

Acoustic Design Statement for the Residential Development at Bayswater House, Hever Court Road, Gravesend, Kent, DA12 5UQ

Planning Application Reference 20241069

Prepared for Alder Design & Build Ltd

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1 How to read this document

This document contains [hyperlinks](#) to cross-reference sections, subsections and [references](#). Lists of [tables](#) and [figures](#) are provided after the [table of contents](#). These indexes contain hyperlinks to the corresponding items.

This acoustic design statement makes use of complex and technical terminology common to the field of acoustics and residential development. Key [terms](#) and [symbols](#) are provided in the [terminology section](#) which are based on the core elements of this acoustic design statement and the noise survey. A [table of abbreviations](#) is provided at the end of the terminology section.

The scope of this acoustic design statement is outlined in the [introduction](#) along with information about the proposed development. A brief overview of the development site is provided in the [site description section](#) which includes the site boundaries, the main sources of noise and notable features that affect noise levels at the site.

This acoustic design statement is based on a framework of [guidance policies and standards](#) which cover planning policy at the national and local level to the scientific guidance underpinning the impact of noise on health and quality of life. Hyperlinks to official sources of freely available online versions of these guidance documents are listed in the [references section](#).

The [summary of environmental noise survey section](#) contains an illustration of the measurement locations where noise levels at the development site have been measured along with: (1) [graphs](#) showing time histories; (2) an [assessment for the presence of prominent tones](#); and (3) [summary tables](#) which have been used for the assessments of noise and the subsequent recommendations. The [site survey record section in the appendix](#) reports the measurement equipment used and the corresponding [field calibration](#) and [laboratory calibration](#) as well as the [weather](#) conditions forecasted and observed during the noise survey.

The [initial noise risk assessments](#) provide a sense of scale to the measured noise levels in the context of potential health effects and the corresponding sound insulation which will affect the design of the development.

The noise impact assessments are used to determine if open windows (i.e. a solely natural ventilation scheme) provide suitable internal acoustics or if alternative means of ventilation are required, under general ventilation and overheating conditions. The [noise impact assessments for types of rooms](#) are based on habitable rooms which show where such rooms may be placed to help protect more sensitive rooms and to optimise the cost-benefit of facade elements' sound insulation performance. The [noise impact assessments for specific rooms](#) are based on the data detailed in the [input data for assessments and calculations section](#).

The [recommended facade sound insulation specifications](#) are based on the noise levels measured during the noise survey, the internal noise level guidelines, and the [input data for assessments and calculations section](#). The specifications are shown in tabular form for each habitable room at the development with regards to the walls, roof, windows and background ventilators, if applicable, for each ventilation system described in the section.

Supplementary [guidance for developers on sound insulations values](#) is presented in the appendix. [Recommended indoor noise levels from mechanical services](#) are provided where these have been recommended and/or are preferred. A commentary on some notable sources of uncertainty is provided in the [design factors, methodology and uncertainty section](#).

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5 Terminology

Key terms, symbols and abbreviations used within this document are defined and explained in this section. For a wider set of terminology please consult the International Standards Organization and International Electrotechnical Commission databases of terminology at <https://www.iso.org/obp/ui> and <http://www.electropedia.org/> respectively.

5.1 Terms

Terms are listed alphabetically.

Average sound level (see also $L_{Aeq,T}$ in [symbols](#))

- A simplified description used in this report for the A-weighted equivalent continuous sound pressure level ($L_{Aeq,T}$).

Background sound level (see also $L_{A90,F,T}$ in [symbols](#))

- In the context of British Standard 4142 and noise impacts from commercial/industrial noise sources, such as mechanical services equipment, see symbol $L_{A90,F,T}$.
- In the context of sound insulation testing, the background sound level is the measured energy-average (energetic average) sound pressure level ($L_{eq,T}$) in the receiving room from all sources except the loudspeaker in the source room.

