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February 2023

London Luton Airport Expansion

Planning Inspectorate Scheme Ref: TR020001

Volume 5 Environmental Statement and Related Documents

5.01 Chapter 16: Noise and Vibration

Application Document Ref: TR020001/APP/5.01

APFP Regulation: 5(2)(a)

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

London Luton Airport Expansion Development Consent Order 202x

5.01 ENVIRONMENTAL STATEMENT CHAPTER 16: NOISE AND VIBRATION

Regulation number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference:	TR020001
Document Reference:	TR020001/APP/5.01
Author:	Luton Rising

Version	Date	Status of Version
Issue 1	February 2023	Application issue

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16 NOISE AND VIBRATION

16.1 Introduction

16.1.1 This chapter considers the assessment of significant effects on health and quality of life due to noise and vibration exposure and the likely significant effects due to noise and vibration change (adverse and beneficial) that arise from the Proposed Development.

16.1.2 In summary, the scope of the assessment in this chapter covers the following sources of noise and vibration:

a. noise and vibration from earthworks and construction of the Proposed Development infrastructure;

b. noise and vibration from construction traffic;

c. operational air noise[1];

d. operational ground noise[2];

e. surface access noise, including from the new road infrastructure resulting from the proposed development;

f. fixed plant noise; and

g. operational vibration.

16.1.3 The assessment is based on a core case of expected growth in air traffic; however, sensitivity testing has been undertaken using faster and slower growth cases, which consider throughput being achieved earlier or later than the core case to account for any uncertainties in forecasting.

16.1.4 For operational air noise the assessment uses a baseline defined by the actual air traffic movements that occurred in 2019 as a measure of the noise situation that actually occurred in the baseline year. However, a sensitivity test has been undertaken using a theoretical baseline in which the airport was operating within its current consented short-term noise limits[3]. The assessment also considers the magnitude of noise change from the situation with and without the Proposed Development in future years using a future baseline that is compliant with the current consented long-term noise limits. Further information on the methodology for defining the assessment baseline is presented in **Section 16.5**.

16.1.5 This chapter describes:

a. the legislation, planning policy and other documentation that has informed the assessment (**Section 16.2** with supporting detailed information on local policy provided in **Appendix 16.1** of this ES **[TR020001/APP/5.02]**);

[1] Air noise is defined as noise emissions from all aircraft movements in the landing and take-off cycle associated with the airport
[2] Ground noise is defined as noise emissions from aircraft taxiing between stand and runway, engine testing, Auxiliary Power Units (APU) and fire training ground activities
[3] Current consented noise contour limits for the airport were established in 2014 under Condition 10 of granted planning consent 12/01400/FUL

b. the scope of the assessment for noise and vibration including how comments on noise and vibration within the Scoping Opinion have been addressed (**Section 16.3**);

c. the outcome of consultation and external engagement that has been undertaken to inform the assessment (**Section 16.4**);

d. the noise and vibration assessment methodology (**Section 16.5** with supporting detailed information provided in **Appendix 16.1** of this ES **[TR020001/APP/5.02]**);

e. assumptions and limitations (**Section 16.6**);

f. baseline conditions used for the assessment (**Section 16.7** with supporting detailed information provided in **Appendix 16.1** of this ES **[TR020001/APP/5.02]**);

g. embedded and good practice mitigation measures (**Section 16.8**)**;**

h. the assessment of noise and vibration significant effects (**Section 16.9** with supporting detailed information provided in **Appendix 16.1** of this ES **[TR020001/APP/5.02]**);

i. additional mitigation and compensation measures to be applied to the Proposed Development (**Section 16.10**);

j. the assessment of residual noise and vibration significant effects (**Section 16.11**);

k. an assessment of potential changes to the findings of the noise and vibration assessment, taking into account the predicted future conditions as a result of climate change, known as In-combination Climate Change Impacts (**Section 16.12)**;

l. monitoring that will take place should the Proposed Development be consented (**Section 16.13**); and

m. an overall summary of the assessment of noise and vibration significant effects (**Section 16.14**).

16.1.6 **Appendix 16.1** Noise and Vibration Information of this ES **[TR020001/APP/5.02]** provides supporting detailed information for the noise and vibration assessment, as described above, including details of acoustic terminology.

16.1.7 **Appendix 16.2** Operational Noise Management (Explanatory Note) of this ES **[TR020001/APP/5.02]** provides further detail on the mitigation and compensation described in this chapter.

16.1.8 **Appendix 16.3** Fixed Plant Noise Management Plan of this ES **[TR020001/APP/5.02]** describes the process to reduce and control adverse effects of fixed plant noise arising from operation of the Proposed Development.

16.1.9 This chapter should be read in conjunction with the relevant parts of the following chapters of the Environmental Statement (ES):

a. **Chapter 8** Biodiversity **[TR020001/APP/5.01]** – for likely significant effects of noise and vibration on protected species;

b. **Chapter 10** Cultural Heritage **[TR020001/APP/5.01]** – for the effects of noise and vibration on the setting of heritage assets, such as listed buildings, scheduled monuments, registered parks and gardens and conservation areas;

c. **Chapter 13** Health and Community **[TR020001/APP/5.01]** - for the assessment of health effects which considers the noise effects identified in this chapter; and

d. **Chapter 14** Landscape and Visual **[TR020001/APP/5.01]** - for the contribution of noise to any change in the wider consideration of landscape and visual amenity (including as relevant tranquillity effects at the Chilterns Area of Outstanding Natural Beauty).

16.2 Legislation, policy and guidance

16.2.1 This section identifies the key legislation, policy and other guidance documentation that has informed the assessment of noise and vibration effects.

Legislation

16.2.2 **Table 16.1** lists the key legislation relevant to the assessment of effects of noise and vibration, and how they have been addressed in this ES.

Table 16.1: Noise and vibration legislation

Legislation	How and where addressed in ES
Control of Pollution Act 1974 (CoPA) (Ref. 16.1) This Act provides the definition of Best Practicable Means (BPM) to minimise noise (including vibration), the basis for defence against noise abatement action taken by a local authority (section 60). The Act also provides for i) persons responsible to seek prior consent for works on construction sites including BPM steps to minimise noise and ii) the basis for defining codes of practice (applies to BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites, Part 1: Noise and Part 2: Vibration).	The assessment of construction noise and vibration effects is presented in **Section 16.9**. Best Practicable Means mitigation is a requirement of the Code of Construction Practice (CoCP) provided as **Appendix 4.2** of this ES **[TR020001/APP/5.02]**, and when defining embedded and good practice mitigation measures for construction activities (see **Section 16.8**).
Environmental Protection Act 1990 (Ref. 16.2) Gives Local Authorities duty to investigate and, if necessary, take enforcement against noise or vibration emissions that are identified as a statutory nuisance. Section 80 identifies BPM as a basis for defence against enforcement action. Section 82 provides for individuals to seek for abatement action to be taken by a magistrate's court against noise nuisance.	For construction activities, as set out in the CoCP BPM will be applied as a basis minimising noise and will be agreed with the relevant local authority before construction starts and this will also provide defence against enforcement action. Good practice mitigation measures for construction activities that represent BPM are provided in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**).

Legislation	How and where addressed in ES
The Civil Aviation Act 1982 (Ref. 16.3) Provides that no action for trespass or nuisance can be taken as long as an aircraft observes the provisions of any Air Navigation Order. For the operation of the airport, the Civil Aviation Act states (s76) "*No action shall lie in respect of …nuisance, by reason only of the flight of an aircraft over any property at a height above the ground which, having regard to wind, weather and all the circumstances of the case is reasonable, or the ordinary incidents of such flight, so long as the provisions of any Air Navigation Order and of any orders under section 62 above have been duly complied with*".	Referenced when defining embedded and good practice mitigation measures for aircraft noise (see **Section 16.8**) and additional mitigation measures (see **Section 16.10**).
The Civil Aviation Act 2006 (Ref. 16.4) Allows an airport to charge airline operators based on the aircraft noise emissions and to introduce noise control schemes aimed at avoiding, limiting or mitigating aircraft noise effects.	Referenced when defining embedded and good practice mitigation measures for aircraft noise (see **Section 16.8**).
The Civil Aviation Act 2012 (Ref. 16.5) Defines the scope of airport operations that the CAA has concurrent power over.	Referenced when defining embedded and good practice mitigation measures for aircraft noise (see **Section 16.8**) and additional mitigation measures (see **Section 16.10**).
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref. 16.6) The regulations govern the process for undertaking an Environmental Impact Assessment in England.	Referenced when defining methodologies to identify likely significant noise and vibration effects (see **Section 16.5**) that may occur as a result of the Proposed Development, as well as in defining embedded and good practice mitigation measures to avoid and reduce likely significant adverse effects (see **Section 16.8** and **Section 16.10**).
The Airports (Noise-related Operating Restrictions) (England and Wales) Regulations 2018 (Ref. 16.7) The regulations designate competent authorities for the purposes of EU	Referenced when defining embedded and good practice mitigation measures for aircraft noise (see **Section 16.8**) and additional mitigation measures (see **Section 16.10**).

Legislation	How and where addressed in ES
Regulation 598/2014 (Ref. 16.8). London Luton Airport Operations Limited, as operator of London Luton Airport, is the competent authority.	
Regulation (EU) No 598/2014 Establishes the rules and procedures on the introduction of noise-related operating restrictions at airports within a "Balanced Approach" to noise management, as promoted by the International Civil Aviation Organisation (ICAO). EU 598 seeks to ensure that "noise related operating restrictions" are only imposed: a. when other measures within the Balanced Approach have first been considered; b. where those other measures are not in themselves sufficient to attain the specific noise abatement objectives for the airport. The Airports (Noise-related Operating Restrictions) (England and Wales) Regulations 2018 (Ref. 16.9) implement the requirement to designate competent authorities for the purposes of Regulation (EU) No 598/2014 procedures with regard to the introduction of noise-related operating restrictions at Union airports following the Balanced Approach.	The approach to defining the mitigation measures identified in this ES (see **Section 16.8** and **Section 16.10**) is consistent with the approach set out in Regulation 598.
The Environmental Noise (England) Regulations 2006 (Ref. 16.10) Sets out the requirement for major airports[4] to implement a Noise Action Plan and publish strategic noise maps every five years. The latest Noise Action Plan for Luton Airport (Ref. 16.11) covers the period from 2019-2023. Also sets out Defra's five year cycles of strategic noise	Referenced when defining embedded and good practice mitigation measures for aircraft noise (see **Section 16.8**). There are several Noise Important Areas around Luton, which are areas that are the most exposed to road traffic noise as identified through the noise action planning process for roads carried out by Defra (Ref. 16.12) in line with the regulations. Changes

[4] Defined as civil airports with more than 50,000 movements per year. London Luton Airport is defined as a major airport.

Legislation	How and where addressed in ES
mapping and action plan making for road and railways.	in these areas are addressed in **Section 16.9**.
The Noise Insulation Regulations 1975, as amended 1988 (Ref. 16.13) Sets out the duty and provisions to carry out noise insulation work or to make grants due to noise from new or realigned road schemes and/ or associated works.	Referenced when defining compensation proposals (see **Section 16.10**).
The Land Compensation Act 1973 (Ref. 16.14) This Act provides for depreciation of an interest in land value caused by noise as a physical factor from public works (highway or aerodrome) to be compensated by the responsible authority. Compensation is payable where the noise either arises from activity on land taken (injurious affection) (Part II of the Act) or is physically unconnected to the land interest (Part 1 claims). Provides powers to sound-proof (noise insulate) buildings from noise arising from highways and aerodromes. Provides powers to pay expenses of persons moving temporarily during construction works (due to noise).	Informs compensation proposals (see **Section 16.10**).

Policy

16.2.3 **Table 16.2** lists the planning policies relevant to the assessment of effects of noise and vibration, and how they have been addressed in this ES.

Table 16.2: Noise and vibration policy

Policy	How and where addressed in ES
National Planning Policy Framework (2021) (Ref. 16.15) The Nation Planning Policy Framework (NPPF) states at paragraph 185 that "*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including*	The noise and vibration assessment in **Section 16.9** demonstrates how the Proposed Development will mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life. No unacceptable adverse effects have been identified.

Policy	How and where addressed in ES
cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: *a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;* *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*" The NPPF also states at paragraph 174 that "*Planning policies and decisions should contribute to and enhance the natural and local environment by: …* *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans"*	**Section 16.5** describes how the methodology for identifying adverse effects from noise in this chapter takes relative tranquillity into account in accordance with NPPF paragraph 185b. The methodology for identifying the impact of noise (amongst other factors) on tranquillity for landscape receptors, including the Chilterns AONB as required by the Scoping Opinion, is presented in **Chapter 14** Landscape and Visual of this ES **[TR020001/APP/5.01]**. The methodology for identifying the impact of noise (amongst other factors) on setting and tranquillity of heritage receptors is presented in **Chapter 10** Cultural Heritage of this ES **[TR020001/APP/5.01]**.
Noise Policy Statement for England (NPSE) (2010) (Ref. 16.16) The NPSE sets out the long-term vision of Government noise policy to "*Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development*" (paragraph 1.6) "*This long term vision is supported by the following aims:*	The Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL) are defined in **Section 16.5**. Embedded measures to mitigate and minimise adverse impacts on health and quality of life are identified in **Section 16.8**. Significant adverse impacts are identified in **Section 16.9**. Details on additional measures and compensation to avoid

Policy	How and where addressed in ES
Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development: *a. Avoid significant adverse impacts on health and quality of life;* *b. Mitigate and minimise adverse impacts on health and quality of life; and* *c. Where possible, contribute to the improvements of health and quality of life*." (paragraph 1.7) Paragraph 2.20 identifies the LOAEL as "*the level above which adverse effects on health and quality of life can be detected*". Paragraph 2.21 identifies the SOAEL as "*the level above which significant adverse effects on health and quality of life occur*". Paragraph 2.22 states *"it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant negative impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available"*. Paragraph 2.24 states "*The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise negative effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such negative effects cannot occur"*.	significant impacts where practicable are provided in **Section 16.10**. Improvements to existing impacts of noise on health and quality of life are identified in **Section 16.9** through the reduction of area and population exposed to aircraft noise within the LOAEL and SOAEL contours compared to the 2019 Actuals baseline.

Policy	How and where addressed in ES
National Policy Statement for National Networks – December 2014 (NPSNN) (Ref. 16.17) The NPSNN sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects (NSIP) on the road and rail networks. Of particular relevance to the assessment of road traffic noise is paragraph 5.189, which states: "*Where a development is subject to EIA and significant noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment, which should form part of the environment statement:* • *a description of the noise sources including likely usage in terms of number of movements, fleet mix and diurnal pattern. For any associated fixed structures, such as ventilation fans for tunnels, information about the noise sources including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise.* • *identification of noise sensitive premises and noise sensitive areas that may be affected.* • *the characteristics of the existing noise environment.* • *a prediction on how the noise environment will change with the proposed development:* o *In the shorter term such as during the construction period;*	There are no elements of the Proposed Development on the national road or rail network that would be classified as a NSIP in their own right. However, the NPSNN remains an important and relevant consideration, particularly as works are proposed on the Strategic Road Network (SRN) at Junction 10 of the M1 as part of the Proposed Development. Where the relevant polices of the NPSNN are consistent with the relevant policies of the ANPS, they have not been repeated here and accordingly the ANPS compliance table (**Table 16.3**) provides the necessary policy response. Responses to the NPSNN policies of relevance that are not mirrored in the ANPS are as follows: **Sections 16.5** and **16.7** set out the description of the noise sources as required. **Section 16.3** describes the scope for the assessment of noise sensitive premises and noise sensitive areas included in the assessment with further details of the assessment included in **Section 16.5**, and the assessment of the effects in **Section 16.9**. **Section 16.7** sets out the characteristics of the existing noise environment. **Section 16.9** sets out how the noise environment is predicted to change with the Proposed Development for the noise sources and time-periods required. **Section 16.8** and **Section 16.10** sets out further mitigation and noise management measures.

Policy	How and where addressed in ES
○ *in the longer term during the operating life of the infrastructure;* ○ *at particular times of the day, evening and night as appropriate.* • *an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas.* • *measures to be employed in mitigating the effects of noise. Applicants should consider using best available techniques to reduce noise impacts.* • *the nature and extent of the noise assessment should be proportionate to the likely noise impact.*"	
The Aviation Policy Framework (APF) (2013) (Ref. 16.18) Sets set out the Government policy objective for the management of noise at UK airports, which is summarised at paragraph 3.12 as: "*The Government's overall policy on aviation noise is to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise, as part of a policy of sharing benefits of noise reduction with industry.*"	Information on the measures adopted to achieve the policy objective to limit the number of people significantly affected by aircraft noise is provided in **Section 16.8**. The Noise Envelope (see **Section 16.8**) provides details on how aircraft noise will be controlled and how benefits of noise reduction from next generation technology will be shared in line with the policy objective.
Draft UK Airspace Policy: A framework for balanced decisions on the design and use of airspace (February 2017) (Ref. 16.19) and the Government's Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace (October 2017) (Ref. 16.20) The Government's Consultation Response on the Draft UK Airspace Policy states at paragraph 9 that "The Government's current aviation policy is	The LOAEL values for aircraft noise are defined with reference to UK Airspace Policy in **Section 16.5**. Information on the measures adopted to limit the number of people significantly affected by aircraft noise, including the Noise Envelope, is provided in **Section 16.8**. The Noise Envelope (see **Section 16.8**) provides details on how benefits from new technology will be shared.

Policy	How and where addressed in ES
set out in the Aviation Policy Framework (APF). The policies set out within this document provide an update to some of the policies on aviation noise contained within the APF, and should be viewed as the current government policy." The Government's consultation response, at paragraph 2.69, sets out that *"Consistent with the Noise Policy Statement for England, our objectives in implementing this policy are to: … limit and, where possible, reduce the number of people in the UK significantly affected by the adverse impacts from aircraft noise."* Finally, the Government's consultation response states at paragraph 2.72 that "'*We will set a LOAEL at 51dB LAeq,16h for daytime and based on feedback and further discussion with CAA we are making one minor change to the LOAEL night metric to be 45dB LAeq,8h rather than Lnight to be consistent with the daytime metric.*"	Compensation proposals (see **Section 16.10**) were drafted with reference to the Government's Consultation Response on UK Airspace Policy.
Airports National Policy Statement (ANPS) (2018) (Ref. 16.21)	The relevance of the ANPS is covered in **Table 16.3**.
Beyond the horizon, The future of UK aviation: Making best use of existing runways (2018) (Ref. 16.22) In this document Government has set out its support of airports beyond Heathrow making best use of their existing runways, subject to related economic and environmental considerations being considered. It states at paragraph 1.29 that "*the government is supportive of airports beyond Heathrow making best use of their existing runways. However, we recognise that the development of airports can have negative as well as positive local impacts, including on noise levels. We therefore*	Adverse impacts and significant adverse impacts of noise are identified in **Section 16.9**. Embedded measures to mitigate and minimise adverse impacts on health and quality of life are identified in **Section 16.8**. Details on additional measures to avoid significant impacts where practicable are provided in **Section 16.10**.

Policy	How and where addressed in ES
consider that any proposals should be judged by the relevant planning authority, taking careful account of all relevant considerations, particularly economic and environmental impacts and proposed mitigations."	
Aviation 2050: The Future of UK Aviation (2018) (Ref. 16.23). The draft strategy described in this consultation document proposes new measures at paragraph 3.115 as follows: • *"setting a new objective to limit, and where possible, reduce total adverse effects on health and quality of life from aviation noise. This brings national aviation policy in line with airspace policy updated in 2017* • *Developing a new national indicator to track the long-term performance of the sector in reducing noise. This could be defined either as a noise quota or a total contour area based on the largest airports* • *routinely setting noise caps as part of planning approvals (for increase in passengers or flights)[5]. The aim is to balance noise and growth and to provide future certainty over noise levels to communities. It is important that caps are subject to periodic review to ensure they remain relevant and continue to strike a fair balance by taking account of actual growth and the introduction of new aircraft technology. It is equally important that there are appropriate*	The noise and vibration assessment in **Section 16.9** demonstrates how the Proposed Development will mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life. **Section 16.8** sets out the proposal for a Noise Envelope which will provide a mechanism for predictable growth and the sharing of noise benefits from new aircraft technology with local communities. Footnote 77 in Aviation 2050 has been used to inform the noise limit metric in the Noise Envelope. **Section 16.10** sets out the proposed compensation (noise insulation) measures that have been updated in line with the proposals in Aviation 2050. Consideration of the environmental noise guidelines for the European region published by the World Health Organization (WHO) as referenced by Aviation 2050 is addressed in **Table 16.4**.

[5] "*A noise cap (also known as a noise envelope) is any measure which restricts noise. In its crudest form this could be a simple movement cap, but the government proposes advocating caps which are based on setting maximum noise exposure levels (such as contour area or noise quota). Noise caps should also consider the effect of night fights, given the health costs associated with sleep disturbance. These costs need to balance the benefits of night fights and any restrictions should be proportionate to local circumstances*" (footnote 77 in Aviation 2050).

Policy	How and where addressed in ES
compliance mechanisms in case such caps are breached, and the government wants to explore mechanisms by which airports could 'pay for' additional growth by means of local compensation as an alternative to the current sanctions available • *requiring all major airports to set out a plan which commits to future noise reduction, and to review this periodically. This would only apply to airports which do not have a noise cap approved through the planning system and would provide similar certainty to communities on future noise levels. The government wants to see better noise monitoring and a mechanism to enforce these targets as for noise caps. The noise action planning process could potentially be developed to provide the basis for such reviews, backed up by additional powers as necessary for either central or local government or the CAA"* Additionally, the draft strategy sets out at paragraph 3.121 and 3.122 that "'*The government is also: proposing new measures to improve noise insulation schemes for existing properties, particularly where noise exposure may increase in the short term or to mitigate against sleep disturbance.* *Such schemes, while imposing costs on the industry, are an important element in giving impacted communities a fair deal. The government therefore proposes the following noise insulation measures:* • *to extend the noise insulation policy threshold beyond the current 63dB LAeq 16hr contour to 60dB LAeq 16hr*	

Policy	How and where addressed in ES
• *to require all airports to review the effectiveness of existing schemes. This should include how effective the insulation is and whether other factors (such as ventilation) need to be considered, and also whether levels of contributions are affecting take-up* • *the government or ICCAN to issue new guidance to airports on best practice for noise insulation schemes, to improve consistency* • *for airspace changes which lead to significantly increased overflight, to set a new minimum threshold of an increase of 3dB LAeq, which leaves a household in the 54dB LAeq 16hr contour or above as a new eligibility criterion for assistance with noise insulation*" Finally, the draft strategy states at paragraph 3.106: *"The government is considering the recent new environmental noise guidelines for the European region published by the World Health Organization (WHO). It agrees with the ambition to reduce noise and to minimise adverse health effects, but it wants policy to be underpinned by the most robust evidence on these effects, including the total cost of action and recent UK specific evidence which the WHO report did not assess"*	
Flightpath to the Future: a strategic framework for the aviation sector (May 2022) (Ref. 16.24) 'Flightpath to the future' is a strategic framework for the aviation sector that supports the Department for Transport's vision for a modern, innovative and efficient sector over the next 10 years. Flightpath to the Future does not provide any specific updates to noise policy but refers to the draft policies and aims set out in Aviation 2050 noting that *"these*	Whilst the next steps for noise policy referred to in Flightpath to the Future have yet to be published, the Government has clarified that the draft policies and noise aims in Aviation 2050 remain very relevant. The row above describes how Aviation 2050 has been considered in relation to the noise and vibration assessment.

Policy	How and where addressed in ES
aims remain very relevant and we will set out next steps in 2022/2023".	
Hertfordshire Local Transport Plan 2018-2031 (Ref. 16.25). Policy 21 seeks to minimise noise issues from surface access where practicable.	**Section 16.9** demonstrates that surface access noise issues have been minimised.
Luton Local Plan 2011-2031 (Ref. 16.26) Policy LLP6 sets out requirements for airport expansion including an air noise, ground and noise assessment. Provision on how noise will be controlled and managed must be made.	**Section 16.9** assesses noise effects due to the Proposed Development. **Section 16.8** and **16.10** provide details on how noise effects will be minimised.
Central Bedfordshire Council Local Plan 2035 July 2021 (Ref. 16.27) Policy CC8: Pollution and Land Instability states developments will only be permitted if it can be demonstrated that: *"Measures can be implemented to minimise the impacts of pollution and land instability to an acceptable level without compromising the quality of life for users and occupiers, which protects health, natural and historic environment, water quality, property, infrastructure and amenity"*	**Section 16.9** assesses noise effects due to the Proposed Development. **Section 16.8** and **16.10** provide details on how noise effects will be minimised.
North Hertfordshire Local Plan 2011-2031, November 2022 (Ref. 16.28) Policy D3: Protecting Living Conditions states: *"Planning permission will be granted for development proposals which do not cause unacceptable harm to living conditions. Where the living conditions of proposed developments would be affected by an existing use or the living conditions of an existing development would be affected by a proposed use, the Council will consider whether there are mitigation measures that can be taken to mitigate the harm to an acceptable level. If the Council is not satisfied that mitigation proposals would address the*	**Section 16.9** assesses noise effects due to the Proposed Development. **Section 16.8** and **16.10** provide details on how noise effects will be minimised including compensation proposals for noise insulation.

Policy	How and where addressed in ES
identified harm, development proposals will not be permitted". Paragraph 9.19 states *"All development has the potential to have an adverse impact on its neighbours, in a wide variety of ways. Such harm may arise from traffic generation, parking, loss of daylight and sunlight, noise, overlooking, pollution (including light pollution) and dominance as well as other issues."* Paragraph 9.22 states *"There are two ways mitigation may occur. Either the development can incorporate measures to reduce the effect it has, or it can fund works off site to reduce the impact on those affected by it. This latter course of action may be appropriate for development such as the expansion of airfields, where there will inevitably be an increase in noise, but it may be possible to provide sound protection to those buildings affected by that noise."*	

16.2.4 The Airports National Policy Statement (ANPS) (Ref. 16.21) does not have effect in relation to an application for development consent for an airport development not comprised of an application relating to the Heathrow Northwest Runway. Nevertheless, as set out within paragraph 1.41 of the ANPS, the Secretary of State considers that the contents of the ANPS will be both important and relevant considerations in the determination of such an application, particularly where it relates to London or the south east of England. In particular, the ANPS makes clear that, alongside the provision of a new Northwest Runway at Heathrow, the government supports other airports making best use of their existing runways as set out in Beyond the Horizon: Making best use of existing runways (Ref. 16.22), which is the specific policy context for this application.

16.2.5 In addition, whilst the ANPS does not have effect in relation to the Proposed Development, it sets out a number of principles for environmental impact assessment and compliance and these will be an important and relevant consideration in the determination of the application for development consent. A summary of the relevant provisions for the noise and vibration assessment and how these have been addressed of this ES is provided within **Table 16.3**.

Table 16.3: How relevant noise and vibration requirements of ANPS are addressed in the ES

ANPS Section	How and where addressed in ES
Paragraph 5.67 states that: "*The proposed development must be undertaken in accordance with statutory obligations for noise. Due regard must have been given to national policy on aviation noise, and the relevant sections of the Noise Policy Statement for England, the National Planning Policy Framework and the Government's associated planning guidance on noise. However, the Airports NPS must be used as the primary policy on noise when considering the Heathrow Northwest Runway scheme and has primacy over other wider noise policy sources*".	Although this statement concludes with reference to the Heathrow Northwest Runway scheme, this information is considered relevant to the DCO application for the Proposed Development. The requirements of statutory obligations and policies cited are presented in **Table 16.1** and **Table 16.2**.
Paragraph 5.68 of the ANPS is concerned with the decision-making process and states: "*Development consent should not be granted unless the Secretary of State is satisfied that the proposals will meet the following aims for the effective management and control of noise, within the context of Government policy on sustainable development:* *Avoid significant adverse impacts on health and quality of life from noise;* *Mitigate and minimise adverse impacts on health and quality of life from noise; and* *Where possible, contribute to improvements to health and quality of life*."	The decision-making aims in the ANPS are equivalent to the aims of the NPSE and paragraph 185a) of the NPPF (see **Table 16.2**) and are therefore applicable to the Proposed Development. **Section 16.9** shows that noise during the Project will reduce from 2019 Actuals baseline scenario due to fleet transition to less noisy new generation aircraft, therefore, there will be no increase in significant adverse impacts on health and quality of life from noise as less people will be affected by significant levels of noise in the future. The application of the Noise Envelope (**Section 16.8**) and noise insulation (**Section 16.10**) demonstrates how the Project will mitigate and minimise adverse impacts on health and quality of life. Provision of noise insulation will improve acoustic conditions within dwellings and improve health and quality of life for occupants when compared to a 'with Proposed Development scenario' in which noise insulation is not provided. The noise envelope will provide a mechanism for

ANPS Section	How and where addressed in ES
	predictable growth and the sharing of noise benefits from new aircraft technology with local communities.
Paragraph 5.52 states: "*Pursuant to the terms of the Environmental Impact Assessment Regulations, the applicant should undertake a noise assessment for any period of change in air traffic movements prior to opening, for the time of opening, and at the time the airport is forecast to reach full capacity, and (if applicable, being different to either of the other assessment periods) at a point when the airport's noise impact is forecast to be highest. This should form part of the environmental statement.*"	The assessment years for identifying the likely significant effect of air noise are set out in **Section 16.3**.
Key points relating to the scope of this assessment are set out in Paragraph 5.52, which states that: *The noise assessment should include the following:* *"A description of the noise sources;* *An assessment of the likely significant effect of predicted changes in the noise environment on any noise sensitive premises (including schools and hospitals) and noise sensitive areas (including National Parks and Areas of Outstanding Natural Beauty);* *The characteristics of the existing noise environment, including noise from aircraft, using noise exposure maps, and from surface transport and ground operations associated with the project, the latter during both the construction and operational phases of the project;* *A prediction on how the noise environment will change with the proposed project; and* *Measures to be employed in mitigating the effects of noise.* *These should take into account construction and operational noise (including from surface access arrangements) and aircraft noise".*	A description of the noise sources included in the assessment are set out in **Section 16.5**. The assessment of significant effects covering the identified source of noise and vibration are described in **Section 16.9**. The effect of noise on sensitive landscape and visual receptors is covered in **Chapter 14** Landscape and Visual of this ES **[TR020001/APP/5.01]**. The characteristics of the existing noise environment are provided in **Section 16.7**. An assessment of effects due to construction activities and predictions on how the noise environment will change as a result of the Proposed Development is provided in **Section 16.9**. Measures to be employed in mitigating the effects of noise are described in **Section 16.8** and **Section 16.10**.

ANPS Section	How and where addressed in ES
Paragraph 5.52 goes on to state: *"The applicant's assessment of aircraft noise should be undertaken in accordance with the developing indicative airspace design. This may involve the use of appropriate design parameters and scenarios based on indicative flightpaths*".	The airspace change for London Luton Airport is at very early stages of development (initial options appraisal) and hence there is not sufficient detail to assess the implications of airspace change (which is assessed separately through the Civil Aviation Authority's Airspace Change Process). Consequently, the assessment has been undertaken based on current operational procedures. However, a sensitivity test has been undertaken to demonstrate how airspace change is expected to be accommodated within the Noise Envelope (see **Section 16.9**). Details on how sensitivity tests including airspace change are addressed in the ES is provided in **Section 5.4** of **Chapter 5** of this ES **[TR020001/APP/5.01]**.
Paragraph 5.53 states that: "*Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. For the prediction, assessment and management of construction noise, reference should be made to any British Standards and other guidance which give examples of mitigation strategies. In assessing the likely significant impacts of aircraft noise, the applicant should have regard to the noise assessment principles, including noise metrics, set out in the national policy on airspace*".	The noise requirements of the relevant policy, guidance and British Standards are set out in **Table 16.2** and **Table 16.4**. The assessment methodology, described in **Section 16.5**, has been developed in line with the requirements set out in policy, guidance and British Standards.
Paragraphs 5.54 to 5.66 of the ANPS provide details of the type of mitigation measures that could be incorporated into an airport development during construction or operation. Aspects of mitigation that are relevant to the Project are as follows: Paragraph 5.54 identifies Regulation 598, which establishes the balanced approach to noise management at airports. Paragraph 5.60 requires that the Applicant should put forward plans for a Noise Envelope.	The definition of mitigation measures identified in this ES (see **Section 16.8** and **Section 16.10**) is consistent with the 'Balanced Approach' in the EU 598 Regulations. The Noise Envelope is described in **Section 16.8**. Best practice construction noise mitigation measures are secured through the Code of

ANPS Section	How and where addressed in ES
Paragraph 5.64 states that best practice noise mitigation measures should be adopted for the construction phase.	Construction Practice (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**)

Guidance

16.2.6 **Table 16.4** lists guidance documents relevant to the assessment of effects of noise and vibration, and how they have been addressed in this ES.

Table 16.4: Noise and vibration guidance

Guidance	How and where addressed in ES
Air Navigation Guidance (October 2017) (Ref. 16.29) Provides guidance on environmental objectives on the process of airspace redesign. Identifies the objective to reduce adverse noise effects in airspace from the ground to below 4,000 feet. Identifies supplementary noise metrics to inform communities about changes in aircraft noise for air traffic movements below 7,000 feet.	The Air Navigation Guidance reflects the Government's Consultation Response on the Draft UK Airspace Policy (see **Table 16.2**) in terms of the setting of LOAELs for air noise of 51dB$L_{Aeq,16h}$ for daytime noise and 45dB$L_{Aeq,8h}$ for night-time noise. These LOAELs have been used in the air noise assessment. The Air Navigation Guidance is referenced in the definition of the air noise Study Area (see **Section 16.3**). **Sections 16.8** and **16.10** provide details on measures adopted to reduce total adverse effects on health and quality of life from aviation noise. The supplementary noise metrics mentioned in the Air Navigation Guidance (overflights and number above metrics: N65 for daytime noise and N60 for night-time noise) have been used in the air noise assessment (**Section 16.9**).
CAP1129: Noise Envelopes (Ref. 16.30) A review of the concept of airport Noise Envelopes undertaken by the Civil Aviation Authority (CAA) in response to the APF.	The guidance document has been used to inform the development of the Noise Envelope proposals (see **Section 16.8**).
CAP1498: Definition of overflight (Ref. 16.31)	The definitions in CAP1498 have been used to calculate the overflight supplementary metric for the air noise assessment in **Section 16.9**.

Guidance	How and where addressed in ES
Provides definitions of 'overflight' and an 'overflight metric'	
CAP1616: Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information (Ref. 16.32) CAP 1616a: Airspace Design: Environmental Requirements Technical Annex, 2021 (Ref. 16.33) Published in response to Air Navigation Guidance 2017. Provides guidance on the environmental assessment for airspace changes. Sets out noise metrics to be used when assessing the impact of airspace redesign. The N65 and N60 metrics for daytime and night-time respectively are described as "*secondary metrics*" in CAP1616 as "*those that are not being used to determine significant impacts but which are still able to convey noise effects*." (paragraph B54) CAP1616 states: *"It is important to stress that the overflight metric does not reflect noise impacts; it contains no noise information but has been developed to recognise both that Government policy on airspace refers to overflights and that communities can find the information useful."* (paragraph B61) CAP 1616a Refers to Aviation Environmental Design Tool (AEDT) as *"a recognised and validated noise model"* (paragraph 1.19).	Guidance from CAP1616 and CAP1616a was followed when defining the air noise modelling methodology (see **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**) and when presenting the results of the air noise assessment (**Section 16.9**). Guidance from CAP1616 has been used to inform the use of N65, N60 and overflight metrics to provide additional context to the primary assessment using L_{Aeq}. Air noise modelling has been undertaken using AEDT in line with the CAP1616a guidance.
CAP 1731 Aviation Strategy: Noise Forecast and Analyses (Ref. 16.34)	CAP 1731 has been referenced in the development of the limits in the Noise Envelope which are based on noise contour area (see **Section 16.8**).

Guidance	How and where addressed in ES
To inform the Government's Aviation 2050 strategy, the CAA were commissioned to undertake an analysis of noise forecasts and a consideration of how airport noise may be limited. CAP 1731 reports on these analyses and presents a feasibility study of implementing airport noise limits nationally and locally, including consideration of the pros and cons that noise limits may create and recommendations for appropriate metrics for noise limits. On the recommendation of metrics for noise limits, CAP 1731 concludes that proposed noise limits should consist of (in section 7.6): *"A locally set absolute Quota Count or noise contour area limit at a particular noise level for both day and night for each airport"* With respect to Number Above metrics, CAP 1731 says (in Section 7.6): *"Given that Number Above lacks an ability to restrict population exposure, it is not recommended as a main noise limit. However, Number Above are recognised as a useful supplementary noise metric and it is recommended as a KPI to be monitored at each airport."*	Number Above metrics (N65 and N60) have been used as supplementary metrics in the noise assessment in this chapter, and are included as noise management targets (KPIs) in the Noise Monitoring Plan (**Appendix C** of **Green Controlled Growth Framework [TR020001/APP/7.08]**).
CAP 2091: CAA Policy on Minimum Standards for Noise Modelling, 2021 (Ref. 16.35) Provides the minimum acceptable level of noise modelling that the CAA should undertake for an airport depending on the population exposed to air noise.	Advice in CAP 2091 was followed when determining the level of validation that is required for the Project air noise model. Details on how CAP 2091 was referenced during the air noise model validation process are provided in **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.
CAP 1506: Survey of Noise Attitudes 2014: Aircraft Noise and Annoyance, Second Edition, 2021 (Ref. 16.36) Describes a research study undertaken by the CAA to obtain new and updated evidence on attitudes to aviation noise	The $L_{Aeq,16h}$ is used when defining the methodology for identifying significant effects on health and quality of life due to daytime noise exposure and the likely significant effects due to daytime noise change (adverse and beneficial) that arise from the Proposed Development (**Section**

Guidance	How and where addressed in ES
around airports in England, and how they relate to the UK aircraft noise exposure indices $L_{Aeq,16h}$, L_{den}, N70 and N65. CAP1506 concludes *"There is, therefore merit in considering greater use of 'Number Above' metrics as supplemental indicators to help portray noise exposure, but recognising that evidence-based decisions should continue to use $L_{Aeq,16h}$. In this context N65 is preferred over N70 as noise events in many areas are already beginning to occur at levels less than 70 dB L_{ASmax} and are forecast to reduce over time."* (paragraph 8.10)	**16.5)**. N65 has been used as a supplementary metric to provide context to the daytime noise assessment.
CAP 2161: Survey of Noise Attitudes 2014: Aircraft Noise and Sleep Disturbance (Ref. 16.37) CAP 2161 provides further analysis on the research study described above in CAP 1506, principally on the effect of aircraft noise on sleep disturbance. CAP 2161 concludes *"N60 is found to correlate almost as well as L_{Aeq8h} and L_{night}. Based on this exploratory analysis, there is insufficient evidence to change from the current practice of using average summer night $L_{Aeq,8h}$ noise exposure for UK assessments."* (paragraph 8.9)	The $L_{Aeq,8h}$ is used when defining the methodology for identifying significant effects on health and quality of life due to night-time noise exposure and the likely significant effects due to night-time noise change (adverse and beneficial) that arise from the Proposed Development (**Section 16.5)**. N60 has been used as a supplementary metric to provide context to the night-time noise assessment.
CAP 2250: Survey of Noise Attitudes 2014: Aircraft Noise and Annoyance, Further Analysis, 2022 (Ref. 16.38) CAP 2250 provides further analysis on the research study described above in CAP 1506, principally on the effect of runway alternation and respite on annoyance at Heathrow, which is not relevant to the Proposed Development. The technical peer review of CAP1506 (ref 16.39) concludes that the approach of	The methodology proposed by Basner et al has been used to calculate additional awakenings, though a more recent update to the methodology from 2018 has been used, rather than the 2006 version of the methodology. See **Section 16.5**.

