

Ducks Nest Farm Garden Community Arborfield

Planning Noise Assessment

On behalf of



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Executive Summary

This detailed noise impact assessment has demonstrated that noise should not be viewed as a constraint to the granting of planning permission in full accordance with the aims in the National Planning Policy Framework (NPPF).

The local planning authority may choose to impose certain conditions in order to ensure that amenity is protected. The noise impact assessment has demonstrated that conventional construction methods can ensure compliance with a relevant condition which complies with the six tests in the NPPF.

1.0 Context

- 1.1. It is proposed to develop the site known as Ducks Nest Farm, Arborfield to provide up to 135 residential units.
- 1.2. Noise Solutions Ltd has been appointed on behalf of David Wilson Homes Southern to undertake a noise impact assessment to determine the suitability of the development proposals for residential use.
- 1.3. This report presents the results of the environmental noise survey, the applicable policy/ guidance and the noise impact assessment demonstrating the suitability of the site for residential development.
- 1.4. To assist with the understanding of this report a brief glossary of acoustic terms can be found in **Appendix A**. A more in-depth glossary of acoustic terms can be assessed at the following web address <http://www.acoustic-glossary.co.uk>

2.0 Site Description

- 2.1. The site is located west of Ducks Nest Farm, off Eversley Road, Arborfield, Berkshire, with approximate postcode RG2 9PJ.
- 2.2. The assessment supports a planning application as follows:

A hybrid application comprising:
 - a. A full application for the change of use of land from agricultural land to provide an area of Suitable Alternative Natural Greenspace (SANG), including the details of associated landscaping, planting, drainage measures, parking, walking routes and other works associated with the creation of the SANG.
 - b. An outline application with all matters reserved other than access into the site for a residential development of up to 135 dwellings, open space, internal accesses and parking, drainage measures, landscaping and all other associated works.
- 2.3. The site comprises greenfield, agricultural land, located to the north-west of the former Arborfield Garrison and south west of Arborfield Cross. The site has a point of direct access to the roundabout at the junction of Eversley Road, Langley Common Road and Baird Road and another access off the A327 Observer Way / Arborfield Cross Relief Road.
- 2.4. It is proposed to develop the site for residential use; up to 135 dwellings will be provided.
- 2.5. **Appendix B** contains an aerial photograph showing the site and surrounding area.
- 2.6. The framework masterplan (v21 dated 3 September 2024) is shown in **Appendix E**.

3.0 Policy Context

Noise Policy Statement for England

- 3.1. The Noise Policy Statement for England (NPSE¹), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are: *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
- *avoid significant adverse effects on health and quality of life;*
 - *mitigate and minimise adverse effects on health and quality of life; and*
 - *where possible, contribute to the improvement of health and quality of life."*
- 3.2. The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and quality of life occur.
- 3.3. The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the NPSE). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case: *"...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."*
- 3.4. Importantly, the NPSE goes on to state: *"This does not mean that such adverse effects cannot occur."*
- 3.5. The NPSE does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that: *"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*
- 3.6. It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

¹ Noise Policy Statement for England, Defra, March 2010

National Planning Policy Framework

- 3.7. A new edition of NPPF was published in December 2023 and came into effect immediately. The original National Planning Policy Framework (NPPF²) was published in March 2012, with subsequent revisions made periodically - this document replaced the existing Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise." The December 2023 revised edition contains no new directions or guidance with respect to noise. The paragraph references quoted below relate to the December 2023 edition.
- 3.8. Paragraph 180 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) *"preventing new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land instability."*
- 3.9. The NPPF goes on to state in Paragraph 191:
- "planning policies and decisions 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 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 ...*
- 3.10. The NPPF document does not refer to any other documents or British Standards regarding noise other than the Noise Policy Statement for England (NPSE³).
- 3.11. Paragraph 2 of the NPPF states that *"planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."*
- 3.12. Paragraph 12 of the NPPF states that *"The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed"*.

² National Planning Policy Framework, DCLG, March 2012

³ Noise Policy Statement for England, DEFRA, March 2010

- 3.13. Paragraph 123 states that "Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land".

Planning Practice Guidance – Noise

- 3.14. An updated Planning Practice Guidance (PPG⁴) for noise was published on 22 July 2019 and provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:
- Whether or not a significant adverse effect is occurring or likely to occur;
 - Whether or not an adverse effect is occurring or likely to occur; and
 - Whether or not a good standard of amenity can be achieved.
- 3.15. This guidance introduced the concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). NOAEL differs from NOEL in that it represents a situation where the acoustic character of an area can be slightly affected (but not such that there is a perceived change in the quality of life). UAEL represents a situation where noise is 'very disruptive' and should be 'prevented' (as opposed to SOAEL, which represents a situation where noise is 'disruptive', and should be 'avoided').
- 3.16. As exposure increases above the LOAEL, the noise begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise. As the noise exposure increases, it will then at some point cross the SOAEL boundary.
- 3.17. The LOAEL is described in PPG⁵ as the level above which "noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard".
- 3.18. PPG identifies the SOAEL as the level above which "noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present."

⁴ Planning Practice Guidance – Noise, <https://www.gov.uk/guidance/noise--2>, 22 July 2019

⁵ Paragraph: 005 Reference ID: 30-005-20190722

- 3.19. In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG⁶ acknowledges that *"...the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation."*
- 3.20. The relevant guidance in the PPG in relation to the adverse effect levels is summarized below:

Table 1: PPG Effects Table

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not Intrusive	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 perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and Intrusive	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.	Observed Adverse Effect	Mitigate and reduce to a minimum

⁶ Paragraph: 006 Reference ID: 30-006-20190722

Response	Examples of Outcomes	Increasing Effect Level	Action
Significant Observed Adverse Effect Level			
Present and Disruptive	The 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.	Significant Observed Adverse Effect	Avoid
Present and very Disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

3.21. The Planning Practice Guidance⁷ states the following in relation to mitigation measures:

"For noise sensitive developments, mitigation measures can include avoiding noisy locations in the first place; designing the development to reduce the impact of noise from adjoining activities or the local environment; incorporating noise barriers; and optimising the sound insulation provided by the building envelope."

3.22. In addition, the Guide notes that it may also be relevant to consider⁸:

"... whether any adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time (and the effect this may have on living conditions). In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations".

⁷ Paragraph: 010 Reference ID: 30-010-20190722

⁸ Paragraph: 006 Reference ID: 30-006-20190722

Wokingham Borough Council

- 3.23. NSL has emailed Wokingham Borough Council on the 20th April 2022, outlining the survey procedure, assessments proposed and guidance to be assessed against. Key proposals included:
- **Transport noise:** An assessment of the potential impact of noise from road traffic will be undertaken. Predicted external and internal noise levels will be compared with the criteria given in BS8233:2014 and WHO (30 dBA internal night-time, 35 dBA internal daytime, 45 dB $L_{A_{Max}}$ night-time). An external amenity daytime noise criterion of 55 dBA for properties close to the roads was proposed, with the lowest practicable targeted across the site.
 - **Commercial noise:** An assessment of the potential impact of commercial noise (commercial units adjacent to the east of the site at Ducks Nest Farm) will be undertaken in accordance with BS4142:2014. The strictest criterion of BS4142:2014, that rating level does not exceed background, was proposed.
- 3.24. A reply has been received from David Bridle at Wokingham Borough Council, referring only to recent WHO guidance. This report is considered to be consistent with the relevant passages of the linked document.

