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Noise Impact Assessment

Proposed Serviced Apartments (short term let)

St Mary's House, St Mary's Butts, Reading, RG1 2LG.

Proposed change of use of first to third floors from office (Class E) to provide 31 serviced apartments (class C1). Addition of fourth floor to provide 6 serviced apartments (class C1)

KR07645

Version: 1.4

5th February 2025

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For and on behalf of KR Associates (UK) Ltd

Quietly Confident...

Table of Contents

1	Executive Summary	6
1.1	<i>Introduction</i>	6
1.2	<i>Scope of Report.....</i>	6
1.3	<i>Executive Summary of Report.....</i>	7
1.4	<i>Conclusion of Report.....</i>	7
2	Source of Noise and Noise Sensitive Receptors	8
2.1	<i>Local Area</i>	8
2.2	<i>Existing Layout of Site.....</i>	9
2.3	<i>Proposed Development.....</i>	10
2.4	<i>Existing Commercial Sources</i>	11
3	Noise Criterion	13
3.1	<i>Determination of Application in line with the Local Development Plan</i>	13
3.2	<i>Other Relevant Material Considerations</i>	13
3.3	<i>Proposed Criterion for LOAEL.....</i>	14
4	Background Noise Measurements	15
4.1	<i>Locations and Details of Measurements.....</i>	15
4.2	<i>Summary of Results from the Survey.....</i>	15
4.3	<i>3D Noise Map of Existing Noise Climate.....</i>	16
5	Assessment of Noise Levels	17
5.1	<i>Initial Assessment of Commercial Noise Levels to BS 4142</i>	17
5.2	<i>Assessment of Average Internal Noise Levels with the Windows Closed.....</i>	18
5.3	<i>Assessment of Internal Noise Levels with the Windows Open (Night Time).....</i>	18
6	Conclusions and Discussions.....	19
6.1	<i>Mitigation Measures</i>	19
6.2	<i>Conclusions and Discussions</i>	19
6.3	<i>Initial Comments from the Local Authority (Review of version 1.3)</i>	19

Appendices

A	Appendix A – Relevant Material Considerations.....	21
A.1	Reading Borough Council – Local Plan.....	21
A.2	National Planning Policy Framework: 2023 (NPPF)	23
A.3	Noise Policy Statement for England: 2010 (NPSE)	24
A.4	Planning Policy Guidance (Noise) PPG: 2019 (PPG-N)	24
A.5	Other Documents providing guidance on LOAEL and SOAEL	25
A.6	British Standard 8233: 2014 (BS 8233)	28
A.7	British Standard 4142: 2014 + A1: 2019 (BS 4142).....	29
A.8	Approved Document O	30
A.9	Proposed Noise Criterion	31
B	Appendix B - Background Noise Measurement Details... ..	32
B.1	Calibration Details	32
B.2	Weather Conditions During Survey - Week 1: 25/09/24 to 01/10/24.....	33
B.3	Weather Conditions During Survey - Week 2: 02/10/24 to 09/10/24.....	34
B.4	5-minute Ambient Levels (L_{Max} , L_{Aeq} , L_{A90}).....	35
B.5	Hourly and 16 hour (day time) and 8 hour (night time)	36
B.6	6-hour event on Sunday 29 th September and Saturday 5 th October 2024	37
B.7	Summary Table of Levels of Background	38
C	Appendix C – Detailed Calculations of Internal Noise Levels.....	40
C.1	Average Day Time (07:00 to 23:00) – Windows Closed.....	40
C.2	Average Night Time (23:00 to 07:00) – Windows Closed	41
C.3	Average Night Time (23:00 – 07:00) – Windows Open	42
C.4	Maximum Night Time (23:00 – 07:00) – Windows Open	43

Tables

Table 1 – Proposed initial external BS4142 criterion for LOAEL.	14
Table 2 – Proposed internal criterion for NOEL and LOAEL based on BS 8233.....	14
Table 3 – Summary of Measured Ambient and Background Noise Levels.	15
Table 4 – 3D noise map of noise levels incident on the proposed development.....	16
Table 5 – BS 4142 Initial Assessment of the Impact from the existing commercial noise sources.....	17
Table 6 – Resultant Internal Noise Levels within the Proposed Development with the Windows Closed.....	18
Table 7 – Night Time resultant Internal Noise Levels within the Proposed Development with the Windows Open.	18
Table 8 – Policy Planning Guidance (Noise) – Noise exposure hierarchy table.....	25
Table 9 – Summary of Aecom - Identification of SOAEL and LOAEL in support of NPSE dated 2015.....	25
Table 10 – Summary of HS2 Control of Airborne Noise version 3.0 (LOAEL and SOAEL: 2019.....	26
Table 11 – Summary of WHO Guidelines for Community Noise Table 1: 2019.....	26
Table 12 – Summary of WHO / EU Night Noise Guidelines for Europe: 2009.....	26
Table 13 – Summary of WHO Environmental Noise Guidelines for Europe: 2018.	27
Table 14 – Summary of BS 389 for Threshold of Hearing: 2019.	27
Table 15 – Summary of Napier University NANR 116 Open Closed Windows: 2007.	27
Table 16 – Estimation External Levels for NOEL based on Open Window and Threshold of Hearing.....	28
Table 17 – Table 4 of British Standard 8233: 2014 – Residential noise criterion for noise without character.....	28
Table 18 – Proposed Noise Criterion for NOEL, LOAEL and SOAEL for the proposed development Site.....	31
Table 19 – Calibration Details of Meter(s) used for Ambient and Background Noise Measurements.....	32
Table 20 – Calibration Details of Meter(s) used for Ambient and Background Noise Measurements.....	32
Table 21 – Derived Table of Maximum, Ambient and Background Noise Levels for Day, Evening and Night Time.	38
Table 22 – Summary of measurements undertaken at position BN.1 (Front of site).	38
Table 23 – Summary of measurements undertaken at position BN.1 (Rear of site).	39
Table 24 – Transmission loss of building elements (Windows Closed).....	40
Table 25 – Calculation of Average internal noise levels in accordance with BS 8233: 2014 (Windows closed).....	40
Table 26 – Transmission loss of building elements (Windows Closed).....	41
Table 27 – Calculation of Average internal noise levels in accordance with BS 8233: 2014 (Windows closed).....	41
Table 28 – Transmission loss of building elements (Windows Open).	42
Table 29 – Calculation of Average internal noise levels in accordance with BS 8233: 2014 (Windows open).....	42
Table 30 – Transmission loss of building elements (Windows Open).	43
Table 31 – Calculation of Maximum internal noise levels in accordance with BS 8233: 2014 (Windows open).....	43

Figures

<i>Figure 1 – Location of the development site within the wider area.</i>	<i>8</i>
<i>Figure 2 – Layout of existing development site.</i>	<i>9</i>
<i>Figure 3 – Proposed layout of serviced apartments (floors 1 to 4 inclusive).</i>	<i>10</i>
<i>Figure 4 – Existing commercial properties surrounding the development.</i>	<i>11</i>
<i>Figure 5 – Location of mechanical sources surrounding the development.</i>	<i>12</i>
<i>Figure 6 – Location of background noise measurements.</i>	<i>15</i>
<i>Figure 7 – Hourly Weather Condition 25th September 2024 to 1st October 2024.</i>	<i>33</i>
<i>Figure 8 – Hourly Weather Condition 2nd October 2024 to 8th October 2024.</i>	<i>34</i>
<i>Figure 9 – 5-minute data of Maximum, Ambient and Background Noise Levels.</i>	<i>35</i>
<i>Figure 10 – Average Noise Levels (1 hour), Day (16 hour) and Night (1 hour) levels.</i>	<i>36</i>
<i>Figure 11 – Details of specific event on Sunday 29th September and Saturday 5th October 2024.</i>	<i>37</i>

1 Executive Summary

1.1 Introduction

- 1.1.1 KR Associates (UK) Ltd have been instructed to prepare a noise impact assessment to support the planning application for the proposed development.

“Proposed change of use of first to third floors from office (Class E) to provide 31 serviced apartments (class C1). Addition of fourth floor to provide 6 serviced apartments (class C1)”

- 1.1.2 The development will look to create 37 serviced apartments that will aim to provide short term serviced apartments within the centre of Reading for tourists and business professionals. The report will determine the mitigation measures that are required to ensure suitable living conditions of the future occupants and does not place unreasonable restrictions on the existing commercial uses by introducing serviced apartment use within the centre of Reading.
- 1.1.3 The proposal will create serviced apartments (Use Class C1) which will be let on a non-permanent short-term basis to ensure the scheme complies with policy CR6 entitled *“Living in central Reading”*. The policy does not allow for residential dwellings in the central area of Reading. However, the report will use criterion for residential dwelling houses (Use Class C3) to assess the impact of noise on the future occupiers of the serviced apartments.

1.2 Scope of Report

- 1.2.1 The report will determine if future occupants of the development will be exposed to noise that will comply with the Local Development Plan where it is material to the application and any other relevant material considerations as required by Section 38 (6) of the Planning and Compulsory Purchase Act 2004 and section 70 (2) of the Town and Country Planning Act 1990. Consideration will be given to the Local Plan adopted by Reading Borough Council in November 2019 and the other material considerations.

- | | |
|--|--------------------|
| a) Noise from existing sources on converted offices on the 1 st , 2 nd and 3 rd floors. | Policy CR6 and CC8 |
| b) Noise from existing sources on new dwellings on the 4 th floor. | Policy H8 |
| c) Residential dwellings putting undue restrictions on existing commercial uses. | Policy CR2 |
| d) Impact on future occupiers based on levels incident on the façade of the building. | BS 4142: 2019 |
| e) Criteria for internal noise levels with the windows closed. | BS 8233: 2014 |
| f) Consideration of opening windows to control over-heating on internal levels. | ADO |

- 1.2.2 Rhys Scrivener prepared this report on behalf of KR Associates (UK) Ltd for their client. Mr. Rhys Scrivener holds a Master of Science Degree in Noise and Noise Control from the Open University (MSc) and has been a full member of the Institute of Acoustics since 1999 (MIOA).

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1.3 Executive Summary of Report

1.3.1 The report follows the general guidance within British Standard 8233: 2014 to assess the internal noise levels within the proposed development with the windows closed and open.

- | | |
|------------|---|
| Section 1) | Introduction and an executive summary and conclusions. |
| Section 2) | Description of the main sources of noise and the noise sensitive properties. |
| Section 3) | Proposed noise criterion to determine compliance with the Local Development Plan. |
| Section 4) | Ambient and background noise levels of the existing site. |
| Section 5) | Calculation and assessment of the impact of noise and vibration. |
| Section 6) | Conclusions, discussions and recommendations. |

1.3.2 The current ambient noise levels that are likely to impact the proposed serviced apartment facades are 70 dB $L_{Aeq, 1 \text{ hour}}$ during the day time and 63 dB $L_{Aeq, 1 \text{ hour}}$ and 89 dB $L_{Amax, 10\text{-event}}$ during the night time.

1.3.3 It is proposed that future residents of the development are not exposed to internal noise levels that exceed 35 dB $L_{Aeq, 16 \text{ hour}}$, 30 dB $L_{Aeq, 8 \text{ hour}}$, and 45 dB $L_{Amax, \text{fast}}$ during the night time (23:00 to 07:00). Consideration is given to the need of future residents to control over-heating, especially during the hotter summer periods with the introduction of an MVHR unit with a cooling unit.