Energetic average

- The average sound pressure level calculated based on a linear energy (pressure squared) basis for incoherent (i.e. relatively random in phase) sounds by logarithmic addition. This averaging method is applied in the calculation of the A-weighted equivalent continuous sound pressure level (see also $L_{Aeq,T}$ in [symbols](#)) and in most cases of temporal and spatial averaging of sound pressure levels.
- The determination of when energetic averaging is used is based on the context and the mathematical and physical interpretation of the average. For example, the arithmetic average of the background sound pressure levels over the daytime/night-time periods could be used to describe the mean of the distribution of the data recorded in those periods, and the energetic average of the ambient/residual sound pressure levels over the daytime/night-time periods would be used to describe the average sound energy in those periods.

Free-field

- Free-field conditions refer to a measurement location or listening environment where there are no significant contributions from sound reflections from nearby surfaces. In outdoor environments, free-field conditions are around 3.5 metres from a surface, excluding ground level.

Habitable Room

- Different definitions of a habitable room exist depending on the different technical aspects of buildings described within The Building Regulations 2010 ([UK Statutory Instruments 2010](#)) Approved Documents. Bedrooms, living rooms, dining rooms, studios are habitable rooms along with bedrooms which include sanitary appliances/ware or kitchenettes. In cases where multiple room types share the same space, the acoustic design of such spaces should normally yield to the most sensitive use.
- Non-habitable rooms are rooms which are solely described as bathrooms, cellars, corridors, hallways, garages, laundry rooms, sanitary accommodation, toilets, utility rooms.
- The Building Regulations 2010 ([UK Statutory Instruments 2010](#)) designates kitchens as a habitable room for the purposes of fire safety in Approved Document B and access in Approved Document M, however, kitchens are not regarded as a habitable room for the purposes of resistance to sound in Approved Document E, ventilation in Approved Document F and overheating for domestic-type buildings in Approved Document O. The term “habitable room” is also used for the purposes of access in Approved Document K, however, no definitions or references to the definition are provided in the document.
- In the context of British Standard 4142 and noise impacts from commercial/industrial noise sources, the nearest noise sensitive receptor should be at 1 metre in front of the window of a habitable room.

Lowest Observed Adverse Effect Level (LOAEL)

1. “The [LOAEL is the] level above which adverse effects on health and quality of life can be detected.” - ([DEFRA 2010](#), p. 8, para. 2.20)
2. The noise exposure hierarchy table in Planning practice guidance on noise ([MHCLG 2019a](#)) defines the LOAEL as:
 - i. The likely average response of those affected is that the noise is present and not intrusive.
 - ii. The noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. The noise can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.
 - iii. Effects may be observed but they are not adverse and no specific measures are required in this situation.

Noise

- “Noise is related to a human response and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive.” - ([BSI 2019](#), p. III).
- It can be said that “noise” is “sound”, or a categorisation thereof, but not all “sound” can be described as “noise”. See also the term “Sound”.

Night-time noise event

- An individual night-time noise event is an audible activity during the night-time hours when people are expected to be sleeping. In the context of residential development, the night-time hours are between 23:00 and 07:00 accounting for British Summer Time when applicable.
- Common examples include a horn, siren, firework or an individual aircraft, train or vehicle pass-by. In practice, the activities that have taken place during a night are not usually known or understood.
- Noise events are used in the context of determining if it is likely to result in sleep disturbance.
- A noise event is quantified by the maximum noise level ($L_{Amax,F,T}$) across a time interval. The technical background for the selection of the time period is provided in (Paxton et al. 2019, p. 209, Table 1) where various time intervals have been considered across several research studies. A time period of 1 minute is used for this acoustic design statement to consider the likely duration of a noise induced awakening and to provide a balance between avoiding a single event being counted in multiple intervals and undercounting events which fall into the same interval.

No Observed Effect Level (NOEL)

1. “The [NOEL is the] level below which no effect [on health and quality of life due to the noise] can be detected.” - (DEFRA 2010, p. 8, para. 2.20)
2. The noise exposure hierarchy table in Planning practice guidance on noise (MHCLG 2019a) defines the NOEL as:
 - i. The likely average response of those affected is that the noise is not present.
 - ii. There are no observed effects and no specific measures are required in this situation.

