



Toll House, Littleborough

Noise Impact Assessment

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REVISION HISTORY

Revision	Date	Revision Details	Author	Checked
R01	28/01/2025	Original Issue	  Simon Fuller BEng AMIOA	 Susan Witterick BSc MIOA

1 INTRODUCTION

- 1.1 dBx Acoustics Ltd has been appointed by Studio OL3 to carry out a noise survey, and to undertake a noise impact assessment, for the proposed refurbishment of the neighbouring vacant houses at 6 Church Street, Littleborough, OL15 9AF, and 2 Todmorden Road, Littleborough, OL15 9AH.
- 1.2 It is proposed to convert the properties to form a ground floor community hub/tea point and a single first-floor apartment.
- 1.3 Planning permission is sought from Rochdale Borough Council, and a noise impact assessment is required to support the planning application.
- 1.4 The intent of this report is therefore to present the results of the noise survey undertaken at the site, to detail the subsequent noise impact assessment, and to provide outline guidance on appropriate acoustic requirements for façade, glazing and ventilation build-ups to control noise intrusion in line with Rochdale Borough Council's standard planning conditions.
- 1.5 A glossary of acoustic terminology has been supplied in Appendix A in order to assist the reader.

2 ACOUSTIC DESIGN CRITERIA

Local Authority

- 2.1 This site falls under the jurisdiction of Rochdale Borough Council (RBC).
- 2.2 The pre-application response received from RBC, reference *PREAPP/00056/24*, sets the following noise criteria for the development:
- *35 dB(A) Leq (16 hour) in the bedrooms with windows shut and other means of ventilation provided between 7 am and 11pm;*
 - *30dB(A) Leq 8 hour in the bedrooms with windows shut and other means of ventilation provided between 11pm and 7am;*
 - *35 dB(A) Leq (16 hour) in the living room/s with windows shut and other means of ventilation provided between 7 am and 11pm;*
 - *40dB(A) Leq (16 hour) in other habitable rooms with windows shut and other means of ventilation provided at all times.*
 - *Noise in external amenity areas shall not exceed 55 dB(A).*
- 2.3 The criterion for “other habitable rooms” has been assumed to apply to the ground floor Hub space.
- 2.4 RBC have made no reference to plant noise emission criteria, and therefore it is assumed that reference should be made to BS4142:2014 ‘Methods for Rating and Assessing Industrial and Commercial Sound’ in this regard.

National Planning Policy Framework

- 2.5 The revised National Planning Policy Framework (NPPF, last updated December 2023) supersedes the 2012, 2018 and 2019 versions of the NPPF. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, make effective use of land, help to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.
- 2.6 One of the core planning principles is to contribute to conserving and enhancing the natural environment. Allocations of land for development should prefer land of lesser environmental or amenity value, where consistent with other policies in the Framework (Paragraph 181). 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 soil, air, water or noise pollution or land instability (Paragraph 180).
- 2.7 Paragraph 191 of the NPPF states:
- “Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
- *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 (see Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food and Rural Affairs, 2010));*
 - *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”*
- 2.8 Additionally, Paragraph 193 states:
- “Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.”*

Noise Policy Statement for England

- 2.9 The Noise Policy Statement for England (NPSE) aims to “through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:
- *Avoid significant adverse impacts on health and quality of life;*
 - *Mitigate and minimise adverse impacts on health and quality of life; and*
 - *Where possible, contribute to the improvement of health and quality of life”.*
- 2.10 Based on concepts from toxicology, it introduces three ‘Effect Levels’ relevant to the assessment of noise. These 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 effects on health and quality of life can be detected; and
 - SOAEL: Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur.

Planning Practice Guidance

- 2.11 The Planning Practice Guidance for Noise (PPG-N) was published in March 2014 and most recently updated in September 2023. The PPG-N suggests that the most appropriate and cost-effective solutions to potential noise issues are best identified when good acoustic design needs to be considered early in the planning process.
- 2.12 The PPG-N provides the following advice on how to determine the noise impact on development:
- “Plan-making and decision making need to take account of the acoustic environment and in doing so consider:*
- *Whether or not a significant adverse effect is occurring or likely to occur;*
 - *Whether or not an adverse effect is occurring or likely to occur; and*
 - *Whether or not a good standard of amenity can be achieved.”*
- In line with the Explanatory note of the noise policy statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.” (Paragraph 003 Reference ID 30-003-20190722).*
- 2.13 The document goes on to acknowledge the levels of noise exposure at which an effect may occur as provided in the NPSE and introduces a fourth effect level:
- UAE: Unacceptable Adverse Effect: Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise lead to psychological stress or physical effects.

- 2.14 Where residential development is proposed in the vicinity of existing businesses, community facilities or other activities that produce noise, the PPG-N advises that the applicant (or ‘agent of change’) will need to clearly identify the effects of the existing businesses that may cause a nuisance (including noise) and clearly define the mitigation measures being proposed to address any potential significant adverse effects that are identified. The agent of change needs to not only consider the current activities of the business, but the permitted activities too, even if they are not occurring at the time of the application being made. The PPG-N acknowledges that *“It can be helpful for developers to provide information to prospective purchasers or occupants about mitigation measures that have been put in place, to raise awareness and reduce the risk of post-purchase/occupancy complaints.”* (Paragraph 009 Reference ID 30-009-20190722).
- 2.15 It is important to understand that as the PPG-N does not specifically provide any advice with respect to noise levels/limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment and the PPG-N signposts a number of appropriate guidance documents.

BS 8233:2014: ‘Guidance on sound insulation and noise reduction for buildings’

- 2.16 BS 8233:2014 gives guidance for noise levels within residential properties. It discusses appropriate criteria for reasonable rest and sleep conditions and provides noise levels which are considered to provide appropriate conditions in accordance with WHO guidelines. The guidance on limits from the standard is reproduced in Table 1, below.