4.0 Acoustic Standards and Guidance

Institute of Acoustics Professional Practice Guidance

- 4.1. The Institute of Acoustics published a guidance document for new residential development in May 2017, in conjunction with the ANC and the Chartered Institute of Environmental Health, "*to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England*".
- 4.2. The document advocates a two-stage process for consideration of noise affecting new residential developments. Stage 1 is an initial risk assessment of the proposed development site, based on the ambient noise levels in the area. Stage 2 recommends consideration of four main elements:
- demonstration of a "good acoustic design process"
 - observation of internal noise guidelines
 - an assessment of noise affecting external amenity areas
 - consideration of other relevant issues

- 4.3. The initial risk assessment considers the indicative day-time and night-time equivalent continuous noise levels which indicates an “increasing risk of adverse effect” with increasing noise levels⁹.
- 4.4. For Stage 2, the ProPG document recommends that the guidance in BS 8233:2014 is followed.

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

- 4.5. This Standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999¹⁰). These guideline noise levels are shown in Table 2, below:

Table 2: BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living room	35 dB L _{Aeq,16h}	-
Dining	Dining room/area	40 dB L _{Aeq,16h}	-
Sleeping (daytime resting)	Bedroom	35 dB L _{Aeq,16h}	30 dB L _{Aeq,8h}

- 4.6. BS 8233:2014 advises that: “regular individual noise events...can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{Amax,F} depending on the character and number of events per night. Sporadic noise events could require separate values.”
- 4.7. BS8233 also gives general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states¹¹ that:

“If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15dB.”

- 4.8. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15dB should be applied to the whole façade to an internal room being assessed. It should be noted that a sound insulation performance of much greater than 15dB is expected for non-openable standard double glazed windows. However in order to assess the worst case scenario, this report assume that windows may be opened if desired.

⁹ Figure 1, IoA ProPG for New Residential Development, May 2017

¹⁰ World Health Organisation Guidelines for Community Noise, 1999

¹¹ Paragraph G1 in BS8233:2014

- 4.9. The standard also provides advice in relation to design criteria for external noise. It states that:

“for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.

In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.

Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation.

In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.”

- 4.10. With regard to the prediction of noise levels from road traffic noise, the $L_{A10,18hr}$ (as output by the CRTN methodology) can be converted to $L_{Aeq,16hr}$ as follows

$$L_{Aeq,16hr} = L_{A10,18hr} - 2 \text{ dB. (BS 8233 paragraph 6.2.2)}$$

- 4.11. Note that the night-time noise level, $L_{Aeq,8hr}$, can be calculated from $L_{A10,18hr}$ using the conversion formula in the TRL document “*Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping*”, as described later in this section.

Building Regulations Parts L and F

- 4.12. Part L of the Building Regulations mandates that buildings become more airtight, and Part F stipulates ventilation requirements. Even though there appears to be a contradiction in this, Part L limits uncontrollable ventilation while Part F ensures that ventilation requirements are provided in a controlled manner.
- 4.13. The 2021 edition of Approved Document F came into effect on 15 June 2022. Volume 1 sets out the requirements for ventilation of dwellings.
- 4.14. Paragraph 1.9 describes a ventilation strategy comprising extract ventilation of bathrooms and kitchens, whole house ventilation to provide fresh air and “remove water vapour and pollutants not removed by extract ventilation” and purge ventilation used intermittently to “remove high concentrations of pollutants produced by occasional activities (e.g. fumes from painting)”. The use of purge ventilation to control overheating is described in Part O, as noted below.
- 4.15. The assessment within the main part of this report deals with controlling intrusive noise in the “whole house ventilation” scenario.
- 4.16. It is understood that the proposed ventilation strategy for this development is the use of continuous mechanical extract with intake air via trickle ventilators.
- 4.17. While the use of open windows to remove intermittent fumes would inevitably result in increased intrusive sound levels compared to when windows are closed, this is considered not to be significant in acoustic terms because activities producing the fumes to be removed would tend to be short in duration and under the control of the occupants and therefore not likely to take place when occupants are trying to sleep.

Building Regulations Part O

- 4.18. Approved Document O1: Overheating mitigation of the Building Regulations 2010 (2021 edition) came into force on 15 June 2022 for new dwellings. Section 3 in the Approved Document includes the following:

In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- $40\text{dB } L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- $55\text{dB } L_{AFmax}$ more than 10 times a night (between 11pm and 7am).

Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).

World Health Organisation, Guidelines for Community Noise, 1999 (WHO)

4.19. The World Health Organisation (WHO) Guidelines for Community Noise (1999) recommends suitable internal and external noise levels based on dose response research. The levels recommended in this guidance could be correlated to the LOAEL. Relevant guidance from this document is presented below.

- Sleep Disturbance (Night-time internal LOAEL): If negative effects on sleep are to be avoided, the equivalent sound pressure level should not exceed 30dBA indoors for continuous noise.
- Interference with Communication (Daytime internal LOAEL): Noise tends to interfere with auditory communication, in which speech is a most important signal. However, it is also vital to be able to hear alarming and informative signals such as door bells, telephone signals, alarm clocks, fire alarms etc., as well as sounds and signals involved in occupational tasks. The effects of noise on speech discrimination have been studied extensively and deal with this problem in lexical terms (mostly words but also sentences). For communication distances beyond a few metres, speech interference starts at sound pressure levels below 50 dB for octave bands centred on the main speech frequencies at 500, 1 000 and 2 000 Hz. It is usually possible to express the relationship between noise levels and speech intelligibility in a single diagram, based on the following assumptions and empirical observations, and for speaker-to-listener distance of about 1 metre:
 - a) Speech in relaxed conversation is 100% intelligible in background noise levels of about 35dBA, and can be understood fairly well in background levels of 45dBA.
 - b) Speech with more vocal effort can be understood when the background sound pressure level is about 65dBA.

World Health Organisation (WHO) 2009

- 4.20. The introduction of the Directive on Environmental Noise, obliges Member States to assess and manage noise levels. With the support of the European Commission, the WHO Regional Office for Europe has developed night noise guidelines for Europe to help Member States develop legislation to control noise exposure.
- 4.21. The guidelines are based on scientific evidence on the effects of noise and the thresholds above which these effects appear to harm human health.
- 4.22. There is limited evidence that night noise is related to hypertension, heart attacks, depression, changes in hormone levels, fatigue and accidents.
- 4.23. The WHO report summarises the threshold levels of night noise above which a negative effect starts to occur or above which the impact becomes dependent on the level of exposure. For example, the threshold level for waking in the night and/or too early in the morning was 42 dB.
- 4.24. It also establishes that there are differences in the intensity and frequency of noise depending on the source, which lead to different impacts. Road traffic is characterised by low levels of noise per event, but as there are a high number of events, on average it has a greater effect on awakenings than air traffic, which has high levels of noise per event but fewer events.
- 4.25. Integrating these findings, the report proposed a guideline target limit of outdoor night noise of 40 dB (annual average defined as 'L_{night}' in the Environmental Noise Directive). There is not sufficient evidence that the biological effects observed below this level are harmful to health but adverse effects are observed above 40 dB.