Overheating

- “[Overheating is the] phenomenon of excessive or prolonged high temperatures in homes, resulting from internal or external heat gains, which may have adverse effects on the comfort, health or productivity of the occupants. Additional ventilation (above [The Building Regulations 2010 Approved Document F (DLUHC, HMG 2021)] whole dwelling ventilation provisions) is required in order to mitigate overheating.” - (ANC 2020, p. 10, para. 2.8).

Significant Observed Adverse Effect Level (SOAEL)

1. “The [SOAEL is the] level above which significant adverse effects on health and quality of life occur.” - (DEFRA 2010, p. 9, para. 2.20)
2. The noise exposure hierarchy table in Planning practice guidance on noise (MHCLG 2019a) defines the SOAEL as:
 - i. The likely average response of those affected is that the noise is present and disruptive.

- ii. 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. There is a potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life is diminished due to change in acoustic character of the area.
- iii. There is a significant observed adverse effect and this situation must be avoided.

Sound

- “Sound can be measured by a sound level meter or other measuring system.” - (BSI 2019, p. III). See also the term “Noise”.

Ventilation

- “The supply and removal of air (by natural and/or mechanical means) to and from a space or spaces in a building. It normally comprises a combination of purpose-provided ventilation and infiltration.” - (DLUHC, HMG 2021, p. 38)

5.2 Symbols

Symbols used in this document are presented in this section, however, other sources can present variations on notation. Some variations have an identical meaning, for example;

- $L_{eq,Lin}$ may be presented as L_{Zeq} or L_{eq}
- $L_{Amax,F,T}$ may be presented as $L_{AFmax(T)}$
- $L_{A90,F,T}$ may be presented as $L_{AF90(T)}$

In most cases, these differences are the result of standard practice and conformity depending on the setting; sound level meters usually use the notation L_{AF} based on examples given in (IEC 2013) but other guidance, research and standards have used different notation. Other sources may not present any frequency weighting, time weighting, or subscript in the notation (e.g. L_{max} , L_{90}) and in such cases, the interpretation should be explained by the original author.

Mathematical equations defining certain quantities may be found at the internet addresses provided at the [beginning of this section](#).

Symbols are listed alphabetically.

C (pink noise spectrum adaptation term)

- This is a number which can be added to the R_w or $D_{n,e,w}$ to account for medium to high frequency noise (generally above 1600 Hz) where it is relevant.

C_{tr} (urban road traffic noise spectrum adaptation term)

- This is a number which can be added to the R_w or $D_{n,e,w}$ to account for low to medium frequency sound (generally below 1600 Hz) where it is relevant.

dB / dBA / dB(A) / dB re 20μPa (decibel with A-weighting where applicable)

- The decibel (dB) is the standard unit that is used to express sound level. It is a logarithmic measure of the sound pressure in Pascals (Pa) relative to the reference value of 20 micropascals (μPa) in the context of human perception. The reference value represents the approximate threshold of human hearing. Different reference values are used in contexts outside the scope of this report.
- An ‘A’ frequency weighting applies if denoted. This unit is also used with acoustic performance (sound insulation) quantities. The difference between dBA and dB(A) is only in presentation - they do not infer different meanings.
- Where no frequency weighting applies, this is also referred to as a ‘Z’, ‘Linear’ or ‘Lin’ (abbreviated) frequency weighting and this may be indicated by just ‘dB’, however, this is normally accompanied by $L_{eq,Lin}$, L_{Zeq} or L_{eq} .

$D_{n,e,w}$ (Weighted element-normalized level difference for small building elements)

- Single-number quantity used to describe the acoustic performance of building elements smaller than 1 m², such as trickle ventilators.

$L_{A90,F,T}$ (A-weighted background sound pressure level)

- “A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.” - (BSI 2019, p. 2)
- Typically used in the context of commercial and industrial noise assessments, but otherwise, this parameter is useful to understand the underlying noise level which can provide an indication of the relative quietness. This parameter is generally governed by relatively continuous or semi-continuous sounds. For example, road traffic in a general sense can be continuous but a brief vehicle horn blast is not.

