigation 1 is one of the specifications within Performance Based Navigation (PBN). Aircraft must maintain specific navigational accuracy within the

	flight.
RNP APCH	Required Navigation Performance Approach: A type of RNP procedure used in the descent phase of flight.
RNP1	Required Navigation Performance: One of the specifications under Performance Based Navigation (PBN). Aircraft must maintain specific navigation accuracy, and in RNP are aided by on board performance monitoring and alerting. It provides slightly more predictable track keeping when compared to RNAV1.
Route options	A term used in engagement to describe the Design options that have been created in this step of the airspace change process.
SAC	Special Area of Conservation: Designated under the Conservation of Habitats and Species Regulations 2017 as making a significant contribution to the conserving of the habitats of protected species.
SID	Standard Instrument Departure: A pre-determined flightpath set by Air Traffic Control that aircraft follow when departing an airport.
SoN	Statement of Need: The means by which the change sponsor sets out what airspace issue or opportunity it is seeking to address and what outcome it wishes to achieve, without specifying solutions, technical or otherwise. London Stansted Airport's SoN can be found at https://airspacechange.caa.co.uk/documents/download/514.
SPA	Special Protection Area: Protected areas for birds classified under the Wildlife and Countryside Act 1981 and protected under the Conservation of Habitats and Species Regulations 2017.
SSSI	Sites of Special Scientific Interest: Areas of importance designated and protected by Natural England under the Wildlife and Countryside Act 1981 to recognise the land's wildlife, geology or landform is of special interest.
STAR	Standard Terminal Arrival Route
Tranquillity	There is no universally accepted definition of tranquillity and therefore no accepted metric by which it can be measured. In general terms it can be defined as a state of calm. The consideration of impacts upon tranquillity for airspace change is with specific reference to National Parks and Areas of Outstanding Natural Beauty (AONB), plus any locally identified 'tranquil' areas that are identified through community engagement and are subsequently reflected within an airspace change proposal's design principles.
Transition	The part of the arrival route from the Initial Approach Fix (IAF) prior to joining the final approach at the Final Approach Fix (FAF).
Unviable	Options which would not comply with the rules or for flight procedure design, specifically the requirements of ICAO PANS-OPS 8168, or if they are not compliant with these rules, did not have a supporting safety justification.
UTAVA	A navigation fix to the NW of Stansted used STN departures that exit UK to the west and north west.
VHF	Very High Frequency
Viable and good fit	Options that are viable to design and which would be expected to meet the three design principles with which all design options 'must' comply (Safety, Policy and

	Demand).
Viable but poor fit	Options that are viable to design but which would not be expected to meet the requirements of the Safety, Policy, or the Demand Design Principles.
VNAV	Vertical Navigation. A term used in Performance Based Navigation.
VOR	VHF Omni-directional Range (Beacon)

2 Introduction

2.1 Purpose

The London Stansted Airport (STN) Airspace Change Programme (ACP) is currently at Stage 2 – Develop and Assess - of the CAA's CAP1616 airspace change process. Step 2A requires the sponsor to develop a comprehensive list of options that address the Statement of Need (SoN) and that align with the design principles that were developed at Stage 1.

This Design Options Report (DOR) sets out London Stansted's response to that requirement, detailing the design process and the output of that process in the form of design options for both departures and arrivals at London Stansted. It presents the design options identified and describes how those options were refined to provide the comprehensive list of options to be progressed to the design principle evaluation, as reported in the Design Principle Evaluation Report (DPE).

This DOR forms part of the suite of documents submitted to the CAA at Gateway 2 of the CAP1616 process and is intended to be read alongside these documents.

The full suite of Stage 2 submission documents is:

- Stage 2 Summary Document, which draws together the key points from the Stage 2 submission,
- Design Options Report (DOR), this document, which presents the design options that were progressed to the design principle evaluation, as reported in the Design Principle Evaluation Report (DPE)
- Design Principles Evaluation (DPE), which assesses how the design options have responded to the Design Principles and identify those that warrant further analysis at the next step which is the Initial Options Appraisal at Step 2B.
- Initial Options Appraisal Report (IOA), which is the first iteration of the three option appraisals required by CAP1616. The design options appraised within the IOA are the outputs from the Design Principles Evaluation (DPE). The purpose of the IOA is to provide, at a minimum, a qualitative assessment of each option providing stakeholders and the CAA with the relative differences between impacts, both positive and negative.
- The Stakeholder Engagement Report, which explains how engagement has been used in the processes described in the other Stage 2 documents and records its outputs.

The Summary Document provides details of the Government's national programme of airspace change, the process under CAP1616 and the progress to date of the ACP for Stansted. This information is not repeated in this report.

The full suite of reports, together with their supporting appendices, will be published on the CAA Airspace Change Portal www.airspacechange.caa.co.uk.

2.2 Document Overview

CAP1616 Step 2A requires us to develop a comprehensive list of design options that address the SoN and that align with the design principles. This DOR is Stansted's response to that requirement and presents the process followed to arrive at a comprehensive list of design options for evaluation against the design principles, as illustrated in the below flowchart:

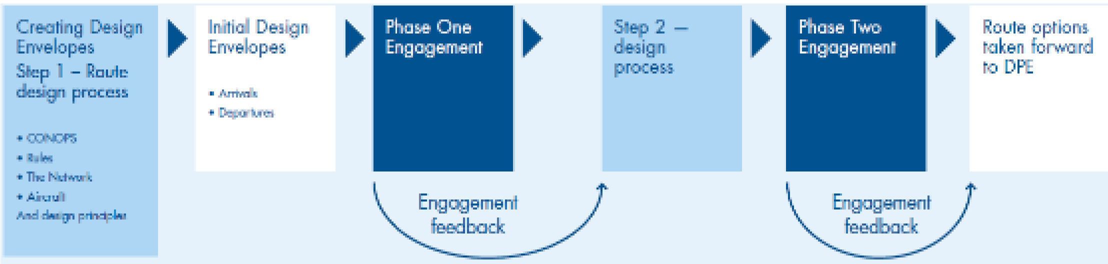


Figure 1 Design option process

This process allowed London Stansted to refine the possible design options to ensure the options progressed to the full DPE addressed the Statement of Need (SoN) and were capable of aligning with the design principles. This process was carried out for both arrivals and departures.

The initial stage of the design process considered the current operations at London Stansted, as well as the requirements identified in the SoN. A design boundary was established based on technical requirements, with design envelopes then developed based on that boundary. The design envelopes formed the broad areas where it would be possible to design options for departures and arrivals.

A second phase of design work was then undertaken to create specific design options from the design envelopes, with an initial assessment of viability applied so as to ensure that only those design options that were capable of aligning with the design principles were progressed to the full DPE.

As required by CAP1616, the design options were tested with potentially affected stakeholders, to gather feedback as to alignment with the design principles and allow further opportunity for any concerns and suggestions to be raised as part of the ongoing two-way conversation at London Stansted. To ensure meaningful engagement, London Stansted opted to undertake two distinct phases of stakeholder engagement, testing first the initial design envelopes and then the design options developed from those envelopes. The engagement undertaken during Stage 2, and how the feedback received was taken into account, is detailed in the separate Stakeholder Engagement Report.

This DOR first describes the background to the design work undertaken during Step 2A, including:

- an explanation of the interaction between the Airspace Change Programme at London Stansted and the NATS En-route (Network) Airspace (Section 3)
- details of the future operational requirements at London Stansted (para 4.2) and the core assumptions (para 4.3).
- a recap of the SoN and the design principles developed during Stage 1 (para 5.2)

- a summary of the current operations at London Stansted (para 5.4)
- a description of the process used to develop the design options (para 5.5)

Section 5 also includes a description of the development of an initial design boundary, the application of design constraints and assumptions to create design envelopes and the subsequent development of design options within those design envelopes. The description of the process for the development of design options also details the design decisions made and provides an explanation of the development of both the "do nothing" and "do minimum" options.

Sections 6 to 19 provide detail of the departure design options and sections 20 to 34 provide detail of the arrivals design options forming the comprehensive list of options. These describe each design envelope in turn, along with each route option within the relevant envelope, including the "do minimum" option, which is based upon the replication of the current routes where these exist. For each design envelope, a description of how the design envelopes and design options were developed is provided alongside a description of the characteristics of the design envelope and design options.

The design options presented in this DOR have been grouped into lettered and numbered options, based upon an initial qualitative assessment of the design options against the "must have" design principles, as described in further detail at para 5.11 of this document and summarised in the below table.

Classification	Criteria	Outcome
Unviable	Would not comply with the requirements of ICAO Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS 8168) or did not have a supporting safety justification for non-compliance.	These options were not designed, due to a lack of compliance with the required standards. As a result, no such options were progressed to the DPE.
Viable but poor fit	Fail to meet the requirements of the three design principles with which all design options 'must' comply (Safety, Policy and Demand).	These are identified as **lettered** options and were not progressed to full the DPE, although an initial evaluation against the three 'must have' design principles is included in the DPE.
Viable and good fit	Expected to meet the three design principles with which all design options 'must' comply (Safety, Policy and Demand).	These are identified as **numbered** options and were progressed to full the DPE.

Table 1 Options Viability - Summary table

As identified in the above table, both the numbered and the lettered options were incorporated within the comprehensive list of options. However, only the numbered options were progressed to the full DPE. The Unviable options referred to within this DOR but were not progressed to the DPE, as they did not comply with the relevant standards, address the SoN or align with the design principles.

Within the relevant departure and arrival sections, each 'viable and good fit' option is described and illustrated by a chart with the designed track over the ground. The rationale for including the option is also provided, in accordance with the Change design principle. However, a detailed assessment of the options against the design principles is not provided, as these assessments are contained in the DPE.

Each section also contains a description of the 'viable but poor fit' options. These form part of the comprehensive list of options but because they fail to meet at least one of the must-have design principles, they have not been designed in full and are not described in the same level of detail as the "viable and good fit options". The background and rationale for this process is described in para 5.11.

For departures the design options are presented on an envelope-by-envelope basis with an analysis of all design options within each envelope. Runway 22 is considered first followed by Runway 04.

For arrivals there is a description of the design envelope and the rationale behind its adoption based upon the application of the Policy design principle. Each arrival option is then described with options for alternative joining points onto final approach of 2,000ft, 2,500ft and 3,000ft.

The full Design Options Evolution can be found in Stage 2 Summary Document Appendix A – Design Options Evolution.

2.3 Stansted Airspace Change- Next Steps

a) Consistent with the requirements of Step 2A of CAP1616, we have undertaken a design process to identify a comprehensive list of route options. In Step 2A, these route options have been evaluated against the design principles that we identified through stakeholder engagement in Stage 1. This work is reported in this Design Options Report (DOR) and the Design Principles Evaluation (DPE). Those that best align with the design principles were carried forward in the process to Step 2B.

b) Route options carried forward to Step 2B have been subject to an initial appraisal. The findings of that appraisal are set out in the IOA and the accompanying assessment tables.

c) The IOA is the first of three appraisals required under CAP1616 and, subject to the approval of the CAA, we will now consider the shortlisted options identified in the IOA in greater detail as part of Stage 3. This further assessment will increasingly make use of quantitative data and will explore local factors in greater detail than the level of assessment has allowed to date. The next stages in our appraisal will be guided by the requirements set out in CAP1616, including the metrics set out in Appendix E.

d) In setting out our shortlist of route options we have benefitted from extensive engagement with stakeholders and the general public. Among the stakeholders were other sponsors of airspace change. We can therefore be confident that our proposals are consistent with the emerging proposals from other change sponsors, in so far as they are known at this time. However, these separate but dependant airspace changes will continue to mature, and it will be important for us to understand how proposals from other airports within our LTMA cluster might interact with the proposals for STN and how collectively our developing route options are best integrated into the network at higher altitudes. We will continue to work with other change sponsors, including NATS, so that our decisions are informed by the best available information and consistent with the developing national masterplan. If required, we will review the work we have undertaken to date to reflect emerging information.

e) The next logical step in considering airspace change is for individual route options to be combined into operating networks. This will support ongoing engagement and, in turn, will allow for a more detailed evaluation against the Design Principles N2, D and E. These consider noise respite, demand, and efficiency respectively.

f) In addition, as the shortlisted route options are combined into operating networks, it is likely that some of the route options will respond less well to the design principles. For example, they may prove to be incompatible with other route options, may conflict with the proposals from other change sponsors or may result in a higher cumulative impact. This may mean that certain route options will be discounted, because they are highly unlikely to perform as well as other options. As such, they would not be taken forward to the full options appraisal or public consultation at Stage 3. Consistent with the developing national masterplan, we recognise that '*trade-offs will be identified by ACP sponsors during the development of the initial and full options appraisals (Stages 2B and 3A of the CAP1616 process) and in collaboration with ACOG when assessing the combined and net impacts of interdependent options'*.

g) Further refinement of route options whereby certain options are not to be appraised fully at Stage 3 will be fully explained in preparing for Stage 3. We will ensure that affected stakeholders are afforded the opportunity to provide feedback prior to the full options appraisal.

3 Connection to the NATS En-route (Network) Airspace

3.1 Overview

Consistent with the "must have" Policy design principle it is essential that the design options at STN are developed in association with, and to align with, the UK Network (En-route) airspace network and they should also respond to the FASI-S programme as it develops. In addition, design options must align with the airspace Masterplan being developed by the Airspace Change Organising Group (ACOG).

FASI-S is the programme to redesign airspace in the south of the UK, including the London Terminal Manoeuvring Area (LTMA) airspace surrounding airports and the upper airspace structure. This is a complex airspace design programme and the CAA's Airspace Modernisation Strategy CAP1711 requires coordination between the different 'sponsors' of airspace changes. These sponsors include STN and NATS En-Route Limited (NERL), which manages this terminal and upper airspace network and will be responsible for the airspace change above 7,000ft.

The Network element of the national programme of airspace modernisation programme is the responsibility of NERL. To inform this separate airspace change proposal, a set of requirements have been agreed between NATS and STN that apply to the future STN airspace design and the requirements that STN have of the network.

3.2 Future Requirements of the NATS En-Route (Network) Airspace

Within the context of the developing Airspace Masterplan, different airport ACP's will develop and progress through the process at differing rates.

To ensure that a consistent network design is created, NATS instigated a process to agree a set of airspace requirements with each airport within the Future Airspace Strategy Implementation - South (FASI-S) programme, including STN. The design options presented in this DOR take account of that process.

3.3 Network Design Assumptions and managing within the Masterplan

3.3.1 Assumptions

As a result of the above requirements, and in light of the developing nature of the FASI-S programme and the Airspace Masterplan, two underlying assumptions have been made to inform the development of design options at STN:

a) There are no fundamental changes planned to the position of the UK coordination points (COP) with other adjacent Flight Information Regions (FIRs). COPs are the agreed points where traffic will either enter or exit UK airspace and are subject to agreement at a NATS network level with adjacent FIRs including France, Netherlands, and Ireland. Whilst there may be additional COP, these will link into the existing route structure that supplies traffic to and from STN.

b) Because NATS is also undertaking a CAP1616 Airspace Change, the structure of the LTMA airspace and the traffic flows within it may change as that project progresses. As a result, the current constraints on traffic routing to and from STN may also change.

3.3.2 Managing the process within the national airspace masterplan

The STN ACP is currently more advanced than NATS' network ACP and although we have worked with NERL to develop our options, their process has not fully developed a comprehensive list of options. As a result, we do not have full visibility of the NERL design options in relation to:

- Route option connectivity for departures within the LTMA, which may change as a result of the design work within NERL and at other airports.
- The type and number of arrival structures envisaged for STN operation above 7,000ft, or the options for where such an arrival structure or structures could be positioned.

In order to address this, we have worked closely with colleagues in NATS/NERL to help us create a comprehensive list of departure and arrival design options that provide flexibility and have the ability to integrate with a new LTMA network. Our discussions with NATS/NERL took account of the current traffic flows and also the AD6 Airspace Change, which has changed the operation of inbounds for both London Luton (LTN) and STN. We then tested our designs with NERL and other change sponsors during the formal stakeholder engagement process.

As the NERL designs progress, it is possible that some of our design options will either be misaligned or conflict with their designs (or those of other airports) and that some design options may need to be further refined or amended in response to the progress of their work.

We will continue engage in discussions across the LTMA and in partnership with NERL and other airports to respond to any such interactions in line with the national airspace masterplan.

Our proposed approach to address any such further information becoming available is described as part of the Next Steps at para 2.3.

4 Future Airspace – Operations

4.1 Overview

At the initiation of the STN Future Airspace Project, the CAA accepted our SoN, which set out the case for change. As set out in the SoN, the ACP at STN has the potential to unlock a wide range of benefits for communities, passengers, airlines, the environment, and the regional economy. It is being progressed in line with UK government policy which has highlighted the strategic need to upgrade the existing airspace network across the UK. This is supported by the CAA's Airspace Modernisation Strategy (CAA AMS), which for airports will require changes to the design of routes and operational ATC techniques used to manage flights below 7,000 feet.

Consistent with the requirements of the AMS, and the Airspace Masterplan developed by ACOG, the ACP at STN has been developed collaboratively, informed by a range of stakeholders, including other sponsors of airspace change.

This section of the DOR describes the operational concepts incorporated into the design options presented in Sections 6 to 34 . These concepts outline how we expect the future airspace to operate, and form one of the foundations for the route option designs alongside the SoN, the design principles in para 5.3, information from the airline fleet equipage survey in para 5.6 and the rules contained within CAA and ICAO documentation. These operational concepts were created with reference to this information and consolidated into the Concept of Operations document described in para 4.2.

In addition, this section explains the approach taken at STN to defining the 'do nothing' and 'do minimum' options for both arrivals and departures.

4.2 Operational Concept

A Concept of Operations document (CONOPS) has been developed. The purpose of the CONOPS document is to outline the operational concepts that will be used to deliver the benefits from the STN Future Airspace Project, consistent with the agreed design principles.

The CONOPS does not contain any airspace designs. Rather, it outlines the concepts to be considered and incorporated into those designs.

Specifically, for the creation of the options contained within this DOR it provides the foundation for the development of the design envelopes and associated route options for both departures and arrivals within those envelopes.

The design options presented in this DOR take account of this document.

4.3 Core Assumptions

The CONOPS includes the following core assumptions:

a) STN will be responsible for the redesign of inbound and outbound routes and procedures from the runway up to and including 7,000ft. Above this altitude, will be the responsibility of NERL. The NERL responsibility includes the design of the arrival holding facilities, currently placed at LOREL and ABBOT which are above 7,000ft.
b) The CAA Airspace Modernisation Strategy requires airports to design future airspace to Performance Based Navigation (PBN) standards. Designing design options to this

standard also aligns with the Policy design principle. Based on the results from the airline fleet equipage survey described in para 5.6 , the STN options will utilise:

- RNAV1 as a minimum and where possible RNP1.
- RNP APCH as the design standard for arrivals.
- CAT IIIB ILS as the primary means of precision approach.

c) The airspace change will be in accordance with the CAA AMS. Any change must allow connection to the wider UK En-Route network and be aligned with the FASI-S programme and take into consideration the needs of other airports

d) Consistent with the "must have" Policy design principles, all Standard Instrument Departures (SID) will be designed to provide continuous climb profiles from runway to an agreed joining point with en-route airspace (assumed to be 7,000ft unless agreed otherwise with NATS). Similarly, all arrival transitions (intermediate approaches) will be designed to provide continuous descent profiles from an agreed exit point from en-route airspace to the joining point with Instrument Landing System (ILS) or 'final approach'.

e) Consistent with the "must have" design principle relating to Safety, the routes will be designed to accommodate the principle of systemisation (minimal ATC intervention). This should result in the design and introduction of PBN routes that are de-conflicted by design. This should enable a reduction in tactical intervention by ATC and a reduced need for vectoring. However, to ensure spacing is consistently maintained (either for wake turbulence, arrival-departure-arrival separation, or in periods of adverse weather) routes will be designed with the assumption that some vectoring will still occur.

f) Noise Preferential Routings (NPRs) have previously been established for STN departures, prior to the ACP. These are overseen by Department for Transport (DFT) and require Secretary of State permission if a change is required. The future design should consider the position of the current NPRs, but these should not constrain the generation of options for the position of departure routes to take forward to engagement and consultation.

g) The required capacity of the future airspace should support the delivery of 43 million pax per annum, consistent with the level permitted by the 2021 planning consent, which equates to 55 per hour combined departures and arrivals.

4.4 'Do Nothing' and Do Minimum Options.

The CAP1616 process requires STN to consider the 'do nothing' scenario and 'do minimum' options for the ACP. The 'do nothing' scenario is used as the baseline for comparison in the Options Appraisals, including the IOA. The 'do minimum' options describe the minimum changes required to address the issues identified in the SoN, and are listed as design options in this DOR.

A description of and rationale for both the 'do nothing' scenario and the 'do minimum' options for both arrivals and departures is provided below.

4.4.1 'Do nothing' departures scenario

The 'do nothing' option for departures would mean that, when the ground-based beacons are taken out of service, there will be no published procedures for aircraft to fly (aside from the Runway 22 Clacton (CLN) and Runway 04 Detling (DET) which have already been designed to PBN). This will mean that for all other SIDs there will be no published procedures, and ATC would be responsible for issuing individual instructions to aircraft prior to departure.

The Design Principle Policy   states that we must comply with the CAA AMS, and this option would fail to do this, specifically in relation to initiative 7) Replication of existing arrival and departure routes with satellite navigation upgrades and initiative 8) Deployment of new arrival and departure routes designed to satellite navigation standards.

In addition, this removal of standardised instructions to aircraft will:

- Not align with the design principles for us to utilise the latest aircraft Technology.
- Result in track dispersal (due to ATC vectoring) which will not provide us with the opportunity to design routes that minimise noise. This track dispersal does not align to the design principle relating to Noise 1 which requires us to minimise the number of people overflown (dispersal is likely to increase this number).
- Significantly increase ATC workload which will lead to a reduced traffic flow. This will result in a failure to meet the Design Principle Demand.
- Not provide a systemised operation in line with the Design Principle Efficiency.

The 'do nothing' option would not align with the CAA Airspace Modernisation Strategy, and the requirement to update airspace to PBN standards. It therefore does not align with the "must-have" Policy design principle and is not a viable option to be progressed as a route option for assessment in the DPE. However, in line with the requirements of CAP1616, it was used as the baseline for assessment during the IOA.

4.4.2 'Do nothing' arrivals scenario

Arrivals are less dependent on navigation aids than departures, under normal operations, because ATC use a process of headings and speeds (vectoring) to route aircraft from 7,000ft. Under the 'do nothing' scenario for arrivals it has been assumed that NATS (as the en-route ATC provider) would design new RNAV holds above 7,000ft, and these holds would be in the same position as they are today (i.e., LOREL and ABBOT). The "do nothing" scenario for arrivals would mean that on leaving these holds, aircraft would be vectored from these holds to final approach by ATC as they are today. Aircraft would then join the ILS for their final approach phase.

However, there are 'Initial Approach Procedures' (IAPs) published which are the basis both for flight planning and to allow an aircraft to leave the hold and safely manage its transition to final approach without radar control or in the case of radio failure. These are based on ground-based beacons and would therefore not be useable after the these are switched off. Without these procedures there is no contingency for aircraft radio failure. The "'do nothing' scenario for arrivals would therefore not be aligned to the "must have" Safety design principle.

In addition, without the IAP this option will:

- Not align with Policy and the CAA AMS initiative 7) which requires airports to provide the "replication of existing arrival and departure routes with satellite navigation upgrades".
- Not align with the design principles for us to utilise the latest aircraft technology.

- Not provide a more systemised operation in line with the Design Principle Efficiency (E).

The 'do nothing' option does not comply with the UK's international obligations to upgrade to PBN which are reflected in the AMS. On that basis (and in line with CAP1616 para E16) it does not align with the "must-have" design principles of Safety and Policy and is not a feasible option. It was therefore not progressed as a route option for assessment in the DPE. However, in line with the requirements of CAP1616, it was used as the baseline for assessment during the IOA.

4.4.3 'Do minimum' departures options

The 'do minimum' option for departures would involve replicating the current routes to PBN standard. This would result in aircraft flying more accurately with more consistent track keeping, but in general the operation would be little changed from today.

The 'do minimum' option would represent the least technological change from current operations. For departures this would involve replicating the current routes using satellite guidance to RNAV1 standard. RNAV1 has been chosen because it's the lowest PBN specification useable by 100% of the airlines that responded to the fleet equipage survey as detailed in para 5.6. This makes this the most realistic 'do minimum' specification.

This is in line with the CAA AMS initiative to replicate existing arrival and departure routes with satellite navigation upgrades. However, because the 'do minimum' only replicates current routes, this approach does not fully meet a number of requirements:

- The Policy design principle leads us to consider the AMS, and in the ends that modernisation must deliver, the AMS requires us to consider options to reduce noise. Whilst routes under the 'do minimum' option may meet this requirement (the creation of RNAV routes will reduce dispersal which has the potential to reduce noise impact) it does not allow us to consider alternative routes to fully explore options to address noise.
- The Noise 2 (N2) design principle requires us to seek ways to consider options for noise respite. However, because the 'do minimum' would be constrained to replicating today's operation this would not be possible – the impacts would be fixed as they are today.
- Furthermore, because departure routes would be fixed in the same climb gradient and position as today it reduces our ability to align with the Efficiency design principle as it would not allow us the scope to minimise interactions with other airports.

This option replicates today's operation and the existing departure procedures to PBN standards. The 'do minimum' for departures is therefore a feasible option and was designed for further assessment in the DOR, DPE and IOA.

4.4.4 'Do minimum' arrivals options

As for the "do nothing" scenario, under the 'do minimum' option for arrivals, it has been assumed that NATS would design new RNAV holds above 7,000ft, and that these holds would be in the same position as they are today to replicate LOREL and ABBOT.

For STN, the responsibility would be to replicate the current IAP from these holds using satellite guidance to RNP APCH standard. This has been chosen because it is the ICAO recommended standard for the initial approach phase and is a navigation specification useable by all airlines that responded to the fleet equipage survey. This ability of all airlines to use the routes makes this the realistic do-minimum specification in line with the CAA AMS initiative to replicate existing arrival and departure routes with satellite navigation upgrades.

Whilst these procedures would be designed and implemented, in practice aircraft will continue to be vectored to final approach by ATC as they are today and would join the ILS for their final approach phase. This would be due to the existence of two holds, which means there would need to be ATC intervention at all stages of the intermediate approach to ensure safety is maintained.

In order to represent the true 'do minimum', this option would need to be implemented as a system (i.e. the design and operation of RNAV versions of both LOREL and ABBOT). This is because:

- This represents today's operation for replication purposes.
- It would not be possible for ATC to manage an arrival system where one arrival transition is systemised, and the other is vectored. This would reduce arrivals capacity and may create separation issues between arriving aircraft. On this basis it would not align with the Safety design principle.
- The replicated IAP will exist as the basis for flight planning and as contingency in the case of radio failure or to provide the ability for aircraft to undertake an approach without radar control.

Because the 'do minimum' only replicates routes, this option does not fully meet a number of requirements:

- In line with the rationale for the arrivals design area detailed in para 20.7 this option would not provide Continuous Descent Approaches (CDA) to both runway ends because the current ABBOT hold is outside of the viable design envelope. It therefore does not align with the "must" Design Principle Policy.
- As operations would be largely unchanged from today (using ATC vectoring), this would not align with our design principle on technology with its requirement to use the latest widely available aircraft navigation technology.

However, because this option mimics today's operation and replicates existing arrivals approach procedures to RNAV standard, the 'do minimum' for arrivals is a feasible option and was designed for further assessment in the DOR, DPE and IOA.

4.5 Controlled Airspace (CAS) Requirements

The system of airspace classification determines the flight rules that apply and the procedures that must be followed. The classification that is assigned depends upon the types of air traffic involved, the density and complexity of air traffic and the need to maintain a high level of safety. In the vicinity of Stansted, there is a mix of airspace including Classes A, C and G.

At STN, the Efficiency design principle states that we will seek to minimise the amount of controlled airspace we require. This design principle seeks to ensure that the needs of other airspace users are considered, including the needs of commercial air transport, general aviation, and the military.

During Stage 2, we have applied the design principles to create a comprehensive list of departure and arrival design options, with the comprehensive nature of the list of design options providing the flexibility to respond to the Efficiency design principle.

This approach recognises that the STN ACP is currently more advanced than other change sponsors' airspace change programmes within the LTMA. In light of this, paragraph 3.3.2 of the DOR references the possibility that the design options identified during Stage 2 may need to be further refined or amended in response to the options emerging from other change sponsors within the LTMA. For this reason it would be premature to define future CAS needs at this stage rigidly.

Therefore, the approach taken to the consideration of CAS at STN is as follows:

1. At Stage 2, we have designed all options within the boundaries of the current CAS in order to align with the Efficiency design principle. This is reflected in the assessment for each option within the DPE.

2. In Stage 3 individual route options will be combined into operating networks that cover both arrivals and departures, and the need to integrate them within the wider airspace network. This will support more detailed analysis and evaluation and will allow the CAS requirements for groups of options to be considered.

3. Within this work we will seek to identify:

- The CAS requirements for the groups of options
- Whether changes to CAS dimensions have the potential to deliver safety, environmental or access benefits to stakeholders.

This work would draw on any previous classification reviews undertaken by the CAA Airspace Classification team within CAP1991 (Procedure for the CAA to review the classification of airspace) and that relate to operations in the airspace around STN.

4. Any benefits would be likely to accrue across a wide range of aviation stakeholders including ATC and airspace users including airlines, the military, and the general aviation community. Depending on the updated AMS and how airspace classes develop, this may also include drone operators.

5. In line with CAP1616, all stakeholders (aviation and non-aviation) will be provided with an indication of the CAS requirements for each set of design options within our Step 3C Consultation material. This will provide an opportunity to review and comment on the analysis undertaken. Comments received will be taken into account and considered as part of the consultation analysis activities in Step 3D.

5 Options Development Rationale

5.1 Introduction

This section describes the steps taken to create the comprehensive list of options:

- Identifying the issues to be addressed in the Statement of Need
- The consideration of the Design Principles
- Identifying the nature of the current operations at STN
- The process to create design envelopes and comprehensive list of options:
    1. The airline fleet equipage survey
    2. The establishment of a boundary for departures and arrivals
    3. The constraints that were applied
    4. The rationale behind the development of design envelopes and design options
    5. The classification of design options through the application of the "viability filter".

5.2 Statement of Need

In December 2018, STN completed Step 1A by submitting a Statement of Need (SoN) to the CAA, setting out why an airspace change was necessary. In January 2019, the CAA approved the SoN, agreeing that STN could initiate an airspace change.

Step 2A of CAP1616 requires change sponsors to identify a comprehensive list of design options that address the SoN and align with the design principles. To ensure that the design options proposed in the DOR addressed the SoN, the following key requirements from the SoN were considered:

- removal of the reliance on ground-based navigational aids
- modernisation of airspace arrangements for aircraft operating to and from the airport at altitudes of 7,000ft and below
- making best use of new navigational technologies, so that the operational efficiency and environmental benefits that modern aircraft offer can be fully realised; and
- integration with other airports and the wider changes to the airspace system being pursued through the national airspace modernisation programme.

The process followed, including the consideration of the design principles during the classification of the design options, reflects these requirements and has ensured the design options are aligned to the SoN.

5.3 Design Principles

During CAP1616 Stage 1, Step 1B, a list of design principles was developed during engagement with stakeholders. These design principles act as a framework which underpins how the design options were developed and are used to evaluate those design options.

The three design principles that have been highlighted in the below table are those which the design options "must" align with. As described in para 5.11, design options that did not align with one or more of these were classified as "viable but poor fit". In addition, the change design principle was applied to all route options, to ensure there was a clear and objective benefit for creating routes that fly over new areas. This benefit was linked to one or more of the design principles.

While the design principles are listed below, this DOR does not provide a detailed assessment of the design options against these design principles. Instead, these assessments are contained in the DPE.

DP Reference	Design Principle Descriptions
Safety (S)	Safety is our highest priority; our routes must be safe for airspace users and communities on the ground and must comply with national and international industry standards and regulations.
Policy (P)	Any changes must be consistent with the CAA's Airspace Modernisation Strategy and the FASI-S programme, taking into account the needs of other change sponsors and airspace users.
Demand (D)	The airspace design must provide for the utilisation of aircraft movements permitted by planning permissions and within statutory limits in force at the airport.
Change (C)	Where we choose routes that fly over new areas there will have to be a clear and objective benefit in doing so.
Technology (T)	Routes should be designed to make use of the latest widely available aircraft navigation technology and facilitate continuous climb and descent to/from both ends of the runway.
Noise (N1)	In order to address the effects of aircraft noise, each route should seek to minimise the number of people overflown.
Noise (N2)	The use of multiple routes and/or other forms of respite, such as different time periods and balanced runway mode when operationally viable, will be considered.
Noise (N3)	Where practical, our route designs should avoid, or minimise effects upon, noise sensitive receptors. These may include designated sites and landscapes (such as SSSI and AONB), cultural or historic assets, and sites providing care.
Balance (B)	Our designs will consider both noise and emissions and seek to strike the best balance. In so doing, we will take account of the Government's altitude-base priorities, which emphasise minimising noise below 7,000 feet.
Efficiency (E)	We will seek to minimise the amount of controlled airspace that we require, and our future route designs should ensure an efficient and systemised operation at Stansted, minimising interactions with other airports and maintaining priority access for emergency services.
Alternatives (A)	Where the adoption of modern navigation standards and/or

	flight profiles mean that some aircraft cannot fly the new routes, we will seek to minimise the environmental impacts from those aircraft.

Table 2. Design Principles (DP)

5.4 Current Operations

STN has a single runway, designated as 22/04 and operational 24 hours a day. It has a mixed fleet of passenger aircraft and an extensive express freight facility serving global destinations. The first stage of the design process considered this current operation, as well as the requirements identified in the SoN and the design principles.

For departures there are currently six Standard Instrument Departure (SIDs) routes for each runway direction which link the airport to the NATS en-route airspace network. However certain SIDs are restricted to fewer movements due to operational restrictions caused by the interaction with other air traffic related to London Heathrow and London City Airports.

For arrivals, the airport has two holding areas, LOREL to the north west and ABBOT to the north east which aircraft are directed towards. There are no fixed flight paths for arriving aircraft from these airborne holding areas until they are established on the instrument landing system (ILS), or 'final approach'. Instead Air Traffic Control (ATC) ensure that aircraft are sequenced for safe separation by controlling the speed, direction, and height of the aircraft prior to them being turned on to the ILS.

Further details of current operations at STN can be found at section 7 of the Summary Document.

5.5 The process to create the design envelopes and comprehensive list of options

To create the design envelopes and the design options, the below sequence was followed to provide a logical development path:

- Step 1: An airline **fleet equipage survey** was undertaken to understand the ability of airlines to fly particular PBN routes, and their climb and descent performance.
- Step 2 –The ICAO PANS-OPS rules and regulations were combined with the information on aircraft performance from Step 1 to understand where aircraft could fly and create a **boundary** for both departures and arrivals.
- Step 3 –The airspace and operations around STN were reviewed to identify any **constraints and considerations.**
- Step 4a – Combining this information with the design principles and supporting CONOPS, we developed a set of **design envelopes** and these were shared with stakeholders to seek feedback in the first phase of engagement.
  - Departure design envelopes start at the runway and terminate at 7,000ft. where they join the NATS airspace network.
  - Arrivals design envelopes start at 7,000ft., which is the interface with the NATS airspace network, and descend to the runway.

- Step 4b: We then used the feedback received during the first phase of engagement to refine the design envelopes and develop specific **design options** within them.
  - For departures we created options that provided a tangible benefit (when compared to the current routes), which is in line with our Change design principle.
- For arrivals we used the same route development process and also applied the need to provide CDAs (driven by the Policy design principle) to both runway directions as the basis for refining the size of the design envelopes. Step 5: The design options were **classified** using the "viability filter", as 'viable and good fit', 'viable but poor fit' or 'unviable', as detailed at paragraph 5.11. A second phase of engagement allowed these design options to be tested with stakeholders, before the options were updated to take account of stakeholder feedback prior to the DPE.
- Step 6: The 'viable and good fit' design options were progressed to a full DPE, while the 'viable but poor fit' and 'unviable' design options were discounted.

More detailed information on the process to develop departure options is contained in para 6.2 and for arrivals in para 20.2.

5.6 Step 1 - Airline fleet equipage survey

Our design principles state that we should make use of the latest widely available aircraft technology but also ensure we provide Alternatives for those aircraft that don't have this technology. To give effect to these principles, and prior to the commencement of design activities, we conducted a fleet equipage survey to find out what technology the airlines and their aircraft have and how they could fly.

The aim of this was to understand the capabilities of the aircraft regularly flown into and out of STN to fly PBN routes, and also to understand the performance that could be achieved in the future. This information was important in informing our design work because it helped us create routes that matched operators' capabilities and which responded to the design principles.

The survey covered a wide range of airlines, both passenger and cargo, and the responses received covered 86.4% of the Air Transport Movements (ATM) to and from the airport.

The table below shows the airlines that responded to the survey and their proportion of the total ATMs at STN.

ATM Ranking	Airline	Percentage of Air Transport Movements
1	Ryanair	63.5%
2	EasyJet	10.0%
3	Jet2	6.1%
4	FedEx	2.2%
5	TUI	1%
6	UPS	0.8%
7	West Atlantic	0.8%
8	Swift Air (FedEx feeder)	0.6%
9	Emirates	0.5%
10	BA	0.3%
11	Qatar Airways	0.3%
12	SAS	0.2%
13	DHL	0.1%
	Total % of ATM's covered	**86.4%**

Table 3 Responses to airline fleet equipage survey

The questions asked focussed on operations and capabilities in both 2020 and 2025. The results showed:

- PBN Departure capabilities: By 2025, all aircraft would be capable of operating to at least RNAV1 (GNSS) capability as a minimum. This removes the need for any reference to ground based navigation aids. In addition, 100% of aircraft would be capable of RNP1 operations with 96% of those having the ability to perform these with radius fixed (RF) turns. Further details of these standards and their application in the design of route options at STN is detailed at para 6.5.
- PBN Arrivals capabilities: By 2025, 100% of aircraft would be capable of flying an approach with both Lateral and Vertical Navigation (LNAV/VNAV) capability. In addition, 66% would be capable of flying approaches to the Ground Based Augmentation System (GBAS) standard. By 2025, all aircraft will be capable of flying arrival routes to RNP APCH standard.
- Climb gradients: All airlines that responded could achieve a minimum climb gradient of 6% under 2020 operations. This assumed a scenario of a fully laden aircraft, at an air temperature of +25°c. The aim was to provide a scenario where climb performance may be reduced as a result of the combination of high load factor and high temperature which has the effect of reducing lift. In addition, 9 of the 13 airlines would be capable of an 8% climb gradient under the same conditions, which represented 82% of ATMs. A total of 6 airlines were capable of achieving 10% which equates to approx. 74% of ATMs.

The data on both the PBN capability and climb performance was subsequently used in the creation of both the design envelopes and the design options. The PBN capability was applied to the design options themselves in the creation of the options to both RNAV and RNP1 criteria. The climb data informed the gradient applied in the creation of the design envelopes, with design options designed to a default of 8% as well as the alternative of 6% for lower performing aircraft.

5.7 Step 2 Initial departures and arrivals boundary

To create the **departures** boundary, the information from the fleet equipage survey was applied. This confirmed that all aircraft operating into and out of STN could climb at least a 6% gradient which equates to the following distances from the Departure End of Runway (DER):

- 33.83km from RWY 22 DER
- 33.71km from RWY 04 DER

This created a theoretical omni-directional boundary line, assuming a constant climb (in line with our design principles on Policy and Technology) and this was used as the foundation for the design envelopes and design constraints.

The ICAO PANS-OPS rules relating to the first turn and the minimum turn radius were applied to create theoretical design boundaries for both runway ends. This reduced the dimensions of the design boundary (due to the track mile extension following a turn) and also identified the area within which designs would not align with PANS-OPS requirements and hence the Design Principles for Safety and Policy.

For **arrivals**, and in line with the design principles on Policy and Technology, all arrivals should facilitate a CDA from 7,000ft. A theoretical omni-directional area for arrivals was calculated from 7,000ft to the runway based upon a continuous descent using ICAO and CAA recommendations of 3° (5.24° for the transition/initial approach segment and a Final Approach Descent of 3°.

This was later revised to create a design envelope that assured CDAs to both runway directions, as detailed at para 20.7.

5.8 Step 3: Constraints and Considerations

The constraints were developed by analysing the airspace and current operations in the north east LTMA Airspace. This identified constraints and considerations to the future designs:

- Constraints were defined as aspects that have a direct impact on designs, or limit where we can place our arrival and departure design options.
- Considerations were defined as aspects that do not limit our designs but which we need to take account of in creating options.

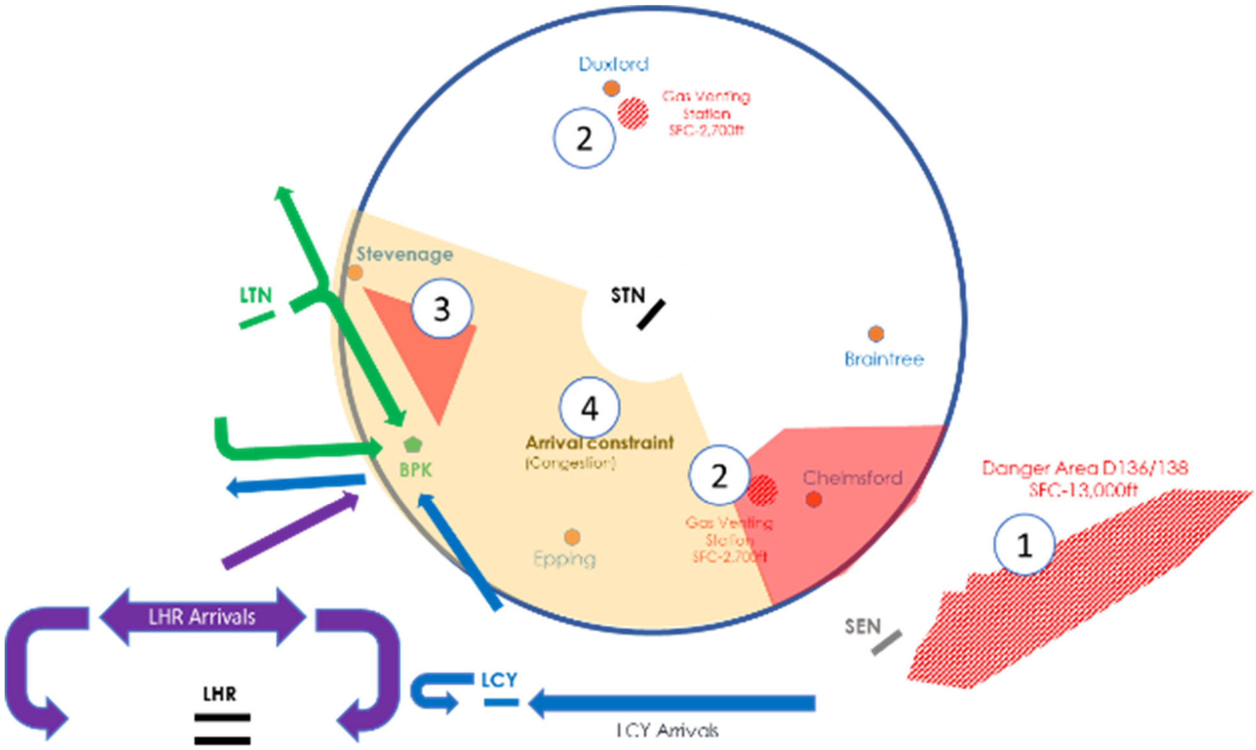


Figure 2 Constraints and Considerations

1. Shoeburyness Danger Area EGD 136 & 138 A/B/C/D (Constraint) This complex set of danger areas lies to the south east of STN close to Southend (SEN). These are used for a variety of military activities including firing of ammunition and explosive devices and extend permanently to 13,000 ft and occasionally to 60,000ft. The analysis concluded that the combination of range and altitude created a constraint for both departures and arrivals in a systemised operation.
2. Cambridge and Chelmsford Gas Venting Stations (Consideration): These two areas are a notified hazard to aircraft in the UK Aeronautical Information Publication (AIP) (see ENR 5.3. Cambridge GVS and Chelmsford GVS). Both have a radius of 0.25nm and an upper limit of 2,700ft from their geographical position. Initially, we considered these areas as a constraint, as a prudent approach taken in line with our Safety design principle.

   However, as part of our route refinement work (following the second phase of engagement) we conducted an impact assessment and because of their altitude and distance from STN we concluded that the areas would not impact either our departure or arrival design options. They were therefore downgraded to be classified as a consideration only.

3. London Luton (Constraint): LTN is approximately 25nm to the west of STN and when operating in easterly mode, all departures initially route towards Stevenage. Based on a 6% climb gradient, STN traffic would be at a similar height to this traffic. The analysis concluded that for safety reasons an area of constraint for LTN interactions should be created to the west.

   Our bilateral discussion with LTN confirmed that they expect that this will remain an area for their flights to operate and that, due to the rules relating to the separation of aircraft and airspace containment, it would be unlikely that the size of this area would significantly reduce. We will continue to keep this under review during our ongoing discussions with both NERL and LTN, but do not expect the constraint to be removed.

4. Airspace congestion to the south west of STN (arrivals constraint): Our analysis identified LTN, Heathrow (LHR), London City (LCY) and SEN as having the ability to influence future STN designs. On further analysis, we identified multiple SIDs from these airports which are based upon Brookmans Park (BPK) which is within the design boundary for STN departures and arrivals.

   Looking into the future, this beacon is scheduled to be removed from service and aircraft flying in this area will transfer to PBN. However, even with this change of reliance and movement of routes, the analysis concluded that this would remain a highly congested area for departures because of the proximity of the airports and the need to connect to the upper airspace network system to leave UK airspace.

   Our design principles require us to find a safe and efficient system of operation that makes best use of PBN. Currently the area to the south west makes it highly unlikely that if we designed routes in this area this could be achieved. Placing an arrival structure would create multiple interactions between our descending aircraft and other climbing aircraft such that neither operations could operate efficiently.

   'Designing in' these interactions in what is likely to remain congested airspace would not be a safety-first strategy. Furthermore, it is not in line with the Government Airspace Modernisation Strategy which calls for interactions to be eliminated and would limit the ability for the new airspace system to deliver a CDA to STN from 7,000ft. On that basis we have created a constraint of congested airspace within which we do not propose to start our arrivals design options from 7,000ft.

5.9 Step 4a: Creating design envelopes

The next step was to create a set of design envelopes. Details of the process followed for departures is described at para 6.2 and for Arrivals at para 20.2. In summary the process was:

- For **departures**, design envelopes start at the runway and finish at 7,000ft. They expand in a linear fashion until they are 8,000m or approx. 4.5nm wide when they reach 7,000ft, with the width providing flexibility to create design options that respond to different elements of the design principles. Most envelopes are based upon the current SIDs, with additional envelopes created where we considered these may provide a clear and objective benefit in line with our Change design principle.
- For **arrivals**, a similar approach was used. The starting point was to use the existing conventional approach procedures from LOREL and ABBOT as a 'do minimum' baseline. We then constructed arrivals design envelopes where a CDA to at least one runway end was possible. We considered six alternative areas from where the 7,000ft starting point could be located, which included the two existing hold positions. These initial design areas formed the arrivals design envelopes used for the first phase of stakeholder engagement and were underpinned by Initial Approach Fixes (IAF) positioned to provide a foundation to the envelope. From all these fixes a CDA was possible to at least one runway direction.

Both departure and arrivals design envelopes were designed to address the SoN and the design principles. They took into account the constraints and considerations detailed above and information from the airline fleet equipage survey, which informed the navigation standard being applied and the climb gradient being used.

These design envelopes were shared with stakeholders to seek feedback in the first phase of engagement. This phase one engagement gave stakeholders the opportunity to comment on the process followed and the design envelopes created. It also enabled us to use their feedback to influence subsequent amendments to the design envelopes and take account of the views in the next stage of the design process, where the specific design options were developed.

5.10 Step 4b Creating Design options

Following the first stage of stakeholder engagement, changes were made to the design envelopes to take account of stakeholder feedback (as detailed at section 4 of the Stakeholder Engagement Report. Design options (in the form of routes) were then created within each design envelope.

- For **departures**, the starting point for the design of the design options was a PBN replication of the existing SID (if there was an existing SID within the design envelope) to act as a 'do minimum' baseline. Having established the 'do minimum' option for the design envelopes containing existing routes, further design options were developed within the design envelope that responded to the design principles. Consistent with the Change design principle, which requires any new routes to achieve a clear and objective benefit, additional routes were identified where it is was likely they could provide a benefit that aligned with one or more the design principles. Examples include creating a more direct routing to reduce emissions, reducing the number of people overflown or avoiding noise sensitive areas. Where a design envelope did not contain an existing route, a new set of design options were developed using the same principles.

- The initial **arrivals** design envelopes covered a wide area within which a continuous descent approach was possible to at least one runway direction. In the second stage we refined this area by applying the "must-have" Policy design principle and the requirement to provide a continuous descent approach (CDA). This resulted in a reduction of the design envelopes and design options were then designed within these design envelopes, commencing at an Initial Approach Fix (IAF) of 7,000 ft. Any option unable provide for CDAs for both runway ends was not fully aligned to the Policy design principle and could only be classed as Viable but Poor Fit, with reference to the route classification exercise detailed at para 5.11 below. As with departures, design options were developed on the basis of a clear link to one or more of the design principles. Design options were designed to join the final approach at a Final Approach Fix (FAF) at either 2,000ft, 2,500ft or 3,000ft.

For both departures and arrivals, each route option, and the link to the relevant design principles was communicated via phase two of the stakeholder engagement process, with further changes being made to the design options to take account of the feedback received (as detailed at section 4 of the Stakeholder Engagement Report).

5.11 Step 5: Route Option Classification – the viability filter

In line with CAP1616 we created a comprehensive list of design options. However, not all of the design options created were feasible options or would align with the "must have" design principles.

Our design process adopted an approach that identified a long list of options and then refined this list of options to focus on the viable options to be progressed to the full DPE. To achieve this, a viability filter was applied to the long list of design options. This resulted in design options being classified in one of three categories according to their compliance with safety requirements and alignment with the 'must-have' design principles. These 'must-have' design principles are Safety, Policy and Demand.

Design options were classified into one of three categories, as described below. These three categories were 'unviable', 'viable and poor fit' and 'viable and good fit'.

5.11.1 'Unviable' design options

'Unviable' design options were defined as design options that:

a) Would not fully comply with the requirements of PANS-OPS8168; and
b) Would not have an approved safety justification for the lack of compliance with the PANS-OPS criteria. At STN the current CLN1E and DET1D SIDs have a turn radius that is lower than the PANS-OPS minimum for the type of procedure. However, these legacy routes are supported by a CAA approved safety case and have been demonstrated to be safe since their introduction. These routes therefore were not classified as 'unviable'.

'Unviable' design options include options that may be non-compliant with PANS-OPS in relation to:

- Minimum Stabilization Distance (MSD)

- Position of the first turn in relation to departure end of runway (DER)
- Turn radius based on speed, altitude and climb gradient
- Procedure Design Gradient (PDG)

The categories and nature of the design options identified as 'unviable' are summarised for each design envelope in sections 7 to 19 for departures and sections 23 to 33 for arrivals. However, due to the volume of non-compliant options, these were not designed or subjected to further analysis. This approach is consistent with both our 'must have' design principle Safety and the guidance given in CAP1616 para 127, which acknowledges that the scope for multiple options may be limited where, for example, options do not align with relevant international standards (in our case, PANS-OPS 8168).

Unviable options were not progressed to the DPE or IOA.

5.11.2 Viable

All other design options that passed this initial test were classified as Viable and were then classified into two sub-categories, based on compliance with the 'must have' design principles: Viable and Good fit against Design Principles or Viable but Poor Fit against Design Principles.

- 'Viable and poor fit' options are those that would not be expected to meet the requirements of the Safety, Policy or Demand design principles. These options are described in this report and the DPE but were not subjected to a full evaluation in the DPE or progressed to the IOA, as they do not address the SoN or align with the design principles. The application of the 'must have' design principles to the design options at this stage is described below:
    - <u>Safety</u>: The application of this design principle identified the potential for inbuilt hazards or where significant safety concerns were present. This included where the relevant option has the potential to create a hazardous interaction between the route and other aircraft. Alternatively, the route may have conflicted with, or cause aircraft to fly through notified Danger Areas.

      In the absence of a full safety analysis at this stage of the CAP1616 process, where such an interaction has been identified, a qualitative assessment was made to ascertain whether the relevant route option was classified as viable and good fit or viable but poor fit. This assessment is detailed within the rationale for each Viable but Poor fit option within sections 7 to 19 for departures and sections 23 to 33 for arrivals of this DOR.
    - <u>Policy</u>: The Air Navigation Guidance 2018 and the CAA AMS (CAP1711) set out initiatives that airspace modernisation must deliver. These can be summarised as:
        a. Safety:
        b. Efficiency: The most efficient use of airspace and the expeditious flow of traffic including greater runway throughput.
        c. Integration: Facilitating the greatest possible access to all users.
        d. Environmental performance: including shorter or more fuel-efficient flightpaths and allowing for noise impacts to be better managed. This includes the use of CDAs and CCOs.

e. Defence and security: ensuring designs take account of the interests of national security.
f. International alignment with ICAO and the EU.

Where a route option showed misalignment with one or more of these objectives, a qualitative assessment was made to ascertain whether the relevant route option was classified as viable and good fit or viable but poor fit. This assessment is detailed within the rationale for each Viable but Poor fit option, as presented within sections 7 to 19 for departures and sections 23 to 33 for arrivals of this DOR.

Demand: The application of this 'must have' design principle identified design options which may create interactions with airborne holds, arrival routes or departure routes. Whilst not unsafe, these may require ATC intervention or result in a reduction in capacity. This assessment is detailed within the rationale for each Viable but Poor fit option within sections 7 to 19 for departures and sections 23 to 33 for arrivals of this DOR.

- 'Viable and Good fit' design options that were classified as 'viable and good fit' were defined as routes that would be expected to meet the three design principles with which all design options 'must' comply (Safety, Policy or Demand). These are included as numbered options in this DOR and were progressed for full evaluation within the DPE.

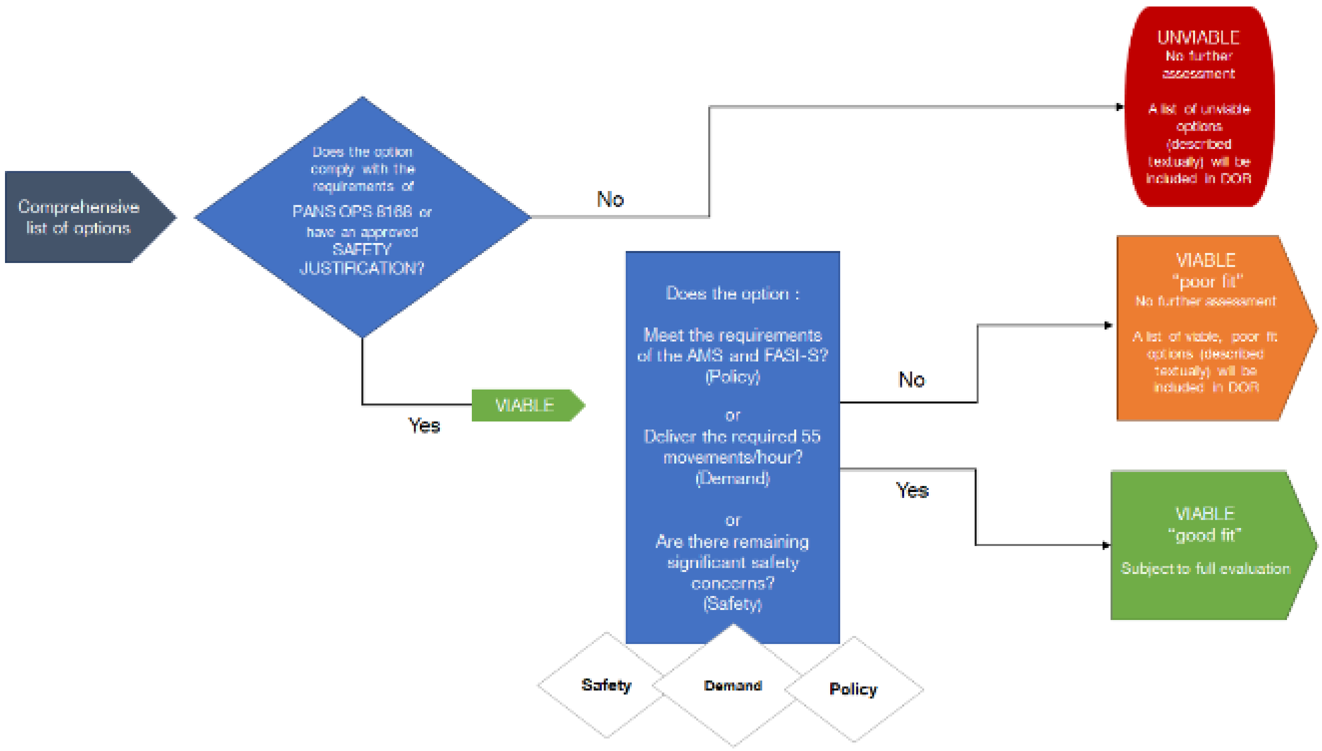


Figure 3 Flow Diagram of Viability analysis

6 Departure Designs – Introduction

6.1 Design Envelope and Route Option Details - Overview

Sections 6 to 19 of this DOR provide a technical overview of the departures design envelopes and a breakdown of the design options within them.

In line with CAP1616 guidance, the departures design options start at the runway and end at 7,000ft.

This section of the DOR contains details of:

1. The process followed to create the design envelopes and design options for departures.
2. An introduction to each departure design envelope, including how it relates to the current SID structure.
3. A simplified map showing the location of each design envelope and the routes that have been designed within it.
4. An Options Summary table showing the comprehensive options for each design envelope. This includes options from the numbered list ("viable and good fit"), the lettered list ("viable and poor fit") and any unviable options that we have considered but discounted. For the unviable routes, the basis for their having been discounted is provided.
5. A detailed description of each route option. In those design envelopes where a route currently exists, the first described design options relate to the replication of the current conventional routes to PBN standards, to provide the 'do minimum' options. Additional options are then provided for alternative routes.

For each route option there is a description of what has been designed, and the rationale for designing the route (the "why"). In addition, where applicable, an explanation of which design principles the route seeks to align with is provided.

Each route option is also accompanied by a map and an explanation of the ICAO PANS-OPS design criteria used.

6.2 Departure Design – Development Process

The departure design process comprised a sequence of steps commencing with the creation of our initial design envelopes – broad areas where it would be possible to design options as detailed in para 5.9 and 5.10.

For departures, the first step was to create a theoretical omni-directional boundary, based upon a CCO from the runway to 7,000ft (as shown in para 5.7) and which encompassed the current SIDs.

The airspace within the initial boundary was then reviewed to consider the PANS-OPS criteria and identify the constraints and considerations (as shown in para 5.8) that may impact on the identified area or limit the positioning of the design envelopes.

This exercise included the consideration of:

- The PANS-OPS criteria, with regards to the initial turn after departure. This ruled out certain areas within the initial boundaries where we could not put forward design options due to the first turn being below the PANS-OPS permitted altitude.
- Any other constraints and considerations which may impact departures, including Danger Areas, operations from adjacent airports including LTN and LCY and areas of congested airspace within the NERL LTMA.

Having established the above constraints and considerations, a set of initial design envelopes were produced, taking into account five criteria:

- Rules: CAA and ICAO PANS-OPS rules relating to Instrument Flight Procedure (IFP) design, including turn altitudes and radius and stabilisation requirements.
- Aircraft: The fleet equipage survey, which gave us detail on the navigation standards that airlines can fly and the climb performance they can achieve.
- Network: Traffic flows within the London TMA (LTMA) and potential 7,000ft joining points for STN traffic.
- SoN and Design Principles: The STN design principles as detailed in para 5.3 and the Statement of Need (SoN) that supports these.
- CONOPS: The STN Concept of Operations to support the change, specifying how the new airspace should work.

The design envelopes start at the runway and expand in a linear fashion until they are 8000m or approx. 4.5 nm wide when they reach 7,000ft. This approach provided lateral flexibility to create design options that responded to different elements of the design principles, including noise, track length or interaction with traffic from other airports. Further details on the rationale behind each of the design envelopes is shown at para 6.3.

Seven design envelopes were created for each runway end in the first design phase. These design envelopes were based on a combination of 8% and 6% climb gradients, in line with the results from the airline fleet survey and design principle on Alternatives. The additional envelopes were:

- Runway 22: Runway heading directly to the south west, aimed at creating noise respite and a more direct route for traffic currently using the NUGBO SID. This aligns to the Balance, Noise 2 (N2) and Demand design principles.
- Runway 04: A more direct route to the north east, aimed at splitting departures to create noise respite and a more direct for traffic currently using the CLN SID. This aligns to the Design Principle Noise 2 and Demand design principles.

Two existing SIDs had already been designed to PBN standards which were consulted upon and agreed in 2018. These are the Clacton (CLN) from Runway 22 and Detling (DET) from Runway 04. Both of these SIDs have been previously approved by the CAA. Consistent with the requirements of CAP1616 these routes were treated equally with other options and considered on their merits. As a result, design envelopes were created around them, with the existing SIDs representing the 'do minimum' options for these design envelopes.

The initial design envelopes were underpinned by conceptual PBN SIDs to ensure that they complied with the requirements of PANS-OPS in their basic design and to provide a foundation to the envelope. Stakeholders were then invited to comment on the initial design envelopes during the phase one engagement.

The stakeholder engagement exercise carried out during Stage 2 is detailed in the Stakeholder Engagement Report. As described in that report, the feedback collected from the phase one engagement informed the revision of the design envelopes and the creation of design options within those envelopes.

The process described above resulted in:

- Updates to the position of the West A and West B design envelopes to reflect feedback received during the phase one engagement. These design envelopes were realigned because of the need to better reflect the route that would be taken within the airspace network beyond 7,000ft and to seek ways to reduce interaction with LTN traffic in line with the Design Principle Efficiency (E). The change was also intended to provide greater opportunities to avoid overflying communities in line with Noise 1 (N1) design principles, to provide more opportunity to create respite in line with Noise 2 (N2) design principle and to reduce fuel burn by reducing track miles in line with Balance.
- The creation of an additional design envelope from Runway 22, referred to as Runway 22 north east. This is aimed at creating a shorter and less congested route for traffic routing to exit UK airspace to the north east when compared to the 22 East Departure design Envelope in line with the Balance and Demand design principles. It also presented the opportunity to provide noise relief in line with Noise 2 (N2) design principle and a lower climb rate alternative to that of the 22 East design envelope to meet our Alternatives design principle.
- The creation of PBN replications of the existing SIDs as a set of 'do minimum' options.
- The creation of a comprehensive list of 'viable and good fit' options (see para 5.110) within the design envelopes. These design options are designed to provide a clear and objective benefit (in relation to the current SID) in line with our Change design principle. There is therefore a clear link between each option and one of the design principles or the feedback we received.
- The creation of 'viable but poor fit' options (see para 5.11) that did not satisfy the requirements of the 'must have' design principles.
- The identification of 'unviable' options that were not progressed due to safety reasons.

The output from this process is described in sections 7 to 19 of this DOR and were shared with stakeholders during the phase two engagement. Feedback from this process resulted in one change to the routes presented to stakeholders:

- Runway 22 Option 3: Engagement feedback suggested changes to tracks in this design envelope on the basis of Noise 1 (N1) design principle.

The updated design options within this design envelope are included in this DOR along with all other design envelopes and design options that form the comprehensive list.

6.3 Design Envelopes Summary

The STN design envelopes start at the runway and expand until they are 8000m or approx. 4.5 nm wide when they reach 7,000ft. This approach provided lateral flexibility to create design options that respond to different elements of the design principles. So that we were able to create the widest range of options, the design envelopes are defined by the end point of the routes created within them, rather than by defining a fixed end point. This gave us the ability to create different lateral and vertical tracks for the design options.

In the phase one engagement we showed an initial set of design envelopes based largely around the current route network, to seek feedback from stakeholders on both the concept and the position of these design envelopes. We then considered this feedback and applied the design principles to refine the design envelopes and create a comprehensive list of design options. For some design envelopes, the process of considering the design options had the effect of changing the dimensions or position of the design envelopes from the initial designs shown to stakeholders during the phase one engagement.

The maps below show the design envelopes shared with stakeholders. These include the amendments that were made to the design envelopes and, in the case of Runway 22, the additional 22 north east design envelope that was introduced in response to stakeholder feedback. The diagrams show:

- where envelopes were extended or added with black shading
- where they were reduced with red shading.

The dimensions of the design envelopes are based upon the rationale and diagrams within CAA CAP1498 Definition of Overflight Document. This states that a 1,888m lateral displacement at 7,000ft would be expected to result in a 3dB reduction in noise which is the minimum difference that can ordinarily be perceived on the ground. By expanding the width of the end of the envelope from 1,888 to a 4,000m lateral displacement either side of centreline this will equate to a total end width of 8,000m or 4.32nm.

For design purposes, this was rounded up to 4.5nm, and from the application of basic noise assessment tools, we forecast a noise dispersal of approximately 17-19dB between the lateral edges of the end of the envelope and is one which would be expected to result in a perceivable difference on the ground.

6.3.1 Runway 22 Design Envelopes

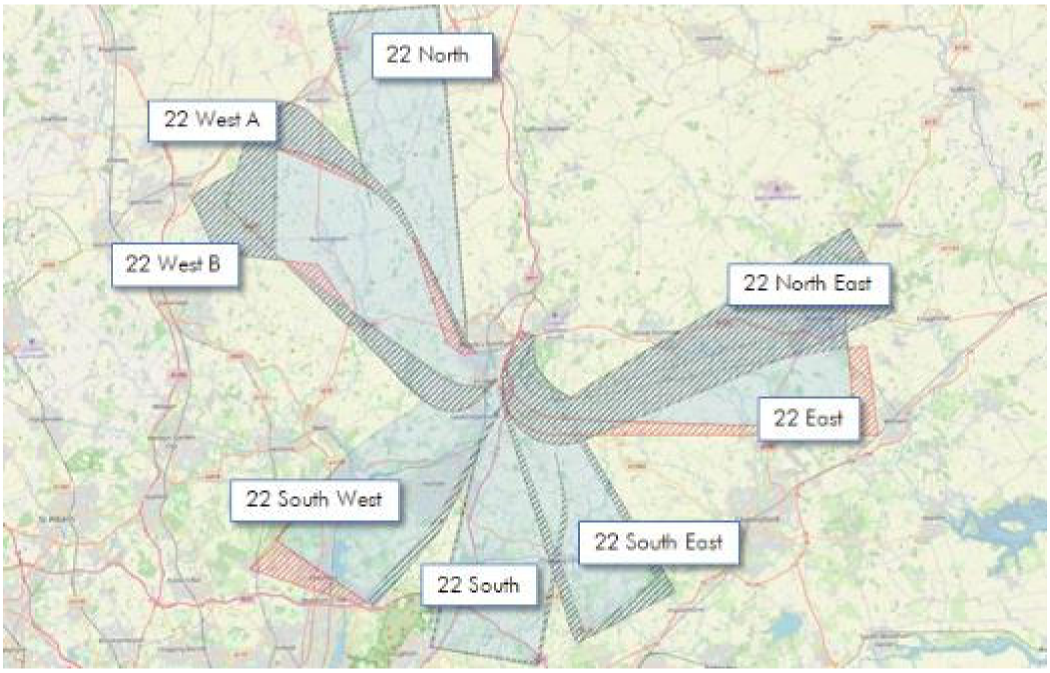


Figure 4 Runway 22 Design Envelopes

6.3.2 Runway 04 Design Envelopes

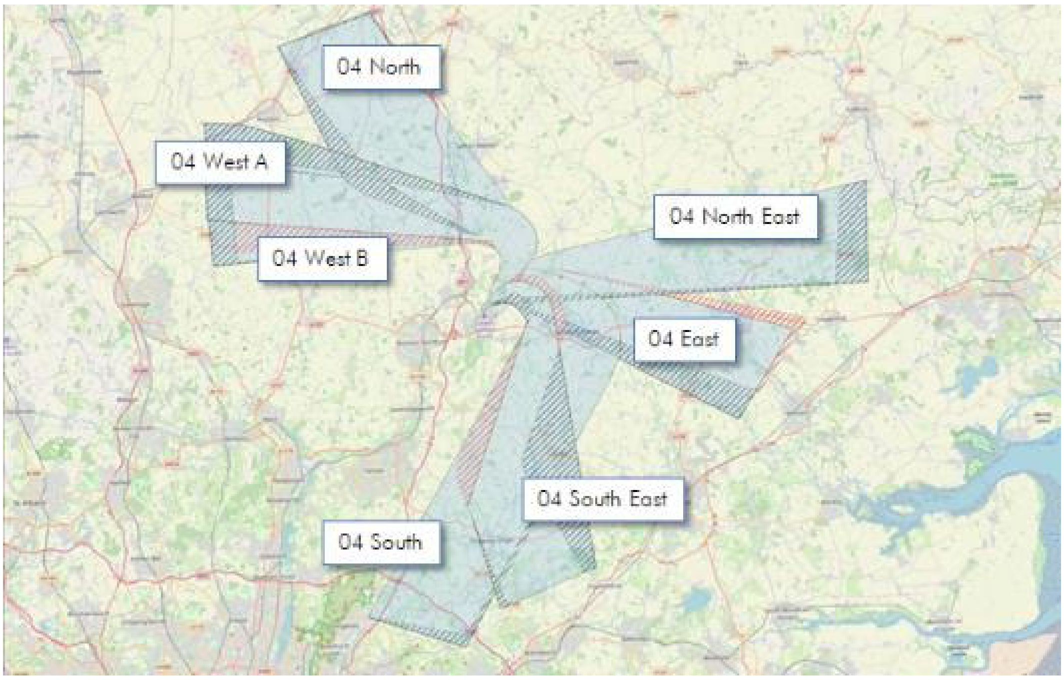


Figure 5 Runway 04 Design Envelopes

6.4 Design Envelopes – Climb Gradient Summary

As detailed in para 5.6, the airline fleet equipage survey asked airlines to supply information on both their PBN capabilities and their climb performance.

The question asked was: "Assuming ISA +10 conditions (25°c) could the worst performing aircraft that operates in your fleet from STN fly a departure climb gradient of 6%, 8%,10% or 12%?".

The survey indicated that by 2025 all aircraft would be capable of climbing at 6% and over 82% of current fleets could meet a gradient of 8%. However at 10% and above this number decreased below 75% especially for aircraft travelling longer distances or to the limit of their range.

On the basis of this information, the design envelopes were designed as follows:

- Consistent with our Technology design principle our default climb gradient for the design envelopes and the routes within them has been set at 8%. This is higher than the ICAO minimum of 3.3% and reflects the capability of the majority of the aircraft at STN.
- To be consistent with our design principle on alternatives we have designed some envelopes to accommodate a lower climb gradient of 6%. This ensures we make available a reasonable route structure for slower climbing aircraft.
- We chose to adopt one consistent climb gradient to each route, so that all aircraft flying the same route fly the same minimum climb profile. We have made this decision to ensure that aircraft within the same design envelope are not climbing at significantly different rates, which is consistent with our design principle on safety. Mixed climb rates may result in aircraft coming into conflict resulting in a loss of separation and the need for ATC intervention.

The table below details the procedure climb gradients that have been applied to the routes within the design envelopes, and the alternative routes that have been provided.

Runway 22	Gradient	Notes	Runway 04	Gradient	Notes
West A (UTAVA)	6%	Alternative for 22 North	West A (UTAVA)	6%	Alternative for 04 North
West B (NUGBO)	6%	Alternative for 22 South or Southwest	West B (NUGBO)	6%	Alternative for 04 South
South West (New)	8%		South (LAM)	8%	
South (LAM)	8%		South East (DET)	8%	
South East (DET)	8%		East (CLN)	8%	
East (CLN)	8%		North East (New)	6%	Alternative for 04East
North East (New)	6%	Alternative for 22 East	North (BKY)	8%	
North (BKY)	8%				

Figure 6 Climb Gradients Applied to Each Design Envelope

6.5 PBN Design Criteria

In line with the results of the airline fleet equipage survey detailed at para 5.6, both the replication design options and the new design options have been designed to two design standards. These are RNAV1 and RNP1 with Radius to Fix turns (RNP1+RF).

Both design standards have an accuracy requirement of within 1nm and are fundamentally similar. However, an aircraft flying an RNP1 route is required to have monitoring and alerting equipment on the aircraft, whereas RNAV does not. Additionally, RNP1 offers the capability of Radius to Fix (RF) legs, whereas RNAV does not. Their difference is not noticeable in level flight but in a turn, some difference may be apparent, especially where RF legs are used.

RNAV1: This has the lower aircraft equipment requirement and is therefore more suitable for older aircraft to fly the routes accurately. The use of RNAV1 aligns with the requirement to upgrade to PBN, and the Alternatives design principle but it is not the most modern system available. When aircraft fly RNAV routes, they sometimes refer to ground-based systems to assure their position using Distance Measuring Equipment. This is known as DME/DME. This means that, whilst the aircraft will fly within the accuracy criteria required within the ICAO standard, some dispersion can occur within a turn, depending on how far away these ground-based systems are. The fleet survey confirmed that all aircraft operating into STN were capable of flying routes designed to this standard.

RNP1+RF: This requires on board monitoring and alerting system and aligns with the design principle for the latest available aircraft technology. As the name suggests, this procedure offers the RF path terminator, which implies a constant radius of turn, and usually makes no reference to any ground-based system. Most of the time, the navigation is conducted via satellite reference (GNSS RNP) with aircraft flying to a specific point at the end of the turn for RF legs. This type of procedure is highly accurate and results in less dispersion, but the enhanced equipment requirements mean that not all aircraft are able to fly it (especially the RF legs).

6.6 Departures options description – Example layout

The following sections 7 to 19 detail the departure design envelopes and the design options created within them. Each section includes an introduction, followed by a description and graphic for the relevant design envelope. There is then a summary table that briefly describes the design options, which is followed by a more detailed description of each route.

The graphic below provides an example of the summary table used, to explain the information contained within it.

Standard Instrument Departure (SID).

The runway the option applies to, either RWY 22 or RWY 04.

The design envelope that this route is within.

The option number for this route.

The climb gradient used, either 6% or 8%.

SID RWY 22 NORTH-EAST Option 1 (6%)

Description	Rationale for Inclusion
This section provides a written description of the option including the criteria it has been designed to, and any features of the design such as turning points or areas the route avoids, or overflies.	This is the reason why we have included the route as an option. It doesn't evaluate the design, but just provides a reason why it is in the list of options when compared to the design principles.

7 SID RWY 22 WEST

7.1 Introduction to SID RWY 22 WEST Design Envelopes

This envelope was originally designed as a single envelope to cater for traffic routing to the south and west from Runway (RWY) 22. The original envelope was based around both the current UTAVA and NUGBO SIDs, and after departure, design options within this envelope turned right to terminate at 7,000ft.

However, although these two SIDs currently route on the same initial track, they diverge after 7,000ft. The UTAVA is used for traffic to the west and north west, and the NUGBO for traffic to the south west. For this reason, it was decided to separate the two SID replications, after the first round of stakeholder engagement and provide alternative routes, but to delineate each of the envelopes to show more clearly which SID the design options aim to replicate.

Therefore, there are two envelopes: SID RWY 22 WEST A (based on UTAVA), and SID RWY 22 WEST B (based on NUGBO). Each route option is annotated A or B accordingly. There is some overlap between the two envelopes, which reduces the separation on some options.

7.2 Design Envelope Location Maps

7.2.1 SID RWY 22 WEST A Envelope

This envelope is based on the existing UTAVA SID, although the envelope for 22 WEST A has been moved slightly to the north of UTAVA and orientated to the north west to align it with the NERL route network after 7,000ft. This is aimed at reducing fuel burn in accordance with the Design Principle Balance (B).

The initial track closely mimics the 22 WEST B envelope/NUGBO SID and for ATC separation purposes, the SIDS do not offer any divergence at any point.

In accordance with the Design Principle Balance (B) this envelope has been designed at a fixed climb gradient of 6%. This is flyable by all aircraft flying into STN and this envelope therefore provides an alternative for aircraft unable to achieve the steeper 8% climb gradient.

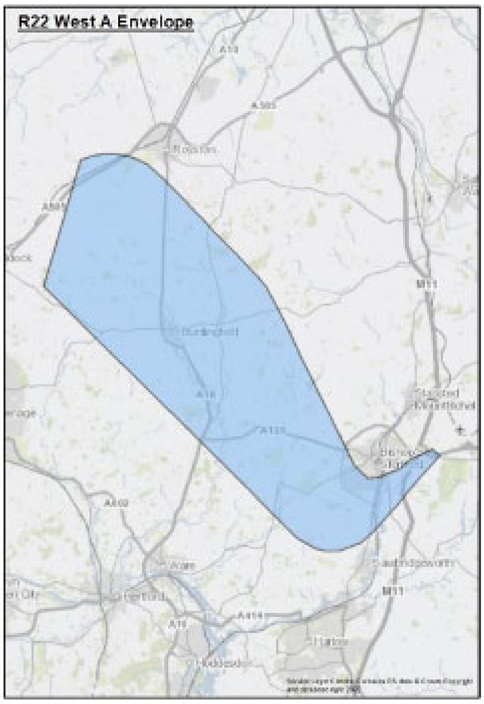


Figure 7 Runway 22 WEST A Envelope

7.2.2 SID RWY 22 WEST B Envelope

This envelope is based on the existing NUGBO SID. It is used by traffic departing STN and heading to the south and south west. In the absence of any other route to the south during the daytime, it is heavily utilised. The initial track closely mimics the 22 WEST A envelope/UTAVA SID and for ATC separation purposes, the SIDs do not offer any divergence at any point. In accordance with the Alternatives design principle this envelope has been designed at a climb gradient of 6%. This is flyable by all aircraft flying into STN and this envelope therefore provides an alternative to those aircraft unable to achieve the steeper 8% climb gradient.

Although used for south and south west bound traffic, the current SID is designed to route north initially before turning west to join the NATS network airspace in the vicinity of SILVA. Only at this point do aircraft turn south and route to exit UK airspace. This is a legacy profile constructed to separate STN traffic from LTN traffic and to reduce interactions with departing traffic from LHR. The route taken (and the sharing of the initial track with the current UTAVA SID) results in noise concentration, delays to departures and additional fuel burn when compared to a more direct route.

As detailed in para 5.8, we have placed a design constraint to the south of Stevenage. Our bilateral discussions with LTN concluded that routes to and from Luton are likely to continue to operate in this area and this has dictated the shape of the design envelope and design options. However, as the process develops and further discussions take place between STN, LTN and NATS we will continue to keep this under review. This is in line with the Design Principle Balance to reduce fuel burn and CO2 emissions.

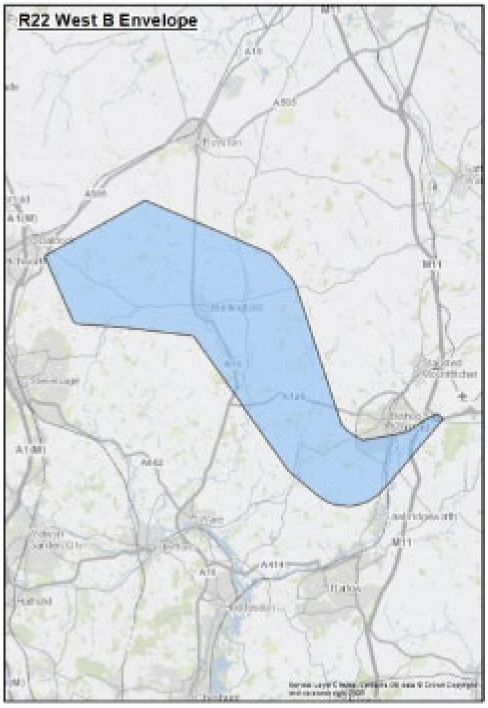
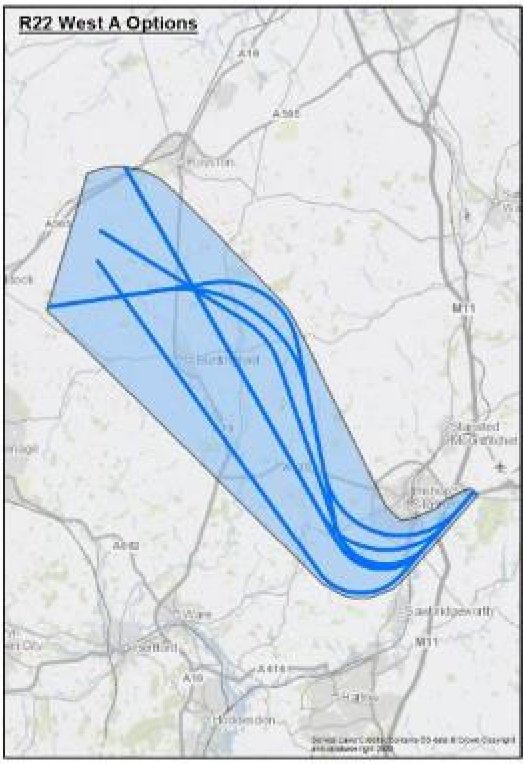


Figure 8 Runway 22 WEST B Envelope



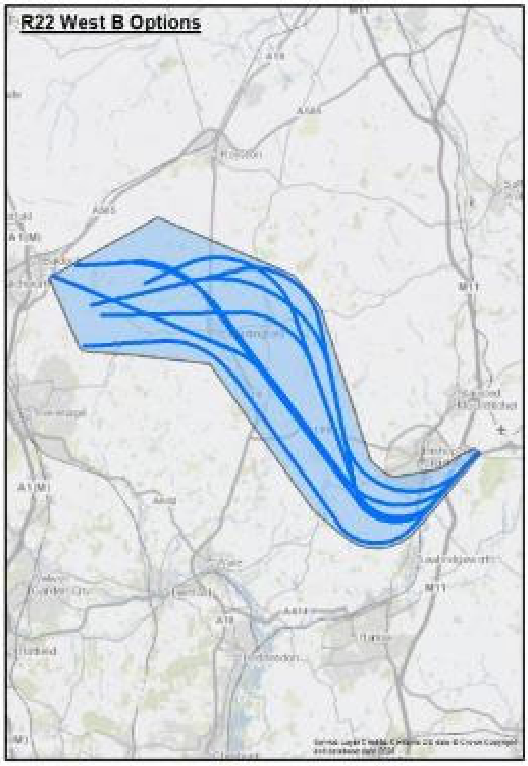


Figure 9 Runway 22 WEST A and B Envelopes and Options

7.3 SID RWY 22 WEST (A & B) Options Summary Table

'Viable and good fit' against design principles		'Viable but poor fit 'against design principles		'Unviable '	
1A UTAVA	This option is included to provide a **replication** of the existing conventional **UTAVA** SID using PBN technology. The route has been designed as an **RNAV1** route using fly-by points and the climb gradient has been set at 6%.	A16	Left 270° wraparound. West A		Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
2B NUGBO	This option is included to provide a **replication** of the existing conventional **NUGBO** SID using PBN technology. The route has been designed as an **RNAV1** route using fly-by points and the climb gradient has been set at 6%.	B17	Right 450° wraparound. West A		
3A UTAVA	This option is included to provide a **replication** of the existing conventional **UTAVA** SID using PBN technology. The route has been designed as an **RNP1** route using RF turns and the climb gradient has been set at 6%.	C18	Extended straight ahead then north. West A		

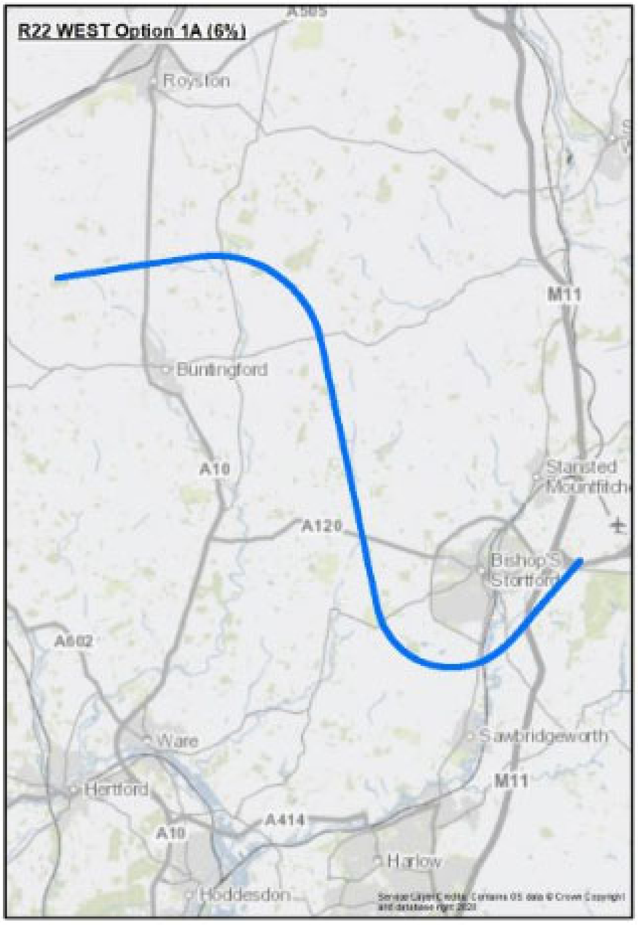
'Viable and good fit' against design principles		'Viable but poor fit 'against design principles		'Unviable '	
4B NUGBO	This option is included to provide a replication of the existing conventional NUGBO SID using PBN technology. The route has been designed as an RNP1 route using RF turns and the climb gradient has been set at 6%.	D19	Left 270° wraparound. West B		
5A UTAVA	This is an RNAV1 departure featuring a fly-by turn which routes on a direct track towards UTAVA. The first turn is later than the current SIDs but it provides a direct expeditious routing for aircraft towards the end of the design envelope. The route terminates to the west side of the envelope.	E20	Right 450° wraparound. West B		
6A UTAVA	This is an RNAV1 route and utilises a fly-by waypoint turn. It has a similar initial turn as Option 1A but provides a more direct expeditious route to the end of the envelope to reduce the track miles flown. The route terminates to the east side of the envelope.	F21	Extended straight ahead then north-west B		
7A UTAVA	This follows a similar track to Option 6A but has been designed to RNP1 using RF turns and therefore utilises more accurate technology. This option has an initial turn that routes between the tracks of the initial turns of Option 1A and Option 3A. It then maintains a north westerly track direct to the end of the WEST A envelope. The route terminates to the east side of the envelope.				
8B NUGBO	This is an RNAV1 route that utilises fly-by waypoints to create a slightly more direct departure towards NUGBO. The initial turn is similar to Option 2, hence close to the existing departure, but then the route turns more northerly before taking a westerly				

'Viable and good fit' against design principles		'Viable but poor fit 'against design principles		'Unviable '	
	track toward NUGBO. This option is slightly more direct that the replication option and terminates in the centre of the envelope.				
9A UTAVA	This is an RNAV1 route featuring fly-by turns to provide a north westerly bearing to be established prior to the end point. It is included in the envelope to offer a hybrid design, which provides an earlier split between the UTAVA and NUGBO SIDs to aid noise dispersal and capacity. This option terminates in the centre of the envelope and avoids overflight of St Elizabeth's Centre.				
10B NUGBO	This is an RNAV1 departure featuring fly-by turns and a more direct track towards NUGBO. The initial track is identical to Option 9A, but on reaching a point east abeam Buntingford it turns west. It is included in the envelope to offer a hybrid design, which provides an earlier split between the UTAVA and NUGBO SIDs to aid noise dispersal and capacity. This option terminates to the south of the envelope and avoids overflight of St Elizabeth's Centre.				
11B NUGBO	This option is an RNAV departure utilising fly-by waypoints, that has the later right turn of Option 5A, and then routes to the west edge of the envelope. On reaching a point south abeam Buntingford, the route splits on a westerly track towards the north of Stevenage to the south of the envelope. This option avoids overflight of Bishops Stortford, and Buntingford and reduces the number of track miles flown when compared to the current SID.				
12B	This is an RNAV departure utilising fly-by waypoints, which follows the initial track of Option 6A. The track				

'Viable and good fit' against design principles		'Viable but poor fit 'against design principles		'Unviable '	
NUGBO	routes through the centre of the envelope and turns slightly left onto a north westerly track towards Letchworth to terminate in the centre of the envelope before reaching Baldock.				
13B NUGBO	This is an RNP1 version of Option 12B and uses the more accurate technology of RF turns. It follows the initial turn of Option 7A, but once west of Bishop's Stortford, the track routes through the centre of the envelope and turns slightly left onto a north westerly track towards Letchworth to terminate in the centre of the envelope before reaching Baldock.				
14B NUGBO	This is an RNAV1 departure utilising fly-by waypoints. It turns north after Bishops Stortford and then routes through the centre of the envelope on a north westerly track to route east of Buntingford.				
15B NUGBO	This is an RNP1 version of Option 14B and uses the more accurate technology RF turns. It turns north after Bishops Stortford and then routes through the centre of the envelope on a north westerly track to route east of Buntingford.				

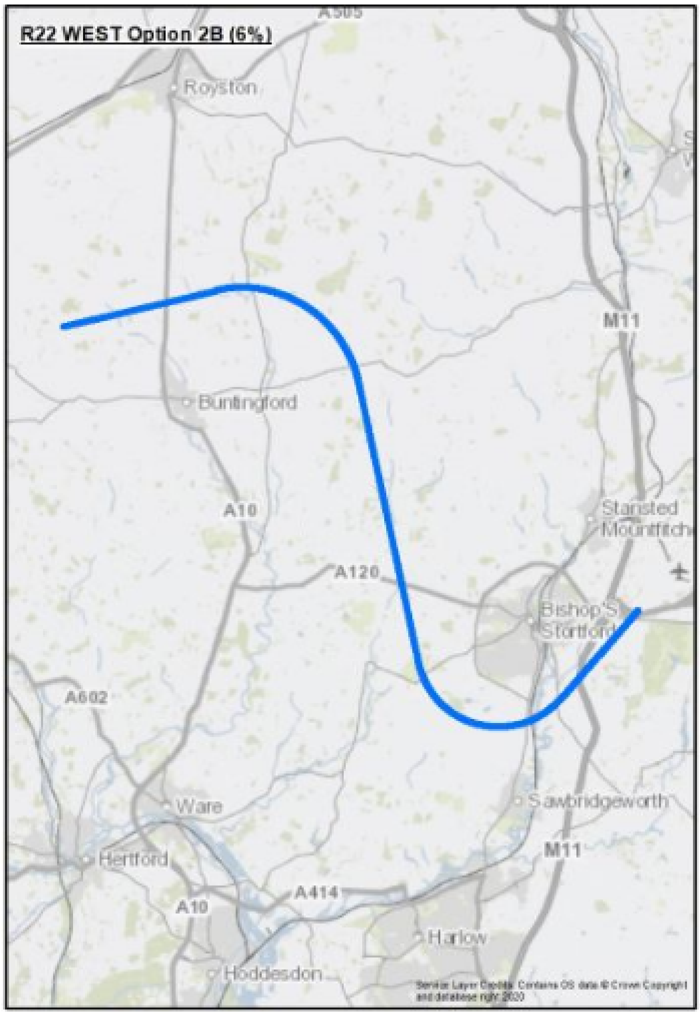
7.4 SID RWY 22 WEST Option 1A (6%)

Description	Rationale for Inclusion
*Option 1A is provided as an **RNAV1** replication of the current conventional departure to UTAVA and uses fly-by waypoints to create an approximate replication of the existing published conventional UTAVA departure with a climb gradient of 6%.* *As a replicated route, it follows a similar track over the ground as current published route and connects to the NATS network at the existing UTAVA fix.* *However, because it does not route on a direct track to UTAVA after the first turn it does not maximise fuel efficiency. In addition, it terminates on a westerly heading meaning that it does not align with the en-route structure, which routes to the north west.*	Replication: Aligns to a 'do minimum' option. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



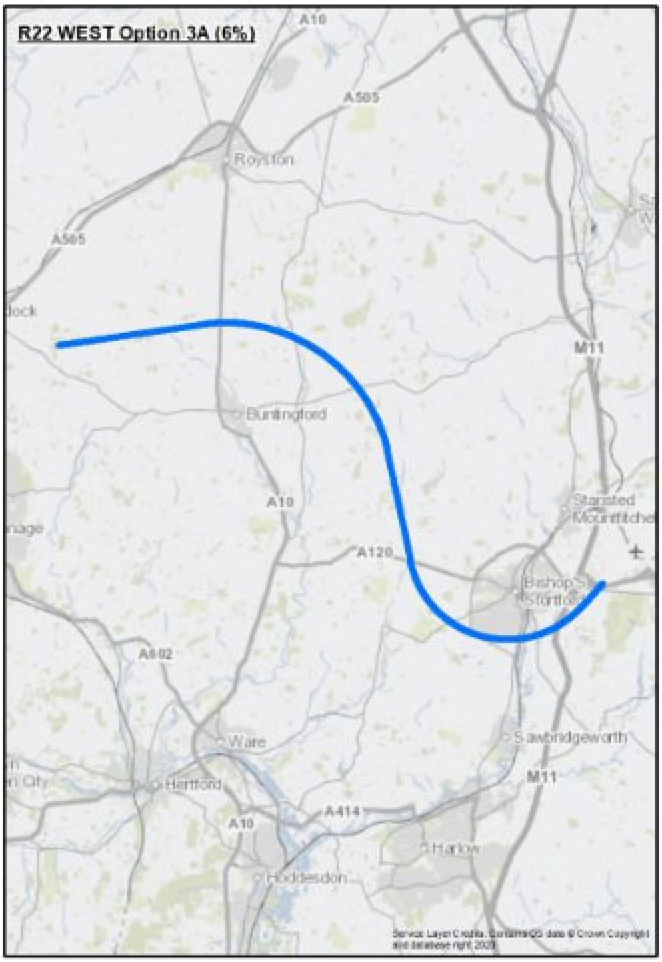
7.5 SID RWY 22 WEST Option 2B (6%)

Description	Rationale for Inclusion
*Option 2B is provided as an **RNAV1** replication of the current conventional departure to NUGBO and uses fly-by waypoints to create an approximate replication of the existing published conventional NUGBO departure with a climb gradient of 6%.* *As a replicated route it follows a similar track over the ground as the current published route and connects to the NATS network at the existing NUGBO fix.* *However, because it does not route on a direct track to NUGBO after the first turn, it does not maximise fuel efficiency.*	Replication: Aligns to a 'do minimum' option. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



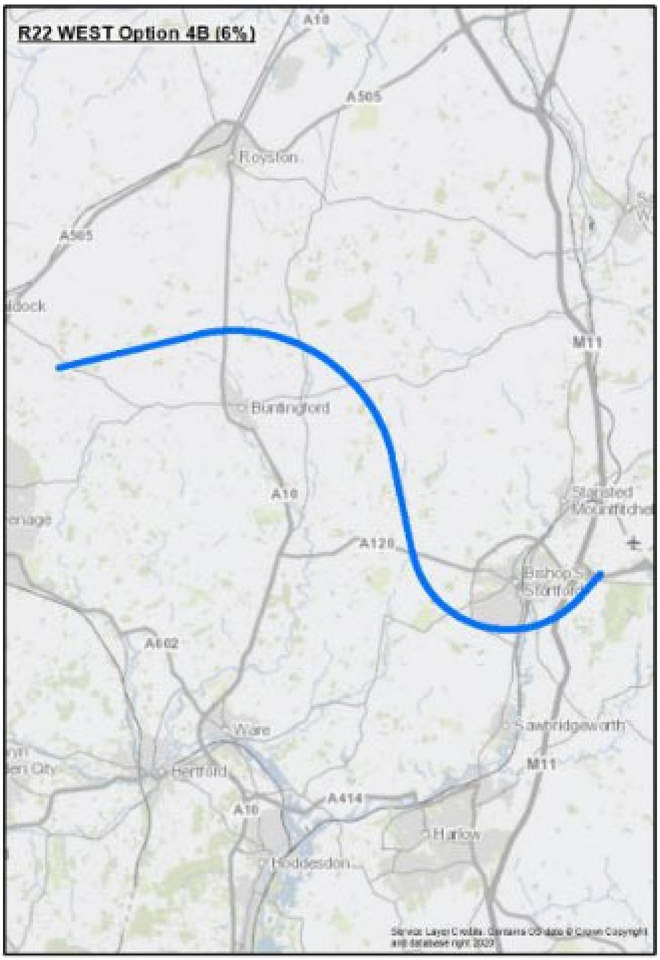
7.6 SID RWY 22 WEST Option 3A (6%)

Description	Rationale for Inclusion
Option 3A is provided as an ***RNP1*** *replication with RF turns at 6% to create an approximate replication of the existing published conventional UTAVA departure.* *As a replicated route it follows a similar track over the ground as the current published route and connects to the NATS network at the existing UTAVA fix.* *However, because it does not route on a direct track to UTAVA after the first turn, it does not maximise fuel efficiency. In addition, it terminates on a westerly heading meaning that it does not align with the en-route structure, which routes to the north west.*	Replication: Minimum change but using a more accurate design standard. Technology: RNP1 allows for the use of RF legs, therefore defining a much more predictable, and reliable track over the ground.