Calculation of Road Traffic Noise 1988

- 4.26. The Calculation of Road Traffic Noise (CRTN) memorandum, produced by the Department of Transport for the Welsh Office, describes the procedures for calculating noise from road traffic and is widely used in UK noise assessment. Paragraph 1 of the introduction states that:

"These procedures are necessary to enable the entitlement under the Noise Insulation Regulations to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning"

- 4.27. Section III of this memorandum details the shortened measurement procedure whereby measurements of the L_{A10} parameter are made over any three consecutive hours between 10:00 and 17:00. From the arithmetic average of the three 1-hour values, the $L_{10,18hr}$ noise levels is derived

$$L_{A10,18\text{ hour}} = 1/3 \sum L_{A10,3\text{ hour}} - 1\text{ dB}$$

before derivation of the $L_{Aeq,16hr}$ (daytime) value (see BS8233:2014 guidance).

Transport Research Laboratory – Converting the UK Traffic Noise Index $L_{A10,18hr}$ to EU Noise Indices for Noise Mapping

- 4.28. This document provides a method for converting the $L_{A10,18hr}$ level to the L_{night} level (or $L_{Aeq,8hr}$) using the following formula, applicable to non-motorway roads;

$$L_{Aeq,8hr} = 0.90 \times L_{A10,18hr} - 3.77\text{dB}$$

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

- 4.29. BS 4142:2014+A1:2019¹² is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes *“sound from fixed plant installations which comprise mechanical and electrical plant and equipment”*.
- 4.30. The procedure contained in BS 4142:2014 is to quantify the *“specific sound level”*, which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.
- 4.31. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.
- 4.32. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: *“Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.”*

¹² For brevity, references to “BS 4142” and “BS 4142:2014” should be read as “BS 4142:2014 + A1:2019”

- 4.33. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*
- 4.34. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:
- *Typically, the greater this difference, the greater the magnitude of the impact.*
 - *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
 - *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
 - *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*
- 4.35. The standard does state that *"adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*
- 4.36. The standard goes on to note that: *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*
- 4.37. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:
- "An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."*
- 4.38. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

5.0 Survey details

Road traffic Noise Surveys

- 5.1. Environmental noise surveys were undertaken at three locations to establish the typical, and range of, incident environmental noise levels at the proposed residential development.
- 5.2. Measurements accorded with the methodology of the shortened procedure for road traffic noise measurement described in CRTN¹³. Data are free-field.
- 5.3. Full details of the survey are provided in [Appendix C](#) and results are summarised in the following Table.

Table 3: Summary of Measured Road traffic Noise surveys

Measurement Position	Hourly period start time	Measured Sound Pressure Level, free-field (dB)		
		L _{Aeq,T}	L _{Amax,fast} ¹	L _{A10,T}
CRTN1 Eversley Road	29/03/2022 10:00	56.7	67.5	60.6
	29/03/2022 11:00	57.6		61.7
	29/03/2022 12:00	57.5		61.5
CRTN2 Observer Way ¹⁴	29/03/2022 10:30	53.1	65.8	56.1
	29/03/2022 11:30	52.1		54.3
	29/03/2022 12:30	52.1		54.2
CRTN3 Swallowfield Road ¹⁵	29/03/2022 14:10	53.4	66.6	57.7
	29/03/2022 15:10	54.3		58.5
	29/03/2022 16:10	54.5		59.0
¹ The 10 th highest L _{AMax} from the survey period, with data binned to 1-minute samples.				

¹³ Department of Transport Welsh Office 1988 'Calculation of Road Traffic Noise'

¹⁴ A327, also known as Arborfield Cross Relief Road

¹⁵ Measurements were made at location CRTN3 to support the assessment of a previous scheme with a larger area. While there are now no proposed buildings close to Swallowfield Road the survey data has been to inform the assessments for the middle of the site and data is therefore included for completeness

- 5.4. The following table summarises the overall daytime and night-time noise level parameters as required for BS8233:2014 and WHO assessments, as determined from survey data using the TRL and CRTN transformations described in Section 4, as calculated for the survey location.

Table 4 Summary of calculated daytime and night-time environmental noise levels

Period	Parameter	Survey location		
		CRTN1 Eversley Road	CRTN2 Observer Way	CRTN3 Swallowfield Road
Overall daytime level (dB)	L_{Aeq}, 16 hours	58.3	51.9	55.4
Overall night-time level (dB)	L_{Aeq}, 8 hours	50.5	44.7	47.9
	¹L_{AMax,f}	67.5	65.8	66.6
<i>¹10th highest value measured during the survey period; data binned to 1-minute samples.</i>				

- 5.5. Measured octave band sound pressure levels for the survey period are given in Table 5 below. Spectra are presented for daytime, night-time and 10th-highest L_{AMax} event.

Table 5 Measured octave band sound pressure levels at the measurement locations

Measurement Position	Parameter	Incident sound pressure levels (dB) at Octave Band Centre Frequencies (Hz)								dBA
		63	125	250	500	1000	2000	4000	8000	
CRTN1 Eversley Road	L _{Zeq} , 16hr (day)	63	58	55	51	56	51	40	31	58
	L _{Zeq} , 8hr (night)	55	50	47	43	48	43	32	23	50
	L _{ZMax}	74	67	70	59	61	59	58	58	67
CRTN2 Observer Way	L _{Zeq} , 16hr (day)	62	58	52	48	48	42	32	23	52
	L _{Zeq} , 8hr (night)	55	51	45	41	41	35	25	16	45
	L _{ZMax}	67	71	71	58	59	54	46	47	66
CRTN3 Swallowfield Road	L _{Zeq} , 16hr (day)	61	57	53	49	52	48	39	31	55
	L _{Zeq} , 8hr (night)	54	49	45	41	45	40	32	23	48
	L _{ZMax}	75	76	64	61	61	56	57	49	67

Background Environmental Noise Survey

- 5.6. An unattended environmental sound pressure level survey was undertaken from Friday 5th November to Monday 8th November 2021. The survey was primarily undertaken in order to establish the typical, and range of, background noise levels at the proposed residential development. Data are free-field.

- 5.7. Levels at BG1 are typical of those experienced in areas where there is potential for commercial noise from Ducks Nest Farm to be audible, being in an area of housing in reasonable proximity to the Eversley Road.
- 5.8. Full details of the survey are provided in [Appendix C](#) alongside time history graphs of the measurement results.
- 5.9. The key results of the survey are summarised in Table 6 below.

Table 6 Summary of survey results – ranges of measured statistics

Position	Measurement period	Range of recorded sound pressure levels (dB)			
		L _{Aeq} (15mins)	L _{Amax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
BG1	Daytime (07.00 – 23.00 hours)	52-64	69-83	55-68	29-55
	Daytime (08:00 – 17:00 hours)	59-64	71-83	64-68	40-55
	Night-time (23.00 – 07.00 hours)	24-63	35-81	25-68	20-43

- 5.10. The results are shown in the histograms below.

