



Consultants in Sound and Vibration

Report

23-0031-R3

23 October 2025

New Road Farm, Melksham

Outline Noise Assessment

BY Acoustics

105 Woodlands Avenue
West Byfleet
Surrey, KT14 6AP

E Office@byacoustics.com

T +44 1932 932038

www.byacoustics.com

Registered in England and Wales no. 12165927

Revision Number	Date	Comments	Author	Approved by
0	23/10/2025	First Issue	Ian Yates	Johnny Berrill

Prepared by

BY Acoustics

On behalf of:

Bloor Homes

Ashby Road

Measham

Swadlincote

Derbyshire

DE12 7JP

Table of Contents

1	Introduction	1
2	Site and Development Proposals	1
3	Relevant Guidance	1
3.1	BS 8233	1
3.2	Building Regulations Part O	2
3.3	Acoustics, Ventilation and Overheating	2
3.4	Planning and Consultation Guidance Note: Noise and Vibration	2
4	Noise Survey	6
5	Outline Residential Scheme Design	8
6	Outline Noise Assessment	10
6.1	Introduction	10
6.2	Building Envelope and Internal Noise Levels	10
6.3	Garden Noise Levels	12
7	Conclusion	13
Appendix A - General Planning Guidance on Noise and Overheating		
A.1	BS 8233	
A.2	Building Regulations Part O and Approved Document O	
A.3	Acoustics, Ventilation and Overheating	
A.4	BS 4142:2014 Methods for rating & assessing industrial & commercial sound	
Appendix B - Survey Data		
Measured Sound Level Histories		
Glossary of Terms		



1 Introduction

- 1.1 Bloor Homes intend to submit an outline planning application for residential-led mixed use development of the land at New Road Farm, Melksham.
- 1.2 BY Acoustics has been appointed to undertake an environmental noise survey to establish the prevailing noise levels at the site and inform the layout and design of the proposed development. This report sets out details of the noise survey along with an assessment of noise constraints.

2 Site and Development Proposals

- 2.1 The existing site can be seen in Fig 4.1. It comprises farmland, bordered by the A3102 (Sandridge Common) road to the south and New Road (and existing farmyard & buildings) to the east. The A3102 is a relatively busy road, with a 40 mph speed limit. New Road is a quiet lane with little traffic.
- 2.2 The site is bordered by open countryside to the north, with open countryside also being present east of New Road.
- 2.3 Existing housing is located immediately to the west of the site, and to the south beyond the A3102.
- 2.4 The New Road Farm buildings and yard are to be retained alongside the proposed development. It is understood from the owner that there is very little activity at the yard, with a window cleaning business gaining access typically twice a day to retrieve and return a vehicle stored in one of the buildings. This accords with observations of no activity at all during attended portions of the noise survey (please refer to section 4 below).
- 2.5 The proposed development will be focused to the south and west of the site, with open space providing a soft edge to the development to the north (such that none of the land directly to the north of New Road Farm buildings and yard will include any built development). There is to be a buffer of at least 10 to 15 m between the A3102 hedgerow and the nearest housing.

3 Relevant Guidance

3.1 BS 8233

- 3.1.1 Appendix A sets out relevant planning-related guidance concerning noise and overheating. The criteria set out in Table 3.1 overleaf are appropriate for whole-dwelling ventilation conditions.
- 3.1.2 With regard to private gardens attached to dwellings, the aim should be to minimise outdoor noise levels as far as reasonably practical, while also having regard to guidance in BS 8233 (as set out in Appendix B).



Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq, 16 \text{ hour}}$	—
Dining	Dining room / area	40 dB $L_{Aeq, 16 \text{ hour}}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ hour}}$	30 dB $L_{Aeq, 8 \text{ hour}}$
Sleeping (noise events)	Bedroom	-	45 dB L_{Amax} not normally exceeded more than 10-15 times per night

Table 3.1 Internal noise criteria (for whole dwelling ventilation conditions)

3.2 Building Regulations Part O

- 3.2.1 Although not directly relevant to the planning process, the requirements of Part O of the Building Regulations can potentially have a material effect on the proposed development, so it can be important for them to be considered at planning stage.
- 3.2.2 Details of Approved Document O are set out in Appendix B. It states that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds either of the following levels:
- 40 dB $L_{Aeq, 8h}$ (23:00-07:00) in bedrooms
 - 55 dB L_{AFmax} more than 10 times a night (23:00-07:00) in bedrooms
- 3.2.3 An assumption can be made of a 9 dB reduction from external free-field to internal noise levels with windows open. This is commensurate with the simplified assessment procedure in section 1 of Approved Document O. Applying this figure leads to the following external free-field noise thresholds at locations representative of proposed bedroom windows:
- 49 dB $L_{Aeq, 8h}$ (23:00-07:00)
 - 64 dB L_{AFmax} more than 10 times a night (23:00-07:00)

3.3 Acoustics, Ventilation and Overheating

- 3.3.1 With regard to external noise levels outside proposed dwellings, reference can be made to Table A.2 and Table A.3 in Appendix A. Depending on where site noise levels sit in relation to the values in those tables, it may also be appropriate to assess internal noise levels in relation to Table A.4.

3.4 Planning and Consultation Guidance Note: Noise and Vibration

- 3.4.1 The Wilshire Council guidance note on Noise and Vibration includes a five-tier hierarchy of noise mitigation to protect noise-sensitive premises.
- 3.4.2 The guidance note states that good acoustic design takes an integrated approach to achieve optimal acoustic conditions in both internal and external noise-sensitive locations and does not just focus on compliance with recommended internal and external noise exposure standards.



- 3.4.3 It also states that the hierarchy levels must be considered starting with level 1; the assessor should only move on to the next level when they have fully considered and implemented all reasonable measures that may be applied and where necessary justified why a measure is not practical for the application.

Hierarchy Level 1: Control of Noise at Source

- 3.4.4 Level 1 relates to noise from exiting sources such as industrial, commercial or entertainment premises. It is therefore not relevant to this application.

Hierarchy Level 2: Site Layout and Design

- 3.4.5 Level 2 states that the checklist below should be considered as early as possible in the design of a residential scheme:

Measure	Detail
Distance attenuation	Maximising the distance between noise sources and receptors.
Topography and existing screening	Topography or existing screening, that will be present for the lifetime of the development, may be used to screen the proposed receptors from the noise source
Noise barriers	Noise barriers such as bunds and barrier blocks, may be included in the scheme to provide screening
Layout	The layout of a scheme may be used to reduce noise propagation across the site.

Table 3.2 Hierarchy level 2 checklist

Hierarchy Level 3: Dwelling Layout and Orientation

- 3.4.6 Level 3 states that the following checklist should be considered as early as possible in the design of a scheme:

Measure	Detail
External dwelling layout	Locate non sensitive uses such as bin stores and garages on the side facing the noise source. Protect gardens with the building structure.
Internal dwelling layout	Avoid windows to habitable rooms such as bedrooms and living rooms facing towards the noise source.
Building height	Consider low rise dwellings that may be better shielded/protected by the topography or screening, or consider location and orientation of taller buildings that may provide screening for other parts of the site.
Innovative design strategies	Consider innovative design strategies including, but not limited to, courtyards, acoustic balconies, and single aspect dwellings to protect sensitive areas.

Table 3.3 Hierarchy level 3 checklist



Hierarchy Level 4: Planning Restrictions

- 3.4.7 Level 4 relates to planning controls of noise sources forming part of a proposed development. It is therefore not relevant to this application.

