Response Document

CAP1616 Stage 2 Develop and Assess

MAG Manchester Airport

Alignment to CAP1711 Airspace Modernisation Strategy

The CAA published its refreshed Airspace Modernisation Strategy (AMS) on 23 January 2023, replacing the former AMS dated December 2018. The refreshed AMS pulls together the ICAO Global Air Navigation Plan, the 2018 AMS and also new requirements that the CAA has identified through stakeholder engagement.

However, the MAN Stage 2 submission, including the Viability Filter within the DOR, the Design Principles Evaluation (DPE) and the Initial Options Appraisal (IOA) that assessed alignment to Design Principle Policy, were based on assessments carried out against the requirements of the version of the AMS (December 2018) in force at the time of those assessments.

MAG have assessed the refreshed 2023 AMS to understand the scope of the refreshed document, and to review whether the application of the revised requirements would result in a material change to the results of the above assessments. This exercise concluded that, whilst the 'Ends' that detail the outcome that modernisation of airspace must deliver have been reduced from six to four, the changes within the refreshed AMS:

- Would not have changed any of the results of the initial viability assessment conducted as part of the DOR.
- Would not have changed the results of the subsequent assessments in the DPE and IOA.

Given that no change would result from the application of the refreshed AMS to the MAN Stage 2 submission, it has been agreed with the CAA that it would not be practical or proportionate to require MAN to revise the Stage 2 assessments for the purpose of this resubmission.

It was therefore agreed that this MAN Stage 2 resubmission (Extraordinary Gateway March 2023) would be submitted in accordance with the requirements of the original AMS dated December 2018, and that assessment work within Step 3A and beyond would be aligned to the refreshed 2023 AMS. Therefore, unless otherwise stated, references within this [Response] document and the Stage 2 reports are to the December 2018 AMS.

Criterion 1: The change sponsor must have produced a comprehensive list of airspace change design options.

Q1. CAP1616 para 125 – The sponsor must clearly explain how they have considered DP 4 Emissions, during the filtering process, given that the wording confers an obligation and how this obligation has been considered in trade-offs against noise impacts as per the Government's altitude-based priorities.

Where a design principle **must** be met, as for design principles Safety, Policy and Capacity, this has been made clear in the wording of the design principle by the use of the word "*must*". This can be contrasted with the reference to minimising and, where possible, reducing emissions in Design Principle Emissions. As a result, while Design Principle Emissions is a design principle to be factored into the DPE, it is not one of the 'must have' design principles and is therefore intended to be considered alongside the other design principles as part of a balanced assessment, rather than to impose an obligation to be considered as part of the Viability Filter. This distinction reflects paragraph 115 of CAP1616, which acknowledges that, "*principles may contradict one another, and some may be prioritised over others*". Nonetheless, emissions were considered as part of the Viability Filter due to the reference within Design Principle Policy to the AMS, as described below.

The Viability Filter includes an evaluation against Design Principle Policy, based on alignment to the 'Ends' (i.e., the objectives) within the AMS and compliance with FASI-N. The 'Ends' detail the outcome that modernisation of airspace must deliver, and it is these criteria that were used as the basis for the assessment against Design Principle Policy as part of the Viability Filter. The assessment was not intended to identify those options that respond well to the 'Ends' of the AMS (i.e., a test of 'Pass'), but rather to identify where an option clearly failed to align to the 'Ends' within the AMS.

In relation to Environmental Performance, the 'Ends' make specific reference to reducing emissions per flight by creating more fuel-efficient flightpaths, and better managing the impact of noise. This was addressed within the Viability Filter as follows:

- **Reducing carbon emissions**: This 'End' was considered by identifying any routes that were clearly fuel inefficient because of the highly indirect nature of their track, which would create additional and unnecessary fuel burn. An example of this is the departure option "Runway 05L/R North Option C6" described at [DOR section 7.7] which has a left wraparound that would involve greater track mileage than is necessary by taking traffic south and east before turning it north.
- **Reducing noise impact**: This 'End' was considered by identifying the clear inability of a design option to provide noise benefits when compared to other options within a design envelope. An example of this is the arrival option "Runways 23L/23R – 3,000ft FAF Transitions North Option B4" described at [DOR section 34.11] which has an IAF outside the arrivals design envelope. This would result in this option being unable to provide a CDA to both runway directions, creating a sub-optimal descent profile such that the option demonstrated an inability to provide noise benefits.

As a result, both emissions and noise impacts were considered at a high level within the Viability Filter, through the lens of the "must have" Design Principle Policy and the AMS.

The potential for trade-offs between design principles Emissions, Noise N1, Noise N2 and Noise N3 is reflected in the assessment of design options against those design principles in the DPE. In addition, consistent with the Government's altitude-based priorities, the AMS identifies the potential for trade-offs, including between noise and emissions. For the purposes of the Viability Filter, the potential for trade-offs (including in relation to noise and emissions) has now been expressly acknowledged by the introduction of the Trade Off Assessment, as described in response to Q2, below.

Specifically in relation to emissions and noise, the Trade Off Assessment considered noise benefits below 4,000ft in line with the 'Altitude based priorities' in the DfT Air Navigation Guidance 2017 (ANG)

Following the introduction of the Trade Off Assessment into the Viability Filter process, a full review of all 'viable poor fit' options was undertaken, so as to ensure no options were prematurely discounted. Details of that exercise are provided in the response to Q2, below, including a table to summarise the reclassification of options as a result of the Trade Off Assessment.

The CAA's attention is drawn to relevant amendments at:

Document	Section
Design Options Report (DOR)	5.14.

Q2 CAP1616 para 125 – The sponsor must be clearer on what elements of Policy were met or not met to remove options under the viability filter. The AMS recognises that there will be trade-offs. It is difficult to see how any option can 'fully' accord with the AMS; for example, how can an option be considered 'unsafe' yet accord with 'Policy'. (Most of the Policy 'not mets' under the viability filter refer to 'greater track mileage', should this be Emissions?)

As summarised in our response to Q1, the Viability Filter was not intended to identify those options that respond well to (or "accord with") the 'Ends' of the AMS (a test of 'Pass'), but rather to identify where an option clearly failed to align to the 'Ends' within the AMS. In classifying options, where it was clear that an option would not align to one of the 'Ends' of the AMS it was classified as a "Red" and considered as a candidate for dismissal. However, it is recognised that the AMS is wide ranging and there may be a need for trade-offs, particularly with respect to noise and fuel burn.

In response to the CAA's feedback, three updates have been made:

1. To provide clarity on what elements of Policy were not met, the description of the assessment against Design Principle Policy at section 5.14.2 of the DOR now provides a clear signpost to the 'Ends' within the AMS and a narrative on the criteria used to assess each option against the 'Ends'. This also removes the ambiguity identified by CAA in relation to 'greater track mileage' by expressly linking it to the requirement in the AMS to 'reduce carbon emissions'.
   This does not represent a change in approach. Rather, the additional text serves to clarify the approach already taken.
2. The Viability Filter has been modified, introducing a two-step process into the consideration of Design Principle Policy to acknowledge the potential for trade-offs between the 'Ends' of the AMS. This change is described in further detail below and within section 5.14.2 of the DOR.
3. Additional text has been provided in the "Viable Poor Fit" table for each Design Envelope. This describes how the two-step process in respect of Design Principle Policy has been applied to each option.

