RSK Acoustics

1&2 Longcroft Green, Welwyn

Planning Noise Assessment

Report 206/0491/R1

1&2 Longcroft Green, Welwyn

Planning Noise Assessment

Report 206/0491/R1

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0	1st Issue	27 April 2022	James Whiddett-Turle	Lee Montague

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Planning Noise Assessment

1 Introduction

1.1 Planning Permission is sought for the development of land at 1&2 Longcroft Green, Welwyn to include a number of dwellings.

1.2 RSK Acoustics have been commissioned to undertake surveys to quantify noise and vibration levels from the nearby railway lines and general noise climate at the site; as well as to assess noise and vibration levels against relevant national and local planning policy and guidance.

1.3 This report documents the methodology and results of the survey, the subsequent assessment and any necessary mitigation measures required to meet noise and vibration criteria.

2 Site Description

2.1 The site is located on land at 1&2 Longcroft Green, Welwyn at the end of Longcroft Green itself, a short, single-tracked access road to other residences. The site and surrounding area can be seen in attached site plan figure 206/0491/SP1.

2.2 The site is bound to the south by residences along Stanborough Mews, to the west by residences along Longcroft Green with the A6129 beyond. The A6129 reaches a roundabout to the north west of the site and continues along the northern boundary of the site and is a heavily trafficked road.

2.3 Railway lines lie adjacent to the site along the eastern boundary at a lower ground level than the site, running under a bridge beneath the A6129. The railway lines were observed to be in frequent use while on site.

3 Planning and Noise and Vibration Criteria

3.1 **Noise**

Local Planning Policy

3.1.1 The Welwyn Hatfield District plan was adopted in 2005 and is the current Local Plan in use. Local planning Policy R19 'Noise and Vibration Pollution' states:

"Proposals will be refused if the development is likely:

To generate unacceptable noise or vibration for other land uses; or

To be affected by unacceptable noise or vibration from other land uses.

Planning permission will be granted where appropriate conditions may be imposed to ensure either:

An adequate level of protection against noise or vibration; or

That the level of noise emitted can be controlled.

Proposals should be in accordance with the Supplementary Design Guidance."

3.1.2 The policy does not include specific technical performances, therefore we look towards national planning guidance and other relevant technical standards.

National Guidance and Policy and Industry Policy

3.1.3 Relevant National Planning Policy and Guidance is set out within the NPPF[1], NPSE[2] and PPG[3], all of which are described in more detail in attached Appendix A, as well as the AVO[4] and Part O of the Building Regulations.

Internal Noise Criteria

3.1.4 Using the above noted planning guidance along with the technical criteria set out in BS 8233:2014[5], internal criteria have been set. These can be seen in the table below:

Activity	**Location**	**07:00 to 23:00**	**23:00 to 07:00**
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

T1 Internal Noise Level Criteria

3.1.5 The previous edition of BS8233 included quantitative guidance with respect to night-time L_{Amax} noise levels in bedrooms. BS8233:2014 does not provide such guidance, however in paragraph 7.7.5.1.1 it is noted that the recommendations for ambient noise in hotel bedrooms are similar to those for living accommodation and Table H.3 in Annex H.3 gives example night-time L_{Amax} limits in hotel bedrooms of 45-55dB.

[1] National Planning Policy Framework
[2] National Policy Statement for England
[3] Planning Practise Guidance
[4] Acoustics, Ventilation and Overheating 2020
[5] British Standard 8233:2014 Sound Insulation and Noise Reduction for Buildings

3.1.6 The lower limit of 45 dB L_{Amax} is to be applied for maximum levels of typical night-time events, in line with WHO Night Noise Guidelines and ProPG.

External Noise Criteria

3.1.7 Aspirational limits have been set for private external amenity areas of 55dB $L_{Aeq,T}$. This is as per BS 8233:2014 upper guidance for gardens. We highlight that for small balconies BS 8233 notes that "noise limits should not be necessary".

3.2 Vibration

3.2.1 Guidance on acceptable levels of vibration in residential buildings can be found in BS 6472:2008[6]. The standard considers the human response to vibration in buildings, in the frequency range of 0.5 Hz to 80 Hz.

3.2.2 BS 6472 uses the concept of Vibration Dose Values (VDVs) to consider the likely impact of vibration upon people.

3.2.3 BS 6472 gives the following guidance on VDVs affecting residential properties:

Place	Low probability of adverse comment [1]	Adverse comment possible	Adverse comment probable [2]
Residential, 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential, 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

T2 VDV ranges and relationship with probability of adverse comment
[1]Below these ranges adverse comment is not expected
[2]Above these ranges adverse comment is very likely

3.2.4 In our assessment we have measured ground-borne vibration from continuous logging of all train passbys at site during both daytime and night time periods.

[6] British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings (vibration sources other than blasting)

4 Noise and Vibration Survey

4.1 Methodology and Instrumentation

4.1.1 Unattended noise measurements were taken at two positions on site; which can be seen in the attached site plan 206/0491/SP1 and described below:

- MP1 – 1.5m above local ground level along the eastern boundary of the site in full view of the adjacent railway lines.
- MP2 – Approximately 2m above local ground level at the north eastern corner of the site in full view of the A6129 and adjacent railway lines.

4.1.2 Measurements were undertaken between 17:45 on 17th March and 15:45 on 21st March 2022. These were made in the L_{Aeq}, L_{A90} and L_{Amax} indices (see the Glossary of Acoustic Terms for an explanation of the noise units used).

4.1.3 Vibration measurements were undertaken at a position adjacent to MP1 and is also shown in attached site plan 206/0491/SP1 as VP1.

4.1.4 Measurements were undertaken using the equipment listed in table T3 below:

Item	Manufacturer	Type
Sound Level Analyser	Norsonic	118
Acoustic Calibrator	Norsonic	1251
Weatherproof windshield	Norsonic	1212
Sound Level Analyser	Rion	NL-52
Acoustic Calibrator	Rion	NC-74
Weatherproof windshield	Rion	WS-15
Ground borne Vibration Monitor	Rion	XV-2P
3-axis Accelerometer	Rion	PV-83C

T3 Equipment used during unattended survey.

4.1.5 The vibration monitor was installed on a mounting plate conforming to DIN 45669-2 standards, fixed via spikes in intimate contact with the ground; the accelerometer aligned with the direction of the railway lines.

4.1.6 The microphones were fitted with weatherproof windshields and the sound level meters were calibrated before and after the survey to ensure a consistent and acceptable level of accuracy was maintained throughout. No significant drift was noted to have occurred.

4.1.7 The weather during the set up and collection of the equipment was noted to be of clear skies, mild temperature, little to no breeze and dry roads. Publicly available data suggests the weather remained the same for the survey duration.

4.1.8 Frequent rail traffic noise was noted to dominate the noise climate across the site, with road traffic noise from the A6129 present.

4.1.9 Temporary maintenance works to the railway were carried out on 20th March 2022, which can be seen illustrated in time history graphs 206/0491/TH1&TH2. As such, the period affected (found to be between 0100 on 20th March and 0400 on 21st March) has been removed and not considered within our assessment.

4.2 Noise Results

4.2.1 The survey results can be seen in the attached time history graphs 206/0491/TH1&TH2 for position MP1 and MP2 respectively. The day and night-time noise levels at MP1 across the full survey are presented in table T4 below:

MP1	**Daytime (0700-2300)**	**Night-time (2300-0700)**	
	$L_{Aeq,16hr}$	$L_{Aeq,8hr}$	$L_{Amax,F}$ +
17th March	67*	60	84
18th March	67	60	83
19th March	66	60*	77*
20th March	N/A**	62*	82*
21st March	67*	-	-

T4 Representative $L_{Aeq,16hr}$, $L_{Aeq,8hr}$ and L_{Amax} noise levels at MP1
+10th highest 1-minute $L_{Amax,F}$
*full period not measured
**period removed due to temporary railway maintenance works

4.2.2 The day and night-time noise levels at MP2 across the full survey are presented in table T5 below:

MP2	Daytime (0700-2300)	Night-time (2300-0700)	
	$L_{Aeq,16hr}$	$L_{Aeq,8hr}$	$L_{Amax,F}$ [+]
17th March	71*	65	88
18th March	72	64	88
19th March	71	65*	86
20th March	N/A**	68*	87
21st March	72*	-	-

T5 Representative $L_{Aeq,16hr}$, $L_{Aeq,8hr}$ and L_{Amax} noise levels at MP2
[+]2nd-4th highest 15-minute $L_{Amax,F}$ as appropriate typical noise level
*full period not measured
**period removed due to temporary railway maintenance works

4.3 Vibration Results

4.3.1 At VP1, of all three axes measured, the z axis levels were found to be the dominant axis of vibration. The results of the VDV measurements in this axis are therefore presented in the table below:

Date	Vibration Dose Value $ms^{-1.75}$	
	Daytime (0700-2300)	Night-time (2300-0700)
	$VDV_{d,16hr}$	$VDV_{d,8hr}$
17th March	0.233*	0.131
18th March	0.259	0.119
19th March	0.263	0.197*
20th March	N/A**	0.185*
21st March	0.312*	-

T6 Measured VDV at VP1
*full period not measured
**period removed due to temporary railway maintenance works

5 Noise Assessment

5.1 Overview

5.1.1 Octave band sound levels have been assessed at the proposed dwellings as shown on the layouts provided by *Richard Morton Architects* (ref: 192-102_ Proposed Site-20220207).