Table 1: Internal Ambient Noise Limits (BS8233)

Activity	Location	07:00h – 23:00h	23:00h – 07:00h
Resting	Living room	35dBL _{Aeq,16h}	-
Dining	Dining room/area	40dBL _{Aeq,16h}	-
Sleeping (daytime resting)	Bedroom	35dBL _{Aeq,16h}	30dBL _{Aeq,8h}

- 2.17 It should be noted that these limits represent the average noise level over the 16-hour day or 8-hour night period. This potentially means that higher noise levels may be experienced internally over a shorter period (e.g., individual passing trams or vehicles). These equivalent noise levels, over a period of time, are the best representation of the average noise level and are generally the main focus when it comes to evaluating noise exposure.
- 2.18 Under the updates to BS 8233 in 2014, for both day and night-time cases, a relaxation of up to 5dB is considered to provide “reasonable internal conditions” where development is considered necessary or desirable.
- 2.19 To assess the maximum noise levels, the World Health Organisation (WHO) document “Guidelines for Community Noise: 1999” recommends that maximum noise levels (dBL_{Amax,F}) do not exceed 45dBL_{Amax,F} more than 10-15 times a night.

Outdoor Noise Levels in External Amenity Areas

- 2.20 BS 8233: 2014 and the World Health Organisation (WHO) document 'Guidelines for Community Noise: 1999' present guidance for external noise levels within outdoor amenity areas of residential properties to be within $55\text{dB}_{\text{L}_{\text{Aeq}},16\text{h}}$.
- 2.21 It is, however, noted that compliance with these levels may not always be practical, and that the benefits of a development in other areas may take precedence over achieving external amenity noise levels.

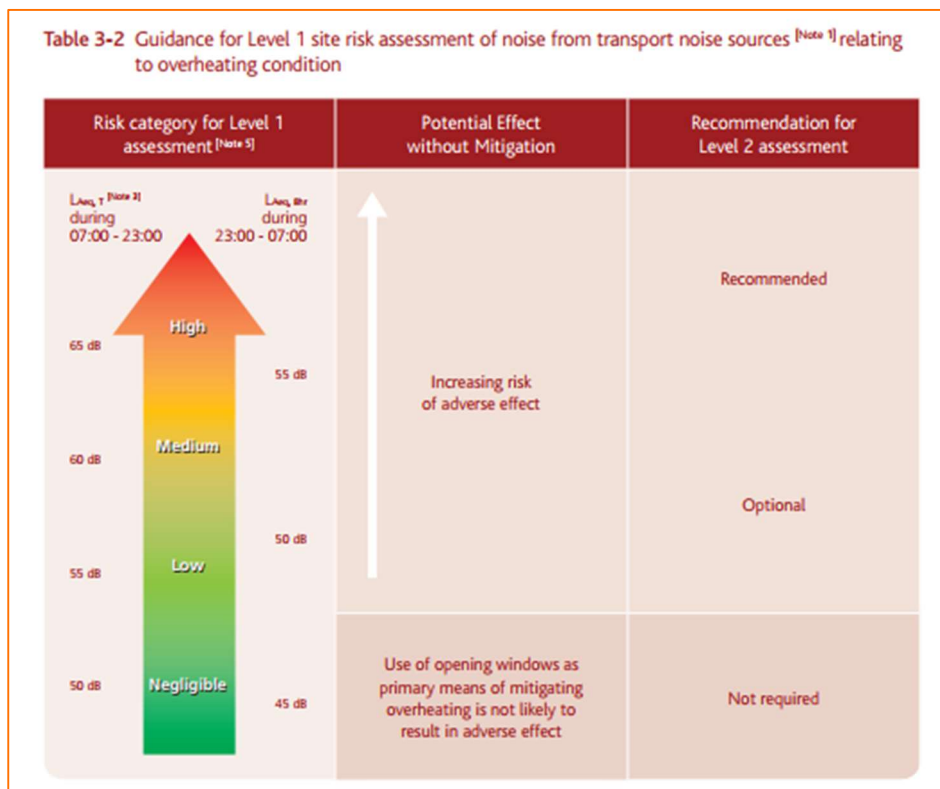
The Building Regulations 2010: Overheating: Approved Document O

- 2.22 Section 3 of Overheating: Approved Document O (ADO) states the following;
- "3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).*
- 3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.*
- A. $40\text{dB}_{\text{L}_{\text{Aeq}},T}$, averaged over 8 hours (between 11pm and 7am).*
- B. $55\text{dB}_{\text{L}_{\text{AFmax}}}$, more than 10 times a night (between 11pm and 7am).*
- 3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use."*
- 2.23 It is also highlighted that guidance on reducing the passage of external noise into buildings can be found in the Association of Noise Consultants' 'Acoustics, Ventilation and Overheating: Residential Design Guide' (2020).

Ventilation and Overheating: Residential Design Guide 2020 (AVO)

- 2.24 AVO outlines a two-level procedure to estimate the potential impact on occupants in the case of the overheating condition.
- 2.25 The AVO Level 1 assessment is used to determine the 'Potential Effect without Mitigation' and to establish if there is a requirement for a Level 2 Assessment.
- 2.26 A level 1 assessment is undertaken by comparing the external noise levels measure to the values shown on Table 3-2 of AVO, reproduced as Figure 1, below.

Figure 1: AVO Table 3-2, Guidance for Level 1 Site Risk Assessment



- 2.27 If required, a Level 2 assessment is then undertaken by comparing the predicted internal noise levels to Table 3-3 of AVO, reproduced as Figure 2, below.

Figure 2: AVO Table 3-3, Guidance for Level 2 Assessment

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

Internal ambient noise level ^[Note 2]			Examples of Outcomes ^[Note 3]	
$L_{Aeq,T}$ ^[Note 4] during 07:00 – 23:00 ^[Note 5]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 6]		
> 50 dB	> 42 dB	Normally exceeds 65 dB L_{Amax}	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
 Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. ^[Note 7]
≤ 35 dB	≤ 30 dB	Do not normally exceed L_{Amax} 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response ^[Note 8] . Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

- 2.28 It can be seen from the figures above that there are no strict numerical limits for an acceptable level of noise within residences during the overheating condition.
- 2.29 Table 3-3, however, does suggest that night-time noise levels of $\geq 42 \text{ dB}_{L_{Aeq,8\text{hour}}}$ or $65 \text{ dB}_{L_{Amax,F}}$ can be considered upper limits for acceptable noise levels in rooms in which overheating is controlled by the use of open windows.

