



NOISE ASSESSMENT

on behalf of

COURTS (WREXHAM) LIMITED

for the site at

1-2 HIGH STREET, WREXHAM, LL11 1AF

REPORT DATE: 22ND JUNE 2021

REPORT NUMBER: 102577

Miller Goodall Ltd
Ground Floor
Ashworth House
Deakins Business Park
Blackburn Road
Egerton
Bolton
Lancashire
BL7 9RP

Tel: 01204 596166

www.millergoodall.co.uk

Company registration number 5201673

Summary

This report provides evidence to discharge condition 4 of planning policy ref WRR P/2020/0660.

A noise assessment was undertaken to predict the potential impact of environmental noise, including road traffic, upon a proposed development consisting of the mixed-use redevelopment of 1-2 High Street, Wrexham, LL11 1AF. The development consists of a retail unit on the ground floor and 2 residential flats per floor on the 1st floor to 3rd floor. This was requested by the Local Authority to support a planning application for the development.

Measurements were made both internally and externally of the existing building. Sound insulation testing measurements were also made of noise levels within the development between the retail unit on the ground floor and the residential first floor apartments. This data was subsequently used to predict the potential impact of noise from likely activities associated with the proposed development when in use.

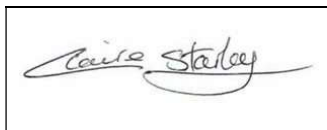
The report recommends various mitigation measures to control noise levels. With the implementation of these recommendations, it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation and that this provides sufficient evidence to discharge the planning condition.

Record of changes

Prepared By Claire Starley AMIOA

Reviewed By Jo Miller MIOA

Signed



22nd June 2021

Signed



22nd June 2021

Date

Date

Version	Date	Change	Initials
1	22nd June 2021	Initial issue	CS
2	30 th June 2021	Added condition wording to summary and introduction	CS

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1 Introduction

1.1 Miller Goodall Ltd, on behalf of Courts (Wrexham) Limited, has undertaken a noise assessment in respect of the impact of noise from environmental and road traffic sources upon a proposed residential development for 6 dwellings above a retail unit at 1-2 High Street, Wrexham.

1.2 The site has planning approval ref WRR P/2020/0660 and the condition relating to noise is detailed below:

No part of the development shall commence until a noise survey in order to determine noise levels for both day and night has been carried out, and a detailed report of the survey findings together with a detailed scheme of noise attenuation and or noise insulation measures has been submitted to and approved in writing by the Local Planning Authority. The scheme of noise insulation and attenuation measures shall include those measures required between the ground floor commercial use and the residential uses in the upper floors. The measures as are approved shall be fully implemented prior to first occupation of the development.

2 Site Description

2.1 The site is located at 1-2 High Street, Wrexham, LL11 1AF. The site location is shown outlined in red in Appendix A.

2.2 To the south of the site runs the High Street, from east to west. High Street is lined on both sides with retail units, bars and eateries. It is unclear whether the spaces above these retail spaces are residential or not. It has been assumed that there are further residential properties and office accommodation above the retail, bars and eateries in the area.

2.3 To the west of the site runs Hope Street, a pedestrianized road, which runs from north to south of our proposed site. Hope Street is lined on both sides with large retail units, such as New Look, WHSmith's, Banks and charity shops. Again, it is unclear if above these retail spaces are residential properties or storage space for the unit below.

2.4 The north and east of the site backs directly onto the other buildings in the area. As the development has no capability for windows overlooking this area any noise sources have been disregarded.

3 Proposed Development

3.1 The proposal is to develop an existing building, previously a Nationwide bank, into a mixed-use property.

3.2 The proposal is for 6 flats starting from the 1st floor to the 3rd floor over a redeveloped retail unit on the ground floor.

3.3 Entrance into the flats will be via High Street, at the most eastern point of the property from Hope Street.

4 Policy Context

4.1 Noise Policy Statement for England

- 4.1.1 The Noise Policy Statement for England (NPSE¹), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

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

- avoid significant adverse effects on health and quality of life;
- mitigate and minimise adverse effects on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.”

- 4.1.2 The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and the quality of life occur.

- 4.1.3 The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the Statement). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case:

“...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development”.

- 4.1.4 Importantly, the NPSE goes on to state:

“This does not mean that such adverse effects cannot occur”.

- 4.1.5 The Statement does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that:

“Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available”

- 4.1.6 It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

¹ Noise Policy Statement for England, Defra, March 2010

4.2 National Planning Policy Framework

4.2.1 The National Planning Policy Framework (NPPF²) initially published in March 2012, was updated in June 2019. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"³.

4.2.2 The revised NPPF advises that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives). One of these is an environmental objective which is described in par. 8 (c):

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

4.2.3 At par. 170 we are advised that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) 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.

4.2.4 Par. 180 goes on to state:

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

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

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

4.2.5 Par. 182 seeks to ensure that any development does not prejudice the legally permitted operations and activities of other, existing non-residential uses, stating:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could

² National Planning Policy Framework, Ministry of Housing, Communities and Local Government, June 2019

³ Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

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."

4.3 Planning Practice Guidance – Noise

4.3.1 As of March 2014, a Planning Practice Guidance⁴ for noise was issued which provides additional guidance and elaboration on the NPPF, the guidance was updated in July 2019. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- 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.

4.3.2 In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:

"...the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation".

4.3.3 Examples of these factors include:

- The source and absolute noise level of the source along with the time of day that it occurs;
- Where the noise is non-continuous, the number of noise events and pattern of occurrence;
- The frequency content and acoustic characteristics of the noise;
- The effect of noise on wildlife;
- The acoustic environment of external amenity areas provided as an intrinsic part of the overall design;
- The impact of noise from certain commercial developments such as night clubs and pubs where activities are often at their peak during the evening and night.

4.3.4 The PPG also provides general advice on the typical options available for mitigating noise. It goes on to suggest that Local Plans may include noise standards applicable to proposed developments within the Local Authority's administrative boundary, although it states that:

"Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed".

⁴ Planning Practice Guidance – Noise, <https://www.gov.uk/guidance/noise--2> 22nd July 2019.

