



Residential Noise Assessment

Site Address: The Old Library, Wellington Road, Dewsbury, WF13 2PQ

Client Name: Orange Design Studio Ltd

Project Reference No: NP-013247



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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise impact assessment for a residential development ('the proposed development') at The Old Library, Wellington Road, Dewsbury, WF13 2PQ ('the site'). The proposed development is for 14no. residential dwelling flats. The site is subject to noise from road traffic emissions and commercial activity.

The applicant has submitted a planning application (ref. 2025/92139/40) to the Local Planning Authority ('LPA'), Kirklees Metropolitan Council. This report has been prepared to accompany the planning application.

A noise survey has been undertaken to establish the prevailing sound levels at the proposed development. The findings have been subsequently used to assess the suitability of the site for residential use. Measures required to mitigate noise impacts for the proposed development have been assessed in accordance with the relevant performance standards, legislation, policy, and guidance.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.1 Standards, Legislation, Policy & Guidance

The following performance standards, legislation, policy, and guidance have been considered to ensure good acoustic design in the assessment:

- National Planning Policy Framework (2024).
- Noise Policy Statement for England (2010).
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings.'
- Approved Document F: Volume 1 Dwellings (2021).
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide).

Further information on the legislation can be found in Appendix B.

2. Environmental Noise Survey

2.1 Measurement Methodology

An unattended noise level survey was undertaken at the site to determine the existing noise climate in the area. The following table outlines the measurement dates and particulars. All sound level meters were fitted with a proprietary environmental kit, complete with a 130mm diameter windshield.

Location	Survey Dates	Measurement Particulars
MP1	26/10/2025 – 29/10/2025	Equipment mounted on a lamp post at a height of 3.5m on Wellington Road, in free-field conditions.
MP2	07/11/2025 – 10/11/2025	Equipment mounted on the rear stairwell at a height of 5m on the corner of Old Westgate and Wheelwright Street, in free-field conditions.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



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Figure 2 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The proposed development site is located off Wellington Road, Dewsbury. The surrounding area comprises predominantly commercial premises, with some residential dwellings understood to be in close proximity. The site itself consists of a disused library building, bordered by other apparently vacant properties to the south and west. Nearby uses include 'Ali Baba's' takeaway to the northeast and 'The Squash Club', an entertainment venue forming the southeastern corner of the adjacent terrace and associated beer garden within the central courtyard. NOVA Acoustics has been informed by the club

proprietor that the club usually closes around 00:00, but it does have a late license until 04:00, which may be used at times.

During the site visits, typical local activity included vehicle movements along the surrounding road network and pedestrian traffic passing the site. Vehicles were also observed to use the parking areas at the front of the building regularly, including both on-street spaces and the dedicated car park situated between the site and Dewsbury Ring Road (A638). Although 'Ali Baba's' operates as a takeaway, no external plant was visible or audible during the visits.

'The Squash Club' was operational throughout the measurement period, with regular activity observed during both site visits. While no specific programmed event was taking place during the second visit, the venue was operating under typical conditions, and the external beer garden was in normal use. As such, the measurements obtained are considered representative of standard operational activity at the venue.

Given that the beer garden was active under typical operating conditions during the second site visit, the noise levels measured at MP2 are considered suitably representative of normal external noise exposure at the rear of the site. A predictive assessment of noise breakout from the main internal function area has nevertheless been undertaken and is presented within this report for completeness. However, the predicted internal breakout noise levels are considered negligible when compared with the noise generated by activity within the external beer garden and are therefore not the controlling noise source for the assessment.

The acoustic environment at the front is characterised as moderate to high in level, with noise primarily influenced by road traffic on the surrounding network, particularly the A638 and Wellington Road. At the rear, the acoustic environment is low to moderate when the pub's beer garden is closed. When open, the noise levels at the rear façade increase, as will be assessed in Section 3 of this report.

2.3 Environmental Noise Survey Results

Ambient Sound Level Analysis

The following section outlines the measured sound levels during the survey. The time history results can be found in Appendix D.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$, dB)							$L_{Aeq,T}$ (dB)	'Typical' $L_{AFmax,1min}$ (dB)
		63	125	250	500	1k	2k	4k		
MP1	$L_{eq,16hr}$ (Day)	67	63	60	59	59	55	48	62	--
	$L_{eq,8hr}$ (Night)	61	56	54	53	54	51	48	58	74
MP2	$L_{eq,16hr}$ (Day)	57	55	54	51	50	45	40	54	--
	$L_{eq,8hr}$ (Night)	51	49	51	47	44	39	32	49	69
	Loudest $L_{eq,1hr}$ (Day)	58	60	62	59	57	52	46	61	--
	Loudest $L_{eq,1hr}$ (Night)	55	53	55	50	48	44	42	54	--

Notes:

[1] The 'typical' $L_{AFmax,1min}$ is the value exceeded fewer than 10 times throughout the night-time periods.

[2] The loudest $L_{eq,1hr}$ daytime and night-time values have been taken from Saturday and Sunday most sensitive operational hours (18:30 – 19:30 and 00:00 – 01:00 hours, respectively).

Table 2 – Sound Level Results Summary

As shown in the previous table, the noise levels measured during the loudest periods are significantly higher than the average $L_{Aeq,16hr}$. This indicates that noise emissions from 'The Squash Club' beer garden are clearly distinguishable above the general ambient sound levels during peak activity. Accordingly, the ambient noise levels recorded during these loudest periods have been used to inform the noise break-in assessment at the rear of the development.

Façade Sound Level Adjustment Between MP2 and Proposed Apartments

The MP2 measurement position was located on the emergency stairwell at the rear of the existing building. This measurement location is suitable for capturing representative source levels; however, several of the proposed apartments will be positioned at different distances from the beer garden compared with the MP2 position. As noise levels reduce with distance, corrections must be applied to ensure that the predicted façade levels for each apartment accurately reflect their specific exposure.

Based on site observations, the distance between the beer garden and the MP2 monitoring location is approximately 9 m. In comparison:

- Apartment 7 is located closer to the source, with a separation distance of approximately 3.5 m.
- Apartments 13 and 14 are positioned farther from the source, with the closest windows at approximately 16 m.

Applying this correction ensures that the façade noise levels used for the subsequent noise break-in assessment accurately account for the increased exposure of each apartment to the beer garden activity.

