Residential Noise Assessment

Site Address: Spring Grove Gardens, 50 Paul Lane, Colne Bridge, Huddersfield, HD5 0PU

Client Name: Orange Design Studio Ltd

Project Reference No: NP-009504

Authorisation and Version Control

Revision	Date	Reported By	Checked By
01	14/07/2023	R Whitfield, MSc, AMIOA	S Chesney, MSc, MIOA
02	15/08/2023		

Amendment History

Revision	Summary of Amendments
01	First Draft.
02	Updated after comments from the Client.

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Delivering sustainable development by promoting good health and well-being through effective management of noise.

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a new-build residential dwelling ('the Proposed Development') at Spring Grove Gardens, 50 Paul Lane, Colne Bridge, Huddersfield, HD5 0PU ('the Site').

The site is subject to noise from road traffic emissions and commercial activity associated with the nearby shooting centre. Accordingly, a noise survey has been undertaken to establish the prevailing sound levels at the proposed development. The findings have been subsequently used to assess the suitability of the site for residential use. Measures required to mitigate noise impacts for the proposed development have been assessed in accordance with the relevant performance standards, legislation, policy, and guidance.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Standards, Legislation, Policy & Guidance

The following performance standards, legislation, policy, and guidance have been considered to ensure good acoustic design in the assessment:

- National Planning Policy Framework (2021)
- Noise Policy Statement for England (2010)
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings'
- ProPG: 'Planning and Noise 2017' (including supplementary documents 1 & 2).
- Approved Document O: Overheating (2021)
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide)

Further information on the legislation can be found in Appendix B.

Proposal Brief

The figure below shows the proposed residential dwelling. The area directly north of the dwelling will be maintained as green belt land, with a small external amenity space located along the south and east of the dwelling.

The building will be constructed of cavity masonry with a cladding finish at first-floor level with a pitched warm roof. It is also understood that a MVHR unit will be installed at the site as the primary ventilation strategy.

Drawing Ref No. (20)001 produced by 'Orange Design Studio'

Figure 1 – Proposed Location Plan

2. Environmental Noise Survey

Measurement Methodology

The following table outlines the measurement dates and particulars.

Location	Survey Dates	Measurement Particulars
MP1	05/06/2023 – 06/05/2023	Equipment mounted on a tripod at a height of 1.5m between the existing outbuilding, towards the northern boundary of the development site.
MP2	05/05/2023 – 06/05/2023	Equipment mounted on a tripod at a height of 1.5m between the existing outbuilding, towards the southern boundary of the development site.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:

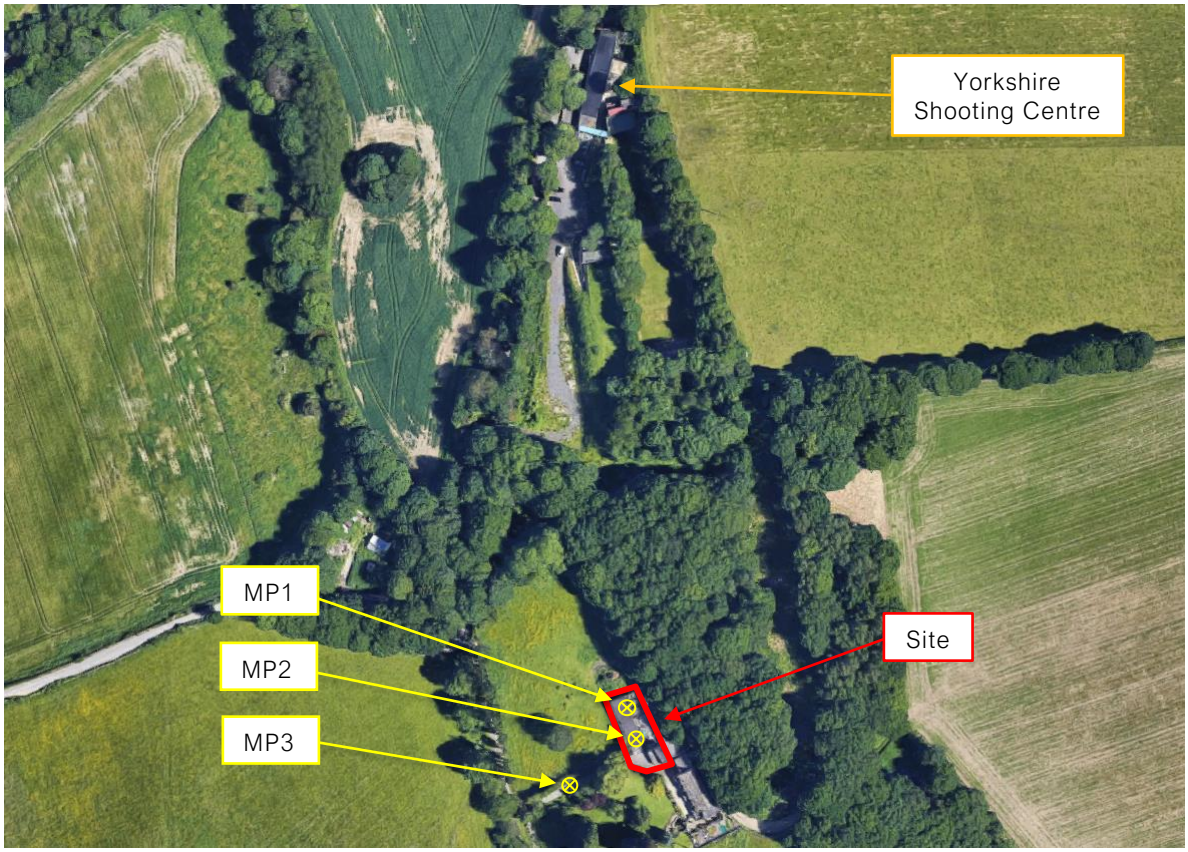

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Figure 2 – Measurement Locations and Site Surroundings

Context & Subjective Impression

The proposed development site is located at Spring Grove Gardens, Colne Bridge, Huddersfield. The area surrounding the site consists primarily of agricultural land in all directions. A single residential dwelling bounds the site to the south and Yorkshire Shooting Centre (YSC) is located approximately 130m to the north. YSC advertises the following operational hours:

- Monday and Wednesday: 07.30 – 22.00
- Friday: 11.00 – 17.00
- Weekends: 13.00 – 17.00.

It is understood that there are 2no. dedicated external shooting areas associated with YSC at approximately 175m and 230m from the proposed dwelling's northern façade. From further analysis of the measured data, it is understood that there was limited activity at the shooting range during the unattended survey.

The acoustic environment in the absence of shooting noise associated with the nearby centre is deemed to be low to moderate in level and the noise profile is dominated by traffic emissions from the local road network including Paul Lane and Bog Green Lane. During the site visits it was noted that road traffic emissions from Paul Lane were most dominant during standard 'rush hour' and Bog Green Lane is heard in the distance.

Environmental Noise Survey Results

The following section outlines the measured sound levels during the unattended survey (i.e., in the absence of noise from the shooting range). The time history results can be found in Appendix D.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$ dB)						$L_{Aeq,T}$ (dB)	$L_{AFmax,1min}$ (dB)
		125	250	500	1k	2k	4k		
MP1	$L_{eq,16hr}$ (Day)	48	41	38	35	37	41	45	--
	$L_{eq,8hr}$ (Night)	33	29	26	23	20	21	29	50
MP2	$L_{eq,16hr}$ (Day)	49	42	40	35	37	44	47	--
	$L_{eq,8hr}$ (Night)	31	28	25	21	18	21	28	50

Table 2 – Sound Level Results Summary

Note: Further analysis of the measurement data shows that noise levels significantly increase during the night-time period from approximately 03:00 hrs. As the measured levels generally only rise within the higher frequency bands, it is believed this is due to birdsong during the dawn chorus and has therefore not been included in the assessment.

3. Noise Break-in Assessment and Sound Insulation Scheme

Internal Noise Level Criteria

The following table outlines the internal acoustic design criteria outlined in BS8233.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35dB $L_{Aeq,16hr}$	--
Dining	Dining Room/Area	40dB $L_{Aeq,16hr}$	--
Sleeping (Daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$ 45dB L_{AFmax*}

**Note 1: The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.*
**Note 2: ProPG:2017 which is relevant to 'New Residential' states; "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".*
Note 3: BS8233 states: "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved".
Note 4: BS8233 states: "The levels shown in Table 4 (criteria shown above) are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.
Note 5: BS8233 states: "If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Table 3 – Acoustic Design Criteria

This BS8233 criteria is deemed to be suitable during periods when the nearby shooting range is not in operation (i.e., during the night-time).

However, during the daytime it was noted that noise emissions from the Yorkshire Shooting Centre were audible at the development site and has the potential to cause adverse impact. Noise characteristics associated with the shooting range are generally considered to be highly impulsive therefore, it is considered appropriate to assess the resulting daytime L_{Amax} levels at the site. As there are no defined criteria for daytime L_{Amax} levels, the night-time criterion has been adopted to assess internal noise levels.