Hierarchy Level 5: Building Envelope

- 3.4.8 Level 5 states, with our emphasis added:

*“Reliance on the building envelope must be the last consideration once all other reasonable measures have been utilised. The noise exposure hierarchy table in the PPG Noise identifies having to close windows, **where there is no alternative ventilation**, to reduce noise levels as an adverse impact. The severity of the impact depends upon how often it is necessary to close the windows.”*

- 3.4.9 It goes on to state:

“An option that is sometimes considered to achieve a satisfactory internal noise environment is sealing of the building envelope (i.e. through the provision of non-openable windows). However, this is considered a poor acoustic solution and as such should only be considered where this is necessary for air quality reasons.”

- 3.4.10 It is important to make a distinction between the following two situations:

- a) The provision of non-opening windows (as described in the above quote under 3.4.9); and
- b) The assessment of internal noise levels with windows closed and alternative ventilation provided, but with windows **remaining openable** at occupants' discretion.

- 3.4.11 Level 5 goes on to state:

“Where reliance on closed windows for part of a dwelling is deemed appropriate it will be necessary to avoid overheating and to provide sufficient ventilation to provide comfort cooling. In such circumstances, trickle vents are not considered appropriate. The provision of an alternative form of natural ventilation will be required to aid thermal comfort. If this is impracticable then a Mechanical Ventilation Heat Recovery (MVHR) system with fully automated summer bypass may be acceptable. A separate overheating assessment for the development may also be necessary in such circumstances.”

- 3.4.12 In relation to trickle vents, the above quote is presumably intended to mean that trickle vents are not appropriate to control overheating on their own (since there are often circumstances where acoustic trickle vents can be used for background / whole-dwelling ventilation while achieving requisite noise levels, and other means are used for rapid and overheating ventilation).

- 3.4.13 Level 5 goes on to stress the importance of using openable windows as the primary means of ventilation where possible, and the need to justify any assessment of internal noise levels with windows closed (e.g. where MVHR or other alternative means of ventilation are used).

- 3.4.14 Section 6.4 of the guidance note includes internal noise limits, which are the same as the targets set out in section 3.1.

- 3.4.15 Section 6.4 also includes a limit of 50 dB $L_{Aeq, 16-hour}$ for noise levels in gardens and terraces.

- 3.4.16 The guidance note also makes reference to the Professional Practice Guidance on Noise (ProPG). It should be noted that Supplement 2 of the ProPG states the following:



“It is acknowledged that the inherent challenge of introducing noise-sensitive development in noisy locations can limit the extent to which good acoustic design can be achieved in harmony with the other factors that influence the overall quality of a scheme and that compromises may need to be made e.g. accepting that it may not always be possible to achieve acoustic standards with windows open or accepting that noise levels in parts of the outdoor amenity areas may not be optimal”

Summary

3.4.17 The guidance note includes the following summary in section 5:

- i) ECP will not accept any strategy that recommends the use of non-openable windows for residential properties as a means of securing the internal acoustic environment.
- ii) Where openable windows are provided, ECP will not accept a strategy that relies on the occupier of the noise sensitive premises having to close the window during noisy activities.
- iii) A mitigation strategy that includes closed windows for noise without character will only be considered by ECP once all other acoustic mitigation measures have been considered and implemented where possible. In these circumstances, the number of closed windows must be restricted to a minimum of habitable rooms and never for a whole dwelling.

3.4.18 A similar statement is also made in section 6.4 of the guidance note:

“Closed windows to mitigate transport noise will only be considered if all other reasonable measures in the hierarchy have been utilised and only for an absolute minimum of rooms. Designs that result in whole dwellings needing windows close to mitigate transport noise will not be accepted.”

Ventilation

3.4.19 The guidance note also includes a separate subsection on ventilation, stating the following:

“Where enhanced glazing or other mitigation to the building envelope is necessary to ensure the indoor noise climate is acceptable, it will be necessary to provide a scheme of ventilation to remove the need to open windows other than for purge ventilation. The ventilation scheme will be expected to provide thermal comfort during summer months; acoustic trickle vents will not be sufficient in such circumstances.”

“Any requirement for ventilation shall be met either via acoustic vents, a scheme of mechanical ventilation, or another method of ventilation which is comparable to the above. In any case the ventilation proposed must not compromise the acoustic integrity of the building envelope. Trickle vents are only suitable where the overall noise mitigation of the building envelope meets acceptable internal criteria with windows open. Where overheating is a factor Approved Document O is relevant.

Where some form of mechanical ventilation is proposed, resultant noise levels due to the operation of the ventilation system at maximum rate should not exceed NR25 (However, the combined impact of noise break-through from the building envelope and noise generated by any mechanical ventilation at maximum rate shall at all times meet the requirements of this section and the internal noise criteria provided in Section 7.7 of BS 8233.



In all instances where mechanical ventilation is proposed, the design statement should consider the air quality around the development to ensure the highest quality of intake air.”

3.4.20 It should be noted that the requirement for NR25 at maximum ventilation rate is unlikely to be a realistic requirement. As stated in section A.3 of Appendix A, the Acoustics Ventilation and Overheating guide indicates the following acceptable noise levels due to mechanical services operating in overheating mode:

- Bedrooms 30 ($\pm$ 5) dB L_{Aeq}
- Living / Dining Rooms 35 ($\pm$ 5) dB L_{Aeq}

4 Noise Survey

- 4.1 A visit was made to the site on Thursday 25th January 2024, to deploy non-attended noise monitors, carry out short attended measurements and make observations on the noise climate. A return visit was made on Friday 26th January to collect the instrumentation.
- 4.2 Non-attended measurements were made using two NTi Audio XL2-TA analysers, with microphones in outdoor shrouds incorporating windshields. These systems were set to log noise levels continuously in 15-minute periods, in terms of L_{Aeq} , L_{Amax} , L_{A90} and in whole octave bands, with 1-minute resolution for key parameters. The instruments were also equipped with triggered audio recording capability to assist with noise source identification.
- 4.3 Additional attended measurements were also made using a Norsonic 131 analyser fitted with a windshield, to help quantify noise levels from the A3102.
- 4.4 Each system was calibrated before and after the survey, with a drift of 0.5 dB or less noted in all cases. The measurement positions are shown on Fig 4.1 overleaf and described below.

Noise Measurement Positions

- | | |
|----|--|
| N1 | Non-attended free-field location 1.5 m above ground at hedgerow adjacent to farmyard |
| N2 | Non-attended free-field location 1.5 m above ground at boundary with A3102, approximately 4 m from nearest edge of carriageway, east of roundabout |
| N3 | Attended free-field location 1.5 m above ground at boundary with A3102, approximately 4 m from nearest edge of carriageway, west of roundabout |
- 4.5 During deployment and attended measurements on Thursday 25th January, road surfaces were damp from overnight rain but were not wet and did not have the sound characteristics associated with being wet. Measurement position N1 was located on exposed higher ground, where a light wind from the south-southwest prevailed. Positions N2 and N3 were on lower sheltered ground, where there was no wind.
 - 4.6 There was no rain during either of the site visits. Weather records indicate that the intervening period was predominantly dry but with some periods of inclement weather as follows:
 - 03:00-04:00 Friday 26th January: significant rainfall
 - 02:00-06:00 Friday 26th January: significant wind speeds



Fig 4.1 Plan showing noise measurement positions N1, N2 and N3

- 4.7 During collection on 26th January there was no wind at any of the locations and road surfaces had dried out following the overnight rain.
- 4.8 The inclement weather only appears to have affected noise levels at N1, with N2 and N3 being more sheltered and dominated by road traffic nearby. It is possible that wet road surfaces during the night could have marginally increased night-time period noise levels at N2 but this would only result in a slightly more robust assessment.
- 4.9 Inclement weather aside, the noise climate was observed to be dominated by road traffic noise from the A3102. Other less significant sound sources included occasional vehicles on New Road, birdsong and occasional aircraft.
- 4.10 During setup, collection and the attended portions of the survey, no activity was observed at the existing farmyard. There is nothing in the non-attended data to suggest that there was any significant activity there at any time during the survey.
- 4.11 The results of the survey are presented in Appendix C and the table below.



