ECO TECHNOLOGY LCZ LTD

P4B Architecture Ltd

Langdale Mews, Manchester

Acoustic Assessment



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LANGDALE MEWS, MANCHESTER

Acoustic Assessment

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1. Introduction

Eco Technology LCZ Ltd has been commissioned by P4B Architecture Ltd (hereafter referred to as “the Client”), to undertake an acoustic assessment to support planning application no. 141161/FO/2024 submitted to Manchester City Council. The application proposal for Langdale Mews, Langdale Avenue, Manchester M19 3NT (hereafter referred to as “the Site”) consists of the erection of a three-storey side extension with accommodation in the roof to provide three flats (3 x 1 bed) and outdoor pergola for residents.

An acoustics glossary is included in Appendix A to assist the reader.

1.1. Site Description

Existing Site

Langdale Mews is located in the District Centre of Levenshulme. The existing building is a four-storey apartment block with dormer windows on the front and rooflights at the rear. Each of the ground, first, and second floors contains 4no. two-bedroom apartments. The top floor (third) has four one-bedroom apartments.

To the north and east, the surrounding area is mainly residential, with terraced and semi-detached houses. To the south, there are single-storey garage units. To the east, the site is bordered by a terrace of buildings with shops and commercial units at ground level, fronting Stockport Road.

One of these businesses is The Taste of Shinwari, a restaurant on Stockport Road. At the rear of the restaurant is a ventilation system that is directly visible from the east-facing side of Langdale Mews.

Figure 1.1: Site Plan



Development Proposals

The proposals are to extend the existing apartment block to create 2no. one-bed apartments on the ground, first floor and 1no. one-bed duplex apartment over the second and third floor.

Figure 1.2: Proposed Scheme Layout



1.2. Scope of Works

The following scope of works has been undertaken:

- A continuous environmental sound survey at the worst-case position of the Site along with additional sample measurements to determine prevailing acoustic conditions;
- Noise break-in calculations in accordance with BS EN ISO 12354-3[1] and BS 8233[2] have been undertaken to achieve internal noise levels whilst also considering whole-dwelling ventilation in accordance with AD-F[3];
- BS 4142[4] assessment undertaken to determine the impact from the neighbouring commercial /industrial sources. Where the Rating Level exceeds the background sound level (i.e., $L_{Ar,Tr} - L_{A90}$ > 0 dB), the impact should be considered in context, following BS 4142 guidance. To help demonstrate compliance with BS 8233 and reduce the risk of adverse impacts, the identified acoustic character corrections (e.g. for tonality or intermittency) have been applied to the internal noise level after break-in[5];
- Mitigation in the form of glazing and ventilation specifications and minimum sound reduction indices for non-glazed constructions has been provided; and
- An assessment of outdoor amenity area in line with BS 8233 guidance.

[1] BS EN 12354-3:2000 *'Building Acoustics. Estimation of acoustic performance in buildings from the performance elements. Airborne sound insulation against outdoor sound', 2000.*
[2] BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings.'*
[3] The Building Regulations 2010 'Approved Document F'.
[4] BS 4142: 2014+A1: 2019 *'Methods for rating and assessing industrial and commercial sound'.*
[5] Further evidence of compliance as per example Condition 13 of the CIEH Noise Management Guide: Technical Guidance Note 1

2. Planning Policy and Guidance

Relevant national planning policy and guidance documents comprise:

- National Planning Policy Framework (2023);
- Noise Policy Statement for England (2010);
- BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings';*
- WHO Guidelines for Community Noise (1999); and
- BS 4142: 2014+A1: 2019 *'Methods for rating and assessing industrial and commercial sound'.*

2.1. Outline Planning Permission REF: 141161/FO/2024

Relevant planning condition of the referenced application is as follows:

9) a) Before above ground development commences, a scheme for acoustically insulating the proposed residential accommodation against noise from the A6 Stockport Road shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including local commercial premises. The potential for overheating shall also be assessed and the noise insulation scheme shall take this into account. The approved noise insulation and ventilation scheme shall be completed before any of the residential units hereby approved are occupied

Reason - To secure a reduction in noise from traffic or other sources, in order to protect future residents from noise disturbance and to reduce the potential for overheating, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester, policies DM1 and SP1 of the Manchester Core Strategy and the National Planning Policy Framework (NPPF).

2.2. BS8233:2014 Criteria

Internal acoustic targets have been informed by residential amenity within dwellings outlined in BS 8233.

Table 2.1: Indoor ambient noise levels for dwellings.

Acitivty	Location	07.00 to 23.00	23.00 to 07.00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room /area	40 dB $L_{Aeq,16hour}$	-
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

2.2.1. WHO Guidelines for Community Noise Criteria

BS 8233 does not give a definitive level for internal maximum noise levels or define an appropriate number of exceedances per night. However, the WHO guidelines state *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more that 10-15 times per night. (Vallet & Vernet),"* therefore this will be considered as additional criteria as well as the aforementioned ambient sound levels from BS 8233.

2.3. BS 4142: 2014+A1: 2019

BS 4142 describes methods for rating and assessing industrial and/or commercial sound and includes, but is not limited to, the assessment of:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical equipment;
- Sound from the (un)loading of goods and materials at industrial/commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes such as that from forklift trucks on or around an industrial and/or commercial site.