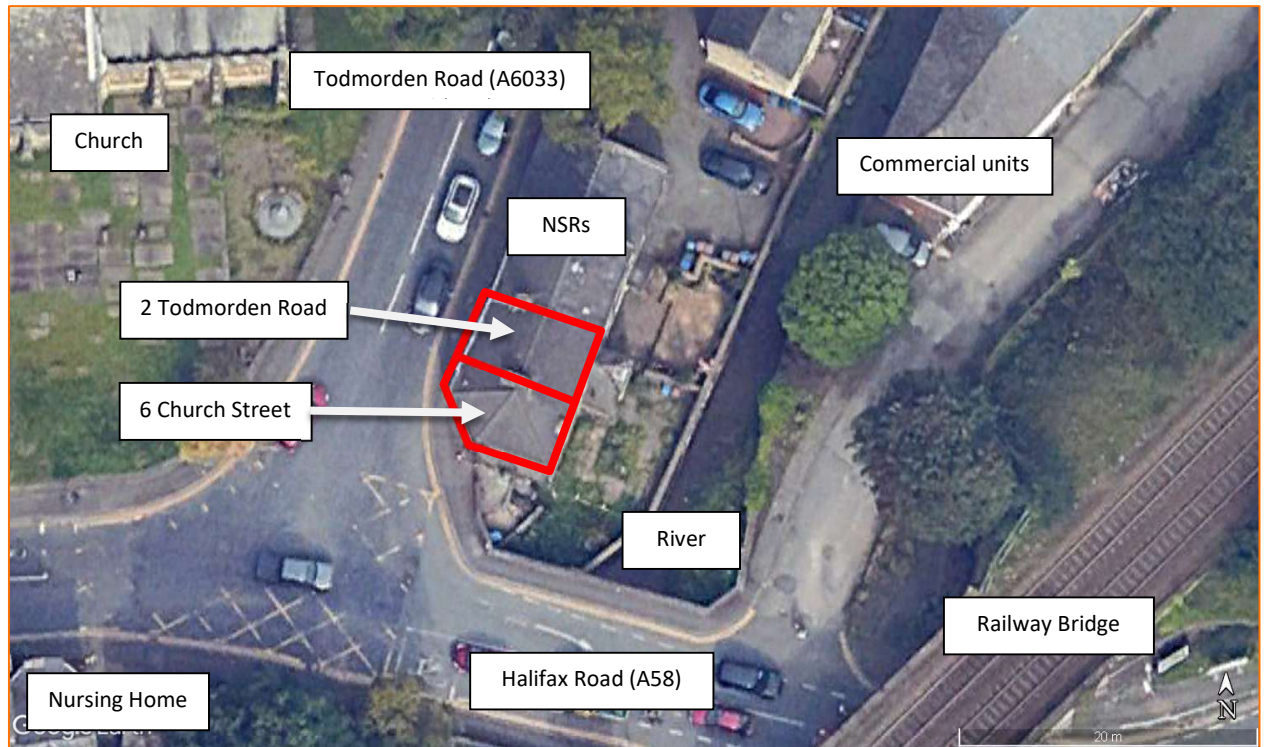
BS 4142:2014 + A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'

- 2.30 BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating is determined and compared with the existing local Background Sound Level.
- 2.31 The Rating Level ($dB_{L_{Ar,Tr}}$) is evaluated from the Specific Noise Level by including several, cumulative corrections to account for factors such as distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristics.
- 2.32 The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:
- a) Typically, the greater this difference, the greater the magnitude of the impact.
 - b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3 SITE DESCRIPTION

- 3.1 The proposed site is located at 6 Church Street and 2 Todmorden Road. Figure 3, below, illustrates the site location.

Figure 3: Site Location Plan



- 3.2 The site is at the junction of Todmorden Road (A6033) and Halifax Road (A58).
 3.3 An elevated double track railway line is located approximately 26m east of the site boundary.

Noise Sources

- 3.4 During the daytime period, noise levels at the site were dominated by road traffic noise (RTN) and occasional train movements. At night, road traffic and ambient noise from the adjacent river are audible.
 3.5 Commercial units are located to the north east. Activity from these units was not audible during the attended periods of the noise survey and a review of the survey data indicates that activity at this site did not impact the noise climate.

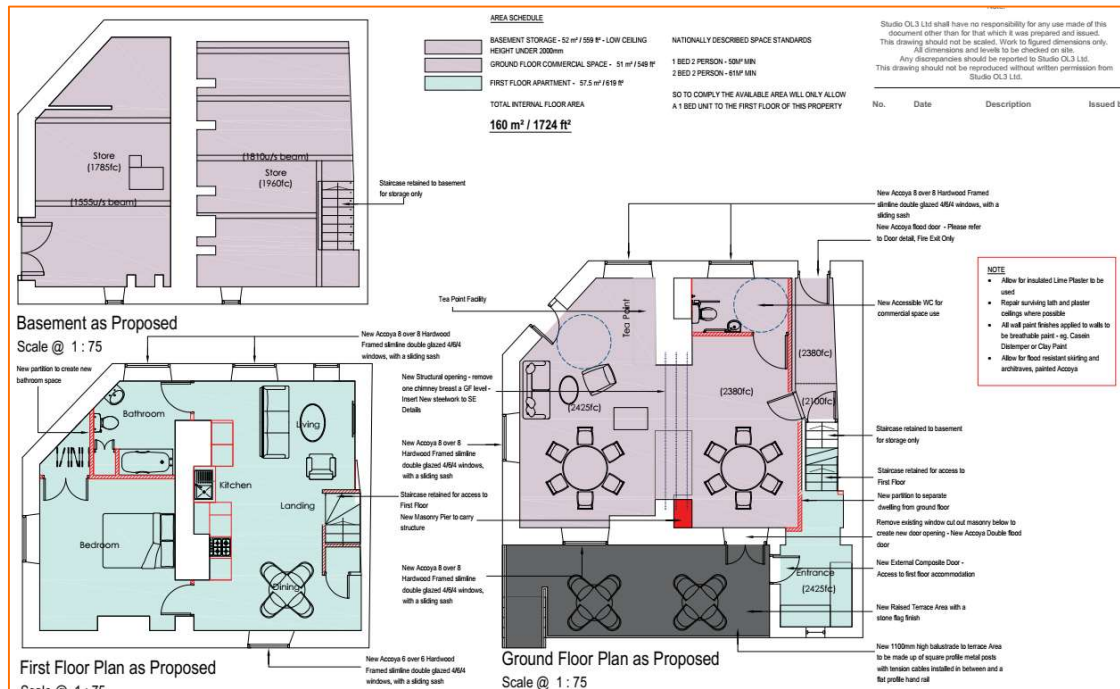
Noise Sensitive Receptors

- 3.6 The nearest noise sensitive receptors (NSR) are the adjacent residential property at 4 Todmorden Road, and a nursing home to the south west of the site.

