

Environmental Noise Impact Assessment Report for Planning

200-202 Broad Street, Reading, RG1 7QJ

Report Reference 20418.ENIA-RPT.02

Project Address	200-202 Broad Street, Reading, RG1 7QJ
Report Title	Environmental Noise Impact Assessment Report for Planning
Prepared For	TE Broad St Ltd
Report Reference Number	20418.ENIA-RPT.02
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Document Revision History		
Revision Reference	Issue Date	Purpose and/or Description of Revision
First Issue	17 th October 2025	Environmental noise impact assessment report prepared in support of a planning application for change of use of upper floors to nine self-contained flats, including change to the ground floor entrance, enlargement of rear windows and removal of roof level plant enclosure.

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1 INTRODUCTION

ES Acoustics Ltd have been instructed by TE Broad St Ltd to prepare a noise impact assessment for the proposed development at 200-202 Broad Street, Reading, RG1 7QJ.

This report is prepared to support a full planning application for the change of use of the upper floors to nine self-contained flats, including a change to the ground floor entrance, enlargement of rear windows and removal of roof level plant enclosure.

This assessment aligns with the principles of government planning policy on noise, as outlined in the National Planning Policy Framework (NPPF), the National Planning Practice Guidance (NPPG) on Noise, and the Noise Policy Statement for England (NPSE), and follows the recommended approach for the assessment of noise in relation to residential development, as outlined in the Professional Practice Guidance on Planning and Noise: New Residential Development (ProPG).

The structure of this report is as follows:

- Site context and background information, including the location of the application site and details of the proposal.
- A summary of the National and Local Planning Policy, British Standards and Good Practice Guidance relevant to the proposal, which have informed this assessment.
- Details of the environmental noise surveys undertaken on site to determine current ambient and background sound levels.
- The ProPG Stage 1 initial site risk assessment.
- The ProPG Stage 2 Acoustic Design Statement, including:
 - Element 1 – demonstrating a “Good Acoustic Design Process”;
 - Element 2 – observing internal “Noise Level Guidelines” and providing mitigation measures as required;
 - Element 3 – undertaking an “External Amenity Area Noise Assessment”; and
 - Element 4 – consideration of “Other Relevant Issues”.
- An assessment of other relevant noise considerations for the scheme, including:
 - An assessment of direct noise transfer between the ground floor commercial unit (bank) and the first floor residential units to ensure that sufficient resistance to the passage of sound is provided.
 - An assessment of noise emissions from the proposed air source heat pump plant in accordance with BS 4142:2014+A1:2019 ‘Method for rating industrial noise affecting mixed residential and industrial areas’ to ensure that suitable mitigation is established so that noise emissions from the units have a low likelihood of adverse impact.

2 SITE CONTEXT AND DEVELOPMENT PROPOSAL

2.1 Site Description

The application site is located in the centre of Reading. The site comprises the existing five-storey (with basement) building at 200-202 Broad Street, being a prominent corner plot at the four-way junction of Oxford Road, Broad Street, West Street and St Mary's Butts. This junction represents the gateway to the pedestrianised Broad Street and the entrance to the main high-street shopping core of Central Reading.

The site boundary is outlined in the figure below:



Figure 1 Proposed development site (Image reference: Colman Architects)

2.2 Proposal

Planning permission is sought for the change of use of the upper floors to nine self-contained flats, including a change to the ground floor entrance, enlargement of rear windows and removal of roof level plant enclosure.

Proposed floor plans are presented on the following page for context when reading this report.



Figure 2 Proposed floor plans

3 PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE

3.1 Summary

The following planning policy and good practice guidance documents have been reviewed and considered when preparing this report:

- National Planning Policy
 - National Planning Policy Framework (NPPF)
 - Noise Policy Statement for England (NPSE)
 - National Planning Practice Guidance (NPPG)
- Local Planning Policy and Guidance
 - Reading Borough Council Local Plan
 - Reading Borough Council SPG: Residential Conversions
 - Reading Borough Council SPG: Sustainable Design and Construction
- Other Acoustic Guidance
 - World Health Organisation Guidelines for Community Noise (1999)
 - WHO Environmental Noise Guidelines for European Region (2018)
 - BS 8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'
 - ProPG: Planning & Noise Professional Practice Guidance (2017)
 - Possible Options for the Identification of SOAELs and LOAELs in Support of the NPSE (2014)
 - Approved Document O: Overheating and the 'Approved Document O Noise Guide' (published by the Institute of Acoustics and Association of Noise Consultants)
 - BS 4142: 2014 +A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'

A summary of the documents reviewed is provided in Appendix B.

3.2 Report Methodology

This report follows the recommended approach for noise impact assessment provided within ProPG: Planning & Noise Professional Practice Guidance (2017).

The initial stage 1 risk assessment would provide an indication of the likely risk of adverse effects from noise, were no subsequent mitigation to be included as part of the development proposal, and whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

The stage 2 assessment, otherwise known as an Acoustic Design Statement, would present the mitigation measures required to ensure that future occupants of the proposed development are adequately protected from external noise.

4 ENVIRONMENTAL NOISE SURVEY

4.1 Measurement Location and Procedure

Noise surveys were undertaken on the proposed site, as shown in the figure below:



Figure 3 Noise survey measurement locations

The locations were chosen to collect data representative of the levels expected on the site due to all nearby sources.

The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*', with automated monitoring undertaken between 12:00 on 10/10/2025 and 11:00 on 13/10/2025 for all monitoring positions.

The key acoustic descriptors measured for this assessment are as follows:

- $L_{Aeq,T}$ (the continuous equivalent A-weighted noise level over a given time period, T);
- $L_{AFMax,T}$, the maximum sound level over each measurement period;
- $L_{A90,T}$ (the noise level exceeded for 90% of the measurement period T , referred to as the 'background' noise level).

An initial appraisal of the site determined road traffic noise from the surrounding roads to be the dominant source affecting the site. It should be noted that general vehicular access for the public is restricted on both West Street and Oxford Street. Therefore, vehicular traffic surrounding the site is mainly comprised of buses, taxis, mopeds and delivery vehicle traffic.

In addition to the vehicle traffic on the surrounding roads, the Broad Street Mall and associated rooftop car park lie to the south of the site.

To the north of the site, there are a number of plant installations serving the surrounding buildings, although most are at a significant distance from the façade.

The aforementioned car park and plant are more easily seen on the Google Earth view, shown below:

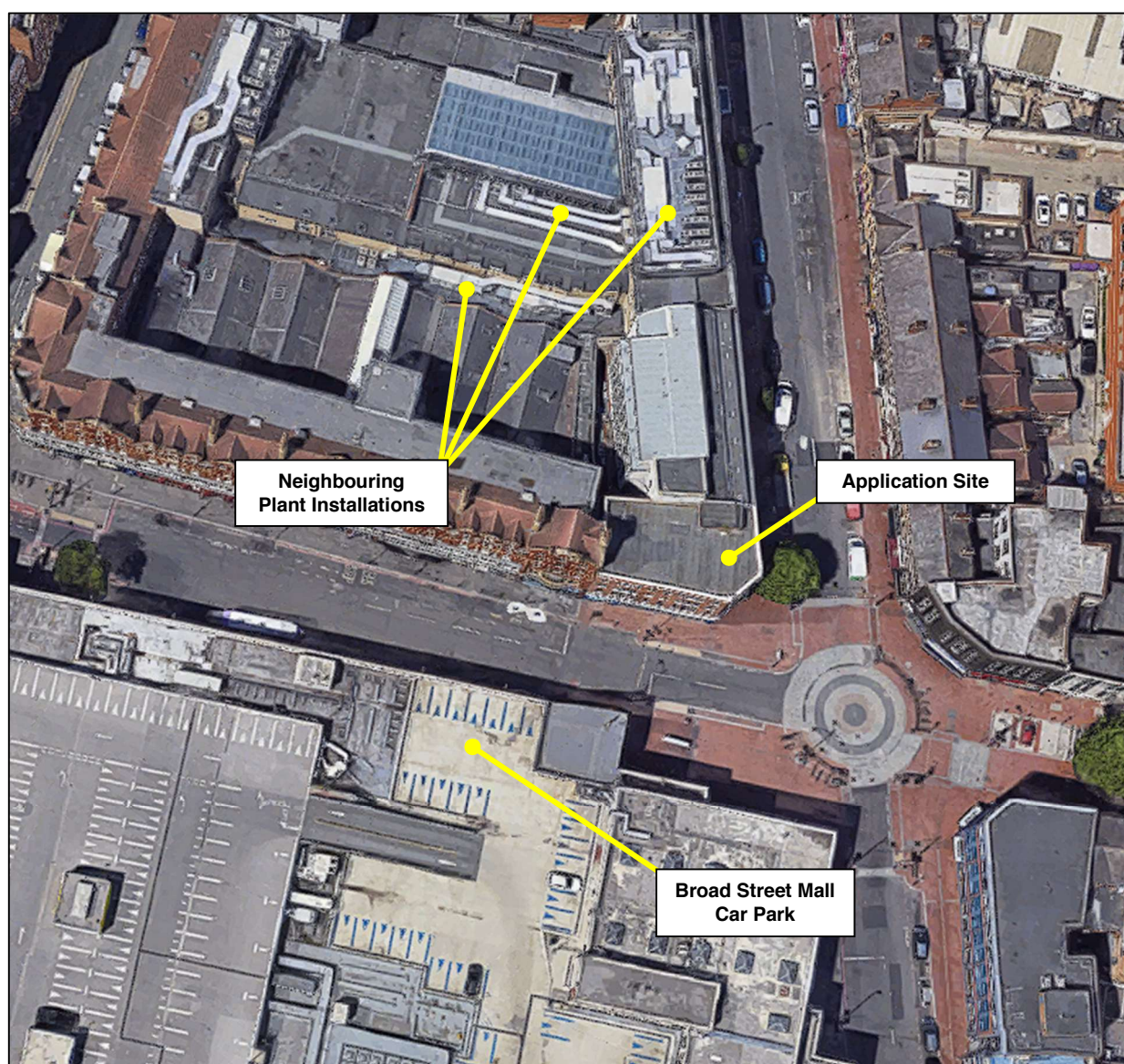


Figure 4 Google Earth aerial view showing surrounding noise sources

4.2 Measurement Equipment

The table below presents the equipment used for the baseline noise surveys. The equipment calibration was verified before and after use and no abnormalities were observed.

Equipment	Make and Model	Serial Number
Sound Level Meter	Svantek 958 Class 1 Sound Level Meter	69074
Microphone Capsule	MTG MK 255	19233
Microphone Preamplifier	Svantek SV 12L	25991
Sound & Vibration Meter	Svantek 958A	69072
Microphone Capsule	PCB 377B02	355563
Microphone Preamplifier	PCB 426E01	168159
Sound Level Meter	Convergence Instruments NSRT MK4 Type 1	CNN8pfW4U9U3CJti44pZFD
Calibrator	Svantek SV33 Class 1 Sound Calibrator	125829

Table 1 Noise survey equipment

4.3 Weather Conditions

Weather conditions during the automated monitoring were generally dry with light winds and, therefore, suitable for the measurement of environmental noise. Temperature and wind speed were measured via an anemometer installed alongside the noise monitoring equipment. Data on precipitation has been sourced from a local weather station¹, with no rainfall reported during the survey period.

A summary of the weather data is reported in Table 2.

Date	Time	Temperature (avg) ° C	Wind Speed (avg) m/s
10/10/2025	12:00 – 23:00	16.1	0.6
10-11/10/2025	23:00 – 07:00	12.8	0.5
11/10/2025	07:00 – 23:00	13.9	0.7
11-12/10/2025	23:00 – 07:00	7.1	0.7
12/10/2025	07:00 – 23:00	12.0	0.6
12-13/10/2025	23:00 – 07:00	12.1	0.5
13/10/2025	07:00 – 11:00	13.4	0.8

Table 2 Weather data

4.4 Survey Results

A noise time history of the measurement data is presented in Appendix C.

A summary of the measurement results is presented in Table 3.

Measurement Position	Period	Ambient Sound Level L_{Aeq, T} (dB)	Background Sound Levels (Mean / Median / Mode) L_{A90} (dB)	10 th Highest Maximum Noise Level (per night) L_{AFmax} (dB)
1	Daytime 07:00-23:00	67	56 / 57 / 57	n/a
	Night-time 23:00-07:00	63	50 / 51 / 43	82, 82, 81
2	Daytime 07:00-23:00	66	58 / 58 / 58	n/a
	Night-time 23:00-07:00	61	50 / 50 / 45	82, 82, 82
3	Daytime 07:00-23:00	52	48 / 48 / 48	n/a
	Night-time 23:00-07:00	48	47 / 46 / 46	67, 62, 66

Table 3 Measured noise levels

¹ Weather Station: Binfield, UK. ID: E0805, located 14 km from the site at Latitude 51.417, Longitude -0.782

In the case of ambient sound levels ($L_{Aeq, T}$), data has been logarithmically averaged during each relevant period to establish the above sound levels, e.g. the daytime 07:00-23:00 level of 67 dB $L_{Aeq, 16 \text{ hour}}$ at Monitoring Position 1 has been established by logarithmically summing the levels from the following periods: 10/10/2025 daytime 12:00-23:00, 11/10/2025 daytime 07:00-23:00, 12/10/2025 daytime 07:00-23:00 and 13/10/2025 daytime 07:00-11:00.

In the case of background sound levels (L_{A90}), mean, median and modal values have been established, as well as a statistical analysis being undertaken, as shown in Appendix D. In most cases, a suitable method of establishing a “representative” background sound level is to select the lowest of the mean, median and modal values. Based on an analysis of the statistical distribution of background sound levels, it is considered appropriate to use the lowest of the mean, median and modal values as a representative background sound level, which in this case are the modal values. Representative background sound levels that will be used for the front and rear of the building are defined in Table 4.

Location	Period	Representative Background Sound Levels L_{A90} (dB)
Front of the application site	Daytime 07:00-23:00	57
	Night-time 23:00-07:00	43
Rear of the application site	Daytime 07:00-23:00	48
	Night-time 23:00-07:00	46

Table 4 Representative background sound levels

5 PROPG STAGE 1 INITIAL SITE NOISE RISK ASSESSMENT

The environmental noise surveys have determined noise levels expected at the façades of the proposed development site, which would be the same for the first, second and third floors. The proposed first floor plan is shown below, with façade types assigned based on the noise levels incident upon them (D suffix is used for daytime levels and N suffix is used for night-time levels):



Figure 5 Noise levels during daytime and night-time at 1m from façades

An initial site risk assessment has been undertaken following the guidance presented in ProPG during daytime and night-time hours. Due to the variations in noise levels across the façades, the risk assessment has been undertaken on a façade-by-façade basis.