Figure 1 Histogram of daytime L_{A90} background sound pressure levels

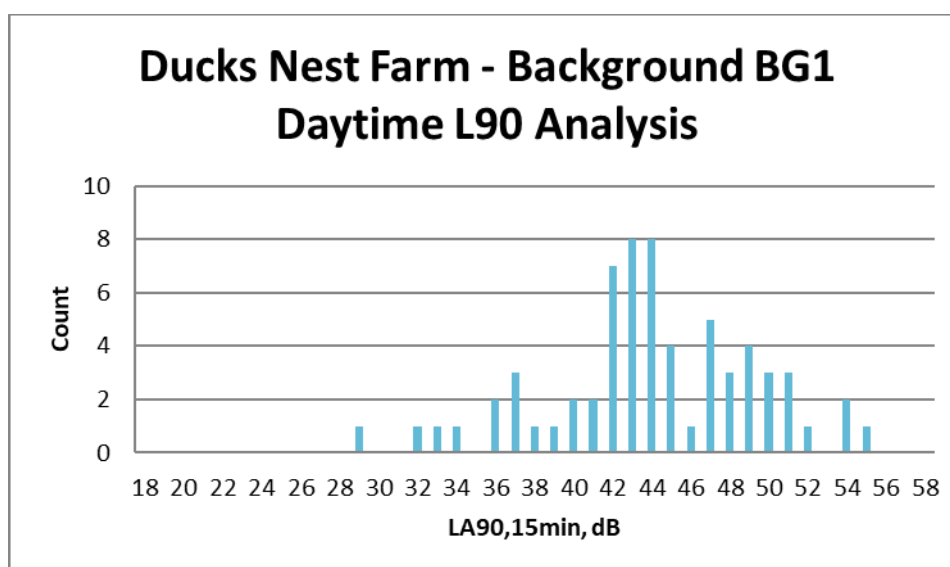


Figure 2 Histogram of night-time L_{A90} background sound pressure levels

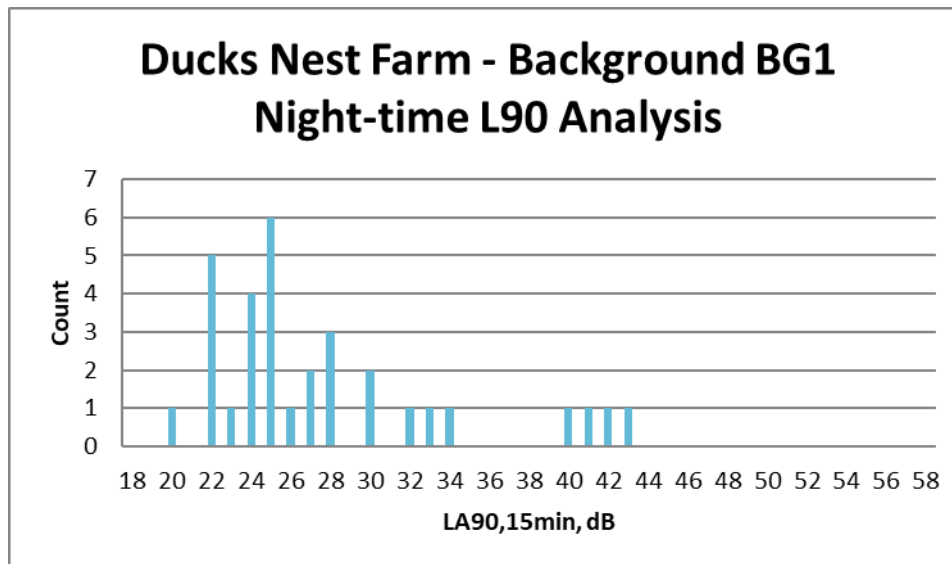
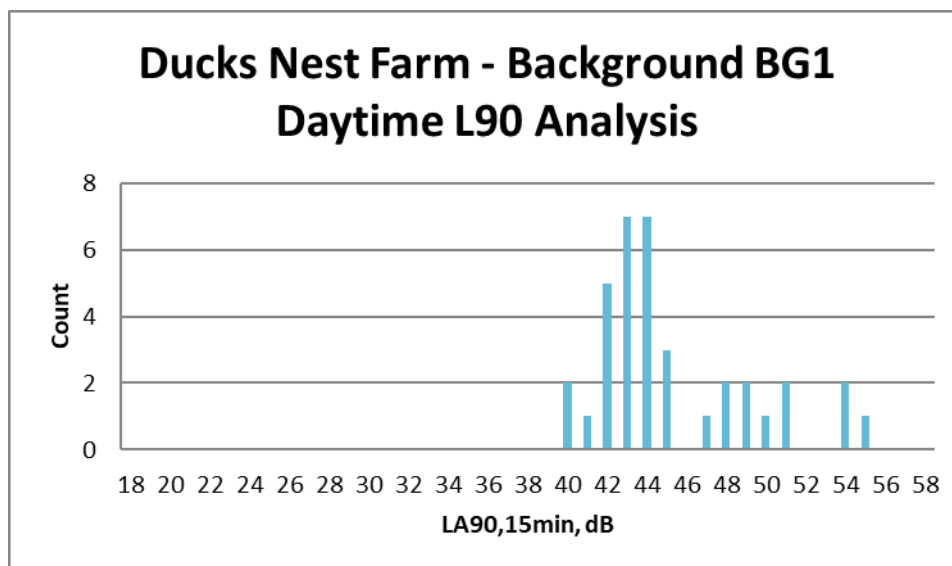


Figure 4 Histogram of day-time L_{A90} background sound pressure levels for business hours



5.11. The following values are therefore considered to be robustly representative of the existing background sound pressure levels at proposed noise sensitive receptors:

- 42 dB L_{A90} during the 08:00 to 17:00 daytime period;
- 36 dB L_{A90} during the full daytime period; and
- 22 dB L_{A90} during the full night-time period.

Commercial Sound Survey

- 5.12. An attended environmental sound pressure level survey was undertaken across two periods, as follows:
- Tuesday 29th March 2022 14:10 to 17:10
 - Wednesday 30th March 2022 14:00 to 17:00
- 5.13. For this analysis, only data from the first of these days is presented and analysed as noise from the commercial areas was considerably more audible than on the second day, informing a worst case.
- 5.14. Noise was audible from a variety of workshop type sources, comprising primarily hand and power tools and vehicle movements.
- 5.15. Full notes were taken in order to separate noise due to commercial sources from road traffic and aircraft. Further details are presented in [Appendix B](#) (locations) and [Appendix C](#) (survey data).

Covid-19

- 5.16. It should be noted that the environmental noise survey discussed in this report was undertaken in March 2022, at a time when the coronavirus pandemic was causing no significant disruption to typical working patterns and other activity.

6.0 Residential Noise Assessment

Initial risk assessment

- 6.1. Results for worst-case plots and the 'typical' plot (100m from Eversley Road) are shown below and compared with the risk guidance values shown in Figure 1 of ProPG.

Table 7 Comparison of external sound pressure levels with ProPG guidance

Plot location	Period/Parameter	External sound level, dB	ProPG Noise Risk Assessment category
Eversley Road	Daytime L_{Aeq} 16hr	58	low
	Night-time L_{Aeq} 8hr	50	low
	Night-time $L_{Amax,f}$	67	non-negligible
Observer Way	Daytime L_{Aeq} 16hr	52	low/negligible
	Night-time L_{Aeq} 8hr	45	low
	Night-time $L_{Amax,f}$	65	non-negligible

Plot location	Period/Parameter	External sound level, dB	ProPG Noise Risk Assessment category
Typical mid-site plot	Daytime L_{Aeq} 16hr	53	low/negligible
	Night-time L_{Aeq} 8hr	46	low
	Night-time $L_{Amax,f}$	58	negligible

- 6.2. With reference to the worst-case 'low' category, the ProPG document notes that:

At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.

