8 Albemarle Street, South Shields

Noise impact assessment

12166.1

11th December 2024

Revision A

ANC ACOUSTICS & NOISE CONSULTANTS

Institute of Acoustics sponsoring organisation

8 Albemarle Street, South Shields

Noise impact assessment

12166.1A

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1 Summary

1.1 This report has been prepared in support of a planning application for the proposed conversion of an existing public house to a house in multiple occupation (HMO) at 8 Albemarle Street, South Shields.

1.2 Noise levels affecting the proposed development from nearby bus station and other sources have been measured during the daytime and night-time periods and the façade noise impact calculated.

1.3 The existing noise risks upon the site are assessed in accordance with current planning policy and relevant guidance.

1.4 The acoustic performance requirements for glazing and ventilators are summarised in Table 1. The ventilation designer will need to consider the ventilation constraints for determining an Approved Document F compliant ventilation strategy.

1.5 Based on the details outlined in this report, the noise risks identified are considered to be mitigated and minimised, and the site is considered suitable for residential development.

Rooms affected	Glazing performance	Trickle ventilator performance
Bedrooms	**≥ 36 dB R_w** e.g. Pilkington Insulight 10 / 12 / 4 mm double glazing	Up to one vent per bedroom, **≥ 39 dB $D_{ne,w}$** *Or* Up to 2 vents per bedroom, **≥ 42 dB $D_{ne,w}$**
Lounge	**≥ 31 dB R_w** Standard 4 mm double glazing, e.g. Pilkington Insulight 4 / 12 / 4 mm	Up to 4 standard (non-acoustic) vents, **≥ 30 dB $D_{ne,w}$**
Example trickle ventilators that achieve the minimum performance requirements are shown in Table 8. Other suitable ventilator products are available.		

Table 1: Summary of minimum façade sound insulation treatment

2 Introduction

2.1 A conversion of an existing public house to a house in multiple occupation (HMO) has been proposed at 8 Albemarle Street in South Shields.

2.2 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the potential noise impact on the proposed development site in support of a planning application.

2.3 The primary noise source considered in this assessment is bus activities associated with the bus station located to the west of the site. Other sources include noise from fixed plant located to the rear of the site, and less significant road traffic noise on the surrounding road networks.

2.4 The site location, noise survey locations and most significant noise sources are shown in Figure 1.

2.5 The purpose of this report is to identify appropriate acoustic design parameters and the manner in which these may be achieved in practice.

2.6 The scope of our appointment includes:

- Measure the existing noise environment during the daytime and night-time;
- Calculate the highest noise impact on the worst affected façade;
- Identify and assess noise impacts on the proposed site;
- Determine potential noise impact under whole dwelling ventilation condition according to Approved Document F strategies;
- Provide a detailed scheme for the mitigation of noise to reduce the risk of adverse effect, in accordance with local and national policy requirements.

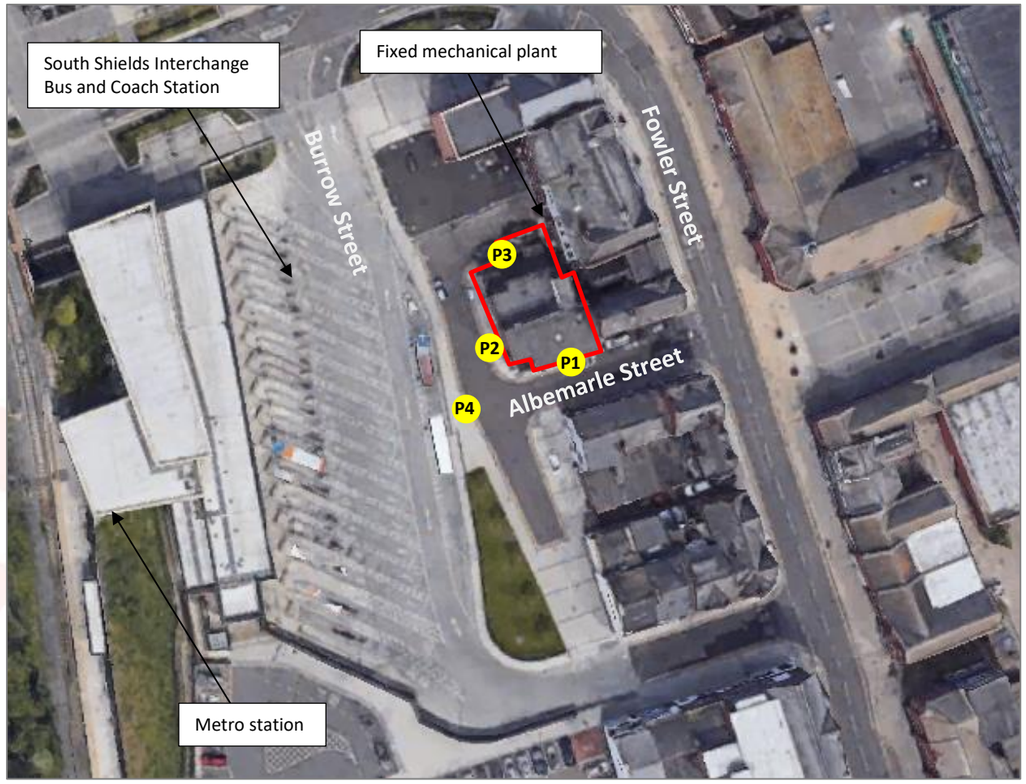


Figure 1: Site location outlined in red and measurement positions indicated by markers P1-P4