The following table outlines the corrected sound levels.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$, dB)							$L_{Aeq,T}$ (dB)	'Typical' $L_{AFmax,1min}$ (dB)
		63	125	250	500	1k	2k	4k		
Apartment 7	Predicted Loudest $L_{eq,1hr}$ (Day)	56	57	57	56	54	48	43	58	--
	Predicted Loudest $L_{eq,1hr}$ (Night)	55	52	56	51	48	42	33	53	69
Apartments 13 & 14	Predicted Loudest $L_{eq,1hr}$ (Day)	53	55	57	54	52	47	41	56	--
	Predicted Loudest $L_{eq,1hr}$ (Night)	50	48	50	45	43	39	37	48	69

Table 3 – Adjusted Façade Sound Level Results Summary

Background Sound Level Analysis

Outlined in the following table are the background sound levels ($L_{90,T}$) measured at MP2. As 'The Squash Club' was already operational during the survey, background measurements were taken during non-operational periods immediately before and after its activity (16:00–17:00 for daytime and 04:00–05:00 for night-time). The octave band levels have been used as the baseline for the noise breakout assessment.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{90,15min}$ dB)							$L_{A90,15min}$ (dB)
		63	125	250	500	1k	2k	4k	
MP2	Daytime (16:00 – 17:00)	53	51	47	45	46	40	27	49
	Night-time (04:00 – 05:00)	40	42	37	34	33	27	21	37

Table 4 – Octave Band Background Sound Level Results Summary

3. Acoustic Design Considerations & The Proposal

3.1 Low Frequency Entertainment Noise

As previously discussed, noise from the amplified music played in the beer garden could be intrusive to future residents, particularly considering that some of the proposed development windows overlook the beer garden and are in close proximity. To assess whether music noise may pose a potential issue to the proposed development, analysis has been undertaken of the ambient noise levels measured at the 63Hz and 125Hz octave band frequencies. The results are presented below, with the club licensed opening hours highlighted in red.

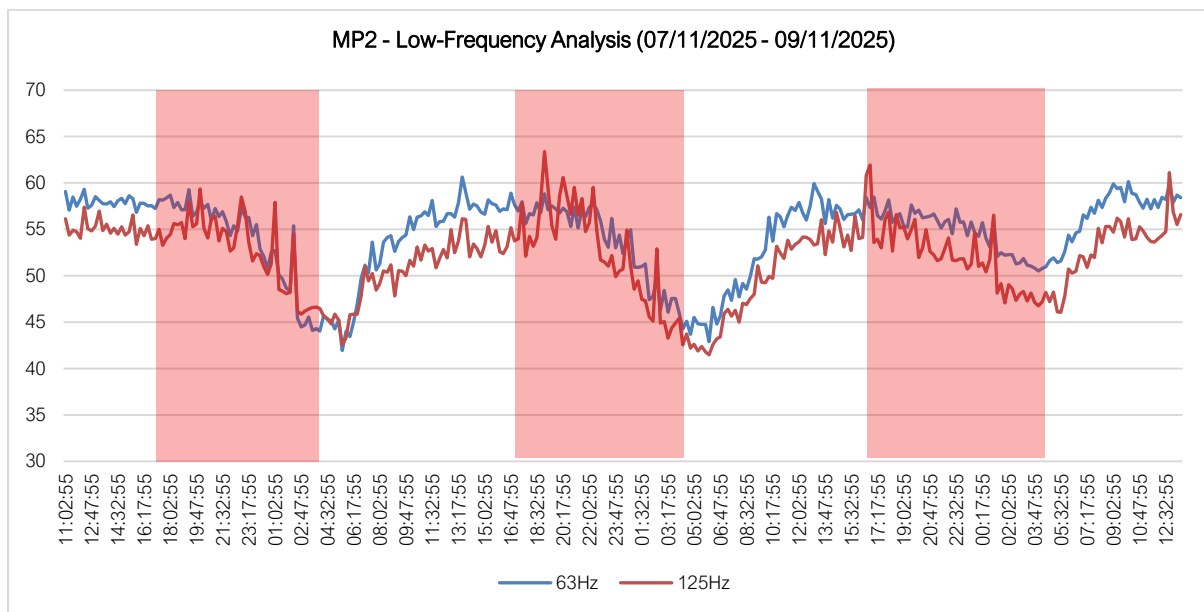


Figure 3 – MP2 Low Frequency Noise Analysis

As can be seen, the low-frequency measurements do not follow a typical diurnal pattern at MP2 and are particularly prominent during the club's opening hours. This indicates that amplified music was being played within the beer garden during the noise monitoring, and this aligns with the club's proprietor comments.

Whilst it is understood that the future occupants of the proposed development may expect slightly higher levels during operational hours of the venue, this cannot be relied upon and it is still possible that they could be negatively impacted by entertainment noise in the area, which may lead to complaints. Given this, it is thought that the agent of change principle must be considered.

3.2 Mid Frequency Patron Noise

As previously discussed, the pub's beer garden is adjacent and overlooks the rear façade of the proposed development. Therefore, there is potential for patron noise to be intrusive to future residents during the beer garden opening hours. To assess whether patron noise may pose a potential issue to the proposed development, analysis has been undertaken of the ambient noise levels at the 500Hz, 1kHz and 2kHz octave band frequencies. The results are presented below, with the brewery opening hours highlighted in red.

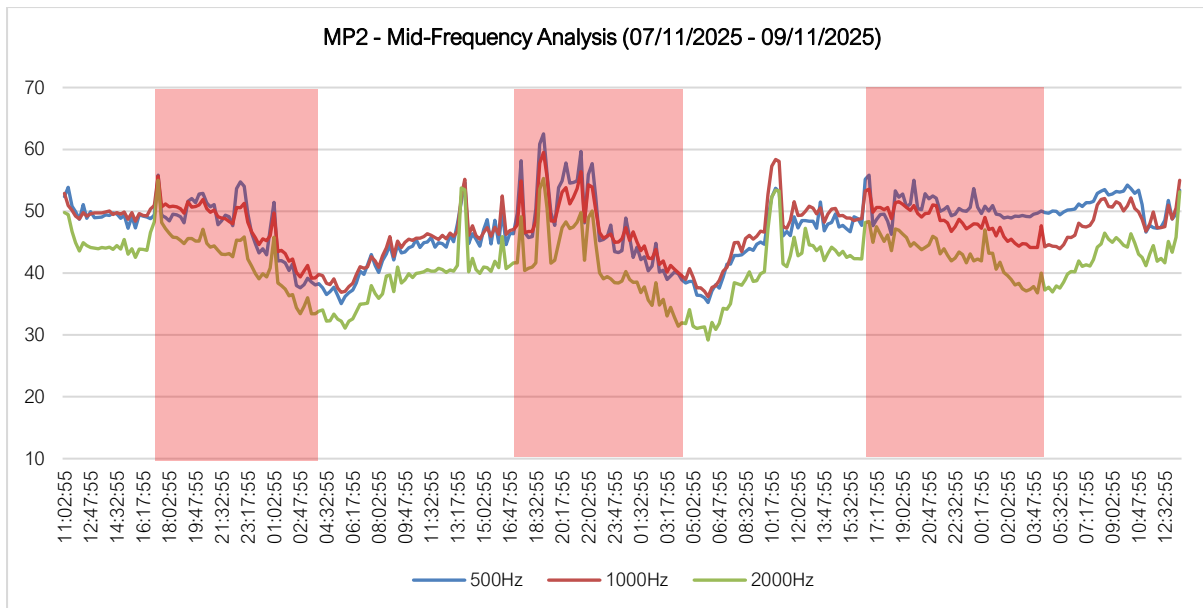


Figure 4 – MP2 Mid Frequency Analysis

As can be seen above, the majority of periods of increased mid-frequency content correspond to opening times. Given the proximity of MP2 to the brewery’s outdoor area and the absence of other significant mid-frequency noise sources nearby, it is concluded that these increases were primarily caused by patron noise. These observations are consistent with the findings of the long-term noise survey and indicate that patron noise is the dominant acoustic source in this area, along with the external music, with the potential to be intrusive. Accordingly, the noise levels measured during the loudest periods - as presented in Tables 2 and 3 - will be used to inform the break-in assessment for the eastern façade of the proposed development.