The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people who are typically outside residential premises. Although indoor effects can be indicated where the façade composition is known. A summary of the approach set out in BS 4142 is set out below:

Establish or predict the specific sound level of the source(s) by considering both the ambient (includes the source to be assessed) and residual (excludes the source to be assessed but includes all remaining sources) sound level;

- Measure the representative background sound levels, typically by measuring close to the receptor location;
- Rate the specific sound level to account for any distinguishing characteristics (see below);
- Estimate the impact by subtracting the background sound level from the rating level; and
- Consider the initial estimate of impact, as determined above, in the context of the noise and its environment.

The specific sound level is rated to account for distinguishing characteristics by using penalties for tonality, impulsivity, intermittency, and other sound characteristics.

The character corrections are flexible according to whether the acoustic character is just perceptible at the noise receptor, or is clearly perceptible or highly perceptible, and range from 0 to 6 dB for tonal noise, 3 to 9 dB for impulsive noise, and 3 dB for other non-tonal/impulsive acoustic characteristics.

An initial estimate of impact of the specific sound is obtained by subtracting the background sound level from the rating level. Typically, the greater the difference, the greater the magnitude of impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;
- At differences lower than +5 dB a low impact is likely, depending on the context. The lower the rating level is to the measured background sound level, the less likely it is that the specific sound source will have an impact.

The results of the initial assessment should then be considered in light of all pertinent contextual factors.

3. Sound Surveys

3.1. Methodology and Equipment

An unattended environmental sound survey has been undertaken between 15:00 on Thursday 22nd and 16:30 Friday 23rd May 2025 to establish prevailing acoustic conditions at the worst-case façade position. One sound level meter (SLM) was installed at the position described as follows:

- **Continuous Measurements 1 (CM1):** Centre of south facing façade, one metre out of partially opened 1st floor window, overlooking Flixton Road

An attended survey was also carried out, during which sample measurements (SM) were taken at SM1, SM2, and SM3. These were used to calibrate the acoustic model of the Site.

The approximate measurement locations are shown in Figure 1.1.

Measurements were taken using Class 1 integrating/averaging SLMs houses, where appropriate, in environmental protection apparatus. The SLMs were field calibrated before and after the survey, using a Class 1 calibrator, with no significant drift in calibration noted.

The SLMs were setup to record A-weighted ambient, maximum and background sound levels at a minimum along with associated octave band spectra.

3.2. Survey Conditions and Observations

3.2.1. Meteorological Conditions

Weather conditions during attended survey and installation and collection of unattended equipment were dry with low wind speeds. Historic weather data was monitored over the course of the survey which indicated suitable measurement conditions i.e., wind speeds of <5m/s and dry.

Therefore, it can be concluded that there were no adverse meteorological conditions, and all measurement data is acceptable to inform the assessment.

3.2.2. Site Observations

- The main source of noise in the area is traffic on Stockport Road and is therefore the dominant noise on the west facing façade of the Site. Noise levels on the east façade are therefore lower as a result of shielding provided by the existing building. The east façade of the proposed extension would therefore benefit in the same way.
- The west-facing façade of the proposed extension will have a direct line of sight to a ventilation system and air handling unit serving The Taste of Shinwari restaurant, as shown in Figure 3.1.

Figure 3.1: Photographs showing nearby industrial /commercial noise sources



3.3. Results

A full time-history of measured noise survey results is provided in Appendix B.

The measured ambient levels (façade), at CM1, for daytime and night-time periods, along with the highest maximum noise level during the night-time are presented below in Table 3.1.

Table 3.1: Measured façade levels

Date	Daytime Ambient $L_{Aeq,16hr}$ dB	Night-time (Thursday 22/05/25)	
		Ambient $L_{Aeq,8hr}$ dB	10th Highest Maximum $L_{AFmax,2min}$
Thursday 22/05/25 **Friday 23/05/25**	55*	51	66
***Partial levels combined to form 16hr period**			

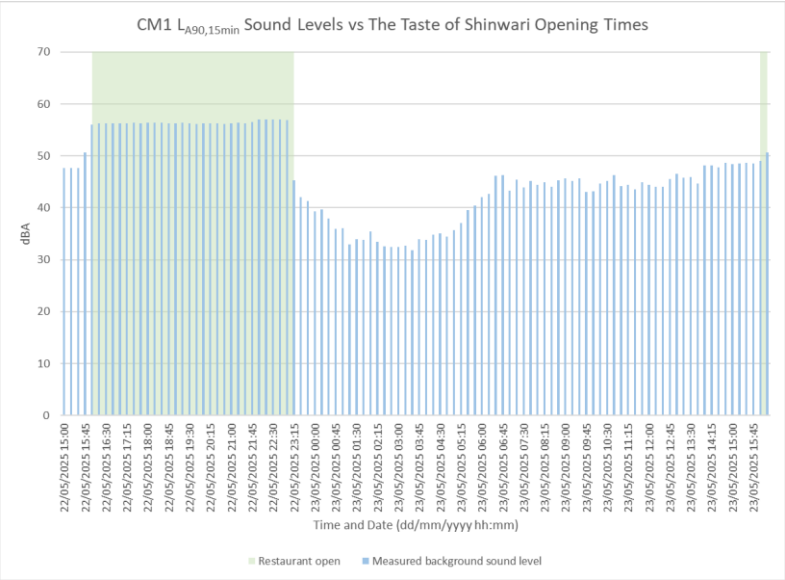
The highest measured $L_{Aeq,1hr}$ during the restaurant operating hours (16:00 – 23:30) is shown below in Table 3.2.