Guidance	How and where addressed in ES
calculating additional awakenings using the methodology proposed by Basner et al (2006, Ref 16.40) is robust and well established.	
Independent Commission on Civil Aviation Noise (ICCAN)[6] (now disbanded) A Review of Aviation Noise Metrics and Measurement, 2020 (Ref. 16.41) Recommends an assessment of air noise using LAeq,T based metrics with supplementary metrics used to provide context.	The $L_{Aeq,T}$ metric has been used as the primary metric for the air noise assessment and supplementary noise metrics have been used to provide additional context to the assessment (**Section 16.9**).
Planning Practice Guidance Noise (PPGN) (2019) (Ref. 16.42) Provides guidelines to assist with the implementation of the NPPF and NPSE.	Likely significant effects due to noise exposure and noise change (adverse and beneficial) that arise from the Proposed Development are identified in **Section 16.9**. **Section 16.8**, **16.10,** and **Appendix 16.2** of this ES **[TR020001/APP/5.02]** provide details on how noise effects are managed.
Professional Practice Guidance: Planning and Noise (ProPG) (2017) (Ref. 16.43) ProPG provides planning guidance for the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources. Provides guidance for land use planning for residential developments around airports.	Referenced in **Appendix 16.1** of this ES **[TR020001/APP/5.02]** when defining assessment criteria and the night-time UAEL for surface access noise.
World Health Organisation Guidelines for Community Noise, 1999 (Ref. 16.44) Provides guidelines based on scientific knowledge about the health impacts of community noise.	Referenced when defining the assessment methodology in **Section 16.5**.
World Health Organisation Night Noise Guidelines for Europe, 2009 (Ref. 16.45) Provides guidance on the effects that noise at night can have on sleep.	Referenced when defining the assessment methodology in **Section 16.5**.

[6] ICCAN where disbanded in September 2021, with the Civil Aviation Authority taking on some of its roles from April 2022

Guidance	How and where addressed in ES
World Health Organisation Environmental Noise Guidelines for the European Region, 2018 (Ref. 16.46) The updated guidelines identify a new dose-response relationship between noise and health effects.	Although the dose-response relationship in the new WHO Guidelines is not currently adopted in UK policy, sensitivity testing using the relevant updated relationships in the WHO guidelines has been undertaken and is presented in **Chapter 13** Health and Community of this ES **[TR020001/APP/5.01]**.
BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (Ref. 16.47). Sets out a method for rating and assessing sound of an industrial and/or commercial nature	Used to define the assessment process for fixed plant as required by the Scoping Opinion (see **Table 16.5**).
BS 7445 'Description and Measurement of Environmental Noise' (Ref. 16.48) Sets out the methods for undertaking environmental noise monitoring.	Guidance was referenced when undertaking baseline noise monitoring, as presented in **Section 16.5**.
British Standard 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites Noise' (Ref. 16.49) Sets out methodologies for the calculation and assessment of construction noise.	BS 5228-1 was referenced to define the construction noise assessment methodology in **Section 16.5**. Noise predictions were undertaken using BS 5228-1 calculation methodologies and construction plant noise data was referenced as detailed in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.
British Standard 5228-2:2009+A1:2014: 'Code of practice for noise and vibration control on construction and open sites Vibration' (Ref. 16.50) Sets out methodologies for the calculation and assessment of construction vibration.	BS 5228-2 was referenced to define the construction vibration assessment methodology in **Section 16.5**. Data on vibration from construction activities in BS 5228-2 was referenced for the assessment presented in **Section 16.9**.
BS 7385-2 Evaluation and Measurement for Vibration in Buildings – Part 2 – Guide to Damage Levels from Ground-borne Vibration, 1993 (Ref. 16.51) Provides guidance on assessing vibration induced damage in buildings.	BS 7385-2 was referenced to define the construction vibration assessment methodology in **Section 16.5**.

Guidance	How and where addressed in ES
Calculation of Road Traffic Noise, 1988 (Ref. 16.52) Sets out methodologies for calculating road traffic noise levels.	Methodologies in the Calculation of Road Traffic Noise, as detailed in **Section 16.5**, were applied to calculate road traffic noise for assessments in **Section 16.9**.
Design Manual for Roads and Bridges LA111 (DMRB), 2020 (Ref. 16.53). Sets out methodologies for assessing road traffic noise levels.	Recommended methodology used to assess the impact of changes in road traffic noise (see methodology in **Section 16.5**)

16.3 Scope of the assessment

16.3.1 This section describes the scope of the noise and vibration assessment, including how the assessment has responded to the Scoping Opinion. The temporal and spatial scope, the relevant receptors, and matters scoped in and out are identified. A description of engagement undertaken with relevant technical stakeholders to develop and agree this scope is provided in **Section 16.4**.

Scoping Opinion

16.3.2 The Environmental Impact Assessment (EIA) Scoping Report set out the proposed scope and assessment methodologies to be employed in the EIA and is provided in **Appendix 1.1** and **Appendix 1.2** to this ES **[TR020001/APP/5.05]**.

16.3.3 In response to that Scoping Report, a Scoping Opinion was received from the Planning Inspectorate on 9 May 2019 and is provided in **Appendix 1.3** in of this ES **[TR020001/APP/5.05]**.

16.3.4 **Table 16.5** describes the main matters highlighted by the Planning Inspectorate in the Scoping Opinion and how these have been addressed in this ES. Responses to all comments received in the Scoping Opinion are provide in **Appendix 1.4** of this ES **[TR020001/APP/5.02].**

Table 16.5: Noise and vibration Scoping Opinion comments

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
2.2.24	The Inspectorate understands the relationship between the Proposed Development and the future air space change process, which may not run in parallel. However, the Inspectorate considers that the ES methodology should be compatible with the methodological approaches outlined in the CAA's CAP 1616 and CAP 1616a documents to ensure consistency and continuity between the two assessment processes. Where the ES methodology is not consistent with the CAA's CAP approach, this should be identified and explained.	A comparison between the noise assessment methodologies adopted for the EIA and those recommended in CAP1616a is presented in **Appendix 5.3** in of this ES **[TR020001/APP/5.02]**. This shows that the ES methodology is compatible with the methodological approaches outlined in CAP1616 and 1616a. The only exceptions are the requirement for airspace change proposals to present 'operational diagrams that portray existing traffic patterns and proposed traffic patterns' which are not relevant as they specifically relate to airspace change and the recommended use of 100% L_{Aeq} contours which are described as "additional optional noise metrics" in CAP1616 and are not required in the methodology for identifying adverse noise effects.

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
4.5.1	An assessment of vibration effects arising from construction vehicles on the existing road network should be provided as part of the ES, in line with the methodological approach set out in the Design Manual for Roads and Bridges	A qualitative assessment of construction traffic vibration has been undertaken in line with the methodological approach set out in the Design Manual for Roads and Bridges (DMRB), see **Section 16.9**.
4.5.2	The ES should include an assessment of operational vibration, where likely significant effects could occur.	A qualitative assessment of operational vibration has been undertaken and is presented in **Section 16.9**.
4.5.4	The ES should clearly describe how the monitoring locations have been selected and the extent to which they are agreed with the relevant consultation bodies. The methodology used for the baseline noise surveys should be described in the ES and/or accompanying technical appendices. The baseline year and the baseline noise monitoring year should be consistent.	Details of noise monitoring locations are described in **Section 4** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**, and how they have been agreed with relevant stakeholders is presented in **Section 16.4**. The baseline monitoring was undertaken predominantly in 2019 and 2020 (pre covid restrictions) and this is consistent with the baseline year of 2019. See **Section 16.5** for how the baseline has been defined.
4.5.5	The ES should describe the study area used for the impact assessment and this must be clearly defined and justified in the ES. The Inspectorate considers that the study area should include the Chilterns Area of Outstanding Natural Beauty (AONB) where relevant, including the potential for cumulative noise impacts with other airport development.	The study area used in the impact assessment has been defined and justified in the ES (**Section 16.3**). The study area for the assessment of tranquillity on landscape receptors includes the Chilterns Area of Outstanding Natural Beauty (AONB), see **Chapter 14** Landscape and Visual of this ES **[TR020001/APP/5.01]**.
4.5.8	The ES should define and assess UAEL for the Proposed Development.	UAEL values for each noise source are presented in **Section 16.5**. No receptors are exposed to noise levels exceeding the UAEL.

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
4.5.10	Consistent with BS5228 Table E1, the assessment of construction noise effects should also include criteria for weekends and Saturdays 07:00-13.00. Whilst Example Method 2 in BS5228 makes reference to durations of one month, or more in the consideration of significant effects, the criteria also include the caveat 'unless works of a shorter duration are likely to result in significant effect'. The duration of effect should not be applied as a blanket principle to rule out any likelihood	Criteria for weekends and Saturdays 07:00-13:00 have been included in **Table 16.11**. Duration of effect along with ambient noise conditions and number of receptors affected are considered to inform whether a significant effect is identified when construction noise levels result in an exceedance of the LOAEL.
4.5.11	The text relating to vibration effects appears to mix peak particle velocity (PPV) and vibration dose value (VDV) as assessment criteria. The ES should distinguish between the vibration criteria for human receptors and those for buildings/structures. Relevant LOAEL and SOAEL criteria should be set out for both effects referencing relevant British Standards such as BS6472 and BS7385.	BS 6472 provides guidance on Vibration in terms of Vibration Dose Values (VDV). Section B.2 of BS 5228-2 states that: "*for construction it is considered more appropriate to provide guidance in terms of the PPV, since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage".* The PPV has been used to assess human disturbance due to construction vibration, which is in line with advice provided in BS 5228-2. BS 7385 contains advice on the potential for vibration induced building damage. Human disturbance typically occurs at levels significantly below those required for building damage. Where a likely significant vibration effect relating to human disturbance has been identified, an assessment of significance in terms of building damage will be undertaken. As no significant construction vibration effects are identified (**Section 16.9**) an assessment of building damage based on BS 7385 guidance is not required.
4.5.12	The ES should assess noise impacts associated with	There are no plans to increase rail services specifically in response to the

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
	increased train movements relating to the Proposed Development where likely significant effects could occur.	Proposed Development. Committed improvements (e.g. those relating to Thameslink 20/20 and the new East Midlands Trains Franchise) are included in the "Do Minimum" and "Do Something" scenarios (defined in **paragraph 16.5.48**). The Luton DART (Direct Air-Rail Transit) will be extended as part of the Proposed Development; however, the extension is underground and so no airborne noise assessment is required. A qualitative assessment of operational vibration from the Luton DART has been undertaken and is presented in **Section 16.9**.
4.5.13	The ES should assess on-site noise emissions from fixed plant relating to the Proposed Development where likely significant effects could occur. Static sources should be assessed using BS4142: 2014 Methods for rating and assessing industrial and commercial sound.	A methodology has been defined in **Section 16.5** that will avoid significant noise effects from fixed plant through a requirement to design plant to comply with a specified process during the detailed design that will take place post-consent. The process has been defined following guidance in BS4142 (Ref. 16.47).
4.5.14	The ES should set out the Applicant's noise insulation policy, justifying any change from existing provisions. The policy should explain how it addresses the proposed policy changes set out in 'Aviation 2050: The future of UK aviation. A consultation.' The list of mitigation omits discussion of how embedded measures such as Fixed Electrical Ground Power and use of electrical vehicles can reduce emissions of noise.	Full details on the proposed noise insulation schemes are presented in the **Compensation Policies, Measures and Community First** document submitted with the application for development consent **[TR020001/APP/7.10]**. Embedded mitigation measures, which include the use of Fixed Electrical Ground Power Units, are detailed in **Section 16.8** and additional mitigation measures are detailed in **Section 16.10**. The approach to electric vehicles in the assessment is described in **Section 16.6**.

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
4.5.15	The Scoping Report proposes that a bespoke noise envelope will be developed to provide a mechanism to manage noise impacts. The relationship between the existing noise envelope and the proposed noise envelope must be set out in the ES and the basis for any departure from the established noise envelope must be fully justified. The ES should explain how the Noise Envelope Design Group provides continuity with existing noise controls at the airport and justify the need for any departures from the conditions of the existing operating consent.	A Noise Envelope Design Group has been established to provide recommendations on the contents of the Noise Envelope. Whilst the existing noise controls have not been formalised as a Noise Envelope, there are noise contour limits, movement limits and quota count limits currently in place, which will be superseded by the noise controls in the proposed Noise Envelope. The details of the Noise Envelope, including how aspects of the existing noise controls have been updated, are provided in the **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**. The ANPS defines a noise envelope as more than just setting constraints but also how the benefit of any improvements in aircraft technology will be shared between the airport and affected communities. Further information on the Noise Envelope is provided in **Section 16.8**.

Spatial scope

Study areas

16.3.5 Topic specific guidance has been used to define study area extents which are defined separately for the following sources:

a. Construction noise and vibration;
b. Aircraft air noise;
c. Aircraft ground noise; and
d. Surface access noise.

16.3.6 Where guidance does not define study area extents, study areas are defined by the extent of the Lowest Observed Adverse Effect Level (LOAEL) for the relevant noise source (as defined in **Section 16.5**). The LOAEL is defined in PPGN as "*the level of noise exposure above which adverse effects on health and quality of life can be detected*". The LOAEL is therefore the appropriate threshold for identifying adverse effects on health and quality of life as required by the second aim of the NPSE to "*mitigate and minimise adverse impacts on*

health and quality of life" and the third aim to "*where possible, contribute to the improvement of health and quality of life*". The first aim to "*avoid significant adverse impacts on health and quality of life*" is related to noise levels above the Significant Observed Adverse Effect Level (SOAEL). Since, by definition, the SOAEL occurs at noise levels above the LOAEL, a study area extent defined by the LOAEL allows identification of adverse effects and significant adverse effects on health and quality of life.

16.3.7 The study area for the assessment of tranquillity on landscape receptors includes the Chilterns Area of Outstanding Natural Beauty (AONB), see **Chapter 14** Landscape and Visual of this ES **[TR020001/APP/5.01]**.

Construction Noise and Vibration Study Area

16.3.8 For construction noise and vibration, the study area has been defined as up to 300m from any construction activity or areas where the daytime and night-time construction noise LOAELs have been exceeded (whichever is larger) and the extent of construction traffic access routes. As ground-borne vibration does not propagate as far as noise, this area also captures the construction vibration study area. The Construction Noise and Vibration Study Area is illustrated in **Figure 16.2** of this ES **[TR020001/APP/5.03]**.

Air Noise Study Area

16.3.9 The study area for air noise has been defined based on guidance within Air Navigation Guidance, which states: "*Below 4,000 feet, there is a strong likelihood that aircraft could create levels of noise exposure above the LOAELs identified above, which is reflected in the Altitude Based Priorities*". In addition, the largest of the baseline and Do-Something (defined in **paragraph 16.5.48)** daytime and night-time LOAEL air noise contours across all assessment scenarios have been used to define extents of the air noise study area. The Air Noise Study Area is illustrated in **Figure 16.1** of this ES **[TR020001/APP/5.03]**.

16.3.10 The air noise study area does not contain any overlap with other airport LOAEL contours and so there is no need to consider noise from other airports in the assessment. Potential cumulative impacts for aircraft noise outside the Lowest Observed Adverse Effect Level (LOAEL) and up to 7,000ft will be assessed through the separate Airspace Change Proposals if there are anticipated to be any cumulative impacts between Luton and other airports, including Heathrow.

Ground Noise Study Area

16.3.11 For ground noise, the study area has been defined based on the largest of the baseline and Do Something (defined in **paragraph 16.5.48**) daytime and night-time LOAEL ground noise contours. The Ground Noise Study Area is illustrated in **Figure 16.2** of this ES **[TR020001/APP/5.03]**.

Surface Access Noise Study Area

16.3.12 The assessment of surface access noise accounts for all road links in the strategic traffic model described in **Chapter 18** Traffic and Transportation of this ES **[TR020001/APP/5.01]**. The study area for surface access noise is defined

based on the extents of the study area for the Transport Assessment, as detailed in **Chapter 18** Traffic and Transportation of this ES **[TR020001/APP/5.01]**. It covers all noise sensitive receptors with road traffic noise levels dominated by the traffic on the roads within the strategic traffic model. As such, it covers all noise sensitive receptors expected to experience changes in road traffic noise as a result of the Proposed Development.

16.3.13 The surface access noise study area is split into a calculation area covering most of Luton and the region around the airport and a wider study area covering the remainder of the road links in the traffic model. The definition of these areas, with reference to DMRB, is provided in **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]** and the calculation area is illustrated in **Figure 16.1** of this ES **[TR020001/APP/5.03]**.

Zone of influence

16.3.14 The Zone of Influence for the noise and vibration assessment covers the combined Study Areas for each assessment topic. The full cumulative effects assessment is provided in **Chapter 21** In-Combination and Cumulative Effects of this ES **[TR020001/APP/5.01]**.

Temporal Scope

16.3.15 For the purposes of assessment, three assessment phases are considered as described in **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**. A summary of the assessment phases for the Core Planning Case is presented in **Table 16.6**.

Table 16.6: Summary of assessment phases in the Core Planning Case

Assessment Phase	Maximum passenger capacity	Construction start year	Construction Completion year	Year predicted passenger capacity reached (assessment year)
Assessment Phase 1	21.5 mppa	2025	2027	2027
Assessment Phase 2a	27 mppa	2033	2036	2039
Assessment Phase 2b	32 mppa	2037	2041	2043

Receptors

16.3.16 This section identifies noise and vibration sensitive receptors that could experience significant effects on health and quality of life or likely significant effects due to noise exposure and noise change from the Proposed Development. The identified receptors are summarised in **Table 16.7**.

Table 16.7: Receptor types

Receptor Group	Receptors in Group
Residential receptors	People, primarily where they live ('residential receptors'), in terms of individual households, nursing homes and care homes and on a wider community basis. This includes any shared community open areas[7] (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).
Non-residential receptors	Non-residential community facilities such as schools, hospitals, places of worship, and noise sensitive commercial properties (see **Table 16.18** for examples), collectively described as 'non-residential receptors'.

Matters scoped in

16.3.17 In line with the Scoping Opinion, the noise and vibration assessment includes assessment of the following noise and vibration sources:

a. construction noise;
b. construction vibration;
c. construction traffic noise;
d. construction traffic vibration;
e. operational air noise;
f. operational ground noise;
g. surface access road traffic noise;
h. fixed plant noise; and
i. operational vibration.

Matters scoped out

16.3.18 The following assessment has been scoped out as agreed through the Scoping Opinion and in consultation with the Noise Working Group (a stakeholder engagement group whose membership is defined in **Section 16.4**).

Operational road traffic vibration

16.3.19 Road traffic vibration has the potential to affect buildings and disturb occupiers. However, DMRB states that "*Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of project design and under general maintenance, so*

[7] 'shared community open areas' are those identified by PPGN that may partially offset noise impacts experienced by people in their households that are either a) a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance)

operational vibration will not have the potential to lead to significant adverse effects." Given that the condition of road surfaces on the majority of the highway network is outside the scope of the Proposed Development, with only localised junction improvements proposed, an assessment of road traffic vibration has been scoped out.

16.4 Stakeholder engagement and consultation

2019 and 2022 statutory consultation

16.4.1 The **Consultation Report** and appendices submitted with the application for development consent **[TR020001/APP/6.01]** and **[TR020001/APP/6.02]** contains a full account of the previous statutory consultation process and issues raised in feedback, as well as responses to feedback and how relevant feedback has been addressed in the noise and vibration assessment.

Technical engagement

16.4.2 Engagement in relation to noise and vibration has been undertaken with a number of prescribed and non-prescribed stakeholders. Consultation on noise and vibration with relevant local authorities has primarily been through the establishment of a Noise Working Group, which has been set up to facilitate ongoing discussion regarding scope, method and assessment findings. The Noise Working Group includes representation from the following boroughs and districts:

a. Luton Borough Council (LBC);
b. North Hertfordshire District Council (NHDC);
c. Central Bedfordshire Council (CBC);
d. Dacorum Borough Council (DBC);
e. Hertfordshire County Council (HCC)
f. Stevenage Borough Council (SBC);
g. Welwyn Hatfield Borough Council (WHBC);
h. East Herts District Council (EHDC);
i. St Albans City and District Council (SCDC);
j. Buckinghamshire County Council (BCC); and
k. Suono (formerly Cole Jarman, CJ), representing the host authorities.

16.4.3 In addition to the Noise Working Group, a Noise Envelope Design Group has been set up to assist in defining the Noise Envelope submitted as part of the application for development consent (see **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**). Details on the Noise Envelope are provided in **Section 16.8**. Membership of the Noise Envelope Design Group includes the following:

a. Independent Chair;
b. Independent acoustic expert;
c. Luton Rising;
d. London Luton Airport Operations Limited (LLAOL, the current operator of the airport);
e. National Air Traffic Services;

f. Independent Commission on Civil Aviation Noise (ICCAN, now disbanded)[8];
g. easyJet (eJ), representing commercial airlines;
h. DHL, representing cargo operators;
i. Signature Flight Support (SFS), representing fixed base operators;
j. Luton Borough Council (LBC);
k. Hertfordshire County Council (HCC);
l. North Hertfordshire District Council (NHDC);
m. Central Bedfordshire Council (CBC);
n. Buckinghamshire County Council (BCC);
o. Bedford Chamber of Commerce (BCCo); and
p. Suono (formerly Cole Jarman, CJ), independent consultant representing the host authorities;
q. Luton and District Association for Control of Aircraft Noise (LADACAN), representing community groups; and
r. London Luton Airport Town and Village Community Committee (LLATVCC, now disbanded).

16.4.4 **Table 16.8** provides a summary of engagement with relevant stakeholders, undertaken to inform the EIA, including the date and time of meetings and a summary of discussions to resolve matters raised.

Table 16.8: Stakeholder engagement relating to noise and vibration

Meeting name and date	Attendees (organisation)	Summary of discussion
Noise monitoring methodology email dated 21 June 2018	The Applicant and representatives Noise Working Group – LBC, NHDC, SBC, CBC, DBC, WHBC, EHDC, SCDC, BCC	The Noise Working Group was consulted on the noise monitoring through a request to comment on a proposed methodology. Through this process, an approach to determining baseline conditions at communities affected by noise generated by airport operations was agreed. This agreed approach was followed when undertaking baseline noise monitoring.
Noise and Vibration Scoping Meeting 25 January 2019	The Applicant and representatives Noise Working Group – LBC, NHDC, SBC, DBC, BCC	A presentation on the contents of the scoping report, which covered the scope and methodology of the assessment, was made to the Noise Working Group. The Noise Working Group was given the opportunity to discuss the contents of the

[8] Whilst it has been confirmed that the Civil Aviation Authority will take on some of the duties of ICCAN, at the time of preparation of the Noise Envelope, the CAA's role with regards to Noise Envelopes was not yet confirmed.

Meeting name and date	Attendees (organisation)	Summary of discussion
		scoping report and request clarification on any topic.
Noise and Vibration ES Results 5 September 2019	The Applicant and representatives Noise Working Group – NHDC, SBC, DBC, BCC, CBC, SCBC	A presentation on the assessment methodology and results presented in the 2019 PEIR was made to the Noise Working Group. The Noise Working Group were asked for feedback on the draft 2019 PEIR, and it was discussed how ongoing work to be undertaken for the ES could be refined for a further assessment.
Noise Working Group Meeting on Statutory Consultation feedback 3 March 2021	The Applicant and representatives Noise Working Group – NHDC, BCC, LBC, DBC	A presentation on statutory consultation feedback was made to the Noise Working Group. Details on how feedback would be addressed in future work was provided.
Noise Working Group Meeting on the 2022 PEIR, 3 February 2022	The Applicant and representatives Noise Working Group – BCC, LBC, EHDC, WHBC	A presentation on the assessment methodology and results presented in the 2022 PEIR was made to the Noise Working Group. The Noise Working Group were asked for feedback on the draft 2022 PEIR, and it was discussed how ongoing work to be undertaken for the ES could be refined for a further assessment.
Noise Working Group Meeting to discuss 2022 Statutory Consultation Feedback, 21 July 2022	The Applicant and representatives Noise Working Group – EHDC, NHDC, LBC, BCC, SCBC, WHBC	Feedback received from the local authorities during the 2022 Statutory Consultation was discussed and proposals were presented as to how they would be addressed in the ES.
Noise Working Group meeting to discuss key assessment topics and the draft Statement of Common Ground, 1 December 2022	The Applicant and representatives Noise Working Group – LBC, NHDC, EHDC, Suono	An update was provided on key assessment topics raised through statutory consultation feedback and previous meetings. The approach to developing the draft Statement of Common Ground was agreed.
Noise Working Group meeting to discuss the draft Statement of Common	The Applicant and representatives	The draft Statement of Common Ground was discussed and the NWG provided preliminary feedback on it.

Meeting name and date	Attendees (organisation)	Summary of discussion
Ground, 9 January 2023	Noise Working Group – LBC, NHDC, WHBC, HCC, Suono	
Noise Envelope Design Group meeting 14 October 2019	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, NATS, eJ, SFS, DHL, LBC, AVDC, NHDC, LADACAN, LLATVCC	The following points were discussed: a. The requirement to establish a Noise Envelope Design Group b. The purpose and objectives of the Noise Envelope Design Group; and c. Confirmation of the Terms of Reference.
Noise Envelope Design Group meeting 13 November 2019	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, eJ, DHL, SFS, CBC, AVDC, HCC, NHDC, CJ LADACAN, LLATVCC	The following points were discussed: a. An enforcement regime; b. Noise management controls for discussion to include aircraft movement caps, noise contour area and shape, noise quota counts, noise violation limits, supplementary metrics; c. Noise Envelope Design Group process and management issues; and d. A presentation of noise contours predictions was also given to the group.
Noise Envelope Design Group meeting 4 December 2019	The Applicant and representatives Noise Envelope Design Group – Chair, eJ, DHL, NATS, SFS, LBC, CBC, AVDC, LADACAN, CJ	The following points were discussed: a. The relative pros and cons of each noise management control b. Noise Envelope Design Group review periods post-submission of the DCO application c. Enforcement regime A presentation of Project movement forecasts was given to the group
Noise Envelope Design Group meeting 17 December 2019	The Applicant and representatives Noise Envelope Design Group – Chair, eJ, CBC, AVDC, HCDC, CJ, LADACAN, LLATVCC	The following points were discussed: a. A Draft Position Paper on Movement Caps b. The relative pros and cons of movement caps were discussed

Meeting name and date	Attendees (organisation)	Summary of discussion
Noise Envelope Design Group meeting 8 January 2020	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, eJ, SFS, CBC, AVDC, HCC, CBC, BCCo, CJ, LADACAN, LLATVCC	The following points were discussed: a. A Draft Position Paper on Noise Violation Limits b. Cole Jarman presented an Addendum to Draft Position Paper on Noise Violation Limits c. The relative pros and cons of noise violation limits were discussed
Noise Envelope Design Group meeting 22 January 2020	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, SFS, DHL, CBC, AVDC, NHDC, LBC, CJ, LADACAN, LLATVCC	The following points were discussed: a. A Draft Position Paper on Quota Systems b. Cole Jarman presented an Addendum to the Draft Position Paper on Quota Systems c. The relative pros and cons of noise violation limits
Noise Envelope Design Group meeting 5 February 2020	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, SFS, DHL, NATS CBC, HCC, BCCo, AVDC, NHDC, LBC, CJ, LADACN, LLATVCC	The following points were discussed: a. A Draft Position Paper on Noise Contours b. The relative pros and cons of noise violation limits c. LAeq,T contours to be retained as a control measure d. 'Number above'[9] contours to be used for information only
Noise Envelope Design Group meeting 11 March 2020	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, SFS, DHL, NATS CBC, AVDC, NHDCC, LBC, CJ, LADACAN, LLATVCC	The following points were discussed: a. A review of noise control measure discussions and a discussion of alternative measures that may be adopted b. A paper on how enforcement of the Noise Envelope may work
Noise Envelope meeting 25 March 2020	The Applicant and representatives Noise Envelope Design Group – Chair, CJ	Discussion of feedback on noise control measures.

[9] Contours that provide information on the number of aircraft movements that exceed 65 dB L_{ASmax} during the daytime and 60 dB L_{ASmax} during the night-time.

Meeting name and date	Attendees (organisation)	Summary of discussion
Noise Envelope Design Group meeting 8 July 2020	The Applicant and representatives Noise Envelope Design Group – Chair, ICCAN, SFS, DHL, NATS HCC, LBC, AVDC, CBC, CJ LADACAN, LLATVCC	The following points were discussed: a. It was agreed how the noise model will be validated b. 'Number above' contour banding c. Quota Count (QC) tolerances d. Noise monitoring location at 2.5 km from start-of-roll[10] e. Use of a fixed modal split for testing compliance with noise contour thresholds and limits f. Implementation of a 3 to 5-year review process to ensure that noise control measures remain relevant g. Discounted movements that will not contribute to noise contours A draft Interim Report to be prepared by the Applicant's representatives covering: a. how noise is controlled and measured b. the type of metrics to be applied c. the general principles of enforcement
Noise Envelope Design Group meeting 17 September 2020	The Applicant and representatives Noise Envelope Design Group – Chair, ICCAN, LLAOL, eJ, DHL, HCC, LBC, BCC, CJ, LADACAN, LLATVCC	The following points were discussed: a. Contents of the draft Interim Report with a view to finalising b. Noise model validation c. Way forward for the Noise Envelope Design Group
LADACAN AND LLATVC meeting on noise model validation 17 June 2021	The Applicant and representatives LADACAN LLATVCC	A detailed presentation on noise model validation was provided to LADACAN and LLATVCC to provide more detail to interested parties in lieu of a presentation to the Noise Envelope Design Group
Noise Envelope Design Group meeting 13 July 2021	The Applicant and representatives Noise Envelope Design Group[11]	The following points were discussed: a. Headline passenger forecasts

[10] The position on the runway that departing aircraft typically start moving as part of their take-off procedure.
[11] A record of attendance is not available for this meeting

Meeting name and date	Attendees (organisation)	Summary of discussion
		b. Updated on the agreed noise model validation c. Green Controlled Growth
Noise Envelope Design Group meeting 7 November 2021	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, DHL, CBC, NHDC, BCC, Suono, LADACAN	Presentations were provided to the Noise Envelope Design Group as follows: a. Update from Luton Rising (a trading name of London Luton Airport Limited) on DCO project milestones b. Update on passenger forecast modelling and fleet mix modelling c. Update on the agreed noise model validation
Noise Envelope Design Group meeting 7 December 2021	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, LBC, NHC, Suono, LADACAN	Presentations were provided to the Noise Envelope Design Group as follows: a. suggested metrics against the controls for the Noise Envelope b. use of noise contours as basis for setting thresholds and limits
Noise Envelope Design Group meeting 14 September 2022	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, SFS, DHL, LBC, NHDC, HCC, CBC, BCC, Suono, LADACAN	The developing Noise Envelope and Green Controlled Growth proposals, including how they had been informed by the Noise Envelope Design Group Interim Report and 2022 Statutory Consultation responses, were presented for discussion with the Noise Envelope Design Group.
Noise Envelope Design Group meeting 12 October 2022	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, DHL, SFS, LBC, NHDC, CBC, BCC, Suono, LADACAN	A draft discussion paper and presentation was provided on the concept of 'sharing the benefits' in aviation noise policy, and how the Noise Envelope will provide a mechanism for sharing the benefits between industry and communities. Responses were provided to Noise Envelope Design Group comments on material shared in the previous meeting.
Noise Envelope Design Group meeting 28 October 2022	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, SFS,	The draft Green Controlled Growth and Noise Envelope document, including the proposed Limits and Thresholds, were presented to the Noise Envelope Design Group for their feedback. The process for

Meeting name and date	Attendees (organisation)	Summary of discussion
	LBC, BCC, NHDC, Suono LADACAN.	writing the final Noise Envelope Design Group report was agreed.
Noise Envelope Design Group meeting 21 November 2022	The Applicant and representatives Noise Envelope Design Group – Chair, LLAOL, SFS, LBC, HCC, BCC, CBC, NHDC, Suono, LADACAN	The draft Noise Envelope Final report was presented and discussed. The process for finalising the report was agreed.
CAA Meeting on 2022 Statutory Consultation feedback 20 September 2022	The Applicant's representatives Civil Aviation Authority	Feedback received from the Civil Aviation Authority during the 2022 Statutory Consultation was discussed and proposals were presented as to how they would be addressed in the ES. The appropriate evidence for next-generation aircraft noise levels were discussed and agreed. CAA's views on the need and scope for an airspace change sensitivity test was discussed.
PHE Meeting on 2019 Statutory Consultation feedback 24 November 2020	The Applicant's representatives Public Health England (now UK Security Health Agency)	Feedback received from PHE Authority during the 2019 Statutory Consultation was discussed and proposals were presented as to how they would be addressed in the ES.
UKHSA Meeting on 2022 Statutory Consultation feedback 20 October 2022	The Applicant's representatives UK Security Health Agency	Feedback received from PHE Authority during the 2022 Statutory Consultation was discussed and proposals were presented as to how they would be addressed in the ES and in a draft Statement of Common Ground.
UKHSA Meeting on 2022 draft Statement of Common Ground 13 December 2022	The Applicant's representatives UK Security Health Agency	The contents of the draft Statement of Common Ground relating to noise were discussed and the process for finalising the Statement of Common Ground was agreed.

16.5 Methodology

Overview

16.5.1 This section outlines the methodology employed for assessing the likely significant effects on noise and vibration from the construction and operation of the Proposed Development. Further details on the methodology are provided in **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

Baseline methodology

16.5.2 The general approach to defining future baseline is described in **Section 5.4** of **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**. The future baseline considered for noise and vibration is described **Section 16.7** of this chapter.

Defining the assessment baseline

16.5.3 A baseline year of 2019 was selected for the noise assessment. This year represents the last year of normal activity at the airport pre-Covid pandemic. Although it is acknowledged that, in 2019, existing noise contour limits[12] were exceeded for both day and night periods, the use of 2019 as a baseline is to identify if there will be any changes to health and quality of life from the last year of typical operating conditions.

16.5.4 With reference to The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) (Ref. 16.6) (which refers to the baseline scenario as "*a description of the relevant aspects of the current state of the environment*"), it is considered appropriate to model the noise impact that occurred in 2019 using actual air traffic movement data to represent the 'current baseline' and allow a comparison against actual experienced noise conditions. This baseline is referred to as the 2019 Actuals baseline.

16.5.5 The use of the 2019 Actuals baseline is also in line with the Scoping Opinion that notes at 4.5.4 that "*The baseline year and the baseline noise monitoring year should be consistent*". The baseline monitoring (field measurements to inform noise model validation and characterisation of existing environment) was undertaken predominantly during 2019 and 2020.

16.5.6 However, in response to statutory consultation feedback, a sensitivity test has been undertaken using a '2019 Consented' baseline modelled using a theoretical 2019 fleet that would have been compliant with the current consented short-term noise limit. Results of the sensitivity test are presented in **Section 16.9** and **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.5.7 The assessment of likely significant effects focuses on the use of a future baseline representing the situation in future assessment years without the Proposed Development. The future air noise baseline is compliant with the

[12] Current consented short-term noise contour limits for the airport were established in 2014 under Condition 10 of granted planning consent 12/01400/FUL. Noise contour limits, as modelled using INM, were set at 19.4 km^2 for the daytime 57dB$L_{Aeq,16h}$ noise contour and 37.2 km^2 for the night-time 48dB$L_{Aeq,8h}$ noise contour.

airport's current consented long term noise limits in each assessment year and therefore demonstrates a scenario where the airport is operating within its consented noise limits (see **Section 16.7**).

16.5.8 To define consistent and representative baseline noise levels at community locations across the study area and to enable consistent comparison with future baseline, 'Do Minimum' and 'Do Something' scenarios (defined in **paragraph 16.5.48**), the baseline for air noise and road traffic noise has been validated and calculated as described below.

16.5.9 The 2019 air noise baseline was defined through noise modelling using the Aviation Environmental Design Tool (AEDT) and 2019 aircraft movement data for the 92-day summer period (16 June to 15 September inclusive). The 2019 air noise baseline is defined in **Section 16.7** and illustrated in **Figure 16.5** for daytime noise and **Figure 16.6** for night-time noise **[TR020001/APP/5.03].** The air noise model was validated using 2019 radar track data and measured noise data from LLAOL's permanent and temporary monitoring stations. Details on noise data used for validation and the model validation method are provided in **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.5.10 Overflight contours for the 2019 air noise baseline are presented in **Figure 16.7** for daytime and **Figure 16.8** for night-time **[TR020001/APP/5.03]**. N65 and N60 contours (see **Table 16.15**) for the 2019 air noise baseline are presented in **Figure 16.9** and **Figure 16.10** respectively **[TR020001/APP/5.03]**.

