by acoustics

Consultants in Sound and Vibration

Report

23-0030-R1

4 December 2023

Springwell Lane, Whetstone

Noise Constraints

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Revision Number	Date	Comments	Author	Approved by
0	25/09/2023	First Issue	Ian Yates	Johnny Berrill
1	04/12/2023	Amended layout	Ian Yates	Johnny Berrill

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1 Introduction

1.1 A residential development is proposed on Springwell Lane, Whetstone.

1.2 This report sets out the methodology and results of a survey conducted at the site to quantify prevailing noise levels, together with an assessment of noise constraints and mitigation likely to be required.

2 Site Description

Existing Site and Surroundings

2.1 The site is located on Springwell Lane, which is a residential road carrying very little traffic. It currently comprises a large bungalow (unoccupied), along with grounds and various outbuildings. The site can be seen in Fig 4.1 later in this report.

2.2 The north and south boundaries of the site are with residential properties in Alice Gardens and Ewan Close. The east boundary is formed by Springwell Road. The west boundary is with industrial premises. Some of the nearby residential properties are also immediately adjacent to the industrial boundary.

2.3 There is a gated lane forming part of the proposed development site, running along the northern boundary, ostensibly linking Springwell Lane with the industrial premises. However, the industrial premises are accessed via a lane off Dog and Gun Lane, well to the north.

2.4 The small industrial premises immediately adjacent to the site comprise a monumental masonry business (Autumn Memorials) and a double-glazing repair business (Academy Glass), both of which appear to operate during the day only, not in the evening or at night. The access road to those units runs alongside the west boundary of the application site. The yard serving Autumn Memorials and other small industrial units to the north of it, is located adjacent to the northwest corner of the proposed residential site. Existing residences in Alice Gardens are also immediately adjacent to the yard and the access road off Dog and Gun Lane.

2.5 The M1 motorway is located approximately 370 m west of the site at its closest, and dominates the noise climate. In parts of the site closest to the western boundary, industrial noise is also audible at times, but not dominant.

Proposed Development

2.6 The proposals are for up to 24 dwellings comprising semi-detached and terraced houses, along with private gardens and associated car parking. The entirety of the site will be developed, so the gated lane will cease to exist.

3 Guidance on Noise and Planning

3.1 Blaby District Council

Adopted Local Plan (2019) Development Management Policy 1 (DM1)

3.1.1 Policy DM1 states that:

"development proposals consistent with other policies of the Local Plan will be supported where the following criteria are met. The development proposal will:

a) Provide a satisfactory relationship with nearby uses that would not be significantly detrimental to the amenities enjoyed by the existing or new occupiers, including but not limited to, consideration of:

i. privacy, light, noise, disturbance and overbearing effect;
ii. vibration, emissions, hours of working, vehicular activity."

Local Plan Core Strategy (2013) Policy CS3 – Sustainable Urban Extension

3.1.2 Although not directly relevant to the proposed development, Policy CS3 includes a section on General Infrastructure, which states:

"The development will need to include appropriate measures to mitigate the noise and air quality impacts arising from the development on new and existing residents (primarily, but not exclusively, those impacts caused by proximity to the M1 and M69 motorways)."

3.2 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

3.2.1 Based on the BS 8233 discussion in Appendix A, the following table sets out targets for internal noise levels within proposed dwellings, under whole-dwelling ventilation conditions.

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 1.1 Internal noise criteria (for whole dwelling ventilation conditions)

3.3 Building Regulations Part O

3.3.1 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.

3.3.2 Details of Approved Document O are set out in Appendix A. 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

3.3.3 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)

3.4 Acoustics, Ventilation and Overheating

3.4.1 With regard to external noise levels outside proposed dwellings, reference can be made to Table A.1 and Table A.2 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.3.

4 Noise Survey Methodology

4.1 A visit was made to the site on Thursday 14th September 2023, to deploy non-attended noise monitors and make observations on the noise climate.

4.2 Non-attended measurements were made using two NTi Audio XL2-TA analysers, with their 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 1/3 octave bands, with 1-minute resolution for key parameters. The instruments were also equipped with audio recording capability to assist with noise source identification. Each system was calibrated before and after the survey, with a drift of less than 0.5 dB noted in all cases.

