137 Oxford Road, Manchester

Noise Impact Assessment

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REVISION HISTORY

Revision	Date	Revision Details	Author	Checked
R01	23/07/2024	Original Issue	Simon Fuller BEng	Ben Tomlin Bsc MIOA
R01A	06/08/2024	Revised Issue	Simon Fuller Simon Fuller (Aug 6, 2024 15:13 GMT+1) Simon Fuller BEng	Ben Tomlin Ben Tomlin Bsc MIOA

1 INTRODUCTION

1.1 dBx Acoustics Ltd has been appointed by Ward Williams LLP to carry out a noise survey, and to undertake a noise impact assessment for a proposed built student accommodation (PBSA) at 137 Oxford Road, Manchester, M1 7DY.

1.2 It is proposed to convert and extend an existing 4-storey building into a 5-storey high PBSA.

1.3 A noise impact assessment is required to support the planning application with Manchester City Council.

1.4 The intent of this report is to present the results of a 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 Manchester City 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 Criteria

2.1 This site falls under the jurisdiction of Manchester City Council (MCC).

2.2 Manchester City Council's document Planning & Noise Technical Guidance (October 2022) sets out their requirements with regard to current guidance and policy, with the aspiration that new developments achieve the highest standards without compromising the health and wellbeing of residents.

2.3 The guidance refers to the WHO Guidelines for Community Noise 1999, BS 8233:2014, BS 4142:2014, NPPF and NPSE as described below.

2.4 MCC has adopted the following internal noise limits for residential properties:

- Bedrooms (night time 23:00-07:00h) 30dB$L_{Aeq,\ 8h}$ (individual noise events should not normally exceed 45dB$L_{Amax,\ F}$ more than 10 times);
- Living Rooms (daytime – 07:00-23:00h) 35dB$L_{Aeq,16h}$.
- Gardens and terraces (daytime) 55dB$L_{Aeq,\ 16h}$.

2.5 MCC also requires that externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB below the typical background noise level at the nearest noise sensitive location.

National Planning Policy Framework

2.6 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.

2.7 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).

2.8 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*."

2.9 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

2.10 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*".

2.11 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.

2.12 Planning Practice Guidance

2.13 The Planning Practice Guidance for Noise (PPG-N) was published in March 2014 and most recently updated in July 2019. 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.

2.14 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).

2.15 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.

2.16 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).

2.17 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'

2.18 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	35dB$L_{Aeq,16h}$	-
Dining	Dining room/area	40dB$L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35dB$L_{Aeq,16h}$	30dB$L_{Aeq,8h}$

2.19 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.

2.20 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.

2.21 To assess the maximum noise levels, the World Health Organisation (WHO) document "Guidelines for Community Noise: 1999" recommends that maximum noise levels (dB$L_{Amax,F}$) do not exceed 45dB$L_{Amax,F}$ more than 10-15 times a night.

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. 40dB$L_{Aeq,T,}$ averaged over 8 hours (between 11pm and 7am).*
>
> *B. 55dBL_{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

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

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,T}$ [Note 3] during 07:00 - 23:00 / $L_{Aeq,8hr}$ during 23:00 - 07:00 High: 65 dB / 55 dB Medium: 60 dB / 50 dB Low: 55 dB / 50 dB Negligible: 50 dB / 45 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

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 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{Af,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 6]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{Af,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response[Note 5]. 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 ≥42dB$L_{Aeq,8hour}$, or 65dB$L_{Amax,F}$ 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 '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 ($dBL_{Ar,Tr}$) 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 137 Oxford Road, Manchester, M1 7DY

3.2 The area around the site consists of two main roads; Oxford Road and Grosvenor Street, and a number of commercial units, with the adjacent commercial units containing apartments on the upper floors.