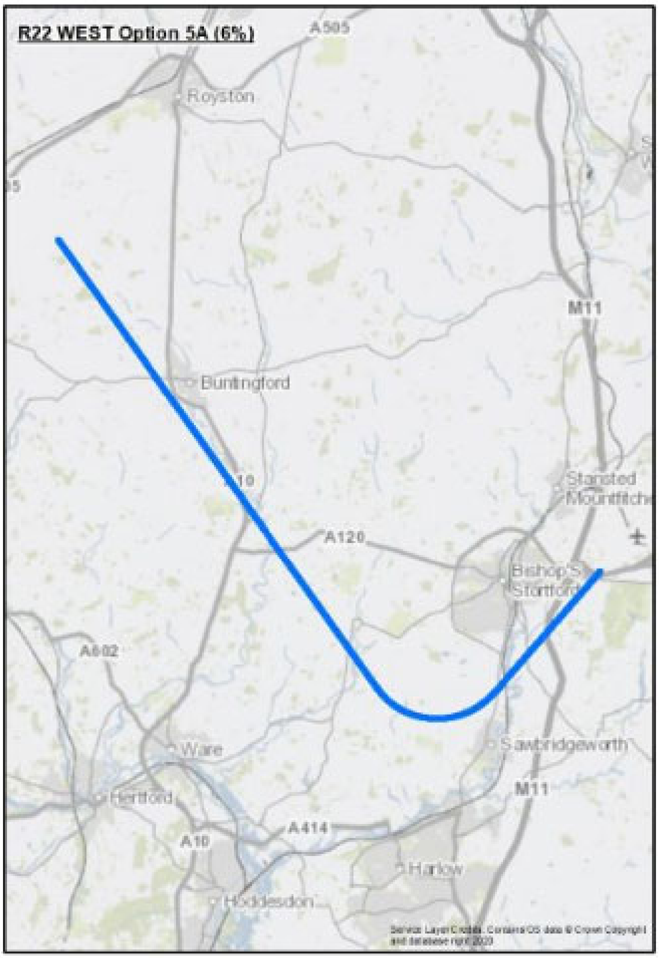
7.7 SID RWY 22 WEST Option 4B (6%)

Description	*Rationale for Inclusion*
*Option 4B is an **RNP1** replication with RF turns at 6% to create an approximate replication of the existing published conventional NUGBO SID.* *As a replicated route it follows a similar track over the ground as the current published route and connects to the NATS network at the existing NUGBO fix.* *However, because it does not route on a direct track to NUGBO after the first turn, it does not maximise fuel efficiency.*	Replication: Minimum change but using a more accurate design standard. Technology: RNP1 allows for the use of RF legs, therefore defining a much more predictable, and reliable track over the ground.



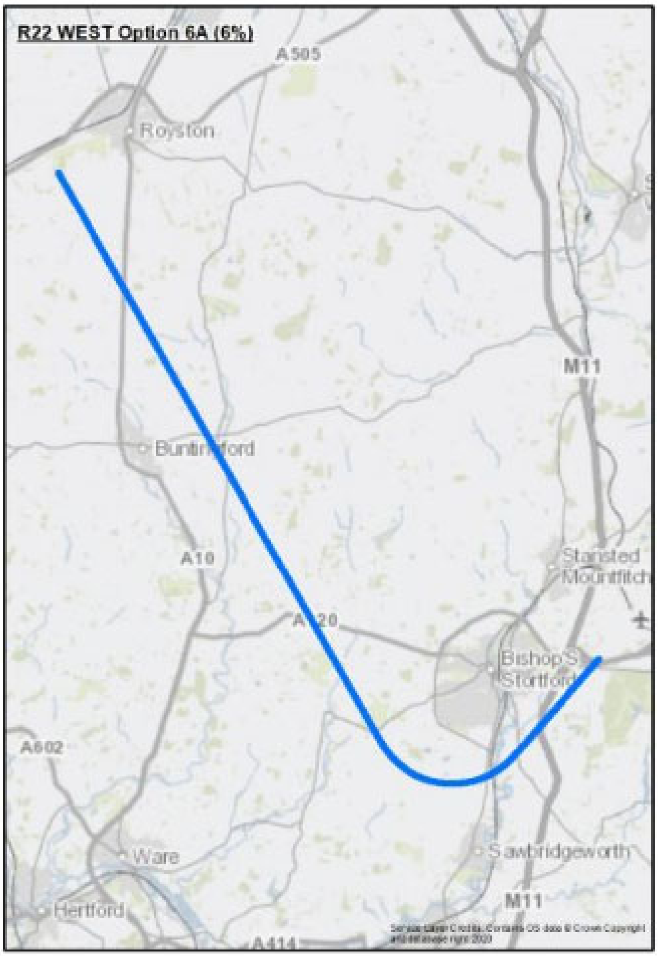
7.8 SID RWY 22 WEST Option 5A (6%)

Description	Rationale for Inclusion
*Option 5A is an **RNAV1** departure featuring a fly-by turn which routes a direct track towards UTAVA. After the first turn it provides a fuel-efficient direct track to the north west by eliminating the turns in the replicated routes.* *It has a delayed initial turn when compared to the existing departure profile, and this ensures that aircraft do not turn overhead Bishop's Stortford and the track then routes to the west of Buntingford.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by avoiding Bishops Stortford and Buntingford.



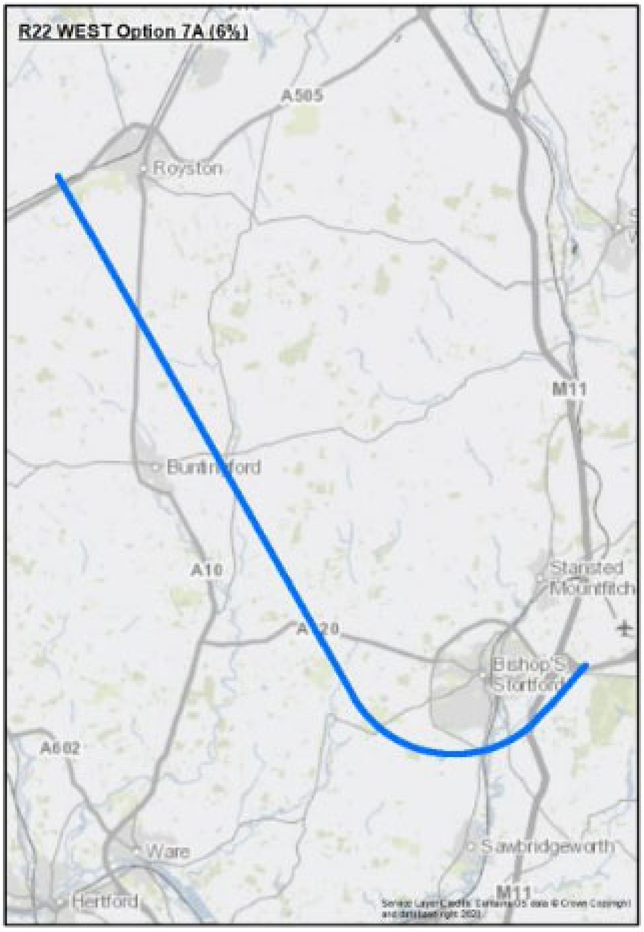
7.9 SID RWY 22 WEST Option 6A (6%)

Description	Rationale for Inclusion
*Option 6A is an **RNAV1** option and utilises a fly-by waypoint to turn closer to the DER to create a direct departure route through the centre of the envelope to 7,000ft whilst eliminating the turns of the replicated routes.* *It has a similar initial turn to Option 1A but on reaching a point west abeam Bishop's Stortford, it turns on to a north westerly track, routeing direct to a point to the north of UTAVA.* *This option routes to the east of Buntingford, and to the west of Royston, and aims to avoid flying close to areas such as Sawbridgeworth, Bishop's Stortford and Much Hadham within the first turn.*	RNAV is the lowest PBN specification and usable by all aircraft in the fleet survey. Balance: More direct routing and reduced track miles when compared to replicated route.



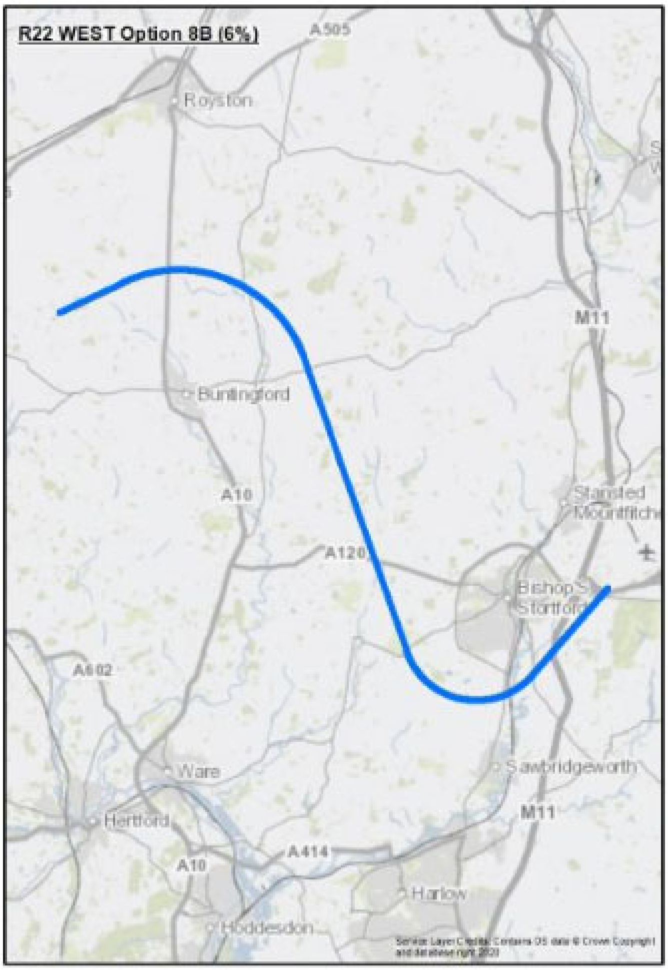
7.10 SID RWY 22 WEST Option 7A (6%)

Description	*Rationale for Inclusion*
Option 7A is similar to Option 6A, but it has been designed to ***RNP1*** *using RF turns and therefore more accurate technology. As with Option 6A it routes through the centre of the envelope to 7,000ft whilst eliminating the turns of the replicated routes.* *The initial turn routes between the tracks of the initial turns of Option 1A and Option 3A and routes on a north westerly track direct to a point to the north of UTAVA.* *This option also routes to the east of Buntingford, and to the west of Royston, and aims to avoid flying close to areas such as Sawbridgeworth, Bishop's Stortford and Much Hadham within the first turn.*	Balance: More direct routing and reduced track miles when compared to replicated route. Technology: RNP1 allows for the use of RF legs, therefore defining a much more predictable, and reliable track over the ground.



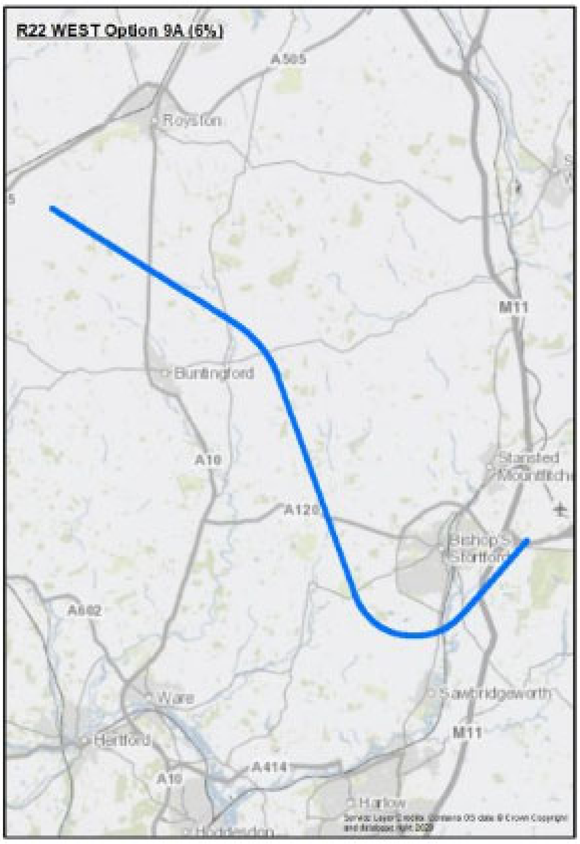
7.11 SID RWY 22 WEST Option 8B (6%)

Description	Rationale for Inclusion
Option 8B is an ***RNAV1*** *route that utilises fly-by waypoints to create a route that tracks slightly further north to reduce possible interaction with LTN traffic. It may permit noise relief if combined with Option 11B.* *The initial turn is similar to Option 2B, and close to the existing departure track, but then the route turns more northerly before taking a westerly track toward NUGBO. Whilst not as direct as some of the options included within this envelope, this option is slightly more direct than the replication option.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Efficiency: Seeks to eliminate interactions with other airports. Noise N2: Offers potential for noise relief if combined with Option 11B.



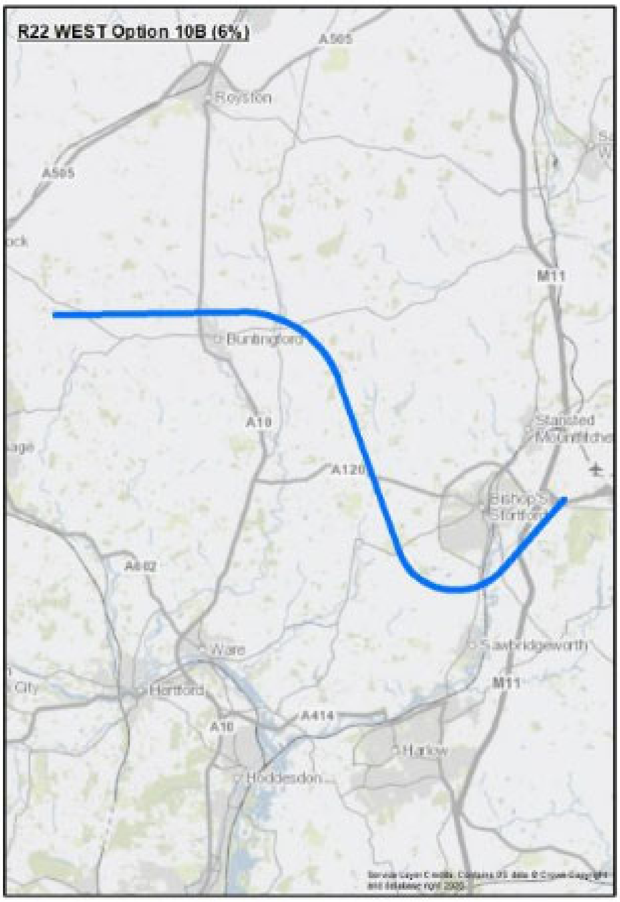
7.12 SID RWY 22 WEST Option 9A (6%)

Description	*Rationale for Inclusion*
*Option 9A is an **RNAV1** departure featuring fly-by turns and a slightly more direct track to a point north of UTAVA by eliminating the turns of the replicated routes, whilst allowing for a north westerly bearing to be established prior to the end point.* *It is included in the envelope to offer a hybrid design, which provides an earlier split between the UTAVA and NUGBO SIDs to aid noise dispersal and capacity. It has also been designed to avoid the major housing developments and provides a possible noise relief option when combined with Option 5A.* *This option terminates in the centre of the envelope and avoids overflight of St Elizabeth's Centre. By providing an earlier split between the two SIDs it has the potential to aid capacity and reduce delays for following flights on WEST B (NUGBO) departure routes.*	Balance: More direct routing and reduced track miles when compared to replicated route. Demand: Has potential to reduce delays for following departures. Noise N1: Has potential to reduce noise impacts by avoiding major settlements. Noise N2: Offers potential for noise relief if combined with Option 5A



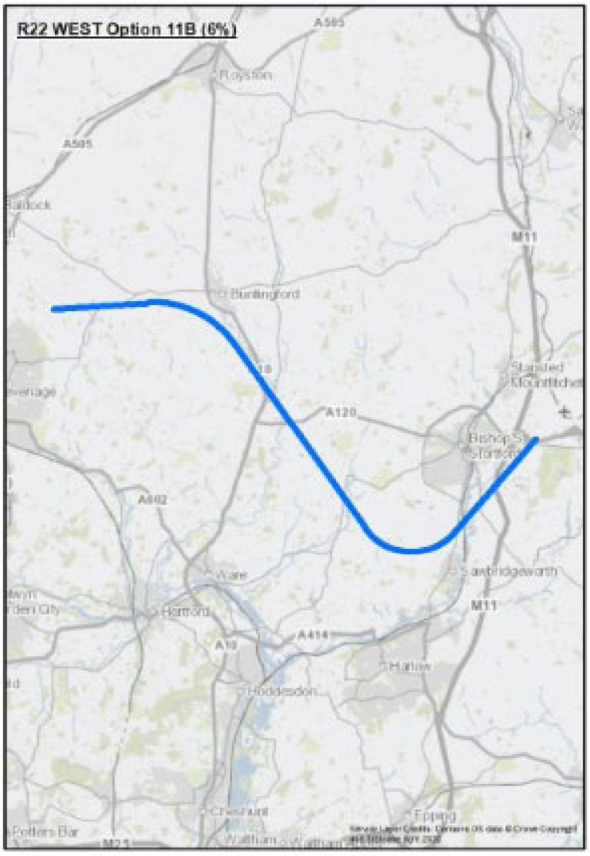
7.13 SID RWY 22 WEST Option 10B (6%)

Description	*Rationale for Inclusion*
*Option 10B is an **RNAV1** departure featuring fly-by turns with a slightly shorter track to NUGBO when compared to the replicated routes.* *It is included in the envelope to offer a hybrid design, which provides an earlier split between the UTAVA and NUGBO SIDs to aid noise dispersal and capacity. It has also been designed to avoid the major centres of population.* *This option terminates in the centre of the envelope and avoids overflight of St Elizabeth's Centre. By providing an earlier split between the two SIDs it has the potential to aid capacity and reduce delays for following flights on WEST B (NUGBO) departure routes.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Noise N1: Has potential to reduce noise impacts by avoiding major settlements. Balance: More direct routing and reduced track miles when compared to replicated route. Demand: Has potential to reduce delays for following departures.



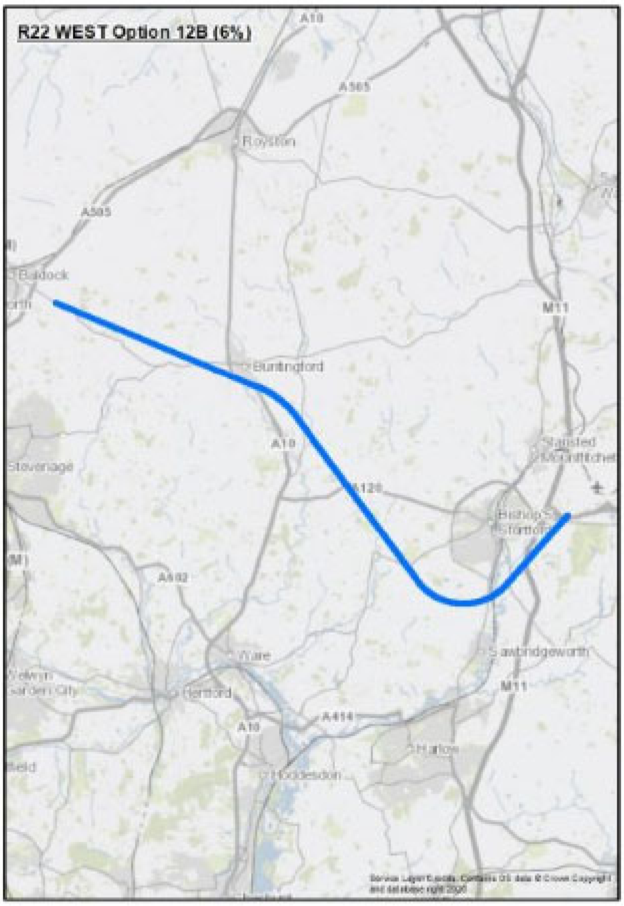
7.14 SID RWY 22 WEST Option 11B (6%)

Description	*Rationale for Inclusion*
*Option 11B is an **RNAV1** departure utilising fly-by waypoints, which seeks to create the shortest (most fuel efficient) route and avoids centres of population. It has been designed to offer possible noise relief when combined with options 2b, 4B or 8B.* *It has a delayed initial turn when compared to the existing departure profile, and this ensures that aircraft do not turn overhead Bishop's Stortford and the track then routes to the west of the envelope. Once the aircraft reaches a point south abeam Buntingford, the route turns left on a westerly track towards the north of Stevenage and the south of the envelope.* *This option avoids overflight of population centres and reduces the number of track miles flown when compared to the current SID.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by avoiding Bishops Stortford and Buntingford. Noise N2: Offers potential for noise relief if combined with other options.



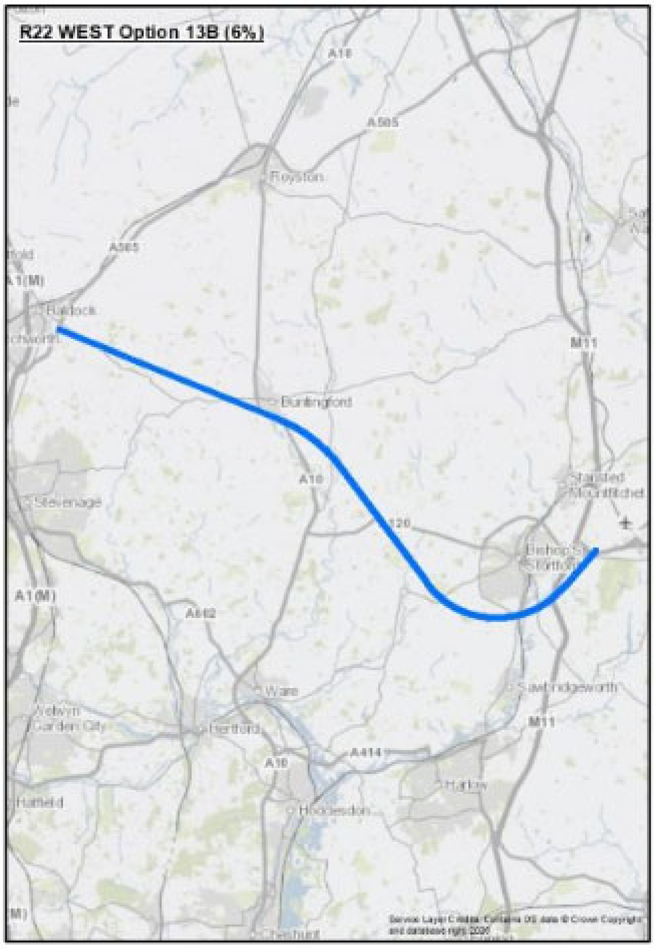
7.15 SID RWY 22 WEST Option 12B (6%)

Description	Rationale for Inclusion
Option 12B is an ***RNAV1*** *departure utilising fly-by waypoints.* *The initial turn takes place after Bishops Stortford and then routes through the centre of the envelope on a north westerly track. It then turns onto a north westerly track at Buntingford towards Letchworth and the northern edge of the envelope to reduce possible interaction with LTN traffic.* *This option is included as it reduces the number of track miles flown when compared to the current SID.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Efficiency: Seeks to eliminate interactions with other airports. Balance: More direct routing and reduced track miles when compared to replicated route.



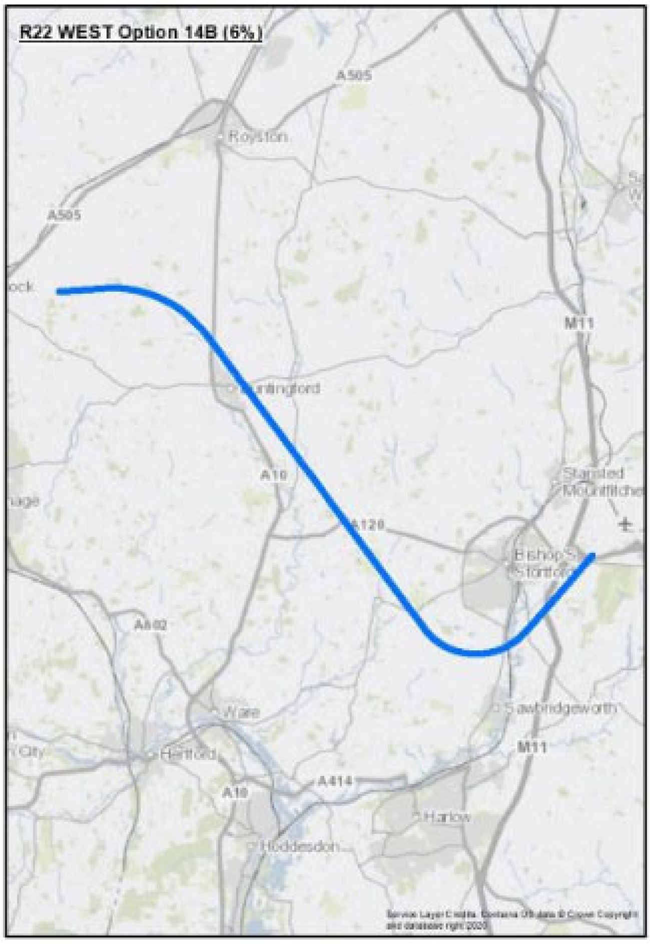
7.16 SID RWY 22 WEST Option 13B (6%)

Description	Rationale for Inclusion
*Option 13B is an **RNP1** departure using RF turns and therefore more accurate technology.* *The initial turn takes place after Bishops Stortford and then routes through the centre of the envelope on a north westerly track. It then turns onto a north westerly track at Buntingford towards Letchworth and the northern edge of the envelope to reduce possible interaction with LTN traffic.* *This option is included as it reduces the number of track miles flown when compared to the current SID.*	Efficiency: Seeks to eliminate interactions with other airports. Balance: More direct routing and reduced track miles when compared to replicated route. Technology: RNP1 allows for the use of RF legs, therefore defining a much more predictable, and reliable track over the ground.



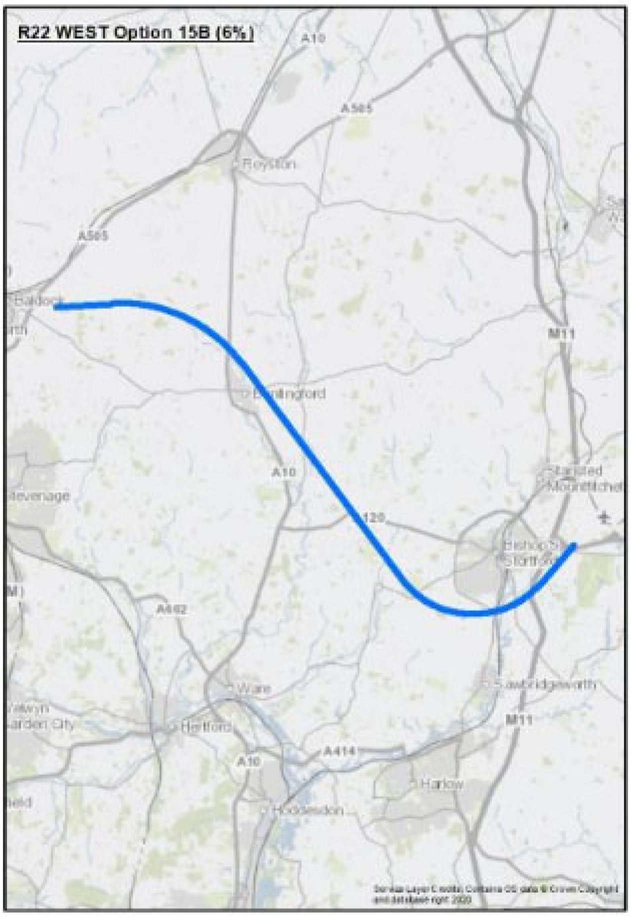
7.17 SID RWY 22 WEST Option 14B (6%)

Description	Rationale for Inclusion
Option 14B is an ***RNAV1*** *departure utilising fly-by waypoints as an alternative to Option 12B.* *The initial turn takes place after Bishops Stortford and then routes through the centre of the envelope on a north westerly track until well north of Buntingford, where it turns on a westerly track towards Letchworth It routes to the north of Stevenage and terminates at the northern edge of the envelope to reduce possible interaction with LTN traffic.* *This option reduces the number of track miles flown when compared to the current SID.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Efficiency: Seeks to eliminate interactions with other airports. Balance: More direct routing and reduced track miles when compared to replicated route.



7.18 SID RWY 22 WEST Option 15B (6%)

Description	Rationale for Inclusion
*Option 15B is an **RNP1** departure using RF turns and therefore utilising the more accurate technology,* *The initial turn takes place after Bishops Stortford and then routes through the centre of the envelope on a north westerly track until well north of Buntingford, where it turns on a westerly track towards Letchworth. It routes to the north of Stevenage and terminates at the northern edge of the envelope to reduce possible interaction with LTN traffic.* *This option is included reduces the number of track miles flown when compared to the current SID.*	Efficiency: Seeks to eliminate interactions with other airports. Balance: More direct routing and reduced track miles when compared to replicated route. Technology: RNP1 allows for the use of RF legs, therefore defining a much more predictable, and reliable track over the ground. Technology: RNP1 allows for the use of Radius to Fix.



7.19 SID RWY 22 WEST – Viable but poor fit'

<table>
<tr><th>Option</th><th>Safety</th><th>Policy</th><th>Demand</th><th>Outcome</th></tr>
<tr><td>A16 Left Wraparound West A</td><td>S</td><td>P</td><td>D</td><td>'Viable but poor fit'</td></tr>
<tr><td colspan="5">After departure from RWY 22, aircraft would make a 270° left-hand turn, fully around the airport, and then begin heading north west through the envelope.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.</td></tr>
<tr><td>B17 Right Wraparound West A</td><td>S</td><td>P</td><td>D</td><td>'Viable but poor fit'</td></tr>
<tr><td colspan="5">After departure from RWY 22, aircraft would make a 450° right-hand turn, flying fully around the airport, and then begin heading north west.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.</td></tr>
</table>

C18 Extended straight ahead then north west A	S	P	D	'Viable but poor fit'
After departure from RWY 22, aircraft would continue straight ahead for longer and then make a right-hand turn back towards the West A design envelope in a track that ventures outside the existing design envelope. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. It must also be noted that this option may extend beyond the design envelope.				
D19 Left Wraparound West B	S	P	D	'Viable but poor fit'
After departure from RWY 22, aircraft would make a 270° left-hand turn, fully around the airport, and then begin heading west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
E20 Right Wraparound West B	S	P	D	'Viable but poor fit'
After departure from RWY 22, aircraft would make a 450° right-hand turn, around the airport, and then begin heading west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.				

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
F21 Extended straight ahead then north west A	S	P	D	'Viable but poor fit'
After departure from RWY 22, aircraft would continue straight ahead for longer and then make a right-hand turn before making another left-hand turn back towards the West B envelope on a track that ventures outside the existing design envelope. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				

8 SID RWY 22 SOUTH-WEST

8.1 Introduction to SID RWY 22 SOUTH-WEST Design Envelope

This is a new design envelope which aligns with the Policy design principle by creating a more fuel-efficient route to the south west in line with the aspirations of the AMS. It also responds to the Demand design principle by creating a means to alleviate congestion on the current West B (NUGBO) SID. As a new envelope there is no Replicated route.

It has been designed with an 8% climb gradient to provide direct connectivity to the network for flights to the south-west. It was developed in response to stakeholder engagement where a more direct routing for south and south-west departures was seen to be beneficial. These departures currently have to turn to the north-west and route via NUGBO which adds an approximately 20nm per flight when compared to a direct track. This option would considerably reduce the track miles flown for these departures and result in a significant fuel and CO_2 saving.

The orientation of the envelope follows a direct runway heading and creates an aiming point in the vicinity of Enfield approximately mid-way between the existing Brookman's Park (BPK) and Lambourne (LAM) points.

Several options have been developed to provide a direct route to the network, all including an 8% climb gradient, and examples diverging by up to 15° either side of a central route (following the extended runway centreline).

8.2 Design Envelope Location Map

The envelope was designed to accommodate departures from RWY 22 maintaining runway heading to join the network on the most expeditious routing for southerly departures. There is currently no existing SID that follows this route, so these would constitute new routes to be considered.

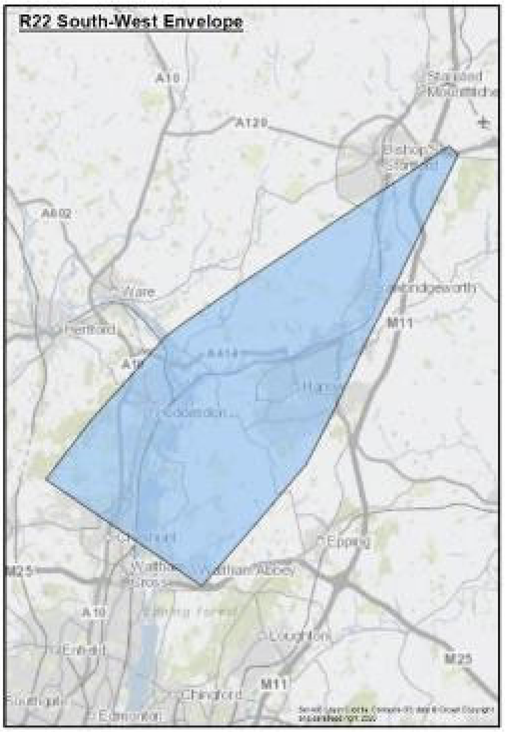


Figure 10 Runway 22 SOUTH- WEST Envelope

8.3 SID RWY 22 SOUTH-WEST Options Summary Table

'Viable and good fit' against design principles		'Viable but poor fit 'against design principles		'Unviable '	
1	This option is included to provide an RNAV 1 route, direct to the end of the design envelope with an 8% climb gradient.	A2	10% Climb or above	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
3	This option provides a 15° divergence to the right of Option 1 and routes aircraft to the northern edge of the envelope.	B7	Left wraparound: left-hand turn, fly around the airport, and then south west.		
4	This option provides a 15° divergence to the left from Option 1 and routes aircraft to the southern edge of the envelope.	C8	Right wraparound: right-hand turn, fly around the airport, and then south west.		
5	This option routes initially to the north of Option1 towards Roydon before turning left towards Waltham	D9	Straight then right and left continue straight ahead followed by a right		

‘Viable and good fit’ against design principles		‘Viable but poor fit ‘against design principles		‘Unviable ‘	
	Cross, thus avoiding Harlow and Hoddesdon.		and immediate left turn to avoid Harlow.		
6	This option follows the runway heading after departure and then turns right to route to the north of Sawbridgeworth, before taking up a direct track towards the northern end of the envelope.	E10	Left of Centre and outside Envelope: left-hand turn in a south-easterly direction, outside this design envelope.		

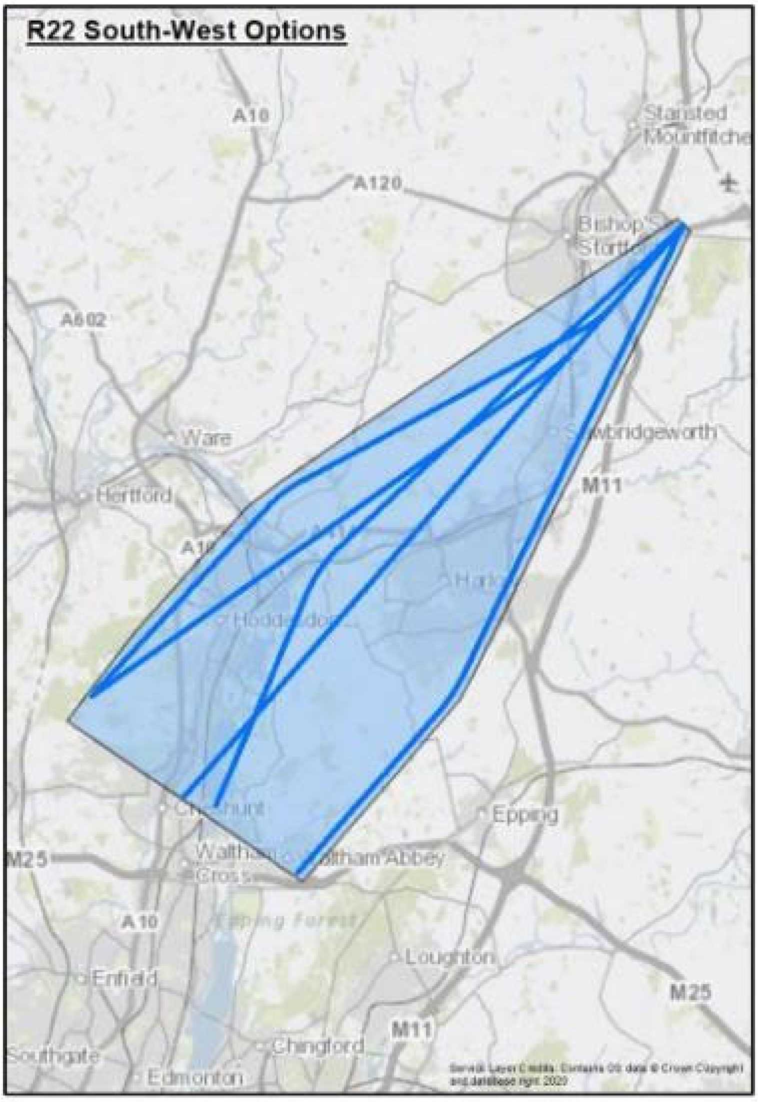
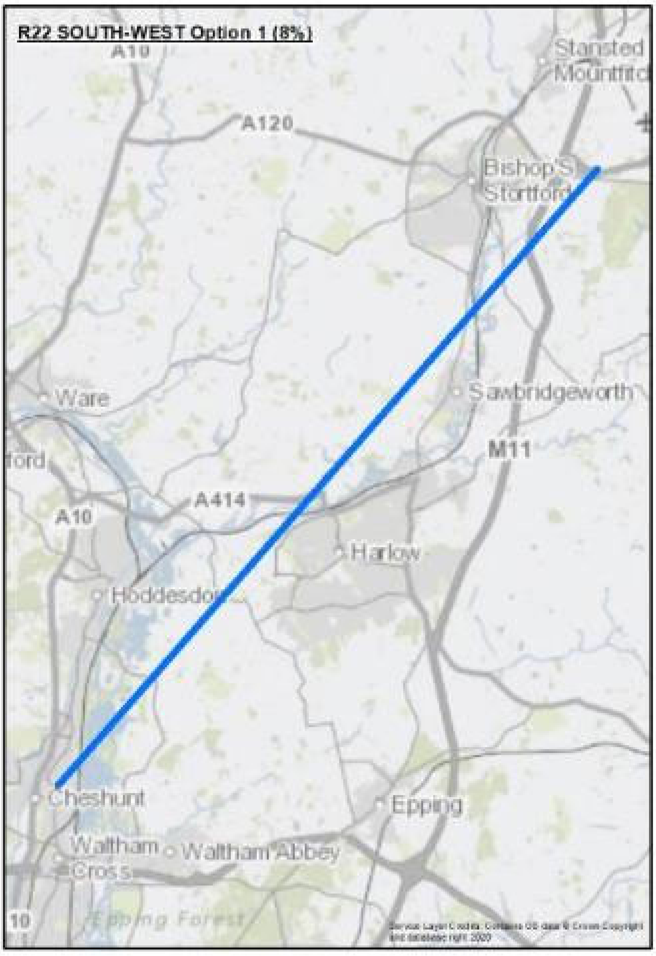


Figure 11 Runway 22 SOUTH- WEST Envelope and Options

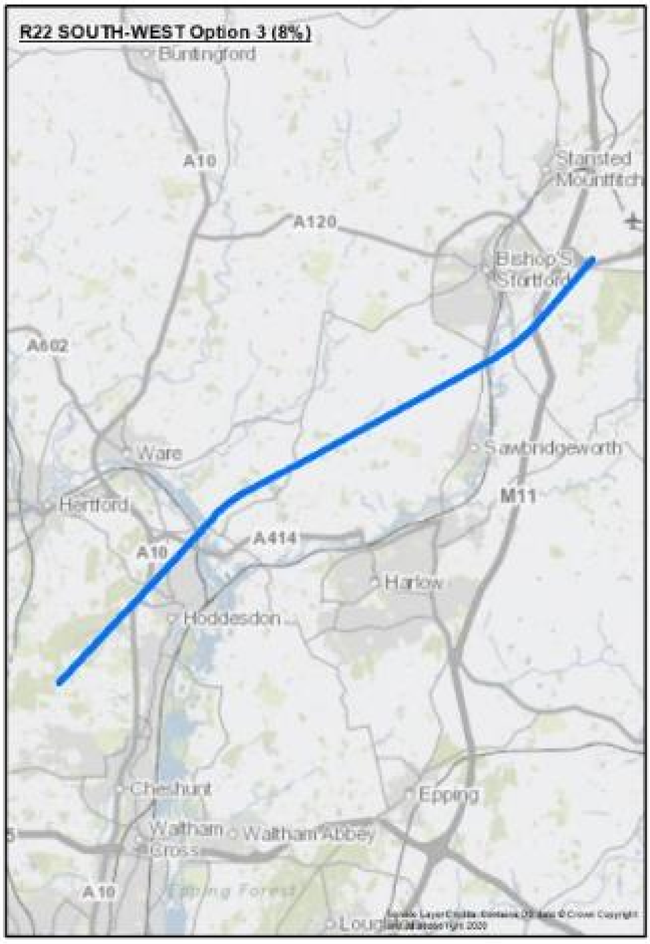
8.4 SID RWY 22 SOUTH-WEST Option 1 (8%)

Description	Rationale for Inclusion
This option provides an RNAV 1 route, that routes on runway heading directly to the end of the design envelope with an 8% climb gradient. It routes to the northern edge of Harlow and the southern edge of the new development at Gilston but represents the most direct and fuel-efficient option for southbound departures.	Balance: Provides a direct and more efficient joining point with the network when compared to existing departure routes via NUGBO. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



8.5 SID RWY 22 SOUTH-WEST Option 3 (8%)

Description	Rationale for Inclusion
This is an RNAV 1 route option at 8% that initially routes on runway heading for approximately 3 miles and then diverges to the right towards the northern edge of the design envelope. It then makes a slight left turn to follow parallel the northern edge of the envelope. *The track divergence takes place to the south of Bishops Stortford and routes traffic to the north of both the new development at Gilston and Harlow.* *This represents an amended option following feedback at engagement. The original option 3 had an earlier track divergence which impacted the southern edge of Bishops Stortford. By moving the position of the first turn to a later position, the noise impact from this route is expected to be reduced.*	Balance: Provides a direct and more efficient joining point with the network when compared to existing departure routes via NUGBO. Noise N1: Has potential to reduce noise impacts by avoiding Harlow and Gilston when compared to option1.



8.6 SID RWY 22 SOUTH-WEST Option 4 (8%)

Description	Rationale for Inclusion
This is an RNAV 1 route option at 8% that diverges by 15° to the left of the extended runway centreline and maintains a track consistent with the southern edge of the envelope. *The track divergence takes place south of Bishops Stortford and routes traffic south of Sawbridgeworth and the centre of Harlow and terminates at the southern edge of the design envelope.* *By creating an early track divergence, this option may reduce runway delays for following traffic departing on 22 WEST A or WEST B routes.*	Balance: Provides a direct and more efficient joining point with the network when compared to existing departure routes via NUGBO. Noise N1: Has potential to reduce noise impacts by avoiding the centre and north of Harlow and Gilston when compared to option1 Demand: Has potential to reduce delays for following departures.

8.7 SID RWY 22 SOUTH-WEST Option 5 (8%)

Description	Rationale for Inclusion
This is an RNAV 1 route option at 8% that routes initially on a track slightly to the north of the Option 1, towards Roydon before turning approx. 15° left towards Cheshunt and terminates near the centre of the envelope. *This track has been created to reduce noise when compared to Option 1 by avoiding direct overflight of Sawbridgeworth, Harlow and Hoddesdon (although it does overfly the new development at Gilston).*	Balance: Provides a direct and more efficient joining point with the network when compared to existing departure routes via NUGBO. Noise N1: Has potential to reduce noise impacts by avoiding existing conurbations of Sawbridgeworth and Harlow when compared to Option1.

8.8 SID RWY 22 SOUTH-WEST Option 6 (8%)

Description	*Rationale for Inclusion*
Option 6 is an RNAV1 route option at 8% that follows the runway track after departure as per Option 1, then turns right to route to the north of Sawbridgeworth and Harlow, before taking up a direct track towards the northern end of the envelope. *This track has been created to reduce noise when compared to Option 1 by avoiding direct overflight of Sawbridgeworth and Harlow.*	Balance: Provides a direct and more efficient joining point with the network when compared to existing departure routes via NUGBO. Noise N1: Has potential to reduce noise impacts by avoiding Harlow and Gilston when compared to option1.

8.9 SID RWY 22 SOUTH-WEST – Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A2 10% Climb or above.	S	P	D	Viable but Poor Fit
This option was included with the same lateral track as Option 1 but with a 10% climb gradient. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is change that facilitates the greatest possible access to all users. Evidence from the airline fleet survey demonstrated that only 50% of airlines could fly this gradient, and on this basis this option would not comply with this initiative (and therefore the Policy DP) as the climb gradient would limit the use of this SID.				
B7 Left Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a left-hand turn, fly around the airport, and then begin heading south west towards the end of the design envelope. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
C8 Right Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a right-hand turn, fly around the airport, and then begin heading south west towards the end of the design envelope. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.				

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. It could not be determined whether this option is unviable due to turn radius and Minimum Stabilisation Distance (MSD), further work would be required to determine this.				
D9 Straight then Right and Left	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would continue flying straight ahead until they reach Harlow, at which point they would make a right turn followed by an immediate left turn to resume a south westerly track towards the end of the design envelope. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns as it may involve conducting turns that are unlikely to be compliant with PANS-OPS. As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. At this stage, it cannot be determined whether this option complies with the MSD within PANS-OPS, if not, it could be deemed unviable.				
E10 Left of Centre and outside Envelope	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a slight left turn and then continue flying straight ahead towards Harlow before making a larger left-hand turn in a south-easterly direction, outside this design envelope. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would overfly a densely populated area (Harlow), having a significant noise impact. A lower impact version of this option is already included within the RWY 22 South envelope as Option 5.				

9 SID RWY 22 SOUTH

9.1 Introduction to RWY 22 SOUTH Design Envelope

This envelope has been created for traffic routing to the south from RWY 22. The envelope is based around the existing LAM 3R SID and all options have been developed with a climb gradient of 8%.

The current LAM3R SID is currently restricted for use by traffic departing STN and heading to London Heathrow (LHR) only. This is because of inbound traffic to LHR holding at the LAM hold. However, bilateral discussions within the LTMA have identified the possibility of changes to current holding arrangements for Heathrow which may make this airspace available. This route is therefore being considered as a southbound envelope for STN, subject to the interactions with the LHR operation (and others within the London TMA) being resolved.

This envelope would considerably reduce the track miles flown for southbound departures and result in a significant fuel and CO_2 saving. When compared to the current NUGBO departure.

9.2 Design Envelope Location Map

This envelope caters for aircraft departing from RWY 22 and then turning left directly towards LAM.

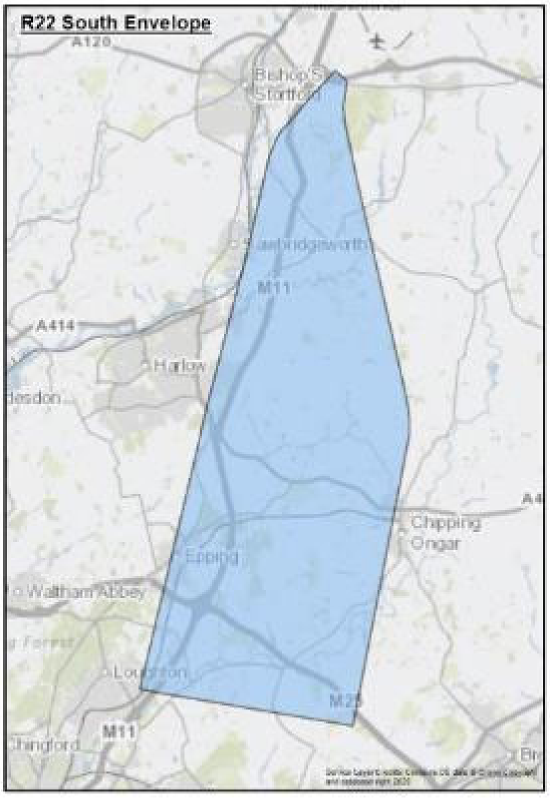


Figure 12 Runway 22 SOUTH Envelope

9.3 SID RWY 22 SOUTH Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	This option is included to provide a replication of the existing conventional SID as an RNAV1 route using fly-by points with the climb gradient set to the LTMA minimum of 6%.	A7	Right turn wraparound towards LAM.	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is included to provide a replication of the existing conventional LAM3R SID using PBN technology. The route has been designed as an RNAV1 route using fly-by points and the climb gradient has been set at 8%.	B8	Left wraparound		
2	This option is included to provide a replication of the existing conventional LAM3R SID using an RNP1 route using RF turns and the climb gradient has been set at 8%.	C9	Extended straight ahead then left		
3	This RNAV1 option was included to provide a more direct routeing towards LAM after departure. It features fly-by waypoints and has an 8% climb gradient.				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
4	This is an RNP1 route option using RF turns and turns left after departure and heads to the centre of the design envelope in the vicinity of Stapleford and LAM. This provides a more expeditious route and reduces the track miles flown when compared to the replicated Options 1 & 2.				
5	This is an RNP1 route option using RF turns heads towards the west of the design envelope by following the track of the M11 motorway as far as practicable towards Epping. This provides a more direct route than the replicated Options 1 & 2 and aims to avoid overflying major population centres.	-			
6	This is an RNP1 route option using RF turns that heads in a more south-easterly track to the east of Matching Tye, and routes to the eastern edge of the design envelope in the vicinity of Greensted Green. It aims to provide a more direct route than the existing SID, whilst avoiding overflight of major populations.	-			

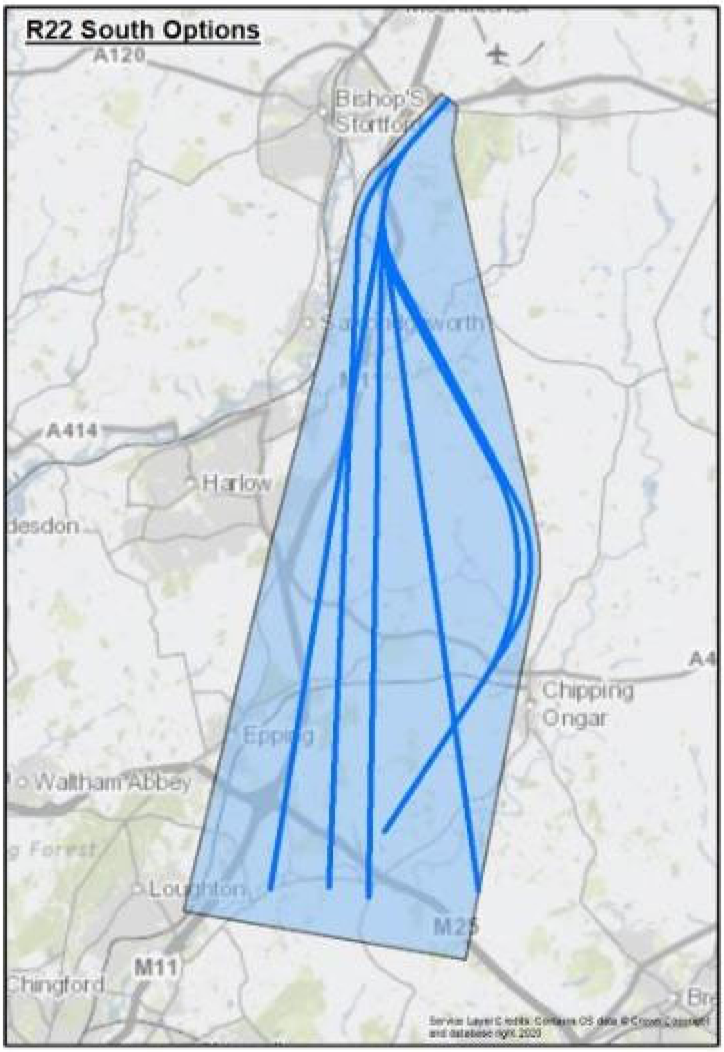
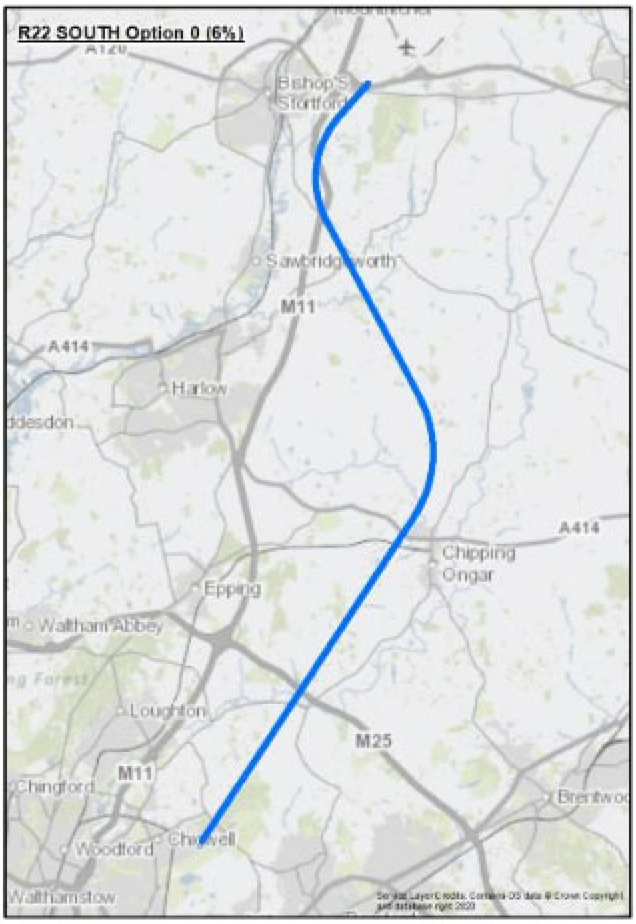


Figure 13 Runway 22 SOUTH Envelope and Options

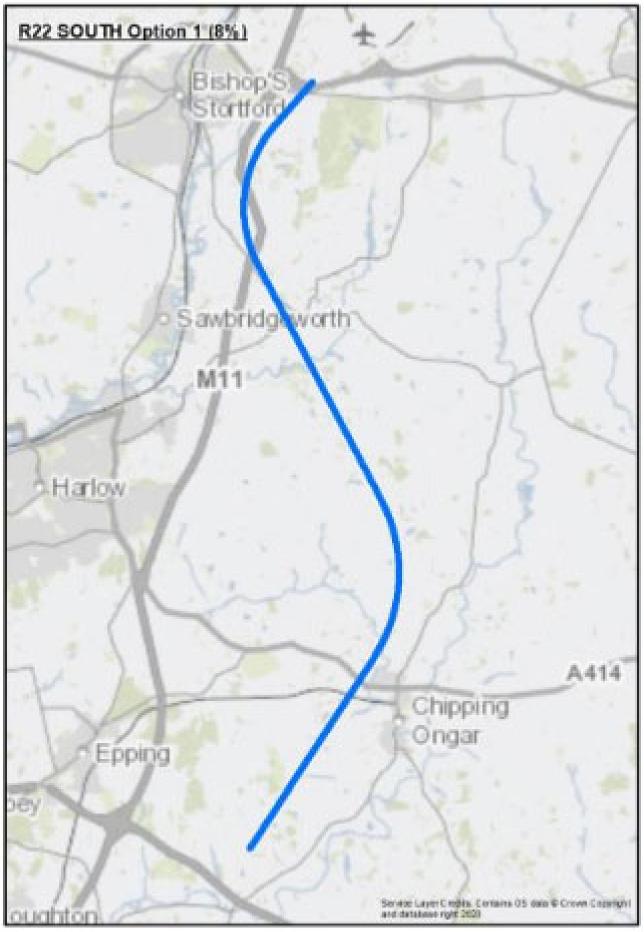
9.4 SID RWY 22 SOUTH Option 0 (6%)

Description	Rationale for Inclusion
Option 0 is provided as an RNAV1 replication of the current LAM3R SID and uses Fly-by Waypoints to create an approximate replication of the existing published conventional LAM3R departure with a climb gradient of 6%. It is considered to be the 'do minimum' option. *As a replicated route it follows a similar track over the ground as the current published route and connects to the NATS network at the existing LAM fix.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs. However, since it replicates the currently published track, it does not present the most efficient route to LAM.*	Replication: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. A 6% climb gradient is a better representation of how traffic performs today. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



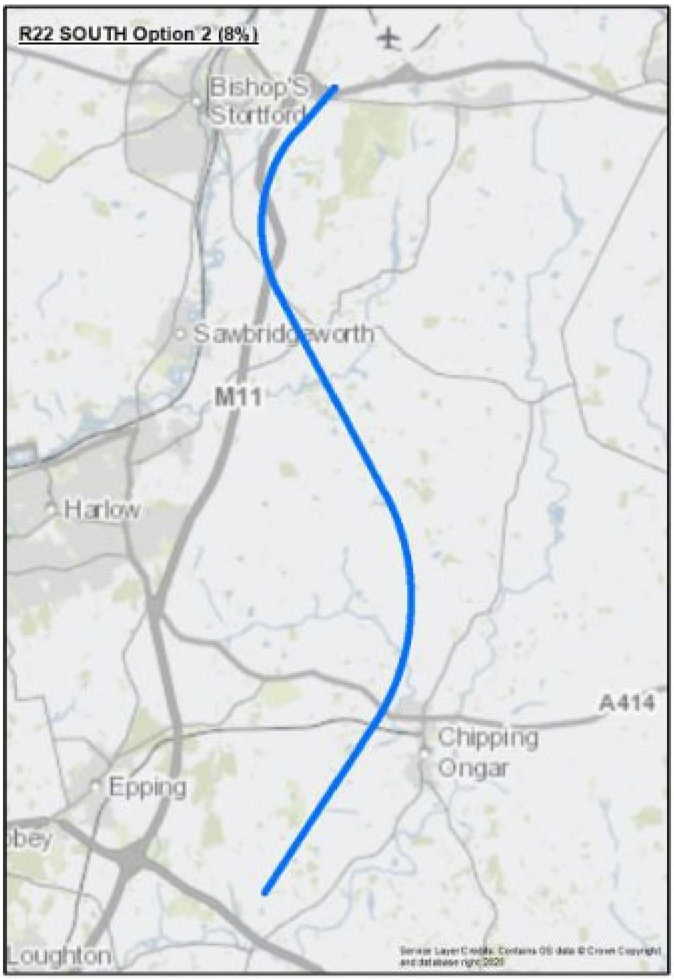
9.5 SID RWY 22 SOUTH Option 1 (8%)

Description	*Rationale for Inclusion*
Option 1 is provided as an RNAV replication of the current LAM3R SID and uses Fly-by Waypoints to create an approximate replication of the existing published conventional LAM3R departure with a climb gradient of 8%. *As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network at the existing LAM fix.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs. However, since it replicates the currently published track, it does not present the most fuel-efficient route to LAM.*	Replication: This route is the same lateral track as Option 0, but it has a higher climb gradient. Therefore, the track over the ground is the same, but aircraft will reach 7,000 ft sooner than when flying on Option 0. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



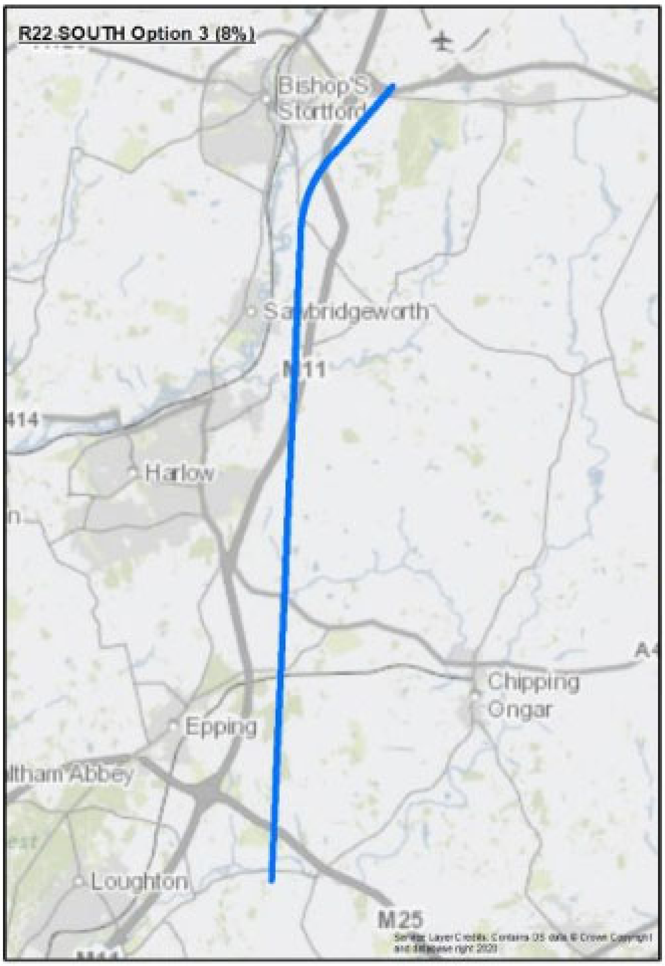
9.6 SID RWY 22 SOUTH Option 2 (8%)

Description	Rationale for Inclusion
Option 2 is provided as an RNP1 replication of the current LAM3R SID, and uses RF turns to create an approximate replication of the existing published conventional LAM3R departure with a climb gradient of 8%. RNP1 + RF provides a higher degree of accuracy during the turns. As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network at the existing LAM fix. *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs. However, since it replicates the currently published track, it does not present the most fuel-efficient route to LAM.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



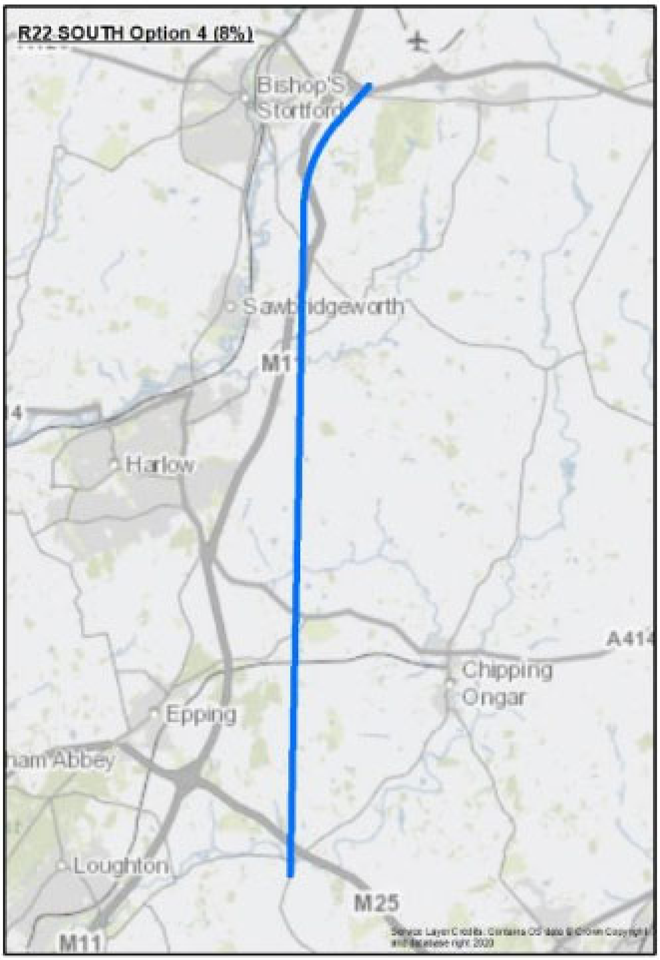
9.7 SID RWY 22 SOUTH Option 3 (8%)

Description	Rationale for Inclusion
Option 3 is an RNAV1 route, which features fly-by waypoints. After the first turn it provides a fuel-efficient direct track to the south by eliminating the turns in the replicated routes. *As per Options 1 and 2, the departure track remains to the east of Bishop's Stortford.* *This option is included to provide an alternative option for an RNAV 1 route, routing directly to LAM with an 8% climb gradient. It represents an efficient route for southbound departures and a higher climb gradient aims to ensure compatibility with the network joining point at LAM.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Balance: More direct routing and reduced track miles when compared to replicated route.



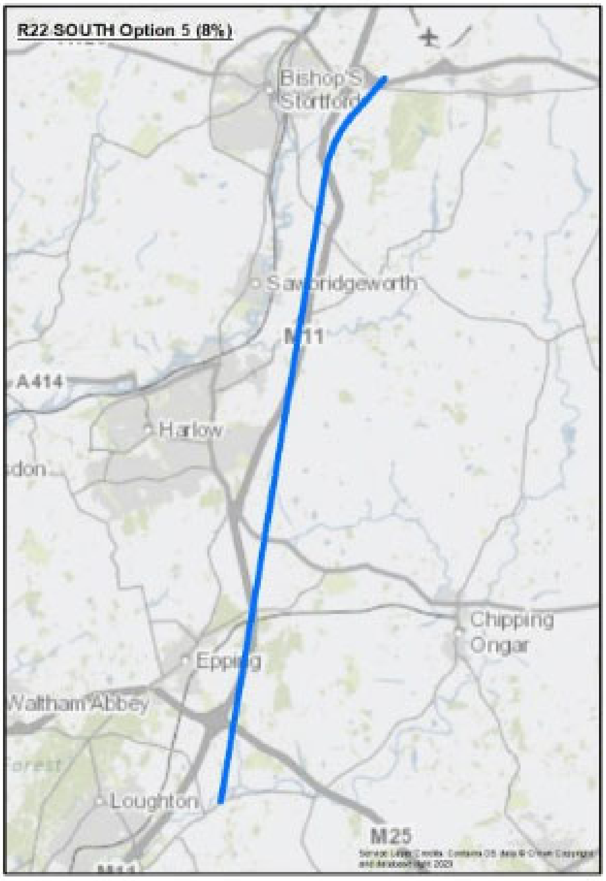
9.8 SID RWY 22 SOUTH Option 4 (8%)

Description	Rationale for Inclusion
Option 4 is an RNP1 with RF option at 8% that straightens onto a more southerly track after the first turn, and routes directly towards the current LAM fix in the centre of the envelope. This provides a more expeditious route and reduces the track miles flown whilst also avoiding overflight of Harlow. *This option is included to provide an alternative option for an RNP1 route, that routes directly to LAM.*	Balance: More direct routing and reduced track miles when compared to replicated route. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground. Noise N3: Avoids the overflight of Hatfield Forest.



9.9 SID RWY 22 SOUTH Option 5 (8%)

Description	Rationale for Inclusion
Option 5 an RNP1 with RF option at 8% that that tracks towards the south and to the west of LAM. This option aims to follow the track of the M11 motorway as far as practicable towards Epping in response to feedback from previous engagement. *This also provides a more direct route than Options 1 & 2 to reduce the track miles flown and aims to avoid overflying major population centres.* *This option is included to provide an alternative option for an RNP1 route, routing directly to a point to the west side of the design envelope and the west of LAM.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce perception of noise impacts by routing via a feature that already generates noise (M11). Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



9.10 SID RWY 22 SOUTH Option 6 (8%)

Description	Rationale for Inclusion
Option 6 is an RNP1 with RF option at 8% that turns left on to a south-easterly track to the east of Matching Tye, and routes to the eastern edge of the envelope in the vicinity of Greensted Green. *It aims to provide a more direct route than the existing SID, whilst also staying as far east as practicable to avoid the overflight of current and planned population centres around Harlow.* *This option is included to provide an alternative option for an RNP1 route, routing directly to a point to the east of the design envelope and the east of LAM.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by routing further east and away from Harlow. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.

9.11 SID RWY 22 SOUTH – Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A7 Right Wraparound	S	P	D	Viable but Poor Fit
A variation to Option 1 which involved aircraft departing Runway 22 and turning right after departure and wrapping 270° around the airport before taking up a heading towards LAM. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
B8 Left Wraparound	S	P	D	Viable but Poor Fit
After departure from Runway 22, aircraft would make a 360° left-hand turn, flying fully around the airport, and then begin heading south. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				

C8 Extended straight ahead then left	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would fly straight ahead and then make a gradual left-hand turn to begin heading south.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would overfly a densely populated area (Harlow), having a significant noise impact. It may also interact with traffic from other airports (Luton and Heathrow) which is misaligned with the efficiency requirement in the AMS for the most efficient use of airspace.

10 SID RWY 22 SOUTH-EAST

10.1 Introduction to SID RWY 22 SOUTH-EAST Design Envelope

This envelope has been created for traffic routing to the south-east from RWY 22. The envelope has been based around the existing DET1R SID and after departure design options within this envelope turn left to head south-east. The climb gradient for all options within this envelope is 8%.

The current DET1R SID can only be used by STN aircraft during night-time operations (2300 – 0600) as per Note 4 in the UK AIP Chart (AD 2-EGSS-6-4 Note 9) – Outside of these hours CLN 8R is issued. This restriction was put in place due to the network capacity during the day and interactions between this SID and traffic for both London City and London Heathrow.

To create a comprehensive list of options, daytime use of this is route is being considered subject to these interactions being resolved. We will continue to work in bilateral discussions across the LTMA and in partnership with NERL and other airports to resolve these interactions. If the required daytime connectivity to the network cannot be provided this suite of design options will remain with appropriate restrictions.

10.2 Design Envelope Location Map

This envelope is shown in the image below:

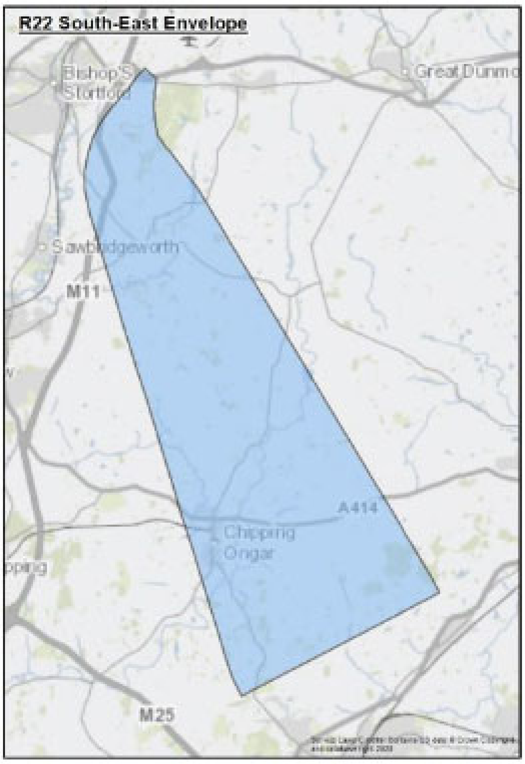


Figure 14 Runway 22 SOUTH-EAST Envelope

10.3 SID RWY 22 SOUTH-EAST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	This option is included to provide a **replication** of the existing conventional DET1R SID using PBN technology. The route has been designed as an **RNAV 1** route using fly-by points and the climb gradient has been set at 6%.	A6	Left 450 °wraparound	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is included to provide a **replication** of the existing conventional DET1R SID using PBN technology. The route has been designed as an **RNAV 1** route using fly-by points and the climb gradient has been set at 8%.	B7	Right wraparound		
2	This option is included to provide a **replication** of the existing conventional DET1R SID using PBN technology. The route has been designed as an **RNP1** using RF turns and the climb gradient has been set at 8%.	C8	Extended straight ahead then left.		
3	This option has been developed as an **RNP1** using RF turns. It has a later turn than the current route and aims to avoid the overflight of the SSSI of				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	Hatfield Heath. The track then continues to the eastern edge of the envelope routing towards Ingatestone. It routes further away from Chipping Ongar than other options within this envelope.				
4	This option has been designed to RNP1 using RF turns and includes a later turn than the replicated routes. This track also avoids the SSS! at Hatfield Heath and routes towards the western edge of the envelope towards Kelvedon Hatch and Brentwood.				
5	This option has been designed using RNP1 with RF turns. It requires aircraft to turn left as tight as permissible under PANS-OPS rules, to route towards the eastern edge of the envelope. By doing this, it aims to avoid Matching Green and Chipping Ongar.	-			

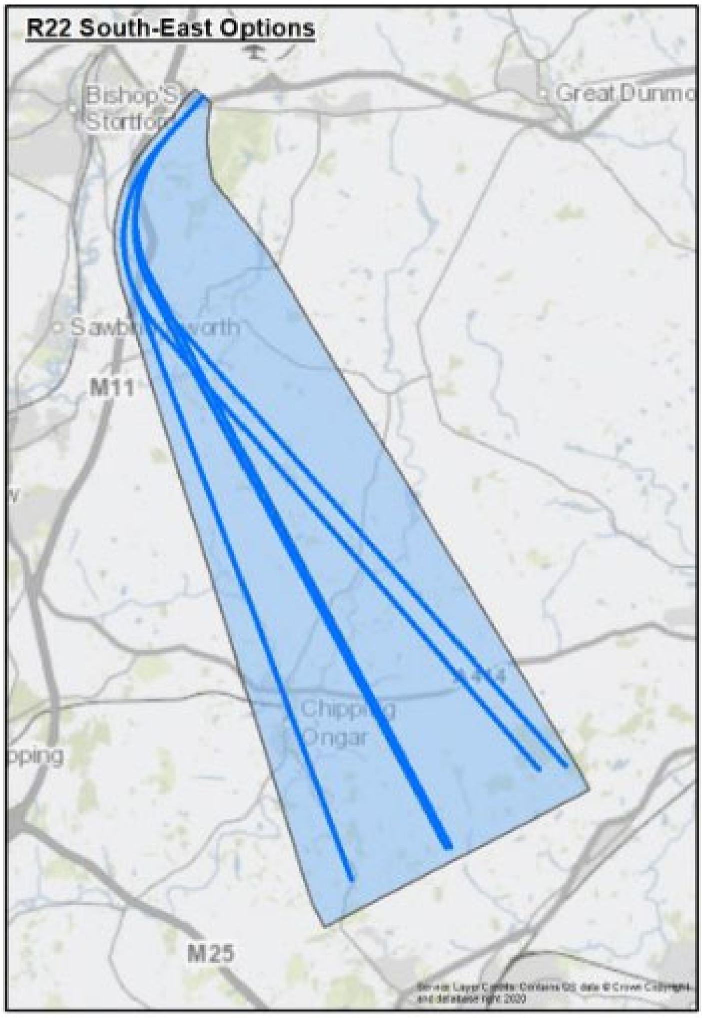
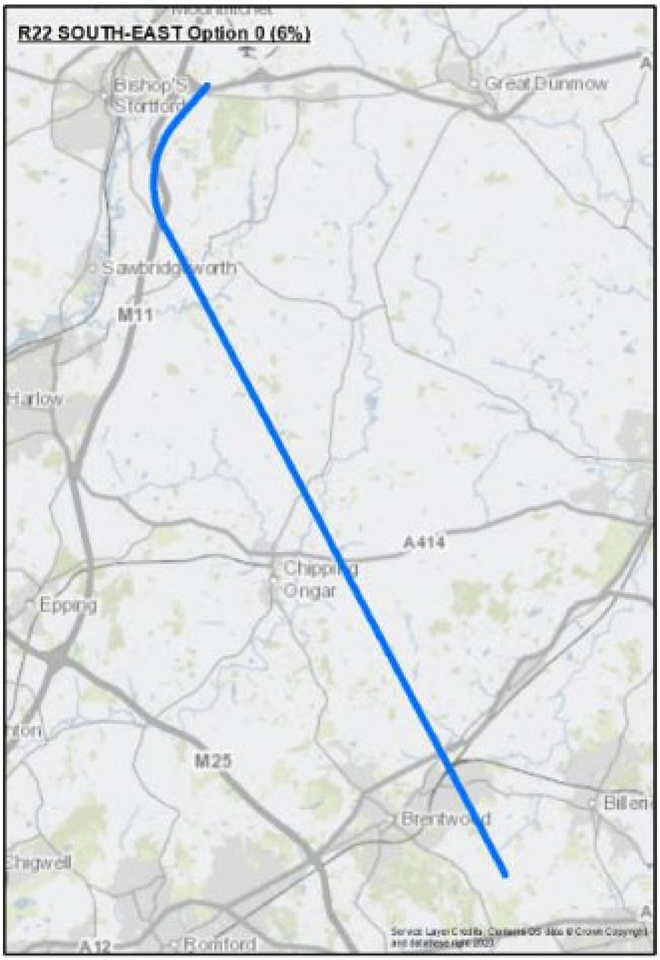


Figure 15 Runway 22 SOUTH-EAST Envelope and Options

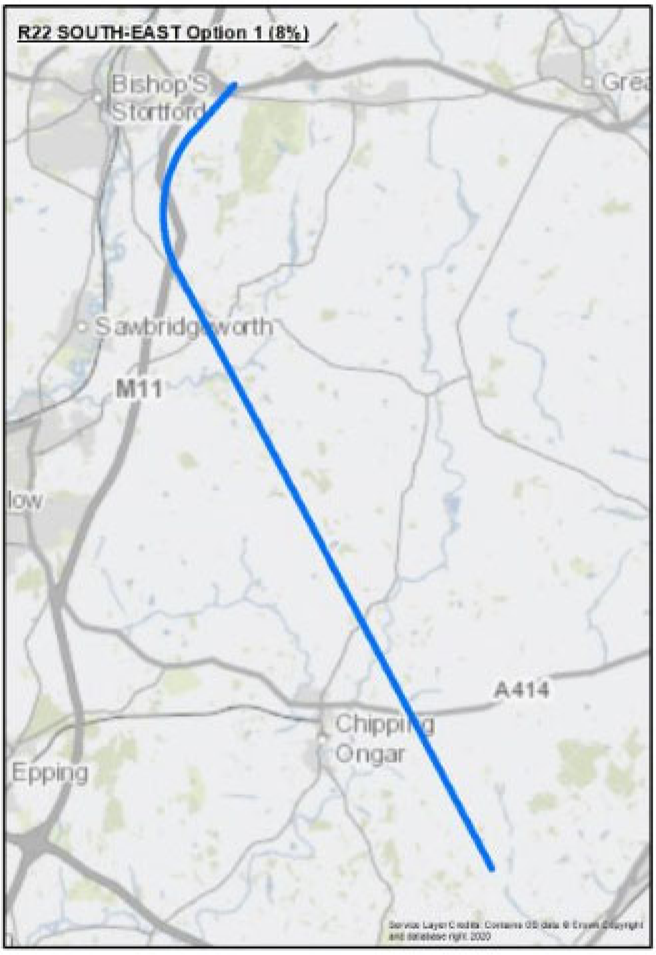
10.4 SID RWY 22 SOUTH-EAST Option 0 (6%)

Description	Rationale for Inclusion
Option 0 is provided as an RNAV replication of the current DET1R SID. It uses Fly-by Waypoints to create an approximate replication of the existing published conventional DET1R departure with a climb gradient of 6%. It is considered to be the 'Do Minimum' option. *As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network in the same area as the existing SID.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Replication: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



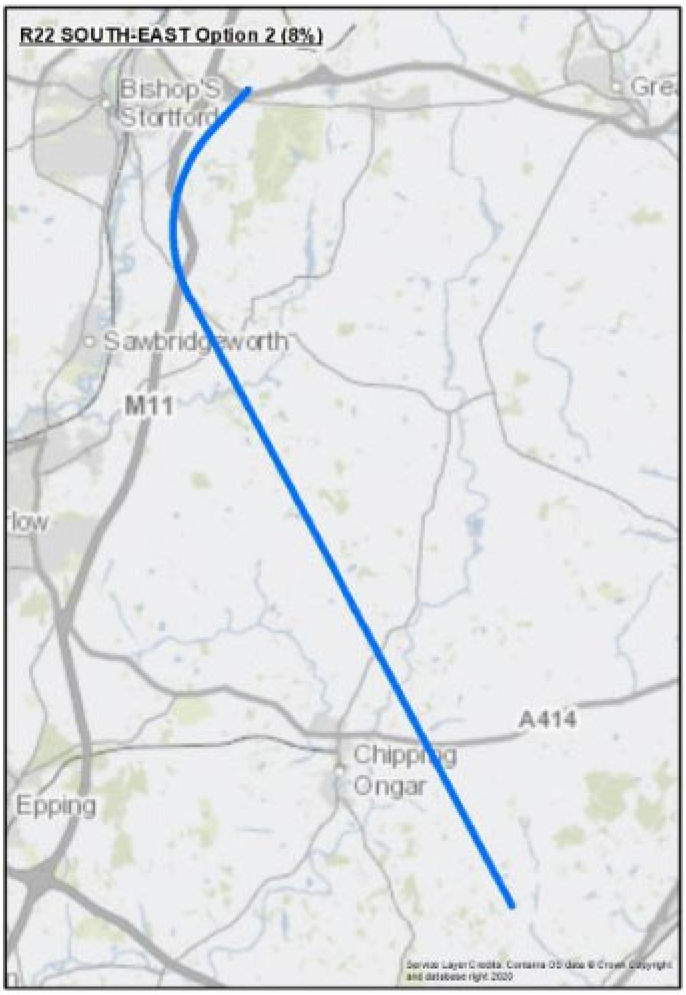
10.5 SID RWY 22 SOUTH-EAST Option 1 (8%)

Description	Rationale for Inclusion
Option 1 is provided as an RNAV ***replication*** *of the current DET1R SID and uses Fly-by Waypoints to create an approximate replication of the existing published conventional DET1R departure with a climb gradient of 8%.* *As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network in the same area as the existing SID.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Replication: Aligns to a 'do minimum' option. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



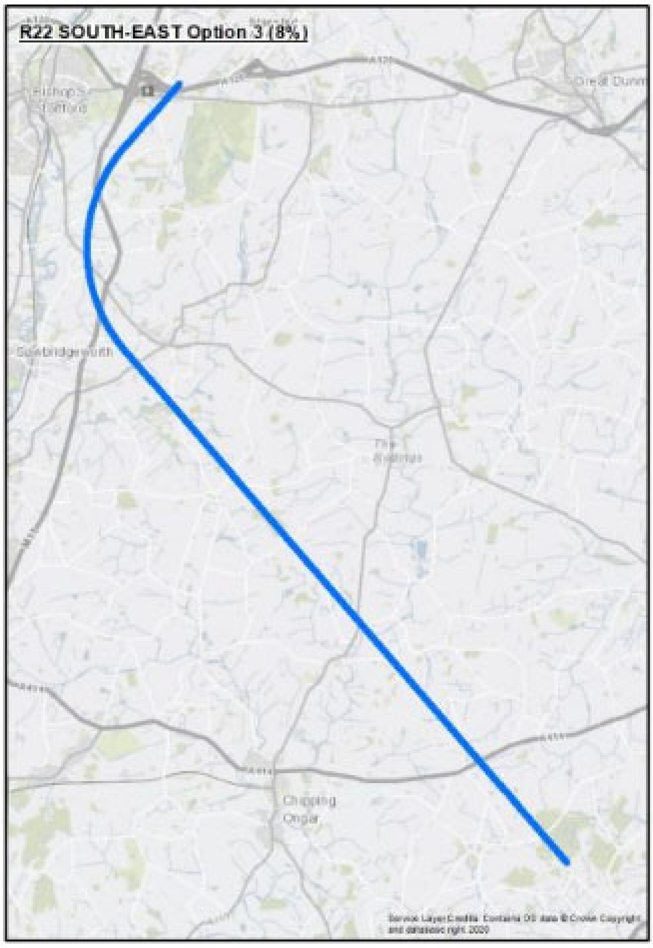
10.6 SID RWY 22 SOUTH-EAST Option 2 (8%)

Description	Rationale for Inclusion
Option 2 is provided as an RNP1 replication of the current DET1R SID, and uses RF turns to create an approximate replication of the existing published conventional DET1R departure with a climb gradient of 8%. RNP1 + RF provides a higher degree of accuracy during the turns. *As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network in the same area as the existing SID.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



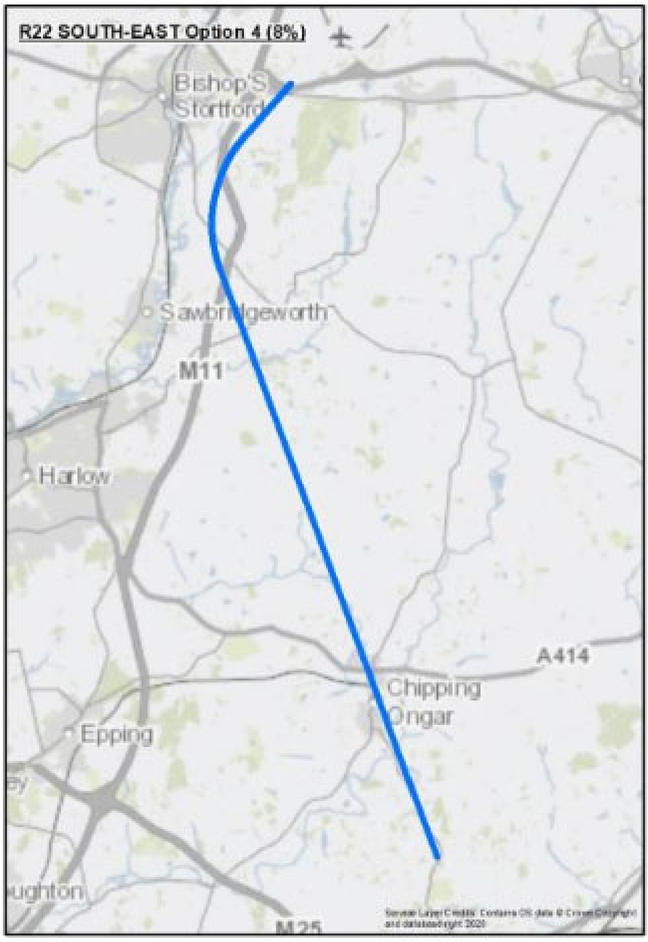
10.7 SID RWY 22 SOUTH-EAST Option 3 (8%)

Description	*Rationale for Inclusion*
Option 3 is an RNP1 route that uses RF turns and has a later turn than the current SID It aims to avoid overflight of the SSSI at Hatfield Forest, and the track then continues to the eastern edge of the envelope routing towards Ingatestone. It routes further away from Chipping Ongar than other options within this envelope.	Noise N1: Has potential to reduce noise impacts by routing further east and away from Chipping Ongar. Noise N3: Avoids the overflight of the SSSI at Hatfield Forest. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



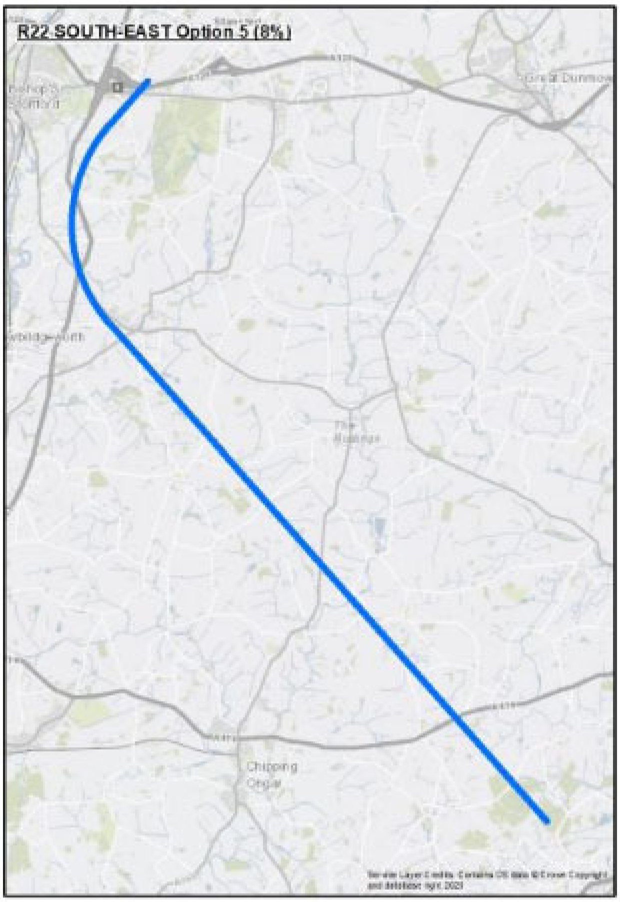
10.8 SID RWY 22 SOUTH-EAST Option 4 (8%)

Description	Rationale for Inclusion
Option 4 has been designed to RNP1 using RF turns and has a later turn than used within the current SID. This option routes towards the western edge of the envelope towards Kelvedon Hatch and Brentwood. It creates a possible noise relief route when combined with options that route to the east side of the envelope (Options 3 or 5).	Noise N1: Has potential to reduce noise impacts by avoiding Fyfield and Norton Heath. Noise N2: Offers potential for noise relief if combined with options 3 or 5. Noise N3: Avoids the overflight of the SSSI at Hatfield Forest. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



10.9 SID RWY 22 SOUTH-EAST Option 5 (8%)

Description	Rationale for Inclusion
Option 5 has been designed as an RNP1 route using RF turns. Utilising RF turns, this route requires aircraft to turn left as tight as permissible under ICAO PANS-OPS rules, to route towards the eastern edge of the envelope. By doing this, it aims to avoid overflight of Hatfield Forest, Matching Green and Chipping Ongar. *This route provides a viable alternative for consideration that aims to avoid overflight of conurbations and noise sensitive areas whilst providing efficient access to the network.*	Noise N1: Has potential to reduce noise impacts by avoiding Chipping Ongar. Noise N2: Offers potential for noise relief if combined with option 4. Noise N3: Avoids the overflight of the SSSI at Hatfield Forest. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



10.10 SID RWY 22 SOUTH-EAST - Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A6 Left Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a constant 450° left-hand turn around the airport, and then begin heading south east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
B7 Right Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a right-hand turn, fly around the airport, and then begin heading south east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				

C8 Extended straight ahead then left	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would fly an extended straight-ahead phase and then make a gradual left-hand turn to begin heading south east.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

11 SID RWY 22 EAST Current CLN 1E

11.1 Introduction to SID RWY 22 EAST Design Envelope

This envelope has been created for traffic routing to the east from RWY 22 at 8% climb gradient. The envelope is based around the current conventional CLN8R SID and the CLN1E SID, which is already designed to RNP1 with RF legs. The design of this RNP1 SID uses a non-PANS-OPS compliant turn radius, however this route has been approved for use by the CAA via a supporting Safety Case and has been safely and accurately flown for over 3 years.

