Residential Noise Assessment

Site Address: 24-26 Fowler Street, South Shields, NE33 2LR

Client Name: Adsen Moore Financial Consulting

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Contents

1. INTRODUCTION 4
1.1 Standards, Legislation, Policy & Guidance 4
1.2 Proposal Brief 4
2. ENVIRONMENTAL NOISE SURVEY 6
2.1 Measurement Methodology 6
2.2 Context & Subjective Impression 6
2.3 Environmental Noise Survey Results 7
2.4 Entertainment Noise Level Analysis 8
3. NOISE BREAK-IN ASSESSMENT AND SOUND INSULATION SCHEME 10
3.1 Internal Noise Level Criteria 10
3.2 Glazing and Whole Dwelling (Background) Ventilation Specification 10
Remainder of External Envelope 11
3.3 11
4. OVERHEATING SCREENING ASSESSMENT 12
4.1 Overheating Screening Assessment 12
5. NOISE BREAKTHROUGH ASSESSMENT AND SOUND INSULATION SCHEME 14
5.1 Noise Breakthrough Criteria 14
5.2 Noise Breakthrough Assessment and Specification – Public House / Bar 15
5.3 Noise Breakthrough Assessment and Specification – Retail / Café 16
5.4 Discussion 17
6. EXTERNAL NOISE LEVEL ASSESSMENT 18
7. CONCLUSION AND ACTION PLAN 19
APPENDIX A – ACOUSTIC TERMINOLOGY 20
APPENDIX B – STANDARDS, LEGISLATION, POLICY, AND GUIDANCE 21
B.1 – National Planning Policy Framework (2024) 21
B.2 – Noise Policy Statement for England (2010) 21
B.3 – BS8233:2014 ‘Guidance on Sound insulation and noise reduction for buildings’ 23
B.4 – Approved Document F Volume 1: Dwellings (2021) 24
B.5 – Acoustics Ventilation and Overheating – Residential Design Guide 2020 24
APPENDIX C – LOCATION PLANS 28
APPENDIX D – ENVIRONMENTAL SURVEY 29
D.1 – Time History Noise Data 29
D.2 – Surveying Equipment 30
D.3 – Meteorological Conditions 30
APPENDIX E – NOISE BREAK-IN CALCULATIONS 31
E.1 – Façades with Background Ventilation 31

List of Figures

Figure 1 – Proposed Development Ground Floor Plans 5
Figure 2 – Measurement Locations and Site Surroundings 6
Figure 3 – MP1 Low Frequency Noise Analysis 8
Figure 4 – MP2 Low Frequency Noise Analysis 8
Figure 5 – AVO Guide Level 1 Risk Category 25
Figure 6 – AVO Guide Level 2 Internal Ambient Noise Levels 27
Figure 7 – Location Plans 28
Figure 8 – MP1 Noise Survey Time History 29
Figure 9 – MP2 Noise Survey Time History 29

List of Tables

Table 1 – Measurement Methodology 6
Table 2 – Sound Level Results Summary 7
Table 3 – Internal Acoustic Design Criteria 10
Table 4 – Double Glazing Specification 11
Table 5 – Secondary Glazing Specification 11
Table 6 – External Noise Level Limits for Overheating Criteria 12
Table 7 – Assumed Internal Sound Level of Bar 15
Table 8 – Noise Breakthrough Assessment – Existing Wall 15
Table 9 – Noise Breakthrough Assessment – Post-Mitigation 16
Table 10 – Noise Breakthrough Assessment 17
Table 11 – BS8233:2014 Internal Ambient Noise Level Criteria 23
Table 12 – AVO Guide (2020) Level 1 Risk Assessment 26
Table 13 – Surveying Equipment 30
Table 14 – Survey Weather Conditions 30

1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the proposed development') at 24-26 Fowler Street, South Shields, NE33 2LR ('the site'). The proposed development is for conversion of former retail unit & offices to self-contained studio flats (retaining ground floor retail unit).

The applicant has submitted planning application no. ST\2024\ENQ\00316 ('the application') to South Tyneside Metropolitan Borough Council. This report has been prepared to accompany the planning application submitted to the Local Planning Authority ('LPA').

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.

1.1 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 (2024).
- Noise Policy Statement for England (2010).
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings.'
- Approved Document F: Volume 1 Dwellings (2021).
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide).

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

1.2 Proposal Brief

The proposal is for the conversion of the existing building from commercial offices and retail units to a mixed-use development. This will consist of commercial towards the front elevation on the ground floor and residential dwellings across the rear from basement level to the third floor. The figure overleaf shows the proposed development layout.

Drawing Ref No. 24037/CAL/01/XX/DR/A/P101/1 from 'Create Architecture'

Figure 1 – Proposed Development Ground Floor Plans

2. Environmental Noise Survey

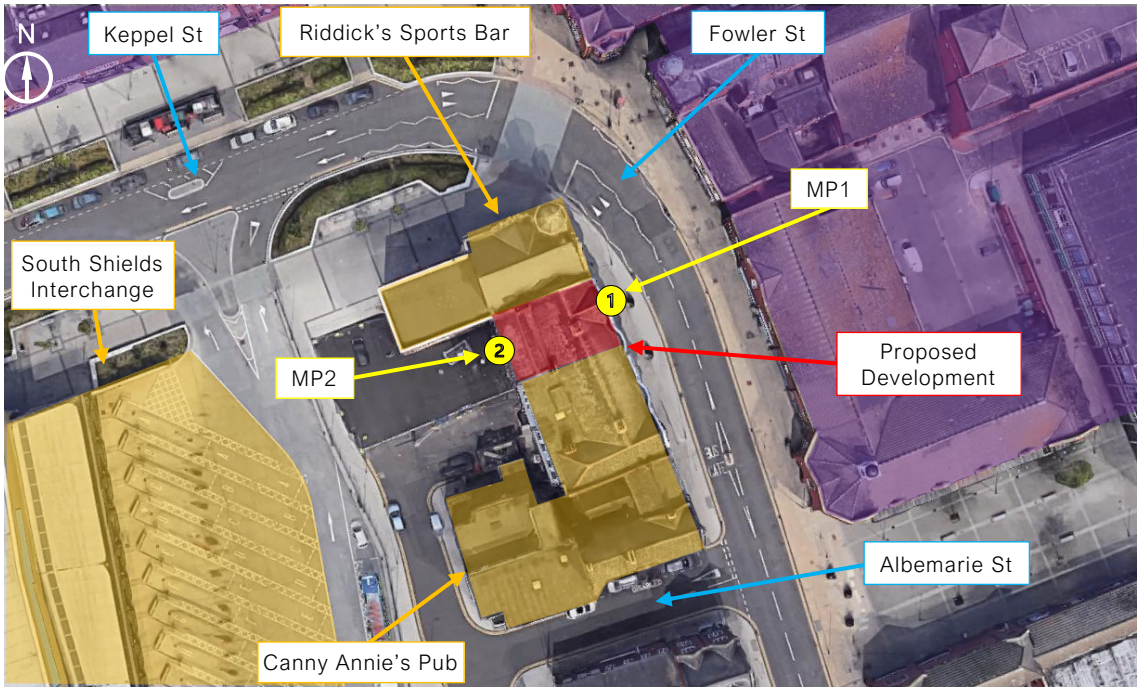
2.1 Measurement Methodology

The following table outlines the measurement dates and particulars. In all instances the microphones were fitted with a proprietary outdoor kit complete with a 130mm diameter windshield. All equipment was field calibrated before and after each set of measurements; negligible drift was noted. The equipment register and survey weather conditions can be found in Appendix D.