Proposed Development

- 3.7 The development comprises a ground floor community hub/tea point and a first floor apartment.
- 3.8 Figure 4, below, shows the proposed building layout.

Figure 4: Proposed Building Layout

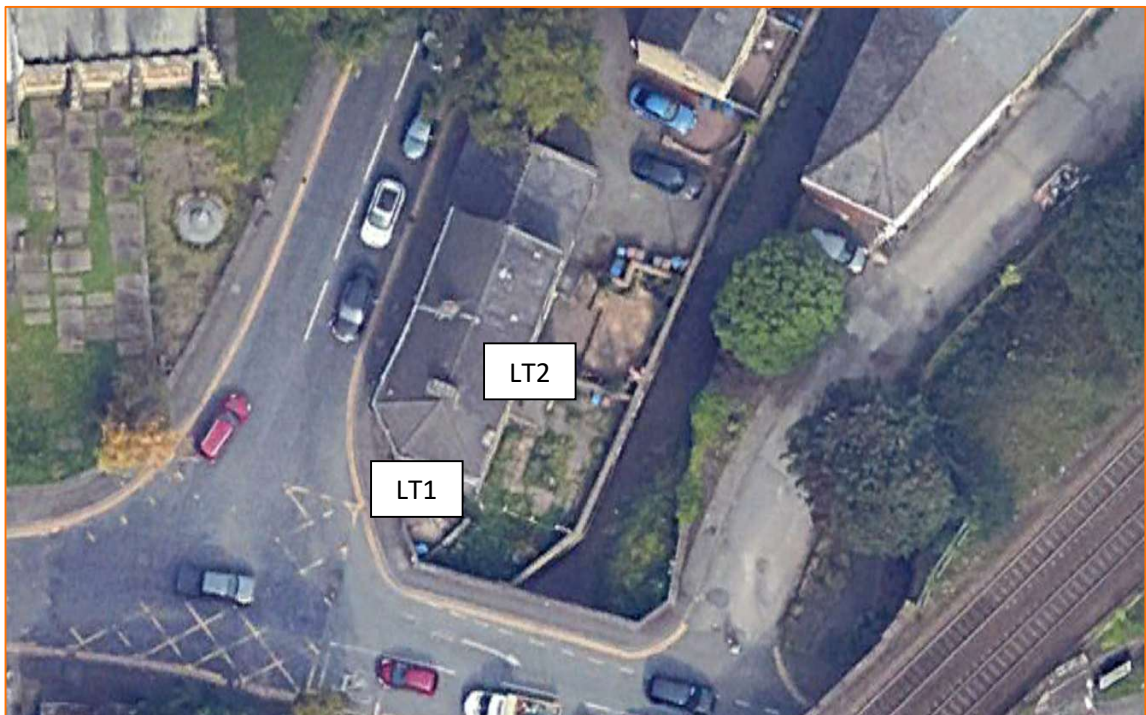


4 ENVIRONMENTAL NOISE SURVEY

Survey Methodology

- 4.1 Unattended long-term measurements (LT) were undertaken from around 12:00h on Monday 13th January 2025 until around 10:00h on Wednesday 15th January 2025. Noise levels were measured continuously throughout, in 15-minute periods.
- 4.2 The microphones were positioned on poles extended from the first floor windows at around 0.5m from the building, and are hence façade measurements.
- 4.3 Figure 5, below, illustrates the monitoring locations.

Figure 5: Monitoring Locations



- 4.4 LT1 overlooked the A58, extended from the proposed bedroom window, and was considered to be the location most affected by environmental noise.
- 4.5 LT2 was to the east of the building, extended from the proposed living room window, and was selected as being representative of potential rail and industrial noise as well as road traffic. This location can also be considered representative of the noise climate at the adjacent NSR at 4 Todmorden Road.

Equipment

4.6 The equipment used during the environmental noise survey is detailed in Table 2, below.

Table 2: Equipment Used in the Environmental Noise Survey

Location	Equipment	(Manufacturer & Part No./ Serial Number)	Serial Number
LT1	Meter	CR:171C	G300656
	Pre-Amp	MV:200F	9136F
	Microphone	MK:224	215619A
	Calibrator	CR:515	87921
LT2	Meter	CR:171B	G300741
	Pre-Amp	MV:200F	9082F
	Microphone	MK:224	211753D
	Calibrator	CR:515	87160

4.7 The sound level meters were calibrated before and after measurements, with no significant drift recorded. An accredited laboratory calibrated the equipment not more than two years prior to the measurements being made, except for the calibrators, which had been calibrated not more than one year prior to the survey.

Weather Conditions

4.8 Weather conditions during noise monitoring were generally cool and dry with scattered clouds on attendance.

4.9 Light rain was reported on Tuesday 14th January between around 09:00h to 12:00h, but with no indication of standing water on the road. A review of the measured data indicates that this had no effect on the measured noise levels.

4.10 Wind speeds were within suitable parameters for the measurement of environmental noise (i.e., generally under 5 ms⁻¹). The measurement microphones were protected with a windshield for the duration of the survey.

5 SURVEY RESULTS

- 5.1 A summary of the Ambient Noise Level and Typical Background Noise Level monitoring results are presented Figures 6 and 7, the Maximum Noise Level results are presented in Figures 8 and 9, and Measured noise levels are presented Tables 3 and 4, below.
- 5.1 All measurements were façade measurements; these have therefore been corrected by -3dB to determine the free-field noise levels incident upon the building.