On this basis, and consistent with our criteria, this is a Viable route option to be included. The minimum climb gradient is being increased from 3.3% to 8%.

The current CLN1E SID is used by traffic departing STN and heading to the east.

11.2 Design Envelope Location Map

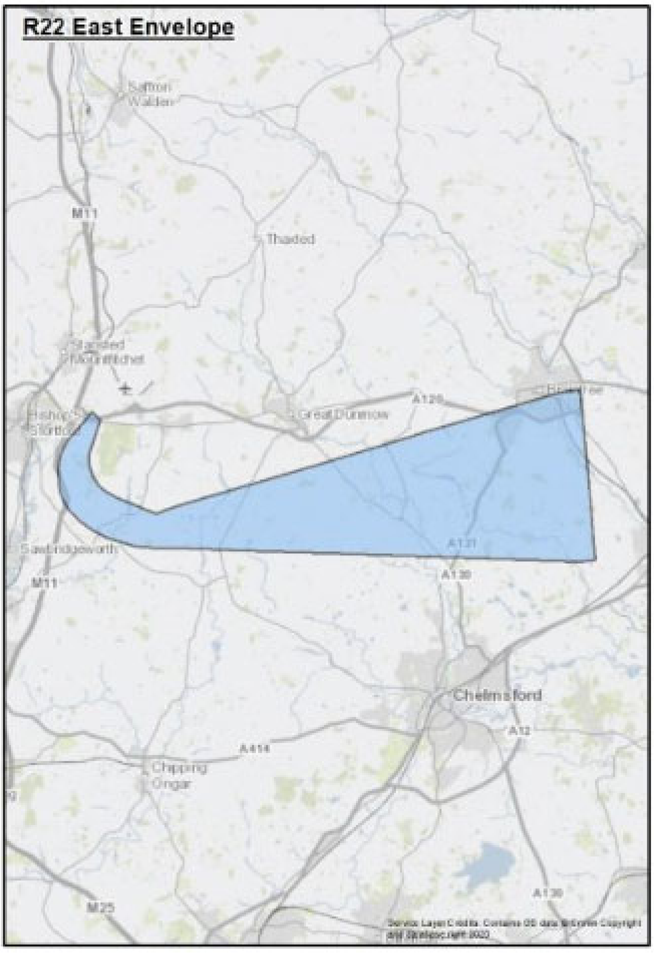


Figure 16 Runway 22 EAST Envelope

11.3 SID RWY 22 EAST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	Option 0 is a reproduction of the existing CLN1E SID using RF legs. A shallower climb gradient has been used in this option at 6% which is lower than the others that have been presented within this envelope. This is intended to present a do minimum option. The existing published SID is set at 3.3% and is restricted in the climb due to airspace constraints.	A4	Left 540° wraparound	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is a reproduction of the existing published CLN1E SID using RF legs. However, a steeper climb gradient has been used in this option as it has been set at 8% which is consistent with the other new options within this envelope.	B5	Right 180° wraparound		
2	This option has been designed to RNP 1 using RF turns, but continues the RF turn to the north-east towards the northern edge of the envelope (towards North End). It has also been designed with an 8% climb gradient.	C6	Extended straight ahead then south.		
3	This option has also been designed as an RNP1 route using RF turns. After departure, it has a				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	shallower turn to the north of High Easter than Option 1 (NC), and then routes towards the southern edge of the envelope towards Gamble's Green.				

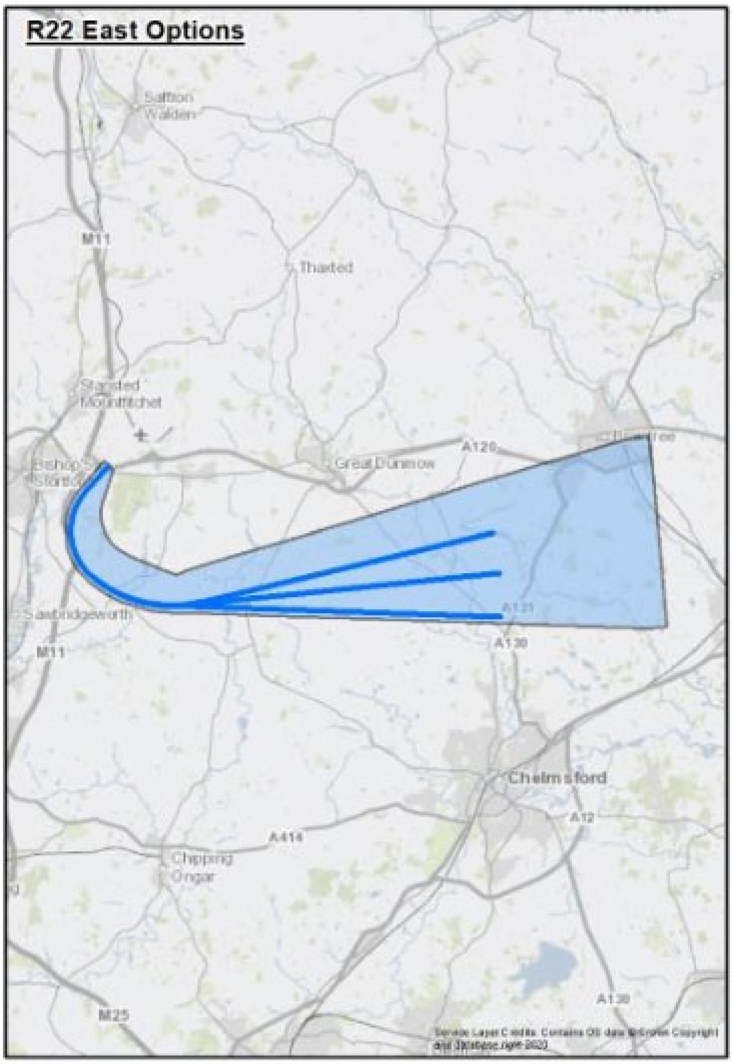
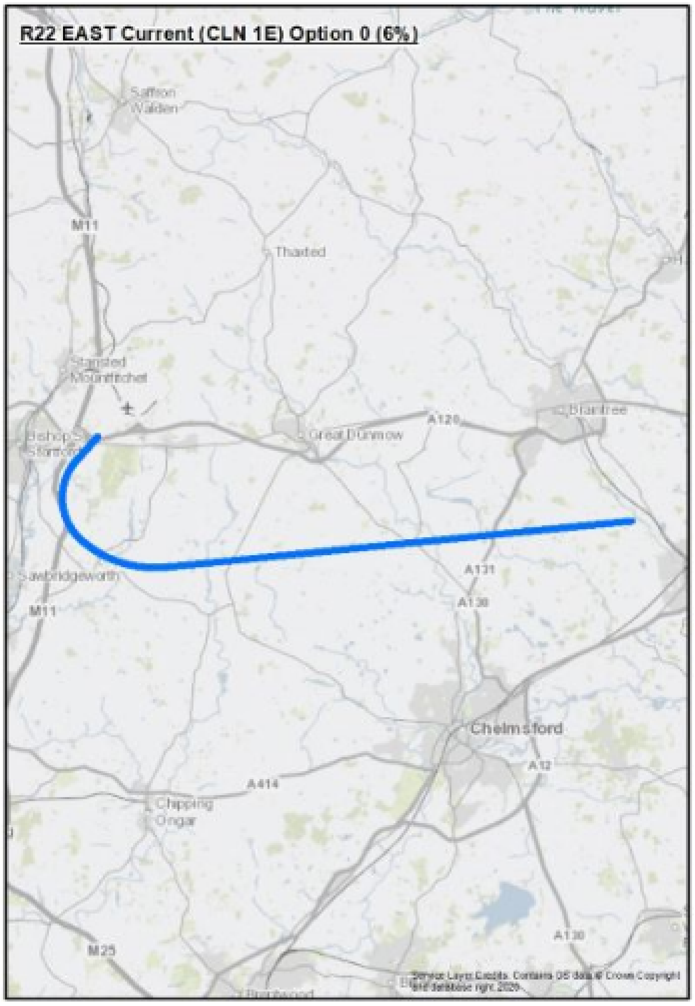


Figure 17 Runway 22 EAST Envelope and Options

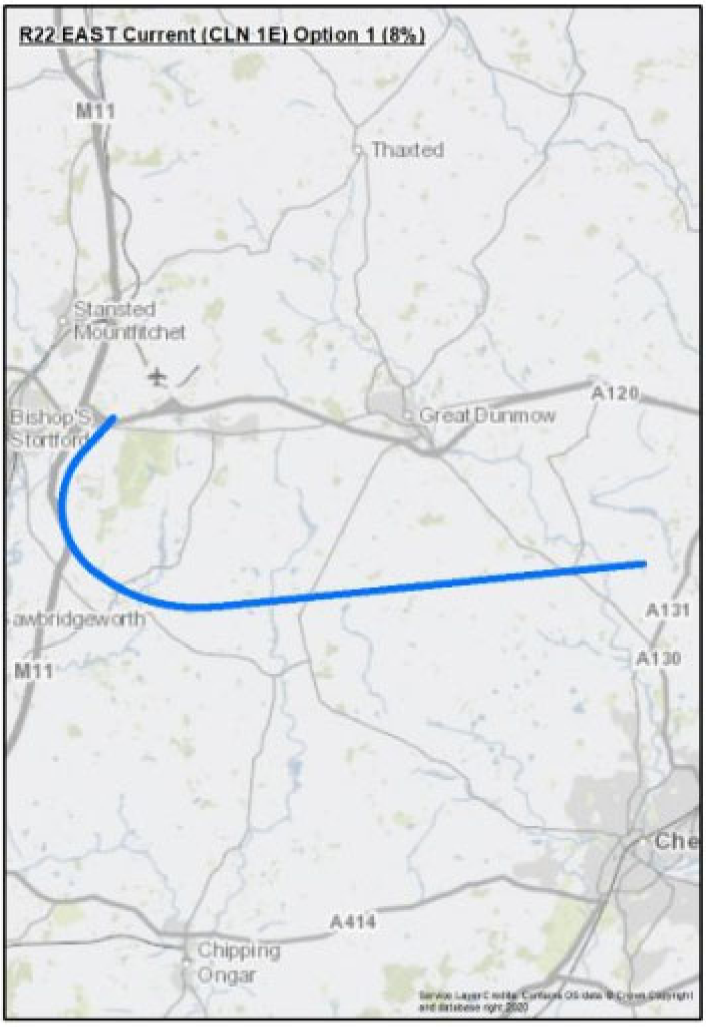
11.4 SID RWY 22 EAST (Current CLN 1E) Option 0 (6%)

Description	*Rationale for Inclusion*
Option 0 is a reproduction of the existing CLN1E SID using RF legs. However, a steeper climb gradient has been used in this option as it has been set at 6% which is lower than the others that have been presented within this envelope. The existing published SID is set at 3.3% and is restricted in the climb due to airspace constraints.	Reproduction: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum.
As an existing but re-profiled route it follows the same lateral track over the ground as current published route and connects to the NATS network in a similar area as the existing SID and in the centre of the design envelope. *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



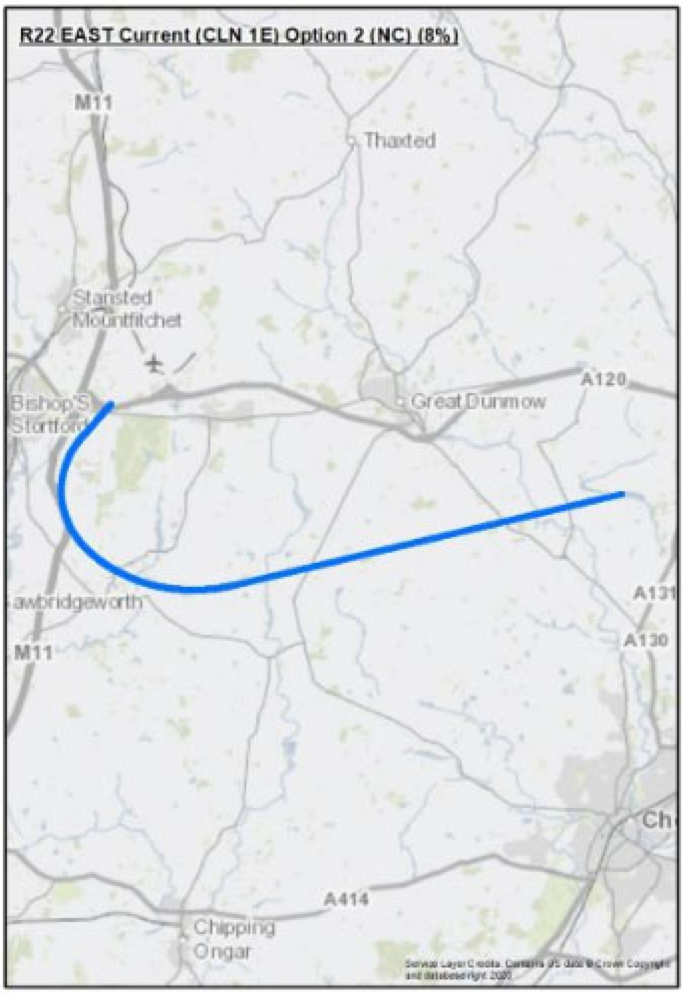
11.5 SID RWY 22 EAST (Current CLN 1E) Option 1 (8%)

Description	*Rationale for Inclusion*
Option 1 is a reproduction of the existing published CLN1E SID using RF legs. However, a steeper climb gradient has been used in this option as it has been set at 8% which is consistent with the other new options within this envelope. The existing SID is set at 3.3% and is restricted in the climb due to airspace constraints. *As an existing but re-profiled route it follows the same lateral track over the ground as current published route and connects to the NATS network in a similar area as the existing SID and in the centre of the design envelope.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Reproduction of existing SID Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



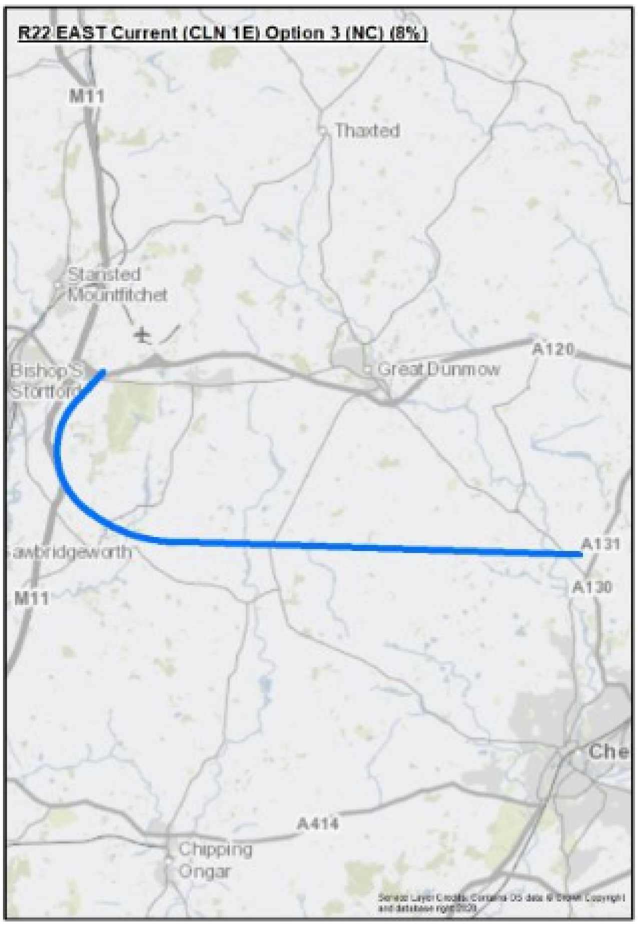
11.6 SID RWY 22 EAST Option 2 (8%)

Description	Rationale for Inclusion
Option 2 has been designed to RNP 1 using RF turns at 8%. This option continues the RF turn to the north-east towards the northern edge of the envelope (towards North End). It then routes towards the racecourse at Great Leighs and to the northern edge of the envelope. This route responds to feedback from stakeholders by aiming to avoid the overflight of noise sensitive areas, whilst providing an efficient option for consideration.	Noise N1: Has potential to reduce noise impacts by avoiding Great Leighs. Designed in response to feedback from stakeholder engagement. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



11.7 SID RWY 22 EAST Option 3 (8%)

Description	Rationale for Inclusion
This option has also been designed as an RNP1 route using RF turns. After departure, it has a shallower turn to the north of High Easter than the current SID and routes towards the southern edge of the envelope towards Gamble's Green. *This route responds to feedback from stakeholders by aiming to avoid the overflight of noise sensitive areas, whilst providing an efficient option for consideration.*	Noise N1: Has potential to reduce noise impacts by avoiding High Easter and Great Leighs. Designed in response to feedback from stakeholder engagement. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



11.8 SID RWY 22 EAST – Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A4 Left Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a constant 540° left-hand turn, fly fully around the airport, and then begin heading east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
B5 Right Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a 180° right-hand turn (opposite to that currently flown), fly around the airport, and then begin heading east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				

C6 Extended straight ahead then South (Long/Short)	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would fly straight ahead and then make a gradual 180° left-hand turn to begin heading east.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

12 SID RWY 22 NORTH

12.1 Introduction to SID RWY 22 NORTH Design Envelope

This envelope has been created for traffic routing to the north from RWY 22. The envelope is based around the current BKY5R SID which is currently used infrequently for flights to the North that are leaving controlled airspace. This is mainly due to the presence of military airspace to the north and lack of network connectivity to the north of BKY

However, to create a comprehensive list of options, this route is being considered as a northbound envelope for STN, subject to the creation of network interfaces. If this is not possible, this design envelope may be re-classified as Viable but Poor fit.

This option may also act as a noise respite option for the current UTAVA SID (22 WEST A).

The climb gradient for all routes within this envelope is 8% which is steeper than the existing BKY5R SID.

12.2 Design Envelope Location Map

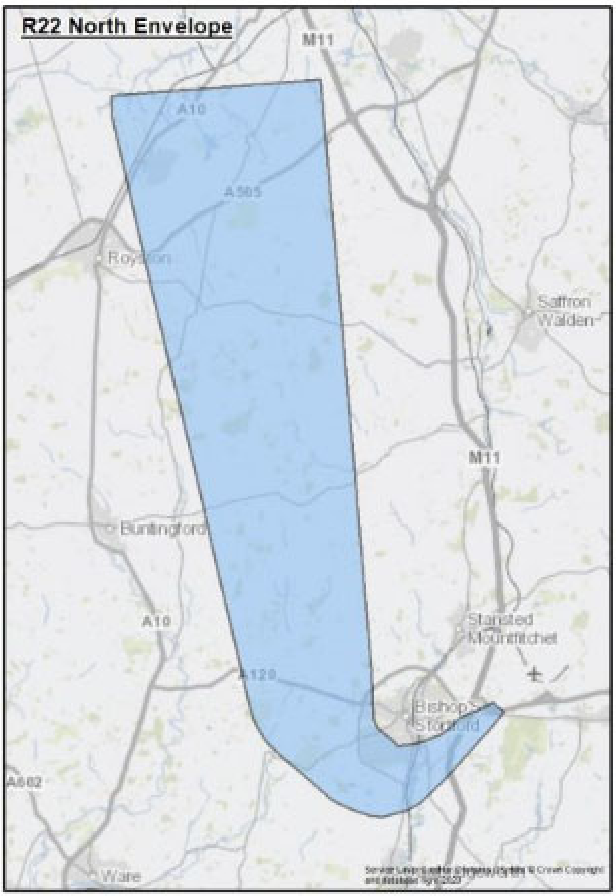


Figure 18 Runway 22 NORTH Envelope

12.3 SID RWY 22 NORTH Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	Option 0 is included to provide a **replication** of the existing BKY5R SID utilising PBN technology. This option is designed as an RNAV1 route utilising fly-by waypoints to replicate the current procedure. It is considered to be the 'do minimum' option.			U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This is an **RNAV1** route at 8% that uses fly-by waypoints to create a PBN **replication** of the existing BKY5R SID.	A9	Left 270° wraparound.		
2	This option is included to provide a **replication** of the existing BKY5R SID but as an **RNP1** option utilising RF turns at a climb gradient of 8%.	B10	Right 450° wraparound		
3	This is an **RNAV1** option at 8% that has been developed to provide a more direct track towards BKY and the centre of the design envelope and reduce the number of track miles flown.	C11	Extended straight ahead and then north.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
4	This option utilises an **RNP1** using RF at 8% and turns to route around the Bishop's Stortford area after departure and directly towards the west side of the design envelope.	D12	Straight ahead then left and 180° right		
5	This is an **RNAV1** option at 8% that utilises fly-by waypoints. It features a later and wider turn than the current SID with a track that initially routes along the western edge of the envelope before turning towards the centre of the envelope.				
6	This option utilises an **RNP1** using RF turns at 8%. It follows the same initial turn as the replicated route utilising RF before turning to the north-east to route to the eastern side of the design envelope. It was developed to avoid overflight of major towns and as a possible option to provide noise relief.				
7	This option utilises an **RNP1** using RF turns at 8%. It features a wider turn than the replicated SID before using a RF turn to route to the north-east of the design envelope.				
8	This option utilises an **RNP1** using RF turns at 8%. it features a wider initial turn than the replicated SID routes on a north-north westerly track along the western edge of the design				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	envelope to the east of Royston.				

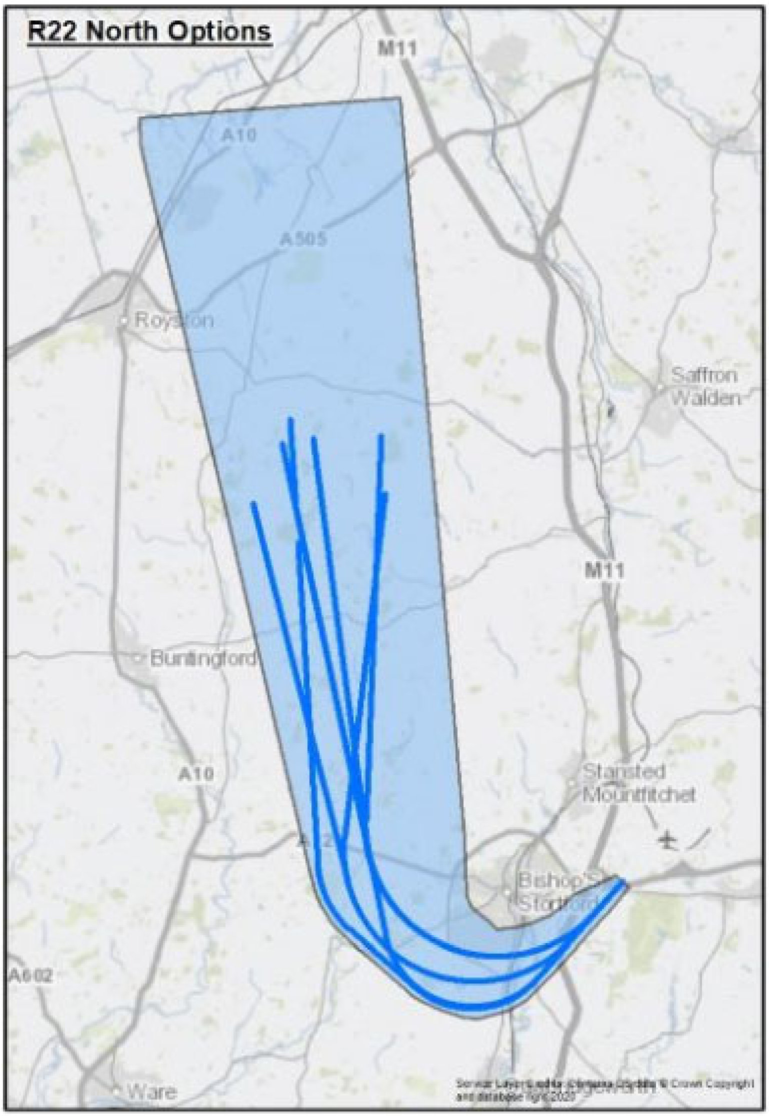
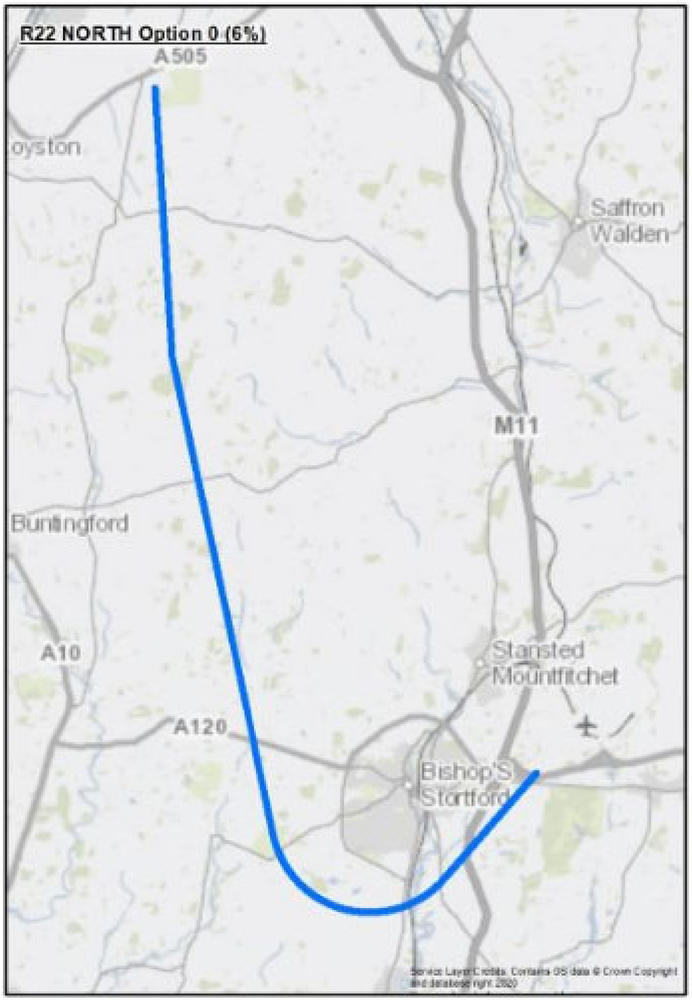


Figure 19 Runway 22 NORTH Envelope and Options

MAG London Stansted Airport

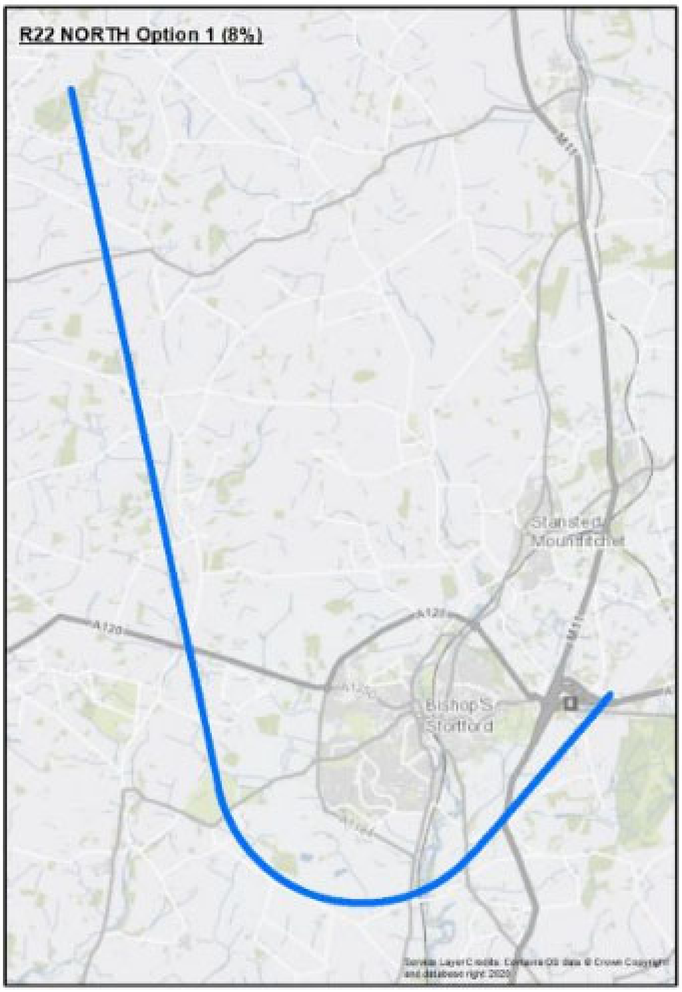
12.4 SID RWY 22 NORTH Option 0 (6%)

Description	Rationale for Inclusion
Option 0 is included to provide a replication of the existing BKY5R SID utilising PBN technology. This option is designed as an RNAV1 route utilising fly-by waypoints to replicate the current procedure. It is considered to be the 'do minimum' option. *As a replicated route it follows a similar track over the ground to the current published route and connects to the NATS network in the same area as the existing SID.* *In addition, as the route seeks to replicate a current procedure it is within the existing NPRs.*	Replication: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



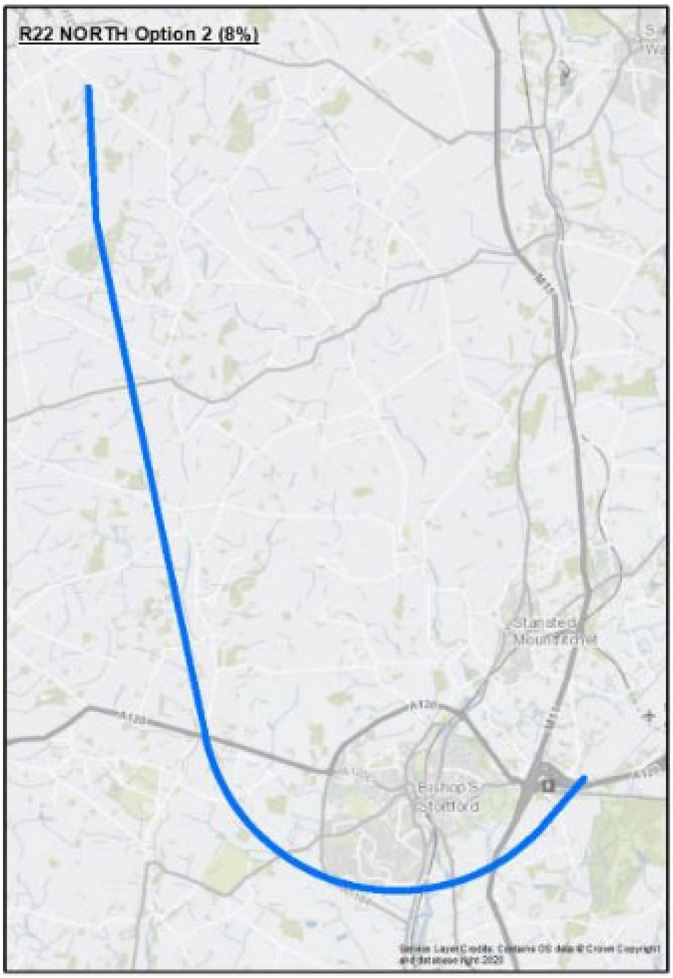
12.5 SID RWY 22 NORTH Option 1 (8%)

Description	Rationale for Inclusion
Option 1 is included to provide a ***replication*** *of the existing BKY5R SID utilising PBN technology. This option is designed as an* ***RNAV1*** *option utilising fly-by waypoints to replicate the current procedure with a climb gradient of 8% which is consistent with the other options within this envelope.* *As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network in the same area as the existing SID.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Replication: Aligns to a replication option but uses a different climb gradient. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



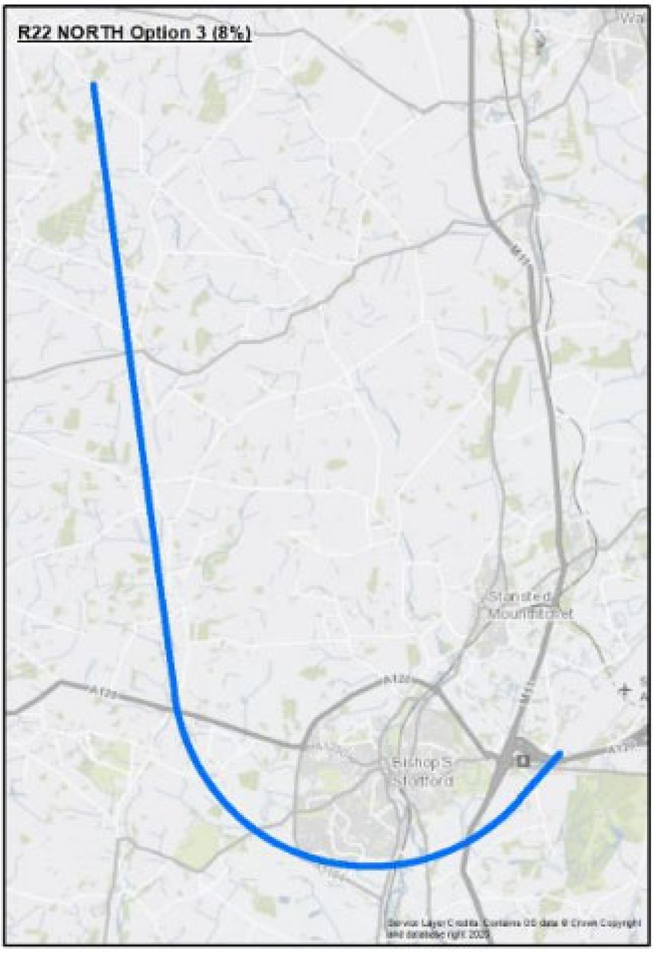
12.6 SID RWY 22 NORTH Option 2 (8%)

Description	*Rationale for Inclusion*
Option 2 is included to provide a ***replication*** *of the existing BKY5R SID utilising PBN technology. This option is designed as an* ***RNP1*** *option utilising RF turns at 8% climb gradient. Due to the accuracy of the type of turn, the initial turn is tighter than that of Option 1 which results in a right turn slightly closer to Bishops Stortford.* *As a replicated route it follows a similar track over the ground as current published route and connects to the NATS network in the same area as the existing SID.* *In addition, as the track seeks to replicate a current procedure it is within the existing NPRs.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



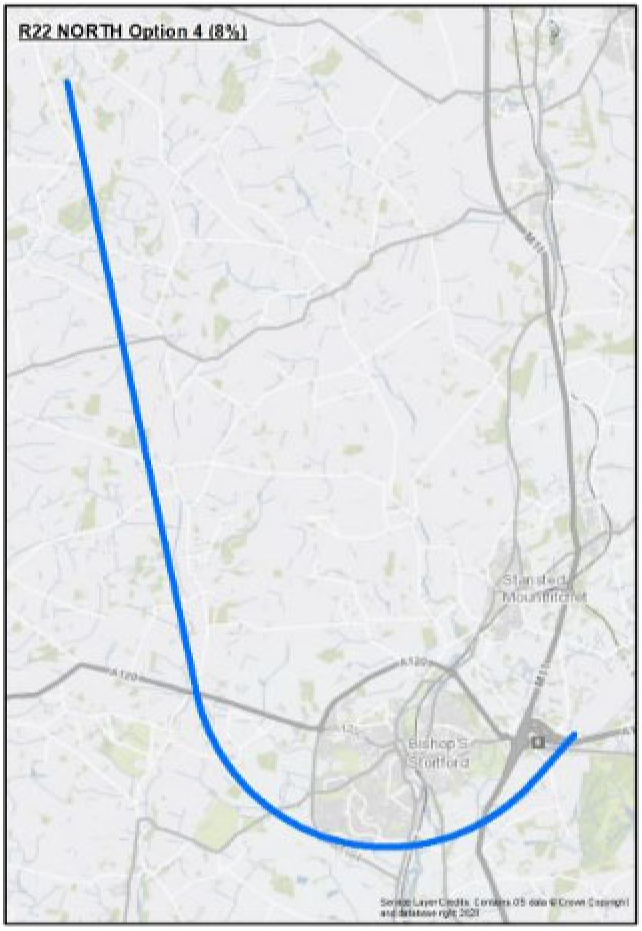
12.7 SID RWY 22 NORTH Option 3 (8%)

Description	Rationale for Inclusion
*This is an **RNAV1** option at 8% that has been developed to provide a more direct track towards the centre of the design envelope using fly-by waypoints.* *It aims to reduce the number of track miles flown by turning slightly earlier and flying slightly closer to Bishops Stortford than the RNAV1 replicated Option 1. This earlier turn also has the potential to aid capacity and reduce delays for following flights on south west departure routes.*	Balance: Provides a direct and fuel-efficient joining point with the network when compared to existing departure routes. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Demand: Has potential to reduce delays for following departures.



12.8 SID RWY 22 NORTH Option 4 (8%)

Description	Rationale for Inclusion
This option utilises RNP1 using RF turns at 8%. *It replicates the current SID initially, but removes the second easterly turn of the replicated route to maintain a heading that terminates in a slightly more westerly position* *Due to the accuracy of the type of turn, the initial turn is tighter than that of the replicated option which results in a right turn slightly closer to Bishops Stortford than the than the RNAV1 replicated Option 1. This earlier turn slightly reduces the number of track miles flown and has the potential to aid capacity and reduce delays for following flights on south west departure routes*	Balance: Provides a slightly more direct and fuel-efficient joining point with the network when compared to existing departure routes. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground. Demand: Has potential to reduce delays for following departures.

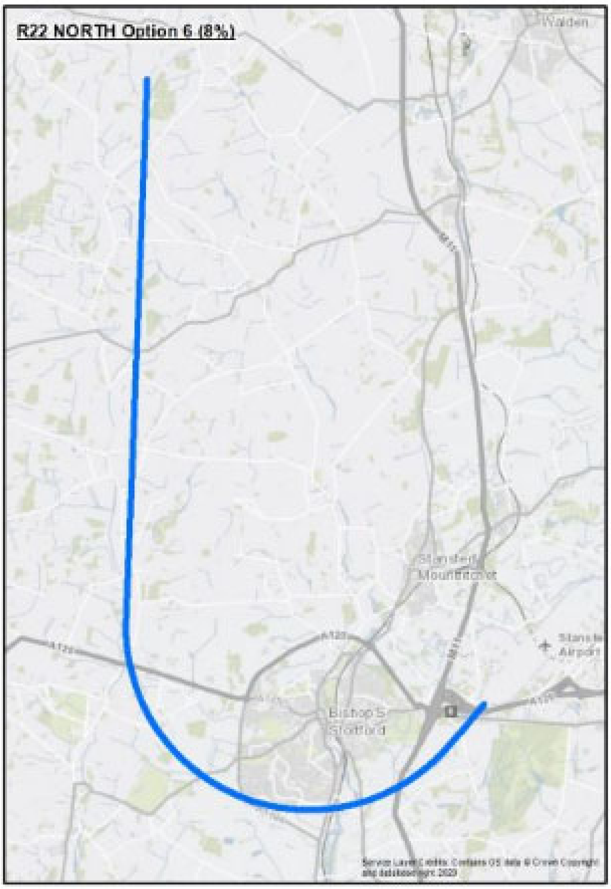


12.9 SID RWY 22 NORTH Option 5 (8%)

Description	*Rationale for Inclusion*
This option is an ***RNAV 1*** *option at 8% that utilises fly-by waypoints.* *It features a later and wider turn than the current SID with a straight stabilised segment between the turns. The result is a track that initially routes along the western edge of the envelope before turning back on a northerly track towards the centre of the design envelope at BKY.* *This option has been designed to provide maximum noise relief for Bishops Stortford and offers potential for noise relief when combined with option 6 or 7.*	RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey. Noise N1: Has potential to reduce noise impacts by avoiding Bishops Stortford. Noise N2: Offers potential for noise relief if combined with other options.

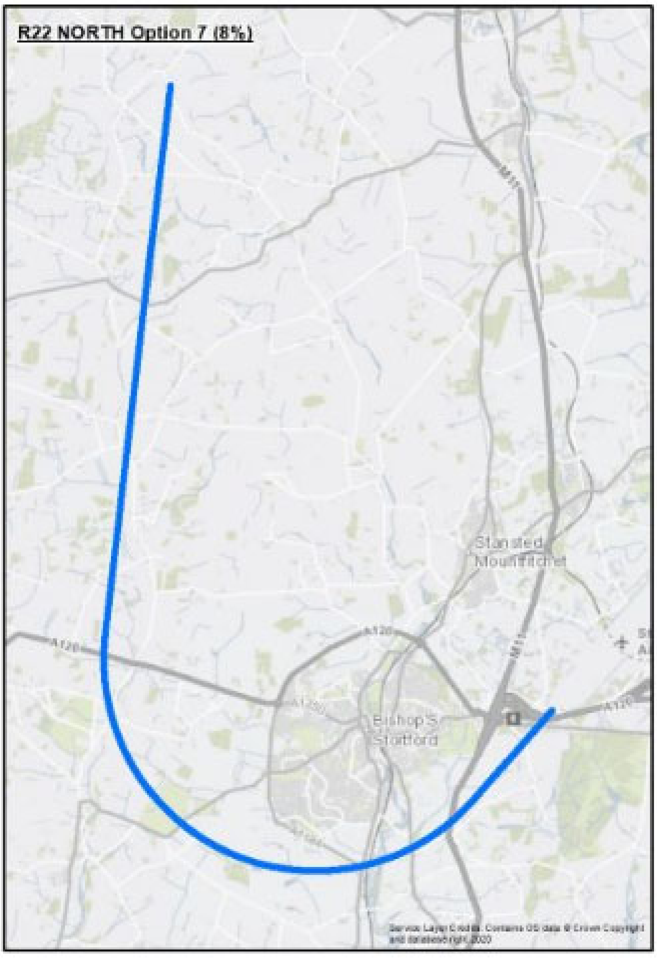
12.10 SID RWY 22 NORTH Option 6 (8%)

Description	Rationale for Inclusion
*This option utilises **RNP1** using RF turns at 8%.* *It follows the same initial turn as the replicated route utilising RF before turning to the north-east to route to the eastern side of the design envelope.* *Due to the accuracy of the type of turn, the initial turn is tighter than that of the replicated option which results in a right turn slightly closer to Bishops Stortford than the RNAV1 replicated Option 1.* *This earlier turn slightly reduces the number of track miles flown and has the potential to aid capacity and reduce delays for following flights on West departure routes. It also offers potential for noise relief if combined with option 5 or 8.*	Balance: Provides a direct and fuel-efficient joining point with the network when compared to existing departure routes. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground. Noise N2: Offers potential for noise relief if combined with other options. Demand: Has potential to reduce delays for following departures.



12.11 SID RWY 22 NORTH Option 7 (8%)

Description	Rationale for Inclusion
This is an ***RNP1*** *route using RF turns at 8%.* *It features a wider turn than the replicated SID to a point abeam Thorley before using an RF turn to route to the north-east of the design envelope towards Duddenhoe.* *The wider track of this route aims to avoid overflight of Bishops Stortford whilst also providing potential for noise relief if combined with option 5 or 8.*	Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground. Noise N1: Has potential to reduce noise impacts by avoiding Bishops Stortford. Noise N2: Offers potential for noise relief if combined with other options.



12.12 SID RWY 22 NORTH Option 8 (8%)

Description	Rationale for Inclusion
*This option utilises an **RNP1** using RF turns at 8%.* *It features a wider initial turn than the current SID, with the initial right turn onto a north-north westerly track abeam Thorley. This means the track routes along the western edge of the design envelope and heads towards Melbourn.* *This option has been designed to provide a fuel-efficient route for traffic heading to the north west, and reduced noise impact for Bishops Stortford. It also offers potential for noise relief elsewhere when combined with option 6 or 7.*	Noise N1: Has potential to reduce noise impact to Bishops Stortford. Noise N2: Has potential to offer noise relief when combined with Options 6 or 7. Balance: Provides a direct and fuel-efficient joining point with the network when compared to existing departure routes. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.

12.13 SID RWY 22 NORTH – Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A9 Left Wraparound	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would make a 270° left-hand turn, fly around the airport, and then begin heading north west towards the end of the design envelope.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

Option	Safety	Policy	Demand	Outcome
B10 Right Wraparound	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would make a 450°right-hand turn, fly around the airport, and then begin heading north west.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

C11 Extended straight ahead then north (Long/Short)	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would continue straight ahead then make a right turn north towards the centre of the envelope. A longer and shorter version of this option were considered.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would overfly the proposed location of a large garden village where a sizeable number of residential developments are planned and having a significant noise impact. Additionally this option would not comply with the environmental improvement initiative within the AMS as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for impact on the subsequent departures from STN, limiting capacity and runway throughput. This would result in aircraft being held for departure for longer, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

D12 Straight ahead then Left and 180 degree right	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would continue straight ahead for approximately 3NM then make a left turn in a southerly direction. The aircraft would then begin a gentle 180° right turn to the south of Harlow back towards the northerly envelope. This takes the track significantly outside the existing design envelope

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for impact on the subsequent departures from STN, limiting capacity and runway throughput. This would result in aircraft being held for departure for longer, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

13 SID RWY 22 NORTH-EAST

13.1 Introduction to SID RWY 22 NORTH-EAST Design Envelope

This is a new design envelope which aligns with the Policy and Demand DPs. As a new envelope there is no Replicated route. It has been created for traffic routing to the north-east and east from RWY 22.

All the options in this envelope have been developed with a 6% climb gradient. This aligns it with the Alternatives design principle by making it more viable for aircraft without the climb performance required to use the East (CLN) envelope which has an 8% climb gradient.

After departure, design options within this envelope turn left and terminate in the vicinity of Braintree. It has been designed for traffic exiting the UK to the north east via REDFA and SOMVA as an alternative to the current CLN departure route.

The aim is to reduce the noise for communities overflown by the CLN SID. The future operating concept for this envelope is that traffic could be shared between this and the 22 East (CLN) envelope in line with the Noise N2 design principle.

It also has the potential to respond to the design principles by:

- reducing fuel burn by shortening the miles flown to the UK airspace boundary when compared to the current CLN SID (Balance)
- relieving demand on the NATS network by providing an alternative to the current CLN SID which is often subject to flow restrictions due to demand from other airports in the London TMA (Demand and Efficiency).

13.2 Design Envelope Location Map

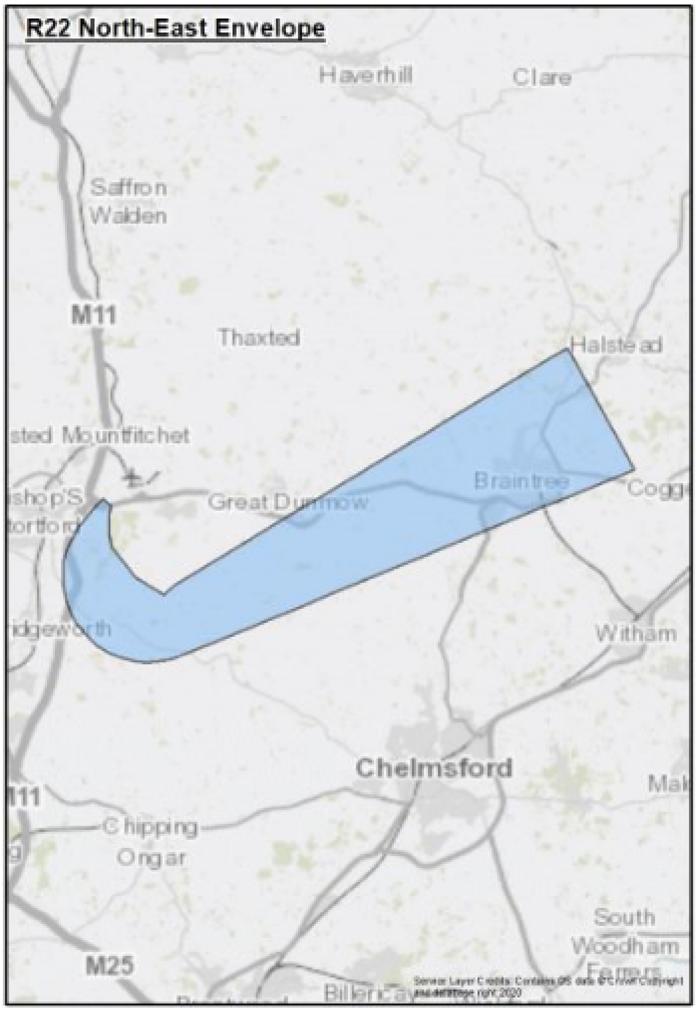


Figure 20 Runway 22 NORTH-EAST Envelope

13.3 SID RWY 22 NORTH-EAST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1	This is an **RNP1** departure using RF turns at 6% climb gradient to follow a direct track towards the centre of the design envelope.	A5	Left 540° wraparound	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
2	Option 2 is an alternative **RNAV1** route at 6% using fly-by waypoints that creates a slightly tighter turn on to a north westerly track when compared to Option 1.	B6	Right 180° wraparound		
3	Option 3 utilises an **RNP1** using RF turns at 6% to turn to the north-east and routes along the southern edge of the design envelope.	C7	Left turn (gradual)		
4	Option 4 utilises an **RNP1** using RF turns at 6% to turn to the north-east and routes to the north of the design envelope.	D8	Right turn (gradual)		

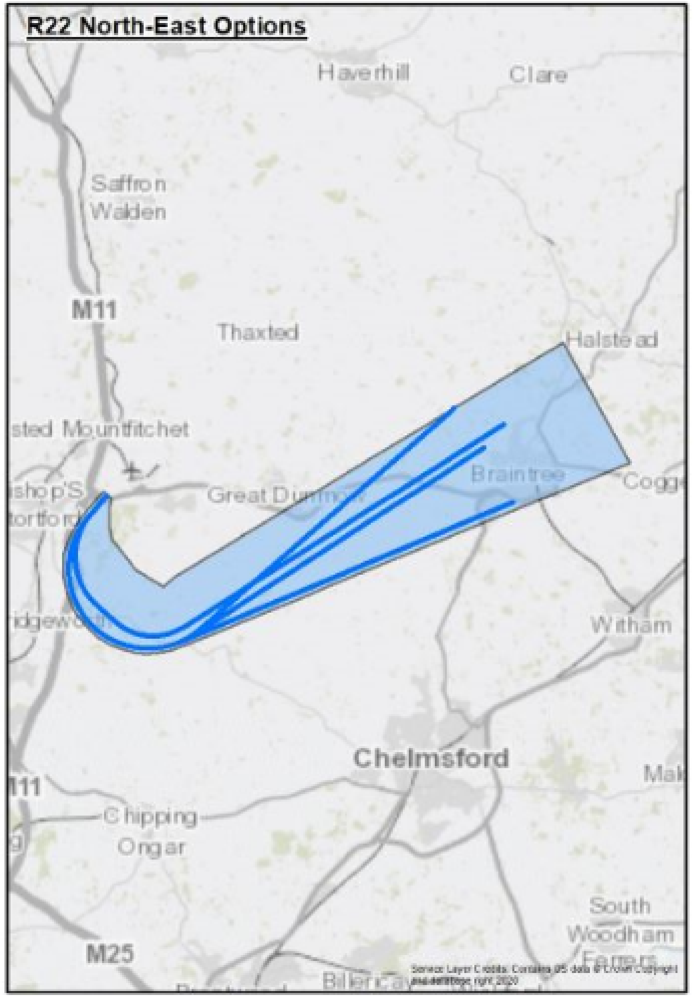
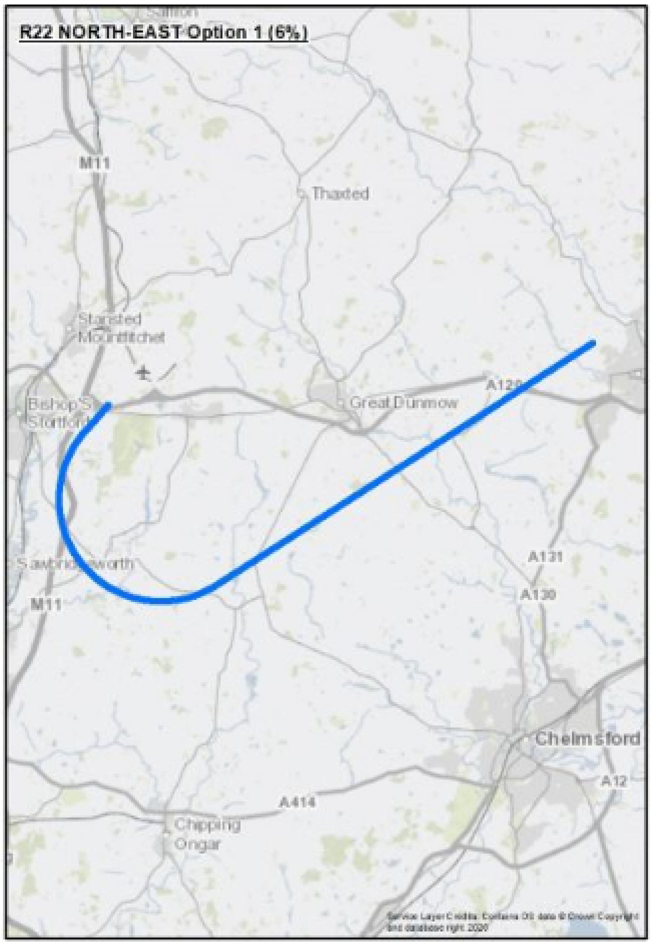


Figure 21 Runway 22 NORTH-EAST (Colne) Envelope and Options

13.4 SID RWY 22 NORTH-EAST Option 1 (6%)

Description	Rationale for Inclusion
This option is an RNP1 departure route at 6% climb gradient that utilises RF turns to follow a direct track towards the centre point of the design envelope. *It turns left as soon as possible after departure (based on the rules for this type of procedure) and follows a track to the north of Braintree. This is the tightest radius possible that would give concentrated aircraft tracks with little dispersion.* *The initial turn after departure avoids overflight of Sawbridgeworth and the route has also been designed to route just north of Braintree.*	Noise N1: Has potential to reduce noise impacts by avoiding Sawbridgeworth, High Easter and Central Braintree. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.

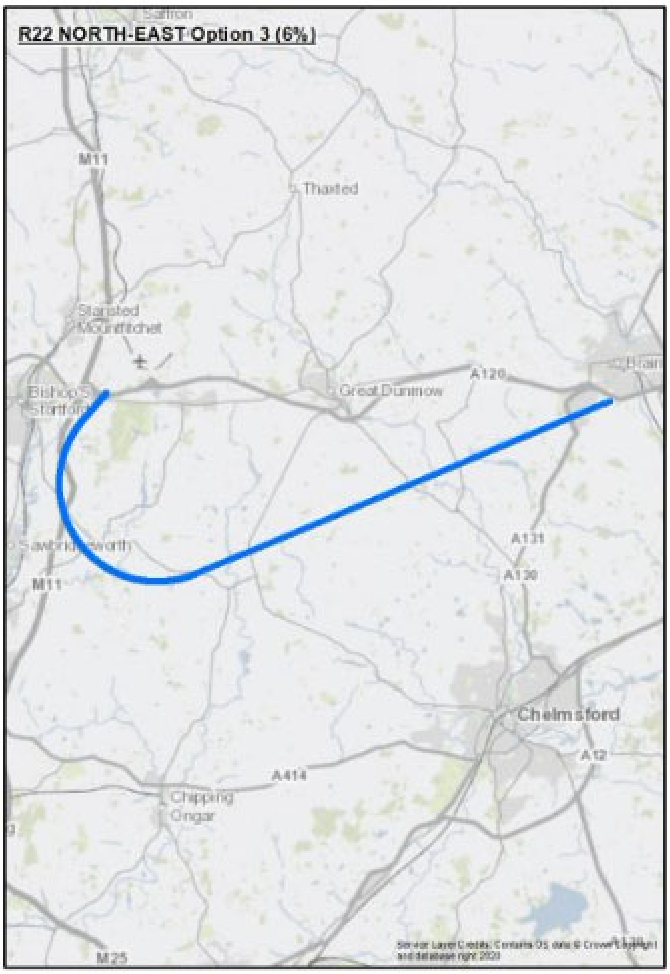


13.5 SID RWY 22 NORTH-EAST Option 2 (6%)

Description	Rationale for Inclusion
Option 2 is an alternative RNAV1 route at 6% using fly-by waypoints that initiates a turn on to a north westerly track earlier than Option 1 and routes to the centre of the design envelope. *The use of RNAV as a design standard has potential to create greater track/noise dispersal than Option 1.* *The initial turn after departure avoids the overflight of Sawbridgeworth and this option routes further north of High Easter than Option 1. It also avoids overflight of Braintree by reaching 7,000ft further north of the town than Option 3.*	Noise N1: Has potential to reduce noise impacts by avoiding Sawbridgeworth, High Easter and Braintree. Noise N2: Design to RNAV offers potential for greater dispersal of routes. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.

13.6 SID RWY 22 NORTH-EAST Option 3 (6%)

Description	Rationale for Inclusion
Option 3 utilises an ***RNP1*** *using RF turns at 6% to turn to the north-east and routes along the southern edge of the design envelope.* *The initial turn after departure avoids the overflight of Sawbridgeworth although this option routes closer to Braintree than Option 2, the track reaches 7,000ft before overflying the southern part of the town.*	Noise N1: Has potential to reduce noise impacts by avoiding Sawbridgeworth and routing south of Braintree. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



13.7 SID RWY 22 NORTH-EAST Option 4 (6%)

Description	Rationale for Inclusion
Option 4 utilises an RNP1 using RF turns at 6% to turn to the north-east and routes to the northern edge of the design envelope. *It turns left as soon as possible after departure (based on the rules for this type of procedure) and follows a track that routes south of Great Dunmow and well north of Braintree. This option has been created as an option that seeks to minimise the overflight of large and noise sensitive communities that are affected by the current East (CLN) SID.* *It also has the potential to reduce delays and noise dispersal for aircraft on the CLN departure by creating greater divergence after departure.*	Demand: Has potential to reduce delays for following departures. Noise N1: Has potential to reduce noise impacts by routing north of High Easter and Braintree and south of Gt Dunmow. Noise N2: Could be used to provide dispersal from aircraft on 22 East routes. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.

13.8 SID RWY 22 NORTH-EAST– Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A5 Left Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a constant 540° left-hand turn, flying fully around the airport, and then begin heading north east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B6 Right Wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 22, aircraft would make a 180° right-hand turn, fly around the airport, and then begin heading north east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
C7 Left turn (gradual)	S	P	D	Viable but Poor

				Fit

After departure from RWY 22, aircraft would make a gradual left-hand turn, flying further to the south before turning back towards the north east. This track takes it outside the existing design envelope.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. It may also interact with traffic from other airports in the London TMA which is not aligned with the efficiency requirement within the AMS.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

D8 Right turn (gradual)	S	P	D	Viable but Poor Fit

After departure from RWY 22, aircraft would make a gradual right-hand turn, flying further to the north before turning back towards the north east. This track takes it outside the existing design envelope.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals and departures from STN on other SIDs. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

14 SID RWY 04 SOUTH

14.1 Introduction to SID RWY 04 SOUTH Design Envelope

This envelope has been created for traffic departing to the south from RWY 04. The envelope is based around the existing LAM2S SID and all options have been developed with a climb gradient of 8%.

The current LAM2S SID is restricted for use by traffic departing STN and heading to London Heathrow (LHR) only. This is because of inbound traffic to LHR holding at the LAM hold. However, bilateral discussions within the LTMA have identified the possibility of changes to current holding arrangements for Heathrow which may make this airspace available. This route is therefore being considered as a southbound envelope for STN, subject to the interactions with the LHR operation (and others within the London TMA) being resolved.

The exception to this is Option 6, which is intended to provide a viable option for traffic departing STN requiring to route to the south-west as a result of airline stakeholder feedback.

This envelope will considerably reduce the track miles flown for southbound departures and result in a significant fuel and CO_2 saving. when compared to the current NUGBO departure.

14.2 Design Envelope Location Map

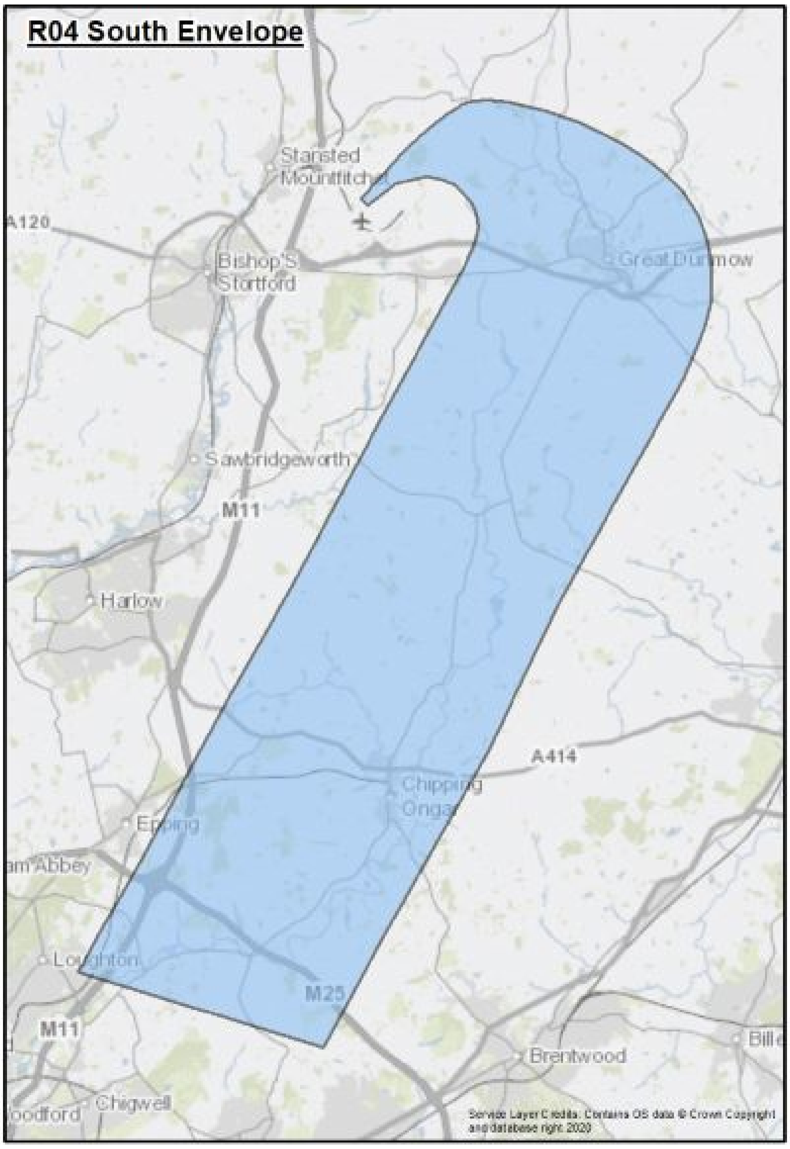


Figure 22 Runway 04 SOUTH Envelope

14.3 SID RWY 04 SOUTH Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	Option 0 is included to provide a **replication** of the existing LAM2S SID utilising PBN technology. This option is designed as an **RNAV1** option at 6% utilising fly-by waypoints to replicate the current procedure. Option 0 is considered to represent 'do minimum.'			U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is included to provide a **replication** of the existing conventional LAM2S SID utilising PBN technology. This option is designed as an **RNAV1** option at 8% utilising fly-by waypoints to replicate the current procedure.	A7	Left wraparound 180°		
2	This option is included to provide a **replication** of the existing conventional LAM2S SID utilising PBN technology at 8%. This option is designed as an **RNP1** option utilising RF turns which aims to replicate the current procedure.	B8	Right wraparound 500°		
3	This option has been developed as an RNAV1 option at 8% using fly-by waypoints to gives a	C9	Extended straight ahead then right.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	slightly wider initial turn than the replicated options to avoid overflying Great Dunmow. The track then turns south and runs down the eastern side of the design envelope.				
4	Option 4 is an RNAV1 route at 8% using fly-by waypoints to make the earliest possible right turn after departure whilst remaining to the east of Great Dunmow. The track then turns south and routes towards the centre of the design envelope.				
5	Option 5 is an RNAV 1 option at 8% that utilises fly-by waypoints and has a wider turn to avoid Great Dunmow. The track then turns south and runs down the extreme eastern edge of the design envelope.				
6	This is an RNAV 1 option at 8% that utilises fly-by waypoints with a wider turn to avoid Great Dunmow. Instead of routing south towards LAM, this route provides an option for south-west departures from RWY 04and the route terminates on a SW heading towards the centre of the design envelope.				

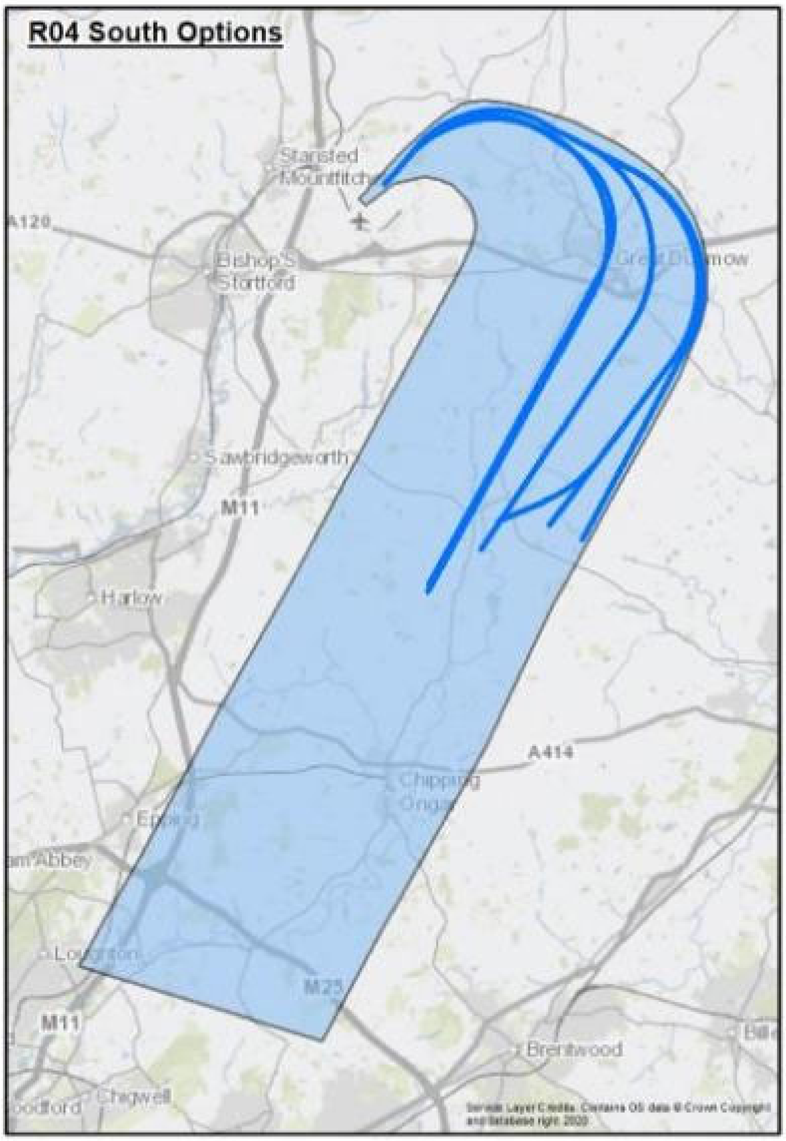
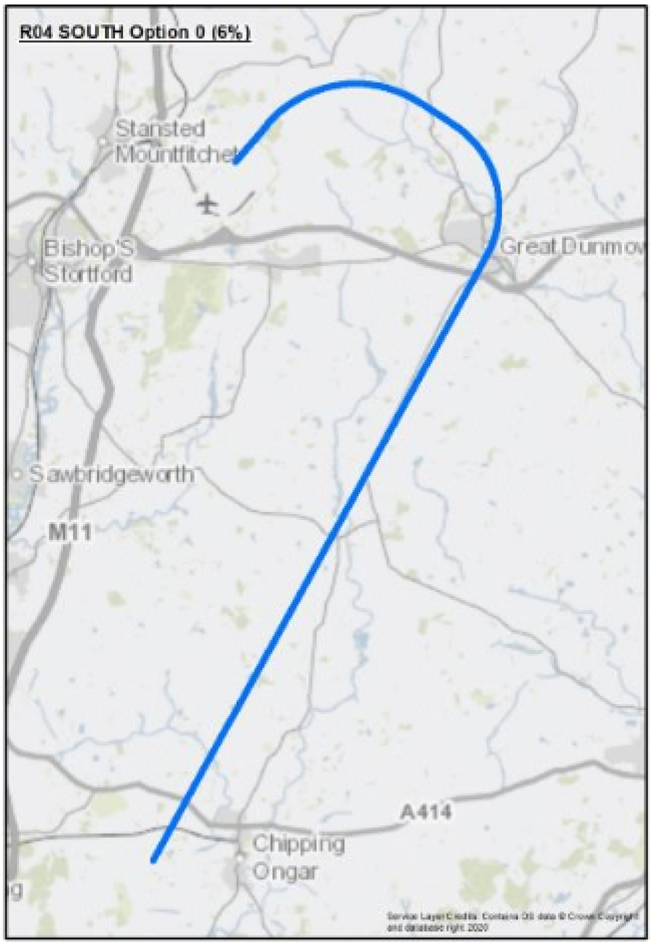


Figure 23 Runway 04 SOUTH Envelope and Options

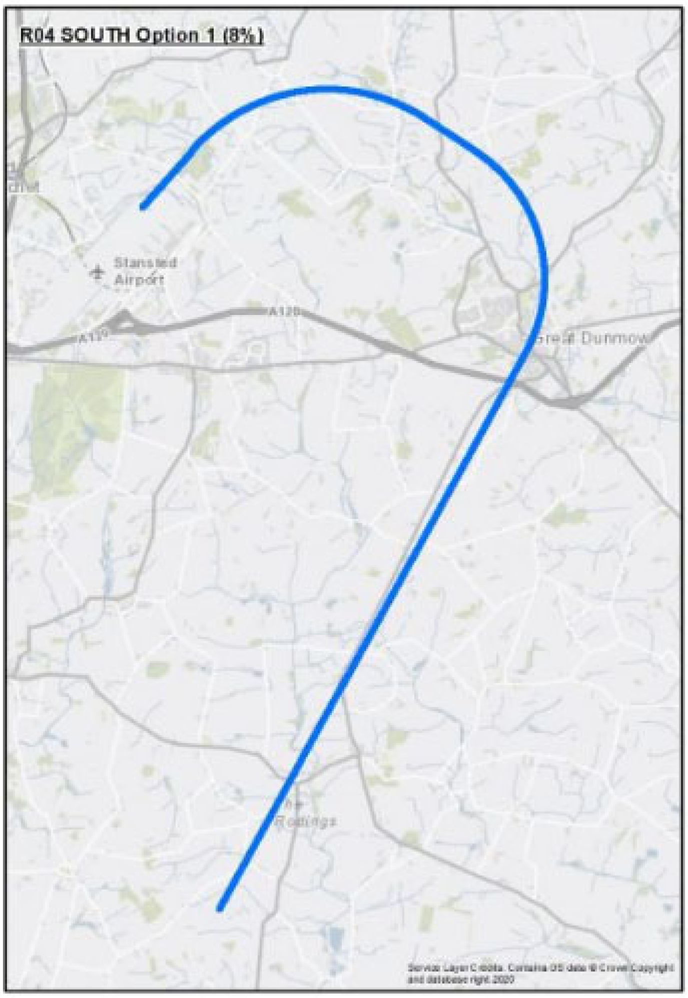
14.4 SID RWY 04 SOUTH Option 0 (6%)

Description	Rationale for Inclusion
Option 0 is included to provide a ***replication*** *of the existing LAM2S SID utilising PBN technology. This option is designed as an* ***RNAV1*** *option at 6% utilising fly-by waypoints to replicate the current procedure. Option 0 is considered to represent 'do minimum.'* *After departure this option turns right at the earliest point possible for this type of procedure and routes south reaching 7,000ft at the centre of the envelope.* *It should be noted that the existing conventional LAM 2S has a turn radius that is tighter than PANS-OPS PBN design criteria. To remain compliant, this replicated option has applied PANS-OPS minima, but this results in a first turn that is wider and results in an option that directly overflies Great Dunmow, whereas the current conventional SID routes inside it.*	Replication: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



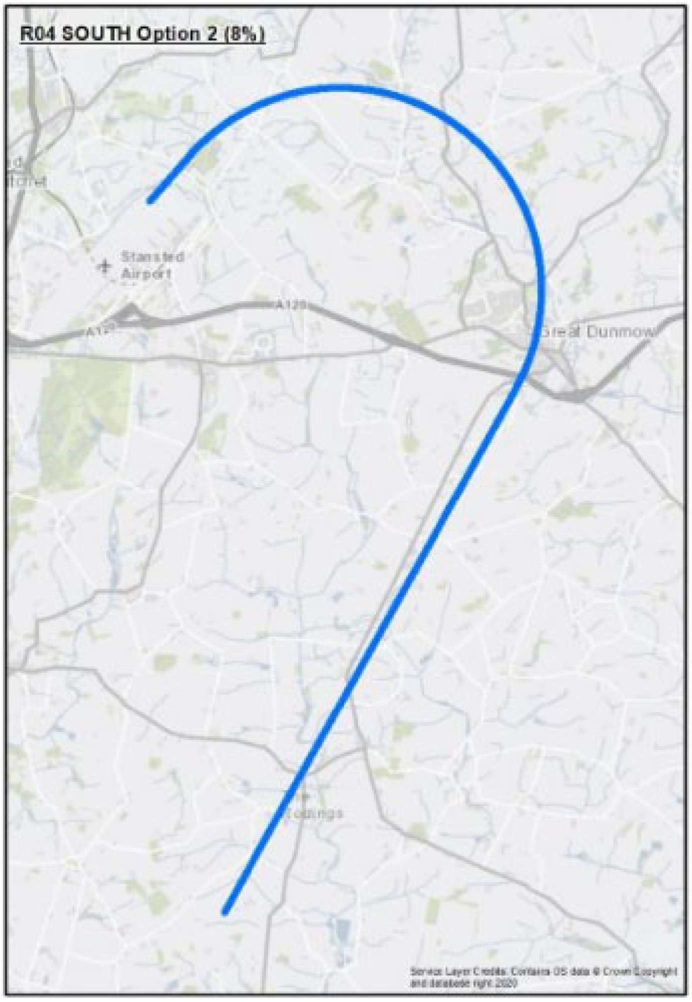
14.5 SID RWY 04 SOUTH Option 1 (8%)

Description	Rationale for Inclusion
Option 1 is included to provide a replication of the existing LAM2S SID utilising PBN technology. This option is designed as an ***RNAV1*** *option at 8% utilising fly-by waypoints to replicate the current procedure.* *After departure this option turns right at the earliest point possible for this type of procedure and routes south reaching 7,000ft at the centre of the envelope.* *It should be noted that the existing conventional LAM 2S has a turn radius that is tighter than PANS-OPS PBN design criteria. To remain compliant, this replicated option has applied PANS-OPS minima, but this results in a first turn that is wider and results in an option that directly overflies Great Dunmow, whereas the current conventional SID routes inside it.*	Replication: Aligns to a 'do minimum' option. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



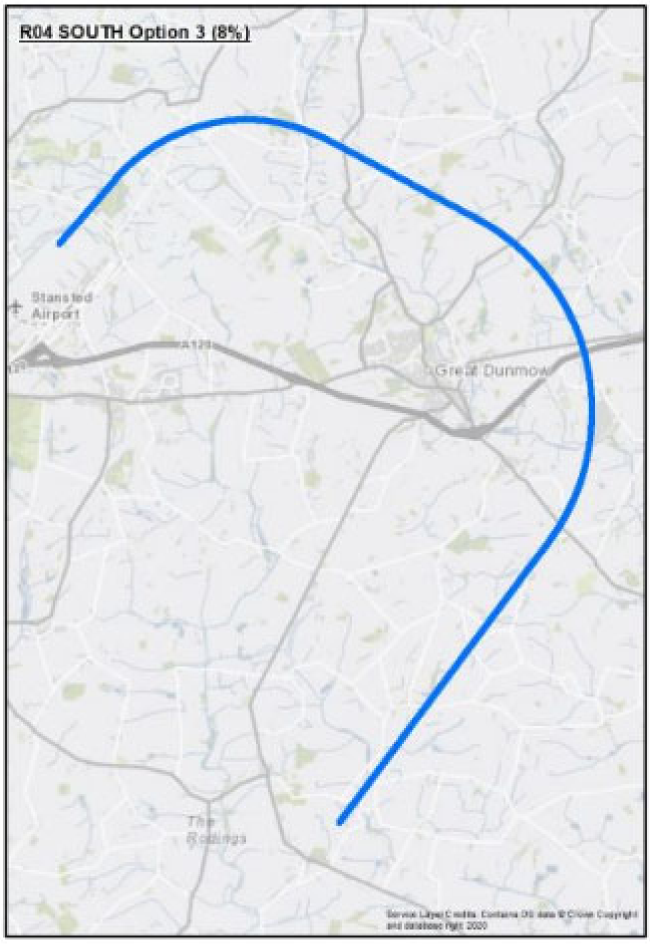
14.6 SID RWY 04 SOUTH Option 2 (8%)

Description	*Rationale for Inclusion*
*This option is included to provide a **replication** of the existing LAM2S SID utilising PBN technology. This option is designed as an **RNP1** option at 8% utilising RF turns which aims to replicate the current procedure.* *After departure this option turns right at the earliest point possible for this type of procedure and routes south reaching 7,000ft at the centre of the envelope.* *It should be noted that the existing conventional LAM 2S has a turn radius that is tighter than PANS-OPS PBN design criteria. To remain compliant, this replicated option has applied PANS-OPS minima, but this results in a first turn that is wider and results in an option that directly overflies Great Dunmow, whereas the current conventional SID routes inside it.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



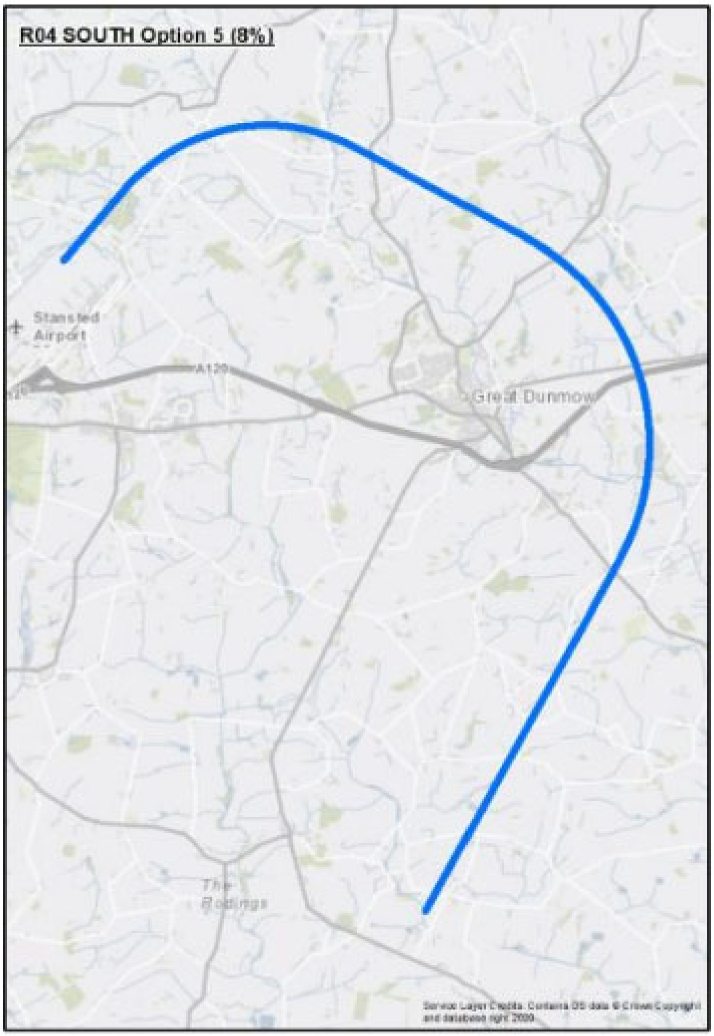
14.7 SID RWY 04 SOUTH Option 3 (8%)

Description	*Rationale for Inclusion*
Option 3 has been developed as an RNAV1 option at 8%, using fly-by waypoints. *After departure this option turns right at the earliest point possible but has then been designed with a southbound turn that avoids overflying Great Dunmow by routing slightly further west before turning south. (This results in the route following the track of the existing CLN4S route initially).* *The track then turns south and runs down the eastern side of the design envelope. routing to the east of High Easter and reaching 7,000ft on the eastern side of the envelope.* *As well as aiming to avoid Great Dunmow immediately after departure, it also aims to avoid Thaxted and Stebbing.*	Noise N1: Has potential to reduce noise impacts by avoiding Great Dunmow. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



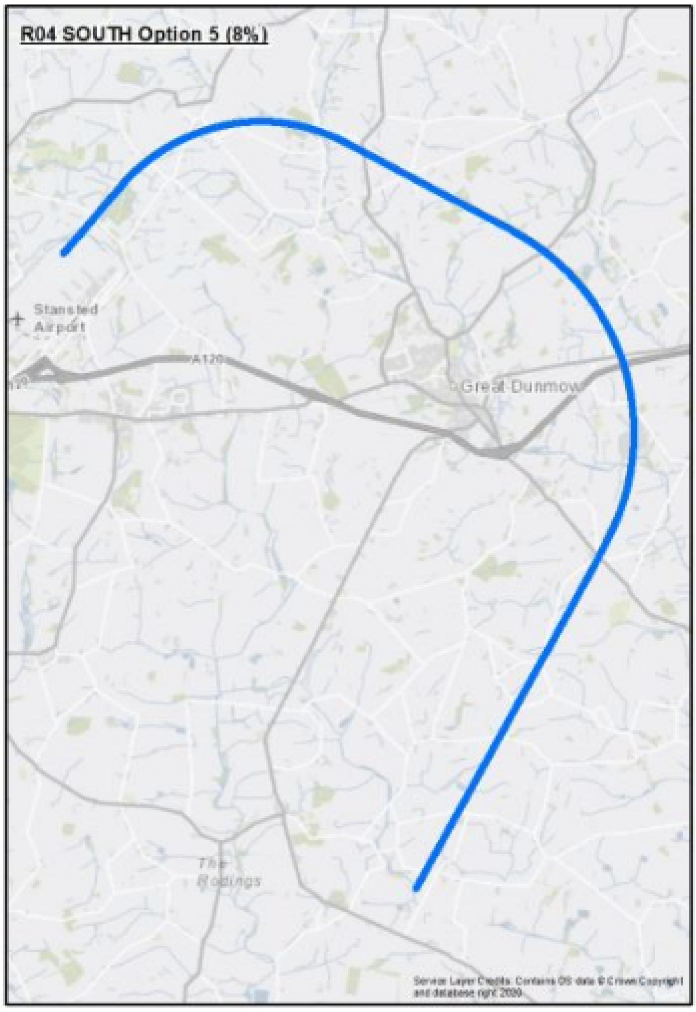
14.8 SID RWY 04 SOUTH Option 4 (8%)

Description	Rationale for Inclusion
Option 4 has been developed as an RNAV1 *option at 8%, using fly-by waypoints.* *After departure this option turns right at the earliest point possible and has then been designed with a southbound turn that avoids overflying Great Dunmow by routing slightly further west before turning south.* *The track then turns south at a position that avoids overflying the village of High Easter which results in a track more through the centre of the design envelope.*	Noise N1: Has potential to reduce noise impacts by avoiding High Easter and Great Dunmow. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



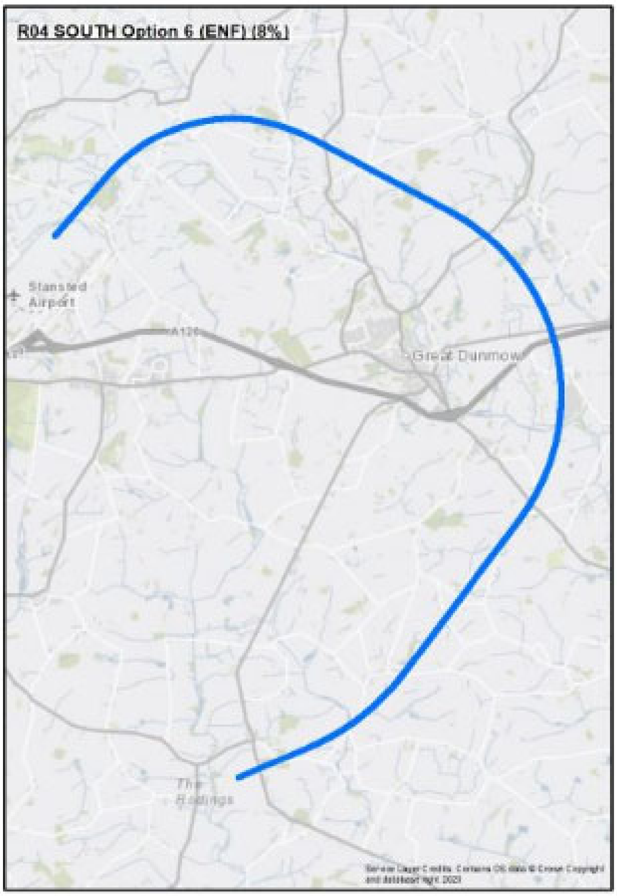
14.9 SID RWY 04 SOUTH Option 5 (8%)

Description	Rationale for Inclusion
Option 5 has been developed as an ***RNAV1*** *option at 8%, using fly-by waypoints.* *After departure this option turns right at the earliest point possible and has then been designed with a southbound turn that avoids overflying Great Dunmow by routing further west before turning south.* *The track turns south at a later position that avoids overflying the village of High Easter to the south-east, which results in a track that runs down the extreme eastern edge of the design envelope.*	Noise N1: Has potential to reduce noise impacts by avoiding High Easter and Great Dunmow. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



14.10 SID RWY 04 SOUTH Option 6 (8%)

Description	Rationale for Inclusion
Option 6 has been developed as an RNAV1 option at 8%, using fly-by waypoints. *This option is included following stakeholder feedback to provide an alternative option to aircraft using the 04 WEST B envelope (used for aircraft heading south-west).* *After departure this option turns right at the earliest point possible and has then been designed with a southbound turn that avoids overflying Great Dunmow by routing further west before turning south.* *The track turns south beyond Great Dunmow around North End, and then makes a final turn on to a south westerly heading shortly before the end of the route option.*	Noise N1: Has potential to reduce noise impacts by avoiding High Easter and Great Dunmow. Noise N2: Offers potential for noise respite if used as an alternative with the 04 WEST B envelope. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



14.11 SID RWY 04 SOUTH – Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A7 Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 180° left-hand turn, and then begin heading south. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B8 Right wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make an approximate 500° right-hand turn, flying fully around the airport to gain altitude, and then begin heading south. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the				

Demand DP.				
C9 Extended straight ahead then right	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would fly an extended straight-ahead phase and then make a right-hand turn to begin heading south west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				

15 SID RWY 04 SOUTH-EAST Current DET 1D

15.1 Introduction to SID RWY 04 SOUTH-EAST Design Envelope

This envelope has been created for traffic routing to the south and south-east from RWY 04 at 8% climb gradient. The envelope is based around the current DET 1S SID (Conventional) and the current DET 1D SID which is already designed to RNP1 with RF legs. This route was approved by the CAA in 2018 following a public consultation under the previous CAP725 process.

The design of this RNP1 SID uses a non-PANS-OPS compliant turn radius, however this route has been approved for use by the CAA via a supporting Safety Case and has been safely and accurately flown since implementation in 2018. On this basis, and consistent with our criteria, this is a Viable route option to be included. The climb gradient is being increased from 3.3% to 8%.

The current DET1D route (RNP1 + RF) can only be used by STN aircraft during night-time operations (2300 – 0600) as per Note 4 in the AIP Chart (AD 2-EGSS-6-7 Note 4) – Outside of these hours CLN 4S is issued. This restriction was put in place due to the network capacity during the day and interactions between this SID and traffic for both London City and London Heathrow.

To create a comprehensive list of options, daytime use of this is route is being considered subject to these interactions being resolved. We will continue to work in bilateral discussions across the LTMA and in partnership with NERL and other airports to resolve these interactions. If the required daytime connectivity to the network cannot be provided this suite of design options will remain with appropriate restrictions.

15.2 Design Envelope Location Map

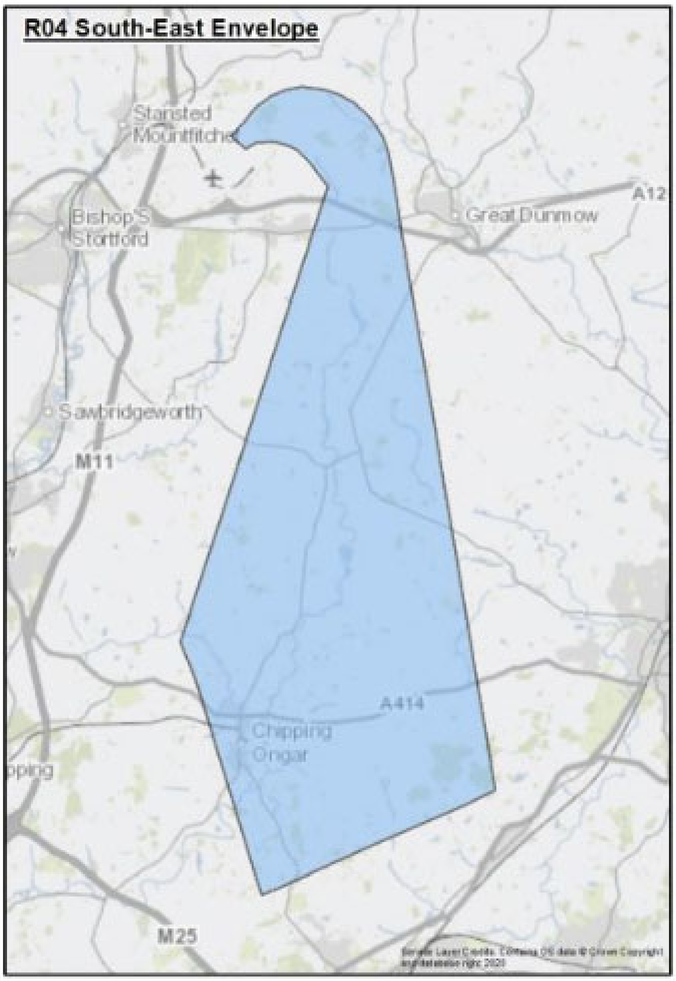


Figure 24 Runway 04 SOUTH-EAST (Current DET1D) Envelope

15.3 SID RWY 04 SOUTH-EAST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	Option 0 is a reproduction of the existing published DET1D SID, which routes to 7,000ft via the north-western side of the design envelope. The existing SID is set at 3.3% climb gradient and is restricted in the climb due to airspace constraints, whereas this option has been designed with a 6% climb gradient.	A5	Left wrapround 270°	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is included to provide a depiction of the existing DET1D SID which routes to 7,000ft via the north-western side of the design envelope. Although the current SID already benefits from being an RNP1 design, this option alters the climb gradient of 8% to be consistent with the other options within this envelope.	B6	Right wraparound 500°		
2	Option 2 is an RNP1 using RF route at 8%. It follows the same turn as the current SID initially but completes the turn earlier to maintain a south-south easterly track along the eastern edge of the envelope to route more directly towards DET.	C7	Extended straight ahead then right		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs			Unviable
3	This option is an RNP1 using RF route at 8%. It follows the same turn as the current SID initially but turns on to a south-easterly track at an earlier point and routes to the centre of the design envelope and towards DET.				
4	This option is an RNP1 using RF route at 8%. It follows the same turn as the current SID initially turns on to a south westerly track which is continued to the end of the route option at 7,000ft with no turn south.				