Building fabric assessment

- 6.3. In order to assess the suitability of the site for the proposed dwellings it is important to predict the internal noise levels within habitable rooms.
- 6.4. The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes etc.).
- 6.5. The variation in incident noise levels on the different façades, along with differences in internal layouts and size of glazed areas, implies that a number of different sound insulation performance levels may be required in order for a specific internal ambient noise level to be reached. Logistically, this could result in increased costs for the development due to bespoke solutions, effects on programme and increase of errors during construction.
- 6.6. Therefore, it is not practical to specify a large number of different external building fabric constructions and this is also not supported by national policy on noise.
- 6.7. The detailed calculation methodology described in BS 8233:2014 has been used in the assessment. The table below presents the input data used to predict the resultant internal noise level in the habitable rooms, confirmed as being representative with David-Wilson Homes.
- 6.8. Typical construction types have been assumed, though it should be noted that the information used is considered to be pessimistic and therefore the resulting assessment errs on the side of caution.

Table 8 Source data for the noise break-in assessment for a typical dwelling

	Living Room	Bedroom
Room Volume (m ³)	44	25
Room Furnishings	Suite, part-carpeted floor, curtains	Bed, carpet, curtains
Area of window (m ²)	4	4
Area of external wall (m ²)	21	16

- 6.9. Based on the information above, and the noise spectrum data shown in Table 5, the resulting internal sound levels may be calculated. The results of the assessment are shown in Table 9.
- 6.10. Note that the 'typical mid-site plot façade' is modelled at 100m from Eversley Road, with 5 dBA of screening from intervening houses/fencing.

Table 9 Predicted internal sound pressure levels (closed windows)

Plot location	Room Type	Reference*	External level (dB)	Predicted internal level (dB)	Proposed LOAEL (dB)	Difference (dB)
Eversley Road	Living room	Daytime L _{Aeq} 16hr	58	29	35	-6
	Bedroom	Daytime L _{Aeq} 16hr	58	31	35	-4
		Night-time L _{Aeq} 8hr	50	23	30	-7
		Night-time L _{Amax,f}	67	42	45	-3
Observer Way	Living room	Daytime L _{Aeq} 16hr	52	25	35	-10
	Bedroom	Daytime L _{Aeq} 16hr	52	27	35	-8
		Night-time L _{Aeq} 8hr	45	20	30	-10
		Night-time L _{Amax,f}	65	42	45	-3
Typical mid-site plot façade	Living room	Daytime L _{Aeq} 16hr	48	19	35	-16
	Bedroom	Daytime L _{Aeq} 16hr	48	21	35	-14
		Night-time L _{Aeq} 8hr	41	13	30	-17
		Night-time L _{Amax,f}	53	27	45	-18
*Daytime L _{Aeq,16hr} , night-time L _{Aeq,8hr} , typical highest night-time maximum noise level (see Section 3).						

- 6.11. These calculations are based on the following (Table 10) glazing and ventilation constructions (with further details provided in Table 11) in order to meet internal noise criteria:

Table 10 Required construction to meet internal noise criteria

Plot location	Room Type	Glazing	Ventilator
Eversley Road	Living room	Type A	Standard trickle ventilator
	Bedroom	Type A	

Plot location	Room Type	Glazing	Ventilator
Observer Way	Living room	Type A	Standard trickle ventilator
	Bedroom	Type A	Standard trickle ventilator
Typical mid-site plot façade	Living room	Type A	Standard trickle ventilator
	Bedroom	Type A	Standard trickle ventilator

- 6.12. The minimum airborne sound insulation performance of each of these constructions is as set out as follows:

Table 11 Proposed building envelope specifications

Item	Spec.	Attenuation (dB) at Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
'Type A' Standard Glazing [typically 4mm glass /16mm cavity /4 mm glass]	SRI	21	24	20	25	34	37	40	40
Standard trickle ventilator	D _{ne}	30	32	32	31	33	31	31	31
Cavity brick-block construction (or cladding with dry-lining with similar acoustic performance)	SRI	35	41	45	45	54	58	55	55

- 6.13. It should be noted that glazing configurations and other constructions described above are for guidance and costings purposes only. It will be the responsibility of the manufacturer to provide evidence of compliance with the required octave band sound reduction performances.
- 6.14. The assessment shows that with typical building constructions and glazing and ventilators, internal noise levels will be significantly below the guidance values in BS 8233:2014 and WHO guidance.

Mitigation of overheating

- 6.15. It is important to note that the building envelope sound insulation specifications and associated advice given in this report are based on meeting the design criteria under the "Whole Dwelling Ventilation" conditions set out in Approved Document F (and formerly referred to as "background ventilation" in previous editions of the AD), as distinct from "Extract Ventilation" or "Purge Ventilation" conditions within the AD, and from the overheating condition (which is only briefly mentioned in AD F).

- 6.16. In January 2020 the Association of Noise Consultants (ANC) and Institute of Acoustics (IoA) published a Residential Design Guide on Acoustic Ventilation and Overheating ("the AVO Guide"), which sets out some of the acoustic design issues associated with the control of overheating. A brief narrative on the contents and relevant detail of the AVO Guide is given in Appendix E.
- 6.17. The following points should be noted, however:
- the resulting internal noise levels in the control-of-overheating condition depend not only on the technical solution used but on the duration that the control is used and the time of day (since the external noise levels vary throughout the day);
 - the internal daytime noise levels set out in Table 3-3 of the AVO Guide have been developed by the members of the AVO Guide working party and represent their opinion on the sound levels that would be acceptable; daytime noise levels fall outside the scope of Approved Document O;
 - the night-time internal noise criteria are as set out in Building Regulations Approved Document O, as summarised in paragraph 4.18.
- 6.18. The AVO guide suggests that a value of 13dB(A) is used for the noise reduction provided by an open window. Resulting internal noise levels would therefore be as shown in Table 12.

Table 12 Predicted internal sound pressure levels (open windows)

Plot location	Room type	Period/ Parameter	External sound level, dB	Internal sound level, dB	AVO/ Part O proposed criterion, dB	Excess, dB
Eversley Road	Living room	Daytime $L_{Aeq\ 16hr}$	58	45	50	-5
	Bedrooms	Daytime $L_{Aeq\ 16hr}$	58	45	50	-5
		Night-time $L_{Aeq\ 8hr}$	50	37	40	-3
		Night-time $L_{Amax,f}$	67	54	55	-1
Observer Way	Living room	Daytime $L_{Aeq\ 16hr}$	52	39	50	-11
	Bedrooms	Daytime $L_{Aeq\ 16hr}$	52	39	50	-11
		Night-time $L_{Aeq\ 8hr}$	45	32	40	-7

Plot location	Room type	Period/ Parameter	External sound level, dB	Internal sound level, dB	AVO/ Part O proposed criterion, dB	Excess, dB
		Night-time $L_{Amax,f}$	65	52	55	-3
Typical mid-site plot façade	Living room	Daytime $L_{Aeq,16hr}$	48	35	50	-15
	Bedrooms	Daytime $L_{Aeq,16hr}$	48	35	50	-15
		Night-time $L_{Aeq,8hr}$	41	28	40	-12
		Night-time $L_{Amax,f}$	53	40	55	-15

- 6.19. Subject to the findings of an overheating assessment to confirm window opening areas required (if necessary), internal noise levels with windows open would be within the values recommended in the AVO guide during the daytime and Part O at night and should therefore be acceptable.

External Amenity noise levels

- 6.20. Worst-case noise levels are considered for plots facing onto each of the boundary roads. 5dBA of attenuation due to standard 1.8m garden fencing is assumed.
- 6.21. All other plots will experience lower noise levels due to greater shielding from the building massing, distance attenuation and any fencing. A typical mid-site plot is included, assuming some screening and typical distance attenuation.