5.1.2 Living room and bedroom dimensions and areas of glazing have been taken from the layouts in the same provided drawing pack.

5.1.3 Distance corrections have been applied to the measured levels as appropriate in order to account for the locations of the proposed façades.

5.2 Internal Noise Levels

Façade and Roof Construction

5.2.1 We have been informed that the proposed façade constructions are that of a typical cavity masonry construction and the roof is to be typical timber rafter with clay tiles. These constructions have been considered as part of our assessment of levels of noise ingress. This does not preclude a change in such constructions, but if lightweight materials are proposed in place, then the assessment may require revision.

Glazing

5.2.2 It will be necessary to provide suitable glazing to ensure that the internal noise criteria can be achieved. Ventilation will be provided mechanically; however, glazing can remain operable at the user's discretion.

5.2.3 In order to achieve the internal noise level criteria, the following sound reduction performances are proposed for different areas of the site, to be achieved as a minimum by the glazing system as a whole.

Glazing Type *Indicative Build-up*	**Sound Reduction Indices *R* across Octave Band Centre Frequency (Hz)**						***R*$_w$**
	125	**250**	**500**	**1k**	**2k**	**4k**	
Glazing Type 1 *6mm glass, 12-24mm air gap, 4mm glass*	22	22	28	39	39	42	**33**
Glazing Type 2 *10mm laminate glass, 12-24mm air gap, 6mm laminate glass*	26	30	35	41	39	46	**38**
Glazing Type 3 *14.8mm laminate glass, 24-48mm air gap, 12.8mm laminate glass*	38	41	46	51	53	57	**50**

T7 Required Sound Reduction performance from the proposed glazing systems

5.2.4 The sound reduction performances quoted in table T7 above are to be achieved by the glazing system taken as a whole and in its installed condition. The specification therefore applies to the glazing and all seals on any operable parts of the system and any required ventilation or condensation control mechanisms. This list is not exhaustive; no part of the windows shall cause the above figures not to be achieved.

5.2.5 The glazing systems set out in table T7 are indicative of build-ups expected to be suitable to provide the required sound reduction performance. However, the performance requirements set out take precedence over the glazing build-up. Any specified solution should be confirmed to achieve the required performance as discussed in the above paragraph, by means of suitable laboratory or on-site test data from other applications.

5.2.6 The glazing types set out above are required in the locations set out in table T8 below:

Glazing Type	**Proposed Location**	
	House	**Flats**
Glazing Type 1	Kitchen/Dining Room Living Room	-
Glazing Type 2	Bedrooms	Living/Dining Rooms
Glazing Type 3	-	Bedrooms

T8 Glazing Type Locations

Ventilation

5.2.7 We have been informed that mechanical ventilation is to be installed in both the flats and the single dwelling. This will remove the need to rely upon trickle ventilators to provide

background ventilation or upon openable windows to provide background and rapid/increased ventilation to the residences. The system supplied should utilise continuously operating fans with a user operated setting to allow an increased ventilation rate when desired. It is anticipated that ventilation systems complying with the requirements of Building Regulations Approved Document F 2010 System 4 (i.e. MVHR) would be used.

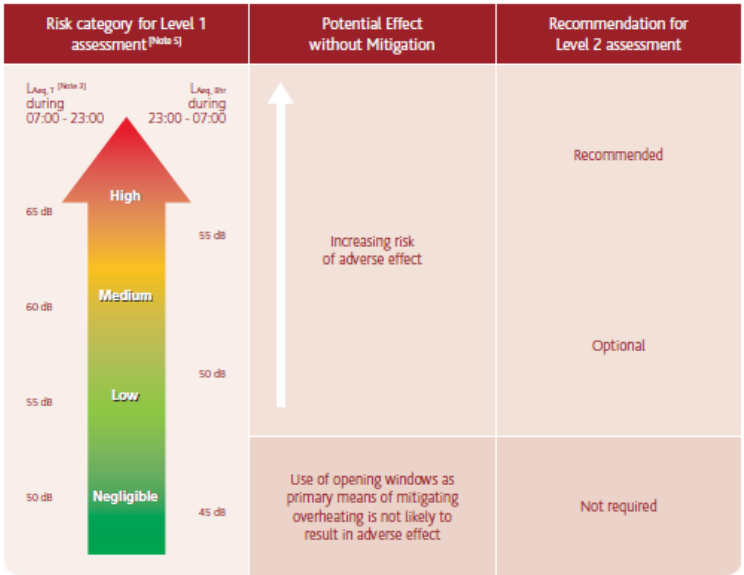
5.2.8 Atmospheric air intake and outlet ductwork terminations must not cause the internal noise criteria to be exceeded due to external noise intrusion. Concealing ductwork above an imperforate plasterboard ceiling (nominal 10kg/m^2) and potential inclusion of in-duct attenuators is expected to be sufficient. This can be reviewed once the very specific MVHR units and ductwork routes are established.

5.2.9 All mechanical ventilation systems should be designed to achieve noise levels inside of no more than NR25 in bedrooms and NR30 in all other habitable rooms under background ventilation mode, with a relaxation afforded for temporary boost increased ventilation rate.

5.2.10 In this case, windows can remain openable for times when purge ventilation is required (purge ventilation being a specific condition as set out in Approved Document F i.e. fume or odour / burnt food smell extraction). Under such specific conditions noise limits need not apply.

5.3 Overheating Conditions

5.3.1 A Level 1 AVO assessment has been carried out in accordance with the guidance detailed in Appendix A. This assessment takes into consideration the worst-case day and night-time noise levels at each assessment position. The outcomes of this assessment are compared against the AVO Level 1 risk assessment tool below. The 'risk' here is applied to relate the potential for issues to arise in respect to the levels of noise affecting receptors when overheating control is provided via open windows.



Level 1 AVO assessment

5.3.2 The results of the assessment at relevant locations are shown below:

Location	Noise Level, dB $L_{Aeq,T}$		AVO Level 1 Risk	
	Day ($L_{Aeq,16hr}$)	Night ($L_{Aeq,8hr}$)	Day	Night
House facing railway	64	59	Medium/High	High
Flats facing railway/road	67	60	High	High

T9 AVO Level 1 Assessment

5.3.3 It can be seen that during the day and night, the façades most exposed to the road and railway are categorised as 'High' risk following guidance in the AVO and so a Level 2 assessment would be 'recommended'. We also note that consideration should be given of the guidance in *Approved Document O*.

5.3.4 When considering the noise to the façades of each building, the assessed night-time internal noise levels considering a partially open window (i.e. 12-15 dB reduction) would be above the guidance value within *Approved Document O* (40 dB $L_{Aeq,8hr}$ and *55* dB L_{AFmax}), where it says any overheating assessment should then be made considering the windows likely to be closed. Measures to mitigate the initial risk of overheating should therefore be considered for these properties such they do not regularly reply on openable windows for the control of chronic overheating.

Mitigation

5.3.5 An overheating assessment has not yet been undertaken. At the time one is, the specific suite of mitigation measures can be fully determined, however the below sets out guidance and measured intended for introduction for this scheme to reduce the potential for overheating.

5.3.6 We highlight the following items from *Approved Document O* and the AVO guidance:

- *Approved Document O* gives a number of examples of mitigation to reduce potential overheating, including glass with higher G values and use of shading (such as shutter or external blinds).
- The AVO guidance states in section 2.20 that 'mechanical ventilative cooling' is one of three typical options to combat overheating.

5.3.7 The following measures will be introduced as part of the scheme:

- The introduction of 'mechanical ventilative cooling' in the form of the MVHR ventilation system to have a manual 'boost' mode to increase ventilation to higher rates;
- Glazing with a good G value to limit solar gain.

5.3.8 Other measures such as the use of blinds can be considered as part of a more detailed overheating assessment.

5.3.9 With the design of the scheme including measures to combat overheating without relying on openable windows (although windows should be openable for times that purge ventilation is necessary), we suggest this is acceptable in planning terms as the approach is consistent with the guidance of *Approved Document O* of the Building Regulations and the AVO guidance. We restate that background ventilation will also be provided by MVHR units to ensure requirements of *Approved Document F* of the Building Regulations are also met with windows closed and adequate ventilation provided.