16.5.11 The 2019 ground noise baseline is presented in **Figure 16.103** for daytime and **Figure 16.104** for night-time **[TR020001/APP/5.03]**.

16.5.12 The 2019 surface access noise baseline is presented in **Figure 16.11** for daytime and **Figure 16.12** for night-time **[TR020001/APP/5.03]**. The road traffic noise model, which is based upon the strategic traffic model described in **Chapter 18** Traffic and Transportation of this ES **[TR020001/APP/5.01]**, has been validated against measured baseline noise data and the results of this validation are presented in **Section 16.7**.

Baseline noise monitoring methodology

16.5.13 Two types of baseline noise monitoring have been undertaken to inform the noise assessment as described in **Table 16.9**. The monitoring is further described in the following subsections.

Table 16.9: Description and purpose of baseline noise monitoring

Baseline noise monitoring	Description	Purpose
Aircraft noise monitoring	Measurement of individual aircraft noise events using LLAOL's permanent and temporary noise monitoring terminals.	Used to validate the aircraft noise model by comparing measured noise levels of individual aircraft types to those predicted by the aircraft noise model.
Ambient noise monitoring	Measurement of all sound sources (ambient noise) at community locations. Noise monitoring was undertaken at locations agreed with the Noise Working Group (see **Section 16.4**) and at additional locations identified through 2019 statutory consultation (see **Section 4** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**).	Used to inform the baseline for the construction noise assessment. Used to validate the baseline road traffic noise levels at key road links in the surface access study area. Used to provide context to the aircraft noise assessment identification of likely significant effects.

Aircraft noise monitoring methodology

16.5.14 Noise data is continually measured by LLAOL at their permanent and temporary monitoring locations. Data collected predominantly in 2019 was used to validate the air noise model. This validation requires comparison of measurements of individual aircraft noise events against predictions from the noise model. The validation is therefore not affected by the change in number of aircraft movements between the summer and winter periods or from one year to another. Nevertheless, it was considered relevant to focus the measurements used for validation on the baseline year, and the 92-day summer period from 16 June to 15 September as far as possible.

16.5.15 Noise monitoring locations for the air noise model validation are presented in **Table 16.10** and **Figure 16.3 [TR020001/APP/5.03]**. These locations are located within the LOAEL contours within which there is reasonable certainty about aircraft altitude and lateral position. Although LLAOL have undertaken monitoring at more locations in 2019 than listed in **Table 16.10**, these locations were at distances from the airport that are outside the LOAEL contours so validation at these locations would not affect the air noise assessment. Additionally, there is substantial variation in aircraft altitude and lateral position at locations outside the LOAEL contours, which introduces a high level of uncertainty when validating against the average profile required by the aircraft noise model.

16.5.16 LLAOL's permanent noise monitors were installed in 2004, prior to the publication of the ISO standard on unattended airport noise monitoring in 2009 (Ref. 16.54). Guidance from the CAA (Ref. 16.35) notes that compliance with the ISO standard is only required for what they define as 'Category A' airports (Luton is 'Category C'). However, a commitment has been made within the Noise Monitoring Plan of GCG that, as the airport expands, the airport operator will review and, if necessary, improve the noise monitoring stations in line with ISO standards (see **Appendix C** of **Green Controlled Growth Framework [TR020001/APP/7.08]**).

16.5.17 Further details on monitoring results at the locations in **Table 16.10** are presented in **Section 4** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

Table 16.10: Air Noise Monitoring Locations used for validation of the aircraft noise model

Monitoring Location ID	Location	Monitoring Period
LTN_KNS	Kensworth	Apr-Jun 2019
LTN_CAD	Caddington	Apr-Jul 2019
LTN_DGN	Dagnall	May-Jul 2019
LTN_MRK	Markyate	Jun-Oct 2019
LTN_FLM	Flamstead	Jun-Oct 2019
LTN_STV	Stevenage	Aug-Oct 2019
LTN_BG	Breachwood Green	Oct-Dec 2019
LTN_SLTN	South Luton	Oct-Dec 2019
LTN_PPR	Pepperstock	Feb-Mar 2020
NMT01	Frogmore	June-Sep 2019
MNT02	Grove Farm, Slip End	June-Sep 2019
NMT03	Pepsal End Farm, Pepperstock	June-Sep 2019

Ambient noise monitoring methodology

16.5.18 Ambient noise monitoring has been undertaken following the principles in BS 7445-1 2003. The geographical extent of noise monitoring at community locations was based on the possible extent of potential adverse noise impacts arising from the Proposed Development, and monitoring locations were agreed through consultation with the Noise Working Group.

16.5.19 Ambient noise monitoring was undertaken during periods from 2018 to 2021[13]. Whilst ambient noise conditions may have changed in the intervening period, a change in noise of 1 dB would require either an approximate 20% reduction or a 25% increase in noise energy. As this level of change is unlikely in the intervening period between monitoring and submission of this ES, noise data is

[13] All noise monitoring was undertaken prior to covid restrictions in 2020, the only exception being road traffic noise monitoring undertaken in the Tea Green area in 2021

considered to be suitably representative of typical noise conditions at each monitoring location and suitable for the purpose for which it is intended.

16.5.20 Noise measurements are intended to cover a 'snapshot' of the existing soundscape at any location. Although the assessment of air noise is based on the 92-day summer period[14], it is not practical to measure at all locations during this period. Nevertheless, the noise data do provide relevant information on the current exposure from all sources at each location including those associated with the airport.

16.5.21 Meteorological conditions recorded by the London Luton Airport weather station have been used to identify periods of adverse weather conditions[15] over the unattended monitoring periods. These periods have been removed from the monitoring results. This is typical for unattended noise surveys over a long period of time (the average measurement duration was 21 days) and is not considered to be a material limitation in the ambient sound survey methodology. It is important to note that this data is used to provide context for the air noise assessment, and does not affect the identification of significant effects, which are based on outputs from the noise modelling. Full details of the noise monitoring, including identified periods of adverse weather that have been removed, are presented in **Section 4** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.5.22 The measurement locations are illustrated in **Figure 16.3a** and **Figure 16.3b** of this ES **[TR020001/APP/5.03]**. Details on baseline noise monitoring and noise monitoring results along with descriptions of the dominant and secondary noise sources from observations made at the start and end of the measurements are presented in **Section 4** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

Concepts for assessing noise

16.5.23 The NPSE sets definitions for 'significant adverse effects' and 'adverse effects' using the concepts:

a. Lowest Observed Adverse Effect Level (LOAEL) – the level above which adverse effects on health and quality of life can be detected; and

b. Significant Observed Adverse Effect Level (SOAEL) – the level above which significant adverse effects on health and quality of life can occur.

16.5.24 The NPSE states that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

16.5.25 Noise levels exceeding the SOAEL should be avoided as far as reasonably practicable. For noise levels exceeding the LOAEL, the NPSE states that:

[14] Period from 16 June to 15 September inclusive
[15] Adverse weather conditions may affect noise measurements and are periods of rain and wind speeds exceeding 5 m/s.

"It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur".

16.5.26 It is a requirement of the NPPF to prevent new developments causing unacceptable adverse impacts. PPGN defines this as:

"*Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress".*

16.5.27 This is referred to as the unacceptable adverse effect. For air noise, a precautionary Unacceptable Adverse Effect Level (UAEL) has been determined at the level where voluntary acquisition of a property or temporary rehousing would be offered.

16.5.28 Whilst it is necessary for assessment purposes to define single thresholds for LOAELs, SOAELs and UAELS for each noise source and time period, it is acknowledged that an individual's response to noise will vary across a population, and that the onset of noise and health effects varies according to the health outcome (e.g. annoyance, sleep disturbance and cardiovascular effects). For more information on the different health effects and how they relate to LOAELs and SOAELs, please see **Appendix 13.4** of this ES **[TR020001/APP/5.02]**.

16.5.29 The noise management measures embedded into the Proposed Development (see **Section 16.8**) collectively meet the second and third aims of Government noise policy to mitigate and minimise adverse effects (above the LOAEL) on health and quality of life from noise and where possible contribute to improvements in health and quality of life from noise.

16.5.30 The compensatory mitigation measures (i.e. noise insulation, see Section **16.10**) have been developed so that in combination with the embedded noise management measures they meet the first aim of Government noise policy to avoid significant adverse effects (above the SOAEL) on health and quality of life from noise. This is achieved through the noise insulation scheme which contains eligibility criteria in line with, and below, the relevant SOAEL values.

16.5.31 Further information on the approach to noise management (mitigation and compensation) and how the aims of Government noise policy have been used to define the noise mitigation hierarchy is presented in **Section 16.8** and **Appendix 16.2** Operational noise management (explanatory note) of this ES **[TR020001/APP/5.02]**.

Construction assessment methodology for residential receptors

Construction Noise

16.5.32 The construction assessment is of a new, temporary source of noise and vibration and is based on an assessment of absolute noise or vibration levels in terms of LOAEL and SOAEL. The method for assessing construction noise

effects is defined based on the current industry standard approach. Criteria for assessing construction noise effects have been defined with reference to 'example method 1 – the ABC method' as defined in Annex E of BS 5228 1:2009+A1:2014 (Ref. 16.49).

16.5.33 Criteria for assessing construction noise are presented in **Table 16.11**. The LOAEL and SOAEL for construction noise are defined in DMRB and, although there is currently a lack of evidence relating to health effects due to construction and earthworks noise, their use has been accepted as appropriate in other consented major schemes[16]. The UAEL for construction noise is based on the trigger level for temporary rehousing as set out in section E.4 of BS 5228-1.

Table 16.11: Thresholds of potential effects of construction noise at residential buildings

Time Period	Threshold Value ($L_{Aeq,T}$ dB) (façade)		
	LOAEL	SOAEL	UAEL
Day (07:00 – 19:00) Saturday (07:00 – 13:00)	65	75	85
Evening (19.00 – 23.00) Weekends (13.00–23.00 Saturdays and 07.00–23.00 Sundays)	55	65	75
Night (23.00 – 07.00)	45	55	65

16.5.34 Although a significant effect due to construction activities may be determined through an assessment based on exceedances of the defined SOAELs for construction noise, consideration of the significance of the effect for temporary construction activities exceeding the LOAEL is undertaken through qualitative consideration of the following:

a. duration of activities;
b. frequency of events;
c. number of receptors; and
d. sensitivity of receptors.

16.5.35 In terms of sound insulation or temporary rehousing due to construction noise, BS 5228-1 states that a property would be eligible if exposed to noise "f*or a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months*". Consequently, these durations have been considered in the identification of significant effects.

Construction Vibration

16.5.36 When defining assessment criteria, reference has been made to BS 5228-2:2009+A1:2014, which provides descriptions of the impact of vibration in terms

[16] For example High Speed 2, A14 Cambridge to Huntingdon, Thames Tideway and Manston Airport

of PPV on human receptors. The PPV is applied to assess construction vibration in accordance with Section B.2 of BS 5228-2, which states that:

"*for construction it is considered more appropriate to provide guidance in terms of the PPV, since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage".*

16.5.37 Human disturbance typically occurs at levels significantly below those required for building damage. Where a likely significant vibration effect relating to human disturbance has been identified, an assessment of significance in terms of building damage has been undertaken with reference to guidance in BS 7385-2.

16.5.38 Criteria for assessing construction vibration are presented in **Table 16.12**. These PPV values are defined as LOAEL and SOAEL in DMRB.

Table 16.12: Thresholds of potential effects of construction vibration on occupants of residential buildings

Time Period	Threshold Value Peak Particle Velocity (mm/s)		
	LOAEL	SOAEL	UAEL
All time periods	0.3	1.0	10.0
Description of effect (BS 5228-2)	Vibration might be just perceptible in residential environments.	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Construction traffic noise

16.5.39 The assessment of construction traffic noise effects applies the LOAEL and SOAEL defined in **Table 16.16** and the short-term assessment criteria from DMRB presented in **Table 16.17.**

Construction traffic vibration

16.5.40 A qualitative assessment of construction traffic vibration has been undertaken in line with the methodological approach set out in the DMRB.

Operational assessment methodology for residential receptors

Assessment years and assessment phases

16.5.41 Paragraph 5.52 of the ANPS requires a noise assessment to be undertaken at the time the airport is forecast to reach full capacity and at a point when the airport's noise impact is forecast to be highest. Consequently, the following assessment years in each of the assessment phases are considered in the assessment of operational noise to cover the Proposed Development when it reaches full capacity and its noise impacts are forecast to be highest, and in intervening years when the maximum passenger capacity is reached in each phase:

a. Assessment phase 1, 2027 – Terminal 1 passenger throughput 21.5 mppa;
b. Assessment phase 2a, 2039 – Terminal 2 reaches passenger throughout of 27 mppa; and
c. Assessment phase 2b, 2043 – Terminal 2 completed and airport at full capacity of 32 mppa.

Aircraft air and ground noise

16.5.42 When describing aircraft, two terms are used in this chapter:

a. 'new generation' – these are aircraft that are currently in service in relatively small but increasing numbers (i.e. Airbus Neo and Boeing 737 MAX) and their transition into the fleet can be predicted with a reasonable degree of accuracy into the mid-2030s. These aircraft are forecast to form the vast majority of the fleet by 2039; and
b. 'next generation' – these are aircraft that will utilise future technologies (which includes sustainable aviation fuel, hydrogen and electric) that are currently in development. The 'next generation' aircraft that are expected to start to become available in the mid-2030s (and the subsequent generation expected after that in the 2050s) do not yet exist and their noise performance is unknown. Although the ES air noise assessment assumes these aircraft will perform no better than new generation aircraft as a reasonable worst case, there are mechanisms in the Noise Envelope within the **Green Controlled Growth Framework [TR020001/APP/7.08]** for reducing noise limits to account for any noise improvement from next generation aircraft (see **Section 16.8**). A sensitivity test has been undertaken to demonstrate the potential benefit from next-generation aircraft. This sensitivity test is summarised in **Section 16.9** and presented in **Section 12** of **Appendix 16.1** of the ES **[TR020001/APP/5.02]**.

16.5.43 To date, LLAOL have produced their noise contours with the Integrated Noise Model (INM) software, which was replaced by AEDT in 2015. Both software packages were produced by the US Federal Aviation Administration (FAA). INM is no longer supported by the FAA and is considered to be a legacy software package. Therefore, AEDT was used to produce noise contours for pre-application assessments and in this ES.

16.5.44 The noise contours produced by the two models are reasonably similar at higher contour bands, but the contours diverge more noticeably at lower contour bands where contours produced using AEDT are, on average, larger than those produced by INM. As such, the results of noise modelling using INM and AEDT are not directly comparable. More details on the differences between INM and AEDT are provided in **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.5.45 LLAOL have continued to use INM to calculate noise contours for their Annual Monitoring Reports and their planning application to grow the airport to 19 mppa (as described in **Chapter 2** of this ES **[TR020001/APP/5.01])** due to the need to

report consistently against the noise contour requirements of their currently permitted development. However, as the Proposed Development requires a new consent, it is considered appropriate to use AEDT to model air noise contours, especially as INM is no longer supported by the FAA.

16.5.46 The use of AEDT (along with the Civil Aviation Authority's (CAA) ANCON, which is the CAA's in-house noise modelling software) is advocated in CAP 1616a as "*a recognised and validated noise model"* (Ref. 16.33). Additionally, the use of AEDT was discussed with the Noise Envelope Design Group and Noise Working Group (see **Section 16.4**), which agreed that it represented current best practice to model air noise.

16.5.47 The assessment of air noise considers growth defined by the Core Planning Case (as described in **Chapter 5** of this ES **[TR020001/APP/5.01]**); however, sensitivity testing has been undertaken based on slower and faster growth cases, which consider throughput being achieved earlier or later than the core case to account for any uncertainties in forecasting.

16.5.48 For each future assessment year, two scenarios have been considered:

a. Do Minimum (DM): In the future, the airport continues to operate at a capacity of 18 mppa (within its existing noise limits) and new generation aircraft are introduced into the operational fleet as assumed in demand forecasts. Road traffic flows increase through natural growth and as a result of other new developments; and

b. Do Something (DS): Aircraft and road traffic associated with the Proposed Development are added to the DM scenario.

16.5.49 The assessment of air and road noise compares the DS scenario against the equivalent future baseline DM scenario (see **Section 16.7)**. For air noise, this provides the impact of the Proposed Development against a scenario where the current permitted limit of 18 mppa is retained, the airport is operating within its currently consented noise limits, and noise contours reduce due to increased numbers of new generation aircraft.

16.5.50 As the assessment of air and ground noise consider the change in noise level of an existing noise source, receptors have been screened for assessment. Where receptors are predicted to experience existing or future noise levels exceeding the LOAEL, an assessment of the impact due to a change in noise level has been undertaken.

16.5.51 The defined LOAEL and SOAEL for aircraft air and ground noise during day and night periods are presented in **Table 16.13**.

Table 16.13: Air and Ground Noise LOAEL and SOAEL

Time Period	Threshold Level dB $L_{Aeq,T}$ for 92 day summer average (free field)		
	LOAEL	SOAEL	UAEL
07:00 to 23:00	51	63	69
23:00 to 07:00	45	55	63

16.5.52 Whereas the LOAEL is defined in national policy, the SOAEL is defined following the approaches adopted in recent planning applications for UK airports (see **Appendix 16.1** of this ES **[TR020001/APP/5.02]** for more details). A precautionary UAEL for air noise has been defined at 69dB$L_{Aeq,16h}$[17] and 63dB$L_{Aeq,8h}$[18]; however, no properties are exposed to noise exceeding these levels in any assessment scenarios.

16.5.53 Although air and ground noise both originate from aircraft, it is recognised that the nature of noise is different from aircraft when they are in the air and on the ground (for example direction and duration). There is no specific research or guidance on how ground noise should be assessed; however, there is considered to be a sufficient link between assessing the effects of air and ground noise due to the emissions originating from the same source. Consequently, in the absence of any specific guidance for ground noise, the LOAEL and SOAEL for air noise are considered applicable to ground noise.

16.5.54 The criteria that have been used to define the significance of effect in terms of changes in air noise are presented in **Table 16.14**. As there is no published guidance for identifying the significance of effect due to changes in air and ground noise, the criteria are based upon the Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Environmental Noise Impact' (Ref. 16.68), Planning Practice Guidance Noise (PPGN) (Ref. 16.42) and professional judgement. The criteria for noise change below the SOAEL were also adopted in the Bristol Airport application to increase airport capacity (Ref. 16.55) and were described as follows in the "Change Criteria" section of the Appeal Decision for the application, paragraph 258 (Ref. 16.56): "*the 3dB is current best practice for assessment within an ES. In light of this, the Panel consider it an appropriate threshold as part of the EIA process.*"

16.5.55 The criteria set different levels for identifying a significant effect depending on whether noise in the DS scenario is either above or below the SOAEL. This addresses the following point in PPGN, which states:

"In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the

[17] NPPF (para 174e) states: "*Planning …decisions should contribute to and enhance the natural and local environment by: e) preventing new .. development from contributing to .. unacceptable levels of .. noise pollution* ..". The PPG(N) definition of unacceptable adverse effect is: "*Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and nonauditory" and that "this situation should be prevented from occurring*" (para 005)
The threshold for these effects is described as an Unacceptable Adverse Effect Level (UAEL).
As an example of an action to prevent unacceptable adverse effects, the NPS for National Networks sets out that "*the applicant may consider it appropriate to provide noise mitigation through the compulsory acquisition of affected properties in order to gain consent for what might otherwise be unacceptable development*." (para 5.199). The APF states "The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB LAeq,16h or more, assistance with the costs of moving." 69 dB LAeq,16h may therefore be considered a 'precautionary UAEL' for daytime noise (because this is the threshold for assisting with the costs of moving rather than mandatory acquisition of homes that would be expected to be required at a high level of noise exposure where the actual UAEL is reached).

[18] The night-time UAEL is informed by the approach adopted in the Bristol Airport Application to increase airport capacity.

overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur".

Table 16.14: Magnitude of Impact Criteria for Changes in Air and Ground Noise

Magnitude of Effect	Change in Noise Level	
	DS Noise Between LOAEL and SOAEL	DS Noise Exceeding SOAEL
Major	6.0 dB or more	4.0 dB or more
Moderate	3.0 dB – 5.9 dB	2.0 dB – 3.9 dB
Minor	2.0 – 2.9 dB	1.0 – 1.9 dB
Negligible	0.1 – 1.9 dB	0.1 – 0.9 dB
No change	0.0 dB	0.0 dB

16.5.56 For DS noise levels between LOAEL and SOAEL, Moderate and Major Adverse effects due to changes in air and ground noise levels are defined as significant effects. For DS noise levels above SOAEL, Minor, Moderate and Major Adverse effects due to changes in air and ground noise levels are defined as significant effects.

16.5.57 In addition to the assessment of the $L_{Aeq,16h}$ and $L_{Aeq,8h}$ noise metrics, context has been provided for the air noise assessment using supplementary noise metrics as defined in **Table 16.15**. As described in the table, the N65, N60 and overflight metrics are described in guidance from the Government and the CAA as supplementary metrics which can provide context and useful information, but are not appropriate for identifying noise impacts or significant effects. These metrics are therefore referenced and described at appropriate points in the noise assessment to provide additional context to the potentially significant noise effects identified using the primary L_{Aeq} metric.

16.5.58 An assessment of objective sleep disturbance using the awakenings metric is presented in **Chapter 13** Health and Community of this ES **[TR020001/APP/5.01]**.

Table 16.15: Supplementary metrics for the air noise assessment

Supplementary Metric	Definition
N65 and N60	'Nabove' contours show the locations where the number of noise events exceeds a specified maximum noise level (L_{Asmax}). For example, the N65 and N60 metrics show the locations exposed to noise levels above 65dBL_{Asmax} and 60dBL_{Asmax} respectively. The N65 and N60 metrics for daytime and night-time respectively are described as "*secondary metrics*" in CAP1616 (Ref. 16.32) as "*those that are not being used to determine significant impacts but which are still able to convey noise effects*." (paragraph B54)

Supplementary Metric	Definition
	The use of Nabove metrics was also considered as part of the SoNA research study (Ref. 16.36) which concluded that "*There is, therefore merit in considering greater use of 'Number Above' metrics as supplemental indicators to help portray noise exposure, but recognising that evidence-based decisions should continue to use LAeq,16h.*" (paragraph 8.10) The use of N60 and N65 as "*supplementary metrics*" is advocated in the Government's Air Navigation Guidance (Ref. 16.29, paragraph 3.11)
Overflights	The definition of the overflights metric is provided in CAP1498 Definition of overflight (Ref. 16.31). Overflights have been calculated using the methodology defined in CAP1498 and the overflight angle of 48.5° as advised in CAP1616a. CAP1616 states: *"It is important to stress that the overflight metric does not reflect noise impacts; it contains no noise information but has been developed to recognise both that Government policy on airspace refers to overflights and that communities can find the information useful."* (paragraph B61) The use of overflights as "*supplementary metrics*" is advocated in Air Navigation Guidance (paragraph 3.11)
Additional awakenings	The concept of additional awakenings is described in *WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep* (Ref. 16.57). The systematic review contains a methodology for predicting additional awakenings due to aircraft noise events based on research studies measuring brain activity during sleep using polysomnography (simultaneous measurement of brain electrical activity, eye movements and muscle tone). The term 'additional' awakenings is used because an average person experiences around 24 spontaneous awakenings per night (Ref. 16.40) before considering the 'additional' awakenings that can be predicted using the methodology described above. The number of additional awakenings should therefore be considered within this context.

Surface access noise

16.5.59 The LOAEL and SOAEL for road traffic noise, used in this assessment for all noise sensitive receptors for the time periods when they are in use, are defined

in **Table 16.16**. These levels are derived from guidance given in DMRB (Ref. 16.58) and further detail is provided in **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. A precautionary UAEL has been set at 74 dB $L_{Aeq,16h}$[19] for daytime and 66 dB $L_{Aeq,8h}$[20] for night-time.

Table 16.16: Road Traffic Noise LOAEL, SOAEL and UAEL

Time Period	Threshold Level dB $L_{Aeq,T}$ for Average Annual Day (free-field)		
	LOAEL	SOAEL	UAEL
07:00 to 23:00[21]	50	63	74
23:00 to 07:00	40	55	66

16.5.60 DMRB provides two classifications for the magnitude of the road traffic noise impact, as shown in **Table 16.17**. These relate to both short-term changes and long-term changes in road traffic noise levels. The short-term classification is the main driver of the initial identification of significant effects.

Table 16.17: Magnitude of traffic noise impacts

Magnitude of Effect	Change in Noise Level	
	Short-term	Long-term
Major	5.0 dB or more	10.0 dB or more
Moderate	3.0 – 4.9 dB	5.0 – 9.9 dB
Minor	1.0 – 2.9 dB	3.0 – 4.9 dB
Negligible	0.1 – 0.9 dB	0.1 – 2.9 dB
No change	0.0 dB	0.0 dB

16.5.61 Negligible changes in the short-term would not cause changes to behaviour or responses to noise, and as such would not give rise to significant effects. For short-term minor, moderate and major changes, DMRB outlines a range of additional factors that are considered in identifying significant effects. For example, where road traffic noise levels are above the SOAEL minor increases are considered significant following the DMRB methodology. These additional factors are listed in **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

Fixed plant noise

16.5.62 The level of design detail at the time of the ES for fixed plant is limited, as is normal for any project of this nature. The methodology for assessment of significant effects of fixed plant is therefore to avoid significant adverse effects, and reduce adverse effects as far as is reasonably practicable, through a

[19] Accepted in the DCO decision for the A14 Cambridge to Huntingdon Improvement Scheme DCO. Refer to ES Appendix 14.3: Noise and vibration significance criteria.
[20] Refer to **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**
[21] LOAEL and SOAEL for the daytime period are calculated from DMRB $L_{A10,18h}$ values by applying a correction of -3 dB to convert from the façade level to a free-field level and by applying a further correction of -2 dB to convert from $L_{A10,18h}$ to $L_{Aeq,16h}$.

requirement to design fixed plant following a noise management process derived from guidance in British Standard 4142. This approach is described in further detail in **Appendix 16.3** of this ES **[TR020001/APP/5.02]**.

Operational vibration

16.5.63 A qualitative assessment of operational vibration has been undertaken by identifying potential sources of vibration and their distance to the nearest sensitive receptors with comparison to recommended study area distances from relevant guidance including DMRB (Ref. 16.53), the Federal Transit Administration's Transit Impact Assessment guidance (Ref. 16.59) and ISO 14837 Mechanical vibration — Ground-borne noise and vibration arising from rail systems (Ref. 16.60).

Non-residential receptors assessment methodology

16.5.64 The approach to the assessment of non-residential receptors differs from that adopted for residential receptors. This is because government policy for noise is based on community exposure response relationships and the noise insulation of a typical dwelling which may not be applicable to non-residential receptors.

16.5.65 Due to the relatively larger study area for air noise compared to the other noise sources assessed in this chapter, the air noise non-residential assessment takes a two-stage process, with an initial screening stage prior to the assessment. For other noise sources, all non-residential receptors within the relevant study area are screened into the assessment.

16.5.66 Screening criteria have been defined that have been used to scope non-residential receptors into the assessment of air noise on a precautionary basis. The screening criteria that have been defined using WHO Community Noise Guidelines, WHO Night Noise Guidelines and UK Noise Insulation Regulations are presented in **Table 16.18**.

Table 16.18: Air noise screening Criteria for Non-residential Receptors

Receptor category	Noise level (outdoors, free field)	
	Day (07:00-23:00)	Night (23:00-07:00)
Auditoria, concert halls, theatres and sound recording and broadcast studios	60 dB L_{AFmax} and 50 dB $L_{Aeq,16h}$	60 dB L_{AFmax} and 50 dB $L_{Aeq,18h}$
Places of worship, courts, lecture theatres and museums	50 dB $L_{Aeq,16h}$	n/a
Schools, colleges and libraries	50 dB $L_{Aeq,16h}$	n/a
Offices	55 dB $L_{Aeq,16h}$	n/a
Hospitals and hotels	50 dB $L_{Aeq,16h}$	45 dB $L_{Aeq,8h}$

16.5.67 Once receptors have been screened into the non-residential assessment, their Do Something noise level and noise change as a result of the Proposed Development has been calculated and compared to a specific assessment criteria. These assessment critera, in terms of noise level and noise change, are presented in **Table 16.19**. Detail on how these levels and change criteria have

been derived, using guidance from IEMA (Ref. 16.68) British Standard 8233 (Ref. 16.61), Building Bulletin 93 Acoustic design of schools: performance standards (Ref. 16.62), Health Technical Memorandum 08-01: Acoustics (Ref. 16.63) and Planning Practice Guidance: Noise (Ref. 16.42) is presented in **Section 11** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.5.68 Whilst the L_{AFmax} metric is used in the screening criteria for critical listening spaces (e.g. auditoria, concert halls, theatres and sound recording and broadcast studios) these do not form part of the assessment of likely significant effects for these receptors. This is because the L_{Amax} levels from individual events would be no greater than experienced in the 2019 baseline (Actuals or Consented) and would reduce over time as new-generation (and then next-generation) aircraft enter the fleet. The assessment therefore focusses on changes in noise exposure as a result of increases in numbers of aircraft movements (and other noise sources).

Table 16.19: Assessment criteria for non-residential receptors

Receptor category	Noise level (outdoors, free field)		Change in noise exposure (DS-DM)
	Day (07:00-23:00)	Night (23:00-07:00)	
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	55-59 $dBL_{Aeq,16h}$	n/a	≥3.0
	≥63 $dBL_{Aeq,16h}$	n/a	≥2.0
Doctor's surgeries and medical centres	≥55 $dBL_{Aeq,16h}$	n/a	≥3.0
Hospitals	≥55 $dBL_{Aeq,16h}$	≥45 $dBL_{Aeq,8h}$	≥3.0
Auditoria, concert halls, theatres and sound recording and broadcast studios	≥50 dB $L_{Aeq,16h}$	≥50 dB $L_{Aeq,8h}$	≥3.0
Places of worship	≥50 dB $L_{Aeq,16h}$	n/a	≥3.0
Offices	≥55 dB $L_{Aeq,16h}$	n/a	≥3.0
Museums	≥55 dB $L_{Aeq,16h}$	n/a	≥3.0
Community and village halls	≥60 dB $L_{Aeq,16h}$	n/a	≥3.0
Courts	≥50 dB $L_{Aeq,16h}$	n/a	≥3.0
Libraries	≥55 dB $L_{Aeq,16h}$	n/a	≥3.0
Hotels	≥50 $dBL_{Aeq,16h}$	≥45 $dBL_{Aeq,8h}$	≥3.0

16.5.69 Where non-residential receptors are identified to have noise level and change above the criteria in **Table 16.19**, the assessment of likely significant effects in **Section 16.9** has been undertaken on an individual basis, taking into account:

a. Do-Something noise level;
b. magnitude of noise level change from Do-Minimum to Do-Something;
c. sensitivity of the receptor;
d. supplementary noise metrics; and
e. the design of the receptor affected, for example, construction of the building façade, ventilation strategy, etc.

Tranquillity

Overview on approach to assessing tranquillity

16.5.70 The approach to assessing tranquillity distinguishes between 'tranquillity' and 'relative tranquillity'. 'Tranquillity' is a valuable and scarce resource that can be identified using methodologies such as those brought forward by Campaign for the Protection of Rural England (CPRE) (Ref. 16.64).

16.5.71 'Relative tranquillity' is considered with reference to NPPF paragraph 185b which requires planning decisions to "*identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*".

Tranquillity

16.5.72 CPRE defines tranquil areas in their tranquillity mapping methodology as "*places which are sufficiently far away from the visual or noise intrusion of development or traffic to be considered unspoilt by urban influences*". Using their methodology, they have produced a tranquillity map for England (Ref. 16.65).

16.5.73 The tranquillity map suggests the areas surrounding the airport within the air noise study area are amongst the least tranquil of places within England. In terms of noise this is consistent with the urban and suburban areas surrounding the airport and that there are no areas "*sufficiently far away from the visual or noise intrusion of development or traffic to be considered unspoilt by urban influences*".

16.5.74 Within the noise study area for the Proposed Development, the assessment of tranquillity is therefore focussed on the consideration of relative tranquillity.

16.5.75 It should be noted however, that tranquillity can be affected to a greater extent by changes in flight paths which could result in areas being newly overflown. Tranquillity will therefore be a key consideration in future airspace change proposals in line with Air Navigation Guidance and the Civil Aviation Authority's CAP1616 process, which is separate to this DCO.

Relative tranquillity

16.5.76 The perception of relative tranquillity is dependent on the sensitivity of the receptor, its use or activity and other considerations such as the visual sense of relative tranquillity. The assessment of relative tranquillity for the Proposed Development is a consideration of an existing noise source (aircraft noise) where the number of aircraft movements in areas currently exposed to aircraft noise would change, but the locations exposed to aircraft noise would not change. Furthermore, the overall noise assessment in this chapter shows a reduction in noise contour areas (day and night) compared to the 2019 Actuals baseline. In other words, the Proposed Development would not give rise to aircraft noise becoming audible and intrusive for the first time at any location within the study area. Impacts on relative tranquillity are therefore primarily associated with absolute noise level exposure and noise change (to areas already exposed) as a result of the Proposed Development.

16.5.77 This approach to the consideration of relative tranquillity is consistent with guidance and a proposed methodology on the impact of noise on the setting and tranquillity of heritage and cultural receptors commissioned by English Heritage (now Historic England) (Ref. 16.66). This methodology considers absolute noise level exposure (relative to thresholds that are analogous to the LOAEL and SOAEL thresholds defined in this chapter) and noise level change, supplemented by number above metrics.

16.5.78 This methodology therefore has the same principles and approach as the noise and vibration assessment on residential receptors (including on a wider community basis) and non-residential receptors presented in this chapter (see **Table 16.7**). It is therefore considered that the methodology for identifying adverse effects from noise in this chapter takes relative tranquillity into account.

Tranquillity and landscape receptors

16.5.79 The methodology for identifying the impact of noise (amongst other factors) on tranquillity for landscape receptors, including the Chilterns AONB as required by the Scoping Opinion, is presented in **Chapter 14** Landscape and Visual of this ES **[TR020001/APP/5.01]**.

Tranquillity and heritage receptors

16.5.80 The methodology for identifying the impact of noise (amongst other factors) on setting and tranquillity of heritage receptors is presented in **Chapter 10** Cultural Heritage of this ES **[TR020001/APP/5.01]**.

16.6 Assumptions and limitations

16.6.1 This section provides a description of the assumptions and limitations to the noise and vibration assessment.

Reasonable Worst Case

16.6.2 **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]** describes the general approach adopted so that a reasonable worst case is assumed in this assessment including the use of parameters, accounting for uncertainty, and incorporating flexibility in design and demand forecasts. This approach is in line with Planning Inspectorate Advice Note Nine: Rochdale Envelope (Ref. 16.67).

16.6.3 The noise and vibration assessment makes use of a reasonable worst-case. The reasonable worst-case for each source of noise and each assessment scenario has been defined following guidance from the Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Environmental Noise Impact' (Ref. 16.68), which state that assessment should "*Include an assessment of a worst-case situation (should consent be granted), when appropriate. In identifying a potential worst-case situation to examine, consideration should be given to an outcome that might occur without the need for further planning consent. However, rather than exploring an extreme worst-case that could occur, the worst-case to be tested should be reasonably likely. Furthermore, it must be physically possible for the worst-case situation to occur. Any such assessment should make clear the assumptions upon which it is based.*"

16.6.4 The assumptions in the following sections apply the reasonable worst-case approach described above.

Construction noise assessment limitations and assumptions

16.6.5 Due to the dynamic and transient nature of construction activities, the assessment of construction noise is based on typical construction works that would occur during each year of the construction phase. This approach allows any likely significant effects due to construction activities to be captured in the assessment and is considered to represent a reasonable worst-case approach.

16.6.6 Construction noise predictions have been undertaken based on information provided in the Construction Method Statement and Programme Report provided as **Appendix 4.1** of this ES **[TR020001/APP/5.02]**. Noise predictions were carried out to represent a conservative scenario where all construction plant is operational. Consequently, the noise predictions construction noise levels and can therefore be considered as a reasonable worst case.

16.6.7 Construction noise predictions have been undertaken using the methodology in BS5228-1 (Ref. 16.49) which is generally considered to be a reliably conservative prediction method for environmental impact assessment and has therefore been used as an industry standard approach for over 30 years.

Air noise assessment assumptions and limitations

Growth

16.6.8 Operational noise effects are assessed at the point when capacity is reached for each assessment phase. These periods are considered to represent periods when likely significant effects due to the Proposed Development are most likely. Consequently, this approach is considered to represent a reasonable worst-case for operational noise. In addition, to ensure that the approach to defining a reasonable worst-case is robust, sensitivity testing has been undertaken on a number of scenarios to determine the potential for greater impacts if demand levels are achieved more quickly or slowly and having regard for the potential for delays to the transition to new generation aircraft. More information on the faster growth and slower growth assumptions that have informed the sensitivity tests are provided in the **Need Case [TR020001/APP/7.04]**. The results of the sensitivity tests are presented in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]** and summarised in **Section 16.9**.

Next-generation aircraft

16.6.9 It is likely that next generation aircraft (including electric or hydrogen powered) will come into service in the mid-2030s and would be operational within the lifespan of the Proposed Development. As details on the potential noise performance of next generation aircraft are limited at the time of preparing this ES, the assessment of air noise effects for the Core Planning Case assumes that next generation aircraft would have a noise performance that is equivalent, and no better, than that of new generation aircraft. This is a conservative approach and represents a reasonable worst case. A sensitivity test has been undertaken to provide an estimate on the reduction in noise that next generation aircraft may provide. The results of the sensitivity tests are presented in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]** and summarised in **Section 16.9**.

General limitations of aircraft noise modelling

16.6.10 Air noise modelling is reliant on the data in AEDT which is used to calculate noise contours. Default data is referenced from the Aircraft Noise and Performance (ANP) database Ref (16.69), which provides Noise-Power-Distance (NPD) data and approach/departure profiles that are used by AEDT.