Measurement Position	Ambient noise, day	Ambient noise, night	Representative maximum, night
N1	49 dB L_{Aeq} , 16 hour	46 dB L_{Aeq} , 1 hour (06:00-07:00)	56 dB L_{Amax}
N2	69 dB L_{Aeq} , 16 hour	62 dB L_{Aeq} , 8 hour	82 dB L_{Amax}

Table 4.1 Noise survey period results

- 4.12 In the above table, the daytime ambient noise levels have been derived over 16 daytime hours (07:00-23:00) from the two partial days over which the survey spanned. Ambient noise levels at night have been derived directly from the 8 night-time hours (23:00-07:00), except at N1 where the 06:00-07:00 has been taken to be representative of the night period, as a worst-case assessment, in terms of road traffic noise, which avoids influence from wind and rain during the earlier part of the night. At position N2, the representative maximum noise level is the 10th highest L_{Amax} , 1-minute of the entire night period. At position N1, it is the single highest L_{Amax} , 1-minute of the 06:00-07:00 (to avoid influence of inclement weather during other parts of the night, while remaining robust).
- 4.13 With reference to the tabulated results in Appendix B, the average difference between concurrent measurements at positions N2 and N3 is negligible. Therefore, the measurements at N2 can be taken to be representative of the whole of the southern boundary.

5 Outline Residential Scheme Design

- 5.1 It must be acknowledged that the design of any proposed residential development needs to take account of a multitude of factors and design disciplines. Acoustic design is never undertaken in isolation but must be balanced against other factors influencing the proposed scheme.



Fig 5.1 Draft Illustrative Masterplan (Marrons)



Hierarchy Level 2: Site Layout and Design

- 5.2 The distances between the A3102 Sandridge Common and the nearest proposed dwellings have been maximised as far as practicable, taking account of other factors such as the need for housing and a viable overall scheme. Hypothetically speaking, the distance could be further increased but at the expense of reducing the number of dwellings the site can accommodate, which would not be a desirable approach. It is worth noting that the Council has a significant housing land supply deficit, and overall, the illustrative site layout and design strategy as presented balances the NPPF objectives of making effective use of land and ensuring healthy living conditions.
- 5.3 Noise barriers (in the form of walls and fences) will be used to help screen gardens where appropriate.
- 5.4 From a design perspective, the introduction of a solid noise barrier along the site's southern boundary with the A3102 would undermine the intended landscape-led approach and the visual quality of the gateway into the development. The frontage will be carefully composed to create an attractive and welcoming edge that integrates planting, green corridors, and generous set-backs to soften the interface with the main road. A continuous barrier would disrupt this character, creating an uninviting, enclosed frontage that conflicts with both placemaking principles and the intended scheme's open and connected feel.
- 5.5 All existing adjacent residential areas also front onto and engage with the A3102, reinforcing a pattern of development that supports natural surveillance, active street edges, and integration with existing infrastructure. The proposed scheme will continue this approach, using careful location and orientation of plots, strategic landscaping, and targeted use of internal acoustic screening to manage noise effectively without compromising design quality. This strategy maintains the development's permeability, visual coherence, and strong relationship with its wider context.
- 5.6 The illustrative layout of the scheme has been designed to help reduce noise propagation across the site in balance with other factors. Once the detailed scheme design progresses beyond outline stage, additional work will be carried out to refine the layout and further minimise noise propagation where practical (while also taking account of numerous other factors). The site layout and dwellings will be designed so that the internal target noise levels can be achieved with open windows in as many properties as possible.

Hierarchy Level 3: Dwelling Layout and Orientation

- 5.7 For the purposes of the illustrative layout, efforts have been made to protect gardens with building structures. Once the detailed scheme design progresses beyond outline stage, additional work will be carried out to refine the layout and further maximise garden screening where practical (while also taking account of numerous other factors).
- 5.8 For a development such as this, it is not practical to avoid windows to habitable rooms facing the A3102 without then giving rise to other, less desirable characteristics (such as single-aspect dwellings or barrier blocks, none of which are considered appropriate here).
- 5.9 While it is hypothetically possible to use innovative design strategies, they are not considered appropriate for this development, which consists of traditional housing rather than flats which could be used as barrier blocks (for example). In the context of the proposed development, measures such as barrier blocks, courtyards, acoustic balconies and single aspect dwellings are detrimental to liveability and urban design.



Hierarchy Level 5: Building Envelope

- 5.10 All other reasonable measures have been utilised, as outlined above, and will continue to be utilised as the scheme design progresses beyond outline stage. Therefore, it will be appropriate to rely on the building envelope to control noise ingress to dwellings.
- 5.11 It is important to note that for the illustrative layout, there is no intention to seal any window shut. All windows would remain openable at occupants' discretion.
- 5.12 For no dwelling on the illustrative layout is it the intention that windows must remain closed throughout the entire dwelling. Even in a very small number of plots where most habitable rooms may rely on closed (but not sealed shut) windows and alternative ventilation, windows can still be open in non-habitable rooms such as bathrooms, and some habitable rooms, without causing noise levels in habitable rooms to exceed guidelines. For all windows (including habitable rooms) residents can still choose to open windows if they prefer.
- 5.13 The illustrative site layout has been designed so that the internal target noise levels can be achieved with open windows in as many properties as possible, with appropriate design of dwellings.
- 5.14 While this is not a particularly noisy site in comparison to those closer to busy transport corridors, noise levels are such that using attenuated natural vents in the most exposed habitable rooms (based on the illustrative layout) would not enable the requisite internal noise levels to be achieved under overheating conditions. Therefore, in such plots, it is likely to be appropriate to use mechanical ventilation systems to remove the need to open windows except for purge ventilation. Further details are set out in subsequent sections below.

Additional Note on Speed Limit

- 5.15 Although not part of the proposed scheme, there is the potential for the speed limit on the A3102 Sandridge Common to reduce from the current 40 mph to 30 mph. This could be expected to reduce noise levels by 1 dB compared with those assessed herein.

6 Outline Noise Assessment

6.1 Introduction

- 6.1.1 The assessment includes an increase of 1 dB compared with levels measured during the noise survey, to account for traffic growth (based on data provided by the project transport consultant).
- 6.1.2 Calculations have been carried out of predicted noise levels at façades and in gardens, to inform illustrative mitigation as set out in the subsections below.
- 6.1.3 The assessment and mitigation specifications are purely illustrative in nature. They will need to be updated once the scheme design is developed beyond outline stage.

6.2 Building Envelope and Internal Noise Levels

- 6.2.1 The glazing types set out in the following table have been assessed for habitable rooms.



