Residential Noise Survey & Assessment

Site Address: James Farm, Ruabon, Wrexham, LL14 6DW

Client Name: Hughes O'Hanlon Architects

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Delivering sustainable development by promoting good health and well-being through effective management of noise.

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for the conversion of existing farm buildings into a number of dwellings for short-term holiday rental ('the proposed development') at James Farm, Ruabon, Wrexham, LL14 6DW ('the site').

The applicant has received conditional approval for planning application reference RUA P/2020/0576 ('the application') from Wrexham County Borough Council. This report has been prepared as evidence to discharge a planning condition imposed by the Local Planning Authority ('LPA').

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:

- The LPAs conditional commentary
- Planning Guidance (Wales), Technical Advice Note (TAN) 11 - Noise
- 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.

1.2 Proposal Brief

The proposal is for the refurbishment of three farm buildings to form five short-term holiday dwellings. The figure below shows the proposed development.

At this stage, it is unknown whether there will be any items of externally fixed mechanical plant at the development. Therefore, in order to form a robust approach, the impact of this will be assessed in the event proposals confirm that plant will be installed.



Drawing Ref No. JFR-LAW-X-X-DR-A-069002-P02 from 'Lawray Architects Penseiri'

Figure 1 – Proposed Development

1.3 Local Planning Authority & Background

The application has gained conditional planning approval. In relation to noise, the following has been requested:

"The development site is in close proximity to the A483, and the developer is therefore advised to carry out a noise survey in order to determine noise levels for both day (07:00 – 23:00 hours) and night (23:00 – 07:00 hours) having regard to Planning Guidance (Wales), Technical Advice Note (TAN) 11 – Noise.

The report of the noise survey findings should include:

a. *Noise levels arising from day/night-time activities in the vicinity of the proposed development site and the impact upon the proposed accommodation, and*
b. *A detailed scheme of noise insulation and / or attenuation measures so designed to safeguard the amenity of the future occupants of the proposed accommodation hereby approved."*

2. Environmental Noise Survey

2.1 Measurement Methodology

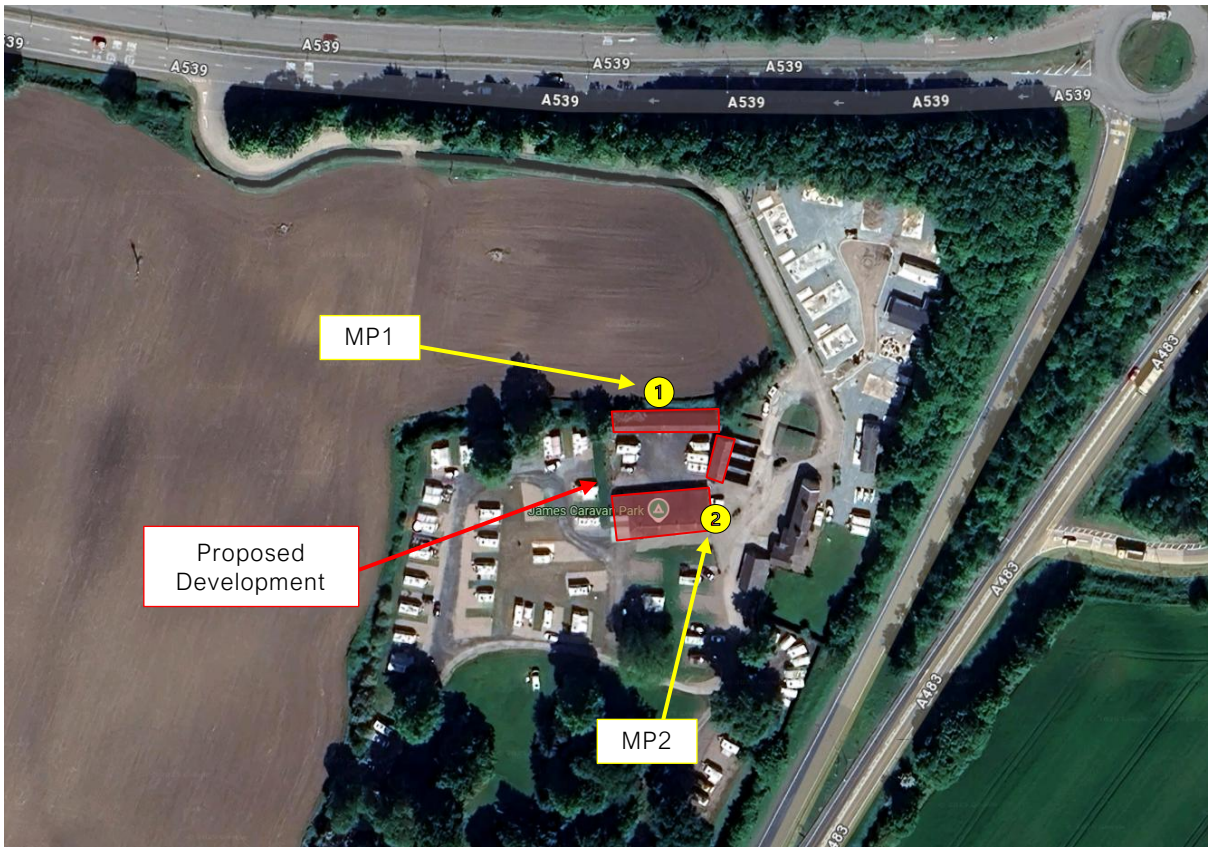
An unattended environmental noise survey was undertaken at the site to determine the existing noise climate affecting the proposed development. Outlined in the following table are the measurement dates and particulars.