16.6.11 NPD data provides sound pressure levels at a range of distances for aircraft at a variety of thrust settings. For modelling purposes, it is necessary to apply one representative NPD curve to each aircraft variant when, in reality, there tends to be variations in the level of noise emitted by different aircraft of the same variant. This is highlighted through the European Union Aviation Safety Agency noise certification data (Ref. 16.70). Aircraft are required to be certified through measurements to provide an Effective Perceived Noise in decibels (EPNdB)[22] at three locations. Whilst this metric is not directly comparable to the $L_{Aeq,T}$ metric it

[22] A measure of human annoyance to aircraft noise that accounts for human response to spectral shape, intensity, tonal content and duration of noise from an Aircraft. Defined in Annex 16 of the ICAO's Convention on International Civil Aviation.

does provide an indication of the range of noise levels produced by the different aircraft of the same variant.

16.6.12 Noise certification occurs at three locations:

a. Flyover – 6.5km from the start-of-roll, under the departure flight path;
b. Lateral – the highest noise measurement recorded at any point 450m from the runway axis during take-off; and
c. Approach – 2km from the runway threshold, under the approach flight path.

16.6.13 The data in **Table 16.20** provides a range of certification data for each of the aircraft that make up over 75% of the fleet in forecasts. Whilst the range in approach noise is reasonably small (up to 3 dB), noise from departing aircraft can have a substantial range with differences in EPNdB of up to 8 dB at the lateral position and up to 11 dB at the flyover position.

Table 16.20: Range of ICAO EPNdB Certification Data per Aircraft

Aircraft	Data Samples	Lateral EPNdB		Flyover EPNdB		Approach EPNdB	
		Min	Max	Min	Max	Min	Max
A319	1,544	90.0	95.0	78.8	89.0	92.2	94.6
A320	1,044	90.2	94.8	80.7	88.4	94.2	96.1
A320Neo	319	84.6	88.1	76.9	83.2	92.0	92.6
A321	1,757	91.0	98.7	82.7	91.6	95.3	97.0
A321Neo	561	87.2	89.6	78.9	87.4	93.4	94.9
B737-800	1,616	87.4	95.8	77.8	88.6	93.5	96.9

16.6.14 The variation in approach and departure noise can arise from different aircraft components in the same variant and how the aircraft is flown. In order to minimise the uncertainty from variable levels of approach and departure noise, a validation exercise has been undertaken. The validation exercise used 2019 radar track and ground speed data. Details on the validation process are presented in **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.6.15 Alterations to default departure profiles in AEDT were made to define a typical departure profile for each of the aircraft that make up over 75%[23] of the fleet. A default departure profile in AEDT is made up of a number of 'climb' and 'accelerate' steps. These steps are defined in more detail in **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.6.16 Altitude and ground speed departure profiles for each aircraft have been adjusted to match typical 2019 radar data. Default departure profiles have been adjusted to match as close as possible the measured SEL noise data for each aircraft at the locations listed in **Table 16.22**. This approach minimises the uncertainty in noise predictions within the presented $L_{Aeq,16h}$ and $L_{Aeq,8h}$ noise contour areas; however, the uncertainty of predictions increases with distance

[23] 75% is specified in the Civil Aviation Authorities Policy on Minimum Standards for Noise Modelling (CAP2091) for an airport the size of Luton

from the airport as there is bigger variation in aircraft's altitude and lateral position.

Aircraft air modelling assumptions

16.6.17 The following assumptions for air noise predictions have been made:

a. Air noise predictions are based on the average daily aircraft movements in the 92-day summer period (16 June to 15 September inclusive), which is the peak period of aircraft activity in line with CAA guidance and standard practice for modelling aircraft noise in the UK.

b. All modelled air noise levels in this ES are based on 2019 baseline radar track data and have been dispersed in accordance with the aircraft movement density of radar tracks. These tracks are assumed to be representative of future airport operations in the absence of any potential airspace changes.

c. Air noise modelling has been undertaken based on a 23% easterly and 77% westerly modal split, which is the 92-day summer average modal split from 2010 to 2019 and represents the long-term average and is assumed to be representative of typical modal split trends.

d. Aircraft movements were split along departure routes for 2019 to 2030 scenarios using the following percentages, which are assumed to be suitably representative:

   i. 3% on 07 Runway Olney beacon routes;
   ii. 6% on 07 Runway Compton beacon routes;
   iii. 13% on 07 Runway Detling beacon routes;
   iv. 11% on 25 Runway Olney beacon routes;
   v. 22% on 25 Runway Compton beacon routes[24]; and
   vi. 45% on 25 Runway Detling beacon routes.

e. For the 2038 to 2049 scenarios, the expected changes to the destinations served by the airlines following the opening of T2 results in a proportionate change to the assumed departure routes as follows (refer to the **Need Case [TR020001/APP/7.04]** for further information):

   i. 5% on 07 Runway Olney beacon routes;
   ii. 7% on 07 Runway Compton beacon routes;
   iii. 12% on 07 Runway Detling beacon routes;
   iv. 15% on 25 Runway Olney beacon routes;
   v. 23% on 25 Runway Compton beacon routes; and
   vi. 39% on 25 Runway Detling beacon routes.

f. For aircraft that were operational at the airport in 2019, measured noise data has been used to provide corrections. Details on assumptions for new generation aircraft are presented in **Section 6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

g. As the A319Neo are not currently operational at the airport and the B738 MAX was not operational in 2019, measured noise data is not currently

[24] This route will be known as the RODNI departure route from March 2023

available for the 2019 baseline year for these aircraft. Consequently, corrections have been applied to previous generation surrogate aircraft to provide data for the likely level of noise emissions from new generation aircraft based on guidance within the Aircraft Noise and Performance (ANP) database (Ref. 16.69). This approach is considered to provide suitably representative noise data for these aircraft.

h. The performance of the A321Neo at the airport is not currently as good as the expected performance from noise certification testing. Through discussions with LLAOL and airline operators, it has become apparent that the poor performance is restricted to particular A321Neo engine variants and other variants perform as would be expected from noise certification testing. Measured noise data was used to predict A321Neo noise in the 2027 scenario; however, it is reasonable to assume that, by 2039, any issues with the A321Neo performance would be resolved through fleet transition to equivalent aircraft that are no worse than the expected performance from noise certification testing. Consequently, A321Neo predictions for the 2039 and 2043 scenarios were modelled based on the modelling methodology referenced from the ANP database.

i. Next generation aircraft would come into service within the assessment period; however, there is limited information available on the potential noise performance of these aircraft. Consequently, for the main assessment, these aircraft are assumed to perform no better than new generation aircraft and a sensitivity test has been undertaken on the potential noise reductions from next generation aircraft (see **Section 16.9**).

Ground noise model assumptions and limitations

16.6.18 Ground noise modelling is limited to predictions, and it has not been possible to validate the predictions to the same extent as air noise due to the dominance of air noise and the inability to distinguish between ground noise and air noise from noise monitoring terminal data.

16.6.19 The following assumptions for ground noise predictions have been made:

a. Ground noise predictions have been based on the average daily aircraft movements in the 92-day summer period.

b. A reasonable worst-case 92-day summer period average day has been modelled based on the following assumptions that have been applied to activities contributing to ground noise emissions:

   i. use of Ground Power Units (GPU) at existing aircraft stands based on the average use of GPUs per day and the average daily number of aircraft at each stand during the 92-day summer period;
   ii. use of Auxiliary Power Units (APU) is limited to General Aviation aircraft for an average of 10 minutes per movement;
   iii. engine ground-running within the Engine Run-up Bay (ERUB) – one event estimated to be 25 minutes at 7% power and 10 minutes at 100% power during the daytime period of a reasonable worst-case day;

iv. aircraft taxi movements have been based on an assumed engine thrust of 10%;
v. taxi times have been based on the 2019 summer average from Eurocontrol taxi-time database Ref (16.71) of 15.6 minutes for departures and 6.3 minutes for arrivals. These taxi times include holding delays; and
vi. fire training activities for 120-minutes during the daytime period of a reasonable worst-case day.

c. There is commitment in place as part of the Proposed Development to retrofit of all Terminal 1 stands with FEGP or non-diesel GPUs by 2040. To account for a reasonable worst-case, it is assumed that Terminal 1 stands will have non-diesel GPUs that emit equivalent levels of noise to existing GPUs.

d. Ground-running and aircraft taxi noise emissions have been modelled in Cadna/A noise modelling software using the ISO 9613 calculation methodology. Ground noise sources have been derived from Aviation Environmental Design Tool (AEDT) outputs using the predicted noise level at the Application Site boundary.

e. Taxi movements associated with Terminal 2 have been averaged equally across the stands.

f. It is assumed that taxiing aircraft will take the most direct route and utilise proposed taxiways.

g. Noise emissions from typical fire training activities have been based on measured noise data from the existing fire training ground.

Surface access model assumptions and limitations

16.6.20 The following limitations of surface access noise predictions have been identified:

a. A small number of road links have very low flows, below the lower cut-off of the Calculation of Road Traffic Noise (CRTN) prediction methodology of 1,000 vehicles Annual Average Weekday Traffic (AAWT) over an 18-hour day. These include Lalleford Road (Luton), Stony Lane and Brick Kiln Lane (Tea Green). As a conservative approach, these road links have been retained in the traffic noise predictions though the contribution to traffic noise levels at nearby receptors must be treated with caution.

b. The road traffic noise model is based upon the strategic traffic model described in the **Transport Assessment** submitted as part of the application for development consent **[TR020001/APP/7.02]**. Therefore, only the roads that form part of the strategic traffic model are considered as road traffic noise sources in the road traffic noise model.

16.6.21 The following assumptions for surface access noise predictions have been made:

a. As a precautionary measure hot rolled asphalt road surfacing has been assumed on all existing roads throughout the study area. The Airport

Access Road is assumed to have a low noise surface as described in **paragraph 16.8.22**.

b. The vertical alignment of the Airport Access Road has been modelled as either the proposed alignment, as shown in the indicative profile for the road **[TR020001/APP/4.9]**, or the existing ground, whichever is higher. This broadly represents the upper limit of the Limits of Deviation (LOD) for the road and represents a reasonable worst case in terms of traffic noise propagation from the road to residential receptors on Devon Way and Eaton Green Road.

c. Although a number of HGVs are included in the road traffic data and noise modelling to represent deliveries to the new fuel storage facility it is assumed that such traffic would not occur in practice as the fuel would be delivered by the new fuel pipeline provided as part of the Proposed Development.

d. Given the government's commitment to end the sale of new petrol and diesel cars and vans by 2030[25] a substantial proportion of the road traffic fleet is likely to be electric during assessment Phase 2a and assessment Phase 2b of the Proposed Development. However, research shows that electric cars are less than 1 dB quieter than petrol and diesel equivalents above 50 km/h (Ref. 16.72). Where vehicles are travelling slower (up to 20 km/h) and therefore quieter, there is a requirement for such vehicles to generate an alternative to engine noise so people can hear the vehicles and hence are aware of their presence. As such electric vehicles are not expected to be much quieter than petrol equivalents at these slow speeds either. The assessment, which is based on petrol and diesel powered vehicles, is not expected to lead to noticeably different road traffic noise levels than would be experienced in practice if there is a significant shift towards electric vehicles in future.

[25] https://www.gov.uk/government/news/government-takes-historic-step-towards-net-zero-with-end-of-sale-of-new-petrol-and-diesel-cars-by-2030

16.7 Baseline conditions

16.7.1 This section provides a description of the existing baseline noise conditions. **Figure 16.3a** and **Figure 16.3b** of this ES **[TR020001/APP/5.03]** shows the locations where noise monitoring has been undertaken.

Assessment Locations

16.7.2 A number of assessment locations have been considered in the assessment of ground noise and earthworks/ construction noise. The assessment locations are those receptors nearest to the Application Site within the study area, i.e. the receptors that have the most potential to experience likely significant effects due to noise and vibration. Although noise and vibration may be perceivable at other receptors in the ground noise and earthworks/construction noise study area, the identified assessment locations will experience the worst-case noise and vibration effects and so if no significant effects are identified at these locations then it can be concluded that there will be no significant effects for any other receptors in study area.

16.7.3 The assessment locations for ground noise and earthworks/ construction noise are presented in **Table 16.21** and illustrated in **Figure 16.2** of this ES **[TR020001/APP/5.03]**.

Table 16.21: Ground Noise and Earthworks/Construction Noise Assessment Locations

Location ID	Description
GR1	Someries area
GR2	65/66 Someries Arch
GR3	Copt Hall and Cottages
GR4	Dane Street Cottages
GR5	Dane Street Farm
GR6	Winch Hill House
GR7	Green Acres, Waldon End
GR8	Waldon End House
GR9	Waldon End Farm
GR10	Ivy Cottages
GR11	Malthouse Green area
GR12	Bowbrook Vale area
GR13	The Dell receptors
GR14	Laxton Close area
GR15	Colwell Rise area
GR16	Keeble Close area
GR17	Layham Drive area
GR18	Lindsay Road area

Location ID	Description
GR19	Barnston Close
GR20	Raynham Way Community Centre
GR21	Eaton Place area
GR22	Eaton Green Road area
GR23	Hartop Court area
GR24	Chertsey Court area

16.7.4 Air noise assessment locations correlate with noise monitoring locations and schools that are likely to be affected by increases in air noise. The locations can be seen in **Figure 16.3** of this ES **[TR020001/APP/5.03]**. These assessment locations have been selected to identify impacts in specific areas through calculation and comparison of DM and DS noise levels. Any impacts identified can be applied to receptors in the general vicinity including nearby parks and gardens (see **Table 16.7**); however, the assessment is not limited to the locations listed in **Table 16.22** and covers the defined study area.

Table 16.22: Air Noise Assessment Locations

Location ID	Description
AR1 / ML1	Someries
AR2 / ML2	Lye Hill, Breachwood Green
AR3 / ML3	Langley
AR4 / ML4	Breachwood Green
AR5 / ML5	Bendish
AR7 / ML7	Luton Hoo
AR8 / ML8	Dagnall
AR9 / ML9	Markyate
AR10 / ML10	Caddington
AR11 / ML11	Woodside Park
AR12 / ML12	Slip End
AR13 / ML13	Strathmore Avenue, Luton
AR14 / ML14	Vauxhall Way, Luton
AR15 / ML15	Eaton Green Road, Luton
AR16 / ML16	Malthouse Green, Luton
AR17 / ML17	Kensworth
AR18 / ML18	Stevenage
AR19 / ML19	Flamstead
AR20 / ML20	Jockey End
AR21 / ML21	Preston
AR22 / ML22	Holywell
AR30 / ML30	Pitstone
AR31 / ML31	St Pauls Walden
AR32	Tennyson Road Primary School (and surrounding residential)
AR33	Hillborough Junior (and surrounding residential)
AR34	St Margaret of Scotland Primary School (and surrounding residential)
AR35	Wenlock Primary School (and surrounding residential)
AR36	Wigmore Primary School (and surrounding residential)
AR37 / ML37	Breachwood Green JMI School (and surrounding residential)
AR38	Caddington Village School (and surrounding residential)
AR39	Slip End Lower School (and surrounding residential)
AR40	Surrey Street Primary (and surrounding residential)

Baseline Air Noise

16.7.5 The results of 2019 Actuals baseline air noise modelling undertaken for the ES using the validated AEDT model are illustrated as noise contour plots in **Figure 16.5** for daytime and **Figure 16.6** for night-time **[TR020001/APP/5.03]**. Analysis of the 2019 Actuals baseline air noise contours for this assessment is presented in **Table 16.23** and **Table 16.24**. The methodology for deriving households and population with noise contours is presented in **Section 7** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.7.6 In the daytime, the 2019 Actuals baseline LOAEL noise contour extends towards Kensworth to the west, Flamstead to the southwest and Stevenage to the east. The daytime SOAEL contour extends to Stockwood Park to the west and between Beachwood Green and Bendish to the east.

16.7.7 In the night-time, the 2019 Actuals baseline LOAEL contour extends to between Whipsnade and Holywell to the west, towards Gaddesdon Row to the southwest and to Stevenage in the east. The night-time SOAEL contour extends to Stockwood Park and Pepperstock to the west and to Stagenhoe Park to the east.

16.7.8 Communities to the east are predominantly exposed to arrivals noise, as to the east of the airport, communities are overflown by arrivals for approximately 74% of the summer. Communities to the west are predominantly exposed to departure noise, as to the west of the airport, communities are overflown by departures for approximately 74% of the summer.

16.7.9 Further information on the air noise baseline environment experienced in 2019 can be found in LLAOL's 2019 annual noise monitoring report (Ref. 16.73) and 2019 Community Noise Reports (Ref. 16.74).

Table 16.23: Daytime Baseline 2019 Actuals Air Noise

Noise Contour $L_{Aeq,16h}$ dB	Cumulative Area (km^2)	Cumulative Number of Households	Cumulative Population
51 (LOAEL)	**58.1**	**20,900**	**41,000**
54	35.4	11,400	21,650
57	20.3	6,000	11,900
60	10.4	2,800	5,350
63 (SOAEL)	**5.6**	**650**	**1,650**
66	2.7	0	0
69 (UAEL)	**1.4**	**0**	**0**

Table 16.24: Night-time Baseline 2019 Actuals Air Noise

Noise Contour $L_{Aeq,8h}$ dB	Cumulative Area (km^2)	Cumulative Number of Households	Cumulative Population
45 (LOAEL)	**74.6**	**32,950**	**67,800**
48	45.3	15,200	29,050
51	26.5	7,100	14,050
54	14.1	3,950	7,500
55 (SOAEL)	**11.2**	**2,650**	**4,950**
57	7.0	1,150	2,350
60	3.6	50	150
63 (UAEL)	1.7	0	0

Baseline surface access noise

16.7.10 Existing levels of surface access noise in the study area vary depending upon the local environment. Noise sensitive receptors close to major roads such as the M1, A1081, A505 and A6 are likely to experience road traffic noise levels above the SOAEL. Most other noise sensitive receptors are predicted to be exposed to surface access noise levels between the LOAEL and SOAEL. Exceptions to this include some residential areas in Luton such as around Peoples Park as well as properties in the rural areas of Mangrove Green and Tea Green to the north-east of the airport, where surface access noise levels are below the LOAEL.

16.7.11 There are 25 Noise Important Areas (NIAs) within the study area. These are primarily located adjacent to the M1, the A505 and the A6. **Figure 16.1** of this ES **[TR020001/APP/5.03]** illustrates the NIAs in the study area.

16.7.12 Baseline noise monitoring was completed at a selection of locations, adjacent to roads considered key routes to the airport, in the vicinity of the Proposed Development. Noise monitoring locations are detailed in **Figure 16.3** of this ES **[TR020001/APP/5.03]**.

16.7.13 A summary of the noise monitoring results at roadside locations is provided in **Table 16.25** which details the measured noise levels for each site and a comparison with the predicted surface access noise levels. Traffic data used to derive the comparisons with the noise measurements is based on data in the strategic traffic model which represents 2016. A linear interpolation of the traffic volumes in the strategic traffic model between 2016 and 2027 indicates that anticipated levels of traffic in 2019 would lead to predicted roadside traffic noise levels within 1 dB of those calculated using 2016 data. Therefore the 2016 surface access traffic data is considered suitably representative of the 2019 baseline year.

Table 16.25: Comparison of baseline noise monitoring and modelling results at roadside locations

Ref.	Description	Measured	Predicted	Comments
		$L_{Aeq,16h}$ dB[26]	$L_{Aeq,16h}$ dB	
ML23	A602 Stevenage Road	74	71	A residential area with a variety of sound sources but dominated by traffic noise from the A602.
ML24	Hitchin Road	67	65	A busy area, dominated by road traffic noise but with other noise sources also present such as pedestrians and vehicle sirens.
ML25	A505 Beech Hill	78	70	Relatively rural location with the sound environment dominated by traffic on the A505.
ML26	A1081 London Road	78	74	Rural location with the sound environment dominated by traffic on the A1081 and M1.
ML27	A505 Hatters Way	79	75	Edge of a residential area with the sound environment dominated by traffic on Hatter's Way and M1.
ML28	A6 New Bedford Road	75	70	A residential area with a variety of sound sources but dominated by traffic noise from the A6.
ML29	B653 Lower Harpenden Road	69	68	A small village with a variety of sound sources but dominated by traffic noise from the B652.
ML41	Brick Kiln Lane	49-56[272]	51	A very quiet rural area with only occasional traffic on Brick Kiln Lane.
ML42	Chalk Hill	55	54	A relatively quiet rural area with regular noise from traffic on Chalk Hill.
ML43	Stony Lane	48	49	A relatively quiet rural area with the sound environment dominated by traffic on Stony Lane although aircraft may be heard in the distance.

[26] $L_{A10,18h}$ value derived from a 3-hour shortened CRTN measurement by subtracting 1 dB as described in the methodology
[27] Long-term measurements were conducted at ML41 allowing a range of $L_{A10,18h}$ values to be reported

Ref.	Description	Measured	Predicted	Comments
		$L_{Aeq,16h}$ dB[26]	$L_{Aeq,16h}$ dB	
ML44	Stony Lane	53	52	A relatively quiet rural area with the sound environment dominated by traffic on Stony Lane although aircraft may be heard in the distance.

16.7.14 In general, the surface access noise predictions are lower than the measured levels next to busy roads (ML23 – ML29) and demonstrate good agreement with measured levels in rural locations around Tea Green and Cockernhoe (ML41 – ML44). At locations with high noise levels (ML23 – ML29) calculated surface access noise levels represent a 16-hour period whereas measured data represent a 3-hour period during the daytime. Traffic counts taken during the monitoring periods typically indicated higher traffic volumes per hour than expected over the full 16-hour period, which explains why some of the surface access noise levels are underpredicted at these locations. At locations with low noise levels (ML23 – ML29) traffic is infrequent and traffic volumes typically sat close to the lower limit of validity of the CRTN method. Nevertheless, predicted levels in these locations showed good agreement with measured levels. Overall, the comparisons between measured and predicted noise levels provide confidence that the noise model developed to estimate the surface access noise impacts of the Proposed Development is a reasonable approximation.

Future baseline

16.7.15 The EIA Regulations require an outline of the likely evolution of the baseline conditions without implementation of the development. This future baseline scenario is known as the Do-Minimum (DM), i.e. it includes the minimum changes that would be expected in the future noise environment in the absence of the Proposed Development.

16.7.16 In the absence of the Proposed Development, there is likely to be a change to the future baseline air noise conditions as a result of fleet transition to less noisy aircraft as the airport is assumed to operate within its long term consented noise limits. Similarly, road traffic noise conditions may change due to natural growth and new developments in proximity to the airport. The DM scenario is used, where appropriate, as a comparator for DS scenario, to show the effect of the Proposed Development against an appropriate reference point. The approach to defining future baseline and the developments identified for consideration are described in **Section 5.4** of **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**. This section describes the future baselines for air noise and surface access noise.

Future air noise baseline

16.7.17 The change in the air noise baseline in terms of noise contour area is presented in **Table 16.26** for daytime noise and in **Table 16.27** for night-time noise. The air noise baseline tends to reduce as time progresses as the fleet is upgraded with new generation aircraft. By 2039, the fleet is assumed to be largely made

up of new generation aircraft, so there is a very marginal reduction in noise contour area between the 2039 and 2043 daytime scenarios. The future air noise baseline is compliant with the airport's current consented long term noise limits in each assessment year and therefore demonstrates a scenario where the airport is operating within its consented noise limits.

16.7.18 It should be noted that, although noise contour areas are presented up to the daytime and night-time UAEL contours, no properties are located within these contours.

Table 16.26: Evolution of daytime air noise baseline

Noise Contour $L_{Aeq,16h}$ dB	Cumulative Contour Area (km²)			
	2019 Actuals Baseline	2027 DM	2039 DM	2043 DM
51 (LOAEL)	**58.1**	**48.5**	**40.7**	**39.5**
54	35.4	27.8	22.7	21.7
57	20.3	14.6	11.4	11.0
60	10.4	7.2	5.8	5.6
63 (SOAEL)	**5.6**	**3.7**	**3.0**	**2.8**
66	2.7	1.8	1.6	1.4
69 (UAEL)	**1.4**	**1.1**	**0.9**	**0.8**

Table 16.27: Evolution of night-time air noise baseline

Noise Contour $L_{Aeq,8h}$ dB	Cumulative Contour Area (km²)			
	2019 Actuals Baseline	2027 DM	2039 DM	2043 DM
45 (LOAEL)	**74.6**	**59.1**	**51.5**	**50.0**
48	45.3	34.4	29.2	28.2
51	26.5	18.6	15.2	14.7
54	14.1	9.2	7.5	7.0
55 (SOAEL)	**11.2**	**7.3**	**6.0**	**5.6**
57	7.0	4.8	3.8	3.6
60	3.6	2.3	1.9	1.7
63 (UAEL)	**1.7**	**1.2**	**1.0**	**1.0**

Future surface access noise baseline

16.7.19 Changes in road traffic flows resulting from natural growth and new developments have the potential to influence the evolution of baseline conditions throughout the lifespan of Proposed Development. Future noise conditions are accounted for in the assessment of surface access noise effects. The road traffic assessment accounts for the increase in traffic flow associated with natural growth road traffic attributable to surrounding development through

the use of the Central Bedfordshire and Luton Traffic Model. Details on the future baseline for surface access can be found in **Chapter 18** Traffic and Transportation of this ES **[TR020001/APP/5.01]** and the **Transport Assessment [TR020001/APP/7.02]**

16.7.20 The change in predicted surface access noise levels between 2019 and 2027 without the Proposed Development is expected to have a negligible impact on road traffic noise. **Table 16.28** summarises the long-term change in predicted surface access levels between the assessment year for assessment Phase 1 (2027) and the year of maximum passenger throughput following assessment Phase 2b (2043) at both residential buildings and other sensitive receptors in the surface access noise study area. Night-time results for non-residential noise sensitive buildings have only been reported for the eight buildings identified as being potentially sensitive at night.

Table 16.28: Long-term change in predicted DM surface access noise levels

Change in noise level		Daytime		Night-time	
		Number of households	Number of non-residential receptors	Number of households	Number of non-residential receptors
Increase in noise level Daytime $L_{Aeq,16h}$ dB Night-time $L_{night,outside}$ dB	0.1 – 2.9	48,547	230	47,880	8
	3.0 – 4.9	28	0	27	0
	5.0 – 9.9	0	0	0	0
	≥10	0	0	0	0
No change	0	40	0	48	0
Decrease in noise level Daytime $L_{Aeq,16h}$ dB Night-time $L_{night,outside}$ dB	0.1 – 2.9	2,047	6	2,707	0
	3.0 – 4.9	0	0	0	0
	5.0 – 9.9	0	0	0	0
	≥10	0	0	0	0

16.7.21 **Table 16.28** is based on the façade at each building, which undergoes the greatest magnitude of change in surface access noise level between 2027 and 2043. The results are provided for the ground floor of the buildings for the daytime impacts and the top floor of each building, for example, 1.5 metres for a

one storey house or 4.0 metres for a two-storey house, for the night-time impacts. These floors have been chosen to represent where residents are likely to be during the day and night-time periods. Further details of the noise model set-up are provided in **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.7.22 Absolute daytime surface access noise levels in 2027, 2039 and 2043 without the Proposed Development are presented in **Figure 16.33**, **Figure 16.57** and **Figure 16.81** of this ES **[TR020001/APP/5.03].** Absolute night-time surface access noise levels in 2027, 2039 and 2043 without the Proposed Development are presented in **Figure 16.34**, **Figure 16.58** and **Figure 16.82** of this ES **[TR020001/APP/5.03]**.

16.7.23 The vast majority (96%) of residential buildings and non-residential noise sensitive receptors within the calculation area would experience a **negligible** (0.1 – 2.9 dB) increase in both daytime and night-time surface access noise levels from 2027 to 2043, in the absence of the Proposed Development. This is due to the general growth in traffic over time and the reasonable worst-case assumption that electrification of the fleet would not change road traffic noise levels.

16.7.24 Some **minor** increases in surface access noise are predicted for 15 residential properties on Stony Lane in the Tea Green area as a result of expected increases in the volume of traffic. Absolute volumes of traffic remain relatively low however, close to the lower limit of validation for the CRTN methodology, and therefore such predicted increases in surface access noise levels should be treated with caution.

16.7.25 Approximately 4% of residential buildings and 3% of non-residential noise sensitive receptors within the study area are predicted to experience a **negligible** (0.1 – 2.9 dB) decrease in daytime surface access noise levels from 2027 to 2043 in the absence of the Proposed Development. These decreases are primarily expected in the vicinity of junction 11 of the M1 where traffic speeds are expected to fall as traffic volume increases.

16.8 Embedded and good practice mitigation

16.8.1 This section describes the embedded and good practice mitigation for noise and vibration that has been incorporated into the Proposed Development design or assumed to be in place before undertaking the assessment. A definition of these classifications of mitigation and how they are considered in the EIA is provided in **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**. However, this section describes mitigation and compensation measures specifically as they relate to the aims and language of Government noise policy. In particular, the term 'compensatory mitigation' is used to describe noise insulation. This is because noise insulation is defined in Government noise policy as 'compensation', and it is applied at the end of the noise management hierarchy (as defined in the following paragraphs). However, it is a compensation measure that can be used as mitigation to reduce adverse effects. The term 'compensatory mitigation' is therefore used in the assessment for these reasons, and to differentiate noise insulation from other measures of financial compensation.

Noise management hierarchy

16.8.2 To meet the aims of Government noise policy, and to generally minimise noise as far as reasonably practicable, noise management measures have been embedded into the Proposed Development or defined in compensation policies in the following order:

a. **Mitigation at source**: optimise the construction and masterplan to minimise noise 'at source' (e.g. the design of fixed plant noise sources and the location of taxiways and ERUB); and then

b. **Mitigation by intervention**: measures used purely to control the path of noise from source to receiver (e.g. noise barriers and bunds); and then

c. **Mitigation by compensation**: through the provision of noise insulation for the receptor (residential and non-residential), see **Section 16.10**.

16.8.3 The noise management measures embedded into the Proposed Development collectively meet the second and third aims of Government noise policy to mitigate and minimise adverse effects on health and quality of life from noise and where possible contribute to improvements in health and quality of life from noise.

16.8.4 The compensatory mitigation measures (see **Section 16.10**) have been developed so that in combination with the embedded noise management measures they meet the first aim of Government noise policy to avoid significant adverse effects on health and quality of life from noise. This is achieved through the noise insulation scheme which contains eligibility criteria in line with, and below, the relevant SOAEL values.

16.8.5 Further information on the approach to noise management (mitigation and compensation) and how the aims of Government noise policy have been used to define the noise mitigation hierarchy is presented in **Appendix 16.2** Operational noise management (explanatory note) of this ES **[TR020001/APP/5.02]**.

Construction noise

16.8.6 Measures are included within the CoCP, provided as **Appendix 4.2** of this ES **[TR020001/APP/5.02]**, to manage noise and vibration emissions from construction activities. The CoCP contains details of Best Practicable Means (BPM), as defined in Section 72 of the Control of Pollution Act (Ref. 16.1). Examples of BPM that will be implemented during construction works are:

a. unnecessary revving of engines will be avoided, and equipment will be switched off when not in use;

b. internal haul routes will be kept well maintained;

c. rubber linings in, for example, chutes and dumpers will be used to reduce impact noise;

d. drop heights of materials will be minimised;

e. plant and vehicles will be sequentially started up rather than all together;

f. plant will always be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading will also be carried out away from such areas; and

g. regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturers' specifications.

16.8.7 Prior to commencement of noisy work or work that is proposed outside of core working hours, the lead contractor will be required to submit an application to the Local Authority for prior consent to carry out noisy work under Section 61 of the Control of Pollution Act (Ref. 16.1) regarding the methods that will be adopted to minimise noise and vibration as far as reasonably practicable. The Section 61 application will set out the specific method of working, the actual working hours required, noise (and if necessary, vibration) monitoring locations, details of communication measures and the BPM mitigation measures implemented to minimise noise and vibration impacts.

Air Noise (the Noise Envelope)

16.8.8 The Noise Envelope is a legally binding framework to monitor, manage and control aircraft noise, including a defined mechanism to share the noise reduction benefits of future technological improvements in aircraft between the airport and local communities. The Noise Envelope will be secured as part of the DCO through Green Controlled Growth (GCG, see **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**) and will be a legally binding framework of limits and controls to manage aircraft noise. The **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]** includes details on how the Noise Envelope will be enforced through GCG, including independent oversight and scrutiny.

16.8.9 Though the ANPS does not have effect in relation to this DCO, it nonetheless contains useful information on the design of Noise Envelopes. In line with ANPS 5.60, the Noise Envelope Design Group has been formed to ensure that "*the*

design of the envelope should be defined in consultation with local communities and relevant stakeholders". See **Section 16.4** for more information on the Noise Envelope Design Group.

16.8.10 The Noise Envelope has been designed to protect communities whilst enabling the airport to operate efficiently and allow it to grow in accordance with the limits defined by the Noise Envelope. The Noise Envelope will provide certainty to the industry and communities about how noise will be managed to comply with government policy to contribute to improvements to health and quality of life.

16.8.11 The Noise Envelope contains legally binding Limits in the form of noise contour areas. The Limits are set with reference to the reasonable worst-case noise contour areas presented in this ES (based on the faster growth sensitivity test). This means that the effects presented in the ES will not be exceeded and that the benefits of 'new generation' aircraft technology will be shared with the communities in the early years of expansion.

16.8.12 The Applicant is committed to sharing the benefits of future technological improvements (in terms of aircraft noise reduction) between communities and industry. The benefit of the transition to 'new generation' aircraft (e.g. the Airbus 320Neo and 321Neo and the Boeing 737Max) in the early years of expansion will be shared with the community, with the Noise Envelope Limits to be set at commensurate levels to secure this. The Noise Envelope also contains a mechanism for the Limit to be reduced in future years (beyond the 2030s) if 'next generation' aircraft are quieter than existing 'new generation' types, or an airspace change is implemented that would enable lower noise levels to be achieved than that forecast in the reasonable worst-case assessment reported in the ES. Further details about the mechanism for sharing the benefits within the Noise Envelope are provided in the **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**.

16.8.13 Further details on how the Noise Envelope proposals have been developed in line with Government policy and relevant guidance, including how the proposals 'share the benefits' of future aircraft technology, is presented in **Section 3** of **Appendix 16.2** of this ES **[TR020001/APP/5.01]**.

Ground Noise

16.8.14 The Proposed Development introduces new building infrastructure that screens receptors to the north of the Proposed Development from ground-based operational noise sources. The design of the Proposed Development has been undertaken to minimise distances between the runway and Terminal 2 stands so that that noise emissions from taxiing aircraft are minimised.

16.8.15 The assessment has assumed that the area designated for ERUB would be moved, with temporary locations in assessment Phase 1 and assessment Phase 2a and a permanent location provided in assessment Phase 2b. The existing ERUB is screened from receptors through use of a bund, which was estimated from ground height data to be approximately 5m in height. For assessment Phase 1, the engine run-up area is moved approximately 50m to the east and a temporary 4m barrier will be constructed to screen noise. The ERUB for each assessment phase is described in **Chapter 4** of this ES

[TR020001/APP/5.01] and locations are illustrated in **Figures 4.1** to **4.3** of this ES **[TR020001/APP/5.03]**.

16.8.16 For assessment Phase 2a, the ERUB will be located approximately 300m to the east and 50m to the north from the original location. The new ERUB will be 12m in height to provide enhanced levels of screening of engine testing activities over the current set up. For assessment Phase 2b, the ERUB will moved to a location approximately 550m to the east and 50m to the north from the original location.

16.8.17 LLAOL currently provides power for aircrafts at stands using Ground Power Units (GPUs), which function similarly to a portable generator. GPUs are quieter than powering an aircraft using the on-board Auxiliary Power Unit (APU) and the use of GPUs at the airport is encouraged to minimise noise emissions. For Terminal 2, new stands will be fitted with Fixed Electrical Ground Power so aircraft can connect directly to the mains electricity supply so GPU use will not be required.

16.8.18 The Applicant has committed as part of the Proposed Development to retrofit of all Terminal 1 stands with FEGP or non-diesel GPUs before 2040. To account for a reasonable worst-case, it is assumed that Terminal 1 stands will have non-diesel GPUs that emit equivalent levels of noise to existing GPUs.

16.8.19 An acoustic barrier is included in the Proposed Development for assessment Phase 1, assessment Phase 2a and assessment Phase 2b to screen receptors from ground noise. The barrier is located to the east and north of proposed new infrastructure in assessment Phase 1. The location of the barrier moves per assessment phase as new airport infrastructure extends to the east. In assessment Phase 2a and assessment Phase 2b, the barrier extends along the security fence approximately between the Terminal 2 building and the ERUB. The barrier is 4m high.

Fixed plant noise

16.8.20 Fixed plant noise will be designed, constructed, operated and maintained in order to meet the noise management process specified in **Appendix 16.3** of this ES **[TR020001/APP/5.02].** This will mean that there will be no significant adverse effects from fixed plant noise.

Surface access noise

16.8.21 In order to avoid significant adverse impacts on health and quality of life from surface access noise the Proposed Development is committed to improving accessibility to the airport, particularly by public transport. Further information on the sustainable transport strategy is detailed in the Surface Access Strategy **[TR020001/APP/7.12]** and Travel Plan **[TR020001/APP/7.12]**.

16.8.22 The Airport Access Road proposed as part the Proposed Development (as described in **Chapter 4** of this ES **[TR020001/APP/5.01])** would be constructed with a low noise, thin surface course system meeting the requirements of a Level 3 surface as specified in Table 9/17 of the Manual Contract Documents

for Highway Works (MCHW) Volume 1 Specification for Highway Works Series 900.

16.9 Assessment

Overview

16.9.1 This section presents the results of the assessment of significant effects on health and quality of life in noise policy terms and likely significant effects in EIA terms with the embedded and good practice mitigation measures, described in the previous section, in place.

16.9.2 This assessment should be read in conjunction with the relevant parts of the following chapters of the Environmental Statement (ES):

a. **Chapter 8** Biodiversity **[TR020001/APP/5.01]** – for likely significant effects of noise and vibration on protected species;

b. **Chapter 10** Cultural Heritage **[TR020001/APP/5.01]–** for the effects of noise and vibration on the setting of heritage assets, such as listed buildings, scheduled monuments, registered parks and gardens and conservation areas;

c. **Chapter 13** Health and Community **[TR020001/APP/5.01]** - for the assessment of health effects which considers the noise effects identified in this chapter; and

d. **Chapter 14** Landscape and Visual **[TR020001/APP/5.01]** - for the contribution of noise to any change in the wider consideration of landscape and visual amenity (including as relevant tranquillity effects at the Chilterns Area of Outstanding Natural Beauty).