Table 13 Predicted external sound pressure levels

Plot location	Daytime External sound level $L_{Aeq,16hr}$ (dB)	Level with fencing attenuation $L_{Aeq,16hr}$ (dB)	Criterion $L_{Aeq,16hr}$ (dB)	Comparison with criterion $L_{Aeq,16hr}$ (dB)
Eversley Road	58	53	55	-2
Observer Way	52	47	55	-8
Swallow-field Road	55	50	55	-5
Typical mid-site plot façade	48	43	55	-12

- 6.22. All plots are found to meet the recommended external noise criterion of 55 dB $L_{Aeq,16hr}$ for amenity spaces set out in BS 8233:2014.

Conclusion

- 6.23. The assessment has demonstrated that, taking into consideration the provision of reasonable practicable measures (i.e. the provision of good quality thermal double glazing and non-acoustic trickle ventilators) adverse effects of noise can be minimised for the development proposals.

7.0 Assessment of existing commercial noise

Commercial uses on eastern site boundary

BS4142:2014 assessment

- 7.1. Surveys have been undertaken close to the eastern site boundary with the commercial area called Ducks Nest Farm. Measured noise levels while commercial sources were audible have been corrected for residual noise and time corrected to yield an overall level over the measurement period.

Table 14 Commercial sound measurements

Total measured SEL (dBA)	Measurement duration (secs)	On-time (secs)	Residual – corrected source level L_{Aeq} (dB)	On-time corrected source level L_{Aeq} (dB)
77.3	7204	435	50.9	38.7

- 7.2. In order to correct for acoustic features which may increase the subjective impact of a commercial noise source, penalties are added as described in the following table.

Table 15 BS4142:2014 penalties

Characteristic	Penalty	Comment
Tonality	0	Not significantly tonal
Impulsivity	3	Occasionally impulsive
Intermittency	3	Source is intermittent
Other	0	Other penalties added
Total	6	

- 7.3. The sound pressure level at the nearest receptor may then be calculated including the effects of distance propagation.
- 7.4. Nearest receptor distances are taken to be on upper floors, as lower floors may potentially benefit from screening by fencing etc. Note that façade locations have not yet been identified, and the following receptor distance is therefore close to the boundary to inform a worst-case.

Table 16 Distance correction

Measured level (dBA)	Distance (m)		Correction (dB)	Receptor level (dBA)
	Representative measured	Receptor		
38.7	30	35	-1.3	37.4

- 7.5. The calculations show that, based on the worst-case set of activities described above, the external noise level at the nearest residential façade is approximately 37 dB $L_{Aeq,1hour}$.
- 7.6. The resulting assessment of predicted noise at the façade is shown in Table 17.

Table 17 Assessment of commercial noise based on worst-case predictions, using BS 4142:2014

Item	Result	Relevant Clauses of BS4142:2014	Commentary
Background sound level	$L_{A90} = 42\text{dB}$	8.1, 8.2	Representative typical background sound level determined from a range of measurements; see Section 5.
Rating level criterion	$L_{A,r} \leq L_{A90}$		Strictest criterion of BS4142:2014
Assessment made during the day-time, so the reference interval is 1 hour		7.2	
Specific Sound Level	$L_{Aeq,T} = 37\text{ dB}$	7.3.6	See notes above
Acoustic Feature Correction	6dB	9.2	See notes above
Rating Level	$(37 + 6)\text{ dB} = 43\text{ dB}$		
Excess of Rating Level over criterion	$(43 - 42)\text{ dB} = 1\text{ dB}$	11	
Assessment of impact:	Indication of a low impact.	11	See notes above

- 7.7. The assessment shows a small exceedance of the rating over background sound levels. An exceedance of +5 is considered to be '*likely to be an indication of an adverse impact, depending on context*' as per BS4142:2014, while an exceedance of 0 is considered "*an indication of..... a low impact*". The identified exceedance of +1 falls between these criteria but is considered by NSL to be an indication of a low impact.
- 7.8. The following should also be taken into consideration when determining the potential impact that may be experienced:

- Commercial activities are understood to occur only during normal working hours. None occur during early morning or late evening when such commercial noise might be considered more intrusive.
- The assessment is undertaken at the worst-affected residential windows. The impact on all other residential windows will be lower due to distance/screening losses.
- The assessment has assumed the worst-case scenario in terms of the levels of noise produced.
- A robust +6dB rating penalty has been added to the measured source level.

7.9. It is to be appreciated that the BS 4142:2014 assessment relates to external noise levels only. To assess internal noise levels, it would be necessary to take into account the sound attenuation provided by windows and ventilation provisions at nearby dwellings and to assess internal noise levels according to guidelines in BS 8233:2014.

BS 8233:2014 internal noise assessment

- 7.10. A BS 4142:2014 assessment considers only external noise levels at the location of sensitive receptors and does not consider the attenuation offered by the building envelope and the resulting internal noise level.
- 7.11. The sound attenuation offered by a building will be governed by its weakest element, acoustically speaking. This is invariably the glazing and any natural ventilation provision. BS8233:2014 and WHO both reference that with windows open for ventilation, a 15dB attenuation below external levels is found. In order to be robust and in agreement with AVO assessments, a lesser 13 dB attenuation is used here.
- 7.12. The following table determines internal noise levels based upon the above, and rating levels determined in the BS4142:2014 assessment. Resultant levels are compared to the L_{Aeq} criteria of BS8233:2014. Note that rating levels (including BS4142:2014 penalties) are used for the L_{Aeq} assessments to account for the worst-case character of the noise.

Table 18 Internal noise levels due to deliveries at most affected residential receptor

Period	Predicted noise rating levels at most affected residential dwelling (dB)		Criterion (dB)	Difference (dB)
	External	Internal		
Daytime ($L_{Aeq,1hr}$)	43	30	35	-5

- 7.13. It can be seen that all BS8233:2014 internal criterion for daytime noise levels in living spaces are met with windows open, even when considering a worst-case, shorter 1 hour period for which the criterion does not strictly apply (requiring as it does a 16-hour period, likely to lead to a lower time-corrected noise level).
- 7.14. With windows closed, internal noise levels would be approximately 10dB lower and the criteria would therefore also be met.
- 7.15. Therefore, returning to the BS4142:2014 guidance and its stated importance of considering absolute noise levels in context, it is therefore considered that no adverse impact due to this commercial noise will result.

Discussion of Uncertainties

- 7.16. Where possible uncertainty in the above assessments has been minimised by taking the following steps:
- Measurements of environmental background sound levels were taken over a robust 24-hour period.
 - The meters and calibrators used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
 - Uncertainty in the calculated impacts has been reduced by the use of well-established calculation methods.

8.0 Summary

- 8.1. Noise Solutions Ltd has been appointed to review the acoustic suitability of a proposed new residential development on the site known as Ducks Nest Farm, Arborfield.
- 8.2. An environmental noise survey at the site was undertaken in order to establish the typical and maximum incident road traffic noise levels at the proposed residential development.

- 8.3. Surveys have been undertaken of existing commercial and background noise. An assessment of noise from existing nearby commercial operations indicates no adverse impacts according to the method described in BS 4142:2014.
- 8.4. The assessment has demonstrated that the proposals will not give rise to significant adverse effects on health and quality of life and that reasonable practicable mitigation measures can be put in place using conventional construction methods in order for adverse effects to be reduced.
- 8.5. Therefore, the assessment has demonstrated that ambient noise levels at the site of the proposed residential development should not be viewed as a constraint for the planning application.