The changes made are described in further detail below.

Policy Criteria

The below clarifications have been provided within section 5.14.2 of the DOR. These do not represent a change in approach. Rather, they serve to clarify the approach already taken.

- A narrative has been added against each of the 'Ends', to describe what has been taken into consideration in assessing alignment to the AMS.
- The DOR explains that the assessment in respect of Design Principle Policy covers all 'Ends' of the AMS with the exception of Safety. This is because safety is already considered in its own right as a "must have" design principle. By assessing it separately, there is a clear

focus on safety as the highest priority. A separate assessment also removes any risk of confusion for stakeholders that may be created by a "double assessment".

- For the Efficiency 'End', the DOR explains that the assessment covers the potential for an option to interact with the routes to and from adjacent airports or to misalign with the traffic flows within wider NATS network. This is because, in so far as it can be considered at this early stage, the implications for runway throughput at MAN were already captured within the Design Principle Capacity, which is also a "must have" design principle.

  This clarification and the subsequent review of the viable poor fit options resulted in some options no longer being classified as Amber for safety and being reclassified as Green, where the previous Amber classification was based on the potential for an interaction with the routes of an adjacent airport. Instead, the potential for interaction was assessed in relation to Design Principle Policy, in relation to the Efficiency 'End'. As above for the Safety 'End' of the AMS, this removes any risk of confusion for stakeholders that may be created by a "double assessment".

Two-step Viability assessment

The AMS identifies the potential for trade-offs between the 'Ends', and in response to CAA feedback we have now ensured that that this is explicitly recognised in the Viability assessment. This resulted in a full review of all 'viable poor fit' options using a two-step process under Design Principle Policy, which took account of the potential for a trade-off between assessment criteria, including between emissions and noise.

The methodology for this review is now explained within section 5.14.2 of the DOR, and the description of all viable poor fit options within the tables in section 7 to 18 for departures and 24 to 36 for arrivals has been updated to provide greater clarity.

A summary of the process is provided below:

- Step 1: Viability assessment: The option was considered against the AMS 'Ends' and, if there is clear misalignment, it is classified as a provisional 'viable poor fit' and given a Red classification.
- Step 2: Trade Off Assessment: Any options identified as 'viable poor fit' in respect of Design Principle Policy were then assessed to consider the potential for trade-offs with respect to any other 'Ends' in particular the 'End' in relation to noise and a consideration of the altitude-based priorities. If there was potential for the option to provide a material benefit against one of the other 'Ends', including in respect of noise below 4,000ft in line with the altitude-based priorities, then the provisional rating was amended to Amber in relation to Design Principle Policy. However, if there was no clear benefit then the option remained as 'viable poor fit' and marked as Red for Design Principle Policy.

If the assessment in respect of Design Principle Policy was the sole determinant of an option being 'viable poor fit' (i.e., both Safety and Capacity were Green), then an option marked Amber for Design Principle Policy was retained for further consideration within the DPE.

Adjustments to the Viable poor Fit tables.

The results tables within each design envelope have been revised to reflect the approach described above. Each table now describes which of the 'Ends' of the AMS the option is misaligned to explicitly details the result of the 'Trade Off Assessment' and sets out any impact on classification.

This review process resulted in the following changes to five options that had previously been categorised as 'viable poor fit' for Design Principle Policy. Of these, two were reclassified as 'viable and good fit' and retained for further analysis in the DPE.

Option	Previous category	New Category	Action
Departures			
05L/05R East – Option A2	Red	Amber	No change due to Safety being classified as Red.
05L/05R West – Option A2	Red	Amber	Reclassified as Viable Good Fit.
05L/05R West – Option C9	Red	Amber	No change due to Safety and Capacity being classified as Red
23L/23R North – Option C9	Red	Amber	No change due to Capacity being classified as Red
Arrivals			
05L/05R 2,500ft Transition North – Option E10	Red	Amber	Reclassified as Viable Good Fit.

For illustration, an example results table is shown below which shows the change to the 05L/05R East – Option A2 departure option identified in the table above. In this case, whilst the option was initially categorised as Red because of misalignment to the Efficiency 'End' of the AMS, the Trade Off Assessment identified a potential noise benefit which resulted in a re-classification to Amber. However, as the assessment in respect of Design Principle Safety was red, the option was not progressed to the full DPE.

Option	Safety	Policy	Capacity
A2 Track divergence 15° to the south then continue north-east.	S	P	C

Originally Option 2 this uses initial track adjustment of 15° right of the departure track, then routing directly north-east to terminate close to the current DESIG SID.

Safety: Inbound aircraft to both MAN and LPL are routed westbound in this narrow area towards the end of this option. This option would route traffic in conflict with this traffic flow. Because of this conflicts, this option was replaced with option 5 which turns traffic south at the end of the SID to avoid the conflict.

Policy: This option fails to align with the ends of the AMS with respect to:

- Efficiency: This option would interact with inbound routes to LPL airport and route against the traffic flows within the NATS network

The trade-off analysis between emissions and noise, identified the potential for a material noise benefit below 4,000ft which resulted in an amber categorisation.

The trade-off analysis against other AMS ends did not identify other material benefits.

The CAA's attention is drawn to relevant amendments at:

Document	Sections
Design Options Report (DOR) –Viability Filter	5.14
DOR Departure Options –Viable Poor Fit	7-18
DOR Arrival Options –Viable Poor Fir	25-36

Q3 CAP1616 para 125 – The sponsor must confirm that options that may have been less than 3nm (for example) from the edge of CAS, would not have performed better against other 'must DPs' as the 3nm figure is a 'should', not a 'must comply'.

We have reviewed the way that our viability assessment takes account of the CAA's Containment Policy. "Containment" was previously considered when judging whether an option was consistent with Design Principle Policy. However, following the wider review of the Viability Filter described in the above response to Q2, which resulted in the review of safety in its own right rather than within Design Principle Policy, Containment, which has clear safety implications, has now been reassigned for consideration as part of the safety assessment in relation to Design Principle Safety.

To address the above comment, we have modified the Viability Filter assessment as follows:

- Within the Viability Filter, the assessment against the Design Principle Policy now concentrates solely on the 'Ends' within the AMS including alignment to FASI-N. As detailed in the response to Q2, above, section 5.14 of the DOR has been updated to describe that process.
- We have re-evaluated our assessment of Containment. Whilst the CAA "Policy for the design of controlled airspace structures" states that routes 'should' be no closer than a minimum distance from the boundary of CAS, it recognises a safety risk by describing a minimum separation criterion of 3nm and mandating the need for a safety case if this criterion cannot be met. This safety risk is also identified in CAP493 Manual of Air Traffic Services Part 1 (MATS Pt.1) which recognises the risk of a loss of separation between aircraft operating close to the boundaries of controlled and uncontrolled airspace.
- As a result, Containment has been included within the high-level safety assessment in relation to Design Principle Safety. This is because the creation of an option that misaligns with the CAA "Policy for the design of controlled airspace structures" would create an inbuilt operational hazard which would not 'comply with industry standards and regulations' - as stipulated by Design Principle Safety.
- This was accounted for in the Viability Filter process by a reconsideration of any uncontained options. Where such an option was within a design envelope that also included fully contained options, an assessment was carried out to consider whether there were any material additional benefits to be gained from the inclusion of the uncontained option. If these existed, the uncontained option would be re-classified as Amber in line with the rationale applied elsewhere in the Viability analysis. If not, it remained as 'viable poor fit'. However, the assessment did not identify any options that were reclassified in this respect.