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- 4.3.5 The PPG was amended in December 2014 to clarify guidance on the potential effect of noise from existing businesses on proposed new residential accommodation. Even if existing noise levels are intermittent (for example, from a live music venue), noise will need to be carefully considered and appropriate mitigation measures employed to control noise at the proposed accommodation.

5 Acoustic Standards and Guidance

5.1 ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise – New Residential Development – May 2017

5.1.1 ProPG: Planning and Noise is new guidance with the aim of delivering sustainable development and promoting good health and well-being through the effective management of noise which may impact on new residential developments. The guidance aims to complement the national planning policy and encourages the use of good acoustic design at the earliest phase of the planning process. It builds upon the recommendations of various other guidance documents including NPPF, NPSE and PPG-Noise, BS 8233 and WHO.

5.1.2 The guidance is applicable to new residential developments which would be exposed predominantly to noise from existing transport sources. The ProPG advocates a risk based approach to noise using a two-stage process:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements: –
 - Element 1 – demonstrating a ‘Good Acoustic Design Process’;
 - Element 2 – observing internal ‘Noise Level Guidelines’;
 - Element 3 – undertaking an ‘External Amenity Area Noise Assessment’; and
 - Element 4 – consideration of ‘Other Relevant Issues’.

5.1.3 The ProPG approach is underpinned by the preparation and delivery of an ‘Acoustic Design Statement’ (ADS), whereby the higher the risk for noise at the site, the more detailed the ADS. The ADS should address the following issues:

- Present the initial site noise risk assessment, including the pre-development acoustic conditions prior to development;
- Describe the external noise levels that occur across the site both before and after any necessary mitigation measures have been incorporated. The external noise assessment with mitigation measures in place should use an informed judgement of typical worst-case conditions;
- Demonstrate how good acoustic design is integrated into the overall design and how the proposed acoustic design responds to specific circumstances of the site;
- Confirm how the internal noise level guidelines will be achieved, including full details of the design measures and building envelope specifications;
- A detailed assessment of the potential impact on occupants should be undertaken where individual noise events are expected to exceed 45 dB $L_{AF,max}$ more than 10 times a night inside bedrooms;

- Priority should be given to enable the use of openable windows where practical across the development. Where this is not practical to achieve the internal noise level guidelines with windows open, then full details of the proposed ventilation and thermal comfort arrangements must be provided;
- Present the findings of the external amenity area noise assessment;
- Present the findings of the assessment of other relevant issues;
- Confirm for a low risk site how adverse impacts of noise will be mitigated and minimised;
- Confirm for a medium or high noise risk site how adverse impacts of noise will be mitigated and minimised and clearly demonstrate that a significant adverse noise impact has been avoided.

5.1.4 ProPG target noise levels are based on existing guidance from BS 8233 and WHO (see below). Table 1 below outlines the guidance noise levels for different room types during day and night times.

Table 1: ProPG guideline indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}$

5.1.5 The footnotes to this table suggest that internal noise level limits can be relaxed by up to 5 dB where development is considered necessary or desirable, and still represent “reasonable” internal conditions. They also suggest that in such cases, external levels which exceed WHO guidance target levels (see WHO section below) may still be acceptable provided that reasonable internal noise levels are achieved. Although, where the acoustic environment of external amenity areas is intrinsic to the overall design, “noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$ ”. The wording of ProPG (and BS 8233:2014) is clear that exceedance of guideline noise levels in external areas should not prohibit the development of desirable developments in any event.

5.2 BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

5.2.1 This standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999)⁵. These guideline noise levels are shown in Table 2, below.

⁵ World Health Organisation Guidelines for Community Noise, 1999

Table 2: BS 8233: 2014 guideline indoor ambient noise levels for dwellings

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

5.2.2 BS 8233:2014 advises that:

“regular individual noise events...can cause sleep disturbance. A guideline value may be set in terms of SEL^6 or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values”.

5.2.3 BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The standard states that it is “desirable” that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ whilst recognising that development in higher noise areas such as urban areas or those close to the transport network may require a compromise between elevated noise levels and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas.

⁶ Sound exposure level or L_{AE}

6 Noise Survey

6.1 Measurements of Existing Noise Sources

- 6.1.1 Noise measurements were undertaken at two locations, internally and externally of 1-2 High Street, Wrexham, in accordance with BS 7445-1: 2003⁷ by Reid Malster of Miller Goodall Ltd. The calibration of the sound level meter was checked before and after measurements with negligible deviation (<0.1 dB).
- 6.1.2 Survey details can be found in Appendix B. Measurements were taken at times considered to be representative of the periods during which the proposed residential accommodation would be subject to the highest levels of ambient noise. External measurements were made out of the 1st floor window, overlooking High Street.
- 6.1.3 The noise sources within the vicinity of the measurement locations are summarised in Table 3, below:

Table 3: Description of noise sources affecting the site.

Measurement Locations	Noise Sources
External	Road noise, dog barking, People's voices - raised. Daily road sweeper passing – differing times each day

6.2 Monitoring Results

- 6.2.1 A summary of the broadband measurement data is provided in Table 4 below with full data in Appendix B. All data are sound pressure levels in dB re 20 µPa.

Table 4: Summary of noise measurements

Measurement Location	Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	Overall L_{AFmax} (dB)	95 th % $L_{AFmax,5min}$ (dB)
External Daytime	07:00	16:00:00	63.9	99	n/a
External Night-time	23:00	08:00:00	63.5	100	85.6

- 6.2.2 Octave band frequency data was obtained during surveying, this was utilised within noise ingress calculations to determine suitable mitigation in terms of glazing and ventilation requirements. This source data is provided in Table 5, below.

⁷ BS 7445-1: 2003 Description and measurement of environmental noise - Part 1: Guide to quantities and procedures

- 6.2.3 Each measurement period consisted of sequential 30 second samples which therefore allowed the variation in noise level over time to be assessed. This data was subsequently used to determine a 'typical' L_{AFmax} noise level and octave band spectrum based on the 95th percentile of individual 5-minute measurements. This data was subsequently utilised within the noise model.