3.3 The Footage and Firkin pub is opposite, with the Deaf Institute music venue next door further down Grosvenor Street.

3.4 A site location plan is provided as Figure 3, below, illustrating the location of the site and the surrounding area.

Figure 3: Site Location Plan



Noise Sources

3.5 Noise levels in the day are dominated by road traffic noise (RTN) from Oxford Road and Grosvenor Street.

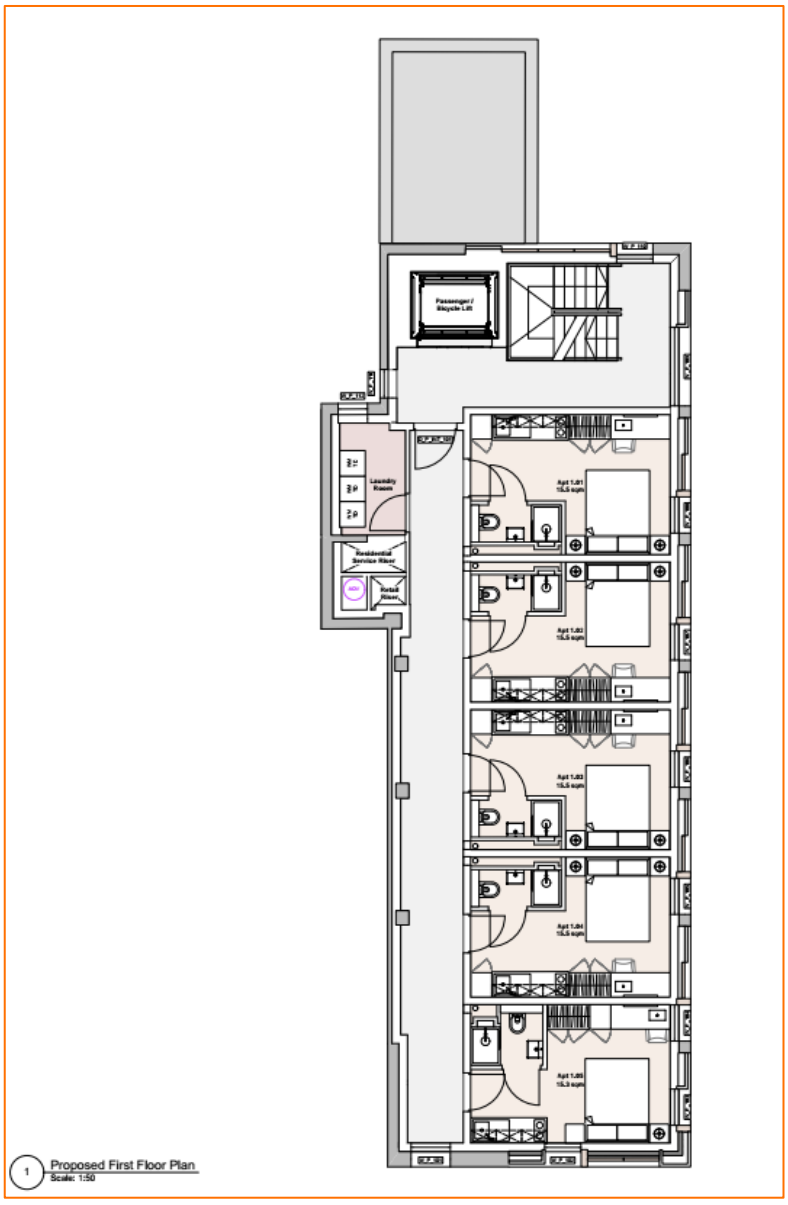
3.6 Noise levels at night are dominated by road traffic noise and entertainment noise.

Proposed Development

3.7 The development will consist of a commercial area on the ground floor, and 20 studio apartments on the upper floors. The usage of the ground floor units is not known at this time.

3.8 Figure 4, below, shows the proposed site layout of the first floor, which is consistent for the upper floors. The apartment facades are facing eastward, towards Grosvenor Street and the entertainment units.

Figure 4: Proposed Apartments Layout



Noise Sensitive Receptors

3.9 The nearest noise sensitive receptors are the apartments above the commercial units adjacent to the site.

4 ENVIRONMENTAL NOISE SURVEY

Methodology

4.1 Long term unattended monitoring was undertaken from around 16:00h on Friday 5th July 2024 to around 15:30h on Monday 8th July 2024. Noise levels were measured continuously throughout, in 15-minute periods.

