



Residential Noise Assessment

Site Address: 10 Ffordd Caerfyrddin, Wrexham, LL11 2LD

Client Name: [REDACTED]

Project Reference No: NP-009886



Authorisation and Version Control

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Amendment History

Revision	Summary of Amendments
01	--

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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 a new build residential development ('the Proposed Development') at 10 Ffordd Caerfyrddin, Wrexham, LL11 2LD ('the Site').

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.

Standards, Legislation, Policy & Guidance

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

- Planning Policy for Wales (PPW, 2021)
- Technical Advice Note 11 (TAN 11)
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings'
- ProPG: 'Planning and Noise 2017' (including supplementary documents 1 & 2).
- Approved Document O: Overheating (2021)
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide)

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

Proposal Brief

The proposal is for the demolition of an existing garage and the erection of a detached 3-bedroom residential dwelling-house. The figure below shows the proposed development.



Drawing Ref No. W184/004 from 'Blueprint Architectural Services'

Figure 1 – Proposed Development

2. Environmental Noise Survey

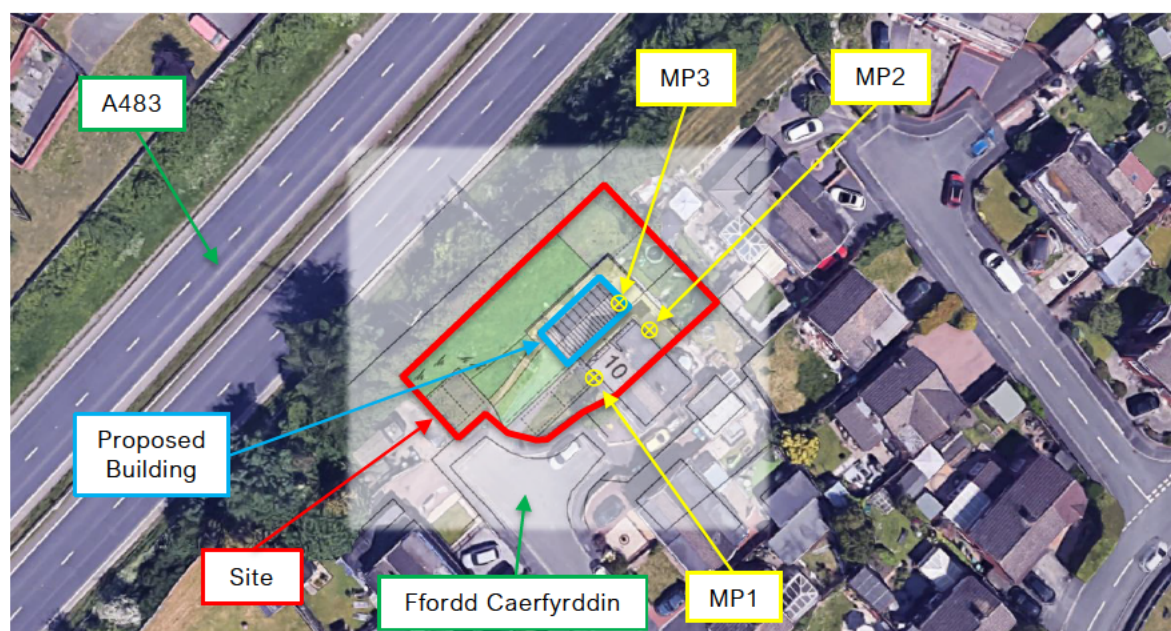
Measurement Methodology

The following table outlines the measurement dates and particulars.

Location	Survey Dates	Measurement Particulars
MP1	05/09/2023 – 07/09/2023	Equipment mounted protruding from a first-floor window at 1.5m distance from the building façade on Ffordd Caerfyrddin.
MP2	05/09/2023 – 07/09/2023	Equipment mounted protruding from a rear first-floor window at 1.5m distance from the building façade.
MP3	07/09/2023	Equipment mounted on a tripod atop the existing garage at a height of 4m from ground level. This is considered to be the approximate location of the nearest façade of the proposed development.