3 Planning policy and noise criteria

3.1 National Planning Policy Framework (NPPF)

3.2 The National Planning Policy Framework (NPPF) Reference 1, sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. In respect of noise, Paragraph 180, 191 and 193 of the NPPF states the following:

3.3 Paragraph 180:

"e) 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…"

3.4 Paragraph 191:

"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 impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[65 [See Explanatory Note to the Noise Policy Statement for England];

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;

3.5 Paragraph 193:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed. "

3.6 Noise Policy Statement for England (NPSE)

3.7 The Noise Policy Statement for England, Reference 2, states three policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

3.8 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
  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.
- Lowest Observed Adverse Effect Level (LOAEL)
  This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
  This is the level above which significant adverse effects on health and quality of life occur

3.9 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.10 It is considered that meeting the internal ambient noise level limits given in BS 8233, which are in line with those given by the World Health Organisation, Reference, adequately achieve the first and second aims of the NPSE.

3.11 Professional Practice Guidance on Planning & Noise

3.12 Professional Practice Guidance on Planning & Noise: New Residential Development (ProPG), Reference 3, is a guidance document on the management of noise within the planning system in England for new build housing developments.

3.13 The document draws together guideline limits for internal noise levels from external transport sources from other sources of guidance, including BS 8233, Reference 4, and the World Health Organisation (WHO) Guidelines for Community Noise, Reference 5.

3.14 These criteria are consistent with those usually adopted by the Local Environmental Health Department and are presented in Table 2.

Activity	Location	Guideline upper limit, dB		
		$L_{Aeq, daytime}$	$L_{Aeq, night-time}$	L_{AFmax}
Resting	Living room	35	-	-
Dining	Dining room	40	-	-
Sleeping (daytime resting)	Bedroom	35	30	45

Table 2: Internal noise level requirements

3.15 The daytime period is defined as the 16 hours between 07:00 to 23:00 hours and the night-time period is defined as the 8 hours between 23:00 to 07:00 hours.

3.16 With regards to the night-time L_{AFmax} criterion, ProPG 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 45 dB $L_{Amax,F}$ more than 10 times a night."

3.17 It is considered that the adopted internal ambient noise level targets align with the LOAEL following the terminology of the NPSE, such that meeting these targets adequately achieves the aims of the NPPF and NPSE.

3.18 ProPG states:

"Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally."

3.19 Internal ambient noise levels 10 dB above the daytime and night-time values in Table 2 are therefore identified as the SOAEL.

3.20 **Commercial & industrial noise guidance**

3.21 BS 4142, Reference 8, defines an assessment method to quantify the potential level for adverse impact from commercial and / or industrial noise sources impacting upon sound sensitive receptors i.e. residential development.

3.22 The method estimates the impact significance by comparing the Rated noise against the background sound levels, as summarised below:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around + 5dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound sources having a low impact, depending on the context.

3.23 The terminology used in BS 4142 to describe the various levels of adverse impact is consistent with the terminology used in the NPPF, NPSE and PPG-N.

3.24 ProPG states:

"In the special case where industrial or commercial noise is present on the site but is "not dominant" (i.e where the impact would be rated as lower than adverse (subject to context), if a BS 4142:2014 assessment was to be carried out), its contribution may be included in the noise level used to establish the degree of risk (and if included, this should be clearly stated)."

3.25 NPPF states:

"…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."

3.26 Therefore, where an adverse impact is identified an acoustic design process is required to demonstrate how the risk of adverse impact can be mitigated and minimised in the finished development.

3.27 **Commercial noise assessment criterion proposal**

3.28 An internal limit of NR 20 is proposed for habitable rooms when considering any identified noise impacts from fixed plant.

3.29 Unlike the BS 8233 criteria, the proposed NR 20 criterion is based on a noise rating curve that sets maximum permissible sound pressure levels across different octave band frequencies. This criteria aids in protecting future residents from any potential issues with low frequency noise.

3.30 In our experience, this criterion is typically acceptable to local authorities for addressing sources of this nature.

4 Noise sources and measurements

4.1 Measurements

4.2 Measurements of the existing noise environment were made during the daytime on 12th November 2024 and during the evening into the night-time 19th November 2024, using the guidance of BS 7445, Reference 7.

4.3 The measurement locations are shown in Figure 1.

4.4 The microphones at positions P1, P2 and P3 were located approximately 1 m away from the existing building elevations, as such the measured levels include the direct and reflected sound. A 3 dB correction is applied to the measured façade levels to determine the free-field noise levels.

4.5 The microphone at position P4 was located approximately 3.5 m above the ground, away from other reflective surfaces, as such the measured noise level is considered to be free-field.

4.6 The equipment used is listed in Table 3.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-09585-E0
Calibrator	Larson Davis CAL 200	12573
Sound Level Meter	NTi XL2	A2A-12269-E0
Calibrator	Larson Davis CAL 200	13404
Sound Level Meter	NTi XL2	A2A-14176-E0
Calibrator	Larson Davis CAL 200	15307

Table 3: Equipment used

4.7 All sound level meters and calibrators used meet the technical specifications of BS 7445 and have current calibration certificates traceable to national standards. The equipment was field-calibrated before and after the measurement with no significant drift in sensitivity noted.

4.8 Weather conditions were dry with wind speeds below 5 m/s.

4.9 Noise sources

4.10 The most significant noise source affecting the proposed development during the daytime and night-time at all noise survey positions was activities associated with the South Shields Interchange Bus and Coach Station site to the west of the proposed development.

4.11 Bus station activities include buses entering and leaving the site, parking, idling, use of horns and reversing signals.