4. Predictive Noise Breakout Assessment

As described in Section 2.2, 'The Squash Club' did not hold any specific event during the second site visit (MP2). Therefore, to ensure that noise breakout from activities within the club does not result in adverse effects at the nearby residential receptors (NSRs), a predictive noise breakout assessment is provided in the following section.

4.1 Acoustic Design Criteria

'The Good Practice Guide on the Control of Noise from Pubs and Clubs' comments that where entertainment noise takes place on a regular basis, associated sources should be inaudible within noise-sensitive properties at any time.

In order to achieve relative inaudibility within residential properties, it is recommended that noise breakout emissions from the site do not exceed the background sound levels (L_{90}) in each octave band at the external façades of the closest NSRs.

The predicted noise levels within 'The Squash Club' are based on recordings taken by NOVA Acoustics of a live, amplified band in a performance room. This again is thought to represent a worst-case scenario considering the likely usage of the space.

It is understood that the external walls of the building comprise 200mm masonry blockwork with an assumed minimum density of 2000kg/m³. The Squash Club operates solely at ground-floor level, with two additional floors above. The intermediate floor constructions are understood to be masonry concrete, with an assumed minimum thickness of 150mm. Given the mass and construction of the upper floors, noise breakout via the roof structure is not considered to be a significant pathway and has therefore been excluded from the assessment.

The sound reduction for these building elements has been predicted using INSUL 9 software. The results are shown in the following table.

Description	Octave Frequency Band (Hz, dB)						
	63	125	250	500	1k	2k	4k
External Wall Sound Reduction (SRI)	43	43	44	52	59	64	69

Table 5 – SRI of Building Envelope Elements

Noise breakout levels have been assessed to the closest residential bedroom which is a bedroom window approximately 10m from the façade of the building. The calculations have been conducted assuming the following:

- The building facades are thought to be the weakest element in terms of sound reduction.
- All windows and doors will remain closed during operations except for access.
- The sound power levels of the glazed elements have been calculated using the formula: $L_{W,rad} = L_{P,rev} - C_d - R + 10 \log(S)$, where, S is the surface area of the façade element, C_d is the correction applied to account for the difference between reverberant internal conditions and non-reverberant external conditions (-5dB), and R is the sound reduction provided by the façade

element. The planar propagation loss from the façade elements has been calculated from the point source region.

The resultant L_{eq} noise breakout emissions at the closest window of NSR1 are assessed against the background noise levels in the table below.

Description	Octave Frequency Band (Hz, dB)							Overall (dBA)
	63	125	250	500	1k	2k	4k	
Worst-case Internal Noise Level (L_{eq})	96	103	102	104	97	93	88	104
Façade SRI (R')	43	43	44	52	59	64	69	--
Internal to External Correction (C_d)	-5							--
Sound Power Level of façade (L_w)	57	64	62	56	42	33	23	57
Total Attenuation	-25							--
Total External Noise Level at NSR1 (L_{eq})	32	39	37	31	17	8	-2	52
Background Noise Level (MP2, 04:00 – 05:00, L_{90})	40	42	37	34	33	27	21	37
Exceedance of Background Noise Level	-8	-3	0	-3	-16	-19	-23	-5

Table 6 – Noise Breakout Assessment

As can be seen, the criteria are expected to be achieved in all frequency bands and overall. Therefore, this level would result in a 'No Observed Adverse Effect Level' ('NOAEL') at the receptor in accordance with the NPSE and the NPPF. Given this, no further mitigation measures are deemed necessary to account for breakout of the building.

5. Agent of Change and Recommended Mitigation Measures

Given the Section 3 assessment's outcome, the 'Agent of Change' principle must be considered in order to reduce the likelihood of complaints from future residents and avoid placing undue restrictions on the nearby venues.

Regarding this, the following is stated in paragraph 200 of the NPPF:

"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."

Considering this, it is thought that good acoustic design principles must be implemented at the site to protect the amenity of future residents and avoid placing undue restrictions on the adjacent establishments.

The 'ProPG Planning and Noise' (May 2017) guidance, was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. ProPG aims to encourage better acoustic design of new residential developments by promoting good health and wellbeing through the effective management of noise. It outlines four key elements which should be considered in the assessment of noise:

- Element 1 – demonstrating a "Good Acoustic Design Process".
- Element 2 – observing internal "Noise Level Guidelines".
- Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
- Element 4 – consideration of "Other Relevant Issues".

The ProPG supplementary document 2 provides the following 'Good Acoustic Design' hierarchy of noise management measures which are considered to be relevant to this development:

1. Reduction of noise at the source.

It is acknowledged that controlling noise emissions from external music and patron activity can be particularly challenging, especially in instances where bedroom windows directly overlook the outdoor area in close proximity.

In this case, reducing music and patron noise at the source may be considered feasible through traditional physical mitigation measures if the existing canopy is repaired or upgraded. If unfeasible, the most effective approach is the implementation of a robust Noise Management Plan. This should include measures such as actively monitoring the outdoor area to prevent shouting or raised voices, restricting the use of the space to background music.

As the neighbouring businesses are not owned or operated by the client; it is advised that the client contacts the operators to discuss the possibility of noise mitigation. It is understood however that this may not be feasible.

2. Reorientation of the development

Given the nature of the development and the fixed position of the existing window openings, opportunities to reorient the internal layout to improve the acoustic environment are limited. As illustrated in Figure 1, several apartments include bedrooms and living rooms that overlook the adjoining beer garden. When considered alongside the wider design constraints of the scheme, it is anticipated that avoiding overlooking of this façade would be challenging to achieve in practice.

Nevertheless, particular consideration should be given to windows directly facing the beer garden, as these façades are subject to elevated external noise levels. Where reorientation is not feasible, alternative mitigation measures should be considered to ensure that suitable internal noise conditions are achieved.