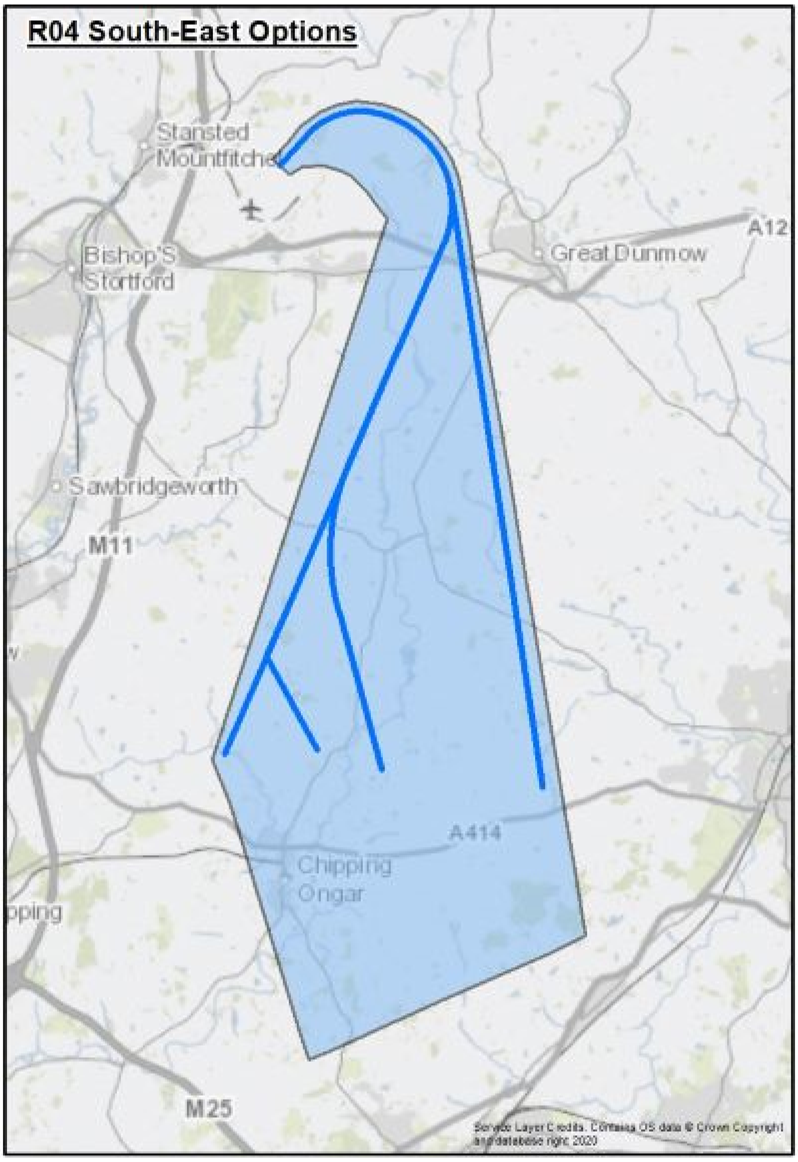
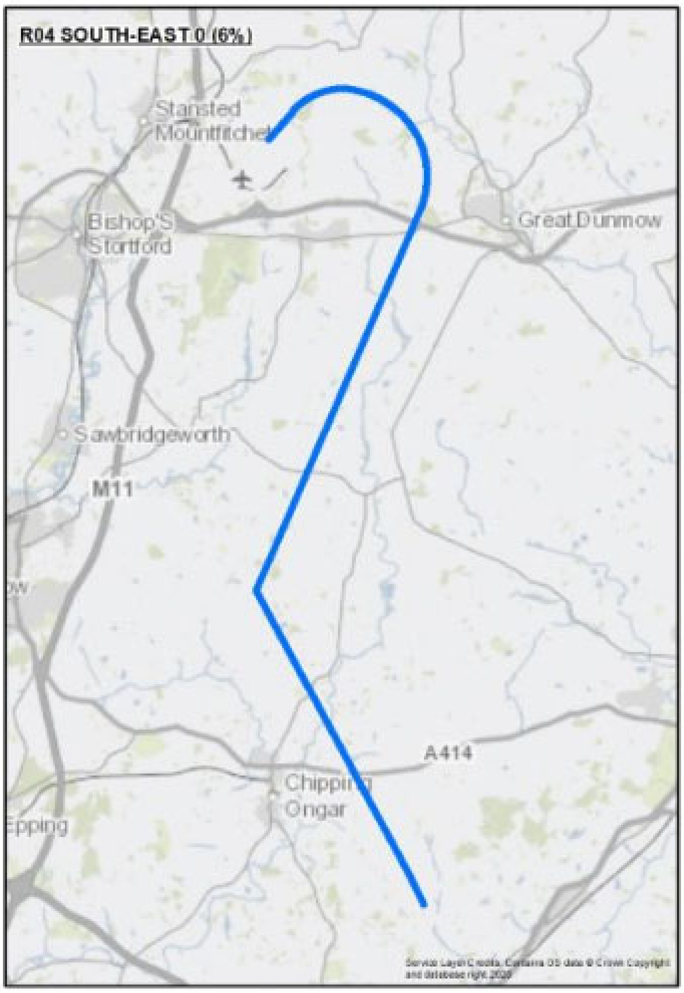


Figure 25 Runway 04 SOUTH-EAST (Current DET1D) Envelope and Options

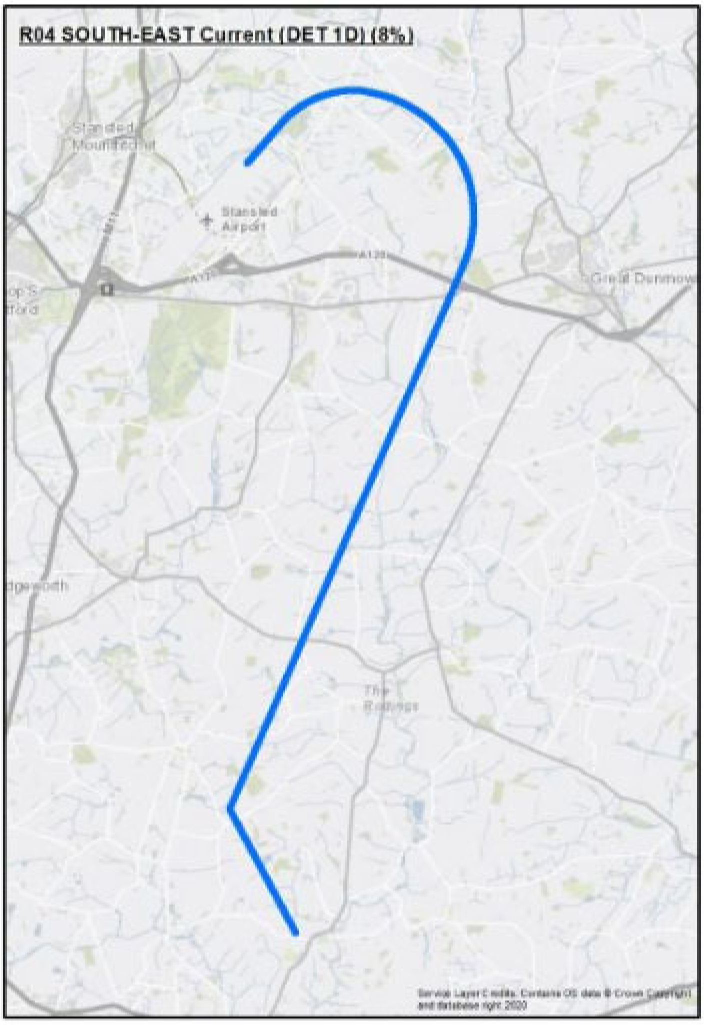
15.4 SID RWY 04 SOUTH-EAST (Current DET1D) Option 0 (6%)

Description	Rationale for Inclusion
Option 0 is a reproduction of the existing published DET1D SID, which routes to 7,000ft via the north-western side of the design envelope. *Although the current SID already benefits from being an RNP1 design, this option alters the climb gradient of 6% to be consistent with the other options within this envelope. The existing SID is set at 3.3% climb gradient and is restricted in the climb due to airspace constraints.*	Reproduction of existing published SID: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



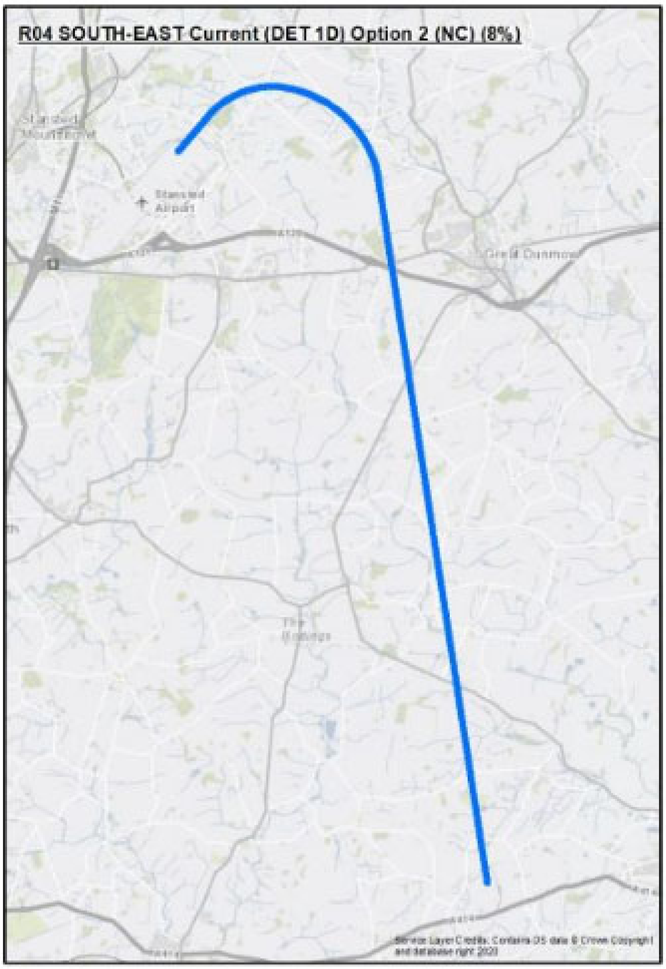
15.5 SID RWY 04 SOUTH-EAST (Current DET1D) Option 1 (8%)

Description	Rationale for Inclusion
Option 1 is included to provide a depiction of the existing DET1D SID which routes to 7,000ft via the north-western side of the design envelope. *Although the current SID already benefits from being an RNP1 design, this option alters the climb gradient of 8% to be consistent with the other options within this envelope. The existing SID is set at 3.3% climb gradient and is restricted in the climb due to airspace constraints.*	Replication: Aligns to the existing SID but has been designed with a different climb gradient. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



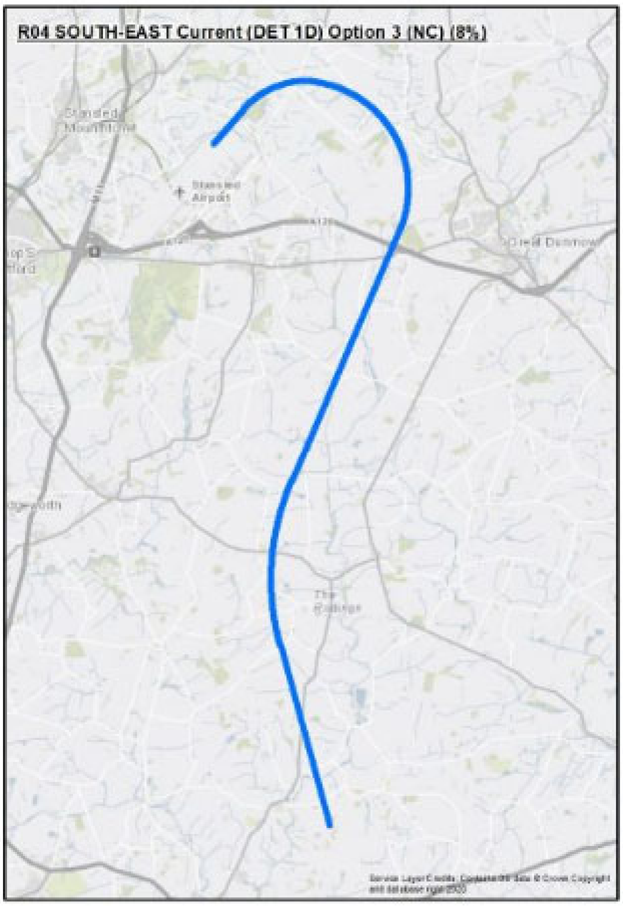
15.6 SID RWY 04 SOUTH-EAST (Current DET1D) Option 2 (8%)

Description	*Rationale for Inclusion*
Option 2 is an RNP1 using RF route at 8%. It follows the same turn as the current SID initially but completes the turn earlier to maintain a south-south easterly track along the eastern edge of the envelope to route more directly towards DET. *This results in a track that remains inside of Great Dunmow but results in fewer track miles flown than the current procedure.* *This option offers a more direct routing towards the DETLING area, and although it aims to turn before Great Dunmow, it flies over High Easter.*	Balance: More direct routing and reduced track miles when compared to replicated route. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



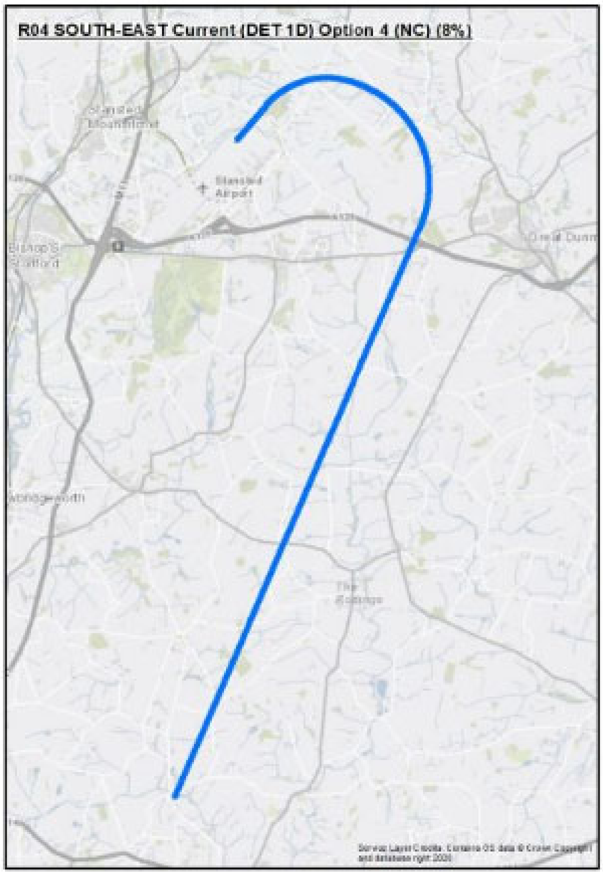
15.7 SID RWY 04 SOUTH-EAST (Current DET1D) Option 3 (8%)

Description	Rationale for Inclusion
This option is an RNP1 using RF route at 8%. *It follows the same turn as the current SID initially but turns on to a south-easterly track as far as the village of Aythorpe Rodding. The turn to the south-east is made at this earlier point and the route heads on a south-easterly track to 7,000ft towards the centre of the design envelope, and to the west of High Easter.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by avoiding High Easter. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



15.8 SID RWY 04 SOUTH-EAST (Current DET1D) Option 4 (8%)

Description	Rationale for Inclusion
Option 4 is an RNP1 using RF route at 8%. *It follows the same turn as the current SID initially turns on to a south westerly track which is continued to the end of the route option at 7,000ft with no turn south. The route terminates on the north-west side of the design envelope at a point abeam the aerodrome at North Weald.* *It has been designed to avoids overflight of Chipping Ongar and North Weald and has been included as an option to reduce likelihood of interaction with traffic from adjacent airports (LHR and LCY) which is a feature of the current DET departure.*	Noise N1: Has potential to reduce noise impacts by avoiding High Easter Efficiency: Provides an option to minimise the interactions with adjacent airports. Aims to avoid flying over noise sensitive areas. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



15.9 SID RWY 04 SOUTH-EAST – Viable but Poor Fit and Unviable Options

Option	Safety	Policy	Demand	Outcome
A5 Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make an approximate 270° left-hand turn, flying fully around the airport, and then begin heading south east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B6 Right wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make an approximate 500° right-hand turn, flying fully around the airport to gain altitude, and then begin heading south east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				

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C7 Extended straight ahead then right	S	P	D	Viable but Poor Fit

After departure from RWY 04, aircraft would fly an extended straight-ahead phase and then make a right-hand turn to begin heading south west back towards DET.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with arriving traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

16 SID RWY 04 EAST

16.1 Introduction to SID RWY 04 EAST Design Envelope

This envelope has been created for traffic routing to the east from RWY 04 at 8% climb gradient. The envelope is based around the current conventional departure SID CLN4S, and after departure, design options within this envelope turn right and head towards the current CLN DVOR.

This departure route is used by STN departures that head to both the NE Europe (exiting the UK via REDFA and SOMVA) and to SE Europe (exiting the UK via KONAN), which is an additional load imposed on this SID following LAMP1A. CLN is also used by departures from other airports in the London which can results in flow control measures being applied to STN traffic.

The future operating concept for this envelope is that the volume of traffic should be reduced by sharing the traffic between this and the 04 South East (DET) and the new 04 North East envelopes.

16.2 Design Envelope Location Map

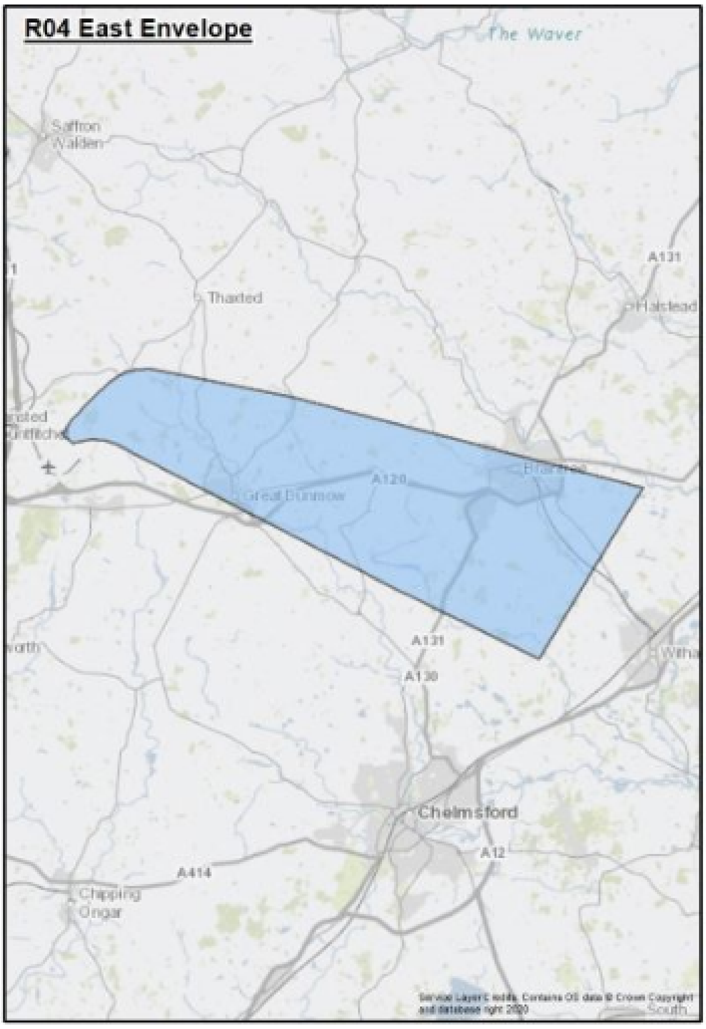


Figure 26 Runway 04 EAST Envelope

16.3 SID RWY 04 EAST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	This option is included to provide a replication of the existing CLN4S SID utilising PBN technology. It is designed as an RNAV1 route at 6% and uses fly-by waypoints to follow the track of the existing procedure as closely as possible in the centre of the envelope.	A7	Left wraparound 300°	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is included to provide a replication of the existing CLN4S SID utilising PBN technology. It is designed as an RNAV1 route at 8% and uses fly-by waypoints to follow the track of the existing procedure as closely as possible in the centre of the envelope.	B8	Right wraparound 450°		
2	This option is included to provide a replication of the existing CLN4S SID utilising RNP1 with RF turns at 8%. It follows the track of the existing procedure as closely as possible in the centre of the envelope.	C9	Extended straight ahead then right		
3	This option is an RNAV1 route using fly-by waypoints at 8%. It follows the same initial turn as the current route				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	but maintains an easterly track along the northern edge of the envelope.				
4	This option is an RNAV1 route using fly-by waypoints at 8%. The first turn commences at the same point as other options but continues this turn to follow a track towards the southern edge of the envelope.				
5	This option is designed utilising RNP1 with RF turns at 8%. It follows the same initial turn and track as the current route but turns to the right before Gt Notley to route towards the southern edge of the design envelope.				
6	This option is designed utilising RNP1 with RF turns at 8%. It commences the turn in the same position as the current route but maintains an easterly track along the northern edge of the envelope until north of Stebbing. It then commences an RF turn to the right and routes to the south of the envelope.				

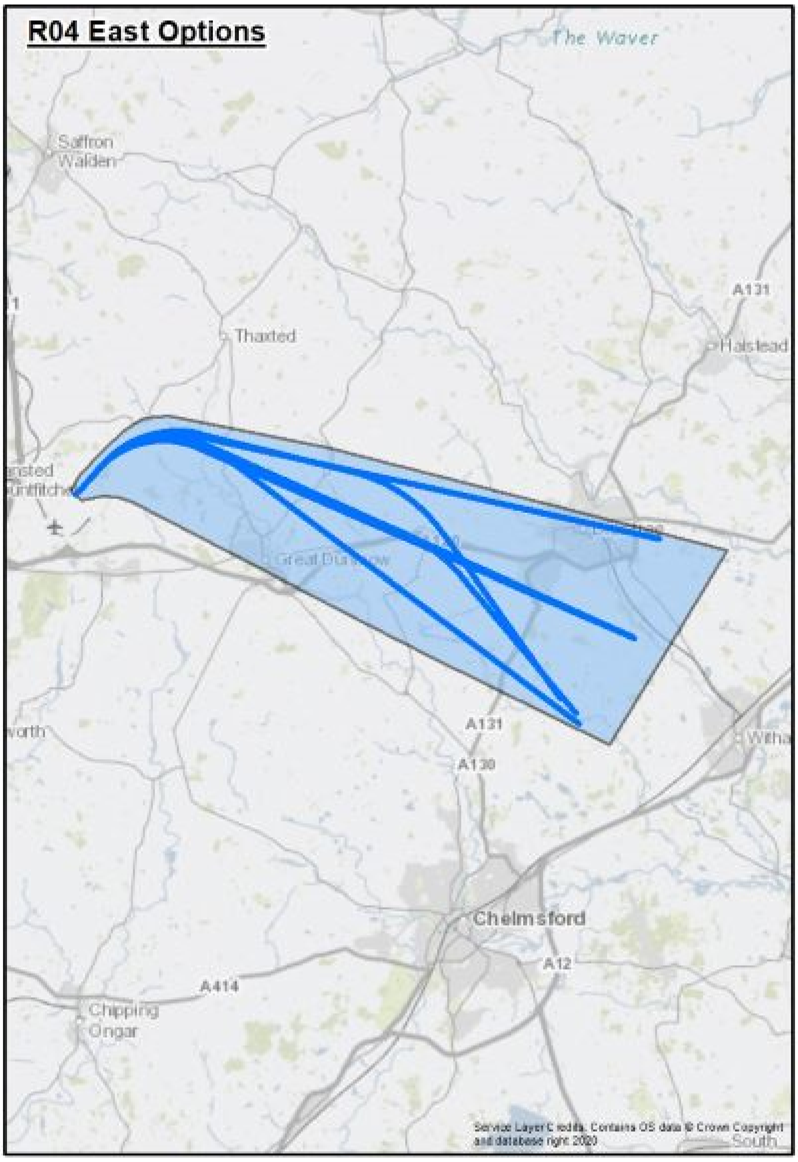


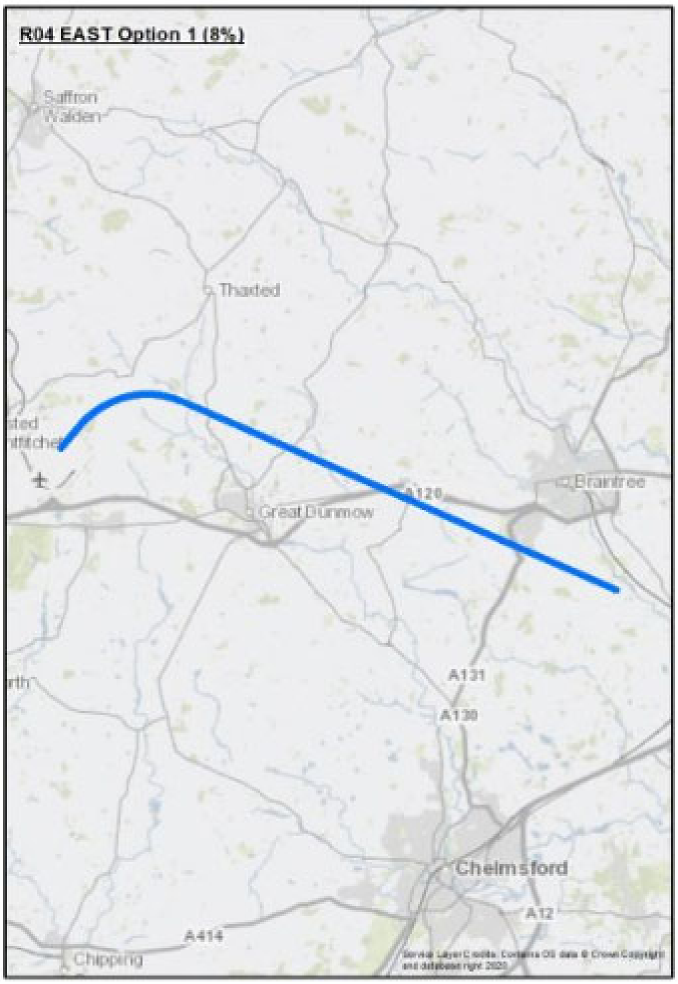
Figure 27 Runway 04 EAST Envelope and Options

16.4 SID RWY 04 EAST Option 0 (6%)

Description	Rationale for Inclusion
Option 0 is included to provide a ***replication*** *of the existing conventional CLN4S SID utilising PBN technology. It is designed as an RNAV1 and uses fly-by waypoints to follow the track of the existing procedure as closely as possible. It is considered to be the 'do minimum' option.* *Although this route is laterally similar to the existing SID, the higher climb gradient aims to introduce efficiencies.*	Replication: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.

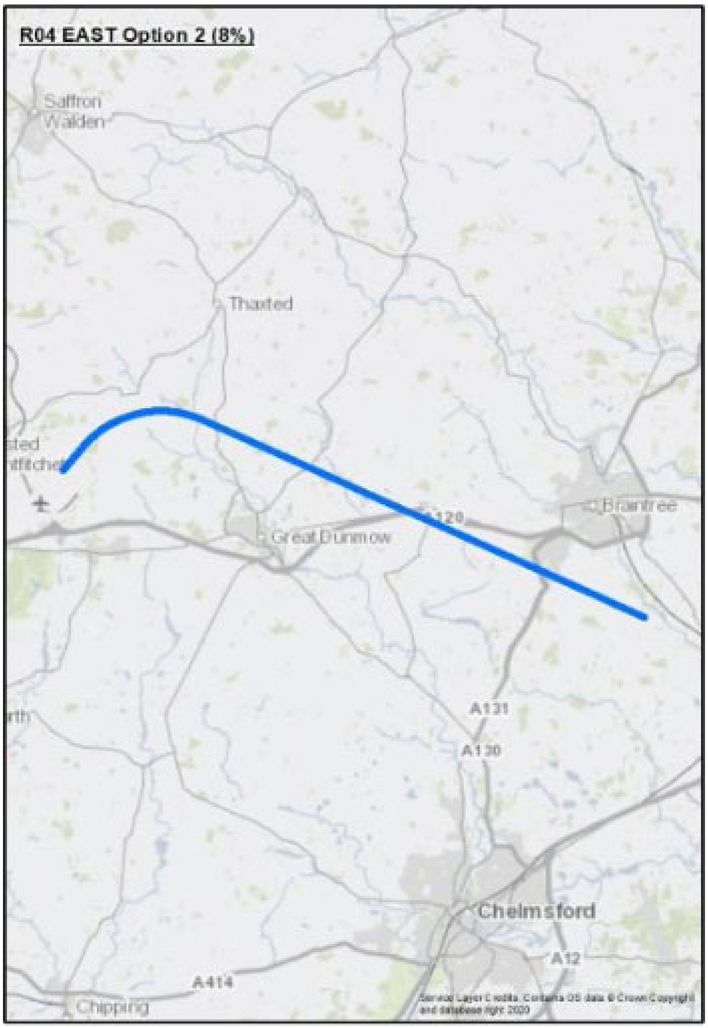
16.5 SID RWY 04 EAST Option 1 (8%)

Description	Rationale for Inclusion
*Option 1 is included to provide a replication of the existing conventional CLN4S SID utilising PBN technology. It is designed as an **RNAV1** route at 8% and uses fly-by waypoints to follow the track of the existing procedure as closely as possible.* *Although this route is laterally similar to the existing SID, it has a higher climb gradient.* *After departure this SID turns right and route in an east south east direction to the north of Great Easton and terminates at 7,000ft in the centre of the design envelope to the south of Braintree.*	Replication option, with higher climb gradient than the 'do minimum' option. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



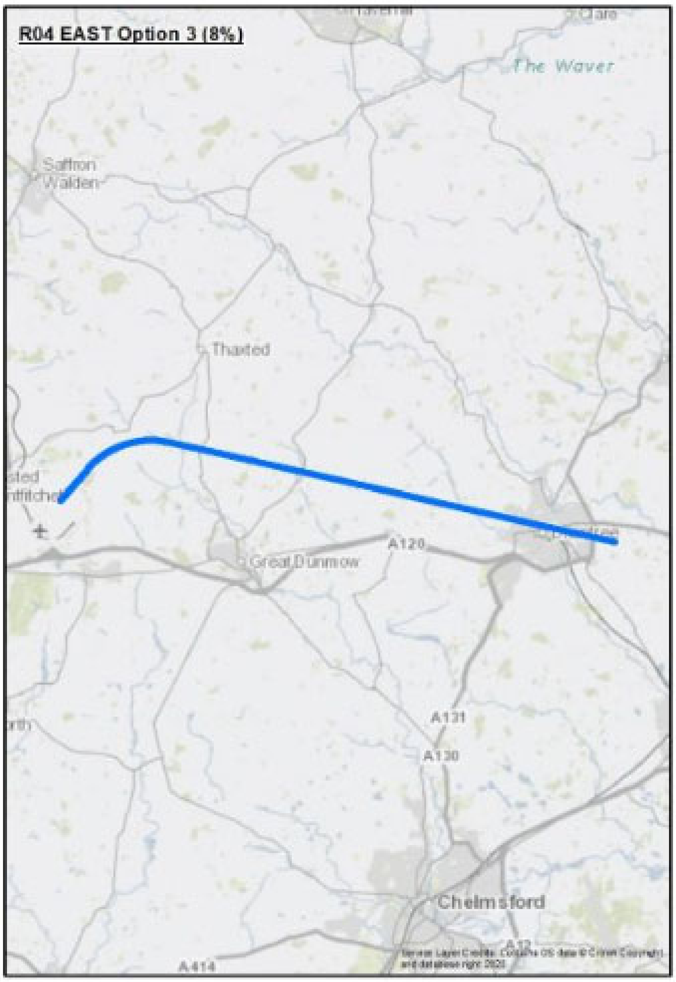
16.6 SID RWY 04 EAST Option 2 (8%)

Description	Rationale for Inclusion
*Option 2 is included to provide a replication of the existing CLN4S SID utilising **RNP1** with RF turns at 8%.* *It follows the track of the existing procedure as closely as possible.* *Although this route is laterally similar to the existing SID, it has a higher climb gradient.* *After departure this SID turns right and route in an east south east direction to the north of Great Easton and terminates at 7,000ft in the centre of the design envelope to the south of Braintree.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



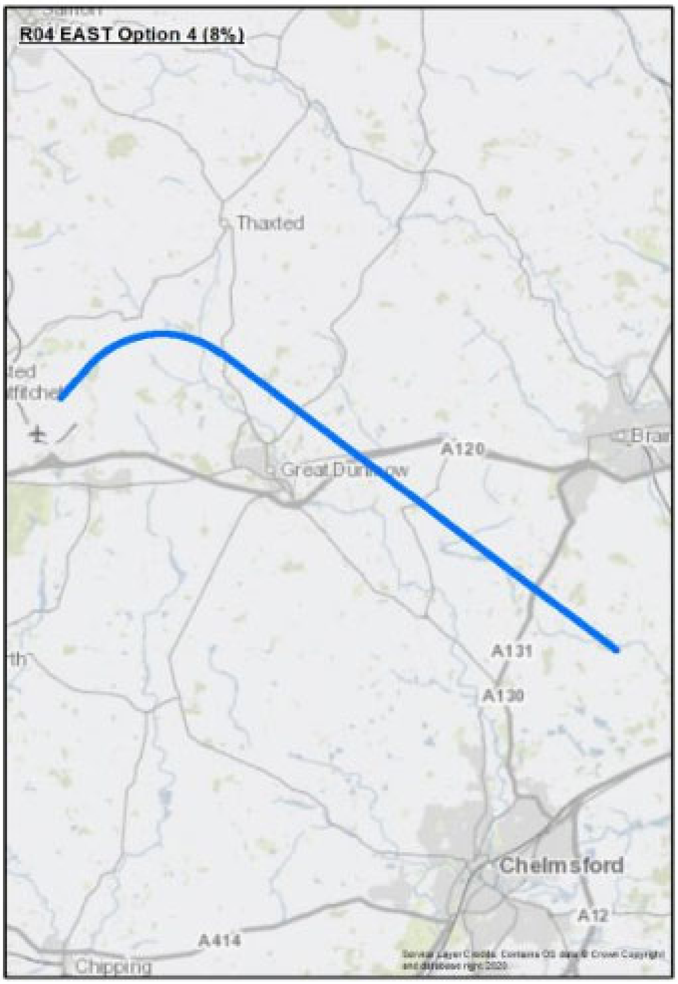
16.7 SID RWY 04 EAST Option 3 (8%)

Description	Rationale for Inclusion
This option is an ***RNAV1*** *route using fly-by waypoints at 8%.* *It follows the same initial turn as the current route but maintains an easterly track along the northern edge of the envelope.* *This option has been developed as a slightly more direct route to exit UK airspace and may also offer the potential as a noise relief route when combined with options that route to the south of the design envelope.* *It avoids overflight of Thaxted, and flies to the north of both Stebbing and Great Dunmow, but flies close to Great Saling and the northern part of Braintree.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N2: May provide an option for noise relief when combined with options to the south of the envelope. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



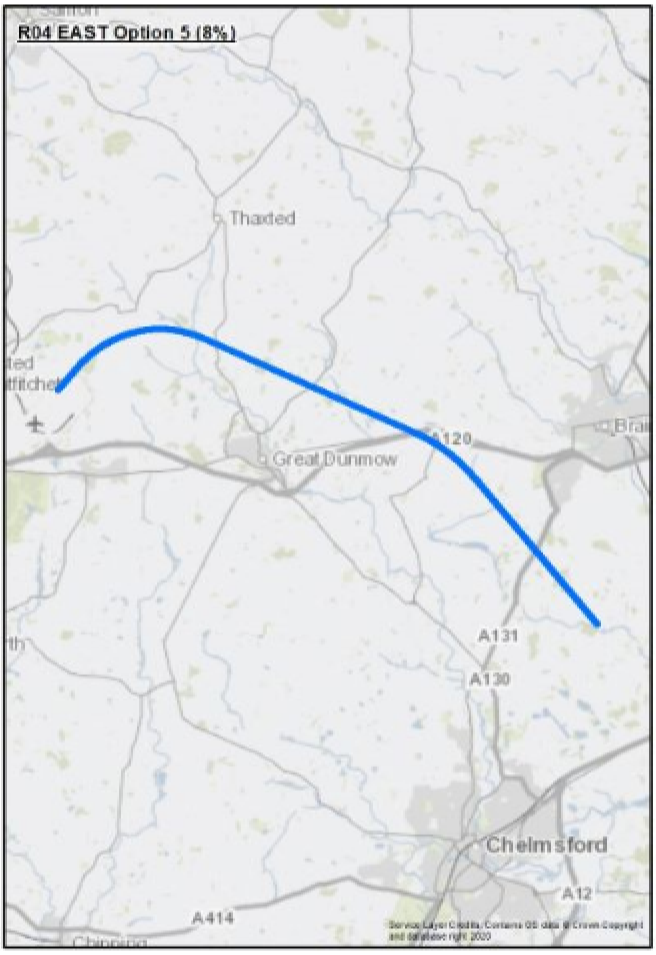
16.8 SID RWY 04 EAST Option 4 (8%)

Description	*Rationale for Inclusion*
*This option is an **RNAV1** route using fly-by waypoints at 8%.* *The first turn commences at the same point as other options but continues this turn to follow a track towards the extreme southern edge of the envelope to the south of Braintree.* *This route has been created to provide noise relief (when compared to the replicated route) for Braintree and Great Notley and may also offer the potential as a noise relief route when combined with options that route to the north of the design envelope.* *The track routes to the north of Great Dunmow, and avoids Braintree and Great Notley, but overflies Felsted and Great Leighs.*	Noise N1: Has potential to reduce noise impacts when compared to the replicated option by routing south of Great Notley and Braintree. Noise N2: May provide an option for noise relief when combined with options to the north of the envelope. RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



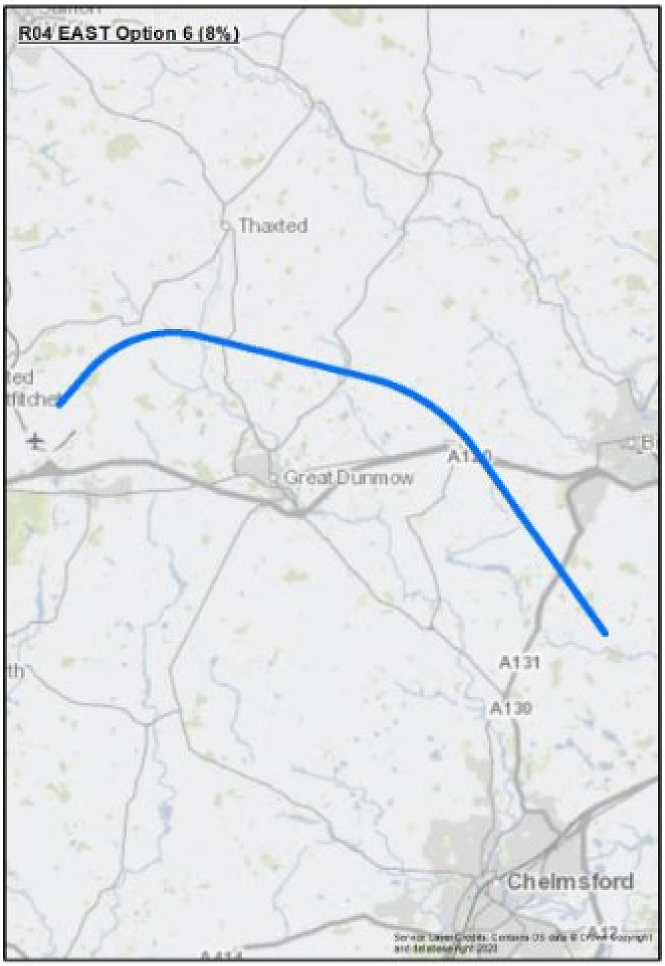
16.9 SID RWY 04 EAST Option 5 (8%)

Description	Rationale for Inclusion
*This option is designed utilising **RNP1** with RF turns at 8%.* *It follows the same initial turn and track as the current route but turns to the right when the track is abeam Great Leighs Racecourse.* *This takes it to the south of Great Notley and Braintree to route towards the southern edge of the design envelope.* *It has been designed following previous stakeholder feedback to seek ways to reduce noise in the area to the south and west of Braintree resulting from the increased traffic on the current CLN SID (following LAMP1A).* *This option is a viable RNP1 alternative utilising the latest technology. It aims to balance efficiency with avoiding overflight of sensitive areas.*	Noise N1: Has potential to reduce noise impacts when compared to the replicated route by routing south of Great Notley and Braintree. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



16.10 SID RWY 04 EAST Option 6 (8%)

Description	Rationale for Inclusion
*Option 6 is designed utilising **RNP1** with RF turns at 8%.* *It commences the turn in the same position as the current route but maintains an easterly track along the northern edge of the envelope until north of Stebbing. It then commences an RF turn to the right and routes to the south of the envelope which takes it to the south of Great Notley and Braintree.* *It has been designed following previous stakeholder feedback to seek ways to reduce noise in the area to the south and west of Braintree resulting from the increased traffic on the current CLN SID (following LAMP1A).*	Noise N1: Has potential to reduce noise impacts when compared to the replicated route Option 1 by routing north of Stebbing and south of Great Notley and Braintree. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



16.11 SID RWY 04 EAST - Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A7 Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make an approximate 300° left-hand turn, flying fully around the airport, and then begin heading east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B8 Right wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 450° right-hand turn, flying fully around the airport, and then begin heading east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the				

Demand DP.				
C9 Extended straight ahead then right	S	P	D	Viable but Poor Fit

After departure from RWY 04, aircraft would continue straight ahead for longer and then make a right-hand turn towards the east.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.

Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for impact on the subsequent departures from STN, limiting capacity and runway throughput. This would result in aircraft being held for departure for longer, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.

It must also be noted that part of this option ventures outside the existing design envelope.

17 SID RWY 04 NORTH-EAST

17.1 Introduction to SID RWY 04 NORTH-EAST Design Envelope

This is a new design envelope which aligns with the Policy and Demand DPs. As this is a new envelope there is no Replicated route. It has been created for traffic routing to the north-east and east from RWY 04.

All the options in this envelope have been developed with a 6% climb gradient. This aligns it with the Alternatives design principle by making it more viable for aircraft without the climb performance required to use the East (CLN) envelope which has an 8% climb gradient.

After departure, design options within this envelope turn right and head in an east north east direction and terminate to the west of Halstead. It has been designed for traffic exiting the UK to the north east via REDFA and SOMVA as an alternative to the current CLN departure route.

The aim is to reduce the noise for communities overflown by the CLN SID. The future operating concept for this envelope is that traffic could be shared between this and the 04 East (CLN) envelope in line with the Noise N2 design principle.

It also has the potential to respond to the design principles by:

- reducing fuel burn by shortening the miles flown to the UK airspace boundary when compared to the current CLN SID (Balance)
- relieving demand on the NATS network by providing an alternative to the current CLN SID which is often subject to flow restrictions due to demand from other airports in the London TMA (Demand and Efficiency).

17.2 Design Envelope Location Map

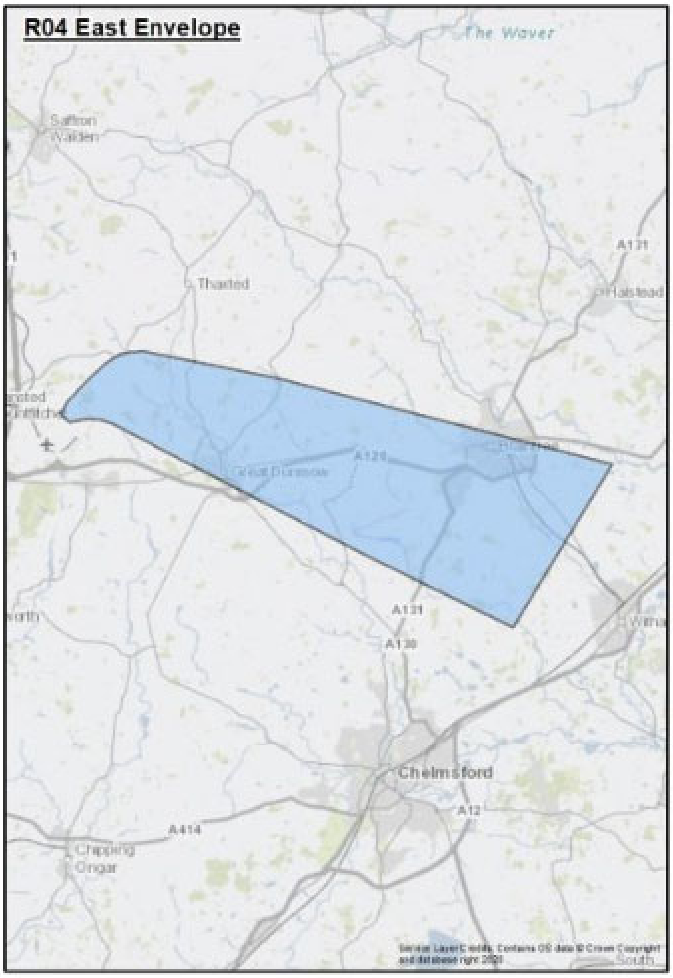


Figure 28 Runway 04 NORTH-EAST Envelope

17.3 SID RWY 04 NORTH-EAST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1	This option is an RNAV1 route at 6% that uses fly-by waypoints to follow a direct track towards the centre of the design envelope.	A5	Left 300° wraparound	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
4	This option is an RNAV1 route at 6% that utilises fly-by waypoints. This option also flies a direct track towards the centre of the envelope but features the earliest possible initial turn after departure.	B6	Right 400° wraparound		
7	This option is an RNAV1 route at 6% using fly-by waypoints. It features the same initial turn as option 1 and then routes along the northern edge of the design envelope.	C9	Extended straight ahead then right.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
8	This option is an RNAV1 route at 6% using fly-by waypoints. It features the same initial turn as option 1 and then routes slightly to the south to terminate towards the southern edge of the design envelope.	D8			

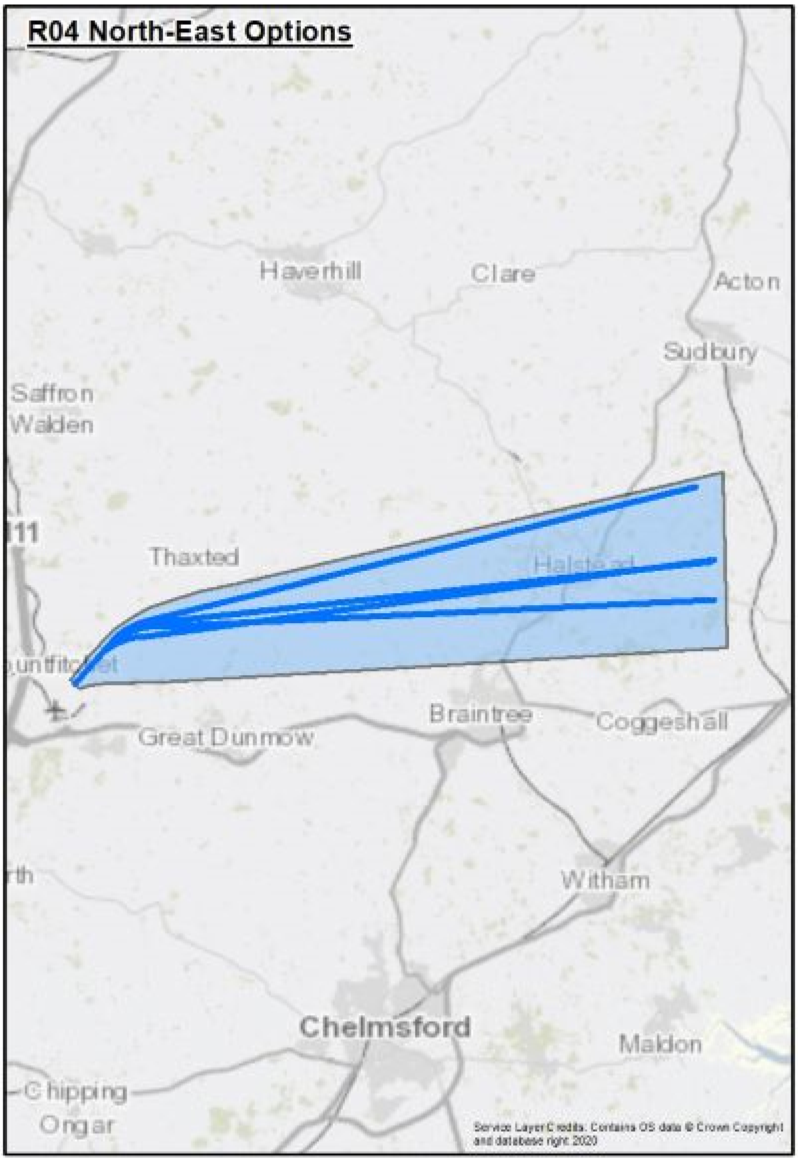
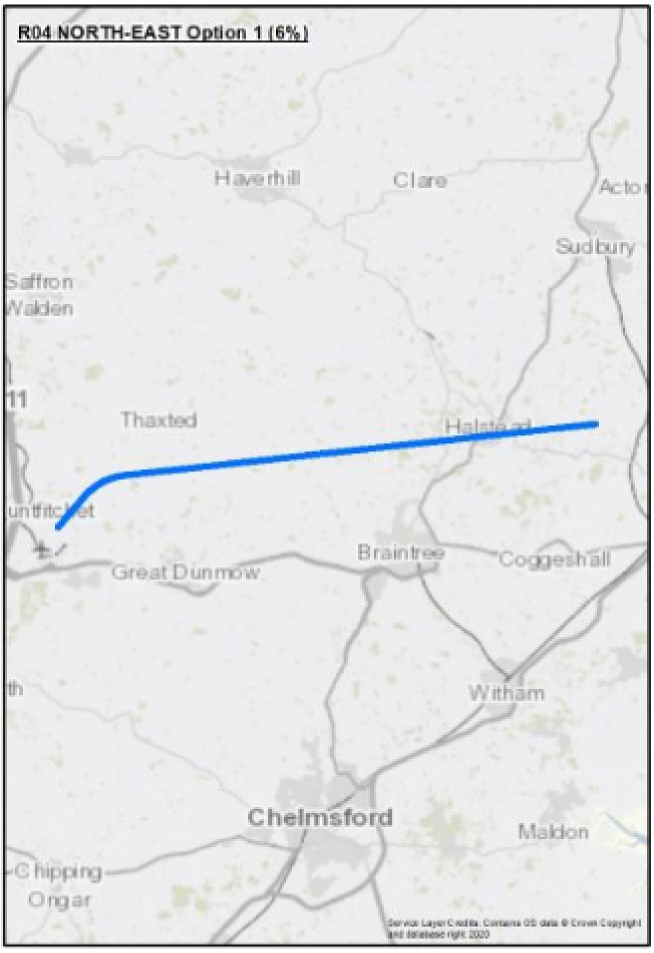


Figure 29 Runway 04 NORTH-EAST Envelope and Options

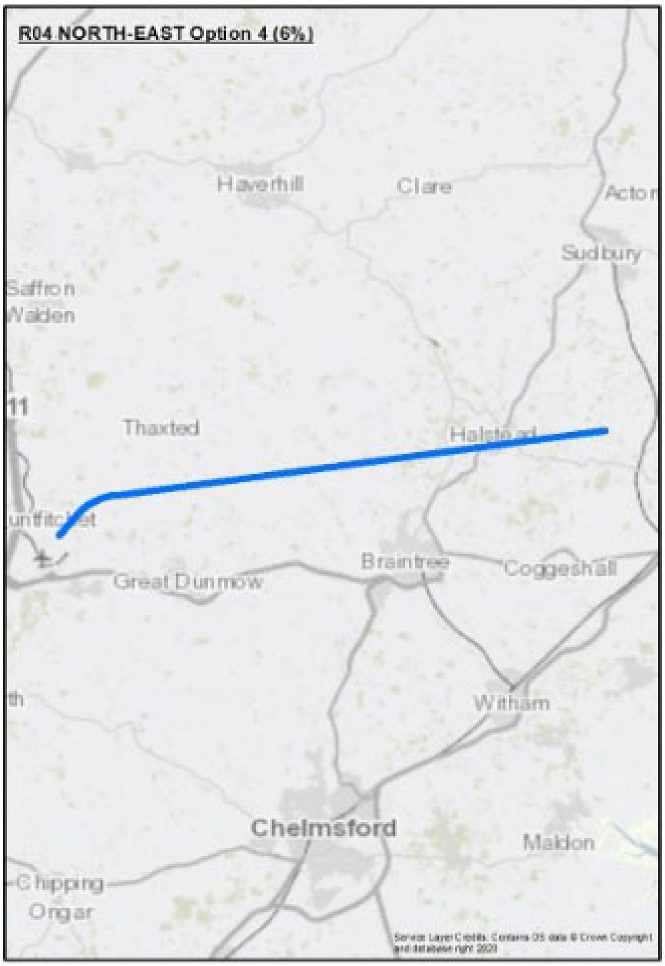
17.4 SID RWY 04 NORTH-EAST Option 1 (6%)

Description	*Rationale for Inclusion*
This option is an RNAV1 route at 6% that uses fly-by waypoints to follow a direct track towards the centre of the design envelope. *The initial turn after departure avoids Thaxted by routing to the south and then continues on a track to the centre of the design envelope passing overhead Halstead. This offers a direct track to leave UK airspace at REDFA.*	Balance: Direct (fuel efficient) routing to exit UK airspace. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



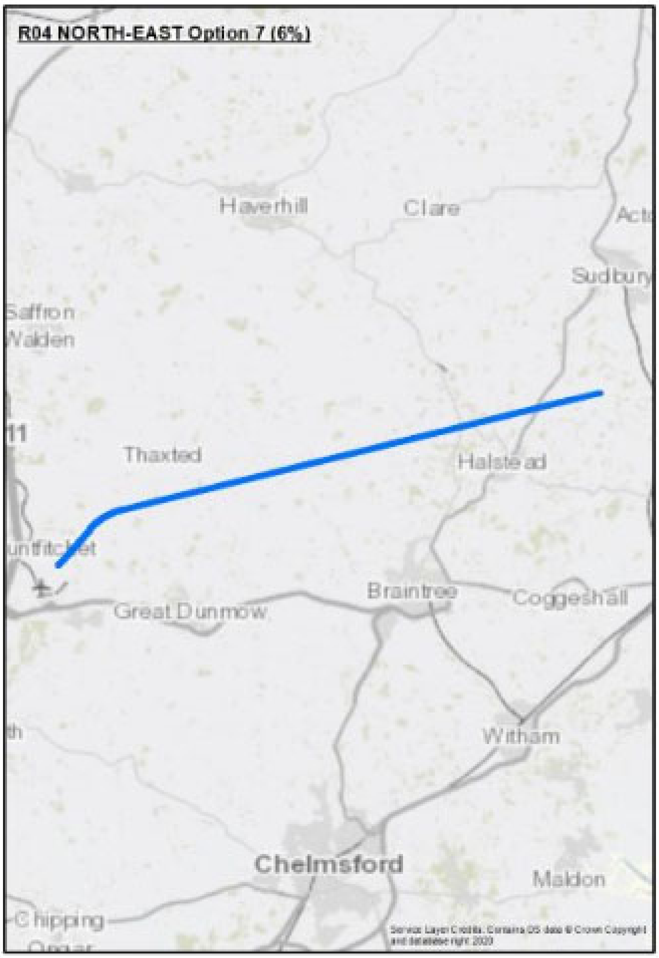
17.5 SID RWY 04 NORTH-EAST Option 4 (6%)

Description	Rationale for Inclusion
*This option is an **RNAV1** route at 6% that utilises fly-by waypoints.* *This option also flies a direct track towards the centre point of the design envelope but features the earliest possible turn after departure. This has been provided to improve runway utilisation/reduce delays to subsequent departures on other routes.* *The initial turn after departure avoids Thaxted by routing to the south and then continues on a track to the centre of the design envelope passing overhead Halstead.*	Demand: Has potential to reduce delays for following departures. Balance: Direct (fuel efficient) routing to exit UK airspace. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



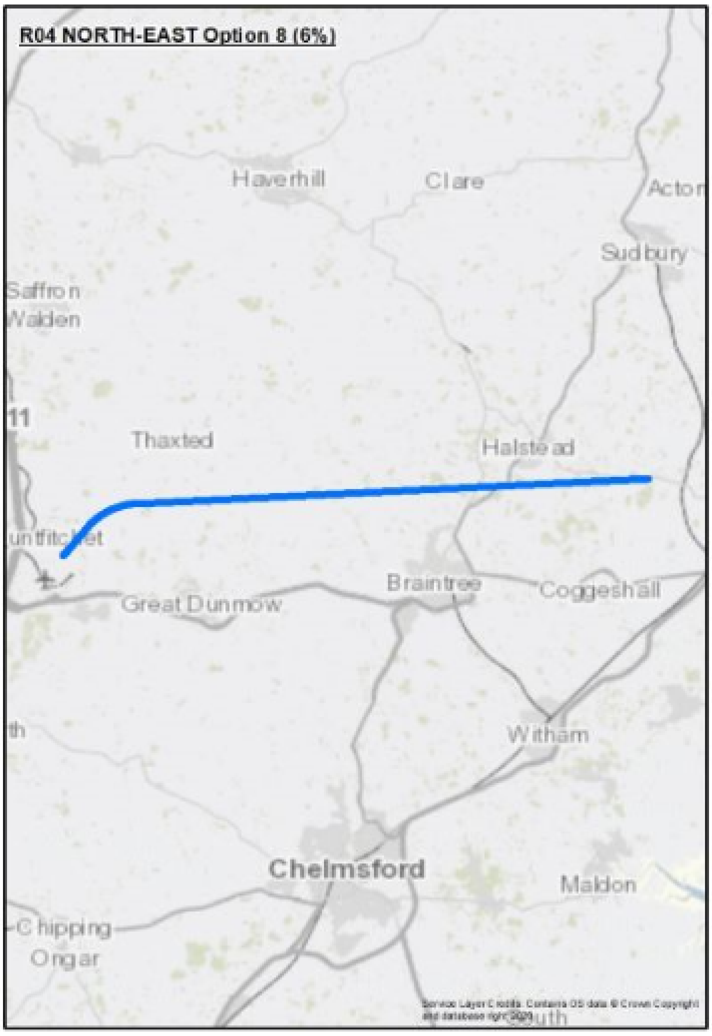
17.6 SID RWY 04 NORTH-EAST Option 7 (6%)

Description	Rationale for Inclusion
*This option is an **RNAV1** route at 6% using fly-by waypoints.* *It features the same initial turn as option 1 and then routes along the northern edge of the design envelope.* *The initial turn avoids Thaxted and this option has been designed to route to avoid the direct overflight of Halstead by routing to the north of the town.*	Noise N1: Has potential for lower noise impact by avoiding the overflight of Halstead. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



17.7 SID RWY 04 NORTH-EAST Option 8 (6%)

Description	Rationale for Inclusion
*This option is an **RNAV1** route at 6% using fly-by waypoints.* *It features the same initial turn as option 1 and then routes slightly to the south to terminate towards the southern edge of the design envelope.* *The initial turn avoids Thaxted and this option has been designed to route to avoid the direct overflight of Halstead by routing to the south of the town.*	Noise N1: Has potential for lower noise impact by avoiding the overflight of Halstead. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



17.8 SID RWY 04 NORTH-EAST - Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A5 Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make an approximately 300° left-hand turn, fly fully around the airport, and then begin heading north east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B6 Right wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make an approximately 400° right-hand turn, flying fully around the airport, and then begin heading north east. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the				

Demand DP.				
C9 Extended straight ahead then right	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would continue straight ahead for longer and then make a right-hand turn towards the north east. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. It is also acknowledged that there may be some interaction with the adjacent East Anglia Military Training Area and arrivals to Luton, but at this stage this interaction is unclear.				

18 SID RWY 04 NORTH

18.1 Introduction to SID RWY 04 NORTH Design Envelope

This envelope has been created for traffic routing to the north from RWY 22. The envelope is based around the current BKY2S SID which is currently used infrequently for flights to the north that are leaving controlled airspace. This is mainly due to the presence of military airspace to the north and lack of network connectivity to the north of BKY

However, to create a comprehensive list of options, this route is being considered as a northbound envelope for STN, subject to the creation of network interfaces. If this is not possible, this design envelope may be re-classified as Viable but Poor fit.

The climb gradient for all routes within this envelope is 8% which is steeper than the existing SID.

18.2 Design Envelope Location Map

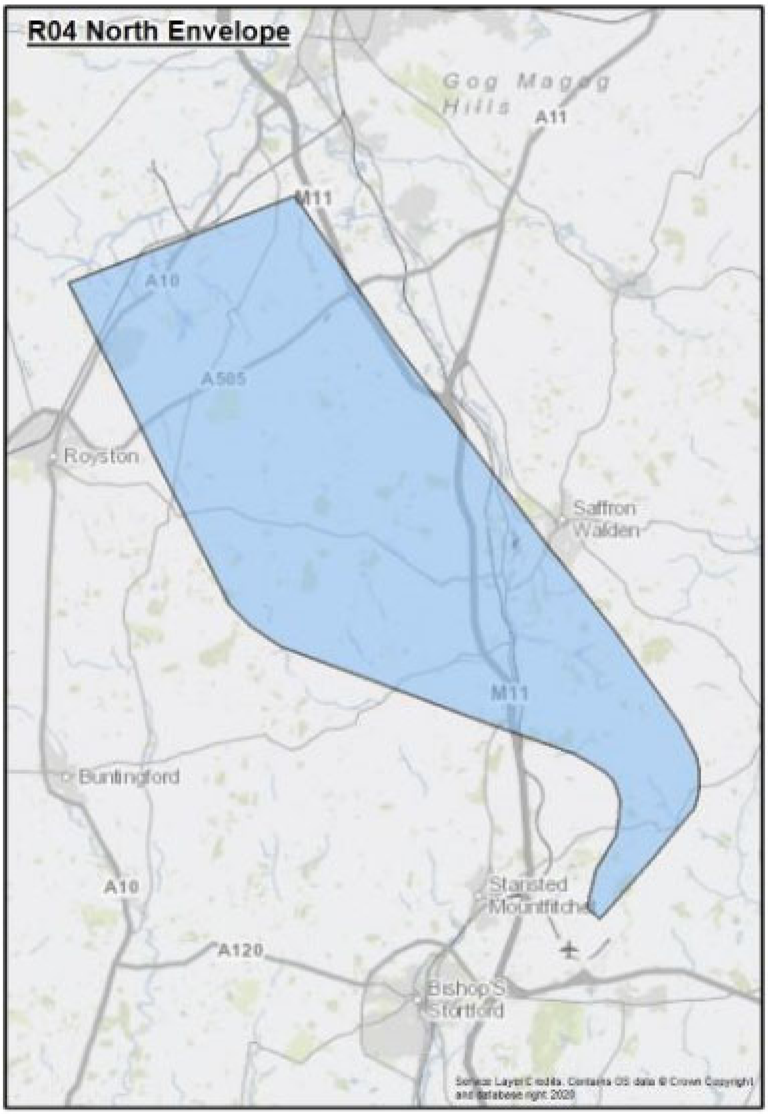


Figure 30 Runway 04 NORTH Envelope

18.3 SID RWY 04 NORTH Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
0	This option is an **RNAV1** route at 6% that uses fly-by waypoints to create a PBN **replication** of the existing BKY2S SID.	A8	Left 450° wraparound	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
1	This option is an **RNAV1** route at 8% that uses fly-by waypoints to create a PBN **replication** of the existing BKY2S SID.	B9	Right 270° wraparound		
2	This option is included to provide a PBN **replication** of the existing BKY2S SID but as an **RNP1** option utilising RF turns at a climb gradient of 8%.	C10	Extended straight ahead then left		
3	This option is an **RNAV1** option at 8% using fly-by waypoints. It has the same first turn as the replicated option but takes a more direct route (that eliminates the double turn of the replicated routes) towards the centre of the	D11	Follow the M11 north		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	design envelope.				
4	This option is an RNP1 route using RF turns at 8%. It has the earliest PANS-OPS compliant turn after departure and then routes towards the centre of the design envelope.				
5	This is a RNP1 route using RF turns at 8%. It has the earliest possible initial turn after departure and aligns closely to the replicated option to route towards the west side of the design envelope				
6	This option is an RNP1 route using RF turns at 8%. It replicates the first turn after departure but then heads along the eastern edge of the design envelope.				
7	This option is an RNP1 route using RF turns at 8%. It replicates the first turn after departure but then makes a second turn to the north west to route through the centre of the design envelope.				

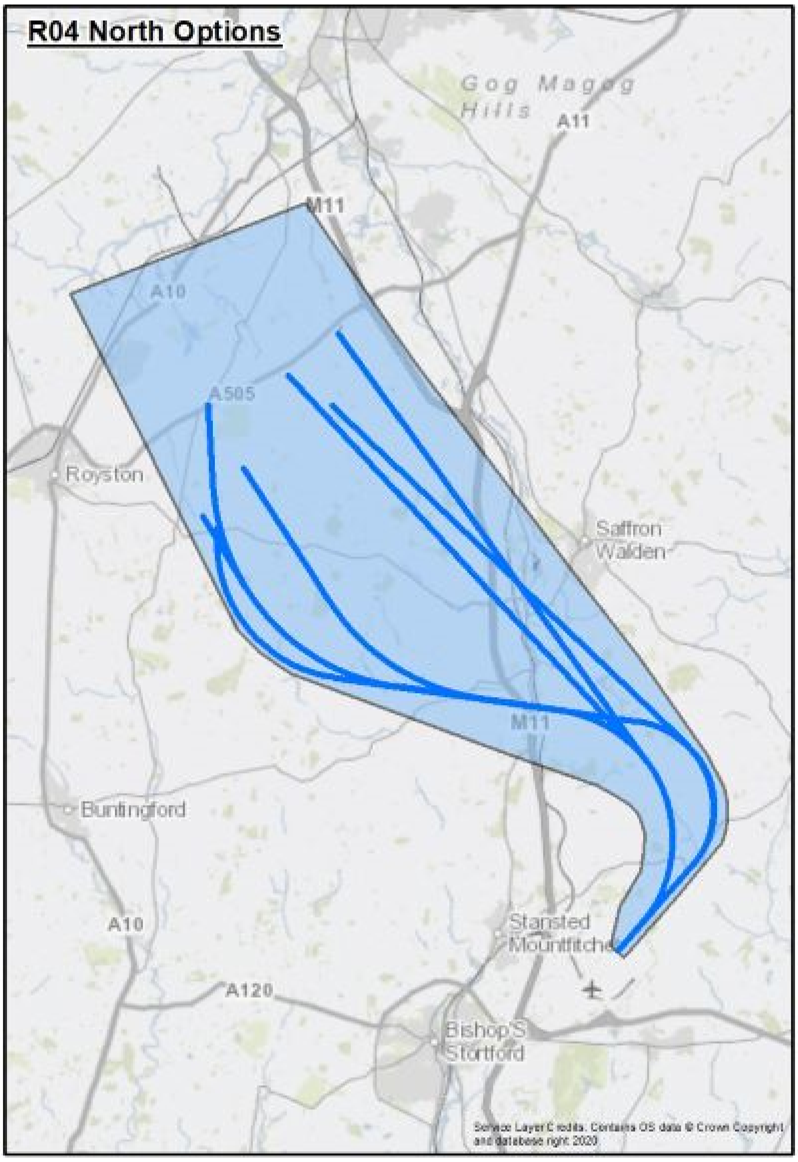
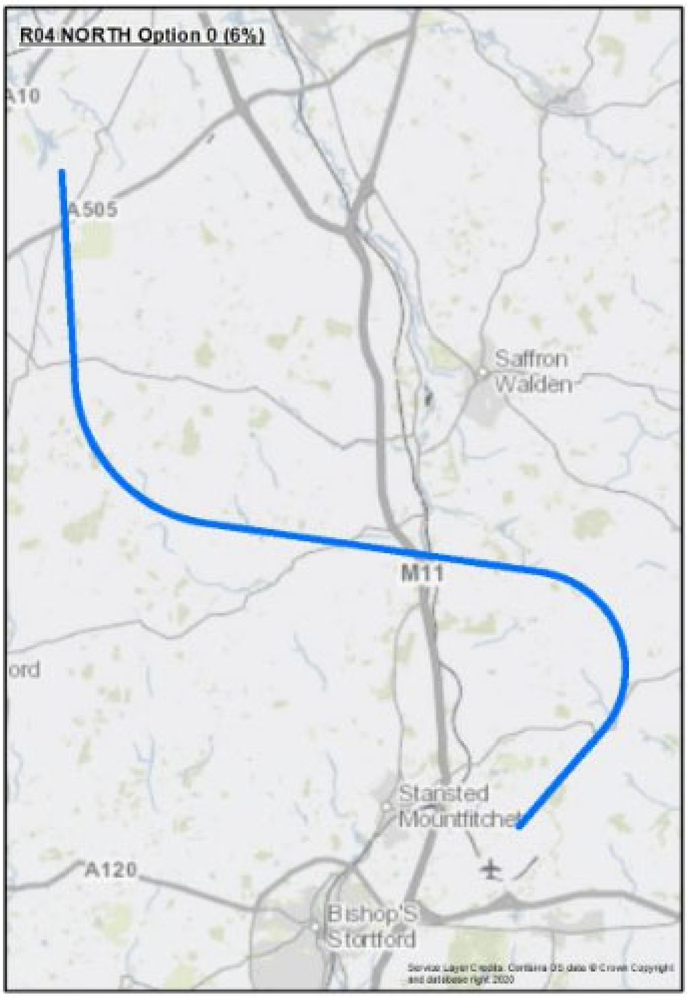


Figure 31 Runway 04 NORTH Envelope and Options

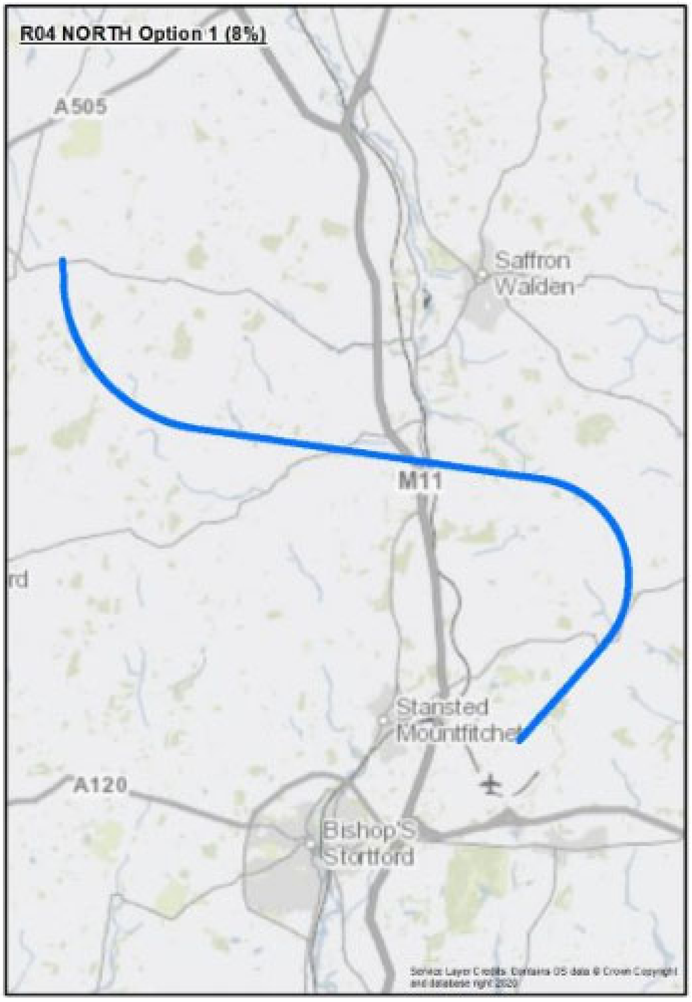
18.4 SID RWY 04 NORTH Option 0 (6%)

Description	Rationale for Inclusion
*Option 0 is an **RNAV1** departure that uses fly-by waypoints to create a PBN **replication** of the existing conventional BKY2S SID.* *This route is laterally similar to the existing SID, but with a climb gradient of 6%. The existing published SID has a climb gradient of 3.3%, but all other options within this envelop have been designed with a climb gradient of 8%.* *After departure the initial turn is to the north west with a second turn to the north to route to the centre of the design envelope.*	Replication: Aligns to a 'do minimum' option that provides a climb gradient to the LTMA minimum. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



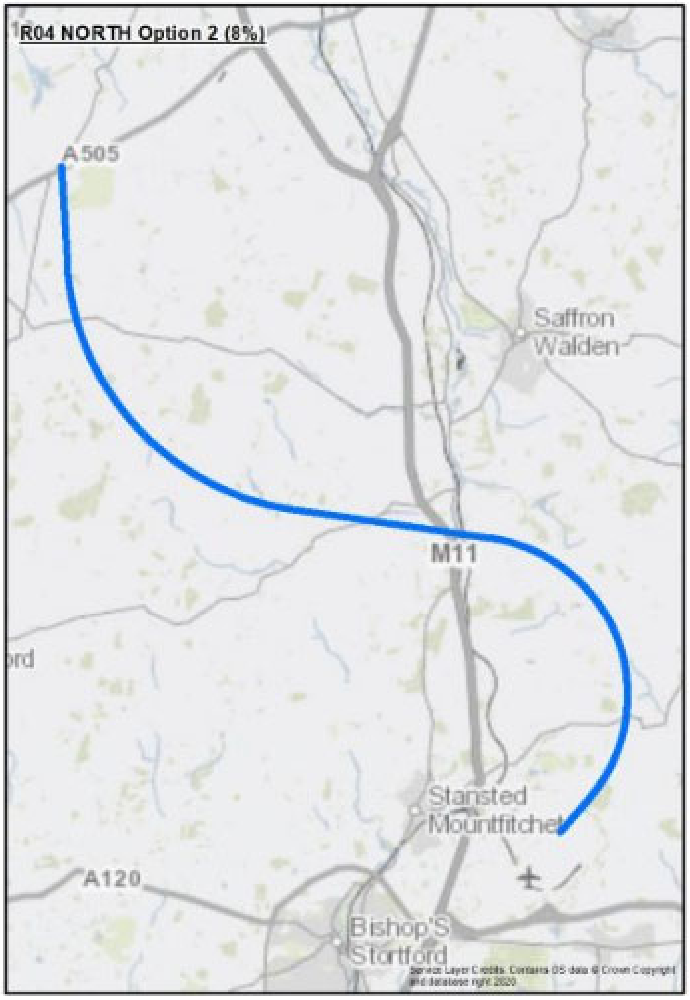
18.5 SID RWY 04 NORTH Option 1 (8%)

Description	Rationale for Inclusion
*Option 1 is an **RNAV1** departure that uses fly-by waypoints to create a PBN **replication** of the existing conventional BKY2S SID.* *This route is laterally similar to the existing SID, but with an increased climb gradient (8%) in line with other options in this envelope.* *After departure the initial turn is to the north west with a second turn to the north to route to the centre of the design envelope.*	Replication: Aligns to a replication of what is currently flown with a steeper climb gradient. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



18.6 SID RWY 04 NORTH Option 2 (8%)

Description	Rationale for Inclusion
This option is included to provide a PBN ***replication*** *of the existing BKY2S SID but as an* ***RNP1*** *option utilising RF turns at a climb gradient of 8%.* *After departure the initial turn is to the north west with a second turn to the north to route to the centre of the design envelope.* *Because of the PANS-OPS criteria for this type of procedure, this option has an earlier first turn than the current conventional SID and for the second turn, the use of RF also results in a slightly different track across the ground.*	Aligns to a replication of what is currently flown with a steeper climb gradient. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.

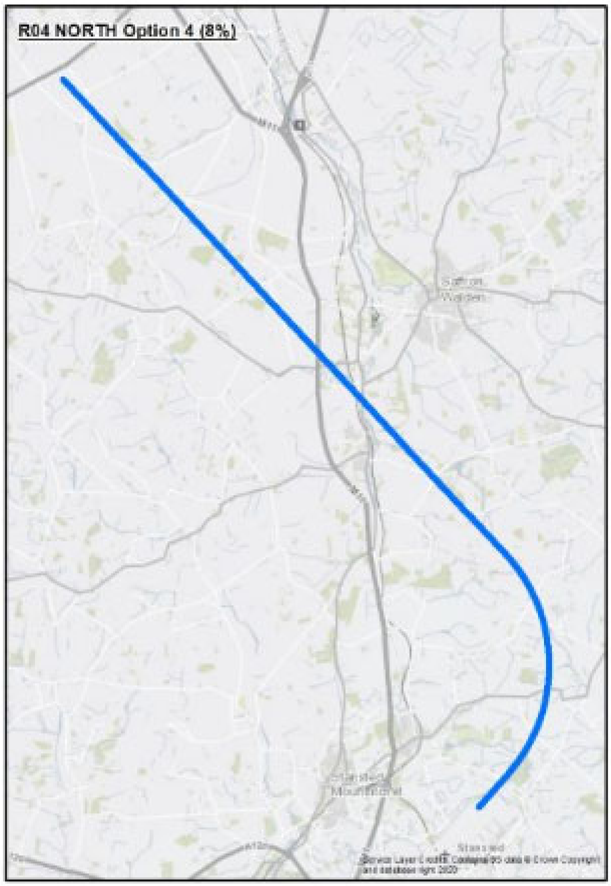


18.7 SID RWY 04 NORTH Option 3 (8%)

Description	Rationale for Inclusion
*This option is an **RNAV1** option at 8% using fly-by waypoints.* *It has the same first turn as the replicated option but takes a more direct route (that eliminates the double turn of the replicated routes) towards the centre of the design envelope.* *After the initial left turn north, this option routes to the north west to avoid major towns including Saffron Walden and terminates at 7,000ft to the west of Duxford.* *This option has been developed to offer a more fuel-efficient route when compared to the replicated option, whilst also avoiding major towns. The position may also create the potential for noise relief if used with options to the west of the envelope.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by routing through the sparsely populated areas to the west of Saffron Walden. Noise N2: May provide an option for noise relief when combined with options to the west of the envelope. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.

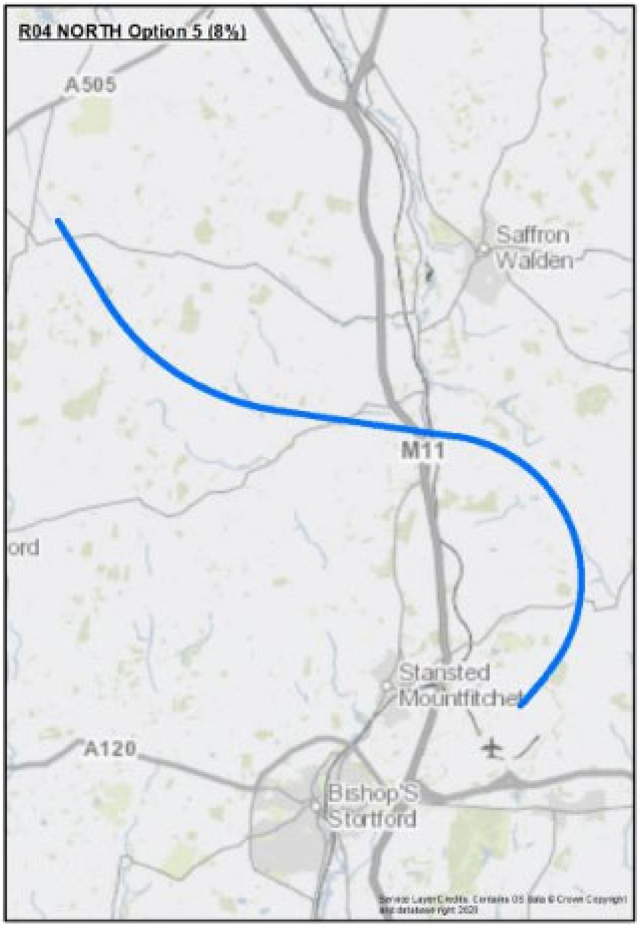
18.8 SID RWY 04 NORTH Option 4 (8%)

Description	Rationale for Inclusion
*This option is an **RNP1** route using RF turns at 8%.* *It has the earliest possible initial turn after departure and then routes towards the centre of the design envelope.* *After the first turn to the north, it takes up a direct route in a north westerly direction to avoid major towns including Saffron Walden and routes towards the centre of the envelope.* *The earlier turn means that this option provides a more fuel-efficient route when compared to the replicated option and may improve runway utilisation/reduce delays to subsequent departures on other routes.* *The route also avoids major towns to the west of Saffron Walden.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by routing through the sparsely populated areas to the west of Saffron Walden. Demand: Has potential to reduce delays for following departures. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



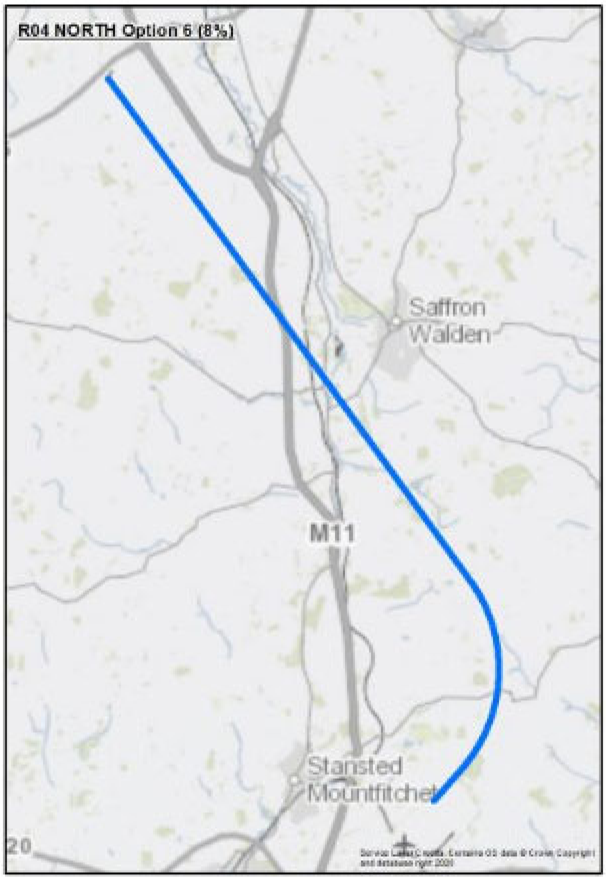
18.9 SID RWY 04 NORTH Option 5 (8%)

Description	Rationale for Inclusion
*This is a **RNP1** route using RF turns at 8%.* *It has the earliest possible initial turn after departure and aligns closely to the replicated option to route towards the west side of the design envelope* *A second turn is made at Langley Upper Green where it follows a track consistent with the western boundary edge of the.* *It has been designed as a possible noise relief route when combined with options on the east of the design envelope (Options 3,4 and 6). In addition, the earlier turn may improve runway utilisation/reduce delays to subsequent departures on other routes.*	Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground. Demand: Has potential to reduce delays for following departures. Noise N2: May provide an option for noise relief when combined with options 3, 4 and 6 to the east of the envelope.



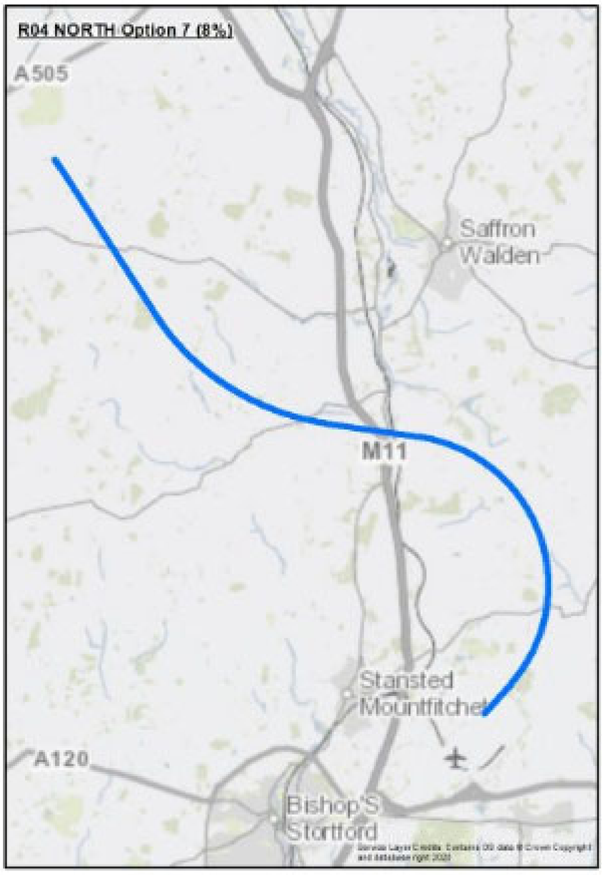
18.10 SID RWY 04 NORTH Option 6 (8%)

Description	Rationale for Inclusion
This option is an ***RNP1*** *route using RF turns at 8%.* *It has the earliest PANS-OPS compliant turn after departure and then heads along the eastern edge of the design envelope.* *This option has been created to avoid major towns including Saffron Walden and terminates at 7,000ft in the vicinity of Duxford. In addition, the earlier turn may improve runway utilisation/reduce delays to subsequent departures on other routes.* *It may also be considered as a possible noise relief route when combined with options on the east of the design envelope.*	Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by routing through the sparsely populated areas to the west of Saffron Walden. Noise N2: May provide an option for noise relief when combined with options to the west of the envelope. Demand: Has potential to reduce delays for following departures. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



18.11 SID RWY 04 NORTH Option 7 (8%)

Description	*Rationale for Inclusion*
This option is an ***RNP1*** *route using RF turns at 8%.* *It replicates the first turn after departure but then makes a second turn to the north west to route through the centre of the design envelope and terminates to the SE of Melbourn.* *It has been designed to avoid Audley End (English Heritage site) and Saffron Walden and was developed considering stakeholder feedback regarding the new housing development proposed at Melbourn.*	Noise N1: Has potential to reduce noise impacts by routing through the sparsely populated areas to the west of Saffron Walden. Noise N3: Avoids the English Heritage site at Audley End. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground. 8% climb gradient improves efficiency and is deemed to be flyable by most aircraft operating from STN.



18.12 SID RWY 04 NORTH – Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A8 Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a left-hand turn, fly 450° around the airport, and then begin heading north. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B9 Right wraparound.	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 270° right-hand turn, fly around the airport, and then begin heading north. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				

C10 Extended straight ahead then left	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would continue straight ahead for longer and then make a left-hand turn before making another left-hand turn towards the north west and the north. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. It must also be noted that part of this option ventures outside the existing design envelope.				
D11 Follow the M11 to the north	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would continue straight ahead for longer and then seek to intercept the lateral path of the M11 motorway and use this as a feature to guide the track to 7,000ft. This option was highlighted as part of stakeholder feedback in engagement as a means to reduce noise to the north. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. Analysis of this option showed that following the M11 precisely would be impractical and not in line with PANS-OPS when the rules regarding the Minimum Stabilization Distance (MSD) are applied. As a result this option would not comply with the Safety DP. Alternative options have been created that seek to minimise noise impact in this area.				

19 SID RWY 04 WEST

19.1 Introduction to SID RWY 04 WEST Design Envelopes

This envelope was originally designed as a single envelope to cater for traffic routing to the south and west from RWY 04. The original envelope was based around both the current UTAVA and NUGBO SIDs, and after departure, design options within this envelope turned right to terminate at 7,000ft.

However, although these two SIDs currently route on the same initial track, they diverge after 7,000ft. The UTAVA is used for traffic to the west and north west, and the NUGBO for traffic to the south west. For this reason it was decided to separate the two SID replications after the first round of stakeholder engagement, and provide alternative routes, but to delineate each of the envelopes to show more clearly which SID the design options aim to replicate.

Therefore, there are two envelopes: SID RWY 04 WEST A (based on UTAVA), and SID RWY 04 WEST B (based on NUGBO). Each route option is annotated A or B accordingly. There is some overlap between the two envelopes, which reduces the separation on some options.

19.2 Design Envelope Location Maps.

19.2.1 SID RWY 04 West A Envelope

This envelope is based around the existing UTAVA SID, although the direction of 04 WEST A has been moved slightly to the north of UTAVA and orientated to the north west to align it with the UK route structure after 7,000ft. This is aimed to reduce fuel burn in accordance with the Balance Design Principle.

The initial track closely mimics the 04 West B envelope/NUGBO SID and for ATC separation purposes, the SIDS do not offer any divergence at any point.

In accordance with the Alternatives design principle this envelope has been designed at a climb gradient of 6%. This is flyable by all aircraft flying into STN and this envelope therefore provides an alternative to those aircraft unable to achieve the steeper 8% climb gradient.

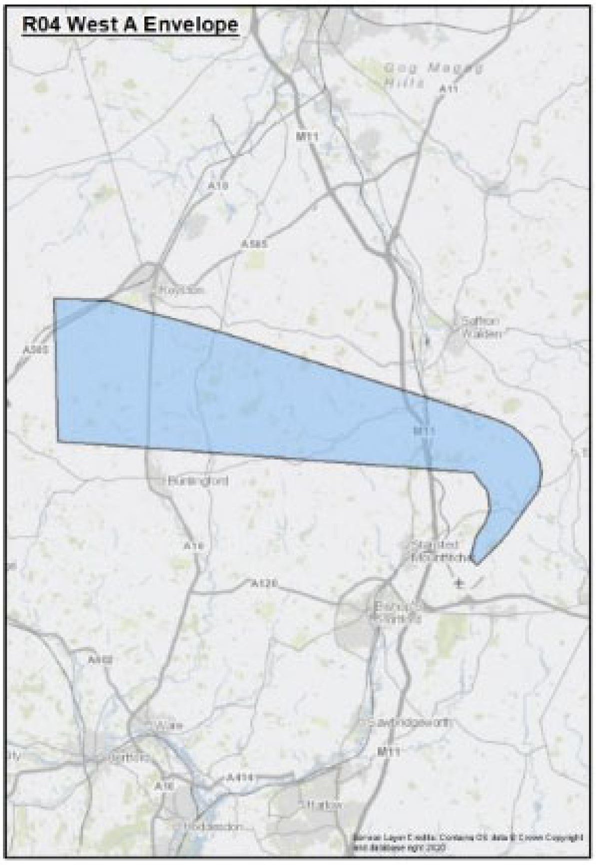


Figure 32 Runway 04 WEST A Envelope

19.2.2 SID RWY 04 WEST B Envelope

This envelope is based around the existing NUGBO SID. The initial track closely mimics the 04 West A envelope/UTAVA SID and for ATC separation purposes, the SIDS do not offer any divergence at any point.

In accordance with the Alternatives design principle this envelope has been designed at a climb gradient of 6%. This is flyable by all aircraft flying into STN and this envelope therefore provides an alternative to those aircraft unable to achieve the steeper 8% climb gradient.

As with the 22 WEST B envelope, the current SID is designed to route north and west initially before turning south due to interactions with departing traffic from Luton and Heathrow. The route taken (and the sharing of the initial track with the current UTAVA SID) results in noise concentration, delays to departures and additional fuel burn when compared to a more direct route.

As detailed in para 5.8, we have placed a design constraint to the south of Stevenage. Our bilateral discussions with Luton concluded that routes to and from Luton are likely to continue to operate in this area and this has dictated the shape of the design envelope and design options. However, as the process develops and further bilateral discussions take place between STN, LTN and NATS we will continue to keep this under review with a view to reducing this constraint. This is in line with the Balance design principle to reduce fuel burn and CO_2 emissions.

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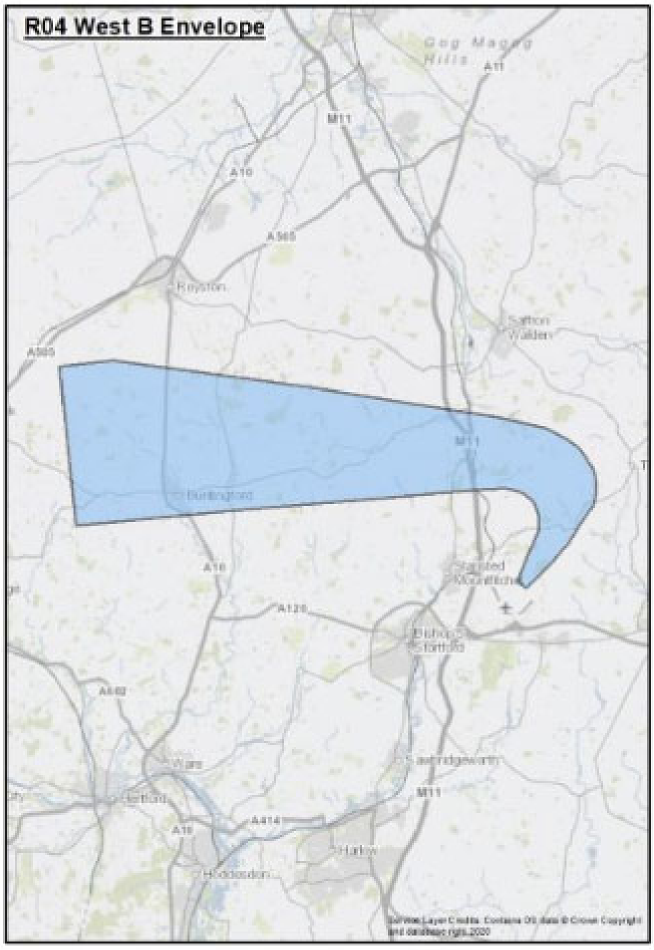


Figure 33 Runway 04 WEST B Envelope

19.3 SID RWY 04 WEST Options Summary Table

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1A UTAVA	This option is an **RNAV1** route at 6% that uses fly by waypoints to create an **replication** of the existing conventional SID to UTAVA.	A11	West A Left wraparound 450°	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distance (MSD) • Position of the first turn in relation to departure end of runway (DER) • Turn radius based on speed, altitude and climb gradient • Procedure Design Gradient (PDG). These options have not been designed and are not described further within this comprehensive list of design options.
2B NUGBO	This option is an **RNAV1** route at 6% that uses fly by waypoints to create an **replication** of the existing conventional SID to NUGBO. .	B12	West A Right wraparound 270°		
3A UTAVA	This option is an RNP1 with RF turns at 6% route to create an **replication** of the existing conventional SID to UTAVA.	C13	West A Extended straight ahead then left.		
4B NUGBO	This option is an RNP1 using RF route at 6% to create a **replication** of the existing conventional SID to NUGBO.	D14	West B Left wraparound 450°		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
5A UTAVA	This option is an **RNP1** using RF turns at 6% route to create a more direct route towards UTAVA. It tracks towards the southern edge of the design envelope to reduce the track miles flown.	E15	West B Right wraparound 270°		
6B NUGBO	This option is an **RNP1** using RF turns at 6%. It has the earliest possible turn after departure and a more direct route through the centre of the envelope towards NUGBO.	F16	West B Extended straight ahead then left.		
7A UTAVA	This option is an **RNAV1** route at 6% that uses fly-by waypoints. It takes a wider turn and routes to the north of the envelope to reduce possible interaction with Luton traffic and places aircraft in a NW direction at the north edge of the design envelope.	-			
8B NUGBO	This is an RNP1 option using RF at 6% It has the earliest possible turn after departure and then routes to the south of the design envelope.				
9A UTAVA	This is an **RNP1** option using RF at 6%. It takes a wider turn and routes to the north of the envelope to reduce possible interaction with Luton traffic and places aircraft in a NW direction at the north edge				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	of the design envelope.				
10A UTAVA	This is an RNP1 option at 6% using RF turns. After the initial turn it follows a west-north westerly track to the centre of the design envelope.				

