PEAK acoustics

Noise Assessment Report

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Environmental Noise Assessment

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Site: 589 Manchester Road, Linthwaite, HD7 5QX

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Executive Summary

An environmental noise assessment has been undertaken regarding land at 589 Manchester Rd Linthwaite, HD7 5QX where it has been proposed to develop 2 No. new residential dwellings.

Environmental noise monitoring was undertaken at the site from Tuesday 6th July – Thursday 8th July 2021. Noise affecting the development was determined to be primarily from road traffic and birdsong.

Design limits were derived for internal noise levels with guidance drawn from BS8233:2014, ProPG and WHO guidelines. The derived design criteria are summarised below.

Selected Assessment Criteria

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Areas	35 dB $L_{Aeq, 16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$ 45 dB L_{AFmax*}
Amenity	Outdoor Areas	50 – 55 dB $L_{Aeq, 16hour}$	-

**individual noise events to not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.*

Existing glazing and ventilation have been reviewed with non-compliance in regard to maintaining desirable internal noise levels within bedrooms during the night; however, desirable internal levels withing living areas during the daytime have been met. Therefore, a revised glazing and ventilation scheme, with changes only occurring in bedrooms, has been given to ensure conditions in habitable rooms remain within the desired design criteria, given below.

Revised Glazing & Ventilation Scheme

Internal Space	Glazing		Ventilation	
	Minimum Performance R_w *(+*C_{tr}*)*	*Example Specification*	*Minimum Performance* $D_{ne,w}$,+C_{tr} (Open)	*Example Specification / Strategy*
		589A & 589B		
GF Bedrooms - Front	37 *(31)*	*4 / 16 / 10*	45	Passive Wall vents
Kitchen/Living - Front	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
Kitchen/Living - Rear	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
		589A		
Attic Bedroom	44 *(38)*	*10 /16 / 8.8SC*	45	Passive Wall vents
GF Bedroom - Rear	37 *(31)*	*4 / 16 / 10*	45	Passive Wall vents
		589B		
Attic Bedroom	42 *(35)*	*8 / 16 / 8.8SC*	45	Passive Wall vents
GF Bedroom - Rear	34 *(29)*	*4 / 16 / 6*	45	Passive Wall vents

Passive window/wall ventilators are deemed suitable for all areas. Recommended Example products for this would be a standard low spec trickle ventilator, *Titon Trimvent XS13 4400EA,* and a passive thru-wall ventilator, *Passivent Fresh 80dB.*

Contents

1. Introduction

1.1. Proposal

It has been proposed to develop a plot of land at 589 Manchester Road, Linthwaite, HD7 5QX. The proposal is in relation to the construction of 2no. semidetached dwellings.

1.2. Reason for Assessment

The land lies adjacent to Manchester Road, concerns were raised by the council with the aim to avoid noise giving rise to significant adverse impacts on health and quality of life as a result of a new development. A noise assessment is to be submitted as part of the planning application to ensure desirable internal noise levels are met within habitable rooms of the proposed development due to the nearby road traffic noise and other sources. The assessment aims to provide a sound insulation scheme for the development.

1.3. Planning Policy & Guidance

1.3.1. National Planning Policy Framework (NPPF)

Guidance for the assessment of noise affecting new residential development is given in the National Policy Framework (NPPF). Section 109 of the NPPF states.

> *"The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of…noise pollution."*

Section 123 states the following aims:

- *"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of a new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

The NPPF seeks to limit the exposure of new development to unacceptable levels of noise, although the policy does not seek to prescribe what constitutes an unacceptable level of noise.

1.3.2. Noise Policy Statement of England (NPSE)

Noise Policy Statement for England (NPSE) was published in March 2010 by The Department for Environment, Food and Rural Affairs (DEFRA). The explanatory note of NPSE defines the terms edes in NPFF:

*"**Significant adverse' and 'adverse;***

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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.*

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effect on health and quality of life can be detected. 2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur."

The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

"2.22 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the "NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

There is no local or national guidance on how the three terms should be defined numerically, it is for the assessor to collate and interpret appropriate guidance on noise, such as may be found in British Standards, and correlate the guidance with the concepts of NOEL, LOAEL and SOAEL.

1.3.3. Planning Practice Guidance: Noise (PPGN)

In March 2014, the Government released the PPG on noise, revised July 2019. This document sets out a number of principles and reinforces the guidance set out in the NPPF and NPSE.

Paragraph 001 of PPGN notes that:

"Noise needs to be considered when new development may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."

It goes on to note in paragraph 003 that:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved."*

The PPGN broadly repeats the NPSE definitions of the NOEL, LOAEL AND SOAEL and it provides a summary table to explain how the terms relate to each other and to typical human response to sound. The table is replicated below in **Table 1.**

Table 1. – PPGN Noise Exposure Hierarchy

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

The PPGN provides advice on how to mitigate the effects of noise, noting that there are options to reduce noise at source, to optimise site layouts and to use planning conditions.

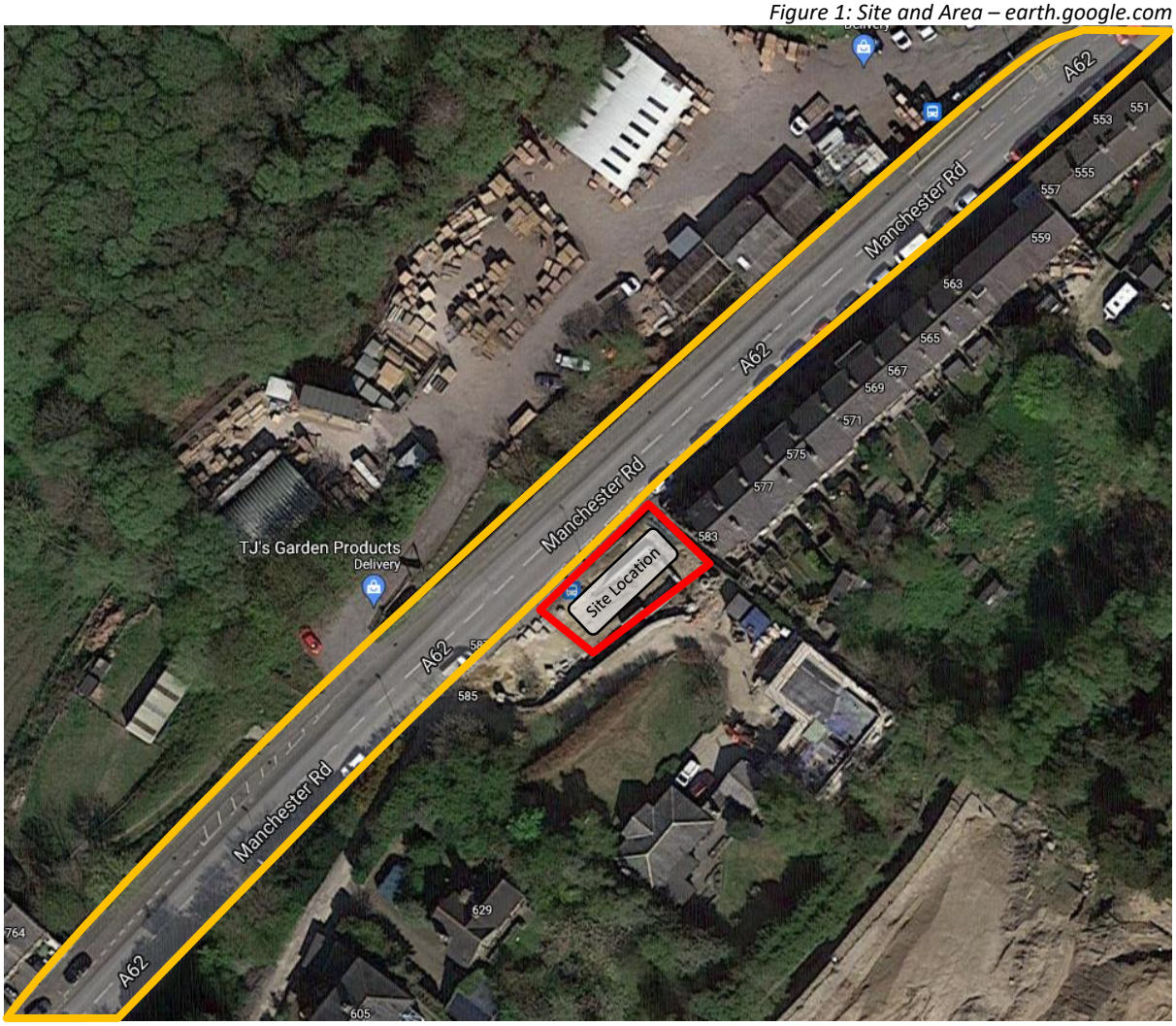
2. Assessment Methodology

2.1. Site Description

The site is located along Manchester Road whereby heavy goods vehicles, buses and cars pass regularly. Two commercial business are located opposite the proposal, *TJs Garden Products* and *Huddersfield pallets Limited.* Existing residential housing makes up the majority of the land to the south.

The site and industrial locations described above are shown in **Figure 1** below.

Figure 1: Site and Area – earth.google.com



2.2. Design Criteria Summary

Guidance on the assessment and design criteria have been drawn from BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings.* Table 4 in Section 7.7.2 of this standard suggests indoor ambient noise levels for dwellings. A summary of this criteria is given below.

Desirable internal noise levels are to be maintained as given in BS8233:2014:

- *<35dB $L_{Aeq,\ 16hr}$ within living areas during the day (07:00 – 23:00)*
- *<30dB $L_{Aeq,\ 8hr}$ within bedrooms at night (23:00 – 07:00)*
- *45dB L_{Afmax} should not be regularly exceeded within bedrooms at night (23:00 – 07:00)*

WHO Guidelines help to define the L_{Afmax} parameter requirements:

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times a night (Vallet & Vernet 1991)".*

Additional guidance may be drawn from ProPG: Planning & Noise which was published "*to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England."*

2.3. Assessment Standards & Justification

'BS8233:2014 – Guidance on sound insulation and noise reduction for buildings' is a recognised standard for assessing and mitigating environmental noise levels upon a proposed noise sensitive development. The standard gives a rigorous calculation method for determining interior noise levels based on measured environmental noise levels.

'World Health Organisation Guidelines for Community Noise (1999)' details suitable noise levels for various activities within residential and commercial buildings.

'Pro PG – Professional Practice Guidance on Planning & Noise' provides practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

3. Environmental Noise Survey

3.1. Survey Measurements

To assess the environmental noise levels affecting the proposed development, an unattended noise survey was undertaken at the site from Tuesday 6th July – Thursday 8th July 2021. This period was selected to capture events and noise levels from weekday periods given the proximity to a nearby busy road network.

Measurements of $L_{Aeq,T}$ and L_{AFmax} were logged in 5-minute intervals in accordance with the provisions of BS7445 - *'Description and Measurement of Environmental Noise'*.