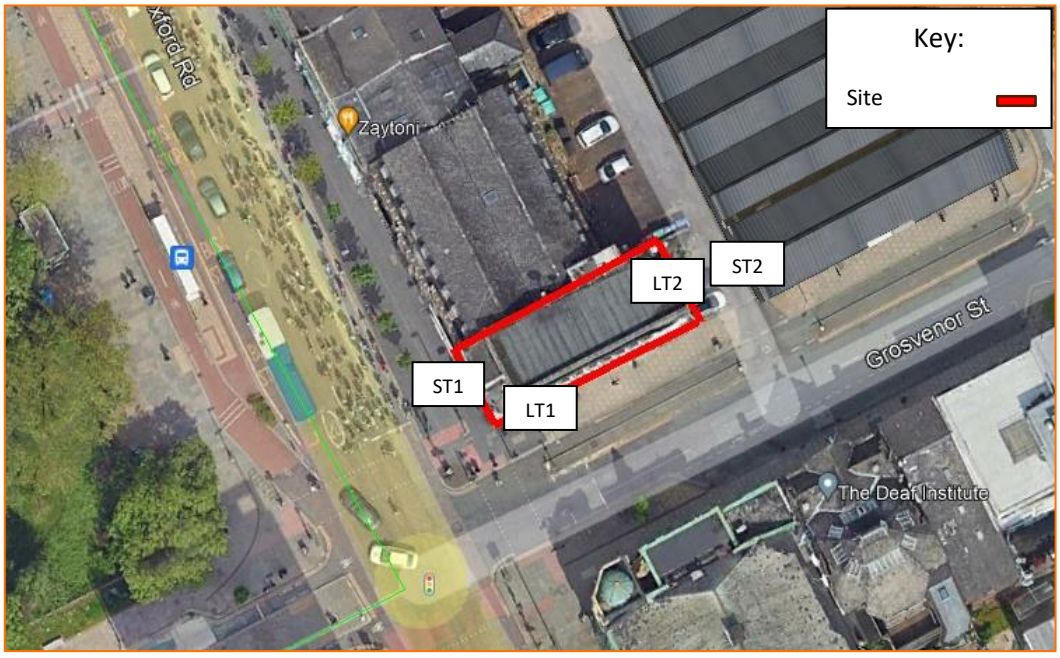
4.2 Monitoring was undertaken out of the first floor window facing Grosvenor Street, nearest to Oxford Road, and out of the rear window facing an access alley at the rear of the building.

4.3 The microphone was positioned at around 0.5m from the façade of the building, and all measurements are hence façade measurements.

4.4 Short term attended measurements were undertaken between around 14:00h and 15:30h on the 8th July 2024, on Oxford Road, and the rear and the driveway from Grosvenor Road to check the variation in noise levels around the site.

4.5 Figure 5, below, illustrates the monitoring positions for the long term (LT), and short term (ST) measurements.

Figure 5: Monitoring positions



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
ST1 / ST2	Meter	NOR 140	1403443
	Pre-Amp	NOR 1209	12967
	Microphone	NOR 1225	18437
	Calibrator	B&K 4231	1821323

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 calibrator, which had been calibrated not more than one year prior to the survey.

Weather Conditions

4.8 Weather conditions during noise monitoring were generally warm and dry with scattered clouds throughout the daytime and night-time measurements.

4.9 Wind speeds were within suitable parameters for the measurement of environmental noise (i.e., generally under 5 ms^{-1}). The measurement microphone was protected with a windshield for the duration of the survey.