LOAEL and SOAEL levels have been established using DEFRA paper “Possible Options for the Identification of SOAELs and LOAELs in Support of the NPSE (2014)” (see Appendix B) based on road traffic noise being the dominant source.

Table 5 shows the risk assessments for daytime and night-time, respectively.

Façade	Time	Result	ProPG Noise Risk Category	Effect Level	Action
1 ■	Daytime 07:00-23:00	L _{Aeq} , 16 hr 67 dB	Medium	SOAEL (64-68)	Mitigate and reduce to a minimum
	Night-time 23:00-07:00	L _{Aeq} , 8 hr 63 dB	High	SOAEL (51-64)	
2 ■	Daytime 07:00-23:00	L _{Aeq} , 16 hr 66 dB	Medium	SOAEL (64-68)	
	Night-time 23:00-07:00	L _{Aeq} , 8 hr 61 dB	High	SOAEL (51-64)	
3 ■	Daytime 07:00-23:00	L _{Aeq} , 16 hr 52 dB	Low	LOAEL (53-59)	
	Night-time 23:00-07:00	L _{Aeq} , 8 hr 48 dB	Low	LOAEL (43-52)	

Table 5 Stage 1 risk assessment during daytime hours

The Acoustic Design Statement presented in Section 6 would ensure that all potential noise impacts are sufficiently mitigated to ensure that no adverse effect on health and quality of life would occur.

6 PROPAG STAGE 2: ACOUSTIC DESIGN STATEMENT

The Stage 1 Initial Site Risk Assessment has identified that parts of the site fall within the “High” noise risk categories, and therefore, a Stage 2 assessment is required.

The Acoustic Design Statement outlined below demonstrates that a good acoustic design process has been followed, and suitable acoustic design advice has been provided to ensure that noise impacts are sufficiently mitigated to ensure ‘no adverse effect on health and quality of life’.

6.1 Element 1: Good Acoustic Design

A good acoustic design process takes a multi-faceted and integrated approach to achieve optimal acoustic conditions, both internally (inside noise-sensitive parts of the building) and externally (in spaces to be used for amenity purposes).

Good acoustic design does not mean overdesign or gold plating of all new development, but seeking to deliver the optimum acoustic outcome for a particular site.

Good acoustic design is not just compliance with recommended internal and external noise exposure standards. Good acoustic design should provide an integrated solution whereby the optimum acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements.

It must be acknowledged that the inherent challenge of introducing noise-sensitive development in noisy locations can limit the extent to which good acoustic design can be achieved in harmony with the other factors that influence the overall quality of a scheme and that compromises may need to be made e.g. accepting that it may not always be possible to achieve acoustic standards with windows open or accepting that noise levels in parts of the outdoor amenity areas may not be optimal.

A good acoustic design will be one that continues to minimise noise impacts and to avoid significant noise effects for the lifetime of the development or as long as is practicable, taking into account other economic, environmental and social impacts.

Planning applications for new residential development should consider the following aspects of good acoustic design: Check the feasibility of relocating or reducing noise levels from relevant sources; Consider options for planning the site or building layout; Consider the orientation of proposed building(s); Select construction types and methods for meeting building performance requirements; Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc; Assess the viability of alternative solutions; Assess external amenity area noise.

The above considerations will then inform how best to deal with noise by either:

- Quietening or removing the source of noise;
- Attenuating the sound on its path from source to receptor;
- Obstructing the sound path between the source and receptor location;

- Improving the sound insulation of the building envelope; or
- Using agreements to manage noise.

In the case of the scheme in question, the dominant environmental noise sources already exist and cannot be removed or altered, and attenuating the sound on its path from source to receptor isn't viable by the nature of the building existing under a different use.

As part of the design process, various options for the building layout were considered to ensure that the scheme delivers functionality, amenity, privacy, daylight and outlook as well as the ability to reduce noise levels to critical spaces as much as is practically possible.

It is considered that a good acoustic design process has been followed, and no other measures could be reasonably implemented without other compromises that will adversely affect living conditions and the quality of life of the inhabitants.

6.2 Element 2: Internal Noise Level Guidelines

6.2.1 Criteria

The initial site risk assessment has identified that a suitable specification for the external building envelope must be established to ensure that the future occupiers of the building are protected from noise.

The criteria that would inform the design of the acoustic building envelope are presented in BS 8233:2014, as summarised below:

Room	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Living Room	≤ 35 dB $L_{Aeq,16hr}$	N/A
Dining Room	≤ 40 dB $L_{Aeq,16hr}$	N/A
Bedroom	≤ 35 dB $L_{Aeq,16hr}$	≤ 30 dB $L_{Aeq,8hr}$

Table 6 BS 8233:2014 indoor ambient noise levels for dwellings

In addition to the above, ProPG requires consideration of individual noise events, which should normally not exceed L_{AFmax} 45 dB more than 10 times in bedrooms at night. This criterion is referenced from the World Health Organization Guidelines for Community Noise (see Appendix B, Section 4.1).

6.2.2 Assessment Methodology

A scheme of suitable noise mitigation measures to protect the proposed dwellings against external noise relates principally to the sound insulation performance of elements of the overall external building envelope. The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes, etc.).

By following the rigorous calculation procedure outlined in Section G.2 of the sound insulation performance for the whole building envelope is assessed, considering each façade element. Note that this calculation method is based on that given in BS EN 12354-3.

6.2.3 Non-Glazed Specifications

The non-glazed external building fabric construction comprises a brickwork cavity wall, which would provide a sound reduction of at least R_w 55 dB.

6.2.4 Glazing Specifications

As external noise levels are relatively comparable for Façade Types 1 and 2, worst-case noise levels would be used to specify one glazing system for both Façade Types. A separate glazing specification would be provided for Façade Type 3, where external noise levels are much lower.

Calculations have been undertaken to reflect worst-case scenarios with regard to ratios of glazing to non-glazing, room dimensions and room absorption characteristics. The results of the calculations are shown in Appendix C.

Minimum octave band sound reduction index (SRI) values required for new glazed elements to be installed are shown in the table below. Façade Types should be cross-referenced with those shown in Figure 5 (Section 5).

Façade Type	Octave band centre frequency SRI, dB						R_w (C; C_{tr})
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
1  & 2 	-25	-26	-26	-35	-43	-44	39 (-2;-5)
3 	No specific acoustic performance required. Standard double glazing would be required to address thermal requirements, which would provide at least R_w 30 dB as a worst-case						30 (-1;-3)

Table 7 Glazing specifications for new window units

Each specification is provided for the whole window unit, including the frame. Sole glass performance data would not demonstrate compliance with this specification. The nominated glazing supplier should verify that their proposed system meets the attenuation figures shown at each centre frequency band.

Example glazing configurations capable of providing the maximum level of sound insulation required are shown in Table 8

Façade Type	Calculated Sound Insulation Requirement for New Window Units	Example Window Construction Capable of Achieving the Sound Insulation Requirement
1  & 2 	39 (-2;-5)	6mm glass / 12mm air gap / 6mm laminated glass
3 	30 (-1;-3)	Standard double glazing, e.g. 4mm glass / 4mm air gap / 4mm glass

Table 8 Example window systems for new window units

Note that the glazing specifications above are in the case that new windows are installed. Should the developer choose to retain the existing windows for Façade Types 1 and 2, a secondary glazing system would be required to ensure that the internal noise levels criteria are achieved (Note that Façade Type 3 would require new windows in any event, due to the existing window openings being enlarged in this area – see architectural elevation plans). As a secondary glazing system would include a significant cavity between the primary and secondary window systems (min. 50mm), the low-frequency performance of the

window system would be reduced, meaning that a higher overall R_w value would be required to achieve the internal noise levels criteria. Example secondary glazing systems that would achieve the internal noise criteria are detailed in Table 9.

Façade Type	Calculated Sound Insulation Requirement for Existing Window + Secondary Glazing	Example Window Construction Capable of Achieving the Sound Insulation Requirement
1  & 2 	41 (-2;-7)	Existing window system + Secondary glazing system comprised of 50mm air gap with a 6.8mm secondary glazing pane

Table 9 Example secondary glazing system

6.2.5 Ventilation Specifications

Whole Dwelling Ventilation and Overheating Mitigation

Based on previous assessments undertaken within the jurisdiction of Reading Borough Council, it is understood that the Environmental Protection Team require the following:

“Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded.”

Partially open windows would result in levels greater than 5 dB above the BS 8233:2014 recommended internal levels for all Façade Types.

Therefore, the scheme shall include the provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation.

The mechanical ventilation system should be designed to meet the internal noise levels as defined in the table below:

Room Type	dB L_{Aeq}	NR
Bedrooms / Living Rooms	30	25
Kitchen / Bathrooms	45	40

Table 10 ADF guidance levels for mechanical building services

Purge Ventilation

The only time windows will be required to be open for the purpose of ventilation will be for occasional ‘purge’ ventilation. With respect to noise levels during purge ventilation conditions, ProPG states the following:

‘...the internal noise level guidelines are generally not applicable under ‘purge ventilation’ conditions as defined by Building Control Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).’

It is therefore not considered necessary to further consider noise levels during purge ventilation conditions. Using windows for this purpose is unlikely to result in any significant adverse effects due to the limited time the window would be open, with the occupant having full control over the open condition.

For the avoidance of doubt, this is not referring to increased ventilation rates that may be required for the purposes of overheating mitigation. This is covered in more detail below.

6.2.6 Predicted Internal Noise Levels

Based on the design measures outlined above, predicted internal noise levels with new windows will be as summarised in Table 11. Full calculations are presented in Appendix E.

Façade Type	Room	Daytime L _{Aeq} , 16 hour dB	Night-time L _{Aeq} , 8 hour dB	Night-time L _{Amax} dB
1  & 2 	Bedroom	33	29	45
	Lounge / Kitchen	35	n/a	n/a
3 	Bedroom	26	22	41

Table 11 Predicted internal noise levels based on Acoustic Design Statement mitigation measures with new windows installed

In the case of secondary glazing system being preferred for Façade Type 1 and 2, predicted internal noise levels will be as summarised in Table 12. Full calculations are presented in Appendix F.

Façade Type	Room	Daytime L _{Aeq} , 16 hour dB	Night-time L _{Aeq} , 8 hour dB	Night-time L _{Amax} dB
1  & 2 	Bedroom	33	30	45
	Lounge / Kitchen	35	n/a	n/a

Table 12 Predicted internal noise levels based on Acoustic Design Statement mitigation measures with secondary glazing systems installed

As demonstrated above, all internal noise levels would be fully compliant with the ProPG guidelines and recommended internal noise levels presented in BS 8233:2014.

6.3 Element 3: External Amenity Area Noise Assessment

No external amenity areas are proposed as part of the proposal.

6.4 Element 4: Assessment of Other Relevant Issues

The final element of the ProPG Stage 2 Assessment is to review other relevant issues. The ProPG identifies five specific areas to review as detailed below.

6.4.1 Compliance with relevant National and Local Policy

In accordance with the principles outlined in the NPSE and NPPF, the preceding evaluation is considered to have effectively demonstrated that the proposed development prevents any significant detrimental effects due to noise while striving to reduce any residual negative impacts. Furthermore, the assessment has been conducted in alignment with the Reading Borough Council's guidelines and the provisions set out in ProPG and BS 8233.

6.4.2 Magnitude and Extent of Compliance with the ProPG

It is considered that the scheme complies with guidance in the ProPG and that a good acoustic design process has been followed.

6.4.3 Likely Occupants of the Development

It is understood that the scheme contains standard residential dwellings only and that future residents are unlikely to be more sensitive to noise than would typically be expected.

Given that the location of the building in a busy city centre, it is likely that occupants could well be more accepting of noise than people who might choose to reside in a quieter rural location or a city location that is subjected to lower levels of environmental noise e.g. a property on a close of cul-de-sac, with no major roads, railways or flight paths nearby.

6.4.4 Acoustic Design Versus Unintended Consequences

ESA are not aware of any unintended adverse consequences of the acoustic design measures presented within this report.

6.4.5 Acoustic Design Versus Wider Planning Objectives

ESA are not aware of any reason why the proposed acoustic design outlined in this report conflicts with wider planning objectives.

Two additional noise-related aspects which require consideration are:

1. Noise transfer from the ground floor commercial unit to the first floor residential units directly above, and ensuring sufficient resistance to the passage of sound is provided; and
2. Noise emissions associated with the external air source heat pump plant proposed as part of the scheme.

These issues are covered in Sections 7 and 8, respectively.

6.5 Recommendations to the Decision Maker

The ProPG notes that the assessment should lead to the choice of one of four possible recommendations from the noise practitioner to the decision maker:

- A. Planning consent may be granted without any need for noise conditions;
- B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
- C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or
- D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

In the case of this scheme, it is recommended that planning consent be granted subject to the inclusion of suitable noise conditions. The three key planning condition considerations in this case are:

1. **Achieving suitable internal noise levels within the development, and suitable external noise levels within amenity areas** – the Acoustic Design Statement provides suitable mitigation measures to ensure that the internal noise criteria are achieved. We would therefore recommend that a planning condition requires that the Acoustic Design Statement detailed in this report be followed in full to ensure that National and Local Planning Policy objectives are achieved.
2. **Ensuring that the air source heat pump plant proposed as part of the scheme is assessed in accordance with BS 4142:2014 to ensure a low likelihood of adverse impact** – as the scheme includes external building services plant in the form of air source heat pump units, it is important that the equipment would not give rise to adverse noise impacts. A full assessment cannot be provided at this time as the plant locations, number of units and the make and model numbers of the units are not yet finalised. Reading Borough Council's validation requirements for planning applications note that "all development should ensure that noise level should be at least 10dBA below existing background levels", pursuant to Policy EN17. A provisional assessment is provided within Section 8, whereby maximum permissible noise limits are established to ensure compliance with the Council's planning policy. It is recommended that a suitable planning condition be imposed for this aspect.