5.4 External Noise Levels

House

5.4.1 Within the garden proposed for the house, external noise levels are calculated to be higher than the aspirational target of 55 dB $L_{Aeq,16hr}$ from BS8233 and WHO guidance.

5.4.2 It is recommended that a close-boarded fence is installed along the boundary such that it provides a screen to the external amenity areas in such a way as depicted in blue below:

5.4.3 The close-boarded fence must be a minimum of 1.8m in height and a minimum of 10kg/m^2 mass per unit area over the full area of the fence and duration of its design life. The fence must be of imperforate construction and the joints of any butting or overlapping components must be ensured to be well sealed to prevent leakage.

5.4.4 Examples of manufacturers of imperforate close-boarded fences are Jacksons Fencing[7], Newton and Frost Fencing Ltd[8] and Gramm Barriers[9]. This is not an exhaustive list and other manufacturers may also have appropriate systems for use in this case.

5.4.5 With this acoustic fence in place we would expect the upper criterion of 55dB $L_{Aeq,16h}$ to be met in the garden.

Flats

5.4.6 Along the proposed balconies associated with the flats of the development, due to proximity of the road and railway, noise levels are higher than the recommended design target for external amenity areas of 55 dB $L_{Aeq,16hr}$ from BS8233:2014.

5.4.7 However, BS8233 states that *"small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses."*

5.4.8 Planning Practice Guidance states:

"The noise impact may be partially off-set if the residents of those dwellings have access to…:

- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;*
- *a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)."*

5.4.9 It is suggested that the balconies are such that they would be considered small in line with BS8233 and that noise limits are not necessary. Furthermore, in line with PPG guidance, it is suggested that the use of *Cassie's Field* to the east is acceptable for use as an external amenity area as it a 5-minute walk from the building.

5.4.10 On this basis, the proposed design is considered to be suitable in terms of external noise levels.

[7] http://www.jacksons-fencing.co.uk/
[8] www.nffltf.co.uk
[9] https://www.grammbarriers.com/

5.5 Planning Summary

5.5.1 With internal noise levels protected in accordance with BS8233 guidance we suggest this satisfies the principles of national planning policy as well as local planning policy R19. With reference to PPG guidance terminology, internal levels with windows closed and adequate ventilation provided should be considered at or below the Lowest Observable Adverse Effect Level (LOAEL) and is therefore acceptable.

5.5.2 For external noise levels, with the garden for the house expected to be within 55dB $L_{Aeq,16h}$ in accordance with BS8233 guidance, we would suggest this meets a level considered LOAEL and therefore complaint with national and local planning policy.

5.5.3 For the flat balconies, although a LOAEL is exceeded, we do not expect the levels to meet that considered to be a Significant Observable Adverse Effect Level (SOAEL). Given guidance in BS8233 notes noise limits to such balconies noise limits should *"not be necessary"* we suggest this satisfies the principles of the NPPF, NPSE and PPG as well as local planning policy. We note that mitigation as described in the PPG in the form of a nearby public park is readily accessible. Therefore, we suggest this is acceptable in planning terms for the given context of flats with small balconies which can be used at the discretion of the occupiers.

6 Vibration Assessment

6.1 Vibration levels measured in the ground at position VP1 have been compared with the criteria set out within BS 6472. It can be seen in our results table T6 that during both the day and the night time, the measured VDVs are at a level within the range of values stated as *"low probability of adverse comment"*.

6.2 It is possible for a building structure to amplify the vibration present in the ground; certain types of foundation can attenuate a proportion of the energy in the ground, meaning that a reduced level of energy will be present in the structure compared to that measured on an open site.

6.3 The Transportation Noise Reference Book (Butterworths, 1987) contains details of typical levels of attenuation that are offered by different types of foundation. Data in respect of typical levels of amplification that can occur with suspended concrete floors are also presented.

6.4 In this instance, we have been informed that the buildings to be constructed on the site would be of a typical cavity masonry construction, one of 3 storeys in height and one of 4 storeys in height; and would likely be installed on small piled foundations.

6.5 Considering the frequencies of excitation in the ground for this site, for a typical single family residence and a small apartment block, the attenuation offered by the foundations would largely counter any amplification caused by the suspended floor structures. While some slight amplification in vibration levels is possible, it is anticipated that levels would remain at or below those where there would be *"low probability of adverse comment"*.

6.6 Accordingly, we conclude that there is no requirement for us to recommend any vibration isolation treatment for the development.

6.7 The assessment has been carried out at a location representing the closest part of the proposed site where it is realistically anticipated that residential buildings would be constructed. At other locations more distant from the railway tracks, the predicted vibration levels would be of a reduced magnitude due to increasing distance from the lines, resulting in additional attenuation of vibration energy. Consequently, the likelihood of any adverse comments of occupants of other parts of the site is further reduced.

6.8 With levels at a low probability of adverse comment, we suggest this is at a level considered to be the LOAEL in PPG planning terminology and therefore complaint with national (NPPF, NPSE, PPG) and local (R19) planning policy.

7 Conclusions

7.1 Planning Permission is sought for the development of land at 1&2 Longcroft Green, Welwyn to include a house and building containing apartments.

7.2 Noise and vibration Surveys have been undertaken at the site and the results summarised in this report.

7.3 A noise ingress assessment has been undertaken against relevant internal noise standards as set out in BS8233. Acoustic sound insulation specifications for the proposed new glazing have been set out.

7.4 It is proposed that the development will benefit from both mechanical ventilation and openable windows. Mechanical ventilation will allow necessary background ventilation rates in accordance with *Approved Document F* of the Building Regulations when windows are closed; as well as providing additional enhanced ventilation rates to combat overheating (in line with a 'mechanical ventilative colling system as noted by AVO guidance). Windows will be openable to allow purge ventilation as required by *Approved Document F* for situations such as fume extraction. Noise limits need not apply under these specific short-term periods.

7.5 With adequate ventilation provided and proposed glazing meeting the specifications set out in this report, the internal amenity of residents will be maintained.

7.6 External noise levels to the proposed garden of the house are assessed to be within BS8233 criteria with the introduction of an acoustic grade garden fence (for which a specification has been provided). To the apartments small balconies are proposed, but BS8233 notes that to such small spaces noise limits should "not be necessary".

7.7 A vibration assessment has been undertaken in accordance with BS 6472, with measured vibration levels found to be within the criteria range for *"low probability of adverse comment"* during both the day and night-time periods.

7.8 With external and internal noise levels adequately controlled and vibration levels considered to have a low probability of adverse comment, this satisfies the requirements of national planning policy (NPPF, NPSE and PPG) and local planning policy R19.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