3.2. Measurement Locations

At position M1, the microphone was positioned out of the 1st floor window of the façade facing Manchester Road, fully exposed to all nearby noise sources. At position M2, the microphone was positioned around 1.5m above ground floor level to the rear of the proposal, deemed representative of rear noise levels

The monitoring locations are shown in **Figure 2** in Section 3.5.

3.3. Weather Conditions

Daytime temperatures of 15 – 20°C were noted during the survey with negligible winds and little precipitation; deemed suitable for conducting environmental noise monitoring. Detailed weather conditions are given in **Appendix C**.

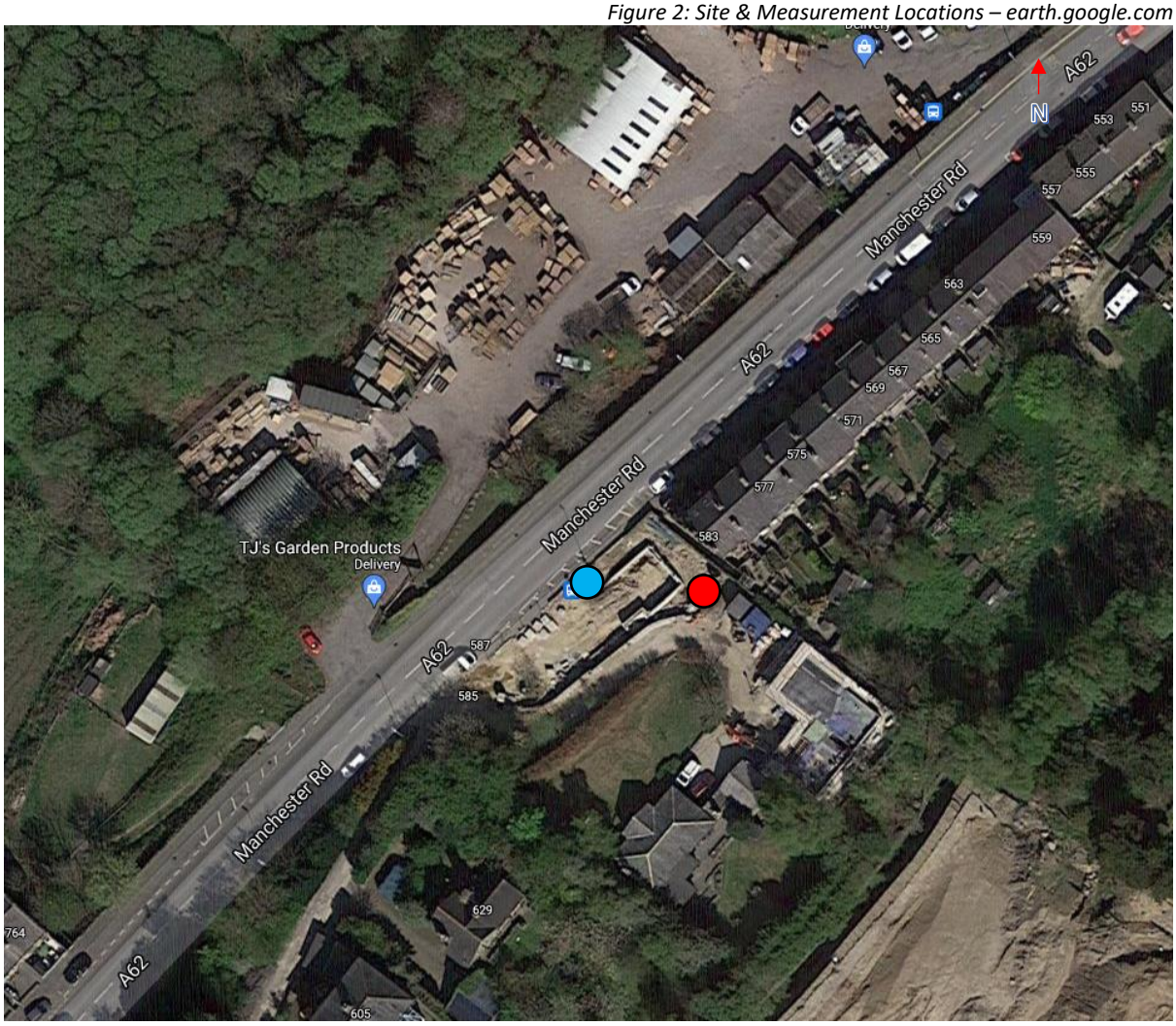
3.4. Measurement Equipment

Measurement equipment complies with accuracy requirements for common environmental noise measurement standards. Equipment was calibrated before and after use and no significant drift occurred during measurements. Up to date calibration certification can be provided upon request. A detailed equipment list is given in **Appendix B** with calibration information in **Appendix D**.

3.5. Monitoring Location

The site and unattended noise monitoring location is shown on Figure 2 below.

Figure 2: Site & Measurement Locations – earth.google.com



Monitoring Location (M1)

Monitoring Location (M2)

3.6. Noise Affecting the Development

The main contributor of noise affecting site arises from road traffic along Manchester Road. Heavy goods vehicles were noted passing regularly as well as smaller vehicles. Commercial activity was noted from *TJs Garden Products* and *Huddersfield Pallets Limited* opposite the dwelling when road traffic levels along Manchester Road subsided. Natural noise sources included birdsong and rustling of trees.

3.7. Environmental Noise Levels

The results from the noise monitoring at position M1 and M2 are summarised below.

Full environmental noise monitoring data is given in **Appendix E.**

Table 2. – Environmental Measurement Summary

Measurement	Date(s)	Period	L_{Aeq} (dB)	Typical* L_{AFmax} (dB)
M1 – Front	6th & 7th July 2021	Day *(16hr Aggregate Periods)*	66.0	-
	6th – 7th July 2021	Night *(8hr)*	60.4	90.3
	7th & 8th July 2021	Day *(16hr Aggregate Periods)*	65.8	-
	7th – 8th July 2021	Night *(8hr)*	60.2	82.5

Measurement M1 was subject to a -3 dB façade correction due to being in close proximity to a reflective surface.

** The given 'Typical' L_{AFmax} levels above are an average of the spectra of the noisiest 10 events of the night-time periods; the maxima levels selected would not ordinarily be exceeded more than 10 times within the night-time, in accordance with the WHO L_{AFmax} parameter guidance.*

To aid in determining the difference in noise levels between the front and rear of the development, a comparative measurement was undertaken at position M2 on Tuesday 6th July 2021. Data from measurement M1 will be utilised to directly compare with measurement M2. The exact same measurement intervals from measurement M1 and measurement M2 have been compared below.

Table 3. – Measurement Results Difference

Period	Measurement	Location	$L_{Aeq,T=5min}$ (dB)	Difference, dB
12:45 – 13:00	M1	Front	69.6	**9.9**
12:45 – 13:00	M2	Rear	59.7	

A 9.9 dB difference in noise levels was noted between measurement data M1 and M2. Therefore, a 10 dB reduction has been applied to measured noise levels at the rear.

The resultant external noise levels for front and rear areas are summarised in the table below.

Table 4. – Corrected Environmental Noise Levels

Zone(s)	Period	$L_{Aeq,T}$ (dB)	Typical L_{AFmax} (dB)
Front	Daytime *(16hr)*	66.0	-
	Night *(8hr)*	60.4	72.3
Rear	Daytime *(16hr)*	56.0	-
	Night *(8hr)*	50.4	62.3

The '*Rear*' zone corrected noise levels, displayed in Table 4, have been utilised within this assessment.

4. Internal Noise Level Assessment

4.1. Design Criteria

BS8233:2014 - *Guidance on sound insulation and noise reduction for buildings* suggests indoor ambient noise levels for dwellings in Table 4, Section 7.7.2. These are summarised below.

Table 5. – BS8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$
		-	45 dB L_{AFMax}

**individual noise events to not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.*

BS8233 states that the guideline values given above are for 'noise without character', such as that from road, rail or air traffic. For defining 'character', a note in Section 7.7.1 of BS8233 states:

> *"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

As the primary noise source under investigation is road traffic, it can be argued that noise breaking into habitable rooms is 'noise without character'. Lower guideline ambient levels are not required.

With regards to Maxima noise events, ProPG Planning and Noise, p. 13, states:

> *"NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,F, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB LAmax,F more than 10 times a night".*

Considering the noise climate affecting the proposed dwelling, it is deemed appropriate to consider individual night-time L_{AFMax} noise events measured during the noise survey.

4.2. Assessment Noise Levels

In the interest of a robust assessment, the loudest of the measurement intervals are to be considered in the assessment of internal noise levels and determining the sound insulation scheme with reference to 'Note 2 of Table 4' in BS8233 given in Section 4.1.

The resultant external noise levels for the assessment of internal ambient noise levels are summarised in the table below.

Table 6. – Assessment Noise Levels

Location	Period	$L_{Aeq,T}$ (dB)	Typical L_{AFmax} (dB)
Front	Daytime *(16hr)* *	66.0	-
	Night *(8hr)* **	60.4	72.3
Rear	Daytime *(16hr)* *	56.0	-
	Night *(8hr)* **	50.4	62.3

*Daytime equivalent sound levels have been extracted from noise data occurring between the 6th & 7th July 2021 for both front and rear.

**Night-time continuous sound levels have been extracted from noise data occurring between the 6th & 7th July 2021. Maxima noise events were extracted from measurement data occurring between the 7th & 8th.

Front and rear noise levels both reference the noise data stated above.

4.3. Internal Noise Level Calculations

Internal noise levels have been calculated to demonstrate that the proposed dwellings can achieve the desired design criteria when appropriate glazing and ventilation systems are utilised.

Room dimensions and glazed areas have been approximated based on the drawings supplied to Peak Acoustics and drawn by '*FCS Consultants*'. Note that assessment is not required for each individual room. The selection of habitable rooms has been chosen as representative of the most noise sensitive areas, which have been selected on account of room and windows sizes.

The noise levels that will exist within the habitable areas of the finished development have been predicted based on the existing noise environment at the site and outline details for the design of the development. The predicted noise levels have been compared with appropriate design criteria. Where the criteria have been predicted to be exceeded, suitable mitigation measures have been identified.

Calculations of internal ambient noise levels have been undertaken using the 'rigorous calculation' method given in Annex G2 of BS8232:2014. Full details of the calculations are provided in **Appendix F.**

5. Review of Existing Glazing & Ventilation Scheme

Glazing and ventilation is or close to being installed throughout the property. The existing scheme has been reviewed to see whether the internal noise level criteria given in **Table 4** has be achieved. The existing scheme is defined in the table below.