Note that no condition is required concerning noise transfer from the ground-floor commercial unit to the first-floor residential units directly above, as the existing floor construction is deemed sufficient to ensure that resistance to the passage of sound is provided. Full details of this are provided within Section 7.

7 SOUND SEPARATION BETWEEN COMMERCIAL AND RESIDENTIAL AREAS

With regards to noise into residential properties from an adjoining space via separating walls and/or floors, Approved Document E of the Building Regulations is the relevant Regulatory Framework.

It is recognised that such documentation is a Building Regulations requirement and not a planning requirement, but it is considered due to there being no national planning policy, British Standard assessment method or other noise limit guidance specifically regarding the direct transfer of noise across a building's shared structure (party walls and/or floors) to residential dwellings from an adjacent internal space. The guidance presented in BS 8233:2014 is intended for external noise sources potentially affecting a dwelling's internal acoustic environment rather than internally from adjacent properties via shared party elements (party walls and/or floors). For such a scenario, BS 8233:2014 references Approved Document E of the Building Regulations as being the relevant Regulatory Framework.

Requirement E1 of Building Regulations Approved Document E provides guidance and minimum standards for sound insulation to be achieved for separating floor and wall constructions to residential dwellings. The target minimum sound insulation standards are shown in the table below (reproduced from table 0.1a of the regulations):

Element	Airborne Sound Insulation $D_{nT,w} + C_{tr}$ (minimum values)	Impact Sound Insulation $L'_{nT,w}$ (minimum values)
Purpose built dwelling-houses and flats		
Walls	45	-
Floors and stairs	45	62
Dwelling-houses and flats formed by a material change of use		
Walls	43	-
Floors and stairs	43	64

Table 13 Dwelling-houses and flats – performance standards for separating walls, separating floors and stairs that have a separating function

For this scheme, the criteria for “*dwelling-houses and flats formed by a material change of use*” would be applicable.

The Approved Document advises that the sound insulation performance standards are appropriate for floors and walls that separate spaces used for normal domestic purposes, and that a higher standard of sound insulation may be required between spaces used for domestic purposes and non-domestic purposes. In these situations, the appropriate level of sound insulation will depend on the noise generated in the non-domestic space, and the document further advises that specialist advice may be needed to establish if a higher standard of sound insulation is required, and if so, to determine the appropriate level. This “appropriate level” would be dependent on the source noise levels expected to be generated within the commercial unit.

As the commercial unit in question is a bank operated by TSB, this would not be considered a significant noise generator, as the main noise generated would only include normal human speech between staff and customers. A bank would not generate high or even moderately high internal noise levels and can even be considered to have less potential for noise impact than if the adjacent spaces were residential

use. This is due to the fact that the commercial unit would only be occupied from 09:00 to 16:00 Monday to Friday, and from 09:00 to 13:00 on Saturday, whereas residential use is typically occupied 24 hours a day with domestic noise occurring at any time, including during the night (e.g. loud music, televisions, or white goods such as a washing machine/tumble driers, etc). The commercial unit in this case would generate no noise during the late evening, night or early morning hours, which are the times most likely to cause disturbance when residents are preparing for sleep and/or sleeping.

It is understood that the structural floor is comprised of a 250mm reinforced concrete slab, with a ceiling below within the bank comprised of an MF-type suspended ceiling with lay-in absorptive ceiling tiles. This existing construction would be expected to provide a sound reduction in the region of $D_{nTw} + C_{tr}$ 55 dB, therefore comfortably surpassing the required level of sound insulation. No additional mitigation measures would be required to protect future residents from the passage of sound from the commercial unit into the flats via the party floor.

8 EXTERNAL BUILDING SERVICES PLANT NOISE IMPACT ASSESSMENT

Once the M&E proposals are finalised, a full assessment should be conducted in accordance with BS 4142:2014+A1:2019, which would inform any necessary mitigation measures. As noted in Section 6.5, we would recommend that this aspect be conditioned.

Reading Borough Council's validation requirements for planning applications note that "all development should ensure that noise level should be at least 10dBA below existing background levels", pursuant to Policy EN17.

Note that the specific criteria would depend on the receptor location relative to the proposed air source heat pump installation locations. Representative background sound levels and maximum permissible noise limits are presented in Table 14.

Location of Noise Sensitive Receptor Relative to Proposed ASHP Installation Location	Period	Representative Background Sound Levels	Maximum Permissible Sound Level to Achieve 10 dBA Below Background as per Policy EN17 dBA
		L _{A90} (dB)	
Front of the application site	Daytime 07:00-23:00	57	47
	Night-time 23:00-07:00	43	33
Rear of the application site	Daytime 07:00-23:00	48	38
	Night-time 23:00-07:00	46	36

Table 14 Maximum permissible sound level to achieve 10 dBA below background as per policy EN17

9 CONCLUSION AND SUMMARY

ES Acoustics Ltd have been instructed by TE Broad St Ltd to prepare a noise impact assessment for the proposed development at 200-202 Broad Street, Reading, RG1 7QJ.

This report is prepared to support a full planning application for the change of use of the upper floors to nine self-contained flats, including a change to the ground floor entrance, enlargement of rear windows and removal of roof level plant enclosure.

This assessment aligns with the principles of government planning policy on noise, as outlined in the National Planning Policy Framework (NPPF), the National Planning Practice Guidance (NPPG) on Noise, and the Noise Policy Statement for England (NPSE), and follows the recommended approach for the assessment of noise in relation to residential development, as outlined in the Professional Practice Guidance on Planning and Noise: New Residential Development (ProPG).

The site has been assessed via environmental noise surveys to ensure that worst-case environmental noise scenarios are considered.

An initial site risk assessment has been undertaken following the guidance presented in ProPG. It has been found that the site falls within the “Low” to “High” noise risk categories, depending on the façade.

An Acoustic Design Statement has been produced to ensure that significant adverse effects due to noise are avoided, or minimised and mitigated. A summary of the recommendations is presented in Section 10 for ease of reference.

The assessment of external noise ingress has concluded that significant adverse effects are unlikely to occur at the proposed residential development if appropriate mitigation measures are implemented.

With regards to sound transference between commercial and residential areas, it is confirmed that the existing floor construction would provide a suitable reduction to the passage of sound, with no further upgrades or mitigation required.

With regards to the proposed air source heat pump units, a full noise impact assessment is not yet possible as the plant locations, number of units and the make and model numbers of the units are not yet finalised. Reading Borough Council’s validation requirements for planning applications note that “all development should ensure that noise level should be at least 10dBA below existing background levels”, pursuant to Policy EN17. A provisional assessment is provided within Section 8, whereby maximum permissible noise limits are established to ensure compliance with the Council’s planning policy. It is recommended that a suitable planning condition be imposed for this aspect

10 SUMMARY OF RECOMMENDATIONS

The recommendations proposed within this report are summarised in the table below for ease of reference:

External Building Fabric Specifications																															
Minimum SRI of Non-Glazed Elements	R_w 55 dB, as provided by the existing cavity brickwork construction																														
Minimum SRI of Glazed Elements in the case of New Windows	Glazing performance specifications:																														
	<table><tr><th rowspan="2">Façade Type</th><th colspan="6">Octave band centre frequency SRI, dB</th><th rowspan="2">R_w (C;C_{tr})</th></tr><tr><th>125Hz</th><th>250Hz</th><th>500Hz</th><th>1kHz</th><th>2kHz</th><th>4kHz</th></tr><tr><td>1 ■ + 2 ■</td><td>-25</td><td>-26</td><td>-26</td><td>-35</td><td>-43</td><td>-44</td><td>39 (-2;-5)</td></tr><tr><td>3 ■</td><td colspan="6">No specific acoustic performance required. Standard double glazing would be required to address thermal requirements, which would provide at least R_w 30 dB as a worst-case</td><td>30 (-1;-3)</td></tr></table>	Façade Type	Octave band centre frequency SRI, dB						R_w (C;C _{tr})	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	1 ■ + 2 ■	-25	-26	-26	-35	-43	-44	39 (-2;-5)	3 ■	No specific acoustic performance required. Standard double glazing would be required to address thermal requirements, which would provide at least R_w 30 dB as a worst-case						30 (-1;-3)
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Example systems:																															
<table><tr><th>Façade Type</th><th>Calculated Sound Insulation Requirement for New Window Units</th><th>Example Window Construction Capable of Achieving the Sound Insulation Requirement</th></tr><tr><td>1 ■ + 2 ■</td><td>39 (-2;-5)</td><td>6mm glass / 12mm air gap / 6mm laminated glass</td></tr><tr><td>3 ■</td><td>30 (-1;-3)</td><td>Standard double glazing, e.g. 4mm glass / 4mm air gap / 4mm glass</td></tr></table>	Façade Type	Calculated Sound Insulation Requirement for New Window Units	Example Window Construction Capable of Achieving the Sound Insulation Requirement	1 ■ + 2 ■	39 (-2;-5)	6mm glass / 12mm air gap / 6mm laminated glass	3 ■	30 (-1;-3)	Standard double glazing, e.g. 4mm glass / 4mm air gap / 4mm glass																						
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Façade Type Reference:																															
Minimum SRI of Glazed Elements in the case of Secondary Glazing Systems	Example system:																														
<table><tr><th>Façade Type</th><th>Calculated Sound Insulation Requirement for Existing Window + Secondary Glazing</th><th>Example Window Construction Capable of Achieving the Sound Insulation Requirement</th></tr><tr><td>1 ■ + 2 ■</td><td>41 (-2;-7)</td><td>Existing window system + Secondary glazing system comprised of 50mm air gap with a 6.8mm secondary glazing pane</td></tr></table>	Façade Type	Calculated Sound Insulation Requirement for Existing Window + Secondary Glazing	Example Window Construction Capable of Achieving the Sound Insulation Requirement	1 ■ + 2 ■	41 (-2;-7)	Existing window system + Secondary glazing system comprised of 50mm air gap with a 6.8mm secondary glazing pane																									
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Ventilation Recommendations Approved Document F	Mechanical ventilation with suitable noise limits:																														
	<table><tr><th>Room Type</th><th>dB L_{Aeq}</th><th>NR</th></tr><tr><td>Bedrooms / Living Rooms</td><td>30</td><td>25</td></tr><tr><td>Kitchen / Bathrooms</td><td>45</td><td>40</td></tr></table>	Room Type	dB L_{Aeq}	NR	Bedrooms / Living Rooms	30	25	Kitchen / Bathrooms	45	40																					
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Kitchen / Bathrooms	45	40																													
Separating Party Floor Between Commercial Areas																															
Sound Insulation Between Commercial and Residential Areas	No mitigation required.																														
Proposed Air Source Heat Pump Units																															
Maximum Permissible Noise Limits	<table><tr><th>Location of Noise Sensitive Receptor Relative to Proposed ASHP Installation Location</th><th>Period</th><th>Representative Background Sound Levels L_{A90} (dB)</th><th>Maximum Permissible Sound Level to Achieve 10 dBA Below Background as per Policy EN17 dBA</th></tr><tr><td rowspan="2">Front of the application site</td><td>Daytime 07:00-23:00</td><td>57</td><td>47</td></tr><tr><td>Night-time 23:00-07:00</td><td>43</td><td>33</td></tr><tr><td rowspan="2">Rear of the application site</td><td>Daytime 07:00-23:00</td><td>48</td><td>38</td></tr><tr><td>Night-time 23:00-07:00</td><td>46</td><td>36</td></tr></table>	Location of Noise Sensitive Receptor Relative to Proposed ASHP Installation Location	Period	Representative Background Sound Levels L_{A90} (dB)	Maximum Permissible Sound Level to Achieve 10 dBA Below Background as per Policy EN17 dBA	Front of the application site	Daytime 07:00-23:00	57	47	Night-time 23:00-07:00	43	33	Rear of the application site	Daytime 07:00-23:00	48	38	Night-time 23:00-07:00	46	36												
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Table 15 Summary of recommended mitigation measures

GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel scale - dB

The decibel (dB) is a relative unit of measurement used in acoustics. The dB is a logarithmic ratio between a measured level and a reference level of 0 dB (i.e the threshold of human hearing). Simply put, the decibel compresses the wide range of sounds we hear into more manageable numbers.

Addition of noise from several sources

Sound produced by multiple sound sources are added logarithmically e.g. power ratio of 2 = 3dB, power ratio of 10 = 10dB. Therefore, two equally intense sound sources operating simultaneously produce a sound level which is 3dB higher than a single source e.g. 60dB + 60dB = 63dB.

Subjective impression of noise

Human response to sound is highly individualized and often based on psychological factors such as emotion and expectation. Sensitivity to sound typically depends on the loudness, pitch, duration of the occurrence, and time of occurrence (e.g. a sound source could cause annoyance during the night where it would not during the day). The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level	Change in perceived loudness
1 dB	Imperceptible
3 dB	Just barely perceptible
6 dB	Clearly noticeable
10 dB	About twice as loud

'A' Weighted Frequency Filter - dB(A)

The human ear is not equally sensitive in all frequencies. The A-weighting filter was devised to take this into account when undertaking noise measurements and allows a sound level meter to replicate the human ears response to sound.

$L_{Aeq, T}$

Sound can fluctuate widely over a given period. L_{Aeq} is the A-weighted equivalent continuous sound level, with T denoting the time period over which the fluctuating sound levels were averaged e.g. $L_{Aeq, 16h}$ is the equivalent continuous noise level over an 16 hour period.

L_{A90}

A-weighted sound level exceeded for 90% of the measurement period, calculated via statistical analysis. The L_{A90} descriptor is typically used to establish background sound levels for noise impact assessments

L_{A10}

A-weighted sound level exceeded for 10% of the measurement period, calculated via statistical analysis.

L_{AFmax}

A-weighted sound level maximum sound pressure level that has been measured over a given time period

GLOSSARY OF ACOUSTIC TERMINOLOGY

Octave Bands

The audio or frequency spectrum of the human ear is in the range of 20Hz to 20 kHz. The spectrum tells how the energy of the sound signal is distributed in frequency. Octave bands divides the audio spectrum into 10 equal parts. The International Standards Organisation defines the centre frequency of these bands as 31.5Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1kHz, 2kHz, 4kHz, 8kHz and 16kHz.

Noise Rating (NR) Curves

A method of rating noise using a set of curves relating octave band sound pressure levels. Typically used for building services systems within offices

Airborne sound

Sound radiated from a source into the surrounding air e.g. musical instruments, tv/radio, machinery/equipment. Airborne sound insulation refers to the reduction or attenuation of airborne sound, usually via a solid partition between a source and receiver.