1.4 Conclusion of Report

1.4.1 The proposed mitigation measures will ensure that the proposed development gives rise to acceptable noise levels for future occupiers of the serviced apartments. The proposed development complies with the relevant parts of the Local Development Plan and all other relevant material considerations. It would be recommended that the development of the serviced apartments at the application site includes the following minimum mitigation measures to ensure compliance with the Local Development Plan and all other relevant material considerations.

- a) Acoustic glazing with a minimum performance of R_w 38 dB.
e.g. 4mm – 12mm – 4mm – 16mm airgap – 6.4mm laminated.
Manufacturer to provide verified test certificate.
- b) No trickle type vents within the façade of the building.
- c) MVHR whole house ventilation. The system will need to provide an over performance of R_w 45 dB or more which could be achieved with standard 1,800mm long attenuators.
- d) Consideration will need to be given to including cooling units within the MVHR unit to remove the need to open windows to control over-heating. This is important as the glazing façade has a high percentage of glazing.

2 Source of Noise and Noise Sensitive Receptors

2.1 Local Area

- 2.1.1 St Mary's House is located within the centre of a pedestrian area in Reading at the junction of Broad Street and St Mary's Butts. The site is located to the north of St Mary the Virgin Church and can be accessed from a shared service yard at the rear from Hosier Street.



Figure 1 – Location of the development site within the wider area.

2.2 Existing Layout of Site

2.2.1 The existing sites consists of a basement, ground floor currently occupied by Café Nero and Cancer Research and three floors of offices. The offices are accessed from an entrance off St Mary's Butts and from the shared car park at the rear of the site.

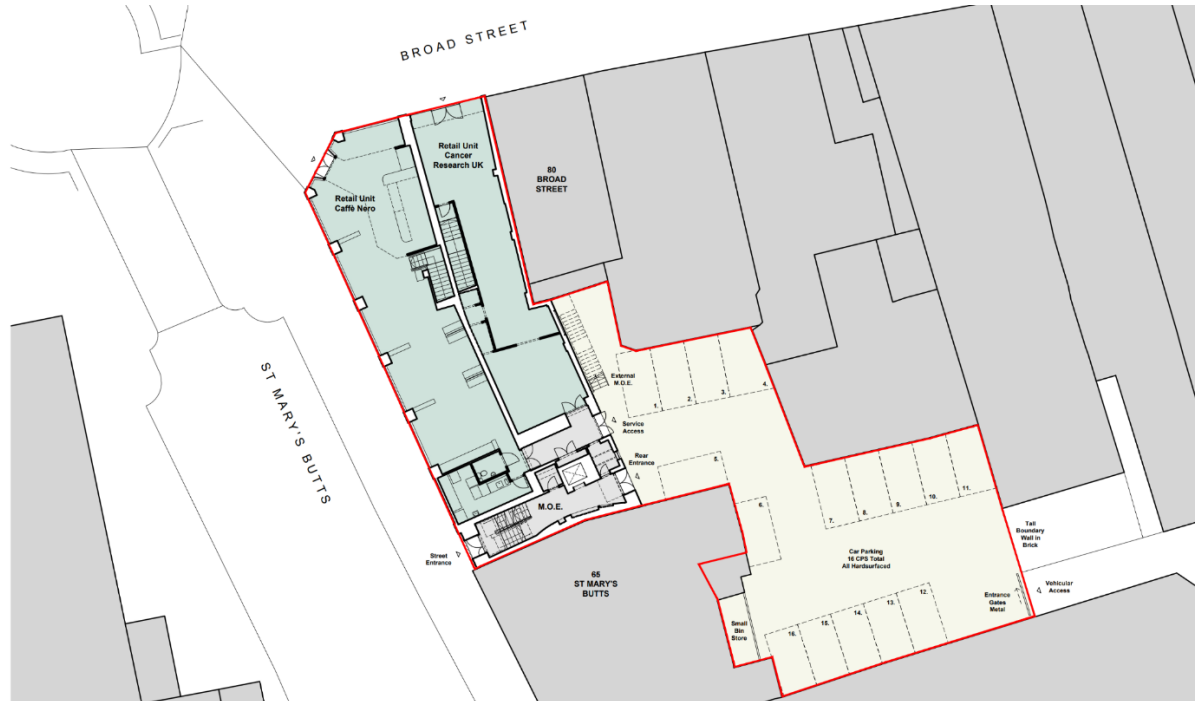


Figure 2 – Layout of existing development site.

2.2.2 The rear shared car park is surrounded by the rear of various restaurants and commercial properties all of which have extract fans and multiple AC heat pumps mounted on walls and flat roofs.

2.3 Proposed Development

2.3.1 The proposed development will create nine individual serviced apartments on the first floor along with the reception and common amenity area. The second and third floors have the same layout providing eleven serviced apartments on each floor while the new fourth floor will provide an additional six serviced apartments. The development will have a total of 37 serviced apartments, 31 from the conversion of the existing offices and 6 from the construction of the new fourth floor.



Figure 3 – Proposed layout of serviced apartments (floors 1 to 4 inclusive).

2.4 Existing Commercial Sources

2.4.1 The site is located at the junctions of St Mary's Butts and Broad Street and is surrounded by a number of cafés, restaurants, and fast-food facilities that all have multi-AC heat pumps and kitchen extracts. A number of these facilities back onto the court yard at the rear of the proposed development and currently are able to operate their facilities without considering noise.

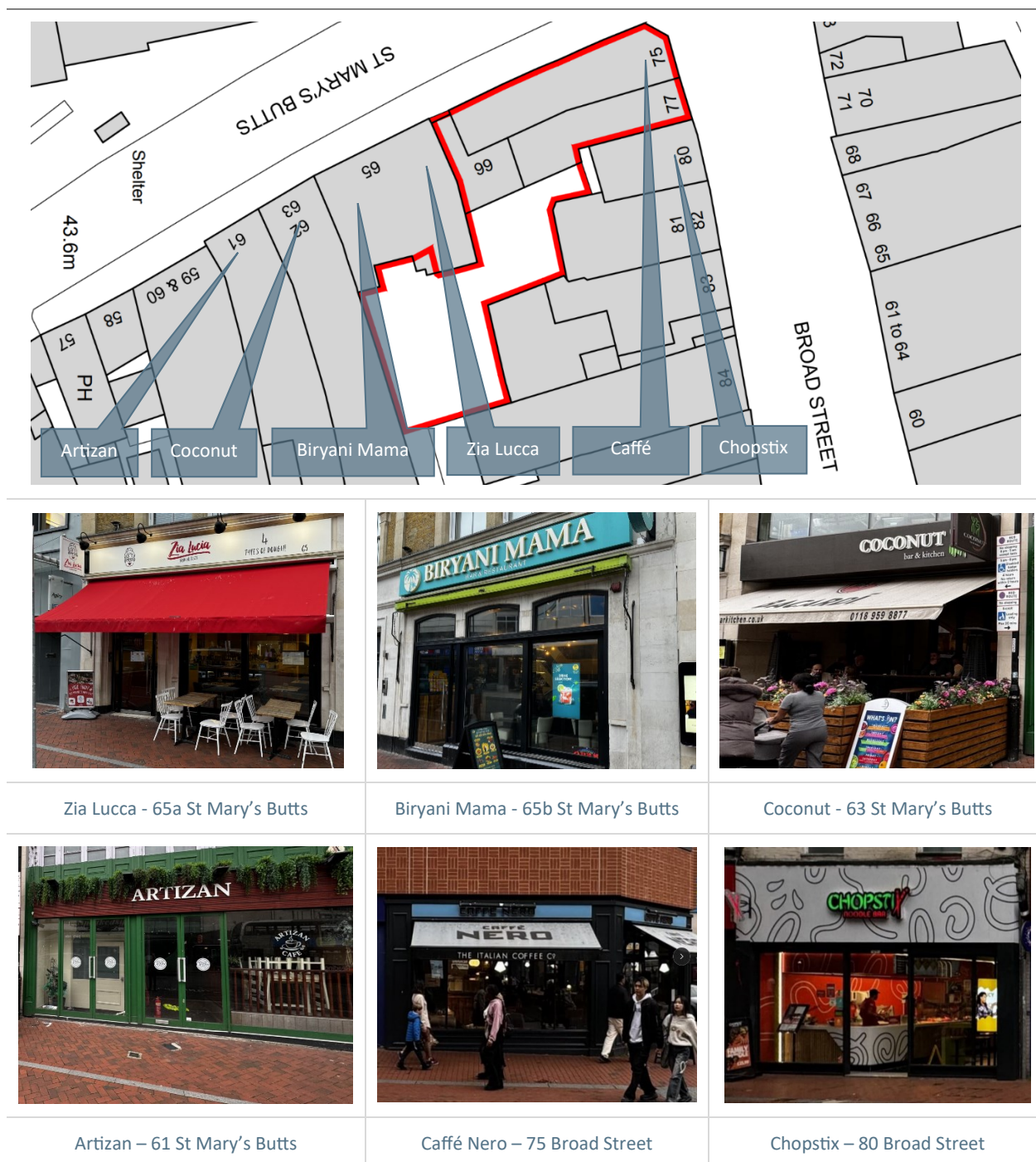


Figure 4 – Existing commercial properties surrounding the development.

2.4.2 Consideration will also need to be given to these facilities that will need to replace their heat pumps by 2030 and the impact of the proximity of the proposed development on future planning applications.

2.4.3 To ensure the proposed development does not place unreasonable restrictions on the current and future use of the commercial properties, it is considered appropriate to assume that that each of the facilities have or could require the following equipment.

a) Blue Square

4-No AC heat pumps each with a sound power level of $L_{w(A)}$ 75 dB producing a total nominal heating load of 60 kW (indoor temperature of 20°C and an outdoor temperature of 7°C).

b) Red Circle

Kitchen Extract with no attenuation with a nominal sound power level of $L_{w(A)}$ 75 dB.

c) Green Square

5 No AC VRV style heat pumps each with a sound power level of $L_{w(A)}$ 85 dB producing a total nominal heating load of 250 kW (indoor temperature of 20°C and an outdoor temperature of 7°C).



Typical wall mounted AC heat pumps



Typical roof mounted AC heat pumps



Typical high level kitchen extracts

Figure 5 – Location of mechanical sources surrounding the development.

3 Noise Criterion

3.1 Determination of Application in line with the Local Development Plan

- 3.1.1 Section 38 (6) of the Planning and Compulsory Purchase Act 2004 and section 70 (2) of the Town and Country Planning Act 1990 requires the following when determining planning applications.

“Section 38 Development Plan

(6) If regard is to be had to the development plan for the purpose of any determination to be made under the planning Acts the determination must be made in accordance with the plan unless material considerations indicate otherwise.

Section 70 Determination of applications: general considerations

(2) In dealing with an application for planning permission or permissions in principle the authority shall have regard to:

*(a) the provisions of the development plan, so far as material to the application,
(c) any other material consideration.”*

- 3.1.2 The Reading Borough Reading Local Plan was adopted in November 2019 and included the following policies.

- | | |
|---------------------------------------|--|
| a) EN16 Pollution and Water Resources | Adequate mitigation in areas of high noise levels. |
| b) EN17 Noise Generating Equipment | Criterion for the assessment of mechanical equipment. |
| c) CR2 Design in Central Reading | Agent of Change principle – Impact on existing commercial. |
| d) CR6 Living in Central Reading | Mitigation for central Reading developments. |
| e) CC8 Safeguarding Amenity | Criteria for new residential dwellings. |
| f) H8 Residential Conversions | Criteria for residential dwellings formed by conversion. |

3.2 Other Relevant Material Considerations

- 3.2.1 The following are material considerations which should be used when determining the current planning application which are detailed in full in Appendix A of the report.