16.9.3 This chapter provides an assessment of noise effects on people, primarily where they live (‘residential receptors’) in terms of individual households, nursing homes and care homes and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of ‘relative tranquillity’ (see methodology in **Section 16.5**). The chapter also contains an assessment of noise effects on non-residential receptors. See **Table 16.7** for a summary of receptor types.

16.9.4 A summary of the assessment of effects is provided in **Table 16.76** in **Section 16.14**. Significant effects are described in further detail in this section.

16.9.5 Effects that may arise due to absolute levels of noise and vibration are defined in terms of ‘below LOAEL’, ‘above LOAEL and below SOAEL’ and ‘above SOAEL’ and are described in **Table 16.29** with reference to the “Noise exposure hierarchy table” in PPGN.

Table 16.29: Noise Effect Level Descriptions

Effect	Description from PPGN
'below LOAEL'	"*Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.*"
'above LOAEL and below SOAEL'	"*Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.*"
'above SOAEL'	"*Noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.*"

16.9.6 The assessment of noise effects has been undertaken with reference to the three aims of the Noise Policy Statement of England (which are also reflected in paragraph 5.68 of the ANPS). The three aims and how they are responded to in the Proposed Development are as follows.

Avoid significant adverse effects[28] on health and quality of life from noise

16.9.7 Significant adverse effects on health and quality of life are determined by exposure to noise above the SOAEL. No exposure above the SOAEL is predicted for construction noise or ground noise.

16.9.8 For air noise, the 2019 Actuals baseline determines the number of properties last experiencing significant adverse effects on health and quality of life when the airport was operating under pre-covid circumstances. In this assessment, future DS air noise predictions for each assessment phase are compared to the 2019 Actuals baseline to demonstrate that there will be a reduction in properties experiencing significant adverse effects on health and quality of life. Continuing significant adverse effects due to exposure above the air noise SOAEL will be avoided by the enhanced noise insulation scheme (see **Section 16.10**).

16.9.9 For surface access noise, indirect significant adverse effects on health and quality of life that have been identified in this chapter as a result of intensification of road traffic using existing public highways in assessment Phase 2a and 2b where noise exposure is already above the SOAEL without

[28] The NPSE uses the term 'impacts'' however, this has been changed to 'effects' to align with terminology used in national noise policy and this ES chapter

the Proposed Development. These effects will be reassessed using updated road traffic information, and if the effects are confirmed, noise insulation will be provided to avoid these indirect significant effects. See **Appendix 16.2** of this ES **[TR020001/APP/5.01]** for further information on the reassessment of surface access noise indirect significant effects.

Mitigate and minimise adverse effects on health and quality of life from noise

16.9.10 The embedded mitigation measures presented in **Section 16.8** will mitigate and minimise adverse impacts from noise. These include the Noise Envelope which is designed to protect communities whilst enabling the airport to operate efficiently and allowing it to grow in accordance with the limits defined by the Noise Envelope. The limits and thresholds in the Noise Envelope will ensure that known improvements in aircraft technology will be shared between local communities and the Applicant.

Where possible, contribute to improvements to health and quality of life

16.9.11 Properties experiencing noise levels exceeding the SOAEL (day and night) are currently eligible for a contribution to insulation under the existing compensation scheme. These properties would be eligible for a full package of sound insulation through the enhanced noise insulation scheme (see **Section 16.10** and **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**). Additionally, the enhanced sound insulation scheme would provide a financial contribution towards agreed noise insulation work for properties experiencing noise for those below the SOAEL but within the 54dB$L_{Aeq,16h}$ noise contour. These proposals represent a substantial improvement on the current insulation package offered and would allow an increased number of properties to benefit from sound insulation. Sound insulation would contribute to improvements in health and quality of life through achieving good internal acoustic conditions at properties affected by aircraft noise. Sound insulation also provides a means to address the noise aim of the APF to limit and where possible reduce the number of people in the UK significantly affected by aircraft noise by providing a means to avoid significant effects on health and quality of life. This was considered in the Cranford Appeal decision (Ref. 16.75) which states at paragraph 1087 *"Against this background I consider that the proffered mitigation between SOAEL and UAEL is consistent with the APF and would be sufficient to avoid significant observed adverse effects."*

16.9.12 The Noise Envelope will include a mechanism for reducing the noise limits in future years when the noise benefits of future technology (next-generation aircraft and/or benefits from airspace change) are known. This would mean that the number of people exposed to air noise levels above the LOAEL and SOAEL could be less than those reported in this assessment for assessment Phase 2a and 2b, and could provide an even greater reduction in exposure compared to the 2019 Actuals baseline.

Construction effects

Construction Noise

Assessment Phase 1

Main Application Site

16.9.13 The assessment of construction noise in assessment Phase 1 on the Main Application Site (as described in **Chapter 2** of this ES **[TR020001/APP/5.01]**) covers representative worst-case assessment scenarios for each year of the construction period from 2025 to 2027.

16.9.14 Details of how works being undertaken during these periods have informed the construction noise and vibration assessment are presented in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Full details of the works being undertaken are presented in **Appendix 4.1** of this ES **[TR020001/APP/5.02]**.

16.9.15 Predictions of reasonable worst-case construction noise levels have been undertaken at assessment locations detailed in **Table 16.21**. The predicted maximum construction noise level for assessment Phase 1 scenarios assessed at each assessment location are provided in **Table 16.30**. The construction noise effect at each assessment location has been identified based on criteria presented in **Table 16.11**. Effects in terms of LOAEL and SOAEL are described in **Table 16.29**.

16.9.16 Full details of predicted construction noise levels for each scenario are presented in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Assessment locations are illustrated in **Figure 16.4** of this ES **[TR020001/APP/5.03]**.

Table 16.30: Assessment Phase 1 Predicted Reasonable Worst-case Construction Noise Levels

Receptor	Highest Predicted Construction Noise Level dB $L_{Aeq,T}$ (façade)
Below LOAEL	
GR1	52
GR2	31
GR3	47
GR4	51
GR5	49
GR6	57
GR7	62
GR8	59
GR9	62
GR10	59
GR11	61
GR12	60
GR13	61
GR22	64
GR23	60
GR24	54
Above or equal to LOAEL and below SOAEL	
GR14	65
GR15	66
GR16	67
GR17	68
GR18	72
GR19	71
GR20	68
GR21	67
Above or equal to SOAEL	
No exceedances of SOAEL have been predicted	

16.9.17 The assessment of construction noise indicates that there is unlikely to be any exceedances of the SOAEL during assessment Phase 1 construction. As such, assessment Phase 1 construction activities are considered to be **not significant**.

16.9.18 Temporary exceedances of the LOAEL are noted at some receptors during assessment Phase 1 construction. In addition, one non-residential receptor is

identified as exceeding criteria in **Table 16.19.** A summary of receptors that may be affected by construction noise and the construction activity that results in the exceedance are presented in **Table 16.31**.

Table 16.31: Assessment Phase 1 Affected Receptors

Year	Source of Noise	Number of Properties Exceeding LOAEL	Number of Non-residential Receptors
1	Substation construction	16	1
2	P9 car park construction P6/P7 car park construction	36	2
3	-	0	0

16.9.19 The number of receptors that are predicted to experience noise levels exceeding the LOAEL during year 1 of assessment Phase 1 are 16 properties to the north of Eaton green Road. Additionally, one non-residential receptor (Raynham Way Community Centre) is identified as exceeding criteria in **Table 16.19**. This is due to substation construction works (Work No. 4w) to the west of car park P9 (Work No. 4o(01)) (as described in **Chapter 4** of this ES **[TR020001/APP/5.01]**.

16.9.20 Work on the substation involves the following phases:

a. Foundation and base
b. Structure
c. Excavation for cables

16.9.21 Noise predictions cover a reasonable worst-case, which is considered to be the foundation and base phase. This phase is unlikely to last for longer than 3 months given the size of the work area footprint (approximately 4,000 m^2) and the maximum substation height of 7.6 m, which would not require substantial foundations.

16.9.22 A further consideration is ambient noise levels at this location, which are measured at ML15 at 66dB$L_{Aeq,12h}$ during the period of 07:00 to 19:00. Consequently, given the temporary and relatively short period of likely exposure to noise levels exceeding the LOAEL, the low number of receptors affected and the comparatively high ambient noise conditions, noise effects during year 1 of assessment Phase 1 are considered to be **not significant**.

16.9.23 In year 2 of assessment Phase 1, construction activities at the P9 car park (Work No. 4o(01)) are predicted to result in exceedances of the LOAEL at 36 properties to the north of Eaton Green Road. Additionally, one non-residential receptor (Raynham Way Community Centre) in year 2 of assessment Phase 1 is identified as exceeding criteria in **Table 16.19**. Calculations of noise due to P9 car park works are based on construction of a new car park when works on

the P9 cark park will only reconfigure an existing car park, which would generate lower levels of noise than laying a new surface. Consequently, if exceedances of the LOAEL occur, they are only likely to happen for limited periods.

16.9.24 Considering the low likelihood of exceedance of the LOAEL for extended periods of time and the measured ambient noise levels of 66dB$L_{Aeq,12h}$, it is concluded that construction noise effects during year 2 of assessment Phase 1 are **not significant**.

16.9.25 One non-residential receptor (Wigmore Valley Park Community Centre) is identified as exceeding the absolute noise level criteria in **Table 16.19** in year 2 of assessment Phase 1 due to a combination of P6/P7 and P9 car park construction works. Whilst, the predicted noise levels of 65dB$L_{Aeq,T}$ exceeds non-residential assessment criteria for community centres in **Table 16.19**, the exceedance will be temporary and limited for periods when both P6/P7 and P9 construction works are undertaken simultaneously in areas of the respective sites that are closest to Wigmore Valley Park Community Centre. As any temporary exceedances of the threshold are likely to be limited and the levels of construction noise are not considered sufficient to disrupt regular activities at Wigmore Valley Park Community Centre, it is concluded that construction noise effects during year 2 of assessment Phase 1 are **not significant**.

16.9.26 Whilst the effects are temporary in nature, an exceedance of the LOAEL represents noise that is considered to be noticeable and intrusive. Consequently, mitigation measures should be adopted to minimise noise as far as reasonably practicable. Mitigation measures secured through the CoCP (see **paragraph 16.8.6**) are considered to represent appropriate best practicable means and will ensure that construction noise is minimised at all times throughout the construction programme.

M1 (J10) Works

16.9.27 Assessment Phase 1 M1 junction 10 works (Work No. 6e(n)) include widening of the northbound off-slip to provide a third lane on the approach to the roundabout, with the widening accommodated in the existing verge and embankment.

16.9.28 Widening to the western circulatory carriageway to provide four circulating lanes, with this widening accommodated in the existing landscaped area on the inside of the roundabout. Amendments to the exit from the roundabout onto the A1081, to allow three lanes to diverge from the roundabout. This widening would be accommodated within existing verge area.

16.9.29 The nearest receptors to work areas are located approximately 100m away (to the west of the junction 10 slip road). At this distance, construction noise from typical road work activities is unlikely to exceed the LOAEL. Although the LOAEL is unlikely to be exceeded, mitigation measures secured in the CoCP will ensure that construction noise is minimised at all times. Consequently, noise from assessment Phase 1 M1 (J10) works will be **not significant**.

Potential out of hours work

16.9.30 Due to the site being an operational airport, out of hours works may be necessary due to safety requirements. Potential out of hours works that may occur during assessment Phase 1 are works:

a. Terminal 1 enhancements; and

b. M1 junction 10 works.

16.9.31 The requirement for out of hours works during assessment Phase 1 would be confirmed once a lead contractor is appointed and the construction methodology is finalised. All out of hours works would be subject to a Section 61 application (as secured in the CoCP), which would require the lead contractor to provide details, where required, on the methodology, mitigation, communication strategy and monitoring. Following this process would mean that it is likely that impacts for out of hours operation will be **not significant**.

Assessment Phase 2a

Main Application Site

16.9.32 The assessment of construction noise in assessment Phase 2a covers representative worst-case assessment scenarios for each year of the construction period from 2032 to 2035.

16.9.33 Details of how works being undertaken during these periods have informed the noise and vibration assessment are presented in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Full details of the works being undertaken are presented in **Appendix 4.1** of this ES **[TR020001/APP/5.02]**.

16.9.34 Predictions of reasonable worst-case construction noise levels have been undertaken at assessment locations detailed in **Table 16.22**. The predicted maximum construction noise level for assessment Phase 2a scenarios assessed at each assessment location are provided in **Table 16.32**. The construction noise effect at each assessment location has been identified based on criteria presented in **Table 16.11**. Effects in terms of LOAEL and SOAEL are described in **Table 16.29**.

16.9.35 Full details of predicted construction noise levels for each scenario are presented in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Assessment locations are illustrated in **Figure 16.4** of this ES **[TR020001/APP/5.03]**.

Table 16.32: Assessment Phase 2a Predicted Reasonable Worst-case Construction Noise Levels

Receptor	Highest Predicted Construction Noise Level dB $L_{Aeq,T}$ (façade)
Below LOAEL	
GR1	49
GR2	42
GR3	45
GR4	51
GR5	50
GR6	62
GR7	57
GR8	56
GR9	57
GR10	56
GR11	58
GR12	60
GR13	61
GR14	64
GR19	64
GR20	62
GR21	61
GR22	59
GR23	58
GR24	50
Above or equal to LOAEL and below SOAEL	
GR15	66
GR16	67
GR17	66
GR18	65
Above or equal to SOAEL	
No exceedances of SOAEL have been predicted	

16.9.36 The assessment of construction noise indicates that there is unlikely to be any exceedances of the SOAEL during assessment Phase 2a. As such, assessment Phase 2a construction activities are considered to be **not significant**.

16.9.37 Exceedances of the LOAEL are noted during year 2, 3 and 4 of assessment Phase 2a. This is due to construction works on the east section of the Airport

Access Road (AAR) and are predicted to affect seven receptors located of the north of Eaton Green Road. Exceedances of the LOAEL are identified due to works on the northern spur of the AAR that connects to Eaton Green Road.

16.9.38 As the northern spur of the AAR makes up a small part of the road, works on this section of road would be limited in duration. When considering the measured ambient noise levels at this location of 66dB$L_{Aeq,12h}$, the low number of receptors affected and the limited duration of exposure time, it is concluded that construction noise effects during assessment Phase 2a are **not significant**.

16.9.39 One non-residential receptor (Wigmore Valley Park Community Centre) is identified as exceeding the absolute noise level criteria in **Table 16.19** in year 2, 3 and 4 of assessment Phase 2a due to AAR construction works. Whilst, the predicted noise levels of 64dB$L_{Aeq,T}$ exceeds non-residential assessment criteria for community centres in **Table 16.19**, the exceedance will be temporary and limited for periods when AAR works are being undertaken eastern spur of the AAR. As any temporary exceedances of the threshold are likely to be limited and the levels of construction noise are not considered sufficient to disrupt regular activities at Wigmore Valley Park Community Centre, it is concluded that construction noise effects during year 2, 3 and 4 of assessment Phase 2a are **not significant**.

16.9.40 Temporary exceedances of the LOAEL are noted at some receptors during assessment Phase 2a. Mitigation measures secured through the CoCP (see **paragraph 16.8.6**) will ensure that construction noise is minimised as far as reasonably practicable throughout the construction programme.

M1 (J10) Works

16.9.41 Assessment Phase 2a M1 junction 10 works (Work No. 6e(o)). include widening to the A1081 westbound carriageway to enable two left turn lanes to continue onto the M1 southbound on-slip, where widening is also proposed. The nearest receptors to these works are approximately 400m to the west, which is sufficiently far that noise emissions from works will be below the LOAEL. Although the LOAEL is unlikely to be exceeded, mitigation measures secured in the CoCP will ensure that construction noise is minimised at all times. Consequently, noise from assessment Phase 2a M1 (J10) works will be **not significant**.

Potential out of hours work

16.9.42 Due to the site being an operational airport, out of hours works may be necessary due to safety requirements. Potential out of hours works that may occur during assessment Phase 2a are:

a. Terminal 2 pier construction.
b. Luton DART extension works;
c. underground services;
d. runway/ taxiway interface works; and

e. M1 junction 10 works.

16.9.43 The requirement for out of hours works during assessment Phase 2a would be confirmed once a lead contractor is appointed and the construction methodology is finalised. All out of hours works would be subject to a Section 61 application (as secured in the CoCP), which would require the lead contractor to provide details of the contain details, where required, on the methodology, mitigation, communication strategy and monitoring. Following this process would mean that it is likely that impacts for out of hours operation will be **not significant**.

Assessment Phase 2b

Main Application Site

16.9.44 The assessment of construction noise in assessment Phase 2b covers representative worst-case assessment scenarios for each year of the construction period from 2037-2041.

16.9.45 Details of how works being undertaken during these periods have informed the noise and vibration assessment are presented in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Full details of the works being undertaken are presented in **Appendix 4.1** of this ES **[TR020001/APP/5.02]**.

16.9.46 Predictions of reasonable worst-case construction noise levels have been undertaken at assessment locations detailed in **Table 16.22**. The predicted maximum construction noise level for assessment Phase 2b scenarios assessed at each assessment location are provided in **Table 16.33**. The construction noise effect at each assessment location has been identified based on criteria presented in **Table 16.11**. Effects in terms of LOAEL and SOAEL are described in **Table 16.29**.

16.9.47 Full details of predicted construction noise levels for each scenario are presented in **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Assessment locations are illustrated in **Figure 16.4** of this ES **[TR020001/APP/5.03]**.

Table 16.33: Assessment Phase 2b Predicted Reasonable Worst-case Construction Noise Levels

Receptor	Highest Predicted Construction Noise Level dB $L_{Aeq,T}$ (façade)
Below LOAEL	
GR1	61
GR2	33
GR3	54
GR4	51
GR5	48
GR6	63
GR7	55
GR8	51
GR9	55
GR10	57
GR11	61
GR12	62
GR13	62
GR14	62
GR15	64
GR16	57
GR17	58
GR18	59
GR19	59
GR20	56
GR21	51
GR22	54
GR23	49
GR24	58
Above or equal to LOAEL and below SOAEL	
No exceedances of LOAEL have been predicted	
Above or equal to SOAEL	
No exceedances of SOAEL have been predicted	

16.9.48 The assessment of construction noise indicates that there is unlikely to be any exceedance of the LOAEL or SOAEL during assessment Phase 2b. As such, assessment Phase 2b construction activities are considered to be **not significant**.

16.9.49 One non-residential receptor (Wigmore Valley Park Community Centre) is identified as exceeding the absolute noise level criteria in **Table 16.19** in year 3 and 4 of assessment Phase 2b due to construction of New Century Park buildings. Whilst, the predicted noise levels of 62dB$L_{Aeq,T}$ exceeds non-residential assessment criteria for community centres in **Table 16.19**, the exceedance will be temporary and limited for periods when construction of New Century Park buildings is undertaken in areas of the respective sites that are closest to Wigmore Valley Park Community Centre. As any temporary exceedances of the threshold are likely to be limited and the levels of construction noise are not considered sufficient to disrupt regular activities at Wigmore Valley Park Community Centre, it is concluded that construction noise effects during year 3 and 4 of assessment Phase 2b are **not significant**.

16.9.50 Mitigation measures secured through the CoCP (see **paragraph 16.8.6**) will ensure that construction noise is minimised as far as reasonably practicable throughout the construction programme.

M1 (J10) Works

16.9.51 Assessment Phase 2b M1 junction 10 works (Work No. 6e(p)) include widening of the western circulatory carriageway to provide five lanes, realignment of the A1081 exit to enable three lanes to exit roundabout onto A1081 and provision of two southbound merging lanes onto the M1. The nearest receptors to these works are approximately 200m to the west, which is sufficiently far that noise emissions from works will be below the LOAEL. Although the LOAEL is unlikely to be exceeded, mitigation measures secured in the CoCP will ensure that construction noise is minimised at all times. Consequently, noise from assessment Phase 2b M1 (J10) works will be **not significant**.

Potential out of hours work

16.9.52 Due to the site being an operational airport, out of hours works may be required due to safety requirement. Potential out of hours works that may occur during assessment Phase 2b are:

a. Terminal 2 pier construction; and

b. M1 junction 10 works.

16.9.53 The requirement for out of hours works during assessment Phase 2b would be confirmed once a lead contractor is appointed and the construction methodology is finalised. All out of hours works would be subject to a Section 61 application (as secured in the CoCP), which would require the lead contractor to provide details, where required, on the methodology, mitigation, communication strategy and monitoring. Following this process would mean that it is likely that impacts for out of hours operation will be **not significant**.

Construction vibration

16.9.54 Construction vibration effects are defined in terms of ‘below LOAEL’, ‘above LOAEL and below SOAEL’ and ‘above SOAEL’. Effects in terms of LOAEL and SOAEL are described in **Table 16.29**.

Assessment Phase 1

16.9.55 The nearest receptor, which is residential, to the Main Application Site is approximately 50m away. This receptor may experience perceptible levels of vibration during earthworks compaction, which will be undertaken using vibratory rollers[29].

16.9.56 The level of vibration experienced at sensitive receptors would depend on the ground conditions; however, calculations of vibration based on manufacturers specification for vibratory rollers (see **Section 5** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**) indicates that there is a 5% probability that the PPV would exceed 0.3mm/s (equal to the LOAEL) at a distance of 50m. As this level of PPV is predicted to only occur for 5% of the time when a vibratory roller is operated at the nearest boundary to the receptor, an exceedance of the LOAEL is considered to be unlikely.

16.9.57 There is only one receptor at a distance of 50 m from the Main Application Site boundary with all other receptors located further than 80m away. Consequently, all other receptors would experience vibration levels below the LOAEL.

16.9.58 Piling may be required to build the foundation of the P9 car park. The nearest receptors (GR18), which are residential, to the P9 car park boundary are approximately 20m away. The level of vibration experienced at sensitive receptors would depend on the ground conditions; however, calculations of vibration based on BS 5228-2 data for piling activities (see **Section 5** of **Appendix 16.1** of this ES of this ES **[TR020001/APP/5.02]**) result in a predicted PPV of 0.7 mm/s (above LOAEL and below SOAEL) at a distance of 20m. This assumes a continuous flight augur piling method would be adopted, which it typical for this type of construction and considered to be best practice.

16.9.59 Calculations indicate that the LOAEL for construction vibration may be exceeded up to a distance of 40 m from the site boundary. If piling is required for the P9 car park, there are 12 properties within this distance of the P9 car park boundary that may be affected. These properties would only be affected by potential adverse levels of duration for limited periods of time (less than 10 days in a consecutive 15-day period) when piling is taking place within 40 m.

16.9.60 Based on the results of vibration calculations, the number of receptors exposed and the duration of exposure, assessment Phase 1 construction vibration is considered to be **not significant**.

Assessment Phase 2a

16.9.61 Piling would take place in assessment Phase 2a to support earthworks, for the Luton DART extension and for Terminal 2 infrastructure; however, the distance to nearest receptors (minimum distance of approximately 500m) is such that piling induced vibration is unlikely to be perceptible. Earthworks may be required in proximity of GR6; however, the Main Application Site is at a distance of 40m so calculations indicate that there is a 95% probability that the PPV

[29] A vibratory roller is a piece of machinery that is used to flatten or smooth materials like compact soil or asphalt.

would not exceed 0.4mm/s (above LOAEL and below SOAEL). As this level of PPV is predicted to only occur for 5% of the time when a vibratory roller is operated at the nearest boundary to the receptor, an exceedance of the LOAEL is considered to be unlikely.

16.9.62 There is only one receptor at a distance of 50 m from the Main Application Site boundary with all other receptors located further than 100m away. All other receptors would experience vibration levels below the LOAEL.

16.9.63 Consequently, based on the results of vibration calculations, the number of receptors exposed and the duration of exposure, assessment Phase 2a construction vibration is considered to be **not significant**.

Assessment Phase 2b

16.9.64 Piling would take place in assessment Phase 2b to support earthworks and for Terminal 2 infrastructure; however, the distance to nearest receptors (minimum distance of approximately 200m) is such that piling induced vibration is unlikely to be perceptible. As with assessment Phase 2a, earthworks may be required in proximity of GR6; however, the closest distance that earthworks may be undertaken does not change from assessment Phase 2a so there is a 95% probability that the PPV would not exceed 0.4 mm/s (above LOAEL and below SOAEL). As this level of PPV is predicted to only occur for 5% of the time when a vibratory roller is operated at the nearest boundary to the receptor, an exceedance of the LOAEL is considered to be unlikely.

16.9.65 There is only one receptor at a distance of 50 m from the Main Application Site boundary with all other receptors located further than 100m away. All other receptors would experience vibration levels below the LOAEL.

16.9.66 Consequently, based on the results of vibration calculations, the number of receptors exposed and the duration of exposure, assessment Phase 2b construction vibration is considered to be **not significant**.

Construction traffic noise

16.9.67 The primary access route to the Main Application Site would be via Junction 10 of the M1, along the A1081 (New Airport Way), then via President Way or the proposed AAR. Whilst there may be other access routes used by a small amount construction traffic, these routes will consist of heavily trafficked main roads that will be unaffected by the additional construction traffic and have not been considered further in the assessment.

16.9.68 As no sensitive receptors are located with 50m of President Way or proposed AAR, the construction traffic assessment focuses on potential changes in noise due to construction traffic on the A1081. The A1081 has existing high traffic flows. Consequently, as noise is not sensitive to small changes in traffic flows, it would require a large number of vehicle movements to result in an appreciable change in road traffic noise.

16.9.69 Construction traffic flow data is provided in **Appendix 4.1** of this ES **[TR020001/APP/5.02]**.

Assessment Phase 1

16.9.70 The assessment of construction traffic noise for assessment Phase 1 considers increases in road traffic noise from the 2019 baseline scenario. This is taken as a conservative estimation of road traffic flows during assessment Phase 1.

16.9.71 Construction traffic data suggests that, during peak periods in assessment Phase 1, there would be approximately, on average, 97 heavy goods vehicles (HGVs) per day. 2019 baseline data for the A1081 provides the lowest flow level for the section between the A505 and Percival Way, of 23,137 18-hour annual average weekday traffic (AAWT) with 161 HGVs. Construction traffic movements on this section of road would result in an increase in noise of 0.4 dB. This is equivalent to a **negligible** impact which is **not significant**.

Assessment Phase 2a

16.9.72 The assessment of construction traffic for assessment Phase 2a noise considers increases in road traffic noise from the 2027 DS scenario (end of assessment Phase 1). This is taken as a conservative estimation of road traffic flows during assessment Phase 2a.

16.9.73 Construction traffic data suggests that, during peak periods in assessment Phase 2a, there would be approximately, on average, 198 HGVs per day. 2027 DS data for the A1081 provides the lowest flow level for the section between the A505 and Percival Way, of 28,183 18-hour annual average weekday traffic AAWT with 603 HGVs. Construction traffic movements on this section of road would result in an increase in noise of 0.5 dB. This is equivalent to a **negligible** impact and is **not significant**.

Assessment Phase 2b

16.9.74 The assessment of construction traffic noise for assessment Phase 2b considers increases in road traffic noise from the 2039 DS scenario. This is taken as a conservative estimation of road traffic flows during assessment Phase 2b.

16.9.75 Construction traffic data suggests that, during peak periods in assessment Phase 2b, there would be, on average, approximately 127 HGVs per day. 2039 DS data for the A1081 provides the lowest flow level for the section between the A505 and Percival Way, of 17,101 18-hour annual average weekday traffic (AAWT) with 185 HGVs. Construction traffic movements on this section of road would result in an increase in noise of 0.6 dB. This is equivalent to a **negligible** impact and is **not significant**.

Construction traffic vibration

16.9.76 When considering traffic generated vibration, DMRB states that: "*Ground-borne vibrations are produced by the movement of rolling wheels on the road surface and can be perceptible in nearby buildings if heavy vehicles pass over irregularities in the road*" (Paragraph A5.25).

16.9.77 Occupants of buildings would be at risk to disturbance from traffic generated vibration if buildings were "…*founded on soft soils close to heavily trafficked*

older roads where the road surface is uneven or constructed from concrete slabs which can rock under the weight of passing heavy vehicles" (paragraph A5.25).

16.9.78 Given that construction traffic would access/egress the Main Application Site using A-roads, construction traffic would use routes that are required to be kept in good condition due to heavy traffic flows. Additionally, haul routes and access roads will be kept well maintained to minimise construction traffic induced vibration (see **Appendix 4.2** of this ES **[TR020001/APP/5.02]**). Consequently, the conditions described above for risk of disturbance from construction traffic vibration are unlikely to occur on roads used by construction traffic and construction traffic vibration is considered to be **not significant**.

Operational effects

Air Noise

16.9.79 The assessment of air noise has been undertaken using the $L_{Aeq,T}$ noise metric to assess the likely effects on health and quality of life due to noise exposure and the likely significant effects due to noise change (adverse and beneficial) that arise from increased aircraft movements as a result of the Proposed Development. Additional context to the assessment is provided through the use of supplementary noise metrics.

16.9.80 The noise assessment considers the impact of the Proposed Development against future baseline years which account for the noise benefits from fleet transition to new generation aircraft if current consented passenger limits were retained. Further information on the forecasts and assumptions on transition to new generation aircraft are provided in **Section 7** of the **Need Case [TR020001/APP/7.04]**.

16.9.81 The assessment of air noise is undertaken through consideration of both the change in noise level as a result of the Proposed Development and the absolute noise level as a result of the Proposed Development. Details on the methodology for the air noise assessment and results are presented in **Section 6** and **7** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.9.82 The predicted change in noise between the DM and DS scenarios for each assessment phase has been identified for all receptors within the study area. The significance of effect of the change in noise is determined based on whether an assessment location experiences noise levels of between LOAEL and SOAEL or exceeding the SOAEL in the DS scenarios. Effects in terms of LOAEL and SOAEL are described in **Table 16.29**.

Assessment Phase 1

Residential receptors

16.9.83 This section provides an assessment of operational air noise effects in assessment Phase 1 on people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private

open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).

16.9.84 Analysis of noise contours has been undertaken to ascertain the area coverage, number of households and population that are likely to be affected by air noise and to identify the location and extent of significant effects.

16.9.85 Analysis of area coverage by assessment Phase 1 2027 DM and DS air noise contours are presented in **Table 16.34** for daytime $L_{Aeq,16h}$ (see **Figure 16.13** and **Figure 16.15** in this ES **[TR020001/APP/5.03]**) and **Table 16.35** for night-time $L_{Aeq,8h}$ (see **Figure 16.14** and **Figure 16.16** in this ES **[TR020001/APP/5.03]**).

16.9.86 Analysis of households and population within assessment Phase 1 2027 DS daytime $L_{Aeq,16h}$ and night-time $L_{Aeq,8h}$ air noise contours are presented in **Section 7.8** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.9.87 Additional details on supplementary noise metrics (awakenings, overflights and number above contours) for assessment Phase 1 are provided in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]** and the following figures:

a. DM and DS daytime overflight contours are presented in **Figure 16.19** and **Figure 16.21** of this ES **[TR020001/APP/5.03].** DM and DS night-time overflight contours are presented in **Figure 16.20** and **Figure 16.22** of this ES **[TR020001/APP/5.03]**.

b. DM and DS daytime N65 contours are presented in **Figure 16.23** and **Figure 16.25** of this ES **[TR020001/APP/5.03].** DM and DS night-time N60 contours are presented in **Figure 16.24** and **Figure 16.26** of this ES **[TR020001/APP/5.03].**

Table 16.34: Assessment Phase 1 2027 Daytime Air Noise Analysis – Area

$L_{Aeq,16h}$ dB Noise Contour	2019 Actual Baseline Cumulative Area (km^2)	2027 DM Cumulative Area (km^2)	2027 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2) (DS-Baseline)	Change in Cumulative Area (km^2) (DS-DM)
51 (LOAEL)	**58.1**	**45.5**	**52.3**	**-5.8**	**+6.8**
54	35.4	26.3	30.6	-4.8	+4.3
57	20.3	13.7	16.4	-3.9	+2.7
60	10.4	6.8	8.0	-2.4	+1.2
63 (SOAEL)	**5.6**	**3.5**	**4.2**	**-1.4**	**+0.7**
66	2.7	1.7	1.9	-0.8	+0.2
69 (UAEL)	**1.4**	**1.0**	**1.1**	**-0.3**	**+0.1**

Table 16.35: Assessment Phase 1 2027 Night-time Air Noise Analysis – Area

$L_{Aeq,8h}$ dB Noise Contour	2019 Actual Baseline Cumulative Area (km^2)	2027 DM Cumulative Area (km^2)	2027 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2) (DS-Baseline)	Change in Cumulative Area (km^2) (DS-DM)
45 (LOAEL)	**74.6**	**56.1**	**70.8**	**-3.8**	**+14.7**
48	45.3	32.4	42.2	-3.1	+9.8
51	26.5	17.6	24.1	-2.4	+6.5
54	14.1	8.7	12.5	-1.6	+3.8
55 (SOAEL)	**11.2**	**7.0**	**9.7**	**-1.5**	**+2.7**
57	7.0	4.6	6.3	-0.7	+1.7
60	3.6	2.2	3.1	-0.5	+0.9
63 (UAEL)	**1.7**	**1.2**	**1.5**	**-0.2**	**+0.3**

16.9.88 A summary of population within the LOAEL, SOAEL and UAEL contours is provided in **Table 16.36** for the 2019 actuals baseline, the DM and the DS scenarios.

Table 16.36: Assessment Phase 1 2027 Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Population				
	2019 Actual Baseline	2027 DM	2027 DS	Change DS – 2019 Actuals Baseline	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	39,350	25,000	31,600	-7,750	6,600
Above SOAEL and below UAEL	1,650	50	450	-1,200	400
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	62,850	38,350	52,050	-10,800	13,700
Above SOAEL and below UAEL	4,950	2,100	3,800	-1,150	1,700
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

16.9.89 **Table 16.36** demonstrates that there is a reduction in the total population exposed between the LOAEL and SOAEL and between the SOAEL and UAEL in DS 2027 compared to the 2019 Actuals Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

16.9.90 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in **Table 16.13**. During the daytime and night-time, the population exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 1.

16.9.91 The community areas that experience continuing exposure above the SOAEL are indicated by those within the SOAEL contours for daytime and night-time in **Figure 16.17** and **Figure 16.18** in this ES **[TR020001/APP/5.03],** and are

summarised in **Table 16.37**. The results of noise predictions using primary and supplementary metrics at the individual air noise assessment locations representative of these communities are presented in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. As described in the **Section 16.5**, these supplementary metrics provide additional context to the identified effects, but do not change the conclusions of the assessment.

Table 16.37: Assessment Phase 1 2027 Community areas that experience continuing exposure above the air noise SOAEL

Location	Community area[30]	Daytime / Night-time
To the west of the airport	Properties along Cutenhoe Road and the southern end of Park Street, represented by AR13	Daytime and night-time
	Community areas around Luton Hoo Memorial Park, broadly between the A1081, Linden Academy, Tennyson Road Primary School (South Campus) and Stockwood Park, represented by AR13, AR32 and AR40	Night-time only
	Isolated properties to the south of the A1081 on London Rd	Night-time only
	Isolated properties to the south of the A1081 on The Luton Drive and Lower Harpenden Road	Daytime and night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only
To the east of the airport	Southern parts of Beachwood Green, represented by AR37	Night-time only
	Lye Hill, represented by AR2	Daytime and night-time
	Isolated properties to the north of Bendish, represented by AR5	Night-time only
	Other isolated properties between the airport and Stagenhoe park	Night-time only

16.9.92 The communities described above which experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation (see **Section 16.10**).

16.9.93 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. **Table 16.38** provides a summary of the population experiencing changes in noise using the criteria outlined in **Table 16.14**. The geographic areas over which these changes occur

[30] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

for daytime and night-time are presented in **Figure 16.17** and **Figure 16.18** of this ES **[TR020001/APP/5.03]**.

Table 16.38: Assessment Phase 1 2027 Summary of DS-DM air noise change

Magnitude of effect	Noise increase (DS-DM)	Population experiencing change	
		Day	Night
DS noise above LOAEL and below SOAEL			
Negligible	0.1 - 0.9dB	31,600	19,050
	1.0 - 1.9dB	0	33,000
Minor	2.0 - 2.9dB	0	0
Moderate	3.0 - 5.9dB	0	0
Major	6.0dB or more	0	0
DS noise above SOAEL and below UAEL			
Negligible	0.1 - 0.9dB	450	0
Minor	1.0 - 1.9dB	0	3,800
Moderate	2.0 - 2.9dB	0	0
	3.0 - 3.9dB	0	0
Major	4.0dB or more	0	0
DS noise above UAEL			
Unacceptable	0.1 dB or more	0	0

16.9.94 No receptors within the study area experience a decrease in air noise between the DM and the DS scenarios. The increase in air noise from the DM to the DS scenarios during the daytime period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately 15%. The total increase in aircraft movements during the daytime period is forecast to be approximately 11%. The increase in air noise during the night-time period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately of 29%. The total increase in aircraft movements during the night-time period is forecast to be approximately 26%. Due to the limit of 9,650 movements during the night quota period (from 23:30 to 06:00) the increase in movements during the night-time period will mostly occur in the periods from 06:00 to 07:00 and 23:00 to 23:30. This restriction will be retained in future as a requirement of the DCO.

16.9.95 During the daytime, the population of 31,600 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 1dB corresponding to a **negligible** adverse effect which is **not significant**. Of this population, the 15,050 between the 54dB$L_{Aeq,16h}$ contour and the 63dB$L_{Aeq,16h}$ contour would be eligible for noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.96 During the daytime, the population of 450 exposed to noise between the SOAEL and UAEL experience noise increases of less than 1dB corresponding to a **negligible** adverse effect which is **not significant**. This population would

be eligible for a full package of noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.97 During the night-time, the population of 52,050 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 2dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. Of this population, the 11,650 outside the night-time SOAEL but inside the 54dB$L_{Aeq,16h}$ contour would be eligible for noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.98 During the night-time, the population of 3,800 exposed to noise between the SOAEL and UAEL experience noise increases corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above SOAEL. This population is illustrated by the area within the SOAEL contour in **Figure 16.18b** in this ES **[TR020001/APP/5.03]** and includes the community areas listed in **Table 16.39**. This population would be eligible for a full package of noise insulation which would avoid the adverse likely significant effects (see **Section 16.10** and **Section 16.11**).