4.12 Other noise sources, observed to be significantly less dominant than those associated with the bus station, included birdsong, distant road traffic, and activities associated with the ground floor public house.

4.13 The noise from the public house (music and patrons' conversations) was observed during the night-time, with no impact noted during the daytime. The impact is excluded from the assessment presented in this report, as the premise will not operate once the development is in use.

4.14 Plant noise was observed due to a unit located to the rear of the site during the night-time survey. No plant noise was identifiable during the daytime surveys.

4.15 The plant was audible only in close proximity to the unit during the night-time. No audible impacts were noted at any of the noise surveys' locations. It is considered that noise from the unit may be audible at the façade of the development during periods when other noise sources (pub noise, bus station noise) are quieter and do not create a masking effect. To assess this impact, sample noise measurements 1 m from the plant were carried out and propagation calculated to the worst affected windows of habitable rooms. The BS 4142 assessment of plant noise impact measured during the night-time is presented in Section 4.23.

4.16 No noise impacts associated with the nearby metro lines or any other commercial premises were identified.

4.17 Results

4.18 The time histories of the $L_{Aeq,\ 1\ sec}$ recorded are shown in Appendix A; the measured daytime (incl. evening, past 22:30 hrs) and night-time noise levels are shown in Table 4.

Position	Parameter	dB(A)	Octave band centre frequency, Hz					
			125	250	500	1k	2k	4k
P1 *(front of the existing pub)*	Daytime, $L_{Aeq,\ 1\text{-}hr}$	**61**	46	50	53	55	55	51
P2 *(elevation facing the bus station)*	Daytime, $L_{Aeq,\ 1\text{-}hr}$	**64**	51	53	55	59	59	53
	Evening, $L_{Aeq,\ 5\text{-}min}$	**56**	44	49	50	50	46	45
P3 *(rear side of the site)*	Evening, $L_{Aeq,\ 5\text{-}min}$	**62**	52	55	55	57	52	46
P4	Night-time, $L_{Aeq,\ 30\text{-}mins}$	**60**	48	51	52	56	54	48
	Night-time, $L_{AF,max}$	**79**	-	-	-	-	-	-
Plant	Plant noise level, measured 1 m from the unit	**61**	50	54	55	55	52	45

Table 4: Measured façade noise levels

4.19 The measured levels in the peak daytime hours and during first portion of the night time period can be assumed representative of the whole 16 hours daytime and 8 hour night time periods as

per typical BS 8233 reference periods; this is considered to be a prudent assumption, as it is expected that the quieter periods when the bus station activities are less frequent (not included in the measured levels) would likely to present a lower average noise level of each period.

4.20 The single event maximum noise levels presented in Table 4 are the highest noise levels measured during the night-time survey due to bus station activities. The levels presented are therefore used as the design case to determine compliance against ProPG Note 4 of Figure 2.

4.21 It was not feasible to measure the noise levels at the back of the site (P3) due to access restrictions during the daytime.

4.22 Additionally, due to the ground floor public house patrons gathering in front of the entrance of the premise and loud music breakout via doors and windows, night-time measurements at P1 were also not possible (access restrictions and significant impacts of pub noise). Other locations around the site were also affected by the music noise; where possible, the noise data affected by pub noise has been excluded from the assessment.

4.23 **BS 4142 results – mechanical plant impact**

4.24 Noise from fixed plant upon the rear of the building has been assessed in accordance with BS 4142 to determine the potential for adverse effects on the proposed development.

4.25 A summary of the assessment is presented in Table 5.

4.26 The background sound level of 51 dB L_{A90} presented has been determined based on the night-time data from measurement undertaken 1 m from the plant unit.

4.27 As this may not be representative of the quietest period during the night, an assessment has also been carried out against suitable background sound data taken from The National Noise Incidence Study 2000/2001 (United Kingdom): Volume 1 – Noise Levels, Reference 9. This study identifies representative background levels for various Land Use Categories. Categories 3 and 4 are considered suitable for use in this assessment.

4.28 An excerpt from the study with background sound data presented is shown in Appendix A, with categories used outlined in green.

Parameter	Worst-case noise sensitive location: windows of the proposed Bedroom 7 and Bedroom 8, first floor
Plant noise impact 1 m from the unit (corrected to free-field), dB(A)	58
Distance correction, dB	-15
Time correction, dB (assumed that plant operates continuously during the 15-minute reference period)	0
Calculated specific noise level at the most exposed window of the proposed development, dB(A)	43
Characteristic penalty due to tonality, dB(A)	+3
Rating sound level, dB(A)	46
Background sound level, $L_{A90,15min}$ dB(A) (measured at P4 / based on noise incidence study)	51 / 37
Exceedance over the background, dB	-5 / +9
Interpretation of the result (risk)	Low / Adverse

Table 5: BS 4142 assessment summary – night-time

4.29 The BS 4142 results indicate that a risk of an adverse effect is likely for the most exposed location (windows of the proposed Bedroom 7 and Bedroom 8, first floor), during the quietest night-time periods. For other locations of the proposed development, the risk of adverse effect is unlikely.

4.30 Therefore, an acoustic design process is required for the worst-case location to demonstrate how the risk of adverse impact can be mitigated and minimised in the finished development. This is demonstrated in Section 5 of this report.

5 Achieving internal noise levels

5.1 **Façade sound insulation calculations**

5.2 Free field noise levels representative for the worst-case façade sound insulation bedroom and lounge used for design calculation are shown in Table 6.

5.3 Noise data for the night-time at P4 has been used. Given that this location is slightly closer to the bus station than the site location, this is considered to be prudent.