- a) National Planning Policy Framework last updated in December 2023 (NPPF).
- b) Noise Policy Statement for England published in 2010 (NPSE).
- c) Online Planning Policy Guidance – Noise updated in 2019 (PPG-N).
- d) Other document providing guidance on LOAEL AND SOAEL.
- e) British Standard 8233: 2014 (BS 8233).
- f) British Standard 4142: 2014 + A1: 2019 (BS 4142).

3.3 Proposed Criterion for LOAEL

- 3.3.1 The initial assessment is undertaken in accordance with BS 4142 which uses the calculated specific noise levels at the assessment position and applies a feature correction to account for the specific character of the noise to determine the rating noise levels. The rating noise level is then compared against the minimum 15-minute background noise levels to determine the initial impact on future occupiers of the development.

NPSE	PPG - Noise		BS 4142 Assessment		Justification
Impact	Response	Action	Day 07:00 – 23:00	Night 23:00 – 07:00	
LOAEL	Not Intrusive	No Specific	- 0 dB (Low Impact)		Appendix A

External Sound Pressure Levels (dB) – Reference 2×10^{-5} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 1 – Proposed initial external BS4142 criterion for LOAEL.

- 3.3.2 To ensure the proposed development complies with the Local Development Plan and all other relevant material considerations, the proposed development should ensure that the noise emissions meet the requirements for LOAEL but ideally the requirements for NOEL. The criterion has considered the context of the site, the surrounding area and the character of the individual noise sources. The criterion has been set to ensure future residents are not exposed to noise levels that are likely to cause a disturbance that could lead to a Noise Abatement Notice under the Environmental Protection Act 1990 (Amended 1993).

NPSE	PPG - Noise		Proposed Internal Noise Criterion		Justification
Impact	Response	Action	Day 07:00 – 23:00	Night 23:00 – 07:00	
NOEL	Not Intrusive	No Specific	30 dB L_{Aeq} , 15 minutes 50 dB L_{Amax} , fast	25 dB L_{Aeq} , 15 minutes 40 dB L_{Amax} , fast	Appendix A
LOAEL	Intrusive	Mitigate & Reduce	35 dB L_{Aeq} , 15 minutes 60 dB L_{Amax} , fast	30 dB L_{Aeq} , 15 minutes 45 dB L_{Amax} , fast	

External Sound Pressure Levels (dB) – Reference 2×10^{-5} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 2 – Proposed internal criterion for NOEL and LOAEL based on BS 8233

- 3.3.3 The above criterion is based on the guidance within British Standard 8233: 2014 but following the guidance within the note of section 7.7.1 includes a 5 dB correction for the noise as it is considered to be distinctive with a character which is different to the anonymous noise sources such as traffic and activity in the local area.

4 Background Noise Measurements

4.1 Locations and Details of Measurements

- 4.1.1 Ambient noise and vibration measurements were undertaken on the site between 16:00 on Wednesday 25th September 2024 and around 16:00 on Sunday 6th October 2024 at two measurement positions on the roof of the building. Position BN.1 was at the front of the site on the corner of the building facing St Mary's Butts and position BN.2 was at the rear of the site behind the lift shaft building.

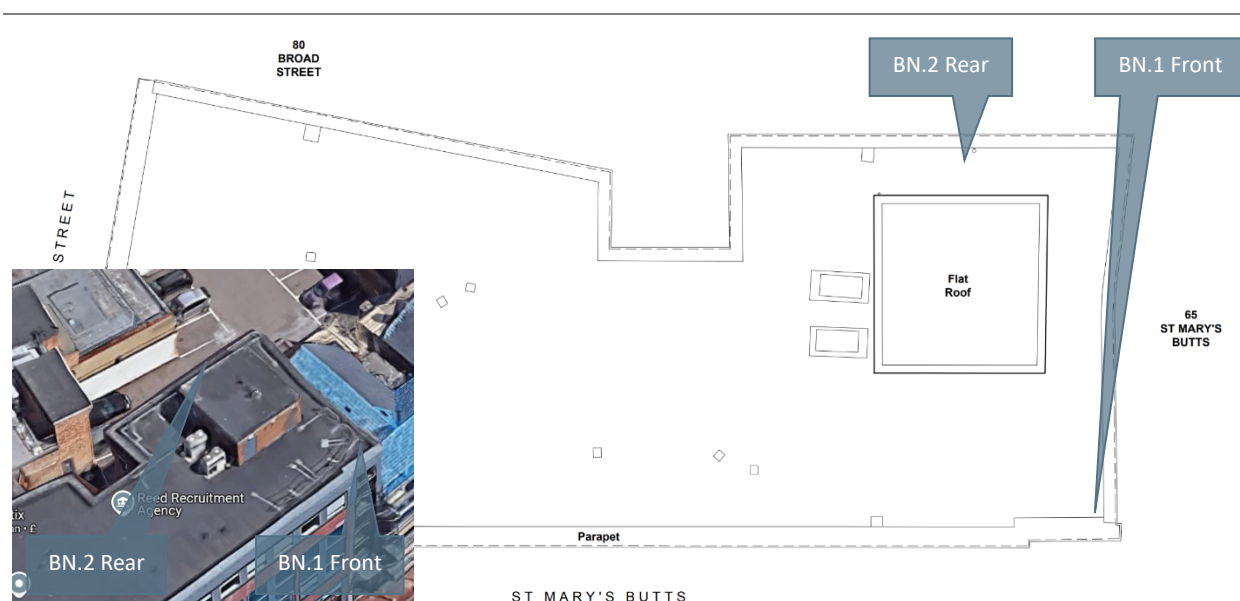


Figure 6 – Location of background noise measurements.

4.2 Summary of Results from the Survey

- 4.2.1 Details of the weather during the survey and the calibration details of the meter are included within Appendix B of the report. The following table provides a summary of the results from the survey.

Date	Day (07:00 – 19:00)			Evening (19:00 – 23:00)			Night (23:00 – 07:00)		
	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}
BN.1 Front	87	67	53	78	61	54	82	59	50
BN.2 Rear	80	59	47	72	59	47	75	56	42

Sound Pressure Levels (dB) – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ – Uncertainty of $\pm 0.5 \text{ dB}$ (95% confidence, $k=2$)

Table 3 – Summary of Measured Ambient and Background Noise Levels.

- 4.2.2 The above noise levels have taken the highest 10-event maximum and average level and the lowest background noise level within each period to establish the typical ambient and background noise climate impacting the site.

4.3 3D Noise Map of Existing Noise Climate

4.3.1 For the purposes of assessing the internal noise climate for future occupiers of the building the worst-case levels were used. The background noise measurements indicated that the highest hourly average noise levels were 70 dB LAeq, 1 hour during the day time between 07:00 and 23:00 and 63 dB LAeq, 1 hour during the night time between 23:00 and 07:00.

4.3.2 The following noise map was created assuming the mechanical sources associated with the surrounding commercial properties are all operating at their maximum level and general activity on St Mary's Butts and Broad Street.



Resultant Façade Levels	Octave Band Centre Frequency (Hz)								Sum A	NR Curve
	63	125	250	500	1K	2K	4K	8K		
1 st Floor Level facing St Mary's Butts	57	60	64	66	65	63	60	54	70	65

Sound Pressure Levels (dB) – Reference 2×10^{-5} pascals – Uncertainty of ± 2.0 dB (95% confidence, $k=2$)

Table 4 – 3D noise map of noise levels incident on the proposed development.

5 Assessment of Noise Levels

5.1 Initial Assessment of Commercial Noise Levels to BS 4142

5.1.1 The initial assessment is based on the surrounding mechanical equipment

BS 4142: 2014 + A1: 2019 Initial Estimate		Impacts from existing and proposed commercial noise sources on the proposed serviced apartment (let on short term basis)		
		Day (07:00 - 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
Assessment Time Period		1 hour		15-minutes
Specific Noise Levels		63 dB L _{Aeq} , 1 hour		63 dB L _{Aeq} , 15 minutes
Feature Correction	Tonal	+0 dB Is not present	+2 dB Just Perceptible	+4 dB Perceptible
	Impulse	+0 dB Is not present	+0 dB Is not present	+0 dB Is not present
	Distinctive	+0 dB Is not present	+0 dB Is not present	+0 dB Is not present
	Intermittent	+0 dB Is not present	+0 dB Is not present	+0 dB Is not present
Rating Noise Levels		63 dB L _{Aeq} , 1 hours	65 dB L _{Aeq} , 1 hours	67 dB L _{Aeq} , 15 min
Background Noise Level		47 dB L _{A90} , 15 min	47 dB L _{A90} , 15 min	42 dB L _{A90} , 15 min
Initial Assessment		+17 dB	+17 dB	+25 dB
Likely Impact Depending on Context		Significant Adverse Impact	Significant Adverse Impact	Significant Adverse Impact

Table 5 – BS 4142 Initial Assessment of the Impact from the existing commercial noise sources.

5.1.2 The initial assessment indicates that the current existing or future mechanical service associated with the commercial properties surrounding the development will have an adverse impact on the future occupants living inside the building based on the level's incident on the façade of the building.

5.1.3 However, in terms of the context of introducing new serviced apartments occupied on a short-term basis to this noise climate, it will be possible to include the mitigation measures within the design to ensure the future occupiers are actually exposed to acceptable levels internally.

5.2 Assessment of Average Internal Noise Levels with the Windows Closed

5.2.1 The following table provides a summary of the highest internal noise levels that are likely to exist within the proposed serviced apartments with the windows closed. The detailed calculations are provided within Appendix C.

Internal Position Windows Closed	Octave Band Centre Frequency (Hz)								Sum A	NR Curve
	63	125	250	500	1K	2K	4K	8K		
Day Time (07:00 to 23:00)	35	39	40	34	21	20	20	(18)	35	30
Night Time (23:00 to 07:00)	28	32	33	27	14	13	13	(11)	28	23

Sound Pressure Levels (dB) – Reference 2×10^{-5} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 6 – Resultant Internal Noise Levels within the Proposed Development with the Windows Closed.

5.2.2 When the windows are closed, future occupiers of the proposed serviced apartments will be exposed to internal noise levels that are likely to be below the Lowest Observed Adverse Effect Level (LOAEL) but slightly above the No Observed Effect Level (NOEL). In terms of the response to residential occupiers within the noise exposure hierarchy of the Planning Policy Guidance, the levels fall between the LOAEL and NOEL. These levels would be considered as “Not Intrusive” and unlikely to cause “any change in behaviour, attitude, or other physiological response” and as such would require no further action.

5.3 Assessment of Internal Noise Levels with the Windows Open (Night Time)

5.3.1 The following table provides a summary of the internal noise levels with the windows open with an equivalent area of 0.2m^2 to control over-heating during the hotter summer months.

Internal Position Windows Open 0.2m^2 Night Time (23:00 to 07:00)	Octave Band Centre Frequency (Hz)								Sum A	NR Curve
	63	125	250	500	1K	2K	4K	8K		
Maximum Internal Levels	49	56	61	62	65	54	50	(47)	66	64
Average Internal Levels	27	33	36	35	36	31	26	(24)	39	35

Sound Pressure Levels (dB) – Reference 2×10^{-5} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 7 – Night Time resultant Internal Noise Levels within the Proposed Development with the Windows Open.