Table 7. – Existing Glazing & Ventilation Scheme

Internal Space	Glazing		Ventilation	
	Existing Performance R_w *(+*C_{tr}*)* [1]	*Specification* [2]	*Existing Performance* $D_{ne,W}$,+$C_{tr\ (Open)}$	*Specification / Strategy*
		589A & 589B		
Attic Bedrooms	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
GF Bedrooms - Front	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
GF Bedrooms - Rear	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
Kitchen/Living - Front	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
Kitchen/Living - Rear	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators

N.B Note that other glazing configurations and ventilators can achieve the given minimum performance requirements.

[1] The sound insulation value of the glazing should take into account the glass as well as the frame and perimeter seal.

[2] Example glazing specification format given as 'XXmm Float / 16mm Air gap / XXmm Float'.

6. Internal Noise Levels

It is determined that by using mitigation as specified in **Table 6** for the building façades, the outcome summarised in the following table is achieved.

Table 8. – Internal Noise Levels

Internal Space	Noise Parameter	Internal Noise Level (dB)	Within Design Criteria?
589A - Attic Bedroom	Night-time $L_{Aeq, 8hr}$	27	Yes
	Night-time L_{AFmax}	50	No
589B - Attic Bedroom	Night-time $L_{Aeq, 8hr}$	28	Yes
	Night-time L_{AFmax}	51	No
589A – GF Bedroom Front	Night-time $L_{Aeq, 8hr}$	28	Yes
	Night-time L_{AFmax}	51	No
589B – GF Bedroom Front	Night-time $L_{Aeq, 8hr}$	28	Yes
	Night-time L_{AFmax}	51	No
589A – GF Bedroom Rear	Night-time $L_{Aeq, 8hr}$	28	Yes
	Night-time L_{AFmax}	51	No
589B – GF Bedroom Rear	Night-time $L_{Aeq, 8hr}$	28	Yes
	Night-time L_{AFmax}	51	No
589A – Living/Kitchen Front	Daytime $L_{Aeq, 16hr}$	35	Yes
589A – Living/Kitchen Rear	Daytime $L_{Aeq, 16hr}$	24	Yes
589B – Living/Kitchen Front	Daytime $L_{Aeq, 16hr}$	35	Yes
589B – Living/Kitchen Rear	Daytime $L_{Aeq, 16hr}$	24	Yes

For the daytime assessment for living areas, the desirable limit of BS8233:2014 suggests a guideline of 35 dB $L_{Aeq,16hr}$ for resting conditions, and up to 40 dB is considered acceptable for necessary developments. All results, with implementation of the existing sound insulation scheme given in **Table 6**, would place the internal daytime noise levels at and below 35 dB, therefore within the desired limit.

For the night-time assessment for bedrooms, BS8233:2014 suggests a desirable guideline of 30 dB $L_{Aeq, 8hr}$ for sleeping conditions, with an acceptable limit of 35 dB $L_{Aeq, 8hr}$. Individual noise events (Measured with fast time-weighted Maximum) should not normally exceed 45 dB L_{AFmax}. Implementation of the existing sound insulation scheme given in **Table 6** would place the internal continuous night-time noise levels as below 30 dB and within the desirable category. However, maximum noise events are predicted to exceed the 45 dB L_{AFmax} limit. A revised sound insulation scheme for all bedrooms is therefore required to achieve desirable L_{AFmax} noise levels. See **Section 7.**

7. Revised Glazing & Ventilation Sound Insulation Scheme

The following revised glazing and ventilation scheme has been provided to achieve the desirable L_{AFmax} internal noise levels displayed in **Table 4**, as the existing scheme failed to attain this. This is specified in the table below.

Table 9. – Glazing & Ventilation Scheme

Internal Space	Glazing		Ventilation	
	Minimum Performance R_w *(+*C_{tr}*)* **[1]**	*Example Specification* **[2]**	*Minimum Performance* $D_{ne,W}$,+$C_{tr\ (Open)}$	*Example Specification / Strategy*
		589A & 589B		
GF Bedrooms - Front	37 *(31)*	*4 / 16 / 10*	45	Passive Wall vents
Kitchen/Living - Front	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
Kitchen/Living - Rear	36 *(29)*	*4 / 20 / 4*	32	Trickle Ventilators
		589A		
Attic Bedroom	44 *(38)*	*10 /16 / 8.8SC*	45	Passive Wall vents
GF Bedroom - Rear	37 *(31)*	*4 / 16 / 10*	45	Passive Wall vents
		589B		
Attic Bedroom	42 *(35)*	*8 / 16 / 8.8SC*	45	Passive Wall vents
GF Bedroom - Rear	34 *(29)*	*4 / 16 / 6*	45	Passive Wall vents

N.B Note that other glazing configurations and ventilators can achieve the given minimum performance requirements.

[1] The sound insulation value of the glazing should take into account the glass as well as the frame and perimeter seal.

[2] Example glazing specification format given as 'XXmm Float / 16mm Air gap / XXmm Float'.

8. Internal Noise Levels

It is determined that by using mitigation as specified in **Table 8** for the building façades, the outcome summarised in the following table is achieved.

Table 10. – Internal Noise Levels

Internal Space	Noise Parameter	Internal Noise Level (dB)	Within Design Criteria?
589A - Attic Bedroom	Night-time $L_{Aeq, 8hr}$	21	Yes
	Night-time L_{AFmax}	44	Yes
589B - Attic Bedroom	Night-time $L_{Aeq, 8hr}$	20	Yes
	Night-time L_{AFmax}	44	Yes
589A – GF Bedroom Front	Night-time $L_{Aeq, 8hr}$	21	Yes
	Night-time L_{AFmax}	44	Yes
589B – GF Bedroom Front	Night-time $L_{Aeq, 8hr}$	21	Yes
	Night-time L_{AFmax}	44	Yes
589A – GF Bedroom Rear	Night-time $L_{Aeq, 8hr}$	20	Yes
	Night-time L_{AFmax}	44	Yes
589B – GF Bedroom Rear	Night-time $L_{Aeq, 8hr}$	20	Yes
	Night-time L_{AFmax}	44	Yes
589A – Living/Kitchen Front	Daytime $L_{Aeq, 16hr}$	35	Yes
589A – Living/Kitchen Rear	Daytime $L_{Aeq, 16hr}$	24	Yes
589B – Living/Kitchen Front	Daytime $L_{Aeq, 16hr}$	35	Yes
589B – Living/Kitchen Rear	Daytime $L_{Aeq, 16hr}$	24	Yes

For the daytime assessment for living areas, the desirable limit of BS8233:2014 suggests a guideline of 35 dB $L_{Aeq,16hr}$ for resting conditions, and up to 40 dB is considered acceptable for necessary developments. All results, with implementation of the derived sound insulation scheme given in **Table 8**, would place the internal daytime noise levels as below 35 dB, therefore within the desired limit.

For the night-time assessment for bedrooms, BS8233:2014 suggests a desirable guideline of 30 dB $L_{Aeq, 8hr}$ for sleeping conditions, with an acceptable limit of 35 dB $L_{Aeq, 8hr.}$ Individual noise events (Measured with fast time-weighted Maximum) should not normally exceed 45 dB L_{AFmax}. Implementation of the derived sound insulation scheme given in **Table 8** would place the internal continuous night-time noise levels as below 30 dB and the maximum noise events as typically below 45 dB L_{AFmax}, therefore within the desirable category.

It is noted that BS8233 section 7.2.2 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'. This statement implies that the use of closed windows and an alternative means of ventilation is acceptable.

All habitable rooms will be provided with either: proprietary wall or window mounted trickle vents, or an acoustic attenuated passive ventilation system, which provides an open area equivalent to a partially open window, to achieve background ventilation in accordance with the Building Regulations requirements as per the table above. This will negate the need for open windows for the purposes of ventilation.

9. External Amenity Areas

A walled off garden area is present to the west of the proposal. BS8233:2014 provides a desirable guideline of 50 dB $L_{Aeq,16hr}$ for external amenity spaces and an acceptable guideline of 55 dB $L_{Aeq,16hr}$ for noisier environments. External daytime noise levels were measured between 65 – 66 dB $L_{Aeq,16hr}$ over the 2-day survey period, therefore viewed as an exceedance of the acceptable guidelines.

However, the garden area to the west of the dwellings is walled off at roughly 1m above road height. If the height of this wall were to be extended to at least 1.5m, then this would act as a barrier between the external amenity space and Manchester Road, warranting a reasonable 10 dB reduction in noise levels. This would result in external amenity noise levels ranging between 55 – 56 dB, a minor and negligible exceedance of the acceptable criteria. Further, measurements were taken at 1st floor level with the microphone fully exposed to all road traffic along Manchester Road. Measurements at ground floor and to the side of the property, where the garden is situated, would likely be lower than 65 – 66 dB. After the garden wall height extension, this would mean external noise levels within the garden area would be lower still.

Further '*ProPG: Planning & Noise guidance'* states the following:

> *"Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*
>
> *A relatively quiet façade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling." – P.17 Element 3*

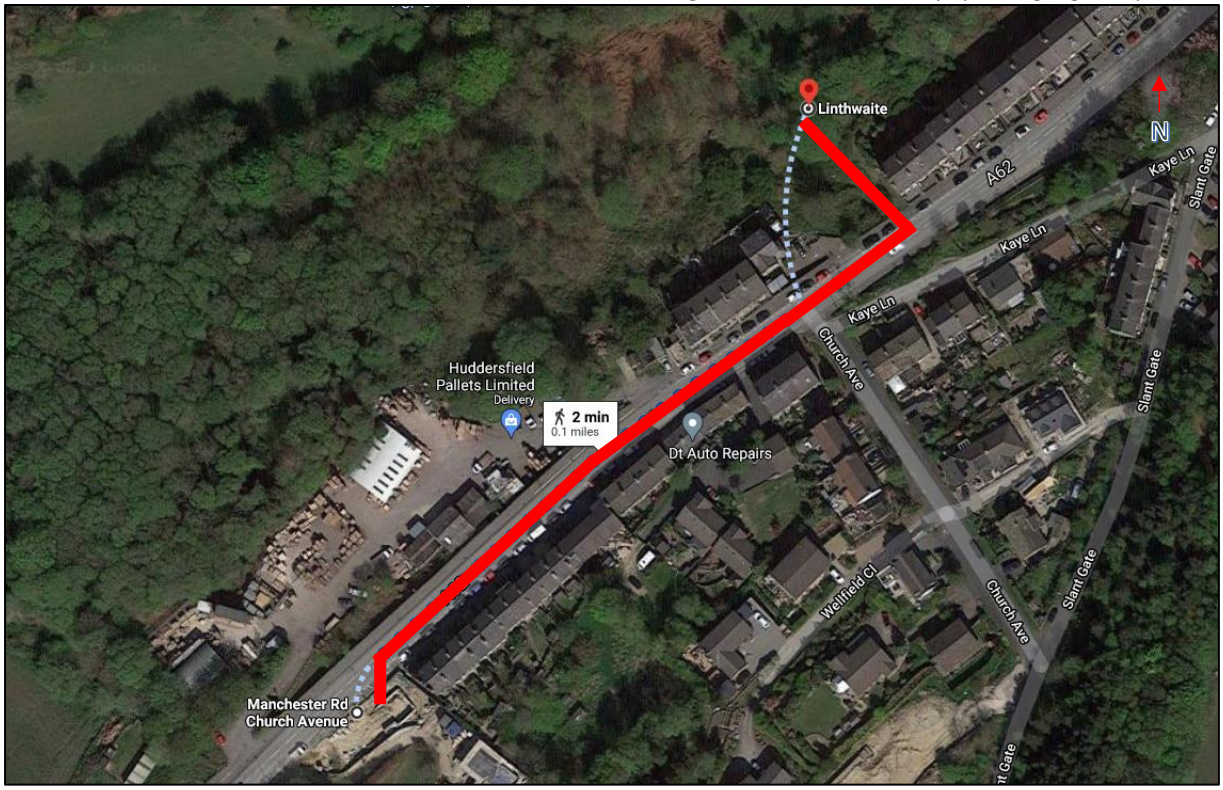
Noise levels towards the rear side of the property were measured at 55 – 56 dB. Here the meter was still exposed to traffic along Manchester Road. The south facing façade is considered a *'quiet façade',* a line-of-sight correction of up to 10 dB reduction can be applied to measured noise levels, to account for full screening from the noise sources by the building itself. This would bring external noise levels at this façade down to 45 – 46 dB, therefore within the desirable category.