Table 5: Octave band free-field external noise level spectra

Measurement Descriptor	Sound Pressure Level, dB in Octave Band Centre Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Day $L_{Aeq,16hr}$	70	64	61	62	60	56	49	41	64
Night, $L_{Aeq,8hr}$	66	59	60	61	60	55	49	42	64
Night L_{max}	78	77	78	77	85	80	69	61	86

7 Impact of Existing Noise Sources on the Development

7.1 Predicted Internal Noise Levels Assessed to ProPG Guidance Levels

- 7.1.1 Based on ProPG guidance levels, it is proposed that noise from the development is controlled to 30 dB L_{Aeq} in bedrooms at night and 35 dB L_{Aeq} in habitable rooms during the day, and that noise from individual events such as vehicle pass-bys does not regularly exceed an indoor level of 45 dB L_{AFmax} .
- 7.1.2 The generally accepted rule of thumb is that a window left open for ventilation provides 10 - 15 dB attenuation from external noise sources with the WHO Guidelines for Community Noise suggesting 15 dB. The DEFRA report NANR116: Open/Closed Window Research⁸ suggests the figure to be between 12 and 18 dB for road and rail traffic. ProPG indicates that where external noise levels are more than 15 dB higher than the internal noise targets, openable windows should not be relied upon as the sole means of ventilation and some form of acoustically attenuated ventilation may be required. This equates to an external noise level of 45 dB L_{Aeq} / 60 dB L_{Amax} during the night or 50 dB L_{Aeq} during the day.
- 7.1.3 Measured external noise levels at the site are above the threshold levels for which openable windows can be used for ventilation. Mitigation measures to reduce the noise impact have been applied as described in the following section of this report.

⁸ NANR116: 'Open/closed window research' Sound Insulation through ventilated open windows, Defra April 2007

7.2 Mitigation for Achieving Good Acoustic Design

7.2.1 In order to assess the potential glazing and ventilation requirements for dwellings, noise ingress calculations were undertaken based on the methodology in BS EN 12354-3⁹. Room and window dimensions were taken from the architect plans provided for the assessment.

7.2.2 The areas of the proposed site where internal noise may exceed the standards are bedrooms on elevations closest to, and facing, High Street and Hope Street. Night-time periods have been assessed as the standards are more onerous than for daytime periods.

7.2.3 There are 2 choices for glazing and ventilation strategy:

- Choice A: Mechanical ventilation
- Choice B: Acoustic trickle ventilation.

7.2.4 Noise ingress calculations are provided in Appendix C with a summary of the results in Table 6, below:

Table 6: Predicted internal noise levels for both Natural and mechanical ventilation.

Choice	Description	External Noise Levels		Predicted Internal Noise Levels		BS 8233 Criteria		Exceedance of Criteria		Proposed Glazing and Ventilation
		dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	dB $L_{Aeq,T}$	dB L_{AFmax}	
Choice A Mechanical Ventilation	1 st and 2 nd Floor Bedrooms (night-time)	64	86	27	45	30	45	-3	0	Option A1
	3 rd Floor Bedrooms (night-time)	64	86	29	44	30	45	-1	-1	Option A1
	Living rooms/dining kitchens (daytime)	64	N/A	35	N/A	35	N/A	0	N/A	Option A2
Choice B Acoustic Trickle Ventilation	1 st and 2 nd Floor Bedrooms (night-time)	64	86	27	45	30	45	-3	0	Option B1
	3 rd Floor Bedrooms (night-time)	64	86	29	45	30	45	-1	0	Option B2
	1 st and 2 nd Floor Living rooms/dining kitchens (daytime)	64	N/A	35	N/A	35	N/A	0	N/A	Option B3

- **Option A1** - Glazing with minimum weighted sound reduction index of 29 dB $R_w + C_{tr}$ (e.g. 6/12/8.4 Stadip silence); and mechanical ventilation rather than tickle ventilation, such as dMEV ventilation system extracting air to the roof.

⁹ BS EN 12354-3:2000 Building acoustics. Estimation of acoustic performance in buildings from the performance of elements - Airborne sound insulation against outdoor sound

- **Option A2** - Glazing with minimum weighted sound reduction index of 33 dB $R_W + C_{tr}$ (e.g. 6/12/4); and mechanical ventilation rather than tickle ventilation, such as dMEV ventilation system extracting air to the roof.
- **Option B1** - Glazing with minimum weighted sound reduction index of 30 dB $R_W + C_{tr}$ (e.g. 8/12/4); ventilators with a minimum element normalised sound level difference of 49 dB $D_{ne,W}$.
- **Option B2** - Glazing with minimum weighted sound reduction index of 27 dB $R_W + C_{tr}$ (e.g. 6/12/8.4 Stadip silence); ventilators with a minimum element normalised sound level difference of 49 dB $D_{ne,W}$.
- **Option B3** - Glazing with minimum weighted sound reduction index of 40 dB $R_W + C_{tr}$ (e.g. 10/16/16.8 Stadip silence); ventilators with a minimum element normalised sound level difference of 49 dB $D_{ne,W}$.

7.3 Acoustic Design Statement

Typical Issues for low / medium / high risk sites	Statement
Relevant noise sources identified	This assessment has considered noise from road traffic, music (entertainment), people noise and M&E noise.
Multiple source contributions carefully quantified	All noise sources have been measured over a weekend period to obtain a worst case assessment.
Assess extent of noise risk for unmitigated site (current and foreseeable future, 15 years ahead)	Unmitigated site will see risk of excessive noise levels, principally from high levels of road traffic noise from High Street.
Greater coverage across the site (all buildings, all relevant heights)	N/A.
Alternative site layouts considered	There are limited options to change the layout of the site.
Adequate non-sensitive use for screening	The site is relatively small and therefore not an option to provide screening to sensitive areas.
Opportunities to mitigate the noise source within the site	Unable to mitigate traffic noise at source.
Opportunities to mitigate the noise source outside owned land; Physical mitigation; Operational management	Unable to mitigate noise sources in external areas.
Maximise separation	The site is relatively small and therefore not an option to provide additional setbacks.
Existing topographical advantages; Change site level	Not applicable, effectively a flat site between source and receptor.
Noise barriers – screening opportunities	Not possible to use noise barriers.
Site layout – protecting residential units	Limited opportunity to protect residential development due to the small nature of the site.