5.3.2 The results show that if the windows are open the levels would be above the Adverse Effect Level. The levels are at a level where occupiers would need to close the windows as defined within section 3 of Approved Document O. The average noise levels would be slightly below the requirement of $40\text{ dB } L_{Aeq, 8\text{ hours}}$ between 23:00 and 07:00 but the maximum noise levels would be above the $55\text{ dB } L_{Amax, fast}$ between 23:00 and 07:00 hours. The maximum noise levels between 23:00 and 07:00 are likely to be a result of people shouting within the streets.

6 Conclusions and Discussions

6.1 Mitigation Measures

- 6.1.1 It would be recommended that the development of the serviced apartments at the application site includes the following minimum mitigation measures to ensure compliance with the Local Development Plan and all other relevant material considerations.
- a) Acoustic glazing with a minimum performance of R_w 38 dB.
e.g. 4mm – 12mm – 4mm – 16mm airgap – 6.4mm laminated.
Manufacturer to provide verified test certificate.
 - b) No trickle type vents within the façade of the building.
 - c) MVHR whole house ventilation. The system will need to provide an over performance of R_w 45 dB or more which could be achieved with standard 1,800mm long attenuators.
 - d) Consideration will need to be given to including cooling units within the MVHR unit to remove the need to open windows to control over-heating. This is important as the glazing façade has a high percentage of glazing.

6.2 Conclusions and Discussions

- 6.2.1 The proposed mitigation measures will ensure that the proposed development gives rise to acceptable noise levels for future residents. The proposed development complies with the relevant parts of the Local Development Plan and all other relevant material considerations.
- 6.2.2 The over-heating strategy for the building requires that windows are fully openable for short periods to control over-heating during the hotter periods of the summer. The assessment contained within Appendix C indicates that the criterion contained within Section 3 of Approved Document O entitled *“Ensuring the overheating mitigation strategy is useable”* will be met with the window open up to around 0.2m² open area for the average noise levels but not the maximum noise levels.

6.3 Initial Comments from the Local Authority (Review of version 1.3)

- 6.3.1 The following comments have been received from Jonathan Markwell, Principal Planning Officer at Reading Borough Council in the email response of 30th January 2025.

“Please clarify what you have designed the mitigation to achieve, as you propose a criterion to allow for a 5 dB penalty for the nature of the noise, but then it is not clear that this is being met by the proposed mitigation?”

You have not considered the noise transfer from ground floor uses to first floor - this should be considered and demonstrated to be appropriate for the future serviced apartments.”

6.3.2 **Compliance with Criterion**

The report lays out the proposed criterion in table 2 in section 3.3.2. detailing the internal levels for No Observed Effect Level (NOEL) and Lowest Observed Adverse Effect Level (LOAEL). The report provides detailed calculation of the noise transfer through the façade of the building in Appendix C and a summary of the calculations within section 5.2.

6.3.3 With the windows closed, the resultant levels will be slightly above the NOEL but below the LOAEL. This was detailed in section 5.2.2 above. In terms of the Planning Policy Guidance (PPG) these are considered as “*Not Intrusive*” and unlikely to cause “*any change in behaviour, attitude, or other physiological response*” and as such would require no further action. The report therefore concludes that the levels comply with the local development plan, and in particular policies EN16, EN17, CR2, CR6, CC8 and H8 of the 2019 Reading Plan.

6.3.4 With the windows open, the average levels are below the level which Approved Document O suggests that residents will need to close their windows due to excessive noise. However, the maximum levels are above this level, mainly from late night patrons in the area shouting, indicating that residents would need to close their windows. This is detailed in section 5.3.2 above. If the maximum noise levels with the windows open is not considered appropriate, then a mechanical ventilation and or cooling system could be introduced to negate the need for occupants to open windows to control over-heating.

6.3.5 A typing error has been corrected in table 7 in section 5.3.1 which had the average and maximum levels switched and the label added to confirm they are the levels calculated during the night time period.

6.3.6 **Internal Noise Transfer**

Internal noise transfer is usually considered by the Building Regulations 2010 and in particular Part E of Schedule 1. Approved Document E currently requires an airborne sound insulation between a residential dwelling and another area of the building of $D_{nTw} + C_{Tr}$ 45 dB or more.

6.3.7 However, to ensure future occupiers of the serviced apartment are not disturbed by the operations of the current or future ground floor occupiers of the commercial properties, the airborne sound insulation will be upgraded to 10 dB above the minimum Building Regulations requirements. i.e. $D_{nTw} + C_{Tr}$ 55 dB or more.

6.3.8 The design of the required acoustic floor to 1st floor will be detailed within the fully developed construction design. It would be recommended that if planning permission is granted a condition is imposed that requires prior to occupation an airborne sound insulation test undertaken in accordance with BS EN ISO 16283 – Part 1: 2014 + A1: 2017 entitled “*Acoustics. Field measurement of sound insulation in buildings and building elements. – Airborne sound insulation*” to prove the completed structure has a minimum airborne sound insulation of $D_{nTw} + C_{Tr}$ 55 dB or more. It should be noted that the current occupiers of the ground floor units are unlikely to have substantial operations between 23:00 and 07:00 hours.

End of Main Body of Report

A Appendix A – Relevant Material Considerations

A.1 Reading Borough Council – Local Plan

A.1.1 The Reading Borough Local Plan was adopted in November 2019 and includes the following policies which relate to noise and are relevant for this development:

- | | |
|---------------------------------------|--|
| a) EN16 Pollution and Water Resources | Adequate mitigation in levels of high noise levels. |
| b) EN17 Noise Generating Equipment | Criterion for the assessment of mechanical equipment. |
| c) CR2 Design in Central Reading | Agent of Change principle – Impact on existing commercial. |
| d) CR6 Living in Central Reading | Mitigation for central Reading developments. |
| e) CC8 Safeguarding Amenity | Criteria for new residential dwellings. |
| f) H8 Residential Conversions | Criteria for residential dwellings formed by conversion. |

A.1.2 Policy EN16 entitled “*Pollution and Water Resources*” requires residential dwellings within areas of high noise levels to have adequate mitigation measures to minimise the overall impacts.

“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.

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...”

A.1.3 Policy EN17 entitled “*Noise Generating Equipment*” provides useful guidance for the assessment of mechanical noise that could impact residential occupiers, and states:

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

A.1.4 Policy CR2 entitled “*Design in Central Reading*” provides details of the attributes any application will be required to have, with section d) providing specific advice on the Agent of Change principle i.e. introducing new residential properties must not place undue burden on existing commercial properties.

“d) Development should be designed with consideration of adjacent development sites, and should not prevent or cause unreasonable burdens on the future development of those sites.”

A.1.5 Policy CR6 entitled *“Living in Central Reading”* provides criteria for residential dwellings within the central area of Reading with part ii) relating specifically to noise.

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.”

A.1.6 Policy CC8 entitled *“Safeguarding Amenity”* requires that any proposed residential development should not result in unacceptable living conditions for future residential occupiers.

“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;*
- *Vibration;”*

A.1.7 Policy H8 entitled *“Residential Conversions”* provides details of the requirements when converting spaces for residential occupation.

“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;”*

A.2 National Planning Policy Framework: 2023 (NPPF)

- A.2.1 The National Planning Policy Framework: 2023 (NPPF) sets out the Government's planning policies and how these should be applied and provides a framework within which local prepared plans for housing and other developments can be produced. The NPPF is considered a material consideration when determining planning applications.
- A.2.2 The core principle of the NPPF is the presumption in favour of sustainable development and provides a balance between the benefits of the development against any significant adverse impacts.

"2. Plans and decision should apply a presumption in favour of sustainable development.

For decision-taking this means:

c) approving development proposals that accord with an up-to-date development plan without delay..."

- A.2.3 Section 15 of the NPPF entitled *"Conserving and enhancing the natural environment"* provides the following advice at paragraph 180.

"180. Planning policies and decisions should contribute to and enhance the natural and local environment.

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of ...noise pollution."

- A.2.4 Further advice on noise is provided at Paragraph 191 under the title *"Pollution"*.

"191. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life⁶⁵."

- A.2.5 Note 65 within section a) of paragraph 185 of the NPPF refers to the Noise Policy Statement for England dated 2010.

A.3 Noise Policy Statement for England: 2010 (NPSE)

- A.3.1 Defra published its document entitled *“Noise Policy Statement for England”* in March 2010 (NPSE) to clarify the long term *“Noise Policy Vision”* which is detailed in paragraph 1.6.

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

- A.3.2 The NPSE provides the following aims on the management and control of environmental noise at section 1.7:

*“- 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.”*

- A.3.3 The NPSE provides a useful definition of the lowest and significant adverse effect levels at paragraphs 2.20 and 2.21, respectively.

“NOEL – No Observed Effect Level This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level This is the level above which significant adverse effects on health and quality of life occur.”

A.4 Planning Policy Guidance (Noise) PPG: 2019 (PPG-N)

- A.4.1 The Ministry of Housing, Communities and Local Government last updated its online guidance on noise entitled *“Noise - Advice on how planning can manage potential noise impacts in new development”* in July 2019 (PPG) and enhances the guidance within the NPPF and NPSE providing the following outline advice in paragraph 001.

“Noise needs to be considered when development may create additional noise or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). When preparing plans, or taking decisions about new development, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset.”

A.4.2 Paragraph 005 of the PPG provides useful guidance on the noise exposure hierarchy based on the response of residential occupiers of dwellings.

Response	Details of Outcomes	Action
No Observed Adverse Effect Level (NOEL)		
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 Specific Measures
Lowest Observed Adverse Effect Level (LOAEL)		
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.	Mitigate and Reduce
Significant Observed Adverse Effect Level (SOAEL)		
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	Avoid
Very 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	Prevent

Table 8 – Policy Planning Guidance (Noise) – Noise exposure hierarchy table.

A.5 Other Documents providing guidance on LOAEL and SOAEL

A.5.1 Aecom were commissioned by Defra to produce a document entitled “Possible Options for the Identification of SOAEL and LOAEL in Support of NPSE” under reference NANR 316 which was published in 2015. Table 1.1 entitled “Summary of Outcomes” provides an indication of numerical values for NOEL and SOAEL for various sources.

Source	Annoyance 07:00 to 23:00		Sleep Disturbance 23:00 to 07:00	
	LOAEL	SOAEL	LOAEL	SOAEL
Road	56 dB LAeq, 16 hours	66 dB LAeq, 16 hours	46 LAeq, 8 hours	56 LAeq, 8 hours
Rail	63 dB LAeq, 16 hours	72 dB LAeq, 16 hours	55 LAeq, 8 hours	68 LAeq, 8 hours
Air	52 dB LAeq, 16 hours	60 dB LAeq, 16 hours	41 LAeq, 8 hours	53 LAeq, 8 hours

Table 9 – Summary of Aecom - Identification of SOAEL and LOAEL in support of NPSE dated 2015.

A.5.2 During the planning for the High Speed 2 rail link (HS2) the factsheet entitled “*HS2 - Control of Airborne Noise*” version 3.0 dated June 2019 was produced which provided the following clarification of the absolute noise levels for LOAEL and SOAEL. Table 1 in Appendix B provided the “*Operational airborne noise impact and effects levels from altered roads and operational railway*”.