In order to assess the external noise levels from the YSC, guidance from CIEH 'Clay Target Shooting' has been used.

(CIEH) Clay Target Shooting: Guidance on the Control of Noise (2003)

The CIEH guidelines will be used to predict the level of impact in the external areas of the proposed development considering the shooting noise emissions from the Target Club.

The guidance was developed by the Chartered Institute of Environmental Health and uses maximum noise level events from gunshots to calculate expected levels of noise impact in external amenity areas.

According to the document, "*The scope of (the) guidance is limited to clay target (pigeon) shoots. It should not be taken as having any application to other outdoor shooting events or other gun club activities*". The target club is thought to use guns that fire exclusively 0.22-inch (5.6mm) calibre ammunition, and as such, the assessment is outside of the scope of the guidance. However, due to the

lack of other more appropriate guidance, it is thought that the CIEH document provides the most suitable criteria for this assessment.

Shooting Noise Survey Results and Assessment

Measurements of gun shots were taken at MP1 & MP3, which is between the existing outbuildings and further along the driveway, respectively. The location of MP3 was chosen to avoid screening by the outbuildings. As such, MP3 will be used for the following assessment, as it is believed to show a clearer representation of the potential impact incident upon the proposed development site.

It is stated that impact should be predicted using the 'SNL' (Shooting Noise Level) measured on site. This is calculated by taking the logarithmic average of the 25 loudest shots. The graph below shows the maximum noise level events measured during a target shooting event.

According to the criteria, with an SNL lower than 55dB annoyance is unlikely to occur, between 55dB and 65dB annoyance is likely to occur, and above 65dB there is a high likelihood of annoyance to occur.

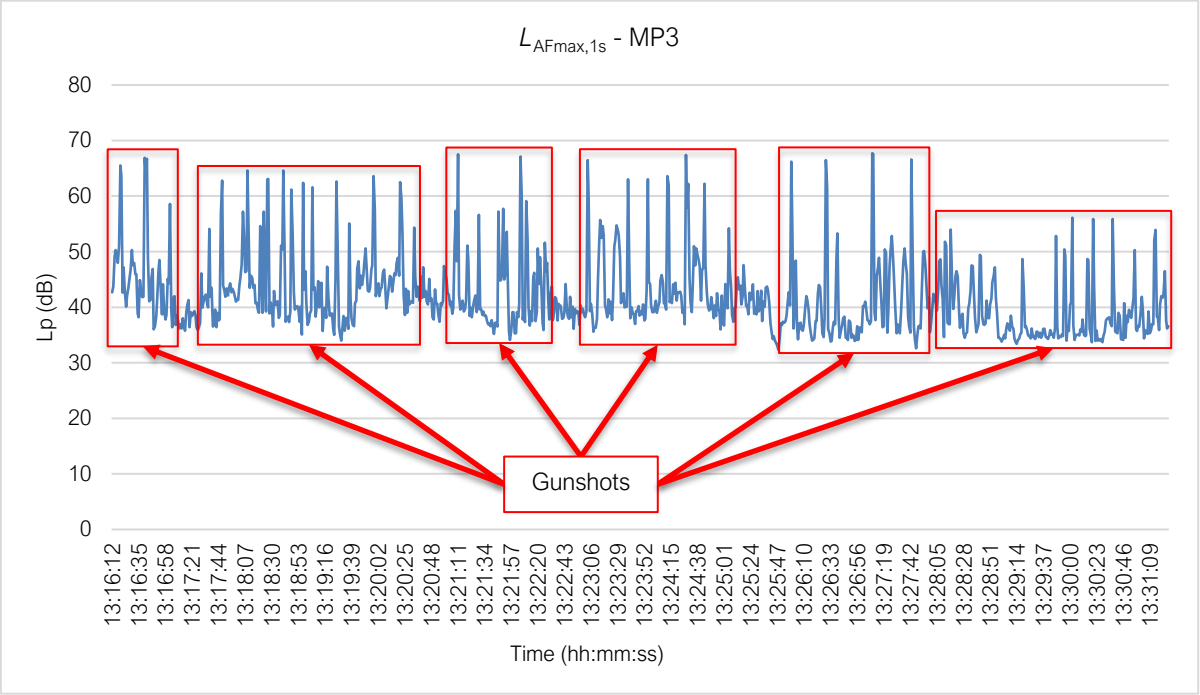

Figure 3 – Shooting Noise Level Survey

CIEH Assessment

The following table compares the calculated mean SNL measured at MP3 with the recommended criteria provided in the CIEH guidance. At this measurement position, shooting noise was deemed to be clearly dominant in the acoustic environment.