Appendix A Acoustic Terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.

Appendix B Aerial photograph of site with approximate location of noise measurement positions



Appendix C Environmental Sound Survey

Details of environmental sound survey

- C.1 Specific details of each of the four surveys are contained in the tables and figures below.
- C.2 The sound level meters were programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices for consecutive 15-minute sample periods (or 1 hour for the 3-hour road traffic surveys) for the duration of the survey.

Measurement positions

- C.3 The sound level meters were located as indicated in [Appendix B](#) and described in the survey summary table below.
- C.4 In accordance with BS 7445-2:1991 'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use', the measurements were undertaken under free-field conditions.

Equipment

- C.5 Details of the equipment used during the survey are provided in the tables describing each specific survey. The sound level meters were calibrated before and after the survey; no significant change (± 0.2 dB) in the calibration level was noted.

Weather Conditions

- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for the environmental noise measurements. The survey summary tables below present the weather conditions recorded on site at the beginning and end of the survey.

Results

- C.7 The results of the survey are considered to be representative of the typical incident noise levels at the proposed site.
- C.8 The results of the surveys are presented in the time history graphs which follow.

CRTN1: Eversley Rd

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971 / 111624	18/06/2021	Factory conformation certificate
Condenser microphone	ACO Pacific 7052E / 80036		
Preamplifier	Svantek SV 18 / 112639		
Calibrator	Svantek SV 33B / 83850	20/10/2021	1501134-1

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B; 25 metres from centre of boundary hedge.	10.00 to 13:00 29 th Mar 2022	Temperature (°C)	9	12
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	None	None
		Cloud cover (oktas – see guide)	8	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes (no standing water)	Yes(no standing water)
		Wind Speed (m/s)	0	0.2
		Wind Direction	-	NE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No
Noise sources noted at setup and collection:		Local traffic dominates – occasional aircraft.		

CRTN2: Observer Way

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977/ 97446	12/02/2021	Factory conformation certificate
Condenser microphone	Microtech MK255 / 20194		
Preamplifier	Svantek SV12L / 106487		
Calibrator	Svantek SV 30A / 10847	30/06/2021	1500577-1

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B; 17 metres from centre of boundary fence/hedge.	10:30 to 13:30 29 th Mar 2022	Temperature (°C)	9	12
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	None	None
		Cloud cover (oktas – see guide)	8	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes (no standing water)	No
		Wind Speed (m/s)	1.1 (Max)	3.5 (Max)
		Wind Direction	N	NE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No
Noise sources noted at setup and collection:		Local traffic dominates, Aircraft occasionally audible.		

CRTN3: Swallowfield Rd

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971 / 111624	18/06/2021	Factory conformation certificate
Condenser microphone	ACO Pacific 7052E / 80036		
Preamplifier	Svantek SV 18 / 112639		
Calibrator	Svantek SV 33B / 83850	20/10/2021	1501134-1

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B; 11 metres from centre of boundary fence/hedge.	14.10 to 17.10 29 th Mar 2022	Temperature (°C)	12	10
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	None	None
		Cloud cover (oktas – see guide)	8	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	No
		Wind Speed (m/s)	0.5	0.5
		Wind Direction	E	NE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No
Noise sources noted at setup and collection:		Local road traffic dominates.		

BG1: Background at Harts Close

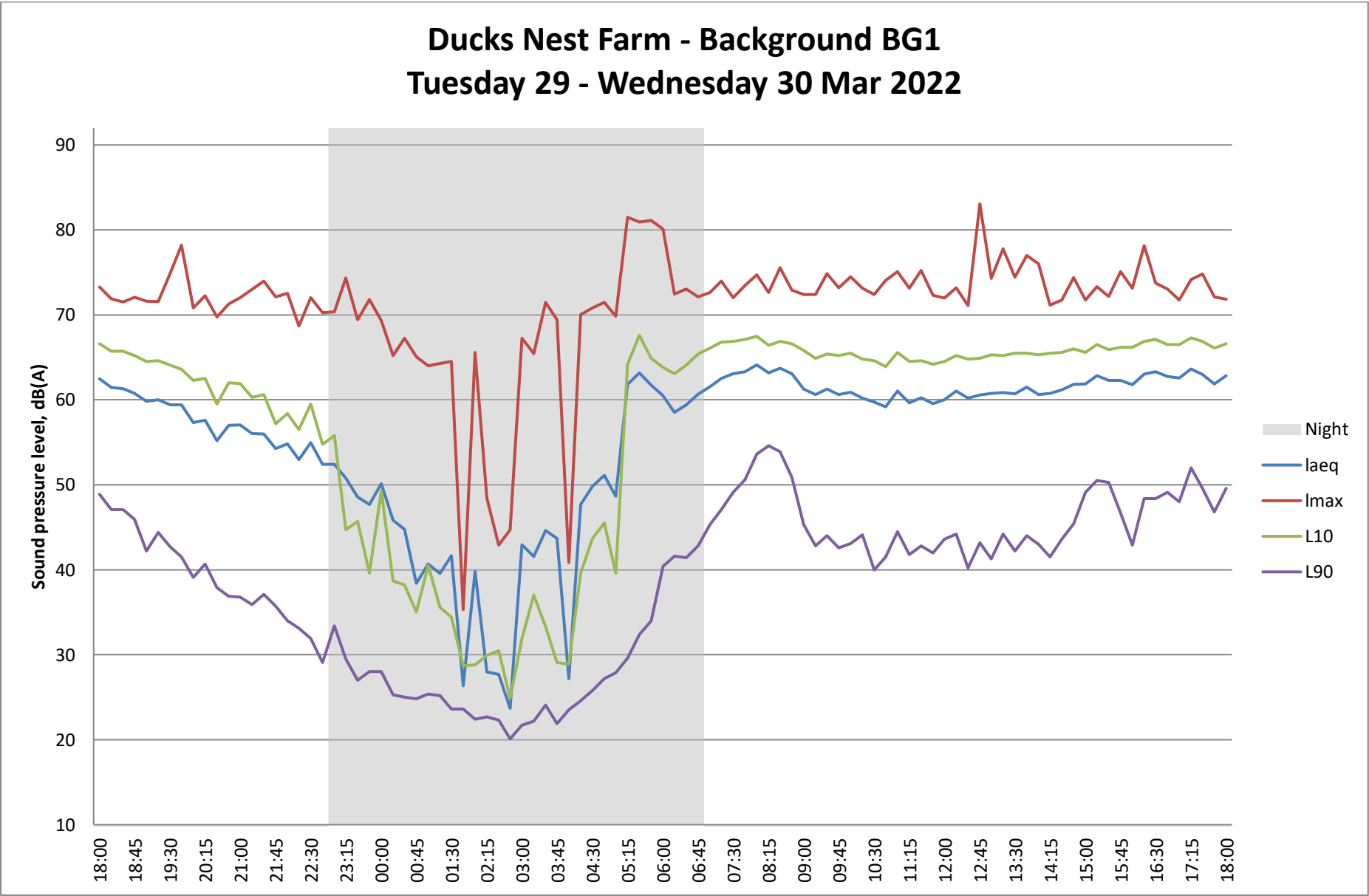
Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971 / 111624	18/06/2021	Factory conformation certificate
Condenser microphone	ACO Pacific 7052E / 80036		
Preamplifier	Svantek SV 18 / 112639		
Calibrator	Svantek SV 33B / 83850	20/10/2021	1501134-1

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B; lamp-post outside 3 Harts Close	18.00 29 Mar - 18.15 30 Mar 2022	Temperature (°C)	10	8
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	None	None
		Cloud cover (oktas – see guide)	8	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Dry	Dry
		Wind Speed (m/s)	0.5 (Max)	1.0 (Max)
		Wind Direction	NE	N
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No
Noise sources noted at setup and collection:		Road traffic, bird calls and trees rustling.		