Design external amenity spaces (e.g. balconies) to reduce noise entering sensitive rooms	No external areas proposed.
Access to quiet open space on or off-site	Achieved by provision of shielded rear gardens.
Non-sensitive elements as screens	Not possible, due to the small size of the site.
Building layout to self-screen sensitive rooms	Not possible, due to the small size of the site.
Orientation of noise sensitive rooms away from the source of noise exposure i.e. quiet facades	Not possible due to the small scale of the development.
Building treatment to screen openings	Not relevant
Consideration of alternative acoustic options	Considered, but not relevant within financial and design constraints.
Window location & size on affected facades	Internal noise criteria achieved by utilising acoustic glazing rather than reducing glazing size
Innovative facade and window designs e.g. plenum windows	Considered, but not possible within financial and design constraints.
Façade insulation design	Standard brick/block façade construction, is not the weak point of the façade.
Ventilation – natural, from quiet facade	Discussed as an alternative to acoustic rated trickle ventilators. Further input required from mechanical services engineer.
Acoustic performance of ventilation; Thermal comfort	Acoustic rated passive trickle ventilators proposed. Overheating in worst-case summer conditions may be possible issue in rooms facing High Street, when windows left closed.
Complete Acoustic Design Process throughout	Yes

8 Transmission of Noise within the Development

8.1 The nature of the development means that there is potential for noise from some areas to travel to sensitive noise areas as follows;

- Noise from the ground floor retail unit to the first-floor residential accommodation.

8.2 Noise from Ground Floor Retail Unit

8.2.1 Noise emissions from the retail unit on the ground floor are currently unknown as the retail unit is currently unoccupied. It is considered unlikely that the retail unit will generate high noise levels as a retail unit, but there is a possibility that the ground floor unit could be redeveloped into an eatery or café which may have louder noise levels than a retail shop. If this were the case planning permission would be needed, which would require the upgrading of the ground floor ceilings.

8.2.2 For the purposes of this assessment, a sound insulation test was undertaken between the ground floor and 1st floor. The results from this test show that the floor between the ground floor retail and the first-floor apartments achieved an airborne rating of 46 dB $D_{nTw} + C_{tr}$. This exceeds the minimum requirement for building regulations, which is 43 $D_{nTw} + C_{tr}$ for conversions and 45 dB $D_{nTw} + C_{tr}$ for new builds.

- 8.2.3 It is considered that the level of sound reduction between the floor would be suitable for a purely retail purpose. If however permission is sort for louder uses, such as café's or takeaways, then additional sound insulation measures would be required.

9 Mitigation Measures

9.1 Building Envelope – Roof Construction

- 9.1.1 It is recommended that the existing roof is underlined with:

- 100mm foil faced insulation between rafters,
- 9mm plywood and 62.5mm laminated insulated plasterboard under with an additional 15mm wallboard.

9.2 Building Envelope: Glazing and Ventilation

- 9.2.1 Table 7 provides a summary of the proposed glazing scheme at the development. These are:

- **Option A1** - Glazing with the minimum sound reduction index stated in Table 7, below (to achieve 29 dB $R_w + C_{tr}$); this could be met using glazing with a 6/12/8.4 Stadip silence configuration, i.e. 6 mm and 8.4 mm panes either side of a cavity width of 12 mm, to be confirmed by the glazing supplier. dMEV ventilation system extracting air to the roof.
- **Option A2** - Glazing with the minimum sound reduction index stated in Table 7, below (to achieve 33 dB $R_w + C_{tr}$); this could be achieved using glazing with a 6/12/4, to be confirmed by the glazing supplier. dMEV ventilation system extracting air to the 'quiet' facade or roof.
- **Option B1** - Glazing with the minimum sound reduction index stated in Table 7, below (to achieve 30 dB $R_w + C_{tr}$); this could be achieved using glazing with an 8/12/4 configuration, to be confirmed by the glazing supplier. Natural ventilation stated in Table 8 below (to achieve 49 $D_{ne,w}$) this could be met with a Renson, 771AK.
- **Option B2** - Glazing with the minimum sound reduction index stated in Table 7, below (to achieve 27 dB $R_w + C_{tr}$); this could be achieved using glazing with 6/12/8.4 Stadip silence, to be confirmed by the glazing supplier. Natural ventilation stated in Table 8 below (to achieve 49 $D_{ne,w}$) this could be met with a Renson, 771AK.
- **Option B3** - Glazing with the minimum sound reduction index stated in Table 7, below (to achieve 40 dB $R_w + C_{tr}$); this could be achieved using glazing with a 10/16/16.8 Stadip silence, to be confirmed by the glazing supplier. Natural ventilation stated in Table 8 below (to achieve 49 $D_{ne,w}$) this could be met with a Renson, 771AK.

Table 7: Minimum sound reduction indices of glazing

Choice A or B	Glazing Option	Sound Reduction Index, dB R_w in Octave Band Centre Frequency, Hz								R_w	C_{tr}	$R_w + C_{tr}$
		63	125	250	500	1k	2k	4k	8k			
Choice A Mechanical Ventilation	Option A1	19	25	25	33	44	44	49	49	37	-5	33

Choice B Natural Ventilation	Option A2	17	23	22	27	38	40	41	41	33	-4	29
	Option B1	20	26	22	28	38	41	42	42	33	-4	30
	Option B2	19	25	25	33	44	44	49	49	37	-5	33
	Option B3	23	29	36	42	44	47	59	59	44	-4	40

9.2.2 Table 8 provides a summary of the proposed ventilation scheme at the development. These are

Table 8: Minimum sound reduction indices of Ventilator

Choice A or B	Glazing Option	Sound Reduction Index, dB R_w in Octave Band Centre Frequency, Hz								$D_{n,e,w}$	C_{tr}
		63	125	250	500	1k	2k	4k	8k		
Choice B Natural Ventilation	All Choice B Options	30	39	40	44	49	53	64	64	49	-4

9.2.3 Whilst the provision of acoustic trickle ventilators will allow background ventilation to be achieved in conjunction with the required indoor noise levels, it may be necessary to consider alternative ventilation solutions in order to achieve compliance both with Part F of the Building Regulations (ventilation) and with the required indoor noise levels. These alternative solutions could be in the form of continuous mechanical extract (MEV) or continuous mechanical supply and extract with heat recovery (MVHR) systems. The M&E consultant will be able to advise on the suitability of mechanical ventilation systems.