Glazing Reference	Sound Reduction, R (dB), at Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000

Glazing Type G1 25 27 35 43 42 50

Example G1 Glazing Unit: 8.8mm laminate glass / 24mm void / 6.8mm acoustic laminate glass

Glazing Type G2: standard thermal double glazing

Table 6.1 Illustrative glazing octave band sound reduction

- 6.2.2 It is anticipated that Glazing Type G1 will apply to habitable rooms in the south, east and west elevations of the first row of dwellings facing the A3102. For non-habitable rooms such as bathrooms and standalone kitchens, glazing type G2 is sufficient.
- 6.2.3 For all other dwellings, it is anticipated that standard thermal double glazing will suffice throughout.
- 6.2.4 The example configurations in the table are provided for guidance only. For Glazing Type G1 it is the numerical performance in each octave band which must be achieved by the complete installed window, including but not limited to any opening lights, seals and condensation control mechanisms.
- 6.2.5 The following illustrative passive vents have been assessed, with up to two in each habitable room:

Vent Reference	Element Normalised Level Difference, $D_{n,e}$ (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000

Vent Type V1 40 38 32 47 53 36

Example V1 Vent: Zehnder Greenwood 5000EA AC2 (with Acoustic Set)

Vent Type V2: standard trickle vent e.g. $D_{n,e,w}$ 29 dB

Table 6.2 Illustrative passive background vent octave band sound reduction

- 6.2.6 It is anticipated that Vent Type G1 will apply to habitable rooms in the south, east and west elevations of the first row of dwellings facing the A3102, as well as some elevations of a small number of additional dwellings within approximately 60 m of the A3102 hedgerow.
- 6.2.7 For the majority of dwellings on the site, it is anticipated that target internal noise levels will be achieved with windows open. For a similar quantum of dwellings as indicated in 6.2.6 above, it is anticipated that alternative ventilation may be required (e.g. ducted extract/supply, with integrated attenuation and potentially with heat recovery and summer bypass mode) for habitable rooms that do not have a window in an unmarked façade. This is to enable windows to be closed while still providing suitable overheating mitigation. It will be necessary to assess this in greater detail as the scheme design progresses beyond outline stage.



- 6.2.8 Although it is likely that some habitable room windows will be treated as being closed for the purposes of achieving targeted internal noise levels, all windows to all rooms are to remain openable at occupants' discretion.
- 6.2.9 The detailed design of ventilation systems can be controlled by planning condition. It is suggested that the detailed design process covers the following matters:
- Ventilation rates to be informed by a suitable overheating assessment for each affected habitable room.
 - Combined noise levels due to external noise intrusion via windows/vents/ducts and due to the operation of ventilation systems in background / whole-dwelling mode shall not exceed the noise levels specified in section 6.4 of the Wiltshire Council Planning Consultation Guidance Note on Noise and Vibration, version 1.
 - Any mechanical ventilation system operating at higher ventilation rates to control overheating shall not cause noise levels to exceed 35 dB L_{Aeq} in bedrooms and 40 dB L_{Aeq} in living rooms, in accordance with the Acoustics Ventilation and Overheating Guide.
 - All mechanical ventilation systems are to be occupant controllable.
- 6.2.10 A suitable planning condition (similar to wording that has been used for other residential developments in Somerset) is as follows:

"No development above slab level shall commence until an assessment has been conducted to establish locations and details of mechanical ventilation systems to be installed to habitable rooms, where required to enable internal noise criteria to be achieved under overheating conditions, has been submitted to and approved in writing by the Local Planning Authority. The development shall then be carried out in strict accordance with the approved details for the lifetime of the development."

6.3 Garden Noise Levels

- 6.3.1 As stated in sections A.1.8 and A.1.9 of Appendix A, garden noise levels above 50 or 55 dB $L_{Aeq, 16-hour}$ should not lead to refusal of planning consent, but rather should trigger reasonable measures to minimise noise levels. This is also the approach stated in the ProPG referenced by the Wiltshire Council Planning Consultation Guidance Note. Thus, the illustrative layout has been designed to minimise garden noise levels as much as possible, through screening by buildings. Noise levels will be further minimised using acoustic screens (walls or fences) with a height of up to 2.0 m at garden boundaries, where appropriate.
- 6.3.2 Predicted noise levels in the open spaces forming part of the development are well below 50 dB $L_{Aeq, 16-hour}$. Those spaces are expected to be within 5 minutes' walk of all dwellings within the development. This is another mitigating factor for gardens where noise levels exceed 50 dB $L_{Aeq, 16-hour}$.
- 6.3.3 On the basis of the illustrative layout, at the great majority of dwellings noise levels will be 50 dB $L_{Aeq, 16-hour}$ or less throughout the garden.
- 6.3.4 It is anticipated that it will be possible to progress the scheme design beyond outline stage, such that no garden is subject to noise levels exceeding 55 dB $L_{Aeq, 16-hour}$ and the great majority are provided with areas (or the entire garden) benefiting from less than 50 dB $L_{Aeq, 16-hour}$.



7 Conclusion

7.1 This report sets out details of a noise survey and illustrative noise assessment for outline planning purposes. The conclusions are summarised as follows:

- The site is considered suitable for residential development in terms of noise levels, which have been minimised as far as practical through appropriate design of the illustrative layout, provided that the scheme is progressed taking account of the contents of this report
- Suitable indoor noise levels will be achieved with windows open in the majority of homes
- Sections 6.2 and 6.3 of this report sets out illustrative noise mitigation specifications, along with descriptive indications of locations where they are likely to apply; this is likely to include the provision of alternative means of ventilation in some dwellings (but with windows remaining openable at occupants' discretion).
- Further assessment can be controlled by planning condition.

7.2 A suitable planning condition is suggested as follows:

“No development above slab level shall commence until an assessment has been conducted to establish locations and details of mechanical ventilation systems to be installed to habitable rooms, where required to enable internal noise criteria to be achieved under overheating conditions, has been submitted to and approved in writing by the Local Planning Authority. The development shall then be carried out in strict accordance with the approved details for the lifetime of the development.”



Appendix A - General Planning Guidance on Noise and Overheating

A.1 BS 8233

- A.1.1 Guidance on indoor noise levels due to external environmental noise from sources such as transportation is included in BS 8233:2014 (Guidance on sound insulation and noise reduction for buildings).
- A.1.2 BS 8233 is based upon the WHO Guidelines for Community Noise (World Health Organisation, 2000), which included L_{Amax} recommendations for dwellings. Taking account of both sources, the following table summarises the guidelines.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB L_{Aeq} , 16 hour	—
Dining	Dining room / area	40 dB L_{Aeq} , 16 hour	—
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} , 16 hour	30 dB L_{Aeq} , 8 hour
Sleeping (noise events)	Bedroom	-	45 dB L_{Amax} not normally exceeded more than 10-15 times per night

Table A.1 Internal noise criteria (for whole dwelling ventilation conditions)

- A.1.3 BS 8233 notes that the levels are based on annual average data and do not need to be achieved at all times.
- A.1.4 The standard also notes that the assessment should be based on open trickle vents (or other mechanisms) providing adequate ventilation.
- A.1.5 It also states that where development is considered necessary or desirable, despite noise levels being above aspirational goals, the internal target noise levels may be relaxed by up to 5 dB while still achieving reasonable internal conditions. Given the preceding point above, the implication is that this can apply with windows closed and trickle vents open. The standard pre-dates the more recent development of guidance on overheating (below), so the targets in the standard (including up to 5 dB relaxation) can be applied to the whole-dwelling ventilation condition. When assessing the overheating condition, it may be appropriate to allow further relaxation in noise targets, beyond those mentioned in BS 8233 (depending on the circumstances). This is discussed further in the subsequent section below.
- A.1.6 The standard also indicates that if achieving the internal noise levels (relaxed by 5 dB if necessary) relies on windows being closed, appropriate alternative ventilation will need to be provided. Section 8.4.5.4 of the standard refers to Approved Document F of the Building Regulations and indicates that habitable rooms should be provided with background ventilation (whole dwelling ventilation as defined in Approved Document F). BS 8233 states that this can be provided via open windows or trickle vents, which accords with the earlier statements above, concerning trickle vents. It also states that windows can remain openable for rapid or purge ventilation, or at the occupant's choice.