5 SURVEY RESULTS

Long Term Noise Survey

5.1 A summary of the noise levels measured are presented in Figures 6 and 7, and Tables 3 and 4, below.

Figure 6: Long Term Survey Façade Data for LT1

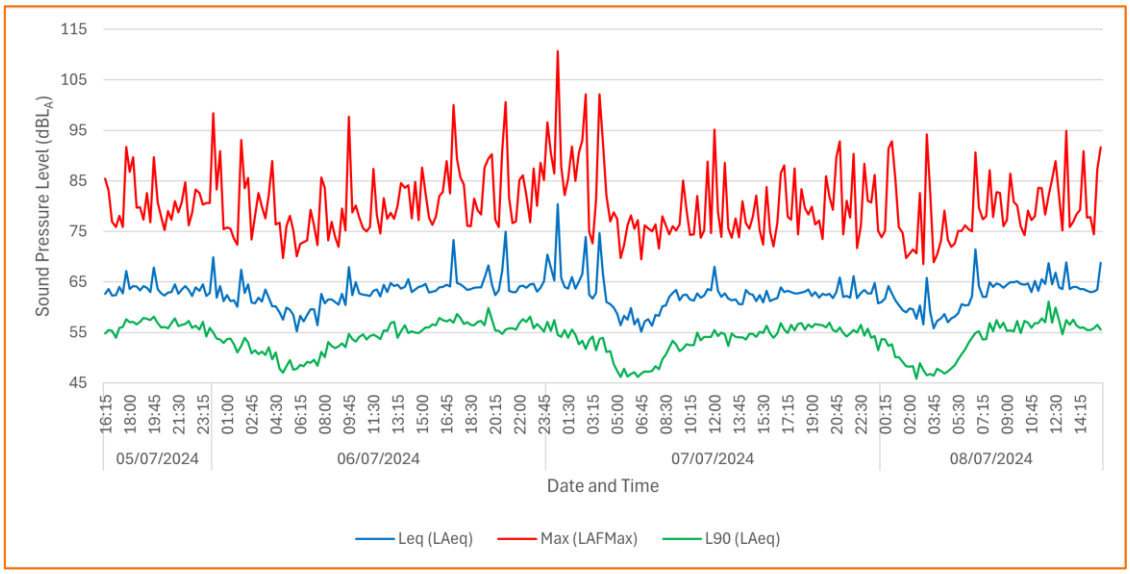


Figure 7: Long Term Survey Façade Data for LT2

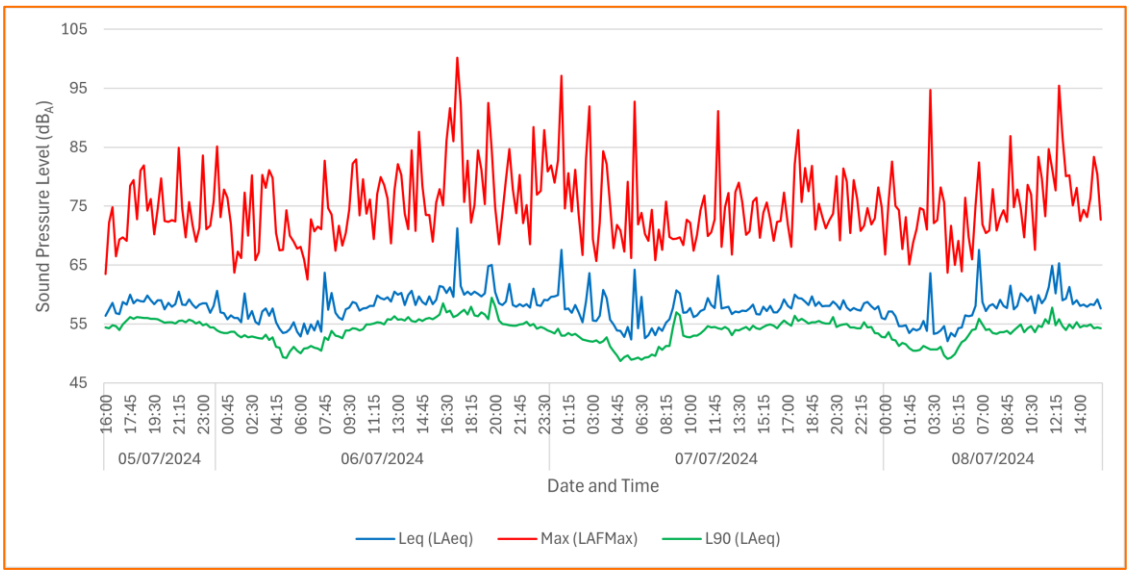


Table 3: Summary of Façade Measured Noise Levels for LT1

Start	End	Period	Ambient Noise Level, $dBL_{Aeq,T}$	Typical Maximum Noise Level, $dBL_{Amax,F}$	Typical Background Noise Level, $dBL_{A90,T}$
05/07/24 16:00h	05/07/24 23:00h	Day	64	--	56
05/07/24 23:00h	06/07/24 07:00h	Night	63	86	54
06/07/24 07:00h	06/07/24 23:00h	Day	65	--	56
06/07/24 23:00h	07/07/24 07:00h	Night	69	89	55
07/07/24 07:00h	07/07/24 23:00h	Day	63	--	54
07/07/24 23:00h	08/07/24 07:00h	Night	62	86	54
08/07/24 07:00h	08/077/24 15:30h	Day	65	--	55

Table 4: Summary of Façade Measured Noise Levels for LT2

Start	End	Period	Ambient Noise Level, $dBL_{Aeq,T}$	Typical Maximum Noise Level, $dBL_{Amax,F}$	Typical Background Noise Level, $dBL_{A90,T}$
05/07/24 16:00h	05/07/24 23:00h	Day	59	--	56
05/07/24 23:00h	06/07/24 07:00h	Night	57	78	53
06/07/24 07:00h	06/07/24 23:00h	Day	61	--	55
06/07/24 23:00h	07/07/24 07:00h	Night	59	82	54
07/07/24 07:00h	07/07/24 23:00h	Day	58	--	54
07/07/24 23:00h	08/07/24 07:00h	Night	58	76	51
08/07/24 07:00h	08/077/24 15:30h	Day	60	--	55

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 typical maximum noise levels consider the highest values measured, excluding one off atypical events, that are not exceeded more than 5 to 10 times per night, to comfortably meet MCC's 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'* (BS4142).