Description	Value (L_{AFmax}, dB)	Effect Descriptor
CIEH SNL Criteria	<55	Annoyance is less likely to occur.
	>55 to <65	Annoyance is likely to occur.
	>65	Highly likelihood of annoyance to occur.
Calculated SNL at MP3	**65**	**Highly likelihood of annoyance to occur.**

Table 4 – CIEH Mean Shooting Noise Level Assessment

As can be seen in the table above, it is highly likely that annoyance could occur due to noise from the neighbouring shooting range.

To further mitigate potential noise impacts within the external amenity area, the orientation and design of the site utilises the building envelope to maximise screening effects from the shooting range. Although the external criteria are still not likely to be achieved, it should be noted that there are other residential dwellings within 300m of the shooting range which will be subject to similar levels of gun shot noise.

Given the adopted internal criteria, it is anticipated that measures can implemented to mitigate potential adverse effect for future occupants of the proposed development.

Glazing and Ventilation Specification

It is understood that no passive means of ventilation are proposed at the development as a MHVR system will be installed. Given the low noise levels at the site during times when the shooting range is not in operation, there is no requirement for specific façade treatments to achieve the BS8233 criteria. Therefore, the glazing strategy focuses on achieving the adopted internal noise criteria with the shooting range in operation. Calculations considering the following sound insulation scheme can be found in Appendix E.

Sound Insulation Scheme – All Living Rooms & Bedrooms									
Description	Octave Frequency Band (Hz, dB)							Overall (dB)	
	63	125	250	500	1k	2k	4k		
6mm Glass / 16mm Air Cavity / 4mm Glass	21	20	26	38	37	39	21	31 (R_W)	27 (R_W + C_{tr})

Table 5 – Glazing Specification

Any other window capable of providing this attenuation will be suitable provided the glazing suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

Overheating Assessment

The AVO Guide advises that if windows are open regularly to provide higher rates of ventilation to mitigate overheating, this will lead to elevated internal noise levels which could lead to undesirable living conditions.

However, it is proposed that a MVHR unit is installed at the site. This system should be designed to ensure future occupants will not need to rely on opening windows to overcome overheating conditions. This will also further reduce the likelihood of adverse impact from the nearby shooting range within the development, with a closed window providing sufficient attenuation from external shooting noise.

4. Conclusion and Action Plan

The proposed development has been assessed against the acoustic design criteria and a sound insulation scheme has been provided to ensure the criteria has been achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The proposed glazing specification should be installed as shown in Section 3.
2. An MVHR unit capable of providing sufficient ventilation during overheating conditions should be installed.
3. The external amenity area should utilise the screening provided by the building envelope to reduce noise associated with the nearby shooting range as much as practicably possible.

The findings of this report will require written approval from the Local Authority prior to work commencing.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 μPa)
Background Sound	Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for N% of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10\log_{10}(p/p_0)^{2.}$ Where: p is the root-mean-square sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 μPa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy, and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

Paragraph 185 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 impact 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; and*
c) *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes, and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life.
- Mitigate and minimise adverse impacts on health and quality of life.
- Where possible, contribute to the improvement of health and quality of life.

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 'Guidance on Sound insulation and noise reduction for buildings'

BS8233 provides guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, 'WHO Guidelines on Community Noise, 1999'. The Guidelines on Community Noise (1999) document defines community noise to include noise from "industries" and "construction". The desirable criteria levels of steady state, "anonymous" noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 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 $L_{Aeq,8hour}$ 45 dB L_{AFmax}*

Table 6 – BS8233 Internal Ambient Noise Level Criteria

**ProPG:2017 states that's good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 time a night within noise sensitive rooms such as bedrooms. However, where it is not reasonably practicable to achieve the guideline then the judgment 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.*

It is noted, however, that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the 'LOAEL' as defined in the NPSE in Appendix B.

B.4 – ProPG: Planning and Noise (2017)

ProPG Planning and Noise published May 2017 by the Association of Noise Consultants (ANC) was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. ProPG aims to encourage better acoustic design of new residential developments promoting good health and wellbeing through the effective management of noise. It therefore outlines four key elements which should be considered in the assessment of noise:

- Element 1 – demonstrating a "Good Acoustic Design Process".
- Element 2 – observing internal "Noise Level Guidelines".
- Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
- Element 4 – consideration of "Other Relevant Issues".