9.2.4 Should such a system be considered, it is important that they be selected for low noise operation, and it is recommended that a noise level of no more than 28 dB L_A as a result of the operation of the ventilation system should be targeted within habitable rooms.

9.2.5 A coloured mark-up illustrating the location of the three glazing and ventilation options proposed is provided in Appendix C.

9.3 Consideration of Other Discipline Requirements

- 9.3.1 It is recommended that you confirm the suitability of all recommended noise mitigation measures with your architects, structural engineers, building contractors, fire consultants and material manufacturers prior to procurement and field application so that when the recommended noise control measures are implemented on site they will satisfy the requirements of all disciplines, therefore, should not cause any health and safety issues.

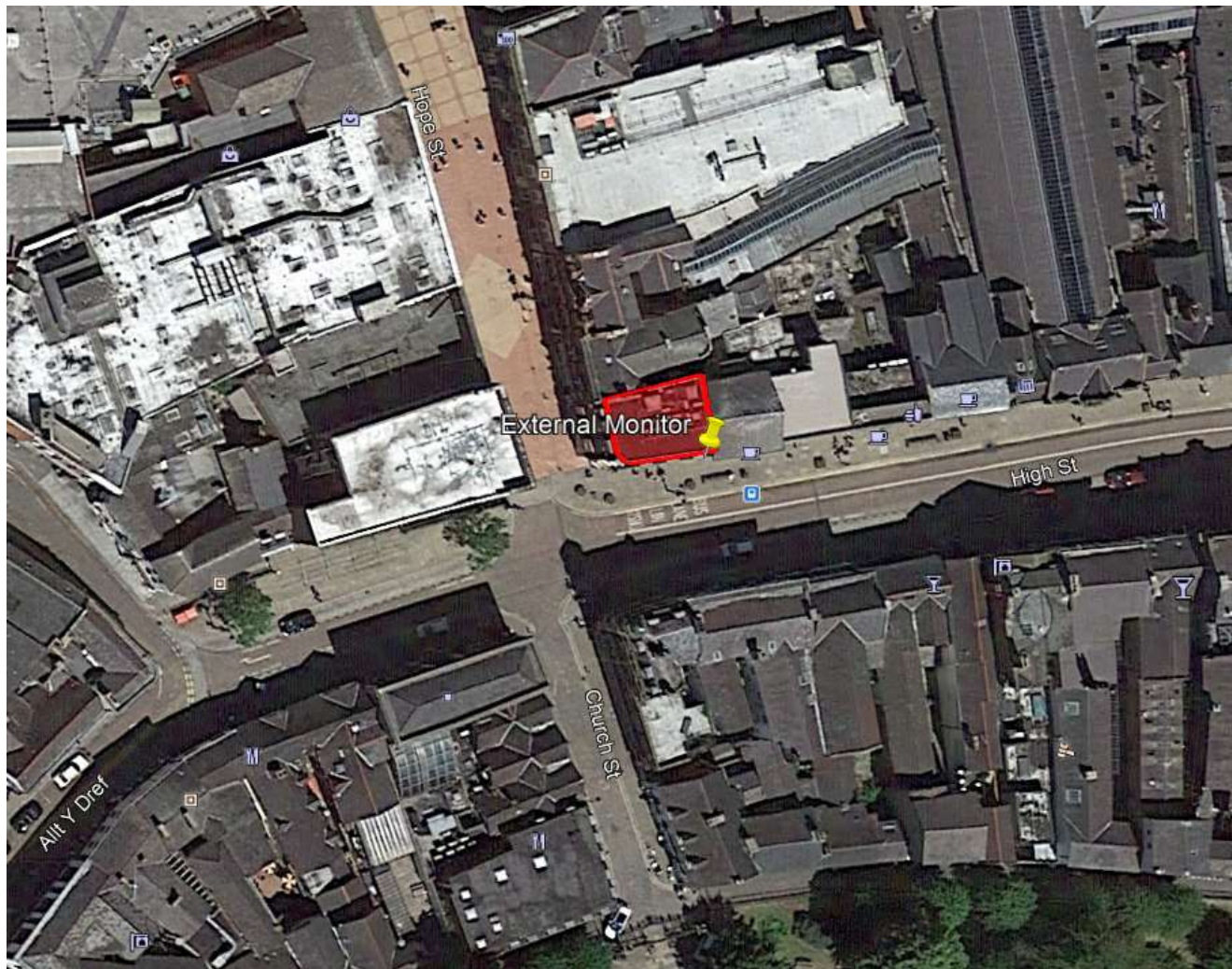
10 Conclusions

- 10.1 A noise assessment was undertaken to assess the impact of existing noise upon an existing building which is to have a change of use from a retail property to a mixed-use development, retail and residential, in the vicinity of 1-2 High Street, Wrexham, LL11 1AF.
- 10.2 Internal and external noise measurements have been taken at the location of the site out of a 1st floor window as well as a floor impact assessment between the ground floor retail unit and the first-floor residential apartments.
- 10.3 The assessment concluded that the internal noise levels are able to meet the internal noise criteria set in BS8233 and ProPG with the use of carefully selected glazing and ventilation options.
- 10.4 An assessment of the party floor between the ground floor retail unit and the 1st floor apartments has been undertaken. The results are better than the criteria for building regulations however there may be a requirement for a higher level of sound insulation once the operations of the retail unit are known.
- 10.5 In conclusion, with the implementation of our recommendations, it is considered that a suitable and commensurate level of protection against noise will be provided to the occupants of the proposed accommodation.