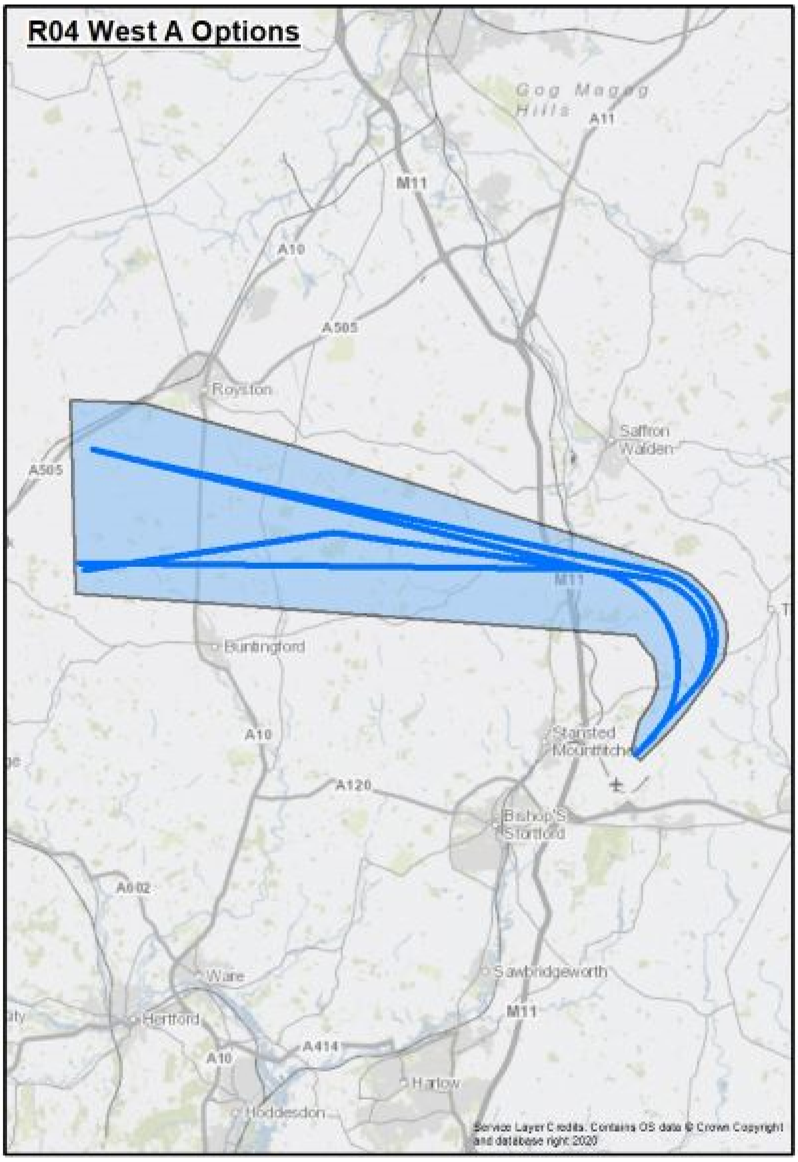


Figure 34 Runway 04 WEST A Envelope and Options

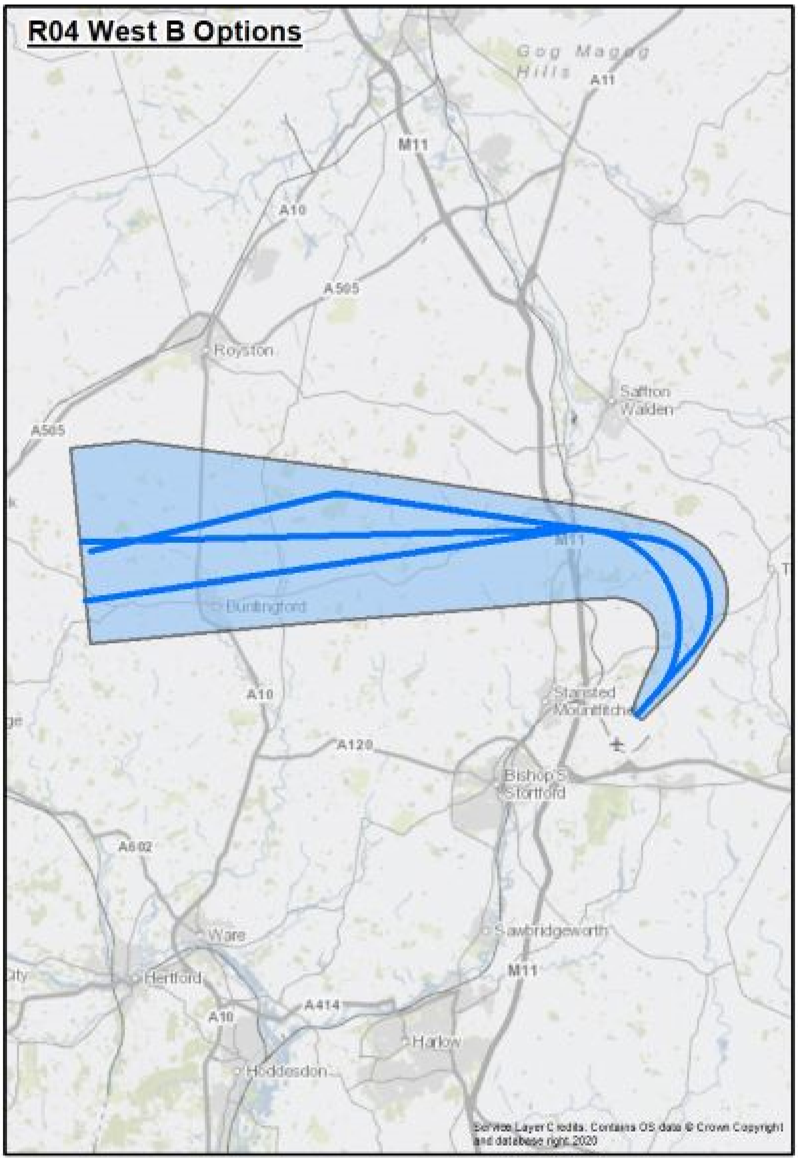
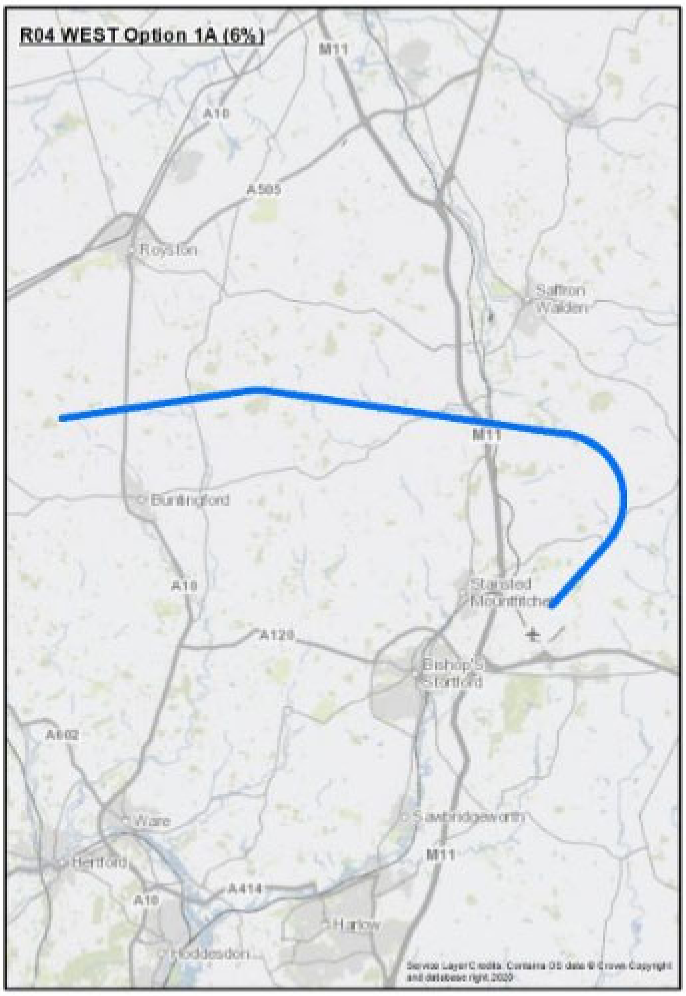


Figure 35 Runway 04 WEST B Envelope and Options

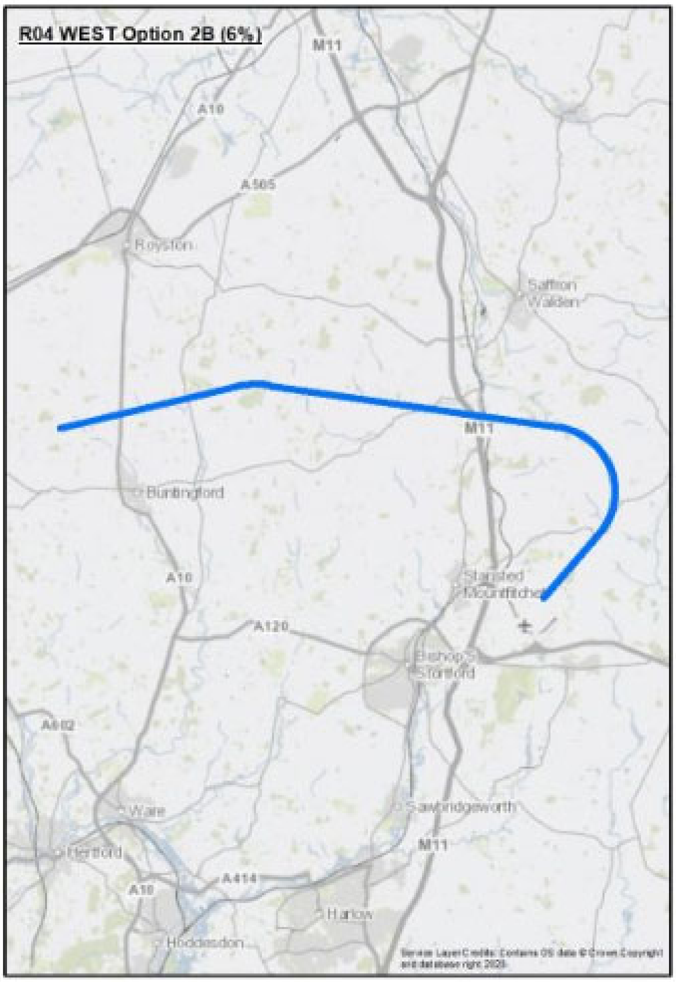
19.4 SID RWY 04 WEST Option 1A (6%)

Description	*Rationale for inclusion*
*This option is an **RNAV1** route at 6% that uses fly by waypoints to create an **replication** of the existing conventional SID to UTAVA* *As a replicated route it follows a similar track over the ground as the current published route and connects to the NATS network at the existing UTAVA fix. However, this places it to the extreme south of the envelope on a heading that does not align with the en-route structure, which routes to the NW.*	Replication: Aligns to a 'do minimum' option. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



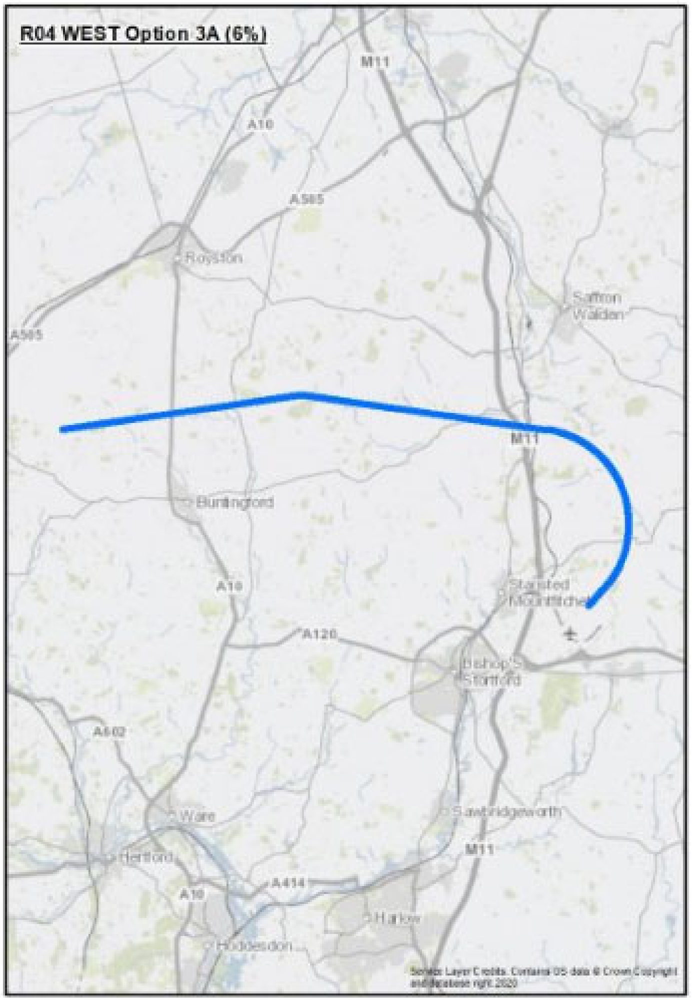
19.5 SID RWY 04 WEST Option 2B (6%)

Description	*Rationale for inclusion*
*This option is an **RNAV1** route at 6% that uses fly by waypoints to create a replication of the existing conventional SID to NUGBO* *As a replicated route it follows a similar track over the ground as current route and connects to the NATS network at the existing NUGBO fix. After departure the route has a left turn with a track along the north edge of the envelope, before turning left and terminating at 7,000ft in the centre of the envelope.* *Because it does not route on a direct track to NUGBO after the first turn it does optimise the track miles flown. Furthermore, this route is used by aircraft flying to southern European destinations and the requirement to head north before being able to turn southbound requires additional route miles to be flown that are not fuel efficient.*	Replication: Aligns to a 'do minimum' option. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



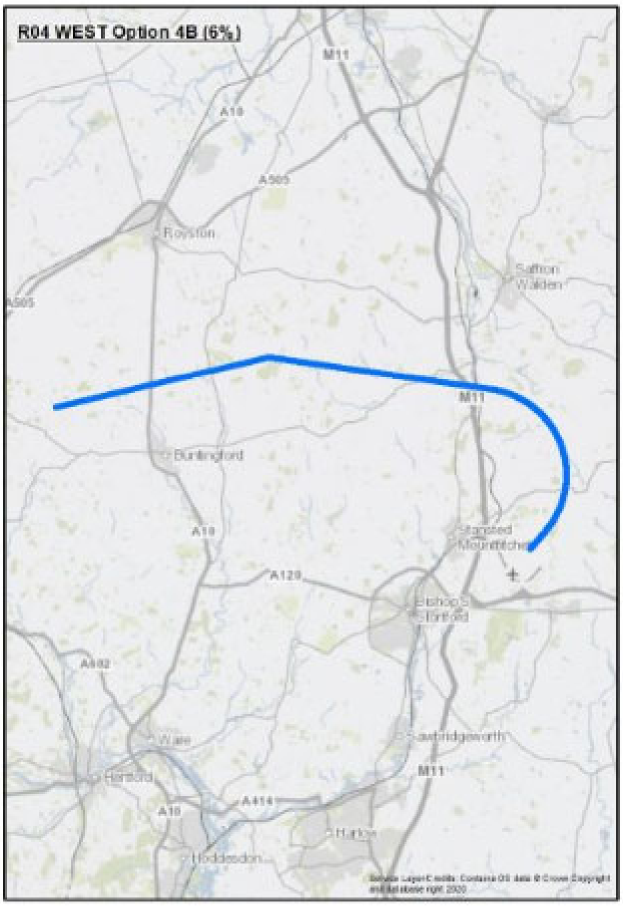
19.6 SID RWY 04 WEST Option 3A (6%)

Description	Rationale for inclusion
*This option is an **RNP1** with RF turns at 6% route to create a replication of the existing conventional SID to UTAVA.* *As a replicated route it follows a similar track over the ground as current conventional route and connects to the NATS network at the existing UTAVA fix.* *The main difference to the current procedure is that the initial turn after departure is slightly west of the current conventional route (i.e. slightly earlier). This is due to the PANS-OPS rules for an RF turn.* *The route connects to the NATS network at the existing UTAVA fix. However, this places it to the extreme south of the envelope on a heading that does not align with the en-route structure, which routes to the NW.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



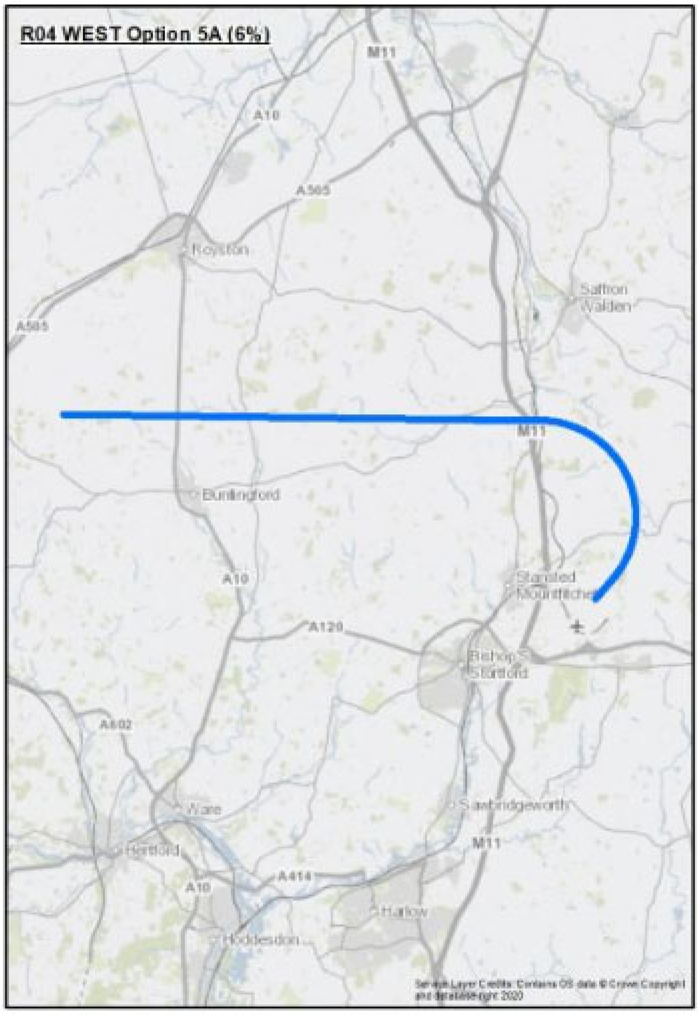
19.7 SID RWY 04 WEST Option 4B (6%)

Description	*Rationale for inclusion*
This option is an RNP1 using RF route at 6% to create a ***replication*** *of the existing conventional SID to NUGBO.* *It follows a similar track over the ground as the current conventional route and connects to the NATS network at the existing NUGBO fix. The main difference to the current procedure is that the initial turn after departure is slightly west of the current conventional route (i.e. slightly earlier). This is due to the PANS-OPS rules for an RF turn.* *After departure the route has a left turn with a track along the north edge of the envelope, before turning left and terminating at 7,000ft in the centre of the envelope.* *The route connects to the current NUGBO fix but because it does not route on a direct track to NUGBO after the first turn it does not maximise fuel efficiency. Furthermore, this route is used by aircraft flying to southern European destinations and the requirement to head north before being able to turn southbound requires additional route miles to be flown that are not fuel efficient.*	Replication: Minimum change but using more accurate design standard. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



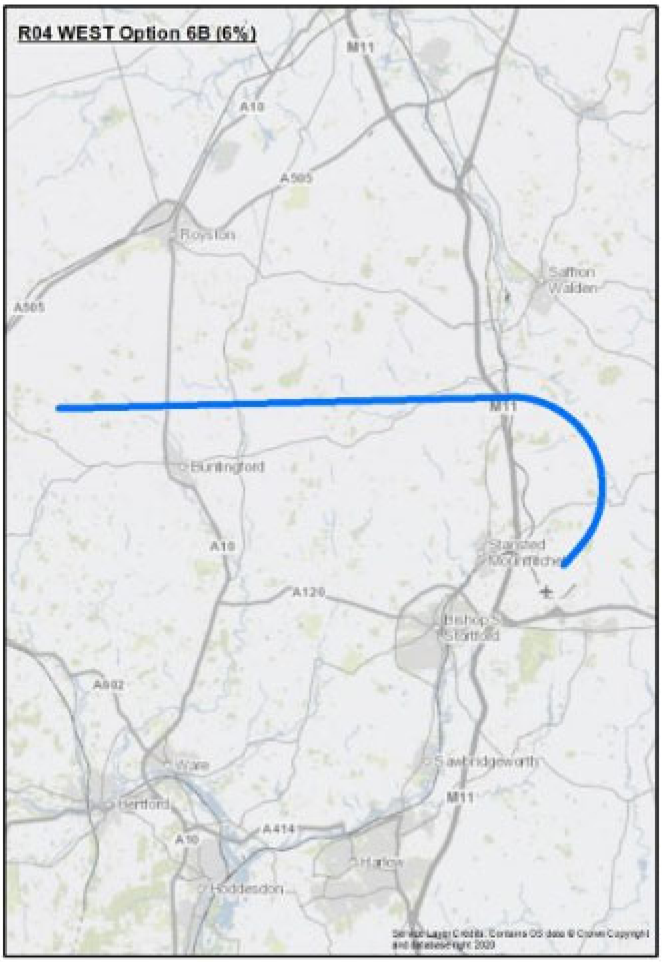
19.8 SID RWY 04 WEST Option 5A (6%)

Description	Rationale for inclusion
*This option is an **RNP1** using RF turns at 6% route to create a more direct route towards UTAVA.* *It uses the earliest possible RF turn after departure and tracks towards the southern edge of the design envelope. This initial turn moves the aircraft track slightly west of the current conventional route. It terminates at the southern edge of the design envelope and in a westerly heading which is more aligned to the NATS network beyond 7,000ft.* *It has been designed to reduces the number of track miles flown and increase fuel efficiency. This is achieved the through the removal of the intermediate fix at BKY, which eliminates the need for traffic to fly slightly more to the north. In addition, the earlier RF turn provides an opportunity to improve runway utilisation/reduce delays to subsequent departures on other routes.*	Balance: More direct routing and reduced track miles when compared to replicated route. Demand: Has potential to reduce delays for following departures. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



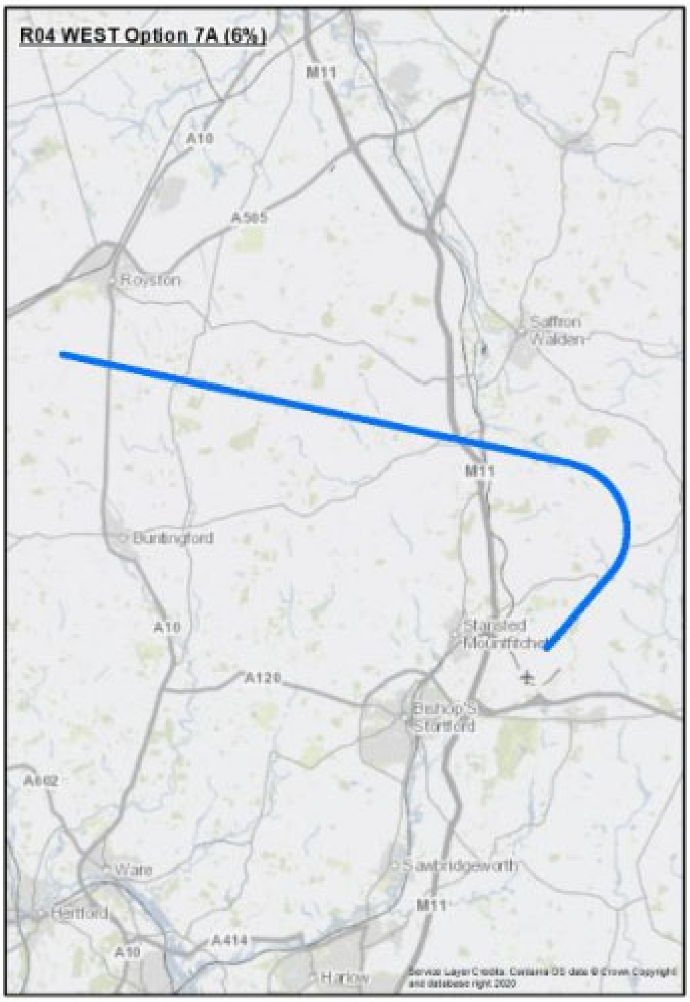
19.9 SID RWY 04 WEST Option 6B (6%)

Description	*Rationale for inclusion*
*This option is an **RNP1** using RF turns at 6%. It has the earliest possible PANS-OPS compliant turn after departure and a more direct route through the centre of the envelope towards NUGBO.* *It uses the earliest possible RF turn after departure which moves the aircraft track slightly west of the current conventional route. It terminates at the centre of the design envelope and in a westerly heading which is more aligned to the NATS network beyond 7,000ft.* *It has been designed to reduces the number of track miles flown and increase fuel efficiency. This is achieved the through the removal of the intermediate fix at BKY, which eliminates the need for traffic to fly slightly more to the north. In addition, the earlier RF turn provides an opportunity to improve runway utilisation/reduce delays to subsequent departures on other routes.*	Balance: More direct routing and reduced track miles when compared to replicated route. Demand: Has potential to reduce delays for following departures. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



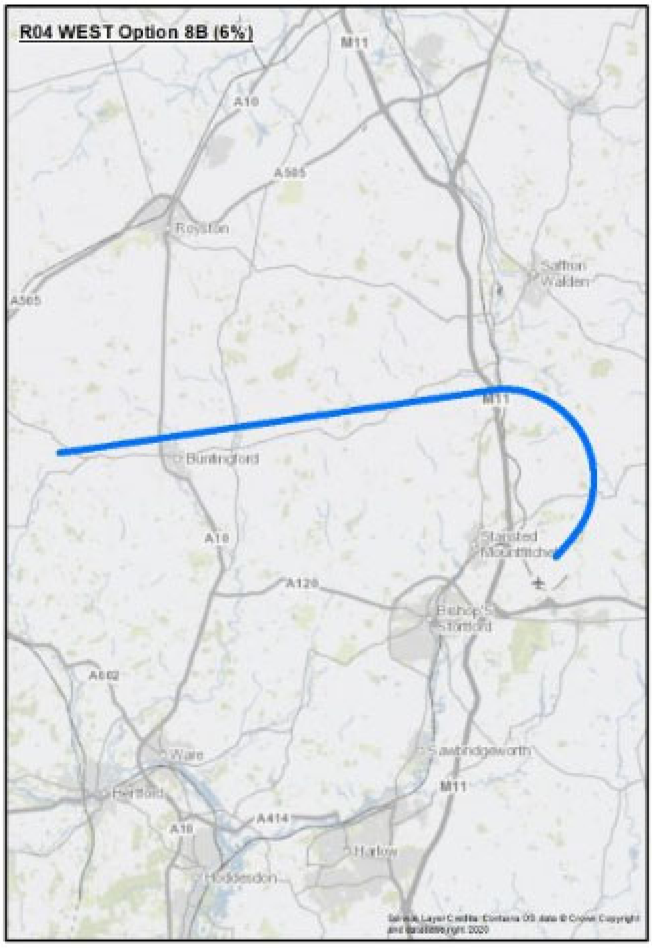
19.10 SID RWY 04 WEST Option 7A (6%)

Description	Rationale for inclusion
This option is an RNAV1 route at 6% that uses fly-by waypoints. *It takes a wider initial fly by turn than the replicated route Option 1A and routes to the north of the envelope to terminate on a north westerly heading at 7,000ft.* *It has been designed to place aircraft on a track that is aligned to the NATS network after 7,000ft and also to reduce the potential for interaction with Luton traffic.*	Efficiency: Seeks to eliminate interactions with other airports and places flights in a direction that is aligned to the NATS network. Alternatives: RNAV is the lowest PBN specification and usable by all aircraft that responded in the fleet survey.



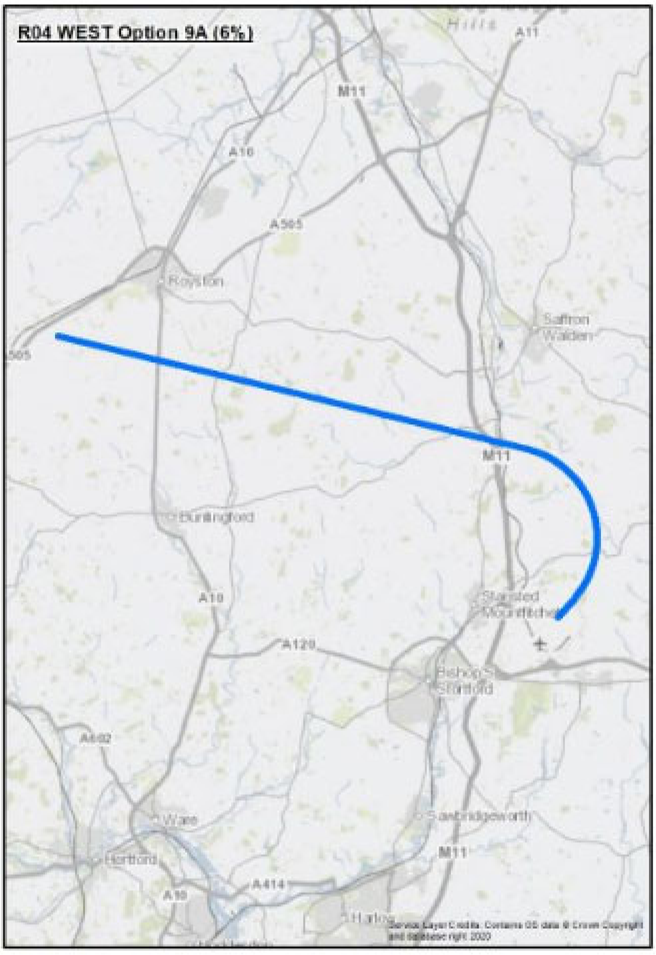
19.11 SID RWY 04 WEST Option 8B (6%)

Description	Rationale for Inclusion
*This option is an **RNP1** using RF turns at 6%.* *It has the earliest possible turn after departure and then continues this turn to route to the south of the design envelope.* *This initial turn moves the aircraft track slightly west of the replicated route 2B. It terminates at the southern edge of the design envelope and in a south westerly heading.* *It has been designed to avoid the direct overflight of Newport and to place aircraft on a track that is more aligned to the NATS network after 7,000ft. In addition, the earlier RF turn provides an opportunity to improve runway utilisation/reduce delays to subsequent departures on other routes.*	Demand: Has potential to reduce delays for following departures. Balance: More direct routing and reduced track miles when compared to replicated route. Noise N1: Has potential to reduce noise impacts by routing slightly south of Newport Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



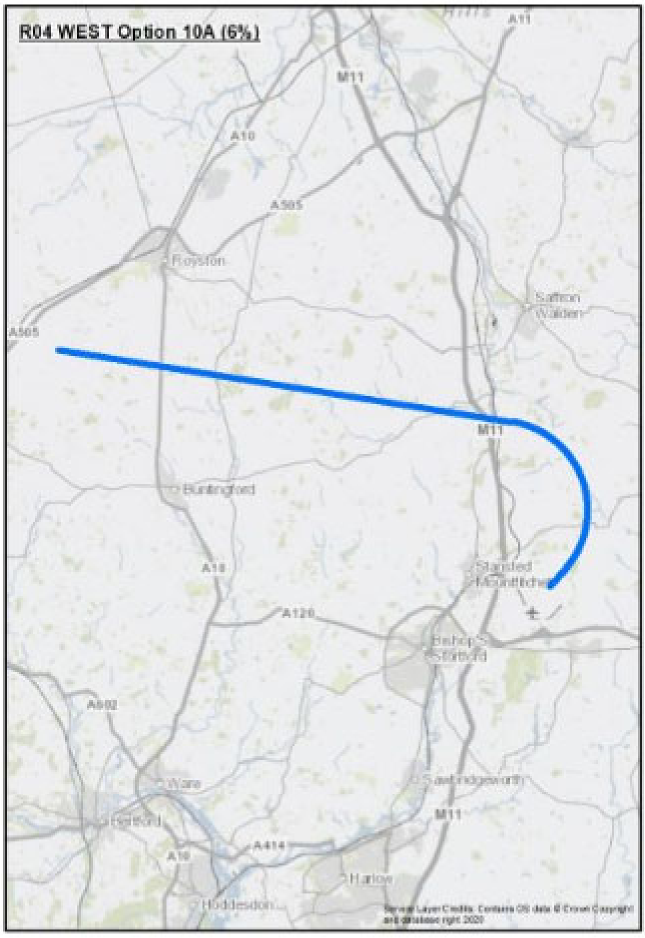
19.12 SID RWY 04 WEST Option 9A (6%)

Description	*Rationale for Inclusion*
*Option 9A is an **RNP1** route that utilises RF turns at 6%.* *It uses the earliest possible RF turn after departure and tracks towards the northern edge of the design envelope. This initial turn moves the aircraft track slightly west of the current conventional route. It terminates at the northern edge of the design envelope and in a north westerly heading.* *It has been designed to place aircraft on a track that is aligned to the NATS network after 7,000ft and to reduce the potential for interaction with Luton traffic. In addition, the earlier RF turn provides an opportunity to improve runway utilisation/reduce delays to subsequent departures on other routes.*	Efficiency: Seeks to eliminate interactions with other airports and places flights in a direction that is aligned to the NATS network. Demand: Has potential to reduce delays for following departures. Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



19.13 SID RWY 04 WEST Option 10A (6%)

Description	Rationale for Inclusion
This is an ***RNP1*** *option at 6% using RF turns.* *After departure it uses the earliest possible RF turn and tracks towards the centre of the design envelope. This initial turn moves the aircraft track slightly west of the current conventional route. It terminates in the centre of the design envelope in a north westerly heading.* *It has been designed to avoid the direct overflight of Newport, to place aircraft on a track that is aligned to the NATS network after 7,000ft and to reduce the potential for interaction with Luton traffic. In addition, the earlier RF turn provides an opportunity to improve runway utilisation/reduce delays to subsequent departures on other routes.*	Efficiency: Seeks to eliminate interactions with other airports and places flights in a direction that is aligned to the NATS network. Demand: Has potential to reduce delays for following departures. Noise N1: Has potential to reduce noise impacts by routing slightly south of Newport Technology: RNP1 allows for the use of Radius to Fix (RF) legs, therefore defining a much more predictable, and reliable track over the ground.



19.14 SID RWY 04 WEST - Viable but Poor Fit Options

Option	Safety	Policy	Demand	Outcome
A11 West A Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 450° left-hand turn, fly around the airport, and then begin heading west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
B12 West A Right wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 270° right-hand turn, flying fully around the airport, and then begin heading north west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the				

Demand DP.				
C13 West A Extended straight ahead then left.	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would continue straight ahead for longer and then make a gradual left-hand turn towards the west. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				
D14 West B Left wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 450° left-hand turn, fly around the airport, and then begin heading west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
E15 West B Right wraparound	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would make a 270° right-hand turn, flying fully around the airport, and then begin heading north west. Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between departures and interactions with both arriving traffic and traffic on the Missed Approach Procedure (MAP). As a result this option would not comply with the Safety DP.				

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions. Demand: The Demand DP requires options to provide for the permitted capacity at the airport. This option may not comply with this DP due to the potential for interactions with arrivals. This interaction would lead to ATC intervention and the need for additional separation between flights, resulting in a reduction in movement rates. As a result this option may limit the ability to utilise capacity at the airport and would not comply with the Demand DP.				
F16 West B Extended straight ahead then left.	S	P	D	Viable but Poor Fit
After departure from RWY 04, aircraft would continue straight ahead for longer and then make a gradual left-hand turn towards the west. Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it involves greater track mileage than is necessary, leading to increased fuel burn and greenhouse gas emissions.				

20 Arrivals Designs – Introduction

20.1 Envelope and Route Option Details – Overview

In line with CAP1616, the arrivals design options start at 7,000ft and end at the runway.

This section of the DOR contains details of:

- Assumptions made with regard to the arrivals designs and the interaction with the NATS network.
- The process followed to create the arrivals design envelopes.
- The process followed to establish the arrivals design constraints.
- The process followed to create the arrivals design options.
- A summary of the comprehensive list of arrivals options considered with respect to each of the joining points.
- A diagram that displays the positions of all Initial Approach Fixes (IAFs) that form the comprehensive list of options. The IAF is the start of the Approach procedure, with an altitude of 7,000ft to align with our design responsibilities under CAP1616.
- A description of the Final Approach designs for each runway. These Final Approaches commence at the Final Approach Fix (FAF)
- Details of all 'viable and good fit' Intermediate Approach options that align with the FAF of 2,000ft, 2,500ft and 3,000ft.
- A summary of the 'viable but poor fit' options that were developed for each envelope.

20.2 Development of Arrivals Options - Process

The arrivals design process was made up of a sequence of steps commencing with the creation of initial design envelopes – broad areas where it would be possible to design options.

The first step was to create a theoretical omni-directional boundary, based upon a Continuous Descent Approach from 7,000ft and which encompassed the current arrival holds at LOREL and ABBOT.

The airspace within that boundary was then reviewed to identify constraints and considerations (see para 20.6) that may impact this area or limit the positioning of the Initial Approach Fix (IAF) – the place from which our arrivals from 7,000ft will start. With this information, we then applied the design principles and supporting Concept of Operations (CONOPS) document to develop a set of design envelopes, which were presented during the first phase of stakeholder engagement.

We considered four operating modes, each of which would be used to provide traffic to both runway 22 and runway 04.:

1. East of the airport and incorporating the current ABBOT hold.
2. West of the airport and including the current LOREL hold.
3. At 90 degrees to the runway from the east (Centre East).
4. At 90 degrees to the runway from the west (Centre West).

These operating modes established the initial design envelopes, which were then shared with stakeholders during the phase one engagement through the use of 6 diagrams to explain the modes and differing aircraft positions depending on runway direction. These were underpinned by design options (IAFs 1 to11) which were created as concept IAFs to provide a foundation to the envelope. From all these initial IAFs a CDA was possible to at least one runway direction.

Feedback collected in the first phase of engagement was considered and informed the revision of the design envelopes. During this process, we refined the design area based upon the Policy design principle and achievement of CDA to both runway ends. Details of the criteria and process for this are at para 20.7.

This process resulted in:

- A reduction in the arrivals design area from that shared with stakeholders during the phase one engagement, based on the application of CDAs.
- The creation of a long list of comprehensive options, comprising 23 IAFs at 7,000 feet. This included the original 11 options plus an additional 12 options.
- The discounting of IAF 3, 6, 7 and 11 from further analysis. These were concept IAFs that were created at the outset of the design process to act as a foundation to the arrivals design envelopes.
    a) IAF3 was assessed as 'viable but poor fit' following analysis of routes within the NERL network. ATS routes M197 and Q295 route across this area and provide a network join for LTN, LCY and LHR departing traffic. Routing STN arrivals through this area is not consistent with the Policy design principle because the AMS for systemised airspace requires interactions to be designed out of the network on safety grounds.
    b) IAFs 6,7 and 11 were assessed as 'viable but poor fit' on the basis of them not aligning with the Policy DP due to their not being able to fulfil the objective of a CDA to both runways.

Details of the process, rationale and criteria used to create the revised design envelopes are detailed in para 20.7 and both this and the revised list of viable and good fit options were shared with stakeholders in the second phase of engagement.

The route option development process covered the creation of:

1. <u>'Do minimum'</u>: PBN replications (RNP APCH) of the current conventional initial approach procedures from LOREL and ABBOT without radar control (as per the UK AIP). This assumed that NATS would design new RNAV holds above 7,000ft, and these holds will be in the same position as they are today.

2. New arrival options: These are based upon the application of the design principles from a range of IAFs as detailed in para 21.221. Full details of each option are shown in the subsequent sections.

All the viable and good fit arrival options were shared at the second stage of engagement with stakeholders. This included routes within each of the four design envelopes (East, West, Centre East, and Centre West) within our reduced design area, and included graphics to show both the route and the options for joining the final approach at 2,000ft, 2,5000ft and 3,000ft.

20.3 Arrivals – Design Assumptions and Considerations

20.3.1 PBN application to arrivals.

The design principle relating to Technology states that the route designs should be based upon the latest aircraft technology widely available. Based on the results from the fleet equipage survey, the arrivals designs would meet the requirements of all PBN mandates by utilising RNP APCH as the design standard for arrivals.

20.3.2 Systemisation and ATC vectoring.

Consistent with the design principles relating to Safety and Technology the arrival design options have been designed to accommodate the principle of systemisation (minimal ATC intervention). However, the assumption is that some ATC vectoring will still occur to ensure safe spacing between aircraft is consistently maintained, either for wake turbulence, arrival-departure-arrival separation, or in periods of adverse weather. ATC vectoring may also be a tool to aid the provision of noise relief in line with Noise N2 design by using ATC instructions to vary the joining point onto final approach.

20.3.3 Continuous Descent Approaches (CDAs).

Our Technology design principle specifically identifies the use of CDAs as a benefit of the future airspace design. This aligns with national policy and guidance from Government and the CAA. Both our arrivals envelopes and the design options within them have been designed with the intention of providing CDAs to both runway directions. Where possible, and in line with our Noise N1 design principle we have also sought to apply latest CAA policy on Low Noise Arrivals Metrics as detailed in CAP2302.

20.3.4 Current arrivals noise procedures

To present a comprehensive list of viable design options, the design process has not been constrained by the existing Noise Abatement procedures. Any changes required to these procedures will be subject to separate negotiation and agreement as required.

20.4 Arrivals – Engagement with NATS on Arrivals Structures

Bilateral meetings have been held with NATS to discuss the factors affecting the placement of the STN arrivals structure and the 7,000ft starting point for our arrivals, taking account of our requirements and design principles. These discussions concluded:

a) The NATS / LTN AD6 airspace change will introduce a number of routes which will influence the position of the STN arrival structure(s).

b) The NATS network is not considering major changes to the UK network coordination points (COPs) or the traffic orientation structure (TOS) although changes to boundary interfaces may occur depending on negotiations with adjacent Flight Information Regions (FIRs). Therefore, STN inbound traffic can be assumed to arrive in the London area in a similar pattern as it does today.

c) The area to the south west of STN is complicated because of LTN, LHR and LCY traffic and is likely to remain so, especially with the expected routes for LTN AD6. The intensity of traffic would make this unsuitable for an arrival structure on both a safety and a capacity basis. This aligns with the constraints we identified in para 5.6 and 20.6.

d) The area to the east of STN needs to take note of London Southend Airport (SEN) and the Shoeburyness Danger area and the outbound routes towards Clacton (CLN) from other London airports. This advice resulted in the classification of IAF3 as 'viable but poor fit' on the basis of the interaction with these routes.

We have worked closely with colleagues in NATS/NERL to help us create a comprehensive list of arrival design options that provide flexibility and have the ability to integrate with a new LTMA network. Our discussions with NATS/NERL took account of the current traffic flows and also the AD6 Airspace Change, which has changed the operation of inbounds for both LTN and STN. We then tested our designs with NERL and other change sponsors during the formal stakeholder engagement process.

20.5 Arrivals Development Strategy

As a result of the process we have followed and the comments from the engagement process we are carrying forward a comprehensive list of arrivals options to the DPE. However, as the NERL designs progress, it is possible that some of our design options will either be misaligned or conflict with their choices (or those of other airports) and that some design options may need to be further refined or amended in response to the progress of their work. We will continue to work in bilateral discussions across the LTMA and in partnership with NERL and other airports to respond to any such interactions.

In some cases, it may not be possible to provide the required connectivity to the network which may result in design options being re-classified as 'viable but poor fit'. In such a scenario, our assessment of these design options would be discontinued.

Further information on this is provided at the Next Steps description at para 2.3of this DOR.

Our approach has been to:

- We have not designed our arrival design options as part of a network with our departures. This is because we consider it possible that the position of arrival options will be required to change in order to align with the traffic flows within the NERL and LTMA network.
- We will seek to optimise each aspect (departures and arrivals) and then to use the process of bilateral discussions with NERL, to agree network

connectivity and optimal positions, taking into account both the STN design principles and the available airspace within the network. This will drive the development of a system that encompasses departures and arrivals and takes account of other ACPs within the LTMA cluster.

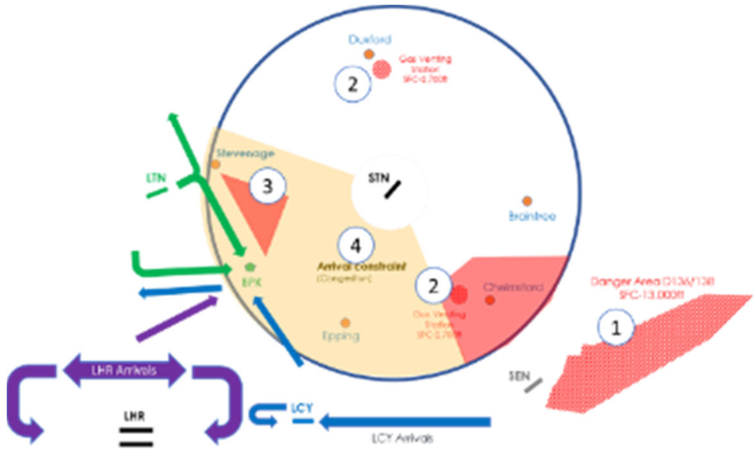
20.6 Arrivals Options – Constraints and Considerations

As detailed in paragraph 5.6 the constraints and considerations for arrivals were developed by analysing the airspace and current operations in the NE London TMA Airspace. This analysis identified constraints and considerations to the future designs:

- Constraints were defined as aspects that have a direct impact on designs, or limit where we can place our arrival and departure design options.
- Considerations were defined as aspects that do not limit our designs but which we need to take account of in creating design options.

20.6.1 Constraints

For arrivals, the principle constraint is the airspace to the south-west of STN, identified as number 4 in the diagram below. As per para 5.6.4 and following discussions with the NATS network (detailed in para 20.4c), we have identified this as an area of complexity due to multiple routes to and from LTN, LHR, LCY and SEN. Looking into the future, this will remain a highly congested area for departures because of the proximity of these airports and the need to connect to the upper airspace network system to leave UK airspace.



On that basis we have created this as an area of congested airspace within which we will not start our arrivals design options from 7,000ft.

20.6.2 Considerations

From an operational and noise perspective, the point at which aircraft join the Instrument Landing System (ILS) is an important consideration. Currently, joining criteria are set by central government as a noise abatement measure and any changes would therefore require government approval. In order to apply our assumptions, detailed at para 20.3.4, we have assumed that the government would support any changes that are the result of the STN ACP and that approval should not be considered as a constraint.

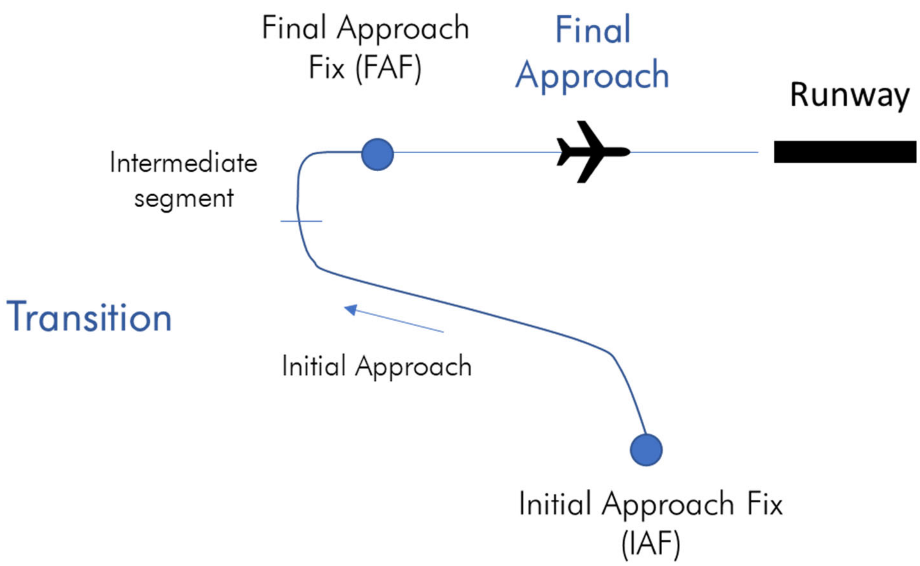
Revising options for the ILS joining point would offer the opportunity to reduce the track miles flown, especially for RWY 04 and would help facilitate CDAs. The two joining point criteria are currently set below. They apply equally for both runways. (UK AIP AD 2.21 para 12 and 13):

- Daytime 06:00 – 23:30 (local) ILS Joining Point is not below 2,000ft.

- Night-time 23:30 – 06:00 (local) ILS Joining Point is not below 3,000ft and 10NM.

20.7 Arrivals Design – Scope of Design

The diagram below provides a representation of the key elements of an arrival procedure.



Our designs have been created in accordance with PANS-OPS rules and comprise:

a) Transition: The part of the arrival route between the Initial Approach Fix (IAF) which is at 7,000ft and the Final Approach Fix (FAF). The transition encompasses an initial approach and a short intermediate segment.

b) Final Approach: The route taken by the aircraft between the final approach fix, and landing on the runway. This is a straight line, normally guided by the Instrument Landing System.

Paragraph 20.8 provides further information on the criteria used for our designs.

20.8 Arrivals Design– Viable Design Area

Our 'must have' design principles were used to classify the arrivals options into 'unviable', 'viable but poor fit' and 'viable and good fit'. This process is explained in detail in para 5.11.

Within these design principles, the Policy design principle states that "Changes must be consistent with the CAA's Airspace Modernisation Strategy and the FASI-S programme, taking into account the needs of other change sponsors and airspace users". We sought guidance from three documents to inform this aspect of our design:

- The Transport Act 2000, which requires the CAA to take account of any guidance on environmental objectives given to it by the Secretary of State

- The Air Navigation Guidance 2017 which includes a section on environmental objectives, which the CAA is required to take account of in respect of its air navigation functions and in accordance with the Transport Act 2000.
- CAP1711 Airspace Modernisation Strategy, which is also driven by the Transport Act 2000, as Chapter 3 sets out the ends that modernised airspace must deliver, derived from UK and international policies and laws.

These documents provide objectives on environmental aspects and managing noise and both the Air Navigation Guidance and the Airspace Modernisation Strategy specifically highlight the use of Continuous Descent Approaches (CDAs) as a means for achieving these objectives.

We therefore concluded that any option that does not provide for CDAs for both runway ends would not be aligned to the 'must have' Policy design principle and can only be classed as 'viable but poor fit'. This also ensures that all of our arrival options are aligned with our Technology design principle.

Our arrivals design area has therefore been based on design parameters which allow CDAs to both runway ends. We have used the following criteria to identify a comprehensive list of design options:

- <u>Initial approach:</u> An initial approach (transition) starting from an Initial Approach Fix (IAF) at 7,000ft. The descent gradient should be between 3.5° and 1.5° which is within PANS-OPS CDO recommended range for CDAs. It also encompasses the optimal descent gradient identified within CAA Low Noise Arrival Metric (CAP2302).

- <u>Intermediate segment:</u> Our design area assumes 2.5nm level intermediate segment. PANS-OPS allows for a range of this level segment of between 4.5nm and 1.5nm and our choice of 2.5nm aligns with CAA guidance on CDAs.

- <u>Final approach joining</u>: Taking into consideration local conditions, we have calculated the minimum final approach segment to start at 2,000ft amsl, which equates to 5.04nm for runway 22 and 5.07nm for Runway 04 (PANS-OPS recommends the optimal length of the final approach segment as 5nm). In order to provide alternatives that may create noise relief we have also designed options that join at 2,500ft amsl and 3,000ft amsl. We did not create options beyond 3,000ft as this would result in there being no options capable of being flown on a CDA to both runway ends and to do so would lead to unnecessary concentration of noise, which would not respond to the stakeholder feedback we received, which reinforced the importance of noise respite under design principle N2.

- <u>Final approach gradient</u>: We have assumed that the ILS will continue to be the primary approach aid and for CATIII operations that results in a 3° final approach descent angle.

The application of these design criteria results in two overlapping arcs. Within the overlap area, a CDA to both runways is achievable (based upon the criteria above) and options in this area are deemed 'viable and good fit'.

Outside of these arcs, a CDA to only one runway is possible and designs in this area were classified as 'viable but poor fit'.

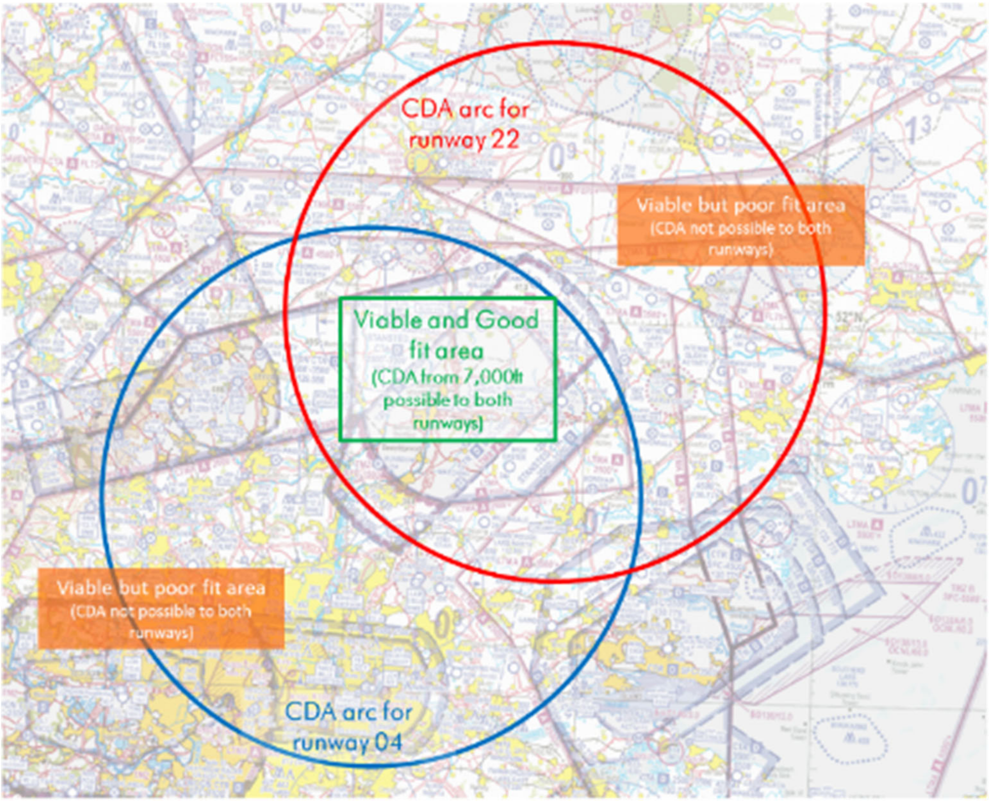


Figure 36 Classification of Design Area for Arrivals

The diagram above shows the overlapping arcs for options with a 2,000ft joining point (or approximately 5 miles) onto final approach which was chosen as the minimum in line with ICAO guidance.

Additional envelopes were created for a 2,500ft and 3,000ft joining point, although the additional track miles required to fly these routes resulted in a progressive reduction to the overlapping area.

There was found to be no overlapping area at a 3,500ft joining point meaning that there is no common CDA area, and in line with the criteria described above, no options were designed for this range or above.

21 Arrival Options – Summary

21.1 Summary Tables – All Arrivals Options

The tables below summarise all of the options considered and the ability to provide a CDA to both runway directions.

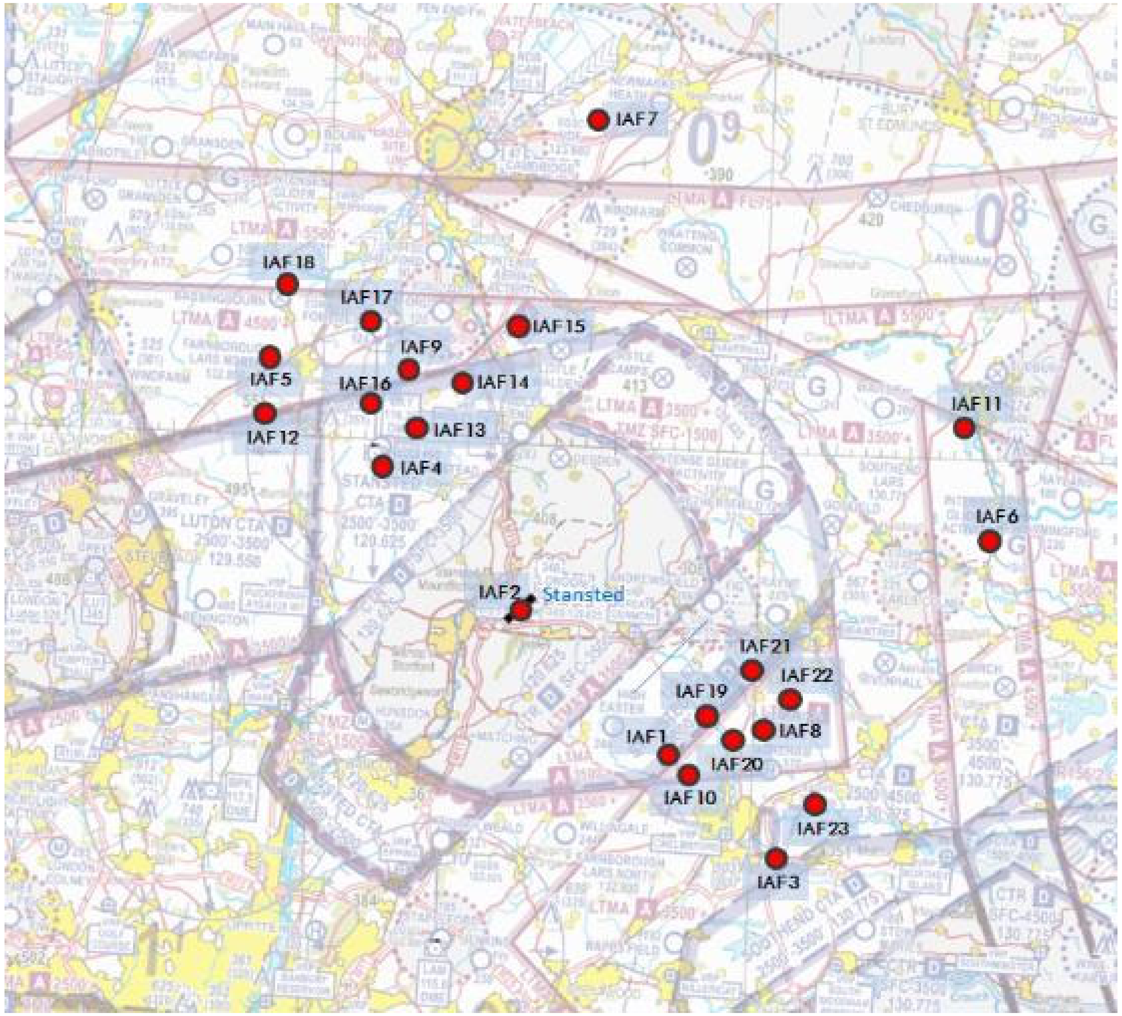
Initial Approach Fix (IAF) altitude			Runway 22				Runway 04			
2,000FT	Option	Within viable CDA area?	Track distance (m)	Descent Angle (%)	Descent Gradient (°)		Track distance (m)	Descent Angle (%)	Descent Gradient (°)	
	Option 1	YES	33,424	4.6%	2.6		33,192	4.6%	2.6	
	Option 2a	YES	37,224	4.1%	2.3		36,990	4.1%	2.4	
	Option 2b	YES	37,225	4.1%	2.3		36,992	4.1%	2.4	
	Option 3	YES	-	-	-	-	-	-	-	Viable Poor Fit: Not aligned to Safety and Policy DPs.
	Option 4	YES	33,426	4.6%	2.6		33,192	4.6%	2.6	
	Option 5	YES	39,169	3.9%	2.2		38,992	3.9%	2.2	
	Option 6	NO								
	Option 7	NO								
	Option 8	YES	28,755	5.3%	3.0		40,370	3.8%	2.2	
	Option 9	YES	28,756	5.3%	3.0		40,370	3.8%	2.2	
	Option 10	YES	33,917	4.5%	2.6		33,782	4.5%	2.6	
	Option 11	NO								
	Option 12	YES	40,268	3.8%	2.2		34,701	4.4%	2.5	
	Option 13	YES	29,553	5.2%	3.0		37,063	4.1%	2.4	
	Option 14	YES	24,566	6.2%	3.5		42,086	3.6%	2.1	
	Option 15	NO					48,362			
	Option 16	YES	32,141	4.7%	2.7		36,815	4.1%	2.4	
	Option 17	YES	31,576	4.8%	2.8		43,500	3.5%	2.0	
	Option 18	YES	38,244	4.0%	2.3		41,121	3.7%	2.1	
	Option 19	YES	29,115	5.2%	3.0		37,507	4.1%	2.3	
	Option 20	YES	30,853	4.9%	2.8		38,575	4.0%	2.3	
	Option 21	YES	24,358	6.3%	3.6		42,294	3.6%	2.1	
	Option 22	YES	26,416	5.8%	3.3		43,801	3.5%	2.0	
	Option 23	YES	34,443	4.4%	2.5		43,042	3.5%	2.0	

Initial Approach Fix (IAF) altitude			Runway 22			Runway 04		
2,500FT	Option	Within CDA area?	Track distance (m)	Descent Angle (%)	Descent Gradient (°)	Track distance (m)	Descent Angle (%)	Descent Gradient (°)
	Option 1	YES	36,284	3.8%	2.2	36,052	3.8%	2.2
	Option 2a	YES	40,084	3.4%	2.0	39,851	3.4%	2.0
	Option 2b	YES	40,085	3.4%	2.0	39,852	3.4%	2.0
	Option 3	NO						
	Option 4	YES	36,286	3.8%	2.2	36,053	3.8%	2.2
	Option 5	YES	41,418	3.3%	1.9	41,233	3.3%	1.9
	Option 6	NO						
	Option 7	NO						
	Option 8	NO						
	Option 9	NO						
	Option 10	YES	36,577	3.7%	2.1	36,440	3.8%	2.2
	Option 11	NO						
	Option 12	NO						
	Option 13	YES	32,357	4.2%	2.4	39,910	3.4%	2.0
	Option 14	YES	27,365	5.0%	2.9	44,939	3.1%	1.7
	Option 15	NO						
	Option 16	YES	34,618	4.0%	2.3	39,423	3.5%	2.0
	Option 17	NO						
	Option 18	NO						
	Option 19	YES	31,913	4.3%	2.5	40,354	3.4%	1.9
	Option 20	YES	33,465	4.1%	2.3	41,383	3.3%	1.9
	Option 21	YES	27,163	5.0%	2.9	45,147	3.0%	1.74
	Option 22	NO						
	Option 23	NO						

Initial Approach Fix (IAF) altitude			Runway 22			Runway 04		
3000FT	Option	Within CDA area?	Track distance (m)	Descent Angle (%)	Descent Gradient (°)	Track distance (m)	Descent Angle (%)	Descent Gradient (°)
	Option 1	YES	39,274	3.1%	1.8	39,041	3.1%	1.8
	Option 2a	YES	43,473	2.8%	1.6	43,242	2.8%	1.6
	Option 2b	YES	43,744	2.8%	1.6	43,240	2.8%	1.6
	Option 3	NO						
	Option 4	YES	39,273	3.1%	1.8	39,041	3.1%	1.8
	Option 5	NO						
	Option 6	NO						
	Option 7	NO						
	Option 8	NO						
	Option 9	NO						
	Option 10	YES	39,547	3.1%	1.8	39,409	3.1%	1.8
	Option 11	NO						
	Option 12	NO						
	Option 13	NO						
	Option 14	NO						
	Option 15	NO						
	Option 16	NO						
	Option 17	NO						
	Option 18	NO						
	Option 19	NO						
	Option 20	NO						
	Option 21	NO						
	Option 22	NO						
	Option 23	NO						

21.2 Summary Map – Placement of Initial Approach Fixes (IAF)

The map below details the geographical position of all IAFs considered as part of the comprehensive list of options.



21.3 Arrivals Design Envelopes

The diagrams below show the design envelopes that contain the design options.

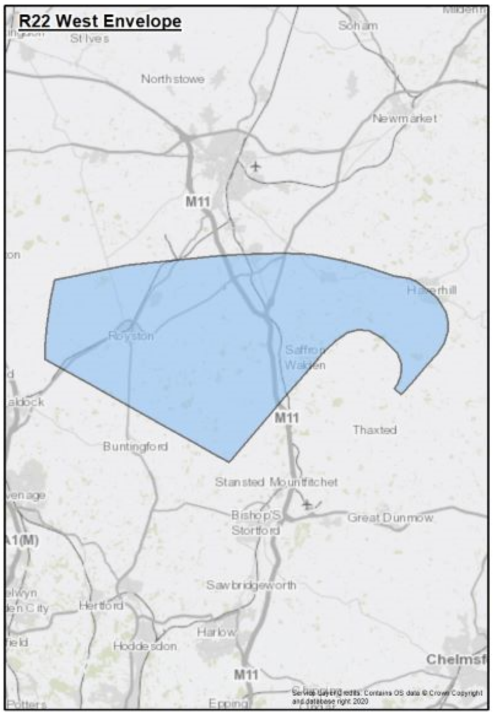


Figure 37 Runway 22 West envelope

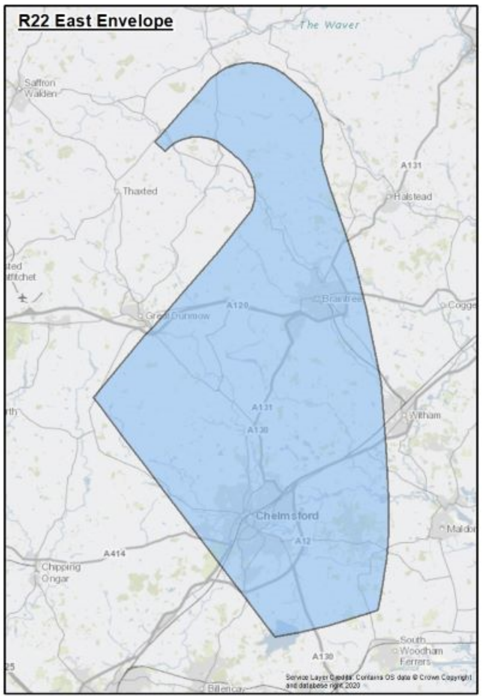


Figure 38 Runway 22 East envelope

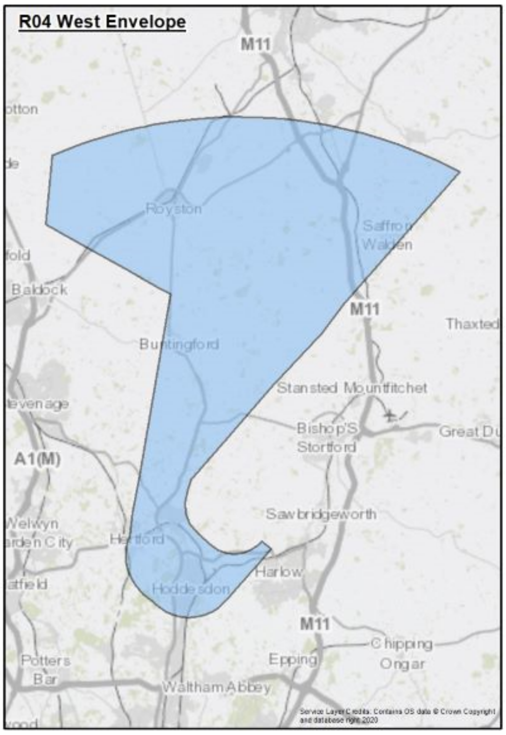


Figure 39 Runway 04 West envelope

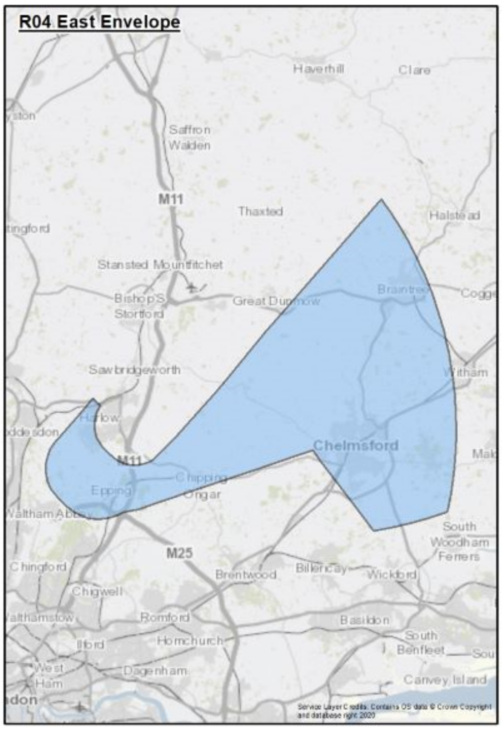


Figure 40 Runway 04 East envelope

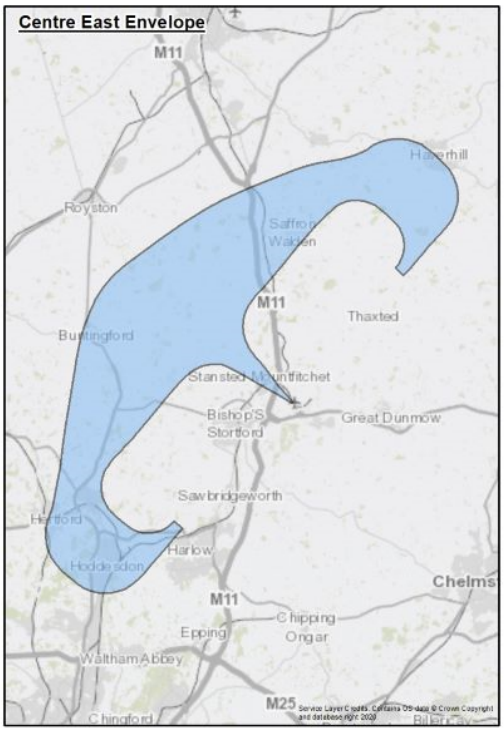


Figure 41 Centre East envelope

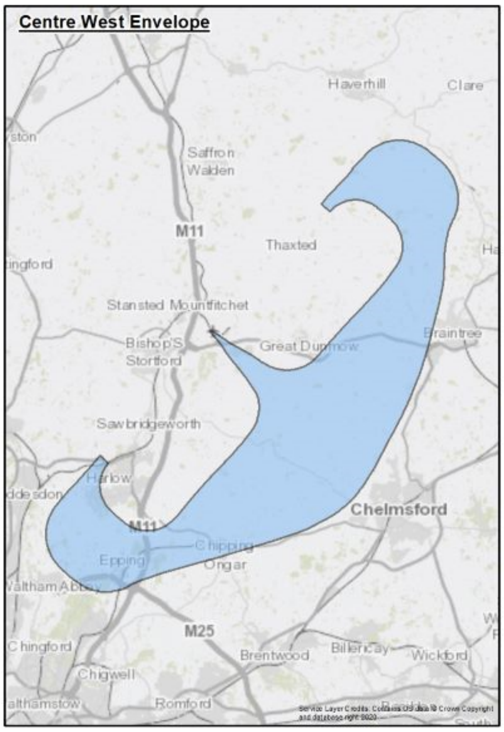


Figure 42 Runway 04 Centre West envelope

21.4 Arrivals Options Description – Example Layout.

The following sections 22 to 34 detail the arrivals design envelopes and the options created within them. Each section includes an introduction, followed by a description and graphic for the design envelope. There is then a summary table that briefly describes the design options, which is followed by a more detailed description of each route.

The graphic below provides an example of the summary table, and an explanation of the information contained within it.

The runway the option applies to, either RWY 22 or RWY 04.

The point at which the route joins the final approach. Either 2,000ft, 2,500ft or 3,000ft.

'Transition' denotes that this relates to an arrival option.

The option number for this route.

RWY 22 - 2,000ft Transition Option 1

Description	Rationale for Inclusion
This section provides a written description of the option including where the route option starts (the position of the Initial Approach Fix (IAF), the descent gradient that it takes and how close this is to an optimal low noise descent, and features of the design such as turning points or areas the route avoids, or overflies.	This is the reason why we have included the route as an option. It doesn't evaluate the design, but just provides a reason why it is in the list of options when compared to the design principles.

22 Approach RWY 22 – 2,000ft FAF

22.1 Overview

This approach provides a 3° final approach descent gradient with a FAF of 2,000ft. The approach is aligned with the runway centreline, which aims to align with the track of the currently published ILS procedure for RWY 22 but intercepts the FAF at 2,000ft instead of 2,500ft.

The intermediate segment length that precedes this segment caters for any turns in the transition at the Intermediate Fix (IF) of up to 90°, which provides sufficient distance for turn anticipation and the Minimum Stabilisation Distance (MSD).

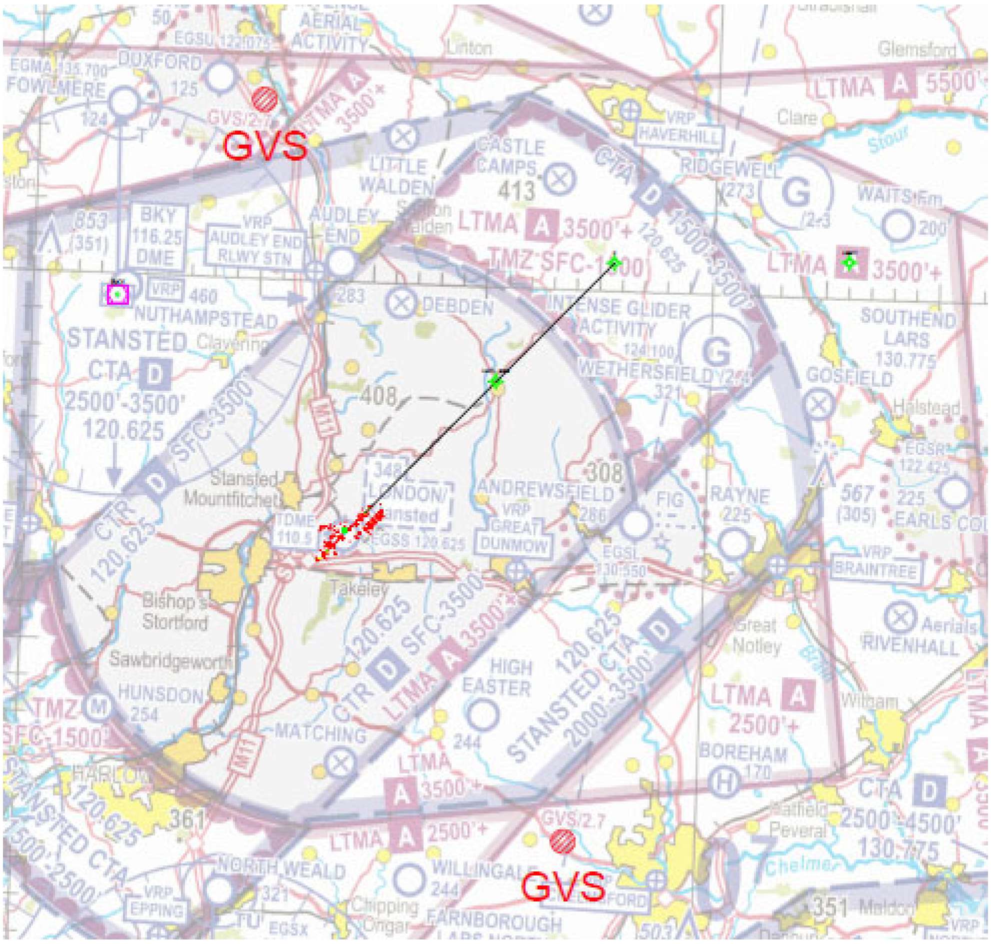


Figure 43 Approach Path RWY 22 – 2,000ft FAF

This approach path is used and is common for each of the transition options with a 2,000ft FAF for RWY 22 detailed below.

23 RWY 22 – 2,000ft Transitions

23.1 Introduction to RWY 22 Transition Options with 2,000ft FAF Envelope

This suite of transitions connects the Initial Approach Fix (IAF) to the RWY 22 approach with a 2,000ft FAF. The intention is to define an IAF position that would facilitate a continuous descent to both runway 22, and to runway 04.

23.2 Design Envelope Location Map: 2,000ft Transitions for RWY 22.

Figure 44 RWY 22 Transitions Design Envelope, 2,000ft FAF

The transition options have been designed using this design envelope as the boundary within which to design 'viable and good fit' options. This takes into account the requirements of the Policy and Technology design principles to facilitate CDAs to both runways.

23.3 RWY 22 Transitions Long List – 2,000ft Outline Longlist

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the south of the aerodrome and west of Braintree.	A3	IAF-3 south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance. Potential to interact with other airports.	U1	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distances (MSD) and the turn onto final approach. • Descent gradients above the PANS-OPS maximum • Turn radius based on speed, altitude, and descent gradient These options have not been designed and are not described further within this comprehensive list of design options.
2a (Central)	7,000ft point that is close to or overhead the aerodrome resulting in an equidistant track to both runway thresholds. Arrivals route from the south east and turn downwind right to the north of the aerodrome and turn right onto final approach.	B6	IAF-6 east of the aerodrome and west of Colchester. Not fully CDA compliant and conflict with departures.		
2b (Central)	7,000ft point that is close to or overhead the aerodrome.	C7	IAF-7 north-east of the aerodrome mid-way between Cambridge and		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	Arrivals route from the north west and turn downwind left to the south east of the aerodrome and turn left onto final approach.		Newmarket. Not fully CDA compliant.		
4 (West)	7,000ft point to the north west of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the north west of the aerodrome and turn right onto final approach.	D11	IAF-11 east of the aerodrome (close to ABBOT). Not fully CDA compliant.		
5 (West)	7,000ft point to the north-west of the aerodrome (close to the northern position of the current LOREL hold). Arrivals route from west of Royston to the north west of the aerodrome and turn right onto final approach	E15	IAF 15 positioned to the north to the east of Duxford. Not fully CDA compliant.		
8 (East)	7,000ft point to the south east of the aerodrome which introduces a more optimal CDA for runway 22. Arrivals route to the south east of the aerodrome and west of Braintree and turn left onto final approach.				
9 (West)	7,000ft point to the north west of the aerodrome which introduces a more optimal CDA for runway 22. Arrivals route to the north of the aerodrome to avoid Saffron Walden and turn right onto final approach. .				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
10 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. A possible noise relief option that routes to the south east of the aerodrome and west of Braintree.				
12 (West)	7,000ft point to the north-west of the aerodrome (close to the southern position of the current LOREL hold). Arrivals route from west of Royston to the north west of the aerodrome and turn right onto final approach				
13 (West)	7,000ft point to the north west of the aerodrome which introduces a more optimal CDA for runway 22. Arrivals route to the north west of the aerodrome and turn right onto final approach.				
14 (West)	7,000ft point to the north west of the aerodrome which provides the shortest route for runway 22. Arrivals route to the north west of the aerodrome and turn right onto final approach.				
16 (West)	7,000ft point to the north west of the aerodrome which introduces an optimal CDA for runway 22. Arrivals route to the north west of the				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	aerodrome and turn right onto final approach.				
17 (West)	7,000ft point to the north west of the aerodrome which optimises a CDA for runway 22. Arrivals route to the on a more northerly track and turn right onto final approach avoiding Saffron Walden				
18 (West)	7,000ft point to the north west of the aerodrome at the northern boundary of the design envelope. Arrivals route via the most northerly track of all those in this area and turn right onto final approach.				
19 (East)	7,000ft point to the south east of the aerodrome with a slight bias for runway 22 arrivals. Routes to the south east of the aerodrome and west of Braintree.				
20 (East)	7,000ft point to the south east of the aerodrome (close to option 19), with a slight bias for runway 22 arrivals. A possible noise relief option that routes to the south east of the aerodrome and west of Braintree.				
21 (East)	7,000ft point to the south east of the aerodrome close with the shortest possible				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	route for runway 22 arrivals. A possible noise relief option that routes to the south east of the aerodrome and west of Braintree.				
22 (East)	7,000ft point to the south-east of the aerodrome with a bias for runway 22 arrivals. A possible noise relief option that routes to the south west of the aerodrome and west of Braintree.				
23 (East)	7,000ft point to the south east of the aerodrome at the southern boundary of the design envelope.				

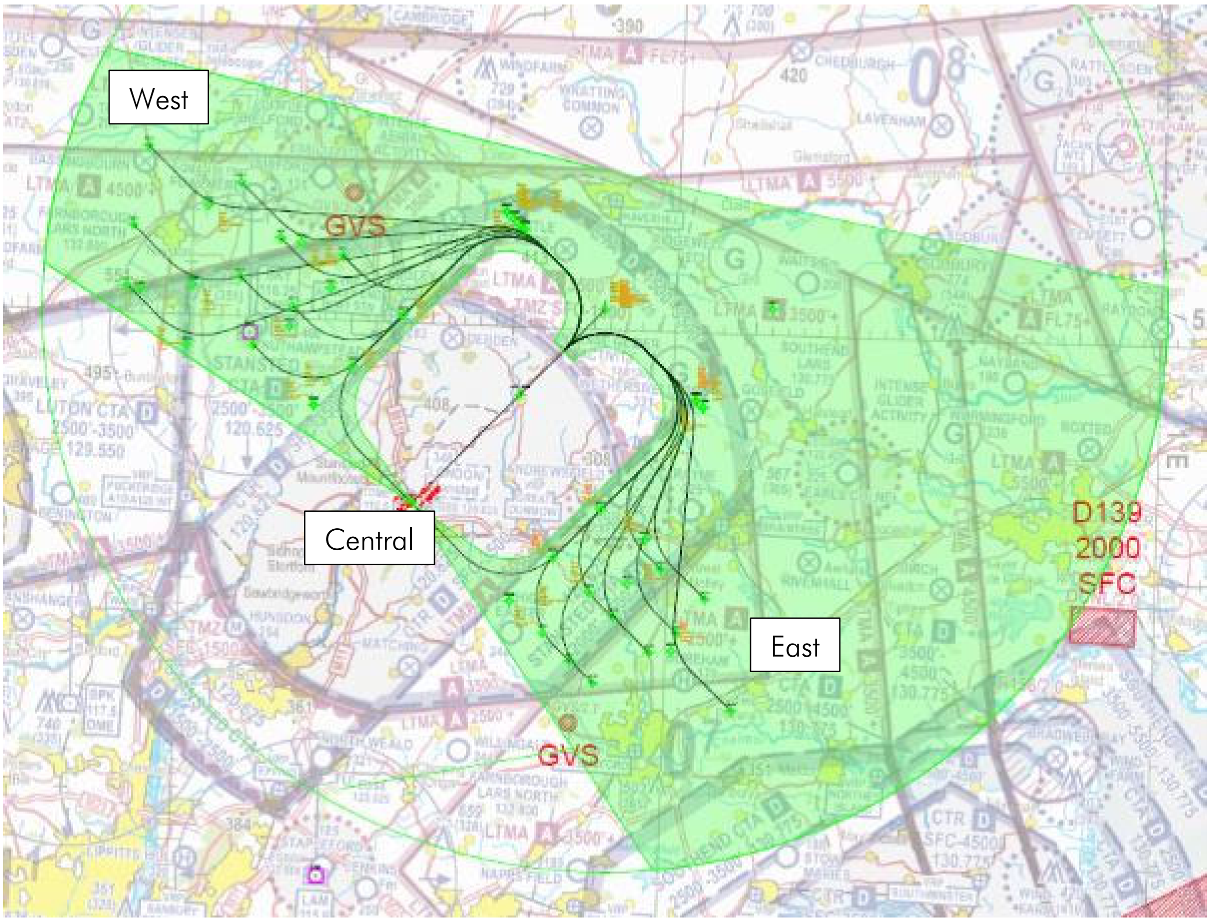
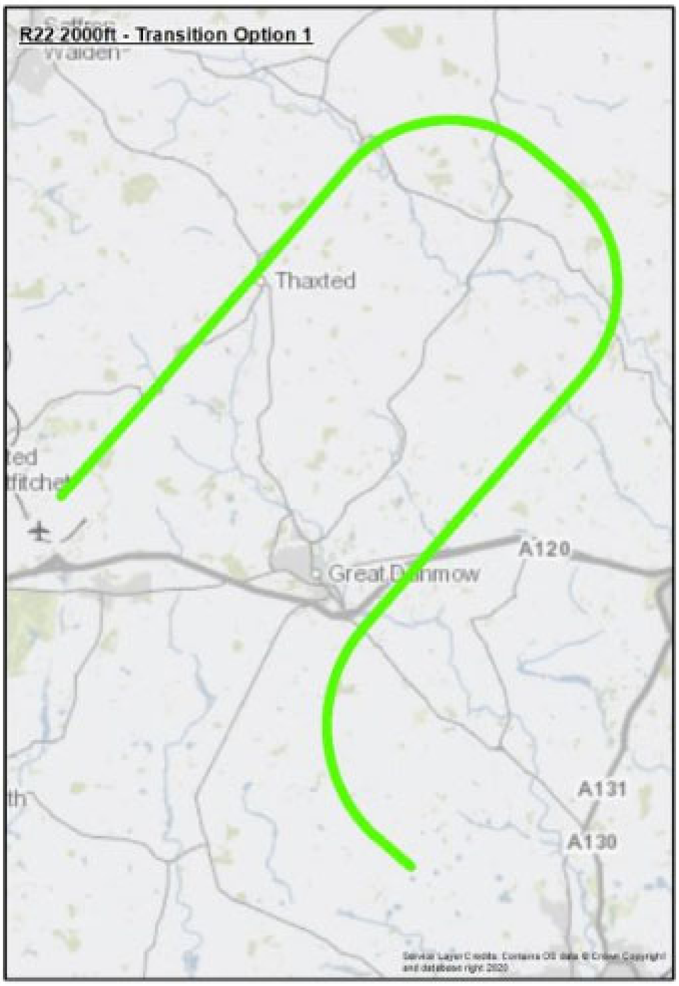


Figure 45 RWY 22 Transitions Design Envelopes, 2,000ft FAF and Transition Options
(West, Central and East options)

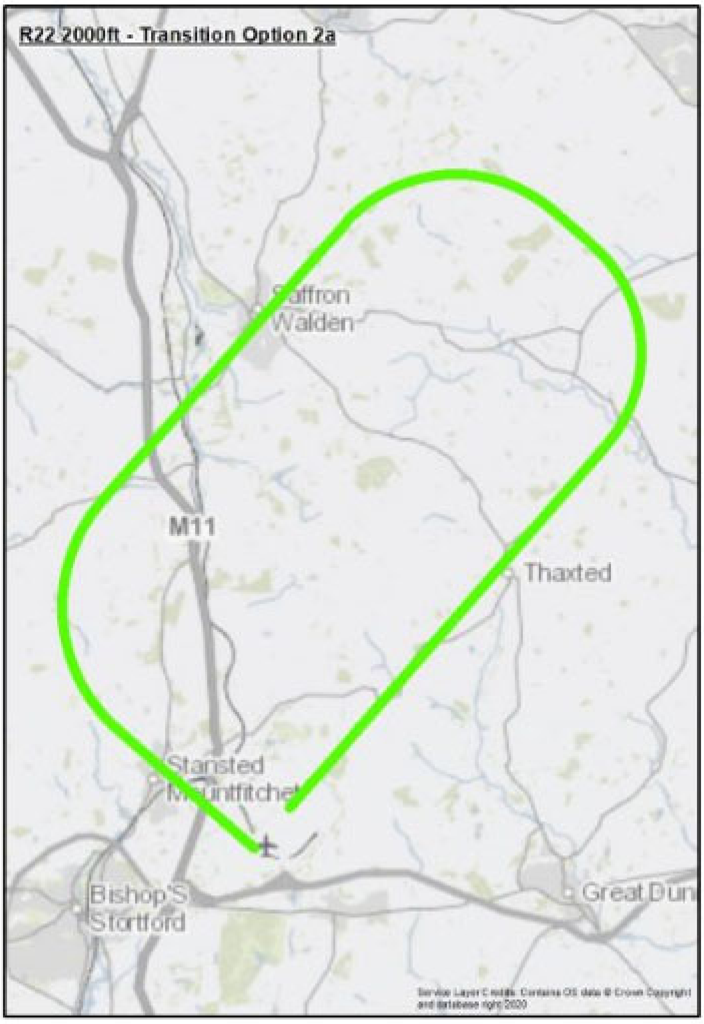
23.4 RWY 22 - 2,000ft Transition Option 1

Description	*Rationale for Inclusion*
Option 1 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.6% (2.6°) for both runways.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Braintree.



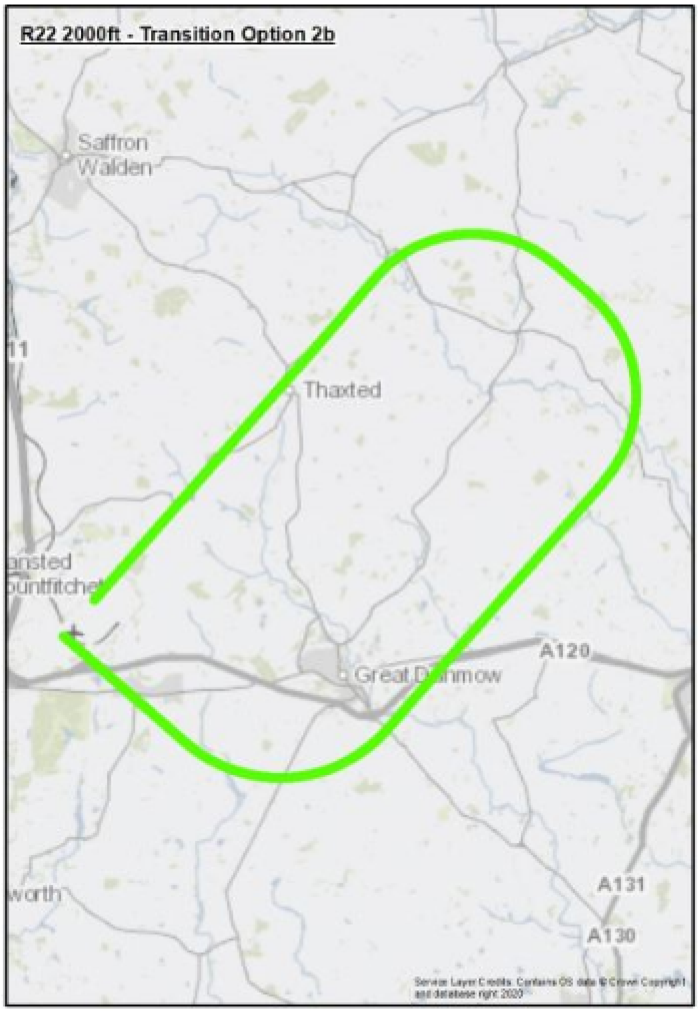
23.5 RWY 22 - 2,000ft Transition Option 2a

Description	Rationale for Inclusion
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the south east and turn downwind right, and then turn right base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.1% (2.4°) for both runways.* *From the IAF the route turns north-east onto a downwind track parallel with the final approach and routes over Saffron Walden. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient.