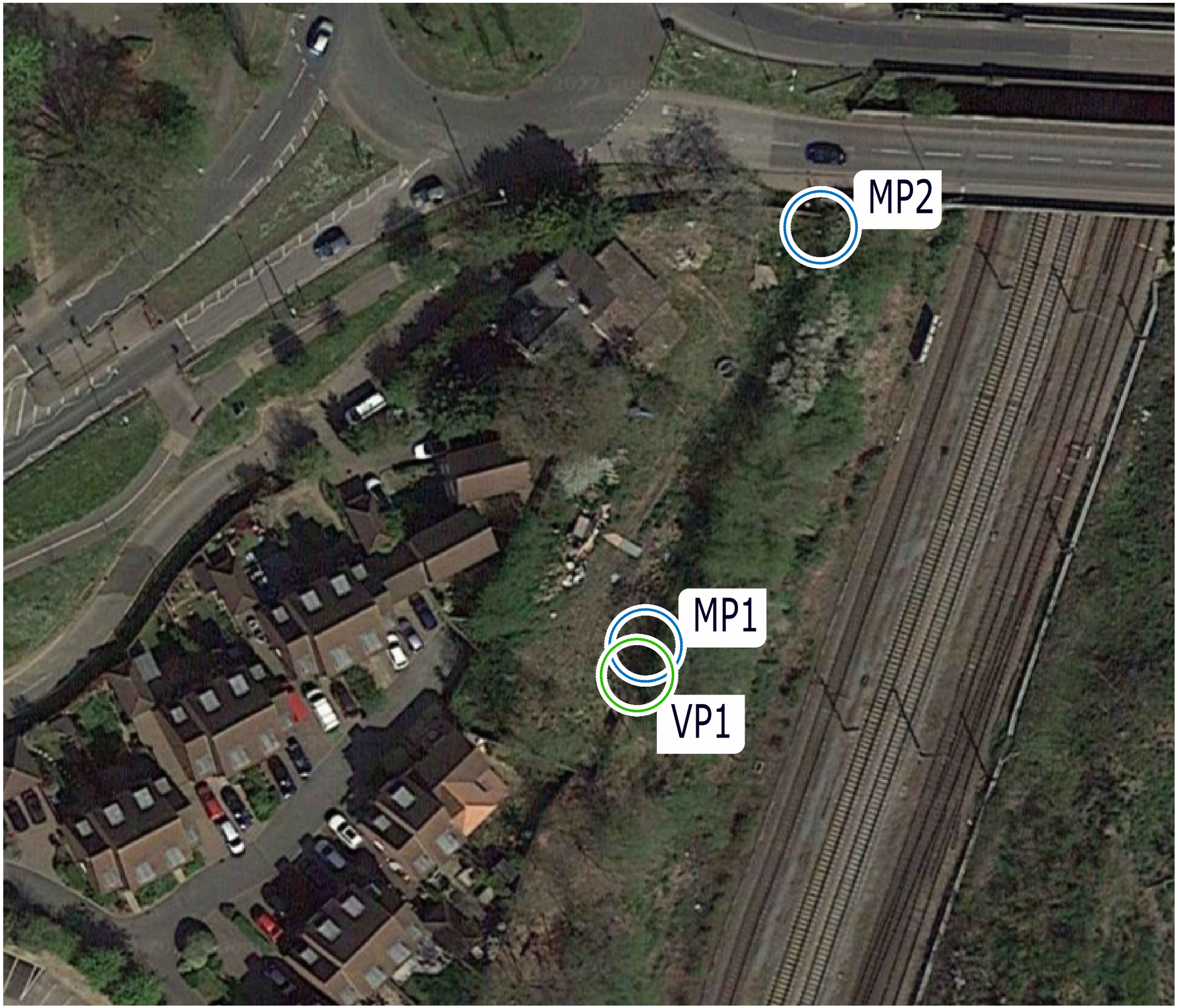


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Figure 206/0491/SP1

Title:

Site Plan
Showing noise and vibration survey measurements

Noise Measurement Position
Vibration Meaurement Position

North

Project:

1&2 Longcroft Green, Welwyn

Date: April 2022

Revision: -

Scale: Not to scale

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Noise Level Time History at Position MP1, 17 to 21 March 2022

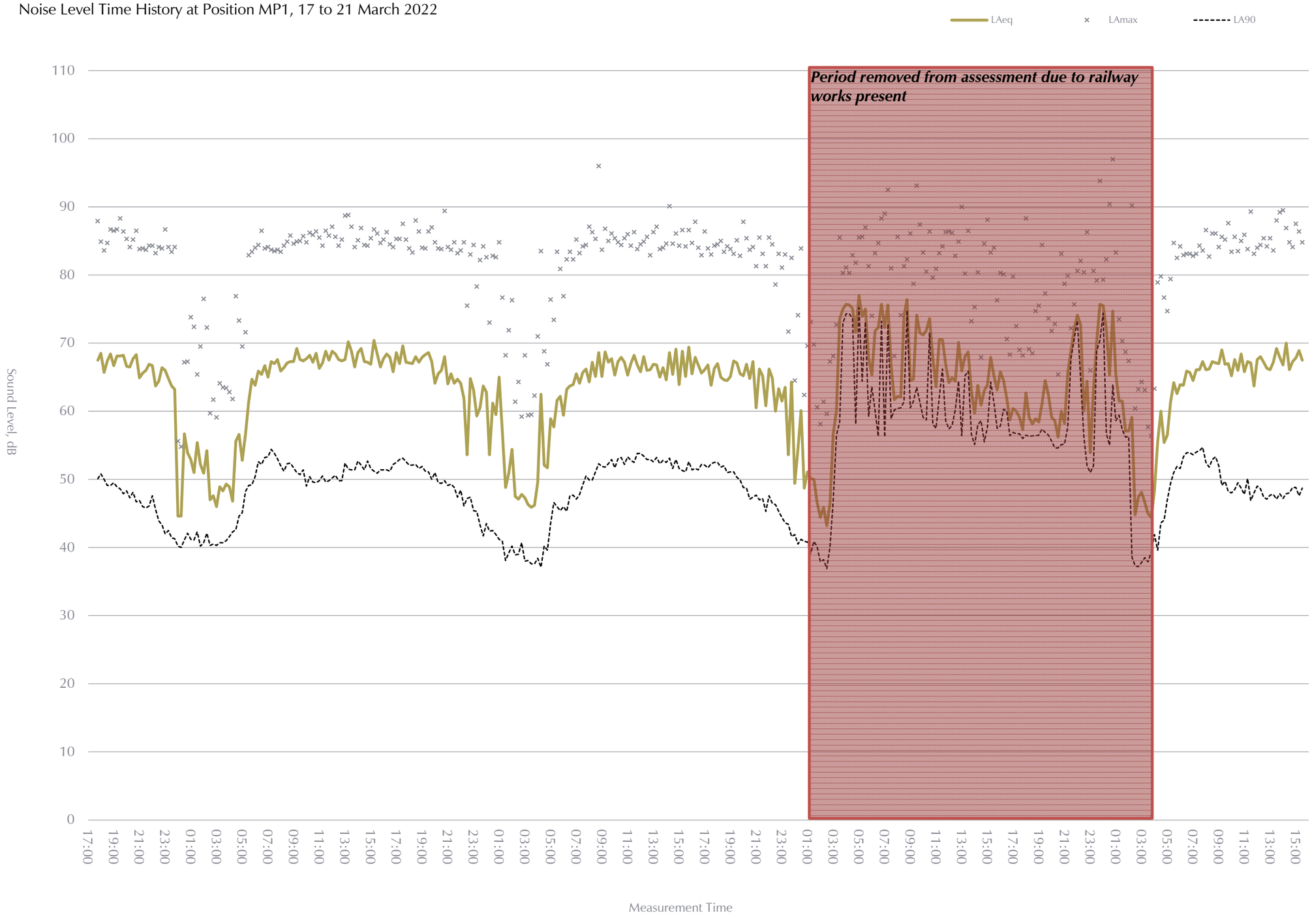

Figure 206/0491/TH01

Noise Level Time History at Position MP2, 17 to 21 March 2022

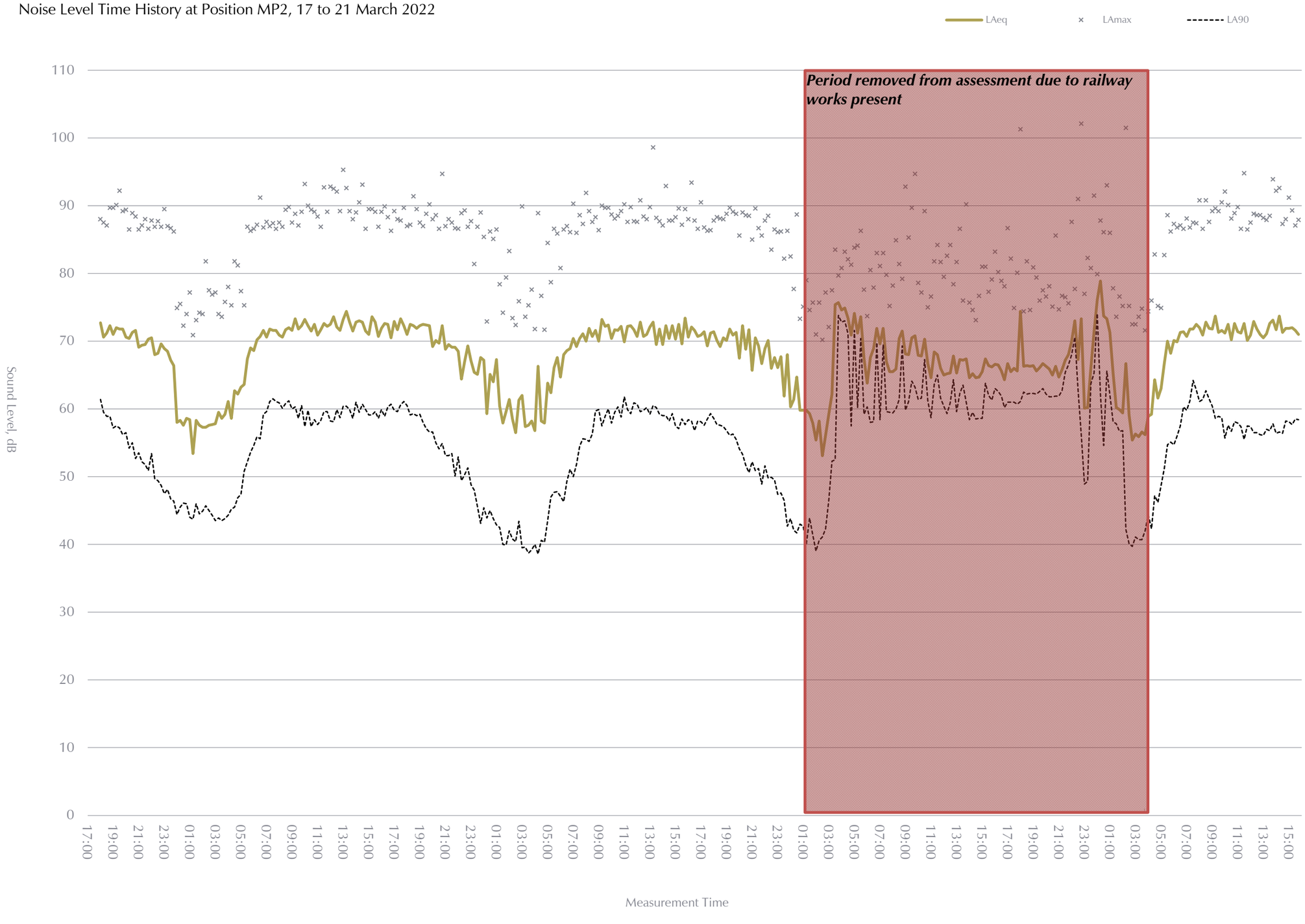

Figure 206/0491/TH02

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Appendix A

Subject:	**Planning Considerations and Guidance**		
Project:	**1&2 Longcroft Green, Welwyn**		
Date:	**27 April 2022**	**Prepared:**	**JW**
Revision:	**0**	**Approved:**	**LM**

This document sets out the various standards and national guidance upon which the design advice has been based.