The CAA's attention is drawn to relevant amendments at:

Document	Section
Design Options Report (DOR) –Viability Filter	5.14

Criterion 3: The change sponsor must have produced a design principle evaluation that the CAA has accepted showing how its design options have responded to the design principles.

Q4 CAP1616 para 128 – The sponsor must provide quantified data for the do-nothing baseline and evaluate it in the DPE or provide a clearer analysis as to how it aligns to the DPs, so that stakeholders can understand how the options have responded against the baseline; (key example is DP Emissions and the distances used, there appear to be differences in the IOA Full Analysis Tables).

The quantified data for the 'do nothing' scenarios has now been provided at sections 4.2 and 4.3 of the DPE.

As detailed at section 3.2 of the DPE, the 'do nothing' scenarios were used as a comparator to provide a comparison that allows meaningful evaluation of design options against the design principles that refer to a degree of change (specifically design principles Emissions, Noise N1 and Noise N3).

For example, (from section 4.2 of the DPE) the East departures design envelope was compared against SONEX 'do nothing' scenarios for design principles Emissions, Noise N1 and Noise N3, as shown below.

Runway	Criteria	SONEX 'Do Nothing' Scenario
23L	Emissions	Estimated track length: 45km (24nm)
23L	Noise 1, 4,000ft	Estimate of total population overflown: 1,900
23L	Noise 1, 7,000ft	Estimate of total population overflown: 121,000
23L	Noise 3, 4,000ft	Estimate of total noise sensitive areas overflown: 3
23L	Noise 3, 7,000ft	Estimate of total noise sensitive areas overflown: 193
23R	Emissions	Estimated track length: 48km (26nm)
23R	Noise 1, 4,000ft	Estimate of total population overflown: 7,800
23R	Noise 1, 7,000ft	Estimate of total population overflown: 207,600
23R	Noise 3, 4,000ft	Estimate of total noise sensitive areas overflown: 11
23R	Noise 3, 7,000ft	Estimate of total noise sensitive areas overflown: 355

In relation to the alignment of the 'do nothing' scenarios to the design principles, the CAA's attention is drawn to updated section 4.4.1 of the DOR for departures, which explains:

"*Because the 'do nothing' departures scenario does not align with the 'must have' Design Principle Policy it is not a viable option and will not be carried forward as an option for assessment within the DPE. Indeed, the 'do nothing' scenario may very well represent a worsening in comparison with the current position.*"

Similarly, for arrivals, section 4.4.2 of the DOR (which is unchanged from the original submission) explains:

"Because the 'do nothing' arrivals scenario does not provide procedures in accordance with the CAA AMS or the PBN-IR it does not align with the 'must have' Design Principle Policy and will not be carried forward as an option for evaluation within the DPE. Again, there may very well be deterioration in comparison with the current operations."

This position is also signposted in the DPE in section 3.2:

"The 'do nothing' scenario is then used as the baseline for comparison in the Options Appraisals, including the IOA. The 'do minimum' option(s) describe the minimum changes required to address the issues identified in the SoN and are listed as design options for assessment in this DPE. As the 'do nothing' scenario fails to comply with the requirements of the AMS and does not align with the 'must have' design principles, it was not assessed as an option in this DPE.

However, the nature of the design principles, Emissions, Noise N1 and Noise N3 means that a baseline is required to inform the comparative nature of the evaluation. As such, for the evaluation of design options against these design principles, 'do nothing' has been used for comparative purposes. The way in which the 'do nothing' has been considered as part of the evaluation against each of these design principles is detailed in sections 4.2, 4.3, 4.7, 4.8 and 4.10. A description of and rationale for the 'do nothing' scenario and the 'do minimum' options for both arrivals and departures is provided in section 4.4 of the DOR and is not repeated here."

This reflects the requirement at para 128 of CAP1616 to evaluate the design options against the design principles. As the 'do nothing' scenarios did not pass the Viability Filter (as detailed at sections 4.4.1 and 4.4.2 of the DOR), they do not form viable options and are not part of the "*comprehensive list of options*" referred to at para 125 of CAP1616. As a result, they were not progressed for full evaluation as part of the DPE. Instead, they were retained for comparative purposes only, with 'do minimum' scenarios developed for evaluation, as envisaged by para E21 of CAP1616.

All data, including that for the 'do nothing' scenarios has also been quality assured for use in DPE v2, with updated evaluation provided in sections 5 to 29. This data and associated evaluation supersedes DPE v1 and the previously published outputs. Alignment with the IOA has also been quality assured.

The CAA's attention is drawn to relevant amendments at:

Document	Sections
Design Options Report (DOR) – 'Do Nothing' Departures Scenario	4.4.1
Design Principle Evaluation (DPE) – Acceptance/Rejection Criteria	4.2 and 4.3
Design Principle Evaluation (DPE) – Standard Instrument Departures - Evaluation	5 to 17
Design Principle Evaluation (DPE) – Standard Instrument Departures Evaluation Summary	18
Design Principle Evaluation (DPE) – Transitions - Evaluation	20 to 28

Q5 CAP1616 para 128 – The sponsor must explain how options that have been through 2 Safety filters and considered 'viable good fit' then get 'not mets' or 'partials' for must have DPs (Safety) in the DPE; (for example, DPE p428 RWY 23 West Options 3B, 4, 5A, 5B, 6 all get 'not mets' for Safety and green for Policy).

Stage 2 of CAP1616 requires sponsors to produce a comprehensive list of options that respond to the design principles, which for MAN included the 'must have' design principles of Safety, Policy and Capacity.

Initially, the list of options took account of general constraints and considerations only. This process is described in section 5.8 of the DOR and did not include any safety analysis of the constraints, including those created by LPL operations.

The options were then progressed to a Viability Filter assessment, as described at section 5.14 of the DOR. As detailed in response to Q1, above, the Viability Filter assessment was not intended to identify those options that responded well to the 'must have' design principles, but rather to identify where an option clearly failed to align to the 'must have' design principles. In the case of the Design Principle Safety, this was considered in two steps, as detailed in Figure 17 of the DOR. Further, as described in section 5.14.2 of the DOR, where there was any doubt or further analysis was required to evaluate alignment, options were carried forward for further assessment as part of the DPE.

As a result, it is possible that an option may initially be assessed as green ('viable and good fit') against the Design Principle Safety within the Viability Filter (indicating it is not clearly misaligned) but that the same option is subsequently assigned a classification of either amber ('partial') or red ('not met') in the subsequent DPE and IOA.

With regard to the options for Runway 23W identified in the above question, these were created within Stage 2A to a climb gradient of 6%. Whilst they received no specific comments from stakeholders on their viability, the potential for interactions between these MAN Runway 23W departure options and LPL runway 27 arrivals from the north was highlighted at a bilateral meeting with LPL. At that stage the interaction was not viewed as unsafe because the options were merely seeking to formalise current tactical vectoring practice, although the bilateral findings resulted in the creation of additional options 7 to 12 (at a steeper climb gradient) in order to mitigate the interaction between arrivals and departures, pending more detailed analysis. Subsequent analysis was carried out as part of ongoing bilateral meetings with Liverpool John Lennon Airport (LPL) identified a potential safety concern with the original options, based on LPL continuing with the arrivals options in their current position. This resulted in the revised 'not met' classifications for Design Principle Safety within the DPE and the IOA for options 2, 3B, 4, 5A, 5B and 6.