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

Context & Subjective Impression

The development site is located adjacent to the existing dwelling 10 Ffordd Caerfyrddin, in the approximate location of the existing garage. The area surrounding the site consists primarily of residential dwellings.

Situated to the west of the proposed development is A483 dual carriageway, which is considered to be the dominant noise source in the surrounding area.

Environmental Noise Survey Results

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)	$L_{AFmax,1min}$ (dB)
		125	250	500	1k	2k	4k		
MP1	$L_{eq,16hr}$ (Day)	56	56	59	63	56	41	64	--
	$L_{eq,8hr}$ (Night)	51	52	53	56	50	38	58	70
MP2	$L_{eq,16hr}$ (Day)	54	52	54	56	49	39	58	--
	$L_{eq,8hr}$ (Night)	48	46	46	48	42	31	50	62

Table 2 – Sound Level Results Summary

Short-Term Noise Survey

The following table outlines the short-term noise measurement recorded at MP3.

Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$ dB)						$L_{Aeq,T}$ (dB)
	125	250	500	1k	2k	4k	
07/09/2023: 11:51 – 12:27 (Day)	61	57	59	62	55	43	64

Table 3 – Short-Term Monitoring Results – MP3

As can be seen in Table 3, the short-term measurements recorded at the proposed façade location (MP3) are consistent with those measured at MP1. Further analysis of the measurements shows that the levels at MP1 are approximately 1dB lower during the equivalent time period (11:45 – 12:30) as the values measured at MP3. As such, the $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ levels at MP1 will be increased by 1dB and used for the assessment at the proposed development site. This is considered to reflect the closer separation distance from the proposed development to the A483 road traffic and will present a worst-case scenario to further safeguard future occupants.

3. TAN 11: Noise Assessment

TAN 11 is used to categorise noise level for proposed development sites. Annex A offers four noise exposure categories (NECs) for dwellings. The categories range from A-D, where A is the lowest noise levels and D is the highest. The tables below provide a breakdown of the NECs and relative advice.

Time	Noise Exposure Category (dB L _{Aeq,T})			
	A	B	C	D
07:00 - 23:00	<55	55-63	63-72	>72
23:00 – 07:00	<45	45-57	57-66	>66

Table 4 – TAN 11 Threshold for Road Traffic Noise

A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 5 – TAN 11 Noise Exposure Categories

In order to categorise the proposed development site, we must compare the measured levels with those presented in Table 8, above. As can be seen in Section 2 the noise levels incident upon the proposed facades are predicted to be 65dB L_{Aeq,16hr} during the daytime period and 58 dB L_{Aeq,8hr} during the night-time period. As such, the proposed development site would be classified under noise exposure category C.

4. Noise Break-in Assessment and Sound Insulation Scheme

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 $L_{Aeq,16hr}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 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} 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 3: BS8233 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 5dB and reasonable internal conditions still achieved .

Note 4: BS8233 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 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 6 – 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.

Glazing and Background Ventilation Specification

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria. At this stage of the development, internal floor plans are not available. Therefore, indicative noise break-in calculations have been undertaken using nominal room dimensions and façade elements. Further details regarding the break-in calculations can be found in Appendix E.

Description	Octave Frequency Band (Hz, dB)							Overall (dB)	
	63	125	250	500	1k	2k	4k		
6mm Glass / 16mm Air Cavity / 4mm Glass	20	21	20	26	38	37	39	31 (R_w)	27 ($R_w + C_{tr}$)
Titon Standard Vent + C75 (2 No. Trickle)	--	38	36	35	42	39	42	35 ($D_{ne,w}$)	34 ($D_{ne,w} + C_{tr}$)

Table 7 – Glazing and Ventilation Specification (All Living Rooms and Bedrooms)

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.