5.4 Octave band $L_{Aeq,T}$ noise levels in the 125 Hz to 2 kHz calculation range indicated in BS 8233 have been adjusted to match the single figures calculated A-weighted noise levels for each position.

Location	Parameter	dB(A)	Octave band centre frequency, Hz A-weighted free-field noise level, dB				
			125	250	500	1k	2k
Worst-case bedroom	Daytime, $L_{Aeq,\ 1\text{-}hr}$	**61**	48	51	53	57	57
	Night-time, $L_{Aeq,\ 30\text{-}min}$	**60**	48	51	52	56	54
	Night-time, $L_{AF,max}$	**79**	-	-	-	-	-
Lounge	Daytime, $L_{Aeq,\ 1\text{-}hr}$	**58**	43	48	50	53	53

Table 6: A-weighted external free-field noise levels used to calculate façade sound insulation

5.5 The calculation method for façade sound insulation is in accordance with BS 8233 and the principles of BS EN 12354-3, Reference 12.

5.6 From ISO 16283, Reference 13, the reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room. This value is used for both living rooms and bedrooms.

5.7 Details of the methodology used to calculate internal noise levels are provided on our website: https://www.apexacoustics.co.uk/calculation-facade-sound-insulation/.

5.8 The minimum glazing and ventilator performances presented in the summary table are calculated to be required to reduce noise levels to below the LOAEL for internal noise levels in those rooms most exposed to external noise ingress.

5.9 Noise levels in less exposed but similarly protected rooms will be lower and therefore also comply with the internal noise level targets.

5.10 The most exposed rooms are those with the largest ratio of window area to room volume, as well as those closest and most exposed to the noise sources.

5.11 Example glazing units that achieve the performance standards shown in the summary, Table 1.

5.12 The room and window dimensions used in the calculations are taken from the architects' plans and elevations, Reference 10.

5.13 The sound reduction of the masonry portion of the facade is much higher than that of the glazing and ventilation provision. Therefore, noise penetration through the masonry is disregarded as relatively insignificant.

5.14 Calculated internal noise levels on the basis of the identified minimum performance requirements are presented in Table 7.

5.15 An example full calculation for the worst affected location is shown in Appendix A, based on manufacturers test data from the example glazing and ventilator products.

Room affected	Calculated internal level			
	Daytime dB $L_{Aeq,\ 16\ hr}$	Night-time dB $L_{Aeq,\ 8\ hr}$	Night-time dB $L_{Amax,\ F}$	Plant impact, dB $L_{Aeq,\ 15\ min}$
Bedroom	30	30	45	14 (NR 8)
Lounge	33	-	-	-

Table 7: Summary of calculated worst-case internal noise levels

5.16 Based on the proposed façade sound insulation provision and the level and frequency of the measured maximum noise event, 45 dB $L_{Amax,\ F}$ is unlikely to be exceeded more than 10 times per night, and is therefore below the LOAEL described in paragraph 3.16.

5.17 **Internal ambient noise level – plant impact mitigation**

5.18 Based on the glazing and ventilator provision identified, and with a closed window strategy, the internal noise level from the plant impacts on the rear façade during the night-time are calculated to be no higher than 14 dB inside the worst-affected bedroom.

5.19 The calculated internal noise level from plant is significantly below both the NR criteria proposed, and the BS 8233 night-time limit. This tolerance can be considered a margin for any potential fluctuations and source characteristics.

5.20 The plant impact on the worst-case bedrooms is calculated to be significantly lower than the calculated internal noise levels due to bus station activity, such that the plant noise is likely to be predominantly masked by other noise sources.

5.21 It is considered that with the proposed elevation enhancement, the identified adverse impact due to plant is sufficiently mitigated.

5.22 **Noise and Approved Document F ventilation conditions**

5.23 The proposed development will be required to meet Part F of the Building Regulations with regard to the whole dwelling ventilation condition, as described in Approved Document F (AD-F), Reference 11. HMO's are understood to be covered by Volume 2 of AD-F, which does not provide the same prescribed ventilation systems as Volume 1 does for dwellings.

5.24 Apex have reviewed the acoustic implications for ventilators to the façade, to maintain the calculated sound insulation values. It is the responsibility of the ventilation designer to consider these restrictions for determining a suitable strategy.

5.25 Example ventilators that achieve the performance standards are identified in Table 8.

Location	Trickle ventilator performance	Example products (others also feasible)
Bedrooms	**≥ 39 dB $D_{ne,w}$**	Greenwood 5000EAW.AC1 - 5000EA vent + 1 acoustic set
	≥ 42 dB $D_{ne,w}$	RW Simon Acoustic EHAS + AEA851
Lounge	**≥ 30 dB $D_{ne,w}$**	Standard trickle vent (non-acoustic) e.g. Brookvent SM1200 or RW Simon Framevent

Table 8: Example trickle ventilators

5.26 On the basis of the constraints to AD-F ventilation strategies, the façade sound insulation with the provision for ventilation may be assessed with windows closed.

5.27 Purge ventilation conditions as described by AD-F is manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and/or disperse water vapour. Purge ventilation may be provided by natural means (e.g. an openable window) or mechanical means (e.g. a fan).

5.28 For AD-F purge ventilation conditions, ProPG states:

"It should also be noted that the internal level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food)."

5.29 Considering this guidance, opening windows is considered acceptable for these occasional events without giving risk to potential adverse effect on occupants.

5.30 It should be emphasised that the above is not intended to constitute a ventilation strategy design, which is the responsibility of others. Once the ventilation strategy is established, if the details vary from those described above, the proposed details should be reassessed for acoustic performance.