However, at the time of the DPE assessment, the LPL ACP was paused, meaning that LPL were unable to create any additional design options to facilitate an assessment of cumulative impacts that would allow trade off compromises to be made by MAN. Therefore, as described at section 18.1 of the DOR, it was considered appropriate that options 2, 3B, 4, 5A, 5B and 6 were not

discounted within the Viability Filter, and all options remained in the MAN comprehensive list, pending the re-commencement of the LPL ACP in Jan 2023. All of these options are therefore contained within the DOR and evaluated in the DPE.

With regard to the classification of these options against Design Principle Policy, Q2 clarifies the approach taken to the consideration of design principles Safety and Policy within the Viability Filter. This approach was applied consistently across the DPE, as described at section 4.4, and the IOA, as described as part of the Safety Assessment carried out in accordance with CAP760 and reported at section 4 of the IOA. Therefore, in respect of the Design Principle Policy, the assessment in the DPE and IOA covers all 'Ends' of the AMS with the exception of safety. This is because safety is already considered in its own right as a "must have" design principle and assessing it separately removes any risk of confusion for stakeholders that may be created by a "double assessment". For this reason, when assessed against Design Principle Policy in the original submission, the original options (2, 3B, 4, 5A, 5B and 6) were marked as green as they aligned to all other 'Ends'.

No amendments have been made to the DPE to address the CAA's above request for further explanation. However, further information as to the evaluation carried out can be found at section 17 of the DPE.

The CAA's attention is drawn to relevant amendments at:

Document	Section
Design Options Report (DOR) –Viability Filter	5.14

Q6 CAP1616 para 128 – The sponsor must also explain how these options then align with DP Policy, which refers to according with the AMS; the first 'End' of the AMS is to maintain a high standard of safety.

The Design Principle Policy states that the airspace change must accord with the Civil Aviation Authority's Airspace Modernisation Strategy (AMS). This document sets out the ''Ends'' that airspace modernisation must deliver. Safety is one the 'Ends'.

In addition to the Design Principle Policy, MAN also have a stand-alone Design Principle Safety. This is one of three 'must have' design principles.

As described in response to Q1, above, rather than considering safety twice (implicitly in the Policy Design Principle and explicitly in the Design Principle Safety) safety was assessed in its own right as one of the 'must have' design principles. This ensured there was a clear focus on safety as the highest priority and that the risk of a "double assessment", which may have caused confusion for stakeholders, was removed.

This approach was initially applied within the Viability Filter (as reported in the DOR) and, to ensure consistency, was then applied throughout the subsequent analysis within the DPE, as described at section 4.4, and the IOA, as described as part of the Safety Assessment carried out in accordance with CAP760 and reported at section 4 of the IOA.

As a result, Safety was not considered within the Design Principle Policy assessment, but as part of the Design Principle Safety assessment.

No changes have been made to the DPE in response to the CAA's above comment. However, the CAA's attention is drawn to relevant amendments at:

Document	Section
DOR - Viability Filter	5.14. Design Principle Policy bullet a) Safety

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Q7 CAP1616 para 128 – The sponsor must produce a DPE summary table(s) that will allow stakeholders to understand how the options have responded against one another and why options have been rejected, without recourse to a list of statements that are in a different order and do not offer any explanation, for example the 'SME judgement' applied (DPE Appendix 1-2).

The DPE has been updated to include summary tables that will allow stakeholders to understand how the options have responded against one another within a departures design envelope or transitions FAF altitude group. These tables include the categorisation of each design option as one of the following, as described in further detail at updated sections 4.2 and 4.3 of the DPE:

- Best
- Do Minimum (Replication)
- 4,000ft Beneficial
- Add. Qual.
- Rejected
- Best but incomplete IAF (only applies to transitions options)
- 4,000ft beneficial but incomplete IAF (only applies to transitions options)

This is designed to support stakeholders' understanding of how the updated acceptance/rejection criteria detailed in sections 4.2 and 4.3 of the DPE have been applied to the design options.

The CAA's attention is drawn to relevant amendments at:

Document	Sections
DPE – Acceptance/Rejection Criteria	4.2 and 4.3
DPE – Summary Tables	6.4, 7.7, 8.9, 9.6, 10.11, 11.9, 12.10, 13.8, 14.7, 15.14, 15.15, 16.18, 16.19, 16.20, 17.13, 20.7, 21.8, 22.4, 23.6, 24.6, 25.7, 26.10, 27.7 and 28.7.

Q8 CAP1616 para 128 – The sponsor must also provide an explanation of what level assessment has been carried out when evaluating DP Safety – if the route is not PANS-OPS compliant then should it be 'partially' safe.

Paragraph 5.14 of the Design Options Report (DOR) outlines the approach taken to PANS-OPS compliance as part of the Viability Filter. In summary, any design options that did not fully comply with the requirements of PANS-OPS 8168 or did not have an approved safety justification for non-compliance were categorised as 'unviable'. These 'unviable' options were not designed, subjected to further analysis or progressed to the DPE or IOA.

While it is possible that some existing conventional SIDs may not be fully PANS-OPS compliant but are in operational use because of a supporting safety case (such as at London Stansted[1]), there are no conventional SIDs at MAN that are non-compliant with PANS-OPS. There are therefore no replications that require to be categorised as Partial (Amber) for Design Principle Safety based on evidence of current flyability with a supporting safety case. For this reason, the Partial (Amber) evaluation criteria for Design Principle Safety at section 4.4 of the DPE does not contain a qualifying statement to refer to a supporting safety case.

In summary, all MAN options have been created to comply with PANS-OPS, and no options are classified as partial as a result of non-compliance to these standards with a supporting safety case. Those options classified as partial within the DPE refer to those where additional safety mitigations or processes would be required in line with the criteria at section 4.4 of the DPE.

The RAG criteria for Safety in section 4.4 of the DPE, for Design Principle Policy has been updated to reflect this.

Design Principle S	Safety Our routes must be safe and must comply with industry standards and regulations.		
	Not met When assessed in isolation, this option is not considered be safe, designable or to comply with industry standards and regulations.	**Partial** When assessed in isolation, this option may be considered as safe, designable and meet with industry standards and regulations; however, additional safety mitigations or processes would be required.	**Met** When assessed in isolation, this option is considered to be safe, designable and meet with industry standards and regulations, including PANS-OPS.

Note 1: At London Stansted some existing SIDs are not fully PANS-OPS compliant but are in operational use because of a supporting safety case. In this case, the associated replication to PBN standards would also be non-compliant, but because the conventional route is approved as safe, the replicated PBN option was also considered as safe, subject to an approved safety case on the new procedure. However, at Stage 2 of the CAP1616 process this could not be wholly proven, and therefore the alignment against Design Principle Safety at Stansted contained a qualifying statement to this effect and categorised these options as Amber within the Viability Filter to be progressed to the DPE and IOA for further consideration. This was reflected in the DPE evaluation criteria for Design Principle Safety which contained the same qualifying statement and described a Partial alignment (Amber) as a route that was "not compliant with PANS-OPS but where there was sufficient evidence to demonstrate that it can be flown safely". At Manchester,

there are no conventional SIDs that are non-compliant to PANS-OPS requirement, and therefore the qualifying statement is not required.