Table 3.2: Highest measured ambient level

Date and time	Highest Hourly Ambient $L_{Aeq,1hr}$ dB
Thursday 22/05/2025 **(15:00 – 16:00)**	58

A time history of background sound levels measured at CM1 is presented below in Figure 3.2, with reference to the operating hours of the nearby restaurant indicated by the green shaded areas.

Figure 3.2:Time-history of background sound levels at CM1 with reference to The Taste of Shinwari opening periods



4. Facades Exposed to Industrial /Commercial Noise

The north-west corner of the Site is exposed to industrial noise sources associated with The Taste of Shinwari restaurant, which typically operates daily from 16:00 until midnight. A BS 4142 assessment was undertaken to evaluate the impact on receptors overlooking this equipment. Measurements were taken at CM1, representing the worst-case location for existing receptors. A CadnaA® acoustic model was then developed to assess the noise impact on the proposed extension.

4.1. Background Sound Level

During the site visit, the ventilation system was not operational as the restaurant was closed. The air-handling unit however was operating but could only be heard at close range and was not audible at CM1 due to significant masking from Stockport Road. When the ventilation system is active, measurements at CM1 indicate this is the dominant source of noise.

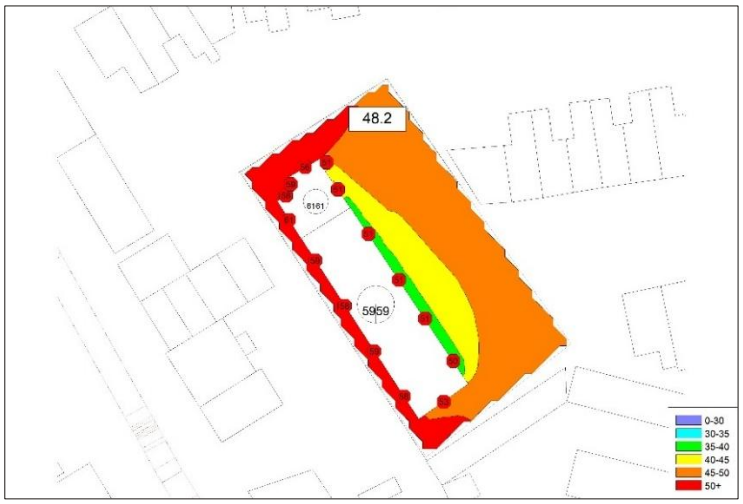
As the restaurant operates into the first hour of the night-time period (23:00 – 00:00) on some evenings, both daytime and night-time background sound levels have been determined for assessment.

- For the daytime assessment, the background sound level was based on the period before the restaurant opened, when then ventilation system was off. As shown in Figure 3.2, levels during this time approximately ranged between 45 dB and 50 dB $L_{A90,15min}$. A representative value of 45 dB $L_{A90,15min}$ has been adopted.
- For the night-time assessment, the first 15-minute L_{A90} immediately after the restaurant had closed was used to determine the background sound for the 23:00 – 00:00 period, 42 dB $L_{A90,15min}$.

4.2. Specific Noise Level

The CadnaA® model predicts that the highest hourly ambient noise level on the most exposed façade of the Site is 61 dB. This has therefore been adopted as the specific sound level for both daytime and night-time BS 4142 assessments.

Figure 4.1: Predicted ambient levels across the site



4.3. Initial Numerical Impact Assessment

The results of the Initial Numerical Impact Assessment (INIA) for facades impacted by industrial noise sources are presented in Table 4.1.

BS 4142 states that appropriate corrections should be applied to the source value where acoustic features i.e., tonality, impulsivity and intermittency are present or expected to determine the Rating Level. Measurements at position CM1 were assessed in accordance with Annex C of BS 4142, and no tonal characteristics were identified from the industrial noise source. Additionally, intermittency or impulsiveness was not apparent in the measurement data as the noise sources were constant when operating.

The noise level is clearly dominant when occurring and therefore a character correction of +3 dB has been applied since it would likely attract attention.

Table 4.1: BS 4142 - INIA

Assessment Step	Daytime	Night-time
Specific Sound Level at Receptor, dB $L_{Aeq,T}$	61	
Acoustic Feature Correction, dB	+3 (for being readily distinguished)	
Rating Level, dB $L_{Ar,Tr}$	64	
Background Sound Level, dB $L_{A90,15min}$	45	42
Rating over Background, dB	+19	+21
Estimation of Impact	**Significant Adverse Impact**	

The results show that the impact on receptors affected by industrial noise is significant. The recommended glazing and ventilation should therefore mitigate this impact and account for any acoustic features associated with the specific sound.

4.4. Context

The initial estimate of the sound does not account for all the contextual factors. As BS 4142 suggests, the impact may be less in practice by accounting for the context where the following factors should be considered:

- The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

4.4.1. Absolute Level of Sound

BS 4142: 2014 states:

> *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night".*

In this case, the specific sound level affecting the Site during the daytime is 61 dB, which exceeds the lowest assessed background of 42 dB L_{A90} by 19dB. Both levels are high and therefore the initial significant adverse impact cannot be reduced due to the absolute level of sound.