Location	Survey Dates	Measurement Particulars
MP1	14/03/2025 – 17/03/2025	Equipment mounted on a lamp post at a height of 3.5m on Fowler Street.
MP2	14/03/2023 – 17/03/2025	Equipment mounted protruding from a first-floor window at approximately 1m distance from the building façade at the rear of site, overlooking Albemarie Street / Burrow Street (façade correction applied).

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



StaticText "Imagery ©2025 Google, Imagery ©2025 Airbus, Map data ©2025

Figure 2 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The proposed development site is located off Fowler Street, South Shields. The area surrounding the site consists primarily of commercial premises and residential dwellings that are located on the floors above.

The commercial properties are generally composed of retail units and are considered low risk. However, the development site also adjoins 'Riddick's Sports Bar' to the north, overlooks the rear of 'Canny Annie's

Pub' to the south and is in full view of 'South Shields Interchange' to the west, which is the main bus station for the town.

'Riddick's' is newly operational and held its first opening weekend during the measurement period. As such, the measurements are believed to have captured a 'typical' busy event and are considered robust. Operational hours are 10:00 – 22:30, Sunday to Thursday and 10:00 – 23:30, Friday to Saturday.

'Canny Annie's' appears to be an entertainment venue and holds extended opening hours. Operational hours are varied throughout the week and are between 15:30 – 04:00, Tuesday to Sunday. The venue is closed on Mondays.

During the site visit it was observed that noise from non-anthropogenic sources, such as seagulls, was highly audible. Plant units servicing neighbouring premises were noticed to the rear of the development, however, any associated noise emissions were inaudible over the residual noise climate.

As discussed, a large bus station is also located at the rear of the site. It was noted that vehicles arrive regularly, park and remain with engines in an idle state until leaving the station. Additionally, further to the west, there is metro station with audible trains arriving and departing regularly.

In summary, the acoustic environment is deemed to be moderate to high in level and the noise profile was dominated by road traffic noise emissions, with any commercial and pedestrian noise second in nature at the front façade. Noise from the bus station is significantly dominant to the rear.

2.3 Environmental Noise Survey Results

The following section outlines the measured sound levels during the survey. 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)	'Typical' $L_{AFmax,1min}$ (dB)
		63	125	250	500	1k	2k	4k		
MP1	Average $L_{eq,16hr}$ (Day)	62	59	57	59	59	55	50	63	--
	Average $L_{eq,8hr}$ (Night)	61	59	55	56	56	53	48	60	83
	Highest $L_{eq,1hr}$ (Day)	64	65	63	64	64	58	54	67	--
	Highest $L_{eq,1hr}$ (Night)	63	61	61	60	61	61	56	66	83
MP2	Average $L_{eq,16hr}$ (Day)	62	58	57	54	54	51	46	58	--
	Average $L_{eq,8hr}$ (Night)	57	55	53	51	49	45	41	54	74
	Highest $L_{eq,1hr}$ (Day)	64	60	59	59	59	55	49	63	--
	Highest $L_{eq,1hr}$ (Night)	64	59	56	54	55	51	45	58	74

Table 2 – Sound Level Results Summary

2.4 Entertainment Noise Level Analysis

The following graphs show the $L_{eq,15min}$ sound levels measured in the 63Hz and 125Hz 1/1 octave bands throughout the entire survey. These values are used to assess if entertainment noise is likely to have been comparatively audible in the environment.