The CAA's attention is drawn to relevant amendments at:

Document	Section
DPE	4.4

Q9 CAP1616 para 128 – The sponsor needs to explain how every option accords with the AMS, when other DPs that sit under the AMS (safety, emissions, noise) do not meet the criteria stated.

Safety

As detailed in our response to Q6, rather than considering safety twice (implicitly in the Design Principle Policy and explicitly in the Design Principle Safety), safety was assessed in its own right as one of the 'must have' design principles – Design Principle Safety. As a result, safety was not considered within the Design Principle Policy assessment, but as part of the Design Principle Safety assessment.

As summarised in our response to Q1, the DOR Viability Filter has been modified, introducing a two-step process into the consideration of Design Principle Policy to acknowledge the potential for trade-offs between the 'Ends' of the AMS. This change is described in further detail in the description below and also within section 5.14.2 of the DOR.

Emissions and noise

A similar approach has been applied in the DPE to reflect the 'Ends' of the AMS in the design principle criteria for Design Principle Policy, with section 4.5 having been updated to account for the evaluations of Design Principle Noise N1 and Design Principle Emissions. The following updated RAG criteria for Design Principle Policy is detailed at section 4.5 of the DPE.
Not met: *When assessed in isolation, the option does not meet the ends of the AMS.*

For the purpose of the DPE, an option will not meet the environmental ends of the AMS if it is expected to increase the population affected by noise both between 0ft and 4,000ft and 0ft and 7,000ft, as well as having a longer track length (and therefore assumed greater emissions) than the relevant 'do nothing' scenario.

Increase is defined as being greater than 110% of the 'do nothing' value for the respective metric.

Partial: *Assessed in isolation, the option is considered likely to be consistent with some of the ends of the AMS.*

For the purpose of the DPE, an option will partially meet the environmental ends of the AMS if it is expected to reduce or limit the impact of no more than two of the following metrics: the population affected by noise between 0ft and 4,000ft; the population affected by noise between 0ft and 7,000ft; track length (and therefore assumed emissions) compared to the relevant 'do nothing' scenario.

Limit is defined as being within plus or minus 10% of the 'do nothing' value for the respective metric.
Reduce is defined as being less than 90% of the 'do nothing' value for the respective metric.

Met: *Assessed in isolation, this options accords with the ends of the AMS.*

For the purpose of the DPE, an option will meet the environmental ends of the AMS if it is expected to reduce or limit the population affected by noise both between 0ft and 4,000ft and 0ft and 7,000ft, as well as reducing the track length (and therefore assumed lesser emissions) than the relevant 'do nothing' scenario.

Limit is defined as being within plus or minus 10% of the 'do nothing' value for the respective metric.
Reduce is defined as being less than 90% of the 'do nothing' value for the respective metric.

This evaluation resulted in Runways 05L/05R South Option 7A and Runways 05L/05R South Option 7B not meeting Design Principle Policy as they were expected to increase the population affected by noise both between 0ft and 4,000ft and 0ft and 7,000ft, as well as having a longer track length, therefore assumed greater emissions, than the relevant 'do nothing' scenario. These options were previously accepted as additionally qualified.

The full evaluation of the design options against the design principles are located in the summary tables in the DPE in sections 6.4, 7.7, 8.9, 9.6, 10.11, 11.9, 12.10, 13.8, 14.7, 15.14, 15.15, 16.18, 16.19, 16.20, 17.13, 20.7, 21.8, 22.4, 23.6, 24.6, 25.7, 26.10, 27.7 and 28.7. In addition, the Summary Document Appendix A - Design Options Evolution details the full evolution of each of the design options through Stage 2.

The list of options carried forward to the IOA for further analysis are listed in the response to Q10 below.

The CAA's attention is drawn to relevant amendments at:

Document	Section
DPE	4.5

Q10 CAP1616 para 128, para B29, para E19 – The sponsor must explain and evidence that the Government's altitude-based priorities have been appropriately considered in the discounting of options in the viability filter and the DPE, i.e., an option that might have performed better in terms of noise has not been discounted over preference for another that performs better in reducing emissions.

As detailed in the response to Q2, above, the AMS identifies the potential for trade-offs between the 'Ends', and this is now explicitly recognised in the incorporation of a two-step process (trade off assessment) under Design Principle Policy as part of the Viability Filter in the DOR. This takes account of the potential for a trade-off between assessment criteria to avoid the premature discounting of options. Within this trade off assessment, any options identified as 'viable poor fit' in respect of Design Principle Policy were then assessed to consider the potential for trade-offs

with respect to any other 'Ends' including noise below 4,000ft and a consideration of the altitude-based priorities.

Within the DPE, in accordance with the DfT's Air Navigation Guidance 2017 (ANG), altitude-based priorities, to ensure options which are evaluated as potentially limiting the number of people overflown below 4,000ft are not prematurely discounted at the DPE Stage, the following has been added to the Acceptance/Rejection criteria listed at sections 4.2 and 4.3 of the DPE.

Updated Acceptance/Rejection criteria for Departures:

Design options not identified as 'best performing', equal to the 'best performing' or 'do minimum' were reconsidered to establish whether the population overflown up to 4,000ft was less than that of an option already accepted. Any identified options were subsequently accepted. In the summary tables, this is denoted as '4,000ft beneficial'.

A hypothetical example for Departures is shown in section 4.2 of the DPE.

Updated Acceptance/Rejection criteria for Arrivals:

Design options not identified as 'best performing', equal to the 'best performing' or 'do minimum' were reconsidered to establish whether the population overflown up to 4,000ft was less than that of an option already accepted. Any identified options were subsequently accepted. In the summary tables, this is denoted as '4,000ft beneficial'.

A hypothetical example for Arrivals is shown in section 4.3 of the DPE.

This updated evaluation process resulted in 14 departure options and 11 transitions options being considered to progress to the IOA for further analysis. The full evaluation of the design options against the design principles are located in the summary tables in the DPE in sections 6.4, 7.7, 8.9, 9.6, 10.11, 11.9, 12.10, 13.8, 14.7, 15.14, 15.15, 16.18, 16.19, 16.20, 17.13, 20.7, 21.8, 22.4, 23.6, 24.6, 25.7, 26.10, 27.7 and 28.7.

Departures:

RW 23R East Option 1C (newly accepted as 4,000ft beneficial)

RW 23R East Option 4A (previously accepted as 'best')

RW 23L East Option 8B (newly accepted as 4,000ft beneficial)

RW 23R East Option 6A (newly accepted as 4,000ft beneficial)

RW 23R East Option 6B (previously accepted as 'Add. Qual.')

RW 23R East Option 8A (newly accepted as 4,000ft beneficial)

RW 23R East Option 8B (newly accepted as 4,000ft beneficial)

RW 23R East Option 8C (newly accepted as 4,000ft beneficial)

RW 23L North Option 6A (previously accepted as 'Add. Qual.')

RW 23L South Option 7B (newly accepted as 4,000ft beneficial)

RW 23R South Option 5C (newly accepted as 4,000ft beneficial)

RW 23R South Option 7B (newly accepted as 4,000ft beneficial)

RW 05R South Option 6B (newly accepted as 4,000ft beneficial)

RW 05L West Option 4B (newly accepted as 4,000ft beneficial)

Transitions:

Transition RW 23R North Option 8A 3,500ft FAF (previously accepted as 'Add. Qual.')