Following on, '*ProPG: Planning & Noise guidance'* also states:

> *"…if the residents are provided, through the design of the development or the planning process, with access to:*
>
> *A relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations." – P.18 Element 3*

The immediate surrounding consists of predominantly agricultural and countryside land. There appears to be an area of greenery accessible to the public around a 2 minutes' walk from the proposal. This is shown in Figure 3 below.

Figure 3: Accessible Amenity Space – google.maps.com



Following implementation of the garden wall height extension, the *'quiet façade'* and with numerous alternative amenity spaces within a short distance of the proposal, future residents will likely have access to numerous quiet external amenity spaces.

10. Conclusions

An environmental noise assessment has been undertaken regarding land at 589 Manchester Rd Linthwaite, HD7 5QX where it has been proposed to develop 2 No. new residential dwellings.

Environmental noise monitoring was undertaken at the site from Tuesday 6th July – Thursday 8th July 2021. Noise affecting the development was determined to be primarily from road traffic and birdsong.

Design limits were derived for internal noise levels with guidance drawn from BS8233:2014, ProPG and WHO guidelines. An existing glazing and ventilation scheme was found to be insufficient in protecting against maxima noise levels within bedrooms which is associated to sleep disturbance. A revised glazing and ventilation scheme has been provided ensure conditions in habitable rooms remain within the design criteria.

A discussion on external amenity spaces has been provided. It is thought that future residents will have access to numerous quiet external amenity spaces, both at the proposal and in the surrounding area.

APPENDIX A – Measurement Details

Measurement(s)	Kit	Start Date	Start Time	End Date	End Time
M1	A2	06/07/2021	12:35	08/07/2021	14:25
M2	A1	06/07/2021	12:45	06/07/2021	13:00

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A2	Sound Meter	Svantek	971	1	40305
A2	Pre-Amp	Svantek	SV12L	1	32484
A2	Calibrator	Svantek	SV33A	1	90273
A1	Sound Meter	Svantek	958	1	34525
A1	Pre-Amp	Svantek	SV12L	1	32484
A1	Microphone	Microtech Gefell	MK255	1	11561

APPENDIX C - Meteorology Details

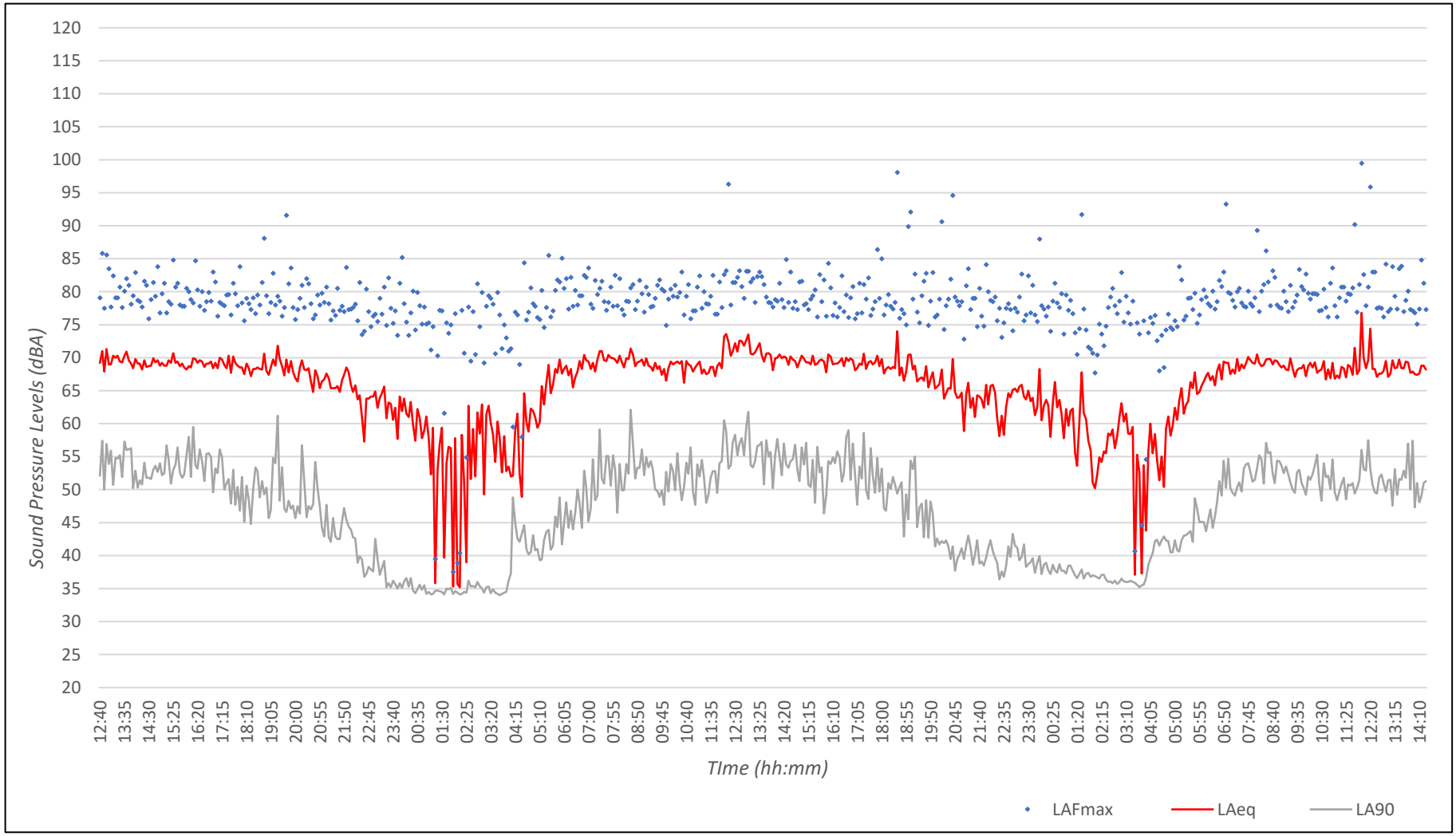
Date	Temp C°	Wind Speed m/s	Wind Direction	Humidity %	Precipitation mm	Cloud Cover (Oktas)
06/07/21	15	4 – 5	W	87	1	8/8
07/07/21	18	4 – 5	WSW	77	0.7	8/8
08/07/21	20	4 – 5	W	58	0	2/8

APPENDIX D - Calibration Details

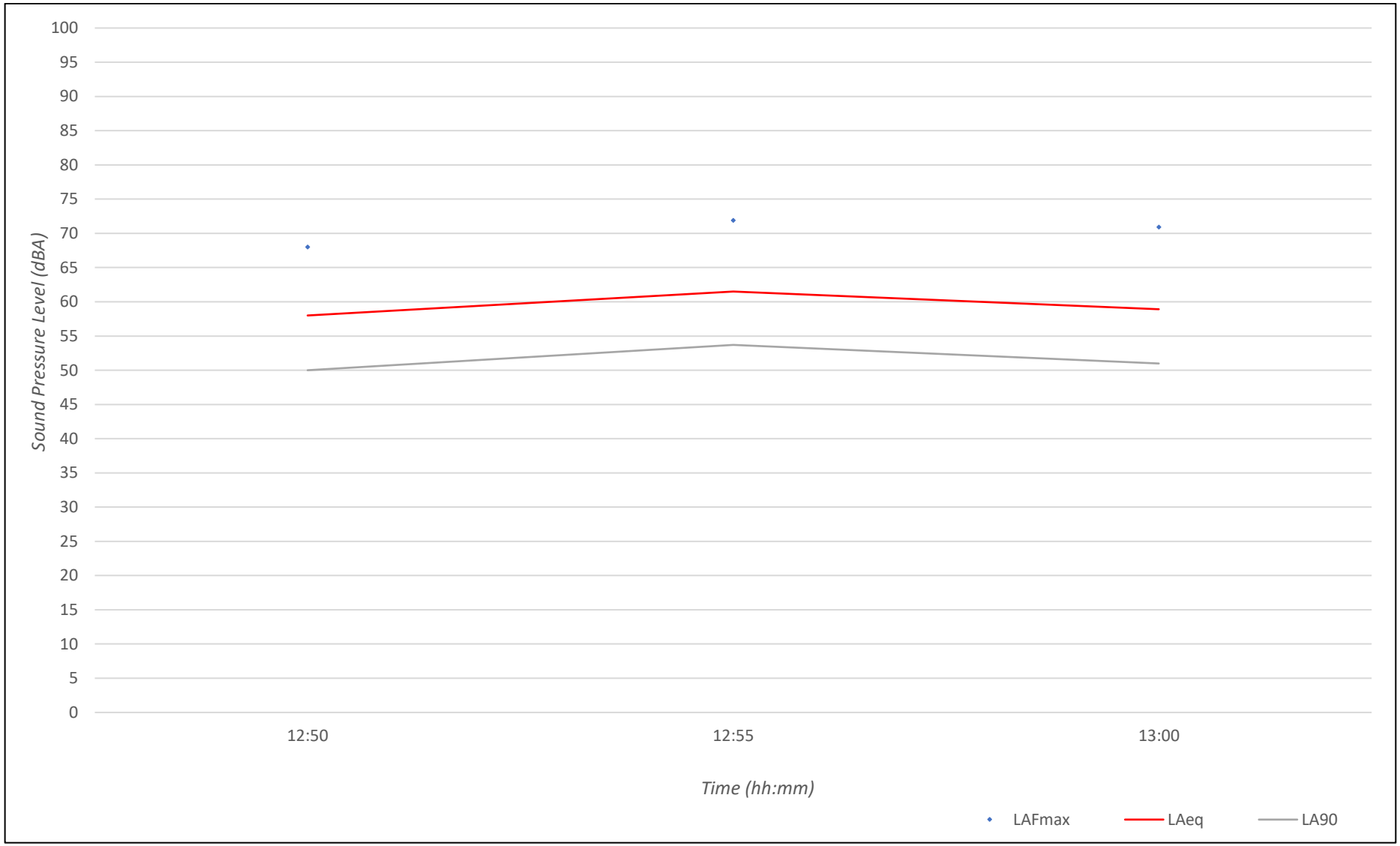
Kit	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
A2	113.8	1.82	1.81