Impact sound

Sound resulting from the impact between colliding objects, e.g. footfall impact upon a floor. Impact sound insulation refers to the resistance of a floor to the transmission of impact sound, typically via the installation of a 'resilient layer'

Flanking sound

The transmission of airborne sound between two adjacent rooms by paths other than via the separating partition between the rooms, e.g. the abutment point of a wall and floor.

Structure-borne noise

Noise caused by the vibration of elements of a structure. This can result in reradiated noise, whereby the vibrating element transmits airborne sound into a space e.g. vibration caused by mechanical plant installed within a plant room which is not adequately isolated from the structure, or construction/demolition work in an adjacent building.

Reverberant sound

Sound in an enclosed space (usually a room), which results from repeated reflections at the boundaries. Reverberation time is the time taken for a steady sound level in an enclosed space to decay by 60dB, measured from the moment the sound source is switched off. A example of a typically reverberant space would be a classic church. Absorptive materials can be used to reduce reflections and reverberation times.

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

1 NATIONAL POLICY

1.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) covers issues relating to noise and planning in England.

The paragraphs relating to noise state:

187. *Planning policies and decisions should contribute to and enhance the natural and local environment by; [...]*
- 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. 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*
198. *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;*
- 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; [...]*
200. *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.*

1.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The long-term vision of the Government noise policy is to '*Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.*'

The NPSE vision noted above is supported by the following aims:

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

APPENDIX B

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

- 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

The NPSE outlines observed effect levels relating to the above, as follows:

- *No observed effect level (NOEL): this is the level of noise exposure below which no effect at all on health or quality of life can be detected;*
- *Lowest observed adverse effect level (LOAEL): this is the level of noise exposure above which adverse effects on health and quality of life can be detected;*
- *Significant observed adverse effect level (SOAEL): This is the level of noise exposure above which significant adverse effects on health and quality of life occur;*

Noise effect levels are not set at absolute noise level targets, but instead vary depending on the context and character of the noise and site-specific factors which may impact on the severity of the effect. The NPSE states:

'It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.'

1.3 National Planning Practice Guidance (NPPG)

The NPPG provides practical guidance on how the NPPF should be applied as well as and guidance on the factors influencing whether noise may be a concern at the planning stage and how adverse effects can be mitigated. The table below summarises the effect levels presented within the NPSE, as follows:

Response	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific Measures required
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate & reduce to a minimum

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

Response	Examples of Outcomes	Increasing Effect Level	Action
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, 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.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1 Noise exposure hierarchy

2 LOCAL POLICY

2.1 Reading Borough Local Plan

The Local Plan presents the following noise-related planning policies:

CC8: SAFEGUARDING AMENITY

Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

...

- Noise and disturbance

...

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy.

As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable.

Where an otherwise acceptable development could change its character to a use that would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes.

EN16: POLLUTION AND WATER RESOURCES

Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution; where it would result in no deterioration in, or ideally enhance, ground and surface water quality; and where adequate water resources, sewerage and wastewater treatment infrastructure will be in place to support the proposed development prior to occupation.

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.

EN17: NOISE GENERATING EQUIPMENT

Where noise generating equipment is proposed, the noise source specific⁶¹ level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor.

H8: RESIDENTIAL CONVERSIONS

Proposals to convert buildings into self-contained flats or for multiple occupation will be assessed against the impact on the amenity and character of the surrounding area, particularly in terms of intensification of activity, loss of privacy, loss of external amenity space, the provision and location of adequate on-site car parking and the treatment of bin storage areas and other related servicing. Proposals to convert properties into self-contained flats or for multiple occupation will only be acceptable where:

...

- *There are no unacceptable adverse impacts to residents of the scheme or surrounding properties arising from noise and disturbance in terms of the number and layout of units proposed and the proximity to other properties;*

...

CR6: LIVING IN CENTRAL READING

Proposals for residential development within the central area will be assessed against the following criteria:

...

ii) Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated.

...

APPENDIX B

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

3 BEST PRACTICE AND GUIDANCE

3.1 World Health Organization (WHO) Guidelines

WHO Guidelines for Community Noise (1999) provides guideline values for community noise in specific environments. This has since been supplemented by WHO Environmental Noise Guidelines for European Region (WHO, Regional office for Europe, 2018).

The WHO guideline values most relevant to new residential development are outlined in the table below:

Specific Environment	Critical Health Effects	L _{Aeq, T} [dB]	L _{Afmax} [dB]	Time Base
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	n/a	07:00-23:00
	Sleep disturbance night-time	30	45	23:00-07:00
Dwelling, outdoors	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00
Outdoor living area	Serious annoyance, daytime and evening	55	n/a	07:00-23:00
	Moderate annoyance, daytime and evening	50	n/a	07:00-23:00

Table 2 Guideline Values from WHO Guidelines for Community Noise (1999)

The effects of noise in dwellings are typically sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms at night are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events, but the guidance also notes that lower noise levels may be disturbing depending on the nature of the noise source.

3.2 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

Table 4 of BS 8233:2014 (reproduced below) provides guidance on recommended internal ambient noise levels in residential spaces based on World Health Organization (WHO) research.

Room	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Living Room	≤ 35 dB L _{Aeq,16hr}	N/A
Dining Room	≤ 40 dB L _{Aeq,16hr}	N/A
Bedroom	≤ 35 dB L _{Aeq,16hr}	≤ 30 dB L _{Aeq,8hr}

Table 3 BS 8233:2014 indoor ambient noise levels for dwellings

The following notes should be considered alongside the levels presented above:

- The levels presented above are for steady external noise sources without a specific character. Noise is considered to have a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate*
- The levels are based on annual average data and do not have to be achieved in all circumstances e.g. it is normal to exclude occasional events, such as fireworks night or New Year's Eve*

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

- *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*
- *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*
- *The levels outlined above are not applicable under “purge ventilation” conditions as defined by Approved Document F of the Building Regulations, as this should only occur occasionally e.g. to remove odour from painting or burnt food). However, the levels above should be achieved whilst providing sufficient background ventilation, either via passive or mechanical methods*

It should be noted that the 2014 version of BS 8233:2014 does not include any specific requirement for maximum instantaneous noise levels ($L_{\max}$) within dwellings. However, methodology for the assessment of maximum noise levels is included in ProPG and referenced in WHO guidelines.

Section 7.7.3.2 of BS 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’ presents desirable guideline levels for amenity areas. The section is presented in its entirety below:

“For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.”

3.3 ProPG: Professional Practice Guidance on Planning and Noise

ProPG was published to provide practitioners with guidance and a recommended approach for the assessment of noise impact on residential developments during the planning stage.

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The guidance can be seen as the missing link between the current NPPF and its predecessor, PPG24 (Planning Policy Guidance 24: Planning and Noise), which provided a prescriptive method for assessing sites for residential development but without the nuance of the key elements described in ProPG.

The guidance seeks to assist in the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise and encourage a good acoustic design in and around proposed new residential development whilst considering national policy on planning and noise.

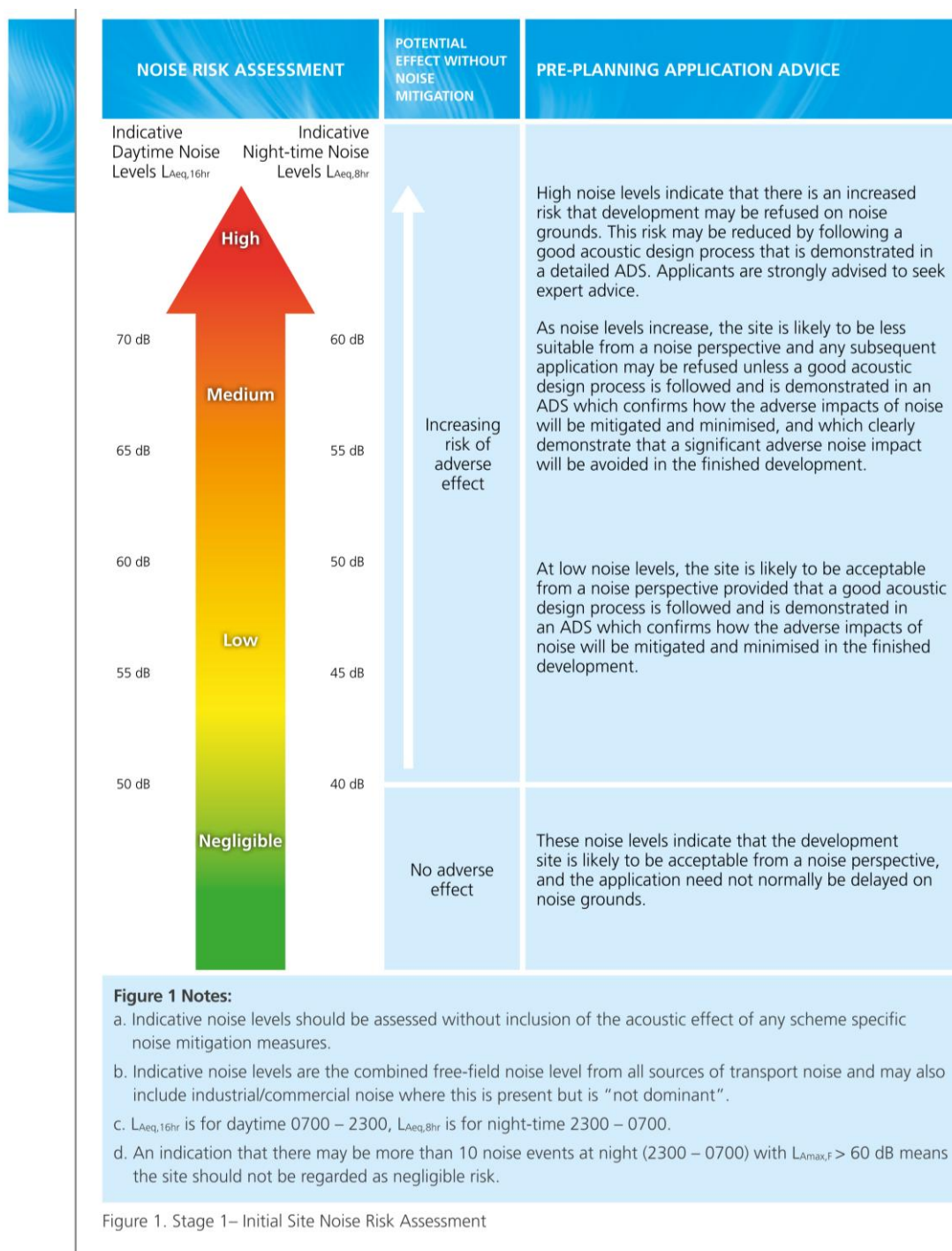
The recommend approach for assessment is summarised below:

- *Stage 1 – an initial noise risk assessment of the proposed development site*
- *Stage 2 – a systematic consideration of four key elements:*
 - *Element 1 – Demonstrating a “Good Acoustic Design Process” (including feasibility of reducing or relocating existing noise sources, site orientation and building layout and appropriate constructions methods to meet performance requirements);*
 - *Element 2 – Observing internal “Noise Level Guidelines” (as presented in Section 4.2, with additional consideration of individual noise events which should normally not exceed L_{AFmax} 45 dB more than 10 times in bedrooms at night);*
 - *Element 3 – Undertaking an “External Amenity Area Noise Assessment” (ProPG aligns with BS 8233:2014 and suggests that noise levels in external amenity areas should ideally not be above $L_{Aeq,16hr}$ 50-55dB. However, there is an acceptance that these guideline values may not be achievable in all circumstances where development might be desirable, and in such situations, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited.); and*
 - *Element 4 – Consideration of “other relevant issues” (including compliance with national and local policy, acoustic design vs unintended adverse consequences, acoustic design vs wider planning objectives)*

To help consider noise at a site at an early stage an initial noise risk assessment should assess the Noise Risk Category of the site to help provide an indication of the likely suitability of the site for new residential development from a noise perspective. The table below sets out the indicative noise levels for the Noise Risk Categories and a description of the potential effect of noise where no further noise mitigation is to take place as well as additional guidance.

APPENDIX B

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3.3.1 Possible Options for the Identification of SOAELs and LOAELs in Support of the NPSE (2014)

Commissioned by Defra and developed through research conducted by AECOM, the study titled "Possible Options for the Identification of SOAELs and NOAELs in Support of the NPSE" explores potential numerical values for SOAELs and NOAELs, which are concepts introduced within the Noise Policy Statement for England (NPSE). Following the revocation of PPG24: Planning and Noise in 2012, which previously outlined Noise Exposure Categories with defined numerical thresholds, the NPSE faced criticism for lacking specific quantitative guidance. Although both the NPSE and the National Planning Policy Framework (NPPF) advocate for context-

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driven, location-specific noise criteria, the absence of numerical benchmarks posed challenges in applying the NPSE effectively.

To address this, the research project proposes indicative values and potential value ranges for SOAELs and NOAELs across various noise sources, with the findings summarised in Table 4.

Source	Effect	LOAEL	SOAEL
Road	Annoyance (Daytime)	56 (53-59)	66 (64-68)
	Sleep (Night-time)	46 (43-52)	56 (51-64)
Rail	Annoyance (Daytime)	63 (61-66)	72 (70-74)
	Sleep (Night-time)	55 (52-63)	68 (61-77)
Air	Annoyance (Daytime)	52 (50-54)	60 (58-62)
	Sleep (Night-time)	41 (40-49)	53 (47-60)

Table 4 Possible Value & Ranges of Values for LOAEL & SOAEL

3.3.2 Approved Document O: Overheating

Approved Document O took effect on 15 June 2022 with the aim to protect the health and welfare of occupants of a building by reducing the occurrence of high indoor temperatures with residential buildings.

Paragraph 3.3 covers the noise consideration and is presented below:

3.3 *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).*

Following the adoption of ADO, the 'Approved Document O Noise Guide' has been published by the Institute of Acoustics and Association of Noise Consultants to provide guidance for practitioners when implementing the standards within ADO relating to noise.

Requirement O1 requires reasonable provision for limiting unwanted solar gain as well as providing an adequate means of removing excess heat from the indoor environment. Compliance with Requirement O1 can be demonstrated via a simplified method or via dynamic thermal modelling.