Initial Impact Assessment	**Significant Adverse**
Modification due to absolute level of sound	**Significant Adverse**

4.4.2. Character and Level of the Residual Sound

BS 4142: 2014 states:

> *"Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound."*

Measurement data at CM1 clearly shows that noise levels from the ventilation system serving The Taste of Shinwari is significantly higher than the residual background level. As such, the initial impact assessment cannot be reduced and remains significant.

Initial Impact Assessment	**Significant Adverse**
Modification due to character and level of the residual sound	**Significant Adverse**

4.4.3. Sensitivity of the Receptor and Design Measures that Secure Good Conditions

BS 4142 says to consider:

> *The sensitivity of the receptor and whether dwellings or other premises used for residential purpose will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
>
> - *Façade insulation treatment;*
> - *Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
> - *Acoustic screening.*

The Site is in close proximity to commercial activity with windows at the rear having direct line of sight to industrial noise-generating equipment. As such, the potential for noise disturbance is inherently higher than for dwellings in more typical residential environments. The facade design has incorporated enhanced glazing and ventilation specifications that ensure sufficient sound insulation.

These measures ensure that internal noise levels remain within BS 8233:2014 criteria, even accounting for acoustic feature corrections from the BS 4142 rating level.

To limit the need to open windows, an overheating assessment, typically required for new-build dwellings under Approved Document O, should be applied to the extension. This will help ensure that suitable design measures are in place to manage excess heat without exposing the occupant to industrial noise.

Initial Impact Assessment	**Significant Adverse**
Modification due to receptor sensitivity and design measures	**Low Impact**

4.5. Assessment of the Industrial /Commercial Noise Impact

Although the absolute sound level impacting the proposed Site at the rear is relatively high and the industrial source is in direct view of the receptors on the west facade, the building has been designed with mitigation that ensures good internal acoustic conditions. The acoustic character of the sound has been addressed through façade design, and all penalties have been incorporated into the internal noise level predictions. Additionally, the assessment has used a higher noise level than the typical 16-hour and 8-hour values, meaning internal conditions will be better than predicted for much of the daytime (until 16:00) and night-time periods (after midnight). Internal adverse impacts have been mitigated and avoided, and while external adverse impacts remain, internal noise levels have been controlled in line with the aims of the NPPF.

5. Internal Noise Level Assessment

5.1. Calculation Input Parameters

Internal ambient noise levels have been calculated in accordance with BS EN ISO 12354-3 with example calculations provided in Appendix C.

The measured façade levels have been converted to free-field equivalent by subtracting 3 dB.

Room Dimensions

Internal layout dimensions have been determined as per architectural drawings received from P4B Architecture as follows:

- Proposed Site Plan – 06D, 23061
- Proposed Floor Plans – 07b, 23061
- Proposed Elevations – 08b, 23061

Non-Glazed Elements

A brick/cavity/block external wall construction, typical of new build has been considered, in conjunction with a timber roof as a worst-case, therefore each element should achieve a minimum sound insulation performance of $R_w + C_{tr}$ 48dB.

Glazing Specification

The calculations have been undertaken for each habitable space using the glazing specifications outlined in Table 5.1.

Table 5.1: Glazing specifications

Reference	Min. Performance $R_w + C_{tr}$	Typical Glass Configuration
A	29	4mm panel 20mm air gap 4mm panel
B	34	6mm panel 16mm argon 6.8mm Pilkington Optiphon

Ventilation Strategy

Break-in calculations are based upon ventilation in accordance with Approved Document F. Decentralised continuous mechanical extract ventilation (DMEV) should be used in kitchens and wet rooms, with each habitable room requiring a minimum equivalent area (EA) of 4000mm^2 for background ventilation.

For the calculations, ventilation has been assumed to comprise either one 5000 mm² EA hole in wall vent or two 2500 mm² EA direct path trickle vents per habitable room.

All ventilation details outlined in this report should be reviewed by an AD-F ventilation specialist to confirm suitability for the proposed project.

5.2. Example Calculation

The noise break-in results for the façade most impacted by industrial noise are shown in Table 5.2.

Table 5.2: Predicted internal noise levels for rooms overlooking rear

Room Type	Predicted Internal Daytime Sound Level $L_{Aeq,16hr}$ dB	Predicted Internal Night-time Sound Level	
		Ambient LAeq,8hr dB	Highest Maximum L_{AFmax} dB
Bedroom	25	25	28
Kitchen /Living Room	25	-	-

The results demonstrate compliance with the requirements of BS 8233 and Who Guidelines.

To further support this, the overarching mitigation strategy incorporates the feature correction penalties identified through the BS 4142 assessment. These corrections, such as penalties for tonality, impulsivity or intermittency have been applied to the calculated internal noise levels to ensure a robust demonstration of compliance with BS 8233.