Transition RW 05R North Option 10B 2,500ft FAF (newly accepted as 4,000ft beneficial)

Transition RW 05R North Option 1A 3,000ft FAF (newly accepted as 4,000ft beneficial)

Transition RW 05R North Option 2A 3,000ft FAF (newly accepted as 4,000ft beneficial)

Transition RW 05R North Option 6A 3,000ft FAF (subsequently rejected due to incomplete IAF)

Transition RW 05R North Option 7A 3,000ft FAF (subsequently rejected due to incomplete IAF)

Transition RW 05R North Option 7B 2,500ft FAF (subsequently rejected due to incomplete IAF)

Transition RW 05R North Option 8A 3,000ft FAF (previously accepted as 'Add. Qual.')

Transition RW 05R North Option 8B 2,500ft FAF (newly accepted as 4,000ft beneficial)

Transition RW 05R North Option 9A 3,000ft FAF (previously accepted as Add. Qual.)

Transition RW 05R North Option 9B 2,500ft FAF (newly accepted as 4,000ft beneficial)

The CAA's attention is drawn to relevant amendments at:

Document	Sections
DPE – Acceptance/Rejection Criteria	4.2 and 4.3,
DPE – Summary Tables	6.4, 7.7, 8.9, 9.6, 10.11, 11.9, 12.10, 13.8, 14.7, 15.14, 15.15, 16.18, 16.19, 16.20, 17.13, 20.7, 21.8, 22.4, 23.6, 24.6, 25.7, 26.10, 27.7 and 28.7.

Criterion 4: The change sponsor must have produced an Initial Options Appraisal (phase I).

Q11 CAP1616 para B27 – The sponsor must provide supporting evidence for the rationale that the implementation of CAP1781 will result in no changes in aircraft behaviour compared to today and therefore is appropriate to be considered as the do-nothing baseline.

Paragraph B27 of CAP1616 requires a baseline for all environmental assessments. Paragraph B27 states that this, "will be a 'do nothing' scenario and will largely reflect the current-day scenario, although taking due consideration of known or anticipated factors that might affect that baseline". This is reflected at paragraph E22, which states, "the baseline must be considered in relation to its context, which may be changing" before giving the example of, "planned changes that have not yet been implemented."

The implementation of CAP1781 process is one of the factors that paragraphs B27 and E22 require to be taken into account. Further, it is considered by MAN that the implementation of CAP1781 would allow current operations to continue with no material changes to aircraft behaviours.

This assumption within the DOR, DPE and IOA (that the implementation of CAP1781 will result in no changes in aircraft behaviour) is based upon:

- CAP1781 Page 6, which states that "RNAV Substitution is intended to maintain existing tracks over the ground for an agreed period, during which the affected airspace is being redeveloped". Furthermore, the process makes it clear that the CAA approval to use RNAV substitution is based on a demonstration that the aircraft tracks over the ground will be unchanged.
- To provide assurance that the implementation of CAP1781 has not led to changes in aircraft behaviour, the CAA has placed a requirement on sponsors to undertake pre and post monitoring of track keeping (CAP1781 p23 refers). This includes the use of existing ground tracks from which to monitor performance and following decommissioning of the navaid these will be used as the baseline from which to monitor post implementation aircraft performance.
- To further ensure track keeping doesn't change, the FMS coding providers have agreed to maintain their coding in accordance with a Data Quality Requirement (DQR) which ensures any proposed coding changes will be agreed with the sponsor and the CAA. (CAP1781 p24 refers).
- At the conclusion of the process, and on the basis of the correct application of CAP1781, the CAA has classified any change under this procedure as a Level 2C. This is typically a change which reflects, the current use of the airspace "and which does not alter traffic patterns below 7,000ft (above mean sea level)" (CAP1781 p23 refers).

Given the intention to rationalise DVORs across the UK, MAN intend to use the CAP1781 process to provide a temporary solution using RNAV substitution, pending the full implementation of airspace change under CAP1616. Before commencing this process, we conducted an Airline Fleet Equipage survey which is detailed at Section 5.6 of the DOR. This

confirmed that all aircraft operating at MAN are already capable of flying RNAV1 procedures which is the baseline technical requirement for flying RNAV substitution outlined in CAP1926 (General Requirements and Guidance Material for the use of RNAV Substitution).

On this basis and given that CAA approval under CAP1781 is conditional upon there being no change in aircraft behaviour requirements, we are confident in our assumption that this is an appropriate do-nothing baseline. To ensure this is the case, MAN will follow the CAP1781 process as outlined (including the pre and post implementation monitoring of track keeping) to assure the CAA and stakeholders that this assumption is correct. This will include notifying airlines of the intention to apply RNAV substitution in order for them to ensure that all requirements of CAP1926 that apply to airlines are implemented.

Additional text has been added to the DOR to clarify this position:

Document	Section
DOR	4.4.1

Q12 CAP1616 para 128, para B29, para E12 – The sponsor must confirm and evidence that the discounting of options using their overflight methodology is consistent with the altitude-based priority of reducing the total adverse effects on people below 4,000ft, given that total adverse impacts are measured using LAeq and TAG and therefore include the frequency of flights, while the overflight metric does not reflect any noise impacts.

The CAP1616 process ultimately requires that noise impacts are measured using LAeq and the Government's Transport Analysis Guidance (TAG), as part of the Full Options Appraisal (FOA) at Step 3A. TAG outputs and LAeq contours are described by CAP1616 as primary noise metrics, for determining total significant adverse impacts and are used to inform stakeholder consultation. These metrics take account of both the design options being assessed and the number of flights they support. The production of LAeq contours is the result of a complex modelling process, that will take place as part of the FOA. CAP1616 recognises that the options appraisal process evolves from the 'Initial' appraisal at Step 2B to a more detailed evidence base being built through further appraisals at Step 3A and 4A, with para 146 stating"…less detail will be required for the Initial appraisal".

The 'overflight' assessment described in the Stage 2 submission documents, including the Initial Options Appraisal (IOA), uses the methodology outlined in CAP1498 "Definition of Overflight" as a mechanism to consider how each design option has responded to the design principles, in terms of populations overflown and as a proxy for noise effects below 4,000ft. This is consistent with the aims of CAP1498 detailed at para 1.5 of that report, which states that the aim of the methodology is to "define an overflight metric which may be used to quantitatively compare different airspace options". The approach is also consistent with the emerging methodology under development by ACOG for the 'Cumulative Assessment Framework' (CAF). As such, we consider that that we have applied "overflight' assessment appropriately and that it is a reasonable approach to inform this stage of the process, providing the "indicator of the likely noise impacts" required by para E12 of CAP1616 in respect of the IOA.

The limitations of overflight assessment are described in CAP1498, which recognises that it does not set out to directly assess noise impacts. Instead, it provides a means to quantify the number of people, dwellings and sensitive areas overflown. This has been used by MAN at Step 2B to present the possible effect of proposals on local communities that are exposed to noise from aircraft up to 7,000ft.