The ProPG supplementary document 2 provides the following 'Good Acoustic Design' hierarchy of noise management measures which LPAs should encourage. These are shown below, In descending order of preference:

Order of Preference	Noise Management Measure
1	Reduction of the noise generated at source by redesign, relocation, or containment. *
2	Maximising the spatial separation of noise source(s) and receptor(s).
3	Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
4	Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.
5	Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
6	Using the layout of the scheme to reduce noise propagation across the site.
7	Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms.
8	Using the building envelope to mitigate noise to acceptable levels.

Table 7 – Hierarchy of Noise Management Measures

**Not from ProPG*

B.5 – Approved Document 0: Overheating (2021)

Approved Document O states the following in relation to noise:

1. 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).
2. Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
    a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
    b. 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).
3. Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

    NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).B.6 - Acoustics Ventilation and Overheating – Residential Design Guide 2020

B.6 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233 should be achieved considering adequate ventilation as defined by Building Regulations 'Approved Document F' ('ADF') whole dwelling ventilation. However, for a whole dwelling ventilation system such as MVHR 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.

The 'Institute of Acoustics' ('IOA') and the 'Association of Noise Consultant's ('ANC') have published 'The AVO Guide: 2020' document 2020. It provides guidance for those acousticians involved in the design of buildings to prevent noise ingress to and achieve reasonable internal levels. This provides valuable guidance on ventilation and overheating in support of the "Good Acoustic Design" principle advocated by ProPG. Along with guidance showing an acoustic assessment during the overheating condition, the AVO Guide (2020) provides a framework that has a two-level assessment procedure to estimate the potential impact on occupants:

Level 1 Risk Assessment

AVO 'Level 1' risk assessment criteria guide based on external free field ambient noise levels for dwellings relying on purge ventilation (e.g., opening windows) to prevent summertime overheating. AVO Guide Table 3-2 detailed in the figure below. To assess the possibility of overheating it is reasonable to relax the BS 8233 internal ambient noise levels from opening a window by 5 decibels (5dB). Also, it is assumed that a partially open window will provide a sound reduction of 13dB. Therefore, to achieve internal noise levels in line with BS 8233 the façade external noise levels should fall inside the levels shown in Table 3-2.