A1 National Planning Policy Framework (NPPF)

A1.1 The National Planning Policy Framework (NPPF), published in March 2012 and updated in July 2021, is currently the relevant document for defining the national policy toward noise sensitive development. It refers to the Noise Policy Statement for England (NPSE), which is discussed in the subsequent section.

A1.2 The current policy on sustainable development influences the emphasis of any noise assessment. The development of a quiet, rural site is by most measures less sustainable than the development of a site located near existing infrastructure and facilities. The rating of development sites based on prevailing noise levels should reflect this.

A1.3 Specifically, on the subject of noise, paragraph 185 of NPPF states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a. mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b. identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"

A1.4 Paragraph 185 references the Noise Policy Statement for England and no other particular standards.

A1.5 On the general issue of amenity, paragraph 130 states that planning policies and decisions should ensure that developments:

"create places that […] promote health and well-being, with a high standard of amenity for existing and future users…"

A1.6 Further to this, paragraph 174 states that planning policies and decisions should contribute to and enhance the natural and local environment by:

"preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution"

A1.7 A notable inclusion in the July 2018 edition of NPPF is the 'agent of change' principle in paragraph 187. In terms of noise, this principle requires that those proposing a new noise sensitive development incorporate sufficient mitigation such that the operation of existing premises in the area is not unreasonably restricted in order to control noise impact upon the new development:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

A2 Noise Policy Statement for England (NPSE)

A2.1 This NPSE does not set quantitative guidelines for the suitability of noise sensitive development in an area depending on the prevailing levels of noise. Absent, therefore, is reference to specific noise thresholds which determine whether noise sensitive development is suitable and, if so, whether particular mitigation factors need to be considered.

A2.2 Instead, the NPSE sets out three aims:

The first aim of the Noise Policy Statement for England

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

The second aim of the Noise Policy Statement for England

"Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

The third aim of the Noise Policy Statement for England

"Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

A2.3 Paragraph 2.24 states that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life. It also states that this does not mean that such adverse effects cannot occur.

A2.4 In essence, therefore, each development site must be judged on its ability to deliver on each of the stated aims. Quantifying the prevailing noise levels is therefore an essential first step in assessing a given site.

A2.5 The NPSE refers to SOAEL, the Significant Observed Adverse Effect Level. This is defined as the level above which significant adverse impacts on health and quality of life occur. Given the overall thrust of the NPSE, the SOAEL is therefore an important assessment standard although the document also comments that:

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

A2.6 Attention is drawn to the fact that the SOAEL is the level above which significant adverse effects can be observed. Importantly, it should be noted that the overall objective is to avoid or minimise significant adverse impacts; some degree of impact is acceptable and it is not necessary to seek to achieve no impact at all.

A3 Planning Practice Guidance (PPG)

A3.1 The Department for Communities and Local Government 'Planning Practice Guidance' (PPG) was published on 6 March 2014 and updated in July 2019.

A3.2 The PPG on Noise expands upon the NPPF and NPSE and sets out more detailed guidance on noise assessment. Like the NPPF and NPSE, the guidance does not include any specific noise levels but sets out further principles that should underpin an assessment.

A3.3 The PPG includes a section on noise, which states:

"*Plan-making and decision making need to take account of the acoustic environment and in doing so consider:*

whether or not a significant adverse effect is occurring or likely to occur;

whether or not an adverse effect is occurring or likely to occur; and

whether or not a good standard of amenity can be achieved."

A3.4 It then refers to the NPSE and states that the aim is to identify where the overall effect of the noise exposure falls in relation to Significant Observed Adverse Effect Level [1] (SOAEL), the Lowest Observed Adverse Effect Level [2] (LOAEL) and the No Observed Effect Level [3] (NOEL).

A3.5 The guidance then presents a table, which is reproduced as table 0 overleaf. The implication of the final line of the table is that only the 'noticeable and very disruptive' outcomes are unacceptable and should be prevented. All other outcomes (i.e. all other lines in the table) can be acceptable, depending upon the specific circumstances and factors such as the practicalities of mitigation.

[1] The level of noise exposure above which significant adverse effects on health and quality of life occur.
[2] The level of noise exposure above which adverse effects on health and quality of life can be detected.
[3] The level of noise exposure below which no effect at all on health or quality of life can be detected.

Response	Examples of Outcomes	Increasing effect level	Action
NOEL *(No Observed Effect Level)*			
Not present	No Effect	No Observed Effect	No specific measures required
NOAEL *(No Observed Adverse Effect Level)*			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL *(Lowest Observable Adverse Effect Level)*			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL *(Significant Observed Adverse Effect Level)*			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

AT1 Summary of Noise Exposure Hierarchy (from PPG)

A3.6 Under the topic of further considerations relating to mitigating the impact of noise on residential developments, the PPG states:

"Noise impacts may be partially offset if residents have access to one or more of:

a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling;

a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;

a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or

a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance)."

A3.7 This is not to say that access to the above items is mandatory, rather that it can help to offset any noise impacts.

A4 Internal and External Noise & Vibration Design Criteria

A4.1 **British Standard BS 8233:2014**

A4.1.1 Guideline values for dwellings with respect to internal and external noise levels are included in BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (BSi).

A4.1.2 The standard states 50 dB $L_{Aeq,\,T}$ as being desirable as a steady state noise level not to be exceeded in gardens. It also states 55 dB $L_{Aeq,\,T}$ as an upper guideline value. The time period *T* is usually taken to be the 16 hour day (07:00h to 23:00h).

A4.1.3 Paragraph 7.7.3.2 of the standard goes on to say 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.

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

plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

A4.1.4 It can be seen that external noise levels, especially on small balconies to apartment blocks, are not proposed to be a controlling index by which suitability of a residential site is defined.

A4.1.5 Therefore, when designing noise sensitive developments that incorporate gardens or other external amenity areas, the intent shall be to provide an area for each property in which the noise levels are consistent with these standards. Where these standards cannot be achieved, then reasonable measures shall be employed to provide screening or other forms of mitigation so as to minimise the noise levels in the external amenity areas.

A4.1.6 An important principle here is that sustainable development sites will often be exposed to relatively high levels of environmental noise, and while means are available to insulate internal spaces, they are not always available to protect external spaces. Strict adherence to the enforcement of such external noise criteria would preclude development in the majority of areas considered for development in semi-urban or urban environments or in areas in the vicinity of transportation noise sources. This is why the external standards shall be viewed as targets or triggers of mitigation measures rather than thresholds not to be exceeded in all circumstances.

A4.1.7 Buildings can be designed to achieve specific levels of insulation against external noise. It is reasonable, therefore, to set specific internal noise standards as the test of whether a development satisfies the requirements of the NPPF and the aims of the NPSE. In essence, these require a high quality design that achieves a good standard of amenity.

A4.1.8 Guidance in respect of indoor ambient noise levels is contained in Table 4 of BS 8233:2014 and tabulated below.

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

Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

AT2 Table 4 of BS 8233:2014

A4.1.9 The previous edition of BS 8233 included quantitative guidance with respect to night-time L_{Amax} noise levels in bedrooms. BS 8233:2014 does not provide such guidance, however in paragraph 7.7.5.1.1 it is noted that the recommendations for ambient noise in hotel bedrooms are similar to those for living accommodation and Table H.3 in Annex H.3 gives example night-time L_{Amax} limits in hotel bedrooms of 45-55 dB.

A4.1.10 The WHO study informing the 1999 Guidelines derived the L_{Amax} night time noise standard on the basis of 10 to 15 occurrences per night.