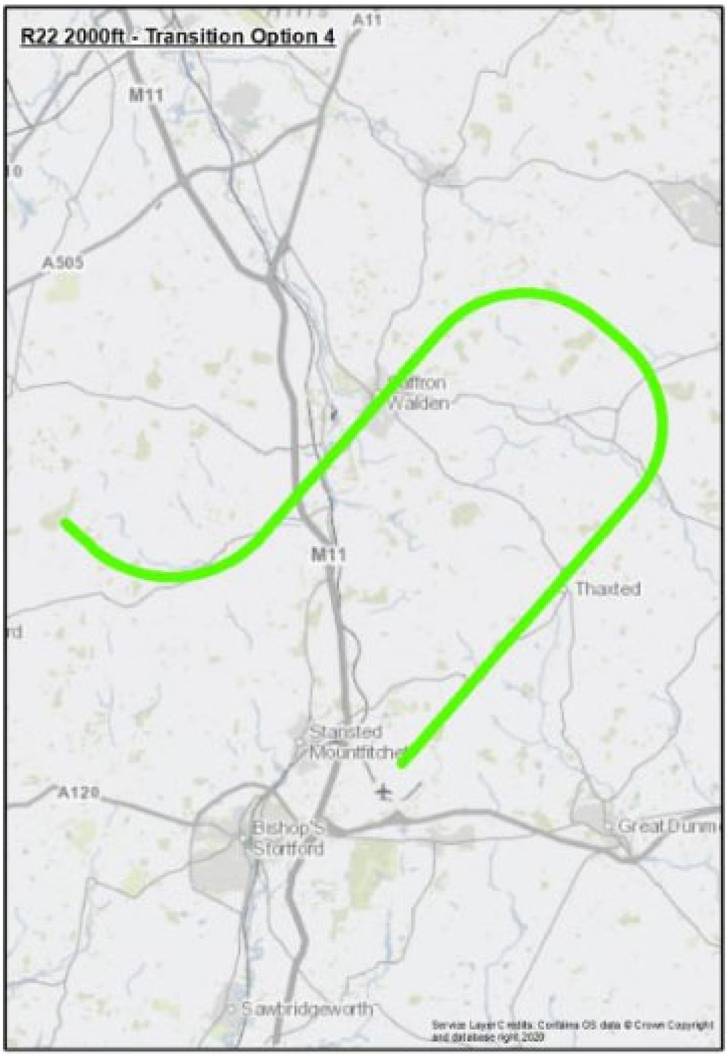
23.6 RWY 22 - 2,000ft Transition Option 2b

Description	*Rationale for Inclusion*
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the north west and turn downwind left, and then turn left base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.1% (2.4) for both runways.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes to the east of Great Dunmow and the west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree.



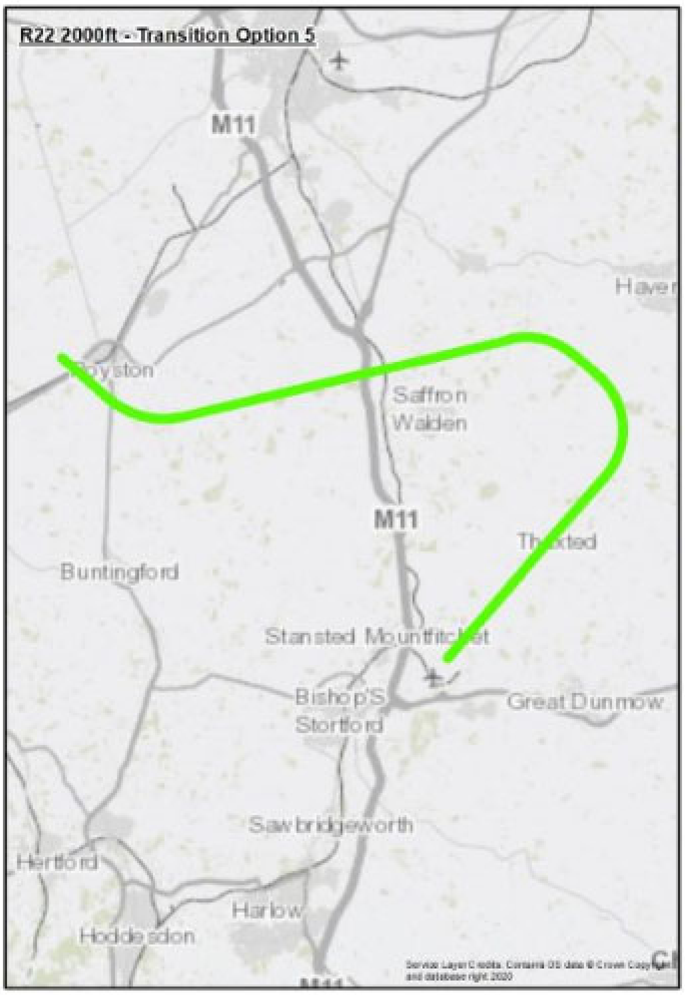
23.7 RWY 22 - 2,000ft Transition Option 4

Description	Rationale for Inclusion
Option 4 has an IAF at 7,000ft to the north west of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.6% (2.6°) for both runways.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes close to Saffron Walden. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient.



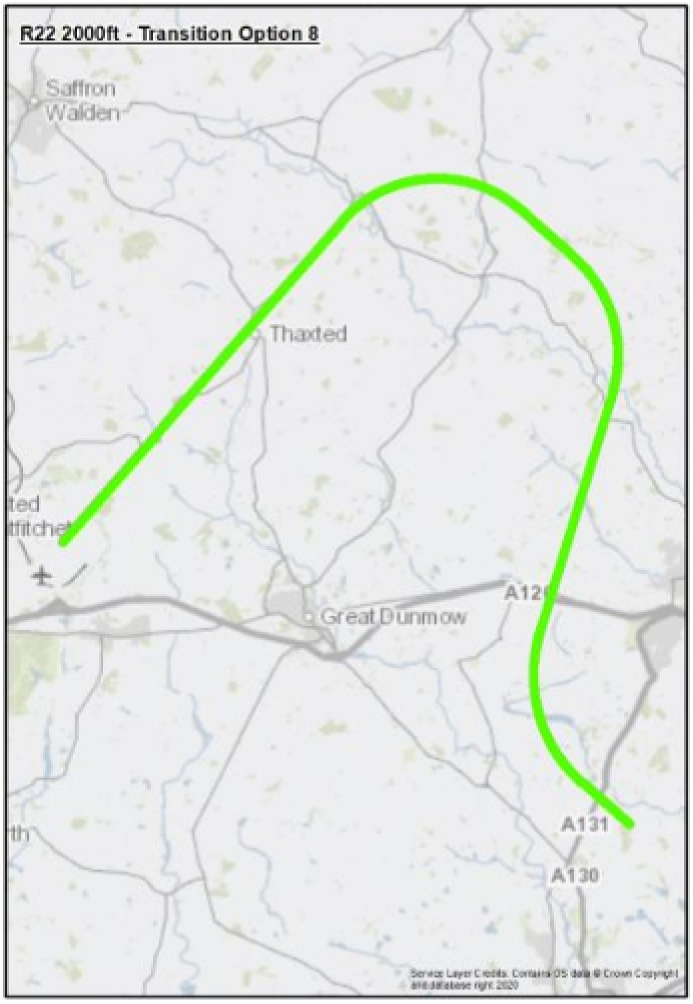
23.8 RWY 22 - 2,000ft Transition Option 5

Description	*Rationale for Inclusion*
Option 5 has an IAF at 7,000ft to the north-west of the airport which is close to the northern element of the current LOREL hold. It has been designed as an option that has minimum change from current operations and may also offer potential for noise relief if combined with Option12. *This IAF introduces longer track miles than previous options and from this position this option enables a CDA at 3.3% (2.2°) which is slightly lower than the optimal gradient for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns east from a position just west of Royston and routes to the north of Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Change: Minimum change when compared to current operation but with potential noise benefit. Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden. Noise N2: May provide an option for noise relief when combined with Option 12.



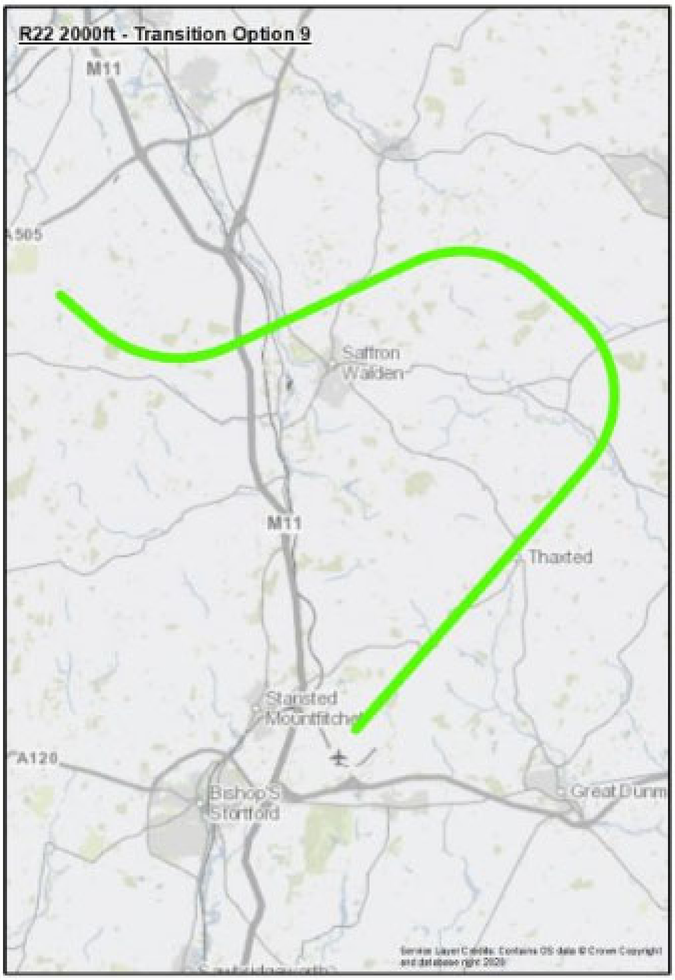
23.9 RWY 22 - 2,000ft Transition Option 8

Description	*Rationale for Inclusion*
Option 8 has an IAF at 7,000ft to the south-east of the airport in the vicinity of Great Leighs. *From this position this option enables a CDA at 5.3% (3°) which is at the upper limits for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *This option has slightly fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns north and routes to the west of Braintree and then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N1: Designed to limit the impact of noise by avoiding overflight of Chelmsford and Braintree. Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights)



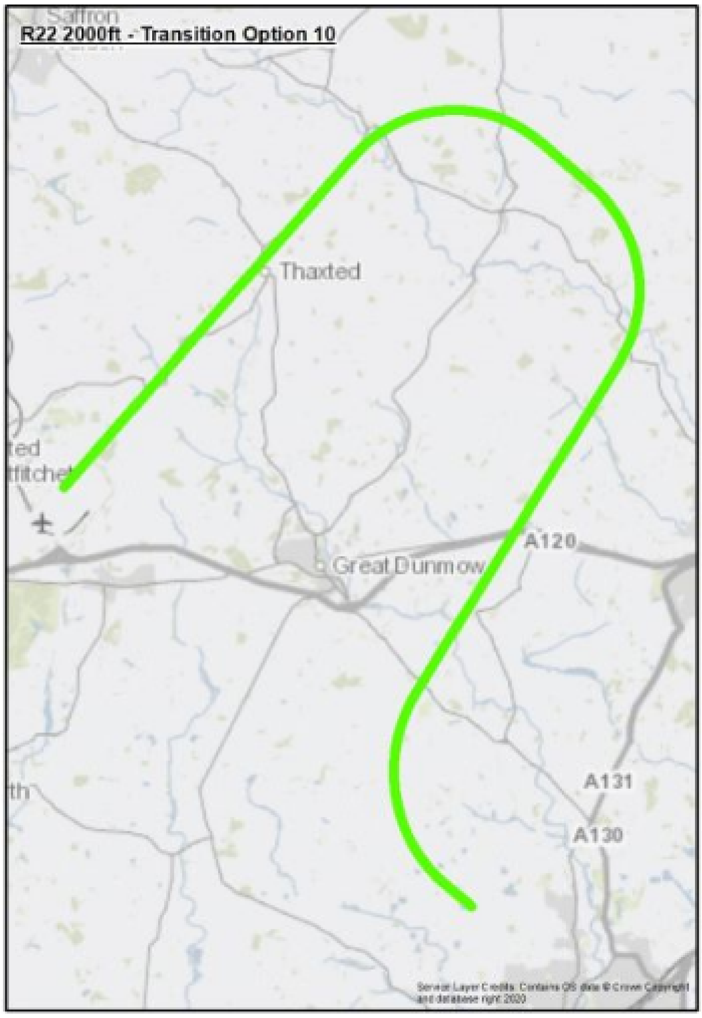
23.10 RWY 22 - 2,000ft Transition Option 9

Description	*Rationale for Inclusion*
Option 9 has an IAF at 7,000ft to the north-west of the airport in the vicinity of Heydon. *From this position this option enables a CDA at 5.3% (3°), which is at the upper limits for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *This option has slightly fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns east and routes to the north of Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N1: Designed to limit the impact of noise by avoiding overflight of Saffron Walden. Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights) Noise N2: May provide an option for noise relief when combined with option 17.



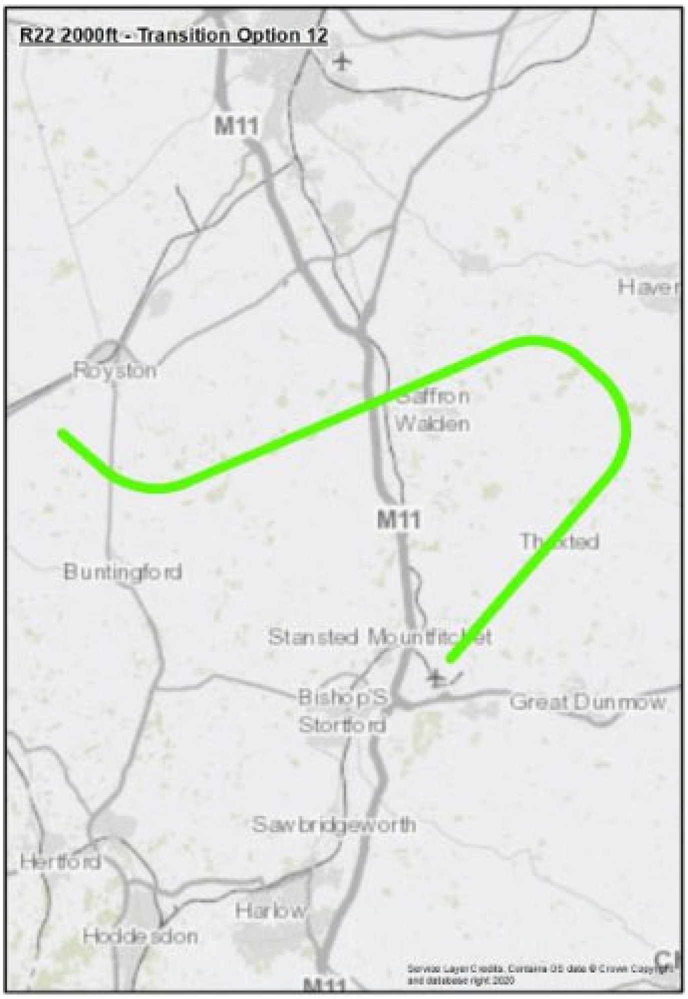
23.11 RWY 22 - 2,000ft Transition Option 10

Description	*Rationale for Inclusion*
Option 10 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold but slightly further south-east than Option 1. It has been designed as an option that offers potential for noise relief if combined with Option 1. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.5% (2.6°) for both runways.* *From the IAF the route turns north-east onto a downwind track and routes further to the east than Option 1 to limit the impact on Great Dunmow and to the west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N2: May provide an option for noise relief when combined with Option 1.



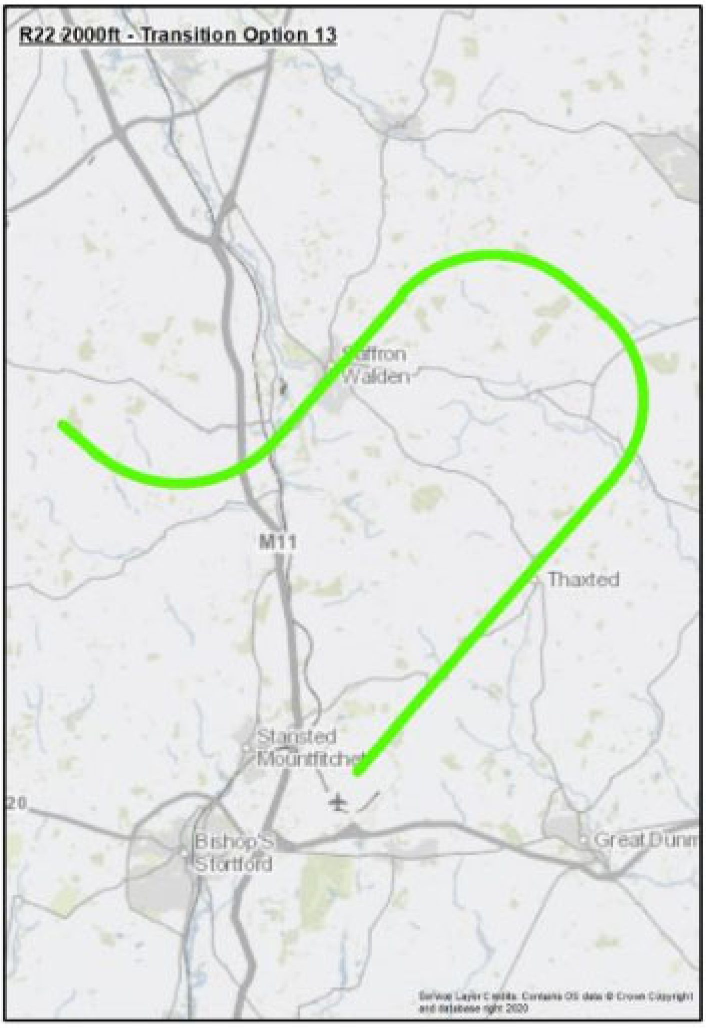
23.12 RWY 22 - 2,000ft Transition Option 12

Description	*Rationale for Inclusion*
Option 12 has an IAF at 7,000ft to the north-west of the airport which is close to the southern element of the current LOREL hold. It has been designed as an option that has minimum change from current operations and may also offer potential for noise relief if combined with Option 5.	Change: Minimum change when compared to current operation but with potential noise benefit.
From this position this option enables a CDA at 3.8% (2.2°), which is slightly lower than the optimal gradient for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.	Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden.
From the IAF the route turns east from a position just west of Royston and routes to the north of Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.	Noise N2: May provide an option for noise relief when combined with Option 5.



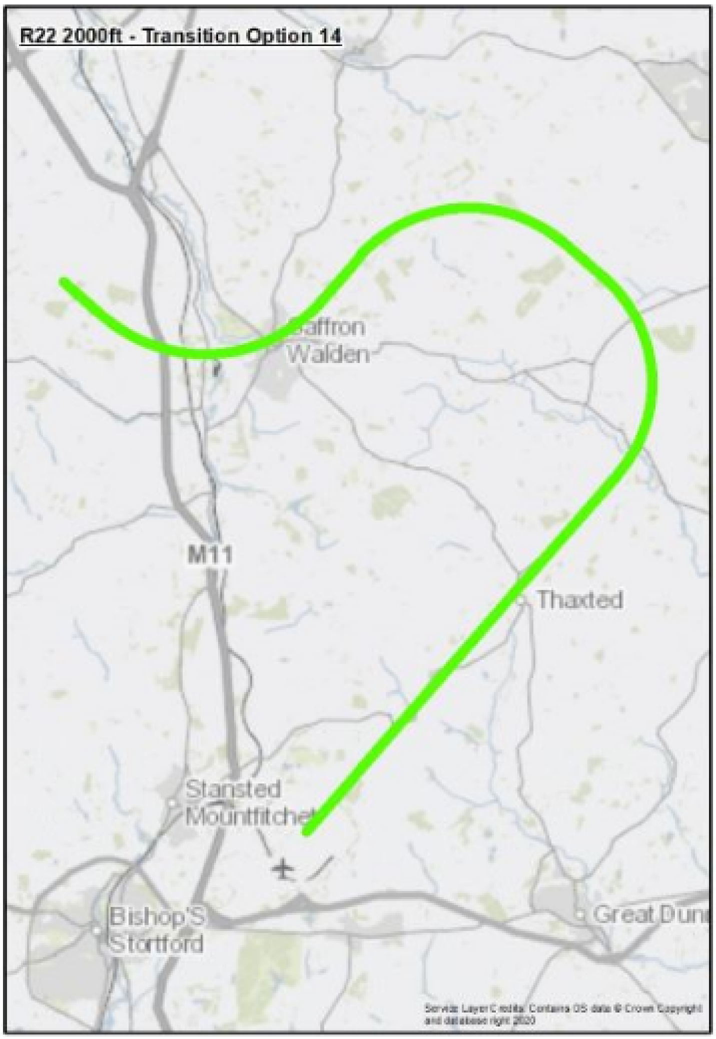
23.13 RWY 22 - 2,000ft Transition Option 13

Description	Rationale for Inclusion
Option 13 has an IAF at 7,000ft to the north-west of the airport in the vicinity of Langley Upper Green. *From this position this option enables a CDA at 5.2% (3°), which is at the upper limits for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *This option has fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns north-east and routes overhead Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights)



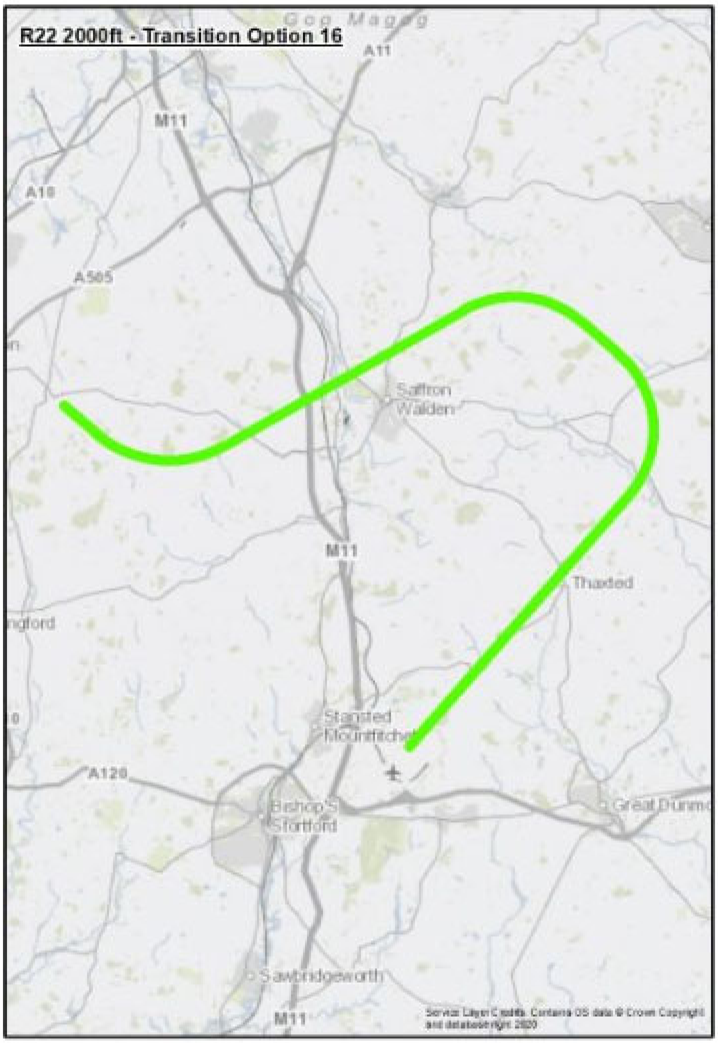
23.14 RWY 22 - 2,000ft Transition Option 14

Description	Rationale for Inclusion
Option 14 has an IAF at 7,000ft to the north-west of the airport in the vicinity of Strethall and has been designed as the shortest PANS-OPS compliant route to runway 22 for this joining point. *As a result, this option has fewer track miles for runway 22 operations, but this results in longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *This option enables a CDA at 6.2% (3.6°), which is above the upper limits for low noise approaches and the recommended range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north-east with a short stabilisation segment and routes and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Shortest possible route (fuel burn) to runway 22 used for approx. 70% of flights.



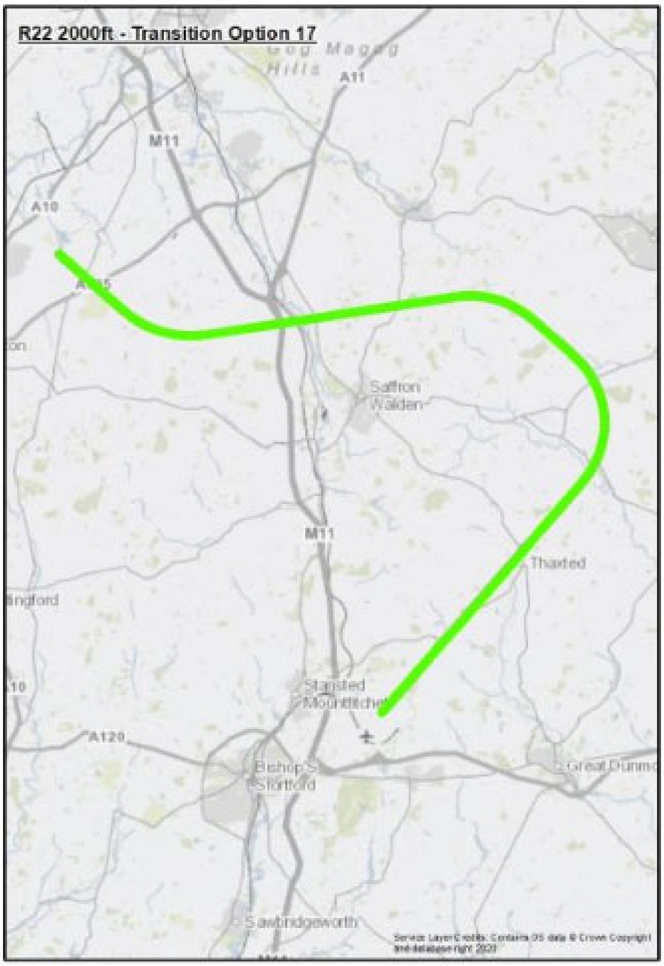
23.15 RWY 22 - 2,000ft Transition Option 16

Description	Rationale for Inclusion
Option 16 has an IAF at 7,000ft to the north-west of the airport in the vicinity of Great Chishill. *From this position this option enables a CDA at 4.7% (2.7°) which is close to the optimal gradient for low noise approaches and within the range for CDAs defined within CAA and ICAO guidance.* *This option has fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns north-east and routes to avoid Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights). Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden.



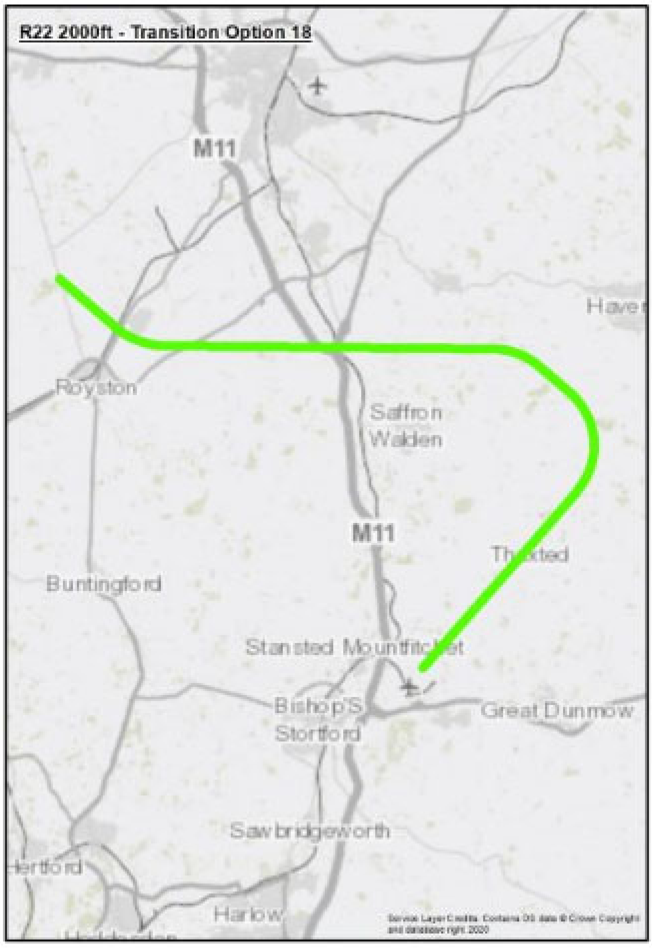
23.16 RWY 22 - 2,000ft Transition Option 17

Description	*Rationale for Inclusion*
Option 17 has an IAF at 7,000ft to the north-west of the airport, approx. 1 mile north-east of Melbourn. *From this position this option enables a CDA at 4.8% (2.75°), which is slightly above the optimal gradient for low noise approaches but within the range for CDAs defined within CAA and ICAO guidance.* *This option has fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns east and routes south of Ickleton and to the north of Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights). Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden. Noise N2: May provide an option for noise relief when combined with Option 9.



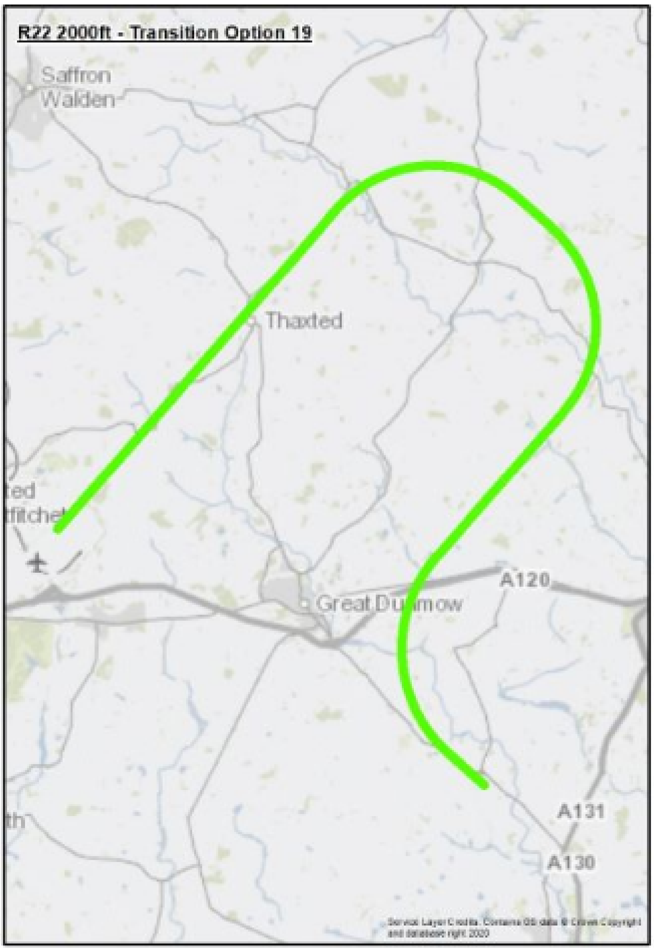
23.17 RWY 22 - 2,000ft Transition Option 18

Description	*Rationale for Inclusion*
Option 18 has an IAF at 7,000ft to the north-west of the airport at a position close to the northern boundary of the design envelope close to Bassingbourn Barracks. *From this position this option enables a CDA at 4% (2.3°), which is close to the optimal gradient for low noise approaches and within the range for CDAs defined within CAA and ICAO guidance.* *This option is close to equidistant to both runway directions but has slightly fewer track miles for runway 22 operations. This results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns east between Royston and Melbourn and routes to the north of Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Almost equal track miles (fuel burn) for both runways. Noise N1: Close to optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Royston and Saffron Walden.



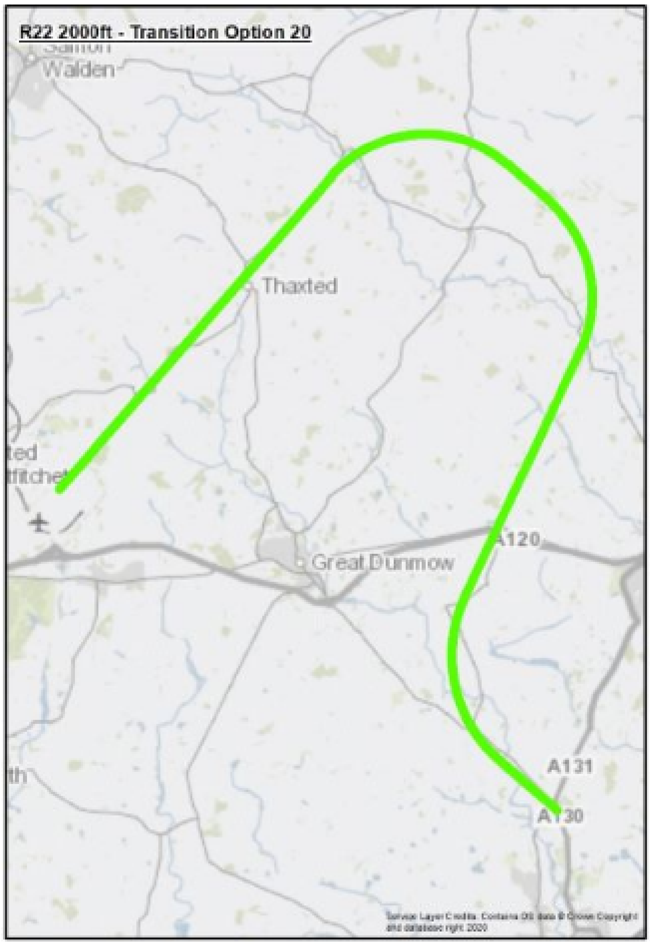
23.18 RWY 22 - 2,000ft Transition Option 19

Description	Rationale for Inclusion
Option 19 has an IAF at 7,000ft to the south-east of the airport which is almost equidistant to each runway threshold but with a slightly shorter track for runway 22. It has been designed as an option that offers potential for noise relief if combined with Option 20. *From this position this option enables a CDA at 5.2% (3°), which is at the upper limits for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north-east onto a downwind track and routes further to the East of Great Dunmow and west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights). Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N2: May provide an option for noise relief when combined with Option 20.



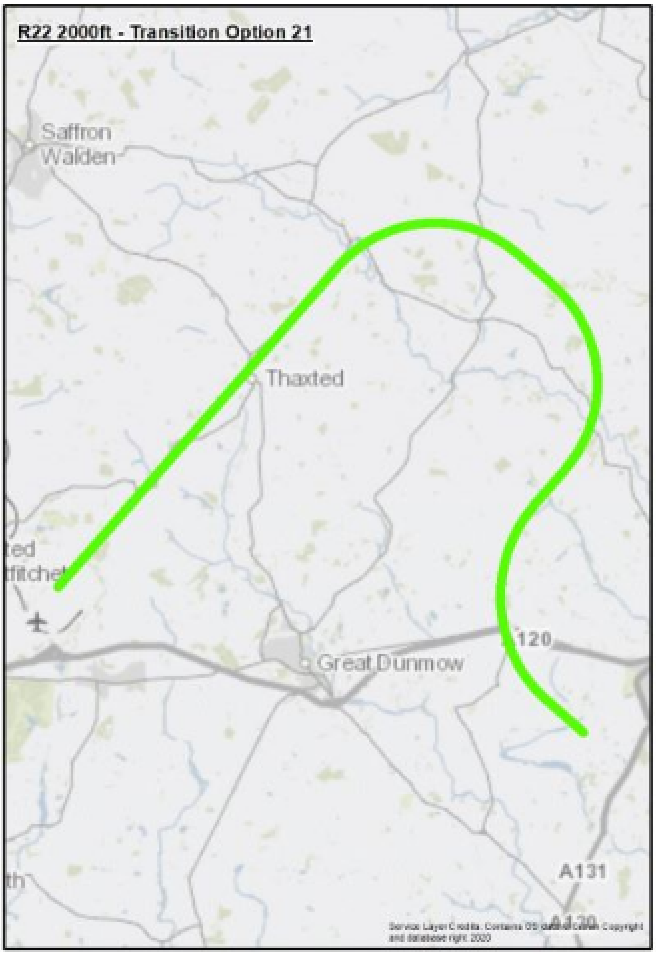
23.19 RWY 22 – 2,000ft Transition Option 20

Description	*Rationale for Inclusion*
Option 20 has an IAF at 7,000ft to the south-east of the airport close to Option 19, which is almost equidistant to each runway threshold but with a slightly shorter track for runway 22. It has been designed to offer potential for noise relief if combined with Option 19. *From this position this option enables a CDA at 5% (2.9°), which is at the upper limits for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north-east onto a downwind track and routes further to the east of Great Dunmow and west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights). Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N2: May provide an option for noise relief when combined with Option 19.



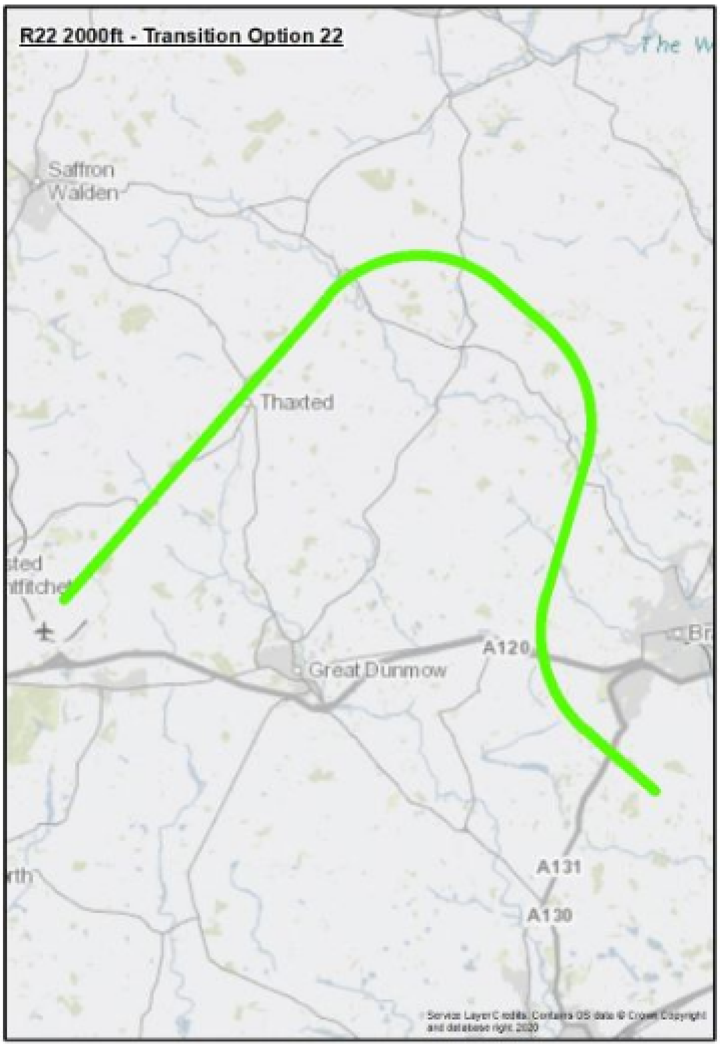
23.20 RWY 22 - 2,000ft Transition Option 21

Description	Rationale for Inclusion
Option 21 has an IAF at 7,000ft to the east of the airport to the south east of Braintree and has been designed as the shortest PANS-OPS compliant route to runway 22 for this joining point and may offer potential for noise relief when combined with Option 22. *As a result, this option has fewer track miles for runway 22 operations, but this results in longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *This option enables a CDA at 6.3% (3.6°), which is above the upper limits for low noise approaches and the recommended range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north-east with a short stabilisation segment and then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N2: May provide an option for noise relief when combined with Option 22. Balance: Shortest possible route (fuel burn) to runway 22 used for approx. 70% of flights.



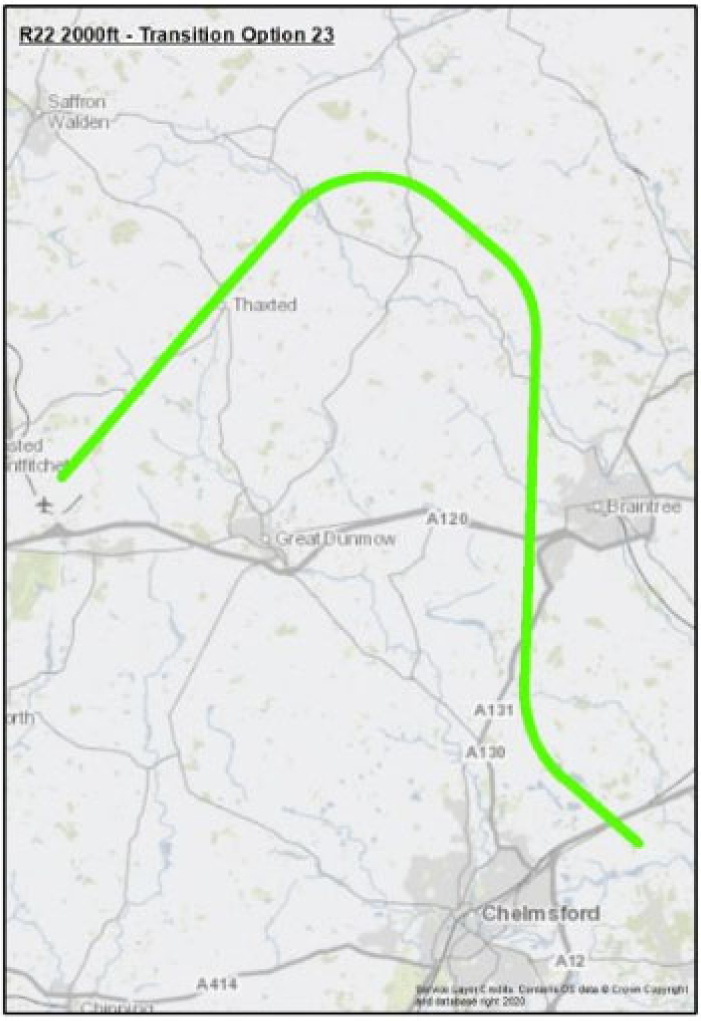
23.21 RWY 22 - 2,000ft Transition Option 22

Description	*Rationale for Inclusion*
Option 22 has an IAF at 7,000ft to the east of the airport and to the south of Braintree. It has been designed to offer potential for noise relief if combined with Option 21. *As a result, this option has fewer track miles for runway 22 operations, but this results in longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *This option enables a CDA at 5.8 (3.3°), which is above the upper limits for low noise approaches and the recommended range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east with a short stabilisation segment and then turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights). Noise N2: May provide an option for noise relief when combined with Option 21.



23.22 RWY 22 - 2,000ft Transition Option 23

Description	Rationale for Inclusion
Option 23 has an IAF at 7,000ft to the south east of the airport at a position close to the southern boundary of the design envelope mid-way between Chelmsford and Witham. *From this position this option enables a CDA at 4.4% (2.5°), which is the optimal gradient for low noise approaches and the range defined for CDAs defined within CAA and ICAO guidance.* *After 7,000ft the route turns north and routes to the west of Braintree before turning left onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N1: Optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Braintree.



23.23 RWY 22 - 2,000ft Transitions: Viable but Poor Fit Options

23.23.1 RWY 22 - 2,000ft Transition Option A3

IAF-3 is south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance than other equidistant options. It facilitates a CDA but with a sub-optimum profile.

Reason for exclusion: Design Principles Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between STN arrivals and interactions with traffic to and from other airports on routes M197 and Q295 and the network joining points for LTN, LCY and LHR departing traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is efficiency and the expeditious flow of traffic including greater runway throughput. By creating interactions with routes traffic for other airports this option would not comply with this initiative (and therefore the Policy DP) as it has the potential to require ATC interaction which would reduce this efficiency.

23.23.2 RWY 22 - 2,000ft Transition Option B6

IAF-6 east of the aerodrome and west of Colchester. The IAF lies outside of the 2,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principles Policy and Safety.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

23.23.3 RWY 22 - 2,000ft Transition Option C7

IAF-7 is north east of the aerodrome mid-way between Cambridge and Newmarket to the north east of STN. It was designed as a mirror for Option B6. The IAF lies outside of the 2,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach

(CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

23.23.4 RWY 22 - 2,000ft Transition Option D11

IAF-11 is north east of the aerodrome close to the current ABBOT hold. The IAF is outside of the 2,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

23.23.5 RWY 22 - 2,000ft Transition Option E15

IAF-15 is positioned to the north to the east of Duxford and to the north west of STN. The IAF is outside of the 2,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the Minimum Stabilisation Distance (MSD) requirements within PANS-OPS. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

24 Approach RWY 04 – 2,000ft FAF

24.1 Overview

This approach is included within the options to provide a 3°final approach descent gradient with a Final Approach Fix (FAF) of 2,000ft. The approach is aligned with the runway centreline, which aims to align with the track of the currently published ILS procedure for RWY 04 but intercepts the FAF at 2,000 ft instead of 2,500ft.

The intermediate segment length that precedes this segment caters for any turns in the transition at the Intermediate Fix (IF) of up to 90°, which provides sufficient distance for turn anticipation and the Minimum Stabilisation Distance (MSD).

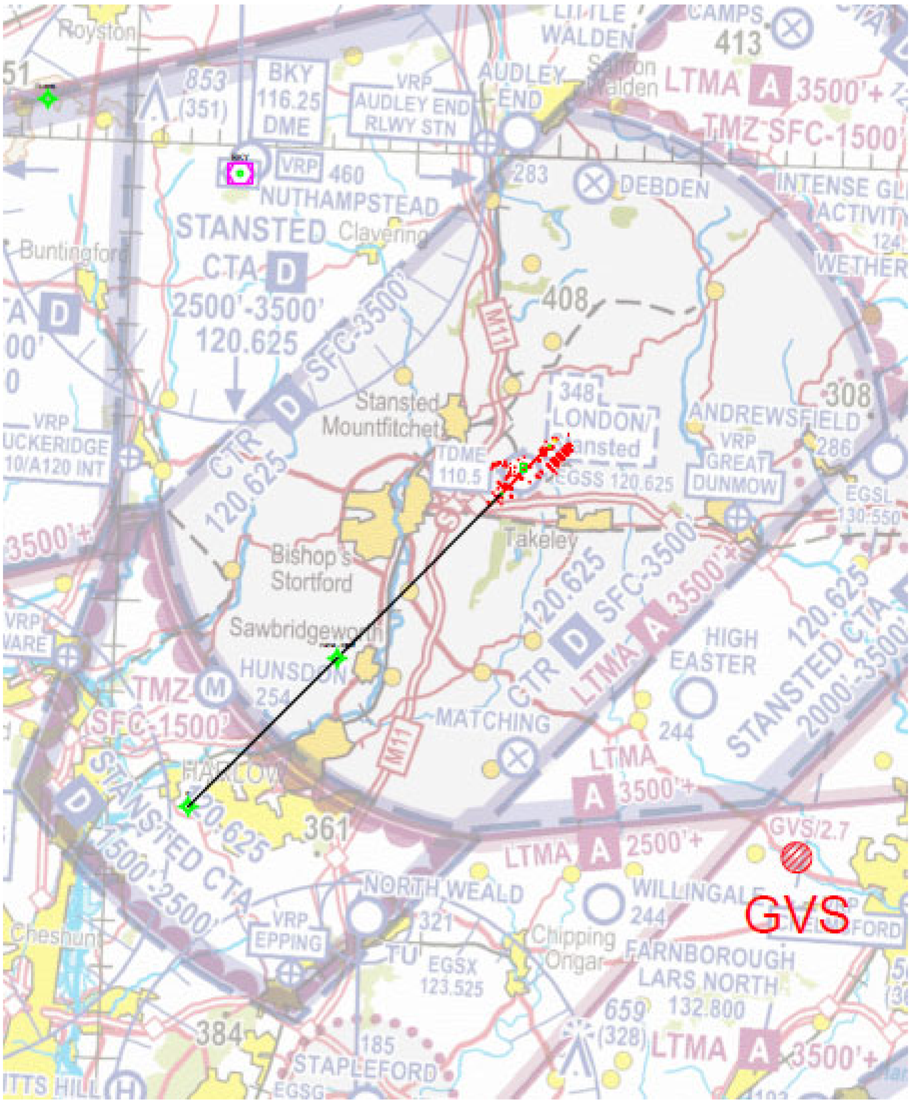


Figure 46 Approach Path RWY 04 – 2,000ft FAF

This approach path is common for each of the transition options with a 2,000ft FAF for RWY 04 detailed below.

25 RWY 04 – 2,000ft Transitions

25.1 Introduction to RWY 04 Transition Options with 2,000ft FAF Envelope

This suite of transitions connects the Initial Approach Fix (IAF) to the RWY 04 Approach with a 2,000ft FAF. The intention has been to define an IAF position that would facilitate a continuous descent to both RWY 04, and to RWY 22.

25.2 Design Envelope Location Map: 2,000ft transition for RWY 04.

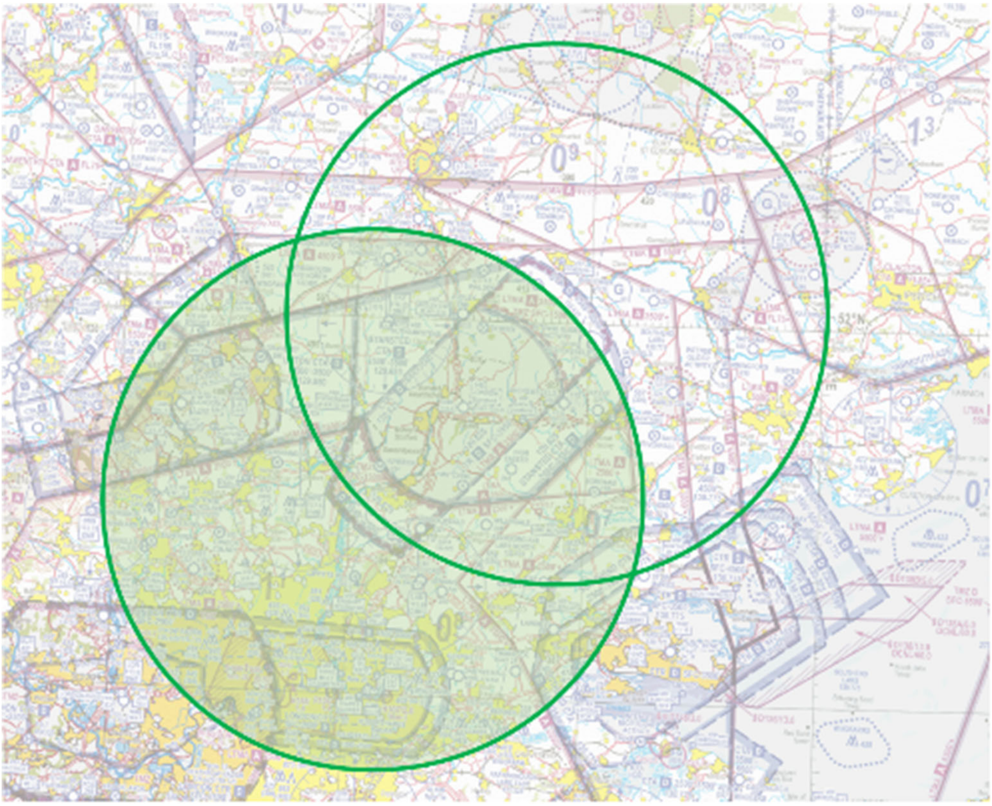


Figure 47 RWY 04 Transitions Design Envelope, 2,000ft FAF

The transition options have been designed using this design envelope as the boundary within which to design "Viable and Good fit" options. This takes into account the requirements of the Policy and Technology design principles to facilitate CDAs to both runways.

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25.3 RWY 04 Transitions Long List – 2,000ft Outline Longlist

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the SE of the aerodrome and turn right onto final approach. .	A3	IAF-3 South and east of the aerodrome, equidistant to both runway thresholds but at a greater distance. Potential to interact with other airports.	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distances (MSD) and the turn onto final approach. • Descent gradients above the PANS-OPS maximum • Turn radius based on speed, altitude, and descent gradient These options have not been designed and are not described further within this comprehensive list of design options.
2a (Central)	7,000ft point that is close to or overhead the aerodrome resulting in an equidistant track to both runway thresholds. Arrivals route from the SE and turn downwind left to the NW of the aerodrome and turn right onto final approach.	B6	IAF-6 East of the aerodrome and west of Colchester. Not fully CDA compliant.		
2b (Central)	7,000ft point that is close to or overhead the aerodrome. Arrivals route from the NW and turn	C7	IAF-7 north-east of the aerodrome mid-way between Cambridge and Newmarket.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	downwind right to the S of the aerodrome and turn right onto final approach.		Not fully CDA compliant.		
4 (West)	7,000ft point to the NW of the aerodrome (close to BKY). Arrivals route to the SW and turn left onto final approach.	D11	IAF-11 East of the aerodrome (close to ABBOT). Not fully CDA compliant.		
5 (West)	7,000ft point to the north of the aerodrome (close to LOREL). Arrivals route south and turn left onto final approach.	E15	IAF 15 positioned to the east of Duxford. Not fully CDA compliant.		
8 (East)	7,000ft point to the south-east of the aerodrome. Slightly extended track miles for 04, routes SW and turns right onto final approach.				
9 (West)	7,000ft point north of the aerodrome. Slightly extended track miles for 04, routes SW and turns left onto final approach.				
10 (East)	7,000ft point south of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the SE of the aerodrome and turn right onto final approach.				
12 (West)	7,000ft point to the north of the aerodrome (close to LOREL). Arrivals route south and turn left onto final approach.				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
13 (West)	7,000ft point to the north of the aerodrome. Slightly extended track miles for 04, routes SW and turns left onto final approach.				
14 (West)	7,000ft point to the north west of the aerodrome. CDA compliant but has extended track miles for 04, routes SW and turns right onto final approach.				
16 (West)	7,000ft point to the north west of the aerodrome. Slightly extended track miles for 04, routes SW and turns left onto final approach.				
17 (West)	7,000ft point further to the north of the aerodrome. Slightly extended track miles for 04, routes SW and turns left onto final approach.				
18 (West)	7,000ft point to the north west of the aerodrome at the northern boundary of the design envelope. Extended track miles for 04, routes SW and turns left onto final approach.				
19 (East)	7,000ft point to the south east of the aerodrome. Routes to the S of the aerodrome turns right onto final approach.				

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
20 (East)	7,000ft point to the south east of the aerodrome (close to option 19). Routes S of the aerodrome and turns right onto final approach.				
21 (East)	7,000ft point to the south east of the aerodrome with a bias for runway 22 arrivals. Extended track miles for 04, routes SW and turns right onto final approach.				
22 (East)	7,000ft point to the south east of the aerodrome with a bias for runway 22 arrivals. Extended track miles for 04, routes SW and turns right onto final approach.				
23 (East)°	7,000ft point to the SE of the aerodrome at the southern boundary of the design envelope. Extended track miles for 04, routes SW and turns right onto final approach.				

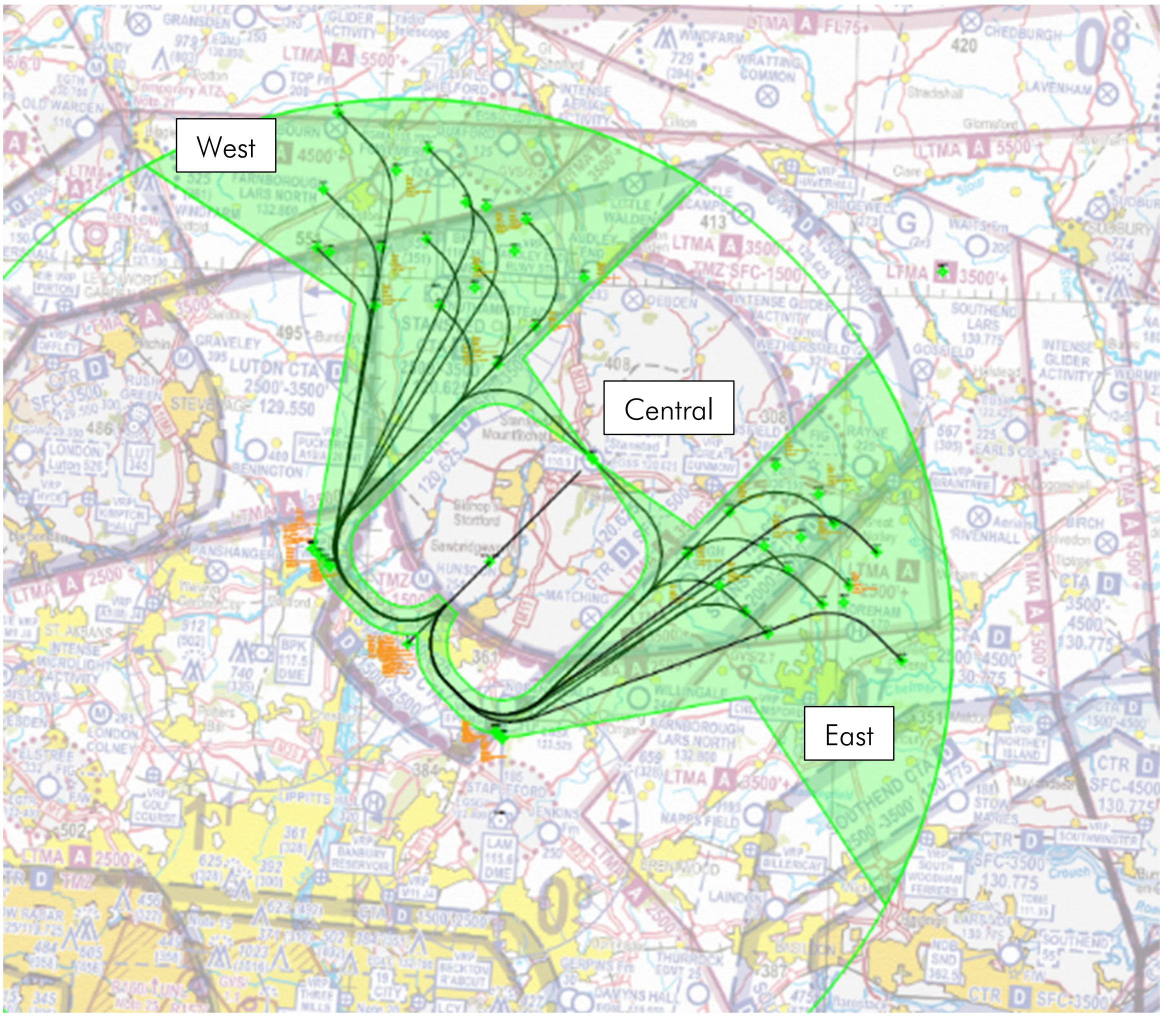
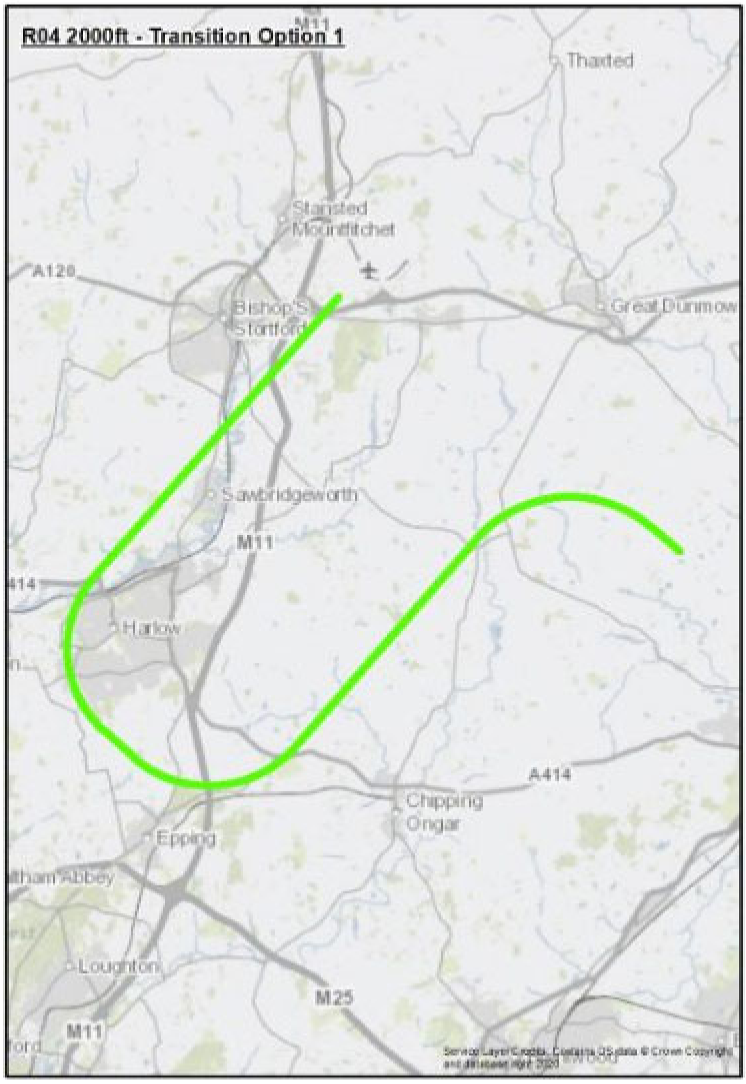


Figure 48 RWY 04 Transitions Design Envelope, 2,000ft FAF and Transition Options

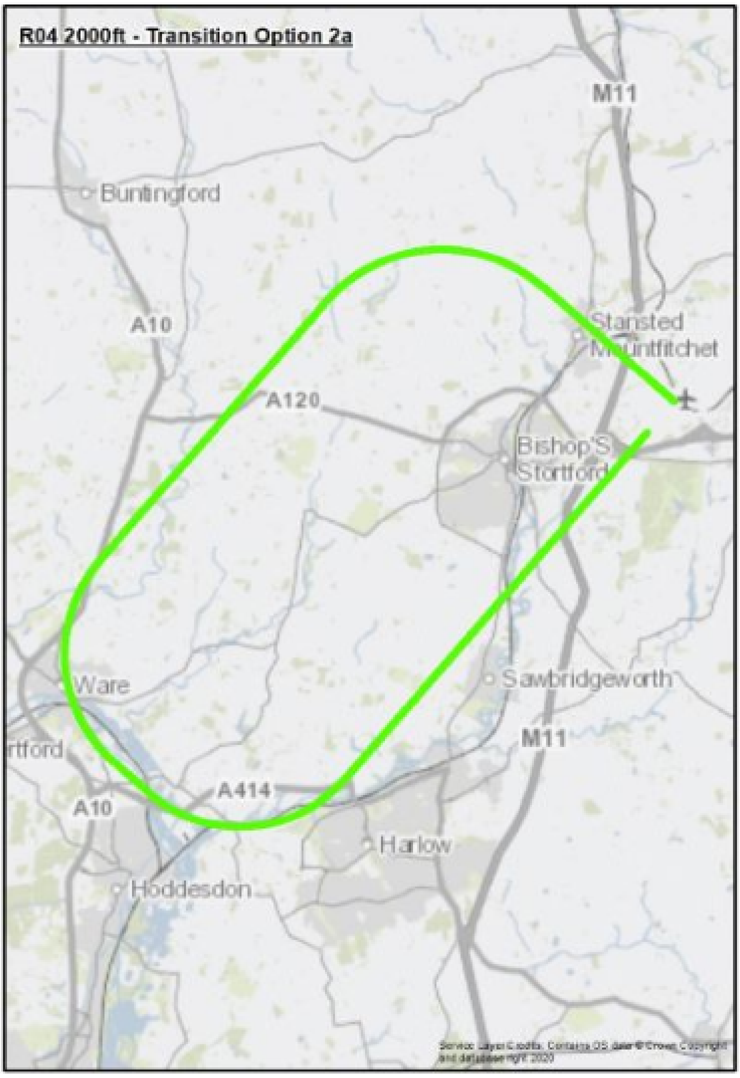
25.4 RWY 04 - 2,000ft Transition Option 1

Description	Rationale for Inclusion
Option 1 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.6% (2.6°) for both runways.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and overhead North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient.



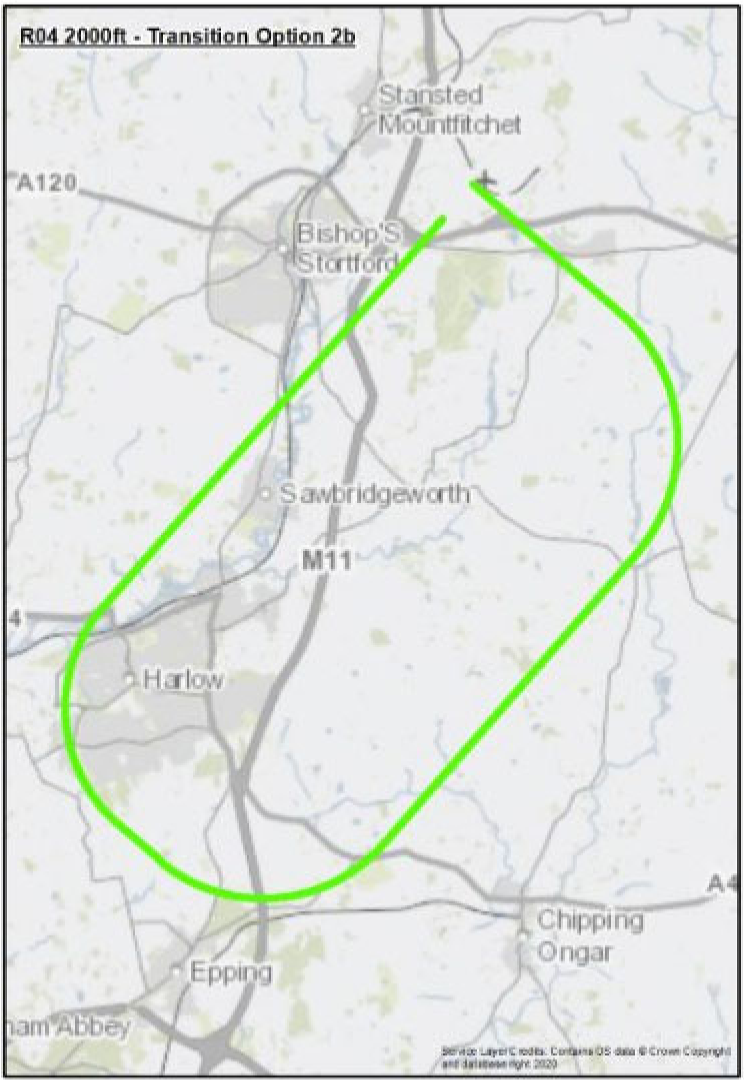
25.5 RWY 04 - 2,000ft Transition Option 2a

Description	*Rationale for Inclusion*
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the SE and turn downwind left. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.1% (2.4°) for both runways.* *From the IAF the route is heading north west and then turns south west onto a downwind track parallel with the final approach and routes close to Ware at which point it turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient.



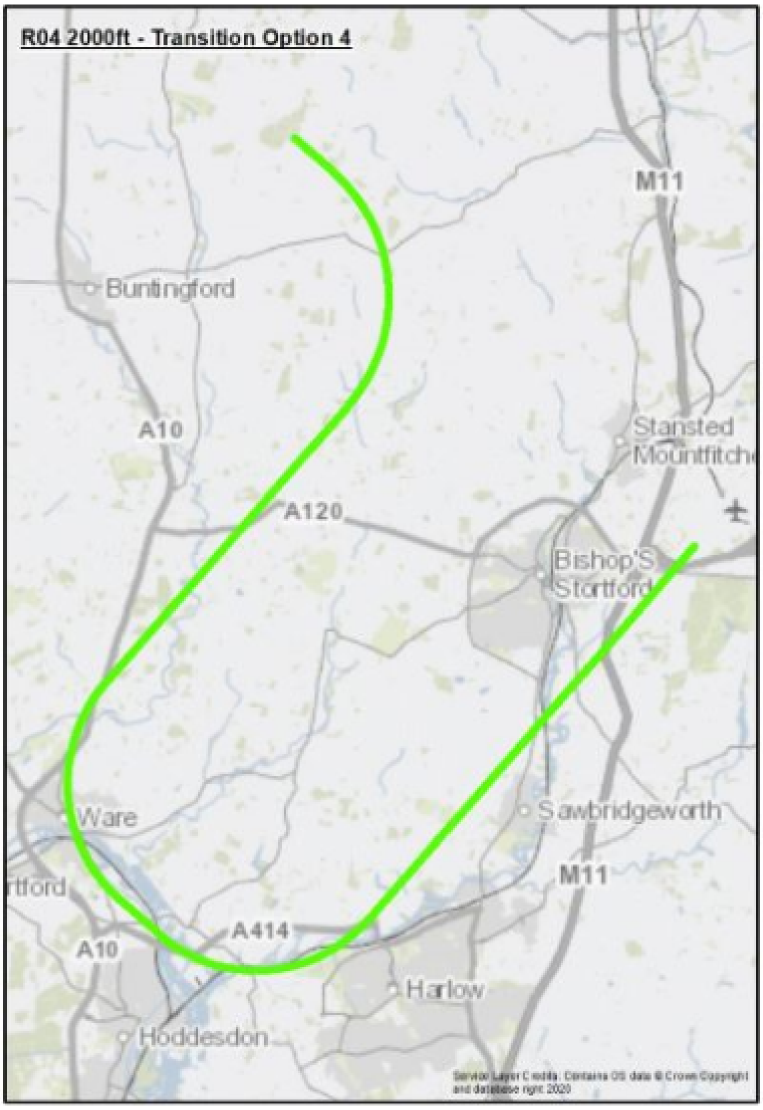
25.6 RWY 04 - 2,000ft Transition Option 2b

Description	*Rationale for Inclusion*
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the NW and turn downwind right, and then turn left base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.1% (2.4°) for both runways.* *From the IAF the route is heading south east and then turns south west onto a downwind track parallel with the final approach and overhead North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient.



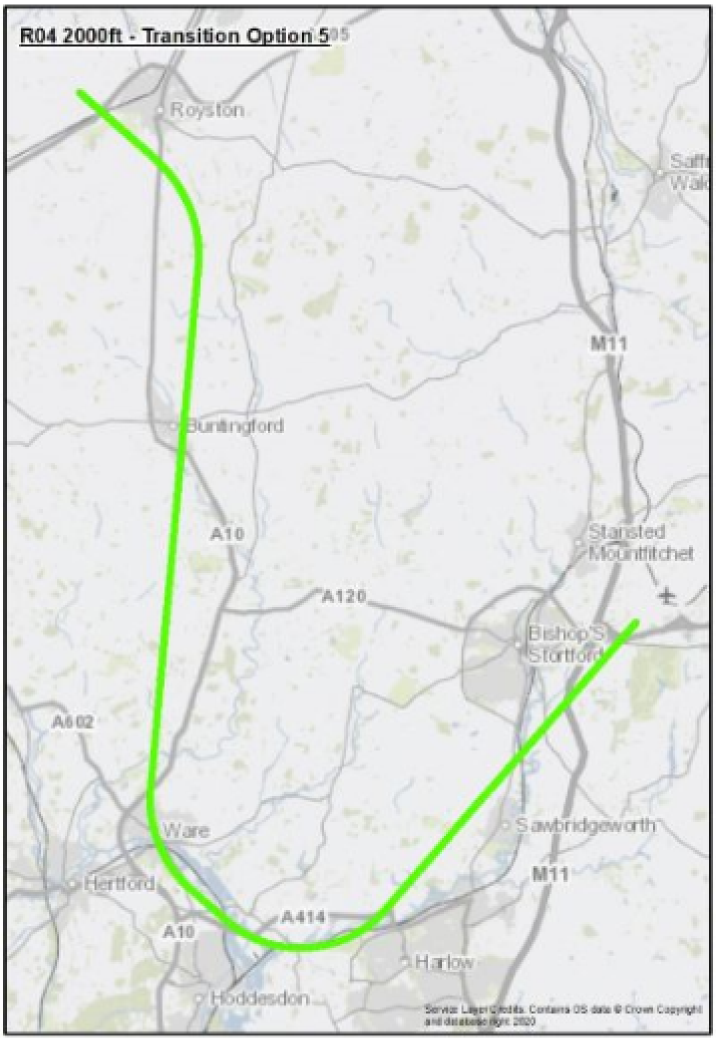
25.7 RWY 04 - 2,000ft Transition Option 4

Description	*Rationale for Inclusion*
Option 4 has an IAF at 7,000ft to the north west of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.6% (2.6°) for both runways.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and routes close to Ware at which point it turns left onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient.



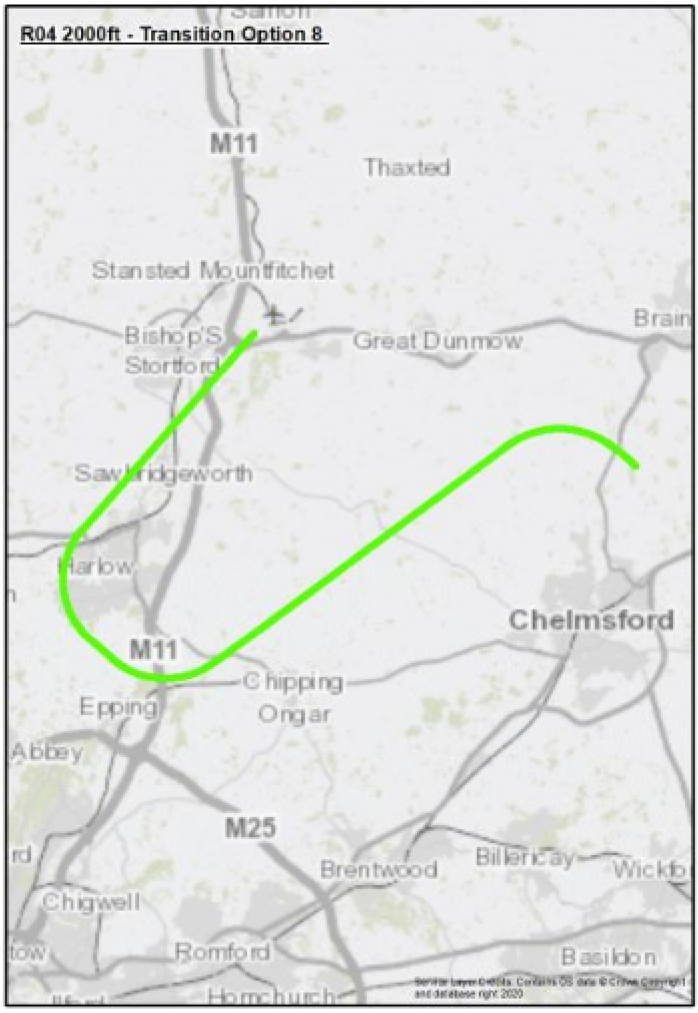
25.8 RWY 04 - 2,000ft Transition Option 5

Description	Rationale for Inclusion
Option 5 has an IAF at 7,000ft to the north west of the airport which is close to the northern element of the current LOREL hold. It has been designed as an option that has minimum change from current operations and may also offer potential for noise relief if combined with Option12.	Change: Minimum change when compared to current operation but with potential noise benefit.
From this position this option enables a CDA at 3.9% (2.2°) which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.	Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden.
From the IAF the route turns south from a position just west of Royston and routes just south of Buntingford and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.	Noise N2: May provide an option for noise relief when combined with option 12



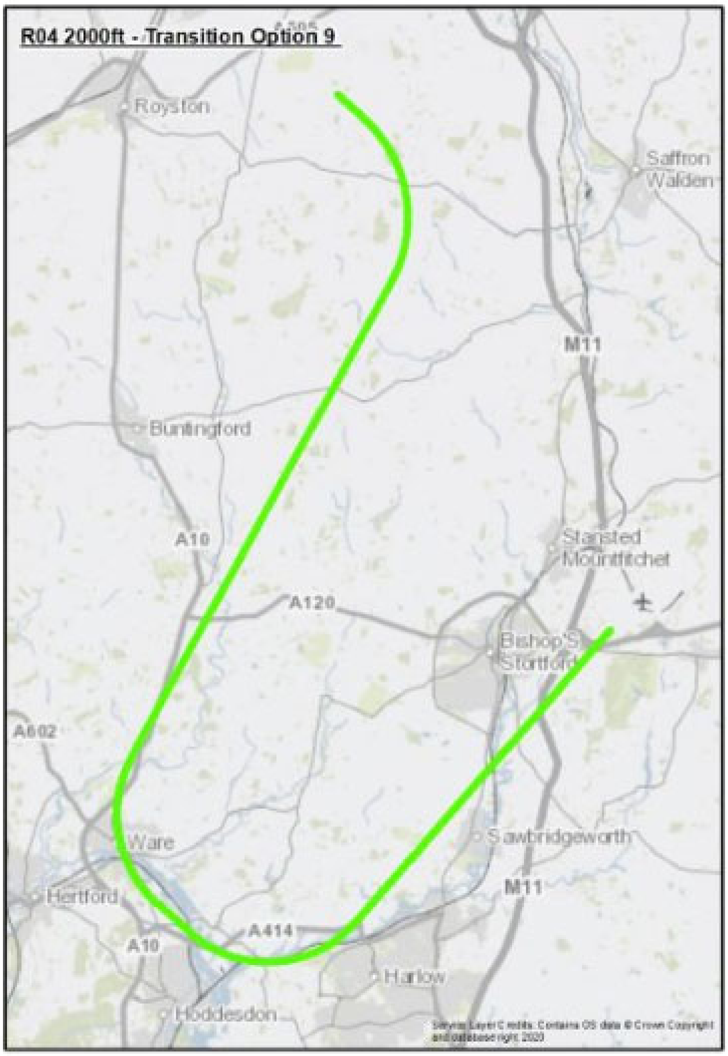
25.9 RWY 04 - 2,000ft Transition Option 8

Description	*Rationale for Inclusion*
Option 8 has an IAF at 7,000ft to the south-east of the airport in the vicinity of Great Leighs. This option has a slight bias for runway 22 and this results in slightly longer track miles and a shallower CDA for this runway. *From this position this option enables a CDA at 3.8% (2.2°) which is just below the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and overhead North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N1: Close to optimal low noise CDA gradient.



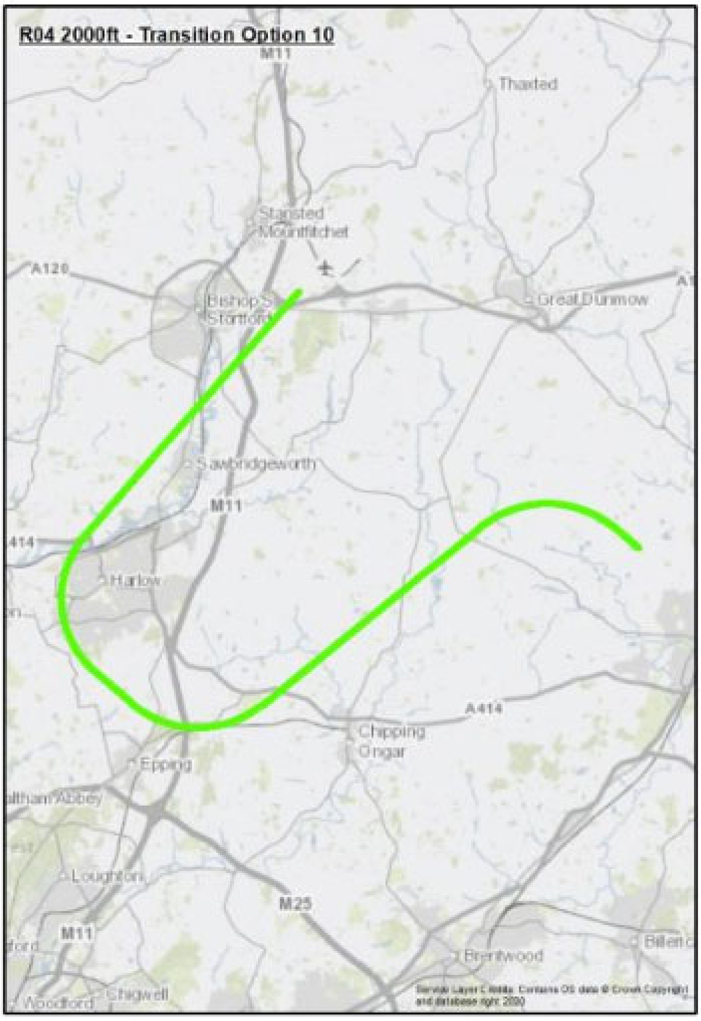
25.10 RWY 04 - 2,000ft Transition Option 9

Description	*Rationale for Inclusion*
Option 9 has an IAF at 7,000ft to the north west of the airport in the vicinity of Heydon. This option has a slight bias for runway 22 and this results in slightly longer track miles and a shallower CDA for this runway. *From this position this option enables a CDA at 3.8% (2.2°) which is just below the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west and routes close to Puckeridge and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Noise N1: Close to optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with option 17.



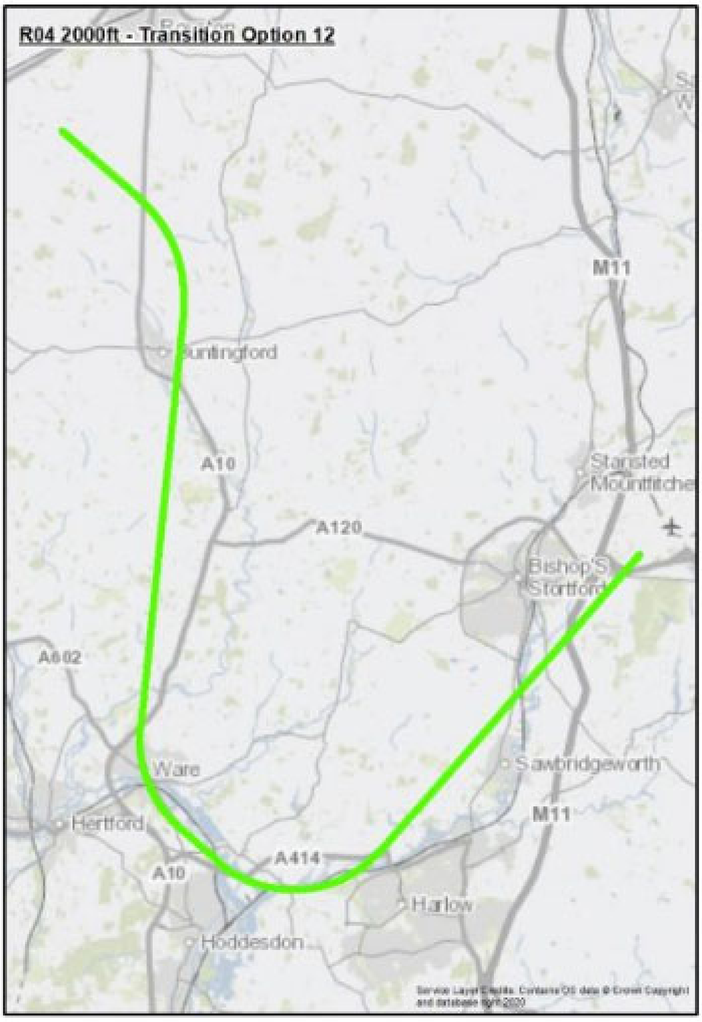
25.11 RWY 04 - 2,000ft Transition Option 10

Description	Rationale for Inclusion
Option 10 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold but slightly further SE than Option 1. It has been designed as an option that offers potential for noise relief if combined with Option1. *From this position there is an equal distance between each runway threshold, and this option enables an optimal low noise CDA at 4.5% (2.6°) for both runways.* *From the IAF the route turns south west onto a downwind track and routes further to the south than Option 1 to create noise dispersal. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with Option 1.



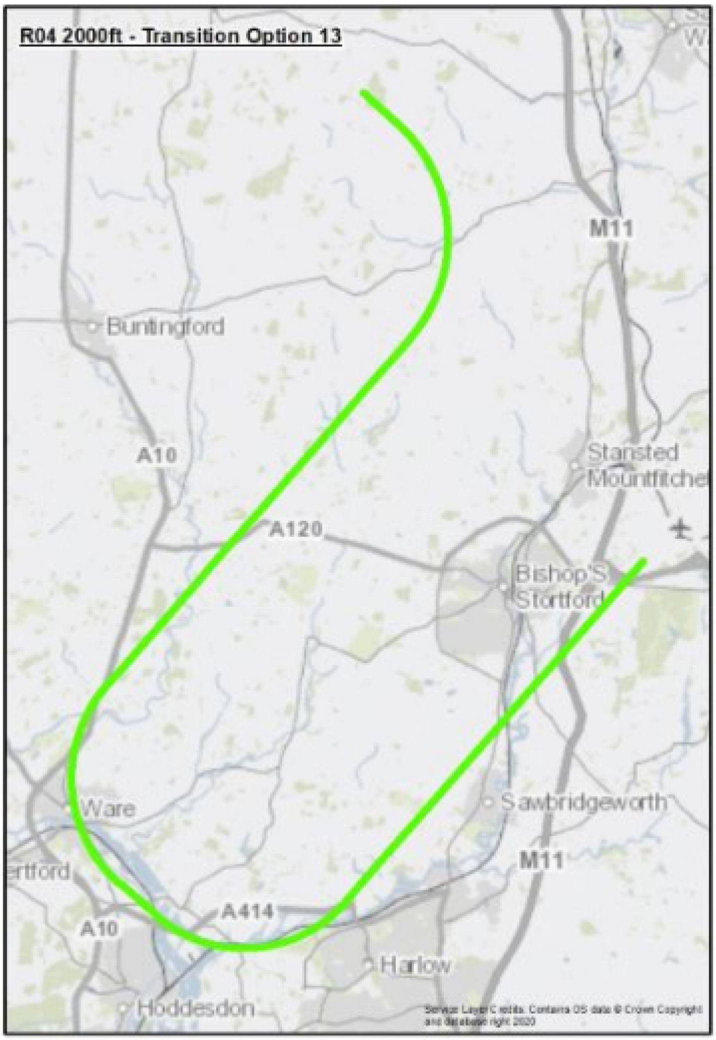
25.12 RWY 04 - 2,000ft Transition Option 12

Description	Rationale for Inclusion
Option 12 has an IAF at 7,000ft to the north west of the airport which is close to the southern element of the current LOREL hold. It has been designed as an option that has minimum change from current operations and may also offer potential for noise relief if combined with Option 5. *From this position this option enables a CDA at 4.4% (2.5°) which is the optimum for low noise approaches and within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south from a position just west of Royston and routes just south of Buntingford and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Change: Minimum change when compared to current operation but with potential noise benefit. Noise N1: Optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with option 5.



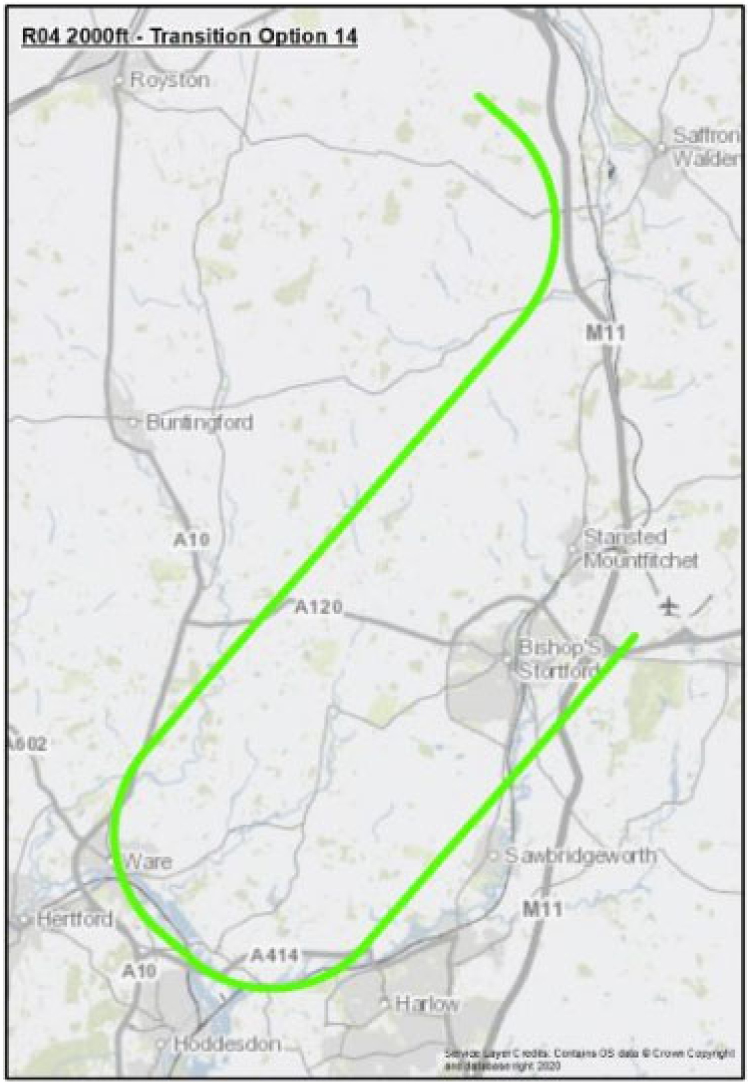
25.13 RWY 04 - 2,000ft Transition Option 13

Description	*Rationale for Inclusion*
Option 13 has an IAF at 7,000ft to the north west of the airport in the vicinity of Langley Upper Green. This option has a slight bias for runway 22 and this results in slightly longer track miles for this runway. *From this position this option enables a CDA at 4.1% (2.3°) which is close to the optimal for low noise approaches and within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west on a track parallel with the final approach and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Noise N1: Close to optimal low noise CDA gradient. Noise N1: Avoids major towns as far as possible (within the constraints imposed by the joining point).



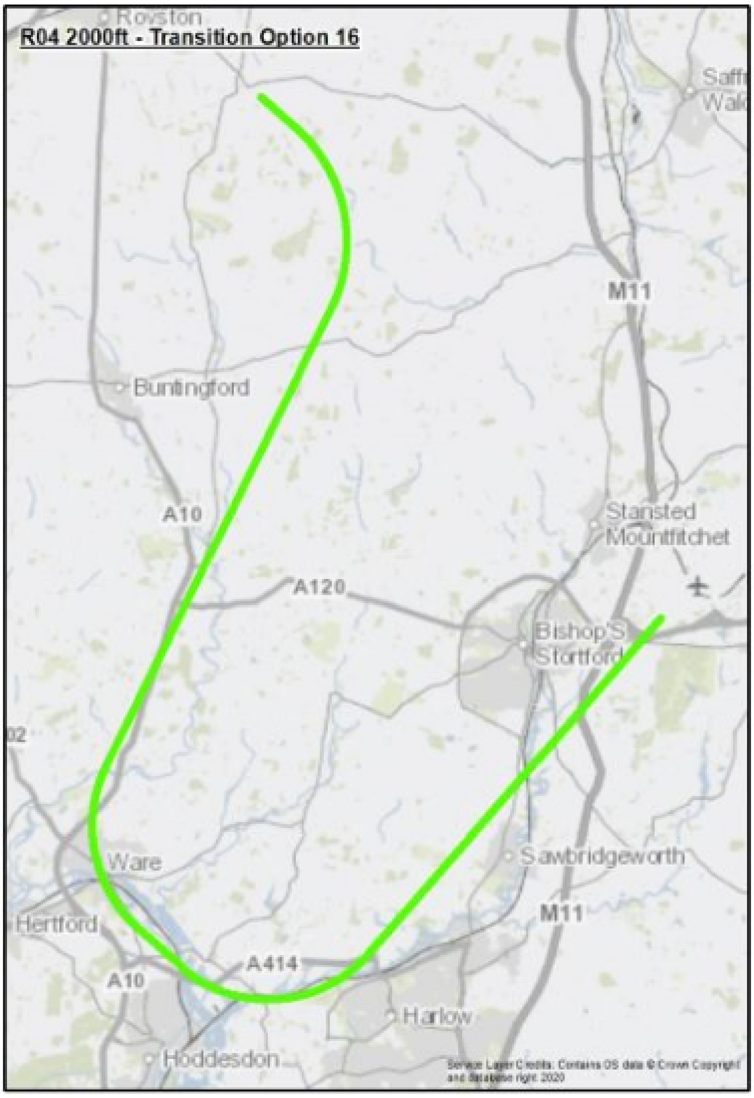
25.14 RWY 04 - 2,000ft Transition Option 14

Description	*Rationale for Inclusion*
Option 14 has an IAF at 7,000ft to the north west of the airport in the vicinity of Strethall to create the shortest viable route for runway 22 which results in longer track miles for this runway. *For 04 this option enables a CDA at 3.6% (2.1°) which is slightly below the optimal for low noise approaches but within the recommended range for CDAs within CAA and ICAO guidance.* *From the IAF the route turns south west on a track parallel with the final approach and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Noise N1: Avoids major towns as far as possible (within the constraints imposed by the joining point).



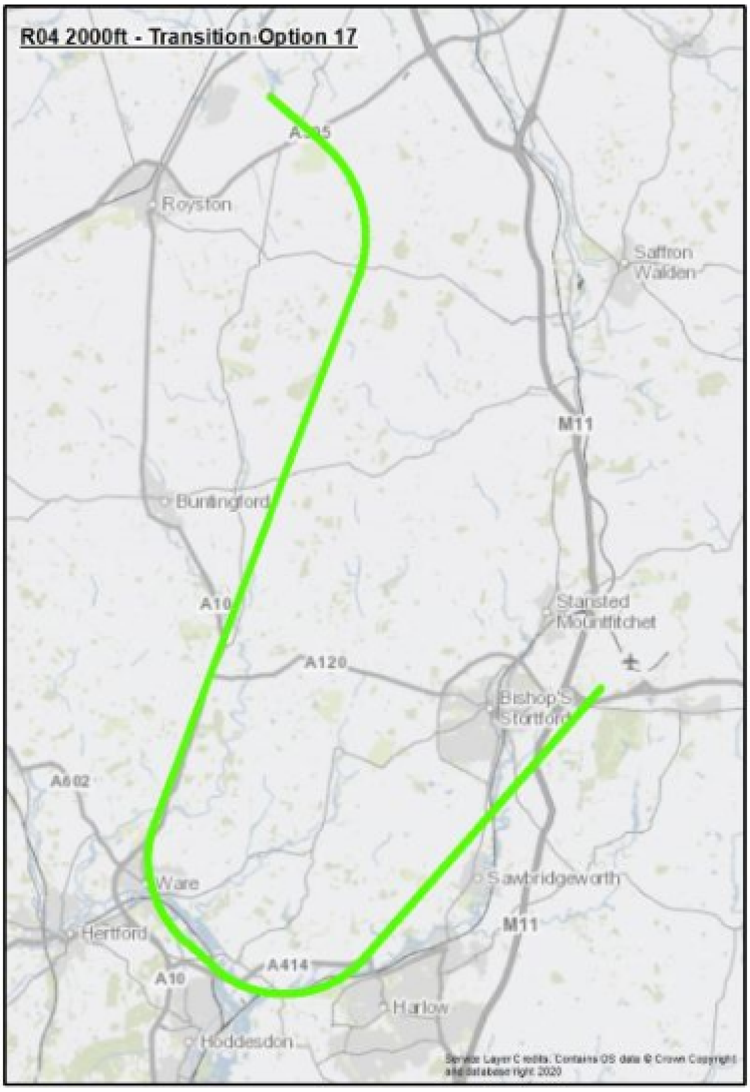
25.15 RWY 04 - 2,000ft Transition Option 16

Description	Rationale for Inclusion
Option 16 has an IAF at 7,000ft to the north west of the airport in the vicinity of Great Chishill. This gives a slight bias for runway 22 which results in slightly longer track miles for this runway. *From this position this option enables a CDA at 4.1% (2.3°) which is close to the optimal gradient for low noise approaches and within the range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west and routes close to Puckeridge and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Noise N1: Close to optimal low noise CDA gradient. Noise N1: Avoids major towns as far as possible (within the constraints imposed by the joining point).