Short Term Noise Survey

5.5 Table 5 presents a summary of the short-term measurements, compared to the long term measurements, which has been used to determine the noise levels on the elevation facing Oxford Road.

Table 5: Short Term Measurements Compared to Long Term Measurements

Time Duration	Short Term Location	Ambient Noise Level, $dBL_{Aeq,15min}$	Long Term Location	Ambient Noise Level, $dBL_{Aeq,15min}$	Difference, dB
14:15h-14:30h	ST1	68	LT1	64	4
15:15h-15:30h	ST1	67	LT1	63	4
14:45h-15:00h	ST2	59	LT2	58	1

5.6 In reference to Table 5, it can be seen that noise levels on the Oxford Road elevation are likely to be around 4dB higher than those measured at LT1.

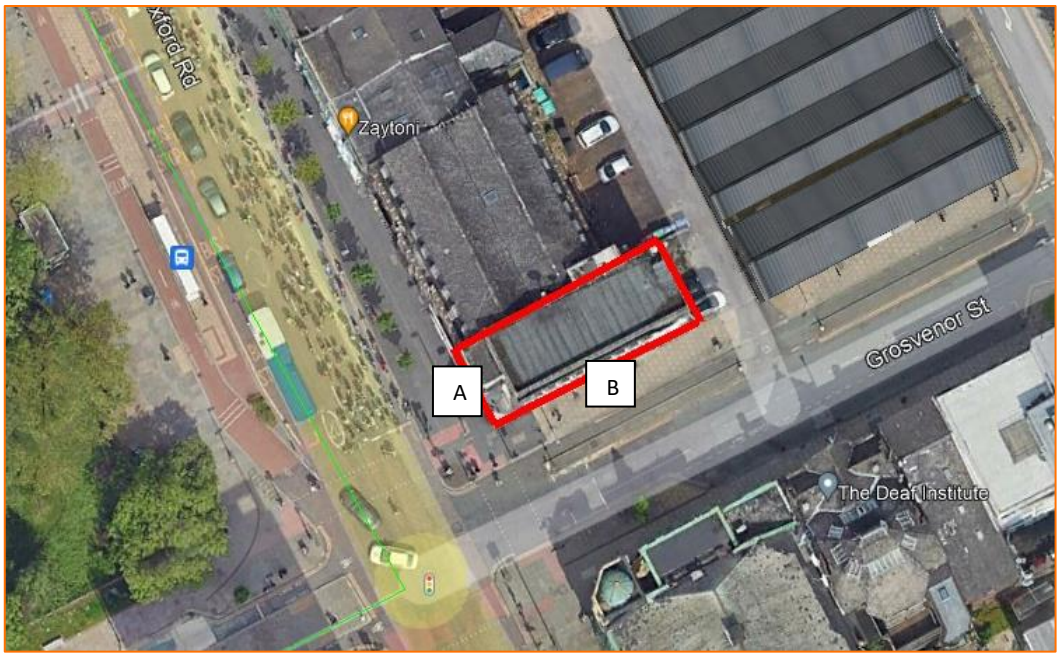
Overall

5.7 The highest averaged ambient, typical maximum, and lowest typical background noise levels measured over the survey period have been used to provide a robust assessment.

5.8 All measurements were façade measurements; these have therefore been corrected by -3dB to determine the free-field noise levels incident upon the building.

5.9 Figure 8 below, illustrates the façade elevations used in the assessment.

Figure 8: Facades assessment



5.10 On the basis of the above, Table 6, below, presents a summary of the free-field noise levels used to calculate noise ingress.