While it is acknowledged that the overflight assessment does not consider the frequency of flights, this does not present an issue for the purpose of providing an indicator of likely noise impacts, for the reasons outlined below:

- At this stage, design options were assessed as peer groups, that is within groups of design options (design envelopes) that would perform the same function if they were ultimately included in an operating network.
- Design options within the same design envelope were subsequently accepted or rejected based on the appraisal requirements as described in section 2 of the IOA relative to the 'do nothing' baseline for that design envelope and, indirectly, to the other options within the relevant design envelope as described in section 7 of the IOA.
- The forecast number of flights has deliberately not been considered as part of the overflight assessment at this stage. Instead, the size of the population likely to be overflown has been estimated, both to a height of 4,000ft and to 7,000ft (reflecting the altitude-based priorities within the ANG 2017), irrespective of the number of times this may be predicted to happen in any given period. This is because, once systemised (at Stage 3), all design options within a given peer group (or design envelope) will fulfil the same role within that system, servicing identical traffic types and volumes. This means that the frequency of flights would not be a distinguishing factor between design options within a design envelope at stage 2. As a result, the consideration of the frequency of flights would not have any bearing on the outcome of the analysis, removing any need to consider the number of flights at this stage.

Therefore, we consider our approach to be consistent with the altitude-based priority of reducing the total adverse effects on people below 4,000ft and, due to the similarities in predicted assessment results described above, do not consider the use of overflight assessment at Step 2B to have resulted in any options being prematurely discounted. As envisaged by CAP1616, further detailed noise modelling work, with reference to LAeq and TAG, will be carried out at Stage 3 to evidence and support this. At this stage we will agree network route allocations with NERL to ensure all traffic within the forecast is allocated to the correct network traffic flow and UK airspace exit points. This will ensure that environmental modelling that informs the Full Options Appraisal (FOA) allocates accurate forecast traffic volumes for each route.

The required introduction of PBN and the greater accuracy that it delivers is highly likely to lead to a concentration of flights on any single flight path, keeping to a minimum the number of people overflown but at the same time potentially intensifying the impact experienced by those people. In identifying the best performing options within each peer group (or 'corridor') now and subsequently combining those options into operational systems, at Step 3A we will explore how different combinations of design options might be used to provide noise respite and relief (subject to Full Options Appraisal at Step 3A).

The CAA's attention is drawn to relevant text and amendments:

Document	Section

IOA	6.3

Q13 CAP1616 13 para B11, para E11 – The sponsor must explain the rationale used while considering the modal track and radar vectoring areas in the overflight analysis for the baseline. As the route options are assumed in isolation without such radar vectored areas, it is unclear how an appropriate comparison can be made in the IOA, and overflown numbers be used as a metric upon which options can be discounted. As locations overflown are counted only once, this would mean impacts are now fewer as compared to the baseline in terms of number of people overflown, however that much more concentrated.

Under current operations at MAN, management of the airspace below 7,000ft relies heavily on ATC tactical vectoring with little systemisation employed. This applies to both departures and arrivals and the effect of this is described in section 2 of the DOR.

Therefore, in carrying out the departures overflight analysis for the baseline, MAN has chosen to include a defined polygon area which takes account of this practice and incorporates flights which have been taken off the SID by ATC and tactically vectored.

The same approach has been applied to the baseline assessment for arrivals, and as described in section 3.3.2 of the IOA, overflight analysis has been conducted based on the number of people that may be overflown within the existing radar vectoring areas.

To achieve this output, modal tracks were established within the radar vectoring areas from each direction for each runway configuration. This allows for consistent assessment within the IOA, when comparing the proposed arrival/transition design options to the 'do nothing' scenario. In doing this, the aim is to show complete transparency in using the data relating to tracks actually flown by aircraft today as a comparator.

Consistent with the AMS and the Design Principle Technology the introduction of PBN routes under this airspace change will accommodate the principle of systemisation (reduced ATC intervention). For departures, this is anticipated to result in a significant reduction in tactical vectoring by ATC with an increased number of aircraft remaining on their SIDs until joining the NATS upper network airspace. For arrivals, a reduction in vectoring is expected on the initial transition below 7,000ft, but to ensure safe separation between arriving aircraft is maintained, and runway capacity is used efficiently, some vectoring will be required prior to aircraft joining final approach.

In the IOA, we consider that the significant reduction or removal of tactical vectoring, particularly for departures, means that the area of the overflight cone, (about the modal average path), is sufficient to capture the extent of the population likely to be overflown for the purpose of the overflight analysis. This removes the need for additional radar vectoring areas to be considered at this stage. However, until departures and arrivals have been developed into systems that are safe, maintain the required separation from the routes at MAN and adjacent airports, and which link into the NATS network, it is not possible to predict the scale of this vectoring or where it may take place and consequences for the number of people overflown. Work to develop these will take

place in Step 3A as the shortlisted design options, defined in section 7 of the IOA, are combined into operating networks.

The required introduction of PBN inevitably brings with it a concentration of flight paths, keeping to a minimum the number of people overflown but at the same time potentially intensifying the impact experienced by those people. In identifying the best performing options within each corridor now and subsequently combining those options into operational systems, where we will explore how different combinations of design options might be used to provide noise respite and relief (subject to Full Options Appraisal at Step 3A). The fuller picture necessary at Step 3A will clarify impacts on ground level receptors from the options under consideration.

The CAA's attention is drawn to relevant text and amendments:

Document	Sections
DOR	1.3 and 4.3 g
DPE	4.8
IOA	3.3.1, 3.3.2, 3.4.2, 7.1, 7.2, 7.3, 7.4 and 7.5

Q14 CAP1616 para B11, E11 – The sponsor must explain why overflight of planned property developments has been considered in the DPE but not in the IOA.

In the IOA, the 'Noise impact on health and quality of life' has been reassessed to account for planned property developments (rounded to the nearest 50). This data was collated by CBRE on five-year housing plans. See "Future Housing Sites" in the Stage 2 Summary Document V2 Glossary for more information. As such, the IOA has been resubmitted using data and a methodology which aligns with that in the DPE.

Consistent with the DPE, the below methodology was used to estimate the future population:

- Divide the current population identified by the number of existing households; this gives an average population per household for each design option.
- Multiply the number of proposed dwellings by the average population per household for each design option.
- The sum of the existing population and the future population provides the estimate for the total number of people overflown.

The CAA's attention is drawn to relevant text and amendments:

Document	Section
IOA	Section 2.5.1

Q15 CAP1616 para B11, para E11 – The sponsor must also explain how the modal track and associated vector areas relate to the mean track used in CAP2091 minimum standards for noise modelling given that overflight has been used as a proxy for LAeq and therefore any overflight modelling assumptions should be consistent with those required for noise as per the required CAP2091 minimum noise modelling category.

As detailed in the response to Q12, the 'overflight' assessment described in the Stage 2 submission documents, including the IOA, uses the methodology outlined in CAP1498 Definition of Overflight, which states that the aim of the methodology is to "define an overflight metric which may be used to quantitatively compare different airspace options".

CAP1498 recognises that an aircraft does not have to pass directly overhead, to be considered an overflight. Instead, overflight should be defined to include aircraft that pass over and to the side of an observer (see section 4.8 of the DPE). The geometry of this definition dictates that, the higher the aircraft, the broader the overflight footprint. It therefore follows that a shallower climb or descent profile gradient will result in a longer, thinner footprint than a steeper climb or descent profile gradient. A consequence of this can be that, despite there being little difference between the lateral tracks of design options, the population overflown may, in some instances, differ markedly.