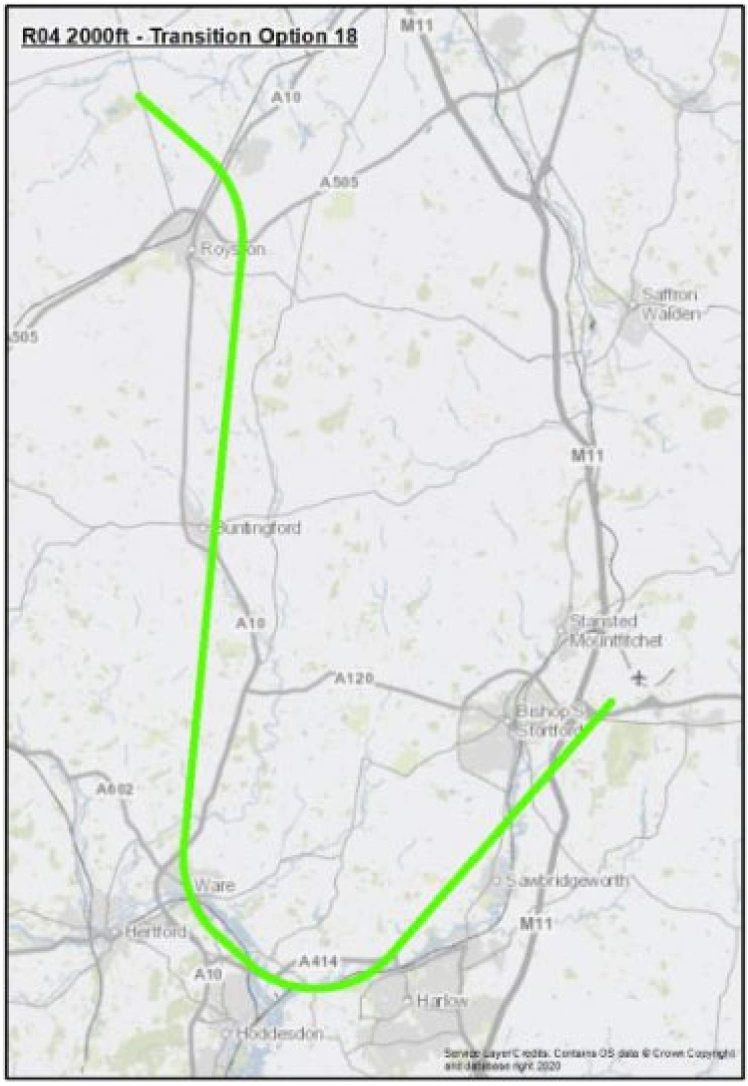
25.16 RWY 04 - 2,000ft Transition Option 17

Description	*Rationale for Inclusion*
Option 17 has an IAF at 7,000ft to the north west of the airport, approx. 1 mile north east of Melbourn. This gives a slight bias for runway 22 which results in slightly longer track miles for this runway. *From this position this option enables a CDA at 3.5% (2°) which is below the optimal gradient for low noise approaches but within the range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west and routes close to Puckeridge and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Noise N2: May provide an option for noise relief when combined with option 9.



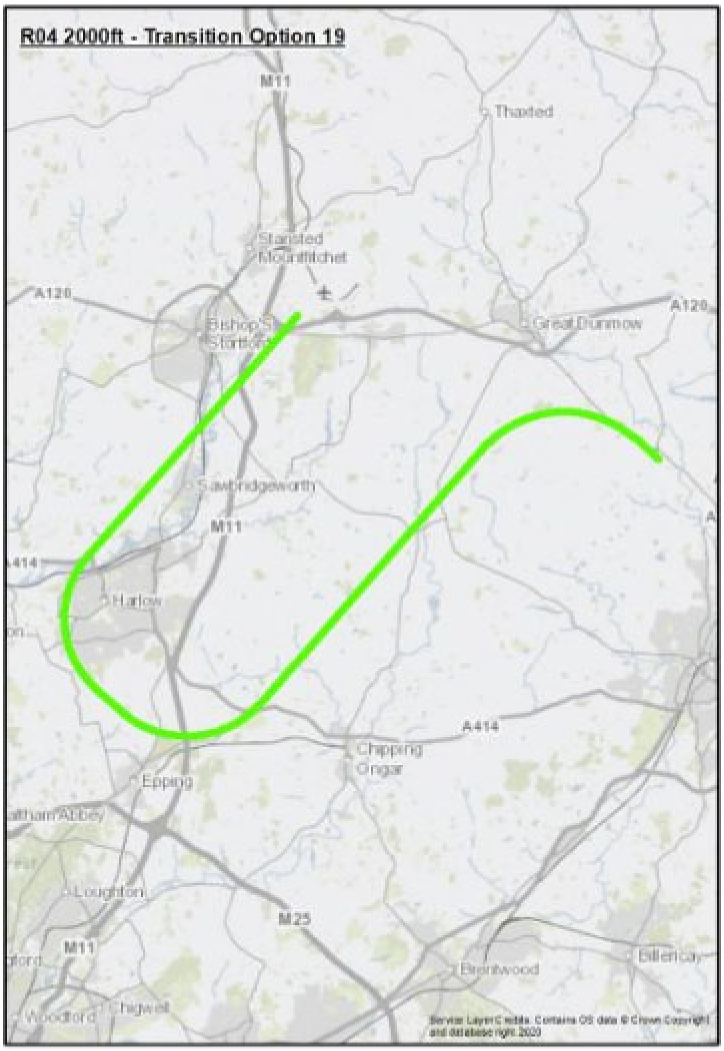
25.17 RWY 04 - 2,000ft Transition Option 18

Description	*Rationale for Inclusion*
Option 18 has an IAF at 7,000ft to the north west of the airport at a position close to the northern boundary of the design envelope close to Bassingbourn Barracks. This gives a slight bias for runway 22 which results in slightly longer track miles for this runway *From this position this option enables a CDA at 3.7% (2.1°) which is below the optimal gradient for low noise approaches but within the range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south from a position just West of Royston and routes just south of Buntingford and then turns left onto base leg close to Ware and establishes aircraft on a 2,000ft final approach.*	Noise N1: Designed to limit the impact of noise by avoiding Royston.



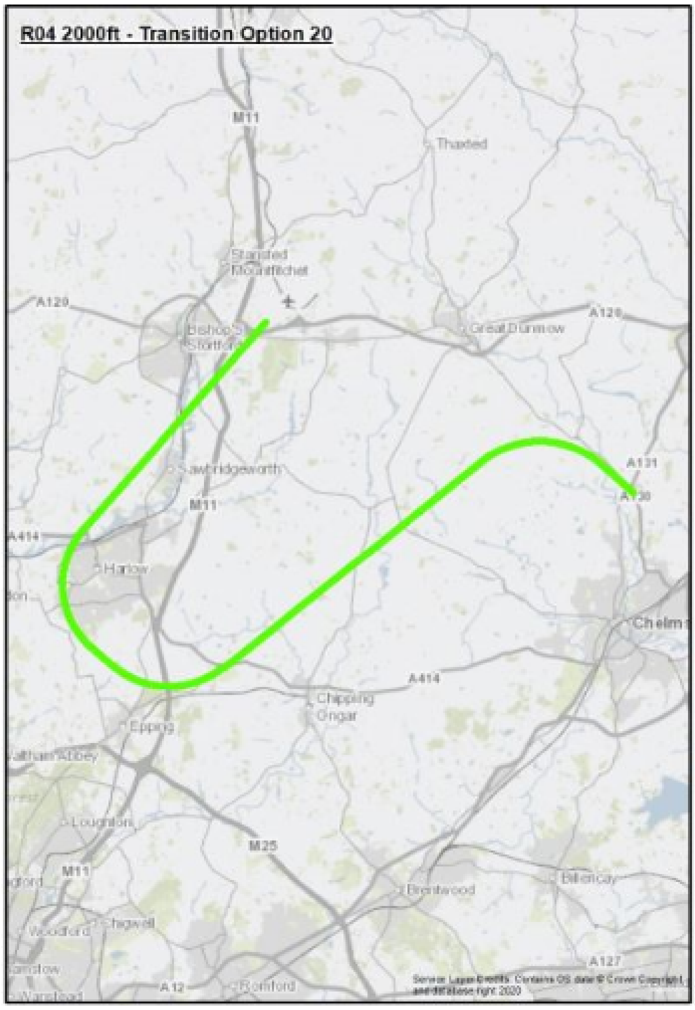
25.18 RWY 04 - 2,000ft Transition Option 19

Description	*Rationale for Inclusion*
Option 19 has an IAF at 7,000ft to the south-east of the airport which is almost equidistant to each runway threshold but with a slightly shorter track for runway 22. It has been designed as an option that offers potential for noise relief if combined with Option 20. *From this position this option enables a CDA at 4.1% (2.3°) which is close to the optimal for low noise approaches and within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and overhead North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Approximately equal track miles (fuel burn) for both runways. Noise N1: Close to optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with option 20.



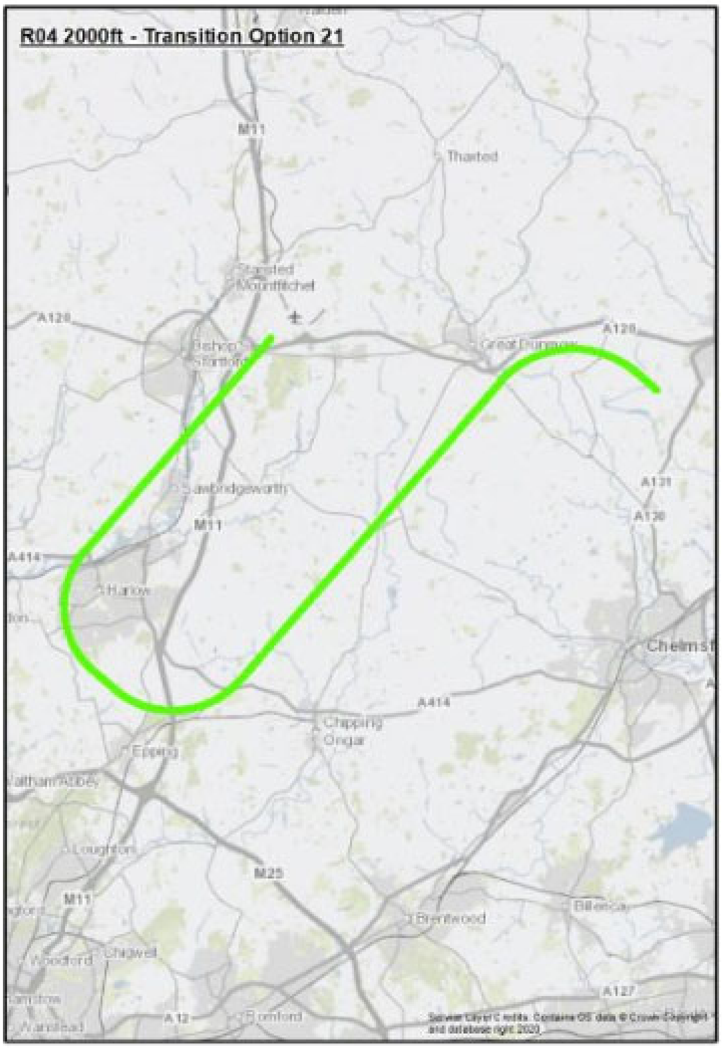
25.19 RWY 04 - 2,000ft Transition Option 20

Description	*Rationale for Inclusion*
Option 20 has an IAF at 7,000ft to the south-east of the airport close to Option 19 which is almost equidistant to each runway. It has been designed to offer potential for noise relief if combined with Option 19. *From this position this option enables a CDA at 4% (2.3°) which is close to the optimal for low noise approaches and within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track to the south of High Easter and overhead North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Balance: Approximately equal track miles (fuel burn) for both runways. Noise N1: Close to optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with option 20.



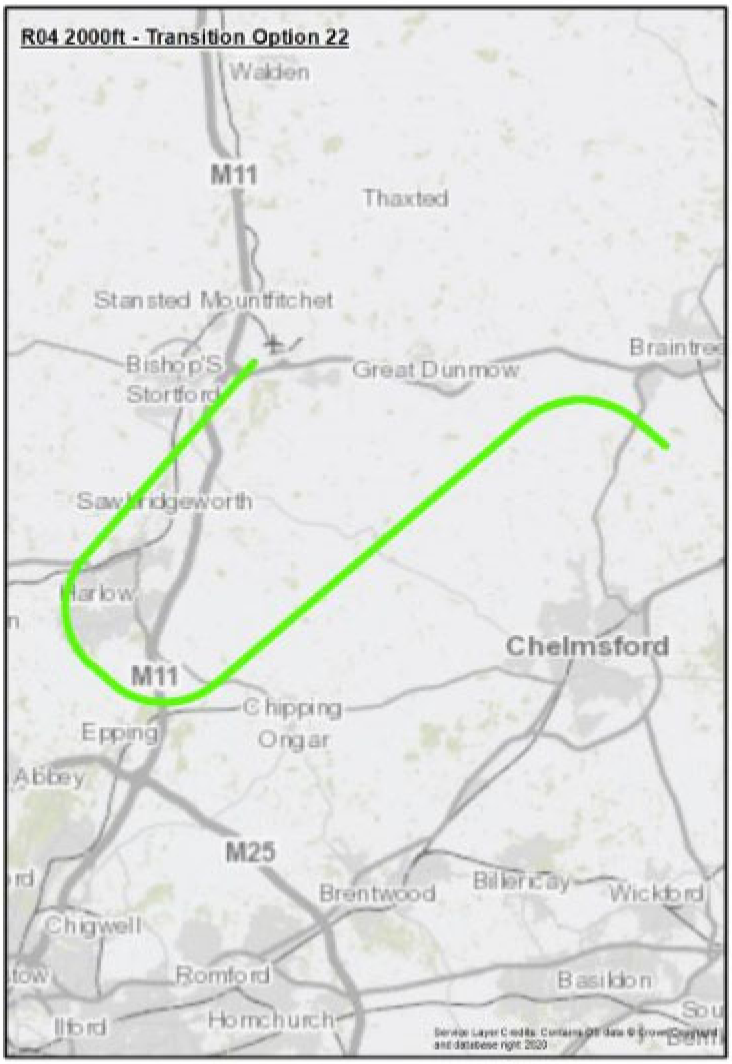
25.20 RWY 04 - 2,000ft Transition Option 21

Description	*Rationale for Inclusion*
Option 21 has an IAF at 7,000ft to the east of the airport to the south east of Braintree and has been designed as the shortest PANS-OPS compliant route to runway 22. This results in longer track miles for this runway. It may offer potential for noise relief when combined with Option 22. *This option enables a CDA at 3.6% (2.1°) which is slightly below the optimal for low noise approaches but within the recommended range for CDAs within CAA and ICAO guidance.* *From the IAF the route turns south west to the south of Great Dunmow onto a downwind track parallel with the final approach and overhead North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N2: May provide an option for noise relief when combined with option 22.



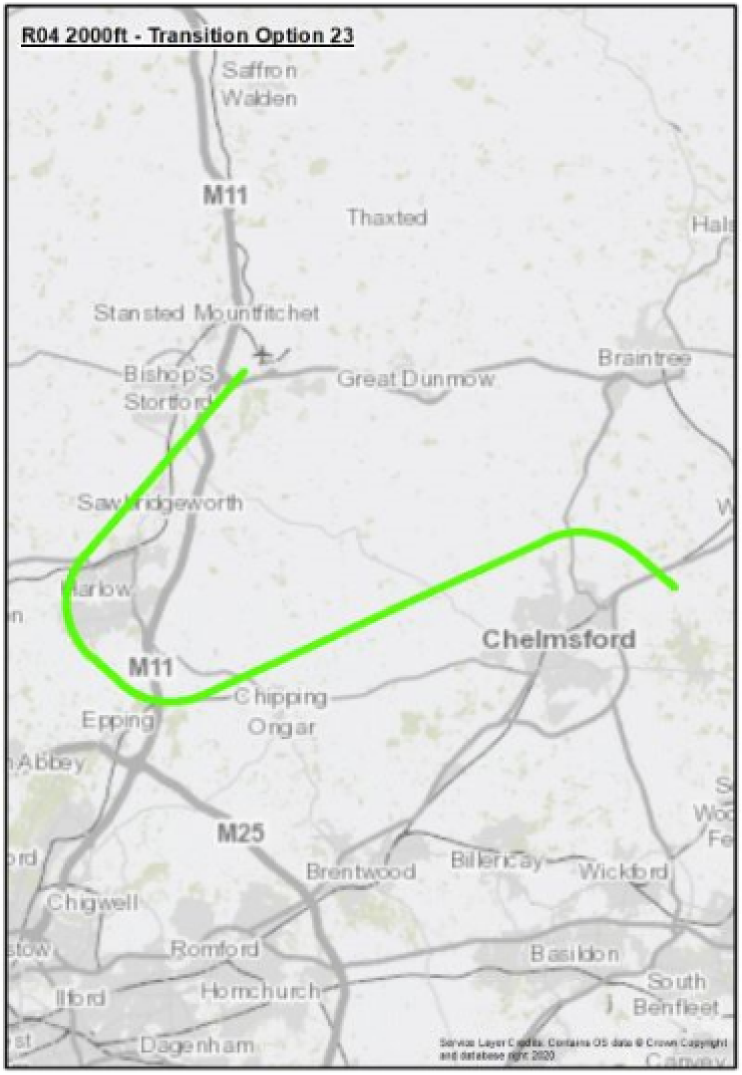
25.21 RWY 04 - 2,000ft Transition Option 22

Description	*Rationale for Inclusion*
Option 22 has an IAF at 7,000ft to the east of the airport and to the South of Braintree. It has been designed to offer potential for noise relief if combined with Option 21 *This option enables a CDA at 3.5% (2°) which is below the optimum for low noise approaches but within the recommended range for CDAs within CAA and ICAO guidance.* *From the IAF the route turns south west to the south of Great Dunmow onto a track that intercepts option 21 in the vicinity of North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N2: May provide an option for noise relief when combined with option 21



25.22 RWY 04 - 2,000ft Transition Option 23

Description	*Rationale for Inclusion*
Option 23 has an IAF at 7,000ft to the south east of the airport at a position close to the southern boundary of the design envelope mid-way between Chelmsford and Witham. *From this position this option enables a CDA at 3.5% (2°) which is below the optimal gradient for low noise approaches but within the range defined for CDAs defined within CAA and ICAO guidance.* *After 7,000ft the route turns west and routes to the north of Chelmsford before turning right onto base leg to establish aircraft on a 2,000ft final approach.*	Provides a CDA to both runway directions.



25.23 RWY 04 – 2,000ft Transitions: Viable but Poor Fit Options

25.23.1 RWY 04 - 2,000ft Transition Option A3

IAF-3 is south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance than other equidistant options. It facilitates a CDA but with a sub-optimum profile.

Reason for exclusion: Design Principles Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between STN arrivals and interactions with traffic to and from other airports on routes M197 and Q295 and the network joining points for LTN, LCY and LHR departing traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is efficiency and the and the expeditious flow of traffic including greater runway throughput. By creating interactions with routes traffic for other airports this option would not comply with this initiative (and therefore the Policy DP) as it has the potential to require ATC interaction which would reduce this efficiency.

25.23.2 RWY 04 - 2,000ft Transition Option B6

IAF-6 east of the aerodrome and west of Colchester. The IAF lies outside of the 2,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principles Policy and Safety.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

25.23.3 RWY 04 - 2,000ft Transition Option C7

IAF-7 is north east of the aerodrome mid-way between Cambridge and Newmarket to the north east of STN. It was designed as a mirror for Option B6. The IAF lies outside of the 2,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach

(CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

25.23.4 RWY 04 - 2,000ft Transition Option D11

IAF-11 is north east of the aerodrome close to the current ABBOT hold. IAF is outside of the 2,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

25.23.5 RWY 04 - 2,000ft Transition Option E15

IAF-15 is positioned to the north to the east of Duxford and to the north west of STN. The IAF is outside of the 2,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the Minimum Stabilisation Distance (MSD) requirements within PANS-OPS. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

26 Approach RWY 22 – 2,500ft FAF

26.1 Overview

This approach is included within the options to provide a 3°final approach descent gradient with a FAF of 2,500ft to RWY 22. The approach is aligned with the runway centreline, which aims to align with the currently published ILS procedure for RWY22. The intermediate segment length that precedes this segment, caters for any turns in the transition at the Intermediate Fix (IF) of up to 90°, which provides sufficient distance for turn anticipation and the Minimum Stabilisation Distance (MSD).

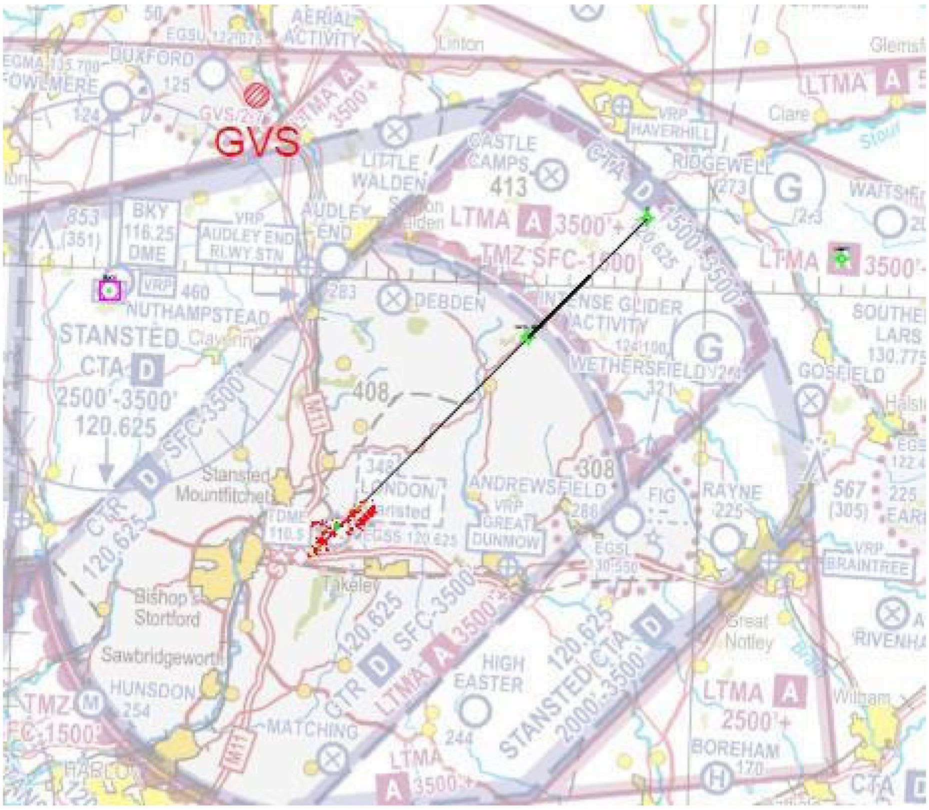


Figure 49 Approach Path RWY 22 – 2,500ft FAF

This approach path is common for each of the transition options with a 2,500ft FAF for RWY 22 detailed below.

27 RWY 22 - 2,500ft Transitions

27.1 Introduction to RWY 22 Transition Options with 2,500ft FAF Envelope

This suite of transitions connects the Initial Approach Fix (IAF) to the RWY 22 Approach with a 2,500ft FAF. The intention has been to define an IAF position that would facilitate a continuous descent to RWY 22, and to RWY 04.

27.2 Design Envelope Location Map: 2500ft transition for RWY 22.

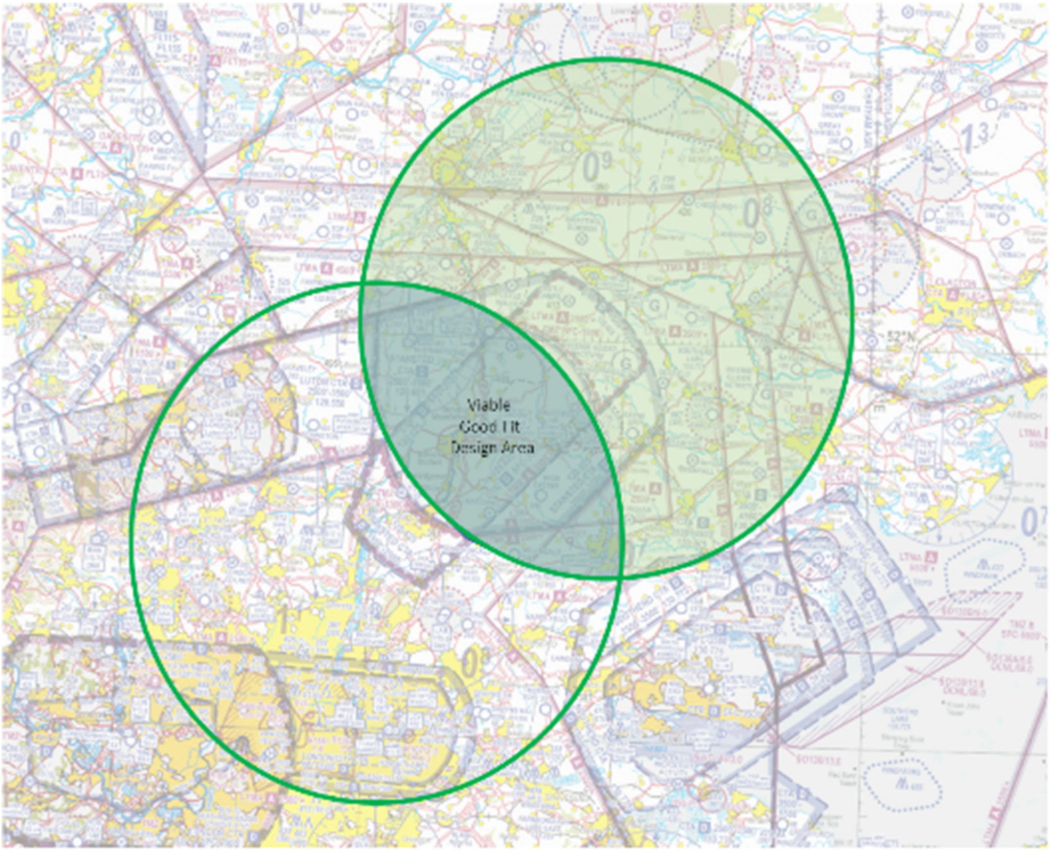


Figure 50 RWY 22 Transitions Design Envelope, 2,500ft FAF

The transition options have been designed using this design envelope as the boundary within which to design "Viable and Good fit" options. This takes into account the requirements of the Policy and Technology design principles to facilitate CDAs to both runways.

27.3 RWY 22 Transitions Long List – 2,500ft Outline Longlist

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the S of the aerodrome and west of Braintree.	A3	IAF-3 South and east of the aerodrome, equidistant to both runway thresholds but at a greater distance. Potential to interact with other airports.	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distances (MSD) and the turn onto final approach. • Descent gradients above the PANS-OPS maximum • Turn radius based on speed, altitude, and descent gradient These options have not been designed and are not described further within this comprehensive list of design options.
2a (Central)	7,000ft point that is close to or overhead the aerodrome resulting in an equidistant track to both runway thresholds. Arrivals route from the SE and turn downwind right to the N of the aerodrome and turn right onto final approach.	B6	IAF-6 East of the aerodrome and west of Colchester. Not fully CDA compliant and may conflict with departures.		
2b (Central)	7,000ft point that is close to or overhead the aerodrome. Arrivals route from the NW and turn	C7	IAF-7 north-east of the aerodrome mid-way between Cambridge and Newmarket.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	downwind left to the SE of the aerodrome and turn left onto final approach.		Not fully CDA compliant.		
4 (West)	7,000ft point to the north west of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the NW of the aerodrome and turn right onto final approach.	D8	IAF-8 South-east of the aerodrome between Chelmsford and Braintree. Not fully CDA compliant.		
5 (West)	7,000ft point to the north west of the aerodrome (close to the northern position of the current LOREL hold). Arrivals route from west of Royston to the NW of the aerodrome and turn right onto final approach	E9	IAF-9 North of the aerodrome to the south west of Duxford. Not fully CDA compliant.		
10 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. A possible noise relief option that routes to the SE of the aerodrome and west of Braintree.	F11	IAF-11 East of the aerodrome close to ABBOT. Not fully CDA compliant.		
13 (West)	7,000ft point to the north west of the aerodrome which introduces a more optimal CDA for runway 22. Arrivals route to the NW of the aerodrome and turn right onto final approach.	G12	IAF-12 West of the aerodrome close to LOREL. Not fully CDA compliant.		
14 (West)	7,000ft point to the north west of the aerodrome which provides the shortest route for runway 22.	H15	IAF 15 positioned to the east of Duxford.		

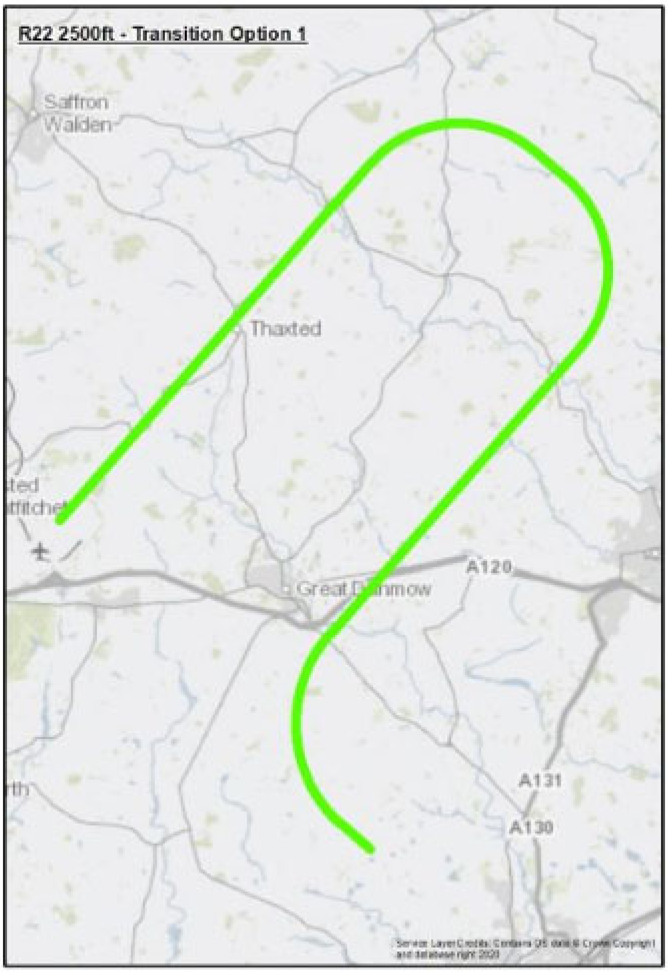
Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	Arrivals route to the NW of the aerodrome and turn right onto final approach.		Not fully CDA compliant.		
16 (West)	7,000ft point to the north west of the aerodrome which introduces an optimal CDA for runway 22. Arrivals route to the NW of the aerodrome and turn right onto final approach.	I17	IAF 17 positioned to the west of Duxford. Not fully CDA compliant.		
19 (East)	7,000ft point to the south east of the aerodrome with a slight bias for runway 22 arrivals. Routes to the SE of the aerodrome and west of Braintree.	J18	IAF 18 positioned to the north of Royston at the northern boundary of the design envelope. Not fully CDA compliant.		
20 (East)	7,000ft point to the south east of the aerodrome (close to option 19), with a slight bias for runway 22 arrivals. A possible noise relief option to the SE of the aerodrome and west of Braintree.	K22	IAF 22 positioned to the south of Braintree. Not fully CDA compliant.		
21 (East)	7,000ft point to the south east of the aerodrome close with the shortest possible route for runway 22 arrivals. A possible noise relief option that routes to the SE of the aerodrome and west of Braintree.	L23	IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. Not fully CDA compliant.		

27.4 RWY 22 Transition Options – 2,500ft FAF and Envelope Design Area

Figure 51 RWY 22 Transitions Design Envelope, 2,500ft FAF and Transition Options

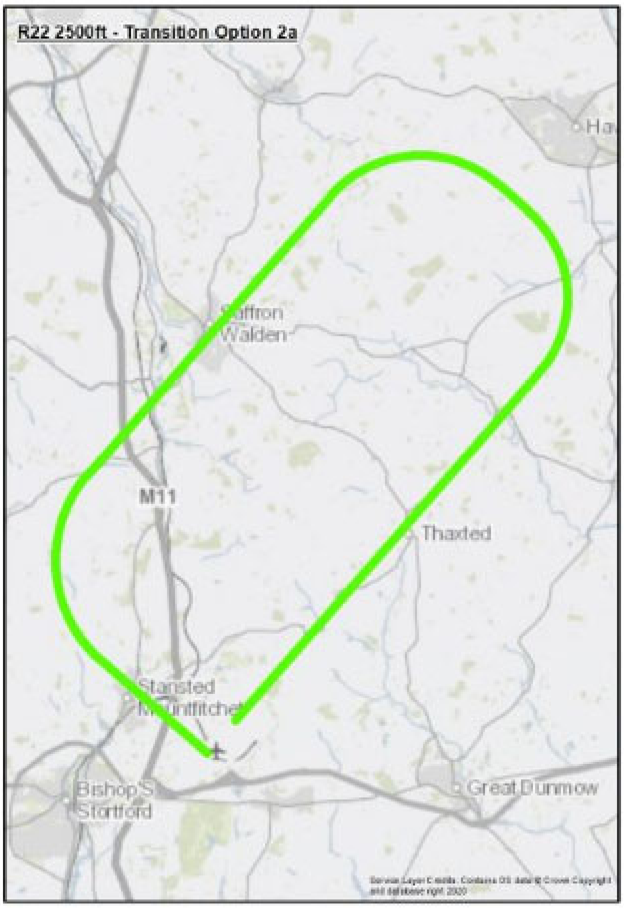
27.5 RWY 22 - 2,500ft Transition Option 1

Description	Rationale for Inclusion
Option 1 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.8% (2.2°) which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to optimal low noise CDA gradient for both runways. Noise N1: Designed to limit the impact of noise by avoiding Braintree. Noise N2: May provide an option for noise relief when combined with Option 10.



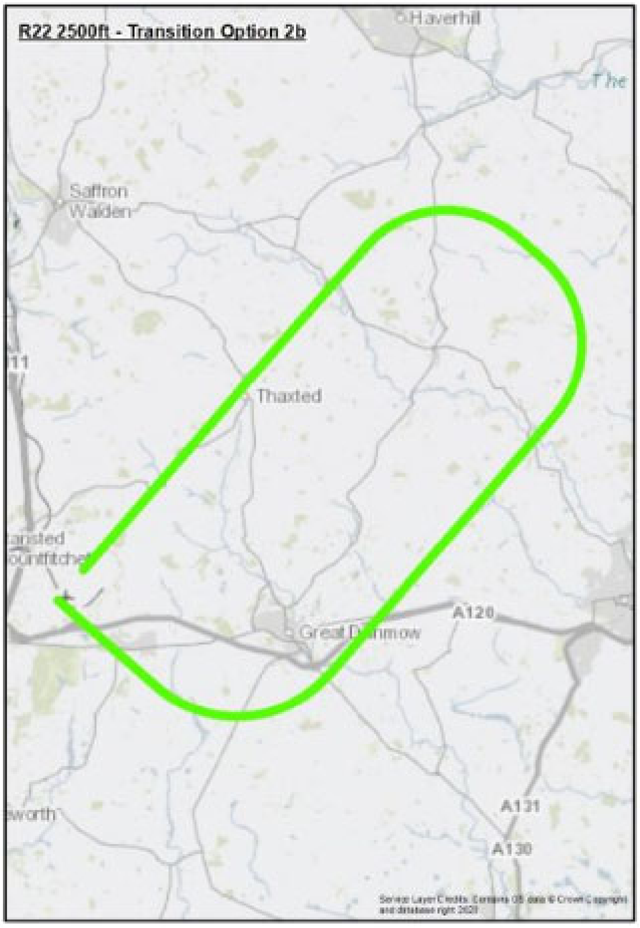
27.6 RWY 22 - 2,500ft Transition Option 2a

Description	Rationale for Inclusion
This central transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the SE and turn downwind right, and then turn right base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables a CDA at 3.4% (2°) for both runways. which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes over Saffron Walden. It then turns right onto base leg and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways.



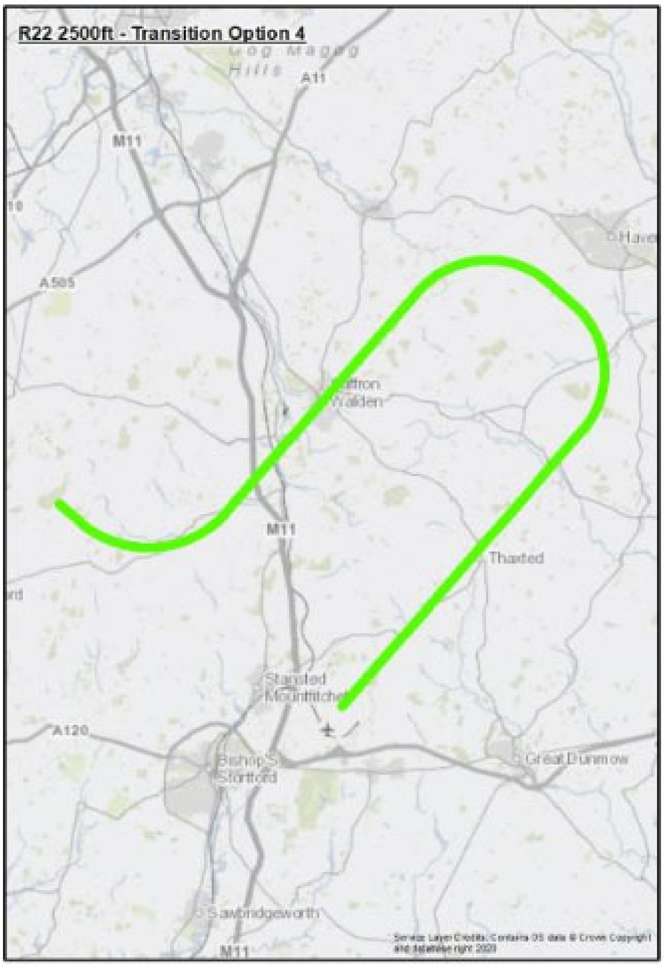
27.7 RWY 22 - 2,500ft Transition Option 2b

Description	*Rationale for Inclusion*
This central transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the NW and turn downwind left, and then turn left base onto the final approach. *This option enables a CDA at 3.4% (2°) for both runways. which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes to the east of Great Dunmow and the west of Braintree. It then turns left onto base leg close to Wethersfield and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways.



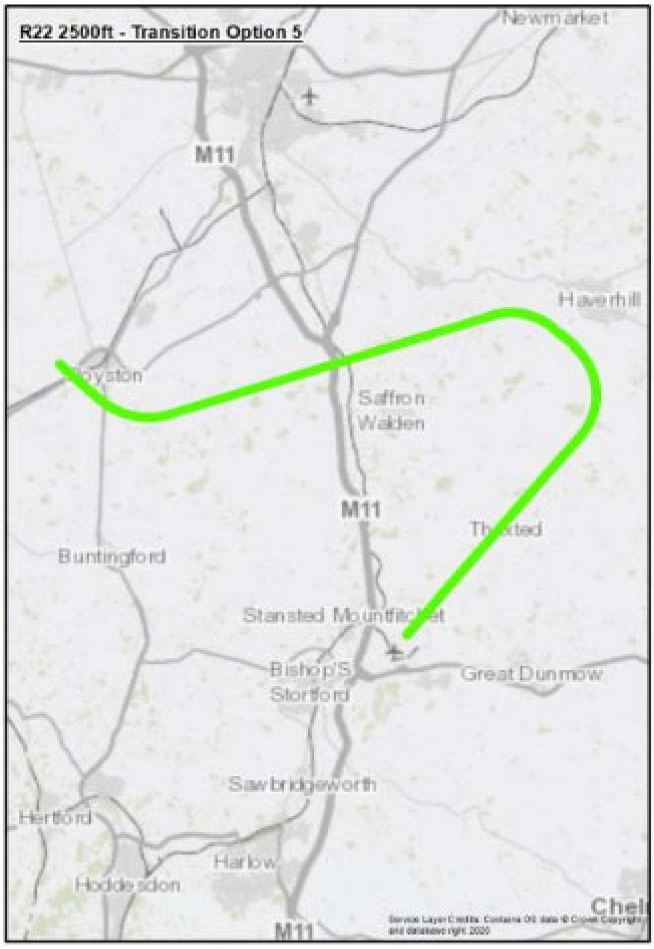
27.8 RWY 22 - 2,500ft Transition Option 4

Description	*Rationale for Inclusion*
Option 4 has an IAF at 7,000ft to the north west of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold, and this option enables a CDA at 3.8% (2.2°) which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes close to Saffron Walden. It then turns right onto base leg and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to the optimal low noise CDA gradient.



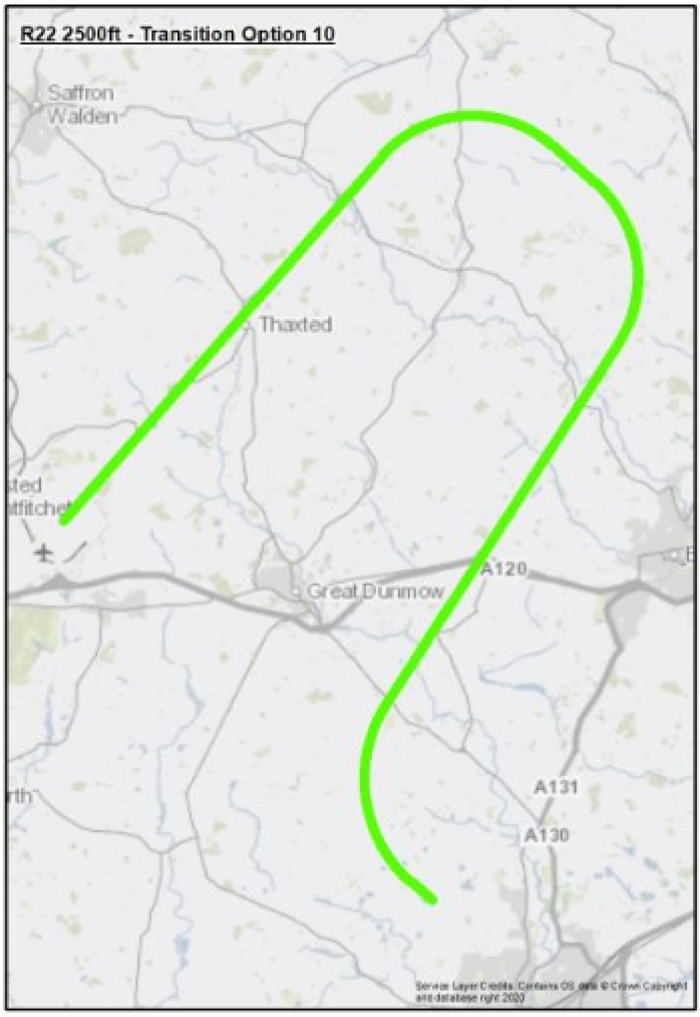
27.9 RWY 22 - 2,500ft Transition Option 5

Description	*Rationale for Inclusion*
Option 5 has an IAF at 7,000ft to the north west of the airport which is close to the northern element of the current LOREL hold. It was designed as a mirror to Option A3 (see 'Viable but Poor Fit Options'). *It has been designed as an option that has minimum change from current operations and may also offer potential for noise relief if combined with Option12.* *From this position this option enables a CDA at 3.9% (2.2°) which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns east from a position just west of Royston and routes to the north of Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Change: Minimum change when compared to current operation but with potential noise benefit. Noise N1: Close to the optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden. Noise N2: May provide an option for noise relief when combined with option 12.



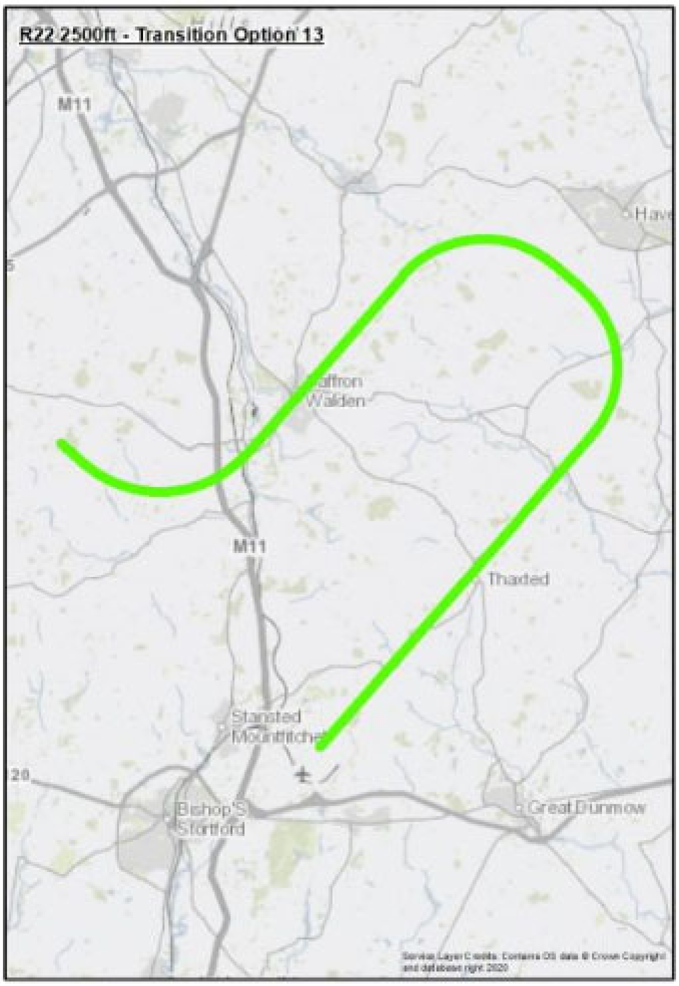
27.10 RWY 22 - 2,500ft Transition Option 10

Description	Rationale for Inclusion
Option 10 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. It has been designed as an option that offers potential for noise relief if combined with Option1. *From this position this option enables a CDA at 3.8% (2.2°) which is slightly lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track and routes further to the East than Option 1 to limit the impact on Great Dunmow and to the west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,500ft final approach.*	Noise N1: Close to the optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N2: May provide an option for noise relief when combined with Option 1.



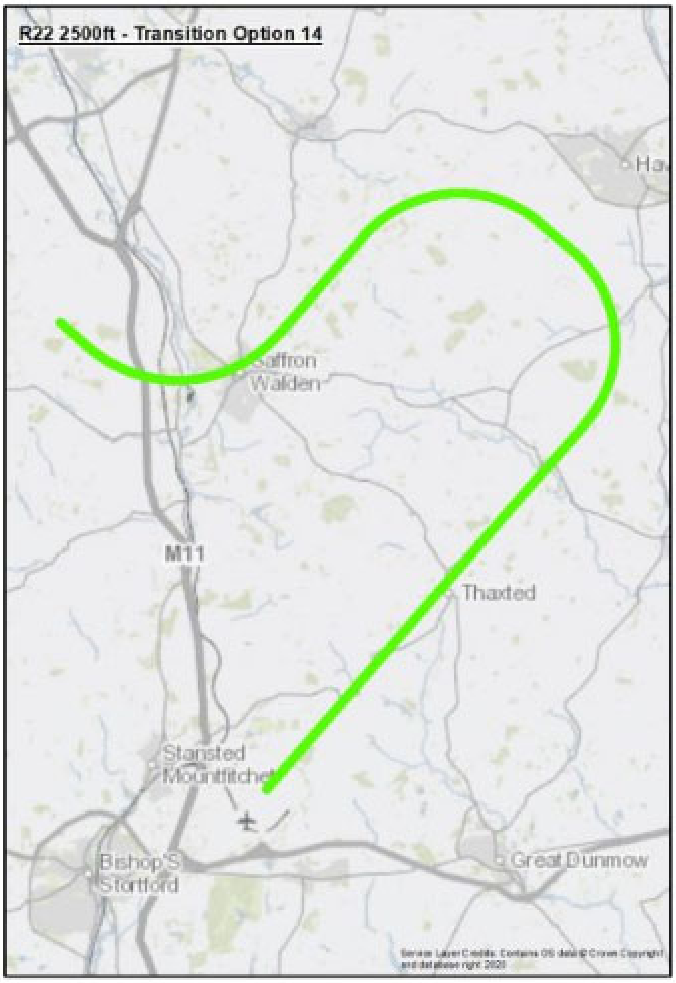
27.11 RWY 22 - 2,500ft Transition Option 13

Description	*Rationale for Inclusion*
Option 13 has an IAF at 7,000ft to the north west of the airport in the vicinity of Langley Upper Green. *From this position this option enables a CDA at 4.2% (2.4°) which is within the optimal range for low noise approaches and the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *This option has fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns north east and routes overhead Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Noise N1: Optimal low noise CDA gradient. Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights)



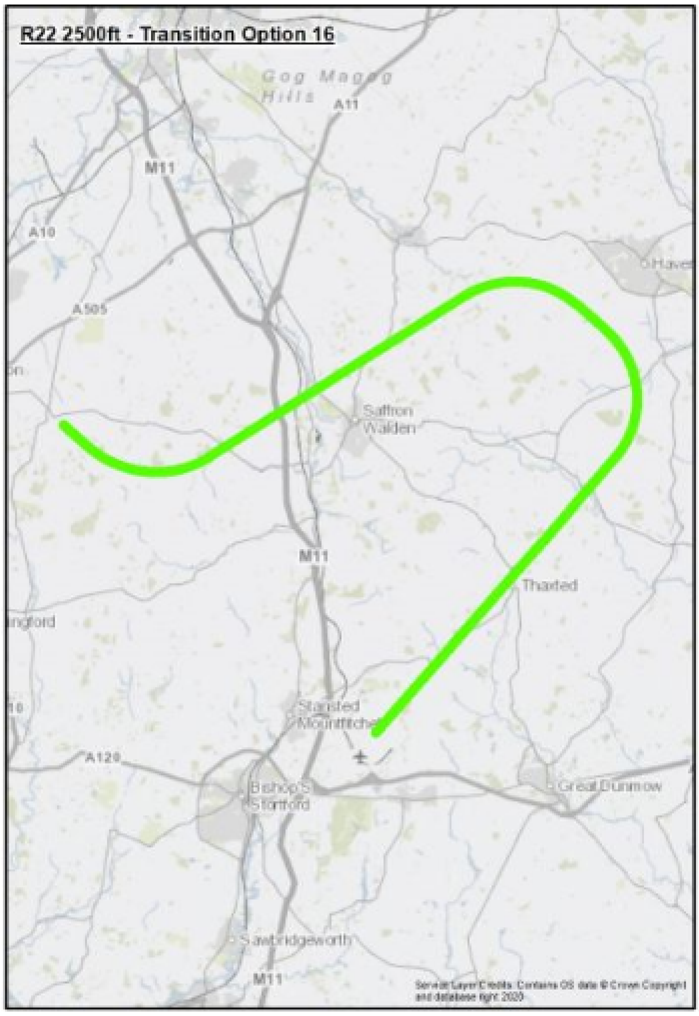
27.12 RWY 22 - 2,500ft Transition Option 14

Description	*Rationale for Inclusion*
Option 14 has an IAF at 7,000ft to the north west of the airport in the vicinity of Strethall and has been designed as the shortest PANS-OPS compliant route to runway 22 for this joining point. *As a result, this option has fewer track miles for runway 22 operations, but this results in longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *This option enables a CDA at 5% (2.9°) which is at the upper limits for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east with a short stabilisation segment and routes and then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Balance: Shortest possible route (fuel burn) to runway 22 used for approx. 70% of flights.



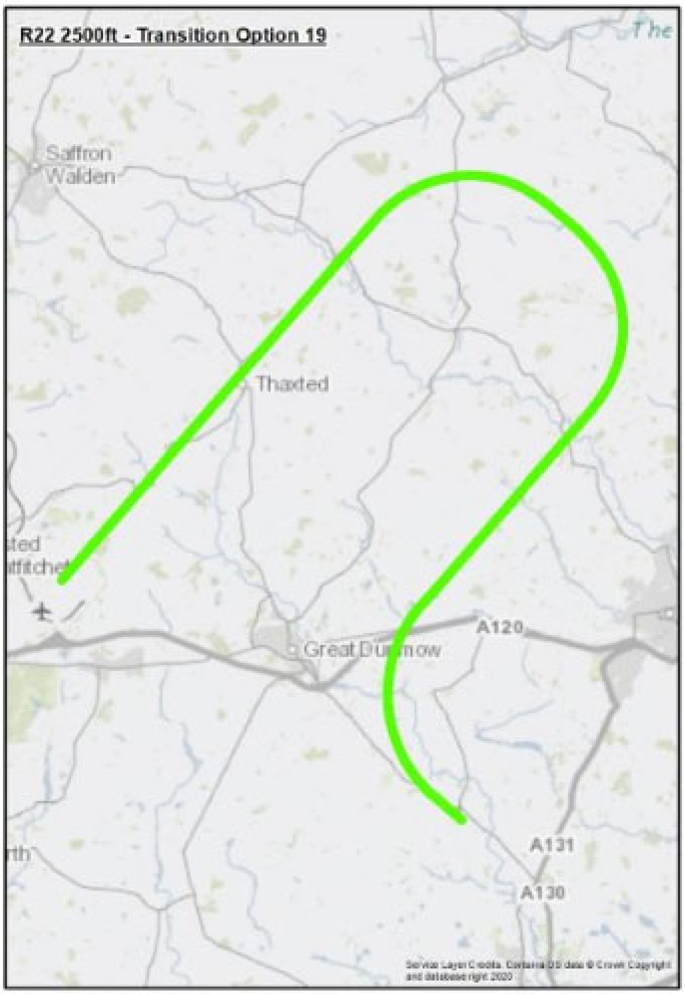
27.13 RWY 22 - 2,500ft Transition Option 16

Description	Rationale for Inclusion
Option 16 has an IAF at 7,000ft to the north west of the airport in the vicinity of Great Chishill. *From this position this option enables a CDA at 4% (2.3°) which is close to the optimal gradient for low noise approaches and the range defined for CDAs defined within CAA and ICAO guidance.* *This option has fewer track miles for runway 22 operations (than those that are equidistant for both runways), but this results in slightly longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *From the IAF the route turns north east and routes to avoid Saffron Walden and then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Noise N1: Close to the optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Saffron Walden. Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights)



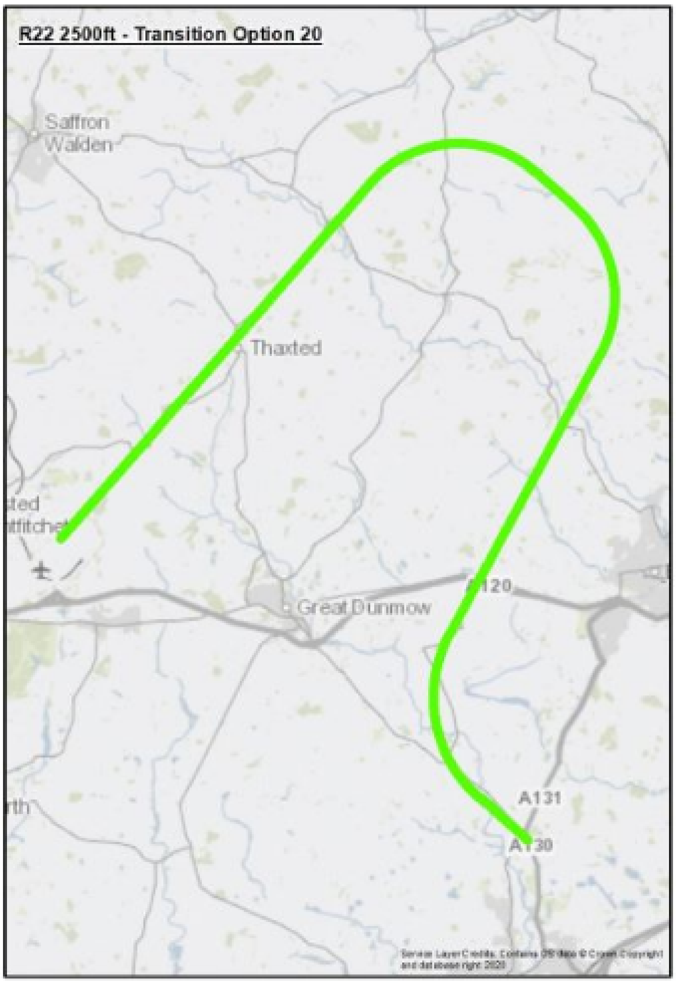
27.14 RWY 22 - 2,500ft Transition Option 19

Description	Rationale for Inclusion
Option 19 has an IAF at 7,000ft to the south-east of the airport which is almost equidistant to each runway threshold but with a slightly shorter track for runway 22. It has been designed as an option that offers potential for noise relief if combined with Option 20. *From this position this option enables a CDA at 4.3% (2.5°) which is the optimal for low noise approaches and within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track and routes further to the east of Great Dunmow and west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,500ft final approach.*	Noise N1: Optimal low noise CDA gradient. Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N2: May provide an option for noise relief when combined with option 20. Balance: Optimised track miles (fuel burn) for runway 22 (used for approx. 70% of flights).



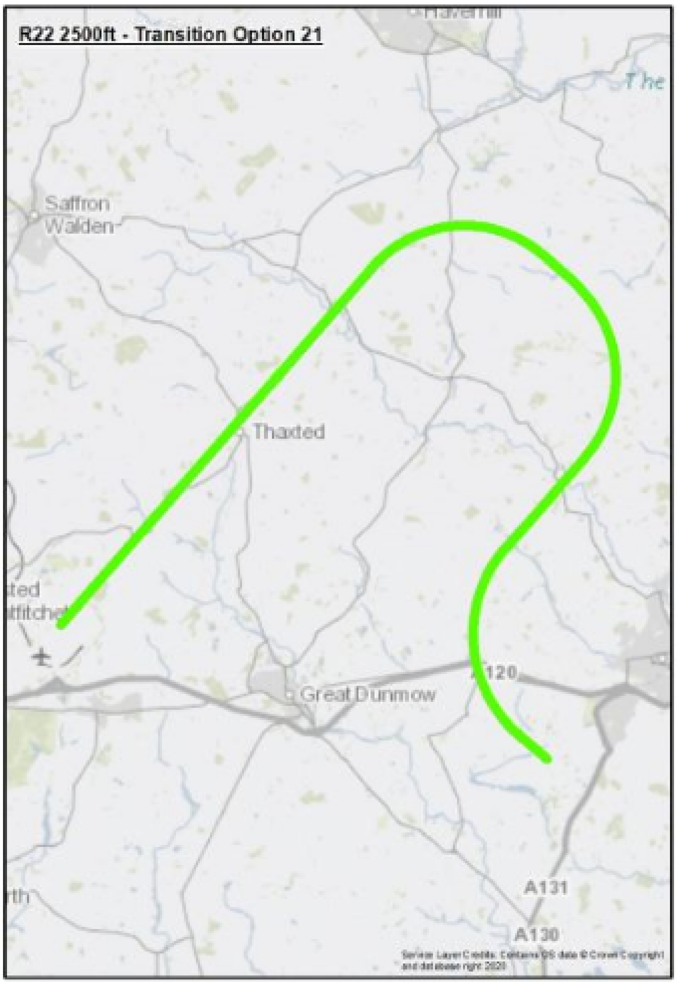
27.15 RWY 22 - 2,500ft Transition Option 20

Description	*Rationale for Inclusion*
Option 20 has an IAF at 7,000ft to the south-east of the airport close to Option 19 which is almost equidistant to each runway threshold but with a slightly shorter track for runway 22. It has been designed to offer potential for noise relief if combined with Option 19. *From this position this option enables a CDA at 4.1% (2.3°) which close to the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track and routes further to the east of Great Dunmow and west of Braintree. It then turns left onto base leg and establishes aircraft on a 2,500ft final approach.*	Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N1: Close to the optimal for a low noise CDA. Noise N2: May provide an option for noise relief when combined with option 19.



27.16 RWY 22 - 2,500ft Transition Option 21

Description	*Rationale for Inclusion*
Option 21 has an IAF at 7,000ft to the east of the airport to the south east of Braintree and has been designed as the shortest PANS-OPS compliant route to runway 22 for this joining point and may offer potential for noise relief when combined with Option 22. *As a result, this option has fewer track miles for runway 22 operations, but this results in longer track miles and a shallower CDA for the reciprocal route from this position to runway 04.* *This option enables a CDA at 5% (2.9°) which is slightly above the upper limits for low noise approaches but within the recommended range for CDAs within CAA and ICAO guidance.* *From the IAF the route turns north east with a short stabilisation segment and routes and then turns left onto base leg and establishes aircraft on a 2,500ft final approach.*	Noise N1: Close to the optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with option 22. Balance: Shortest possible route (fuel burn) to runway 22 used for approx. 70% of flights.



27.17 RWY 22 - 2,500ft Transitions: Viable but Poor Fit Options

27.17.1 RWY 22 - 2,500ft Transition Option A3

IAF-3 is south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance than other equidistant options. It facilitates a CDA but with a sub-optimum profile.

Reason for exclusion: Design Principles Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between STN arrivals and interactions with traffic to and from other airports on routes M197 and Q295 and the network joining points for LTN, LCY and LHR departing traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is efficiency and the and the expeditious flow of traffic including greater runway throughput. By creating interactions with routes traffic for other airports this option would not comply with this initiative (and therefore the Policy DP) as it has the potential to require ATC interaction which would reduce this efficiency.

27.17.2 RWY 22 - 2,500ft Transition Option B6

IAF-6 east of the aerodrome and west of Colchester. The IAF lies outside of the 2,500ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principles Policy and Safety.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.3 RWY 22 - 2,500ft Transition Option C7

IAF-7 is north east of the aerodrome mid-way between Cambridge and Newmarket to the north east of STN. It was designed as a mirror for Option B6. The IAF lies outside of the 2,500ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.4 RWY 22 - 2,500ft Transition Option D8

IAF-8 is positioned south-east of the aerodrome between Chelmsford and Braintree. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.5 RWY 22 - 2,500ft Transition Option E9

IAF-9 is positioned north of the aerodrome to the south west of Duxford and north of STN. This was designed as a mirror of Option D8. This option introduces acceptable track miles and CDA for this runway but not for 04. There is also the potential of interaction with AD6 arrival routes operated by Luton Airport. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.6 RWY 22 - 2,500ft Transition Option F11

IAF-11 is north east of the aerodrome close to the current ABBOT hold. IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.7 RWY 22 - 2,500ft Transition Option G12

IAF-12 is positioned west of the aerodrome close to the current LOREL hold. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.8 RWY 22 - 2,500ft Transition Option H15

IAF-15 is positioned to the north to the east of Duxford and to the north west of STN. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the Minimum Stabilisation Distance (MSD) requirements within PANS-OPS. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.9 RWY 22 - 2,500ft Transition Option I17

IAF 17 is positioned to the west of Duxford and north of the aerodrome. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.10 RWY 22 - 2,500ft Transition Option J18

IAF 18 is positioned to the north of Royston at the northern boundary of the design envelope. The IAF is outside of the 2,500ft design area so CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.11 RWY 22 - 2,500ft Transition Option K22

IAF 22 is positioned to the south of Braintree. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

27.17.12 RWY 22 - 2,500ft Transition Option L23

IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

28 Approach RWY 04 – 2,500ft FAF

28.1 Overview

This approach is included within the options to provide a 3° final approach descent gradient with a FAF of 2,500ft. The approach is aligned with the runway centreline, which aims to align with the currently published ILS procedure for RWY 04. The intermediate segment length that precedes this segment caters for any turns in the transition at the Intermediate Fix (IF) of up to 90°, which provides sufficient distance for turn anticipation and the Minimum Stabilisation Distance (MSD).

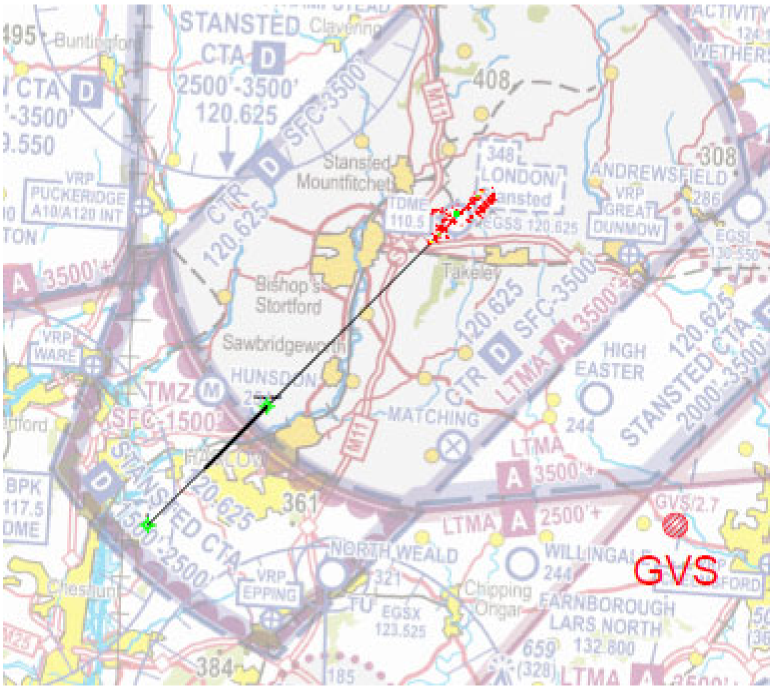


Figure 52 Approach Path RWY 04 – 2,500ft FAF

This approach path is common for each of the transition options with a 2,500ft FAF for RWY 04 detailed below.

29 RWY 04 - 2,500ft Transitions

29.1 Introduction to RWY 04 Transition Options with 2,500ft FAF Envelope

This suite of transitions connects the Initial Approach Fix (IAF) to the RWY 04 Approach with a 2,500ft FAF. The intention has been to define an IAF position that would facilitate a continuous descent to RWY 04, and to RWY 22.

29.2 Design Envelope Location Map: 2,500ft transitions for runway 04.

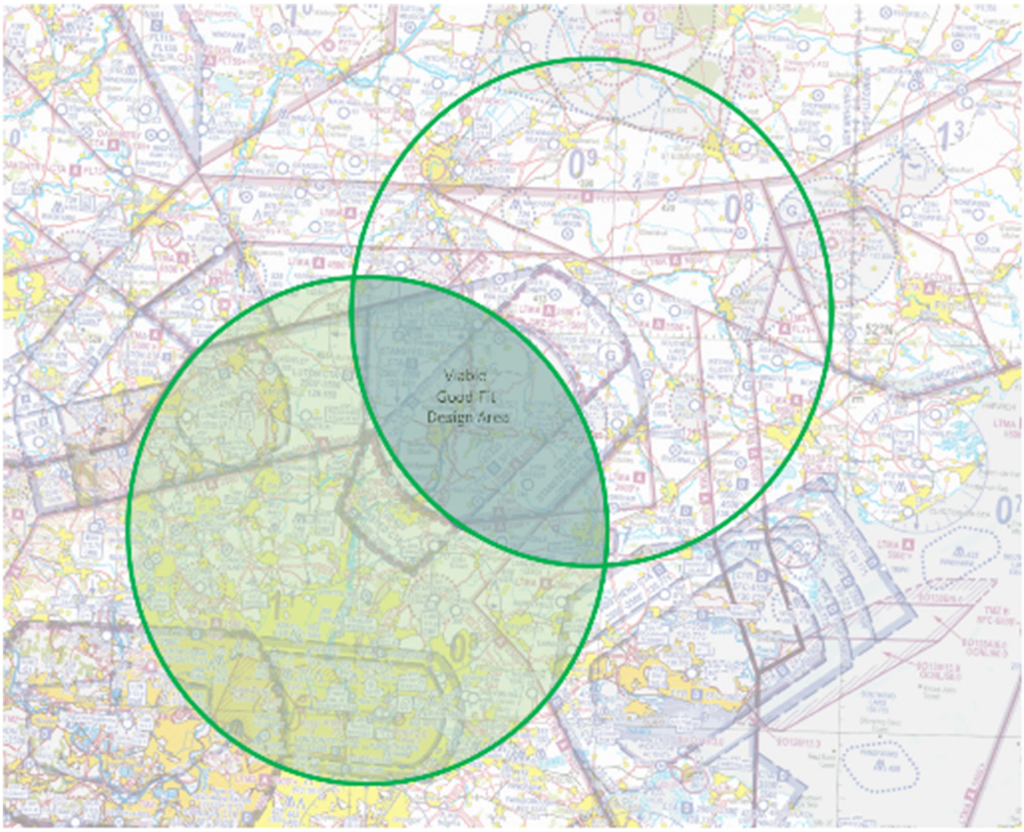


Figure 53 RWY 04 Transitions Design Envelope, 2,500ft FAF

The transition options have been designed using this design envelope as the boundary within which to design "Viable and Good fit" options. This takes into account the requirements of the Policy and Technology design principles to facilitate CDAs to both runways.

29.3 RWY 04 Transitions Long List – 2,500ft Outline Longlist

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the SE of the aerodrome and turn right onto final approach. .	A3	IAF-3 South and east of the aerodrome, equidistant to both runway thresholds but at a greater distance. Potential to interact with other airports.	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distances (MSD) and the turn onto final approach. • Descent gradients above the PANS-OPS maximum • Turn radius based on speed, altitude, and descent gradient These options have not been designed and are not described further within this comprehensive list of design options.
2a (Central)	7,000ft point that is close to or overhead the aerodrome resulting in an equidistant track to both runway thresholds. Arrivals route from the SE and turn downwind left to the NW of the aerodrome and turn right onto final approach.	B6	IAF-6 East of the aerodrome and west of Colchester. Not fully CDA compliant and may conflict with departures.		
2b (Central)	7,000ft point that is close to or overhead the aerodrome. Arrivals route from the NW and turn	C7	IAF-7 North-east of the aerodrome mid-way between Cambridge and Newmarket.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	downwind right to the S of the aerodrome and turn right onto final approach.		Not fully CDA compliant.		
4 (West)	7,000ft point to the NW of the aerodrome (close to BKY). Arrivals route to the SW and turn left onto final approach.	D8	IAF-8 South-east of the aerodrome between Chelmsford and Braintree. Not fully CDA compliant.		
5 (West)	7,000ft point to the north of the aerodrome (close to LOREL). Arrivals route south and turn left onto final approach.	E9	IAF-9 North of the aerodrome to the south west of Duxford. Not fully CDA compliant.		
10 (East)	7,000ft point south of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the SE of the aerodrome and turn right onto final approach.	F11	IAF-11 East of the aerodrome close to ABBOT. Not fully CDA compliant.		
13 (West)	7,000ft point to the north of the aerodrome. Slightly extended track miles for 04, routes SW and turns left onto final approach.	G12	IAF-12 West of the aerodrome close to LOREL. Not fully CDA compliant.		
14 (West)	7,000ft point to the north west of the aerodrome. CDA compliant but has extended track miles for 04, routes SW and turns right onto final approach.	H15	IAF 15 positioned to the east of Duxford. Not fully CDA compliant.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
16 (West)	7,000ft point to the north west of the aerodrome. Slightly extended track miles for 04, routes SW and turns left onto final approach.	I17	IAF 17 positioned to the west of Duxford. Not fully CDA compliant.		
19 (East)	7,000ft point to the south east of the aerodrome. Routes to the S of the aerodrome turns right onto final approach.	J18	IAF 18 positioned to the north of Royston at the northern boundary of the design envelope. Not fully CDA compliant.		
20 (East)	7,000ft point to the south east of the aerodrome (close to option 19). Routes S of the aerodrome and turns right onto final approach.	K22	IAF 22 positioned to the south of Braintree. Not fully CDA compliant.		
21 (East)	7,000ft point to the south east of the aerodrome with a bias for runway 22 arrivals. Extended track miles for 04, routes SW and turns right onto final approach.	L23	IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. Not fully CDA compliant.		

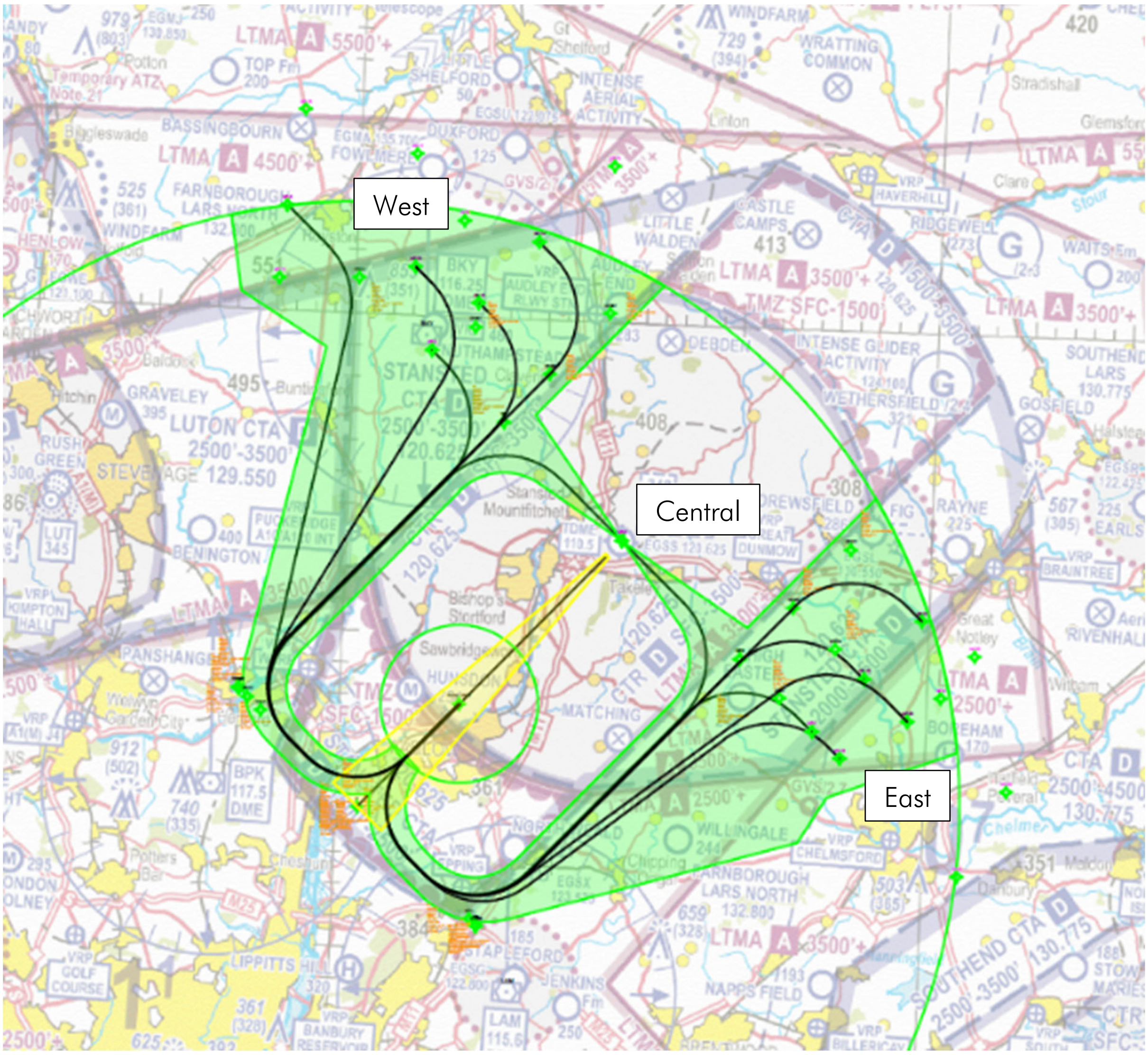
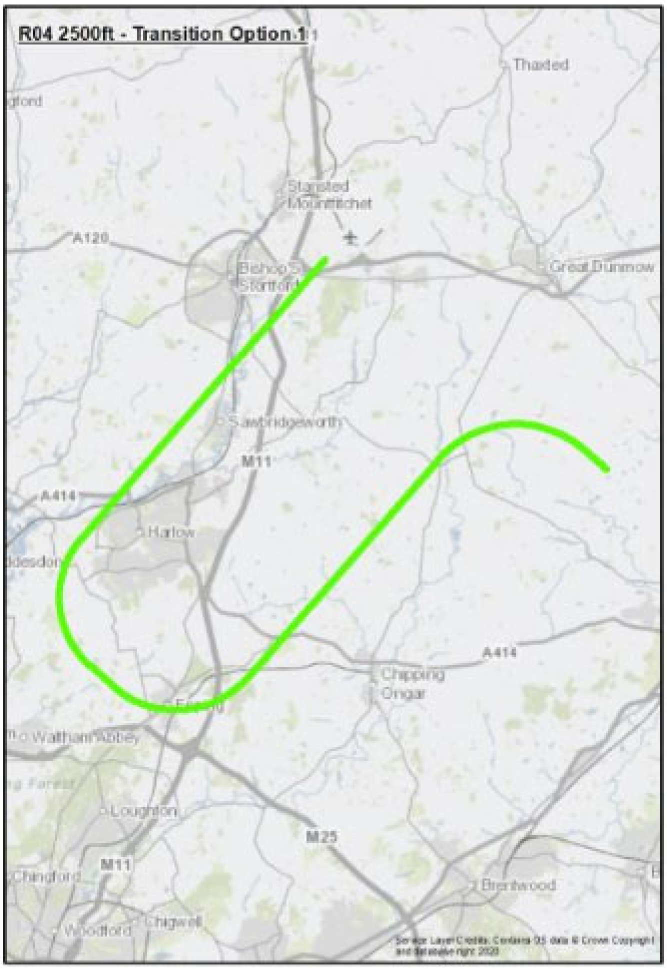


Figure 54 RWY 04 Transitions Design Envelope, 2,500ft FAF and Transition Options

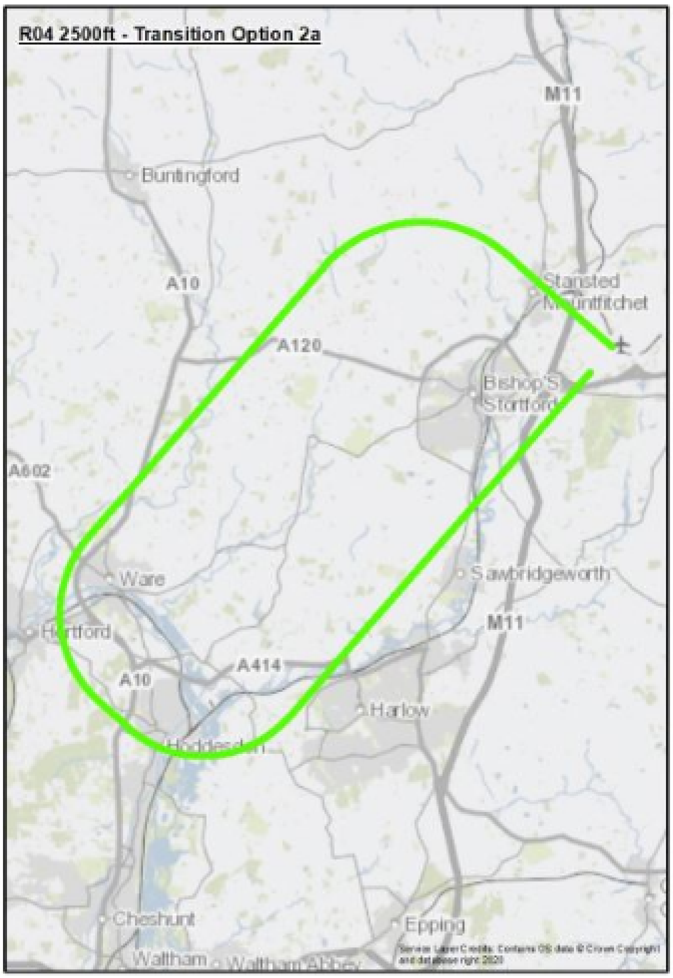
29.4 RWY 04 - 2,500ft Transition Option 1

Description	Rationale for Inclusion
Option 1 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. *From this position this option enables a CDA at 3.8% (2.2°) which is just below the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and close to North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to the optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with Option 10.



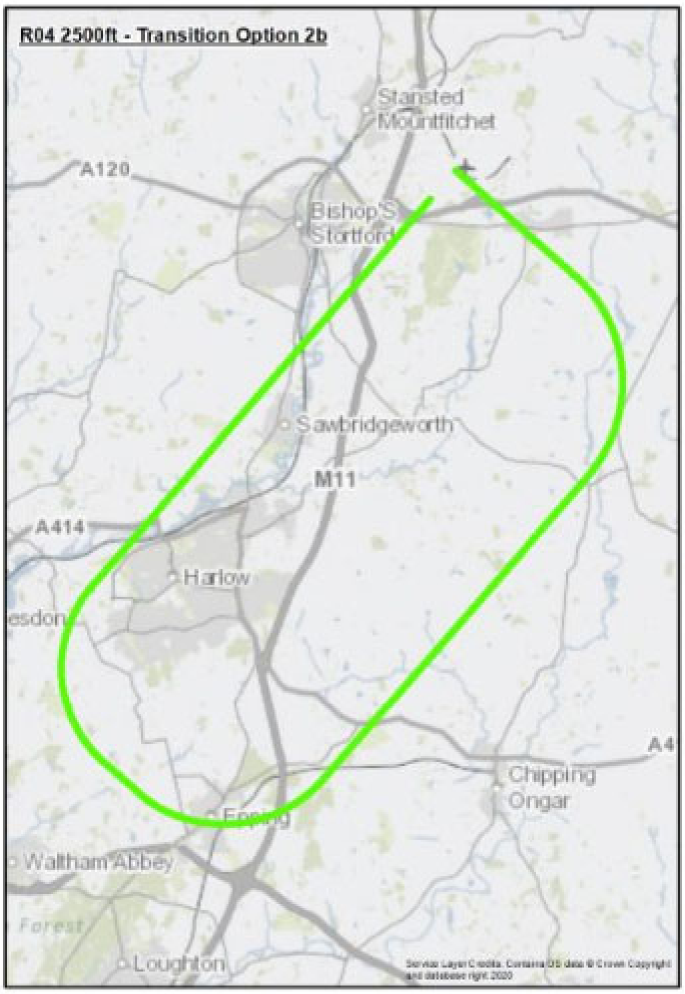
29.5 RWY 04 - 2,500ft Transition Option 2a

Description	Rationale for Inclusion
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the SE and turn downwind left. *From this position this option enables a CDA at 3.4% (2°) which is just below the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route is heading north west and then turns south west onto a downwind track parallel with the final approach and routes outside of Ware at which point it turns left onto base leg and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to the optimal low noise CDA gradient.



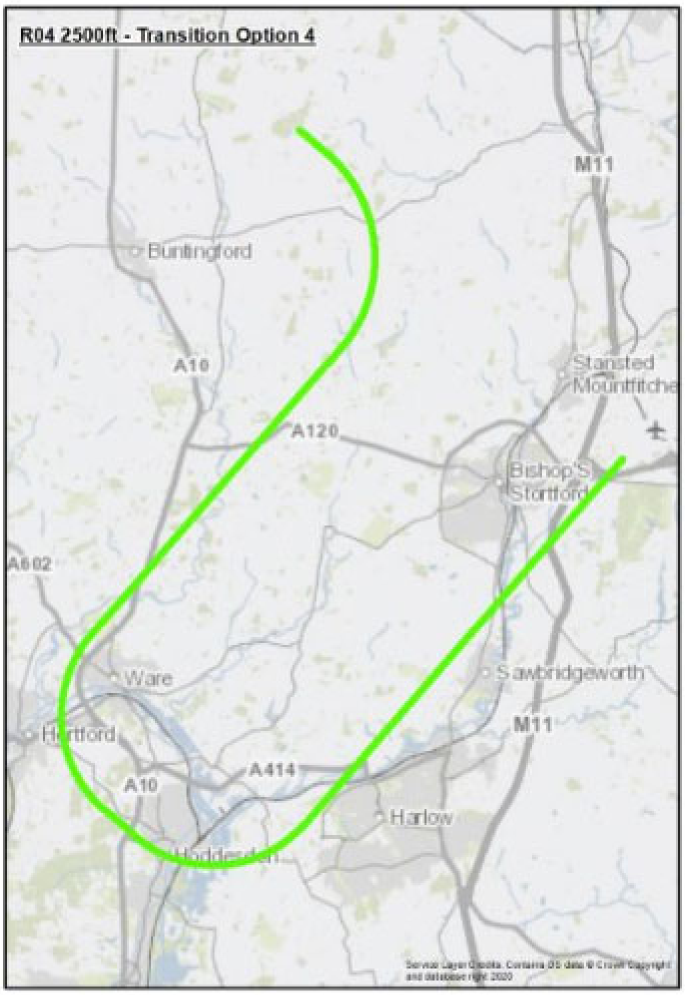
29.6 RWY 04 - 2,500ft Transition Option 2b

Description	*Rationale for Inclusion*
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the NW and turn downwind right, and then turn left base onto the final approach. *From this position this option enables a CDA at 3.4% (2°) which is just below the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route is heading south east and then turns south west onto a downwind track parallel with the final approach close to North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to the optimal low noise CDA gradient.



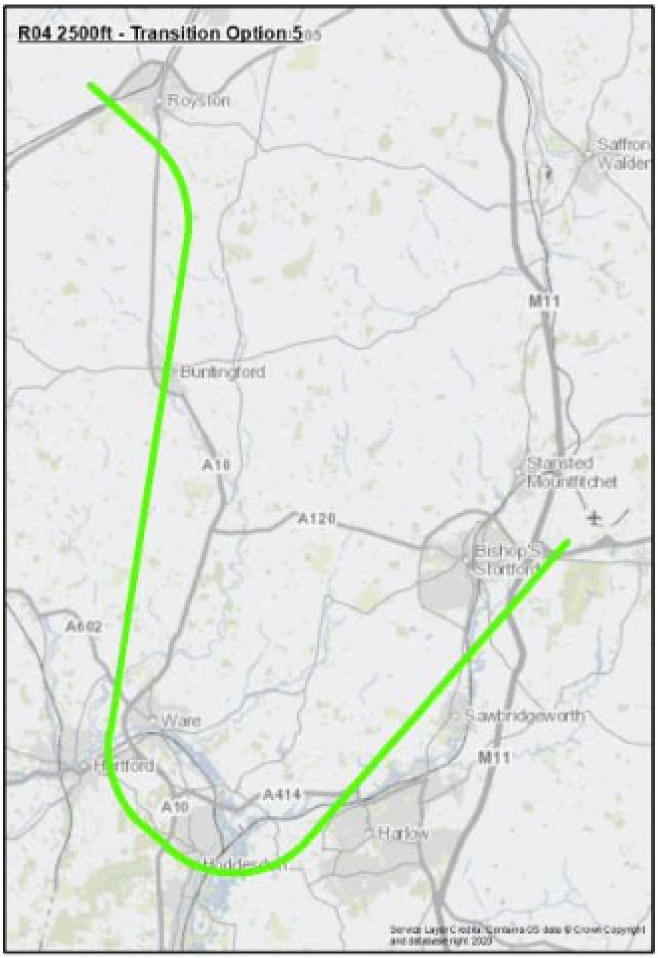
29.7 RWY 04 - 2,500ft Transition Option 4

Description	Rationale for Inclusion
Option 4 has an IAF at 7,000ft to the north west of the airport which is equidistant to each runway threshold. *From this position this option enables a CDA at 3.8% (2.2°) which is close to the optimal for low noise approaches and within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and routes close to Ware at which point it turns left onto base leg and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to the optimal low noise CDA gradient.



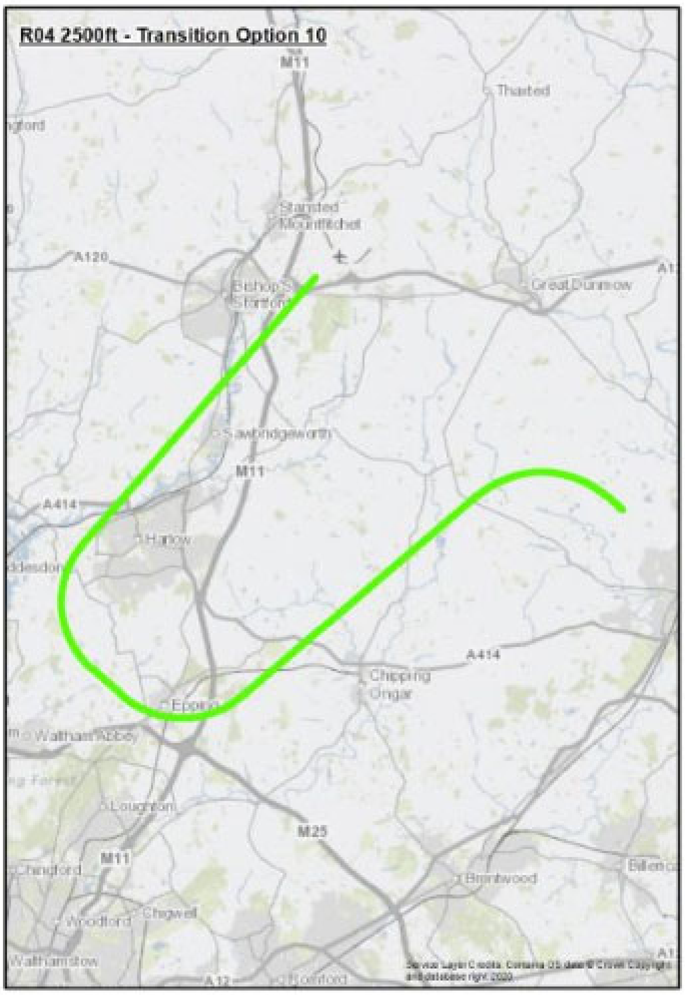
29.8 RWY 04 - 2,500ft Transition Option 5

Description	Rationale for Inclusion
Option 5 has an IAF at 7,000ft to the north west of the airport which is close to the northern element of the current LOREL hold. It has been designed as an option that has minimum change from current operations and may also offer potential for noise relief if combined with Option12. *From this position this option enables a CDA at 3.3% (2°) which is lower than the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south from a position just west of Royston and routes just south of Buntingford and then turns left onto base leg close to Ware and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Change: Minimum change when compared to current operation but with potential noise benefit. Noise N2: May provide an option for noise relief when combined with option 5.



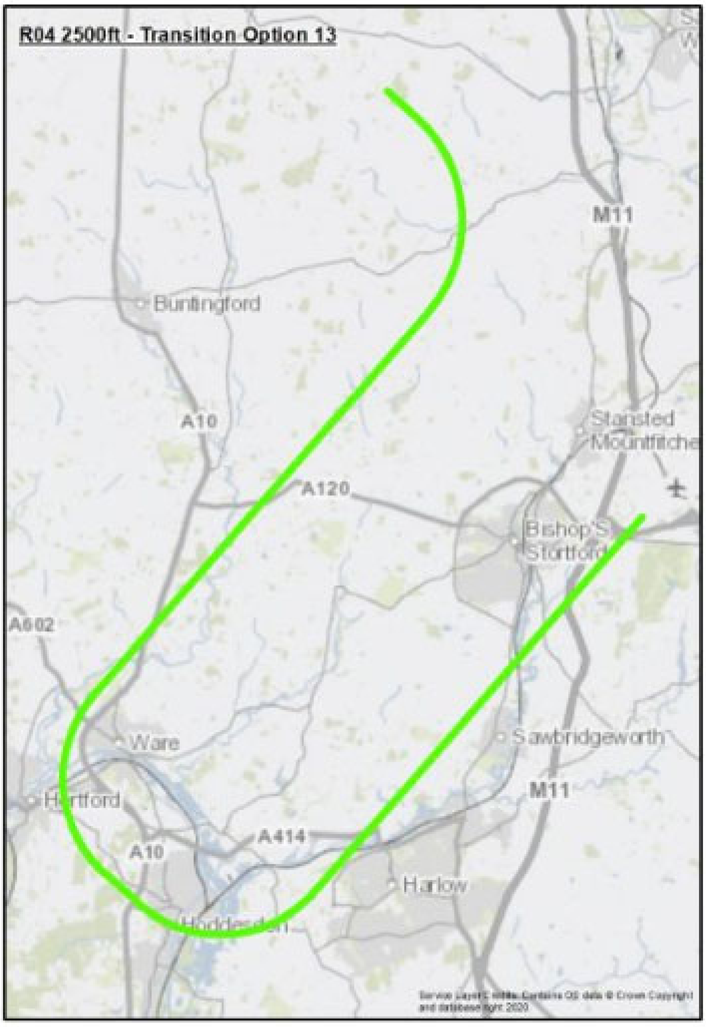
29.9 RWY 04 - 2,500ft Transition Option 10

Description	*Rationale for Inclusion*
Option 10 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. It has been designed as an option that offers potential for noise relief if combined with Option1. *From this position this option enables a CDA at 3.8% (2.2°) which is close to the optimal for low noise approaches and within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track and then turns right onto base leg close to Epping and establishes aircraft on a 2,500ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Close to the optimal low noise CDA gradient. Noise N2: May provide an option for noise relief when combined with Option 1.