5. Open Window Noise Break-In Assessment

Internal Noise Levels with Open Windows Criteria

The AVO Guide advises that if windows are open regularly to provide higher rates of ventilation to mitigate overheating, this will lead to elevated internal noise levels which could lead to undesirable living conditions. If windows are opened rarely the occupants may be able to tolerate elevated noise levels due to the inherent benefits of natural ventilation. This assessment will firstly assess whether the internal noise level criteria can be achieved with open windows. The AVO Guide provides criteria for both daytime and night-time periods which shown below.

Windows	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	AVO Guide Table 3-3 Example Outcomes	AVO Guide Table 3 – 2 Recommendation for Level 2 Assessment
Rarely Open	50dB L _{Aeq,16hour}	42dB L _{Aeq,8hour} Normally Exceeds 65dB L _{AF,max}	Noise causes a material change in behaviour e.g., having to keep windows closed most of the time	Recommended
Increasing Noise Level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	Optional
Often Open	40dB L _{Aeq,16hour}	35dB L _{Aeq,8hour} Normally Exceeds 45dB L _{AF,max}	Noise can be heard, but does not cause any change in behaviour	Not Required

Table 8 – AVO Guide Open Window Criteria

To advise if openable windows can be used as the ventilation strategy (whilst maintaining reasonable internal noise levels), an open window assessment will be provided. The suitability of the internal noise levels will be based upon the internal noise criteria above and an open window providing 13dB attenuation. If required, an alternative ventilation strategy compliant with Approved Document F will be proposed.

Open Window Assessment

This assessment will firstly consider whether the internal noise level criteria from Table 3 – 3 of the AVO Guide can be achieved with open windows.

External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
65dB L _{Aeq,16hr} (Day)	53	+12	63	+2
59dB L _{Aeq,8hr} (Night)	48	+11	55	+4
70dB L _{AF,max} (Night)	58	+12	78	-8

Table 9 – Open Window Assessment

The external noise levels exceed the AVO Guides 'Rarely Open' criteria which means that windows cannot be used for the primary means of ventilation and an alternate ventilation strategy is required that is capable of a higher rate of ventilation. A mechanical extract ventilation system should be installed to provide 'Whole Dwelling Ventilation' in accordance with Approved Document F. It is understood that continuous MEV extract fans installed in accordance with the specified trickle ventilators to allow the ingress of fresh air will be adequate. The ventilation system should be designed by an appropriately qualified person to ascertain compliance with the relevant Building Regulations. Special consideration should be given to 1.5 to 1.7 of Approved Document F to assist in the design of the ventilation system and to ensure the self-generated noise levels from the MEV extract fans to not exceed the specified criteria.

6. External Noise Level Assessment

The following section analyses the external amenity area noise levels across the proposed development.

It must be noted that there is an existing berm (approx. 3m in height) that extends along the north-western boundary, separating the site from the primary source of noise (A483). All long-term noise measurements have been undertaken above the level of the berm and therefore do not include any screening provided by the berm.

It is proposed that the external amenity area is located directly behind the berm, with the potential to extend the existing garden area further to the north-west via installation of a retaining wall (and therefore maintaining the height difference between the external amenity area and the top of the berm). Accordingly, calculations have been undertaken to predict the loss associated with the additional path difference in accordance with Chart 9b of CRTN. The receiver point is assumed to be in the centre of the proposed amenity area (5m) at a height of 1.5m above floor level.

It should be noted that there are other garden areas associated with existing dwellings in the surrounding area that are at a similar separation distance from the A483 and therefore it is anticipated that suitable external noise levels can be achieved at the proposed development.

The table below outlines the predicted noise level based on the above assumptions. Full calculations can be found in Appendix F.

Noise Level without Mitigation (dB)	Barrier Attenuation (dB)	Noise Level with Mitigation (dB)	BS8233 Criteria (dB)	Exceedance (dB)
65dB $L_{Aeq,16hr}$	-16	49	50 – 55 $L_{Aeq,16hr}$	-1

Table 10 – External Amenity Area Noise Level Assessment

Table 10 above, shows that the predicted noise level falls below the BS8233 criteria after calculating the mitigation provided by the existing berm. Therefore, it is considered that suitable levels are achievable within amenity areas at the site. As such, no additional mitigation measures are deemed necessary.