The simplified method presents minimum free areas for bedrooms as a percentage of the floor area for high and medium risk locations, which are 13% and 4% respectively. The ADO Noise Guide clarifies the following external noise levels above which the simplified method cannot be used:

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Parameter	High Risk Location	Moderate Risk Location
$L_{Aeq,8h}$ averaged over 8 hours (between 11pm and 7am)	45 dB	50 dB
L_{AFmax} more than 10 times a night (between 11pm and 7am)	60 dB	65 dB

Table 5 External noise levels above which the simplified method cannot be used (Ref: ADO Noise Guide)

Note that these values do not account for façade elements in front of the window (e.g. balconies).

The thermal modelling method requires a CIBSE TM59 assessment and consideration of acceptable strategies for reducing overheating risk via limiting solar gains and removing excess heat from the building.

Paragraphs 2.7 and 2.10 are presented below:

2.7 Solar gains in summer should be limited by any of the following means.

a. Fixed shading devices, comprising any of the following.

- i. Shutters, ii. External blinds, iii. Overhangs, iv. Awnings.*

b. Glazing design, involving any of the following solutions.

- i. Size, ii. Orientation, iii. g-value, iv. Depth of the window reveal.*

c. Building design – for example, the placement of balconies.

d. Shading provided by adjacent permanent buildings, structures, or landscaping.

2.10 Excess heat should be removed from the residential building by any of the following means.

a. Opening windows (the effectiveness of this method is improved by cross-ventilation).

b. Ventilation louvres in external walls.

c. A mechanical ventilation system.

d. A mechanical cooling system

In meeting the obligations noted above, consideration must be given to noise during night, pollution, security, protection from falling and protection from entrapment.

The ADO Noise Guide suggests that in the case of dynamic thermal modelling (when noise and air quality are not a constraint), the primary approach to remove excess heat should be via an open window. From the established external noise exposure at each bedroom window, the outside to inside level difference should be calculated, and then the target Equivalent Area should be predicted using the following equations (depending on whether the required level difference is free-field or façade):

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Equation 1⁸

$$EA \text{ based on façade level difference} = V \times 10^{\left(\frac{-(D_{2m,nT} + 5)}{10}\right)}$$

Where

$D_{2m,nT}$ is the is the façade level difference between the A-weighted level 2m in front of the façade ($L_{1,2m}$), and the standardised internal A-weighted level ($L_{eq,2,nT}$). In the absence of any better alternative method, the same principle can be applied to L_{AFmax} .

V is the room volume (m^3)

EA is the Equivalent Area of the open window (m^2)

Equation 2⁸

$$EA \text{ based on freefield level difference} = V \times 10^{\left(\frac{-(D_{nT} + 8)}{10}\right)}$$

The total maximum Equivalent Area for each bedroom to meet the required standardised level difference should then be communicated to the dynamic thermal modelling consultant to verify whether or not the building is still at risk of overheating with the Equivalent Areas calculated.

In the case where openable windows are not suitable and a mechanical ventilation system is required, the following noise limits should be observed:

Parameter	Bedrooms
Mechanical ventilation or mechanical cooling system noise	$L_{Aeq,T} 30 (\pm 5)$ dB

Table 6 Recommended noise level for mechanical ventilation or mechanical cooling systems

Higher noise levels than those in Table 2, e.g. by up to 10 dBA, may be appropriate in some operating scenarios, where rapid changes to the cooling or ventilation rates quickly improve the thermal comfort of the occupant. Equally, lower noise levels may be appropriate for some types of residential development.

The ADO Noise Guide suggests the following assessment steps:

To determine if an open window can be used for removing excess heat, it is recommended that the acoustic consultant adopts the following process:

1. Establish the night-time noise exposure at all bedroom windows as advised in this document;
2. Determine the outside to inside sound insulation for each bedroom window required to meet the noise threshold;
3. Determine the Equivalent Area to achieve the required outside to inside sound insulation as determined in 2) above; and
4. Communicate the required total maximum night-time Equivalent Area via an open window for the dynamic thermal modeller to use.

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For bedrooms that cannot rely on an open window to remove excess heat at night due to noise constraints, the thermal modeller should identify the solution to remove excess heat. The acoustic consultant can then advise the acoustic requirements for any proposed provisions.

One clear way of communicating the advice is to provide a mark-up showing the required performance at each façade / window.

The dynamic thermal modelling report should contain sufficient reference to any associated noise assessment, the required sound insulation performance and maximum night-time Equivalent Area and the basis for defining these.

3.4 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

BS 4142:2014+A1:2019 provides a methodology for rating and assessing the impacts of industrial and commercial sound at noise sensitive receptors. In the context of this report, this guidance would be relevant for any new fixed plant installations that might be installed for the scheme.

The methodology involves comparing the Rating Noise Level due to the sound source/s under assessment with the existing background sound level (L_{A90}) when the noise source is not operating to estimate the initial impact, as follows (Typically, the greater this difference, the greater the magnitude of the impact):

- a) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context*
- b) A difference of around +5 dB could be an indication of an adverse impact, depending on the context*
- c) The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context*

The standard notes that a noise source under assessment will have a 'low impact' when the 'rating level' of a noise source is less than the existing background sound. It is also important to note that any quantitative assessment results are assessed considering the context in which the sound occurs.

The standard notes three types of context within Clause 11, which are:

- 1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

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

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might

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simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

- 2) *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*
- 3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as i. facade insulation treatment, ii. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation, and iii. acoustic screening.*

The definitions noted above are described below:

- **Specific sound** – sound source being assessed ($L_s = L_{Aeq, Tr}$)
- **Residual sound** – Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound ($L_r = L_{Aeq, T}$)
- **Ambient sound** – totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far ($L_a = L_{Aeq, T}$)
- **Background level** – sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval ($L_{A90, T}$)
- **Rating level** – specific sound level plus any adjustment for the characteristic features of the sound ($L_{Ar, Tr}$)

With regards to background sound levels, BS 4142:2014+A1:2019 notes:

“In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.”

With regards to the ‘rating level’, the adjustments for the characteristic features of the sound are outlined below:

- *Tonality – +2 dB for a tone which is ‘just perceptible’ at the noise receptor, +4 dB where it is ‘clearly perceptible’, and +6 dB where it is ‘highly perceptible’*
- *Impulsivity – +3 dB for a tone which is ‘just perceptible’ at the noise receptor, +6 dB where it is ‘clearly perceptible’, and +9 dB where it is ‘highly perceptible’*
- *Intermittency – +3 dB if the intermittency is readily distinctive against the residual acoustic environment*

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- *Other sound characteristics – where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.*

It must be noted that as the rating level is determined at the closest noise sensitive receptor, the acoustic feature corrections should be applied based on the level at receptor location, not at source. This is particularly relevant when noise propagation characteristics cause differences in sound reduction at various frequency bands.

Note that the assessment reference periods that should be considered for daytime and night-time, as defined within the standard, are:

- *One hour period for a sound source operating during daytime hours (07:00-23:00 hours)*
- *Fifteen-minute period for a sound source operating during the night-time (23:00-07:00 hours)*

ES Acoustics Notes regarding Context:

The notes presented below are informed by the BS 4142:2014+A1:2019 Technical Note prepared by the Association of Noise Consultant Good Practice Working Group. Assessment context is often misunderstood or applied incorrectly, and the notes are therefore presented to provide a clear picture on what aspects of context should be considered when assessing the overall impact of a particular scenario:

Subclause 11(1)

The second paragraph notes that absolute levels may be as, or more, important than relative outcomes where background and rating levels are low. It is important to note that both background and rating levels would need to be low for this particular caveat to apply.

BS 4142 does not indicate how the initial estimate of impact should be adjusted when background and rating levels are low, only that the absolute levels may be more important than the difference between the two values. It is likely that where the background and rating levels are low, the absolute levels might suggest a more acceptable outcome than would otherwise be suggested by the difference between the values. For example, a situation might be considered acceptable where a rating level of 30dB is 10dB above a background sound level of 20dB, i.e. an initial estimate of a significant adverse impact is modified by the low rating and background sound levels. However, there may be situations where the opposite is true, and it is for the assessor to justify any modifications to the initial estimate of impact.

BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90} , and low rating levels as being less than about 35 dB $L_{Ar,Tr}$. We would consider that similar values would not be unreasonable in the context of the current edition of BS 4142.

The third paragraph states that "where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts".

In the ordinary application of BS 4142 the residual sound level is not compared with the background sound level to determine the level of impact. The third paragraph is therefore taken to mean that the level of impact caused

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by the residual level has been determined by professional judgement or with reference to another document, such as the Noise Insulation Regulations 1975 (as amended 1988). Where professional judgement is used, it should be appropriately justified.

Where the residual sound levels are very high, a significant adverse impact might be declared in a situation where the rating level exceeds the background sound level by, say, 4dB, i.e. since the residual sound levels are already considered to cause a significant impact, any worsening of the situation would be considered a significant adverse impact, even if the difference between the rating level and background sound level would not suggest this to be the case.

Subclause 11(2)

The second aspect of context described in BS 4142 relates to the character and level of the specific sound. In essence, whether or not the character of the sound is distinguishable from the character of the ambient or residual acoustic environment or is incongruous.

BS 4142 does not provide instruction as to how to treat the assessment outcomes in these circumstances, nor does it explain how to distinguish between this contextual consideration and the process for applying rating penalties. The latter is itself informed by the distinctive characteristics of the specific sound in the context of the residual sound environment.

Where character-based contextual matters are taken into account, the assessor should make it clear how these matters are distinct from those that informed the rating level corrections, and what the implications of these further character assessments should be. For example; new deliveries on an estate entailing rating penalties for reversing alarms and impulsive noise but these types of noise are already present at other existing premises, so contextually the impact is reduced. Conversely, where the residual level is largely comprised of natural sounds, such as the sea or birdsong, so the impact from the specific source might be increased.

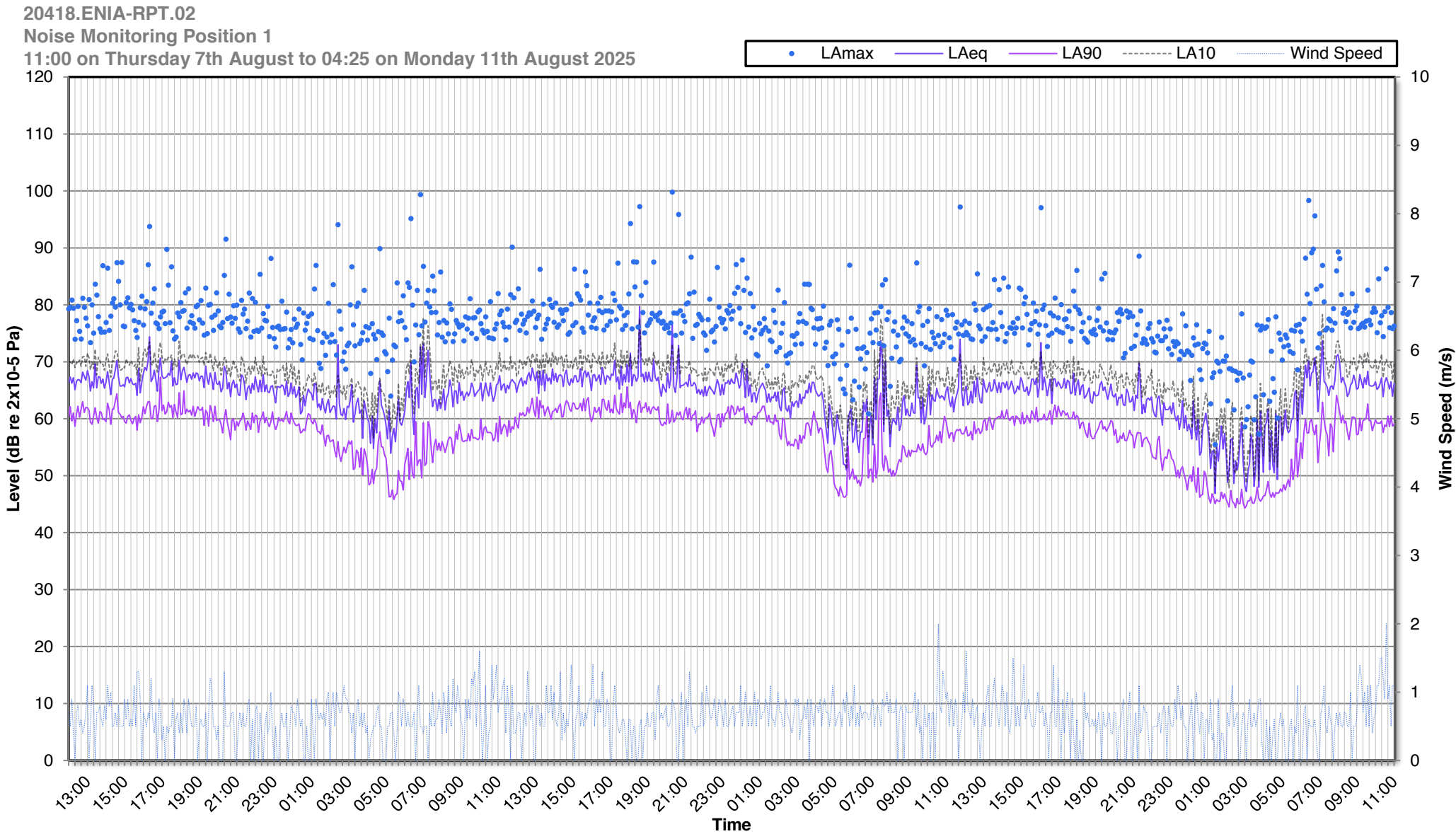
Subclause 11(3)

The third contextual matter described in Clause 11 relates to the receptor itself. It is important to note that the reference at the start of this section of BS 4142 to 'the sensitivity of the receptor' refers to a generic receptor type, i.e. a dwelling, and not to the particular attitudes or responses of a particular person (although if the residential receptor type is specific it may have a bearing e.g. student accommodation).

The ANC working group notes that this part of BS 4142 allows the internal noise environment to be considered, despite BS 4142 excluding such matters from its Scope (Subclauses 1.1, 1.2 and 1.3). The working group considers that the consideration of the internal noise environment is only valid in a BS 4142 assessment where it relates to the contextual elements of the assessment.