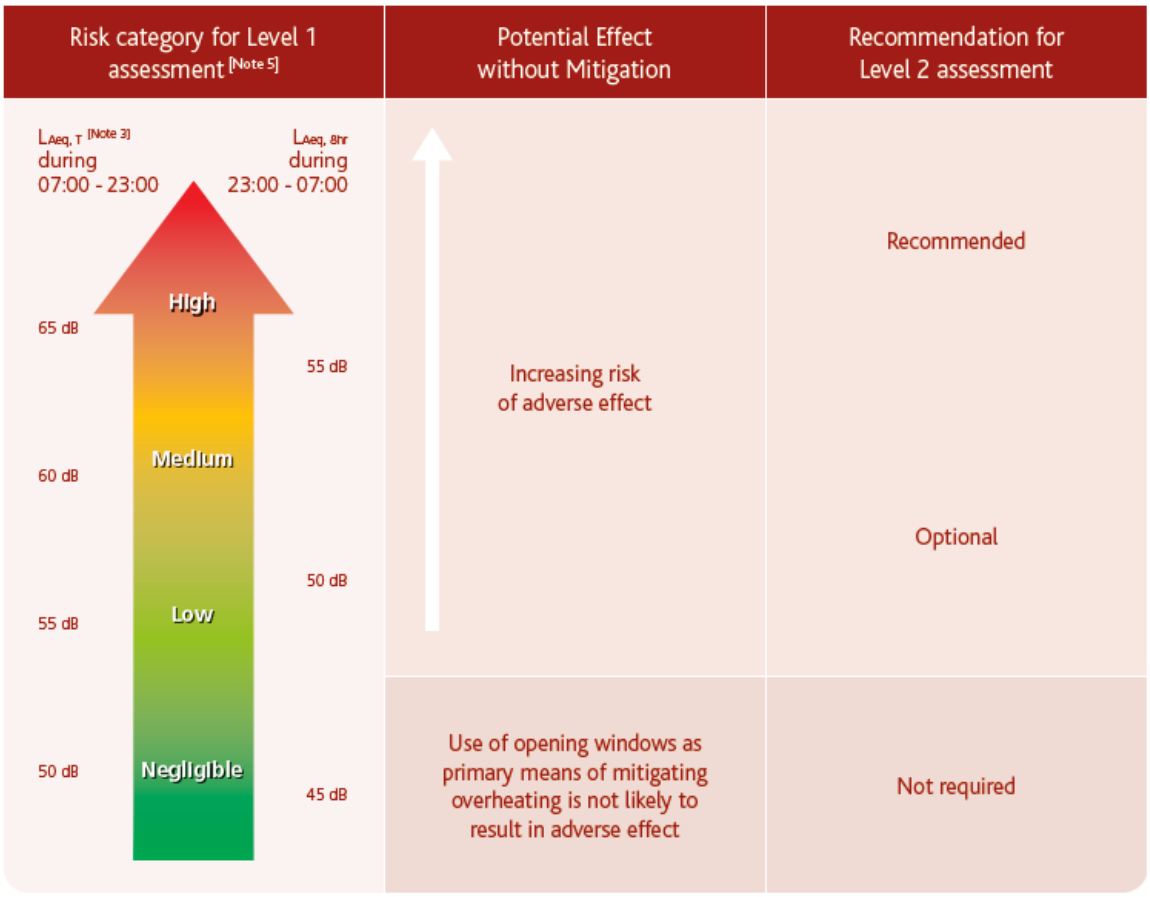

Table 3-2 of AVO Guide (2020)

Figure 4 – AVO Guide Level 1 Risk Category

The AVO Guide (2020) seeks to determine the level of risk associated with overheating in a new residential development based on the existing noise climate. The AVO risk categories are detailed in the table below with clearer categorisation.

Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥63dB $L_{Aeq,16hour}$	≥55dB $L_{Aeq,8hour}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62dB $L_{Aeq,16hour}$	52 – 54dB $L_{Aeq,8hour}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56dB $L_{Aeq,16hour}$	49 – 51dB $L_{Aeq,8hour}$	Low Risk	
≤53dB $L_{Aeq,16hour}$	≤48dB $L_{Aeq,8hour}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 8 – AVO Guide (2020) Level 1 Risk Assessment

Level 2 Risk Assessment:

A 'Level 2' assessment of noise is recommended where a dwelling using purge ventilation (e.g., open windows) reaches Level 1 'High Risk' or 'Medium Risk'. The Level 2 assessment guidance comments that where internal ambient noise levels are >50dB $L_{Aeq,16hr}$ (day) or >42dB $L_{Aeq,8hr}$ (night) then the outcome might be that the noise causes a material change in behaviour, e.g., having to keep windows closed for the majority of the time, or there is the potential for sleep disturbance.

To conduct a Level 2 assessment, the following minimum information is required:

- Statement of the overheating criteria being applied.
- Description of the provisions for meeting the stated overheating criteria. This should include, where relevant, the area of façade opening.
- Details of the likely internal ambient noise levels whilst using provisions for mitigating overheating, and the method used to predict these.
- Estimation of how frequently and for what duration such provisions are required to mitigate overheating.
- Consideration of the effect of individual noise events.
- Assessment of the adverse effect on occupants.

The figure below outlines the AVO Guide (2020) guidance for a Level 2 assessment of noise from transport sources relating to the Overheating Condition.

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 $L_{AF,max}$	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 $L_{AF,max}$ 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.

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.

Table 3-3 of AVO Guide (2020)