Source	Annoyance Day Time 07:00 to 23:00		Sleep Disturbance Night Time 23:00 to 07:00	
	LOAEL	SOAEL	LOAEL	SOAEL
Road and Rail	50 dB LAeq, 16 hours	65 dB LAeq, 16 hours	40 dB LAeq, 8 hours	55 dB LAeq, 8 hours
			60 dB LAfMax	80 dB LAfMax

Table 10 – Summary of HS2 Control of Airborne Noise version 3.0 (LOAEL and SOAEL: 2019

A.5.3 The World Health Organisation published a document entitled “*Guidelines for Community Noise*” in 1999 which included the following guideline values in Table 1 entitled “*Guidelines values for community noise in specific environments*”.

Environment		LAeq,t	LAMaxfast
Inside Dwelling	Moderate annoyance daytime and evening	35 dB LAeq, 8 hours	--
	Bedrooms sleep disturbance night-time	30 dB LAeq, 8 hours	45 dB LAfMax
Outside	Bedrooms sleep disturbance (window open)	45 dB LAeq, 8 hours	60 dB LAfMax

Table 11 – Summary of WHO Guidelines for Community Noise Table 1: 2019

A.5.4 The World Health Organisation then published another document entitled “*Night Noise Guidelines for Europe*” in 2009. Table 3 within the summary of the document entitled “*Effects of different levels of night noise on the populations health*” provides useful guidance on the NOEL and SOAEL thresholds.

Effect Level	Health Effects on Population	Lnight, outside
NOEL	No substantial observed biological effects	30 dB LAeq, 8 hours
SOAEL	Situation considered increasingly dangerous for public health	above 55 dB LAeq, 8 hours

Table 12 – Summary of WHO / EU Night Noise Guidelines for Europe: 2009.

A.5.5 The World Health Organisation then published a document entitled “*Environmental Noise Guidelines for the European Region – Executive Summary*” in 2018.

Source	Annoyance Day Time 07:00 to 23:00	Sleep Disturbance Night Time 23:00 to 07:00
Road	53 dB L _{Aeq} , 16 hours	45 dB L _{Aeq} , 8 hours

Table 13 – Summary of WHO Environmental Noise Guidelines for Europe: 2018.

A.5.6 British Standard 389: Part 7: 2019 entitled “*Acoustics: Reference zero for the calibration of audiometric equipment. Reference threshold of hearing under free-field and diffuse-field listening conditions*” provides the threshold at which noise is likely to be inaudible for a young healthy adult.

Noise Source	Octave Band Centre Frequency (Hz)								Sum A	NR Curve
	63	125	250	500	1K	2K	4K	8K		
1 st Floor Bedroom	45	28	17	10	8	6	5	2	21	12

Sound Pressure Levels (dB) – Reference 2×10^{-5} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 14 – Summary of BS 389 for Threshold of Hearing: 2019.

A.5.7 Napier University produced a document under reference NANR 116 entitled “*Open / Closed Window Research – Sound Insulation through ventilated domestic windows*” in April 2007. The document provided the estimated performance of a partially open window with an area of 0.2 m^2 in table 5-6 entitled “*Statistically Derived $D_{n,e}$ insulation ratings for window openings (dB)*”. However, if you apply the principles of British Standard 12354 – Part 3 entitled “*Building acoustics. Estimation of acoustic performance of buildings from the performance of elements – Airborne Sound*” you can estimate the performance of an open window with an area of 1.5 m^2 .

Noise Source	Octave Band Centre Frequency (Hz)								Δ Sum A	R_w
	63	125	250	500	1K	2K	4K	8K		
Partially Open Window (0.2 m^2)	20	14	14	16	14	17	19	20	19	16
Fully Open Window (1.5 m^2)	5	6	7	7	7	7	7	7	5	8

Transmission Loss (dB)

Table 15 – Summary of Napier University NANR 116 Open Closed Windows: 2007.

- A.5.8 We can therefore use the threshold of hearing, and the worst-case performance of an open window derived from the methodology within BS 12354 – Part 3 to determine the No Observed Adverse Effect Level (NOEL) externally from any bedroom window.

Position	Octave Band Centre Frequency (Hz)								Sum A	NR
	63	125	250	500	1K	2K	4K	8K		
External from Habitable Room	50	34	24	17	15	13	12	9	26	18

Table 16 – Estimation External Levels for NOEL based on Open Window and Threshold of Hearing.

A.6 British Standard 8233: 2014 (BS 8233)

- A.6.1 British Standard 8233: 2014 entitled “Guidance on sound insulation and noise reduction for buildings” provides some useful criterion for internal noise levels within dwellings within section 7.7.2 entitled “Internal ambient noise levels for dwellings”. (CD12.5). ProPG provides a criterion for the maximum internal noise (L_{Amax}) during the night time period in figure 2 in section 2.27 (CD12.3).

Area of Development	Day Time (07:00 to 23:00)	Night Time (23:00 to 07:00)
Resting Living Room	35 dB L_{Aeq} , 16 hours	--
Sleeping Bedroom	35 dB L_{Aeq} , 16 hours	30 dB L_{Aeq} , 8 hours
		45 dB L_{Amax} , 10-event
External Amenity Area	55 dB L_{Aeq} , 16 hours	--

Table 17 – Table 4 of British Standard 8233: 2014 – Residential noise criterion for noise without character.

- A.6.2 It should be noted that the criterion is based on sources without character as detailed in paragraph 7.7.1 .

“This subclause applies to external noise as it affects the internal acoustic environment from sources without a specific character, previously termed “anonymous noise”. Occupants are usually more tolerant of noise without a specific character than, for example, that from neighbours which can trigger complex emotional reactions. For simplicity, only noise without character is considered in Table 4.

NOTE Noise has 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.”

- A.6.3 BS8233 provides the following advice for the assessment of industrial noise, which is often considered to have a specific character in section 6.5.2 entitled “Assessment of Industrial Noise”.

“Where industrial noise affects residential or mixed residential areas, the methods for rating the noise in BS 4142 should be applied. BS 4142 describes methods for determining, at the outside of a building:

- a) noise levels from factories, industrial premises or fixed installations, or sources of an industrial nature in commercial premises; and*
- b) background noise level.”*

A.6.4 It is therefore considered appropriate to apply a correction to the criterion within BS 8233 to account for the character of the noise from the proposed development to establish a suitable level of LOAEL and SOAEL.

A.7 British Standard 4142: 2014 + A1: 2019 (BS 4142)

A.7.1 British Standard 4142: 2014 + A1: 2019 entitled *“Methods for rating and assessing industrial and commercial sound”* provides a methodology to determine the impact of industrial noise on occupiers of residential dwellings. The overall scope of the standard is clarified in the last paragraph of section 1.1.

“The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.”

A.7.2 The 2019 amendment to the standard added the following clarification that it is not designed as a methodology to assess internal noise levels within residential dwellings from industrial sources.

“The methodology set out in Clauses 7, 8, and 9 of this standard is not intended to be used to assess the extent of the impact at indoor locations. Internal sound levels can be taken into account as outlined in Clause 11.

The standard is not intended to be applied to the assessment of indoor sound levels.”

A.7.3 The assessment methodology uses the calculated specific noise levels at the assessment position and applies a feature correction to account for the specific character of the noise to determine the rating noise levels. The rating noise level is then compared against the underlying background noise levels. The assessment of the results is defined within the commentary of section 11 entitled *“Assessment of the Impacts”*.

“The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

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

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

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

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

A.8 Approved Document O

A.8.1 The recent update to the Building Regulations came into effect on 15th June 2022 and now includes Part O of Schedule 1 entitled *“Requirement 01 overheating mitigation (regulations 40B)”*. Approved Document O entitled *“Overheating”* now includes a requirement to protect future occupants of residential dwellings by reducing the occurrence of high indoor temperatures through simplified or dynamic thermal modelling.

“01 Overheating Mitigation

(1) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel (“residences”) to—

(a) limit unwanted solar gains in summer;

(b) provide an adequate means to remove heat from the indoor environment.

A.8.2 Section 3 entitled *“Ensuring the overheating mitigation strategy is useable”* provides details of the internal noise levels within sleeping hours within the bedrooms with the windows opened as detailed within the simplified model.

“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).”

A.9 Proposed Noise Criterion

A.9.1 The initial assessment of the impact of the noise from mechanical services on the future occupiers of the development who may be inside or outside of the building is based on the noise impacting the façade of the building. The assessment is undertaken in general accordance with BS 4142.

A.9.2 To allow for the context of the site, the following criterion is based on the documents detailed in Appendix A.1 to A.6 which are considered appropriate material consideration in determining the application.

NPSE	PPG - Noise		Proposed Noise Criterion		Justification
Impact	Response	Action	Day 07:00 – 23:00	Night 23:00 – 07:00	
NOEL	Not Intrusive	No Specific	30 dB L _{Aeq} , 15 minutes	25 dB L _{Aeq} , 15 minutes	Appendix A
LOAEL	Intrusive	Mitigate & Reduce	35 dB L _{Aeq} , 15 minutes	30 dB L _{Aeq} , 15 minutes	
SOAEL	Disruptive	Avoid	50 dB L _{Aeq} , 15 minutes	45 dB L _{Aeq} , 15 minutes	
	Very Disruptive	Prevent			

External Sound Pressure Levels (dB) – Reference 2×10^{-5} watts – Uncertainty of ± 2.5 dB (95% confidence, k=2)

Table 18 – Proposed Noise Criterion for NOEL, LOAEL and SOAEL for the proposed development Site.

A.9.3 The No Observed Adverse Effect Level (NOEL) is determined by taking the threshold of hearing from BS 389 and assuming the person is located internally within a habitable room with the window fully open offering a level difference of 5 dB (A) from inside to outside calculated in accordance with BS 12354 – Part 3.

B Appendix B - Background Noise Measurement Details...

B.1 Calibration Details

B.1.1 The following equipment was used for the measurement of the background noise levels and was calibrated by ANV Measurement Systems which holds a current scope of accreditation from the United Kingdom Accreditation Service (UKAS). A copy of the calibration certificate is held on file and is available upon request.

B.1.2 Position BN.1 Front of Site

Meters	Sound Level Meter	Microphone	Calibrator
Meter Group	KRE/05/01	KRE/05/2	KRE/05/03
Manufacturer	Casella Instruments		
Model Number	Casella CEL 633	Casella CEL 251	Casella CEL 120/1
Serial Number	2145360	00709	5231047
Calibration Laboratory	ANV Measurements Systems – UKAS Calibration Laboratory		
Calibration Standard	BS IEC 61672 – Part 3: 2006 as modified by UKAS TPS 49 Edition 2: 2009		
Calibration Certificate	U42913	42912	U46419
Calibration Due	10 th January 2025	10 th January 2025	11 th January 2025

Table 19 – Calibration Details of Meter(s) used for Ambient and Background Noise Measurements.

B.1.3 Position BN.2 Rear of Site

Meters	Sound Level Meter	Microphone	Calibrator
Meter Group	KRE/08/01	KRE/08/2	KRE/08/03
Manufacturer	Casella Instruments		
Model Number	Casella CEL 633	Casella CEL 251	Casella CEL 120/1
Serial Number	2425448	00092	5230902
Calibration Laboratory	ANV Measurements Systems – UKAS Calibration Laboratory		
Calibration Standard	BS IEC 61672 – Part 3: 2006 as modified by UKAS TPS 49 Edition 2: 2009		
Calibration Certificate	U42920	42919	U46420
Calibration Due	10 th January 2025	10 th January 2025	11 th January 2025

Table 20 – Calibration Details of Meter(s) used for Ambient and Background Noise Measurements.