A.1.7 While BS 8233:2014 does not include guidance on L_{Amax} noise levels at night in dwellings, it does include example guidance for hotels of 45-55 dB L_{Amax} . There are potential reasons either way for hotels being more or less sensitive than private dwellings. Hotels may be more sensitive, in that occupants are not used to their environment and consequently may be more susceptible to sleep disturbance due to noise events of short duration. Conversely, dwellings may be more sensitive because some occupants may be more protective of their personal environment than if they were in a hotel. The WHO Guidelines (2000) on which BS 8233 is based, do include a guideline for dwellings, which is that for a good sleep a level of 45 dB L_{Amax} should not be exceeded more than 10-15 times per night.

A.1.8 In relation to external noise levels, BS 8233 states the following:

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.

A.1.9 These guideline external noise levels represent aspirational goals. Where noise levels exceed the stated thresholds, it is an indication that mitigation should be employed where reasonable and practical. Exceeding these thresholds does not mean that the site is unsuitable for residential use, nor that planning consent should be withheld.

A.2 Building Regulations Part O and Approved Document O

Part O Requirement O1(1)

A.2.1 Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to:

- (a) limit unwanted solar gains in summer;
- (b) provide an adequate means to remove heat from the indoor environment.

Part O Requirement O1(2)

A.2.2 In meeting the obligations in O1(1):

- (a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and
- (b) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.

A.2.3 The most relevant part of the O1(2)(a) requirement is that in meeting the obligations in O1(1), account must be taken of the occupants' reasonable enjoyment of the residence. Noise will often be a factor in reasonable enjoyment.



ADO Intention (Noise)

- A.2.4 In the Secretary of State's view, requirement O1(2)(a) is met in a new residential building if the building's overheating mitigation strategy for use by occupants takes account of:
- a. Noise at night – ADO paragraphs 3.2 to 3.4 (see Statutory Guidance below);
- and various other (non-noise related) factors (b) to (e) as stated in ADO.

Statutory Guidance

- A.2.5 The statutory guidance in Approved Document O informs the process of complying with the legal requirements.
- A.2.6 ADO Section 1 details a simplified method for demonstrating compliance with the requirements of Part O. ADO Section 2 details a more complex method involving dynamic thermal modelling. Both methods require a multi-disciplinary approach. This report sets out a noise assessment which is commensurate with the simplified method, and which may also be suitable for the more complex method (depending on the window open areas calculated by others in a TM59 assessment or similar).
- A.2.7 ADO paragraph 3.2 states that in locations where external noise may be an issue, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours.
- A.2.8 ADO paragraph 3.3 states that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds either of the following limits:
- 40 dB $L_{Aeq, 8h}$ (23:00-07:00) in bedrooms
 - 55 dB L_{AFmax} more than 10 times a night (23:00-07:00) in bedrooms
- A.2.9 ADO paragraph 3.4 concerns the possibility of using in-situ noise measurements in fully complete bedrooms as evidence that the indoor noise limits are met. It does not indicate that this is the preferred form of evidence. It is reasonable to use pre-construction assessments as evidence (i.e. this report), without the need to conduct post-completion noise measurements.
- A.2.10 Although achieving the indoor noise limits in bedrooms is one way of meeting requirement O1(2)(a), there is nothing in ADO to say that this is the only way. On some sites there may be case for exceeding those levels, particularly when balanced against other factors, including those discussed in ADO.



A.3 Acoustics, Ventilation and Overheating

Introduction

- A.3.1 A residential design guide to acoustics, ventilation and overheating was published by the Institute of Acoustics & Association of Noise Consultants in January 2020. The guide relates primarily to the second of the following conditions that it defines:
- ADF Ventilation condition: provisions for fresh air to achieve whole dwelling ventilation rates (applying at all times) e.g. windows closed and trickle vents open
 - Overheating condition: provisions for ventilative cooling to mitigate overheating (applying only some of the time) e.g. windows open or alternative means of ventilation provided
- A.3.2 The guide also mentions purge ventilation for the purpose of rapidly diluting indoor pollutants (e.g. from painting and decorating, or from burnt food), as defined in Approved Document F of the Building Regulations. It notes that no acoustic criteria apply under such conditions.
- A.3.3 The guide states that:
- "Developments will normally (but not always) require additional ventilation (above ADF whole dwelling ventilation provisions) in order to mitigate overheating"*
- A.3.4 Any such additional ventilation could be provided by open windows or other means (potentially with sound attenuation incorporated). In either case, an assessment may be advisable or required, to determine noise levels under the overheating condition (together with a separate assessment of the extent to which the overheating condition is likely to occur).
- A.3.5 The AVO guide indicates that development proposals should consider the following design principles:
- minimise internal heat generation through energy efficient design
 - orientate buildings and streets to minimise summer and maximise winter solar gains
 - use trees and other shading
 - increase green areas in the envelope of a building, including its roof and environs
 - maximise natural ventilation
 - reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
 - manage the heat within the building through exposed internal thermal mass and high ceilings
 - passive ventilation
 - mechanical ventilation
 - active cooling systems (but reducing reliance on these where possible and, where they are used, ensuring they are the lowest carbon options).



- A.3.6 In Appendix B to the guide, the following statements are made:
- On smaller developments it may be disproportionate to carry out a formal overheating assessment. In this case, the risk factors for overheating may be noted [with reference to the Housing Health and Safety Rating System] along with the provisions for mitigating overheating and the associated noise levels anticipated. The level of risk to occupants may then be considered in a qualitative manner.
 - A qualitative overheating assessment is likely to assume opening windows to mitigate overheating. Thus, even when the overheating risk may appear to be low, the acoustic conditions during the overheating condition should be considered.
- A.3.7 The design guide advocates a two-level assessment of ambient noise levels due to transportation noise sources. The first level considers only external free field noise levels (with internal noise levels being considered indirectly by inference). Depending on the outcome of that assessment it may be advisable to conduct a level 2 assessment, which directly considers internal noise levels.

Level 1 Assessment Criteria

- A.3.8 The guide includes a table (3-2) setting out guidance for a level 1 site risk assessment (noting that the values presented in the table should not be regarded as fixed thresholds to be uniformly applied to all sites). The guide states that the values in Table 3-2 are based on the assumption of a 13 dB difference between the external free-field noise levels and internal ambient noise levels. Based on that table, the following daytime thresholds are proposed for this site:

Day external free field noise level, dB (07:00-23:00)	Potential effect without mitigation	Recommendation for Level 2 assessment
$L_{Aeq, 16 \text{ hour}}$		
≤ 53	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required
54 – 63	Possible adverse effect	Optional
> 63	Likely adverse effect (depending on circumstances)	Recommended

Table A.2 AVO Level 1 assessment thresholds for transport noise sources; Day



- A.3.9 Similarly, the following night-time thresholds are proposed, noting that the highest risk category applies in each case (so, for example, if the ambient noise level is 46 dB $L_{Aeq, 8 \text{ hour}}$ but the typical maximum noise level is 79 dB L_{Amax} then a Level 2 assessment is recommended).