A4.2 ProPG: Planning and Noise (2017)

A4.2.1 ProPG is a guidance document prepared by a working group consisting of representatives of the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH). It provides professional practice guidance on Planning and Noise with regard to new residential development that will be exposed to airborne noise from transport sources. It is also noted that good professional guidance should have regard to any reasonably foreseeable changes to existing, and/or new sources, as well as sources currently effecting the site.

A4.2.2 ProPG provides two stages of assessment, the first being an initial site risk assessment and the second being a full assessment. The second is only necessary when the initial risk assessment and circumstances dictate.

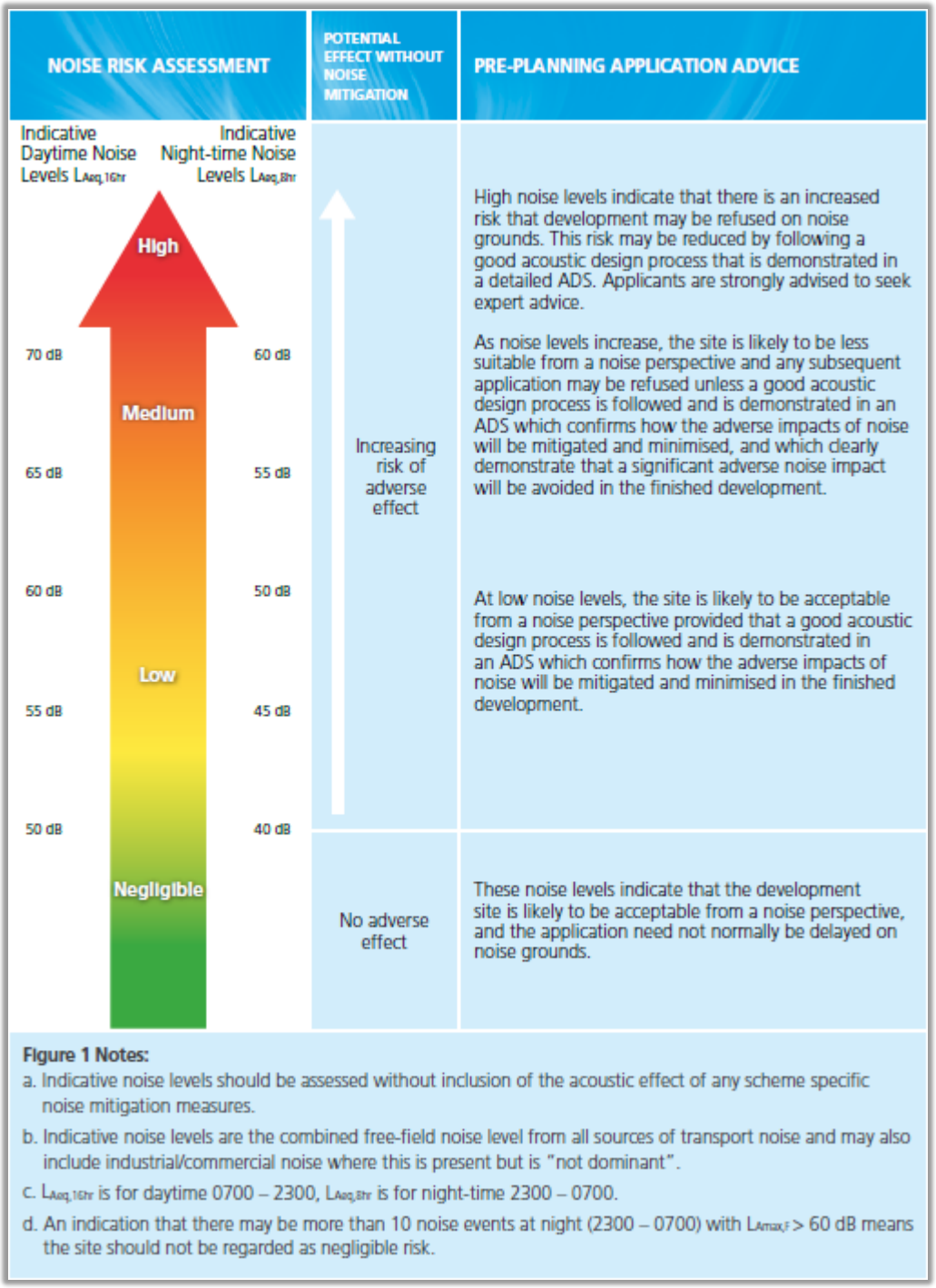
Stage 1: Initial Site Noise Risk Assessment

A4.2.3 ProPG suggests that a Stage 1 initial site risk assessment should be undertaken on all sites at the earliest possible opportunity in order to gauge the potential effect of noise on future residential premises, without the benefit of any noise mitigation measures.

A4.2.4 It is important to note that the initial 'Stage 1' assessment at a proposed residential development is not the basis for the eventual recommendation to the decision maker. It is intended to highlight the importance of good acoustic design within a scheme. For example, a site with a high risk of adverse effect without noise mitigation may not necessarily be unsuitable for development; however, the importance of good acoustic design provided by experts would be critical at such a site, with a detailed acoustic design statement provided.

A4.2.5 ProPG states that a site which displays a low risk of adverse effect without noise mitigation is more likely to be acceptable from a noise perspective, provided that a good acoustic design process is followed, and sites with no risk of adverse effect need not normally be delayed on noise grounds.

A4.2.6 The criteria provided for Stage 1 assessment of the L_{Aeq} noise levels for day and night within the initial site risk assessment are provided below:



A4.2.7 The initial noise risk assessment also considers the effect of L_{Amax} maximum noise levels at night (2300-0700h), where the guidance states:

"An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as a negligible risk."

Stage 2: Overview

A4.2.8 Stage 2 of the ProPG guidance provides a systematic consideration of key elements of acoustic design. The guidance advocates a proportional, risk based approach to the Stage 2 assessment. The Stage 1 risk assessment should inform whether careful consideration is required, with the detailed input of specialist acoustic consultants essential at higher risk sites, or straightforward accelerated decision making potentially possible in relation to lower risk sites.

Stage 2: Element 1 – Good Acoustic Design Process

A4.2.9 ProPG states that a good acoustic design process is an implicit part of achieving the requirements of government noise policy, as set out in the NPSE and NPPF, and outlined in Supplementary Document 1 of the ProPG.

A4.2.10 However, it is also stated that good acoustic design does not simply constitute compliance with recommended internal and external criteria, if the solution adversely affects living conditions within the spaces, and hence the quality of life of the inhabitants. The following example is provided:

"Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided; occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for the approach, is not regarded as good acoustic design."

A4.2.11 Applicants must therefore consider all possibilities for mitigation including but not limited to:

- Checking the feasibility of relocating, or reducing noise levels from relevant sources;
- Considering options for planning the site or building layout;
- Considering the orientation of proposed building(s);
- Selecting construction types and methods for meeting building performance requirements;
- Assessing the viability of alternative solutions;
- Assessing external amenity area noise;
- Examining the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc.

Stage 2: Element 2 – Internal Noise Level Guidelines

A4.2.12 ProPG considers the guidance provided within BS 8233:2014 to be suitable for the assessment of internal noise levels. However, the ProPG provides additional commentary. The following table reproduces the internal ambient criteria provided within Figure 2 of ProPG. The guidance from BS 8233:2014 is displayed in black, with additional comments and criteria from ProPG in blue:

Activity	Location	0700h to 2300h	2300h to 0700h
Resting	Living room	35 dB $L_{Aeq, 16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16h}$	30 dB $L_{Aeq, 8h}$ 45 dB $L_{Amax,F}$ (Note 4)

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A [which advocates reference to available dose-response relationships appropriate for the types of noise source being considered]).

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (see Section 3.D [which states that if certain criteria are fulfilled the noise practitioner should recommend refusal on noise grounds alone, regardless of any case for the development]).

AT3 Table 4 of BS 8233:2014 with ProPG annotations in blue

A4.2.13 It should be noted that the guidance above includes criteria for L_{Amax} noise levels, along with further guidance relating to the assessment of maximum levels in Note 4.

A4.2.14 The ProPG also states in Note 5 that where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed. However, any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position.

Stage 2: Element 3 – External Amenity Area Noise Assessment

A4.2.15 With regard to external amenity spaces, ProPG references the guidance provided within BS 8322:3014, section 6. ProPG presents a statement summarising BS 8233:2014 section 6 which states:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq, 16h}$"

A4.2.16 The standard continues:

"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."

A4.2.17 ProPG also references guidance within the PPG on noise, which states:

"If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended"

A4.2.18 It is highlighted within ProPG that both BS 8233:2014 and the PPG on noise require a decision to be made as to whether or not external amenity areas are intrinsically important to the required design. However, it is noted that the PPG also states that noise impacts may be partially offset if the residents of affected dwellings are provided, through the design of the development or the planning process, with access to alternative spaces as set out in paragraph A3.6 of this appendix.