4.3 The site and measurement positions N1 and N2 are described below and shown in Fig 4.1 overleaf.

N1 Free field location at the western end of an existing outbuilding, 8 m from the industrial boundary fence, 4 m above ground with a line of propagation over the fence to the industrial façade.

N2 At the site boundary, above the closed gate in the gap between two existing buildings, 2.5 m above ground. This was not a true free-field location but could be taken as such to form the basis of a pessimistic assessment.

4.4 Non-attended noise monitoring at positions commenced around noon on Thursday 14th September. The non-attended monitors were collected around on Monday 18th September.

4.5 Rainfall occurred during most of the deployment period on Thursday 14th September. There was very little wind and temperatures were mild.

4.6 Weather conditions during collection on Monday 18th September were mild and clear, with little wind and dry road surfaces.

4.7 Online weather records for the local area indicate that following the initial wet weather at deployment, the remainder of the survey was predominantly free of precipitation. Exceptions were as follows:

- Small amount of rain for a brief period shortly before 07:00 on 15th September
- Significant rainfall around 03:00 on 18th September
- Small amounts of rain between 04:00 and 07:00 and 18th September

4.8 The wind direction was from the southern quadrant initially, altering to be from the western quadrant at times in the evening of the 14th. This continued on Friday the 15th, with wind direction varying between southerly and north-westerly. On Saturday 16th, the wind was predominantly from the north. On Sunday 17th, it was from the north initially, veering to be from the southwest in the afternoon. On Monday 18th the wind was predominantly from the south.

Fig 4.1 Site plan indicating noise measurement positions N1 and N2
Imagery © 2023 Bluesky, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies
Map data © 2023 Google

5 Noise Survey Results and Observations

5.1 On Thursday 14th September, the M1 motorway was observed to entirely dominate the noise climate over the great majority of the site. Adjacent to the west boundary, industrial noise was also audible at times but overall, the M1 remained dominant. The industrial noise heard on 14th September included the following:

- occasional low-level noise emanating from the open door of Academy Glass; barely noticeable
- occasional noise emanating from the open door of Autumn Memorials, such as cutting and hammering; relatively minor
- occasional distant voice announcements from more remote industrial units; unintelligible
- vehicle movements in the yard; barely audible (albeit partially screened by existing outbuildings on the proposed development site)

5.2 On Monday 18th September, the M1 was again entirely dominant. No industrial noise was audible.

5.3 Overall, the industrial noise was **not** considered to be dominant and was judged to represent a low risk. Therefore, a BS 4142 assessment is not considered necessary (please refer to Appendix A).

5.4 The results of the survey are displayed graphically in Appendix B, in terms of 15-minute periods. Noise levels at the site appear to be heavily dependent upon wind direction, due to the M1 motorway being located approximately 370 m west of the site at its closest. On Saturday 16th September, when the wind direction was predominantly from the north (so without a component from the M1 towards the site), daytime L_{Aeq} noise levels were typically around 12 dB lower than on Thursday 14th and Monday 18th, when the wind was from the south and/or west, so likely to include a component from the M1 towards the site (please refer to section 4 of this report for further details of wind directions and weather conditions).

5.5 The following table sets out period ambient noise levels derived directly from the survey data:

Measurement Period	$L_{Aeq,\ 16\text{-hour}}$ day (07:00 – 23:00)		$L_{Aeq,\ 8\text{-hour}}$ night (23:00 – 07:00)	
	N1	N2	N1	N2
14-15 Sep	53 *	51 *	51	50
15-16 Sep	50	51	41	39
16-17 Sep	45	43	37	35
17-18 Sep	45	43	53 ‡	56 ‡

Table 1.2 Period ambient noise levels measured at positions N1 and N2
* not a complete period
‡ affected by heavy rain

5.6 Although the measurements during the day on Thursday 14th September were not made over a complete 16-hour period (because the survey did not commence until early afternoon), it appears likely that the measured noise levels are representative of those under the worst-case wind directions, from the M1 motorway towards the site.

5.7 Noise levels during the final night of the survey are not representative, due to heavy rain significantly affecting them.

5.8 The 1-minute survey data has been examined in terms of L_{Amax} noise levels at night. Excluding the final night (during which heavy rain occurred), a level of 59 dB $L_{Amax,\ 1\text{-minute}}$ was not exceeded more than 10 times during any night at either measurement position.