Table 6: Free-field Noise Levels Used in Assessment

Façade	Daytime Ambient Noise Level, $dB_{LAeq,16hour}$	Night-Time Ambient Noise Level, $dBL_{Aeq,8hour}$	Night Time Maximum Noise Level, $dBL_{Amax,F}$	Daytime Background Noise Level, $dBL_{A90,1hour}$	Night-Time Background Noise Level, $dBL_{Aeq,15min}$
A	66	70	90	55	55
B	62	66	86	51	51

6 BUILDING ENVELOPE SOUND INSULATION

External Noise Break-In Assessment

6.1 An external noise break-in assessment has been undertaken to determine the minimum sound insulation performance of the façades 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 BS 8233:2014 (Table 1, above) are therefore 50dB$L_{Aeq,T}$ in the day, and 45dB$L_{Aeq,T}$ and 60dB$L_{Amax,F}$ at night.

6.3 With reference to Table 6, and the allowable external noise levels detailed above, it can be seen the required indoor noise levels can only be achieved with closed windows.

6.4 Calculations have therefore been undertaken, based on the noise levels detailed in Table 6, above, and the sizes of the rooms and windows indicated on the architectural drawings, to determine the sound insulation performance of the glazing and ventilation required to achieve the BS8233 noise limits, as detailed in Table 7, below.

Table 7: Glazing Sound Insulation Requirements

Facades	Glazing Sound Insulation Performance, dB R_w (+ C_{tr})	Example Glazing Construction, mm	Ventilator Sound Insulation Performance, dB $D_{n,e,w}$
A	40(-6)	10/TC/6.8pvb	44
B	36(-7)	10/TC/4	44

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.

6.6 The glazing configurations shown above are a suggestion only, and alternative configurations may be acoustically suitable.

6.7 The external wall and roof should achieve a sound insulation performance at least 10dB greater than the glazing. This would be easily achieved with the existing concrete walls and roof.

6.8 Windows can be openable at occupant discretion (e.g. for purge ventilation) but must be well sealed when closed.

Floor Separating Ground Floor Retail Units From First Floor Residential Apartments

6.9 The floor separating the ground floor retail units from the first floor apartments should be designed such that noise ingress from the retail units is not an issue.

6.10 It is proposed to control ambient noise levels to at least 10dB below the typical ambient noise levels in the room, and maximum noise levels to at least 5dB below the ambient noise levels in the room. This would ensure that noise is barely perceptible, or inaudible at all times.

6.11 The use of the ground floor units is currently unknown. However, it has been assumed that they would not be a bar or nightclub, and that the units would operate in the daytime period only (i.e. 07:00 to 23:00h).

6.12 At this stage, it is considered that a coffee shop would likely be the noisiest usage. Noise levels measured in a busy city centre coffee shop, with around 50 customers and amplified background music, were around 73dB$L_{Aeq,T}$ and 83dB$L_{Amax,F}$. Calculations indicate that a floor having a sound insulation performance of 50dBR_w would control this to around 20dB$L_{Aeq,T}$ and 30dB$L_{Amax,F}$ in the apartments above.

6.13 There are numerous means of achieving this performance, but examples include a 200mm thick profiled concrete slab, or a 150mm thick profiled concrete slab with a plasterboard ceiling.

6.14 This will be developed at the design stage.

Overheating

6.16 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.

6.17 MCC require that an assessment is made in accordance with Approved Document O.

6.18 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

6.19 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.

6.20 AVO indicates that a Level 2 assessment is 'recommended' when 65dB$L_{Aeq,16hour}$ (daytime) and 55dB$L_{Aeq,8hour}$ (night-time) is exceeded.

6.21 Furthermore, AVO mentions that 'where 78dB$L_{AF,\ max}$ is normally exceeded during the night-time period, a Level 2 assessment is recommended'.

6.22 The Level 1 Assessment is summarised in Table 8, below.

Table 8: AVO Level 1 Assessment

Façade Location	Typical Daytime Noise Levels (dB$L_{Aeq,T}$)	Typical Night-time Noise Levels (dB$L_{Aeq,T}$)	Typical Maximum Noise Level (dBL_{AFmax})	Risk Category (day/night)	AVO Recommendation for Level 2 Assessment
A	66	70	90	Medium / High	Recommended
B	62	66	86	Medium / High	Recommended

6.23 On this basis, a Level 2 Assessment for these dwellings is presented below.

AVO Level 2 Assessment

6.24 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'.

6.25 However, internal noise level limits of 50dB$L_{Aeq,16hour}$ in the day, and 42dB$L_{Aeq,8hour}$ and 65dB$L_{Amax,F}$ 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.'

6.26 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.

6.27 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 9, below and for night-time is shown in Table 10.