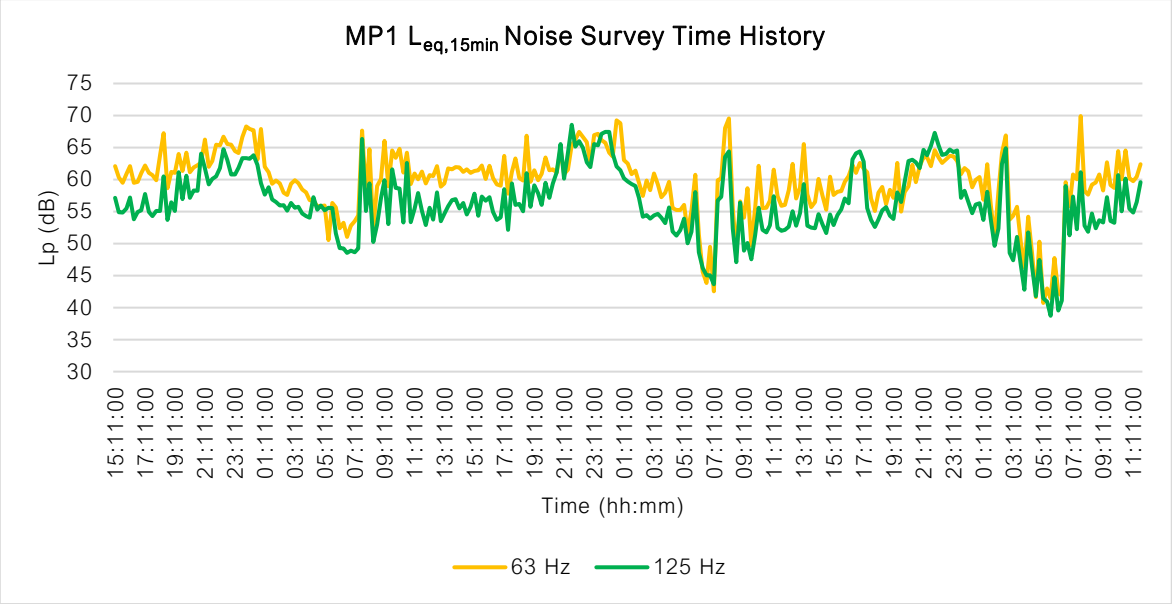


Figure 3 – MP1 Low Frequency Noise Analysis

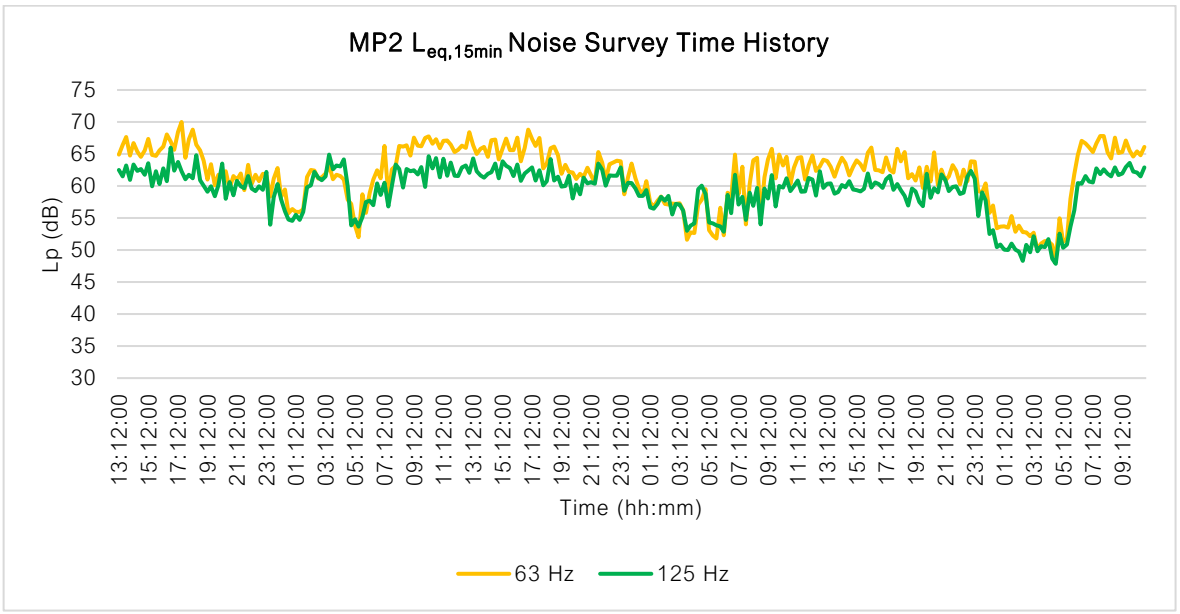


Figure 4 – MP2 Low Frequency Noise Analysis

As can be seen in the time history graphs for MP1, a significant low frequency ramp up in noise level was recorded until the approximate closing of Riddicks Sports Bar. It is likely that these entertainment noise emissions would be clearly perceptible within the acoustic climate.

At MP2 low frequency noise emissions drop abruptly at approximately 11pm. The bus timetables from the South Shields Interchange show that the majority of the regular bus services conclude at approximately 11pm, which suggests that this is primarily caused by noise from busses. However, an elevated period of

low frequency noise emissions was recorded during the latter opening hours of 'Canny Annies', which would also be prevalent in the acoustic climate.

The Agent of Change Principle

The "Agent of Change" must be considered to ensure unreasonable restrictions are not imposed on the neighbouring business' should residential be developed. Paragraph 200 of the NPPF states:

"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."

Where noise from a business is audible inside (with windows open) or in an external amenity area of a proposed dwelling there is potential for the occupant to complain to the LPA regarding the noise generated by the business. As such 'virtual inaudibility' must be considered the criteria. Inaudibility is defined as:

"*Noise is considered to be* inaudible *when it is at a sufficiently low level such that it is not recognizable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question (DEFRA)."*

A review of publicly available documentation on the planning portal has shown that Riddicks Sports Bar is permitted to operate within their noise management plan. As such, the bar will have control measures in the form of amplified music noise limits to ensure that NSRs directly above the bar are not adversely impacted. As such, the proposed development site is deemed suitable for residential development.

Whilst it is not expected that entertainment noise will cause significant adverse impact, to fully protect future occupants of the proposed development against entertainment noise, the façade sound insulation scheme has been calculated considering the following factors:

- The loudest 1-hour measurements recorded at both measurement positions (MP1 and MP2). This is considerably more stringent than using the standard BS8233 criteria (average 16-hour daytime and 8-hour night-time measurements).
- The Moorhouse low-frequency curve, as specified by DEFRA. This is specified to reduce the possibility of adverse impact from low-frequency (63Hz and 125Hz) noise emissions.

Providing the criteria shown above are implemented, it is thought that future occupants will be fully protected from both entertainment noise emissions and any 'just audible' plant noise emissions.

3. Noise Break-in Assessment and Sound Insulation Scheme

3.1 Internal Noise Level Criteria

The following table outlines the internal acoustic design criteria used in the following assessment.

BS8233:2014 Acoustic Design Criteria			
Activity	**Location**	**Daytime (07:00 – 23:00)**	**Night-time (23:00 – 07:00)**
Resting	Living Room	35 dB $L_{Aeq,16hr}$ / NR30	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$ / NR35	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$ / NR30	30 dB $L_{Aeq,8hr}$ / NR25 45 dB 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: BS8233:2014 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 5 dB and reasonable internal conditions still achieved".

Note 4: BS8233:2014 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; BS8233:2014 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 – Internal Acoustic Design Criteria

As previously stated, more stringent criteria are used for the assessment of the development. This is thought to be in line with Note 4 of the table above.

3.2 Glazing and Whole Dwelling (Background) Ventilation Specification

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria. The calculations considering the following sound insulation scheme can be found in Appendix E.

Please note that any other window or ventilation specification 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.

Sound Insulation Scheme – Double Glazing Options								
Description	Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Front & Rear Façade – First & Second Floor Studio Apartments								
6mm Glass / 16mm Argon Cavity / 6.8mm Optiphon Glass (SRI)	21	21	28	37	48	48	54	39 R_W (-6 C_{tr})
Front & Rear Façade – Third Floor Studio Apartments								
6mm Glass / 16mm Air Cavity / 4mm Glass (SRI)	20	21	20	26	38	37	39	32 R_W (-4 C_{tr})
All Façades – Whole Dwelling Background Ventilation								
Greenwoods 25000EA.AC1 (2no. trickle vents, D_{ne})	31	41	40	37	47	43	46	42 $D_{ne,W}$ (-2 C_{tr})

Table 4 – Double Glazing Specification

Sound Insulation Scheme – Secondary Glazing Options								
Description	Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Front & Rear Façade – All Studio Apartments								
Existing 4mm Glass / 150mm Air Cavity / 8mm Secondary Glass (SRI)	13	24	36	43	48	49	50	45 R_W (-8 C_{tr})
All Façades – Whole Dwelling Background Ventilation								
Greenwoods MA3051 (2no. through wall vents, D_{ne})	30	46	45	50	55	65	67	55 $D_{ne,W}$ (-3 C_{tr})

Table 5 – Secondary Glazing Specification

3.3 Remainder of External Envelope

In order to not downgrade the performance of the external fabric as a whole, the remainder of the façade and roofing must provide sound insulation at least 10dB greater than glazing specification above.

The façades of the site are at least 200mm thick brick and will provide ample sound insulation. However, the dormer and room in roof constructions must be considered. The following roofing speciciaiton is advised:

- 8mm roofing slates,
- 9mm plywood deck,
- 150mm timber joists lined with 100mm mineral wool slab insulation (min density 45kg/m^3),
- Isolation clip and furring channels (e.g., iKoustic MuteClip system),
- 2no. 15mm Gyproc SoundBloc plasterboards (min. surface mass 12.6kg/m^2 per board)

4. Overheating Screening Assessment

In order to avoid excessively high temperatures and provide adequate levels of thermal comfort within dwellings, an overheating mitigation strategy must be developed. In low noise areas, this strategy can often rely upon opening windows as the primary source of ventilation, however, in areas with higher levels of noise, this would present a risk of adverse effects on health and quality of life.