Figure 6: Ambient and Background Noise, LT1

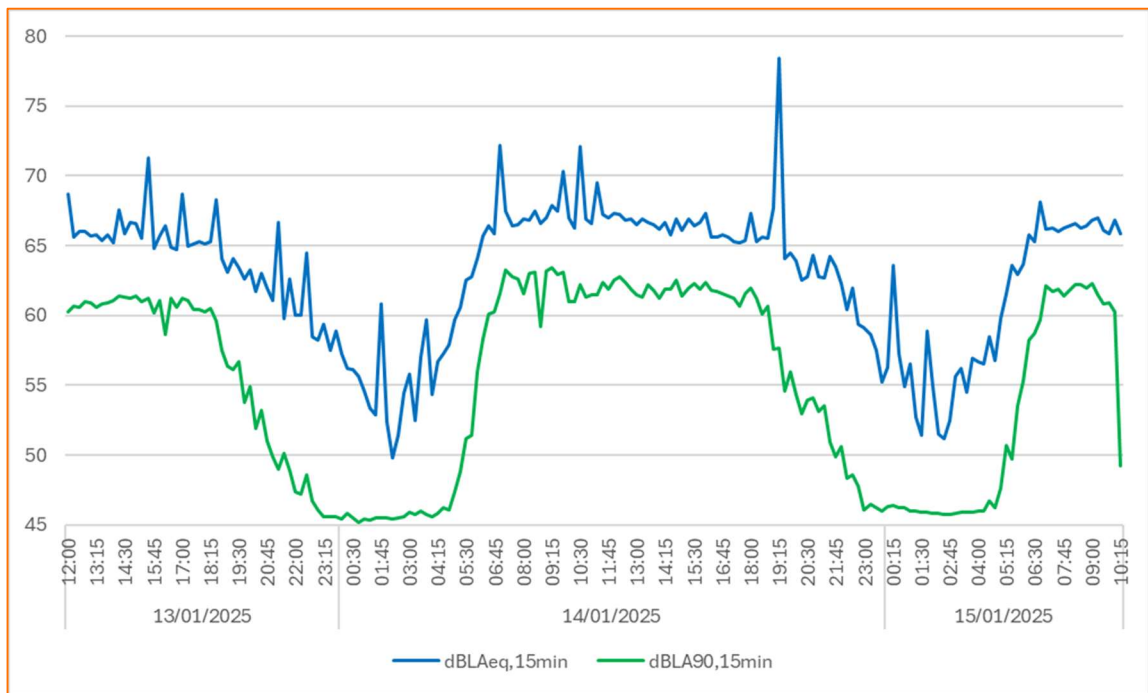


Figure 7: Ambient and Background Noise, LT2

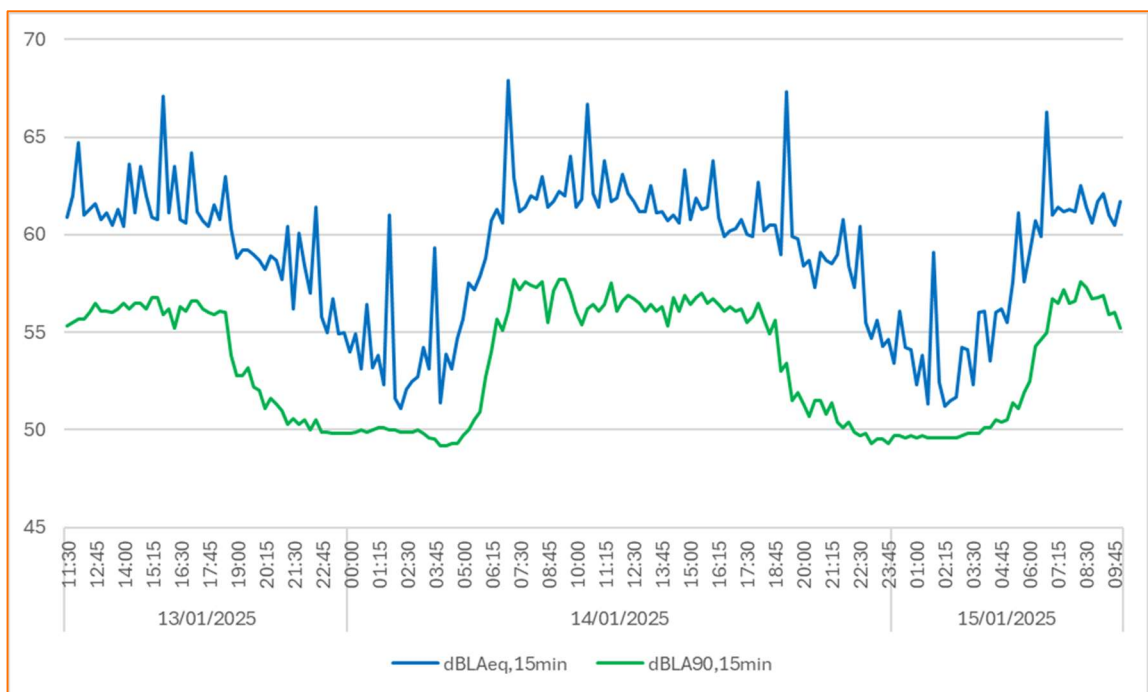


Figure 8: Night Time Maximum Noise Levels, LT1

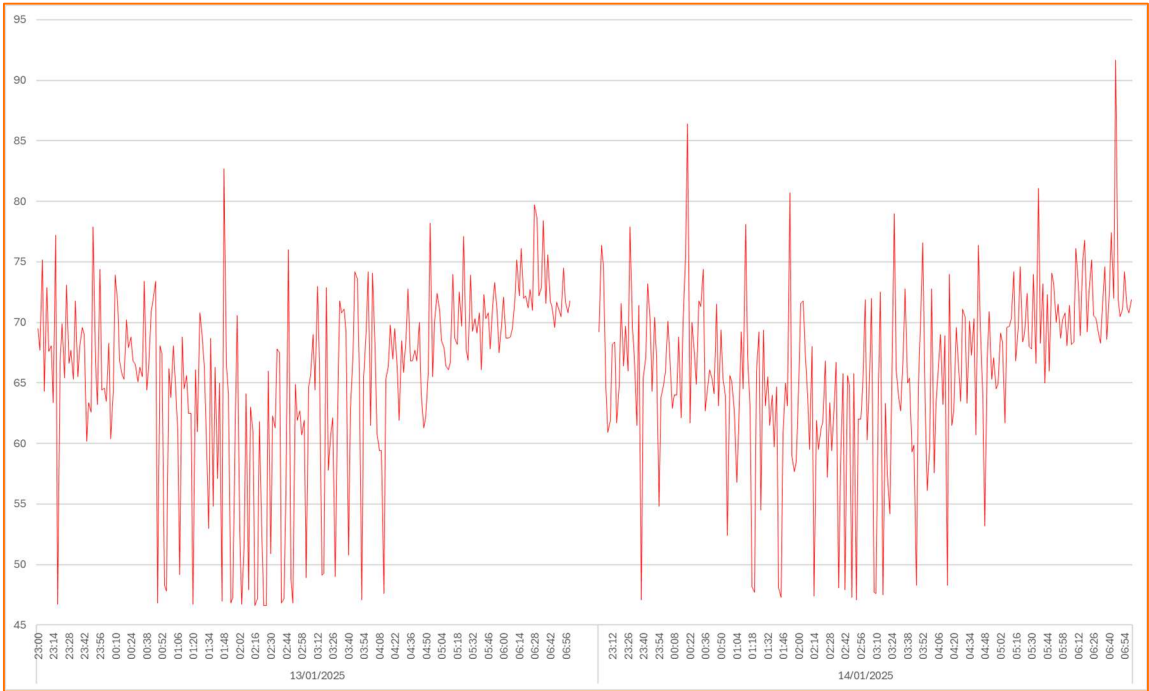


Figure 9: Night Time Maximum Noise Levels, LT2

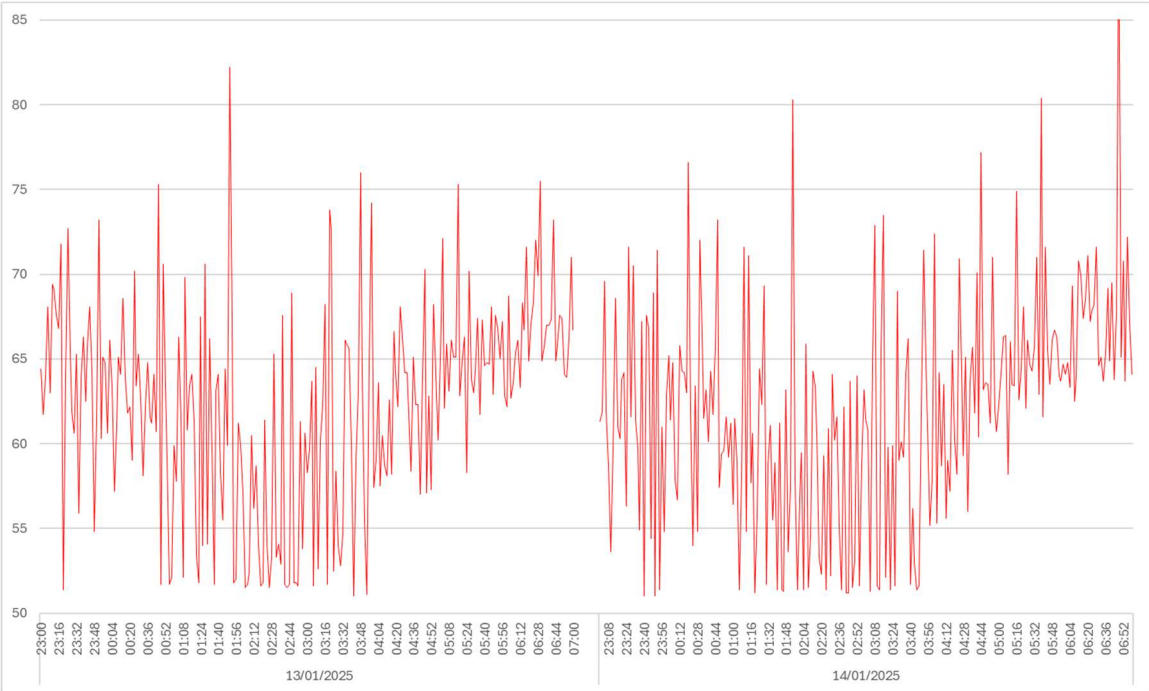


Table 3: Measured Noise Levels, LT1

Date	Period	Ambient Noise Level, dBL _{Aeq,T}	Typical Maximum Noise Level, dBL _{Amax,F}	Typical Background Noise, dBL _{A90,T}
13/01/2025	12:00h-23:00h	65	--	61
13/01/2025	23:00h-07:00h	60	75	46
14/01/2025	07:00h-23:00h	68	--	62
14/01/2025	23:00h-07:00h	60	76	46
15/01/2025	07:00h-10:00h	66	--	62

Table 4: Measured Noise Levels, LT2

Date	Period	Ambient Noise Level, dBL _{Aeq,T}	Typical Maximum Noise Level, dBL _{Amax,F}	Typical Background Noise, dBL _{A90,T}
13/01/2025	12:00h-23:00h	61	--	56
13/01/2025	23:00h-07:00h	56	72	50
14/01/2025	07:00h-23:00h	62	--	56
14/01/2025	23:00h-07:00h	57	73	50
15/01/2025	07:00h-10:00h	61	--	57

- 5.2 The ambient noise levels are the logarithmic average of all measurements taken in each day or night-time period, 16 hours and 8 hours, respectively.
- 5.3 The night-time maximum noise events measured throughout the survey period have been used in the assessment such that maximum events inside building would exceed 45dBL_{Amax,F} no more than 10 to 15 times on the noisiest night in accordance with the World Health Organisation (WHO) document 'Guidelines for Community Noise: 1999' criterion.
- 5.4 In terms of the background noise levels, the typical daytime and night-time background noise levels have been determined using the statistical analysis methodology described in BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'.

Noise Levels Used in the Assessment

5.5 To present a worst-case noise impact assessment, the highest ambient, typical maximum, and lowest typical background noise levels measured over the survey period have been used, as summarised in Table 5 below.