All measurements were undertaken under façade conditions; the results have been corrected to convert them to a free-field level. A 130mm diameter windshield was fitted to each microphone. The equipment was field calibrated before and after the survey; negligible drift was noted.

Location	Survey Dates	Measurement Particulars
MP1	15 – 18/12/2025	Equipment mounted on a tripod at 1.5m above ground, approximately 2m away from the northern façade of the existing farm building.
MP2		Equipment mounted to ironworks approximately 3m above ground and located approximately 1.5m from the south-eastern façade of an existing farm building.

Table 1 – Measurement Methodology

Outlined in the figure below are the site surroundings and measurement locations.



Imagery ©2025 Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2025

Figure 2 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The dwellings will be located within the wider James Caravan Park and form part of the short-term holiday let offer for the site.

Access to the caravan park is off the A539 which is located approximately 95m away from the nearest proposed dwelling to the north. The slip road off the A483 forms the eastern site boundary and is located approximately 55m away from the nearest proposed dwelling. The southern and western boundaries of the site are occupied by existing farmland use and are separated from the proposed dwellings by existing caravan holiday plots.

The acoustic environment was deemed to be subjectively moderate in level, and the noise profile was dominated by road traffic noise emissions the A539 and A483.

2.3 Environmental Noise Survey Results

Ambient and Maximum Noise Levels

Presented in the following table is a summary of the ambient sound levels measured during the unattended noise survey. The typical maximum sound levels measured over a 2-minute sampling period are also presented. The time history results can be found in Appendix D.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, dB)							Overall (dBA)
		63	125	250	500	1k	2k	4k	
MP1	$L_{eq,16hr}$ (Day)	58	52	46	44	51	46	35	53
	$L_{eq,8hr}$ (Night)	52	46	40	40	45	40	28	47
	$L_{Fmax,2min}$ (Night)	64	63	59	53	57	51	39	60
MP2	$L_{eq,16hr}$ (Day)	57	51	48	51	54	49	51	58
	$L_{eq,8hr}$ (Night)	52	45	42	46	49	43	32	51
	$L_{Fmax,2min}$ (Night)	59	62	59	58	61	55	44	63

Table 2 – Sound Level Results Summary

Background Sound Levels

Background sound levels were derived via statistical analysis of the measured $L_{A90,20min}$ data. Background sound levels were chosen depending on the range and distribution of the recorded $L_{A90,20min}$ sound levels. Full noise survey time histories and histograms can be found in Appendix C.

Location	Period	Typical Background Sound Level $L_{A90,T}$ (dB)
MP1	Day: 07:00 – 23:00	50
	Night: 23:00 – 07:00	30
MP2	Day: 07:00 – 23:00	52
	Night: 23:00 – 07:00	34

Table 3 – Background Sound Level Results Summary

As can be seen above, the typical night-time background sound level is 30dB $L_{A90,20min}$ at MP1, which is considered particularly low. In such circumstances, it is commented in BS4142 that 'absolute sound levels may as, or more relevant than the margin by which the rating sound level exceeds the background', and that other guidance may considered.

At night, noise impact is likely to occur inside dwellings due to partially open windows for ventilation and cooling. As such, a target criterion of approximately 33dBA for cumulative specific sound levels outside the most affected receptor windows is deemed appropriate; this would ensure an internal noise level of approximately 20dBA is not exceeded, assuming a partially open window provides approximately 13dB of attenuation.