4.1 Overheating Screening Assessment

Considering that the development is a change of use and not new build, it is not a requirement to achieve the criteria defined in Approved Document O ('ADO'). However, to allow for a reasonable living environment, it is recommended that the less onerous criteria given in the 'Acoustics Ventilation and Overheating Design Guide' ('AVO') should be applied.

Considering that a partially open window provides approximately 13 dB of attenuation (as stated in 'AVO') the proposed internal and external noise criteria are present below and assessed in relation to the measured external noise levels.

Period	Proposed Criteria (dB)		External Level (dB)	
	Internal	External	Measured	Exceedance
Front Façade				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	63	0
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	60	+5
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	82	+4
Rear Façade				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	58	-5
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	54	-1
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	74	-4

Notes:

[1] Criterion taken from the AVO guide. Above this level, it is stated: "Noise causes a material change in behaviour, e.g., having to keep windows closed most of the time."
[2] L_{AFmax} exceeded fewer than 10 times per night.

Table 6 – External Noise Level Limits for Overheating Criteria

The noise levels measured at the front of site exceed the external noise criteria shown in the table above. As such, an assessment of whether the development is at risk of overheating would need to be undertaken by a suitably qualified person. Should the outcome indicate the site is at low risk of overheating, then a secondary ventilation strategy may not be required. If the outcome is that the site is at moderate to high risk, then it is recommended that openable windows are not used as the primary source of ventilation.

Alternative forms of ventilation include passive systems (such as acoustic louvres) and mechanical systems (such as 'centralised mechanical extract ventilation' and 'mechanical ventilation with heat

recovery'). The installation of passive systems is generally preferable; however, the precise requirements must be confirmed with a ventilation specialist. Further to this, it must also be ensured that all ventilation strategies are compliant with the requirements of Approved Document F.

It should be noted that this assessment relates exclusively to overheating mitigation, and as such, open windows may be used for purge ventilation without acoustic constraint. Further advice can be provided by NOVA Acoustics if required.

The external noise levels measured at the rear of site are below the threshold criteria shown in the table above. Given this, it is thought that opening windows can be used as the primary means of mitigating overheating in these areas exclusively. However, it must also be ensured that all ventilation is compliant with the requirements of Approved Document F.

5. Noise Breakthrough Assessment and Sound Insulation Scheme

5.1 Noise Breakthrough Criteria

The proposed development structurally adjoins a commercial property via a separating wall and floor. BS8233:2014 states that the internal noise criteria include 'overall noise' which is the sum of structure borne and airborne noise sources. Noise breaking through from structurally adjoining commercial property will be considered to ensure the total noise from both structurally adjoining commercial properties and external noise ingress, does not exceed the proposed acoustic design criteria.

Guidance on sound insulation between adjoining domestic and non-domestic dwellings is discussed in Approved Document E (ADE) of the Building Regulations, and it stated in section 0.8 of Part E that:

"The performance standards set out in Tables 1a and 1b are appropriate for walls, floors and stairs that separate spaces used for normal domestic purposes. A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations, the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice may be needed to establish if a higher standard of sound insulation is required and, if so, to determine the appropriate level."

The higher standard of sound insulation required is dependent on the level of noise generated within the commercial property. Noise from structurally adjoining commercial sources can lead to elevated impact and as such further consideration is given to the level of audibility, dominance, attention grabbing features, spectral distribution, regularity, change in level, duration, and time of day the sound is occurring. The commercial properties 'Use Classes' can assist in defining a suitable higher standard of sound insulation.

Given the nature of the proposed development, and that the operational hours of the neighbouring businesses cross over into the night-time period, the NR20 curve will be used as the criteria for the breakthrough calculations. Further to this, the Moorhouse curve criteria will be used in the 63Hz and 125Hz octave bands to reduce the possibility of subjective annoyance caused by low frequency noise emissions.

5.2 Noise Breakthrough Assessment and Specification – Public House / Bar

The proposed development building adjoins Riddick's Sports Bar via partition walls. Given that there will be noise from amplified music and patrons, there is the potential for adverse impact.

The following table presents the unweighted sound pressure levels (L_{eq}) thought to be typical of a bar of this type. The internal noise levels within the adjacent bar have been taken from the ANC's 'Little Red Book of Acoustics'. The book gives internal noise levels for a 'Busy Pub/Bar' which are thought to be robust for a development of this size. The source levels include noise from patron conversation and conversational level background music, and was used to assess the premises and its other adjoining residential dwellings (report ref. NP-010578).

Sound Source	1/1 Octave Band Sound Pressure Level (Hz, L_{eq}, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Internal Noise Levels of Busy Pub/Bar (L_{eq})	80	85	85	85	85	80	70	88

Table 7 – Assumed Internal Sound Level of Bar

Models of the existing partition walls have been created with INSUL 9 (sound insulation prediction software). The walls are currently thought to be constructed as follows:

- Minimum of 200mm brickwork (assumed min. density 1600kg/m^3)

The noise breakthrough assessment for this construction type is shown in the following table.

Measurement Period ('t')	1/1 Octave Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Internal Noise Level of Bar (L_{eq})	80	85	85	85	85	80	70	88 (A)
Predicted Sound Reduction of Wall (R)	41	39	42	50	57	62	67	49 $D_{nT,w}$
Predicted Internal Noise Level within Adjacent Residential (L_{eq})	39	46	43	35	28	18	3	39 (A)
NR20 & Moorhouse Curve Criteria	47[1]	41[1]	31	24	20	17	14	25 (A)
Exceedance of Criteria	**-8**	**+5**	**+12**	**+11**	**+8**	**+1**	**-11**	**+14**

Notes:

[1] Moorhouse Curve at 63Hz and 125Hz

Table 8 – Noise Breakthrough Assessment – Existing Wall

As can be seen, the predicted noise levels within the proposed residential spaces exceed the target criteria. As such, further sound insulation measures are required.

Recommendations & Mitigation Measures

To ensure the noise breaking through the adjoining wall is sufficiently attenuated, the following sound insulation upgrades should be implemented at the site:

- Existing 200mm brick (assumed min. density 1600kg/m^3)
- **Min. 25mm air cavity**
- **Min. 70mm independent timber stud filled with 50mm acoustic mineral wool insulation (min. density 45kg/m^3) between studs**
- **2no. 15mm SoundBloc plasterboards (min. surface mass 12.6kg/m^2 per board)**

Shown in the table below is the noise breakthrough assessment considering the proposed sound insulation upgrades.