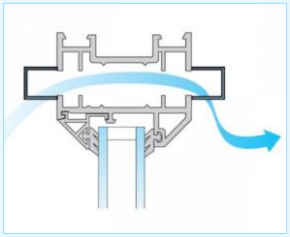
Table 5.3: Predicted internal noise level with acoustic character adjustment

Room Type	Predicted Internal Sound Level with industrial noise activity operating (Including acoustic character penalties)	BS 8233 Criteria
Bedroom	(25 + 3) = **28**	≤35 dB
Living Room		

5.3. Façade Mitigation Summary

Based on the break-in calculations undertaken, mitigation measures have been prescribed to achieve sound levels in accordance with BS 8233 and WHO Guidelines. In addition to the below it is recommended an overheating assessment is carried out as per comments in Section 4.4.3.

Table 5.4: Mitigation Summary

Ref	Glazing Requirements	AD-F Ventilation Requirements
A	4mm panel 20mm air gap 4mm panel **Minimum 29 dB $R_w + C_{tr}$**	Direct Path Trickle Ventilator Standard trickle vent (2500mm² EA) [2no. vents per habitable room required]  **Minimum $D_{n,e,w}$ = 32 dB**
B	6mm panel 16mm air gap 6.8mm Pilkington Optiphon **Minimum 34 dB $R_w + C_{tr}$**	Acoustically Rated Hole-in-Wall Vent Example for costing purposes only: Rytons AAC125HP (8500mm² EA) [1no. vent per habitable room required]  **Minimum $D_{n,e,w}$ = 43 dB**

Corresponding Locations

Reference A mitigation measures outlined above should be applied to habitable rooms as follows.

- Living rooms and bedrooms overlooking Front (east façade)

Reference B mitigation measures should be applied in the following locations.

- Living rooms and bedrooms overlooking rear (west façade)

Figure 5.1: Recommended glazing and ventilation performance locations



6. Outdoor Amenity Noise

An outdoor amenity area is proposed for residents located in the northeast corner of site shown in Figure 6.1.

Figure 6.1: Proposed site plan showing outdoor amenity area highlighted red



BS 8233:2014 states that it is desirable for the steady state noise level in external amenity spaces (such as gardens or outdoor living areas) to be below 50 dB $L_{Aeq,16hour}$ to prevent 'moderate annoyance' with 55dB $L_{Aeq,16hour}$ regarded as an upper limit to prevent 'serious annoyance' for occupants.

The CadnaA® model predicted the free-field ambient sound level of 48 dBA within the proposed outdoor area, which falls below the lower guideline limit. This is shown in Figure 4.1.

6.1. Recommendations

The predicted noise level is below the lower limit therefore no further mitigation is required beyond the proposed 1.8 perimeter fence. It is recommended this fence is close-boarded and extend to the floor leaving no gaps.

7. Conclusions

Eco Technology LCZ Ltd has been commissioned by P4B Architects to undertake an acoustic assessment to measure the impact from surrounding noise sources on the proposed extension of an existing residential apartment block located at Langdale Mews, Langdale Avenue, Manchester M19 3NT.

An environmental sound survey has been undertaken which has determined prevailing acoustic conditions on surrounding the Site.

A robust scheme of mitigation measures set out in Section 5.3 ensured compliance with BS 8233:2014 internal noise levels, while providing a context solution to the industrial noise at the rear, which a significant adverse impact was identified using the BS 4142 assessment methodology.

Noise levels within the proposed outdoor amenity area, as predicted in Section 6, indicate no further mitigation is required beyond the 1.8m high perimeter barrier proposed by the Client.

Limitations applicable to this report are contained in Appendix D.