A4.2.19 ProPG section 2.51 states that Local Planning Authorities (LPAs) will be best placed to provide guidance in relation to what is 'relatively quiet', as the concept will inherently vary between scenarios.

A4.2.20 The advice in section 2.52 of ProPG highlights the increased importance of LPAs protecting publically accessible external amenity spaces in areas that typically exhibit heightened existing noise climates, such as cities, where development is necessary but private external amenity areas below 55 dB $L_{Aeq,16h}$ are not practicable. Publically accessible spaces such as parks and squares in these areas may be providing respite for nearby residents and, therefore, should be protected.

Stage 2: Element 4 – Assessment of Other Relevant Issues

A4.2.21 This section of the guidance relates to all other relevant issues and seeks to build upon relevant national and local planning and noise policies. Examples are provided including, but not limited to, the following:

- Compliance with relevant national and local policy
- Magnitude and extent of compliance with ProPG
- Likely occupants of the development
- Acoustic design v unintended adverse consequences
- Acoustic design v wider planning objectives

A4.2.22 Other issues specific to the site may be added by the LPA, where relevant.

A4.3 The AVO Guide

A4.3.1 The Association of Noise Consultants document *'Acoustics, Ventilation and Overheating Guide'* (AVO) provides guidance for internal noise criteria when additional ventilation is required for thermal comfort.

A4.3.2 A key principle which must be understood is that "Overheating" in the context of the AVO relates to "chronic" overheating. This does not cover overheating during short term heatwaves or similar such events, but rather sustained periods where the internal spaces within a building remain at elevated temperatures.

A4.3.3 Overheating within buildings is a complex problem to measure and analyse and there is no single temperature above which an internal space can be classed as "overheating". The overheating condition is dependent on many factors such as duration, external ambient temperatures and other factors.

A4.3.4 The Chartered Institute of Building Services Engineers (CIBSE) have issued two main tools which are intended to help building designers determine whether internal areas are overheating and to determine thermal comfort (not in relation to acoustics). These are known as TM52[4] and TM59[5].

A4.3.5 Whilst these tools are not directly relevant to acoustics, TM59 is referenced in the AVO as an assessment tool (which would be utilised by services engineers or similar) which can be drawn from to help inform an AVO assessment.

A4.3.6 The three main methods for providing control of overheating provided by the AVO guidance are:

- Passive ventilative cooling – Introducing external air to a space to provide a cooling effect without the use of fans. The most common method is to use open windows but other façade openings can also be used. Note that trickle vents do not enable sufficient airflow to have a significant cooling effect.
- Mechanical ventilative cooling – Using fans to introduce external air to a space to provide a cooling effect. Due to the airflow required, this type of system often involves significant plant and duct size requirements.
- Comfort cooling – Using a mechanical system to cool the air within a space to achieve a user-defined setpoint. This type of system will require some form of mechanical device to cool the air, such as a fan coil unit (FCU), linked to an external condenser unit.

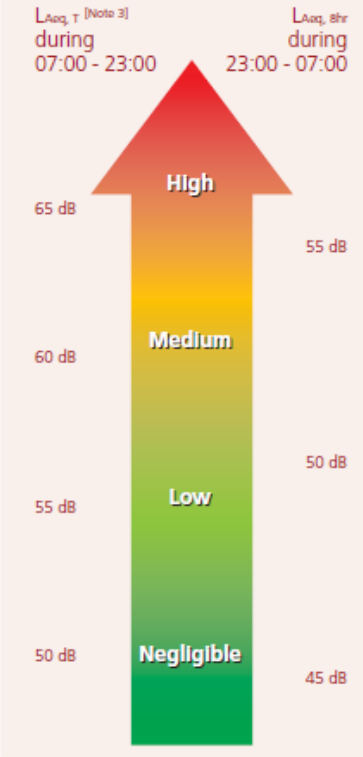
[4] CIBSE TM52: *The Limits of Thermal Comfort: Avoiding Overheating in European Buildings* (2018)
[5] CIBSE TM59: *Design methodology for the assessment of overheating risk in homes* (2017)

A4.3.7 Where windows are opened in order to provide passive ventilative cooling to a residential building, the AVO guidance states that it is reasonable for the internal ambient noise levels to be higher than those set out in BS 8233:2014 for background ventilation:

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

A4.3.8 The guidance suggests an initial 'Level 1' assessment, where day and night-time **external** noise levels are correlated to a number of risk categories ranging from 'Negligible' to 'High'. The "risk" is taken to relate the potential for issues to arise in respect to the levels of noise affecting receptors, when overheating control is provided via open windows.

A4.3.9 Table 3-2 of the guidance, which sets out the Level 1 risk assessment categories, potential effects and recommendations for further assessment is reproduced below (along with its explanatory notes):

<table>
<tr><th>Risk category for Level 1 assessment [Note 5]</th><th>Potential Effect without Mitigation</th><th>Recommendation for Level 2 assessment</th></tr>
<tr><td rowspan="2"> 
</td><td>Increasing risk of adverse effect</td><td>Recommended

Optional</td></tr>
<tr><td>Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect</td><td>Not required</td></tr>
</table>

T1 Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition.

Note 1 - The noise levels suggested assume a steady road traffic noise source but may be adapted for other types of transport. All levels are external free-field noise levels.

Note 2 - The values presented in this table should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships [15, 17].

Note 3 - A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines.

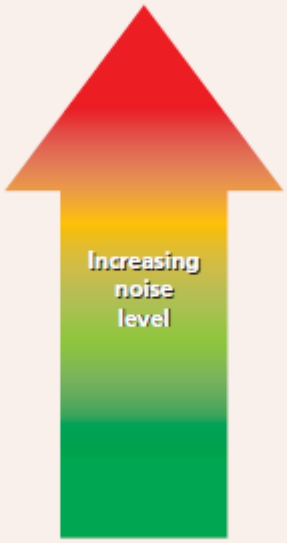
Note 4 - Refer also to references [1, 17, 18, 22] for further guidance regarding individual noise events. Where 78dB $L_{AF,max}$ is normally exceeded during the night-time period (2300 – 0700), a Level 2 assessment is recommended.

Note 5 - The risk of an adverse effect occurring will also depend on how frequently and for what duration the overheating condition occurs. Refer to Figure 3-2.

Note 6 - To evaluate the risk category for a dwelling, all three aspects of external noise exposure (i.e. daytime, night-time and individual noise events) should be evaluated. The highest risk category for any of the three aspects applies.

A4.3.10 If following the initial Level 1 assessment, it is determined that a more detailed Level 2 assessment may be necessary, a more involved and detailed consideration of **internal** noise levels can be undertaken. The Level 2 assessment considers internal noise levels and the proposed façade mitigation measures (including the method of providing cooling). The duration over which overheating may occur is also an important consideration.

A4.3.11 The noise levels within habitable rooms, with the cooling strategy in place, are calculated and compared to the thresholds provided within Table 3-3 "Guidance for Level 2 assessment of noise from transport noise sources relating to overheating condition". This table is reproduced below (again with the associated informative notes):

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{Ar,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{Ar,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response [Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

T2 Table 3-3 Guidance for Level 2 assessment of noise from transport noise sources [note 1] relating to overheating condition.

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

Note 2 - The values presented in this table should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships such as those described in a DEFRA 2014 study [15, 21, 22]. With the exception of individual noise events, the references [15, 21] are based on evidence drawn from external noise levels. There is currently very little robust

evidence linking internal averaged noise levels with health outcomes and occupant behaviour. Internal ambient noise levels would normally be considered for living rooms and bedrooms during the daytime. At night, the levels would normally only be applicable to bedrooms.

Note 3 - A decision must be made regarding the appropriate averaging period to use. The averaging period should reflect the nature of the noise source, the occupancy profile and times at which overheating might be likely to occur. Further guidance can be found within the 2014 IEMA Guidelines.

Note 4 - Refer to references [1, 17, 18, 22] for further guidance regarding individual noise events. The $L_{AF,max}$ indicator associated with the upper category is intended for road traffic; it may be more appropriate to use the "one additional noise-induced awakening" method for noise from rail traffic or aircraft.

Note 5 - The potential for adverse effect will also depend on how frequently and for what duration the overheating condition occurs. Refer to Figure 3-2.

Note 6 - The daytime levels presented in this table may not be appropriate for residential care homes or other situations where conditions for daytime resting are known to be of particular importance.

Note 7 - When evaluating the potential for adverse effect, all three aspects of noise exposure (i.e. daytime, night-time and individual noise events) should be evaluated.

Note 8 - BS 8233 states that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.

Note 9 - It is known that physiological responses do occur at lower levels of L_{AFmax} than 45dB.