Measurement Period ('t')	1/1 Octave Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
Amplified Music Limit Levels (L_{eq})	80	85	85	85	85	80	70	88 (A)
Predicted Sound Reduction of Upgraded Wall (R) [1]	43	58	≥70	≥70	≥70	≥70	≥70	--
Predicted Internal Noise Level within Residential (L_{eq})	37	27	15	15	15	10	10	20 (A)
NR25 & Moorhouse Curve Criteria (dB)	47 [1]	41 [1]	35	29	25	22	20	30 (A)
Exceedance of Criteria	**-10**	**-14**	**-20**	**-14**	**-10**	**-12**	**-10**	**-10**

Notes:

[1] Moorhouse Curve at 63Hz and 125Hz

Table 9 – Noise Breakthrough Assessment – Post-Mitigation

5.3 Noise Breakthrough Assessment and Specification – Retail / Café

The following table outlines the expected level of risk associated with the 'Class Use' of the structurally adjoining commercial businesses and provides a required sound insulation standard including a discussion to justify the standard.

Planning Class	Level of Risk from Noise	Required Sound Insulation Standard (dB)
E(a) Display or retail sale of goods, other than hot food	Low	≥53 $D_{nT,w}$ + C_{tr}

Discussion: The noise emissions produced by retail units may include both amplified music, air handling units, general equipment noise and noise from staff/patrons. Amplified music and noise from general equipment or internal plant associated with these types of facilities is normally of a background level to facilitate conversation and as such is not a primary concern. The noise from staff/patrons can vary significantly and is highly dependent on the nature of the establishment. The required level of sound insulation should consider raised and elevated vocal efforts occurring regularly. The permitted opening hours are not believed to extend into the night-time period (23:00 – 07:00) and as such the sensitivity of the adjoining residential will consider only the daytime period.

Table 10 – Noise Breakthrough Assessment

Floor Specification

Existing:

- Existing floorboard (assumed min. 18mm)
- Existing 200mm timber joists
- Existing lath and plaster (assumed min. 20mm

Proposed Upgrade:

- **12mm overlay plywood**
- **4mm MuteBarrier® mass loaded vinyl (min. surface mass 10kg/m²)**
- Existing 18mm flooring chipboard
- 200mm timber joists **with 150mm acoustic mineral wool insulation (min. density 45kg/m³) tightly and evenly fitted.**
- **Isolation clips (iKoustic MuteClip® or equivalent) and furring channel system affixed to the underside of the joist. (in accordance with the manufacturers guidelines)**
- **2no. 15mm SoundBloc plasterboards (min. surface mass 12.6kg/m² per board) with overlapping joints and sealed with flexible mastic at the perimeter.**

5.4 Discussion

Should the proposed sound insulation upgrades be adhered to, the adopted criteria can be achieved and thus the residential amenity of future occupants can be protected. It should be noted that this report provides an indicative specification that can achieve the required acoustic performance and considers that all flanking routes for sound have been appropriately suppressed. As with any construction project, the ability to meet the specification will rely upon the quality of the built structure. As such the works should be carried out to a high standard of workmanship to ensure that any sound insulation measures are not breached, for example by installing a rigid connection across an isolated connection. The development cannot achieve compliance until sound insulation testing is carried out by a UKAS accredited sound insulation testing company upon completion and assessed against the required sound insulation standard.

6. External Noise Level Assessment

It is noted that the drawings outline a small, shared courtyard to the rear of the development. However, due to the surrounding topography and existing environment, this area is not expected to be used for ‘relaxation’ purposes. As such, no further assessment will be undertaken for the external space.

7. 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 and background ventilation system, or a suitable alternative, should be installed as shown in Section 3.2.
2. The remainder of the external envelope including the roofing should be constructed as per Section 3.3.
3. To assist in the design of the alternative ventilation strategy a TM59 overheating assessment should be undertaken to assess whether the development is at risk of overheating. Should the outcome indicate the site is at low risk of overheating, then a secondary ventilation strategy may not be required. If the outcome is that the site is at moderate to high risk, then it is recommended that openable windows are not used as the primary source of ventilation along the front façade. Alternative ventilation forms are discussed in Section 4.1 it must also be ensured that all ventilation strategies are compliant with the requirements of Approved Document F.
4. At the rear of the site, opening windows can be used as the primary means of mitigating overheating in these areas exclusively. However, it must also be ensured that all ventilation is compliant with the requirements of Approved Document F.
5. The separating walls and floor between the structurally adjoining commercial property and the proposed development should be designed to achieve the required sound insulation. An indicative specification has been provided in Section 5. Further design assistance can be provided by NOVA Acoustics if required.

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 (2024)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2024. 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 187e, 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 198 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 198 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."

This is further expanded using the updated "Noise Exposure Hierarchy Table" which includes an additional level of impact referred to as the 'No Observed Adverse Effect Level' ('NOAEL'). It is stated that at this level: *"noise can be heard, but does not cause any change in behaviour, attitude or other physiological response"*. In addition, noise at this level *"can slightly affect the acoustic character of the area but not such that there is a change in the quality of life".*

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.

BS8233:2014 Internal Ambient Noise Level Criteria			
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 11 – BS8233:2014 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 – Approved Document F Volume 1: Dwellings (2021)

Approved Document F states the following in relation to noise:

- Mechanical ventilation systems, including both continuous and intermittent mechanical ventilation, should be designed and installed to minimise noise. This includes doing all of the following.
    - Correctly sizing and jointing ducts.
    - Ensuring that equipment is appropriately and securely fixed, such as using resilient mountings where noise carried by the structure of the building could be a problem.
    - Selecting appropriate equipment, including following paragraph
- For mechanical ventilation systems, fan units should be appropriately sized so that fans operating in normal background ventilation mode are not overly noisy. This might require fans to be sized so that they do not operate near maximum capacity when in normal background ventilation mode.
- Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation.
- If an exposed façade is close to an area of sustained and loud noise (e.g. a main road), then a noise attenuating background ventilator should be fitted.

B.5 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233:2014 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 8233:2014 internal ambient noise levels from opening a window by 5 decibels (5 dB). Also, it is assumed that a partially open window will provide a sound reduction of 13 dB. Therefore, to achieve internal noise levels in line with BS 8233:2014 the façade external noise levels should fall inside the levels shown in Table 3-2.