At approximately 20dBA internally, it would be it would be highly unlikely for the specific noise emissions to be audible over any internal residual noise or external residual noise ingress, or for any associated acoustic features to be perceptible. Thus, the risk of any adverse impact would be low.

The above background sound levels will be used to inform the basis of any BS4142 assessments.

2.4 Summary

Given the proximity of dwellings to one another and to keep consistency across to the development, the highest external ambient noise levels measured at either MP1 or MP2 will be used to form the noise break-in assessment.

In terms of background sound levels, the lowest figures highlighted in Table 3 and the subsequent commentary will be used to form any BS4142 noise impact assessments.

Please note that it is assumed there is no significant noise breakout from surrounding caravan lots that would exceed the noise levels presented in Table 2 over a continuous 16-hour daytime and 8-hour night-time period.

In doing so, the assessment will have considered worst-case noise impacts and ensure a robust assessment is carried out.

3. Noise Break-in Assessment and Sound Insulation Scheme

3.1 Internal Noise Level Criteria

The noise profile of the area is predominantly "anonymous" steady state noise sources e.g., transport. The following table outlines the internal acoustic design criteria used in the following assessment.

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}*

Notes:
[1] *The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.*
[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".*
[3] *BS8233:2014 states: "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved".*
[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.*
[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 4 – Internal Acoustic Design Criteria

3.2 Determined External Noise Levels

The determined external free-field noise levels incident on the facades of the proposed development have been determined and are presented on the table and in the following figure.

Elevation	Daytime Noise Levels (dB) (07:00 – 23:00)	Night-time Noise Levels (dB) (23:00 – 07:00)	
	Ambient ($L_{Aeq,16hr}$)	Ambient ($L_{Aeq,8hr}$)	Maximum (L_{AFmax})
All Facades	58	51	63

Table 5 – Determined External Free-field Noise Levels

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.

3.3 Glazing and Whole Dwelling (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 D.

Description	Octave Frequency Band (Hz, dB)							Overall (dB)
	63	125	250	500	1k	2k	4k	
All Facades								
6mm Glass / 12mm Cavity / 4mm Glass	20	21	20	26	38	37	39	32 R_W (-4 C_{tr})
Titon Standard Vent + C25 (2 No. Trickle) (D_{ne})[2]	--	36	38	36	32	37	39	35 $D_{ne,W}$ (-2 C_{tr})

Notes:
[1] *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.*
[2] *Please note that the above performance requirements for the trickle vents should be achieved with them in the 'open' position.*

Table 6 – Glazing & Background Ventilation Specification

3.4 Remainder of External Envelope

In order to not downgrade the performance of the façade, the remaining elements of the external envelope e.g. roof & external wall should be designed to achieve 10dB above the glazing sound insulation performances presented above (42dB R'_w).

Please note that this is not an onerous requirement and standard masonry walls and pitched roof details would meet this requirement.

4. 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.

4.1 Overheating Screening Assessment

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 below alongside an assessment.

Period	Proposed Criteria (dB)		External Level (dB)	
	Internal	External	Measured	Exceedance
All Façades				
Daytime ($L_{Aeq,16hr}$)	50 [1]	63	58	-5
Night-time ($L_{Aeq,8hr}$)	42 [1]	55	51	-4
Night-time ($L_{AFmax,T}$) [2]	65 [1]	78	63	-15

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 7 – Overheating Screening Assessment

The noise levels determined on the façades are below the threshold criteria. Given this, it is thought that opening windows can be used as the primary means of mitigating overheating. However, it must also be ensured that all ventilation is compliant with the requirements of Approved Document F.

5. BS4142 Noise Impact Assessment

The proposed plant equipment specification has not yet been finalised. Consequently, plant noise limit levels have been defined to ensure that the noise emissions do not exceed the background sound levels at the closest NSRs should fixed plant be required.

The limit levels are inclusive of any BS4142 rating penalties that should be applied to account for audible characteristics of the noise which could be deemed to cause increased annoyance, such as intermittency, impulsivity, or tonality. The limit levels have been calculated for the daytime and night-time periods, depending on when the plant will be operational.

The calculated plant noise limit levels are shown in the table below.

Description	Daytime Period (dBA)	Night-time Period (dBA)
Background Sound Level ($L_{90,T}$)	50	33
Cumulative Plant Noise Limit Level at NSR ($L_{r,Tr}$)	50	33
BS4142 Assessment Outcome	'Low Impact, dependant on context'	
NPSE & NPPF Assessment Outcome	'No Observed Adverse Effect Level' ('NOAEL')	

Table 8 – BS4142 External Plant Noise Limit Levels

As can be seen in the assessment above, provided the plant limit levels are adhered to, all noise emissions from the external plant units would be controlled to not exceed the existing background sound levels.