Night external free field noise level, dB (23:00-07:00)		Potential effect without mitigation	Recommendation for Level 2 assessment
$L_{Aeq, 8 \text{ hour}}$	L_{Amax}		
≤ 48	≤ 78	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required
49 – 55	-	Possible adverse effect	Optional
> 55	> 78	Likely adverse effect (depending on circumstances)	Recommended

Table A.3 AVO Level 1 assessment thresholds for transport noise sources; Night

- A.3.10 The potential effects apply in the absence of mitigation. Some forms of mitigation could be expected to reduce the effects (and could be put forward for that reason).
- A.3.11 For noise levels in the middle category (possible adverse effect) the likelihood of an adverse effect occurring will often increase with increasing noise level within the relevant range.
- A.3.12 It should be noted that where an adverse effect is assessed, it is not necessarily a significant adverse effect. Its significance would need to be assessed accounting for relevant factors. In the case of ventilation and overheating, one such factor is the likelihood of it being necessary to open windows (and potentially increase internal noise levels), as well as how often and for how long. For example, even if daytime noise levels are above 63 dB $L_{Aeq, 16 \text{ hour}}$ an adverse effect may not occur if the overheating condition only occurs infrequently and for short durations (so windows can be kept shut for the great majority of the time).

Level 2 Assessment Criteria

- A.3.13 A level 2 assessment relates to internal noise levels under the overheating condition and sets out threshold noise levels (in Table 3-3 of the guide, noting that the values presented in the table should not be regarded as fixed thresholds to be uniformly applied to all sites). Note 8 accompanying the table reiterates the advice in BS 8233 that internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. Based on the table and the notes accompanying it, the following thresholds are proposed for this site:



Internal ambient noise level, dB			Likely Assessment
$L_{Aeq, T}$ during 07:00-23:00	$L_{Aeq, T}$ during 23:00-07:00	Individual noise events (L_{Amax}) during 07:00-23:00	
≤ 35	≤ 30	Do not normally exceed 45 dB more than 10 times per night	No observed adverse effect
35 – 50	30 – 42	45 – 65	Possible adverse effect
> 50	> 42	Normally exceeds 65	Significant adverse effect

Table A.4 AVO Level 2 assessment thresholds for transport noise sources

- A.3.14 The daytime assessment period T is not necessarily the 16-hour day as used elsewhere. It may be a shorter period selected to be representative of the times at which overheating could be likely to occur and the relevant room is occupied.
- A.3.15 The guide refers again to the 13 dB reduction (from external free-field noise levels to internal ambient noise levels) through an open window for the purpose of a Level 1 assessment. It states that this level difference is considered representative of typical domestic rooms with simple façade openings of around 2% of the floor area. It goes on to state in paragraph 3.25:
- "The outside-to-inside level difference for a partially open window is related to the window opening area, type and orientation in respect of directional noise sources. This is likely to differ from project-to-project and would require due consideration as part of a Level 2 assessment. A 13 dB correction ought not to be automatically taken as appropriate for all cases."*
- A.3.16 When considering the middle category in terms of L_{Aeq} , it should be noted that while it is possible that an adverse effect could potentially be observed in the range 35-40 dB $L_{Aeq, 16 \text{ hour}}$ and 30-35 dB $L_{Aeq, 8 \text{ hour}}$, it would normally be negligible (since BS 8233 and the AVO guide both indicate that the BS 8233 guideline levels can be increased by 5 dB while still achieving reasonable internal noise levels).
- A.3.17 When considering the middle category in terms of L_{Amax} , it may be relevant to refer to the guidance for hotels in BS 8233:2014. This could indicate that an adverse effect is unlikely until internal noise levels exceed 55 dB L_{Amax} more than 10 times per night.
- A.3.18 A full level 2 assessment would also require assessment of how frequently and for what duration the overheating condition occurs. This would necessitate input from, and collaboration with, other design disciplines. This information would then be analysed in conjunction with the noise levels to determine the likely overall significance. The values in Table A.4 could be modified by this information. For example, if a daytime internal noise level of 52 dB $L_{Aeq, T}$ is assessed for the overheating condition but that only occurs for a short time on a very small number of days per year, the overall effect is not likely to be significant. Conversely, if a daytime noise level of 48 dB $L_{Aeq, T}$ is assessed for the overheating condition and that occurs for long durations on a large number of days per year, the overall effect is likely to be significant.



- A.3.19 It should be noted that these assessments include clear thresholds to help enable consistent evaluations. It does not automatically mean (for example) that an internal daytime noise level of 50.0 dB equates to an insignificant adverse effect, but 50.1 dB produces a significant adverse effect. A degree of judgement is likely to be required when noise levels are close to thresholds. Furthermore, as noise levels reach the upper part of the middle category in Table A.4, there is an increasing risk of a significant adverse effect, which would need to be evaluated.

Building Services Noise

- A.3.20 The guide also includes internal noise levels due to mechanical services, which will apply if such services are used to provide alternative means of ventilation to avoid opening windows under the overheating condition.

Whole Dwelling Ventilation with System 3 or System 4

Bedrooms $\leq 25 \text{ dB } L_{Aeq}$

Living Rooms $\leq 30 \text{ dB } L_{Aeq}$

- A.3.21 If a mechanical system provides whole dwelling ventilation, as defined in Approved Document F (ADF) of the Building Regulations, it would typically be through systems defined in ADF as System 3 (continuous Mechanical Extract Ventilation, MEV) or System 4 (continuous Mechanical supply and extract Ventilation with Heat Recovery, or MVHR). In these cases, the above noise levels are stated as being desirable, at the minimum low ventilation rates required for whole dwelling ventilation.

Extract Ventilation with System 1, System 3 or System 4

Bedrooms $\leq 25 \text{ dB } L_{Aeq}$

Living / Dining Rooms $\leq 30 \text{ dB } L_{Aeq}$

Bathroom / WC / Kitchen $\leq 45 \text{ dB } L_{Aeq}$

- A.3.22 If a mechanical system provides extract ventilation, as defined in ADF, it would typically be through systems defined in ADF as System 1 (intermittent extract fans), System 3 (continuous Mechanical Extract Ventilation, MEV) or System 4 (continuous Mechanical supply and extract Ventilation with Heat Recovery, or MVHR). In these cases, the above levels are stated as being desirable, at the minimum high ventilation rates required for extract ventilation.

Purge Ventilation

- A.3.23 If a mechanical system is used for purge ventilation to rapidly dilute indoor pollutants as defined in ADF (for example to clear smoke or odours such as from burnt food or painting a decorating), no desirable noise levels are set. Generally, significantly increased noise levels would be accepted during purge conditions.