6 Conclusion

6.1 The existing noise impact across the proposed development site has been assessed in support of a planning application.

6.2 An acoustic design process is undertaken to demonstrate how the identified risks of adverse noise impact can be mitigated and minimised in the finished development.

6.3 The potential implications for the design of the façade sound insulation under typical ventilation conditions as described by AD-F is discussed, and the glazing and ventilator acoustic performance requirements to achieve the indoor noise level targets are identified.

6.4 Based on the existing noise risks and details outlined in this report, the site is considered suitable for residential development.

7 References

1 National Planning Policy Framework, Department for Communities and Local Government, December 2023.

2 Noise Policy Statement for England, Department for Environment, Food and Rural Affairs, March 2010.

3 Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), "ProPG: Planning & Noise - New Residential Development," May 2017.

4 BS 8233: 2014, Guidance on sound insulation and noise reduction for buildings.

5 Guidelines for Community Noise, Edited by Birgitta Bergland, Thomas Lindvall, Dietrich H Schwela, World Health Organisation, 1999.

6 AECOM Environment on behalf of DEFRA, NANR316 Possible options for the identification of SOAEL and LOAEL in support of the NPSE, December 2015.

7 BS 7445:2003, Description and measurement of environmental noise. Guide to quantities and procedures.

8 BS 4142: 2014, Method for rating and assessing industrial and commercial sound.

9 Department for the Environment, Food and Rural Affairs, “The National Noise Incidence Study 2000/2001 (United Kingdom): Volume 1 – Noise Levels”, February 2022.

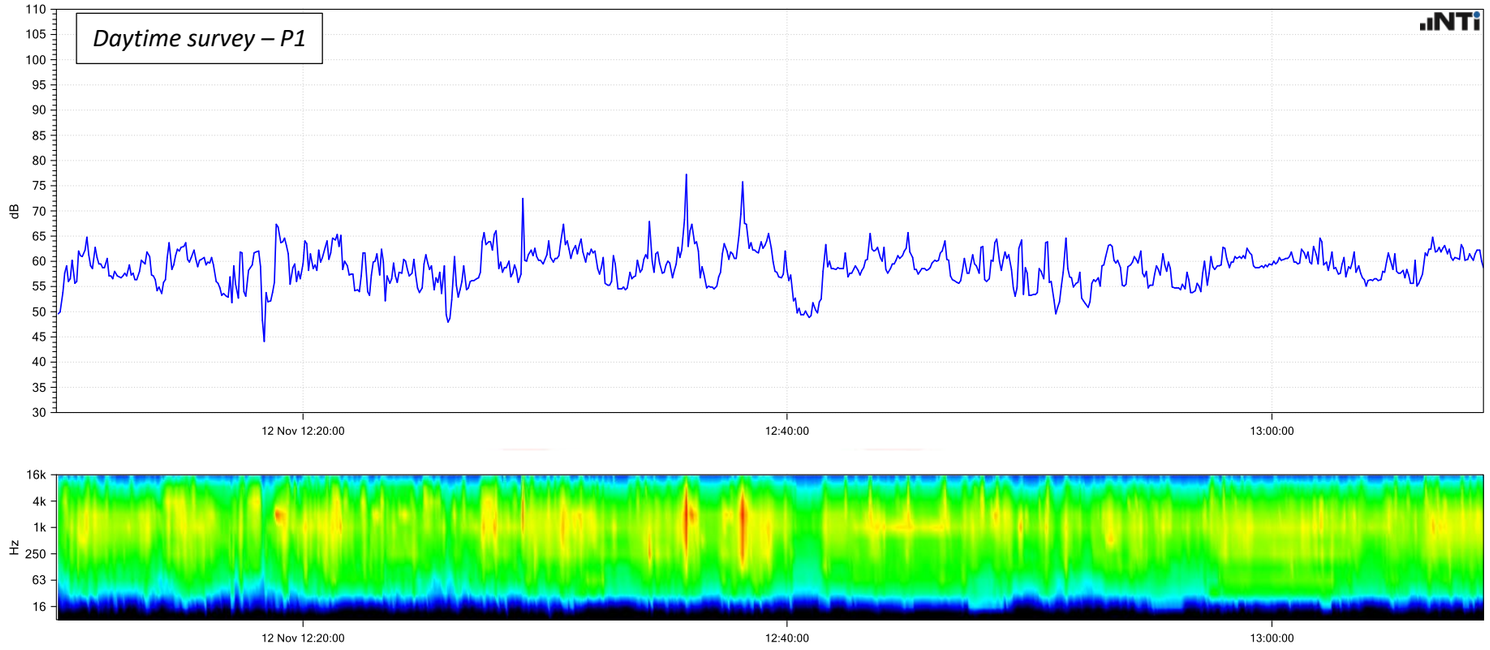
10 Architects Drawings: Building Elevations A453-001, Floor Plans A453-002-003, Buulding Sections A453-004 (09.09.2024 Project North Geomatics); Proposed Basement Plan, Proposed Ground Floor Plan, Proposed First Floor Plan, Proposed Second Floor Plan (27.09.2024 Goldline Architectural Limited).