Table 5: Free-Field Noise Levels Used in Assessment

Daytime Ambient Noise Level, $\text{dBL}_{\text{Aeq},16\text{hour}}$	Night-Time Ambient Noise Level, $\text{dBL}_{\text{Aeq},8\text{hour}}$	Night Time Maximum Noise Level, $\text{dBL}_{\text{Amax},\text{F}}$	Daytime Background Noise Level, $\text{dBL}_{\text{A90},15\text{min}}$	Night-Time Background Noise Level, $\text{dBL}_{\text{Aeq},15\text{min}}$
68	60	76	61	46

6 BUILDING ENVELOPE SOUND INSULATION

- 6.1 An external noise break-in assessment has been undertaken to determine the minimum sound insulation performance of the glazing and ventilation required to meet the internal noise criteria.
- 6.2 Based on a typical reduction in external noise levels to indoor noise levels of 15dB for a partially opened window (based on WHO guidance), allowable external noise levels for compliance with BS8233 (and RBC requirements) are therefore 50dB_{L_{Aeq,T}} outside living rooms in the day, and 45dB_{L_{Aeq,T}} and 60dB_{L_{Amax,F}} outside bedrooms at night.
- 6.3 With reference to Table 5, and the allowable external noise levels detailed above, it can be seen the required indoor noise levels can only be achieved with closed windows and an alternative means of ventilation.
- 6.4 Calculations have therefore been undertaken, based on the noise levels detailed in Table 5, above, and the sizes of the rooms and windows provided, to determine the sound insulation performance of the glazing and ventilators required to achieve the BS8233 noise limits, as detailed in Table 6, below.

Table 6: Glazing and Ventilation Sound Insulation Requirements

Room	Glazing Sound Insulation Performance, dB R _w (+ C _{tr})	Example Glazing Construction, mm	Ventilator Sound Insulation Performance, dB D _{n,e,w}	Example Ventilator
Bedrooms	38(-6)	10/TC/6mm	41	Renson AK80/3
Open Living Space	38(-6)	10/TC/6mm	38	Simon Acoustics EHAS
Hub	31(-6)	4/TC/4mm	33	Standard Trickle
WC	31(-6)	4/TC/4mm	33	Standard Trickle

TC = Thermal Cavity

- 6.5 The sound insulation performances detailed must be achieved by the glazing unit as a whole, including frames, seals, opening lights etc, as opposed to the glass panels alone. Windows can be openable at occupant discretion (e.g. for purge ventilation) but must be well sealed when closed.
- 6.6 The glazing configurations shown above are a suggestion only, and alternative configurations may be acoustically suitable.
- 6.7 Calculations indicate that the external wall and roofs in residential habitable rooms must also achieve a sound insulation performance of at least 51dB_{R_w}.
- 6.8 The external walls comprise 400mm masonry, which will readily meet this requirement.
- 6.9 The roof is a traditional slate tile construction. The ceiling within the apartment should be formed from at least one layer of 15mm high density plasterboard (e.g. British Gypsum SoundBloc or Fireline), with a 50mm mineral fibre quilt laid to the rear.

Overheating

- 6.1 At this stage, an overheating assessment has not been completed. This initial guidance is therefore presented on the basis that an overheating condition may arise, but will need to be reviewed as the scheme progresses.
- 6.2 An assessment has been made in accordance with Approved Document O.
- 6.3 Approved Document O is based on guidance in the Association of Noise Consultants' document '*Acoustics, Ventilation and Overheating Guide*' (2020) (AVO).

AVO Level 1 Assessment

- 6.4 The AVO Level 1 Assessment is used to determine the 'Potential Effect without Mitigation' and to establish if there is a requirement for a Level 2 Assessment.
- 6.5 AVO indicates that a Level 2 assessment is 'recommended' when $65\text{dBL}_{\text{Aeq},16\text{hour}}$ (daytime) and $55\text{dBL}_{\text{Aeq},8\text{hour}}$ (night-time) is exceeded.
- 6.6 Furthermore, AVO mentions that 'where $78\text{dBL}_{\text{AF},\text{max}}$ is normally exceeded during the night-time period, a Level 2 assessment is recommended'.
- 6.7 The Level 1 Assessment is summarised in Table 7, below.

Table 7: Level 1 Assessment

Typical Daytime Noise Levels, $\text{dBL}_{\text{Aeq},16\text{hour}}$	Typical Night-time Noise Levels, $\text{dBL}_{\text{Aeq},8\text{hour}}$	Typical Maximum Noise Level, $\text{dBL}_{\text{AF},\text{max}}$	Risk Category (day/night)
68	60	76	High

- 6.8 On this basis, a Level 2 Assessment is presented below.

AVO Level 2 Assessment

- 6.9 For the Level 2 assessment, there are no definitive criteria proposed, only a sliding scale of *'Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night'*.
- 6.10 However, internal noise level limits of $50\text{dBL}_{\text{Aeq},16\text{hour}}$ in the day, and $42\text{dBL}_{\text{Aeq},8\text{hour}}$ and $65\text{dBL}_{\text{Amax},F}$ at night are the limits at which *'Noise causes a material change in behaviour e.g. having to keep windows closed most of the time....Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep.'*
- 6.11 These limits would therefore appear to be a worst-case upper limit. Furthermore, any adverse effects relating to noise are affected by both the noise level itself, and the duration (how long overheating occurs) and frequency (how many times per year/month) the overheating condition occurs.
- 6.12 AVO specifies an expected reduction from external to internal noise levels of -13dB when a window is open. On this basis, the predicted indoor ambient noise levels (IANL) assuming windows open for the control of overheating during daytime is shown in Table 8, and for night-time is shown in Table 9.

Table 8: AVO Level 2 Assessment - Daytime

Parameter	Facades
External Ambient Noise Level, $\text{dBL}_{\text{Aeq},16\text{hr}}$	68
Reduction, open window, dB	-13
IANL Day-time ($\text{dBL}_{\text{Aeq},16\text{hr}}$)	55
Upper Limit Outlined in AVO	$>50\text{dBL}_{\text{Aeq},16\text{h}}$
Exceedance	+5

Table 9: AVO Level 2 Assessment - Nighttime

Parameter	Facades
External Ambient Noise Level, $\text{dBL}_{\text{Aeq},8\text{hr}}$	60
Reduction, open window, dB	-13
IANL Night-time ($\text{dBL}_{\text{Aeq},8\text{hr}}$)	47
Upper Limit Outlined in AVO	$>42\text{dBL}_{\text{Aeq},8\text{h}}$
Exceedance	+5
External Maximum Noise Level, $\text{dBL}_{\text{Amax},\text{F}}$	76
Reduction, open window, dB	-13
IANL Night-time ($\text{dBL}_{\text{Amax},\text{F}}$)	63
Upper Limit Outlined in AVO	65
Exceedance	-2

- 6.10 It can be seen that the IANL with windows open to control overheating exceeds the upper limit suggested by AVO during the night and daytime periods for the apartment facades due to the ambient noise levels, and a material change in occupant behaviour due to noise may occur.
- 6.11 Alternative means of overheating mitigation should therefore be considered, such as mechanical or hybrid ventilation, if the overheating condition actually occurs.
- 6.12 This will need to be confirmed by the mechanical services consultant.