When assessed in accordance with BS4142, the above would indicate 'low impact, dependant on context', and when assessed with the NPPF and NPSE this would be classed as 'No Observed Adverse Effect Level' ('NOAEL').

Once the plant equipment is fully specified the associated noise emissions should be calculated by an appropriately qualified person to ensure that the limit levels are achieved.

6. Conclusion and Action Plan

The proposed development has been assessed against the adopted 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 proposed glazing and background ventilation system, or a suitable alternative, should be installed as shown in section 3.
2. An overheating assessment is presented in section 4.
    a. On all facades, the external noise levels are low enough such that openable windows can be utilised as the ventilation strategy during periods of overheating.
3. Where any external fixed items of plant are to be installed, a noise level limit has been set in line with BS4142, and this is detailed in section 5.

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 $p0$ is the reference sound pressure (20 µPa)
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 $p0$ is the reference sound pressure (20 µPa)
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), updated 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 9 – 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 time 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 0: Overheating (2021)

Approved Document O states the following in relation to noise:

1. In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
2. Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
    a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
    b. 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).
3. Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

    NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).B.6 - Acoustics Ventilation and Overheating – Residential Design Guide 2020

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.

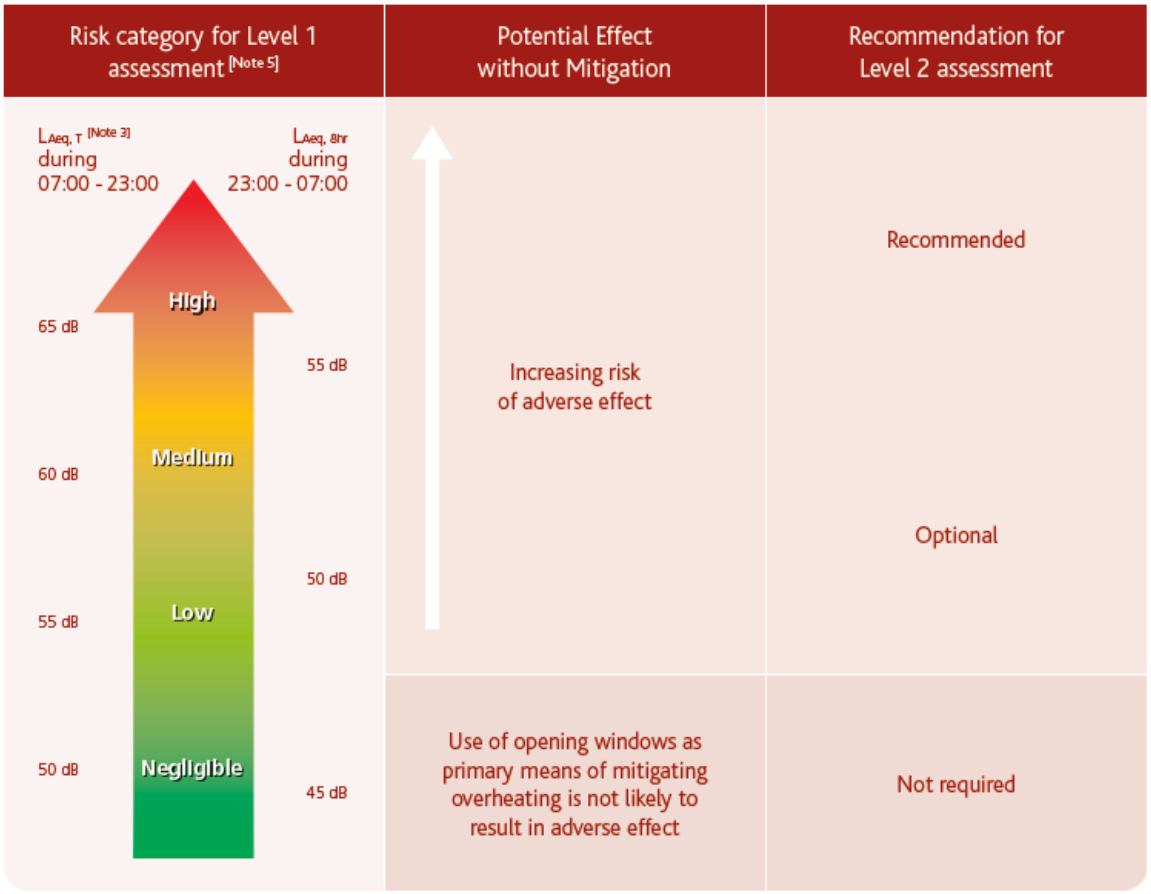


Table 3-2 of AVO Guide (2020)

Figure 3 – 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.