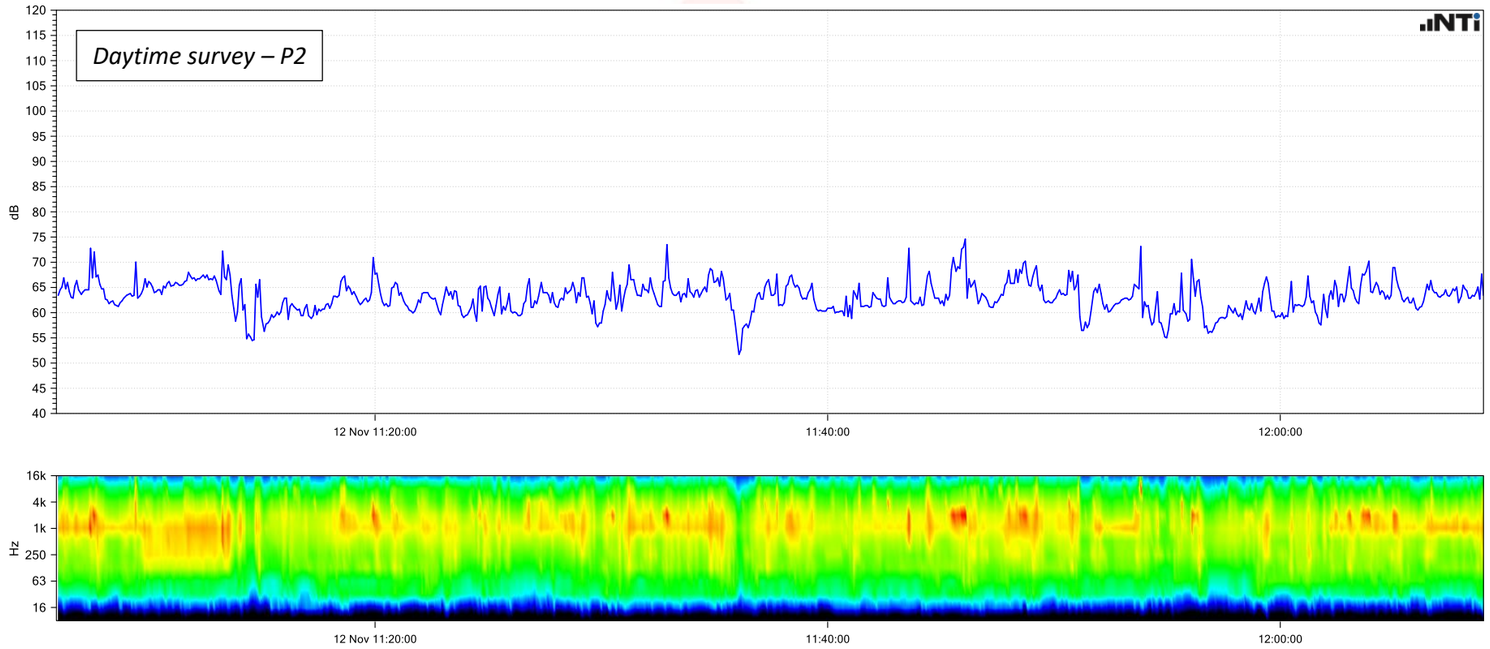
11 Approved Document F 2021 Edition, The Building Regulations 2010.

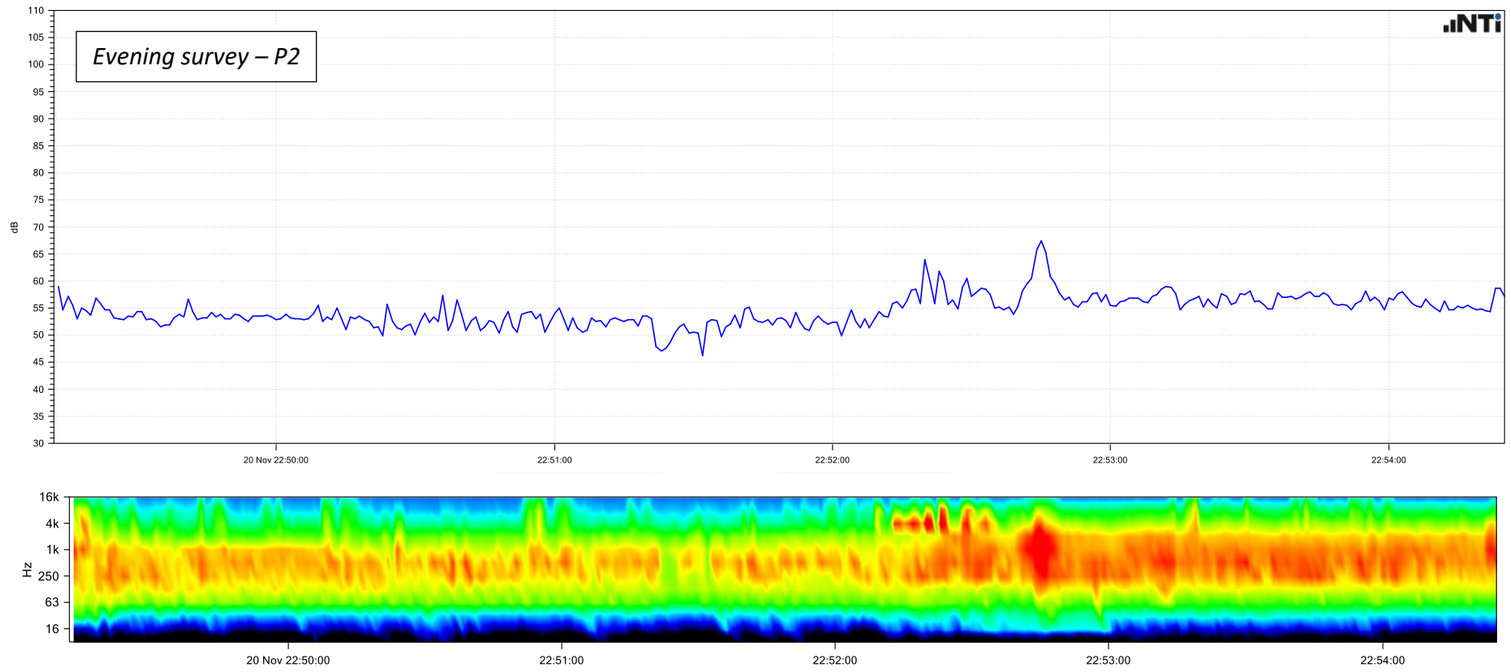
12 BS EN 12354-3:2000, Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound.