APPENDICES

Appendix A: Measurement Positions

How considerations about air quality fit into the development management process.



Appendix B: Noise Survey Details

Table B1: Noise monitoring equipment

location	Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Internal	Class 1 ^{10, 11} Integrating Real Time 1/3 Octave Sound Analyser	NTi XL2-TA	NTi Audio	A2A-11111-E0	06/09/2019	04410/2
	Microphone	NTi MC230A	NTi Audio	A14423	06/09/2019	N/a*
N/A	Class 1 Calibrator ¹²	CAL 200	Larson Davies	14154	07/09/2020	04796/1
External	Class 1 ^{13, 14} Integrating Real Time 1/3 Octave Sound Analyser	NTi XL2-TA	NTi Audio	A2A-15860-E0	20/02/2019	FL-19-113
	Microphone	NTi MC230A	NTi Audio	A16445	20/02/2019	N/a*

*No reference number available, but the certificate is available upon request.

- 10.5.1 Specific, background and ambient noise monitoring was undertaken at the times specified in Table B2, below. Weather conditions were determined both at the start and on completion of the survey. It is considered that meteorological conditions were appropriate for environmental noise measurements. Measurement locations are shown in Appendix A.

¹⁰ IEC 61672-1 (2002) Electroacoustics – Sound level meters Part 1: Specifications

¹¹ IEC 61260 (1995) Electroacoustics – Octave-band and fractional-octave-band filters

¹² IEC 60942 (2003) Electroacoustics – Sound calibrators

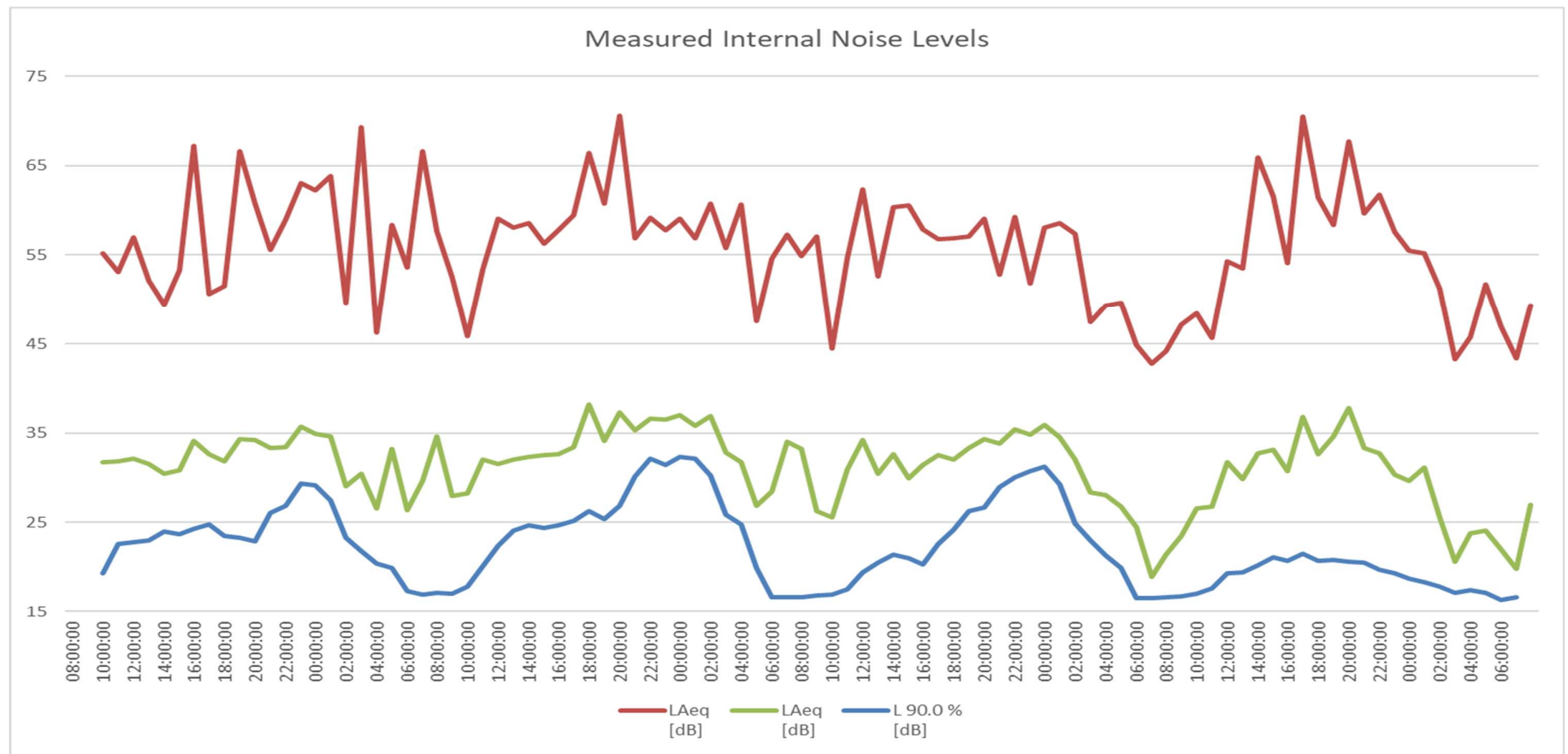
¹³ IEC 61672-1 (2002) Electroacoustics – Sound level meters Part 1: Specifications