Table 9: AVO Level 2 Assessment - Daytime

Parameter	Façade A	Façade B
External Ambient Noise Level, dB$L_{Aeq,8hr}$	66	62
Reduction, open window, dB	-13	-13
IANL Day-time (dB$L_{Aeq,16hr}$)	53	49
Upper Limit Outlined in AVO	>50dB$L_{Aeq,16h}$	>50dB$L_{Aeq,16h}$
Exceedance	**3**	**-1**

Table 10: AVO Level 2 Assessment - Nighttime

Parameter	Façade A	Façade B
External Ambient Noise Level, $dBL_{Aeq,8hr}$	70	66
Reduction, open window, dB	-13	-13
IANL Night-time ($dBL_{Aeq,8hr}$)	57	53
Upper Limit Outlined in AVO	>42$dBL_{Aeq,8h}$	>42$dBL_{Aeq,8h}$
Exceedance	**15**	**11**
External Maximum Noise Level, $dBL_{Amax,F}$	90	86
Reduction, open window, dB	-13	-13
IANL Night-time ($dBL_{Amax,F}$)	77	73
Upper Limit Outlined in AVO	65	65
Exceedance	**12**	**8**

6.28 It can be seen that the IANL with windows open to control overheating would exceed the upper limit suggested by AVO during the night and daytime periods, and a material change in occupant behaviour due to noise would be likely.

6.29 It is therefore recommended that alternative means of overheating mitigation are provided, such as mechanical or hybrid ventilation.

6.30 This needs to be determined and reviewed by the mechanical services consultant.

7 BUILDING SERVICES NOISE EMISSIONS

7.1 It is proposed that 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.

7.2 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 11, below, subject to relative placement building services plant on the proposed unit.

Table 11: Plant Noise Emission Limits

Building Services Plant Noise Emission Limit, $dBL_{Ar,Tr}$	
Daytime Period (07:00 – 23:00)	**Night-time Period (23:00 – 07:00)**
46	43

8 CONCLUSION

8.1 dBx Acoustics Ltd has been appointed by Ward Williams LLP to carry out a noise survey, and to undertake a noise impact assessment for a PBSA at 137 Oxford Road.

8.2 It is proposed to convert and extend an existing 4-storey high building into a 5-storey high PBSA.

8.3 A planning application has been made with Manchester City Council and a noise impact assessment is required.

8.4 To assess the noise environment at the site, a long-term unattended noise survey was undertaken to determine prevailing noise across the site at the most likely noise sensitive proposed residential dwellings.

8.5 To assess the façade on Oxford Road, a short term attended measurement was undertaken to compare with the noise levels measured on Grosvenor Street.

8.6 Using these noise levels, calculations have been undertaken to determine the requirements for façade glazing and ventilation, to achieve internal noise level limits in compliance with BS8233:2014.

6.1 It is not known at this stage whether the overheating condition will occur. However, an indicative AVO assessment of noise levels has been undertaken assuming that it may occur.

6.2 The AVO suggested criteria would recommend that alternative means of overheating mitigation are provided, such as mechanical or hybrid ventilation.

8.7 Plant noise limits have been set such that plant noise at the nearest noise sensitive properties would not be expected to affect residential amenity.

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 (Lp) the reference quantity is 2x10-5 N/m2. The sound pressure level existing when microphone measured pressure is 2x10-5 N/m2 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.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor *T,* often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example, a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
STI	**Speech Transmission Index**, Metric ranging between 0 and 1 representing the transmission quality of speech with respect to intelligibility by a speech transmission channel
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: $D_{nT} = L_1 - L_2 + 10\log(T/T0)$ 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, t**he 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 its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking or moving furniture on a floor structure.
L_{nT}	**Standardised Impact Sound Pressure Level,** a frequency dependent measurement of impact sound insulation, calculated using the following formula: $L_{nT} = L_1 + 10\log(T/T0)$ dB Where: L1 is the mean sound pressure level due to the tapping machine measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T30 measured in seconds). T_o is the reference reverberation time (0.5s for dwellings)
$L'_{nT,w}$	**Weighted Standardised Impact Sound Pressure Level,** a single-figure value (@ 500 Hz) of impact sound insulation, performance, derived according to BS EN ISO 717-2, based on the L_{nT} values at different frequencies (100Hz- 3150 Hz third octave bands).
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
NR	The **Noise Rating level**. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.

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