3. Enhanced façade sound insulation treatment.

Finally, to ensure the possibility of disturbance across the southern façade is reduced as much as is practicable, it is recommended that an enhanced façade sound insulation treatment be implemented as follows:

- The sound insulation scheme at the rear of site should be specified using the loudest 1-hour daytime and night-time measurements during the measurement period (shown in Tables 2 and 3). This should protect future residents against both noise during events and noise from traffic. It should be noted that this is considerably more stringent than using the standard BS8233 criteria (average 16-hour daytime and 8-hour night-time measurements).
- The sound insulation scheme should be specified using the Moorhouse low-frequency curve,. This is designed to reduce the possibility of adverse impact from low-frequency (63Hz and 125Hz) noise emissions.
- The internal ambient noise levels for sensitive rooms proposed on the rear façade will be set at NR25 and NR20 (5dB below the BS8233 recommended noise level limits) during the daytime and night-time, respectively, to ensure that occupant comfort and acoustic amenity is fully protected.
- A mechanical ventilation system should be installed for all sensitive rooms facing the rear façade so that windows are not required to be opened in order to mitigate overheating and provide ventilation. This is not a recommendation for 'sealed closed' windows, however, it will avoid the requirement for windows to be opened.

The LPA will need to be satisfied that achieving the lowest practicable noise levels appropriately considers the 'Agent of Change' principle and will not affect the viability of existing businesses.

Providing the criteria shown above are implemented, it is thought that future occupants will be fully protected from entertainment noise emissions.

6. Noise Break-in Assessment and Sound Insulation Scheme

6.1 Determined External Noise Levels

Considering the particularity of the site surrounding and the different type of noise sources incident on each façade, the following criteria will be implemented.

- **All Other Façades** - The noise profile of the area is predominantly “anonymous” steady state noise sources, especially road noise from New Road Side.
- **Rear Façade** – The noise profile of the areas is dominated by music and patron noise during the beer garden opening hours. When the external area is closed, noise emissions are dominated by distant traffic noise. Therefore, it is recommended that an enhanced façade sound insulation treatment is implemented during the beer garden opening hours.

The following table outlines the internal acoustic design criteria used in the following assessment

6.2 Internal Noise Level Criteria

The criteria used in the assessment are outlined in the following tables. As stated previously, due to the presence of low frequency noise within the immediate area during night-time hours, the Moorhouse Curve criteria are also applied.

Moorhouse Low Frequency Criteria	
All Rooms	63Hz limit of 47dB 125Hz limit of 41dB

Table 7 – Low Frequency Acoustic Design Criteria (Moorhouse)

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$ / NR30	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$ / NR35	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$ / NR30	30 dB $L_{Aeq,8hr}$ / NR25 45 dB L_{AFmax} *

*NOTE 1: The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.

*NOTE 2: ProPG:2017 which is relevant to 'New Residential' states; "In most circumstances in noise sensitive rooms at night (e.g., bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability, and regularity of noise events".

Note 4: BS8233:2014 states: "The levels shown in Table 4 (criteria shown above) are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

Note 5; BS8233:2014 states: "If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Table 8 – Internal Acoustic Design Criteria

The measured sound levels at the proposed development are assessed against the relevant criteria and a sound insulation scheme is provided to achieve a good internal acoustic environment.

6.3 Glazing and Background Ventilation Specification

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria. The calculations considering the following sound insulation scheme can be found in Appendix E.

Description	Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
All Other Facades – Living Rooms & Bedrooms								
6mm Glass / 16mm Argon Cavity / 6.8mm Optiphon Glass (SRI)*	21	21	28	37	48	48	54	40 R _W (-4 C _{tr})
Titon Standard Vent + C75 (2 No. Trickle) (D _{ne})*	25	38	36	35	42	39	42	35 D _{ne,W} (-1 C _{tr})
Rear Façade – Apartments 1 and 8 – Living Rooms & Bedrooms								
6mm Glass / 16mm Argon Cavity / 6.8mm Optiphon Glass (SRI)*	21	21	28	37	48	48	54	40 R _W (-4 C _{tr})
Greenwoods 2500EA.AC1 (2 No. Trickle) (D _{ne})*	31	41	40	37	47	43	46	42 (D _{ne,W}) (-2 C _{tr})
Rear Façade – Apartment 7 – Living Rooms & Bedrooms								
6mm Glass / 16mm Argon Cavity / 6.8mm Optiphon Glass (SRI)*	21	21	28	37	48	48	54	40 R _W (-4 C _{tr})
Greenwoods MA3051 (Through Wall) (D _{ne})*	30	46	45	50	55	65	67	55 (D _{ne,W}) (-3 C _{tr})
Rear Façade – Apartments 13 and 14 – Living Rooms & Bedrooms								
8mm Glass / 16mm Air Cavity / 6mm Glass (SRI)*	20	20	21	33	40	36	48	35 R _W (-6 C _{tr})
Greenwoods 2500EA.AC1 (2 No. Trickle) (D _{ne})*	31	41	40	37	47	43	46	42 (D _{ne,W}) (-2 C _{tr})
Notes:								
*Any other window or ventilation specification capable of providing this attenuation will be suitable provided the glazing suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.								
**Please note that the above performance requirements for the trickle vents should be achieved with them in the 'open' position.								

Table 9 – Glazing & Background Ventilation Specification

6.4 Structural Envelope

It is recommended that the structural elements of the building envelope provide a minimum sound reduction of 50-55dB R_w . This is expected to be achieved with a typical masonry external wall construction without further upgrades. However, where rooms are to be located within the roof space and there are no voided loft spaces, it is recommended that the following roof construction details are followed:

Rooms on the proposed first floor:

- Roofing slates or tiles
- 200mm rafters with 100mm acoustic insulation (min. density of 45kg/m³)
- 2no. 15mm SoundBloc plasterboards

7. Overheating Screening Assessment

In order to avoid excessively high temperatures and provide adequate levels of thermal comfort within dwellings, an overheating mitigation strategy must be developed. In low noise areas, this strategy can often rely upon opening windows as the primary source of ventilation, however, in areas with higher levels of noise, this would present a risk of adverse effects on health and quality of life.

7.1 Overheating Criteria

Considering that the development is a change of use and not new build, it is not a requirement to achieve the criteria defined in Approved Document O ('ADO'). However, to allow for a reasonable living environment, it is recommended that the less onerous criteria given in the 'Acoustics Ventilation and Overheating Design Guide' ('AVO') should be applied. Considering that a partially open window provides approximately 13 dB of attenuation (as stated in 'AVO') the proposed internal and external noise criteria are summarised as follows:

Period	Proposed Criteria (dB)		External Level (dB)	
	Internal	External	Measured	Exceedance
All Other Façades				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	62	-1
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	58	+3
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	74	-4

Notes:

[1] Criterion taken from the AVO guide. Above this level, it is stated: "Noise causes a material change in behaviour, e.g., having to keep windows closed most of the time."

[2] L_{AFmax} exceeded fewer than 10 times per night.