To estimate the size of the population affected by current operations, radar track-keeping data (across the 92-day summer period 16th June to 15th September inclusive) has been used to produce track density analyses for each of the current arrivals patterns and SIDs. These have been used to create a series of 'modal average paths' – a single line that delineates those locations on the ground that have experienced the greatest number of overflights for each of the current arrival patterns and SIDs. The modal average paths depict the line over the ground, most commonly followed by aircraft flying a particular route and as such we are confident this is an appropriate basis for assessment.

Each modal average path has been assessed against the CAP1498 overflight definition both up to a height of:

- 4,000ft, reflecting the point at which an aircraft flying the route is likely to result in noise exposure above the LOAELs, and
- 7,000ft, the height up to which MAN are responsible for the route design.

Further, to ensure the impact of tactical vectoring of aircraft away from the SID has been captured, the extent of the actual spread of tracks, about the modal average path (to a height of 7,000ft) has been mapped, again using radar track-keeping data. This has been used to estimate the area and affected population beneath those tracks. This is known as the 'do nothing' scenario, used for comparative purposes in the DPE and the IOA.

Whilst the 'do nothing' current day scenario has been assessed and included as a baseline comparator, 'do nothing' is not in itself a viable option. Design options within the same design envelope were subsequently accepted or rejected based upon their impact relative to the 'do

nothing' baseline for that design envelope and, indirectly, to the other options within the relevant design envelope.

Whilst CAP2091 does not define in detail how the mean track (specified for noise modelling purposes) should be derived, we understand that it is the mean average track, calculated automatically from radar track-keeping data for the same 92-day summer period that has been used to create the modal average paths. In addition, in the same way as the modal paths, it will be greatly influenced by the locations where aircraft tracks are most concentrated.

In any event, we consider the mean track used in CAP2091, and the modal average paths we have defined are likely to be very similar. To test this assumption, we have compared a number of modal average paths used in this overflight assessment with the corresponding mean tracks (prepared by ERCD) when modelling the summer 2019 LAeq annual noise contours for MAN.

No material differences were found, particularly in locations closer to the airport and which are most likely to feature within subsequent noise contours. In conclusion, we are confident that there is no material risk that assessments using modal average paths resulted in the premature discounting of options.

The CAA's attention is drawn to relevant text and amendments:

Document	Section
IOA	5.1
IOA	5.3

Q16 CAP1616 para 128, para B29, para E12 – The sponsor must explain and evidence that the trade-off against emissions between 4,000 – 7,000 ft. as per the Government's altitude-based priorities has been appropriately considered in the discounting of options in the IOA.

In the original submission the shortlisting methodology considered the performance of the design options within a peer group based on the approximate population impact up to 7,000ft. Section 7.1 – 7.3 of the IOA has been updated to clearly demonstrate the consideration of trade-offs against emissions between 4,000ft – 7,000 ft. as per the Government's altitude-based priorities.

Document	Section
IOA – Shortlisting Criteria	7.1
IOA – Option Classification	7.2
IOA – Shortlisting Methodology	7.3

Q17 CAP1616 para E12 – The sponsor must explain how the evidence required to fill in any identified data gaps will be collected and used to develop the full options appraisal at Stage 3. For example, how two sets of traffic forecasts (one reflecting the baseline and the other reflecting the implementation of the change option) will be developed.

Within the Initial Options Appraisal (IOA) we have described the options we plan to take forward to Stage 3. Work within Stage 3 will involve the combination of individual routes into operating networks. This will support ongoing engagement and, in turn, will allow for a more detailed evaluation against the design principles including those for Noise, Capacity and Emissions as part of the Stage 3 Full Options Appraisal (FOA).

It is acknowledged that, within the FOA, further information will be required, and a table has been created within the IOA that details that information and outlines how we plan to collect it. This includes how we will develop the traffic forecasts to support this analysis. Our Stage 3 FOA will also contain full details of the methodology used when generating the supporting data.

In relation to traffic forecasts, the IOA table sets out our approach to this aspect, An extract from the table, which explains how we will address the baseline and the implementation scenarios is shown below:

Consistent with the requirements of CAP1616, each of the operating networks that we consider in the FOA will be compared to a baseline scenario of do nothing. CAP1616 recognises that in some instances do nothing is not a viable option and in these instances a do minimum scenario should also be prepared. This is the case at MAN and therefore air traffic forecasts model will be prepared to allow for each of our network options, our 'do something' scenarios and for the baseline scenarios of 'do nothing' and 'do minimum'. Our approach to defining each of these air traffic forecast scenarios has previously been set out in correspondence with the CAA (Manchester Airspace Modernisation – CAP1616 Assessment Scenarios dated 6 June 2022). In headline, the scenarios for which we will prepare an air traffic forecast model may be summarised as:

- *'Do nothing' - the actual routes currently flown, incorporating the assumption that CAP1781 would be taken advantage of and potentially extended beyond its current assumed expiration*
- *'Do minimum' - the replication of the current procedures to PBN standard, incorporating the amendment or removal of the existing restrictions on LISTO and the necessary infrastructure improvements to facilitate best use of available runway capacity.*
- *'Do something' – the network design options considered in the FOA, incorporating the necessary supporting physical infrastructure.*

The CAA's attention is drawn to relevant text and amendments:

Document	Section
IOA - Information to collect as part of Full Options Appraisal (FOA) at Stage 3	8.3

Q18 CAP1616 – The sponsor must explain the methodology or provide reference to sources used to estimate the number of people impacted under 51 dB, LAeq 16hr noise contour that is used to set the CAP2091 noise modelling category for the airport for this airspace change proposal.

LAeq noise contours provide input for the Department for Transport's TAG (previously WebTAG) analysis tool. CAP1616 describes TAG outputs as a primary metric, when considering noise impacts. LAeq noise contours also play an important role in informing stakeholder engagement.

The 2019 noise contours for MAN were calculated by ERCD, using the ANCON noise model. Using the 2019 noise contour output as a baseline, currently MAN would be assigned a category of C. However, CAP1616 Appendix B outlines the environmental metrics and assessment requirements, and for the change at MAN, this requires an assessment to be undertaken at year 0 and year 10.

We estimate that a doubling of the number of daytime flights at MAN, would result in a population count within the 51 LAeq, 16hr contour, of 213,000* and this would be sufficient to mandate a move to Category B for the purposes of CAP2091, during the 16-hour daytime modelling period.

However, given the forecast (lesser) increase in the number of flights over the CAP1616 modelling period of around one third, this is likely to be an overestimation and a conservative assumption. The actual figure will likely sit between the recommended minimum threshold for Category B
(160,000) and the mandatory minimum threshold (200,000). Category B therefore becomes the appropriate noise modelling category, and this assumption provides assurance that noise modelling undertaken as part of the full options appraisal will be to the required standard.

*Based upon the premise that, where all else remains unchanged, (traffic mix, flight profiles, dispersion etc), a doubling in the number of flights modelled would result in a 3dB increase in contour noise levels. This would mean that, if 2019 traffic volumes were to double, the 2019 51 LAeq, 16hr contour, would increase in size and shape to become identical to the 2019 48 LAeq, 16hr contour. The size and shape of this 2019 48 LAeq, 16hr contour has been modelled and the population count within the contour is estimated to be 213,000.

The CAA's attention is drawn to relevant amendments at:

Document	Section
IOA	Appendix A2

MAG Manchester Airport

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