5.9 Taking account of the preceding paragraphs, the following ambient and maximum noise levels are taken to be representative of the day and night periods under worst-case wind directions:

- **Day $L_{Aeq,\ 16\text{-hour}}$ 53 dB**
- **Night $L_{Aeq,\ 8\text{-hour}}$ 51 dB**
- **Night L_{Amax} 59 dB**

5.10 The following table sets out representative background sound levels, to provide additional context:

Measurement Period	$L_{A90,\ representative}$ day (07:00 – 23:00)		$L_{A90,\ representative}$ night (23:00 – 07:00)	
	N1	N2	N1	N2
14-18 Sep	42	40	36	34

Table 1.3 Representative background sounds levels at positions N1 and N2

6 Assessment

6.1 Boundary Screening

6.1.1 Industrial noise is not dominant and overall noise levels are not high. Noise levels are already below 55 dB $L_{Aeq,\,16\,hour}$ (much lower when the wind direction is not from the M1 motorway).

6.1.2 Therefore, no mitigation is required. However, as a precautionary measure to account for possible variations in industrial activity, it is recommended that acoustic screening is included to help minimise noise propagation into the closest proposed gardens, as indicated in blue on the following plan. This should comprise a close board timber fence or other suitable construction, with a height of 2.0 m and a mass of at least 20 kg/m^2. There must be no gaps anywhere within the structure, or between the structure and the ground. The screen can be installed in addition to the existing boundary fence, or can replace it.