Table 10 – External Noise Level Limits for Overheating Criteria

As detailed in this report, the noise profile at the rear façade is dominated by commercial noise from music and patrons from the adjacent pub beer garden. Therefore, and to avoid excessively high temperatures and provide adequate levels of thermal comfort within dwellings, a mechanical ventilation system should be installed for all sensitive rooms facing the rear façade so that windows are not required to be opened in order to mitigate overheating and provide ventilation. This is not a recommendation for 'sealed closed' windows, however, it will avoid the requirement for windows to be opened.

It must be ensured that all ventilation strategies (passive or active) are compliant with the requirements of Approved Document F. Further advice can be provided by NOVA Acoustics if required.

7.2 Assessment

All Other Facades

The noise levels measured at the front of site marginally exceed the external noise criteria shown in the table above. As such, an assessment should be undertaken by a suitably qualified person to ascertain if

the rooms on this façade are at risk of overheating. Should the outcome indicate there is a low risk of overheating, then a secondary ventilation strategy may not be required. If the outcome is a moderate to high risk, then it is recommended that openable windows are not used as the primary source of ventilation.

Alternative forms of ventilation include passive systems (such as acoustic louvres) and mechanical systems (such as 'centralised mechanical extract ventilation' and 'mechanical ventilation with heat recovery'). The installation of passive systems is generally preferable; however, the precise requirements must be confirmed with a ventilation specialist.

It should be noted that this assessment relates exclusively to overheating mitigation, and as such, open windows may be used for purge ventilation without acoustic constraint.

8. Conclusion and Action Plan

The proposed development has been assessed against the acoustic design criteria, and a sound insulation scheme has been provided to ensure the criteria has been achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The 'Good Acoustic Design' hierarchy of noise management measures provided in Section 5 should be implemented.
2. The proposed glazing and ventilation system, or a suitable alternative, should be installed as shown in section 6.3.
3. The ventilation strategy provided in Section 7 should be implemented.

The findings of this report will require written approval from the Local Authority prior to work commencing.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T , has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for $N\%$ of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10 \log_{10} (p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy, and guidance.

B.1 – National Planning Policy Framework (2024)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2024. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 187e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

Paragraph 198 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:

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes, and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 198 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

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:
- Where possible, contribute to the improvement of health and quality of life.

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

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. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

This is further expanded using the updated “Noise Exposure Hierarchy Table” which includes an additional level of impact referred to as the ‘No Observed Adverse Effect Level’ (‘NOAEL’). It is stated that at this level: “*noise can be heard, but does not cause any change in behaviour, attitude or other physiological response*”. In addition, noise at this level “*can slightly affect the acoustic character of the area but not such that there is a change in the quality of life*”.

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 ‘Guidance on Sound insulation and noise reduction for buildings’

BS8233 provides guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, ‘WHO Guidelines on Community Noise, 1999’. The Guidelines on Community Noise (1999) document defines community noise to include noise from “industries” and “construction”. The desirable criteria levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 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 $L_{Aeq,8hour}$ 45 dB L_{AFmax}^*

Table 11 – BS8233:2014 Internal Ambient Noise Level Criteria

**ProPG:2017 states that’s good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 times a night within noise sensitive rooms such as bedrooms. However, where it is not reasonably practicable to achieve the guideline then the judgment of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number distribution, predictability, and regularity of noise events.*

It is noted, however, that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the ‘LOAEL’ as defined in the NPSE in Appendix B.

B.4 – Approved Document F Volume 1: Dwellings (2021)

Approved Document F states the following in relation to noise:

- Mechanical ventilation systems, including both continuous and intermittent mechanical ventilation, should be designed and installed to minimise noise. This includes doing all of the following.
 - o Correctly sizing and jointing ducts.
 - o Ensuring that equipment is appropriately and securely fixed, such as using resilient mountings where noise carried by the structure of the building could be a problem.
 - o Selecting appropriate equipment, including following paragraph
- For mechanical ventilation systems, fan units should be appropriately sized so that fans operating in normal background ventilation mode are not overly noisy. This might require fans to be sized so that they do not operate near maximum capacity when in normal background ventilation mode.
- Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation.
- If an exposed façade is close to an area of sustained and loud noise (e.g. a main road), then a noise attenuating background ventilator should be fitted.

B.5 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233:2014 should be achieved considering adequate ventilation as defined by Building Regulations 'Approved Document F' ('ADF') whole dwelling ventilation. However, for a whole dwelling ventilation system such as MVHR it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

The 'Institute of Acoustics' ('IOA') and the 'Association of Noise Consultant's' ('ANC') have published 'The AVO Guide: 2020' document 2020. It provides guidance for those acousticians involved in the design of buildings to prevent noise ingress to and achieve reasonable internal levels. This provides valuable guidance on ventilation and overheating in support of the "Good Acoustic Design" principle advocated by ProPG. Along with guidance showing an acoustic assessment during the overheating condition, the AVO Guide (2020) provides a framework that has a two-level assessment procedure to estimate the potential impact on occupants:

Level 1 Risk Assessment

AVO 'Level 1' risk assessment criteria guide based on external free field ambient noise levels for dwellings relying on purge ventilation (e.g., opening windows) to prevent summertime overheating. AVO Guide Table 3-2 detailed in the figure below. To assess the possibility of overheating it is reasonable to relax the BS 8233:2014 internal ambient noise levels from opening a window by 5 decibels (5 dB). Also, it is assumed that a partially open window will provide a sound reduction of 13 dB. Therefore, to achieve internal noise levels in line with BS 8233:2014 the façade external noise levels should fall inside the levels shown in Table 3-2.

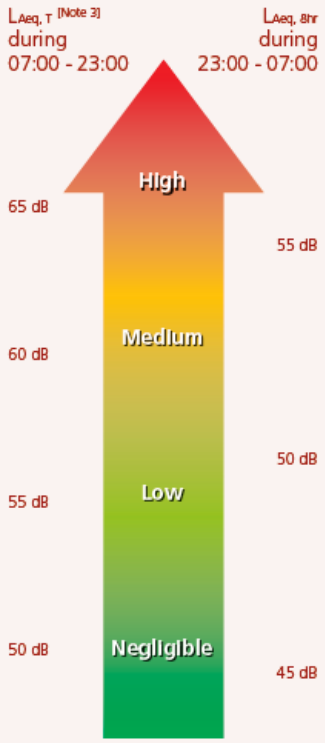
Risk category for Level 1 assessment ^[Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
<p>$L_{Aeq, T}$ ^[Note 3] during 07:00 - 23:00 $L_{Aeq, 8hr}$ during 23:00 - 07:00</p>  <p>65 dB High</p> <p>60 dB Medium</p> <p>55 dB Low</p> <p>50 dB Negligible</p> <p>55 dB</p>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

Table 3-2 of AVO Guide (2020)

Figure 5 – AVO Guide Level 1 Risk Category

The AVO Guide (2020) seeks to determine the level of risk associated with overheating in a new residential development based on the existing noise climate. The AVO risk categories are detailed in the table below with clearer categorisation.