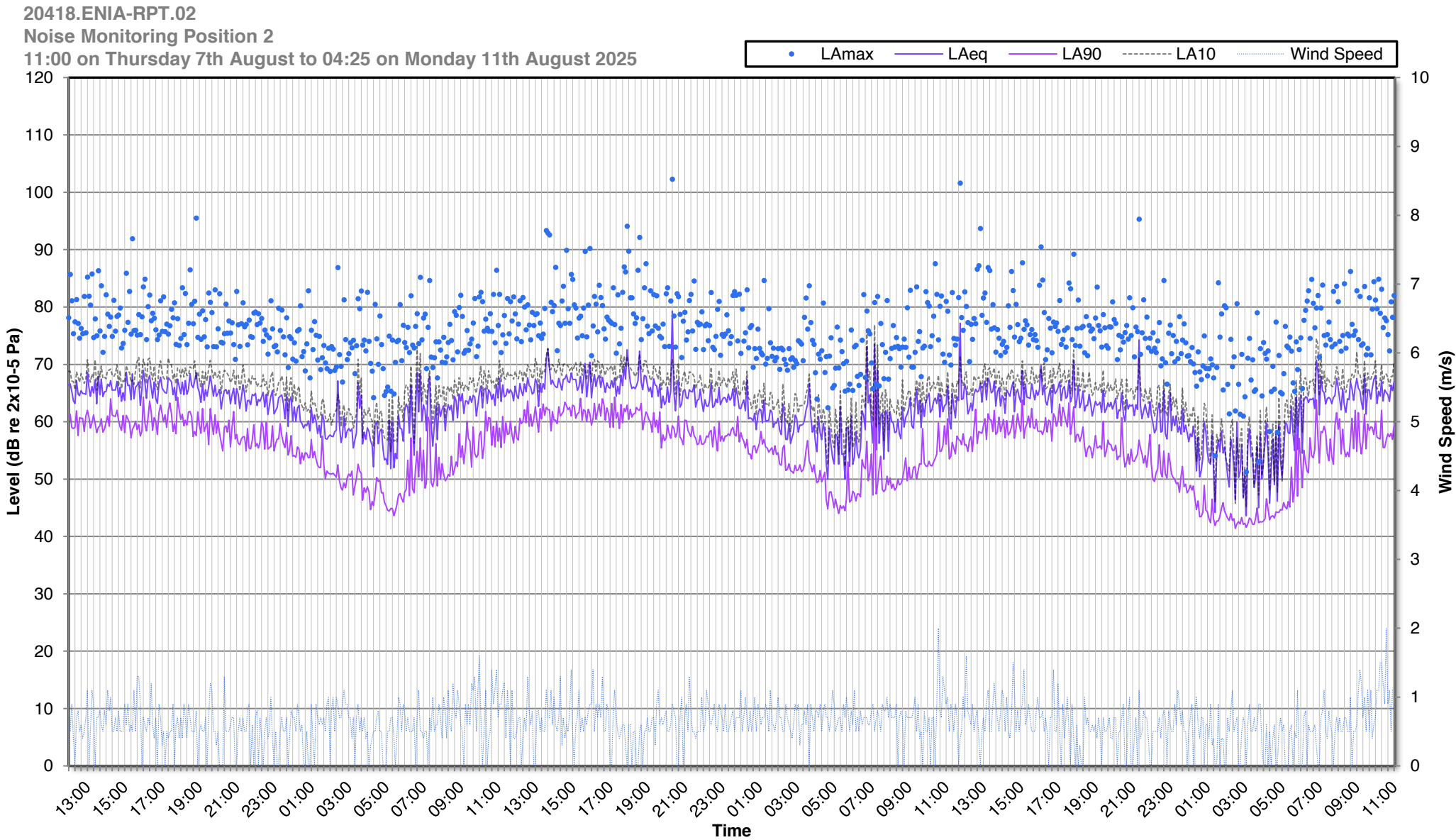
APPENDIX C

ENVIRONMENTAL NOISE TIME HISTORY GRAPH



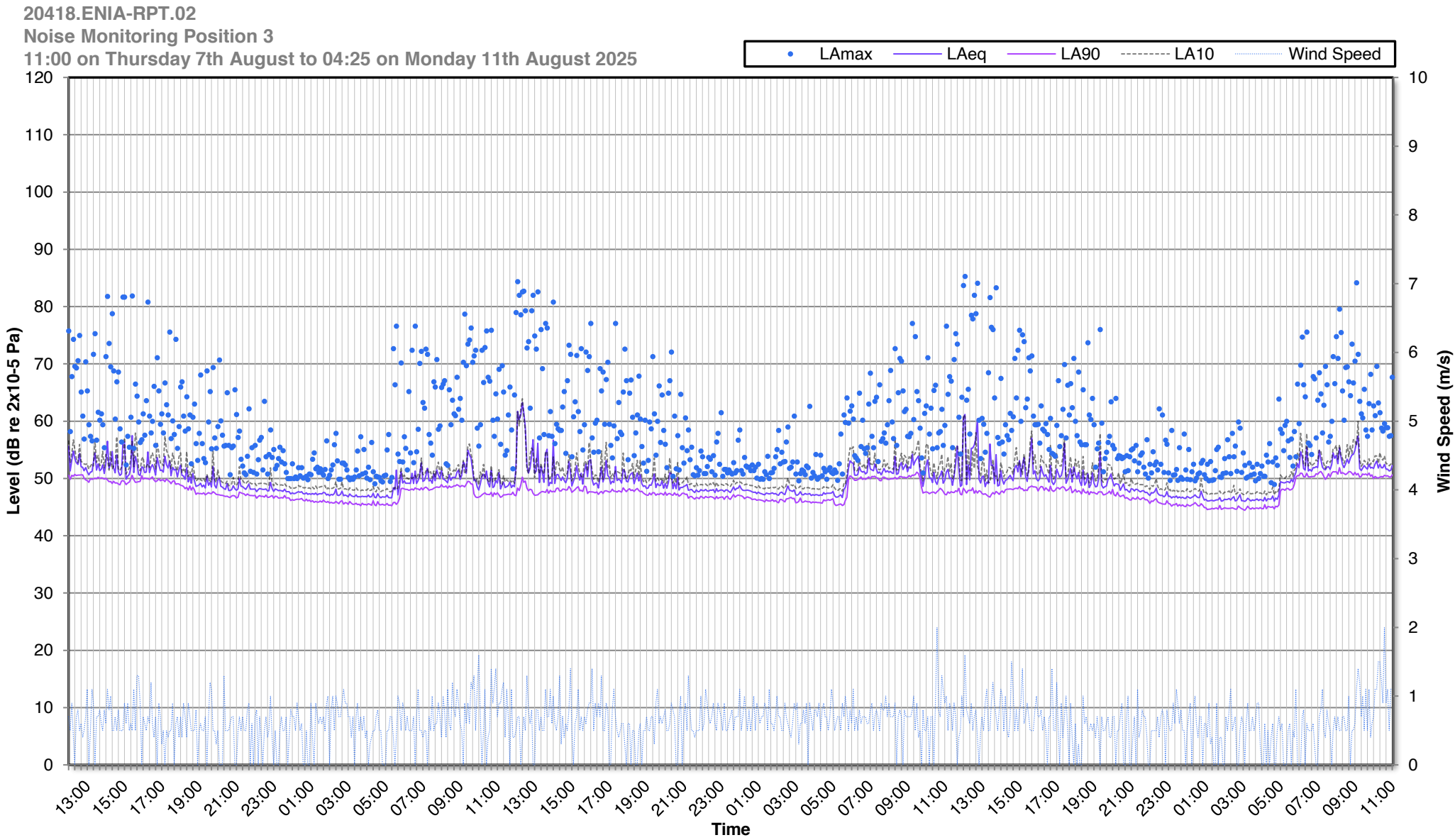
APPENDIX C

ENVIRONMENTAL NOISE TIME HISTORY GRAPH



APPENDIX C

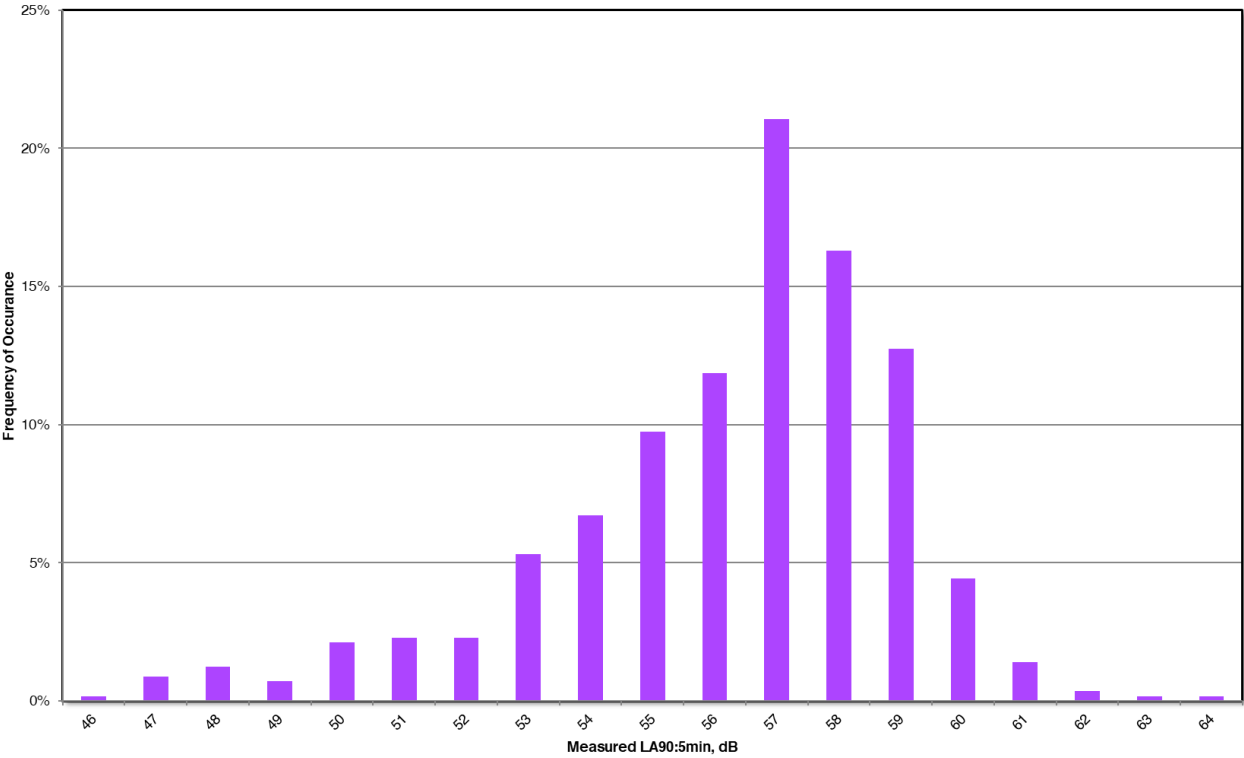
ENVIRONMENTAL NOISE TIME HISTORY GRAPH



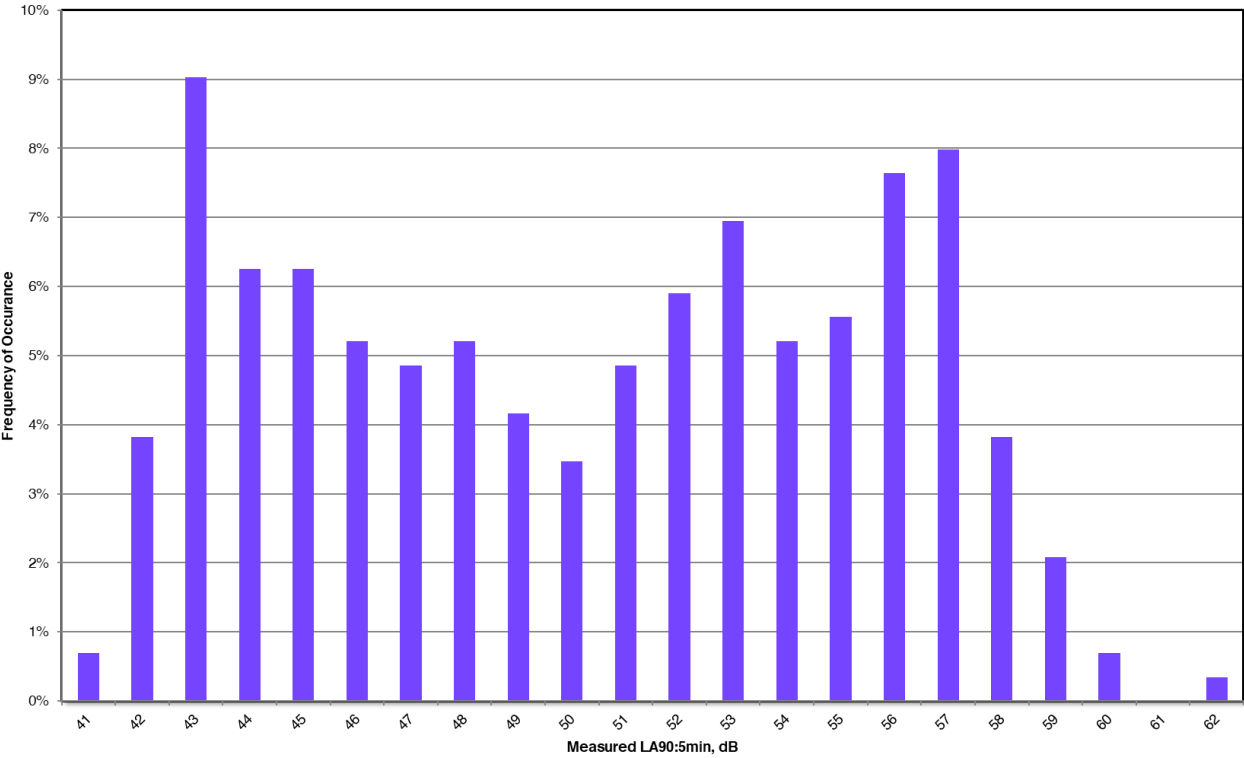
APPENDIX D

STATISTICAL ANALYSIS OF BACKGROUND SOUND LEVELS

20418.ENIA-RPT.02
Noise Monitoring Position 1
11:00 on Thursday 7th August to 04:25 on Monday 11th August 2025
Daytime Statistical Distribution of Background Levels