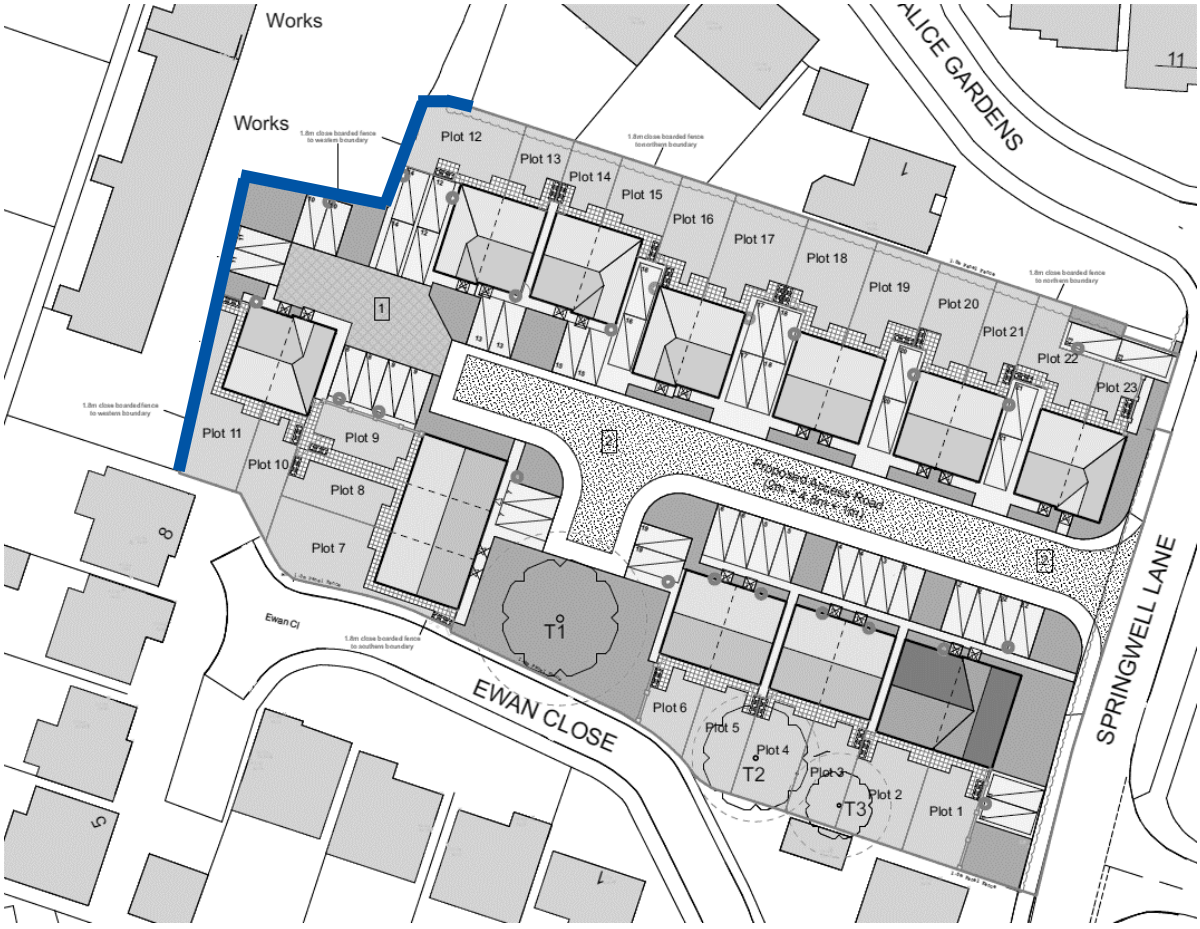


Fig 6.1 Proposed site layout showing recommended 2 m acoustic screen in blue

6.2 External Building Fabric

6.2.1 With the noise levels stated at 5.9 above, standard thermal doubling glazing and direct path trickle vents will be sufficient to ensure suitable internal noise levels with windows closed and trickle vents open (for whole dwelling ventilation). This is assuming cavity masonry external walls, with tiled roof and plasterboard ceiling (or equivalent constructions with similar sound reduction), as well as typical room and windows sizes. If there are any plots where large glazing areas are proposed (e.g. full height windows in bedrooms), these assumptions may need to be revisited.

6.3 Building Regulations Part O

6.3.1 Comparing the night-time noise levels at paragraph 5.9 of this report with the thresholds under paragraph 3.3.3 indicates that L_{Amax} levels are below the threshold. $L_{Aeq,\ 8\text{-hour}}$ noise levels are marginally above the threshold by 2 dB.

6.3.2 Therefore, bedroom windows in elevations likely to be affected by noise from the M1 motorway should be considered for more detailed assessment at a suitable stage (potentially including a TM59 or similar assessment if deemed appropriate). The following plan indicates locations potentially affected.