B.1.4 The associated calibrator was applied to the meter at the start and end of the measurement with a signal of 94 dB(A) which confirmed the meters were working correctly.

B.2 Weather Conditions During Survey - Week 1: 25/09/24 to 01/10/24

B.2.1 The following are the hourly weather conditions for the first week of the background noise survey. The weather was fairly unsettled between Wednesday 25th and Friday 27th September 2024. The rain and high winds could have impacted the ambient noise measurements during this period.

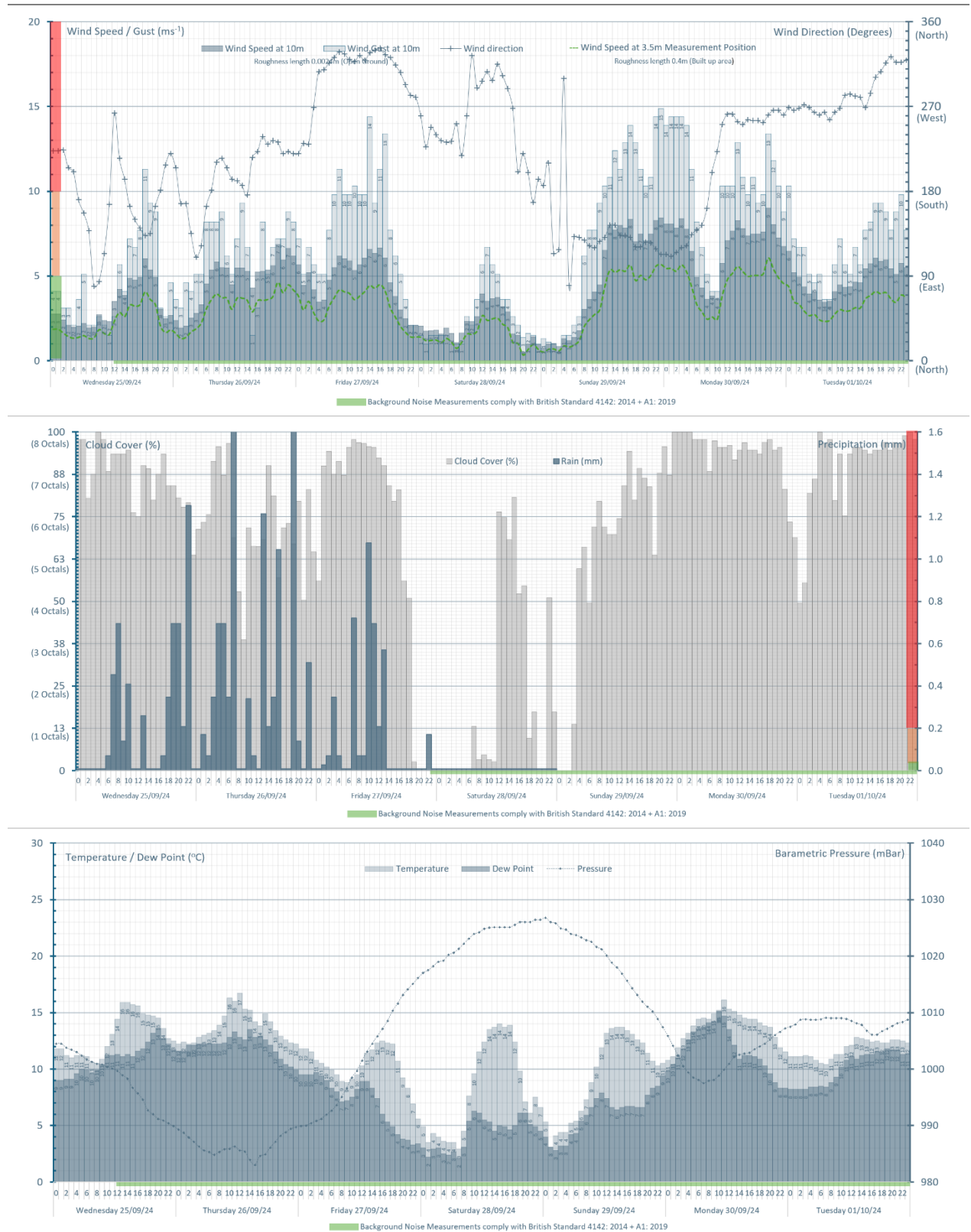


Figure 7 – Hourly Weather Condition 25th September 2024 to 1st October 2024.

B.3 Weather Conditions During Survey - Week 2: 02/10/24 to 09/10/24

B.3.1 The second week of the survey was more settled apart from some rain on Wednesday 2nd November 2024 which is unlikely to have impacted the background measurements.

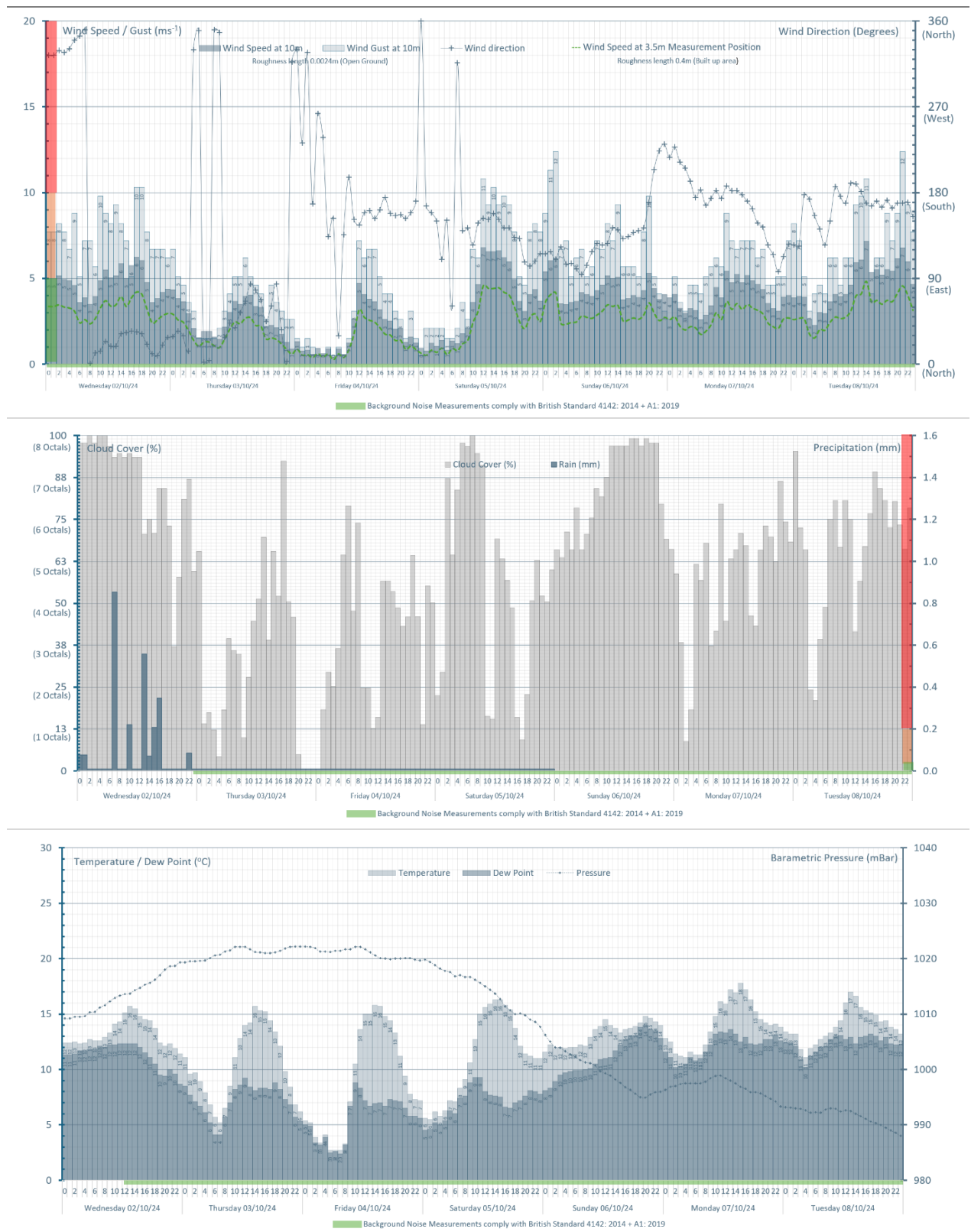


Figure 8 – Hourly Weather Condition 2nd October 2024 to 8th October 2024.

B.4 5-minute Ambient Levels (L_{Max} , L_{Aeq} , L_{A90})

B.4.1 The following 5-minute graphs taken at the front and rear of the roof of the development site show the ambient noise levels over a 12-day period from around 16:00 on Wednesday 25th September 2024 to 15:20 on Sunday 6th October 2024.

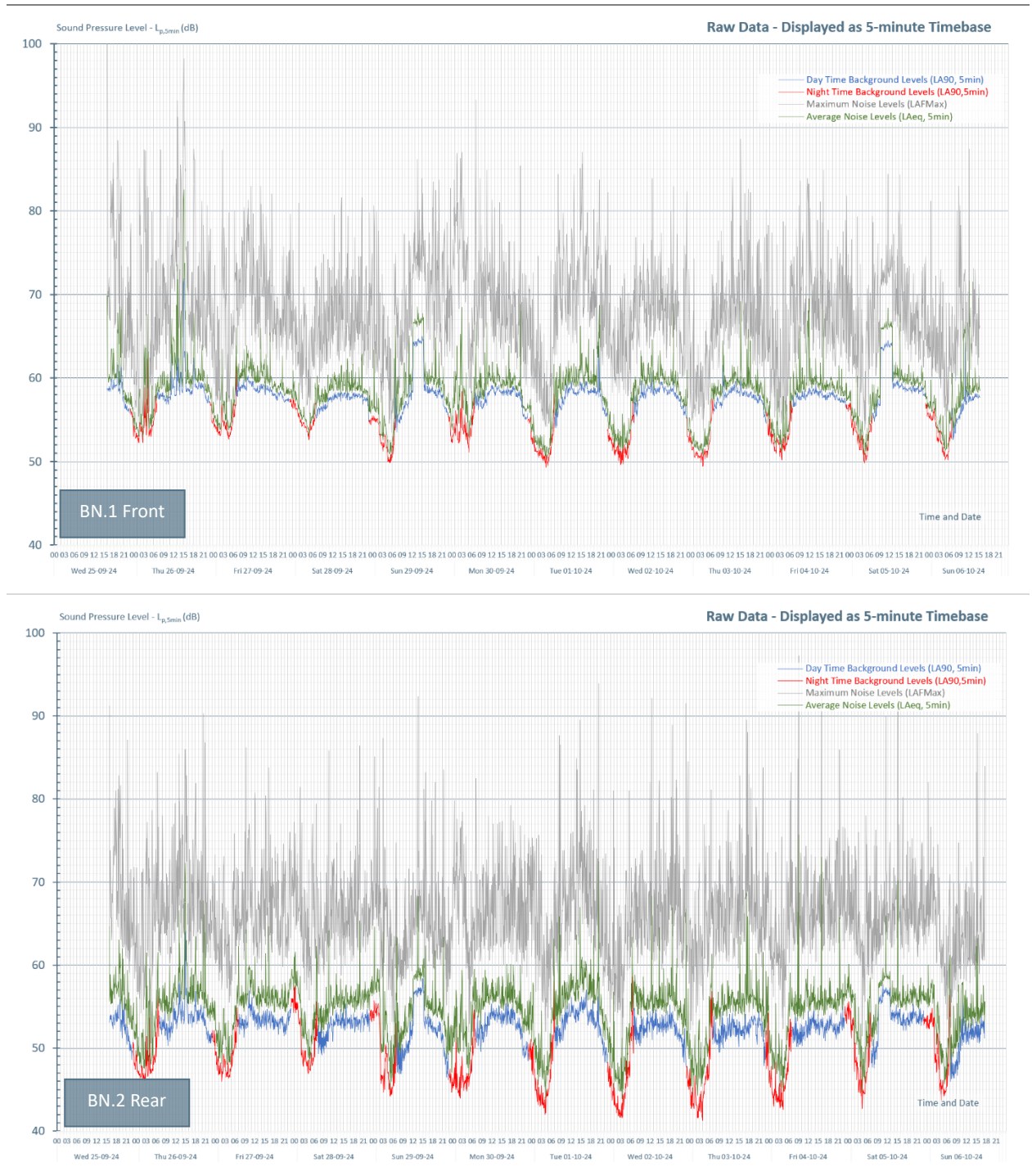


Figure 9 – 5-minute data of Maximum, Ambient and Background Noise Levels.