7 SEPARATING FLOOR

- 7.1 The floor separating the ground floor Hub from the first-floor apartment should be designed such that noise transfer is appropriately controlled.
- 7.2 It is understood that the ground floor will be used as a “Flood Hub”, offering advice to members of the public on flood defence measures and installations for their homes. On this basis, no significant noise would be generated within the space and it is recommended that airborne sound insulation between the ground and first floor should meet the requirements of Approved Document E, i.e. $43\text{dB}D_{nT,w} + C_{tr}$.
- 7.3 Studio OL3 have informed that the existing joists are to be retained, with a new floor deck comprising 22mm flooring particle board and a ceiling comprising one layer of plasterboard.
- 7.4 To meet the airborne sound insulation requirements, the ceiling should be supported on a frame independent of the joists, and the ceiling should comprise either two layers of 15mm standard wallboard, or two layers of 12.5mm high density plasterboard ceiling (e.g. SoundBloc or Fireline). A mineral fibre quilt of minimum thickness 100mm and minimum density 100kg/m^3 should be laid on the rear of the ceiling.

8 EXTERNAL AMENITY AREA

- 8.1 RBC requires that noise in external amenity areas shall not exceed $55\text{dBL}_{\text{Aeq},16\text{hr}}$.
- 8.2 The daytime ambient noise level measured at LT2, at the first floor above the proposed external amenity area, was $62\text{dBL}_{\text{Aeq},16\text{hour}}$.
- 8.3 The external amenity area comprises a ground floor level terrace, and an area of garden adjacent to the river which is and approximately 1.5-2m lower than the road level and shielded from road traffic noise by the existing masonry parapet wall.
- 8.4 On this basis, it has been calculated that due to this screening, the external amenity noise level in the majority of the external area would be around $52\text{dBL}_{\text{Aeq},16\text{hr}}$ and therefore compliant with RBC requirements.

9 BUILDING SERVICES NOISE EMISSIONS

- 9.1 It is proposed that any new items of building services plant should cumulatively achieve a Rating Level of at least 5dB below the typical background noise level at the nearest noise sensitive receptors when assessed in accordance with BS 4142:2014 + A1:2019.
- 9.2 Based on the background noise levels detailed in Table 5, suitable limits to which the cumulative plant noise level should adhere are set in Table 10, below.

Table 10: Plant Noise Emission Limits

Nearest Noise Sensitive Receptor	Plant Noise Emission Limit dBL _{Ar,Tr}	
	Daytime Period (07:00h – 23:00h)	Night-time Period (23:00h – 07:00h)
4 Todmorden Road	56	41

10 CONCLUSION

- 10.1 dBx Acoustics Ltd has been appointed by Studio OL3 to carry out a noise survey and noise impact assessment for the proposed refurbishment of 6 Church Street, Littleborough, OL15 9AF, and 2 Todmorden Road, Littleborough, OL15 9AH to form a ground floor community hub and first floor apartment.
- 10.2 To assess the noise environment at the site, a noise survey has been undertaken to determine the noise climate at the site and nearest noise sensitive receptors.
- 10.3 Based on the results of the noise survey, calculations have been undertaken to determine the acoustics requirements for glazing and ventilation, to achieve internal noise level limits in compliance with BS8233:2014 and the requirements of Rochdale Borough Council.
- 10.4 Guidance on the construction of the separating floor to provide appropriate sound insulation between the ground floor hub and first floor hub is provided.
- 10.5 It is not known at this stage whether an overheating condition will occur. However, an indicative AVO assessment of noise levels has been undertaken assuming that it may occur.
- 10.6 The AVO criteria suggests that the IANL with windows open to control overheating exceeds the upper limit suggested by AVO during the night and daytime periods. On this basis, should overheating occur, alternative means of overheating mitigation would be required.
- 10.7 Plant noise limits have been set such that any noise from building services would not be expected to affect residential amenity at the noise sensitive receptors.
- 10.8 On this basis, noise should not be a limiting factor in any planning application.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is 2×10^{-5} N/m ² . The sound pressure level existing when microphone measured pressure is 2×10^{-5} N/m ² is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A-weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
L_{Fmax}	The instantaneous maximum sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
L_{AFmax}	The instantaneous maximum A weighted sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
$L_{Ar,Tr}$	The rating level: the equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
R	Sound Reduction Index , the laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
R_w	Weighted Sound Reduction Index , a single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
D_w	Weighted Level Difference , the weighted level difference between a pair of rooms, stated as a single figure.
D_{nT}	Standardised Level Difference , a frequency-dependent measurement of airborne sound insulation, calculated using the following formula: $D_{nT} = L_1 - L_2 + 10 \log(T/T_0) \text{ dB}$ Where: L_1 is the energy-averaged sound pressure level due to the pink noise source measured in the source room using a sweep technique. L_2 is the energy-averaged sound pressure level measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (= 0.5s for dwellings).
$D_{nT,w}$	Weighted Standardised Level Difference , a single-figure value of airborne sound insulation performance, derived according to procedures in BS EN ISO 717-1, based on the D_{nT} values at different frequencies (100-3150 Hz third octave bands).
D_{nFw}	Weighted, Normalised Flanking Level Difference , the normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
D_{ne}	Normalised Element Level Difference , The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.

D_{new}

Weighted, Normalised Element Level Difference, The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.

 C_{tr}

Spectrum Adaptation Term, a correction term applied to the sound insulation single-number values (R_w , D_w , and $D_{nT,w}$) in accordance with BS EN ISO 717-1. Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation to its performance at higher frequencies.

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