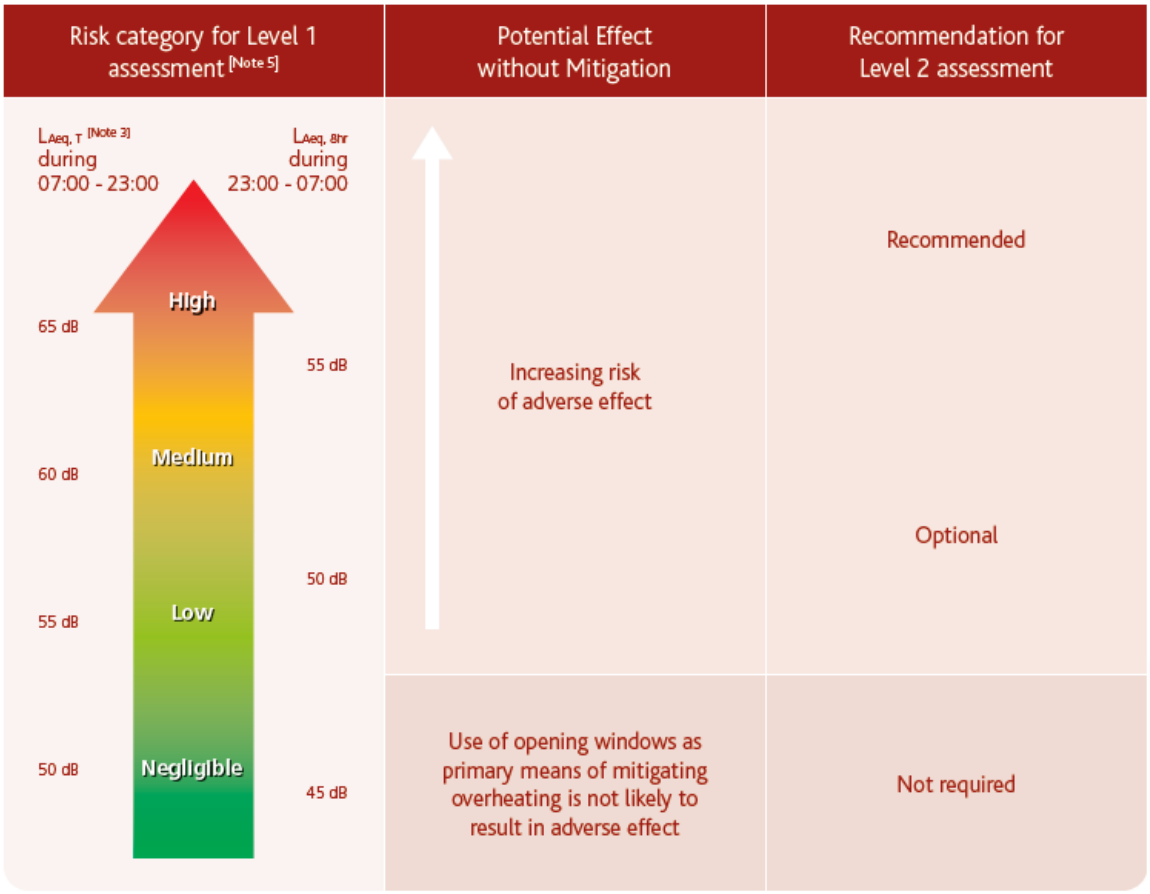


Table 3-2 of AVO Guide (2020)

Figure 5 – 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.

AVO Guide (2020) Level 1 Risk Assessment			
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥63 dB $L_{Aeq,16hour}$	≥55 dB $L_{Aeq,8hour}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62 dB $L_{Aeq,16hour}$	52 – 54 dB $L_{Aeq,8hour}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56 dB $L_{Aeq,16hour}$	49 – 51 dB $L_{Aeq,8hour}$	Low Risk	
≤53 dB $L_{Aeq,16hour}$	≤48 dB $L_{Aeq,8hour}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 12 – 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 >50 dB $L_{Aeq,16hr}$ (day) or >42 dB $L_{Aeq,8hr}$ (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 6 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Location Plans