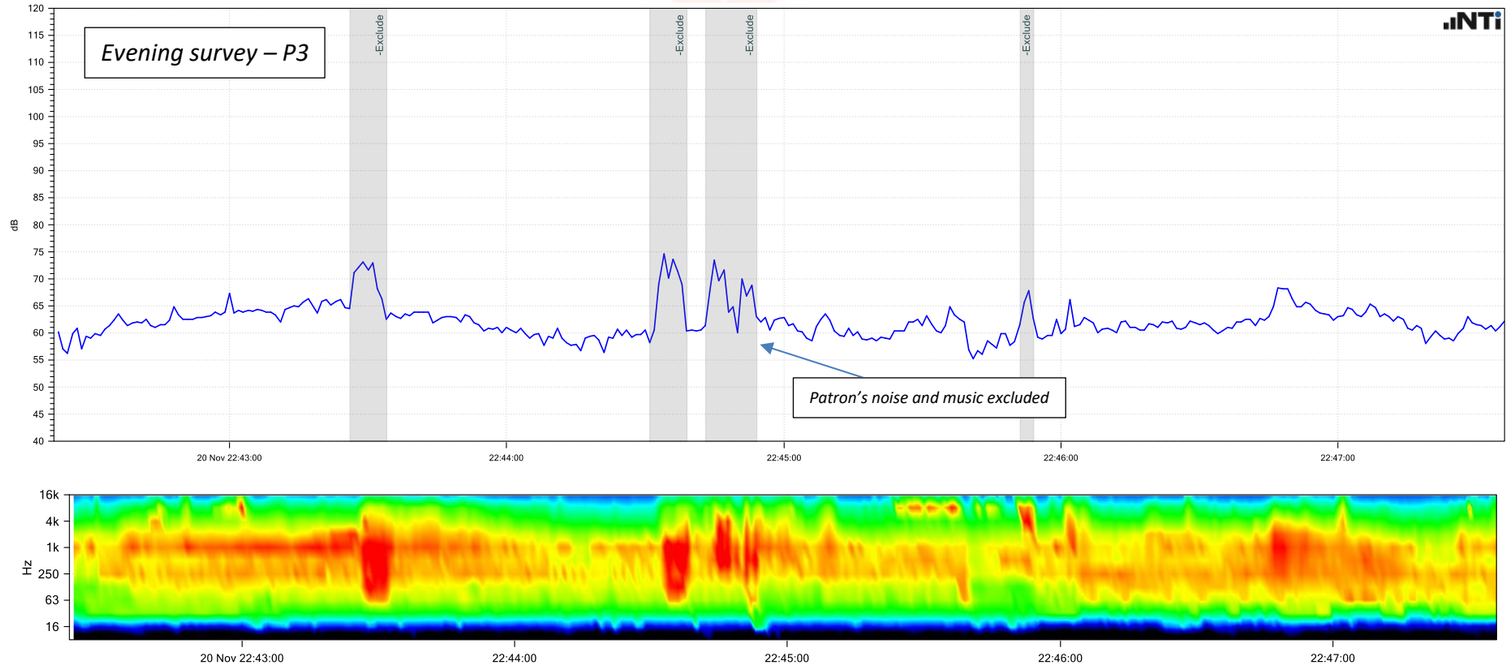
13 BS EN ISO 16283-1:2014 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation.

Appendix A Time histories of the measured noise levels






Evening survey – P2
dB
20 Nov 22:50:00
22:51:00
22:52:00
22:53:00
22:54:00
Hz
16k
4k
1k
250
63
16


Evening survey – P3
-Exclude
Patron's noise and music excluded
dB
20 Nov 22:43:00
22:44:00
22:45:00
22:46:00
22:47:00
Hz
16k
4k
1k
250
63
16