AVO Guide (2020) Level 1 Risk Assessment			
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥ 63 dB $L_{Aeq,16hour}$	≥ 55 dB $L_{Aeq,8hour}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62 dB $L_{Aeq,16hour}$	52 – 54 dB $L_{Aeq,8hour}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56 dB $L_{Aeq,16hour}$	49 – 51 dB $L_{Aeq,8hour}$	Low Risk	
≤ 53 dB $L_{Aeq,16hour}$	≤ 48 dB $L_{Aeq,8hour}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 12 – AVO Guide (2020) Level 1 Risk Assessment

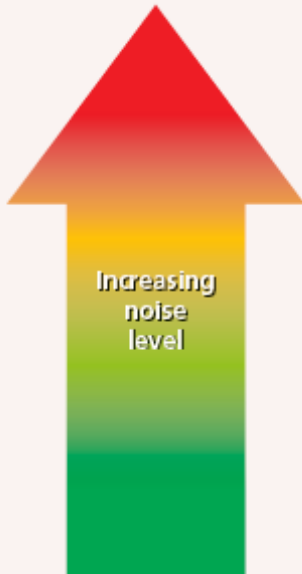
Level 2 Risk Assessment:

A 'Level 2' assessment of noise is recommended where a dwelling using purge ventilation (e.g., open windows) reaches Level 1 'High Risk' or 'Medium Risk'. The Level 2 assessment guidance comments that where internal ambient noise levels are >50 dB $L_{Aeq,16hr}$ (day) or >42 dB $L_{Aeq,8hr}$ (night) then the outcome might be that the noise causes a material change in behaviour, e.g., having to keep windows closed for the majority of the time, or there is the potential for sleep disturbance.

To conduct a Level 2 assessment, the following minimum information is required:

- Statement of the overheating criteria being applied.
- Description of the provisions for meeting the stated overheating criteria. This should include, where relevant, the area of façade opening.
- Details of the likely internal ambient noise levels whilst using provisions for mitigating overheating, and the method used to predict these.
- Estimation of how frequently and for what duration such provisions are required to mitigate overheating.
- Consideration of the effect of individual noise events.
- Assessment of the adverse effect on occupants.

The figure below outlines the AVO Guide (2020) guidance for a Level 2 assessment of noise from transport sources relating to the 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]	$L_{Aeq,sh}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{A, Fmax}$	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.
 <p>Increasing noise level</p>			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	<p>At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods.</p> <p>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.</p> <p>At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. ^[Note 7]</p>
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{A, Fmax}$ 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.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

Table 3-3 of AVO Guide (2020)

Figure 6 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix D – Environmental Survey