7. 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.

Although the site is defined by Noise Exposure Category C within the TAN 11 assessment, it is considered that suitable internal and external noise levels can be achieved when incorporating good acoustic design.

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 4.
2. A mechanical ventilation system should be installed to provide 'Whole Dwelling Ventilation' in accordance with Approved Document F.
3. The height difference between the amenity space and the top of the berm should be maintained to allow for sufficient screening effects from road traffic noise along the A483.

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 – Planning Policy Wales (2021)

Government policy on noise is set out in the Planning Policy Wales (PPW), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 2, paragraph 2.27 states:

Planning authorities should ensure that social, economic, environmental, and cultural benefits are considered in the decision-making process and assessed in accordance with the five ways of working to ensure a balanced assessment is carried out to implement the Well-being of Future Generations Act and the Sustainable Development Principle. There may be occasions when one benefit of a development proposal or site allocation outweighs others, and in such cases robust evidence should be presented to support these decisions, whilst seeking to maximise contributions against all the well-being goals.

Paragraph 3.24 states:

Where significant effects on human health are likely to arise as a result of development plans or individual development proposals, environmental impacts should be considered in full knowledge of the likely consequences for health. Information to assess potential impacts on health can be required through various mechanisms, such as sustainability appraisal of development plans and environmental impact assessments, and where relevant, health impacts should be incorporated into such assessments. In general, the most effective and collaborative ways of working will require shared and integrated approaches to evidence gathering and assessments. Health Impact Assessment¹³ makes a valuable contribution towards plan making. It may be useful when proposing or making decisions on new development along with evidence collected by Public Service Boards.

Evidence on health impacts can help the planning system develop stronger and more coherent approaches towards maximising health and well-being.

B.2 – Technical Advice Note (Wales) 11:1997 Noise

The Technical Advice Note (Wales) (TAN) should be read in conjunction with “Planning Guidance (Wales): Planning Policy, Technical Advice Notes, and circulars.

“This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.”

The Technical Advice Note 11 (TAN 11) details:

- Noise impacts in development plans and development control,
- Adverse noise mitigations
- Noise exposure categories for dwellings.
- Assessment of noise from different sources.
- Examples of planning conditions.
- Specifying noise limits.
- Information on other noise control regimes; and
- Statutory instruments and British Standards.

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 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.

B.5 – Approved Document O: 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.6 – 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.

12/09/2023

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 12 – AVO Guide (2020) Level 1 Risk Assessment

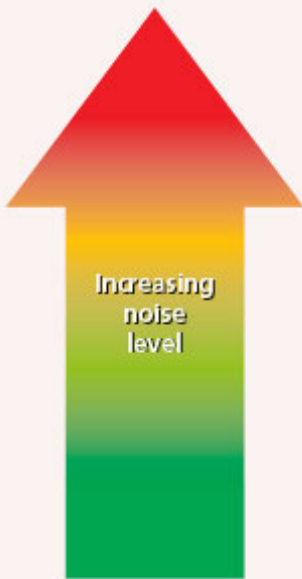
Level 2 Risk Assessment:

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]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{A,Fmax}$	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.
			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 5]
≤ 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 5]. 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 4 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Location Plans