B.4.2 It can be seen that the heavy rain during Thursday 26th September 2024 elevated the maximum and to some extent average noise levels.

B.5 Hourly and 16 hour (day time) and 8 hour (night time)

B.5.1 The following graphs show equivalent continuous level measured over a 1-hour period and the corresponding values over a 16-hour period between 07:00 and 23:00 (day time) and 23:00 and 07:00 (night time).



Figure 10 – Average Noise Levels (1 hour), Day (16 hour) and Night (1 hour) levels.

B.5.2 The results show increased levels during the day time from the excessive rain fall on Thursday 26th September 2024 and during two events held at the St Mary the Virgin church to the south of the site as a result of the ringing of the bells. In general terms it can be seen that the night time background noise level are elevated at the weekend when there are more people in the area.

B.6 6-hour event on Sunday 29th September and Saturday 5th October 2024

B.6.1 The following shows the noise from the bells at the St Mary the Virgin church that occurred between 12:20 to 15:30 on Sunday 29th September 2024. The event was a celebration for the retirement service for Bishop Olivia which started at 3:30pm. There was also bell ringing on Saturday 5th October 2024 which was likely to be prior to several weddings. The Levels are significantly higher at the front of the site due to the reflections and focuses from the side of Broad Street Mall facing onto St Mary's Butts.

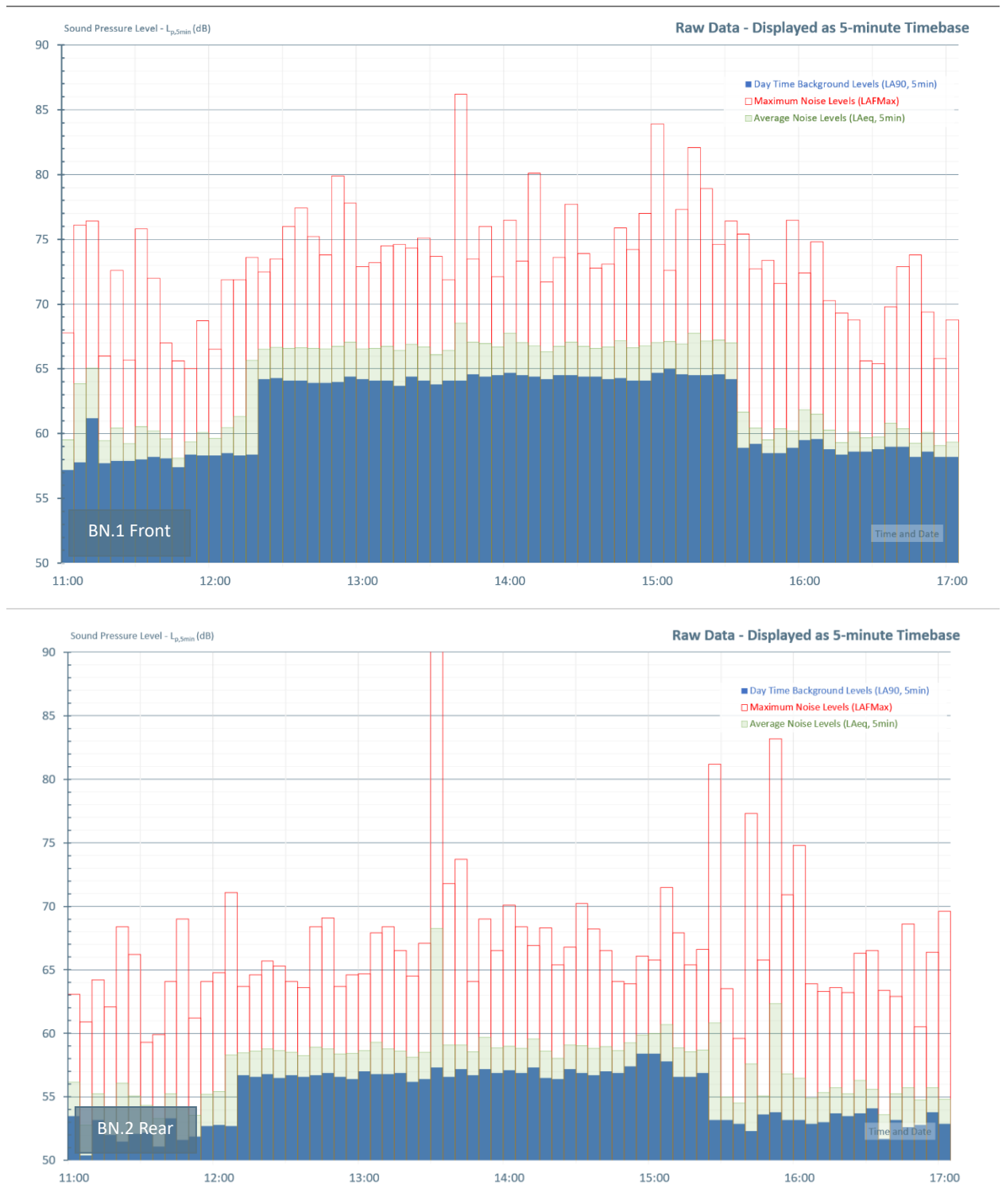


Figure 11 – Details of specific event on Sunday 29th September and Saturday 5th October 2024.

B.7 Summary Table of Levels of Background

B.7.1 The following table provides a summary of the background noise levels recorded at the front of the site (position BN.1) and the rear of the site (position BN.2). In rough terms the maximum levels and underlying background noise levels are around 6 to 8 dB higher at the front of the site. During the day time the average noise levels are around 8 dB higher at the front of the site due to the dominant noise sources being located on St Mary's Butts but during the evening and night time periods the average noise levels are only 2 to 3 dB higher at the front of the site.

Date	Day (07:00 – 19:00)			Evening (19:00 – 23:00)			Night (23:00 – 07:00)		
	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}
BN.1 Front	87	67	53	78	61	54	82	59	50
BN.2 Rear	80	59	47	72	59	47	75	56	42

Sound Pressure Levels (dB) – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ – Uncertainty of $\pm 0.5 \text{ dB}$ (95% confidence, $k=2$)

Table 21 – Derived Table of Maximum, Ambient and Background Noise Levels for Day, Evening and Night Time.

B.7.2 The following is the summary table of the levels recorded at the front of the site (position BN.1).

Date	Day (07:00 – 19:00)			Evening (19:00 – 23:00)			Night (23:00 – 07:00)		
	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}
Wed 25/09/24	-	-	-	78	61	56	81	58	52
Thurs 26/09/24	87	67	57	73	60	57	75	57	53
Fri 27/09/24	80	61	58	70	59	57	70	57	53
Sat 28/09/24	74	59	55	72	59	55	72	56	50
Sun 29/09/24	78	63	54	75	59	56	82	59	52
Mon 30/09/24	78	60	56	70	59	55	70	54	50
Tue 01/10/24	80	60	54	75	61	54	70	54	50
Wed 02/10/24	75	60	56	71	58	54	68	54	50
Thu 03/10/24	78	60	56	71	58	55	74	55	51
Fri 04/10/24	81	61	57	73	59	57	72	56	50
Sat 05/10/24	76	63	55	69	60	57	69	56	50
Sun 06/10/24	73	58	53	-	-	-	-	-	-
Typical	87	67	53	78	61	54	82	59	50

Sound Pressure Levels (dB) – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ – Uncertainty of $\pm 0.5 \text{ dB}$ (95% confidence, $k=2$)

Table 22 – Summary of measurements undertaken at position BN.1 (Front of site).

B.7.3 The following is the summary table of the levels recorded at the rear of the site (position BN.1).

Date	Day (07:00 – 19:00)			Evening (19:00 – 23:00)			Night (23:00 – 07:00)		
	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}	dB L _{Max}	dB L _{Aeq}	dB L _{A90}
Wed 25/09/24	-	-	-	71	56	49	72	53	46
Thurs 26/09/24	80	59	51	69	58	51	71	53	47
Fri 27/09/24	76	57	52	71	56	52	73	56	47
Sat 28/09/24	72	56	50	69	57	52	74	56	44
Sun 29/09/24	72	57	47	68	54	47	75	53	44
Mon 30/09/24	75	57	50	72	55	49	73	52	43
Tue 01/10/24	77	58	51	69	59	49	69	52	42
Wed 02/10/24	74	57	51	72	56	48	71	52	42
Thu 03/10/24	75	57	50	69	56	49	71	52	43
Fri 04/10/24	73	59	51	72	57	52	73	55	43
Sat 05/10/24	74	57	48	70	56	53	71	55	44
Sun 06/10/24	70	54	47	-	-	-	-	-	-
Typical	80	59	47	72	59	47	75	56	42

Sound Pressure Levels (dB) – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ – Uncertainty of $\pm 0.5 \text{ dB}$ (95% confidence, $k=2$)

Table 23 – Summary of measurements undertaken at position BN.1 (Rear of site).

C Appendix C – Detailed Calculations of Internal Noise Levels

C.1 Average Day Time (07:00 to 23:00) – Windows Closed

C.1.1 The following is a table of the transmission losses of the individual elements of the façade construction.

Ref	Element of Façade	Octave Band Centre Frequency (Hz)								Sum A	R _w
		63	125	250	500	1K	2K	4K	8K		
C1.a	Ventilation (MVHR)	28	31	38	43	49	46	41	(35)	--	45
C1.b	Windows Closed - Glazing	26	23	25	32	46	48	53	(60)	--	38
C1.c	Façade Construction	51	57	58	62	70	70	72	(72)	--	57
C1.d	Ceiling of Room (Internal)	38	41	33	40	54	55	55	(52)	--	--

Sound Power Levels (dB) – Reference 1×10^{-12} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 24 – Transmission loss of building elements (Windows Closed).

C.1.2 The following calculations provide an estimate of the internal noise levels within the windows closed to provide ventilation in line with the requirements of Approved Document F.