Figure 5 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Site Plans

Appendix D – Environmental Survey

D.1 – Time History Noise Data

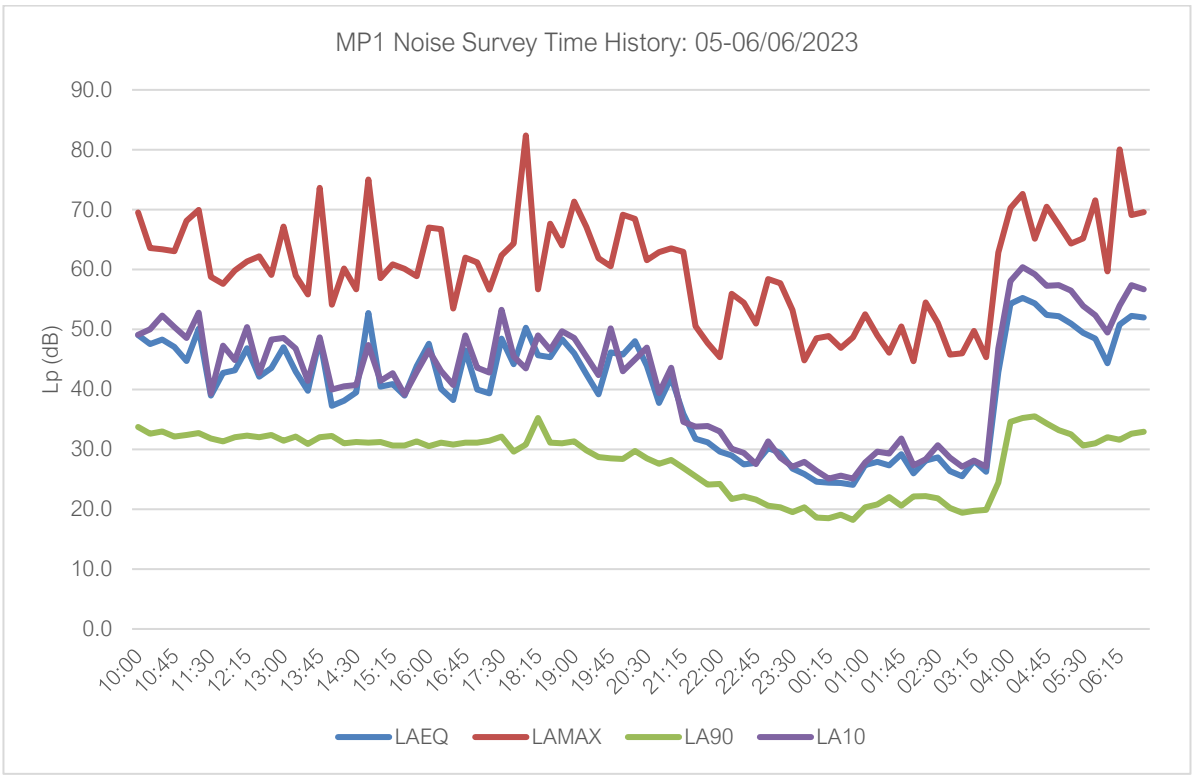

Figure 6 – MP1 Noise Survey Time History

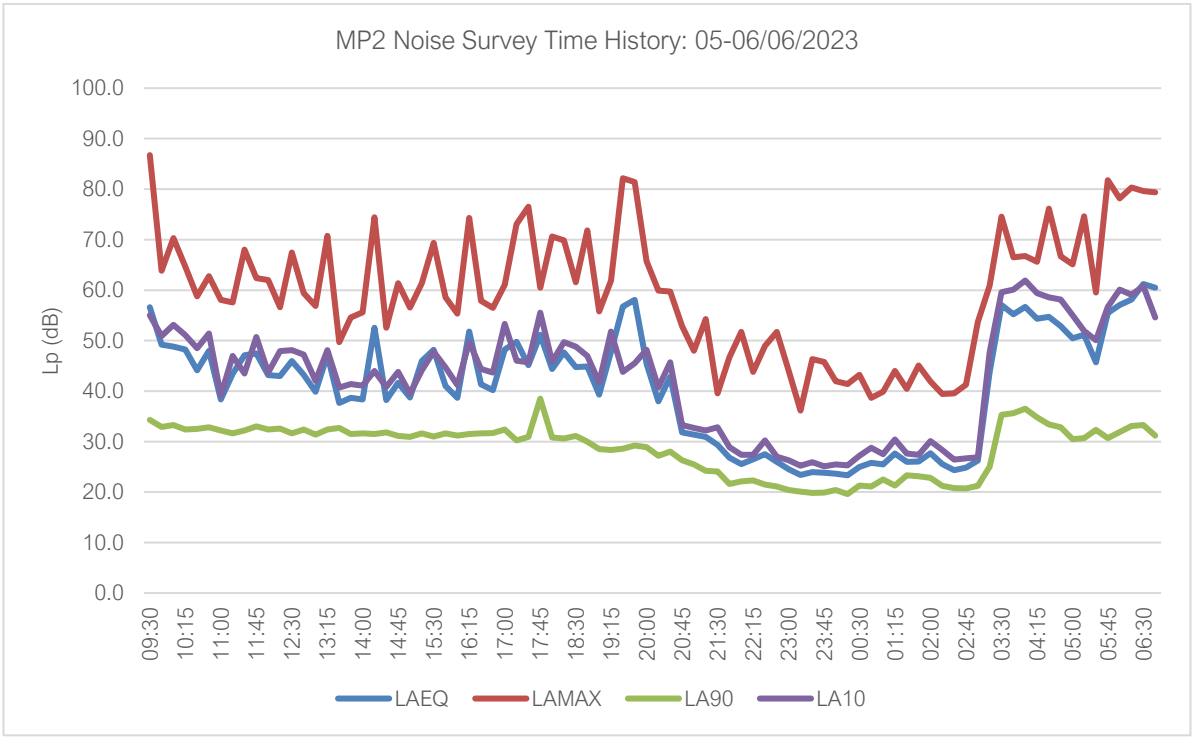

Figure 7 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246471	≤0.4
CESVA CB006 Class 1 Calibrator	901955	
Svantek SV307 Class 1 Sound Level Meter	70884	≤0.1
Svantek SV33B Class 1 Calibrator	125695	
Svantek SV307 Class 1 Sound Level Meter	87871	≤0.1
Svantek SV33B Class 1 Calibrator	125695	