COM1: West of commercial units at Ducks Nest Farm

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977/ 97446	12/02/2021	Factory conformation certificate
Condenser microphone	Microtech MK255 / 20194		
Preamplifier	Svantek SV12L / 106487		
Calibrator	Svantek SV 30A / 10847	30/06/2021	1500577-1

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B; 5m inside boundary fence	14:00 to 17:00 30 th Mar 2022	Temperature (°C)	-	10
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	None	None
		Cloud cover (oktas – see guide)	8	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Dry	Dry
		Wind Speed (m/s)	-	0.5
		Wind Direction	-	NE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No
Noise sources noted at setup and collection:		Commercial sources, bird calls and aircraft audible, some occasional road traffic.		



Appendix D Narrative on AVO Guide

D.1 The *Residential Design Guide on Acoustics Ventilation and Overheating (version 1.1)* ("the AVO Guide") was published in January 2020 by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IoA).

D.2 The AVO Guide states that it "is intended to be used by acoustics practitioners as well as all those involved in the planning, development, design and commissioning of new dwellings. It recommends an approach to acoustic assessments for new residential development that take due regard of the interdependence of provisions for acoustics, ventilation, and overheating".

D.3 It seeks to "assist in educating clients, environmental health/planning officers and other stakeholders of the interdependence of design for acoustics, ventilation and overheating" and recognises that:

To enable designers and planners to make fully informed decisions, however, requires two further pieces of information. The first is to know how long windows will need to be open, which may be determined from a dynamic thermal model, or more qualitatively from the GHA Overheating Risk Tool. The second requires a better understanding of the potential adverse impact of combined exposure to noise and overheating. Crucially, how long will people tolerate higher noise levels in order to stay cool? One suggestion is to consider the overall average day (16h) and night (8h) time average noise levels.

D.4 It notes that there "... is a need to address how ... the strategy for mitigating overheating impacts on the acoustic conditions, and whether a more detailed overheating assessment is required to inform this".

D.5 Section 2 of the AVO Guide sets out the relevant legislation and guidance and notes that "it is important to differentiate between the need to provide 'purge ventilation' as required occasionally under ADF (i.e. to remove smoke from burnt food etc.); against the provision of ventilation to help control overheating, which is not covered by The Building Regulations".

D.6 On the subject of overheating it states:

2.7 There are no specific requirements relating to overheating in The Building Regulations. Both ADF and Approved Document L1A of The Building Regulations briefly mention overheating but do not provide details on what constitutes overheating

2.13 Developments will normally (but not always) require additional ventilation (above ADF whole dwelling ventilation provisions) in order to mitigate overheating. Where

an overheating assessment is undertaken, it should provide details as to the duration and rate of any additional ventilation required to meet overheating compliance criteria. Where this additional ventilation is provided passively, the overheating assessment should also provide information about the required size of façade openings

2.16 An overheating assessment might not always be undertaken for a project and without this information it is difficult to identify noise impacts that may occur during the overheating condition.

D.7 With regard to acoustic criteria it notes that “where a development is considered necessary or desirable, the levels in [BS 8233:2014, Table 4] may be relaxed by up to 5dB and reasonable internal conditions still achieved.” It should be noted that this approach is not accepted by most local authorities, who require the guidance in BS 8233:2014 to be met.

D.8 Section 3 sets out guidance for internal ambient noise levels and recommends that a two-stage process is followed. The Level 1 assessment assumes that opening windows is the primary means of mitigating overheating, while a Level 2 assessment “considers the potential for adverse effect on occupants based on internal ambient noise level”.

D.9 The AVO Guide notes:

3.9 It is suggested here that the desirable internal noise standards within Table 4 of BS 8233:2014 should be achieved when providing adequate ventilation as defined by ADF whole dwelling ventilation. However, it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

D.10 Table 3-3 in the AVO Guide, reproduced below, identifies the suggested highest permissible internal noise levels in the overheating condition:

Table 3-3 Guidance for Level 2 assessment of noise from transport noise sources^[Note 1] relating to overheating condition

Internal ambient noise level ^[Note 2]			Examples of Outcomes ^[Note 3]	
$L_{Aeq,T}$ ^[Note 4] during 07:00 – 23:00 ^[Note 5]	$L_{Aeq,T}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 6]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{Aeq,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. 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.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. ^[Note 4]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{Aeq,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response ^[Note 4] . Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

D.11 The explanatory notes include:

3.15 For the daytime period, the upper category in Table 3-3 is defined on the basis that $L_{Aeq,T}$ 50 dB represents the upper end of the range for reliable speech communication.

3.16 For the night-time period, the upper category in Table 3-3 is defined with reference to the WHO Night Noise guidelines, which state that for external levels above $L_{Aeq,T}$ 55 dB: "adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep-disturbed".

3.18 In the case of the overheating condition, the effect of increased internal ambient noise from external noise sources will depend both on the absolute noise level and the amount of time for which the overheating condition occurs. A good design process should therefore, as a priority, seek to minimise heat gains thereby reducing the amount

and duration of ventilation required to control overheating and the consequential effect from increased ingress of noise.

- D.12 Paragraph 3.26 notes that “The Level 2 assessment suggests that assessment of the adverse effect from noise exposure should include an estimate of how frequently and for what duration the overheating condition occurs.”.
- D.13 Appendix B in the AVO Guide sets out an example application of the guide, and includes examples of passive ventilation solutions and the attenuation each provides. This is set out in Table B-5, reproduced overleaf. It should be noted that in the majority of cases there is a wide range of potential performance values and the actual performance achieved will be depend on the precise design used.

Table B-5 Examples of passive ventilation solutions providing enhanced sound insulation

Design option	Description and references	Approximate Level Difference (external free field level – internal reverberant level)	Improvement relative to a window providing a similar amount of ventilation
Standard opening windows	Window(s) open sufficiently to provide a ventilation free-area equivalent to 2% of the floor area. ^[42]	13 dB	0 dB
Open windows with sound attenuating balconies	Window(s) as above. Balconies may have a solid balustrade or be enclosed to a further degree (maintaining an open area for ventilation). Absorption may be provided to the balcony soffit or potentially to other surfaces. ^[49, 50, 51]	17 – 23 dB	4 – 10 dB
Attenuated or plenum windows	Dual windows (spaced by around 200mm) with staggered openings and absorptive linings to the cavity reveals. Various other configurations also possible in principle. ^[52, 53]	17 – 24 dB	4 – 11 dB
Attenuated vents/louvres	Ventilation openings with integral means of attenuating sound. Typically this may be acoustic louvres or acoustically lined ducts/plena. ^[54, 55]	17 – 29 dB	4 – 16 dB
Attenuated windows or vents/louvres with sound attenuating balconies	Combined use of balconies to provide screening and acoustically attenuated windows or vents. Refer to above for description of each element.	21 – 39 dB	8 – 26 dB

Appendix E Proposed framework masterplan