Appendix A

Technical Terminology

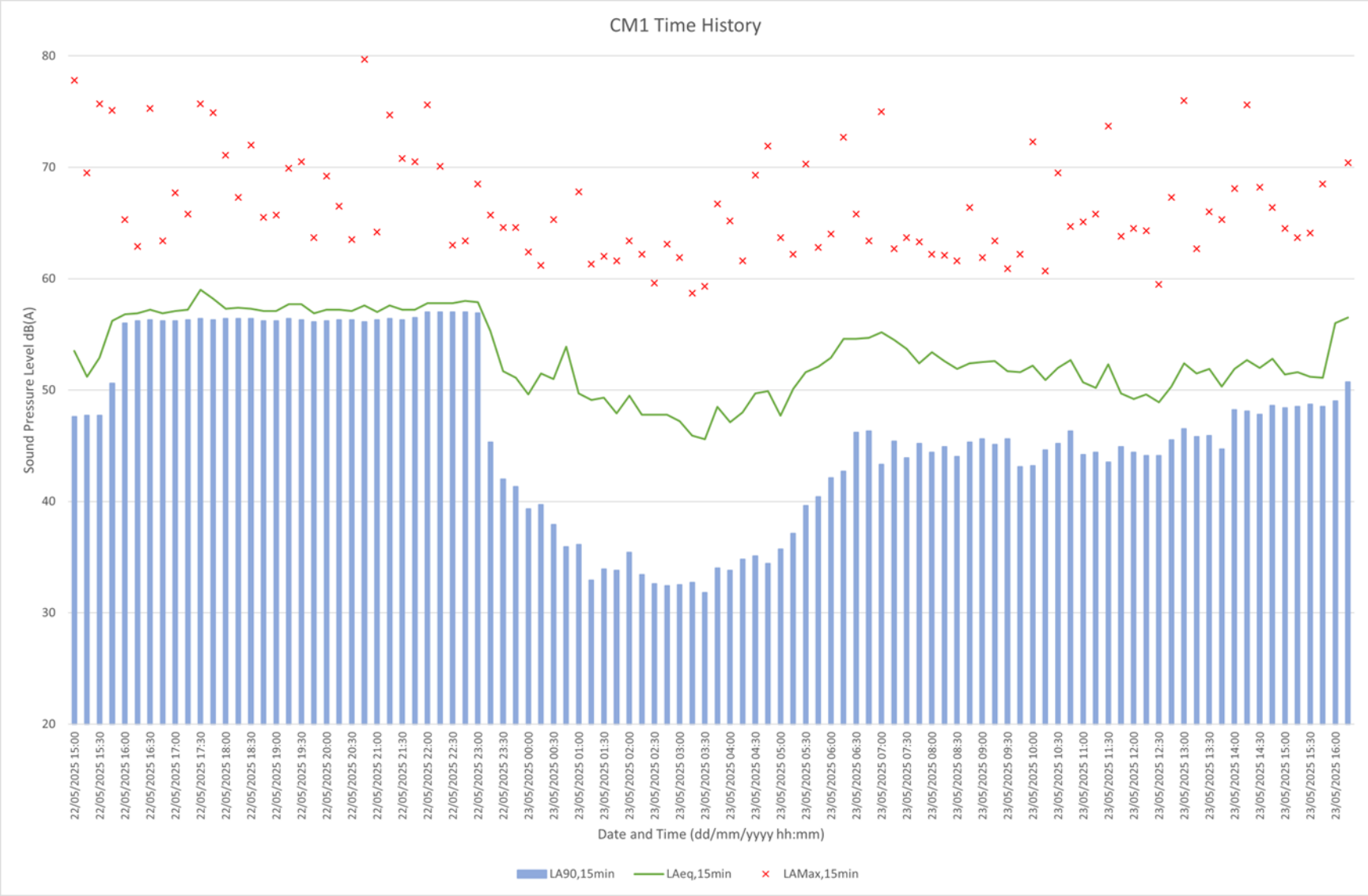
Noise	Typically defined as unwanted, unpleasant or disturbing sound
Frequency (Hz)	The number of oscillations in acoustic pressure per second. It represents the 'tone' of the sound. Often determined in octave bands
Maximum sound pressure level (L_{Fmax})	The maximum or highest sound pressure level measured with a 'fast' time weighting
Equivalent continuous sound pressure level ($L_{eq,T}$)	The average of the total sound energy over a specified time period (T). L_{eq} represents the equivalent sound level that a fluctuating source would have compared to a steady source with the same total sound energy over a specific time period. Commonly used as a descriptor of human perception of sound over time.
'A' weighting	Frequency-dependent weighting based on the response of the human auditory system which has been found to correlate well with the subjective response to sound. Denoted by the use of the letter 'A'. For example, dBA denotes an 'A' weighted sound level in decibels, or L_{Amax} denotes an 'A' weighted maximum sound pressure level.
Internal Ambient Noise Level (IANL)	The noise level within a room or enclosed space. Usually determined as an equivalent continuous sound pressure level over a specific time period ($L_{Aeq,T}$, dB)
Noise Rating (NR) curve	A single figure term used to reflect the spectral frequency content of noise. Although originally proposed to assess environmental noise, NR curves are now typically used to describe noise from mechanical ventilation systems in buildings.
$L_{night,outside}$	The incident external A-weighted long-term average sound level as defined in ISO 1996-2: 1987, determined over all the night periods of a year, in which the night is eight hours between 23:00 and 07:00.
AVO	Acoustics, Ventilation, Overheating (e.g. AVO Guide, AVO Group).
Overheating Strategy Overheating Condition	The situation where measures are in place to mitigate overheating to meet agreed compliance criteria.
Ventilative cooling	Cooling by means of introducing external ambient temperature air at a high ventilation rate. Can be either passive (no fans) or mechanical (with fans).
Purge ventilation	Ventilation to aid removal of high concentrations of pollutants and water vapour released from occasional activities such as painting and decorating or accidental releases such as smoke from burnt food or spillage of water.
Mechanical cooling	Cooling by means of a refrigerant cycle. This would include 'air conditioning' systems and the use of fan coil units (FCUs).
MEV	Mechanical extract ventilation.