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 10 – 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.

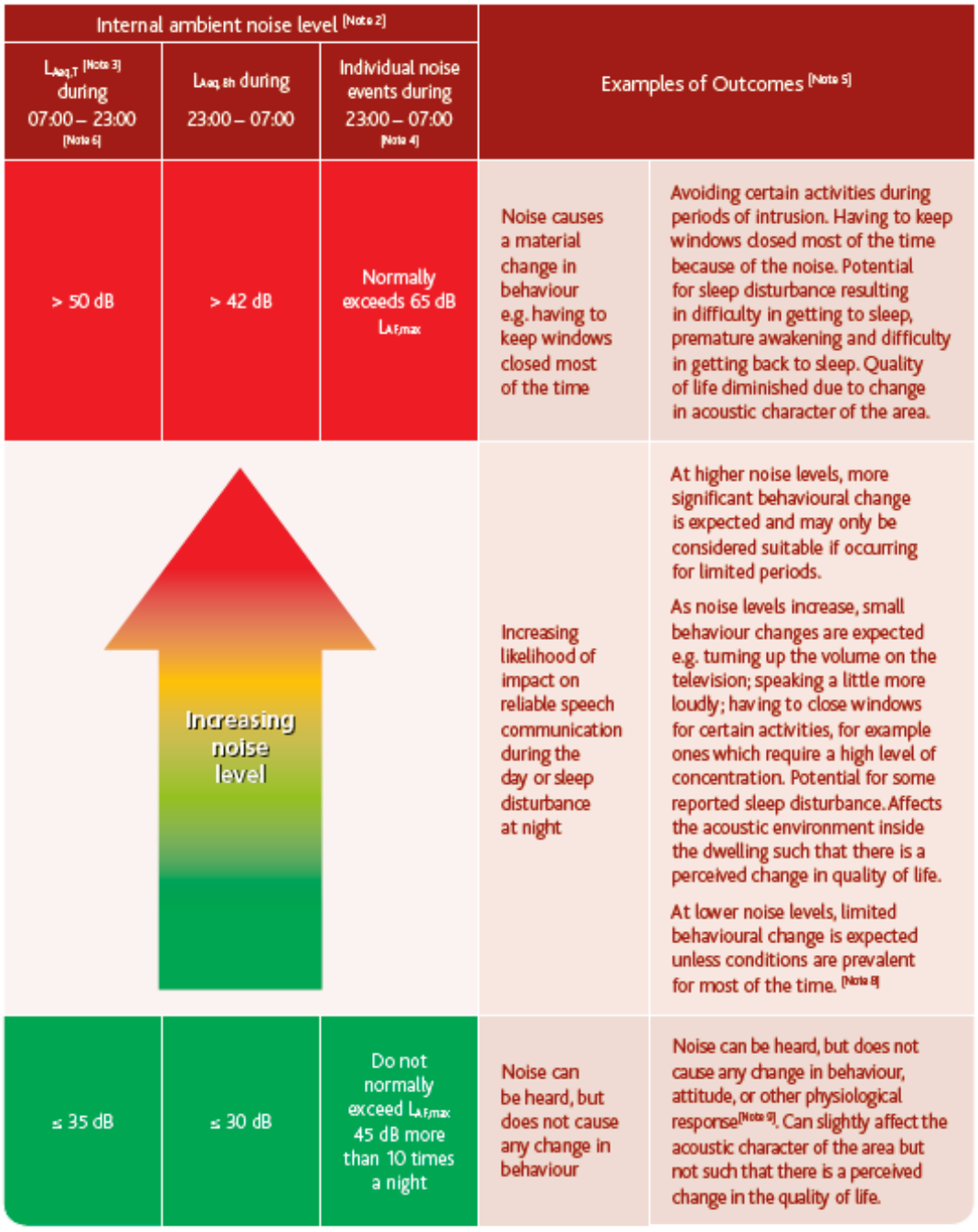
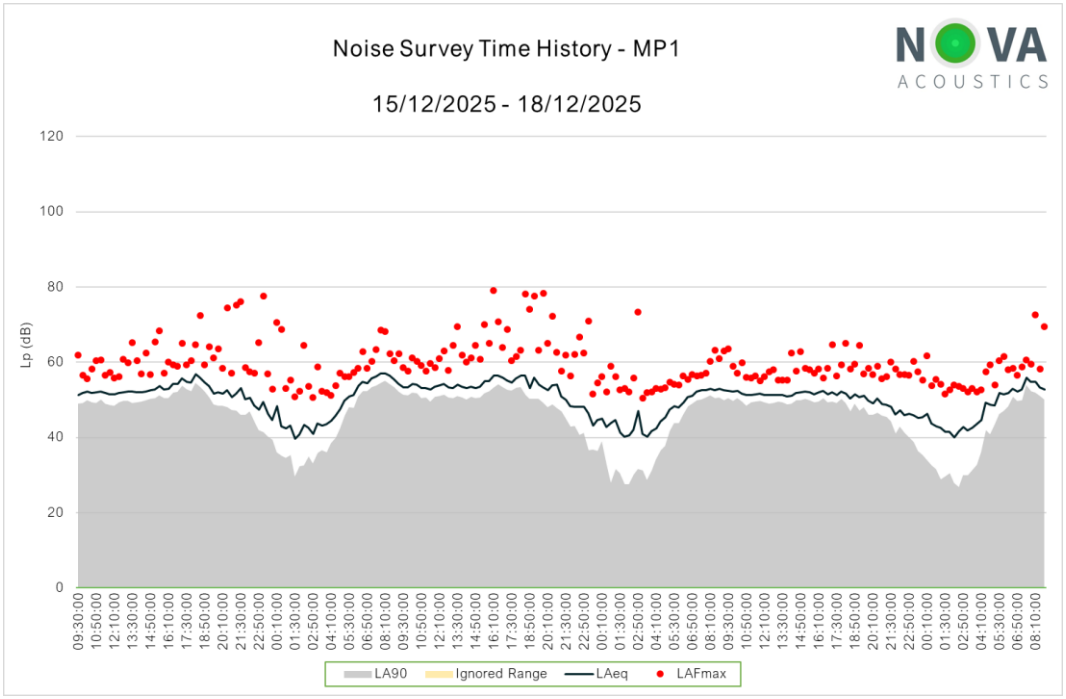