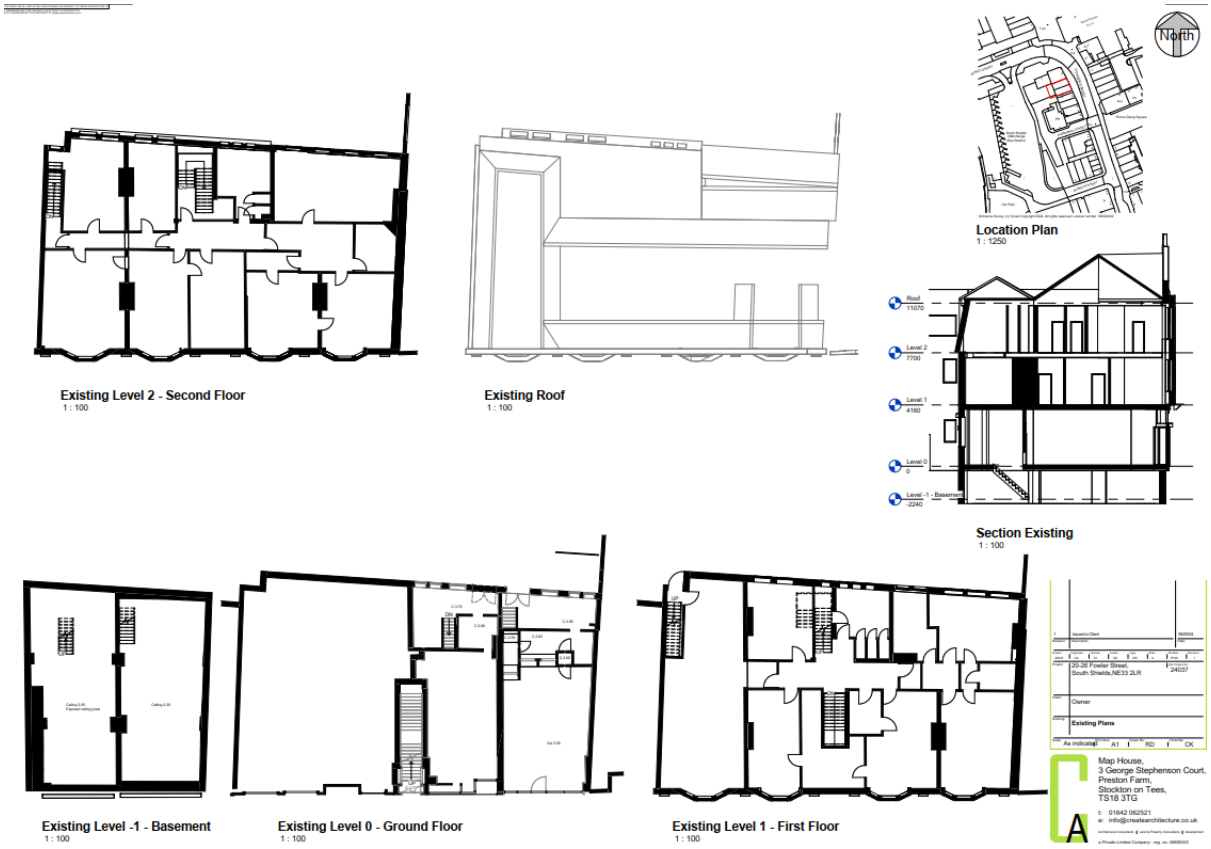


Figure 7 – Location Plans

Appendix D – Environmental Survey

D.1 – Time History Noise Data

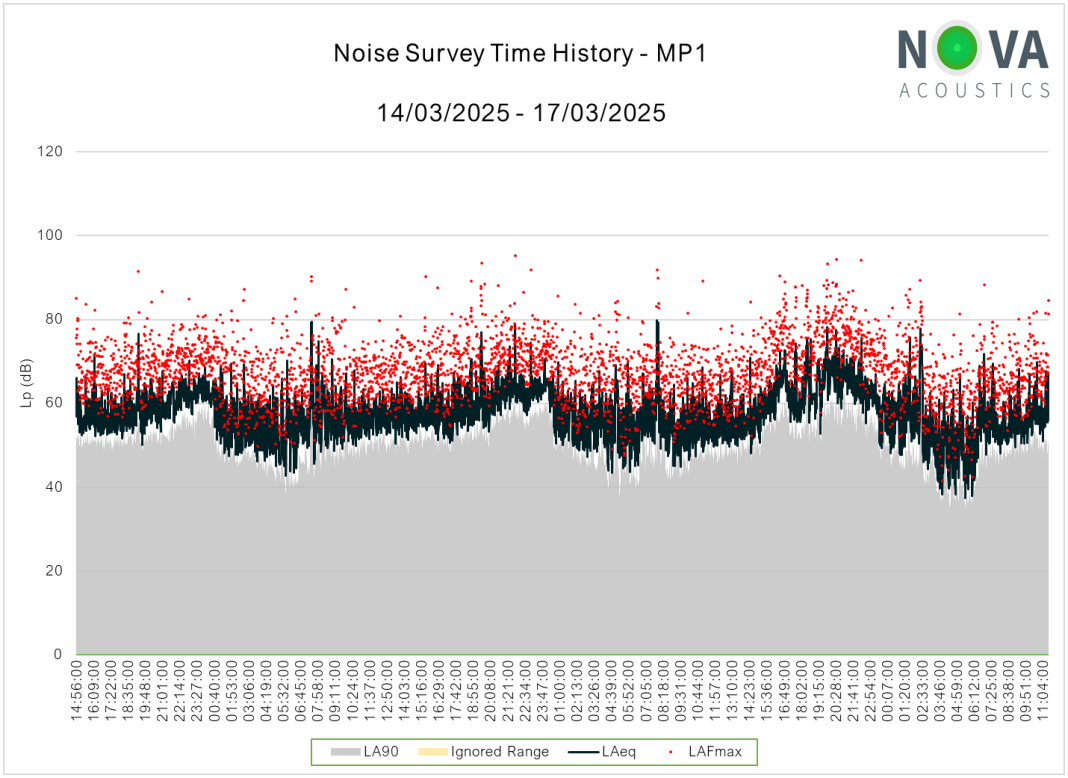


Figure 8 – MP1 Noise Survey Time History

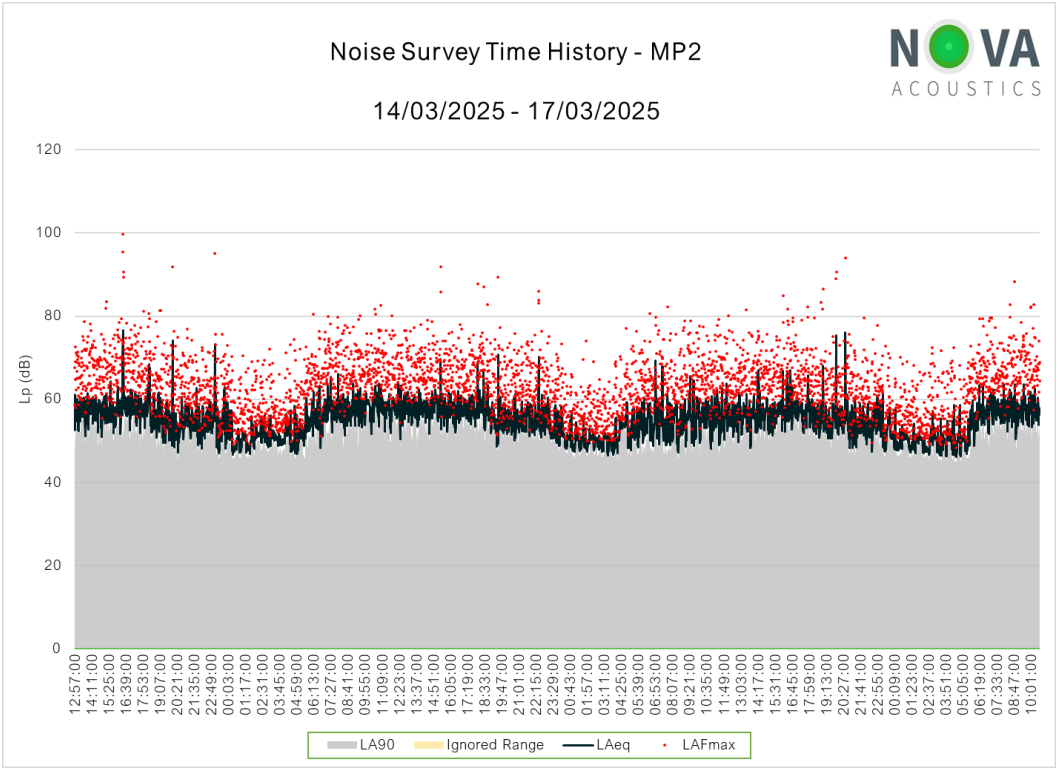


Figure 9 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV307 Class 1 Sound Level Meter	87871	≤0.1
Svantek SV36 Class 1 Calibrator	106876	
Svatek SV971A Class 1 Sound Level Meter	143581	
Svantek SV36 Class 1 Calibrator	106876	

Table 13 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.1 dB. 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 – Cullercoats (Approx. 4.6km N of Site)				
Time Period	Air Temp (^{0}C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
14/03/25: 00:00 – 23:59	1.0 – 9.7	0.0 – 0.3	S	0.6 – 4.7
15/03/25: 00:00 – 23:59	-0.1 – 11.0	0.0	S	0.0 – 2.5
16/03/25: 00:00 – 23:59	1.8 – 9.8	0.0	SE	0.4 – 4.2
17/03/25: 00:00 – 23:59	2.5 – 10.8	0.0	E	1.1 – 4.6

Table 14 – Survey Weather Conditions

Appendix E – Noise Break-in Calculations

E.1 – Façades with Background Ventilation

The façade sound reduction and predicted internal noise levels are calculated assuming the following:

- The calculation method for façade sound reduction is in accordance with BS8233:2014 and BS EN 12354-3.
- The reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room in the UK. Bedrooms are taken as 0.3s.
- Based on the technical drawings provided to NOVA Acoustics, window areas of 3-5m^2 and room volumes of 63-65m^3 are used in the calculations for bedrooms as a worst-case scenario. For living rooms, the calculations are based on a window area of 2m^2 and room volume of56m^3 as a worst-case scenario.
- The acoustic performance of the façade elements is taken from the relevant manufacturer's technical information, or the sound reduction has been predicted using INSUL 9.0.
- For background trickle ventilation a total Equivalent Area of 5000mm^2 per habitable room has been used in the calculations, which equates to 2no. trickle vents (2500mm^2 each).