Table 9 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with negligible deviation noted. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Kirkheaton (Approx. 2km SSW of Site)				
Time Period	Air Temp (^{0}C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
05/06/23 – 00:00 – 23:59	9.8 – 18.8	0.0	E	0.0 – 6.2
06/06/23 – 00:00 – 23:59	9.7 – 13.7	0.0	E	0.2 – 3.3
10/06/23 – 00:00 – 23:59	9.3 – 27.2	0.0	E	0.0 – 5.6

Table 10 – Weather Conditions

Appendix E – Noise Break-in Calculations

The façade sound reduction and predicted internal noise levels are calculated in accordance with BS8233 and BS EN 12354-3.

Based on the technical drawings provided to NOVA Acoustics, the following particulars have been used to inform the noise break-in assessment. The have been chosen to provide a worst-case assessment for each room type.

Living Room		Bedrooms	
Description	Value	Description	Value
Room Volume (3m x 6.2m x 5m)	93m^3	Room Volume (3m x 6m x 4.4m)	79m^3
Glazing Elements	18m^2	Glazing Elements	14m^2
Wall Elements	16m^2	Wall Elements	17m^2
Total Façade Area	*34m^2*	*Total Façade Area*	*31m^2*
Roof Elements	46m^2	Roof Elements	43m^2

Table 11 – Noise Break-in Calculation Particulars

The table below presents typical reverberation times for a furnished living room and bedroom that have been used in the noise break-in calculations.

Description	Reverberation Time at Octave Frequency Band (Hz, s)						
	63	125	250	500	1k	2k	4k
Furnished Living Room	0.7	0.6	0.6	0.5	0.5	0.5	0.4
Furnished Bedroom	0.4	0.4	0.3	0.3	0.3	0.3	0.2

Table 12 – Reverberation Times of Furnished Rooms

The acoustic performance of the façade elements is taken from the relevant manufacturers' technical information, or the sound reduction has been predicted using INSUL 9.0. Sound reduction values are presented in the table below.

The walls are understood to be cavity masonry with a composite panel finish on the exterior. The roofing will be constructed of 175mm timbers lined externally with 18mm OSB, K7 Kingspan insulation, 18mm OSB and 2mm zinc. The internal roof lining is assumed to be 1no. layer of 12.5mm plasterboard.

Description	Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Cavity Masonry Wall	42	47	49	59	60	60	60	59 (R_w)
Roofing	16	28	43	50	55	58	60	51 (R_w)

Table 13 – Sound reduction Index of Façade Elements

The tables below outline the noise break-in calculations during the daytime with the shooting range in operation.

Living Room (First-Floor) Day Time Lmax

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	65	62	56	59	64	62	55	48
Glazing Noise Ingress	30	35	28	32	31	17	11	2
Ventilation Noise Ingress								
Wall Noise Ingress	0	13	2	3	-2	-5	-12	-19
Roof Noise Ingress	19	43	25	13	11	4	-6	-15
Room Absorption Correction		5	5	5	4	4	4	3
Total Noise Ingress	**38**	**52**	**38**	**40**	**39**	**25**	**18**	**8**
NR40	45	67	56	49	43	40	37	34
Exceednce of Criteria	-7	-15	-18	-9	-4	-15	-19	-26

Master Bedroom (First-Floor) Day Time Lmax

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	65	62	56	59	64	62	55	48
Glazing Noise Ingress	29	35	28	32	31	17	11	2
Ventilation Noise Ingress								
Wall Noise Ingress	1	13	2	3	-2	-5	-12	-19
Roof Noise Ingress	19	43	25	13	11	4	-6	-15
Room Absorption Correction		4	3	3	2	2	2	1
Total Noise Ingress	**35**	**50**	**36**	**37**	**36**	**22**	**16**	**6**
NR40	45	67	56	49	43	40	37	34
Exceednce of Criteria	-10	-17	-20	-12	-7	-18	-21	-28


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