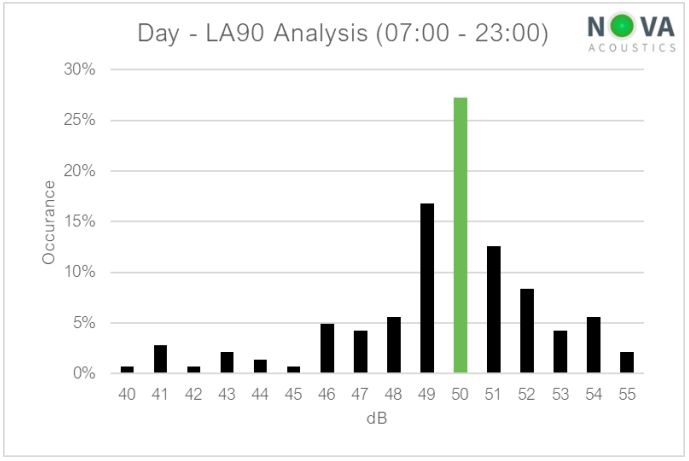
Table 3-3 of AVO Guide (2020)

Figure 4 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Environmental Survey

C.1 – Time History Noise Data





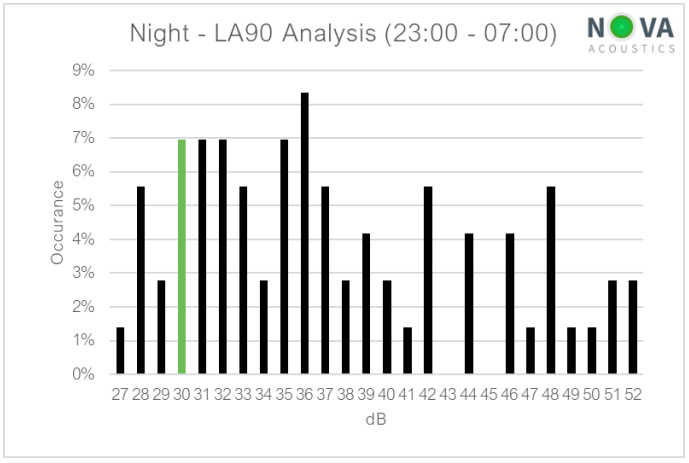


Figure 5 – MP1 Noise Survey Time History

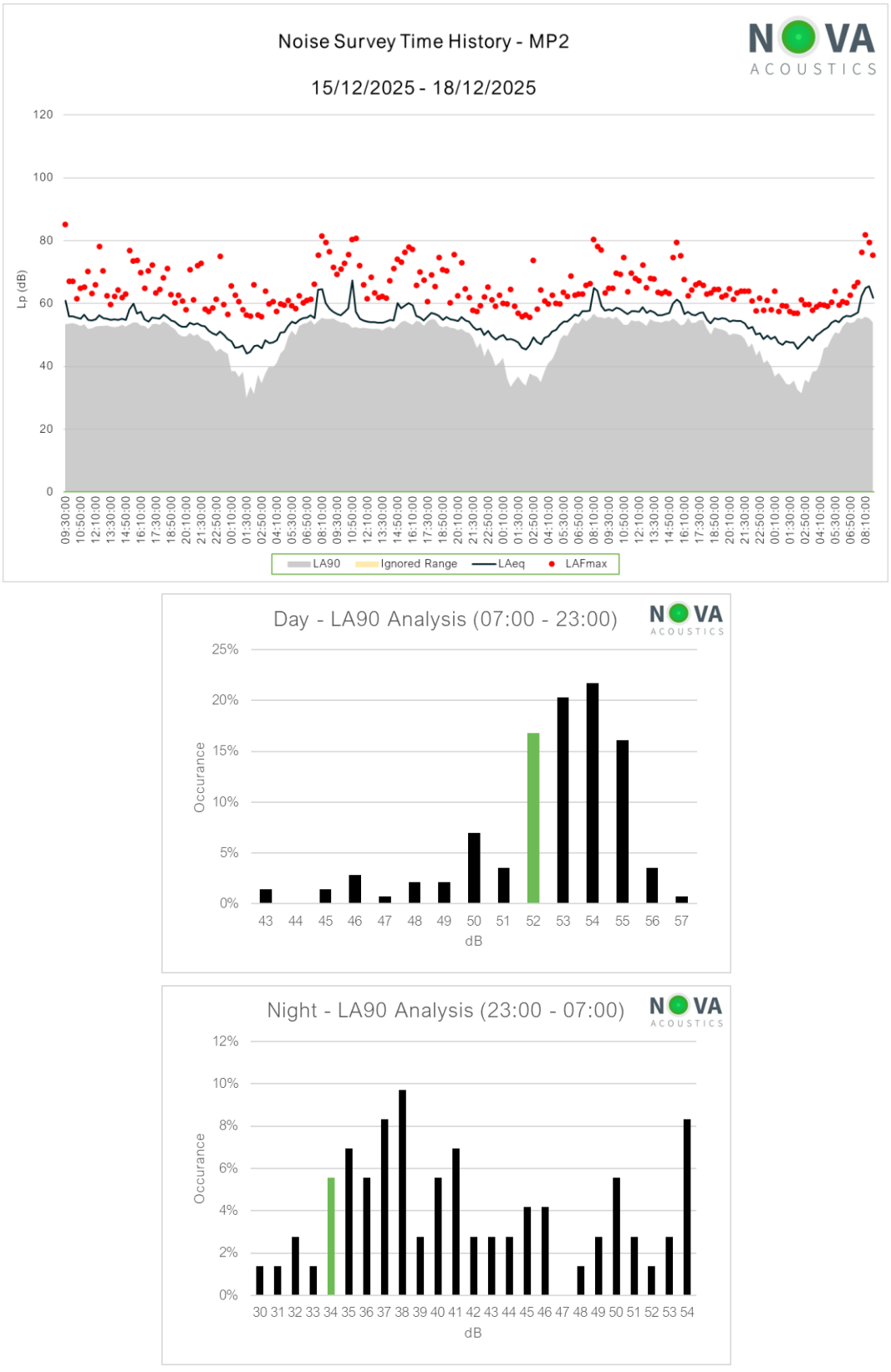


Figure 6 – MP2 Noise Survey Time History

C.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV9777 Class 1 Sound Level Meter	34826	≤0.2
CESVA CB006 Class 1 Calibrator	901955	
Svantek SV971A Class 1 Sound Level Meter	127628	≤0.2
CESVA CB006 Class 1 Calibrator	901955	

Table 11 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation. 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.