BS 8233: 2014 Calculation Internal Levels in Bedroom Windows Closed		Ref	Octave Band Centre Frequency (Hz)							Sum
			63	125	250	500	1K	2K	4K	
Free Field Level	$L_{eq,ff}$	A	57	60	64	66	65	63	60	70 dB(A)
Ventilation, $D_{n,e}$ MVHR (Side Vent) 1.8m Attenuator	$B = \frac{A_0}{S} \cdot 10^{\frac{-D_{n,e}}{10}}$	--	28	31	34	43	49	46	41	R _w 45 dB
		B	0.00072	0.00036	0.00018	0.00002	0.00001	0.00001	0.00004	
Windows, R_{wi} 8 – 20 – 6.4 (No Trickle Vents)	$C = \frac{S_{wi}}{S_f} \cdot 10^{\frac{-R_{wi}}{10}}$	1.2 m²	26	23	25	32	46	48	53	R _w 38 dB
		C	0.00091	0.00182	0.00115	0.00023	0.00001	0.00001	0.00000	
Façade, R_{ewi} Brick + Block 2 x 15mm SB	$D = \frac{S_e}{S_f} \cdot 10^{\frac{-R_{ew}}{10}} c$	8.8 m2	51	57	58	62	70	70	72	R _w 67 dB
		D	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Exposed Roof, R_{rr} Tiled 2 x 15mm SB	$E = \frac{S_{rrr}}{S_f} \cdot 10^{\frac{-R_{rrr}}{10}}$	12.0 m²	99	99	99	99	99	99	99	R _w 99 dB
		E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
$F = 10 \cdot \log_{10}(B + C + D + E)$		F	-27.9	-26.6	-28.8	-36.0	-48.3	-47.6	-44.2	--
A (Furnished)	$G = 10\log_{10}\left(\frac{S}{A}\right)$	--	11	11	14	16	16	15	15	--
		G	3.0	3.0	2.0	1.4	1.4	1.7	1.7	
Internal Level, $L_{eq, 2}$	$L_{eq,2} = A + F + G + 3$	--	35	39	40	34	21	20	21	35 dB(A)

Table 25 – Calculation of Average internal noise levels in accordance with BS 8233: 2014 (Windows closed).

C.2 Average Night Time (23:00 to 07:00) – Windows Closed

C.2.1 The following is a table of the transmission losses of the individual elements of the façade construction.

Ref	Element of Façade	Octave Band Centre Frequency (Hz)								Sum A	R _w
		63	125	250	500	1K	2K	4K	8K		
C2.a	Ventilation (MVHR)	28	31	38	43	49	46	41	(35)	--	45
C2.b	Windows Closed - Glazing	26	23	25	32	46	48	53	(60)	--	38
C2.c	Façade Construction	51	57	58	62	70	70	72	(72)	--	57
C2.d	Ceiling of Room (Internal)	38	41	33	40	54	55	55	(52)	--	--

Sound Power Levels (dB) – Reference 1×10^{-12} watts – Uncertainty of ± 2.5 dB (95% confidence, $k=2$)

Table 26 – Transmission loss of building elements (Windows Closed).

C.2.2 The following calculations provide an estimate of the internal noise levels within the windows closed to provide ventilation in line with the requirements of Approved Document F.

BS 8233: 2014 Calculation Internal Levels in Bedroom Windows Closed		Ref	Octave Band Centre Frequency (Hz)							Sum
			63	125	250	500	1K	2K	4K	
Free Field Level	$L_{eq,ff}$	A	50	53	57	59	58	56	53	63 dB(A)
Ventilation, $D_{n,e}$ MVHR (Side Vent) 1.8m Attenuator	$B = \frac{A_0}{S} \cdot 10^{\frac{-D_{n,e}}{10}}$	--	28	31	34	43	49	46	41	R _w 45 dB
		B	0.00072	0.00036	0.00018	0.00002	0.00001	0.00001	0.00004	
Windows, R_{wi} 8 – 20 – 6.4 (No Trickle Vents)	$C = \frac{S_{wi}}{S_f} \cdot 10^{\frac{-R_{wi}}{10}}$	1.2 m²	26	23	25	32	46	48	53	R _w 38 dB
		C	0.00091	0.00182	0.00115	0.00023	0.00001	0.00001	0.00000	
Façade, R_{ewi} Brick + Block 2 x 15mm SB	$D = \frac{S_e}{S_f} \cdot 10^{\frac{-R_{ew}}{10} c}$	8.8 m2	51	57	58	62	70	70	72	R _w 67 dB
		D	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Exposed Roof, R_{rr} Tiled 2 x 15mm SB	$E = \frac{S_{rr}}{S_f} \cdot 10^{\frac{-R_{rr}}{10}}$	12.0 m²	99	99	99	99	99	99	99	R _w 99 dB
		E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
$F = 10 \cdot \log_{10}(B + C + D + E)$		F	-27.9	-26.6	-28.8	-36.0	-48.3	-47.6	-44.2	--
A (Furnished)	$G = 10\log_{10}\left(\frac{S}{A}\right)$	--	11	11	14	16	16	15	15	--
		G	3.0	3.0	2.0	1.4	1.4	1.7	1.7	
Internal Level, $L_{eq, 2}$	$L_{eq,2} = A + F + G + 3$	--	28	32	33	27	14	13	14	28 dB(A)

Table 27 – Calculation of Average internal noise levels in accordance with BS 8233: 2014 (Windows closed).

C.3 Average Night Time (23:00 – 07:00) – Windows Open

C.3.1 The following is a table of the transmission losses of the individual elements of the façade construction.

Ref	Element of Façade	Octave Band Centre Frequency (Hz)								Sum A	R _w
		63	125	250	500	1K	2K	4K	8K		
C.2.a	Ventilation (MVHR)	31	38	43	49	46	41	(35)	--	45	28
C2.b	Windows Open (0.2m ²)	20	14	14	16	14	17	19	20	19	16
C2.c	Façade Construction	51	57	58	62	70	70	72	(72)	--	57
C1.d	Ceiling of Room (Internal)	38	41	33	40	54	55	55	(52)	--	--

Sound Power Levels (dB) – Reference 1 x 10⁻¹² watts – Uncertainty of +/- 2.5 dB (95% confidence, k=2)

Table 28 – Transmission loss of building elements (Windows Open).

C.3.2 The following calculations provide an estimate of the internal noise levels within the windows closed to provide ventilation in line with the requirements of Approved Document F.

BS 8233: 2014 Calculation Internal Levels in Bedroom Windows Closed		Ref	Octave Band Centre Frequency (Hz)							Sum
			63	125	250	500	1K	2K	4K	
Free Field Level	$L_{eq,ff}$	A	50	53	57	59	58	56	53	63 dB(A)
Ventilation, $D_{n,e}$ MVHR (Side Vent) 1.8m Attenuator	$B = \frac{A_0}{s} \cdot 10^{\frac{-D_{n,e}}{10}}$	--	28	31	34	43	49	46	41	R _w 45 dB
		B	0.00072	0.00036	0.00018	0.00002	0.00001	0.00001	0.00004	
Windows, R_{wi} 8 – 20 – 6.4 (No Trickle Vents)	$C = \frac{S_{wi}}{S_f} \cdot 10^{\frac{-R_{wi}}{10}}$	1.2 m²	20	14	14	16	14	17	19	R _w 38 dB
		C	0.00055	0.00217	0.00217	0.00137	0.00217	0.00109	0.00069	
Façade, R_{ewi} Brick + Block 2 x 15mm SB	$D = \frac{S_e}{S_f} \cdot 10^{\frac{-R_{ew}}{10} c}$	8.8 m2	51	57	58	62	70	70	72	R _w 67 dB
		D	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Exposed Roof, R_{rr} Tiled 2 x 15mm SB	$E = \frac{S_{rr}}{S_f} \cdot 10^{\frac{-R_{rr}}{10}}$	12.0 m²	99	99	99	99	99	99	99	R _w 99 dB
		E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
$F = 10 \cdot \log_{10}(B + C + D + E)$		F	-29.0	-26.0	-26.3	-28.6	-26.6	-29.6	-31.4	--
A (Furnished)	$G = 10\log_{10}\left(\frac{S}{A}\right)$	--	11	11	14	16	16	15	15	--
		G	3.0	3.0	2.0	1.4	1.4	1.7	1.7	
Internal Level, $L_{eq, 2}$	$L_{eq,2} = A + F + G + 3$	--	27	33	36	35	36	31	26	39 dB(A)

Table 29 – Calculation of Average internal noise levels in accordance with BS 8233: 2014 (Windows open).

C.4 Maximum Night Time (23:00 – 07:00) – Windows Open

C.4.1 The following is a table of the transmission losses of the individual elements of the façade construction.

Ref	Element of Façade	Octave Band Centre Frequency (Hz)								Sum A	R _w
		63	125	250	500	1K	2K	4K	8K		
C.2.a	Ventilation (MVHR)	31	38	43	49	46	41	(35)	--	45	28
C2.b	Windows Open (0.2m ²)	20	14	14	16	14	17	19	20	19	16
C2.c	Façade Construction	51	57	58	62	70	70	72	(72)	--	57
C1.d	Ceiling of Room (Internal)	38	41	33	40	54	55	55	(52)	--	--

Sound Power Levels (dB) – Reference 1 x 10⁻¹² watts – Uncertainty of +/- 2.5 dB (95% confidence, k=2)

Table 30 – Transmission loss of building elements (Windows Open).

C.4.2 The following calculations provide an estimate of the internal noise levels within the windows closed to provide ventilation in line with the requirements of Approved Document F.

BS 8233: 2014 Calculation Internal Levels in Bedroom Windows Closed		Ref	Octave Band Centre Frequency (Hz)							Sum
			63	125	250	500	1K	2K	4K	
Free Field Level	$L_{eq,ff}$	A	72	76	82	86	87	79	77	89 dB(A)
Ventilation, $D_{n,e}$ MVHR (Side Vent) 1.8m Attenuator	$B = \frac{A_0}{s} \cdot 10^{\frac{-D_{n,e}}{10}}$	--	28	31	34	43	49	46	41	R _w 45 dB
		B	0.00072	0.00036	0.00018	0.00002	0.00001	0.00001	0.00004	
Windows, R_{wi} 8 – 20 – 6.4 (No Trickle Vents)	$C = \frac{S_{wi}}{S_f} \cdot 10^{\frac{-R_{wi}}{10}}$	1.2 m²	20	14	14	16	14	17	19	R _w 38 dB
		C	0.00055	0.00217	0.00217	0.00137	0.00217	0.00109	0.00069	
Façade, R_{ewi} Brick + Block 2 x 15mm SB	$D = \frac{S_e}{S_f} \cdot 10^{\frac{-R_{ew}}{10} c}$	8.8 m2	51	57	58	62	70	70	72	R _w 67 dB
		D	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
Exposed Roof, R_{rr} Tiled 2 x 15mm SB	$E = \frac{S_{rr}}{S_f} \cdot 10^{\frac{-R_{rr}}{10}}$	12.0 m²	99	99	99	99	99	99	99	R _w 99 dB
		E	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
$F = 10 \cdot \log_{10}(B + C + D + E)$		F	-29.0	-26.0	-26.3	-28.6	-26.6	-29.6	-31.4	--
A (Furnished)	$G = 10\log_{10}\left(\frac{S}{A}\right)$	--	11	11	14	16	16	15	15	--
		G	3.0	3.0	2.0	1.4	1.4	1.7	1.7	
Internal Level, $L_{eq, 2}$	$L_{eq,2} = A + F + G + 3$	--	49	56	61	62	65	54	50	66 dB(A)

Table 31 – Calculation of Maximum internal noise levels in accordance with BS 8233: 2014 (Windows open).