A4.3.12 As detailed in Note 5 above, the level of assessed impact varies depending on the duration for which the 'overheating condition' occurs. Figure 3-2 provides qualitative guidance on combined effect of internal ambient noise level and duration for the overheating situation and is reproduced below (notionally referred to as an AVO diagram):

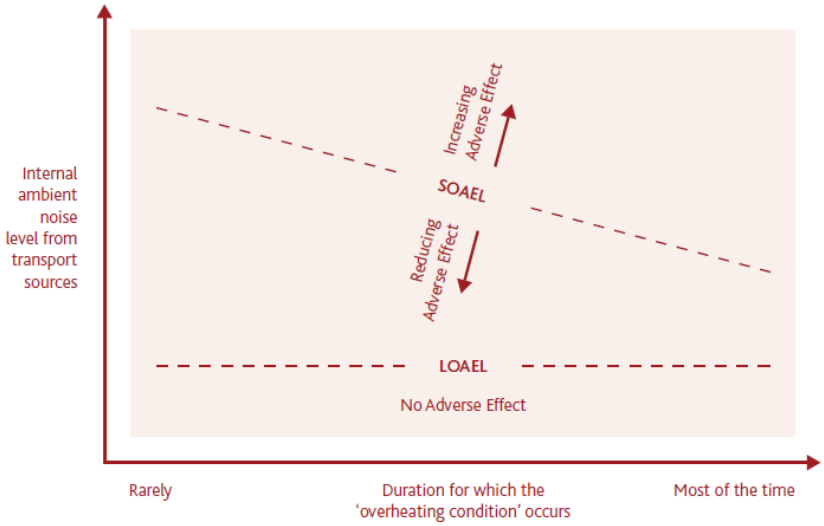


Figure 3-2 Qualitative guidance on combined effect of internal ambient noise level and duration for the overheating situation

A4.3.13 The aim would be to ensure that internal noise levels are mitigated to fall below the Significant Observed Adverse Effect Levels (SOAEL), taking due account of the duration over which overheating occurs. No quantitative guidance is provided in respect to the "Duration" aspect of the plot above, and consultants are required to use professional judgement to determine appropriate levels to be adopted for the SOAEL and Lowest Observed Adverse Effect Level (LOAEL).

A4.3.14 The guidance notes that no specific single noise threshold can be determined, and it suggests each site is considered on its own merits; however, it does indicatively suggest that a range of external noise levels of 53 and 63dB $L_{Aeq,16h}$ daytime and 48 and 55dB $L_{Aeq,8h}$ night time as thresholds of Medium and High risk sites, depending on duration and occurrence of overheating, as well as context.

A4.3.15 The duration for which overheating occurs is clearly a significant consideration. To provide context – a receptor which may be classified as Medium and High risk (in the context of the AVO) at Level 1 assessment stage (using openable windows as a cooling strategy), may in fact be acceptable with no change to the ventilation strategy, providing the overheating condition only occurs rarely.

A4.4 The Building Regulations Part O

A4.1 Approved Document O was released on 15 December 2021 and takes effect on 15 June 2022 for use in England.

A4.2 The approved document gives a *Requirement O1* which aims to protect the health and welfare of occupants of a building by reducing the occurrence of high indoor temperatures. This requirement is as follows:

"(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.

(2) In meeting the obligations in paragraph (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."

A4.3 To meet the above requirement, the standard recommends that a building be designed and constructed to meet both of the following points:

"a. Limiting unwanted solar gains in summer.
b. Providing an adequate means of removing excess heat from the indoor environment."

A4.4 It then goes on to state that compliance with *Requirement O1* can be demonstrated by using one of the following methods:

"a. The simplified method for limiting solar gains and providing a means of removing excess heat.
b. The dynamic thermal modelling method."

A4.5 The simplified method starts by defining the overheating risk category of a new residential building based on location and whether it has cross-ventilation. Based on the risk category it then recommends limiting unwanted solar gains in summer or providing an appropriate means of removing excess heat from the indoor environment.

A4.6 The dynamic thermal modelling method provides a standardised approach to predicting overheating risk for residential buildings using dynamic thermal modelling as an alternative to the simplified method and gives designers more flexibility over the simplified method. It goes on to suggest acceptable strategies for reducing solar gains and removing excess heat.

A4.7 Section 3 of the document addresses whether the overheating mitigation strategy is usable. Regarding noise, Paragraphs 3.2 and 3.3 state the following:

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

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

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

A4.8 Compliance with the Building Regulations Part O document is a statutory requirement. The AVO Guide which is detailed above is not a statutory requirement however it provides guidance on assessing and mitigating overheating.

A4.5 **British Standard BS 6472-1:2008**

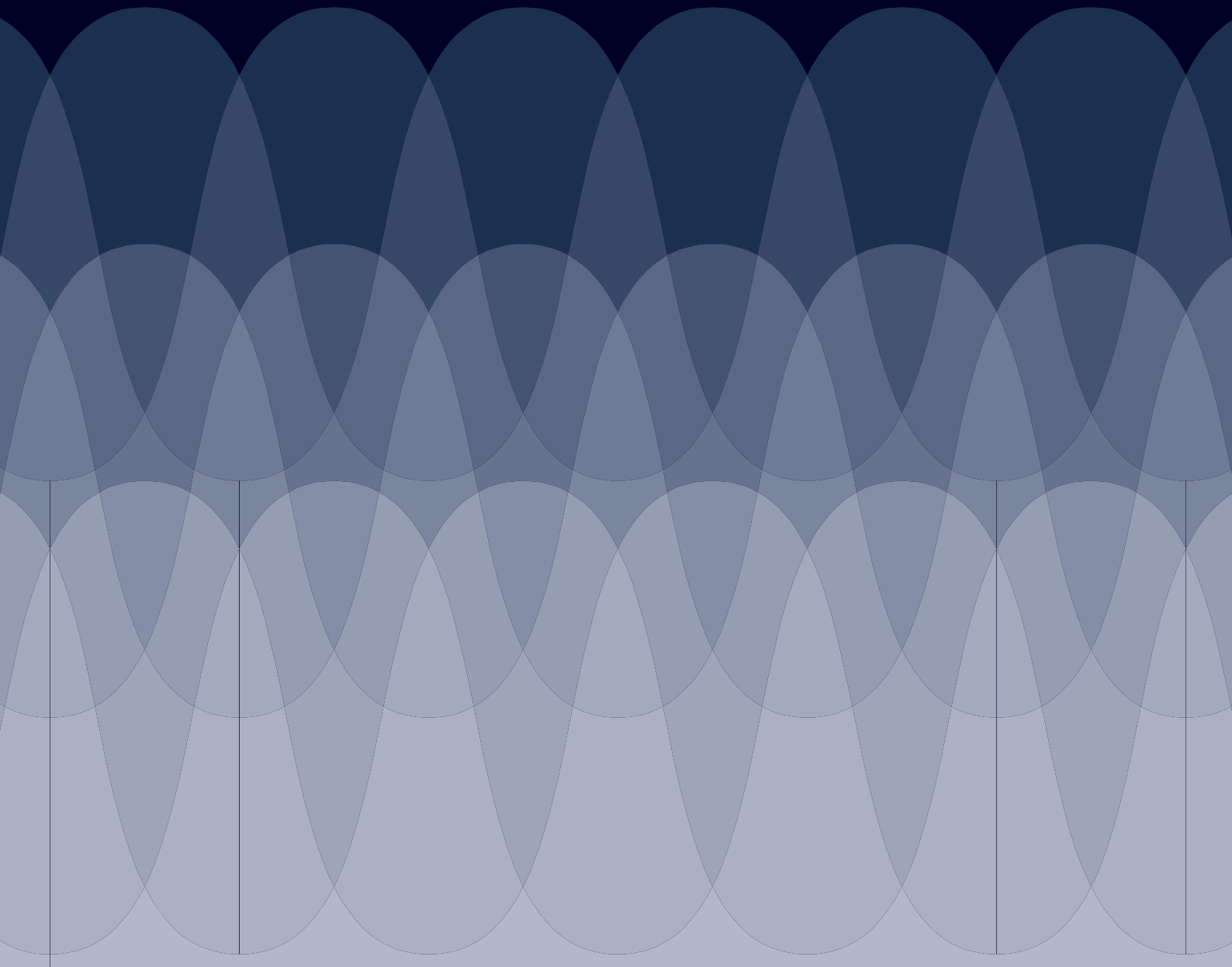
A4.5.1 The two-part standard BS 6472 provided the framework within which vibration in humans should be quantified. Part 1 provides guidance on how people inside buildings respond to building vibration from sources other than blasting and therefore describes how to determine the vibration dose value (VDV) and predicts human response to vibration in buildings over the frequency range 0.5 Hz to 80 Hz.

A4.5.2 Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings are set as:

Place and Time	Low probability of adverse comment, $ms^{-1.75}$	Adverse comment possible, $ms^{-1.75}$	Adverse comment probable, $ms^{-1.75}$
Residential building, 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

AT4 Vibration Dose Criteria Levels

End of Section



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