Figure 5 – Location Plans

Appendix D – Environmental Survey

D.1 – Time History Noise Data

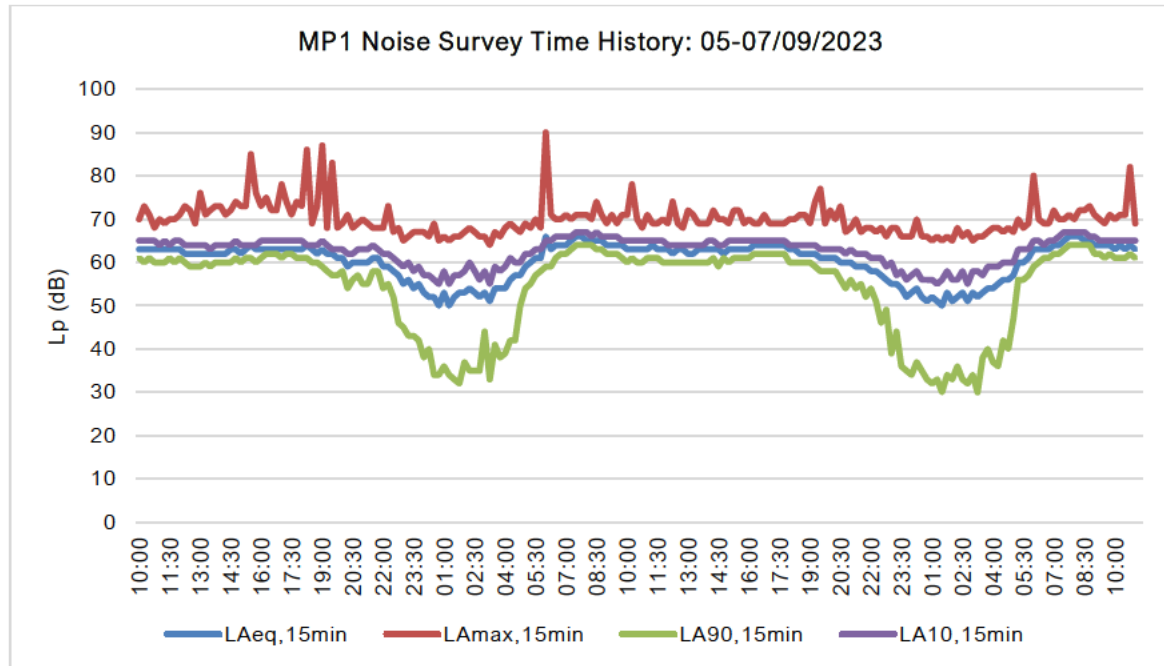


Figure 6 – MP1 Noise Survey Time History

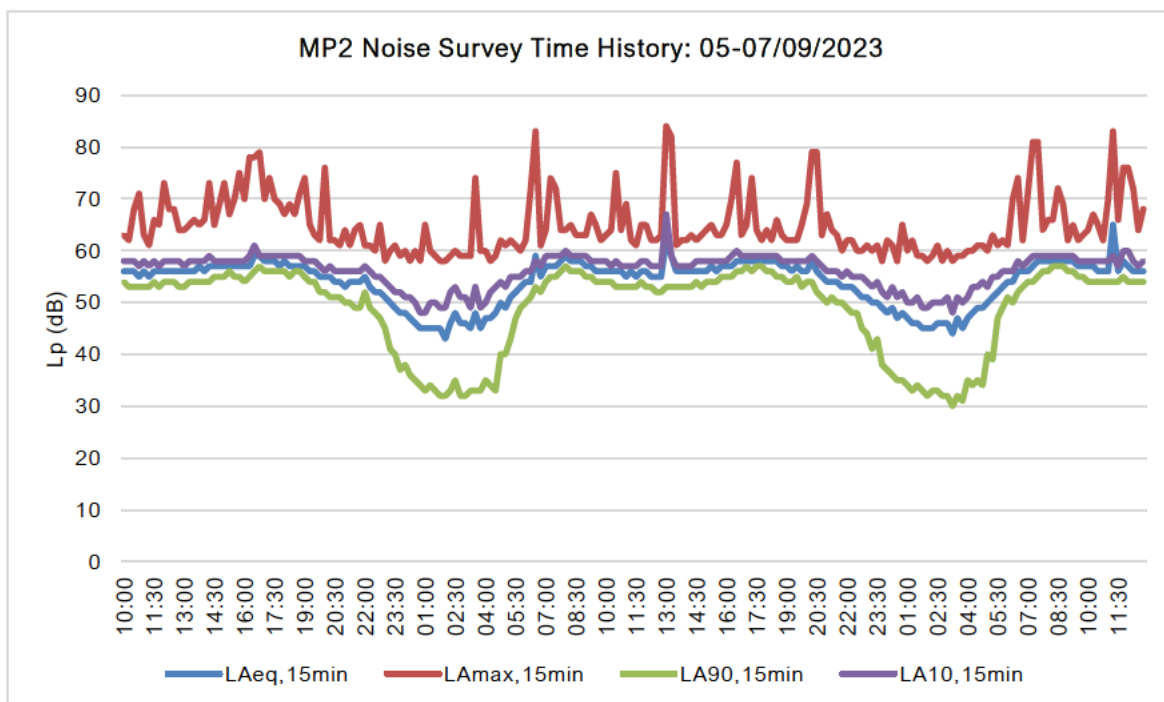


Figure 7 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246458	≤0.2
CESVA CB006 Class 1 Calibrator	901927	
CESVA SC420 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 negligible deviation noted. 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 – Llanarmon-yn-ial (Approx. 14.1km W of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
05/09/23 – 00:00 – 23:59	14.5 – 23.9	0.0	ESE	0.0 – 4.4
06/09/23 – 00:00 – 23:59	13.4 – 25.2	0.0	SSW	0.0 – 0.8
07/09/23 – 00:00 – 23:59	14.3 – 24.0	0.0	SSW	0.0 – 1.8

Table 14 – Weather Conditions

Appendix E – Noise Break-in Calculations

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 and BS EN 12354-3.
- Based on previous experience and measurements of reverberation in furnished rooms, values of 0.5s and 0.3s are assumed for living rooms and bedrooms respectively.
- Technical drawings have not been provided to NOVA Acoustics; therefore, the following assumptions have been made; window areas of 2m² and room volumes of 25m³ are used in the calculations for bedrooms as a worst-case scenario. For living rooms, the calculations are based on a window area of 3m² and room volume of 30m³ as a worst-case scenario.
- The acoustic performance of the façade elements is taken from the relevant manufacturers' 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).

Living Room Daytime Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	64	64	56	56	59	63	56	41