Bedroom 3.5 Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	67	64	65	63	64	64	58	54	0
Glazing Noise Ingress	29	40	41	32	24	13	7	-3	-57
Ventilation Noise Ingress	29	36	27	26	30	20	18	11	-43
Wall Noise Ingress	7	19	15	11	2	1	-5	-9	-63
Roof Noise Ingress									
Room Absorption Correction		-4	-5	-5	-5	-5	-6	-7	-8
Total Noise Ingress	**30**	**40**	**40**	**31**	**29**	**18**	**16**	**7**	**-48**
NR30 & Moorhouse	35	47	41	39	33	30	26	24	22
Exceedance of Criteria	-5	-7	-1	-8	-4	-12	-10	-17	-70

Bedroom 3.5 Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	66	63	61	61	60	61	61	56	0
Glazing Noise Ingress	26	39	37	30	20	10	10	-1	-57
Ventilation Noise Ingress	27	35	23	24	26	17	21	13	-43
Wall Noise Ingress	5	18	11	9	-2	-2	-2	-7	-63
Roof Noise Ingress									
Room Absorption Correction		-4	-5	-5	-5	-5	-6	-7	-8
Total Noise Ingress	**27**	**39**	**36**	**29**	**25**	**15**	**19**	**9**	**-48**
NR25 & Moorhouse	30	47	41	35	28	25	21	19	17
Exceedance of Criteria	-3	-8	-5	-6	-3	-10	-2	-10	-65

Bedroom 3.5 Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Lmax	82	77	75	74	78	77	77	73	0
Glazing Noise Ingress	40	53	51	43	38	26	26	16	-57
Ventilation Noise Ingress	43	49	37	37	44	33	37	30	-43
Wall Noise Ingress	21	32	25	22	15	14	14	10	-63
Roof Noise Ingress									
Room Absorption Correction		-4	-5	-5	-5	-5	-6	-7	-8
Total Noise Ingress	**43**	**54**	**50**	**42**	**42**	**31**	**35**	**26**	**-48**
NR40	45	67	56	49	43	40	37	34	33
Exceedance of Criteria	-2	-13	-6	-7	-1	-9	-2	-8	-81

Bedroom 4.3 Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	67	64	65	63	64	64	58	54	0
Glazing Noise Ingress	22	39	36	19	11	5	-2	-4	-58
Ventilation Noise Ingress	23	30	21	20	24	14	12	5	-49
Wall Noise Ingress	5	17	13	9	0	-1	-7	-11	-65
Roof Noise Ingress	11	36	17	3	-3	-7	-11	-18	-72
Room Absorption Correction		2	1	1	1	1	0	-1	-2
Total Noise Ingress	**29**	**46**	**41**	**27**	**28**	**18**	**15**	**8**	**-48**
NR30 & Moorhouse	35	47	41	39	33	30	26	24	22
Exceedance of Criteria	-6	-1	0	-12	-5	-12	-11	-16	-70

Bedroom 4.3 Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	66	63	61	61	60	61	61	56	0
Glazing Noise Ingress	18	38	32	17	7	2	1	-2	-58
Ventilation Noise Ingress	21	29	17	18	20	11	15	7	-49
Wall Noise Ingress	3	16	9	7	-4	-4	-4	-9	-65
Roof Noise Ingress	10	35	13	1	-7	-10	-8	-16	-72
Room Absorption Correction		2	1	1	1	1	0	-1	-2
Total Noise Ingress	**27**	**45**	**37**	**25**	**24**	**15**	**18**	**10**	**-48**
NR25 & Moorhouse	30	47	41	35	28	25	21	19	17
Exceedance of Criteria	-3	-2	-4	-10	-4	-10	-3	-9	-65

Bedroom 4.3 Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Lmax	82	77	75	74	78	77	77	73	0
Glazing Noise Ingress	33	52	46	30	25	18	17	15	-58
Ventilation Noise Ingress	38	43	31	31	38	27	31	24	-49
Wall Noise Ingress	18	30	23	20	13	11	12	7	-65
Roof Noise Ingress	24	49	27	14	11	6	8	1	-72
Room Absorption Correction		2	1	1	1	1	0	-1	-2
Total Noise Ingress	**43**	**59**	**51**	**38**	**41**	**31**	**35**	**27**	**-48**
NR40	45	67	56	49	43	40	37	34	33
Exceedance of Criteria	-2	-8	-5	-11	-2	-9	-2	-7	-81

Living Room 1.2 Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	63	64	60	59	59	59	55	49	0
Glazing Noise Ingress	25	40	36	28	19	8	4	-8	-57
Ventilation Noise Ingress	25	36	22	22	25	15	15	6	-43
Wall Noise Ingress	3	18	9	6	-4	-5	-9	-15	-64
Roof Noise Ingress									
Room Absorption Correction		-2	-2	-3	-3	-3	-3	-5	-6
Total Noise Ingress	**28**	**43**	**37**	**30**	**26**	**16**	**15**	**5**	**-45**
NR30 & Moorhouse	35	47	41	39	33	30	26	24	22
Exceednce of Criteria	-7	-4	-4	-9	-7	-14	-11	-19	-67

Bedroom 4.2 (Dormer) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	63	64	60	59	59	59	55	49	0
Glazing Noise Ingress	24	34	29	29	23	11	8	0	-49
Ventilation Noise Ingress	9	31	11	11	6	1	-13	-21	-70
Wall Noise Ingress	0	16	7	4	-6	-7	-11	-17	-66
Roof Noise Ingress	10	36	12	-1	-8	-12	-14	-23	-72
Room Absorption Correction		2	1	1	1	1	0	-1	-2
Total Noise Ingress	**28**	**44**	**34**	**33**	**27**	**15**	**11**	**2**	**-48**
NR30 & Moorhouse	35	47	41	39	33	30	26	24	22
Exceednce of Criteria	-7	-3	-7	-6	-6	-15	-15	-22	-70

Bedroom 4.2 (Dormer) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	59	64	59	56	54	55	51	45	0
Glazing Noise Ingress	21	34	28	26	18	7	4	-4	-49
Ventilation Noise Ingress	7	31	10	8	1	-3	-17	-25	-70
Wall Noise Ingress	-3	16	6	1	-11	-11	-15	-21	-66
Roof Noise Ingress	10	36	11	-4	-13	-16	-18	-27	-72
Room Absorption Correction		2	1	1	1	1	0	-1	-2
Total Noise Ingress	**25**	**44**	**33**	**30**	**22**	**11**	**7**	**-2**	**-48**
NR25 & Moorhouse	30	47	41	35	28	25	21	19	17
Exceednce of Criteria	-5	-3	-8	-5	-6	-14	-14	-21	-65

Bedroom 4.2 (Dormer) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Lmax	74	61	59	59	56	67	69	69	0
Glazing Noise Ingress	28	32	28	29	20	19	23	20	-49
Ventilation Noise Ingress	12	29	10	11	3	9	2	-1	-70
Wall Noise Ingress	8	13	5	4	-10	0	3	3	-66
Roof Noise Ingress	9	34	11	-1	-11	-4	1	-3	-72
Room Absorption Correction		2	1	1	1	1	0	-1	-2
Total Noise Ingress	**31**	**41**	**32**	**33**	**24**	**23**	**26**	**22**	**-48**
NR40	45	67	56	49	43	40	37	34	33
Exceednce of Criteria	-14	-26	-24	-16	-19	-17	-11	-12	-81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