APPENDIX E – Noise Survey Results

Environmental Noise Measurement M1, 6th – 8th July 2021



Environmental Noise Measurement M2, 6th July 2021



APPENDIX F – BS8233:2014 Rigorous Design Calculations

Existing Glazing and Ventilation Scheme

Attic Bedroom 589A - Night LAMax

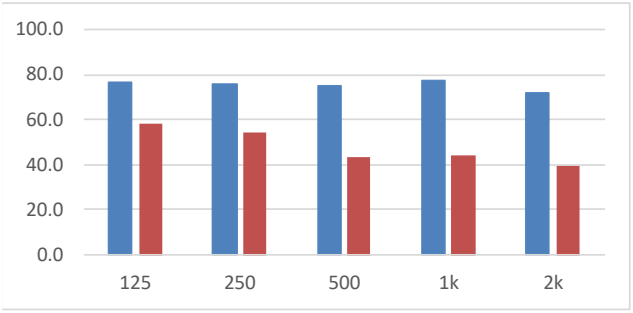
Room Properties

Room Width (m)	6.4
Room Depth (m)	3.3
Room Height (m)	5.0
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	79.6 dB LAmax
Internal Level	50.1 dB LAmax
Insertion Loss	29.5 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	7.49E-05	0.0004	3.8E-05	6E-05	7.5E-05
Term 2	0.000447	0.0006	2.8E-05	4E-06	1.4E-06
Term 3	7.5E-05	3E-05	3E-05	4E-06	1.5E-06
Term 4	0.000831	3E-05	6.6E-06	2E-06	1.7E-06
Internal, dB L_{eq}	58.1	54.6	43.4	44.1	39.5
Internal, dB LAeq	42.0	46.0	40.2	44.1	40.7

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Attic Bedroom 589A - Night Laeq

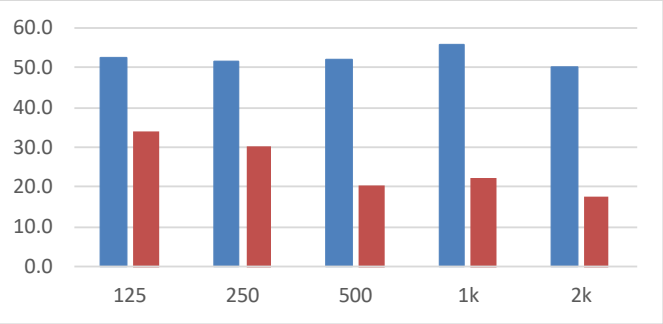
Room Properties

Room Width (m)	6.4
Room Depth (m)	3.3
Room Height (m)	5.0
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	57.9 dB LAeq
Internal Level	27.1 dB LAeq
Insertion Loss	30.9 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 20 / 4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	7.49E-05	0.0004	3.8E-05	6E-05	7.5E-05
Term 2	0.000447	0.0006	2.8E-05	4E-06	1.4E-06
Term 3	7.5E-05	3E-05	3E-05	4E-06	1.5E-06
Term 4	0.000831	3E-05	6.6E-06	2E-06	1.7E-06
Internal, dB L_{eq}	33.8	30.4	20.5	22.2	17.6
Internal, dB LAeq	17.7	21.8	17.3	22.2	18.8

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Attic Bedroom 589B - Night LAeq

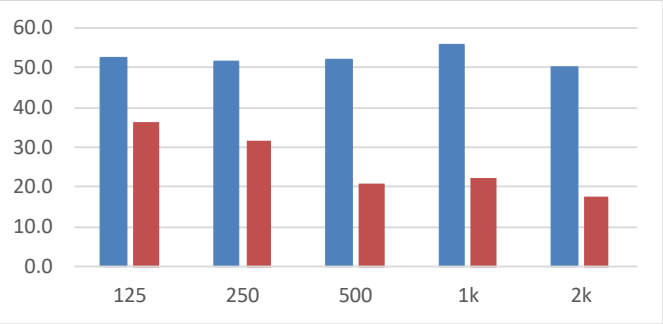
Room Properties

Room Width (m)	5.4
Room Depth (m)	5.0
Room Height (m)	3.3
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	57.9 dB LAeq
Internal Level	27.9 dB LAeq
Insertion Loss	30.1 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 20 / 4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	8.88E-05	0.0004	4.5E-05	7E-05	8.9E-05
Term 2	0.000802	0.001	5.1E-05	6E-06	2.5E-06
Term 3	7.14E-05	3E-05	2.8E-05	4E-06	1.4E-06
Term 4	0.001907	8E-05	1.5E-05	5E-06	3.8E-06
Internal, dB L_{eq}	36.1	31.6	21.0	22.4	17.8
Internal, dB LAeq	20.0	23.0	17.8	22.4	19.0

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Attic Bedroom 589B - Night LAMax

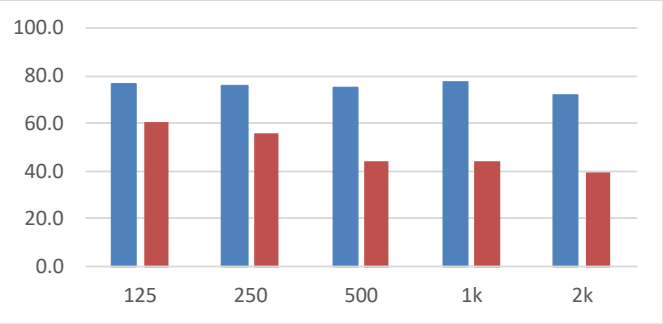
Room Properties

Room Width (m)	5.4
Room Depth (m)	5.0
Room Height (m)	3.3
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	79.6 dB LAmax
Internal Level	51.1 dB LAmax
Insertion Loss	28.5 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 20 / 4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	8.88E-05	0.0004	4.5E-05	7E-05	8.9E-05
Term 2	0.000802	0.001	5.1E-05	6E-06	2.5E-06
Term 3	7.14E-05	3E-05	2.8E-05	4E-06	1.4E-06
Term 4	0.001907	8E-05	1.5E-05	5E-06	3.8E-06
Internal, dB L_{eq}	60.3	55.7	44.0	44.3	39.6
Internal, dB LAeq	44.2	47.1	40.8	44.3	40.8

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589A - Night Laeq

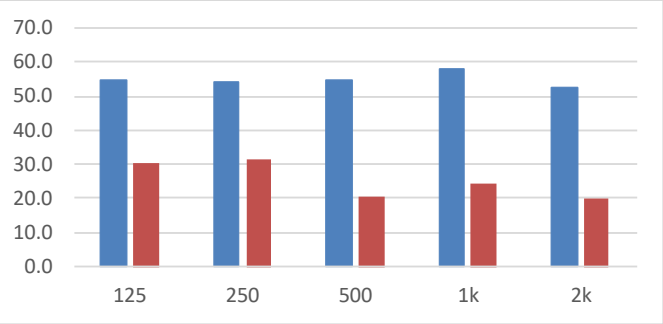
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.2
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	28.3 dB LAeq
Insertion Loss	32.1 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000474	0.0024	0.00024	0.0004	0.00047
Term 2	0.001891	0.0024	0.00012	2E-05	6E-06
Term 3	6.05E-05	2E-05	2.4E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	30.6	31.7	20.6	24.3	19.9
Internal, dB LAeq	14.5	23.1	17.4	24.3	21.1

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589A - Night LAMax

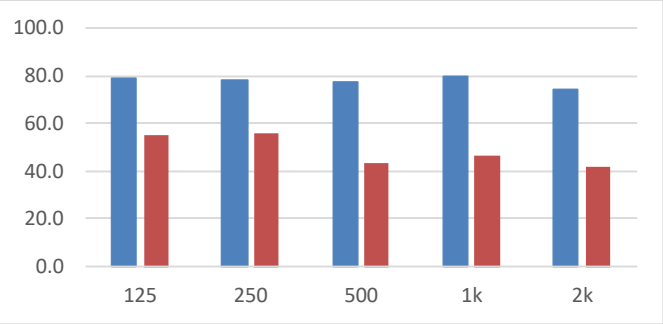
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.2
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	51.2 dB LAmax
Insertion Loss	30.9 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 20 / 4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000474	0.0024	0.00024	0.0004	0.00047
Term 2	0.001891	0.0024	0.00012	2E-05	6E-06
Term 3	6.05E-05	2E-05	2.4E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	54.8	55.8	43.6	46.1	41.7
Internal, dB LAeq	38.7	47.2	40.4	46.1	42.9

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589B - Night Laeq

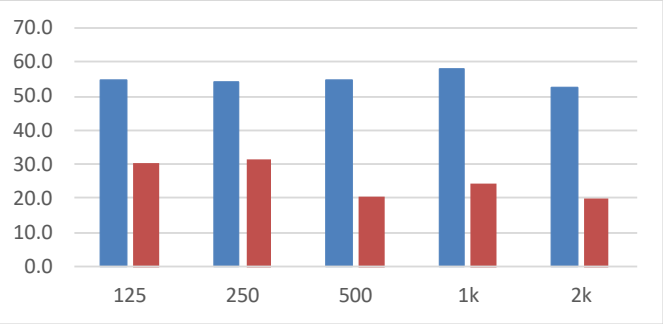
Room Properties

Room Width (m)	3.1
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	28.3 dB LAeq
Insertion Loss	32.1 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000535	0.0027	0.00027	0.0004	0.00054
Term 2	0.002135	0.0027	0.00013	2E-05	6.8E-06
Term 3	5.81E-05	2E-05	2.3E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	30.6	31.7	20.6	24.3	19.9
Internal, dB LAeq	14.5	23.1	17.4	24.3	21.1