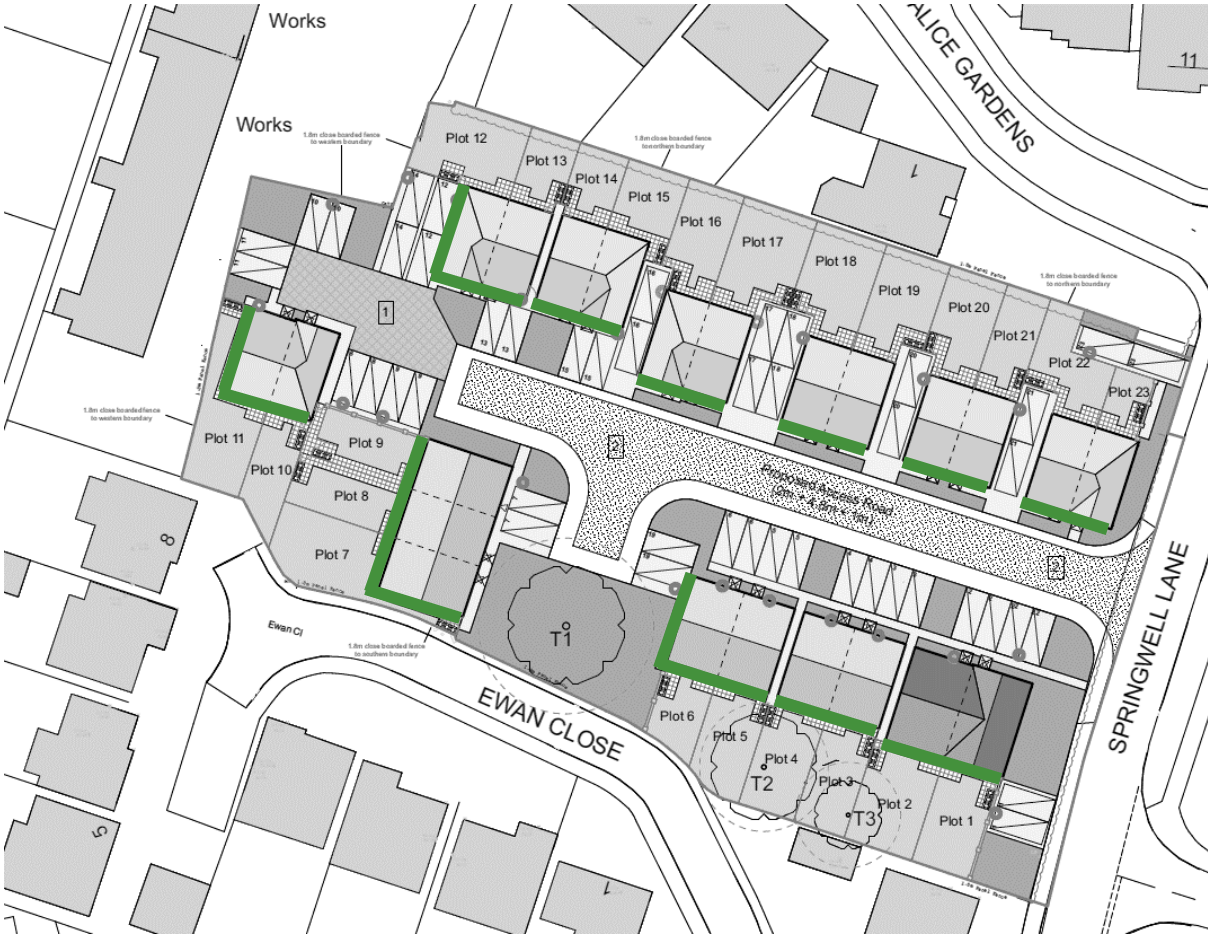


Fig 6.2 Proposed site layout showing elevations for possible bedroom Part O assessment in green

6.3.3 Given the small exceedance, relatively straightforward measures are likely to be suitable in most cases, such as using side-hung windows orientated such that they open away from the M1 motorway.

6.4 Acoustics, Ventilation and Overheating

6.4.1 The situation at night has already been considered in section 6.3 above.

6.4.2 During the day, ambient noise levels are 53 dB $L_{Aeq,\ 16\text{-}hour}$ or less. With reference to Appendix A.3, these noise levels indicate that use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect. Therefore, further assessment or mitigation is not required.

7 Conclusion

7.1 A noise survey has been conducted at the site proposed for residential development. Noise levels are entirely dominated by the M1 motorway, located approximately 370 m west of the site at its closest.

7.2 Noise levels are not particularly high, so standard thermal double glazing and standard trickle vents are sufficient to ensure suitable internal noise levels when windows are closed and whole dwelling background ventilation is provided.

7.3 However, under certain wind conditions, night-time noise levels are marginally above a threshold which indicates that further assessment of bedrooms may be required in relation to Part O of the Building Regulations. Locations where this may be the case have been identified in section 6.3 of this report.

7.4 Although industrial noise is not dominant and is considered a low risk, acoustic screening has been recommended in section 6.1 of this report as a precautionary measure, to account for possible variation of industrial noise.

7.5 Taking account of the aforementioned matters, the site is considered suitable for residential development.

Appendix A - 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:

Daytime external free field noise level, dB (07:00-23:00)	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,\ 16\ hour}$		
≤ 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.1 AVO Level 1 assessment thresholds for road traffic noise; 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 LAeq, 8 hour but the typical maximum noise level is 79 dB LAmax then a Level 2 assessment is recommended).

Night time external free field noise level, dB (23:00-07:00)		Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,\ 8\ hour}$	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.2 AVO Level 1 assessment thresholds for road traffic noise; 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 LAeq, 16 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 23:00-07:00	
≤ 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.3 AVO Level 2 assessment thresholds for road traffic noise

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 $L_{Aeq,\ 16\ hour}$ and 30-35 dB $L_{Aeq,\ 8\ hour}$, 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.3 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.3, 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 ≤ 25 dB L_{Aeq}

Living Rooms ≤ 30 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	≤ 25 dB L_{Aeq}
Living / Dining Rooms	≤ 30 dB L_{Aeq}
Bathroom / WC / Kitchen	≤ 45 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 L_{Aeq}
Living / Dining Rooms	35 (±5) dB L_{Aeq}

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 the 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 $L_{Ar,Tr}$ 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:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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.

A.5 ProPG: Planning and Noise

A.5.1 Professional Planning Practice Guidance (ProPG) on Planning and Noise was published jointly in 2017 by the Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health.