16.9.99 In assessment Phase 1, where likely significant adverse effects due to noise change above SOAEL are predicted to occur as early as 2027, the full roll out of noise insulation may not have been completed before the relevant noise change occurs. However, it is important to note that these communities are already exposed to noise levels above the SOAEL in the 2019 Actuals baseline, and will experience a lower noise exposure in 2027, even with the Proposed Development in place. These effects are therefore not significant effects on health and quality of life as a result of the Proposed Development but are adverse likely significant effects in EIA terms when considering the change from the Do-Minimum (without the Proposed Development) to the Do-Something (with the Proposed Development) scenario in 2027. Whilst the noise insulation scheme will be rolled out as quickly as is reasonably practicable, it may not be possible to offer and install noise insulation (where the offer is accepted) to all impacted communities before the relevant noise change occurs, due to the capacity of the market to meet immediate demand. In such cases there may be temporary adverse likely **significant** effects in assessment Phase 1 until such time as noise insulation can be provided and the adverse likely significant effects avoided.

16.9.100 The results of noise predictions using primary and supplementary metrics at the individual air noise assessment locations representative of these communities are presented in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. As described in the methodology **Section 16.5**, the N65, N60 and overflight metrics are described in guidance from the Government (Ref. 16.29) and the CAA (Ref. 16.32, Ref. 16.36) as supplementary metrics that can provide context and useful information but are not appropriate for identifying noise impacts or significant effects. These metrics are therefore used to provide additional context to the potentially significant noise effects identified using the primary L_{Aeq} metric, but do not change the conclusions of the assessment.

16.9.101 For the communities in **Table 16.39**, the N65 metrics increase by approximately 6-12% when comparing DM to DS. This is in line with the total increase in aircraft movements during the daytime period which is forecast to be approximately 11%. The N60 metrics increase by approximately 23-33% which is in line with the forecast total increase in total aircraft movements during the night of approximately 26%. As the Proposed Development does not change flight paths, and the reduction in L_{Amax} noise levels for individual aircraft occurs in both the Do-Minimum and Do-Something scenarios, the N65 and N60 metrics are generally correlated with the increase in aircraft movements. A similar trend can be observed for the overflight metrics which increase by approximately 10-12% during the day and 25-26% during the night. The relatively small increase in the daytime metrics is in line with the assessment using the primary metrics which identifies no adverse likely significant effects during the daytime.

16.9.102 An assessment of objective sleep disturbance using the awakenings metric is presented in **Chapter 13** Health and Community of this ES **[TR020001/APP/5.01]**.

Table 16.39: Assessment Phase 1 2027 Community areas that experience an adverse likely significant effect due to air noise increases

Location	Community area[31]	Daytime / Night-time
To the west of the airport	Community areas around Luton Hoo Memorial Park, broadly between the A1081, Linden Academy, Tennyson Road Primary School (South Campus) and Stockwood Park, represented by AR13, AR32 and AR40	Night-time only
	Isolated properties to the South of the A1081 on Newlands Rd, London Rd, The Luton Drive and Lower Harpenden Rd	Night-time only
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only
To the east of the airport	Southern parts of Beachwood Green, represented by AR37	Night-time only
	Lye Hill, represented by AR2	Night-time only
	Isolated properties to the north of Bendish, represented by AR5	Night-time only
	Other isolated properties between the airport and Stagenhoe park	Night-time only

[31] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

Non-residential receptors

16.9.103 This section provides an assessment of operational air noise effects in assessment Phase 1 on noise sensitive non-residential receptors. Due to the large number of receptors in the air noise study area, the non-residential assessment for air noise follows a two-stage process.

16.9.104 The first stage of the process is to screen in potentially noise sensitive receptors on a precautionary basis using the screening criteria in **Table 16.18**. The results of this screening are presented in **Table 16.40**. The total number of receptor types screened in is based on a commercial database of registered addresses (see **Appendix 16.1 [TR020001/APP/5.02]**) and is therefore likely to provide an over-estimate (e.g. multiple registered address within the same business or building). Any screened in receptors that have the potential for a likely significant effect based on the assessment criteria defined in **Table 16.19** are investigated on an individual basis to avoid over-estimates.

Table 16.40: Assessment Phase 1 non-residential receptors screened into air noise assessment

Receptor category	Number screened into assessment on a precautionary basis
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	49
Hospitals, doctor's surgeries, medical centres	26
Auditoria, concert halls, theatres and sound recording and broadcast studios	10
Places of worship	33
Offices	158
Museums	3
Community and village halls	16
Courts	2
Libraries	1
Hotels	42

16.9.105 In the second stage of the assessment, the DS noise level and noise level change (DS minus DM) have been calculated for each of the screened in receptors in **Table 16.40**. None of these receptors exceed the assessment criteria in **Table 16.19,** therefore effects on non-residential receptors are predicted to be **not significant**.

16.9.106 As shown in **Table 16.19** there are two levels of assessment criteria for educational facilities due to the increased risk of cognitive impairment at higher noise exposures. Two schools exceed the noise level criteria of 63dB$L_{Aeq,16h}$, namely the Avenue Centre for Education and Surrey St Primary and these schools experience a noise level increase (DS-DM) of less than 1dB. However, these schools are all already exposed above 63dB$L_{Aeq,16h}$ in the 2019 Actuals

baseline, and experience a reduction of 1.4dB from the 2019 Actuals baseline to 2027 DS. The effects on these schools are therefore considered to be **not significant**. Surrey St Primary and the Avenue Centre for Education are within the 63dB$L_{Aeq,16h}$ contour and will therefore be eligible for noise insulation which will improve the internal acoustic conditions within the school.

Assessment Phase 2a

Residential receptors

16.9.107 This section provides an assessment of operational air noise effects in assessment Phase 2a on people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).

16.9.108 As described in **Section 16.6**, the assessment is based upon the assumption that next-generation aircraft (expected to transition into the fleet from the mid-2030s) are no quieter than new-generation aircraft. The results in the assessment therefore represent a reasonable worst-case. A sensitivity test using assumptions about next-generation aircraft noise improvements has been undertaken and is presented in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.03]** and summarised in **Table 16.74**. The Noise Envelope, as described in **Section 16.8**, will contain a binding mechanism to reduce the noise contour limits if next-generation aircraft are proven to be quieter than new-generation aircraft, which would reduce the effects presented in this assessment.

16.9.109 Analysis of noise contours has been undertaken to ascertain the area coverage, number of households and population that are likely to be affected by air noise and to identify the location and extent of significant effects.

16.9.110 Analysis of area coverage by assessment Phase 2a 2039 DM and DS air noise contours are presented in **Table 16.41** for daytime $L_{Aeq,16h}$ (see **Figure 16.39** and **Figure 16.41** in this ES **[TR020001/APP/5.03]**) and **Table 16.42** for night-time $L_{Aeq,8h}$ (see **Figure 16.40** and **Figure 16.42** in this ES **[TR020001/APP/5.03]**).

16.9.111 Analysis of households and population within assessment Phase 2a 2039 DS daytime $L_{Aeq,16h}$ and night-time $L_{Aeq,8h}$ air noise contours are presented in **Section 7.8** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.9.112 Additional details on supplementary noise metrics (awakenings, overflights and number above contours) for assessment Phase 2a are provided in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]** and the following figures:

a. DM and DS daytime overflight contours are presented in **Figure 16.19** and **Figure 16.45** of this ES **[TR020001/APP/5.03].** DM and DS night-time overflight contours are presented in **Figure 16.20** and **Figure 16.46** of this ES **[TR020001/APP/5.03]**.

b. DM and DS daytime N65 contours are presented in **Figure 16.47** and **Figure 16.49** of this ES **[TR020001/APP/5.03].** DM and DS night-time N60 contours are presented in **Figure 16.48** and **Figure 16.50** of this ES **[TR020001/APP/5.03].**

Table 16.41: Assessment Phase 2a 2039 Daytime Air Noise Analysis – Area

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2039 DM Cumulative Area (km^2)	2039 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2) (DS-Baseline)	Change in Cumulative Area (km^2) (DS-DM)
51 (LOAEL)	**58.1**	39.4	50.1	-8.0	+10.7
54	35.4	22.1	28.8	-6.6	+6.7
57	20.3	11.3	15.2	-5.1	+3.9
60	10.4	5.6	7.4	-3.0	+1.8
63 (SOAEL)	**5.6**	2.8	3.8	-1.8	+1.1
66	2.7	1.4	1.8	-0.8	+0.4
69 (UAEL)	**1.4**	0.8	1.0	-0.3	+0.2

Table 16.42: Assessment Phase 2a 2039 Night-time Air Noise Analysis – Area

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2039 DM Cumulative Area (km^2)	2039 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2) (DS-Baseline)	Change in Cumulative Area (km^2) (DS-DM)
45 (LOAEL)	**74.6**	50.2	65.2	-9.4	+15.0
48	45.3	28.4	37.8	-7.4	+9.4
51	26.5	15.0	21.1	-5.4	+6.1
54	14.1	7.2	10.6	-3.5	+3.5
55 (SOAEL)	**11.2**	5.7	8.3	-2.8	+2.6
57	7.0	3.7	5.2	-1.8	+1.5
60	3.6	1.7	2.5	-1.1	+0.8
63 (UAEL)	**1.7**	1.0	1.3	-0.4	+0.3

16.9.113 A summary of population within the LOAEL, SOAEL and UAEL contours is provided in **Table 16.43** for the 2019 Actuals baseline, the DM and the DS scenarios.

Table 16.43: Assessment Phase 2a 2039 Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Population				
	2019 Actuals Baseline	2039 DM	2039 DS	Change DS – 2019 Actuals Baseline	Change DS – DM
Daytime					
Above LOAEL and below SOAEL	39,350	20,100	30,800	-8,550	10,700
Above SOAEL and below UAEL	1,650	0	200	-1,450	200
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	62,850	32,850	52,350	-10,500	19,500
Above SOAEL and below UAEL	4,950	1,500	2,600	-2,350	1,100
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

16.9.114 **Table 16.43** demonstrates that there is a reduction in the total population exposed between the LOAEL and SOAEL and between the SOAEL and UAEL in DS 2039 compared to the 2019 Actuals Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

16.9.115 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in **Table 16.13**. During the daytime and night-time, the population exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 2a.

16.9.116 The community areas that experience continuing exposure above the SOAEL are indicated by those within the SOAEL contours for daytime and night-time in **Figure 16.43** and **Figure 16.44** in this ES **[TR020001/APP/5.03],** and are

summarised in **Table 16.44**. The results of noise predictions using primary and supplementary metrics at the individual air noise assessment locations representative of these communities are presented in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. As described in the **Section 16.5**, these supplementary metrics provide additional context to the identified effects, but do not change the conclusions of the assessment.

Table 16.44: Assessment Phase 2a 2039 Community areas that experience continuing exposure above the air noise SOAEL

Location	Community area[32]	Daytime / Night-time
To the west of the airport	Properties along Cutenhoe Road and the southern end of Park Street, represented by AR13	Daytime and night-time
	Community areas around Luton Hoo Memorial Park, broadly between the A1081, Linden Academy, Oakwood Primary School and Stockwood Park, represented by AR13 and AR40	Night-time only
	Isolated properties to the south of the A1081 on London Rd	Night-time only
	Isolated properties to the south of the A1081 on The Luton Drive and Lower Harpenden Road	Daytime and night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only
To the east of the airport	Southern parts of Beachwood Green, represented by AR37	Night-time only
	Lye Hill, represented by AR2	Daytime and night-time
	Isolated properties to the north of Bendish, represented by AR5	Night-time only
	Other isolated properties between the airport and Stagenhoe park	Night-time only

16.9.117 The communities described above which experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation (see **Section 16.10**).

16.9.118 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. **Table 16.45** provides a summary of the population experiencing changes in noise using the criteria outlined in **Table 16.14**. The geographic areas over which these changes occur

[32] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

for daytime and night-time are presented in **Figure 16.43** and **Figure 16.44** of this ES **[TR020001/APP/5.03]**.

Table 16.45: Assessment Phase 2a 2039 Summary of DS-DM air noise change

Magnitude of effect	Noise increase (DS-DM)	Population experiencing change	
		Day	Night
DS noise above LOAEL and below SOAEL			
Negligible	0.1 – 0.9dB	0	0
	1.0 – 1.9dB	30,800	52,350
Minor	2.0 – 2.9dB	0	0
Moderate	3.0 – 5.9dB	0	0
Major	6.0dB or more	0	0
DS noise above SOAEL and below UAEL			
Negligible	0.1 – 0.9dB	0	0
Minor	1.0 – 1.9dB	200	2,600
Moderate	2.0 – 2.9dB	0	0
	3.0 – 3.9dB	0	0
Major	4.0dB or more	0	0
DS noise above UAEL			
Unacceptable	0.1 dB or more	0	0

16.9.119 No receptors within the study area experience a decrease in air noise between the DM and the DS scenarios. The increase in air noise from the DM to the DS scenarios during the daytime period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately 39%. The total increase in aircraft movements during the daytime period is forecast to be approximately 30%. The increase in air noise during the night-time period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately of 54%. The total increase in aircraft movements during the night-time period is forecast to be approximately 48%. Due to the limit of 9,650 movements during the night quota period (from 23:30 to 06:00) the increase in movements during the night-time period will mostly occur in the periods from 06:00 to 07:00 and 23:00 to 23:30. This restriction will be retained in future as a requirement of the DCO.

16.9.120 During the daytime, the population of 30,800 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 2dB corresponding to a **negligible** adverse effect which is **not significant**. Of this population, the 13,650 between the 54dB$L_{Aeq,16h}$ contour and the 63dB$L_{Aeq,16h}$ contour would be eligible for noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.121 During the daytime, the population of 200 exposed to noise between the SOAEL and UAEL experience noise increases of 1-2dB corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above SOAEL. This population is illustrated by the area within the SOAEL

contour in **Figure 16.43** in this ES **[TR020001/APP/5.03]** and includes the community areas listed in **Table 16.46**. This population would be eligible for a full package of noise insulation which would avoid the significant effects (see **Section 16.10** and **Section 16.11**). By assessment Phase 2a, noise insulation will have been rolled out to all the communities in **Table 16.46** should residents take up the offer in a timely manner.

16.9.122 During the night-time, the population of 52,350 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 2dB corresponding to a **negligible** adverse effect which is **not significant**. Of this population, the 11,250 outside the night-time SOAEL but inside the 54dB$L_{Aeq,16h}$ contour would be eligible for noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.123 During the night-time, the population of 2,600 exposed to noise between the SOAEL and UAEL experience noise increases corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above SOAEL. This population is illustrated by the area within the SOAEL contour in **Figure 16.44** in this ES **[TR020001/APP/5.03]** and includes the community areas listed in **Table 16.46**. This population would be eligible for a full package of noise insulation that would avoid these significant effects (see **Section 16.10** and **Section 16.11**). By assessment Phase 2a, noise insulation will have been rolled out to all the communities in **Table 16.46** should they take up the offer in a timely manner.

16.9.124 The results of noise predictions using primary and supplementary metrics at the individual air noise assessment locations representative of these communities are presented in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. As described in the methodology **Section 16.5**, the N65, N60 and overflight metrics are described in guidance from the Government (Ref. 16.29) and the CAA (Ref. 16.32, Ref 16.36) as supplementary metrics that can provide context and useful information but are not appropriate for identifying noise impacts or significant effects. These metrics are therefore used to provide additional context to the potentially significant noise effects identified using the primary L_{Aeq} metric, but do not change the conclusions of the assessment.

16.9.125 For the communities in **Table 16.46**, the N65 metrics increase by approximately 25-32% when comparing DM to DS. This is in line with the total increase in aircraft movements during the daytime period which is forecast to be approximately 30%. The N60 metrics increase by approximately 44-54% which is in line with the forecast total increase in total aircraft movements during the night of approximately 54%. As the Proposed Development does not change flight paths, and the reduction in L_{Amax} noise levels for individual aircraft occurs in both the Do-Minimum and Do-Something scenarios, the N65 and N60 metrics are generally correlated with the increase in aircraft movements. A similar trend can be observed for the overflight metrics which increase by approximately 13-32% during the day and 48-50% during the night. The larger relative increases in the metrics during the night-time is in line with the assessment using the primary metrics which shows the adverse likely significant effects occur over a larger area during the night-time than the during the daytime.

16.9.126 An assessment of objective sleep disturbance using the awakenings metric is presented in **Chapter 13** Health and Community of this ES **[TR020001/APP/5.01]**.

Table 16.46: Assessment Phase 2a 2039 Community areas that experience an adverse likely significant effect due to air noise increases

Location	Community area[33]	Daytime / Night-time
To the west of the airport	Properties on Cutenhoe Road, broadly between Luton Hoo Memorial Park and Surrey St Primary School, represented by AR40	Daytime and night-time
	Community areas around Luton Hoo Memorial Park, broadly between the A1081, Linden Academy, Tennyson Road Primary School (South Campus) and Stockwood Park, represented by AR13	Night-time only
	Properties on Park Street to the south of Cutenhoe Road	Daytime and night-time
	Isolated properties to the South of the A1081 on The Luton Drive and Lower Harpenden Road	Daytime and night-time
	Isolated properties to the South of the A1081 on London Rd	Night-time only
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Daytime and night-time
To the east of the airport	Southern parts of Beachwood Green, represented by AR37	Night-time only
	Lye Hill, represented by AR2	Daytime and night-time
	Isolated properties to the north of Bendish, represented by AR5	Night-time only
	Other isolated properties between the airport and Stagenhoe park	Night-time only

Non-residential receptors

16.9.127 This section provides an assessment of operational air noise effects in assessment phase 2a on noise sensitive non-residential receptors. Due to the large number of receptors in the air noise study area, the non-residential assessment for air noise follows a two-stage process.

16.9.128 The first stage of the process is to screen in potentially noise sensitive receptors on a precautionary basis using the screening criteria in **Table 16.18**. The results

[33] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

of this screening are presented in **Table 16.40**. The total number of receptor types screened in is based on a commercial database of registered addresses (see **Appendix 16.1 [TR020001/APP/5.02]**) and is therefore likely to provide an over-estimate (e.g. multiple registered address within the same business or building). Any screened in receptors that have the potential for a likely significant effect based on the assessment criteria defined in **Table 16.19** are investigated on an individual basis to avoid over-estimates.

Table 16.47: Assessment Phase 2a non-residential receptors screened into air noise assessment

Receptor category	**Number screened into assessment on a precautionary basis**
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	47
Hospitals, doctor's surgeries, medical centres	23
Auditoria, concert halls, theatres and sound recording and broadcast studios	9
Places of worship	31
Offices	146
Museums	3
Community and village halls	19
Courts	2
Libraries	1
Hotels	38

16.9.129 In the second stage of the assessment, the DS noise level and noise level change (DS minus DM) have been calculated for each of the screened in receptors in **Table 16.47**. None of these receptors exceed the assessment criteria in **Table 16.19,** therefore effects on non-residential receptors are predicted to be **not significant**.

16.9.130 As shown in **Table 16.19** there are two levels of assessment criteria for educational facilities due to the increased risk of cognitive impairment at higher noise exposures. Two schools exceed the noise level criteria of 63 $dBL_{Aeq,16h}$, namely Surrey St Primary and Avenue Centre for Education and these schools experience a noise level increase (DS-DM) of less than 1.5dB. However, these schools are all already exposed above 63 $dBL_{Aeq,16h}$ in the 2019 Actuals baseline, and experience a reduction of 1.9dB from the 2019 Actuals baseline to 2039 DS. The effects on these schools are therefore considered to be **not significant**. Surrey St Primary and the Avenue Centre for Education are within the 63$dBL_{Aeq,16h}$ contour and will therefore be eligible for noise insulation which will improve the internal acoustic conditions within the school.

Assessment Phase 2b

Residential receptors

16.9.131 This section provides an assessment of operational air noise effects in assessment Phase 2b on people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).

16.9.132 As described in **Section 16.6**, the assessment is based upon the assumption that next-generation aircraft (expected to transition into the fleet from the mid-2030s) are no quieter than new-generation aircraft. The results in the assessment therefore represent a reasonable worst-case. A sensitivity test using assumptions about next-generation aircraft noise improvements has been undertaken and is presented in **Appendix 16.1** of this ES **[TR020001/APP/5.03]** and summarised in **Table 16.74**. The Noise Envelope, as described in **Section 16.8**, will contain a binding mechanism to reduce the noise contour limits if next-generation aircraft are proven to be quieter than new-generation aircraft, which would reduce the effects presented in this assessment.

16.9.133 Analysis of noise contours has been undertaken to ascertain the area coverage, number of households and population that are likely to be affected by air noise and to identify the location and extent of significant effects. The results of analysis are presented in the following tables below:

16.9.134 Analysis of area coverage by assessment Phase 2b 2043 DM and DS air noise contours are presented in **Table 16.48** for daytime $L_{Aeq,16h}$ (see **Figure 16.63** and **Figure 16.65** in this ES **[TR020001/APP/5.03]**) and **Table 16.49** for night-time $L_{Aeq,8h}$ (see **Figure 16.64** and **Figure 16.66** in this ES **[TR020001/APP/5.03]**);

16.9.135 Analysis of households and population within assessment Phase 2b 2043 DS daytime $L_{Aeq,16h}$ and night-time $L_{Aeq,8h}$ air noise contours are presented in **Section 7.8** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.9.136 Additional details on supplementary noise metrics (awakenings, overflights number above contours) for assessment Phase 2b are provided in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]** and the following figures:

a. DM and DS daytime overflight contours are presented in **Figure 16.19** and **Figure 16.69** of this ES **[TR020001/APP/5.03].** DM and DS night-time overflight contours are presented in **Figure 16.20** and **Figure 16.70** of this ES **[TR020001/APP/5.03]**.

b. DM and DS daytime N65 contours are presented in **Figure 16.71** and **Figure 16.73** of this ES **[TR020001/APP/5.03].** DM and DS night-time N60 contours are presented in **Figure 16.72** and **Figure 16.74** of this ES **[TR020001/APP/5.03]**

Table 16.48: Assessment Phase 2b 2043 Daytime Air Noise Analysis – Area

$L_{Aeq,16h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2043 DM Cumulative Area (km^2)	2043 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2) (DS-Baseline)	Change in Cumulative Area (km^2) (DS-DM)
51 (LOAEL)	**58.1**	**39.0**	**56.1**	**-2.0**	**+17.1**
54	35.4	21.8	32.6	-2.8	+10.8
57	20.3	11.1	17.4	-2.9	+6.3
60	10.4	5.6	8.6	-1.8	+3.0
63 (SOAEL)	**5.6**	**2.7**	**4.4**	**-1.2**	**+1.7**
66	2.7	1.4	2.1	-0.6	+0.7
69 (UAEL)	**1.4**	**0.8**	**1.2**	**-0.2**	**+0.4**

Table 16.49: Assessment Phase 2b 2043 Night-time Air Noise Analysis – Area

$L_{Aeq,8h}$ dB Noise Contour	2019 Actuals Baseline Cumulative Area (km^2)	2043 DM Cumulative Area (km^2)	2043 DS Cumulative Area (km^2)	Change in Cumulative Area (km^2) (DS-Baseline)	Change in Cumulative Area (km^2) (DS-DM)
45 (LOAEL)	**74.6**	**49.5**	**73.2**	**-1.4**	**+23.6**
48	45.3	28.0	43.2	-2.1	+15.2
51	26.5	14.7	24.0	-2.5	+9.3
54	14.1	7.1	12.4	-1.7	+5.3
55 (SOAEL)	**11.2**	**5.6**	**9.8**	**-1.4**	**+4.2**
57	7.0	3.6	6.0	-1.0	+2.4
60	3.6	1.7	3.0	-0.6	+1.3
63 (UAEL)	**1.7**	**1.0**	**1.4**	**-0.3**	**+0.5**

16.9.137 A summary of population within the LOAEL, SOAEL and UAEL contours is provided in **Table 16.50** for the 2019 Actuals baseline, the DM and the DS scenarios.

Table 16.50: Assessment Phase 2b 2043 Summary of population within the Air Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Population				
	2019 Actuals Baseline	2043 DM	2043 DS	Change DS – 2019 Actuals Baseline	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	39,350	19,950	38,250	-1,100	+18,300
Above SOAEL and below UAEL	1,650	0	500	-1,150	+500
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	62,850	32,400	59,550	-3,300	+27,150
Above SOAEL and below UAEL	4,950	1,350	3,250	-1,700	+1,900
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

16.9.138 **Table 16.50** demonstrates that there is a reduction in the total population exposed between the LOAEL and SOAEL and between the SOAEL and UAEL in DS 2043 compared to the 2019 Actuals Baseline. This reduction in total population exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

16.9.139 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in **Table 16.13**. During the daytime and night-time, the population exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 2b.

16.9.140 The community areas that experience continuing exposure above the SOAEL are indicated by those within the SOAEL contours for daytime and night-time in **Figure 16.67** and **Figure 16.68** in this ES **[TR020001/APP/5.03],** and are

summarised in **Table 16.51**. The results of noise predictions using primary and supplementary metrics at the individual air noise assessment locations representative of these communities are presented in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. As described in the **Section 16.5**, these supplementary metrics provide additional context to the identified effects, but do not change the conclusions of the assessment.

Table 16.51: Assessment Phase 2b 2043 Community areas that experience continuing exposure above the air noise SOAEL

Location	Community area[34]	Daytime / Night-time
To the west of the airport	Properties along Cutenhoe Road and the southern end of Park Street, represented by AR13	Daytime and night-time
	Community areas around Luton Hoo Memorial Park, broadly between the A1081, Linden Academy, Tennyson Road Primary School (South Campus) and Stockwood Park, represented by AR13 and AR40	Night-time only
	Isolated properties to the south of the A1081 on London Rd	Night-time only
	Isolated properties to the south of the A1081 on The Luton Drive and Lower Harpenden Road	Daytime and night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only
To the east of the airport	Southern parts of Beachwood Green, represented by AR37	Night-time only
	Lye Hill, represented by AR2	Daytime and night-time
	Isolated properties to the north of Bendish, represented by AR5	Night-time only
	Other isolated properties between the airport and Stagenhoe park	Night-time only

16.9.141 The communities described above which experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation (see **Section 16.10**).

16.9.142 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. **Table 16.52** provides a summary of the population experiencing changes in noise using the criteria outlined in **Table 16.14**. The geographic areas over which these changes occur

[34] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

for daytime and night-time are presented in **Figure 16.67** and **Figure 16.68** of this ES **[TR020001/APP/5.03]**.

Table 16.52: Assessment Phase 2b 2043 Summary of DS-DM air noise change

Magnitude of effect	Noise increase (DS-DM)	Population experiencing change	
		Day	Night
DS noise above LOAEL and below SOAEL			
Negligible	0.1 - 1.0dB	0	0
	1.0 - 1.9dB	13,450	14,500
Minor	2.0 - 2.9dB	24,800	45,050
Moderate	3.0 - 5.9dB	0	0
Major	6.0dB or more	0	0
DS noise above SOAEL and below UAEL			
Negligible	0.1 - 0.9dB	0	0
Minor	1.0 - 1.9dB	500	150
Moderate	2.0 - 2.9dB	0	3,100
	3.0 - 3.9dB	0	0
Major	4.0dB or more	0	0
DS noise above UAEL			
Unacceptable	0.1 dB or more	0	0

16.9.143 No receptors within the study area experience a decrease in air noise between the DM and the DS scenarios. The increase in air noise from the DM to the DS scenarios during the daytime period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately 62%. The total increase in aircraft movements during the daytime period is forecast to be approximately 48%. The increase in air noise during the night-time period is due to an increase in commercial flights (freight and general aviation movements are unchanged) of approximately of 76%. The total increase in aircraft movements during the night-time period is forecast to be approximately 70%. Due to the limit of 9,650 movements during the night quota period (from 23:30 to 06:00) the increase in movements during the night-time period will mostly occur in the periods from 06:00 to 07:00 and 23:00 to 23:30. This restriction will be retained in future as a requirement of the DCO.

16.9.144 During the daytime, the population of 38,250 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 3dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. Of this population, the 16,000 between the 54dB$L_{Aeq,16h}$ contour and the 63dB$L_{Aeq,16h}$ contour would be eligible for noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.145 During the daytime, the population of 500 exposed to noise between the SOAEL and UAEL experience noise increases of 1-1.9dB corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is

above SOAEL. This population is illustrated by the area within the SOAEL contour in **Figure 16.67** in this ES **[TR020001/APP/5.03]** and includes the community areas listed in **Table 16.53**. This population would be eligible for a full package of noise insulation which would avoid the significant effects (see **Section 16.10** and **Section 16.11**). By assessment Phase 2b, noise insulation will have been rolled out to all the communities in **Table 16.46** should residents take up the offer in a timely manner.

16.9.146 During the night-time, the population of 59,550 exposed to noise between the LOAEL and SOAEL experience noise increases of less than 3dB corresponding to a **negligible** to **minor** adverse effect which is **not significant**. Of this population, the 13,250 outside the night-time SOAEL but inside the 54dB$L_{Aeq,16h}$ contour would be eligible for noise insulation (see **Section 16.10** and **Section 16.11**).

16.9.147 During the night-time, of the population of 3,250 exposed to noise between the SOAEL and UAEL experience noise increases of 1-2.9dB corresponding to a **minor** to **moderate** adverse effect resulting in an adverse likely **significant** effect as the exposure is above SOAEL. This population is illustrated in **Figure 16.68** in this ES **[TR020001/APP/5.03]** and includes the community areas listed in **Table 16.53**. This population would be eligible for a full package of noise insulation which would avoid the significant effects (see **Section 16.10** and **Section 16.11**). By assessment Phase 2b noise insulation will have been rolled out to all the communities in **Table 16.53** should they take up the offer in a timely manner.

16.9.148 The results of noise predictions using primary and supplementary metrics at the individual air noise assessment locations representative of these communities are presented in **Section 7.6** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. As described in the methodology **Section 16.5**, the N65, N60 and overflight metrics are described in guidance from the Government (Ref. 16.29) and the CAA (Ref. 16.32, Ref 16.36) as supplementary metrics that can provide context and useful information but are not appropriate for identifying noise impacts or significant effects. These metrics are therefore used to provide additional context to the potentially significant noise effects identified using the primary L_{Aeq} metric, but do not change the conclusions of the assessment.

16.9.149 For the communities in **Table 16.53**, the N65 metrics increase by approximately 49-53% when comparing DM to DS. This is in line with the total increase in aircraft movements during the daytime period which is forecast to be approximately 48%. The N60 metrics increase by approximately 70-81% which is in line with the forecast total increase in total aircraft movements during the night of approximately 70%. As the Proposed Development does not change flight paths, and the reduction in L_{Amax} noise levels for individual aircraft occurs in both the Do-Minimum and Do-Something scenarios, the N65 and N60 metrics are generally correlated with the increase in aircraft movements. A similar trend can be observed for the overflight metrics which increase by approximately 13-51% during the day and 74-75% during the night. The larger relative increases in the metrics during the night-time is in line with the assessment using the primary metrics which shows the adverse likely significant effects occur over a larger area during the night-time than the during the daytime.

Table 16.53: Assessment Phase 2b 2043 Community areas that experience an adverse likely significant effect due to air noise increases

Location	Community area[35]	Daytime / Night-time
To the west of the airport	Properties on Cutenhoe Road, broadly between Luton Hoo Memorial Park and Surrey St Primary School and on Park Road to the south of Cutenhoe Road, represented by AR40	Daytime and night-time
	Community areas around Luton Hoo Memorial Park, broadly between the A1081, Linden Academy, Tennyson Road Primary School (South Campus) and Stockwood Park, represented by AR13 and AR32	Night-time only
	Isolated properties to the South of the A1081 on The Luton Drive and Lower Harpenden Rd	Daytime and night-time
	Isolated properties to the South of the A1081 on London Rd	Night-time only
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Daytime and night-time
To the east of the airport	Southern parts of Beachwood Green, represented by AR37	Night-time only
	Lye Hill, represented by AR2	Daytime and night-time
	Isolated properties to the north of Bendish, represented by AR5	Night-time only
	Other isolated properties between the airport and Stagenhoe park	Night-time only

Non-residential receptors

16.9.150 This section provides an assessment of operational air noise effects in assessment Phase 2b on noise sensitive non-residential receptors. Due to the large extent of the air noise study area, the non-residential assessment for air noise follows a two-stage process.

16.9.151 The first stage of the process is to screen in potentially noise sensitive receptors on a precautionary basis using the screening criteria in **Table 16.18**. The results of this screening are presented in **Table 16.54**. The total number of receptor types screened in is based on a commercial database of registered addresses

[35] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

(see **Appendix 16.1 [TR020001/APP/5.02]**) and is therefore likely to provide an over-estimate (e.g. multiple registered address within the same business or building). Any screened in receptors that have the potential for a likely significant effect based on the assessment criteria defined in **Table 16.19** are investigated on an individual basis to avoid over-estimates.

Table 16.54: Assessment Phase 2b non-residential receptors screened into air noise assessment

Receptor category	**Number screened into assessment on a precautionary basis**
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	59
Hospitals, doctor's surgeries, medical centres	28
Auditoria, concert halls, theatres and sound recording and broadcast studios	9
Places of worship	36
Offices	158
Museums	3
Community and village halls	23
Courts	3
Libraries	1
Hotels	39

16.9.152 In the second stage of the assessment, the DS noise level and noise level change (DS minus DM) have been calculated for each of the screened in receptors in **Table 16.54**. None of these receptors exceed the assessment criteria in **Table 16.19,** therefore effects on non-residential receptors are predicted to be **not significant**.

16.9.153 As shown in **Table 16.19** there are two levels of assessment criteria for educational facilities due to the increased risk of cognitive impairment at higher noise exposures. Four schools exceed the noise level criteria of 63 $dBL_{Aeq,16h}$, namely Avenue Centre for Education and Surrey St Primary and these schools experience a noise level increase (DS-DM) of less than 2.0dB. However, these schools are all already exposed above 63 $dBL_{Aeq,16h}$ in the 2019 Actuals baseline, and experience a reduction of 1.2dB from the 2019 Actuals baseline to 2043 DS. The effects on these schools are therefore considered to be **not significant**. Surrey St Primary and the Avenue Centre for Education are within the 63$dBL_{Aeq,16h}$ contour and will therefore be eligible for noise insulation which will improve the internal acoustic conditions within the school.

Ground Noise

16.9.154 The assessment of ground noise has been undertaken using the $L_{Aeq,T}$ noise metric to assess the likely effects on health and quality of life due to noise exposure and the likely significant effects due to noise change (adverse and

beneficial) that arise from increased aircraft movements as a result of the Proposed Development.

16.9.155 The noise assessment considers the impact of the Proposed Development against future baseline years which account for the noise benefits from fleet transition to new generation aircraft if current consented passenger limits were retained. Further information on the forecasts and assumptions on transition to new generation aircraft are provided in **Section 7** of the **Need Case [TR020001/APP/7.04]**.

16.9.156 The assessment of ground noise is undertaken through consideration of both the change in noise level as a result of the Proposed Development and the absolute noise level as a result of the Proposed Development. Details on the methodology for the ground noise assessment are presented in **Section 8** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.9.157 The predicted change in noise between the DM and DS scenarios for each assessment phase has been identified for all receptors within the study area. The significance of effect of the change in noise is determined based on whether an assessment location experiences noise levels of between LOAEL and SOAEL or exceeding the SOAEL in the DS scenarios. Effects in terms of LOAEL and SOAEL are described in **Table 16.29**. As the ground noise assessment covers a smaller study area than the air noise assessment and is focussed on specific buildings, the assessment is reported using the number of properties affected rather than population.

Assessment Phase 1

Residential receptors

16.9.158 This section provides an assessment of operational ground noise effects in assessment Phase 1 on people, primarily where they live (‘residential receptors’) in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of ‘relative tranquillity’ (see methodology in **Section 16.5**).

16.9.159 Analysis of noise predictions at each residential property within the ground noise study area has been undertaken to identify the number of households that are likely to be affected by ground noise and to identify the location and extent of significant effects.

16.9.160 Area coverage by assessment Phase 1 2027 DM and DS ground noise contours are illustrated in **Figure 16.27** to **Figure 16.30** in this ES **[TR020001/APP/5.03]**.

16.9.161 A summary of residential properties within the LOAEL, SOAEL and UAEL contours is provided in **Table 16.55** for the 2019 actuals baseline, the DM and the DS scenarios.

Table 16.55: Assessment Phase 1 2027 Summary of residential properties within the Ground Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Residential Properties				
	2019 Actuals Baseline	2027 DM	2027 DS	Change DS – 2019 Actuals Baseline	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	3,680	2,410	2,425	-1,260	+15
Above SOAEL and below UAEL	4	0	0	-4	0
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	4,800	3,400	3,830	-970	+430
Above SOAEL and below UAEL	120	12	7	-113	-5
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

16.9.162 **Table 16.55** demonstrates that there is a reduction in residential properties exposed between the LOAEL and SOAEL and between the SOAEL and UAEL in DS 2027 compared to the 2019 Actuals Baseline. This reduction in residential properties exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

16.9.163 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in **Table 16.13**. During the daytime and night-time, the residential properties exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 1.

16.9.164 The community areas that experience continuing exposure above the SOAEL are indicated by those within the SOAEL contours for daytime and night-time in

Figure 16.29 and **Figure 16.30** in this ES **[TR020001/APP/5.03]** and are summarised in **Table 16.56**.

Table 16.56: Assessment Phase 1 2027 Community areas that experience continuing exposure above the ground noise SOAEL

Location	Community area[36]	Daytime / Night-time
To the south of the airport	Someries, represented by GR1	Night-time only
	Isolated properties on Dane Street	Night-time only

16.9.165 The communities at Someries and Dane Street that experience continuing exposure above the night-time SOAEL are within the night-time air noise SOAEL contour and will be eligible for a full package of noise insulation (see **Section 16.10**).