Overheating Ventilation

Bedrooms 30 (± 5) dB LAeq

Living / Dining Rooms 35 (± 5) dB LAeq

- A.3.24 If a mechanical system is used to provide ventilation to mitigate overheating, it may be through the provision of ambient-temperature air at high ventilation rates (ventilative cooling) or the provision of cooled air (comfort cooling). In these cases, the above noise levels are stated as being desirable, at the rates required to control overheating.
- A.3.25 The systems to control overheating would normally be user-controlled. The ventilation rates may or may not be the same as those required for Extract Ventilation under Building Regulations.
- A.3.26 It should be noted that the desirable noise levels stated for the various categories above would require very careful selection and design of mechanical ventilation systems. This is especially the case for Extract Ventilation and potentially Overheating Ventilation.

A.4 BS 4142:2014 Methods for rating & assessing industrial & commercial sound

- A.4.1 When considering atmospheric noise emissions from mechanical services plant associated with a development, it is appropriate to refer to BS 4142:2014+A1:2019 (Methods for rating and assessing industrial and commercial sound). It defines the rating level $L_{Ar,Tf}$ of a noise source (or combination of sources), which is its specific sound level plus any adjustments for the characteristic features of the sound (such as tones, impulses, or intermittent operation).
- A.4.2 It also describes methods of deriving the representative background sound level in the absence of the specific commercial or industrial noise sources being assessed.
- A.4.3 The standard then describes a method for assessment of the impacts of the commercial or industrial noise. It involves subtracting the representative background sound level from the rating level and considering the following:
- 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.
- A.4.4 The standard indicates 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.”*



- A.4.5 The previous edition of the standard indicated that 30 dB was considered low. On the above basis, it is usually not necessary to set limits any lower than 30 dB.
- A.4.6 Under the latest edition of the standard, limits for rating levels of noise from industrial / commercial premises applying at residential properties are commonly set equal to the representative background sound level, subject to the aforementioned 30 dB cut-off. However, rating noise levels can potentially exceed the representative background by up to 5 dB before an adverse impact is indicated.
- A.4.7 BS 4142 paragraph 1.3 states that it is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels. However, it can often be appropriate for BS 8233 to be used to help assess indoor noise levels and façade design, in conjunction with BS 4142 for external noise levels. Clearly, if the façade and ventilation has been designed to suitably control internal noise levels under a sufficiently wide range of ventilation conditions, then the external noise level outside the window becomes less relevant – or ceases to be relevant altogether. In line with this, the standard also indicates that façade insulation treatment and alternatives means of ventilation/cooling can both be taken into account in the assessment, and potentially modify the outcome (for example such that a low or negligible impact is assessed, when it might otherwise have been a significant adverse impact).
- A.4.8 When using BS 8233 to assess indoor noise levels due to industrial/commercial sources, it may be appropriate to use similar periods to those in BS 4142 (e.g. 1 hour) rather than the full 16-hour day and 8-hour night periods in BS 8233.