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589B - Night LAMax

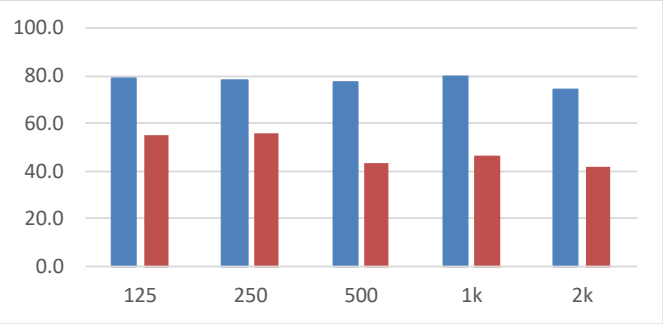
Room Properties

Room Width (m)	3.1
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	51.2 dB LAmax
Insertion Loss	30.9 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000535	0.0027	0.00027	0.0004	0.00054
Term 2	0.002135	0.0027	0.00013	2E-05	6.8E-06
Term 3	5.81E-05	2E-05	2.3E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	54.8	55.8	43.5	46.1	41.7
Internal, dB LAeq	38.7	47.2	40.3	46.1	42.9

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589A - Night Laeq

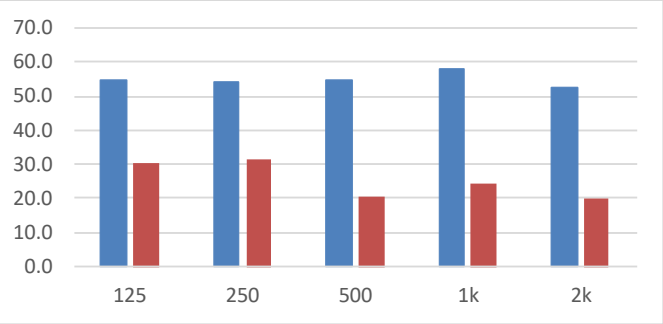
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.1
Room Height (m)	2.4
Glazed Area (m^2)	1.8
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	28.2 dB LAeq
Insertion Loss	32.2 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000474	0.0024	0.00024	0.0004	0.00047
Term 2	0.001702	0.0021	0.00011	1E-05	5.4E-06
Term 3	6.24E-05	2E-05	2.5E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	30.2	31.5	20.5	24.2	19.9
Internal, dB LAeq	14.1	22.9	17.3	24.2	21.1

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589A - Night LAMax

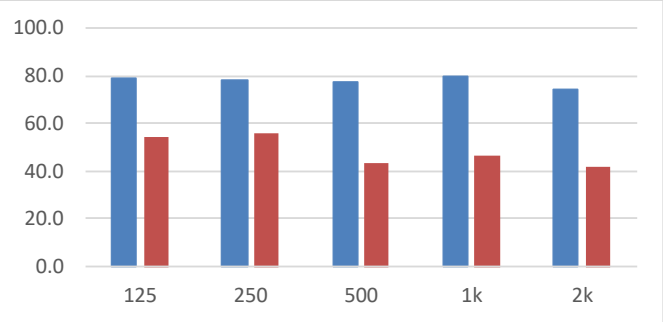
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.1
Room Height (m)	2.4
Glazed Area (m^2)	1.8
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	51.1 dB LAmax
Insertion Loss	31.0 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 20 / 4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000474	0.0024	0.00024	0.0004	0.00047
Term 2	0.001702	0.0021	0.00011	1E-05	5.4E-06
Term 3	6.24E-05	2E-05	2.5E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	54.4	55.6	43.4	46.1	41.7
Internal, dB LAeq	38.3	47.0	40.2	46.1	42.9

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589B - Night Laeq

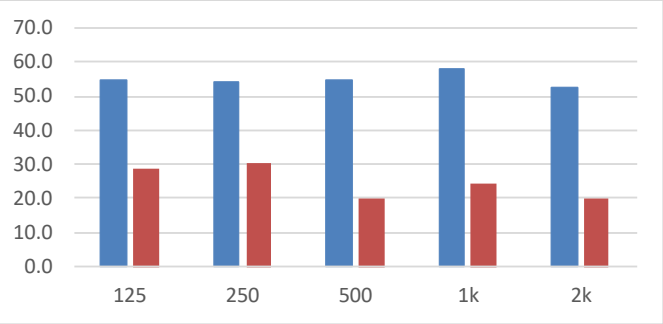
Room Properties

Room Width (m)	3.0
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	1.1
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	27.9 dB LAeq
Insertion Loss	32.5 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000553	0.0028	0.00028	0.0004	0.00055
Term 2	0.001214	0.0015	7.7E-05	1E-05	3.8E-06
Term 3	6.73E-05	3E-05	2.7E-05	3E-06	1.3E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	28.7	30.6	19.9	24.2	19.9
Internal, dB LAeq	12.6	22.0	16.7	24.2	21.1

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589B - Night LAMax

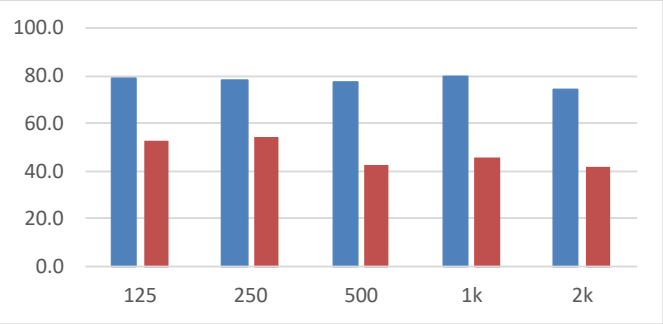
Room Properties

Room Width (m)	3.0
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	1.1
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	50.6 dB LAmax
Insertion Loss	31.5 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000553	0.0028	0.00028	0.0004	0.00055
Term 2	0.001214	0.0015	7.7E-05	1E-05	3.8E-06
Term 3	6.73E-05	3E-05	2.7E-05	3E-06	1.3E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	52.9	54.7	42.9	46.1	41.7
Internal, dB LAeq	36.8	46.1	39.7	46.1	42.9

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Day Laeq - Front Living/Kitchen 589A

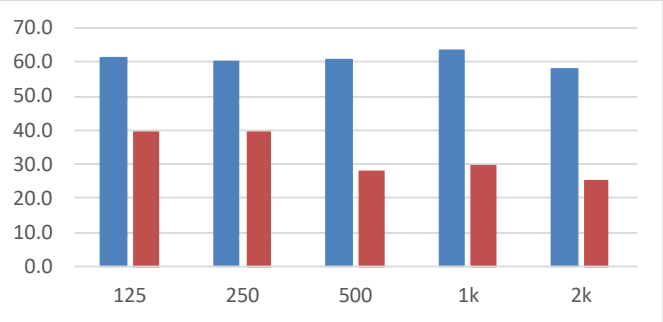
Room Properties

Room Width (m)	7.1
Room Depth (m)	3.2
Room Height (m)	2.6
Glazed Area (m^2)	4.2
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	66.0 dB LAeq
Internal Level	35.0 dB LAeq
Insertion Loss	31.0 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000216	0.0011	0.00011	0.0002	0.00022
Term 2	0.001807	0.0023	0.00011	1E-05	5.7E-06
Term 3	6.14E-05	2E-05	2.4E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	39.5	39.5	28.0	29.9	25.3
Internal, dB LAeq	23.4	30.9	24.8	29.9	26.5

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Day Laeq - Rear Living/Kitchen 589A

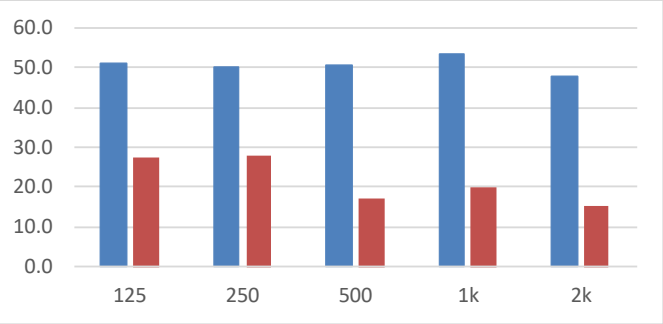
Room Properties

Room Width (m)	7.1
Room Depth (m)	3.2
Room Height (m)	2.6
Glazed Area (m^2)	2.3
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	56.0 dB LAeq
Internal Level	24.2 dB LAeq
Insertion Loss	31.8 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 20 / 4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000216	0.0011	0.00011	0.0002	0.00022
Term 2	0.00099	0.0012	6.2E-05	8E-06	3.1E-06
Term 3	6.95E-05	3E-05	2.8E-05	3E-06	1.4E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	27.4	27.9	17.1	19.7	15.2
Internal, dB LAeq	11.3	19.3	13.9	19.7	16.4

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Day Laeq - Front Living/Kitchen 589B

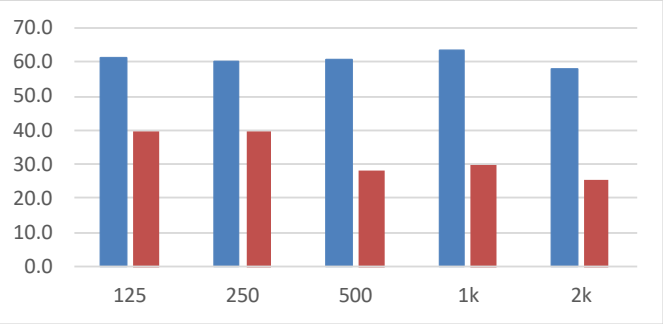
Room Properties

Room Width (m)	6.1
Room Depth (m)	2.6
Room Height (m)	3.1
Glazed Area (m^2)	4.2
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	66.0 dB LAeq
Internal Level	35.0 dB LAeq
Insertion Loss	31.0 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000211	0.0011	0.00011	0.0002	0.00021
Term 2	0.001764	0.0022	0.00011	1E-05	5.6E-06
Term 3	6.18E-05	2E-05	2.5E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	39.5	39.5	28.1	29.9	25.3
Internal, dB LAeq	23.4	30.9	24.9	29.9	26.5

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Day Laeq - Rear Living/Kitchen 589B

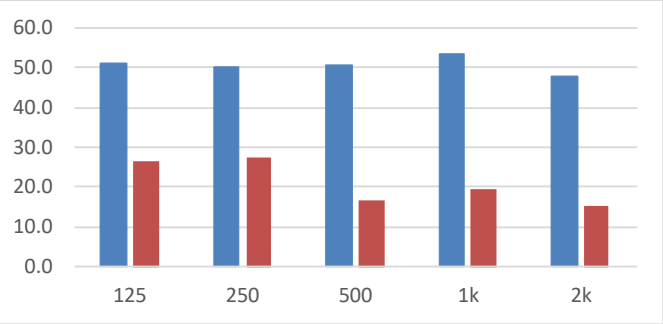
Room Properties

Room Width (m)	6.1
Room Depth (m)	2.6
Room Height (m)	3.1
Glazed Area (m^2)	1.7
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	21	20	33	42	46
Vents, $D_{n,e,w+Ctr}$	34	27	37	35	34