"Free area" as used in AD-O	Approved Document O uses the term "Minimum free area" that is required to be achieved by the Equivalent area of the window openings. AD-O provides the accepted definition of Equivalent area for the description of "free area". The term "free area" is therefore avoided in this document to avoid further confusion.
Acoustic open area	The measurable, cross-sectional, geometric area of an opening. For a partially open window, this is considered to be the lesser of either the size of the hole in the window frame that is left by the opening light, or the combined cross-sectional area around the opening light through which air must pass to move from outside to inside. The area around a hinged opening light includes the triangular areas on the sides adjacent to the hinge, and the rectangular area on the side opposite the hinge. This should not be used for comparing the air-flow performance of elements because this will also be dependent on factors such as depth (length of air-path), surface roughness and tortuosity. Refer to reference 6 for further information.
Effective area, A_{eff}	Defined as the product of the free area and discharge coefficient, this is the preferred parameter for comparing the air-flow performance of elements. Refer to reference 6 for further information.
Equivalent area, A_{eq}	The area of a sharp-edged, circular orifice that gives the same flow rate as the actual opening at a given pressure-difference. In other words, the free-area of a notional circular hole made in an infinitely thin, infinite extent baffle that gives the same air-flow performance as the real opening. Used to describe the area of trickle vents in Approved Document F. Not to be confused with Effective area. Refer to reference 6 for further information.
Coefficient of Discharge, Cd	The ratio of the mass flow rate at the discharge end of the nozzle to that of an ideal nozzle which expands an identical working fluid from the same initial conditions to the same exit pressures.
$D_{n,e}$ / $D_{n,e,w}$	The laboratory tested sound insulation of small building elements, normalised to an equivalent absorption area of 10m2.
Façade level	The sound pressure level measured close to a building façade that includes contribution from both the incident sound and the sound reflected from the façade. Normally taken to be 3dB higher than the equivalent free-field level, when located at 1 metre from a façade.
Free-field level	A measured sound pressure level that is independent of any contributions due to reflections from nearby surfaces and is therefore representative of the direct path only.
R / R_w	The laboratory tested airborne sound insulation of a building element
Sound insulation	The capacity of a structure to prevent sound from reaching a receiving location. Sound energy is not necessarily absorbed; impedance mismatch, or reflection back toward the source, is often the principal mechanism

Appendix B

Time-History of Measured Noise Survey Results

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CM1 Time History
Sound Pressure Level dB(A)
80
70
60
50
40
30
20
22/05/2025 15:00
22/05/2025 15:30
22/05/2025 16:00
22/05/2025 16:30
22/05/2025 17:00
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23/05/2025 13:00
23/05/2025 13:30
23/05/2025 14:00
23/05/2025 14:30
23/05/2025 15:00
23/05/2025 15:30
23/05/2025 16:00
Date and Time (dd/mm/yyyy hh:mm)
LA90,15min
LAeq,15min
LAMax,15min

Appendix C

Example Break-In Calculations

Figure 7.1: Example noise break-in calculation (west façade)

Annex G BS8233 Calculations												
Calculation Set Up Using BS8233 Values												
Frequency Independent Terms												
Ao =	10	m2	Reference absorbtion area									
H =	2.5	m2	Height of the room									
W =	3.6	m2	Width of the room									
Sf =	9	m2	Total façade area of the room									
Swi =	1.5625	m2	Window area of room									
Sew =	7.4375	m2	External wall area									
Srr =		m2	Ceiling area									
S =	9	m2	Total surface are of elements through which sound enters the room (= Sf + Srr)									
d =	3	m2	Depth of the room									
V =	27	m3	Room volume									
Frequency Dependent Terms												
					Octave Band Centre Frequency							R_w + C_{tr} or $D_{n,e,w}$ + C_{tr}
					63	125	250	500	1k	2k	4k	8k	
SRIs													
Parameter	Description		Construction										
Dn,e =	Insulation of trickle vent		Rytons AAC125HP			42	37	38	43	57	64		41
Rwi =	SRI of window		6mm / 16mm argon / 6.8 Pilkington Optiphon			21	28	37	48	48	54		33
Rew =	SRI of external wall		Brick / 100mm Cavity / Block			43	43	44	55	65	76		48
Rrr =	SRI of roof / ceiling												
Absorption Coefficients													
carpet on underlay						0.08	0.24	0.57	0.69	0.71	0.73		
walls, painted and plastered						0.02	0.02	0.03	0.03	0.04	0.05		
double glazing						0.18	0.06	0.04	0.03	0.02	0.02		
ceiling	Armstrong Dune Supreme					0.4	0.45	0.55	0.6	0.5	0.45		
Total Absorption				area									
carpet on underlay				60.48	0	4.8384	14.5152	34.4736	41.7312	42.9408	44.1504	0	
walls, painted and plastered				31.4375	0	0.62875	0.62875	0.943125	0.943125	1.2575	1.571875	0	
double glazing				1.5625	0	0.28125	0.09375	0.0625	0.046875	0.03125	0.03125	0	
ceiling				60.48	0	24.192	27.216	33.264	36.288	30.24	27.216	0	
A from rev time (RT) or abs coeff (AC)?				RT									
A =	Equiv abs area of rec room (AC)				0.00	29.94	42.45	68.74	79.01	74.47	72.97	0.00	
RT						0.5	0.5	0.5	0.5	0.5	0.5		
A =	Equiv abs area of rec room (RT)				0.00	8.64	8.64	8.64	8.64	8.64	8.64	0.00	
A =	Equiv abs area of rec room				0.00	8.64	8.64	8.64	8.64	8.64	8.64	0.00	
TERM A	Leq,ff =	Leq ext ff	60.5 dB(A)			57.69203	57.82795	57.00593	56.4455	54.15386	48.9044		
TERM B	(Ao/S) * 10^(-Dn,e / 10)				0	7.01E-05	0.000222	0.000176	5.57E-05	2.22E-06	4.42E-07	0	
TERM C	(Swi/S) * 10^(-Rwi / 10)				0	0.001379	0.000275	3.46E-05	2.75E-06	2.75E-06	6.91E-07	0	
TERM D	(Sew/S) * 10^(-Rew / 10)				0	4.14E-05	4.14E-05	3.29E-05	2.61E-06	2.61E-07	2.08E-08	0	
TERM E	(Srr/S) * 10^(-Rrr / 10)				0	0	0	0	0	0	0	0	
TERM F	10 Log (B+C+D+E)				0	-28.2665	-32.69	-36.1325	-42.143	-52.8151	-59.377	0	
TERM G	10 Log (S/A)				0	0.177288	0.177288	0.177288	0.177288	0.177288	0.177288	0	
TERM K	+3				3	3	3	3	3	3	3	3	
Leq,2	SPL in room		dB		0.0	32.6	28.3	24.1	17.5	4.5	-7.3	0.0	
A-weighting					-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
LAeq,2			dB(A)		0.0	16.5	19.7	20.9	17.5	5.7	-6.3	0.0	
10^(LAeq,2 / 10)					0	44.69746	93.65313	121.6374	55.97323	3.729087	0.234677	0	
LAeq noise level in room =			**25.1 dB(A)**										
dB(A) reduction =			**35.5 dB(A)**										
LAeq noise level including BS4142 feature corrections =			**28.1 dB(A)**										