Appendix B - Survey Data

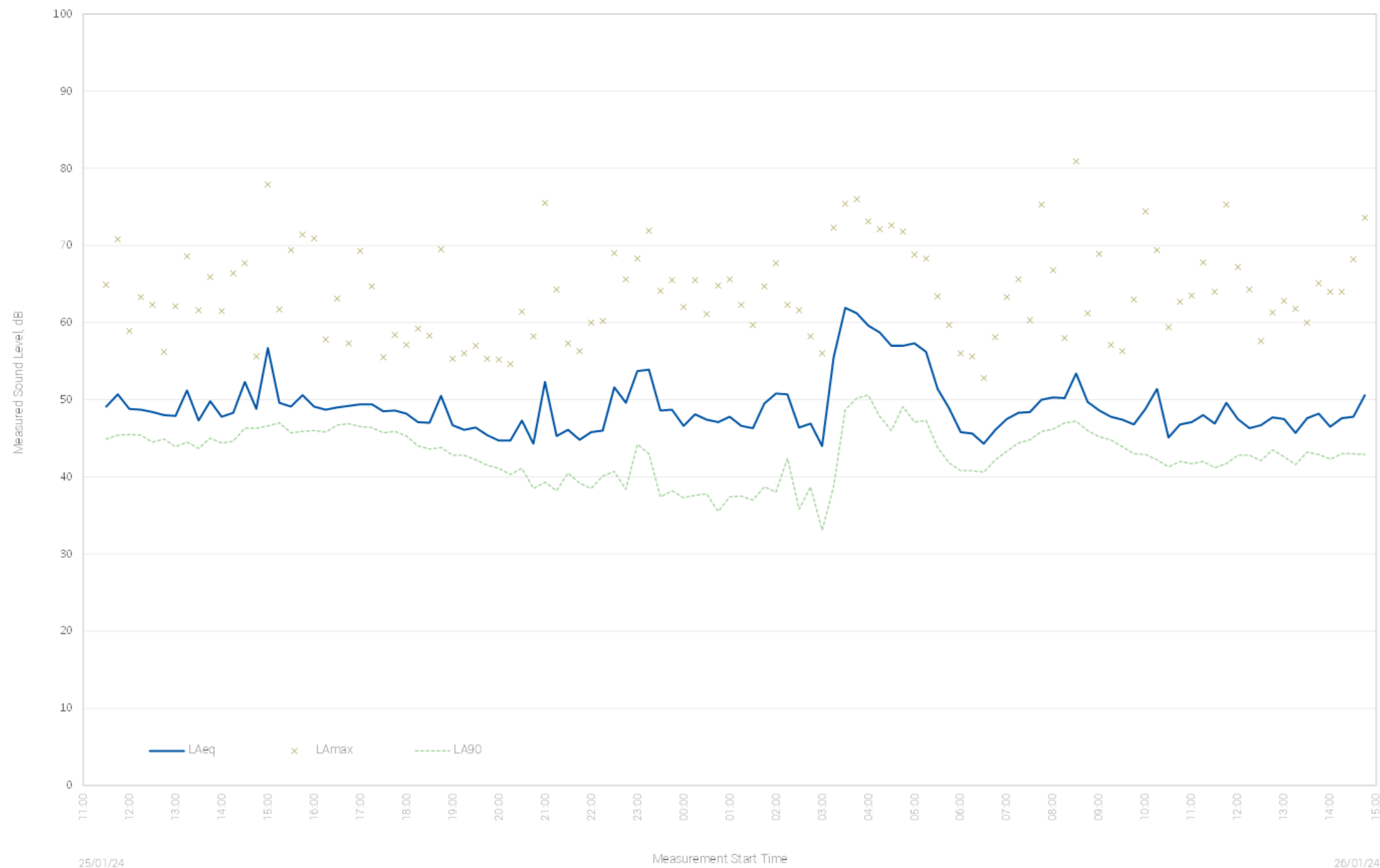
Measured Sound Level Histories

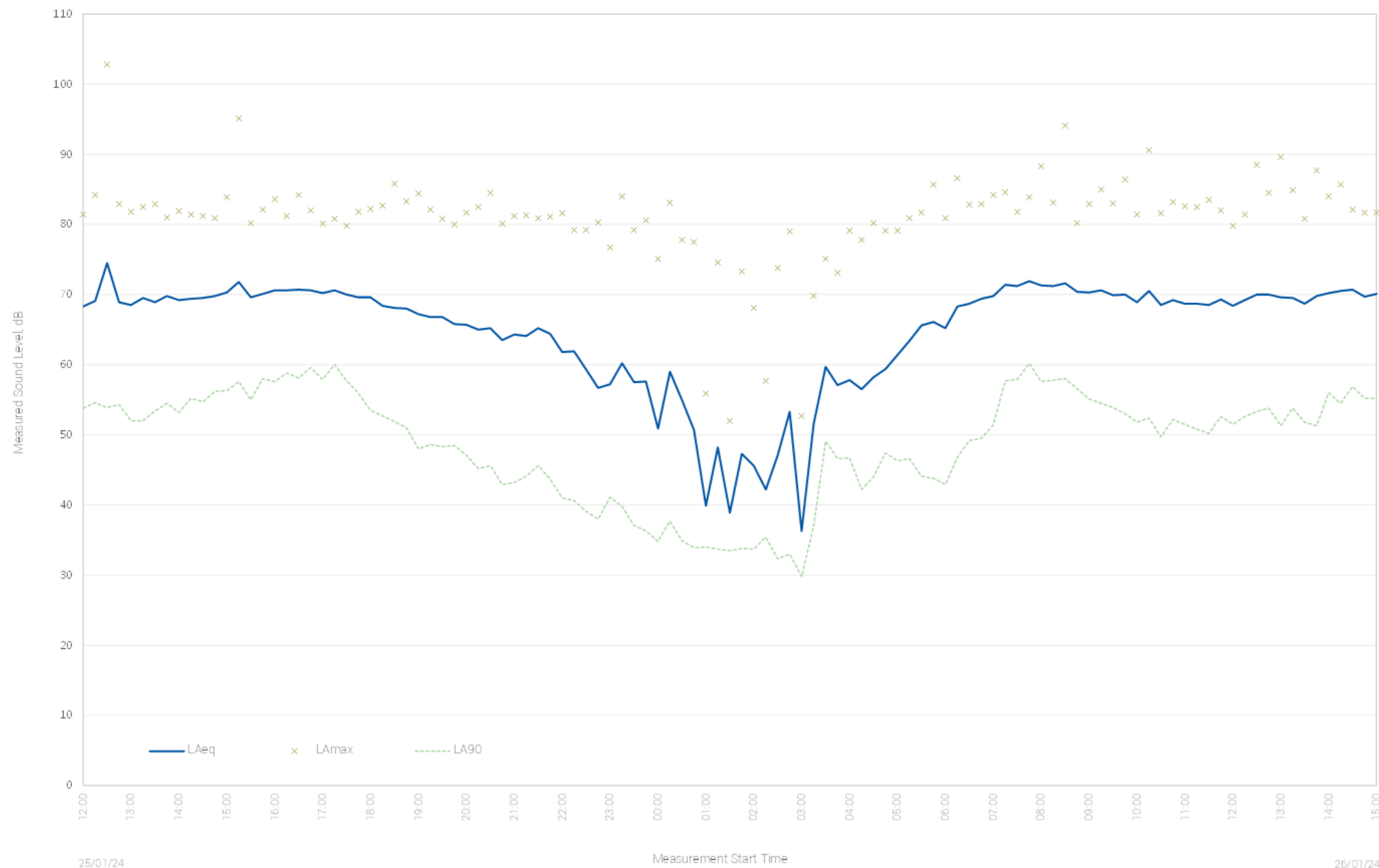
(on subsequent 2 pages)

Attended Noise Measurements

Period	Position N3		Position N2		Difference	
	L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}	L_{Aeq}	L_{Amax}
12:45-13:00	69.1	92.9	68.9	82.9	0.2	-0.8
13:00-13:15	69.7	85.8	68.5	81.8	1.2	4.0
13:15-13:30	69.3	81.5	69.5	82.5	-0.2	-1.0
Average					0.4	0.7

Table B.1 Attended noise measurements at N3, 25/01/2024







Glossary of Terms

decibel: Usually written as decibel or dB, it is a logarithmic scale used for two purposes. One is to make the expression of numerical sound levels more convenient (with a smaller range and fewer digits). The other is to express sound levels in a manner aligned with human interpretation of differences in sound level, which itself is logarithmic in nature.

A-weighting: Applies different weight to sound levels at different frequencies, to represent the variation in sensitivity of the typical human ear with frequency. Thus, a single-value expressed in terms of dBA or dB(A) is the A-weighted sound level, which takes account of the frequency content of the sound.

T: Can vary in meaning, depending on where it is used. For example, when used with L_{Aeq} or L_{Ar} (see below) it represents a specified time period. When used with $D_{nT,w}$ or T_{mf} for example, it represents the reverberation time (see below).

L_{Aeq} : The A-weighted equivalent continuous sound level in dB. This unit can be described as the notional steady noise level that would, over a period, contain the same energy as the fluctuating noise source. It is often considered as the energy average level. This unit is typically used to describe day and night period noise levels, $L_{Aeq,T}$ where T is the time period.

L_{A90} : The A-weighted sound level (in dB) exceeded for 90% of the time specified. This level gives an indication of the sound level during the quieter periods of time in any given fluctuating sound sample. It is used to describe the "background sound level" of an area.

L_{A10} : The A-weighted sound level (in dB) exceeded for 10% of the time specified. This level gives an indication of the sound level during the louder periods of time in any given fluctuating sound sample. It is typically used to help define, measure, and assess road traffic noise.

L_{A01} : The A-weighted sound level (in dB) exceeded for 1% of the time specified. This level can help to quantify the impact of short-duration events (in addition to, or as an alternative to L_{Amax} – see below). For example, it is used in criteria for transient noise potentially affecting teaching and learning in schools.

L_{Amax} : The maximum A-weighted level (in dB) of sound measured in any given period. This unit is used to measure and assess transient noises, particularly those such as individual vehicles, etc impacting on sensitive receptors at night. Unless otherwise stated, the L_{Amax} level is measured using a "fast" sound level meter response (i.e. $L_{Amax,F}$).

L_{AX} , L_{AE} , or SEL: The sound exposure level which contains, within a notional 1-second period, the same quantity of sound energy as the time varying level contained in a single noise event. It could be considered an L_{Aeq} level normalised to 1 second. The use of this unit allows the calculation of the $L_{Aeq,T}$ level over a given period of time (T) for a known number of such single noise events.

L_{Ar,T_r} : The BS 4142:2014+A1:2019 defined rating level comprising the specific noise level for a given source over a given time period, T_r , plus any adjustment for the characteristic features of the noise.

T_{60} : Reverberation time, which is a characteristic of a given room. It is the time taken for sound energy to decay by 60 dB. It is usually impractical to measure directly, so is



represented by T_{20} (which is an estimate of the T_{60} based on the time taken for sound energy to decay by 20 dB), or the similar T_{30} .

T_{mf} : The mid-frequency reverberation time defined in BB93. It is the arithmetic average of the reverberation time in the 500 Hz, 1 kHz and 2 kHz octave bands, which constitute important speech frequencies.

$D_{nT,w}$: The level difference between one room and another, across a sound insulating separating element, normalised to a reverberation time of 0.5 seconds, and weighted to provide a single figure value.

$L'_{nT,w}$: The noise level in a room when the floor in the room above is excited by a calibrated tapping machine or similar, and normalised to a 'standard' reverberation time of 0.5 seconds, and weighted to provide a single figure value.

R_w : This is the sound reduction index, weighted to provide a single figure value, of a particular construction under laboratory conditions, where there is no contributing flanking sound transmission and where the test sample is constructed exactly in accordance with manufacturer's details.

R'_w : This value is the same as R_w but is measured under field conditions, where flanking details, workmanship, or other factors may cause a reduction in performance to that measured under laboratory conditions