16.9.166 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. **Table 16.57** provides a summary of the residential properties experiencing changes in noise using the criteria outlined in **Table 16.14**. The geographic areas over which these changes occur for daytime and night-time are presented in **Figure 16.31** and **Figure 16.32** of this ES **[TR020001/APP/5.03]**.

[36] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

Table 16.57: Assessment Phase 1 2027 Summary of DS-DM ground noise change

Magnitude of effect	Noise change (DS-DM)	Residential properties experiencing change	
		Day	Night
DS noise above LOAEL and below SOAEL			
Major	+6.0dB or more	0	0
Moderate	+3.0 - +5.9dB	0	0
Minor	+2.0 - +2.9dB	10	60
Negligible	+1.0 - +1.9dB	35	580
	+0.1 - +0.9dB	1,110	2,650
	No change	400	110
	-0.1 - -0.9dB	760	380
	-1.0 - -1.9dB	110	50
Minor	-2.0 - -2.9dB	0	0
Moderate	-3.0 - -5.9dB	0	0
Major	-6.0dB or less	0	0
DS noise above SOAEL and below UAEL			
Major	+4.0dB or more	0	0
Moderate	+3.0 - +3.9dB	0	0
	+2.0 - +2.9dB	0	0
Minor	+1.0 - +1.9dB	0	6
Negligible	+0.1 - +0.9dB	0	1
	No change	0	0
	-0.1 - -0.9dB	0	0
Minor	-1.0 - -1.9dB	0	0
Moderate	-2.0 - -2.9dB	0	0
	-3.0 - -3.9dB	0	0
Major	-4.0dB or more	0	0
DS noise above UAEL			
Unacceptable	+0.1 dB or more	0	0

16.9.169 Although there will be increased activity at new Terminal 1 infrastructure and on taxiway routes, noise will be redistributed along new taxiways, activities at the Terminal 1 extension stand. The ERUB is moved in assessment Phase 1 approximately 50m to the east of its current location, which effects how noise propagates outside of the airport boundary. Additionally, the proposed acoustic barrier that will be located to the north and east of the new Terminal 1 infrastructure will screen noise for receptors.

16.9.170 During the daytime, 870 residential properties exposed to noise between the LOAEL and SOAEL experience a decrease in noise of up to 2dB corresponding to a **negligible** effect which is **not significant**. 1,145 residential properties experience an increase in noise of less than 2dB corresponding to a **negligible** effect which is **not significant**. Ten properties experience an increase in noise of between 2 and 2.9dB corresponding to a **minor** adverse effect, which is **not significant**.

16.9.171 During the daytime there are no residential properties exposed above the SOAEL.

16.9.172 During the night-time, 430 residential properties exposed to noise between the LOAEL and SOAEL experience a decrease in noise of up to 2dB corresponding to a **negligible** effect which is **not significant**. 3,230 residential properties experience an increase in noise of less than 2dB corresponding to a **negligible** effect which is **not significant**. 60 properties experience an increase in noise of between 2 and 2.9dB corresponding to a **minor** adverse effect, which is **not significant**.

16.9.173 During the night-time, one property which is exposed to noise levels between the SOAEL and UAEL experiences a noise increase of less than 1 dB corresponding to a **negligible** effect, which is **not significant**. Six residential properties which are exposed to noise between the SOAEL and UAEL experience noise increases corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above the SOAEL. This includes the community areas listed in **Table 16.58**. These properties are within the night-time air noise SOAEL contour and would be eligible for a full package of noise insulation (see **Section 16.10** and **Section 16.11**).

Table 16.58: Assessment Phase 1 2027 Community areas that experience an adverse likely significant effect due to ground noise increases

Location	Community area[37]	Daytime / Night-time
To the south of the airport	Properties adjacent to Someries Castle, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only

Non-residential receptors

16.9.174 This section provides an assessment of operational ground noise effects in assessment phase 1 on noise sensitive non-residential receptors. Non-residential receptors that have the potential for a likely significant effect based on the assessment criteria defined in **Table 16.19** are investigated on an individual basis.

[37] Community areas represent people, primarily where they live (‘residential receptors’) in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

Table 16.59: Assessment Phase 1 non-residential receptors screened into ground noise assessment

Receptor category	Number screened into assessment on a precautionary basis
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	2
Offices	12
Libraries	1
Hotels	6

16.9.175 The DS noise level and noise level change (DS minus DM) have been calculated for each of the screened in receptors in **Table 16.59**. None of these receptors exceed the assessment criteria in **Table 16.19,** therefore effects on non-residential receptors are predicted to be **not significant**.

Assessment Phase 2a

Residential receptors

16.9.176 This section provides an assessment of operational ground noise effects in assessment Phase 2a on people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).

16.9.177 Analysis of noise contours has been undertaken to ascertain the area coverage, number of households that are likely to be affected by ground noise and to identify the location and extent of significant effects.

16.9.178 Area coverage by assessment Phase 2a 2039 DM and DS ground noise contours are illustrated in **Figure 16.51** to **Figure 16.54** in this ES **[TR020001/APP/5.03]**.

16.9.179 A summary of residential properties within the LOAEL, SOAEL and UAEL contours is provided in **Table 16.60** for the 2019 actuals baseline, the DM and the DS scenarios.

Table 16.60: Assessment Phase 2a 2039 Summary of residential properties within the Ground Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Residential Properties				
	2019 Actuals Baseline	2039 DM	2039 DS	Change DS – 2019 Actuals Baseline	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	3,680	1,810	1,885	-1,795	+75
Above SOAEL and below UAEL	4	0	0	-4	0
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	4,800	2,930	3,165	-1,635	+235
Above SOAEL and below UAEL	120	9	7	-113	-2
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

16.9.180 **Table 16.60** demonstrates that there is a reduction in residential properties exposed between the LOAEL and SOAEL and between the SOAEL and UAEL in DS 2039 compared to the 2019 Actuals Baseline. This reduction in residential properties exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

16.9.181 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in **Table 16.13**. During the daytime and night-time, the residential properties exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 2a.

16.9.182 The community areas that experience continuing exposure above the SOAEL are indicated by those within the SOAEL contours for daytime and night-time in

Figure 16.53 and **Figure 16.54** in this ES **[TR020001/APP/5.03],** and are summarised in **Table 16.61**.

Table 16.61: Assessment Phase 2a 2039 Community areas that experience continuing exposure above the ground noise SOAEL

Location	Community area[38]	Daytime / Night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only

16.9.183 The communities at Someries and Dane Street that experience continuing exposure above the night-time SOAEL are within the night-time air noise SOAEL contour and will be eligible for noise insulation (see **Section 16.10**).

16.9.184 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. **Table 16.62** provides a summary of the residential properties experiencing changes in noise using the criteria outlined in **Table 16.14**. The geographic areas over which these changes occur for daytime and night-time are presented in **Figure 16.55** and **Figure 16.56** of this ES **[TR020001/APP/5.03]**.

[38] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

Table 16.62: Assessment Phase 2a 2039 Summary of DS-DM ground noise change

Magnitude of effect	Noise changes (DS-DM)	Residential properties experiencing change	
		Day	Night
DS noise above LOAEL and below SOAEL			
Major	+6.0dB or more	0	0
Moderate	+3.0 - +5.9dB	0	0
Minor	+2.0 - +2.9dB	15	45
Negligible	+1.0 - +1.9dB	160	440
	+0.1 - +0.9dB	1,000	1,620
	No change	130	220
	-0.1 - -0.9dB	450	570
	-1.0 - -1.9dB	130	270
Minor	-2.0 - -2.9dB	0	0
Moderate	-3.0 - -5.9dB	0	0
Major	-6.0dB or less	0	0
DS noise above SOAEL and below UAEL			
Major	+4.0dB or more	0	0
Moderate	+3.0 - +3.9dB	0	0
	+2.0 - +2.9dB	0	0
Minor	+1.0 - +1.9dB	0	4
Negligible	+0.1 - +0.9dB	0	1
	No change	0	2
	-0.1 - -0.9dB	0	0
Minor	-1.0 - -1.9dB	0	0
Moderate	-2.0 - -2.9dB	0	0
	-3.0 - -3.9dB	0	0
Major	-4.0dB or more	0	0
DS noise above UAEL			
Unacceptable	+0.1 dB or more	0	0

16.9.187 Although there will be increased activity at new Terminal 2 infrastructure and on taxiway routes, the extended Terminal 2 buildings, the ERUB and the proposed acoustic barrier (located between Terminal 2 and the ERUB) screen receptors located to the north of the airport from both existing and new activities. Additionally, earthworks that raise the land around the airport act as a partial screen for some receptors to the northeast. Embedded mitigation is effective at reducing noise during the daytime period for some receptors; however, receptors to the south experience increases in noise.

16.9.188 During the daytime, 580 residential properties exposed to noise between the LOAEL and SOAEL experience a decrease in noise of up to 2dB corresponding to a **negligible** effect which is **not significant**. 1,160 residential properties experience an increase in noise of less than 2dB corresponding to a **negligible** effect which is **not significant**. 45 properties experience an increase in noise of between 2 and 2.9dB corresponding to a **minor** adverse effect, which is **not significant**.

16.9.189 No residential properties are predicted to be exposed above the SOAEL during the daytime.

16.9.190 During the night-time, 840 residential properties exposed to noise between the LOAEL and SOAEL experience a decrease in noise of up to 2dB corresponding to a **negligible** effect which is **not significant**. 2,060 residential properties experience an increase in noise of less than 2dB corresponding to a **negligible** effect which is **not significant**. 45 properties experience an increase in noise of between 2 and 2.9dB corresponding to a **minor** adverse effect, which is **not significant**.

16.9.191 During the night-time, one property which is exposed to noise levels between the SOAEL and UAEL experiences noise changes of less than 1 dB corresponding to a **negligible** adverse effect which is **not significant**. 4 residential properties which are exposed to noise between the SOAEL and UAEL experience noise increases corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above SOAEL. This includes the community areas listed in **Table 16.63**. These properties are within the night-time air noise SOAEL contour and would be eligible for a full package of noise insulation (see **Section 16.10** and **Section 16.11**).

Table 16.63: Assessment Phase 2a 2039 Community areas that experience an adverse likely significant effect due to ground noise increases

Location	Community area[39]	Daytime / Night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Night-time only

Non-residential receptors

16.9.192 This section provides an assessment of operational ground noise effects in assessment phase 2a on noise sensitive non-residential receptors. Non-residential receptors that have the potential for a likely significant effect based on the assessment criteria defined in **Table 16.19** are investigated on an individual basis.

[39] Community areas represent people, primarily where they live (‘residential receptors’) in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

Table 16.64: Assessment Phase 2a non-residential receptors screened into ground noise assessment

Receptor category	Number screened into assessment on a precautionary basis
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	1
Offices	12
Libraries	1
Hotels	6

16.9.193 The DS noise level and noise level change (DS minus DM) have been calculated for each of the receptors in **Table 16.64**. None of these receptors exceed the assessment criteria in **Table 16.19** with the exception of two of the hotels (Holiday Inn and Courtyard by Marriott) that are predicted to experience increases in noise of between 3 and 4dB; however, DS scenario noise levels are equivalent to those predicted for the 2019 Actuals baseline.

16.9.194 The increase in noise affects the south facing façades of the hotels and is due to the new taxiway that connects Taxiway Bravo to the western end of the runway. As these hotels are currently exposed to high levels of aircraft noise (in particular from aircraft take-offs) they will have a high level of building envelope attenuation inherent in their design to achieve good internal acoustic conditions for guests. Consequently, although there is a predicted increase in noise, it is expected that the internal acoustic conditions will be unaffected. Therefore, effects on non-residential receptors are predicted to be **not significant**.

Assessment Phase 2b

Residential receptors

16.9.195 This section provides an assessment of operational ground noise effects in assessment Phase 2b on people, primarily where they live (‘residential receptors’) in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of ‘relative tranquillity’ (see methodology in **Section 16.5**).

16.9.196 Analysis of noise contours has been undertaken to ascertain the area coverage, number of households that are likely to be affected by ground noise and to identify the location and extent of significant effects.

16.9.197 Area coverage by assessment Phase 2b 2043 DM and DS ground noise contours are illustrated in **Figure 16.75** to **Figure 16.78** in this ES **[TR020001/APP/5.03]**.

16.9.198 A summary of residential properties within the LOAEL, SOAEL and UAEL contours is provided in **Table 16.65** for the 2019 actuals baseline, the DM and the DS scenarios.

Table 16.65: Assessment Phase 2b 2043 Summary of residential properties within the Ground Noise LOAEL, SOAEL and UAEL contours

Noise exposure	Total Residential Properties				
	2019 Actuals Baseline	2043 DM	2043 DS	Change DS – 2019 Actuals Baseline	Change DS - DM
Daytime					
Above LOAEL and below SOAEL	3,680	1,810	1,815	-1,865	+5
Above SOAEL and below UAEL	4	0	4	0	+4
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0
Night-time					
Above LOAEL and below SOAEL	4,800	2,930	3,050	-1,750	+120
Above SOAEL and below UAEL	120	9	7	-113	-2
Newly above the SOAEL in DS compared to the 2019 Actuals Baseline			0		
Above UAEL	0	0	0	0	0

16.9.199 **Table 16.65** demonstrates that there is a reduction in residential properties exposed between the LOAEL and SOAEL and between the SOAEL and UAEL in DS 2043 compared to the 2019 Actuals Baseline. This reduction in residential properties exposed is due to a reduction in contour areas as a result of new-generation aircraft entering the fleet. There are no receptors in the study area exposed to noise levels above the UAEL in any assessment scenario.

16.9.200 Significant adverse effects on health and quality of life in noise policy terms are determined by noise exposure above the SOAEL as defined in **Table 16.13**. During the daytime and night-time, the residential properties exposed to noise levels above the SOAEL in the DS scenario are also exposed to noise levels above the SOAEL in the 2019 Actuals Baseline. Therefore, there are no new significant adverse effects on health of quality life during the daytime or night-time in assessment Phase 2b.

16.9.201 The community areas that experience continuing exposure above the SOAEL are indicated by those within the SOAEL contours for daytime and night-time in

Figure 16.77 and **Figure 16.78** in this ES **[TR020001/APP/5.03],** and are summarised in **Table 16.66**.

Table 16.66: Assessment Phase 2b 2043 Community areas that experience continuing exposure above the ground noise SOAEL

Location	Community area[40]	Daytime / Night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Daytime and night-time

16.9.202 The communities at Someries that experience continuing exposure above the night-time SOAEL are within the night-time air noise SOAEL contour and will be eligible for a full package of noise insulation (see **Section 16.10**). The communities at Dane Street that experience continuing exposure above the daytime SOAEL are also within the daytime air noise SOAEL so will be eligible for a full package of noise insulation (see **Section 16.10**).

16.9.203 Adverse likely significant effects in EIA terms are determined by noise change from DM to DS and the resulting DS noise exposure. **Table 16.67** provides a summary of the residential properties experiencing changes in noise using the criteria outlined in **Table 16.14**. The geographic areas over which these changes occur for daytime and night-time are presented in **Figure 16.79** and **Figure 16.80** of this ES **[TR020001/APP/5.03]**.

[40] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

Table 16.67: Assessment Phase 2b 2043 Summary of DS-DM ground noise change

Magnitude of effect	Noise change (DS-DM)	Residential properties experiencing change	
		Day	Night
DS noise above LOAEL and below SOAEL			
Major	+6.0dB or more	0	0
Moderate	+3.0 - +5.9dB	0	0
Minor	+2.0 - +2.9dB	35	80
Negligible	+1.0 - +1.9dB	200	440
	+0.1 - +0.9dB	800	1,200
	No change	160	280
	-0.1 - -0.9dB	450	720
	-1.0 - -1.9dB	170	330
Minor	-2.0 - -2.9dB	0	0
Moderate	-3.0 - -5.9dB	0	0
Major	-6.0dB or less	0	0
DS noise above SOAEL and below UAEL			
Major	+4.0dB or more	0	0
Moderate	+3.0 - +3.9dB	0	0
	+2.0 - +2.9dB	2	0
Minor	+1.0 - +1.9dB	2	6
Negligible	+0.1 - +0.9dB	0	1
	No change	0	0
	-0.1 - -0.9dB	0	0
Minor	-1.0 - -1.9dB	0	0
Moderate	-2.0 - -2.9dB	0	0
	-3.0 - -3.9dB	0	0
Major	-4.0dB or more	0	0
DS noise above UAEL			
Unacceptable	+0.1 dB or more	0	0

16.9.206 Although there will be increased activity at new Terminal 2 infrastructure and on taxiway routes, the extended Terminal 2 buildings, the ERUB and the proposed acoustic barrier (located between Terminal 2 and the ERUB) screen receptors located to the north of the airport from both existing and new activities. Additionally, earthworks that raise the land around the airport act as a partial screen for some receptors to the northeast. Embedded mitigation is effective at reducing noise during the daytime period for some receptors; however, receptors to the south experience increases in noise.

16.9.207 During the daytime, 620 residential properties exposed to noise between the LOAEL and SOAEL experience a decrease in noise of up to 2dB corresponding to a **negligible** effect which is **not significant**. 1,000 residential properties experience an increase in noise of less than 2dB corresponding to a **negligible** effect which is **not significant**. 35 properties experience an increase in noise of between 2 and 2.9dB corresponding to a **minor** adverse effect, which is **not significant**.

16.9.208 During the daytime, four residential properties are exposed to noise between the SOAEL and UAEL. Two of these properties experience an increase in noise of between 1.0 and 1.9dB, which corresponds to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above SOAEL. The remaining two properties experience an increase in noise corresponding to a **moderate** adverse resulting in an adverse likely **significant** effect as the exposure is above SOAEL.

16.9.209 During the night-time, 1,050 residential properties exposed to noise between the LOAEL and SOAEL experience a decrease in noise of up to 2dB corresponding to a **negligible** effect which is **not significant**. 1,640 residential properties experience an increase in noise of less than 2dB corresponding to a **negligible** effect which is **not significant**. 80 properties experience an increase in noise of between 2 and 2.9dB corresponding to a **minor** adverse effect, which is **not significant**.

16.9.210 During the night-time, one property which is exposed to noise levels between the SOAEL and UAEL experiences a noise increase of less than 1 dB corresponding to a **negligible** effect, which is **not significant**. Six residential properties which are exposed to noise between the SOAEL and UAEL experience noise increases corresponding to a **minor** effect resulting in an adverse likely **significant** effect as the exposure is above the SOAEL.

16.9.211 Properties experiencing adverse likely significant effects at night from ground noise are within the night-time air noise SOAEL contour and would be eligible for noise insulation. Properties also experiencing significant effects during the daytime are within the daytime air noise SOAEL contour and would be eligible for a full package of noise insulation. Noise insulation would avoid the adverse likely significant effects (see **Section 16.10** and **Section 16.11**).

Table 16.68: Assessment Phase 2b 2043 Community areas that experience an adverse likely significant effect due to ground noise increases

Location	Community area[41]	Daytime / Night-time
To the south of the airport	Someries, represented by AR1	Night-time only
	Isolated properties on Dane Street	Daytime and night-time

Non-residential receptors

16.9.212 This section provides an assessment of operational ground noise effects in assessment Phase 2b on noise sensitive non-residential receptors. Non-residential receptors that have the potential for a likely significant effect based on the assessment criteria defined in **Table 16.19** are investigated on an individual basis to avoid over-estimates.

Table 16.69: Assessment Phase 2b non-residential receptors screened into ground noise assessment

Receptor category	Number screened into assessment on a precautionary basis
Educational facilities (schools, colleges, nurseries, further education, higher education, lecture theatres)	1
Offices	12
Libraries	1
Hotels	6

16.9.213 The DS noise level and noise level change (DS minus DM) have been calculated for each of the receptors in **Table 16.69**. None of these receptors exceed the assessment criteria in **Table 16.19** with the exception of two of the hotels (Holiday Inn and Courtyard by Marriott) that are predicted to experience increases in noise of between 3 and 4dB; however, DS scenario noise levels are equivalent to those predicted for the 2019 Actuals baseline.

16.9.214 The increase in noise affects the south facing façades of the hotels and is due to the new taxiway that connects Taxiway Bravo to the western end of the runway. As these hotels are currently exposed to high levels of aircraft noise (in particular from aircraft take-offs) they will have a high level of building envelope attenuation inherent in their design to achieve good internal acoustic conditions for guests. Consequently, although there is a predicted increase in noise, it is

[41] Community areas represent people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens).

expected that the internal acoustic conditions will be unaffected. Therefore, effects on non-residential receptors are predicted to be not significant.

Surface Access Noise

Assessment Phase 1

Residential receptors

16.9.215 This section provides an assessment of surface access noise effects in assessment Phase 1 on people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).

16.9.216 All the surface access noise comparisons relating to noise sensitive buildings reported herein are based on the façade which undergoes the greatest magnitude of change in traffic noise level as a result of the Proposed Development. The daytime results are provided for the ground floor of each building, and the night-time results are provided for the top floor of each building. This is chosen to reflect where residents are likely to be during these periods. Further details of the traffic noise model set-up are provided in **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

16.9.217 Assessment Phase 1 2027 DM and DS daytime surface access noise contours are presented in **Figure 16.33** and **Figure 16.35** in this ES **[TR020001/APP/5.03]**. Assessment Phase 1 2027 DM and DS night-time ground noise contours are presented in **Figure 16.34** and **Figure 16.36** in this ES **[TR020001/APP/5.03]**. The change in surface noise level from DM to DS for daytime and night-time is shown in **Figure 16.37** and **Figure 16.38** of this ES **[TR020001/APP/5.03].**

16.9.218 **Table 16.70** summarises the short-term changes in predicted surface access noise levels in 2027 between the DM and the DS scenarios for residential receptors.

Table 16.70: Assessment Phase 1 2027 Summary of DS-DM surface access noise change

Magnitude of effect	Noise change (DS-DM)	Residential households experiencing change	
		Day	Night
Increases			
Negligible	0.1 - 0.9dB	27,400	25,400
Minor	1.0 - 2.9dB	300	200
Moderate	3.0 - 4.9dB	4	1
Major	5.0dB or more	0	0
Decreases			
Negligible	0.1 - 0.9dB	21,400	23,300
Minor	1.0 - 2.9dB	1,100	600
Moderate	3.0 - 4.9dB	43	33
Major	5.0dB or more	7	6

16.9.219 In the short-term there is a relatively even spread between increases and decreases in surface access noise levels at residential receptors within the study area. In 2027, approximately 27,400 residential buildings are predicted to experience an increase in daytime road traffic noise levels and approximately 22,550 a decrease. Whilst most of these effects are either **negligible** (0.1 – 0.9 dB) or **minor** (1.0 – 2.9 dB), there are a small number (54) of **moderate** or **major** effects. Most of these are decreases in road traffic noise for properties on Eaton Green Road which is expected to experience a reduction in traffic volume. Conversely, **moderate** increases in surface access noise levels are expected, for four residential properties, primarily as a result of an increase in traffic on Vauxhall Way. At night, the same overall trend in changes to surface access noise levels is predicted.

16.9.220 In accordance with DMRB further analysis has been undertaken on the minor, moderate and major short-term changes reported in **Table 16.70** to identify the significant effects due to the Proposed Development.

16.9.221 Most of the expected **minor** and **moderate** increases in surface access noise are in the vicinity of Vauxhall Way either side of the roundabout with Eaton Green Road, due to an increase in traffic volume. There are also some **minor** increases in the vicinity of the Crawley Green Road and Wigmore Lane roundabout and to the south-east of Hedley Rise as a result of small increases in traffic volume on Crawley Green Road and Eaton Green Road respectively. However, the majority of properties in these areas are expected to experience only **negligible** increases in surface access noise and the general character of the sound environment in the area is not expected to change. Additionally, although some properties close to Vauxhall Way currently experience surface access noise levels above the SOAEL on facades facing the road these facades are expected to experience only **negligible** changes in the noise level. Predominantly surface access noise levels in the area are expected to remain

between the LOAEL and SOAEL. As such, these adverse effects as result of increases in surface access noise are considered to be **not significant**.

16.9.222 The **minor**, **moderate** and **major** reductions surface access noise are concentrated in the vicinity of Eaton Green Road and Wigmore Lane and result from small changes to the distribution of traffic in the area. These impacts are relatively isolated and would not change the acoustic environment of the area. As such, these beneficial effects are considered to be **not significant**.

16.9.223 **Negligible** changes in surface access noise are expected at properties within the road traffic Noise Important Areas (NIAs) within the study area. As such, effects within NIAs are considered to be **not significant**. The position of the NIAs is shown in **Figure 16.1** of this ES **[TR020001/APP/5.03]**.

Non-residential receptors

16.9.224 This section provides an assessment of surface access noise effects in assessment Phase 1 on noise sensitive non-residential receptors.

16.9.225 The surface access noise study area contains around 300 non-residential noise sensitive receptors. The DS noise level and noise level change (DS minus DM) have been calculated for each of these receptors and none are expected to exceed the assessment criteria in **Table 16.19**, therefore effects on non-residential receptors are predicted to be **not significant**.

Assessment Phase 2a

Residential receptors

16.9.226 This section provides an assessment of surface access noise effects in assessment Phase 2a on people, primarily where they live (‘residential receptors’) in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of ‘relative tranquillity’ (see methodology in **Section 16.5**).

16.9.227 Assessment Phase 2a 2039 DM and DS daytime surface access noise contours are presented in **Figure 16.57** and **Figure 16.59** in this ES **[TR020001/APP/5.03].** Assessment Phase 2a 2039 DM and DS night-time surface access noise contours are presented in **Figure 16.58** and **Figure 16.60** in this ES **[TR020001/APP/5.03]**. The change in surface noise level from DM to DS for daytime and night-time is shown in **Figure 16.61** and **Figure 16.62** of this ES **[TR020001/APP/5.03].**

16.9.228 **Table 16.71** summarises the short-term changes in predicted surface access noise levels in 2039 between the DM (without the Proposed Development) and the DS (with the Proposed Development) scenarios at residential buildings.

Table 16.71: Assessment Phase 2a 2039 Summary of DS-DM surface access noise change

Magnitude of effect	Noise change (DS-DM)	Residential households experiencing change	
		Day	Night
Increase			
Negligible	0.1 - 0.9dB	38,400	36,800
Minor	1.0 - 2.9dB	5,200	4,550
Moderate	3.0 - 4.9dB	42	22
Major	5.0dB or more	0	0
Decrease			
Negligible	0.1 - 0.9dB	6,700	6,000
Minor	1.0 - 2.9dB	500	600
Moderate	3.0 - 4.9dB	39	20
Major	5.0dB or more	0	0

16.9.229 In the short-term the majority (38,400) of residential receptors are expected to experience a **negligible** (0.1 – 0.9 dB) increase in daytime surface access noise. Most of the remaining residential receptors are expected to experience either a **minor** (1.0 – 2.9 dB) increase (5,200), **negligible** decrease (6,700) or no change in surface access noise. There are expected to be 42 **moderate** (3.0 – 4.9 dB) increases in road traffic noise in the vicinity of Devon Road as a result of noise from vehicles using the Airport Access Road and also close to Wigmore Lane as a result of traffic changes related to the conversion of the roundabouts to signalised junctions. **Moderate** decreases in the vicinity of Eaton Green Road are expected for 39 residential receptors due to a reduction in traffic volume on this route. At night, the same overall trend in changes to surface access noise levels is predicted.

16.9.230 In accordance with DMRB further analysis has been undertaken on the minor and moderate short-term changes reported in **Table 16.71** to identify the likelihood of significant effects due to the Proposed Development.

16.9.231 **Minor** and **moderate** increases in surface access noise are expected on the south-east facing facades of some properties in the vicinity of Devon Road due to road traffic noise from vehicles using the AAR. As explained in **Section 16.8**, the AAR would be constructed with a low noise road surface to minimise this impact. Given that the absolute noise levels on these facades are expected to remain below the LOAEL and that most of the predicted impacts are **minor**, these effects are classified as **not significant**.

16.9.232 Many properties in the vicinity of Crawley Green Road, either side of Wigmore Lane, are expected to experience **minor** increases in surface access noise as a result of traffic increases on Crawley Green Road. Given these increases are likely to result in little change to the overall acoustic environment, significant adverse effects at these properties are unlikely, excepting where the absolute

DS noise level is above the SOAEL. These properties (approximately 55) are located close to Crawley Green Road, between Vauxhall Way and Hedley Rise. As a result, indirect **significant** adverse effects are predicted to occur at these properties. Noise insulation will be provided to avoid these significant effects if required (see **Section 16.10**).

16.9.233 **Minor** increases in surface access noise are also expected at some properties in the Tea Green area as a result of an increase in traffic on Stony Lane. However, absolute volumes of traffic remain relatively low, close to the lower limit of validation for the CRTN methodology, and therefore such predicted increases in traffic noise levels should be treated with caution. Given that such increases sit in the middle of the **minor** change band and absolute levels are expected to remain relatively low (in the vicinity of the LOAEL), these increases are expected to result in effects that are **not significant**.

16.9.234 The vast majority of properties within road traffic NIAs are expected to experience **negligible** changes in surface access noise in 2039. Three properties on Vauxhall Way, in NIA 5283 and NIA 5282, are expected to experience **minor** changes in road traffic noise as a result of a small increase in traffic volume on this route. As such, effects within NIAs are considered to be **not significant**. The position of the NIAs is shown in **Figure 16.1** of this ES **[TR020001/APP/5.03]**.

Non-residential receptors

16.9.235 This section provides an assessment of surface access noise effects in assessment Phase 2a on noise sensitive non-residential receptors.

16.9.236 The surface access noise study area contains around 300 non-residential noise sensitive receptors. The DS noise level and noise level change (DS minus DM) have been calculated for each of these receptors. Three hotels, the Courtyard by Marriott Luton Airport, the ibis budget Luton Airport and the Hotel ibis London Luton Airport, adjacent to the A505 Airport Way and close to the southern end of the proposed Airport Access Road are expected to experience an increase in road traffic noise of over 3dB on one façade of the building as a result of extra traffic on Airport Way and traffic on the Airport Access Road. These receptors are expected to meet the assessment criteria in **Table 16.19**. However, as explained in **paragraph 16.5.69**, relevant contextual information has been considered in assessing the likely effects at these receptors. As the hotels are so close to the airport the road traffic noise, which is expected to remain below the SOAEL, is not typically the primary noise source. The primary noise source is typically aircraft noise and departure L_{ASmax} noise levels in this location are significantly in excess of the expected road traffic noise levels. With the construction of the building facades for the hotels designed to mitigate the existing aircraft noise it is not considered that significant changes to typical internal noise levels in the hotels would arise from these increases in road traffic noise. Therefore effects on these non-residential receptors, as well as all others that themselves do not meet the criteria in **Table 16.19**, are predicted to be **not significant**.

Assessment Phase 2b

Residential receptors

16.9.237 This section provides an assessment of surface access noise effects in assessment Phase 2b on people, primarily where they live ('residential receptors') in terms of individual households and on a wider community basis. This includes any shared community open areas (e.g. parks) as well as private open space (e.g. gardens). Assessment of these receptors also includes consideration of 'relative tranquillity' (see methodology in **Section 16.5**).

16.9.238 Assessment Phase 2b 2043 DM and DS daytime surface access noise contours are presented in **Figure 16.81** and **Figure 16.83** in this ES **[TR020001/APP/5.03].** Assessment Phase 2b 2043 DM and DS night-time surface access noise contours are presented in **Figure 16.82** and **Figure 16.84** in this ES **[TR020001/APP/5.03]**. The change in surface noise level from DM to DS for daytime and night-time is shown in **Figure 16.85** and **Figure 16.86** of this ES **[TR020001/APP/5.03].**

16.9.239 **Table 16.72** summarises the short-term changes in predicted road traffic noise levels in 2043 between the DM (without the Proposed Development) and the DS (with the Proposed Development) scenarios at residential buildings.

Table 16.72: Assessment Phase 2b 2043 Summary of DS-DM surface access noise change

Magnitude of effect	Noise change (DS-DM)	Residential households experiencing change	
		Day	Night
Increase			
Negligible	0.1 - 0.9dB	31,150	25,000
Minor	1.0 - 2.9dB	6,400	5,900
Moderate	3.0 - 4.9dB	150	86
Major	5.0dB or more	6	1
Decrease			
Negligible	0.1 - 0.9dB	9,900	14,800
Minor	1.0 - 2.9dB	550	500
Moderate	3.0 - 4.9dB	130	113
Major	5.0dB or more	0	0

16.9.240 In the short-term most residential receptors (31,150) are expected to experience a **negligible** (0.1 – 0.9 dB) increase in daytime surface access noise. Most of the remaining residential receptors are expected to experience either a **Minor** (1.0 – 2.9 dB) increase (6,400), **negligible** decrease (9,900) or no change in surface access noise. There are, however, some **moderate** (3.0 – 4.9 dB) increases (150), **major** (5.0 dB or more) increases (6) and **moderate** decreases (130) in daytime surface access noise. The overall pattern of changes in surface access noise closely resembles that described for assessment Phase

2a with **moderate** increases in road traffic noise in the vicinity of Devon Road and Wigmore Lane. The **moderate** increases expected in 2039 in Tea Green are expected to be a combination of **moderate** and **major** increases in 2043. As in 2039 **moderate** decreases are expected in the vicinity of Eaton Green Road. At night, the same overall trend in changes to surface access noise levels is predicted.

16.9.241 The long-term changes in predicted surface access noise levels between 2027 (assessment Phase 1 without the Proposed Development) and 2043 (assessment Phase 2b with the Proposed Development) scenarios at residential buildings are summarised in **Table 16.73**

Table 16.73: Long-term change (2027 to assessment Phase 2b 2043) Summary of DS-DM surface access noise change

Magnitude of effect	Noise change (DS-DM)	Residential households experiencing change	
		Day	Night
Increase			
Negligible	**0.1 - 2.9dB**	52,250	51,700
Minor	**3.0 - 4.9dB**	550	200
Moderate	**5.0 - 9.9dB**	41	33
Major	**10.0dB or more**	1	0
Decrease			
Negligible	**0.1 - 2.9dB**	2,150	3,000
Minor	**3.0 - 4.9dB**	63	37
Moderate	**5.0 - 9.9dB**	0	0
Major	**10.0dB or more**	0	0

16.9.242 In the long-term, the overall trend in changes to road traffic noise levels is similar to that reported in **Table 16.28** for the case without the Proposed Development. In particular, the vast majority of residential properties are expected to experience a **negligible** (0.1 - 2.9 dB) increase in both daytime (93%) and night-time (94%) traffic noise levels between 2027 and 2043. In contrast to the expected changes without the Proposed Development, some **moderate** increases and one **major** increase are expected in Tea Green as a result of increases in traffic on Stony Lane. There are also minor decreases expected at some properties on Eaton Green Road as a result of a reduction in traffic on this route. Such reductions in traffic volume are not expected to occur in the future baseline (i.e. without the Proposed Development).

16.9.243 In accordance with DMRB further analysis has been undertaken on the minor and moderate short-term changes reported in **Table 16.72** to identify the likelihood of significant effects due to the Proposed Development.

16.9.244 The short-term changes in road traffic noise in 2043 exhibit the same overall trend described for 2039 and the implementation of assessment Phase 2a. This leads to the same conclusions with regard to significant effects described in

paragraphs 16.9.231 and **16.9.232**, namely that despite some **minor** and **moderate** increases, adverse effects in the vicinity of Devon Road or Crawley Green Road are classified as **not significant** except where absolute surface access noise levels are above the SOAEL. This relates to the same 55 properties, close to Crawley Green Road between Vauxhall Way and Hedley Rise, described in **paragraph 16.9.232** for which indirect **significant** adverse effects are predicted. Noise insulation will be provided to avoid these significant effects if required (see **Section 16.10**).

16.9.245 However, there are a greater number of properties predicted to experience **moderate** and **major** increases in surface access noise levels in 2043 when compared to 2039 and this impacts the conclusions drawn for properties in Tea Green. At this location, increases in surface access noise due to the Proposed Development are higher than those predicted to occur in 2039, with the short-term increase in 2043 being around 5 dB for properties close to Stony Lane[42]. In addition, the long-term road traffic noise changes are also predicted to be **moderate** or **major**. Therefore, indirect **significant adverse effects** are predicted for approximately 20 residential properties on Stony Lane between Lilley Bottom Road and Darley Road. Noise barriers on this stretch of road are not feasible due to engineering constraints and traffic speeds are too low for a low noise road surface to be particularly effective. However, as set out in the Transport Assessment **[TR020001/APP/7.02]**, Stony Lane has been identified as an area for potential traffic management. As such, through on-going discussions with stakeholders, the Applicant is committed to investigating, and if necessary, funding opportunities for parking controls, traffic management and calming measures. If such measures were to reduce the traffic volume or traffic speed on Stony Lane then the road traffic noise level would also decrease.

16.9.246 The vast majority of properties within road traffic NIAs are expected to experience **negligible** changes in surface access noise in 2043. Six properties on Vauxhall Way, in NIA 5283 and NIA 5282, are expected to experience **minor** changes in road traffic noise as a result of a small increase in traffic volume on this route. As such, effects within NIAs are considered to be **not significant**. The position of the NIAs is shown in **Figure 16.1** of this ES **[TR020001/APP/5.03]**.

Non-residential receptors

16.9.247 This section provides an assessment of operational road traffic noise effects in assessment Phase 2b on noise sensitive non-residential receptors.

16.9.248 The road traffic noise study area contains around 300 non-residential noise sensitive receptors. The DS noise level and noise level change (DS minus DM) have been calculated for each of these receptors. The same three hotels (the Courtyard by Marriott Luton Airport, the ibis budget Luton Airport and the Hotel ibis London Luton Airport) identified in **paragraph 16.9.236** with respect to assessment Phase 2a, are also expected to meet the criteria given in **Table**

[42] Although, with reference to paragraph 16.6.20 in the assumptions and limitations section, current levels of traffic on Stony Lane are below the range of validity for CRTN, by 2043 they are no longer below this limit. Therefore, the additional uncertainty referred to in paragraph 16.6.20 does not apply to these changes.

16.19 in assessment Phase 2b. As in assessment Phase 2a, road traffic noise is however not expected to be the dominant noise source at these locations and therefore significant effects are not expected at these receptors. No other non-residential receptors are expected to exceed the assessment criteria in **Table 16.19** and therefore effects on non-residential receptors are predicted to be **not significant**.