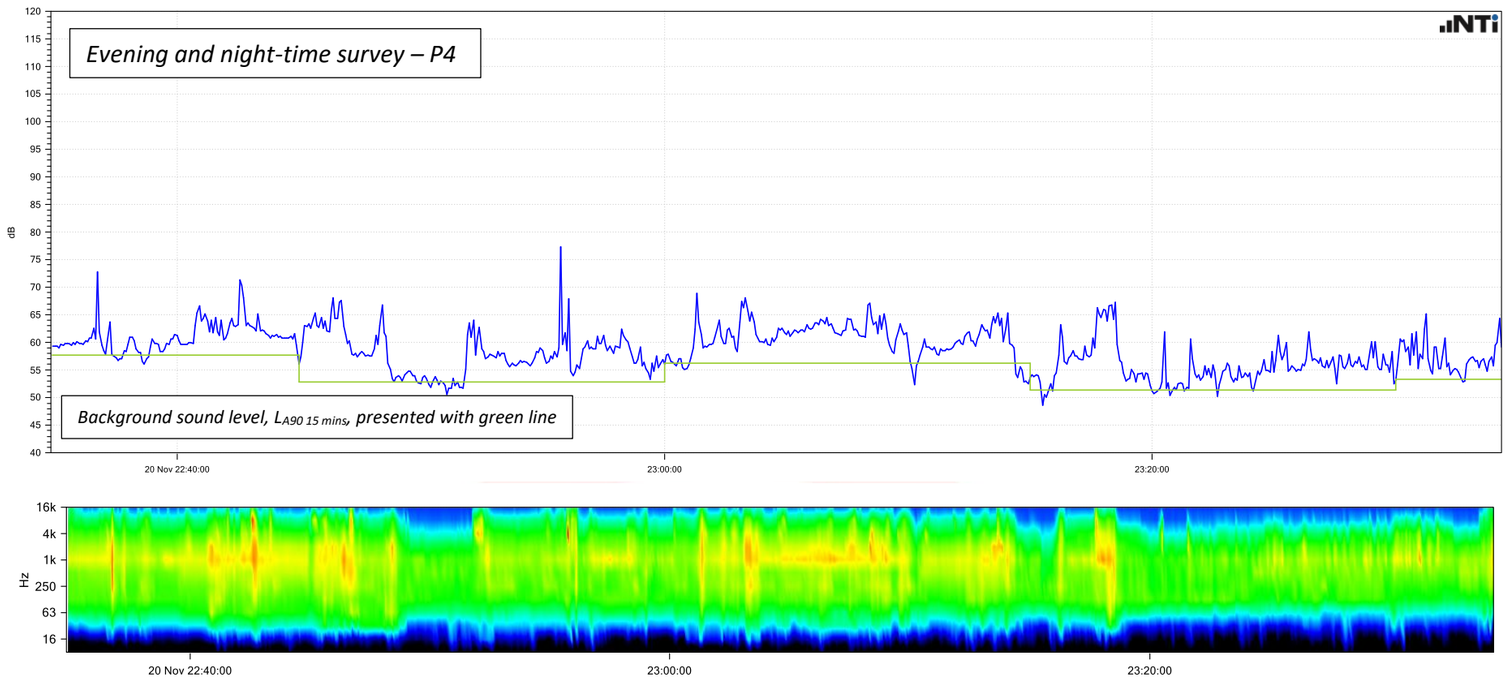


Figure 2: Time history of the recorded noise levels during daytime (inc. evening) and night-time, $L_{Aeq,\ 1\ sec}$

Appendix B Excerpt of the National Noise Incidence Study

Table 6 presents the mean levels calculated for the four most common categories in the sample (accounting for 99% of sites in the sample).

16-hour day time (0700-2300)

Land Use Category	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)
1 – Rural (residential)	54.8	53.5	39.5
2 – Suburban, little road traffic	54.3	53.8	42.1
3 – Urban (residential)	60.6	61.6	47.8
4 – Predominantly residential but with some light industry or main roads	61.5	63.2	48.7

8-hour night time (2300-0700)

Land Use Category	L_{Aeq} (dB)	L_{A10} (dB)	L_{A90} (dB)
1 – Rural (residential)	46.5	42.4	31.5
2 – Suburban, little road traffic	46.0	43.8	34.5
3 – Urban (residential)	51.8	49.2	37.3
4 – Predominantly residential but with some light industry or main roads	53.8	51.3	37.1

Figure 3: Land use categories and representative background sound levels (L_{A90}, dB); data considered in this report marked in green

Appendix C Example façade sound insulation calculations

Bedroom (worst-case)	
Volume, V / m^3	29
Window area, S / m^2	3
Reverberation Time, T / s	0.5
Number of vents feasible	2

Daytime $L_{Aeq,\,T}$ (dB)	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz
External free-field noise, L_{1in}	**61**	48	51	53	57	57
Glazing: 10/12/4 mm, R		25	22	33	40	43
Equation 1, L_2(a)	**28**	21	26	17	14	11
Vent: Acoustic EHAS + AEA851, $D_{n,e}$		41	42	37	43	45
Equation 2, L_2(b)	**26**	14	15	22	20	18
Total noise through all elements, L_2	**30**					

Night-time $L_{Aeq,\,T}$ (dB)	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz
External free-field noise, L_{1in}	**60**	48	51	52	56	54
Glazing: 10/12/4 mm, R		25	22	33	40	43
Equation 1, L_2(a)	**28**	21	26	17	14	8
Vent: Acoustic EHAS + AEA851, $D_{n,e}$		41	42	37	43	45
Equation 2, L_2(b)	**25**	14	15	21	20	15
Total noise through all elements, L_2	**30**					

Night-time L_{AFmax} (dB)	dB(A)
External free-field noise, L_{1in}	**43**
Glazing: 10/12/4 mm, R_w	36
Equation 1, L_2(a)	**40**
Vent: Acoustic EHAS + AEA851, $D_{n,e,w}$	42
Equation 2, L_2(b)	**43**
Total noise through all elements, L_2	**45**

Specific plant impact - night-time $L_{Aeq,\,15\text{-}min}$ (dB)	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz
External free-field noise, L_{1in}	**43**	33	36	37	38	34
Glazing: 10/12/4 mm, R		25	22	33	40	43
Equation 1, L_2(a)	**13**	5	12	2	-5	-11
Vent: Acoustic EHAS + AEA851, $D_{n,e}$		41	42	37	43	45
Equation 2, L_2(b)	**9**	-1	1	6	1	-5
Total noise through all elements, L_2	**14**					
Noise rating, NR (based on L_{eq}, dB)	**8**					

Table 9: Example calculation for the most exposed bedroom