D.1 – Time History Noise Data

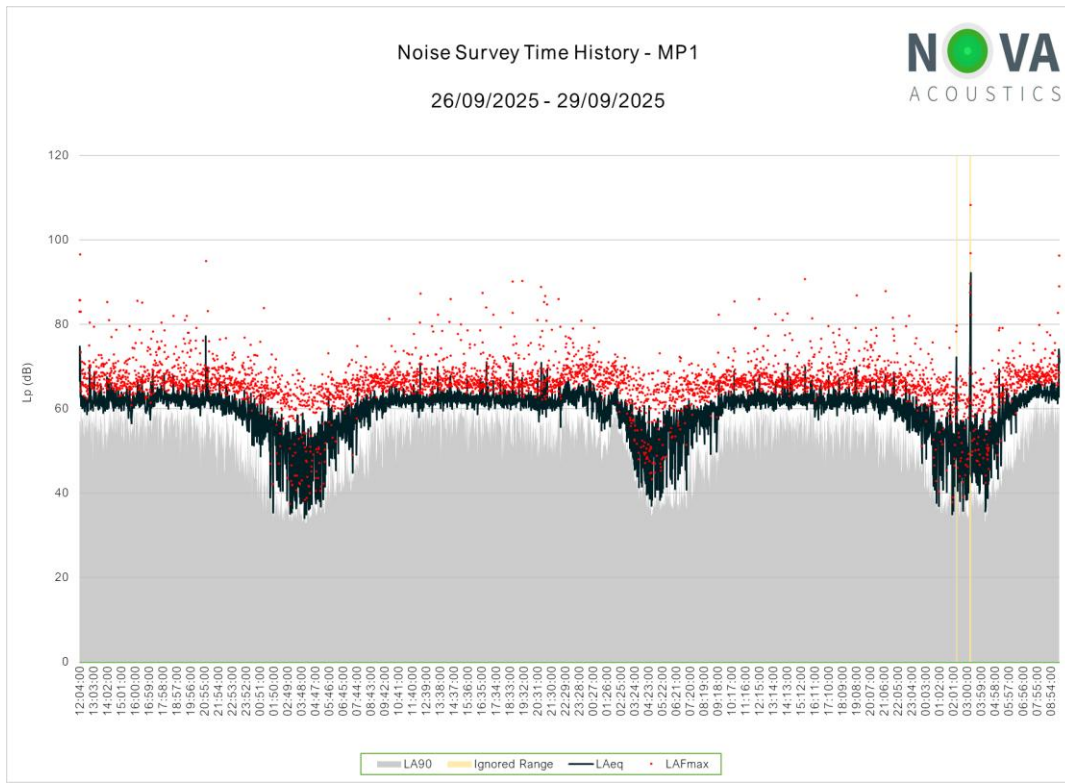


Figure 7 – MP1 Noise Survey Time History

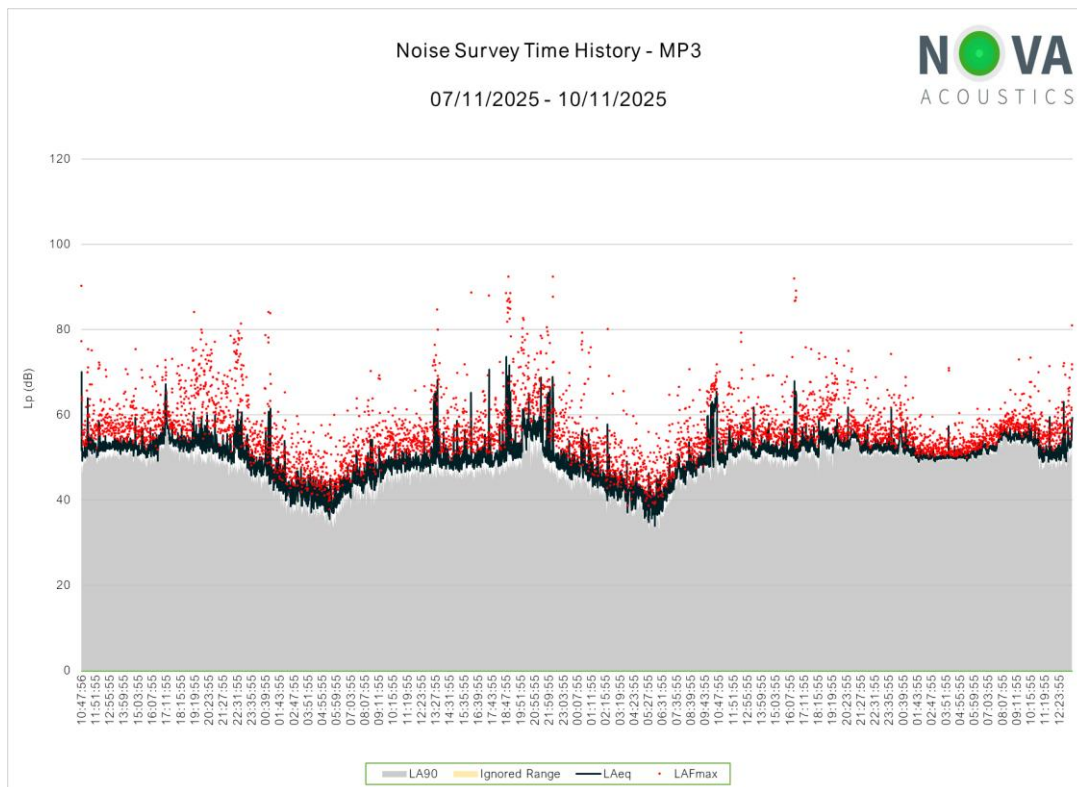


Figure 8 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV971A Class 1 Sound Level Meter	T246458	≤0.2
CESVA CB006 Class 1 Calibrator	902442	
Svantek SV971A Class 1 Sound Level Meter	T250681	≤0.2
CESVA CB006 Class 1 Calibrator	902442	

Table 13 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.2 dB. All sound level meters are calibrated every 24 months, and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Ecowitt (Approx. 4.5km NW of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
26/10/25 – 00:00 – 23:59	6.1 – 18.0	0.0	ESE	0.0 – 1.6
27/10/25 – 00:00 – 23:59	9.4 – 15.0	0.0 – 5.4	SW	0.0 – 3.6
28/10/25 – 00:00 – 23:59	7.4 – 18.1	0.0 – 7.2	ESE	0.0 – 4.0
29/10/25 – 00:00 – 23:59	5.3 – 16.2	0.0	E	0.0 – 4.1
07/11/25 – 00:00 – 23:59	9.7 – 16.1	0.0 – 9.0	S	0.0 – 2.7
08/11/25 – 00:00 – 23:59	6.0 – 13.0	0.0 – 1.2	ESE	0.0 – 6.3
09/11/25 – 00:00 – 23:59	5.6 – 13.0	0.0 – 4.8	S	0.0 – 3.6
10/11/25 – 00:00 – 23:59	7.0 – 13.1	0.0 – 3.6	SSE	0.0 – 4.1

Table 14 – Weather Conditions

Appendix E – Noise Break-in Calculations

E.1 – Façades with Background Ventilation

The façade sound reduction and predicted internal noise levels are calculated assuming the following:

- The calculation method for façade sound reduction is in accordance with BS8233:2014 and BS EN 12354-3.
- The reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room in the UK. This value is used for both living rooms and bedrooms.
- Based on the technical drawings provided to NOVA Acoustics, window areas and room volumes are used in the calculations for bedrooms and living rooms as a worst-case scenario.
- The acoustic performance of the façade elements is taken from the relevant manufacturer's technical information, or the sound reduction has been predicted using INSUL 9.0.
- For background trickle ventilation a total Equivalent Area of 5000mm² per habitable room has been used in the calculations, which equates to 2 No. trickle vents (2500mm² each).
- Exceedances of 1-2dB are deemed to be marginal and deemed acceptable.

Living Room (All Other Façades) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	62	67	63	60	59	59	55	48
Glazing Noise Ingress	24	42	37	28	17	6	2	-11
Ventilation Noise Ingress	22		22	22	21	15	13	3
Wall Noise Ingress	-8	10	0	-4	-16	-16	-21	-28
Roof Noise Ingress	24	44	35	24	17	11	7	-1
Room Absorption Correction		4	4	4	3	3	3	2
Total Noise Ingress	35	53	46	37	30	23	20	9
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	0	-6	-2	-2	-3	-7	-6	-15

Bedroom (All Other Façades) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	62	67	63	60	59	59	55	48
Glazing Noise Ingress	24	41	36	27	16	6	1	-12
Ventilation Noise Ingress	24		25	24	24	17	16	6
Wall Noise Ingress	-3	15	5	1	-11	-12	-16	-23
Roof Noise Ingress	23	44	35	24	16	11	6	-2
Room Absorption Correction		4	4	3	3	3	3	1
Total Noise Ingress	35	53	46	37	31	24	22	11
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	0	-6	-2	-2	-2	-6	-4	-13

Bedroom (All Other Façades) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	58	61	56	54	53	54	51	48
Glazing Noise Ingress	17	34	30	21	11	1	-2	-11
Ventilation Noise Ingress	19		18	18	18	12	12	6
Wall Noise Ingress	-9	8	-2	-5	-17	-17	-19	-22
Roof Noise Ingress	17	37	29	18	11	6	3	-1
Room Absorption Correction		4	4	3	3	3	3	1
Total Noise Ingress	29	46	39	30	25	19	18	11
NR25	30	55	43	35	28	25	21	19
Exceedance of Criteria	-1	-9	-4	-5	-3	-6	-3	-8

Bedroom (All Other Façades) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Lmax	74	75	70	70	69	70	67	61
Glazing Noise Ingress	32	49	44	37	27	17	13	2
Ventilation Noise Ingress	35		32	34	34	28	28	20
Wall Noise Ingress	6	22	12	10	0	-1	-4	-9
Roof Noise Ingress	32	52	43	34	27	22	18	12
Room Absorption Correction		4	4	3	3	3	3	1
Total Noise Ingress	44	61	53	46	42	35	34	25
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-1	-6	-3	-3	-1	-5	-3	-9

Living Room (Rear Façade - Apartments 1 & 8) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	61	58	60	62	59	57	52	46
Glazing Noise Ingress	25	34	36	31	19	6	1	-11
Ventilation Noise Ingress	24	31	23	26	26	14	13	4
Wall Noise Ingress	4	13	10	10	-3	-6	-11	-17
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	28	36	36	32	26	14	12	2
NR25 & Moorhouse	30	47	41	35	28	25	21	19
Exceedance of Criteria	-2	-11	-5	-3	-2	-11	-9	-17