Noise Levels, dB



External Level	56.0 dB LAeq
Internal Level	23.9 dB LAeq
Insertion Loss	32.1 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**36(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4/20/4*
Ventilation	**32**	$D_{n,e,w+Ctr}$	Hit & miss trickle vent *Titon Trimvent XS13 4400EA*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	0.000211	0.0011	0.00011	0.0002	0.00021
Term 2	0.000714	0.0009	4.5E-05	6E-06	2.3E-06
Term 3	7.23E-05	3E-05	2.9E-05	4E-06	1.4E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	26.4	27.3	16.8	19.7	15.2
Internal, dB LAeq	10.3	18.7	13.6	19.7	16.4

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Hit & miss trickle vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Revised Glazing and Ventilation Scheme

Attic Bedroom 589A - Night LAMax

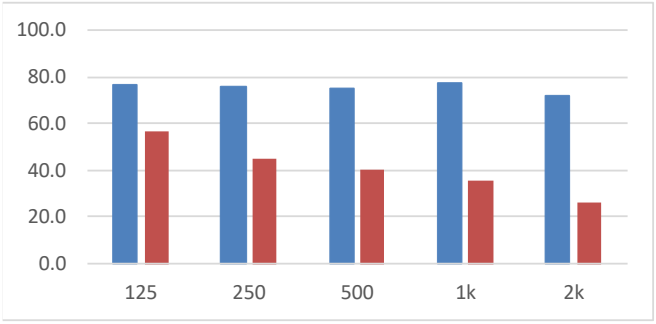
Room Properties

Room Width (m)	6.4
Room Depth (m)	3.3
Room Height (m)	5.0
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	27	32	43	46	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	79.6 dB LAmax
Internal Level	43.9 dB LAmax
Insertion Loss	35.7 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**44(38)**	dB $R_{W(+Ctr)}$	Laminated Double Glazing *10/16/8.8SC*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	1.19E-05	9E-06	9.4E-06	2E-06	7.5E-08
Term 2	0.000112	4E-05	2.8E-06	1E-06	8.9E-07
Term 3	7.5E-05	3E-05	3E-05	4E-06	1.5E-06
Term 4	0.000831	3E-05	6.6E-06	2E-06	1.7E-06
Internal, dB L_{eq}	56.6	44.9	40.2	35.6	26.6
Internal, dB LAeq	40.5	36.3	37.0	35.6	27.8

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Laminated Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Attic Bedroom 589A - Night Laeq

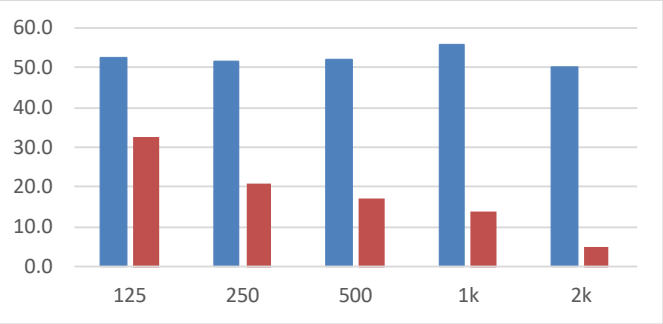
Room Properties

Room Width (m)	6.4
Room Depth (m)	3.3
Room Height (m)	5.0
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	27	32	43	46	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	57.9 dB LAeq
Internal Level	20.5 dB LAeq
Insertion Loss	37.5 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**44(38)**	dB $R_{W(+Ctr)}$	Laminated Double Glazing *10/16/8.8SC*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	1.19E-05	9E-06	9.4E-06	2E-06	7.5E-08
Term 2	0.000112	4E-05	2.8E-06	1E-06	8.9E-07
Term 3	7.5E-05	3E-05	3E-05	4E-06	1.5E-06
Term 4	0.000831	3E-05	6.6E-06	2E-06	1.7E-06
Internal, dB L_{eq}	32.4	20.8	17.2	13.7	4.8
Internal, dB LAeq	16.3	12.2	14.0	13.7	6.0

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Laminated Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Attic Bedroom 589B - Night LAeq

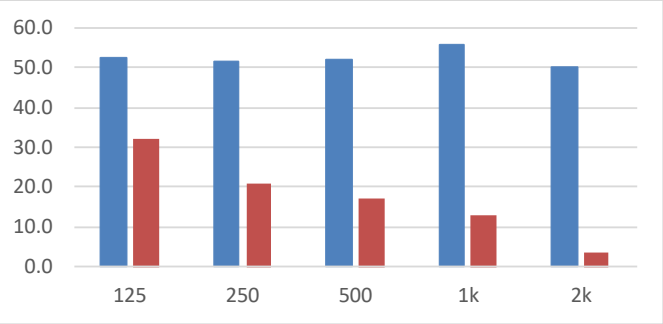
Room Properties

Room Width (m)	5.4
Room Depth (m)	3.3
Room Height (m)	5.0
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	24	31	40	49	51
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	57.9 dB LAeq
Internal Level	20.2 dB LAeq
Insertion Loss	37.8 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**42(35)**	dB $R_{W(+Ctr)}$	Laminated Double Glazing *8 / 16 / 8.8SC*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	1.41E-05	1E-05	1.1E-05	3E-06	8.9E-08
Term 2	0.000265	5E-05	6.7E-06	8E-07	5.3E-07
Term 3	7.41E-05	3E-05	3E-05	4E-06	1.5E-06
Term 4	0.000831	3E-05	6.6E-06	2E-06	1.7E-06
Internal, dB L_{eq}	32.3	20.7	16.9	12.9	3.6
Internal, dB LAeq	16.2	12.1	13.7	12.9	4.8

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Laminated Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Attic Bedroom 589B - Night LAMax

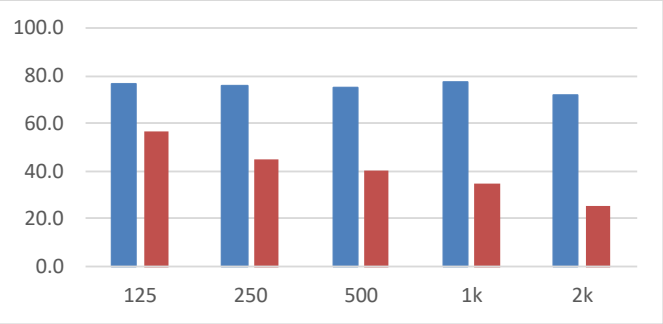
Room Properties

Room Width (m)	5.4
Room Depth (m)	3.3
Room Height (m)	5.0
Glazed Area (m^2)	1.8
Is dwelling within roof	✓

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	29	43	50	55	56
Glazing, dB R_{w+Ctr}	24	31	40	49	51
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	79.6 dB LAmax
Internal Level	43.7 dB LAmax
Insertion Loss	36.0 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**42(35)**	dB $R_{W(+Ctr)}$	Laminated Double Glazing *8 / 16 / 8.8SC*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	1.41E-05	1E-05	1.1E-05	3E-06	8.9E-08
Term 2	0.000265	5E-05	6.7E-06	8E-07	5.3E-07
Term 3	7.41E-05	3E-05	3E-05	4E-06	1.5E-06
Term 4	0.000831	3E-05	6.6E-06	2E-06	1.7E-06
Internal, dB L_{eq}	56.5	44.8	39.9	34.8	25.5
Internal, dB LAeq	40.4	36.2	36.7	34.8	26.7

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Roof / Ceiling (Insul)
Glazing	Laminated Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589A - Night Laeq

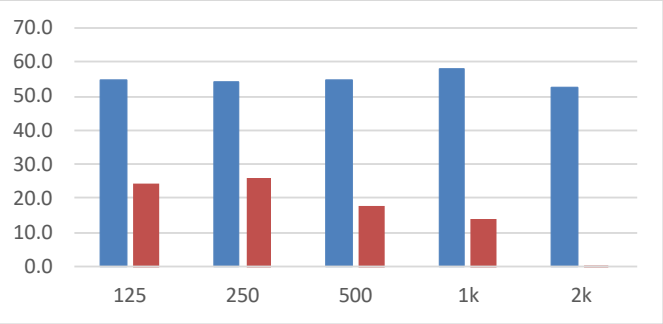
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.2
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	27	23	33	41	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	20.7 dB LAeq
Insertion Loss	39.7 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 10*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	7.51E-05	6E-05	6E-05	1E-05	4.7E-07
Term 2	0.000475	0.0012	0.00012	2E-05	3.8E-06
Term 3	6.05E-05	2E-05	2.4E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	24.6	25.9	17.9	14.0	0.4
Internal, dB LAeq	8.5	17.3	14.7	14.0	1.6

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589A - Night LAMax

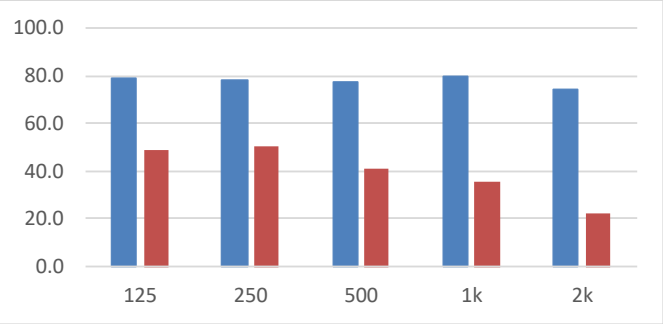
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.2
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	27	23	33	41	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	44.1 dB LAmax
Insertion Loss	38.0 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 10*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	7.51E-05	6E-05	6E-05	1E-05	4.7E-07
Term 2	0.000475	0.0012	0.00012	2E-05	3.8E-06
Term 3	6.05E-05	2E-05	2.4E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	48.8	50.1	40.8	35.9	22.3
Internal, dB LAeq	32.7	41.5	37.6	35.9	23.5

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589B - Night Laeq

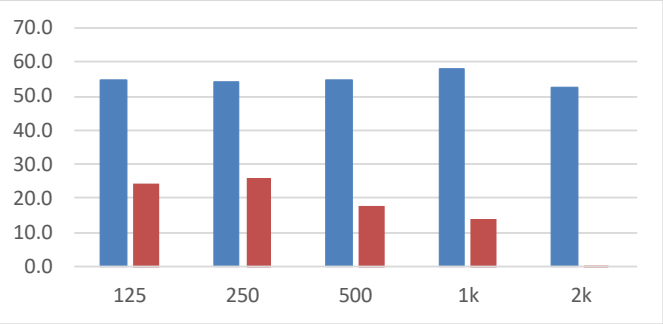
Room Properties

Room Width (m)	3.1
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	27	23	33	41	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	20.6 dB LAeq
Insertion Loss	39.8 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 10*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	8.48E-05	7E-05	6.7E-05	2E-05	5.4E-07
Term 2	0.000536	0.0013	0.00013	2E-05	4.3E-06
Term 3	5.81E-05	2E-05	2.3E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	24.5	25.9	17.8	13.9	0.3
Internal, dB LAeq	8.4	17.3	14.6	13.9	1.5