Fixed Plant Noise

16.9.249 The level of design detail at the time of the ES for fixed plant is limited, as is normal for any project of this nature. The methodology for assessment of significant effects of fixed plant is therefore to avoid significant adverse effects, and reduce adverse effects as far as is reasonably practicable, through a requirement to design fixed plant following a noise management process derived from guidance in British Standard 4142. This approach is described in further detail in **Appendix 16.3** of this ES **[TR020001/APP/5.02]**. As the building services plant will be designed following this approach; the permanent effect of operational building services noise in all assessment phases would be **not significant**.

Operational vibration

16.9.250 Potential sources of operational ground-borne vibration are rail movements on the Luton DART system and aircraft operating on the ground (taxiing or ground-running).

16.9.251 Relevant guidance for operational rail and construction vibration recommends study areas of 60-100m to encompass potential effects from vibration at sensitive receptors (Ref. 16.53, Ref. 16.59, Ref. 16.60). Whilst there is no guidance or methodology for assessing vibration from aircraft operating on the ground, it is considered that they have no greater potential to generate vibration than construction activities, and therefore the 100m study area for construction is expected to encompass any potential vibration effects from aircraft on the ground.

16.9.252 An assessment has been undertaken to determine the minimum distance between the Luton DART and any area on which aircraft would operate on the ground. As the minimum distance is over 400m, which is substantially greater than the 60-100m distances recommended for vibration assessment in the references described above, it is considered that operational ground-borne vibration as a result of the Proposed Development will be **not significant**.

Combined effects

16.9.253 The potential for combined noise effects due to exposure to multiple sources of noise has been considered qualitatively as there is no reliable means of quantitatively assessing the overall noise effects resulting from combined exposure to multiple noise sources.

16.9.254 A small number of six properties to the south of the airport near Someries Castle and on Dane Street experience adverse likely significant effects due to noise change from both aircraft air noise and ground noise during the night-

time. These receptors will be eligible for a full package of noise insulation which would avoid any combined adverse likely significant effect from both air and ground noise (see **Section 16.10** and **Section 16.11**).

16.9.255 There are no other receptors that have been predicted to experience significant effects from more than one source of noise at the same time. Therefore, there are no predicted significant combined effects from multiple noise sources.

Sensitivity tests

16.9.256 There are certain known scenarios and uncertainties that could influence the conclusions of the Core Planning Case assessment. These scenarios and the general approach to considering them in this assessment are described in **Section 5.4** of **Chapter 5** of this ES **[TR020001/APP/5.01]**.

16.9.257 **Table 16.74** provides a summary of any likely changes to the conclusions of the air noise assessment reported in this chapter, in the event that that scenario or risk is realised. Where additional noise modelling was undertaken, details on the results are presented in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.

Table 16.74: Noise sensitivity tests

Sensitivity scenario	Potential impact and change	Summary of likely effect
LLAOL 19 mppa planning application granted	The long-term noise limits in the 19 mppa planning application are equivalent to the current consented long-term noise limits that have been used to define the DM scenario for the assessment in this chapter. Therefore, the significant affects that have been identified due to noise change from the DM to the DS would not be expected to change.	Effects would remain as those reported in this chapter.
Faster growth scenario	The faster growth scenario accounts for uncertainties in forecasting and considers throughput being achieved earlier, with 23 mppa reached in 2027 for assessment Phase 1, 27 mppa reached in 2038 for assessment Phase 2a and 32 mppa in 2042 for assessment Phase 2b. As such, fleet mixes in these earlier years are comprised of less new generation aircraft. Similarly to the Core Planning Case, there is a reduction in the number of people exposed above the LOAEL and SOAEL during the day and night when compared to the 2019 Actuals baseline for all of the faster growth assessment years. There are therefore no new significant effects on health and quality of life during the daytime or night-time in the faster growth case.	For assessment Phase 1, the effects would remain as those reported in this chapter with the addition of an adverse likely **significant** effect for 1,000 people due to **minor/moderate** changes above the daytime SOAEL that would not occur in the core case and the slightly increased

Sensitivity scenario	Potential impact and change	Summary of likely effect
	For assessment Phase 1 during the daytime, the DM to DS change above the LOAEL and below the SOAEL during would increase from **negligible** in the core case to **negligible/minor** in the faster growth case but would remain **not significant**. The DM to DS change above the SOAEL during the daytime would change from **negligible** to **minor/moderate** for an approximate population of 1,000 people which would result in an adverse likely **significant** effect due to noise change that would not occur in the Core Planning Case. For assessment Phase 1 during the night-time, the DM to DS change above the LOAEL and below the SOAEL during would remain **negligible** and **not significant**. The DM to DS change above the SOAEL during the night-time would remain **minor** and result in an adverse likely **significant** effect due to noise change but would affect a slightly larger population (4,250), than in the core case (3,800). As the assessment Phase 2a and assessment Phase 2b faster growth scenarios are only forecast to take place one year before the Core Planning Case, the noise effects are comparable but arrive one year earlier. Further information is provided in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Daytime and night-time faster growth noise contours are presented in **Figure 16.91** and **Figure 16.92 [TR020001/APP/5.03]**.	population within the adverse likely **significant** effect due to **minor** changes above the night-time SOAEL than reported in the core case. These significant effects would be avoided with noise insulation, though as per the core case there may be temporary adverse likely significant effects until such time as noise insulation can be provided for those who wish to take up the offer. For assessment Phase 2a and 2b the effects would remain as reported in the core case.
Slower growth scenario	The slower growth scenario accounts for uncertainties in forecasting and considers throughput being achieved later. In the slower growth scenario, throughput is forecast to reach 21.5 mppa in 2030, 27 mppa in 2046 and 32 mppa in 2049. Consequently, the fleet mix would have a greater likelihood of including more new generation aircraft compared to the	For assessment Phase 1, effects would be reduced compared to those in the core assessment and effects in assessment Phase

Sensitivity scenario	Potential impact and change	Summary of likely effect
	corresponding Core Planning Case assessment years. Similarly to the Core Planning Case, there is a reduction in the number of people exposed above the LOAEL and SOAEL during the day and night when compared to the 2019 Actuals baseline for all of the slower growth assessment years. There are therefore no new significant effects on health and quality of life during the daytime or night-time in the slower growth case. As the slower growth forecasting is more similar to the do-minimum scenario in 2030, the magnitude of noise changes are smaller and noise changes above SOAEL for daytime and night-time would be **negligible** and not significant, therefore the significant effects reported in assessment Phase 1 for the core case would be **not significant** in the slower growth case. In 2046 and 2049, the change effects would be similar to those experienced in the Core Planning Case in 2039 and 2043 but arrive later, so the significant effects due to **minor/moderate** noise change above SOAEL during the day and night would remain. Further information is provided in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. 2030 Daytime and night-time slower growth noise contours are presented in **Figure 16.93** and **Figure 16.94 [TR020001/APP/5.03]**.	1 would be **not significant**. For assessment Phase 2a and 2b the effects would remain as reported in the core case.
Next generation aircraft are quieter in future years	There is a reasonable expectation that next generation aircraft, including zero emission aircraft, will start to enter the fleets from the mid-2030s and so assumptions have been made as to the rate of introduction consistent with those use by Government in the Jet Zero strategy (Ref. 16.76). In 2039 it is assumed that approximately 12% of the fleet would be made up of next-generation	Effects would remain as those reported in this chapter

Sensitivity scenario	Potential impact and change	Summary of likely effect
	aircraft[43], resulting in a decrease in areas of the daytime DS LOAEL and SOAEL contours by 4% and 5% respectively when compared to the core assumption that next-generation aircraft are no quieter than the new-generation aircraft they replace. The night-time LOAEL and SOAEL contours each reduce by approximately 1%. In 2043 it is assumed that approximately 52% of the fleet would be made up of next-generation aircraft, resulting in a decrease in areas of the daytime DS LOAEL and SOAEL contours by 13% and 18% respectively when compared to the core assumption that next-generation aircraft are no quieter than the new-generation aircraft they replace. The night-time LOAEL and SOAEL contours reduce by approximately 9% and 15% respectively. Whilst this would result in a smaller population being affected by aircraft noise above the LOAEL and SOAEL in the DS scenario, the population exposed in the DM scenario would also reduce. Therefore, the identified effects due to change from DM to DS as a result of the Proposed Development would not materially change. Nonetheless, the conclusion that fewer people would be affected overall with quieter next-generation aircraft is important, and the Noise Envelope contains a mechanism for reducing noise limits in future years if next-generation aircraft entering the fleet are quieter (see **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**). Further information is provided in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.	

[43] Further information on the forecasts and assumptions on transition to next-generation aircraft is provided in the **Need Case [TR020001/APP/7.04]**

Sensitivity scenario	Potential impact and change	Summary of likely effect
2019 Consented baseline	In response to statutory consultation feedback, a sensitivity test has been undertaken using a '2019 Consented' baseline modelled using a theoretical 2019 fleet that would have been compliant with the current consented short-term noise limit. As the future baseline is unaffected by this sensitivity test, the potential changes to significant effects arise when comparing back to the 2019 Consented baseline to determine whether there are new significant effects on health and quality of life as a result of new exposure above the SOAEL. During the daytime, the population exposed above the DS SOAEL are also exposed above the SOAEL in the 2019 Consented Baseline in each assessment year, so there are no new significant effects on health and quality of life during the daytime (which is the same conclusion as for the 2019 Actuals baseline). During the night-time, there are no new significant effects on health and quality of life due to new exposure above the SOAEL in 2039, however, that is not the case in 2027 and 2043. In 2027 there is a population of 700 that would be newly exposed above the night-time SOAEL and in 2043 there is a population of 150 that would be newly exposed above the night-time SOAEL which would result in **significant** effects on health and quality of life for these receptors. These significant effects would be avoided through noise insulation. Further information is provided in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**. Daytime and night-time noise contours for the 2019 Consented Baseline are shown in **Figure 16.87** and **Figure 16.88 [TR020001/APP/5.03]**. The difference between the 2019 Actuals Baseline and the 2019 Consented Baseline contours are show in	During the daytime, the effects would remain as those reported in this chapter. During the night-time, there would be new **significant** effects on health and quality of life in assessment Phase 1 and assessment Phase 2b due to new exposure above the SOAEL compared to the 2019 Consented baseline that are not identified in the core assessment which compares to the 2019 Actuals baseline. These significant effects would be avoided through noise insulation, though there may be temporary significant effects on health and quality of life in assessment Phase 1 until such time as noise insulation can be provided for those who wish to take up the offer.

Sensitivity scenario	Potential impact and change	Summary of likely effect
	Figure 16.95 and **Figure 16.96 [TR020001/APP/5.03].**	
Airspace change	As the airspace change process is still ongoing and will provide an assessment of potential noise impacts as part of the separate Airspace Change process, an analysis of noise effects due to airspace change has not been undertaken. Instead, the sensitivity test aims to demonstrate that airspace changes can be accommodated within the Noise Envelope Limits defined in the **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**. Consequently, the sensitivity test only seeks to show how noise contour areas may change as a result of potential changes to departure paths at the noise contour noise limit level of 54dB$L_{Aeq,16h}$ and 48dB$L_{Aeq,8h}$ defined in the Noise Envelope. As the airspace design is in the initial option appraisal stage, only a series of options for airspace change have been submitted to date, the sensitivity test looks to identify how noise contour area may be affected if options that may result in a change to contour shape are brought forward. Consequently, the sensitivity test is based on an airspace design option that is likely to provide the biggest change to the existing flight paths through provision of respite departure routes. The sensitivity test of potential changes to airspace indicates that airspace changes are likely be accommodated within the DCO Noise Envelope, as the estimated noise contour areas fit within the Noise Envelope limits. Further information is provided in **Section 12** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.	Not applicable
J10 without National Highways Smart Motorway upgrade (hard	Modelling surface access noise with and without the Proposed Development under this scenario indicates the same pattern of changes in road traffic noise as reported for assessment Phase 2b under the core scenario.	Effects would remain as those reported in this chapter.

Sensitivity scenario	Potential impact and change	Summary of likely effect
shoulder running scheme)	Further information is provided in **Section 9** of **Appendix 16.1** of this ES **[TR020001/APP/5.02]**.	

16.10 Additional mitigation and compensation measures

16.10.1 This section describes the mitigation and compensation measures identified as a result of the assessment process that are proposed in addition to those already considered to be in place as described in **Section 16.8** Embedded and good practice mitigation measures. These are proposed to reduce, mitigate or avoid the effects on noise and vibration as a result of the construction and operation of the Proposed Development.

16.10.2 The compensatory mitigation measures have been developed so that in combination with the embedded noise management measures in **Section 16.8** they meet the first aim of Government noise policy to avoid significant adverse effects on health and quality of life from noise. This is achieved through the noise insulation scheme which contains eligibility criteria in line with, and below, the relevant SOAEL values.

16.10.3 Further information on the approach to noise management (mitigation and compensation) and how the aims of Government noise policy have been used to define the noise mitigation hierarchy is presented in **Appendix 16.2** Operational noise management (explanatory note) of this ES **[TR020001/APP/5.02]**.

Construction

16.10.4 No significant construction noise or vibration effects have been identified. Consequently, no additional mitigation measures are identified.

Operation

Air noise insulation

16.10.5 As part of the Proposed Development, the current air noise insulation scheme administered by LLAOL will be updated if development consent is granted. The updated noise insulation scheme improves on the current scheme and goes beyond the government proposals set out in Aviation 2050. The proposed residential noise insulation scheme sets a five-tiered scheme as follows:

a. Scheme 1 – for residential properties inside the 63dB$L_{Aeq,16h}$ contour, a full package of agreed noise insulation works to habitable rooms;

b. Scheme 2 – for residential properties inside the 60dB$L_{Aeq,16h}$ contour and outside the 63dB$L_{Aeq,16h}$ contour, a contribution of up to £20,000 for agreed noise insulation works to habitable rooms;

c. Scheme 3 – for residential properties inside the 55dB$L_{Aeq,8h}$ contour and outside the 60dB$L_{Aeq,16h}$ contour, a full package of agreed noise insulation works to bedrooms;

d. Scheme 4 – for residential properties inside the 57dB$L_{Aeq,16h}$ contour and outside the 60dB$L_{Aeq,16h}$ contour, a contribution of up to £6,000 for agreed noise insulation works to habitable rooms; and

e. Scheme 5 – for residential properties inside the daytime 54dB$L_{Aeq,16h}$ contour and outside the 57dB$L_{Aeq,16h}$ contour, a contribution of up to £4,000 for agreed noise insulation works to habitable rooms.

16.10.6 Full details on the proposed noise insulation schemes are presented in **Compensation Policies, Measures and Community First** submitted as part of the application for development consent **[TR020001/APP/7.10]**. The proposed noise insulation schemes will be secured through the Section 106 agreement.

16.10.7 All properties experiencing a significant effect on health and quality of life (i.e. noise levels exceeding the SOAEL) due to aircraft noise are eligible for a fixed contribution towards noise insulation under the current insulation scheme. The proposed noise insulation scheme offers a substantial improvement by offering a fully funded package of insulation for habitable rooms for properties within the daytime SOAEL noise contour and a fully funded package of insulation for bedrooms for properties within the night-time SOAEL. Additionally, properties outside the SOAEL contours and within the 54dB$L_{Aeq,16h}$ noise contour will receive a contribution towards agreed noise insulation works.

16.10.8 The rollout of the noise insulation scheme will begin with, and prioritise those, above the daytime and night-time SOAELS (i.e. Schemes 1 to 3). See **Compensation Policies, Measures and Community First [TR020001/APP/7.10]** for more information on the rollout of the schemes.

16.10.9 Full packages of insulation above the SOAEL are provided so that, in combination with the embedded noise management measures, the first aim of Government noise policy to avoid significant adverse effects on health and quality of life from noise can be met. This approach to meeting the first aim of Government noise policy has been accepted for many large infrastructure projects (e.g HS2) and the approach has been tested in the in the Cranford Appeal decision (Ref. 16.75) which states at paragraph 1087 *"Against this background I consider that the proffered mitigation between SOAEL and UAEL is consistent with the APF and would be sufficient to avoid significant observed adverse effects."*

Next-generation aircraft technology

16.10.10 As described in **Section 16.8**, the Noise Envelope contains a mechanism for the noise contour area Limit to be reduced in future years (beyond the 2030s) if and when quieter 'next generation' aircraft become available, or an airspace change is implemented that would enable lower noise levels to be achieved than that forecast in the reasonable worst-case assessment reported in the ES.

Surface Access

16.10.11 The assessment of surface access noise from the Proposed Development presented in **Section 16.9** has identified the potential for indirect significant adverse effects, in 2039 and 2043, for specific properties on Crawley Green Road due to intensification of road traffic using existing public highways, where road traffic noise levels are expected to be above the SOAEL with the Proposed Development in place.

16.10.12 A program of traffic monitoring has been developed as part of **Transport Related Impacts Monitoring and Mitigation Approach** (TRIMMA) which forms an appendix to the **Transport Assessment** (TA) **[TR020001/APP/7.02]**. This monitoring will be used to provide forecast noise modelling up to 5 years into the future to enable the re-evaluation of the road traffic noise levels at these properties. If significant effects are still anticipated at these properties, offers of noise insulation will be made before the effects occur. This would avoid the significant effects.

16.10.13 Further information on this process of the re-evaluation is provided in **Section 4.2** of **Appendix 16.2 [TR020001/APP/5.02]**, and further information on the noise insulation policy is provided in the **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**.

16.11 Residual effects

Construction

Assessment Phase 1

16.11.1 No significant effects have been identified for assessment Phase 1 construction noise and vibration and no additional mitigation has been proposed. As such, the effects would be as reported in **Section 16.9**.

Assessment Phase 2a

16.11.2 No significant effects have been identified for assessment Phase 2a construction noise and vibration and no additional mitigation has been proposed. As such, the effects would be as reported in **Section 16.9**.

Assessment Phase 2b

16.11.3 No significant effects have been identified for assessment Phase 2b construction noise and vibration and no additional mitigation has been proposed. As such, the effects would be as reported in **Section 16.9**.

Operation

Air Noise

Assessment Phase 1

16.11.4 No new significant effects on health and quality of life have been identified as a result of the Proposed Development, but communities that experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation. Adverse likely significant noise effects during the daytime and night-time have been identified due to change in noise as a result of the Proposed Development in assessment Phase 1. These effects would be avoided by the noise insulation scheme (see **Section 16.10)**. Whilst the noise insulation scheme will be rolled out as quickly as is reasonably practicable, it may not be possible to offer and install noise insulation (where the offer is accepted) to all impacted communities before the relevant noise change occurs, due to the capacity of the market to meet immediate demand. In such cases there may be temporary adverse likely **significant** effects in assessment Phase 1 until such time as noise insulation can be provided.

Assessment Phase 2a

16.11.5 No new significant effects on health and quality of life have been identified as a result of the Proposed Development, but communities that experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation. Adverse likely significant noise effects during the night-time have been identified due to change in noise as a result of the Proposed Development in assessment Phase 2a. These effects would be avoided by the noise insulation scheme (see **Section 16.10)**. By assessment Phase 2a it will be possible to have provided noise insulation to all communities that would

otherwise experience an adverse likely significant effect should they take up the offer in a timely manner.

16.11.6 The Noise Envelope will contain a mechanism for reducing noise Limits in assessment Phase 2a and beyond if quieter next-generation aircraft become available, or an airspace change is implemented that results in reduced noise contour areas. The Noise Envelope will therefore provide a mechanism for reducing adverse effects.

Assessment Phase 2b

16.11.7 No new significant effects on health and quality of life have been identified as a result of the Proposed Development, but communities that experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation. Adverse likely significant noise effects during the daytime and night-time have been identified due to change in noise as a result of the Proposed Development in assessment Phase 2b. These effects would be avoided by the noise insulation scheme (see **Section 16.10)**. By assessment Phase 2b it will be possible to have provided noise insulation to all communities that would otherwise experience an adverse likely significant effect should they take up the offer in a timely manner.

16.11.8 The Noise Envelope will contain a mechanism for reducing noise Limits in assessment Phase 2b and beyond if quieter next-generation aircraft become available, or an airspace change is implemented that results in reduced noise contour areas. The Noise Envelope will therefore provide a mechanism for reducing adverse effects.

Ground Noise

Assessment Phase 1

16.11.9 No new significant effects on health and quality of life have been identified as a result of the Proposed Development, but communities that experience continuing exposure above the SOAEL will be eligible for noise insulation due to air noise exposure. Adverse likely significant noise effects during the night-time have been identified due to change in noise as a result of the Proposed Development in assessment Phase 1. These effects would be avoided by the noise insulation scheme due to air noise exposure (see **Section 16.10)**.

Assessment Phase 2a

16.11.10 No new significant effects on health and quality of life have been identified as a result of the Proposed Development, but communities that experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation due to air noise exposure. Adverse likely significant noise effects during the night-time have been identified due to change in noise as a result of the Proposed Development in assessment Phase 2a. These effects would be avoided by the noise insulation scheme due to air noise exposure (see **Section 16.10)**.

Assessment Phase 2b

16.11.11 No new significant effects on health and quality of life have been identified as a result of the Proposed Development, but communities that experience continuing exposure above the SOAEL will be eligible for a full package of noise insulation due to air noise exposure. Adverse likely significant noise effects during the daytime and night-time have been identified due to change in noise as a result of the Proposed Development in assessment Phase 2b. These effects would be avoided by the noise insulation scheme due to air noise exposure (see **Section 16.10)**.

Surface Access Noise

Assessment Phase 1

16.11.12 No significant effects have been identified for assessment Phase 1 surface access noise and no additional mitigation has been proposed. As such, the effects would be as reported in **Section 16.9**.

Assessment Phase 2a

16.11.13 Indirect significant adverse effects have been identified for approximately 55 properties located close to Crawley Green Road, between Vauxhall Way and Hedley Rise. Traffic monitoring will be used to re-evaluate these significant effects and noise insulation will be provided to avoid these significant effects if required (see **Section 16.10**).

Assessment Phase 2b

16.11.14 Indirect significant adverse effects have been identified for approximately 55 properties located close to Crawley Green Road, between Vauxhall Way and Hedley Rise. Traffic monitoring will be used to re-evaluate these significant effects and noise insulation will be provided to avoid these significant effects if required (see **Section 16.10**).

16.11.15 Indirect significant adverse effects due to noise change have been identified for approximately 20 residential properties on Stony Lane between Lilley Bottom and Darley Road. No additional mitigation has been identified, therefore, these effects remain as reported in **Section 16.9.**

16.12 In-combination climate change effects

16.12.1 This section provides an assessment of potential changes to the findings of the noise and vibration assessment, taking into account the predicted future conditions as a result of climate change, known as In-combination Climate Change Impacts (ICCI). In combination and cumulative effects are reported in **Chapter 21** In-Combination and Cumulative Effects Assessment of this ES **[TR020001/APP/5.01]**.

16.12.2 This assessment has been undertaken using the methodology and climate change predictions described in **Chapter 9** Climate Change Resilience of this ES **[TR020001/APP/5.01]**. The results are provided in **Table 16.75**.

Table 16.75: Noise and vibration in-combination climate change impacts

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
Increase in occurrence of heatwaves	Frequent	Potential to exacerbate noise effects on communities in terms of individual dwellings and on a wider community, due to windows being open more often due to an increase in high temperatures.	The noise assessment criteria assume windows are open when internal noise levels are considered. Consequently, there is no further impact on noise effects arising from the ICCI. However, the effectiveness of noise insulation could be reduced,	Remote	Very low	**Negligible** **Not significant**

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			and noise insulation packages may need to provide a greater emphasis on ventilation.			
Increase in mean temperature and humidity	Frequent	Increases in temperature and humidity of the air reducing the atmospheric attenuation of noise.	Over distances of a few hundred metres, atmospheric effects can be ignored for sound with low frequency prominence, such as aircraft noise. Consequently, increases in temperature and humidity is unlikely to affect ground-based noise sources such as ground noise, construction	Remote	Very low	**Negligible** **Not significant**

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			noise and surface access noise. Due to the longer distances that aircraft noise travels, the effect of increases in temperature and humidity can affect aircraft noise levels. However, the change in atmospheric absorption will only have a significant effect on high frequencies. Given the prominence of low frequencies in aircraft noise, it would take a substantial change in climate to result in a			

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			perceptible change in air noise. Consequently, it is expected that changes in temperature will not result in additional impacts. Increased temperature and humidity could impact aircraft take-off performance, requiring a longer take-off run, slower climb, more thrust and potentially higher noise levels on the ground. However, this would be the case for the DS and DM			

Climate hazard	Likelihood of climate hazard occurring	ICCI identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			scenarios so the identified effects would not be changed.			

16.13 Monitoring

Construction monitoring

16.13.1 Any requirements for monitoring during the construction phase will be agreed with the relevant Local Authority through the Section 61 process in line with the CoCP provided as **Appendix 4.2** of this ES **[TR020001/APP/5.01]**.

Operational monitoring

Aircraft noise

16.13.2 The **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]** describes in detail how monitoring will be undertaken to ensure compliance with the cap on the size of noise contours proposed in the Noise Envelope.

16.13.3 A Noise Monitoring Plan (**Appendix C** to the **Green Controlled Growth Framework [TR020001/APP/7.08]**) sets out how noise contours will be calculated and checked to assess the noise performance of the airport against the Limits and Thresholds set out in the GCG framework. The Noise Monitoring Plan also sets out the additional noise indicators that the airport operator will have to monitor and report to support engagement with communities and stakeholders and to provide additional information to support the optimisation of noise control at the airport.

16.13.4 This Noise Monitoring Plan has been submitted as part of the proposed **Green Controlled Growth Framework [TR020001/APP/7.08]**. It is intended that this Monitoring Plan will be approved as part of the application for development consent, and the Development Consent Order will require the airport operator to undertake monitoring and reporting in accordance with this Monitoring Plan as part of their Green Controlled Growth responsibilities.

16.13.5 As such, this document will establish monitoring and reporting requirements for noise within Green Controlled Growth. Failure to carry out monitoring and reporting in line with this document will constitute a breach of the Development Consent Order and may result in enforcement action as detailed the **Green Controlled Growth Explanatory Note [TR020001/APP/7.07]**.

Surface access noise

16.13.6 A program of traffic monitoring has been developed as part of the Transport Assessment to inform the need and delivery programme for highway interventions. The approach to monitoring of traffic volumes is set out in the **Transport Related Impacts Monitoring and Mitigation Approach** (TRIMMA) which forms an appendix to the **Transport Assessment** (TA) **[TR020001/APP/7.02]**. Under the TRIMMA, traffic surveys and monitoring will be undertaken on an annual basis to provide the information required to undertake forecast surface access noise modelling up to 5 years into the future at properties where an indirect significant adverse effect above SOAEL has been identified in this chapter (Crawley Green Rd). This monitoring and remodelling will be used to identify eligibility for noise insulation if required.

Further information on this process of reassessment is provided in **Section 4.2** of **Appendix 16.2 [TR020001/APP/5.02]**.

16.14 Assessment summary

16.14.1 **Table 16.76** provides a summary of the reasonable worst-case identified impacts, mitigation and likely effects of the Proposed Development on noise and vibration. Additional mitigation and how it will be secured are described and its efficacy shown by the reported residual effect.

Table 16.76: Noise and vibration assessment summary

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
Construction						
Assessment Phase 1 construction noise and vibration (including construction traffic)	Best Practicable Means (BPM) measures are included within the CoCP, **Appendix 4.2** in of this ES **[TR020001/APP/5.02]**	n/a	Residential and non-residential	Not significant	n/a	**Not significant**
Assessment Phase 2a construction noise and vibration (including construction traffic)	Best Practicable Means (BPM) measures are included within the CoCP, **Appendix 4.2** in of this ES **[TR020001/APP/5.02]**	n/a	Residential and non-residential	Not significant	n/a	**Not significant**
Assessment Phase 2b construction noise and vibration (including construction traffic)	Best Practicable Means (BPM) measures are included within the CoCP, **Appendix 4.2** in of this ES	n/a	Residential and non-residential	Not significant	n/a	**Not significant**

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
	[TR020001/APP/5.02]					
Operation – air noise						
Assessment Phase 1 daytime air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	Negligible	Residential	Not significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	**Not significant**
Assessment Phase 1 night-time air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL for 3,800 people[44] which is significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Potential temporary adverse likely **significant** effects at night-time for up to 3,800 people in assessment Phase 1. The noise insulation scheme will be provided is quickly as

[44] Refer to 16.9 and 16.11 for a detailed description of the location of significant effects

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
						reasonably practicable to avoid these significant effects.
Assessment Phase 1 daytime and night-time air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	n/a	Non-residential	Not significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	**Not significant**
Assessment Phase 2a daytime air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL for 200 people[45] which is significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Adverse likely significant effects for 200 people avoided by noise insulation – **not significant**

[45] Refer to **Table 16.46** for a detailed description of the location of significant effects

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
Assessment Phase 2a night-time air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL for 2,600 people[45] which is significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Adverse likely significant effects for 2,600 people avoided by noise insulation – **not significant**
Assessment Phase 2a daytime and night-time air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	n/a	Non-residential	Not significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	**Not significant**
Assessment Phase 2b daytime air noise	Noise Envelope secured in **Green Controlled Growth Framework**	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL for 500 people[46]	Noise insulation secured in Section 106, see **Compensation**	Adverse likely significant effects for 500 people avoided by noise

[46] Refer to **Table 16.53** for a detailed description of the location of significant effects

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
	[TR020001/APP/7.08]			which is significant	**Policies, Measures and Community First [TR020001/APP/7.10]**	insulation – **not significant**
Assessment Phase 2b night-time air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	Negligible to Moderate adverse	Residential	Minor to Moderate adverse effects above the SOAEL for 3,250 people[46] which is significant	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Adverse likely significant effects for 3,250 people avoided by noise insulation – **not significant**
Assessment Phase 2b daytime and night-time air noise	Noise Envelope secured in **Green Controlled Growth Framework [TR020001/APP/7.08]**	n/a	Non-residential	Not significant	Noise insulation secured in **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	**Not significant**
Operation – ground noise						

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
Assessment Phase 1 daytime ground noise	Engine Run-up Bay, acoustic barriers	Negligible to Minor adverse	Residential	Not significant	None identified	**Not significant**
Assessment Phase 1 night-time ground noise	Engine Run-up Bay, acoustic barriers	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL at 6 properties[47] which is significant	Noise insulation for air noise secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Adverse likely significant effects for 6 properties avoided by noise insulation - **not significant**
Assessment Phase 1 daytime and night-time ground noise	Engine Run-up Bay, acoustic barriers	n/a	Non-residential	Not significant	None identified	**Not significant**
Assessment Phase 2a daytime ground noise	Engine Run-up Bay, acoustic barriers, screening provided by Terminal 2	Negligible to Minor adverse	Residential	Not significant	None identified	**Not significant**

[47] Refer to **Table 16.58** for a detailed description of the location of significant effects

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
	buildings, FEGP at Terminal 2					
Assessment Phase 2a night-time ground noise	Engine Run-up Bay, acoustic barriers, screening provided by Terminal 2 buildings, FEGP at Terminal 2	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL at 4 properties[48] which is significant	Noise insulation for air noise secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Adverse likely significant effects for 4 properties avoided by noise insulation - **not significant**
Assessment Phase 2a daytime and night-time ground noise	Engine Run-up Bay, acoustic barriers, screening provided by Terminal 2 buildings, FEGP at Terminal 2	n/a	Non-residential	Not significant	None identified	**Not significant**
Assessment Phase 2b daytime ground noise	Engine Run-up Bay, acoustic barriers, screening provided by	Negligible to Moderate adverse	Residential	Moderate adverse effects above the SOAEL at 2 properties and	Noise insulation for air noise secured in Section 106, see	Adverse likely significant effects for 4 properties avoided by

[48] Refer to **Table 16.63** for a detailed description of the location of significant effects

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
	Terminal 2 buildings, FEGP at Terminal 2			Minor adverse effects above the SOAEL at 2 properties[49] which is significant	**Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	noise insulation - **not significant**
Assessment Phase 2b night-time ground noise	Engine Run-up Bay, acoustic barriers, screening provided by Terminal 2 buildings, FEGP at Terminal 2	Negligible to Minor adverse	Residential	Minor adverse effects above the SOAEL at 6 properties[49] which is significant	Noise insulation for air noise secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]**	Adverse likely significant effects for 6 properties avoided by noise insulation - **not significant**
Assessment Phase 2b daytime and night-time ground noise	Engine Run-up Bay, acoustic barriers, screening provided by Terminal 2 buildings, FEGP at Terminal 2	n/a	Non-residential	Not significant	None identified	**Not significant**

[49] Refer to **Table 16.68** for a detailed description of the location of significant effects

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
Operation – surface access noise						
Assessment Phase 1 daytime and night-time surface access noise	A sustainable transport strategy, detailed in the Surface Access Strategy **[TR020001/APP/7.12]** and Travel Plan **[TR020001/APP/7.12]**	Major beneficial to moderate adverse	Residential and non-residential	Not significant	None identified	**Not significant**
Assessment Phase 2a daytime and night-time surface access noise	A sustainable transport strategy, detailed in the Surface Access Strategy **[TR020001/APP/7.12]** and Travel Plan **[TR020001/APP/7.12].** A low noise surface for the Airport Access Road.	Moderate beneficial to moderate adverse	Residential	Indirect significant adverse effects for approximately 55 properties on Crawley Green Road	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]** (if required)	Indirect adverse likely significant effects for approximately 55 properties on Crawley Green Road avoided by noise insulation if required - **not significant**
Assessment Phase 2a daytime and night-time	A sustainable transport strategy, detailed in the Surface Access Strategy	Moderate beneficial to moderate adverse	Non-residential	Not significant	None identified	**Not significant**

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
surface access noise	**[TR020001/APP/7.12]** and Travel Plan **[TR020001/APP/7.12].** A low noise surface for the Airport Access Road.					
Assessment Phase 2b daytime and night-time surface access noise	A sustainable transport strategy, detailed in the Surface Access Strategy **[TR020001/APP/7.12]** and Travel Plan **[TR020001/APP/7.12].** A low noise surface for the Airport Access Road.	Moderate beneficial to major adverse	Residential	Indirect significant adverse effects for approximately 55 properties on Crawley Green Road	Noise insulation secured in Section 106, see **Compensation Policies, Measures and Community First [TR020001/APP/7.10]** (if required)	Indirect adverse likely significant effects for approximately 55 properties on Crawley Green Road avoided by noise insulation if required - **not significant**
Assessment Phase 2b daytime and night-time surface access noise	A sustainable transport strategy, detailed in the Surface Access Strategy **[TR020001/APP/7.12]** and Travel Plan	Moderate beneficial to major adverse	Residential	Indirect significant adverse effects for approximately 20 properties on Stony Lane	None identified	Indirect adverse likely **significant** effects for approximately 20 properties on Stony Lane

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
	[TR020001/APP/7.12]. A low noise surface for the Airport Access Road.					
Assessment Phase 2b daytime and night-time surface access noise	A sustainable transport strategy, detailed in the Surface Access Strategy **[TR020001/APP/7.12]** and Travel Plan **[TR020001/APP/7.12].** A low noise surface for the Airport Access Road.	Moderate beneficial to moderate adverse	Non-residential	Not significant	None identified	**Not significant**
Operation - fixed plant noise						
All assessment phases daytime and night-time	Fixed plant noise will be designed, constructed, operated and maintained in order to meet the noise management process specified in **Appendix 16.3**	n/a	Residential and non-residential	Not significant	None identified	Not significant

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Type	Description of effect and significance	Additional Mitigation and how secured	Residual Effect
	of this ES **[TR020001/APP/5.02]**. This is secured through a Requirement to the DCO					
Operation - vibration						
All assessment phases daytime and night-time	None identified	n/a	Residential and non-residential	Not significant	None identified	Not significant

Competent Experts

Topic	Role	Company	Qualifications/competencies/experience of author
Noise and vibration	Author	Aecom	BSc Physics with Music, 15 years' experience in environmental and aviation acoustics, MIOA
Noise and vibration	Author	Arup	PhD Environmental Acoustics, MSc Environmental Acoustics, 11 years' experience in environmental and aviation acoustics, MIOA
Noise and vibration	Sub-author	Aecom	Msci Mathematics, PhD Interior Wave Propagation, 18 years' experience in environmental acoustics and road traffic noise, MIOA, MIMA, Cmath
Noise and vibration	Technical reviewer	Aecom	Msci / MA Physics, 21 years' experience in environmental acoustics consultancy and research, MIOA
Noise and vibration	Technical reviewer	Arup	BSc (Hons), Engineering Noise and Vibration, over 30 years' experience in environmental acoustics, FIOA
Noise and vibration	Contributor	Aecom	BA(Hons) Geography, 21 years' commercial experience in geospatial and data science. Chartered Geographer – CGEOG(GIS)

Glossary and Abbreviations

Term	Definition
AAWT	Average Annual Weekday Traffic
AEDT	Aviation Environmental Design Tool
ANP	Air Noise Performance
ANPS	Airports National Policy Statement
BNL	Basic Noise Level
BPM	Best Practicable Means
CAA	Civil Aviation Authority
CRTN	Calculation of Road Traffic Noise
dB	Decibel
DfT	Department for Transport
DM	Do-Minimum
DS	Do-Something
ECAC	European Civil Aviation Conference
END	Environmental Noise Directive
EPA	Environmental Protection Act
EPNdB	Effective Perceived Noise Lecel in Decibels
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organization
ICCAN	Independent Commission on Civil Aviation Noise
INM	Integrated Noise Model
LLAOL	London Luton Airport Operations Limited
LLANAP	London Luton Airport Noise Action Plan
LOAEL	Lowest Observed Adverse Effect Level
NEDG	Noise Envelope Design Group
NOEL	No Observed Effect Level
NPD	Noise-Power-Distance
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
PPGN	Planning Practice Guidance: Noise
SEL	Sound Exposure Level
SOAEL	Significant Observed Adverse Effect Level
SoNA	Survey of Noise Attitudes
SPL	Sound Pressure Level
UAEL	Unacceptable Adverse Effect Level

Term	Definition
WHO	World Health Organization

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