A.5.2 Of particular relevance to this site is the statement in the ProPG that when undertaking a noise risk assessment, the applicable noise level is the combined free-field noise level from all sources of transport noise, and may also include industrial/commercial noise where this is present but is not dominant. It also states that the judgement on whether to undertake a BS 4142 assessment to determine dominance should be proportionate to the level of risk – and in low-risk cases a subjective judgement of dominance, based on the degree of audibility, would normally be sufficient.

Appendix B - Survey Data

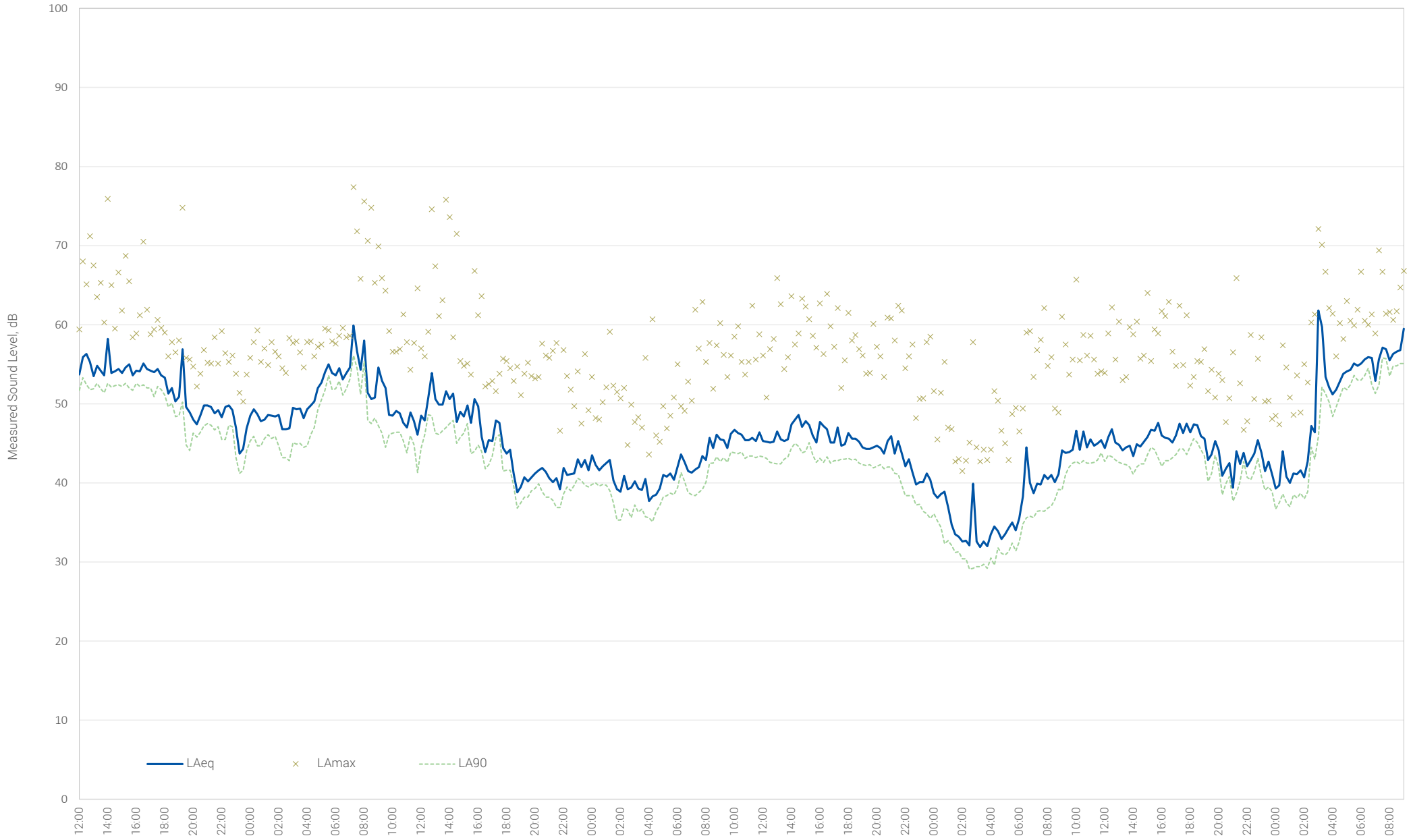
Measured Sound Level Histories

by acoustics

Figure 23-0030-H1

Sound Level History at Position N1

Springwell Lane, Whetstone

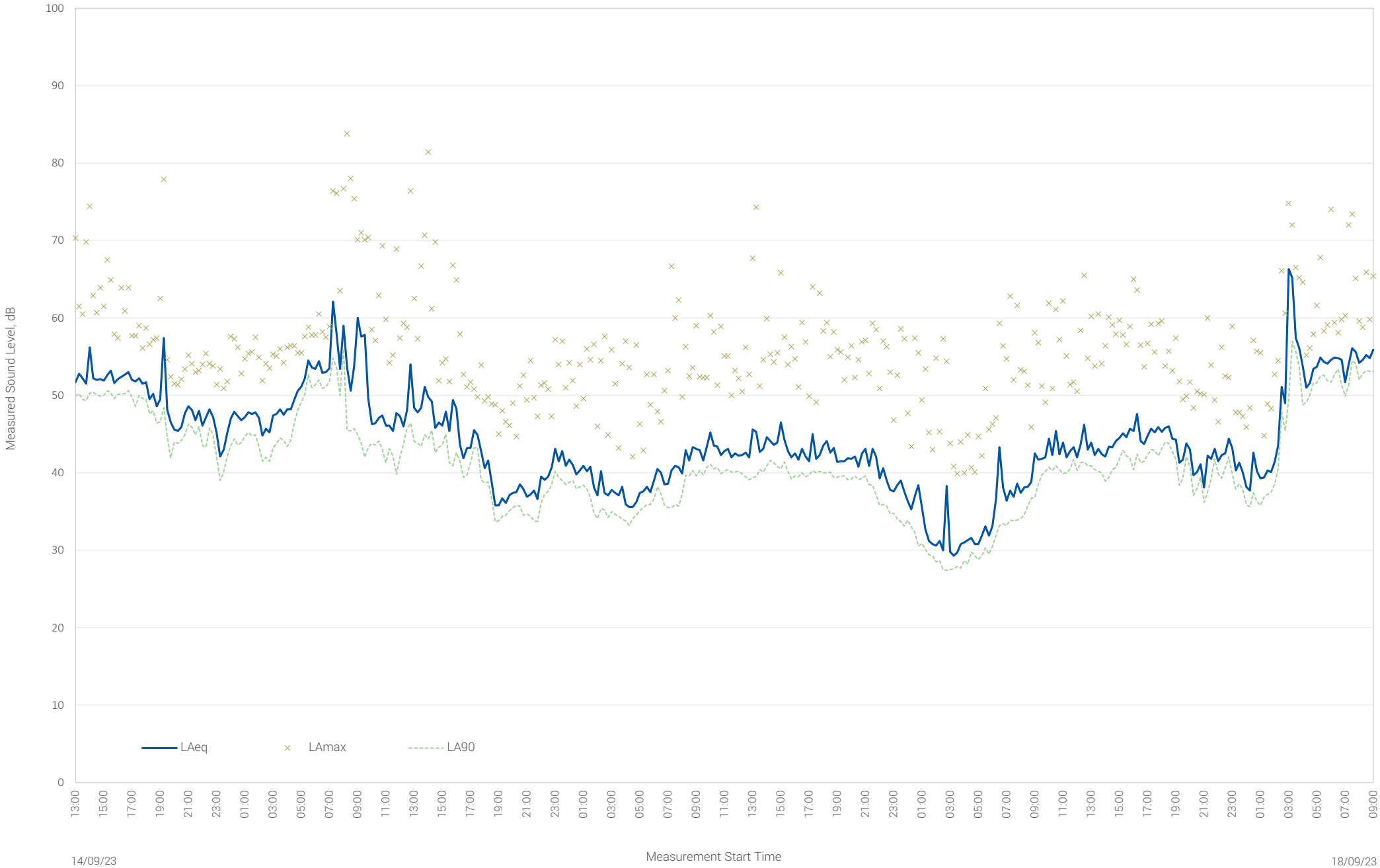


by acoustics

Figure 23-0030-H2

Sound Level History at Position N2

Springwell Lane, Whetstone



14/09/23

Measurement Start Time

18/09/23

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.

$L_{Ar,Tr}$: 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