Figure 7.2: Example noise break-in calculation (east façade)

Annex G BS8233 Calculations													
Calculation Set Up Using BS8233 Values													
Frequency Independent Terms													
Ao =	10	m2	Reference absorbtion area										
H =	2.5	m2	Height of the room										
W =	5.9	m2	Width of the room										
Sf =	14.75	m2	Total façade area of the room										
Swi =	4	m2	Window area of room										
Sew =	10.75	m2	External wall area										
Srr =	0	m2	Ceiling area										
S =	14.75	m2	Total surface are of elements through which sound enters the room (= Sf + Srr)										
d =	4.1	m2	Depth of the room										
V =	60.475	m3	Room volume										
Frequency Dependent Terms													
					Octave Band Centre Frequency								$R_w + C_{tr}$ or $D_{n,e,w} + C_{tr}$
					63	125	250	500	1k	2k	4k	8k	
Parameter	SRIs Description		Construction										
Dn,e =	Insulation of trickle vent		Direct path trickle vent			28.9897	28.9897	27.9897	29.9897	27.9897	27.9897		29
Rwi =	SRI of window		4mm / 20mm / 4mm			21	20	33	42	46	39		28
Rew =	SRI of external wall		Brick / 100mm Cavity / Block			43	43	44	55	65	76		48
Rrr =	SRI of roof / ceiling												
	Absorption Coefficients												
carpet on underlay						0.08	0.24	0.57	0.69	0.71	0.73		
walls, painted and plastered						0.02	0.02	0.03	0.03	0.04	0.05		
double glazing						0.18	0.06	0.04	0.03	0.02	0.02		
ceiling	Armstrong Dune Supreme					0.4	0.45	0.55	0.6	0.5	0.45		
	Total Absorption			area									
carpet on underlay				60.48	0	4.8384	14.5152	34.4736	41.7312	42.9408	44.1504	0	
walls, painted and plastered				46	0	0.92	0.92	1.38	1.38	1.84	2.3	0	
double glazing				4	0	0.72	0.24	0.16	0.12	0.08	0.08	0	
ceiling				60.48	0	24.192	27.216	33.264	36.288	30.24	27.216	0	
A from rev time (RT) or abs coeff (AC)?				RT									
A =	Equiv abs area of rec room (AC)				0.00	30.67	42.89	69.28	79.52	75.10	73.75	0.00	
RT						0.5	0.5	0.5	0.5	0.5	0.5		
A =	Equiv abs area of rec room (RT)				0.00	19.35	19.35	19.35	19.35	19.35	19.35	0.00	
A =	Equiv abs area of rec room				0.00	19.35	19.35	19.35	19.35	19.35	19.35	0.00	
TERM A	Leq,ff =	Leq ext ff	50.5 dB(A)			47.69203	47.82795	47.00593	46.4455	44.15386	38.9044		
TERM B	(Ao/S) * 10^(-Dn,e / 10)				0	0.000856	0.000856	0.001077	0.00068	0.001077	0.001077	0	
TERM C	(Swi/S) * 10^(-Rwi / 10)				0	0.002154	0.002712	0.000136	1.71E-05	6.81E-06	3.41E-05	0	
TERM D	(Sew/S) * 10^(-Rew / 10)				0	3.65E-05	3.65E-05	2.9E-05	2.3E-06	2.3E-07	1.83E-08	0	
TERM E	(Srr/S) * 10^(-Rrr / 10)				0	0	0	0	0	0	0	0	
TERM F	10 Log (B+C+D+E)				0	-25.1625	-24.4322	-29.0588	-31.5553	-29.6493	-29.542	0	
TERM G	10 Log (S/A)				0	-1.17934	-1.17934	-1.17934	-1.17934	-1.17934	-1.17934	0	
TERM K	+3				3	3	3	3	3	3	3	3	
Leq,2	SPL in room		dB		0.0	24.4	25.2	19.8	16.7	16.3	11.2	0.0	
A-weighting					-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	
LAeq,2			dB(A)		0.0	8.3	16.6	16.6	16.7	17.5	12.2	0.0	
10^(LAeq,2 / 10)					0	6.683803	45.88141	45.37066	46.8908	56.5614	16.53118	0	
LAeq noise level in room =			**23.4 dB(A)**										
dB(A) reduction =			**27.1 dB(A)**										

Appendix D

Report Limitations

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