Bedroom (Rear Façade - Apartments 1 & 8) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	61	58	60	62	59	57	52	46
Glazing Noise Ingress	25	34	36	31	19	6	1	-11
Ventilation Noise Ingress	25	31	23	26	26	14	13	4
Wall Noise Ingress	3	13	10	10	-3	-6	-11	-17
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	30	39	39	35	29	17	15	5
NR25 & Moorhouse	30	47	41	35	28	25	21	19
Exceedance of Criteria	0	-8	-2	0	1	-8	-6	-14

Bedroom (Rear Façade - Apartments 1 & 8) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	53	55	53	55	50	48	44	42
Glazing Noise Ingress	18	31	29	24	10	-3	-7	-15
Ventilation Noise Ingress	17	28	16	19	17	5	5	0
Wall Noise Ingress	-4	10	3	3	-12	-15	-19	-21
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	23	36	32	28	20	8	7	1
NR20 & Moorhouse	25	47	39	30	23	20	16	14
Exceedance of Criteria	-2	-11	-7	-2	-3	-12	-9	-13

Bedroom (Rear Façade - Apartments 1 & 8) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Lmax	69	61	63	67	69	65	58	49
Glazing Noise Ingress	31	37	39	36	29	14	7	-8
Ventilation Noise Ingress	34	34	26	31	36	22	19	7
Wall Noise Ingress	9	15	13	15	7	2	-5	-15
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	38	42	42	39	39	25	21	7
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-7	-25	-14	-10	-4	-15	-16	-27

Living Room (Rear Façade - Apartment 7) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	63	60	62	64	61	59	54	48	0
Glazing Noise Ingress	27	36	38	33	21	8	3	-9	-57
Ventilation Noise Ingress	17	34	20	23	15	8	-7	-15	-63
Wall Noise Ingress	5	14	11	11	-2	-5	-10	-16	-63
Roof Noise Ingress									
Room Absorption Correction		-2	-3	-3	-4	-4	-4	-5	-7
Total Noise Ingress	27	39	38	33	21	10	3	-10	-59
NR25 & Moorhouse	30	47	41	35	28	25	21	19	17
Exceedance of Criteria	-3	-8	-3	-2	-7	-15	-18	-29	-76

Bedroom (Rear Façade - Apartment 7) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	63	60	62	64	61	59	54	48	0
Glazing Noise Ingress	24	33	35	30	18	5	0	-12	-60
Ventilation Noise Ingress	17	34	20	23	15	8	-7	-15	-63
Wall Noise Ingress	7	16	13	13	0	-3	-8	-14	-61
Roof Noise Ingress									
Room Absorption Correction		0	0	-1	-1	-1	-2	-3	-4
Total Noise Ingress	27	39	38	33	22	12	3	-8	-57
NR25 & Moorhouse	30	47	41	35	28	25	21	19	17
Exceedance of Criteria	-3	-8	-3	-2	-6	-13	-18	-27	-74

Bedroom (Rear Façade - Apartment 7) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	55	57	55	57	52	50	46	44	0
Glazing Noise Ingress	17	30	28	23	9	-4	-8	-16	-60
Ventilation Noise Ingress	11	31	13	16	6	-1	-15	-19	-63
Wall Noise Ingress	0	13	6	6	-9	-12	-16	-18	-61
Roof Noise Ingress									
Room Absorption Correction		0	0	-1	-1	-1	-2	-3	-4
Total Noise Ingress	20	36	31	26	13	3	-5	-12	-57
NR20 & Moorhouse	25	47	39	30	23	20	16	14	12
Exceedance of Criteria	-5	-11	-8	-4	-10	-17	-21	-26	-69

Bedroom (Rear Façade - Apartment 7) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Lmax	69	61	63	67	69	65	58	49	0
Glazing Noise Ingress	28	34	36	33	26	11	4	-11	-60
Ventilation Noise Ingress	23	35	21	26	23	14	-3	-14	-63
Wall Noise Ingress	11	17	14	16	9	4	-4	-13	-61
Roof Noise Ingress									
Room Absorption Correction		0	0	-1	-1	-1	-2	-3	-4
Total Noise Ingress	31	41	39	36	30	18	7	-7	-57
NR40	45	67	56	49	43	40	37	34	33
Exceedance of Criteria	-14	-26	-17	-13	-13	-22	-30	-41	-90

Living Room (Rear Façade - Apartments 13 & 14) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	56	53	55	57	54	52	47	41
Glazing Noise Ingress	19	23	25	26	11	2	1	-17
Ventilation Noise Ingress	13	19	11	14	14	2	1	-8
Wall Noise Ingress	-5	5	2	2	-11	-14	-19	-25
Roof Noise Ingress	17	30	28	21	12	4	-1	-8
Room Absorption Correction		4	4	3	3	3	2	1
Total Noise Ingress	28	38	37	34	23	14	11	0
NR25 & Moorhouse	30	47	41	35	28	25	21	19
Exceedance of Criteria	-2	-9	-4	-1	-5	-11	-10	-19

Bedroom (Rear Façade - Apartments 13 & 14) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	56	53	55	57	54	52	47	41
Glazing Noise Ingress	20	25	27	28	13	4	3	-15
Ventilation Noise Ingress	16	22	14	17	17	5	4	-5
Wall Noise Ingress	-4	5	2	2	-11	-14	-19	-25
Roof Noise Ingress	16	30	28	21	12	4	-1	-8
Room Absorption Correction		4	4	4	3	3	3	2
Total Noise Ingress	29	39	37	35	26	15	13	2
NR25 & Moorhouse	30	47	41	35	28	25	21	19
Exceedance of Criteria	-1	-8	-4	0	-2	-10	-8	-17

Bedroom (Rear Façade - Apartments 13 & 14) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	48	50	48	50	45	43	39	37
Glazing Noise Ingress	13	22	20	21	4	-5	-5	-19
Ventilation Noise Ingress	8	19	7	10	8	-4	-4	-9
Wall Noise Ingress	-11	2	-5	-5	-20	-23	-27	-29
Roof Noise Ingress	9	27	21	14	3	-5	-9	-12
Room Absorption Correction		4	4	4	3	3	3	2
Total Noise Ingress	22	36	30	28	17	6	5	-2
NR20 & Moorhouse	25	47	39	30	23	20	16	14
Exceedance of Criteria	-3	-11	-9	-2	-6	-14	-11	-16

Bedroom (Rear Façade - Apartments 13 & 14) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Lmax	69	61	63	67	69	65	58	49
Glazing Noise Ingress	31	32	34	37	27	17	13	-8
Ventilation Noise Ingress	30	30	22	27	32	18	15	3
Wall Noise Ingress	7	13	10	12	4	-1	-8	-17
Roof Noise Ingress	27	37	35	30	27	17	9	-1
Room Absorption Correction		4	4	4	3	3	3	2
Total Noise Ingress	41	46	45	45	41	28	24	9
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-4	-21	-11	-4	-2	-12	-13	-25



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