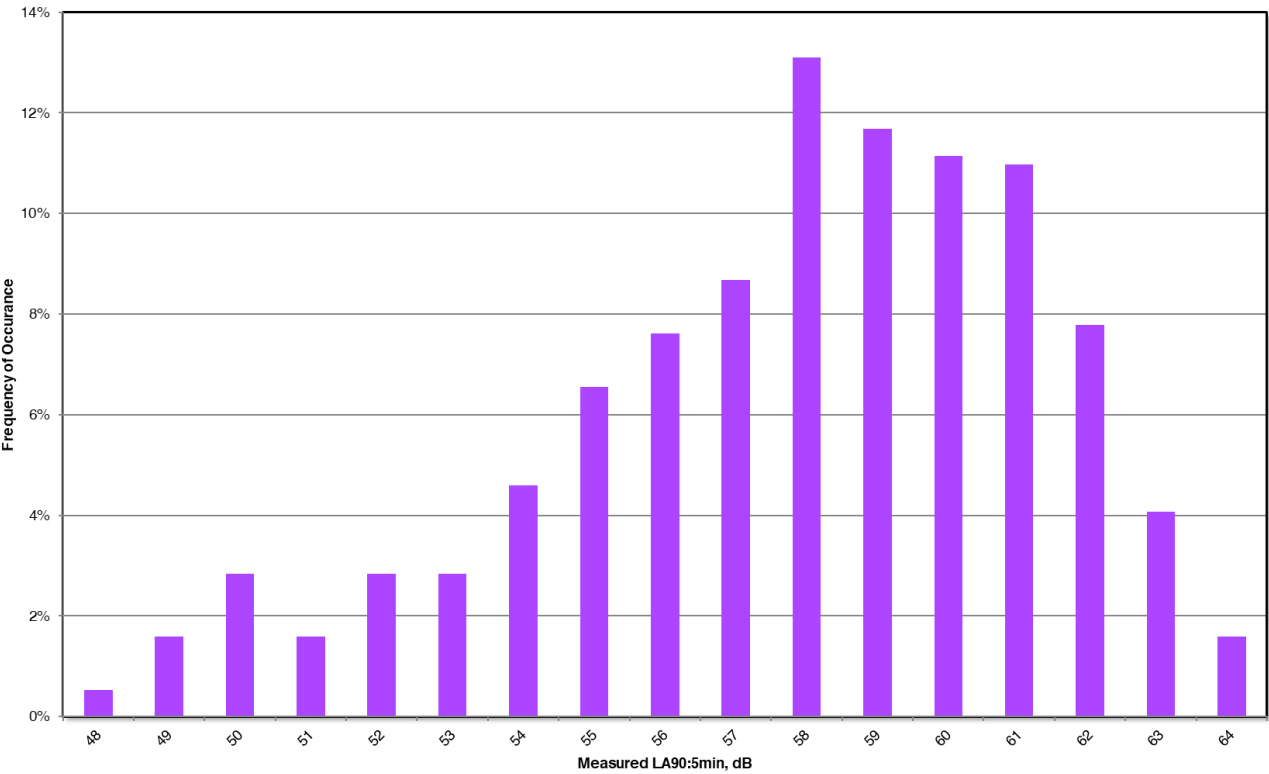
20418.ENIA-RPT.02
Noise Monitoring Position 1
11:00 on Thursday 7th August to 04:25 on Monday 11th August 2025
Night-time Statistical Distribution of Background Levels



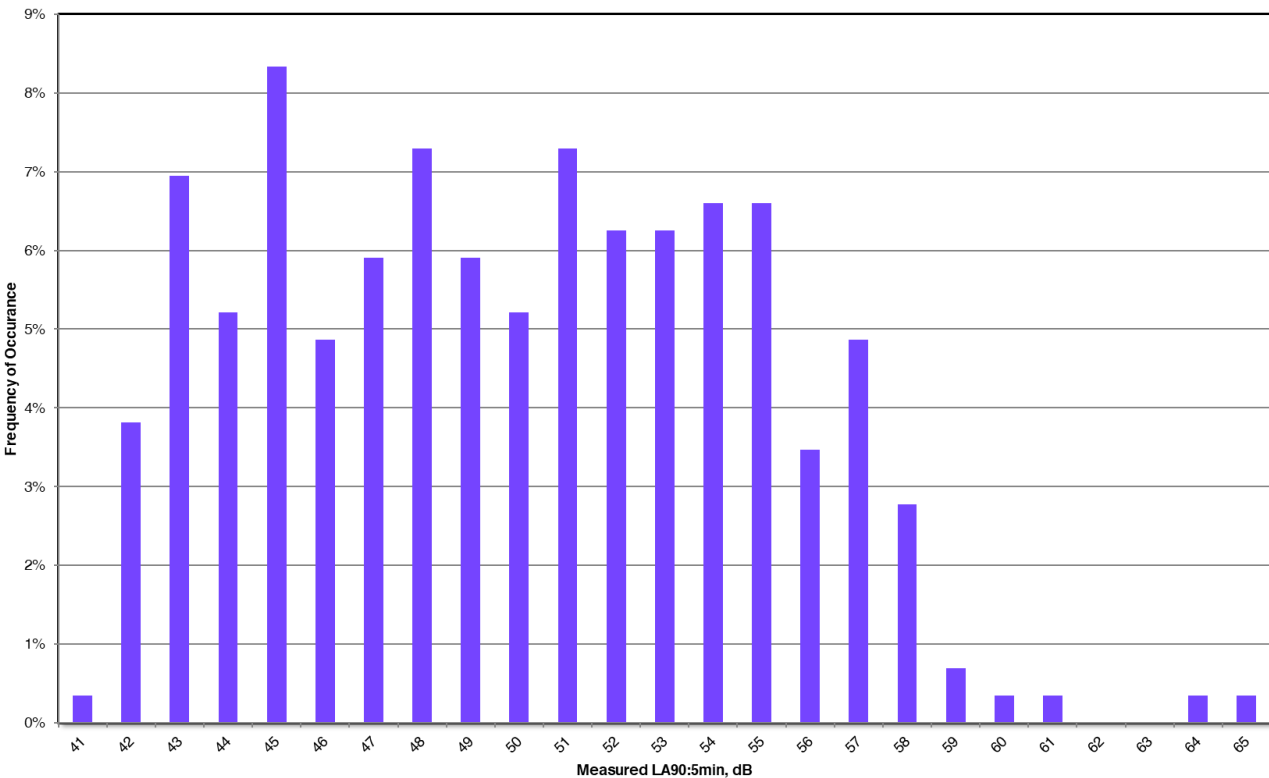
APPENDIX D

STATISTICAL ANALYSIS OF BACKGROUND SOUND LEVELS

20418.ENIA-RPT.02
Noise Monitoring Position 2
11:00 on Thursday 7th August to 04:25 on Monday 11th August 2025
Daytime Statistical Distribution of Background Levels



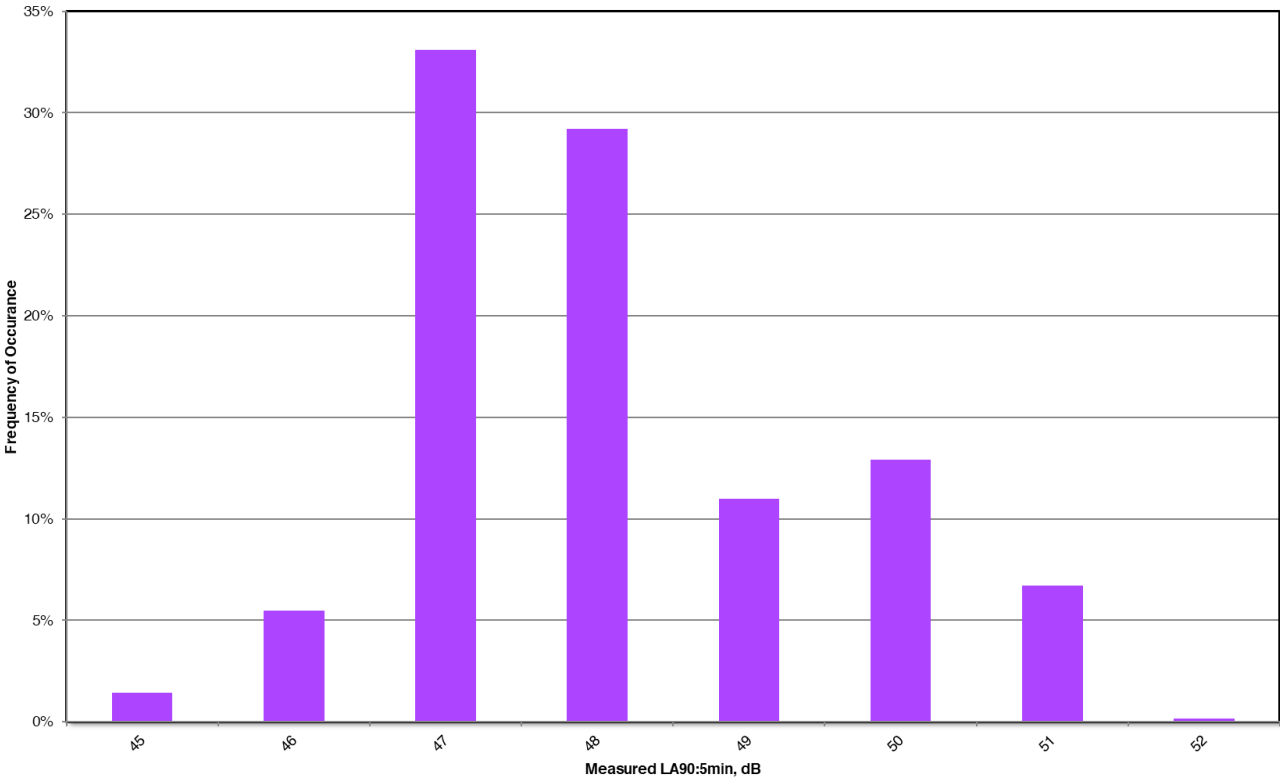
20418.ENIA-RPT.02
Noise Monitoring Position 2
11:00 on Thursday 7th August to 04:25 on Monday 11th August 2025
Night-time Statistical Distribution of Background Levels



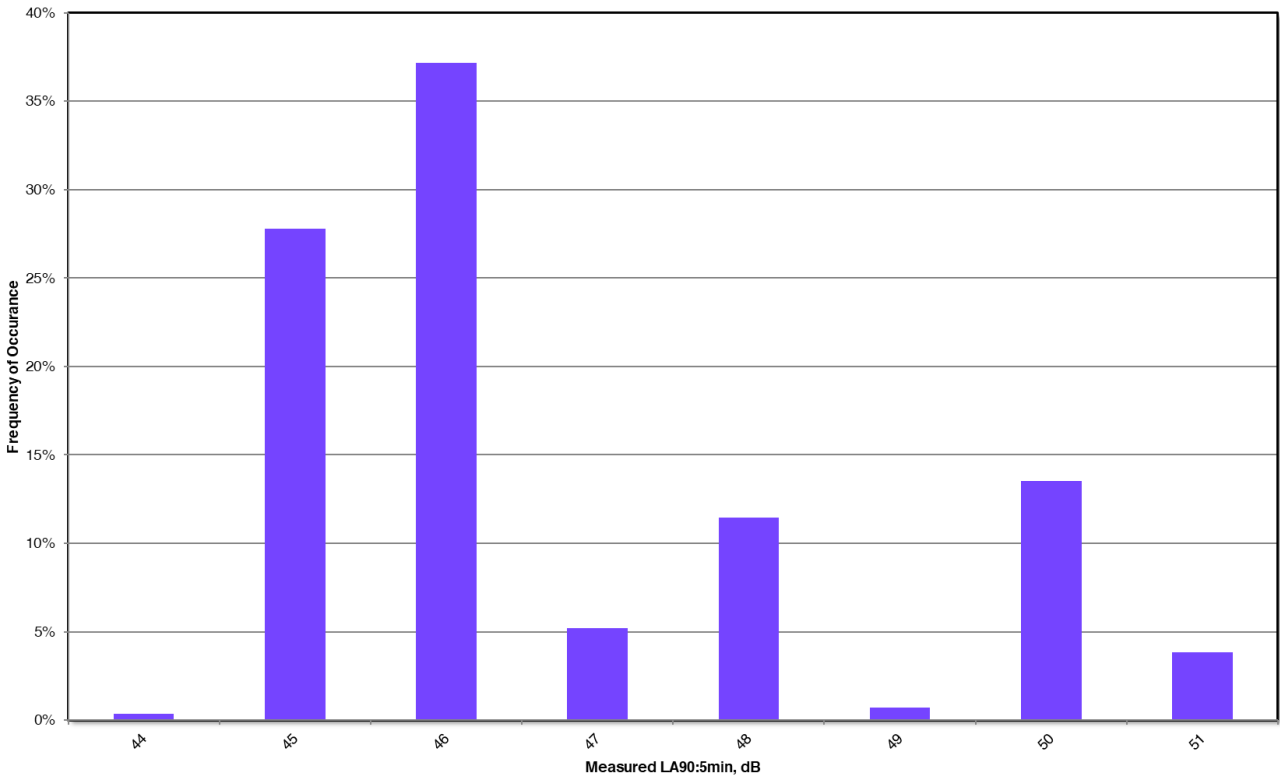
APPENDIX D

STATISTICAL ANALYSIS OF BACKGROUND SOUND LEVELS

20418.ENIA-RPT.02
Noise Monitoring Position 3
11:00 on Thursday 7th August to 04:25 on Monday 11th August 2025
Daytime Statistical Distribution of Background Levels



20418.ENIA-RPT.02
Noise Monitoring Position 3
11:00 on Thursday 7th August to 04:25 on Monday 11th August 2025
Night-time Statistical Distribution of Background Levels



APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

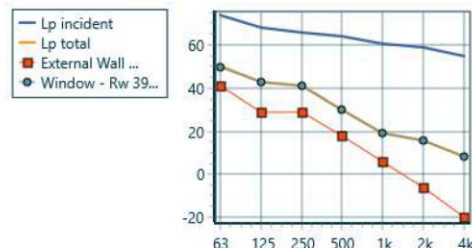
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Lounge, Day LAeq.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	68.0	66.0	64.0	61.0	59.0	55.0	67
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	23
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [20 m²]	13	13	13	13	13	13	13	
Element sound level contribution	41	29	29	18	6	-6	-20	
Element 2 , STL	-25	-26	-26	-35	-43	-44	-48	35
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [10 m²]	10	10	10	10	10	10	10	
Element sound level contribution	50	43	41	30	19	16	8	
Receiver								
Room volume(-10LogV) [80 m3]	-19	-19	-19	-19	-19	-19	-19	35
Reverberation time (s)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
RT (+10LogT)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	50	43	41	30	19	16	8	
Level difference								
D2m,nT	29	30	30	39	47	48	52	LpAinc - LpARev,T0 34