C.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 – Newbridge (Approx. 2.2km NE of Site)				
Time Period	Air Temp (^{0}C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
15/12/25: 00:00 – 23:59	5.7 – 10.3	0.0 – 3.0	SSE	0.0 – 0.8
16/12/25: 00:00 – 23:59	-0.1 – 8.4	0.0	ESE	0.0 – 0.9
17/12/25: 00:00 – 23:59	0.3 – 10.5	0.0 – 4.8	S	0.0 – 1.3
18/12/25: 00:00 – 23:59	6.5 – 9.7	0.0	SSE	0.0 – 0.9

Table 12 – Survey Weather Conditions

Based on a review of the time history data, the rainfall identified did not adversely impact the measurements. Therefore, these periods have been retained within the survey.

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.
- Technical drawings have not been provided at this stage and so window percentage areas of 40% and 30% have been allowed for the living rooms and bedrooms, respectively. Where these figures increase as the design develops, these calculations will need to be revised.
- 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 5000mm^2 per habitable room has been used in the calculations, which equates to 2no. trickle vents (2500mm^2 each).

Living Room

Description	Height (m)	Width (m)	Length (m)	Volume (m3)	Area (m2)
Room	2.5	4	4	40.0	72.0
Single Aspect Façade	--	--	--	--	10.0
Glazing	2	--	2.0	--	4.0
Wall Element	--	--	--	--	6.0
Area of Roof / Ceiling	--	--	--	--	16.0
No. of Ventilators	2				
Room in Roof?	Yes				

Bedroom

Description	Height (m)	Width (m)	Length (m)	Volume (m3)	Area (m2)
Room	2.5	3.0	3.0	22.5	48.0
Single Aspect Façade	--	--	--	--	7.5
Glazing	1.12	--	2.0	--	2.2
Wall Element	--	--	--	--	5.3
Area of Roof / Ceiling	--	--	--	--	9.0
No. of Ventilators	2				
Room in Roof?	Yes				

Living Room Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	58	57	51	48	51	54	49	51	50
Glazing Noise Ingress	17	29	22	20	17	8	4	4	3
Ventilation Noise Ingress	22		14	9	14	21	11	11	10
Wall Noise Ingress	-2	10	6	0	-5	-7	-17	-15	-16
Roof Noise Ingress	14	34	24	12	9	6	1	2	1
Room Absorption Correction		4	4	3	3	3	3	2	0
Total Noise Ingress	**30**	**42**	**33**	**27**	**25**	**27**	**18**	**17**	**14**
NR30	35	59	48	39	33	30	26	24	22
Exceedance of Criteria	-5	-17	-15	-12	-8	-3	-8	-7	-8

Bedroom Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	58	57	51	48	51	54	49	51	50
Glazing Noise Ingress	17	28	21	19	16	7	3	3	2
Ventilation Noise Ingress	24		16	11	16	23	13	13	12
Wall Noise Ingress	-1	11	7	1	-4	-6	-16	-14	-15
Roof Noise Ingress	14	33	23	11	8	5	0	1	0
Room Absorption Correction		5	4	4	4	4	3	2	1
Total Noise Ingress	**32**	**42**	**33**	**28**	**26**	**30**	**20**	**19**	**16**
NR30	35	59	48	39	33	30	26	24	22
Exceedance of Criteria	-3	-17	-15	-11	-7	0	-6	-5	-6

Bedroom Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Leq,T	51	52	45	42	46	49	43	32	32
Glazing Noise Ingress	11	23	15	13	11	2	-3	-16	-16
Ventilation Noise Ingress	19		10	5	11	18	7	-6	-6
Wall Noise Ingress	-6	6	1	-5	-9	-11	-22	-33	-33
Roof Noise Ingress	8	28	17	5	3	0	-6	-18	-18
Room Absorption Correction		5	4	4	4	4	3	2	1
Total Noise Ingress	**26**	**37**	**27**	**22**	**21**	**25**	**14**	**0**	**-2**
NR25	30	55	43	35	28	25	21	19	17
Exceedance of Criteria	-4	-18	-16	-13	-7	0	-7	-19	-19

Bedroom Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k	8k
Measured Lmax	63	59	62	59	58	61	55	44	42
Glazing Noise Ingress	25	30	32	30	23	14	9	-4	-6
Ventilation Noise Ingress	31		27	22	23	30	19	6	4
Wall Noise Ingress	8	13	18	12	3	1	-10	-21	-23
Roof Noise Ingress	21	35	34	22	15	12	6	-6	-8
Room Absorption Correction		5	4	4	4	4	3	2	1
Total Noise Ingress	**39**	**44**	**44**	**39**	**33**	**37**	**26**	**12**	**8**
NR40	45	67	56	49	43	40	37	34	33
Exceedance of Criteria	-6	-23	-12	-10	-10	-3	-11	-22	-25


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