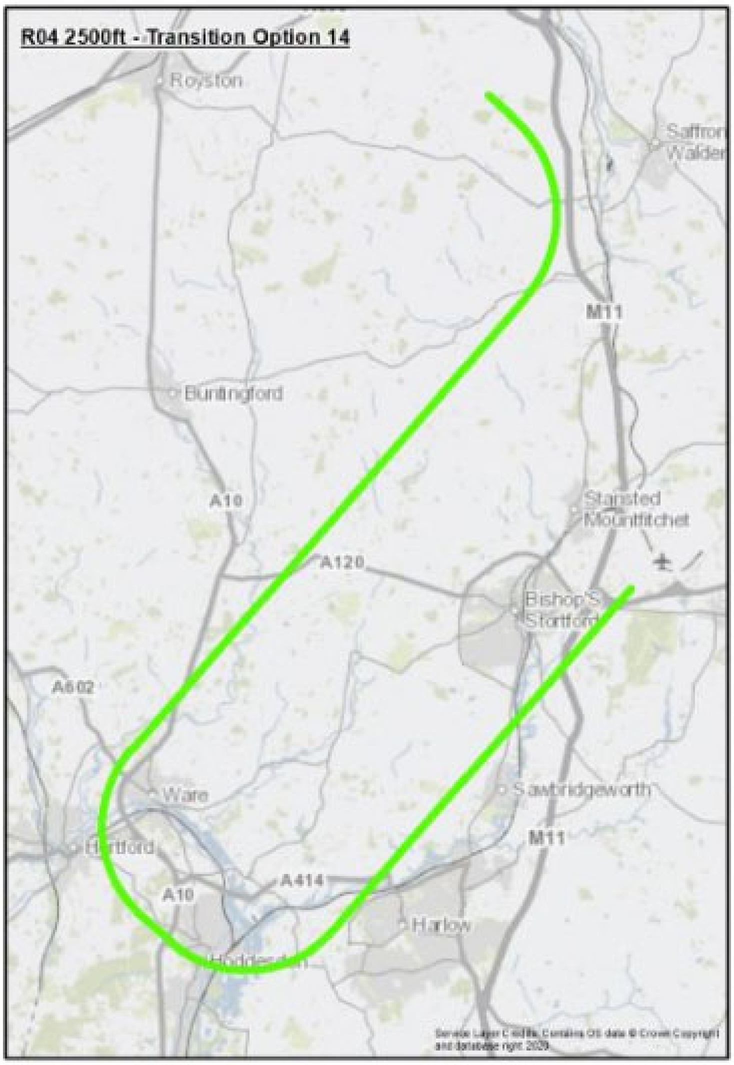
29.10 RWY 04 - 2,500ft Transition Option 13

Description	*Rationale for Inclusion*
Option 13 has an IAF at 7,000ft to the north west of the airport in the vicinity of Langley Upper Green. This option has a slight bias for runway 22 and this results in slightly longer track miles for this runway. *From this position this option enables a CDA at 3.4% (2°) which is below the optimal for low noise approaches but within the acceptable range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west on a track parallel with the final approach and then turns left onto base leg close to Ware and establishes aircraft on a 2,500ft final approach.*	Noise N1: Avoids major towns as far as possible (within the constraints imposed by the joining point).



29.11 RWY 04 - 2,500ft Transition Option 14

Description	*Rationale for Inclusion*
Option 14 has an IAF at 7,000ft to the north west of the airport in the vicinity of Strethall to create the shortest viable route for runway 22 which results in longer track miles for this runway. *For 04 this option enables a CDA at 3.1% (1.7°) which is below the optimal for low noise approaches. Whilst this is within the acceptable range for CDAs defined within ICAO guidance, the potential for level segments exists.* *From the IAF the route turns south west on a track parallel with the final approach and then turns left onto base leg close to Ware and establishes aircraft on a 2,500ft final approach.*	Balance: Shortest possible route (fuel burn) to runway 22 used for approx. 70% of flights. Noise N1: Avoids major towns as far as possible (within the constraints imposed by the joining point).

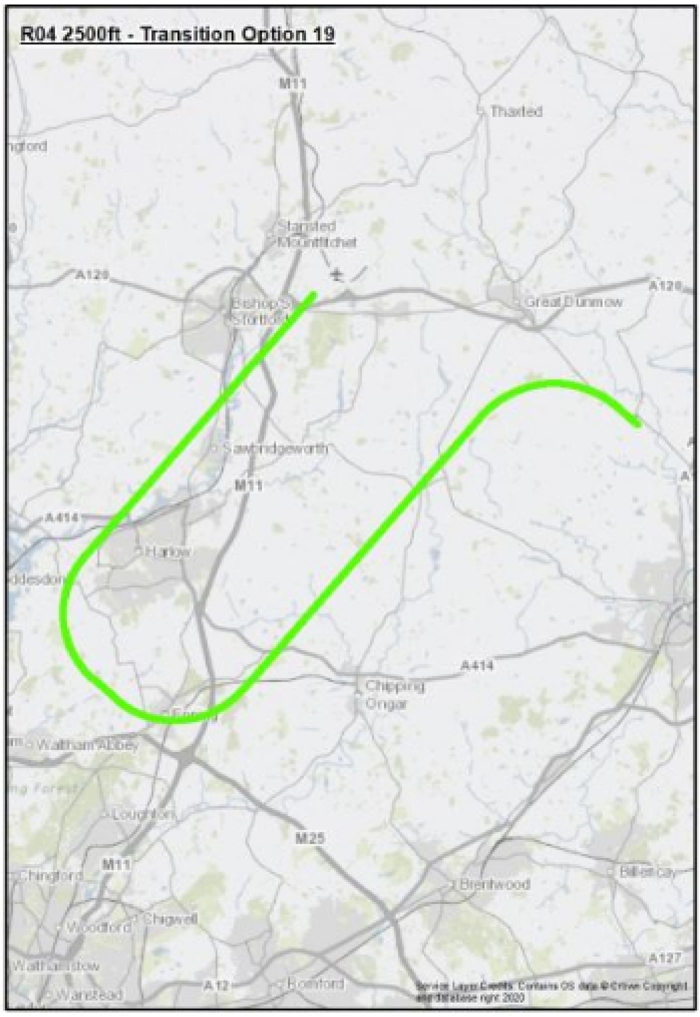


29.12 RWY 04 - 2,500ft Transition Option 16

Description	*Rationale for Inclusion*
Option 16 has an IAF at 7,000ft to the north west of the airport in the vicinity of Great Chishill. This gives a slight bias for runway 22 which results in slightly longer track miles for this runway. *From this position this option enables a CDA at 3.5% (2.°) which is slightly below the optimal for low noise approaches but within the range defined for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west and routes close to Puckeridge and then turns left onto base leg close to Ware and establishes aircraft on a 2,500ft final approach.*	Provides a CDA to both runway directions. Noise N1: Avoids major towns as far as possible (within the constraints imposed by the joining point).

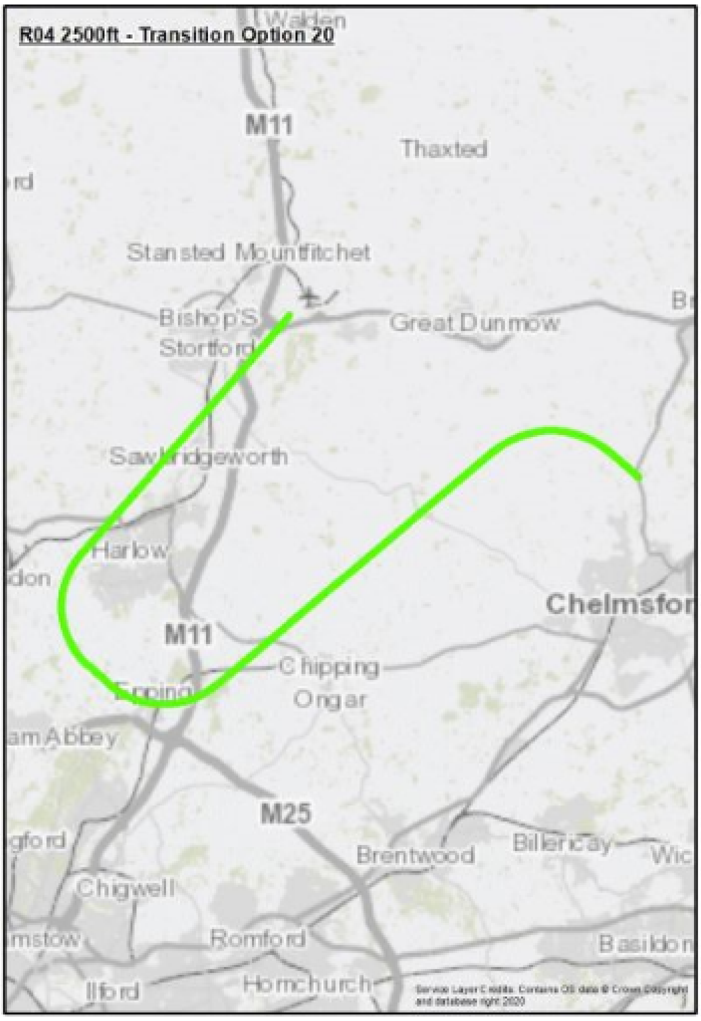
29.13 RWY 04 - 2,500ft Transition Option 19

Description	Rationale for Inclusion
Option 19 has an IAF at 7,000ft to the south-east of the airport which is almost equidistant to each runway threshold but with a slightly shorter track for runway 22. It has been designed as an option that offers potential for noise relief if combined with Option 20. *From this position this option enables a CDA at 3.4% (1.95°) which is below the optimal for low noise approaches. Although within the acceptable range defined for CDAs defined within CAA and ICAO guidance the potential for level segments exists.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and close to North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Provides a CDA to both runway directions. Balance: Approximately equal track miles (fuel burn) for both runways. Noise N2: May provide an option for noise relief when combined with option 20.



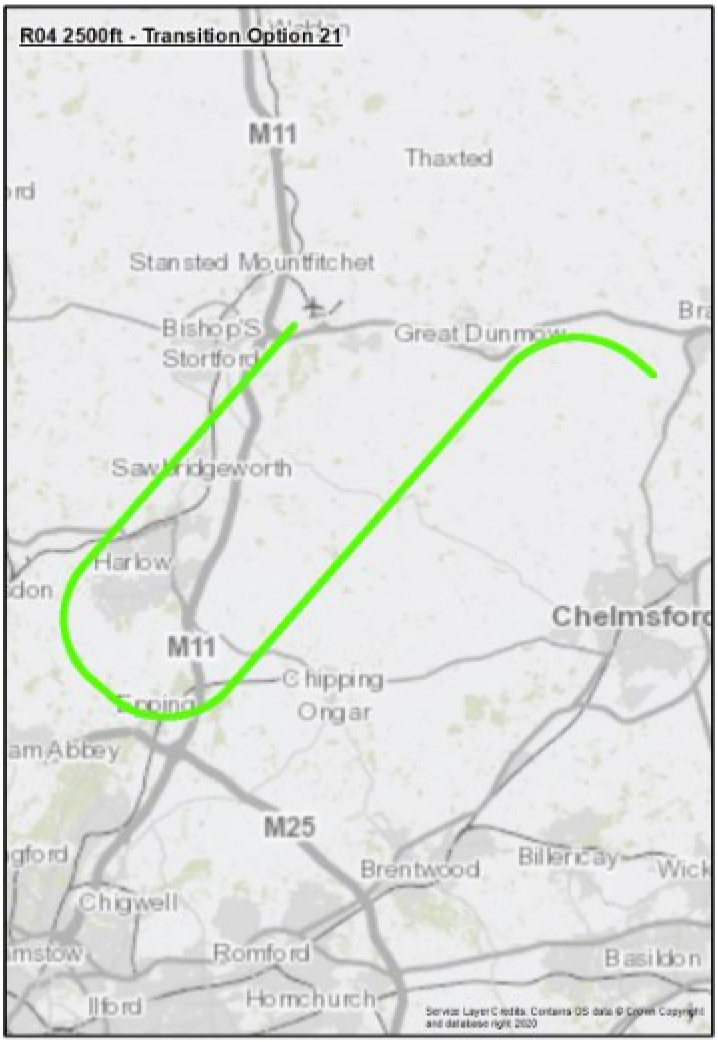
29.14 RWY 04 - 2,500ft Transition Option 20

Description	*Rationale for Inclusion*
Option 20 has an IAF at 7,000ft to the south-east of the airport close to Option 19 which is almost equidistant to each runway. It has been designed to offer potential for noise relief if combined with Option 19. *From this position this option enables a CDA at 3.3% (1.9°) which is below the optimal for low noise approaches. Although within the acceptable range defined for CDAs defined within CAA and ICAO guidance the potential for level segments exists.* *From the IAF the route turns south west onto a downwind track to the south of High Easter and close to North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,500ft final approach.*	Provides a CDA to both runway directions. Balance: Approximately equal track miles (fuel burn) for both runways. Noise N2: May provide an option for noise relief when combined with option 19.



29.15 RWY 04 - 2,500ft Transition Option 21

Description	*Rationale for Inclusion*
Option 21 has an IAF at 7,000ft to the East of the airport to the south east of Braintree and has been designed as the shortest PANS-OPS compliant route to runway 22. This results in longer track miles for this runway. It may offer potential for noise relief when combined with Option 22. *This option enables a CDA at 3% (1.7°) which is below the optimal for low noise approaches. Although within the acceptable range defined for CDAs defined within CAA and ICAO guidance the potential for level segments exists.* *From the IAF the route turns south west to the south of Great Dunmow onto a downwind track parallel with the final approach and close to North Weald aerodrome. It then turns right onto base leg and establishes aircraft on a 2,000ft final approach.*	Noise N2: May provide an option for noise relief when combined with option 22.



29.16 RWY 04 - 2,500ft Transitions: Viable but Poor Fit Options

29.16.1 RWY 04 - 2,500ft Transition Option A3

IAF-3 is south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance than other equidistant options. It facilitates a CDA but with a sub-optimum profile.

Reason for exclusion: Design Principles Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between STN arrivals and interactions with traffic to and from other airports on routes M197 and Q295 and the network joining points for LTN, LCY and LHR departing traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is efficiency and the and the expeditious flow of traffic including greater runway throughput. By creating interactions with routes traffic for other airports this option would not comply with this initiative (and therefore the Policy DP) as it has the potential to require ATC interaction which would reduce this efficiency.

29.16.2 RWY 04 - 2,500ft Transition Option B6

IAF-6 east of the aerodrome and west of Colchester. The IAF lies outside of the 2,500ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principles Policy and Safety.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.3 RWY 04 - 2,500ft Transition Option C7

IAF-7 is north east of the aerodrome mid-way between Cambridge and Newmarket to the north east of STN. It was designed as a mirror for Option B6. The IAF lies outside of the 2,500ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.4 RWY 04 - 2,500ft Transition Option D8

IAF-8 is positioned south-east of the aerodrome between Chelmsford and Braintree. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.5 RWY 04 - 2,500ft Transition Option E9

IAF-9 is positioned north of the aerodrome to the south west of Duxford and north of STN. This was designed as a mirror of Option D8. This option introduces acceptable track miles and CDA for this runway but not for 04. There is also the potential of interaction with AD6 arrival routes operated by Luton Airport. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.6 RWY 04 - 2,500ft Transition Option F11

IAF-11 is north east of the aerodrome close to the current ABBOT hold. IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.7 RWY 04 - 2,500ft Transition Option G12

IAF-12 is positioned west of the aerodrome close to the current LOREL hold. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.8 RWY 04 - 2,500ft Transition Option H15

IAF-15 is positioned to the north to the east of Duxford and to the north west of STN. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the Minimum Stabilisation Distance (MSD) requirements within PANS-OPS. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.9 RWY 04 - 2,500ft Transition Option I17

IAF 17 is positioned to the west of Duxford and north of the aerodrome. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.10 RWY 04 - 2,500ft Transition Option J18

IAF 18 is positioned to the north of Royston at the northern boundary of the design envelope. The IAF is outside of the 2,500ft design area so CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.11 RWY 04 - 2,500ft Transition Option K22

IAF 22 is positioned to the south of Braintree. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

29.16.12 RWY 04 - 2,500ft Transition Option L23

IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. The IAF is outside of the 2,500ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

30 Approach RWY 22 – 3,000ft FAF

30.1 Overview

This approach is included within the options to provide a 3° final approach descent gradient with a FAF of 3,000ft (currently used as a joining point for night operations). The approach is aligned with the runway centreline, which aims to align with the currently published ILS procedure for RWY 22. The intermediate segment length that precedes this segment caters for any turns in the transition at the Intermediate Fix (IF) of up to 90°, which provides sufficient distance for turn anticipation and the Minimum Stabilisation Distance (MSD).

Figure 55 Approach Path RWY 22 – 3,000ft FAF

This approach path is common for each of the transition options with a 3,000ft FAF for RWY 22 detailed below.

31 RWY 22 – 3,000ft Transitions

31.1 Introduction to RWY 22 Transition Options with 3,000ft FAF Envelope

This suite of transitions connects the Initial Approach Fix (IAF) to the RWY 22 Approach with a 3,000ft FAF which could potentially be used for night operations. The intention has been to define an IAF position that would facilitate a continuous descent to RWY 22, and to RWY 04, thereby providing in many cases, a symmetrical transition design.

31.2 Design Envelope Location Map: 3,000ft transitions for runway 22.

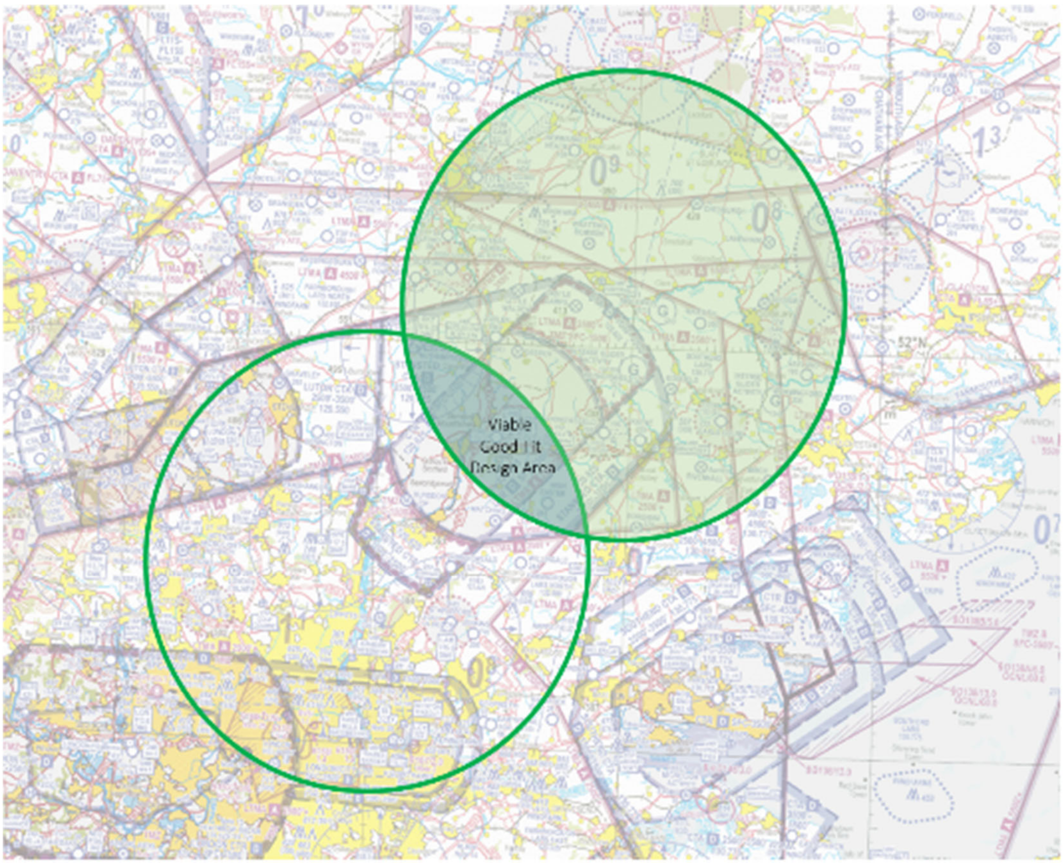


Figure 56 RWY 22 Transitions Design Envelope, 3,000ft FAF

The transition options have been designed using this design envelope as the boundary within which to design "Viable and Good fit" options. This takes into account the requirements of the Policy and Technology design principles to facilitate CDAs to both runways.

31.3 RWY 22 Transitions Long List – 3,000ft Outline Longlist

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the S of the aerodrome and west of Braintree.	A3	IAF-3 South and east of the aerodrome, equidistant to both runway thresholds but at a greater distance. Potential to interact with other airports.	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distances (MSD) and the turn onto final approach. • Descent gradients above the PANS-OPS maximum • Turn radius based on speed, altitude, and descent gradient These options have not been designed and are not described further within this comprehensive list of design options.
2a (Central)	7,000ft point that is close to or overhead the aerodrome resulting in an equidistant track to both runway thresholds. Arrivals route from the SE and turn downwind right to the N of the aerodrome and turn right onto final approach.	B5	IAF-5 is the north west of the aerodrome (close to the northern position of the current LOREL hold). Potential to interact with other airports.		
2b (Central)	7,000ft point that is close to or overhead the aerodrome. Arrivals route from the NW and turn	C6	IAF-6 East of the aerodrome and west of Colchester. Not fully CDA compliant.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	downwind left to the SE of the aerodrome and turn left onto final approach.		May also conflict with STN Clacton departures.		
4 (West)	7,000ft point to the north west of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the NW of the aerodrome and turn right onto final approach.	D7	IAF-7 North east of the aerodrome mid-way between Cambridge and Newmarket. Not fully CDA compliant. IAF may not align with airspace containment policy.		
10 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. A possible noise relief option that routes to the SE of the aerodrome and west of Braintree.	E8	IAF-8 South-east of the aerodrome between Chelmsford and Braintree. Not fully CDA compliant.		
		F9	IAF-9 North of the aerodrome to the south west of Duxford. Not fully CDA compliant.		
		G11	IAF-11 East of the aerodrome close to ABBOT. Not fully CDA compliant.		
		H12	IAF-12 West of the aerodrome close to LOREL. Not fully CDA compliant.		
		I13	IAF 13 positioned to the north west of the aerodrome close to BKY.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
			Not fully CDA compliant.		
		J14	IAF 14 positioned to the north of the aerodrome close to Saffron Walden. Not fully CDA compliant.		
		K15	IAF 15 positioned to the east of Duxford. Not fully CDA compliant.		
		L16	IAF 16 positioned to the north west of the aerodrome north of BKY. Not fully CDA compliant.		
		M17	IAF 17 positioned to the west to the of Duxford. Not fully CDA compliant.		
		N18	IAF 18 positioned to the north of Royston at the northern boundary of the design envelope. Not fully CDA compliant.		
		O19	IAF-19 South east of the aerodrome north of Chelmsford. Not fully CDA compliant.		
		P20	IAF-20 South east of the aerodrome north of Chelmsford. Not fully CDA compliant.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
		Q21	IAF-21 South east of the aerodrome east of Braintree. Not fully CDA compliant.		
		R22	IAF 22 positioned to the south of Braintree. Not fully CDA compliant.		
		S23	IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. Not fully CDA compliant.		

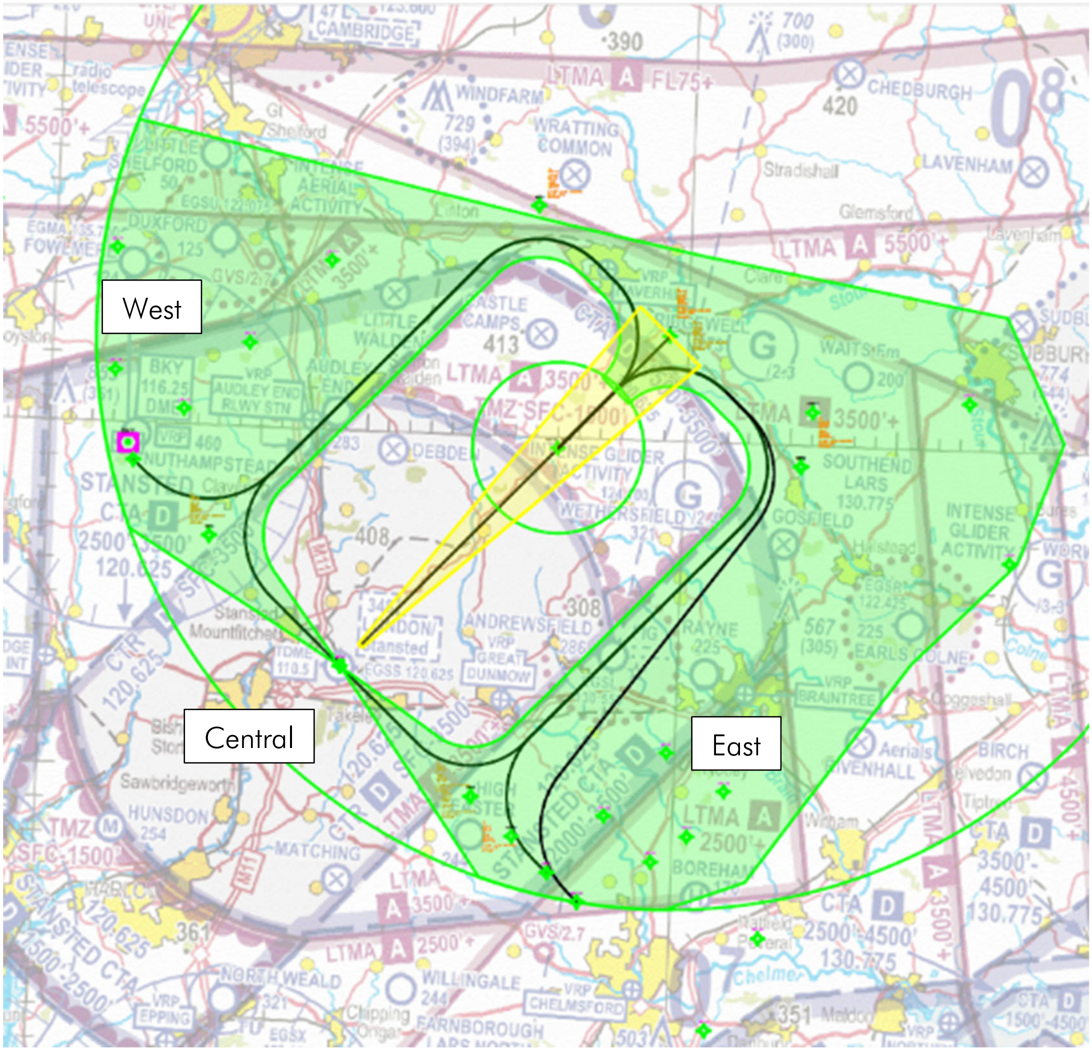
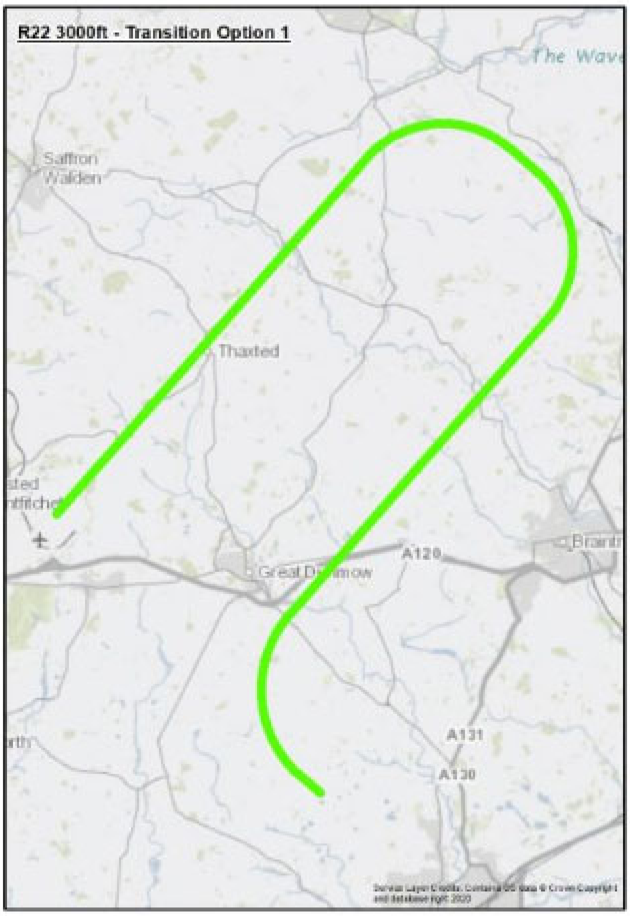


Figure 57 RWY 22 Transitions Design Envelope, 3,000ft FAF and Transition Options

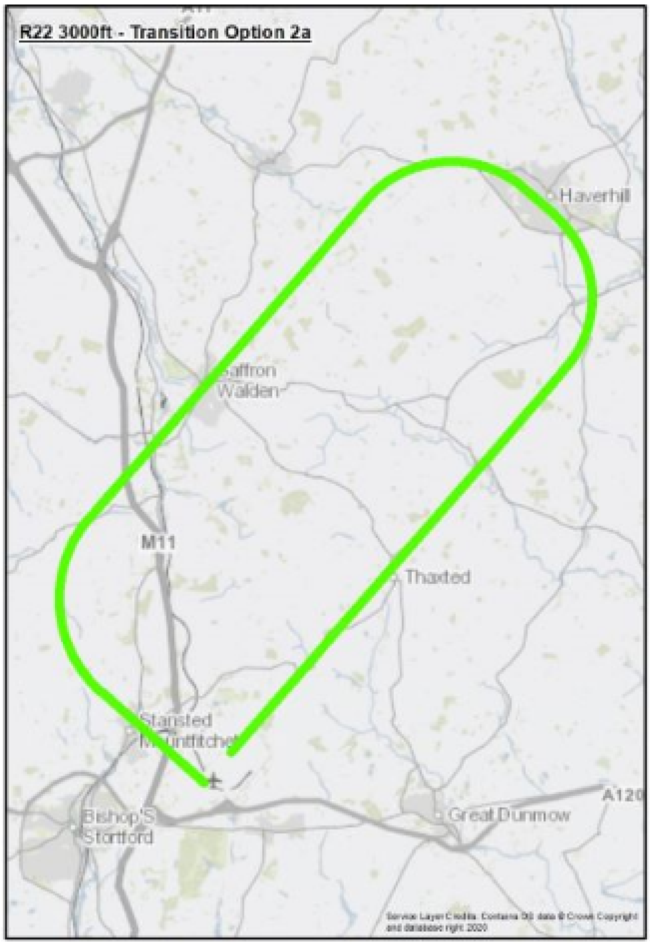
31.4 RWY 22 - 3,000ft Transition Option 1

Description	*Rationale for Inclusion*
Option 1 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.1% (1.8°) which is below the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes west of Braintree. It then turns left onto base leg and establishes aircraft on a 3,000ft final approach.* *The nominal track routes outside of the existing CAS for the theoretical descent profile unless a specific altitude restriction is placed to be explicitly above the LTMA A base (3,500ft) before crossing into the CTA.*	Balance: Equal track miles (fuel burn) for both runways. Noise N1: Designed to limit the impact of noise by avoiding Braintree. Noise N2: May provide an option for noise relief when combined with Option 10.



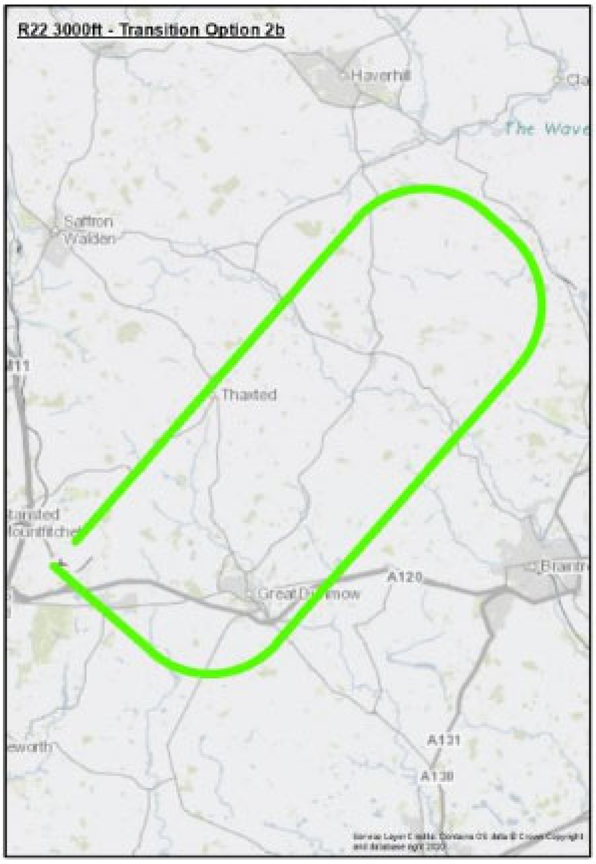
31.5 RWY 22 - 3,000ft Transition Option 2a

Description	Rationale for Inclusion
This central transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the SE and turn downwind right, and then turn right base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables a CDA at 2.8% (1.6°) for both runways which is significantly below the range for low noise approaches but remains within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes over Saffron Walden. It then turns right over Haverhill onto base leg and establishes aircraft on a 3,000ft final approach.* *The nominal track routes outside of the existing CAS for the theoretical descent profile and unless a specific altitude restriction is placed to be explicitly above the LTMA A base (3,500ft) before crossing into the CTA*	Balance: Equal track miles (fuel burn) for both runways. Aligns with current night noise abatement procedures.



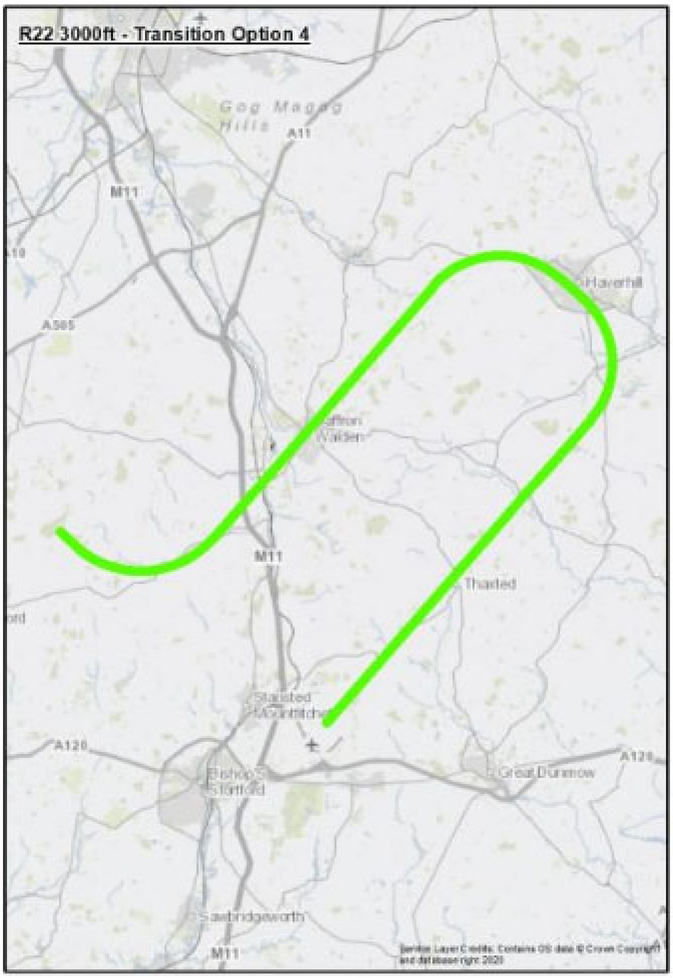
31.6 RWY 22 - 3,000ft Transition Option 2b

Description	*Rationale for Inclusion*
This central transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the NW and turn downwind left, and then turn left base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables a CDA at 2.8% (1.6°) for both runways which is significantly below the range for low noise approaches but remains within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes to the east of Great Dunmow and the west of Braintree. It then turns left onto base leg close to Ridgewell and establishes aircraft on a 3000ft final approach.* *The nominal track routes outside of the existing CAS for the theoretical descent profile unless a specific altitude restriction is placed to be explicitly above the LTMA A base (3,500ft) before crossing into the CTA.*	Balance: Equal track miles (fuel burn) for both runways.



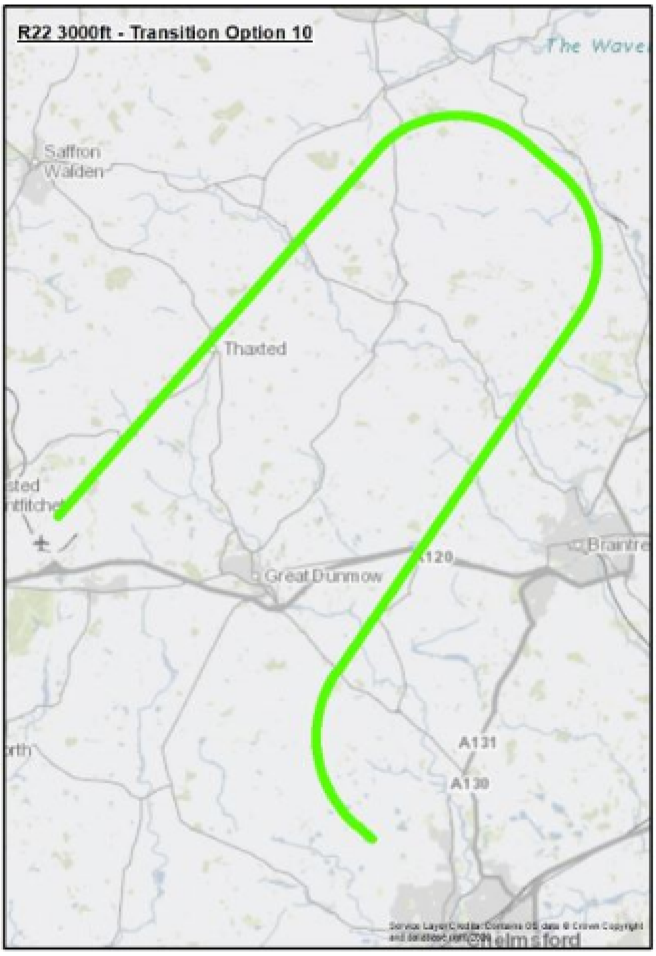
31.7 RWY 22 - 3,000ft Transition Option 4

Description	Rationale for Inclusion
Option 4 has an IAF at 7,000ft to the north west of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.1% (1.8°) which is below the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track parallel with the final approach and routes close to Saffron Walden. It then turns right over Haverhill onto base leg and establishes aircraft on a 3,000ft final approach.* *The nominal track routes outside of the existing CAS for the theoretical descent profile unless a specific altitude restriction is placed to be explicitly above the LTMA A base (3,500ft) before crossing into the CTA.*	Balance: Equal track miles (fuel burn) for both runways. Aligns with current night noise abatement procedures.



31.8 RWY 22 - 3,000ft Transition Option 10

Description	*Rationale for Inclusion*
Option 10 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. It has been designed as an option that offers potential for noise relief if combined with Option1. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.1% (1.8°) which is below the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns north east onto a downwind track and routes further to the east than Option 1 to limit the impact on Great Dunmow and to the west of Braintree. It then turns left onto base leg close to Ridgewell and establishes aircraft on a 3000ft final approach.* *The nominal track routes outside of the existing CAS for the theoretical descent profile and unless a specific altitude restriction is placed to be explicitly above the LTMA A base (3,500ft) before crossing into the CTA.*	Noise N1: Designed to limit the impact of noise by avoiding Great Dunmow and Braintree. Noise N2: May provide an option for noise relief when combined with Option 1.



31.9 RWY 22 - 3,000ft Transitions: Viable, but Poor Fit

31.9.1 RWY 22 – 3,000ft Transition Option A3

IAF-3 is south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance than other equidistant options. It facilitates a CDA but with a sub-optimum profile.

Reason for exclusion: Design Principles Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between STN arrivals and interactions with traffic to and from other airports on routes M197 and Q295 and the network joining points for LTN, LCY and LHR departing traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is efficiency and the and the expeditious flow of traffic including greater runway throughput. By creating interactions with routes traffic for other airports this option would not comply with this initiative (and therefore the Policy DP) as it has the potential to require ATC interaction which would reduce this efficiency.

31.9.2 RWY 22 – 3,000ft Transition Option B5

IAF-5 is the north west of the aerodrome (close to the northern position of the current LOREL hold). It was designed as a mirrored version of Option A3. It introduces more track miles and does facilitate a Continuous Descent but with a sub-optimum profile.

However, there is also the potential of interaction with AD6 routes operated by Luton Airport. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact. In addition the potential interaction with Luton is not aligned to the initiative for efficiency and an expeditious flow of traffic. This interaction would lead to ATC intervention and a potential reduction in network efficiency.

31.9.3 RWY 22 – 3,000ft Transition Option C6

IAF-6 east of the aerodrome and west of Colchester. The IAF lies outside of the 3,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principles Policy and Safety.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.4 RWY 22 – 3,000ft Transition Option D7

IAF-7 is north east of the aerodrome mid-way between Cambridge and Newmarket to the north east of STN. It was designed as a mirror for Option B6. The IAF lies outside of the 3,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.5 RWY 22 – 3,000ft Transition Option E8

IAF-8 is positioned south-east of the aerodrome between Chelmsford and Braintree. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.6 RWY 22 – 3,000ft Transition Option F9

IAF-9 is positioned north of the aerodrome to the south west of Duxford and north of STN. This was designed as a mirror of Option D8. This option introduces acceptable track miles and CDA for this runway but not for 04. There is also the potential of interaction with AD6 arrival routes operated by Luton Airport. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.7 RWY 22 – 3,000ft Transition Option G11

IAF-11 is north east of the aerodrome close to the current ABBOT hold. IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.8 RWY 22 – 3,000ft Transition Option H12

IAF-12 is positioned west of the aerodrome close to the current LOREL hold. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.9 RWY 22 – 3,000ft Transition Option I13

IAF 13 is positioned to the north west of the aerodrome close to BKY DVOR. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.10 RWY 22 – 3,000ft Transition Option J14

IAF 14 is positioned to the north of the aerodrome close to Saffron Walden. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.11 RWY 22 – 3,000ft Transition Option K15

IAF-15 is positioned to the north to the east of Duxford and to the north west of STN. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the Minimum Stabilisation Distance (MSD) requirements within PANS-OPS. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.12 RWY 22 – 3,000ft Transition Option L16

IAF 16 is positioned to the north west of the aerodrome north of BKY DVOR. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.13 RWY 22 – 3,000ft Transition Option M17

IAF 17 is positioned to the west of Duxford and north of the aerodrome. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.14 RWY 22 – 3,000ft Transition Option N18

IAF 18 is positioned to the north of Royston at the northern boundary of the design envelope. The IAF is outside of the 3,000ft design area so CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.15 RWY 22 – 3,000ft Transition Option O19

IAF-19 is positioned south-east of the aerodrome north of Chelmsford. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.16 RWY 22 – 3,000ft Transition Option P20

IAF-20 is positioned south-east of the aerodrome north of Chelmsford. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach

(CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.17 RWY 22 – 3,000ft Transition Option Q21

IAF-21 south-east of the aerodrome east of Braintree. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.18 RWY 22 – 3,000ft Transition Option R22

IAF 22 is positioned to the south of Braintree. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

31.9.19 RWY 22 – 3,000ft Transition Option S23

IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

32 Approach RWY 04 – 3,000ft FAF

32.1 Overview

This approach is included within the options to provide a 3°final approach descent gradient with a FAF of 3,000ft potentially for night operations). The approach is aligned with the runway centreline, which aims to align with the currently published ILS procedure for RWY04. The intermediate segment length that precedes this segment caters for any turns in the transition at the Intermediate Fix (IF) of up to 90°, which provides sufficient distance for turn anticipation and the Minimum Stabilisation Distance (MSD).

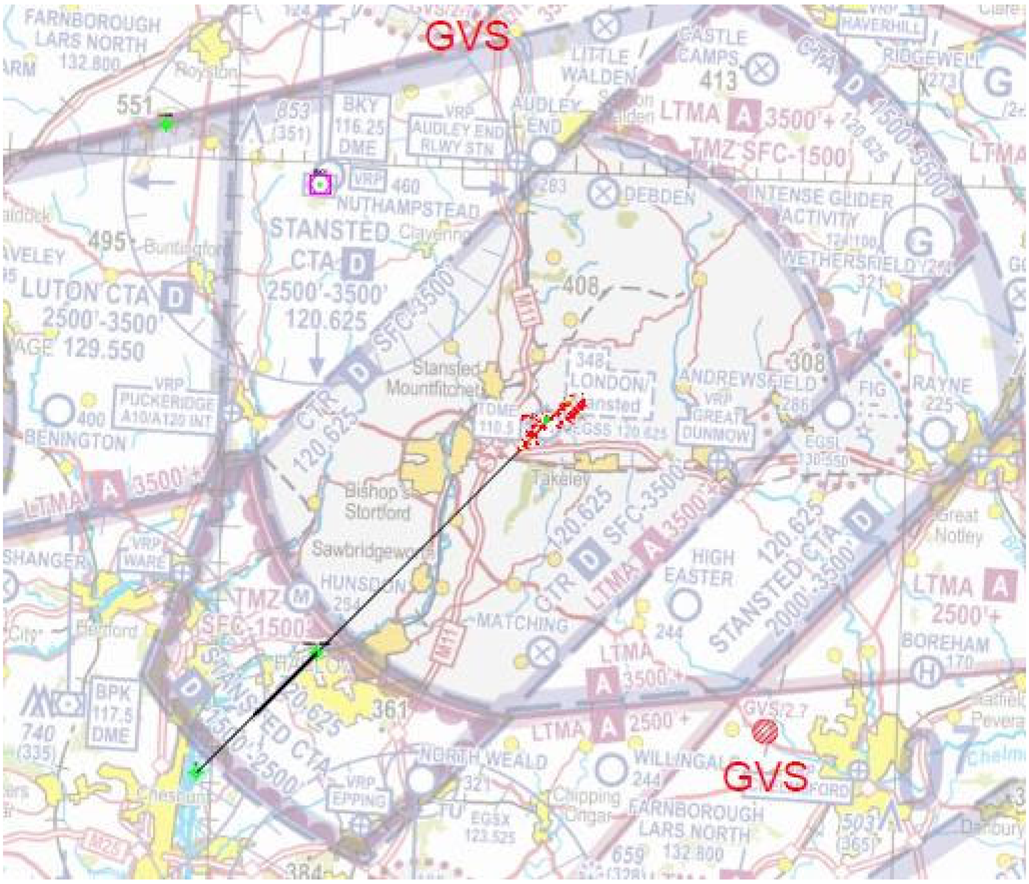


Figure 58 Approach Path RWY 04 – 3,000ft FAF

This approach path is common for each of the transition options with a 3,000ft FAF for RWY 04 detailed below.

33 RWY 04 – 3,000ft Transitions

33.1 Introduction to RWY 04 Transition Options with 3,000ft FAF Envelope

This suite of transitions connects the Initial Approach Fix (IAF) to the RWY 04 Approach with a 3,000ft FAF which could potentially be used for night operations. The intention has been to define an IAF position that would facilitate a continuous descent to RWY 04, and to RWY 22.

33.2 Design Envelope Location Map: 2,000ft transitions for runway 04.

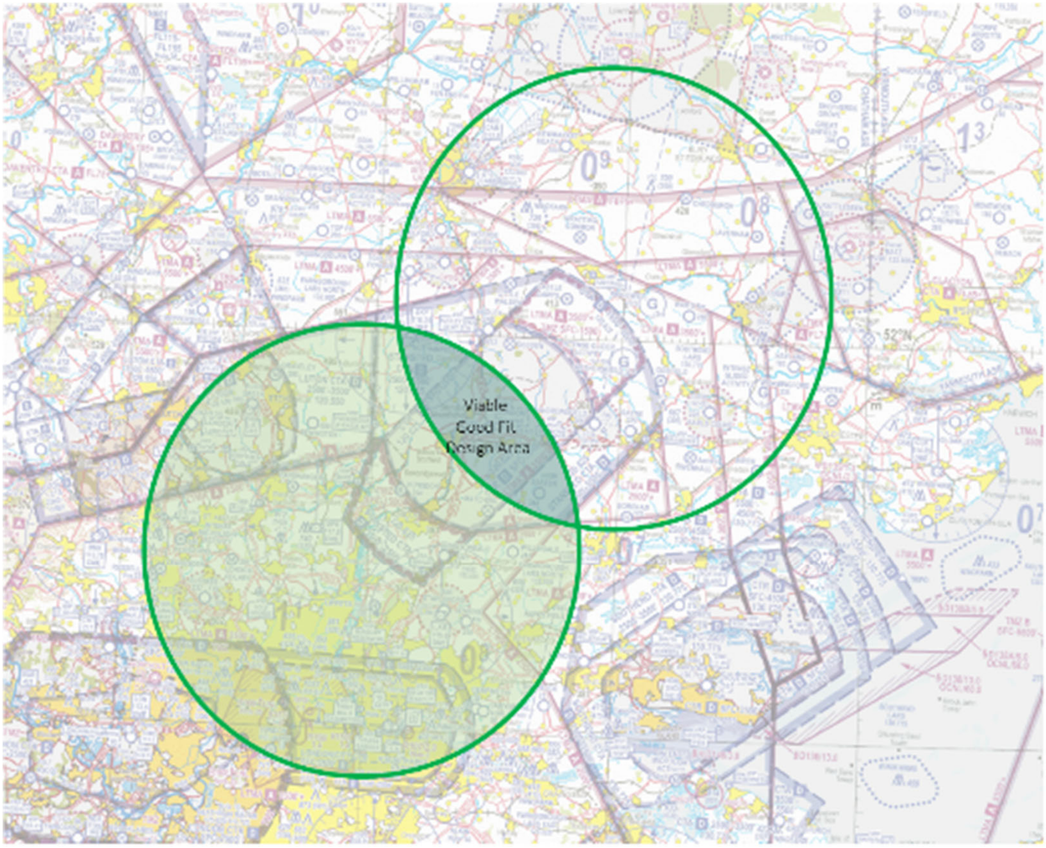


Figure 59 RWY 04 Transitions Design Envelope, 3,000ft FAF

The transition options have been designed using this design envelope as the boundary within which to design “Viable and Good fit” options. This takes into account the requirements of the Policy and Technology design principles to facilitate CDAs to both runways.

33.3 RWY 04 Transitions Long List – 3,000ft Outline Longlist

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
1 (East)	7,000ft point to the south east of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the SE of the aerodrome and turn right onto final approach. .	A3	IAF-3 South and east of the aerodrome, equidistant to both runway thresholds but at a greater distance. Potential to interact with other airports.	U	Unviable options for this envelope are those that would not comply with PANS-OPS 8168 design criteria or did not have a supporting safety justification for non-compliance. These covers options that may be non-compliant with PANS-OPS in relation to: • Minimum Stabilisation Distances (MSD) and the turn onto final approach. • Descent gradients above the PANS-OPS maximum • Turn radius based on speed, altitude, and descent gradient These options have not been designed and are not described further within this comprehensive list of design options.
2a (Central)	7,000ft point that is close to or overhead the aerodrome resulting in an equidistant track to both runway thresholds. Arrivals route from the SE and turn downwind left to the NW of the aerodrome and turn right onto final approach.	B5	IAF-5 is the north west of the aerodrome (close to the northern position of the current LOREL hold). Potential to interact with other airports.		
2b (Central)	7,000ft point that is close to or overhead the aerodrome. Arrivals route from the NW and turn	C6	IAF-6 East of the aerodrome and west of Colchester. Not fully CDA compliant.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
	downwind right to the S of the aerodrome and turn right onto final approach.				
4 (West)	7,000ft point to the NW of the aerodrome (close to BKY). Arrivals route to the SW and turn left onto final approach.	D7	IAF-7 North east of the aerodrome mid-way between Cambridge and Newmarket. Not fully CDA compliant.		
10 (East)	7,000ft point south of the aerodrome which is equidistant to both runway thresholds. Arrivals route to the SE of the aerodrome and turn right onto final approach.	E8	IAF-8 South east of the aerodrome between Chelmsford and Braintree. Not fully CDA compliant.		
	c	F9	IAF-9 North of the aerodrome to the south west of Duxford. Not fully CDA compliant.		
		G11	IAF-11 East of the aerodrome close to ABBOT. Not fully CDA compliant.		
		H12	IAF-12 West of the aerodrome close to LOREL. Not fully CDA compliant.		
		I13	IAF 13 positioned to the north west of the aerodrome close to BKY. Not fully CDA compliant.		
		J14	IAF 14 positioned to the north of the		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
			aerodrome close to Saffron Walden. Not fully CDA compliant.		
		K15	IAF 15 positioned to the east of Duxford. Not fully CDA compliant.		
		L16	IAF 16 positioned to the north west of the aerodrome north of BKY. Not fully CDA compliant.		
		M17	IAF 17 positioned to the west to the of Duxford. Not fully CDA compliant.		
		N18	IAF 18 positioned to the north of Royston at the northern boundary of the design envelope. Not fully CDA compliant.		
		O19	IAF-19 South east of the aerodrome north of Chelmsford. Not fully CDA compliant.		
		P20	IAF-20 South east of the aerodrome north of Chelmsford. Not fully CDA compliant.		
		Q21	IAF-21 South east of the aerodrome east of Braintree.		

Viable and Good Fit against DPs		Viable but Poor Fit against DPs		Unviable	
			Not fully CDA compliant.		
		R22	IAF 22 positioned to the south of Braintree. Not fully CDA compliant.		
		S23	IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. Not fully CDA compliant.		

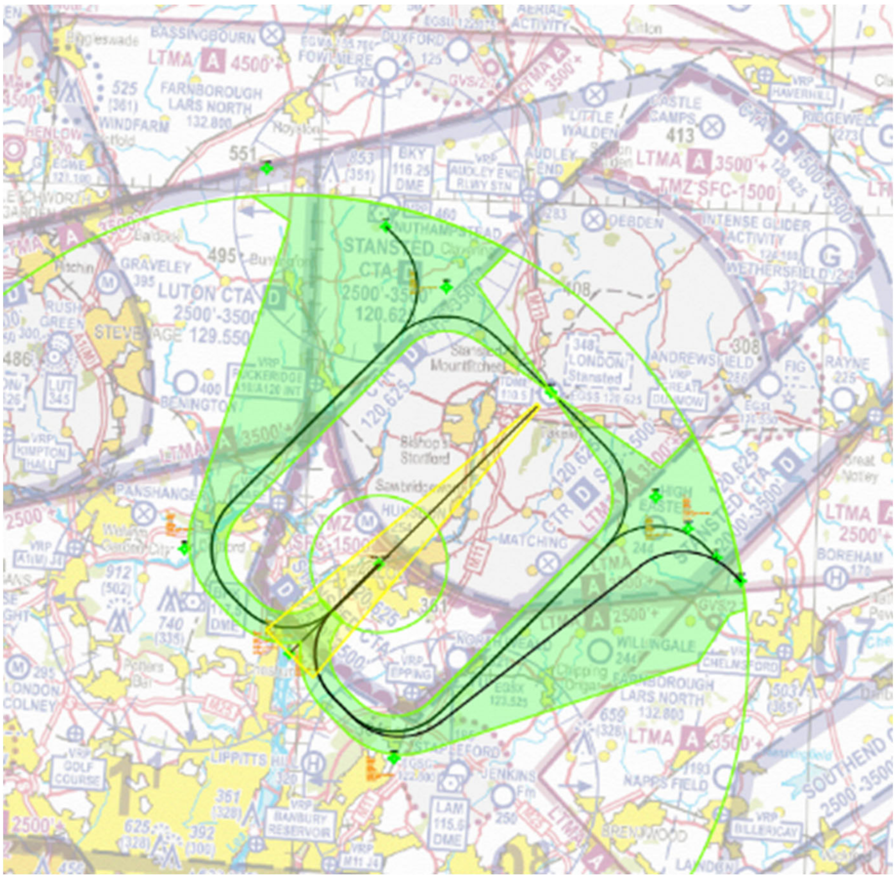
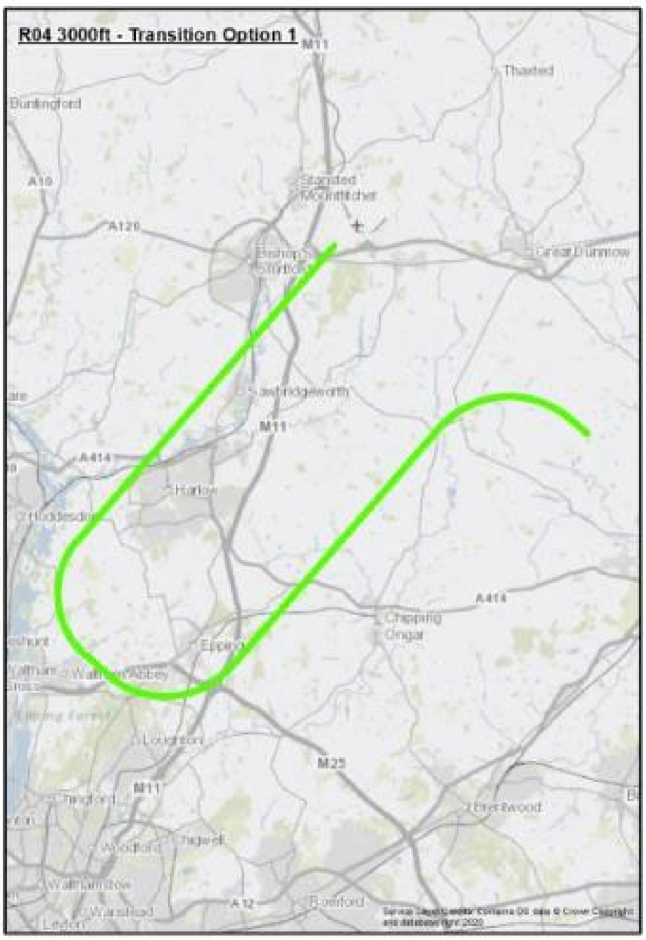


Figure 60 RWY 04 Transitions Design Envelope, 3,000ft FAF and Transition Options

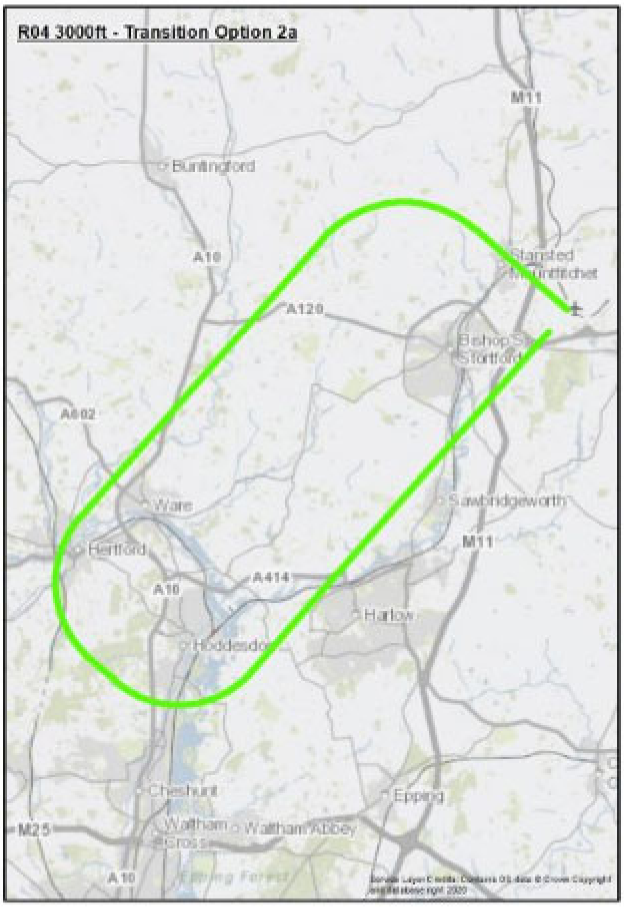
33.4 RWY 04 - 3,000ft Transition Option 1

Description	*Rationale for Inclusion*
Option 1 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.1% (1.8°) which is below the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and turns right onto base leg south of Epping and establishes aircraft on a 3,000ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N2: May provide an option for noise relief when combined with Option 10.



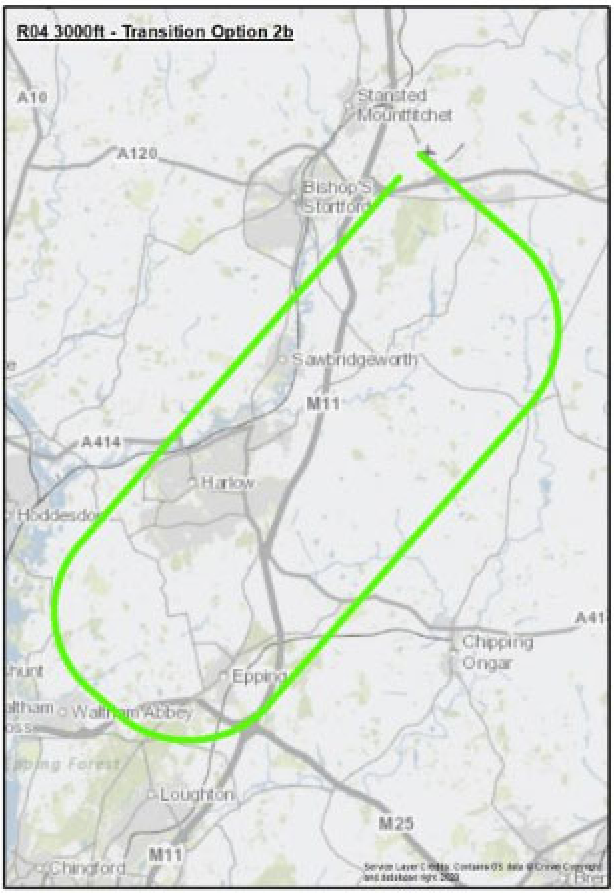
33.5 RWY 04 - 3,000ft Transition Option 2a

Description	Rationale for Inclusion
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the SE and turn downwind left. *From this position there is an equal distance between each runway threshold, and this option enables a CDA at 2.8% (1.6°) for both runways which is significantly below the range for low noise approaches but remains within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route is heading north west and then turns south west onto a downwind track parallel with the final approach and routes outside of Ware at which point it turns left onto base leg and establishes aircraft on a 3,000ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Aligns with current night noise abatement procedures.



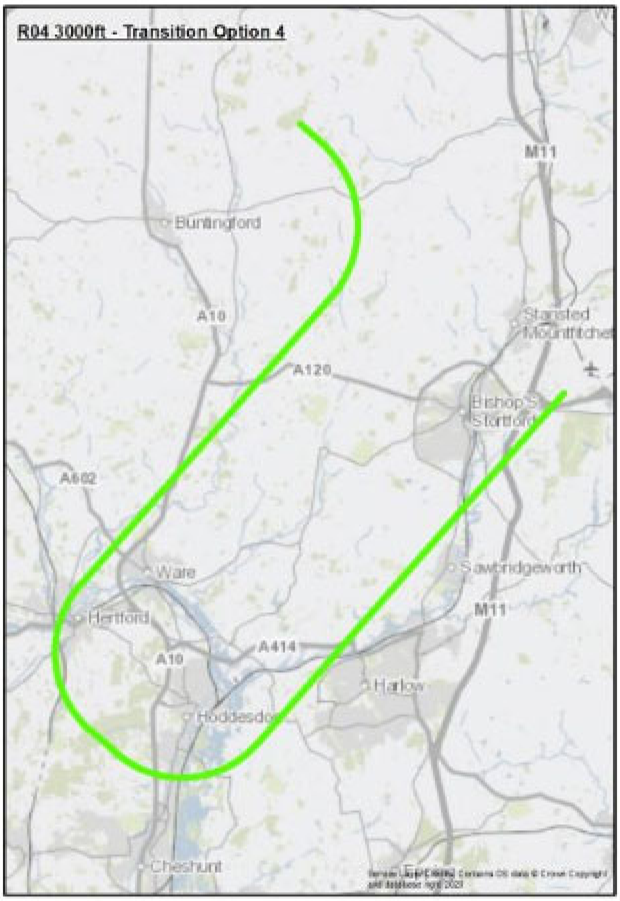
33.6 RWY 04 - 3,000ft Transition Option 2b

Description	Rationale for Inclusion
This transition option has an IAF at 7,000ft approximately overhead the aerodrome. Arrivals reach the 7,000ft routing from the NW and turn downwind right, and then turn left base onto the final approach. *From this position there is an equal distance between each runway threshold, and this option enables a CDA at 2.8% (1.6°) for both runways which is significantly below the range for low noise approaches but remains within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route is heading south east and then turns south west onto a downwind track parallel with the final approach and then turns right onto base leg south of Epping and establishes aircraft on a 3,000ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas. It provides the optimum track miles and Continuous Descent Approaches.*	Balance: Equal track miles (fuel burn) for both runways.



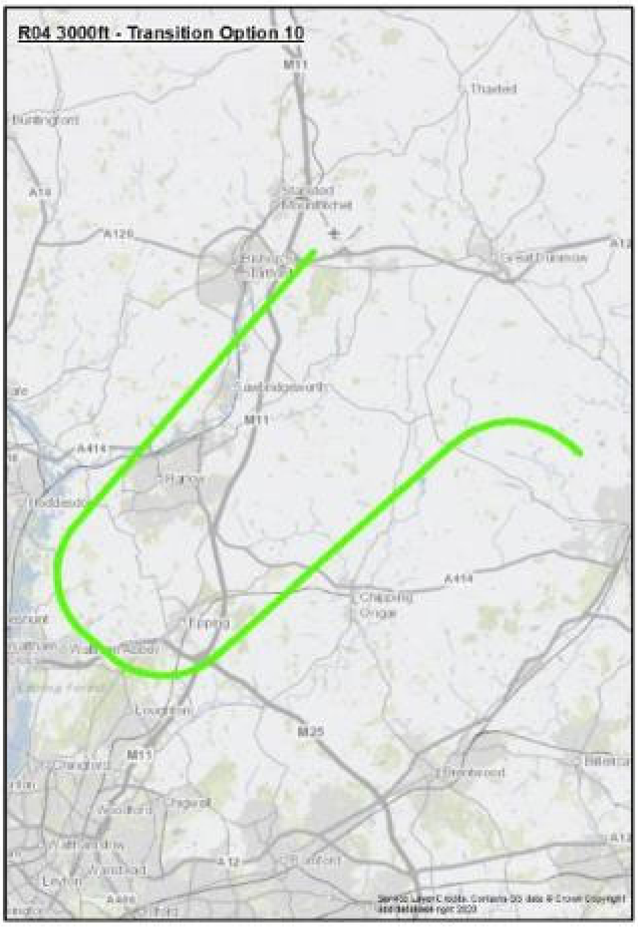
33.7 RWY 04 - 3,000ft Transition Option 4

Description	Rationale for Inclusion
Option 4 has an IAF at 7,000ft to the north west of the airport which is equidistant to each runway threshold. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.1% (1.8°) which is below the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track parallel with the final approach and routes close to Ware at which point it turns left onto base leg and establishes aircraft on a 3,000ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Aligns with current night noise abatement procedures. .



33.8 RWY 04 - 3,000ft Transition Option 10

Description	*Rationale for Inclusion*
Option 10 has an IAF at 7,000ft to the south-east of the airport which is equidistant to each runway threshold. It has been designed as an option that offers potential for noise relief if combined with Option1. *From this position there is an equal distance between each runway threshold which enables a CDA at 3.1% (1.8°) which is below the optimum for low noise approaches but within the acceptable range for CDAs defined within CAA and ICAO guidance.* *From the IAF the route turns south west onto a downwind track and routes further to the south than Option 1 to create noise dispersal. It then turns right onto base leg and establishes aircraft on a 3,000ft final approach.* *Whilst the nominal track is within the existing CAS, no assessment has been made at this stage to determine if it meets the CAA's Containment Policy for the primary containment areas.*	Balance: Equal track miles (fuel burn) for both runways. Noise N2: May provide an option for noise relief when combined with Option 1.



33.9 RWY 04 - 3,000ft Transitions: Viable but Poor Fit

33.9.1 RWY 04 – 3,000ft Transition Option A3

IAF-3 is south and east of the aerodrome, equidistant to both runway thresholds but at a greater distance than other equidistant options. It facilitates a CDA but with a sub-optimum profile.

Reason for exclusion: Design Principles Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns with regards to the safe separation between STN arrivals and interactions with traffic to and from other airports on routes M197 and Q295 and the network joining points for LTN, LCY and LHR departing traffic. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is efficiency and the and the expeditious flow of traffic including greater runway throughput. By creating interactions with routes traffic for other airports this option would not comply with this initiative (and therefore the Policy DP) as it has the potential to require ATC interaction which would reduce this efficiency.

33.9.2 RWY 04 – 3,000ft Transition Option B5

IAF-5 is the north west of the aerodrome (close to the northern position of the current LOREL hold). It was designed as a mirrored version of Option A3. It introduces more track miles and does facilitate a Continuous Descent but with a sub-optimum profile.

However, there is also the potential of interaction with AD6 routes operated by Luton Airport. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact. In addition the potential interaction with Luton is not aligned to the initiative for efficiency and an expeditious flow of traffic. This interaction would lead to ATC intervention and a potential reduction in network efficiency.

33.9.3 RWY 04 – 3,000ft Transition Option C6

IAF-6 east of the aerodrome and west of Colchester. The IAF lies outside of the 3,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principles Policy and Safety.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.4 RWY 04 – 3,000ft Transition Option D7

IAF-7 is north east of the aerodrome mid-way between Cambridge and Newmarket to the north east of STN. It was designed as a mirror for Option B6. The IAF lies outside of the 3,000ft design envelope, so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the CAA Airspace Containment Policy. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.5 RWY 04 – 3,000ft Transition Option E8

IAF-8 is positioned south-east of the aerodrome between Chelmsford and Braintree. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.6 RWY 04 – 3,000ft Transition Option F9

IAF-9 is positioned north of the aerodrome to the south west of Duxford and north of STN. This was designed as a mirror of Option D8. This option introduces acceptable track miles and CDA for this runway but not for 04. There is also the potential of interaction with AD6 arrival routes operated by Luton Airport. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.7 RWY 04 – 3,000ft Transition Option G11

IAF-11 is north east of the aerodrome close to the current ABBOT hold. IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.8 RWY 04 – 3,000ft Transition Option H12

IAF-12 is positioned west of the aerodrome close to the current LOREL hold. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.9 RWY 04 – 3,000ft Transition Option I13

IAF 13 is positioned to the north west of the aerodrome close to BKY DVOR. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.10 RWY 04 – 3,000ft Transition Option J14

IAF 14 is positioned to the north of the aerodrome close to Saffron Walden. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.11 RWY 04 – 3,000ft Transition Option K15

IAF-15 is positioned to the north to the east of Duxford and to the north west of STN. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Design Principle Safety and Policy.

Safety: The Safety DP requires design options to be safe in accordance with national and international industry standards and regulations. This option raised safety concerns through misalignment with the Minimum Stabilisation Distance (MSD) requirements within PANS-OPS. As a result this option would not comply with the Safety DP.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.12 RWY 04 – 3,000ft Transition Option L16

IAF 16 is positioned to the north west of the aerodrome north of BKY DVOR. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.13 RWY 04 – 3,000ft Transition Option M17

IAF 17 is positioned to the west of Duxford and north of the aerodrome. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.14 RWY 04 – 3,000ft Transition Option N18

IAF 18 is positioned to the north of Royston at the northern boundary of the design envelope. The IAF is outside of the 3,000ft design area so CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.15 RWY 04 – 3,000ft Transition Option O19

IAF-19 is positioned south-east of the aerodrome north of Chelmsford. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.16 RWY 04 – 3,000ft Transition Option P20

IAF-20 is positioned south-east of the aerodrome north of Chelmsford. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.17 RWY 04 – 3,000ft Transition Option Q21

IAF-21 south-east of the aerodrome east of Braintree. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.18 RWY 04 – 3,000ft Transition Option R22

IAF 22 is positioned to the south of Braintree. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

33.9.19 RWY 04 – 3,000ft Transition Option S23

IAF 23 positioned to the south east of the aerodrome and north east of Chelmsford. The IAF is outside of the 3,000ft design area so a CDA is achievable for runway 22, but not for 04.

Reason for exclusion: Policy.

Policy: Within the AMS, one of the initiatives that revised airspace must deliver is improved environmental performance. This option would not comply with this initiative (and therefore the Policy DP) as it would not provide a Continuous Descent Approach (CDA) to both runway direction directions, leading to increased fuel burn and noise impact.

34 Do Minimum Arrival Options

34.1 Overview

As detailed at para 4.4.4 of this DOR, under the Do Minimum option for Arrivals, it has been assumed that NATS would design new RNAV holds above 7,000ft, and these holds would be in the same position as they are today to replicate LOREL and ABBOT.

For STN, the responsibility would be to replicate the current Initial Approach Procedures from these holds using satellite guidance to RNP APCH standard. This has been chosen because it is the ICAO recommended standard for the initial approach phase and is a navigation specification useable by 100% of the airlines that responded to the fleet equipage survey. The ability of all airlines to use the routes makes this the realistic do-minimum specification and is in line with the CAA Airspace Modernisation Strategy initiative 7) "Replication of existing arrival and departure routes with satellite navigation upgrades".

Whilst these procedures would be designed and implemented, in practice aircraft would continue to be vectored to final approach by ATC as they are today and would join the ILS (or the current LNAV approaches) for their final approach phase. Because of the existence of two holds, there would need to be ATC intervention at all stages of the intermediate approach to ensure safety is maintained.

In order to represent the true 'do minimum', this option needs to be implemented as a system (i.e. the design and operation of RNAV versions of both LOREL and ABBOT). This is because:

- This represents today's operation for replication purposes.
- It would not be possible for ATC to manage an arrival system where one arrival transition is systemised, and the other is vectored. This would reduce arrivals capacity and may create separation issues due to "compression" between arriving aircraft on the downwind leg of the flight. On this basis it would not align with the Demand and Safety design principles.

The replicated options have been based upon the UK AIP published procedures "Initial Approach Procedures ILS without radar control VOR/DME BKY u/s" in order to replicate a scenario without dependency on any VOR/DME radial. These procedures have a final approach fix at 2,500ft. These are as detailed in the UK AIP at AD2.EGSS-7-16 (runway 04) and AD2.EGSS-7-18 (runway 22).

34.2 RWY 22 – 2,500ft Transition Option 0 – ABBOT

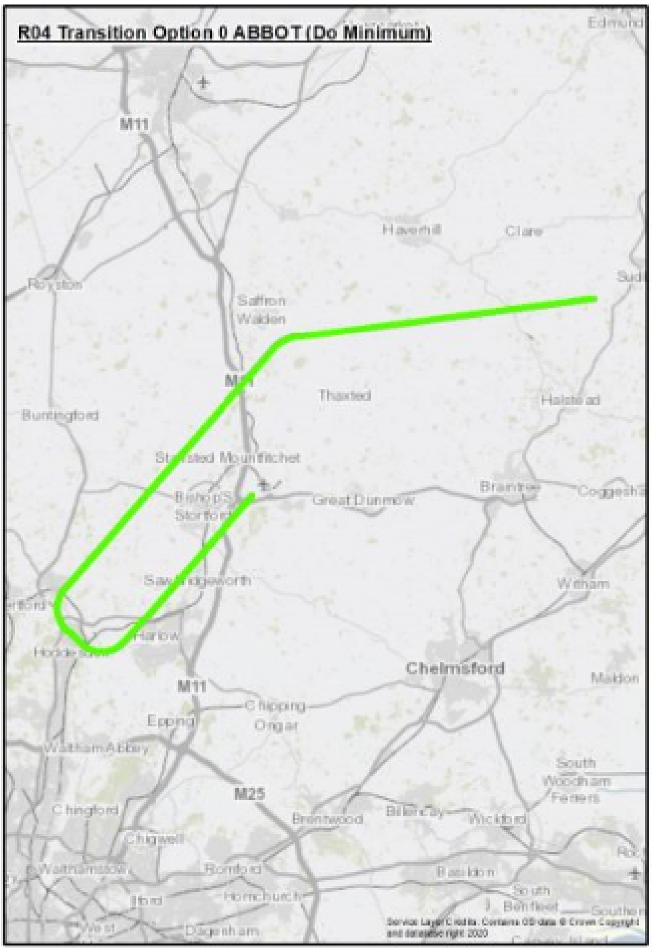
Description	Rationale for Inclusion
This option was developed as a means of replicating the current Initial Approach Procedure without radar control for runway 22 that is currently published using the existing hold at ***ABBOT****.* *From this position to the final approach fix requires an initial approach at 7.9% (4.5°) which is significantly above the optimum for low noise approaches but remains within the acceptable range for CDAs defined within ICAO guidance.* *This is considered to be the 'Do Minimum' for the transitions, since it is not possible to exactly replicate the current situation flown. Currently aircraft are provided radar vectors by ATC, so the tracks can be expected to be spread across a far wider area.* *From the IAF at ABBOT the aircraft descend and route west on base leg before turning left onto final approach to intercept the FAF at 2,500ft.*	Do minimum option.

34.3 RWY 22 – 2,500ft Transition Option 0 – LOREL

Description	Rationale for Inclusion
*This option was developed as a means of replicating the current Initial Approach Procedure without radar control for runway 22 that is currently published using the existing hold at **LOREL**.* *From this position to the final approach fix requires an initial approach at 3.4% (2°) which is slightly below the optimum for low noise approaches but within the acceptable range for CDAs defined within ICAO guidance.* *This is considered to be the 'Do Minimum' for the transitions, since it is not possible to exactly replicate the current situation flown. Currently aircraft are provided radar vectors by ATC, so the tracks can be expected to be spread across a far wider area.* *From the IAF at LOREL the aircraft descend in the vicinity of BKY and then turn left base to route to the north of Saffron Walden before turning right onto final approach to intercept the FAF at 2,500ft.*	Do minimum option.

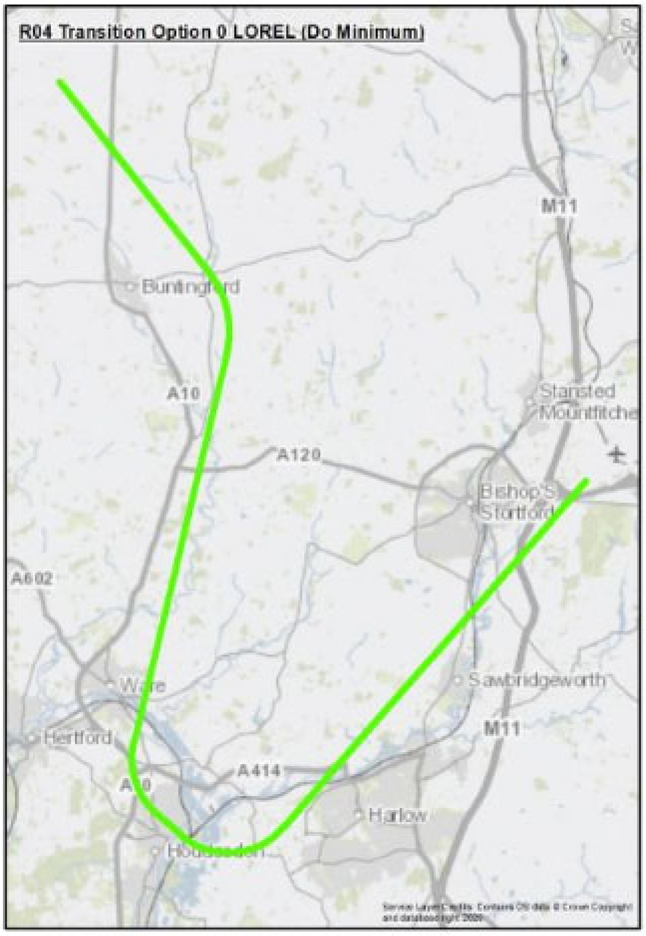
34.4 RWY 04 - 2,500ft Transition Option 0 – ABBOT

Description	*Rationale for Inclusion*
*This option was developed as a means of replicating the current Initial Approach Procedure without radar control for runway 04 that is currently published using the existing hold at **ABBOT**.* *From this position to the final approach fix requires an initial approach at 2% (1.2°) which is significantly below the optimum for low noise approaches. Whilst this is within the acceptable range for CDAs defined within ICAO guidance, the potential for level segments exists.* *This is considered to be the 'Do Minimum' for the transitions, since it is not possible to exactly replicate the current situation flown. Currently aircraft are provided radar vectors by ATC, so the tracks can be expected to be spread across a far wider area.* *From the IAF at ABBOT the aircraft descend and route west before turning left to route downwind to the north of the aerodrome and then turning 180 degrees left to intercept the FAF at 2,500ft.*	Do minimum option.



34.5 RWY 04 - 2,500ft Transition Option 0 - LOREL

Description	Rationale for Inclusion
This option was developed as a means of replicating the current Initial Approach Procedure without radar control for runway 04 that is currently published using the existing hold at ***LOREL****.* *From this position to the final approach fix requires an initial approach at 3.9% (2.2°) which is just below the optimum for low noise approaches and within the acceptable range for CDAs defined within ICAO guidance.* *This is considered to be the 'Do Minimum' for the transitions, since it is not possible to exactly replicate the current situation flown. Currently aircraft are provided radar vectors by ATC, so the tracks can be expected to be spread across a far wider area.* *From the IAF at LOREL aircraft route initially towards BKY and then turn south west before turning left to intercept the FAF at 2,500ft.*	Do minimum option.



Appendix A: Design Decisions

The below table details the key Design Decisions and Assumptions made in the design process to date which have informed the design envelopes and the comprehensive list of design options shown in this DOR, for both arrivals and departures.

The next logical step in considering airspace change is for individual route options to be combined into operating networks. This will support ongoing engagement and, in turn, will allow for a more detailed evaluation against the Design Principles.

In addition, as the shortlisted route options are combined into operating networks, it is likely that some of the route options will respond less well to the design principles. For example, they may prove to be incompatible with other route options, may conflict with the proposals from other change sponsors or may result in a higher cumulative impact. This may mean that certain route options will be discounted, because they are highly unlikely to perform as well as other options. As such, they would not be taken forward to the full options appraisal or public consultation at Stage 3. Consistent with the developing national masterplan, we recognise that 'trade-offs will be identified by ACP sponsors during the development of the initial and full options appraisals (Stages 2B and 3A of the CAP1616 process) and in collaboration with ACOG when assessing the combined and net impacts of interdependent options'.

Further refinement of route options whereby certain options is not to be appraised fully at Stage 3 will be fully explained in preparing for Stage 3. We will ensure that affected stakeholders are afforded the opportunity to provide feedback prior to the full options appraisal.

Table 4 Appendix A Design Decisions

	Decision	Rationale	Impact
D1	Definition of "Design Envelope"	The Design Envelope is the area, based upon our consideration of the SoN and application of the Design Principles (and the rules and regulations for route designs and aircraft operations) within which we will design options.	Design envelopes created for presentation during phase one engagement and within which to develop the design options.

	Decision	Rationale	Impact
D2	All departure envelopes to be designed with a width of 4.5nm at 7,000ft.	Policy and Noise N1 This design decision applies the rationale and diagrams within CAP1498 on definition of overflight and noise distribution. CAP1498 details that a 1,888m lateral displacement at 7,000ft will result in a 3db reduction which is the minimum difference that can ordinarily be perceived on the ground. By using a 4,000m lateral displacement either side of centreline this will equate to a total envelope width of 8,000m or 4.32nm. For design purposes, this has been rounded up to 4.5nm, and would create a dispersal of noise of approximately 19db across the end of the envelope.	Wide design envelopes which give the ability to create design options that respond flexibly to the design principles. The width provides the opportunity to create a reduction in noise impact.
D3	Departure Design Envelopes should not be constrained to the current SID termination points	Policy CAP1616 requires sponsors to consider all possible options. The envelopes should be defined by the routes, rather than a fixed end point. The 7,000ft end point of the furthest route will determine the end position of the design envelope.	Each design envelope has the ability to create design options that respond flexibly to the design principles.

	Decision	Rationale	Impact
D4	Both Lambourne (LAM) and Barkway (BKY) SIDs are included as viable design envelopes.	Policy These SIDs have restrictions to use created by the current airspace design and operating concept within the LTMA. However, these are published SIDs and therefore must be created as 'do minimum' options with alternative options to align with CAP1616 and the AMS.	Design envelopes have been created for North (BKY) and South (LAM) as part of a comprehensive list of options.
D5	Both the current 22 Clacton (CLN1E) and 04 DET1D PBN SIDs are within scope of the ACP.	Policy These were designed to RNP1, and their tracks were approved by CAA following a full public consultation. Because they are designed to PBN standard, they align with the requirements of the AMS. Although this aligns them to the AMS, the vertical tracks need to be re-profiled to align with the CONOPS and the requirements of FASI-S. These routes need to be tested as being viable and these routes remain part of the design options.	Design envelopes have been created that incorporate these routes and routes options have been developed within these design envelopes.

	Decision	Rationale	Impact
D6	Departure climb gradients will use 8% as the default, with 6% as an alternative.	Technology The airline fleet equipage survey indicated that all airlines would be capable of achieving a 6% climb. This survey also indicates that 80% of operators can comfortably meet a minimum climb gradient of 8%. Over time this proportion is likely to increase as older aircraft are phased out. Consistent with our Technology design principle our default default climb gradient for the design envelopes and the routes within them has been set at 8%. This reflects the capability of the majority of aircraft at STN. This also ensures we do not design the future airspace to the lowest performer, but instead capitalise on the investment made by airlines in newer aircraft. However, it is recognised that currently some aircraft may not be able to achieve 8%. Therefore, in line with our Design Principle A (to create Alternatives for those aircraft that cannot meet flight profiles) some routes will be at the lower climb gradient of 6%. This ensures that we make available a reasonable route structure for slower climbing aircraft that still aims to minimise their noise impact too.	A mix of design envelopes, some of which are 8% and others to provide Alternatives at 6%. (see para 6.4 for details)

	Decision	Rationale	Impact
D7	All routes within a design envelope to be designed to the same climb gradient.	Safety We have chosen to adopt one consistent climb gradient to each route within a design envelope, rather than adopt the alternative of two different climb gradients for different aircraft flying the same route. We have made this decision to ensure that aircraft within the same design envelope are not climbing at significantly different rates which is consistent with our design principle on Safety. This avoids the potential for interaction and loss of separation within a systemised operation.	The routes within design envelopes are all designed to the same gradient.
D8	WEST A (current UTAVA) and WEST B (current NUGBO) design envelopes to be treated as two separate routes.	Demand and Noise On both runway directions, the current NUGBO and UTAVA SIDs share a common track for the majority of their route to the SID termination point. This contributes to unnecessary delays on the ground and concentration in the air which has a noise impact. These routes serve different purposes and route in different directions above 7,000ft when they enter the NATS network.	By designing these routes independently this will provide an opportunity to reduce potential delays prior to departure and may reduce noise impact by separating the tracks.

	Decision	Rationale	Impact
D9	Clear criteria will be used to define options that are Viable and Unviable.	Policy CAP1616 requires a Comprehensive List of options to be developed, with a clear rationale for options that are not taken forward. The creation of these criteria provides the foundation for this rationale and early qualitative assessment of routes against the "Must have" design principles.	Routes have been classified into • Viable and Good Fit • Viable and Poor Fit • Unviable. Details are shown at para 5.11.
D10	Designs should avoid the use of Direct to Fix (DF) path terminators.	Safety Path terminators provide the aircraft flight management system with details on how to interpret and fly the route. Where possible the use of Direct to Fix DF path terminators should be avoided because of the ambiguity associated with these in some situations. The interpretation of these fixes by the aircraft Flight Management System and the effect and the effect of weather.	Track to Fix "TF" terminators remove this issue and will be used where possible.
D11	Departure routes to take account of the Gas Venting Stations (GVS) near Chelmsford and	Safety The vertical limit of these areas is 2,700ft, and both are notified hazards to aircraft.	Initial analysis suggested avoidance of these areas on Safety grounds. Further analysis has identified that the distance from STN makes the overflight of

	Decision	Rationale	Impact
	Cambridge.		either GVS highly unlikely. Routes will seek to avoid these where possible but they are not constraints to route design.
D12	Departure and Arrival routes to avoid Shoeburyness Danger Area to the south east.	Safety This complex set of danger areas lies to the south east of STN close to Southend. These are used for a variety of military activities including firing of ammunition and explosive devices and extend permanently to 13,000 ft and occasionally to 60,000ft.	The analysis concluded that the combination of range and altitude created a constraint for both departures and arrivals in a systemised operation Further details of the constraint are shown at para 5.8.
D13	04 South (LAM) design should be PANS-OPS compliant.	Safety The current conventional departure via LAM relies on ground-based navaids, and uses a tighter radius turn than that permitted for PBN departures. However this route has been flown safely since its design, and the creation of a PANS-OPS compliant PBN route results in design options that may overfly Great Dunmow. Our Safety DPs requires routes to be designed to be compliant to ICAO PANS OPS, and the 04 South has therefore been designed to align with this.	The inner area of the design envelope has been designed to the lowest radius possible to replicate the current route flown, whilst remaining PANS-OPS compliant. The eastern edge of the design envelope has been widened to create additional options that avoid overflying Great Dunmow. Further work will be conducted on this route in Stage 3 to seek alternatives that remain consistent with the Safety design principle.

	Decision	Rationale	Impact
D14	The area to the SW of STN should not be used as a 7,000ft starting point (Initial Approach Fix) for arrivals.	Safety and Policy The area to the SW of STN (in the vicinity of Brookmans Park (BPK)) contains several diverging departure routes, most notably outbounds from LCY, LTN and LHR. The placing of the dedicated arrivals structure in this area would add additional complexity by introducing descending traffic. In this respect it would create significant interactions with other airports which is against the Design Principle for Efficiency.	Arrivals routes have been constructed that take account of this as a constraint and are detailed in para 5.8.
D15	There should not be an Initial Approach Fix at 7,000ft to the most SE area of the Arrivals Design Envelope	Safety and Policy Research has highlighted the potential for interactions with traffic from other airports and the NATS network in this area. • ATS routes M197 and Q295 route across this area and provide a network join for both Luton and Heathrow departing traffic. • Departures from London City on a CLN departure route in this area. • Heathrow inbounds to LAM currently route in parallel to the south of these outbound routes and north of the Shoeburyness Danger area. A STN arrival structure in this area would result in our traffic needing to cross the paths of both	We have not designed design options to start in this area to the SE where the STN IAF may conflict with traffic to and from these other airports and the notified ATS routes.

	Decision	Rationale	Impact
		westbound descending traffic and then eastbound climbing traffic in a narrow piece of airspace. Creating interactions and conflictions in this area would not be consistent with the Safety DP nor the Policy DP in relation to the AMS strategy for systemised airspace.	
D16	The gradient for the Initial Approach phase to be between 1.5° and 3°	Safety and Policy The ICAO PANS-OPS recommendation for the optimum descent on the initial approach segment is 2.3° although the maximum allowable is 4.6°. There is no recommended minimum The CAA guidance for a CDA is 3° but recent guidance through the CAA Low Noise Arrival metric recommends the optimal as approx. 2.5°. Gradients above 3° and below 1.5° are likely to have an impact on noise. By choosing this range for arrivals, the STN arrival transitions seek to find an optimal low noise arrival that aligns with PANS-OPS and CAA recommendations in line with the Policy DP	Arrivals design options for Transitions are in line with these criteria.

	Decision	Rationale	Impact
D17	Arrivals: 2000ft will be used as the minimum Final Approach Fix (FAF) Arrivals with a joining point above 3,000ft will not be considered	Safety and Policy The optimum length of the final approach segment within PANS-OPS is 5.0nm. At STN, with a 3° final approach angle, a 2,000ft FAF altitude is at 5.04nm for runway 22 and 5.07nm for runway 04 which is close to this PANS-OPS optimum.	2,000ft has been used as the minimum FAF for all viable good fit and viable poor fit design options. No options have been created with a joining point below 2,000ft on the basis of these being sub-optimal according to PANS-OPS.
D18	Runway dependant IAFs / holds will not be pursued as a concept for arrivals.	Safety and Policy This is a concept that was explored in early concept work however there is both an airspace and a safety consideration. The main issues occurs when the runway direction changes after an arriving aircraft is airborne. Both fuel and flight planning will have been calculated to a common arrival point (IAF). If this IAF changes as a result of a change to the runway in use, this may have flight safety implications. In addition, this creates additional complexity within the LTMA network because of the complex interaction between airports in the London area. From a network safety perspective, and to the best of our understanding, the option of runway dependent holds is not being pursued at any airports in the UK.	All IAFs will be created so that they have the ability to serve both runways. This concept has been applied to the appraisal of options within the IOA.