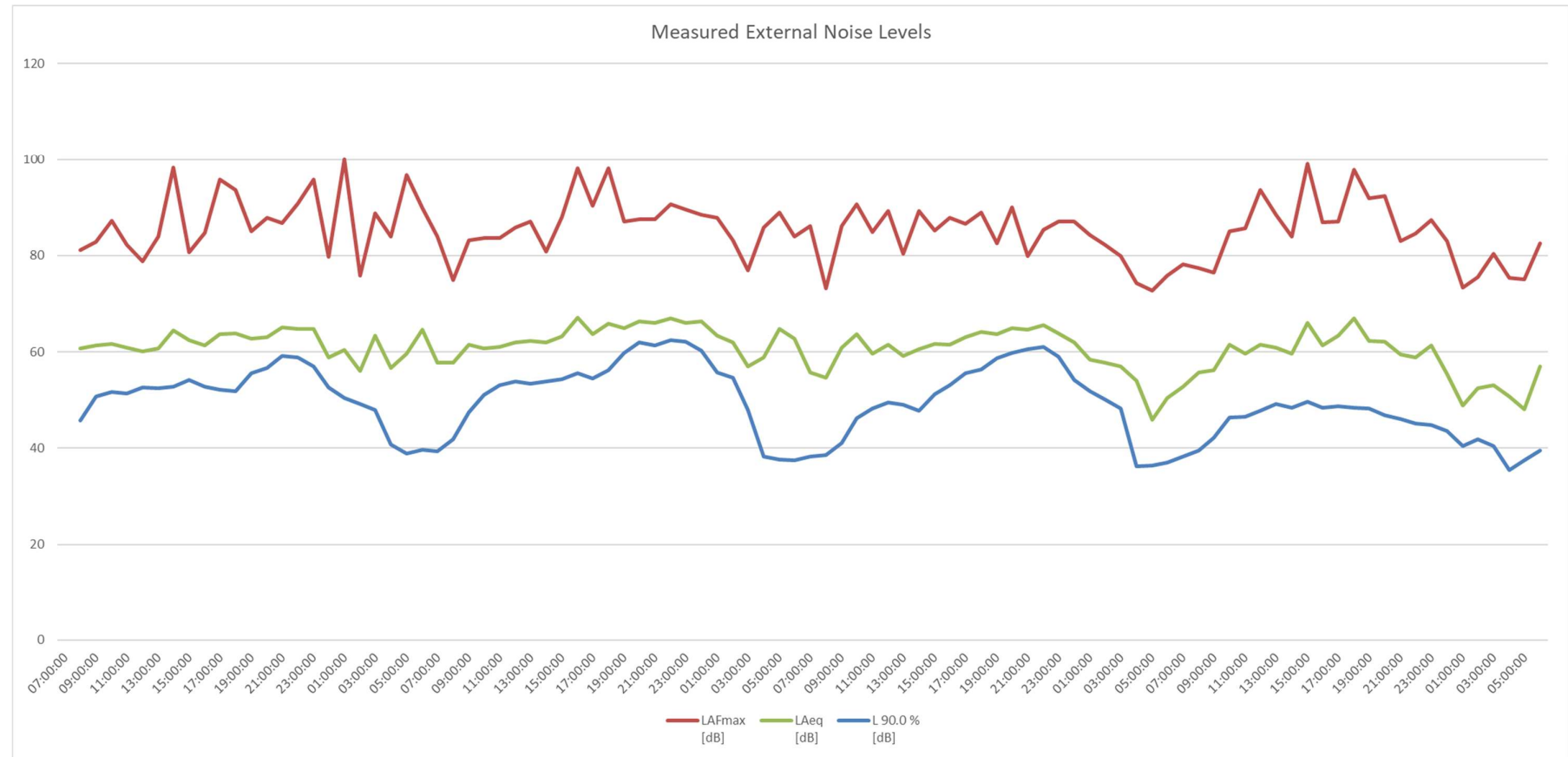
¹⁴ IEC 61260 (1995) Electroacoustics – Octave-band and fractional-octave-band filters

Table B2: Dates, times and weather conditions during noise measurements

Measurement Locations	Date/Time	Weather conditions		
		Description	At Start of Survey	On Completion
P1	28/05/21, 07:00 to 01/06/21, 07:00	Temperature:	10 °C	16 °C
Cloud Cover Symbol Scale in oktas (eighths)  0 Sky completely clear  1  2  3  4 Sky half cloudy  5  6  7  8 Sky completely cloudy  (9) Sky obstructed from view		Precipitation:	Dry	Dry
		Cloud cover (oktas – see opposite):	6	7
		Any fog/snow/ice?	No	No
		Any damp roads/wet ground?	No	no
		Wind speed:	1 - 2 m/s	2 - 3 m/s
		Wind direction:	Variable, generally south easterly	
		Any conditions that may cause temp. inversion (e.g. calm nights with no cloud):	No	No

Measurement Data





Appendix C: Glazing Calculations and Mark ups

Figure C1: First and Second Floor Glazing and ventilation mark-up's



Figure C 2: Third floor glazing and ventilation mark-up's



Figure C3: Example Noise Ingress Calculation: Daytime - Choice B

BS 8233:2014 - Noise Ingress Calculation

Term	Description	Value	Project:	1-2 high street, Wrexham
S_f	Total facade area (m ²)	14.69	Description:	Break-in, 16hr LAeq, from measured façade level, G
S_{wi}	Window area (m ²)	10.81	by:	CS
S_{ew}	External wall area ($S_f - S_{wi}$) (m ²)	3.88	Date:	07/06/2021
S_{tr}	Area of the ceiling (m ²)	0.00	Space:	1st & 2nd floor living room (blue)
S	Total area exposed to noise ingress ($S_f + S_{tr}$)	5.65	Period:	Dattime
x	Room dimension x	5.60	Results:	34 dB LAeq NR 33 -27 dB LAmax
y	Room dimension y	2.70		
z	Room dimension z	2.40		
V	Volume of receiving room (m ³)	36.29		
K	Facade Measurement Correction	-3.00		
A_0	Ref. qbs area (m ²)	10.00		
k	k=3 in BS 8233:2014 + Tolerance	3.00		
	No. of vents in external wall	2.00		
r	Distance to window / vent (m)	0.00		
d	Angle of incidence (deg)	180.00		

Term	Description	Description of noise level	Octave Band Centre Frequency (Hz)								Broadband	
			63	125	250	500	1000	2000	4000	8000	dB(A) 63-8k	dB(A) 125-2k
L_{eqff}	Free-field L_{eq} outside room	29/05/2021 07:00:00-23:00	70	64	61	62	60	56	49	41	64	64
L_{max}	Free-field L_{max} outside room										7	5