** Element descriptions:

#1: External Wall - Rw 55 dB

#2: Window - Rw 39 dB

APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

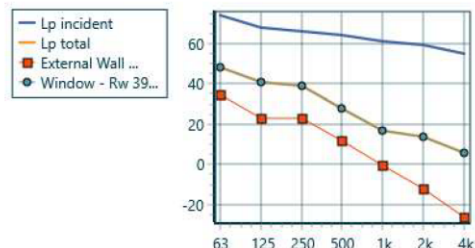
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Bedroom, Day LAeq.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	68.0	66.0	64.0	61.0	59.0	55.0	67
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	17
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.0 m²]	5	5	5	5	5	5	5	
Element sound level contribution	35	23	23	12	0	-12	-26	
Element 2 , STL	-25	-26	-26	-35	-43	-44	-48	33
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.0 m²]	6	6	6	6	6	6	6	
Element sound level contribution	48	41	39	28	17	14	6	
Receiver								
Room volume(-10LogV) [25 m3]	-14	-14	-14	-14	-14	-14	-14	33
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	48	41	39	28	17	14	6	
Level difference								
D2m,nT	28	29	29	38	46	47	51	LpAinc - LpARev,T0 33

** Element descriptions:

#1: External Wall - Rw 55 dB

#2: Window - Rw 39 dB

APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

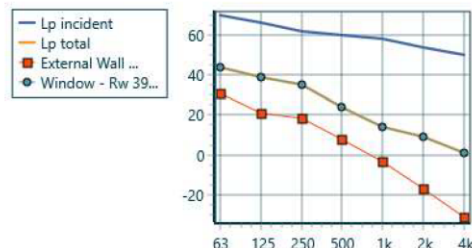
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Bedroom, Night LAeq.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	70.0	66.0	62.0	60.0	58.0	54.0	50.0	63
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	13
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.0 m²]	5	5	5	5	5	5	5	
Element sound level contribution	31	21	19	8	-3	-17	-31	
Element 2 , STL	-25	-26	-26	-35	-43	-44	-48	29
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.0 m²]	6	6	6	6	6	6	6	
Element sound level contribution	44	39	35	24	14	9	1	
Receiver								
Room volume(-10LogV) [25 m3]	-14	-14	-14	-14	-14	-14	-14	29
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	44	39	35	24	14	9	1	
Level difference								
D2m,nT	28	29	29	38	46	47	51	32
								LpAinc - LpARev,T0

** Element descriptions:

#1: External Wall - Rw 55 dB

#2: Window - Rw 39 dB

APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

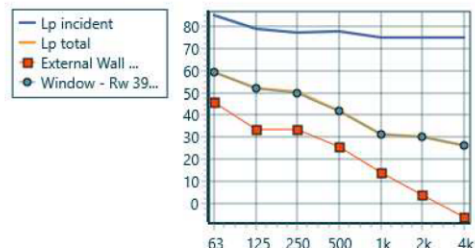
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Bedroom, Night LAmx.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	85.0	79.0	77.0	78.0	75.0	75.0	75.0	82
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	28
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.0 m²]	5	5	5	5	5	5	5	
Element sound level contribution	46	34	34	26	14	4	-6	
Element 2 , STL	-25	-26	-26	-35	-43	-44	-48	45
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.0 m²]	6	6	6	6	6	6	6	
Element sound level contribution	59	52	50	42	31	30	26	
Receiver								
Room volume(-10LogV) [25 m3]	-14	-14	-14	-14	-14	-14	-14	45
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	59	52	50	42	31	30	26	
Level difference								
D2m,nT	28	29	29	38	46	47	51	LpAinc - LpARev,T0
								36

** Element descriptions: #1: External Wall - Rw 55 dB
#2: Window - Rw 39 dB

APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

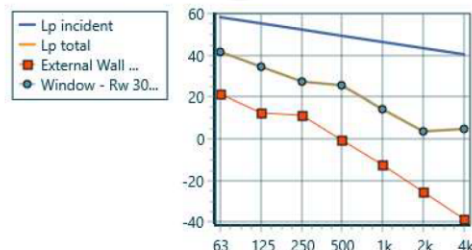
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 3 - Bedroom, Day LAeq.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	58.3	55.3	52.3	49.3	46.3	43.3	40.3	52
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	5
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [6.0 m²]	8	8	8	8	8	8	8	
Element sound level contribution	21	12	11	-1	-13	-26	-39	
Element 2 , STL	-16	-20	-24	-23	-31	-39	-35	26
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [5.0 m²]	7	7	7	7	7	7	7	
Element sound level contribution	41	34	27	25	14	3	4	
Receiver								
Room volume(-10LogV) [30 m3]	-15	-15	-15	-15	-15	-15	-15	26
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	42	34	28	25	14	3	4	
Level difference								
D2m,nT	19	23	27	26	34	42	38	25
LpAinc - LpARev,T0								

** Element descriptions: #1: External Wall - Rw 55 dB
#2: Window - Rw 30 dB

APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

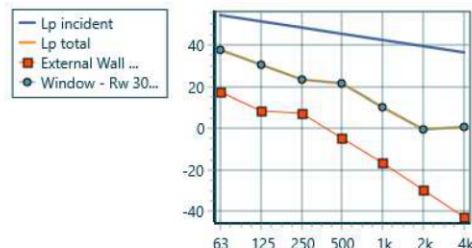
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 3 - Bedroom, Night LAeq.inz

Comment:



Octave Band Centre Frequency (Hz)							
Source	63	125	250	500	1k	2k	4k
Incident sound level (freefield)	54.3	51.3	48.3	45.3	42.3	39.3	36.3
Overall dBA							
Path							
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79
Facade Shape factor Level diff.	0	0	0	0	0	0	0
Insertion Loss	0	0	0	0	0	0	0
Area(+10LogA) [6.0 m²]	8	8	8	8	8	8	8
Element sound level contribution	17	8	7	-5	-17	-30	-43
Element 2 , STL	-16	-20	-24	-23	-31	-39	-35
Facade Shape factor Level diff.	0	0	0	0	0	0	0
Insertion Loss	0	0	0	0	0	0	0
Area(+10LogA) [5.0 m²]	7	7	7	7	7	7	7
Element sound level contribution	37	30	23	21	10	-1	0
Receiver							
Room volume(-10LogV) [30 m3]	-15	-15	-15	-15	-15	-15	-15
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0
Equation Constant	11	11	11	11	11	11	11
Room sound level	38	30	24	21	10	-1	0
Level difference							
D2m,nT	19	23	27	26	34	42	38
LpAinc - LpARev,T0							25

** Element descriptions:

#1: External Wall - Rw 55 dB

#2: Window - Rw 30 dB

APPENDIX E

EXTERNAL NOISE INGRESS CALCULATIONS (NEW WINDOWS)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

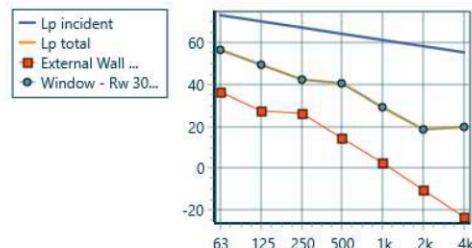
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 3 - Bedroom, Night LAmaz.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	73.3	70.3	67.3	64.3	61.3	58.3	55.3	67
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	20
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [6.0 m²]	8	8	8	8	8	8	8	
Element sound level contribution	36	27	26	14	2	-11	-24	
Element 2 , STL	-16	-20	-24	-23	-31	-39	-35	41
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [5.0 m²]	7	7	7	7	7	7	7	
Element sound level contribution	56	49	42	40	29	18	19	
Receiver								
Room volume(-10LogV) [30 m3]	-15	-15	-15	-15	-15	-15	-15	41
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	57	49	43	40	29	18	19	
Level difference								
D2m,nT	19	23	27	26	34	42	38	LpAinc - LpARev,T0 25

** Element descriptions:

#1: External Wall - Rw 55 dB

#2: Window - Rw 30 dB

APPENDIX F

EXTERNAL NOISE INGRESS CALCULATIONS (SECONDARY GLAZING)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

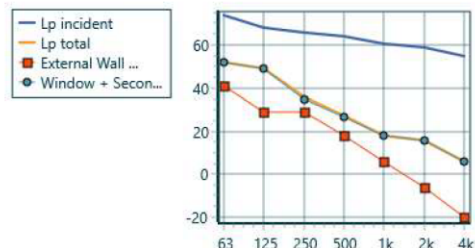
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Lounge, Day LAeq SG check.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	68.0	66.0	64.0	61.0	59.0	55.0	67
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	23
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [20 m²]	13	13	13	13	13	13	13	
Element sound level contribution	41	29	29	18	6	-6	-20	
Element 2 , STL	-23	-20	-32	-38	-44	-44	-50	35
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [10 m²]	10	10	10	10	10	10	10	
Element sound level contribution	52	49	35	27	18	16	6	
Receiver								
Room volume(-10LogV) [80 m3]	-19	-19	-19	-19	-19	-19	-19	35
Reverberation time (s)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
RT (+10LogT)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	52	49	36	27	18	16	6	
Level difference								
D2m,nT	27	24	35	42	48	48	54	34

** Element descriptions:

#1: External Wall - Rw 55 dB
 #2: Window + Secondary Glazing comprised of 6mm cavity and 6mm secondary glass
 none

APPENDIX F

EXTERNAL NOISE INGRESS CALCULATIONS (SECONDARY GLAZING)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

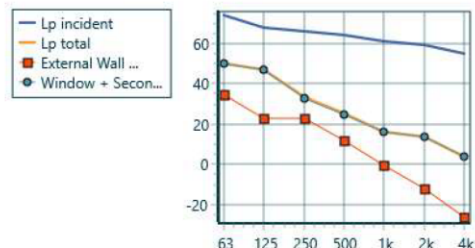
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Bedroom, Day LAeq SG check.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	74.0	68.0	66.0	64.0	61.0	59.0	55.0	67
Path								
Element 1, STL	-37	-43	-41	-50	-59	-69	-79	17
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.0 m²]	5	5	5	5	5	5	5	
Element sound level contribution	35	23	23	12	0	-12	-26	
Element 2, STL	-23	-20	-32	-38	-44	-44	-50	33
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.0 m²]	6	6	6	6	6	6	6	
Element sound level contribution	50	47	33	25	16	14	4	
Receiver								
Room volume(-10LogV) [25 m3]	-14	-14	-14	-14	-14	-14	-14	33
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	50	47	33	25	16	14	4	
Level difference								
D2m,nT	26	23	35	41	47	47	53	33
								LpAinc - LpARev,T0

** Element descriptions:

#1: External Wall - Rw 55 dB
 #2: Window + Secondary Glazing comprised of 6mm cavity and 6mm secondary glass
 none

APPENDIX F

EXTERNAL NOISE INGRESS CALCULATIONS (SECONDARY GLAZING)

Outdoor To Indoor Sound Transmission (v9.0.24)

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Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

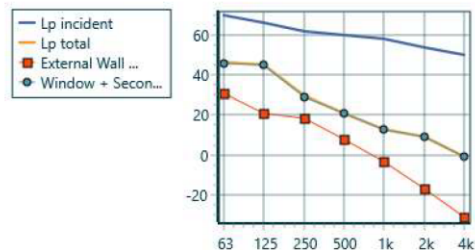
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Bedroom, Night LAeq SG check.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	70.0	66.0	62.0	60.0	58.0	54.0	50.0	63
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	13
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.0 m²]	5	5	5	5	5	5	5	
Element sound level contribution	31	21	19	8	-3	-17	-31	
Element 2 , STL	-23	-20	-32	-38	-44	-44	-50	30
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.0 m²]	6	6	6	6	6	6	6	
Element sound level contribution	46	45	29	21	13	9	-1	
Receiver								
Room volume(-10LogV) [25 m3]	-14	-14	-14	-14	-14	-14	-14	30
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	46	45	29	21	13	9	-1	
Level difference								
D2m,nT	26	23	35	41	47	47	53	31

** Element descriptions:

#1: External Wall - Rw 55 dB
 #2: Window + Secondary Glazing comprised of 6mm cavity and 6mm secondary glass
 none

APPENDIX F

EXTERNAL NOISE INGRESS CALCULATIONS (SECONDARY GLAZING)

Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017

Margin of error is generally within ± 3 dB

- Key No. 6570

Job Name:200-202 Broad Street

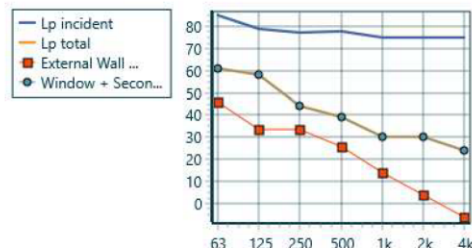
Job No.: 20418

Initials:Daniel Green MIOA

Date:16/10/2025

File Name:Type 1 and 2 - Bedroom, Night LAmx SG check.inz

Comment:



Octave Band Centre Frequency (Hz)								
Source	63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	85.0	79.0	77.0	78.0	75.0	75.0	75.0	82
Path								
Element 1 , STL	-37	-43	-41	-50	-59	-69	-79	28
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [3.0 m²]	5	5	5	5	5	5	5	
Element sound level contribution	46	34	34	26	14	4	-6	
Element 2 , STL	-23	-20	-32	-38	-44	-44	-50	45
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [4.0 m²]	6	6	6	6	6	6	6	
Element sound level contribution	61	58	44	39	30	30	24	
Receiver								
Room volume(-10LogV) [25 m3]	-14	-14	-14	-14	-14	-14	-14	45
Reverberation time (s)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	61	58	44	39	30	30	24	
Level difference								
D2m,nT	26	23	35	41	47	47	53	LpAinc - LpARev,T0 36

** Element descriptions:

#1: External Wall - Rw 55 dB

#2: Window + Secondary Glazing comprised of 6mm cavity and 6mm secondary glass

none