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Front Bedroom 589B - Night LAMax

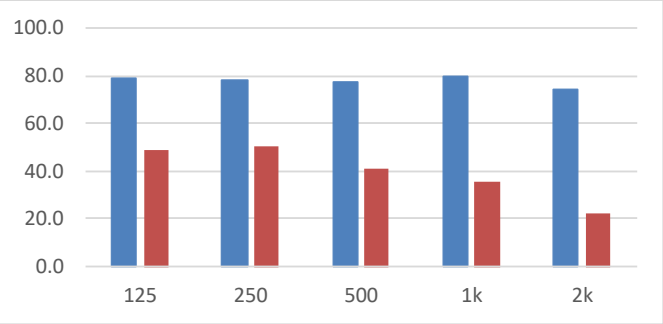
Room Properties

Room Width (m)	3.1
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	2.0
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	27	23	33	41	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	44.1 dB LAmax
Insertion Loss	38.0 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 10*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	8.48E-05	7E-05	6.7E-05	2E-05	5.4E-07
Term 2	0.000536	0.0013	0.00013	2E-05	4.3E-06
Term 3	5.81E-05	2E-05	2.3E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	48.7	50.0	40.8	35.8	22.1
Internal, dB LAeq	32.6	41.4	37.6	35.8	23.3

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589A - Night Laeq

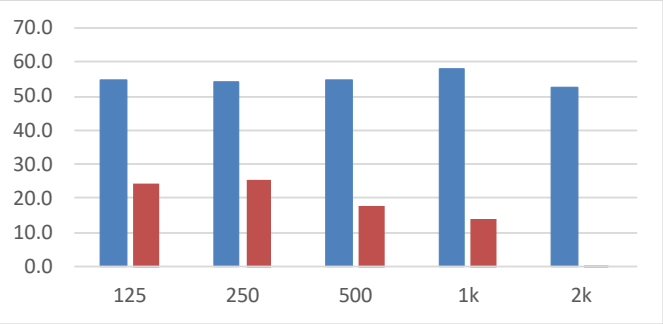
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.1
Room Height (m)	2.4
Glazed Area (m^2)	1.8
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	27	23	33	41	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	20.4 dB LAeq
Insertion Loss	40.0 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 10*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	7.51E-05	6E-05	6E-05	1E-05	4.7E-07
Term 2	0.000428	0.0011	0.00011	2E-05	3.4E-06
Term 3	6.24E-05	2E-05	2.5E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	24.2	25.5	17.6	13.8	0.2
Internal, dB LAeq	8.1	16.9	14.4	13.8	1.4

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589A - Night LAMax

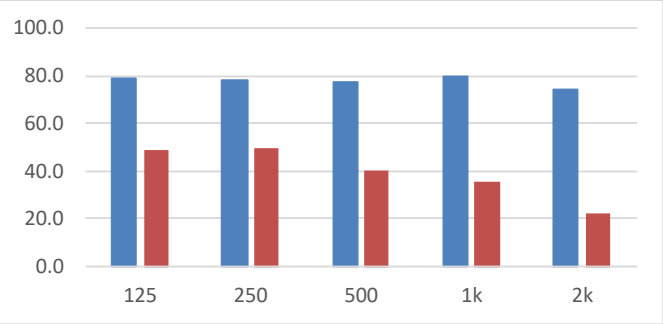
Room Properties

Room Width (m)	3.5
Room Depth (m)	3.1
Room Height (m)	2.4
Glazed Area (m^2)	1.8
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	27	23	33	41	48
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	43.8 dB LAmax
Insertion Loss	38.3 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**37(31)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 10*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	7.51E-05	6E-05	6E-05	1E-05	4.7E-07
Term 2	0.000428	0.0011	0.00011	2E-05	3.4E-06
Term 3	6.24E-05	2E-05	2.5E-05	3E-06	1.2E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	48.5	49.6	40.6	35.6	22.0
Internal, dB LAeq	32.4	41.0	37.4	35.6	23.2

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589B - Night Laeq

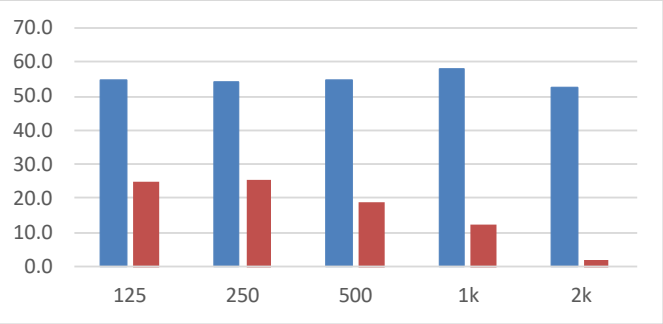
Room Properties

Room Width (m)	3.0
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	1.1
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	24	21	29	43	43
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	60.4 dB LAeq
Internal Level	20.4 dB LAeq
Insertion Loss	40.0 dB LAeq

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**34(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 6*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	8.76E-05	7E-05	7E-05	2E-05	5.5E-07
Term 2	0.000608	0.0012	0.00019	8E-06	7.7E-06
Term 3	6.73E-05	3E-05	2.7E-05	3E-06	1.3E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	24.9	25.4	18.7	12.2	2.2
Internal, dB LAeq	8.8	16.8	15.5	12.2	3.4

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

Rear Bedroom 589B - Night LAMax

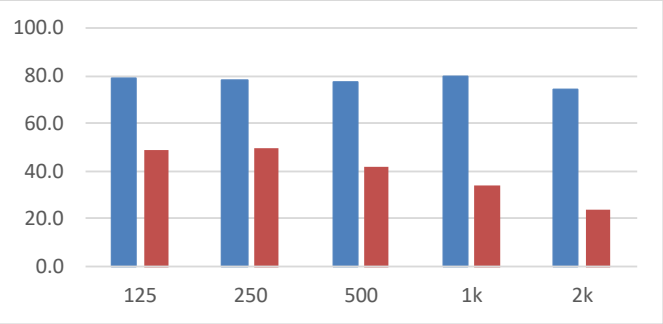
Room Properties

Room Width (m)	3.0
Room Depth (m)	3.0
Room Height (m)	2.4
Glazed Area (m^2)	1.1
Is dwelling within roof	☒

Sound Insulation Properties

Freq. Hz	125	250	500	1k	2k
Wall, dB R_{w+Ctr}	41	45	45	54	58
Roof, dB R_{w+Ctr}	41	45	45	54	58
Glazing, dB R_{w+Ctr}	24	21	29	43	43
Vents, $D_{n,e,w+Ctr}$	42	43	43	49	64

Noise Levels, dB



External Level	82.1 dB LAmax
Internal Level	43.8 dB LAmax
Insertion Loss	38.3 dB LAmax

Sound Insulation Requirement

	Minimum Sound Insulation Requirement		Suitable Systems
Glazing	**34(29)**	dB $R_{W(+Ctr)}$	Double Glazing *4 / 16 / 6*
Ventilation	**45**	$D_{n,e,w+Ctr}$	Passive thru-wall vent *Passivent Fresh 80dB*

Suitable systems given as reference only. Other products that achieve the required sound insulation values are available.

Technical Calculations

Frequency, Hz	125	250	500	1k	2k
Term 1	8.76E-05	7E-05	7E-05	2E-05	5.5E-07
Term 2	0.000608	0.0012	0.00019	8E-06	7.7E-06
Term 3	6.73E-05	3E-05	2.7E-05	3E-06	1.3E-06
Term 4	0	0	0	0	0
Internal, dB L_{eq}	49.1	49.5	41.7	34.1	24.0
Internal, dB LAeq	33.0	40.9	38.5	34.1	25.2

Façade Components

Wall	Brick and block, 75mm cavity
Roof	Not Within Roof Space
Glazing	Double Glazing
Vents	Passive thru-wall vent

Calculations conducted in accordance with BS8233:2014 rigorous calculation method

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

APPENDIX H – Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples common environments and their typical noise levels.

Noise Level	Environment
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a moving car
60 to 70 dB(A)	Typical high street
100 to 110 dB(A)	Fire alarm at 1 metre away
140 dB(A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ($2x10^{-5}$ Pa – threshold of hearing).

$L_{Aeq,\,T}$ – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level in which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

L_{Amax} – the maximum RMS A-weighted sound pressure level occurring within a specified time period; the time weighting is typically either Fast or Slow.

A-Weighting – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

R_w – The Weighted Sound Reduction Index (R_w) is a number used to rate the effectiveness of a soundproofing system or material.

$D_{n,e,W}$ – The Weighted Sound Reduction Index specifically for ventilators.

C_{tr} – C_{tr} is a spectrum adaptation term which method is defined in BS EN ISO 717. The standard uses a reference curve to determine the weighted value of airborne sound insulation. The spectrum adaptation terms C and C_{tr} may are used to take into account different source spectra. 'C_{tr}' is the A-weighted urban traffic noise spectrum.

PEAK acoustics

Let us introduce ourselves

Peak Acoustics formed in 2011, we are a fully accredited specialist consultancy and testing organisation.

We are a diverse team of Acoustic Consultants, Specialist Engineers and Building Compliance Technicians, with a network spanning the UK. We are proud to offer our services nationally, with no job too big or small.

We provide Acoustic Consultancy, Building Compliance Testing and Energy Services.

Additional Services

We offer an extensive range of services in the sectors of Acoustic Consultancy, Building Compliance & Energy Efficiency. We are able to put together custom packages combining multiple services which saves both time and money for you.

Building Compliance

- **Sound Insulation Testing**
- **Air Tightness Testing**
- **Ventilation Testing**
- **Water Efficiency Calculations**
- **Sound Insulation Specification**

Energy Efficiency

- **SAP Calculations**
- **EPC's**
- **SBEM Calculations**
- **Energy Statements**
- **Sustainability Statements**
- **MEES Regulations**
- **Commercial EPC's**

Acoustic Consultancy

- **Noise Assessment for planning conditions**
- **Construction site noise monitoring**
- **Noise at work assessments**
- **Noise & Vibration Impact Assessments**

Peace of mind

We are accredited and registered by all the relevant major UK authorities to provide the services we offer. Peak Acoustics is UKAS accredited for sound insulation testing, ATTMA registered for Air Leakage Testing. and our Energy team are all Domestic On-Completion Energy Assessors.

Our Added Value

We combine our detailed knowledge of building regulations with our technical understanding of building physics, acoustics and environmental sciences to maximise development quality. Our work ensures appropriate strategies and studies are prepared to demonstrate to local authorities how proposed developments will be of high quality and generate acceptable impact on the surrounding environment.

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