Term	Description	Specification									Dn,e,w		Rw	C	Ctr	Rw + Ctr	Comments	
											Dn,e,w		Rw	C	Ctr		Comments	
Dn,e	Dn,e of each ventilator:	771 AK	30	39	40	44	49	53	64	64	-	-	49	-	-	-4		Dnew (C,Ctr) = 48 (0;-2)
	Cumulative Dn,e for all ventilators		27	35	37	41	46	50	61	61								
Rwi	SRI of glazing/window:	8:12:4 mm	20	26	22	28	38	41	42	42	-	-	-	33	-1	-4	30	solaglas
	SRI of external wall:	BS8233 Example - Brick and block external wall	34	40	44	45	51	56	56	56	-	-	-	51	-1	-4		0.0
Rtr	SRI of roof and ceiling:	Ignore roof	130	130	130	130	130	130	130	130	-	-	-	0	0	0		0.0
Term	Description	Type / Comment /Source									dB(A) 63-8k	dB(A) 125-2k						
Leq,2	Internal Leq		50	38	39	33	22	15	6	-1	34	34						
Lmax,2	Internal Lmax		-20	-26	-22	-28	-38	-41	-42	-42	-27	-27						
Leq	via Vent		47	33	28	25	18	10	-8	-16	27	25						
	via Window		52	41	42	36	25	17	9	2	37	37						
	via Wall		34	22	16	15	7	-2	-9	-16	16	15						
	via Ceiling		0	0	0	0	0	0	0	0	7	5						
	via All		53	42	42	36	26	18	10	4	38	37						

Figure C4: Example Noise Ingress Calculation: Night-time - Choice A

Term	Description	Value	Project: 1-2 high street, Wrexham									
S _f	Total facade area (m ²)	15.47	Description: 1-2 high street, Wrexham									
S _{wi}	Window area (m ²)	1.02	by: CS									
S _{ew}	External wall area (S _f - S _{wi}) (m ²)	6.15	Date: 07/06/2021									
S _{tr}	Area of the ceiling (m ²)	11.69	Space: 3rd floor Bedroom (blue)									
S	Total area exposed to noise ingress (S _f + S _{tr})	27.15	Period: Night									
x	Room dimension x	6.15	Results: 29 dB L _{Aeq} NR 24									
y	Room dimension y	2.35	44 dB L _{Amax}									
z	Room dimension z	2.40										
V	Volume of receiving room (m ³)	34.69										
K	Facade Measuremet Correction	-3.00										
A0	Ref. qbs area (m2)	10.00										
k	k=3 in BS 8233:2014 + Tollerance	3.00										
	No. of vents in external wall	1.00										
r	Distance to window / vent (m)	0.00										
d	Angle of incidence (deg)	180.00										

Term	Description	Description of noise level	Octave Band Centre Frequency (Hz)								Broadband	
			63	125	250	500	1000	2000	4000	8000	dB(A) 63-8k	dB(A) 125-2k
L _{eq,ff}	Free-field L _{eq} outside room	00/01/1900 00:00	66	59	60	61	60	55	49	42	64	63
L _{max}	Free-field L _{max} outside room		78	77	78	77	85	80	69	61	87	87

Term	Description	Specification									D _{n,e,w}	R _w	C	C _{tr}	R _w + C _{tr}	Comments		
D _{n,e}	D _{n,e} of each ventilator:	ignore trickle vent	130	130	130	130	130	130	130	130	-	-	0	-	-	0	D _n ew (C _{tr}) = 66 (66/66), Free Area = ∞ +1	
	Cumulative D _{n,e} for all ventilators		130	130	130	130	130	130	130	130								
R _{wi}	SRI of glazing/window:	6:12:8.4 mm Stadip Silence	19	25	25	33	44	44	49	49	-	-	-	37	-1	-5	33	0
	SRI of external wall:	BS8233 Example - Brick and block external wall	34	40	44	45	51	56	56	56	-	-	-	51	-1	-4		0.0
R _{rr}	SRI of roof and ceiling:	Standard Warm Roof	12	27	42	49	54	55	59	59	-	-	-	39	-2	-6		0.0

Term	Description	Type / Comment / Source									dB(A) 63-8k	dB(A) 125-2k
L _{eq,2}	Internal L _{eq}		54	33	26	20	11	5	-5	-12	29	22
L _{max,2}	Internal L _{max}		67	51	43	35	36	30	15	7	44	41

Leq	via Vent		-60	-66	-65	-65	-66	-70	-76	-83	-62	-62
	via Window		39	27	28	20	8	4	-7	-14	23	22
	via Wall		32	20	17	16	9	0	-6	-13	16	16
	via Ceiling		54	32	18	12	6	1	-10	-17	28	18
	via All		54	34	29	22	13	7	-3	-10	29	24

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Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μPa , the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.

dB L_A Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB L_A broadly agree with an individual's assessment of loudness. A change of 3 dB L_A is the minimum perceptible under normal conditions, and a change of 10 dB L_A corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB L_A ; normal conversation about 60 dB L_A at 1 meter; heavy road traffic about 80 dB L_A at 10 meters; the level near a pneumatic drill about 100 dB L_A .

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 2014+A1:2019 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

$L_{A10(18\text{ hour})}$ Often referred to as the UK road traffic noise index, this is the arithmetic average of the values of L_{A10} hourly for each of the 18 one hour periods between 06:00 and 00:00.

R_w Single number rating used to describe the sound insulation of building elements and is defined in BS EN ISO 10140-2: 2010 (formerly BSEN ISO 140-3:1995). It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

$D_{nT,w}$ The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is defined in BS EN ISO 16283-1:2014 (formerly BSEN ISO 140-4:1998). It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.

$D_{ne,w}$ The weighted element-normalized level difference is a single figure rating used to describe the sound insulation of small elements within a larger construction and is defined in BS EN ISO 10140-2:2010 (BSEN ISO 140-10:1991). It is most often used to rate the sound insulation performance of ventilator units e.g. trickle vents.

C_{tr} A single-number spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic. It is defined in ISO 717-1:2013.

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