Glazing Noise Ingress	29	40	31	32	29	21	15	-2
Ventilation Noise Ingress	29		22	24	28	25	21	3
Wall Noise Ingress	10	21	15	12	7	6	-6	-21
Roof Noise Ingress								
Room Absorption Correction		0	0	-1	-1	-1	-2	-3
Total Noise Ingress	34	43	34	35	33	28	24	5
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-1	-16	-14	-4	0	-2	-2	-19

Bedroom Daytime Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	64	64	56	56	59	63	56	41
Glazing Noise Ingress	28	39	30	31	28	20	14	-3
Ventilation Noise Ingress	30		23	25	29	26	22	4
Wall Noise Ingress	5	20	7	5	-2	1	-6	-21
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	32	40	31	32	31	27	22	3
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-3	-19	-17	-7	-2	-3	-4	-21

Bedroom Night-time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	58	58	51	52	53	56	50	38
Glazing Noise Ingress	23	33	25	27	22	13	8	-6
Ventilation Noise Ingress	24		18	21	23	19	16	1
Wall Noise Ingress	-1	14	2	1	-8	-6	-12	-24
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	26	34	26	28	25	20	16	0
NR25	30	55	43	35	28	25	21	19
Exceedance of Criteria	-4	-21	-17	-7	-3	-5	-5	-19

Bedroom Night-time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	70	75	66	63	65	64	62	65
Glazing Noise Ingress	35	50	40	38	34	21	20	21
Ventilation Noise Ingress	36		33	32	35	27	28	28
Wall Noise Ingress	11	31	17	12	4	2	0	3
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	38	51	41	39	37	28	28	27
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-7	-16	-15	-10	-6	-12	-9	-7

Figure 8 – Noise Break-In Calculations



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