$L_{Aeq,T}$ (A-weighted equivalent continuous sound pressure level)

- “Commonly used as a descriptor of human perception of sound over time.” - (ANC 2020, p. 28)
- An average of the sound level with the ‘A’ frequency weighting over a time period (T).
- In the context of residential development, $L_{Aeq,16hr}$ is between the daytime hours of 07:00 and 23:00, and $L_{Aeq,8hr}$ is between the night-time hours of 23:00 and 07:00. The timings account for British Summer Time when applicable.

$L_{Amax,F,T}$ (A-weighted maximum sound pressure level)

- “The maximum or highest sound pressure level measured with a ‘fast’ time weighting [and the ‘A’ frequency weighting over the time period (T)].” - (ANC 2020, p. 28).
- The ‘fast’ time weighting is referenced in guidance and standards published and used within the United Kingdom.

$L_{Amin,F,T}$ (A-weighted minimum sound pressure level)

- The minimum or lowest sound pressure level measured with a 'fast' time weighting and the 'A' frequency weighting over the time period (T).

$R_{A(traffic)}$ (Level difference based on typical urban road-traffic noise spectrum)

- This outside-inside level difference is based on the typical urban road-traffic noise spectrum illustrated in Figure 44 (BRE, CIRIA 1993, p. 30).
- Values for free-flowing motorway traffic would be 1 dB to 3 dB higher because their spectra contain relatively less low-frequency noise.
- It should be noted that these are not the same as the C or C_{tr} corrections which are applied to R_w sound reduction index values (i.e. $R_{A(traffic)}$ is not $R_w + C_{tr}$).

R_m (Average sound reduction index)

- The average sound reduction index is taken over 16 one-third octave bands from 100Hz to 3150Hz - (BRE, CIRIA 1993, p. 30).

R_w (Weighted sound reduction index)

- Single-number quantity used to describe the sound insulation performance of large building elements from laboratory measurements, such as windows, walls, floors and roof structures.

5.3 Table of Abbreviations

Abbreviations are listed alphabetically in the following table.

Table 5.1: Table of Abbreviations.

Abbreviation	Phrase
ADF	Approved Document F
ADO	Approved Document O
ANC	Association of Noise Consultants
BS	British Standard
BSI	British Standards Institute
BST	British Summer Time
CIEH	Chartered Institute of Environmental Health
CME	Continuous Mechanical Extract (also known as MEV)
CMEV / cMEV / C-MEV	Centralised Mechanical Extract Ventilation
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DLUHC	Department for Levelling Up, Housing and Communities
DMEV / dMEV / D-MEV	Decentralised Mechanical Extract Ventilation
EN	European Norms
GMT	Greenwich Mean Time
HMG	His Majesty's Government
ID	Identifier
IEC	International Electrotechnical Commission
IOA	Institute of Acoustics
ISO	International Standards Organization
LNE	Laboratoire national de métrologie et d'essais (French National Laboratory of Metrology and Testing)
LOAEL	Lowest Observed Adverse Effect Level
METAS	Eidgenössisches Institut für Metrologie METAS (Swiss Federal Institute of Metrology METAS)
MEV	Mechanical Extract Ventilation (also known as CME, see also CMEV and DMEV variations)
MHCLG	Ministry of Housing, Communities and Local Government
MVHR	Mechanical Ventilation and Heat Recovery
NA	Not Applicable
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
PTB	Physikalisch-Technische Bundesanstalt (National Metrology Institute of Germany)
SOAEL	Significant Observed Adverse Effect Level
UKAS	United Kingdom Accreditation Service
UTC	Coordinated Universal Time
WHO	World Health Organization

6 Introduction

This document has been prepared by KataSoniKa® for Alder Design & Build Ltd and serves as an acoustic design statement to accompany a planning application for the residential development at Bayswater House, Hever Court Road, Gravesend, Kent, DA12 5UQ with respect to the planning application reference 20241069 for the *“Erection of two storey side extension pitched roof and facades to match the existing building external finishes and dimensions, creating 16 no. additional bedrooms, repositioning of the escape stair, remodelling of the reception/office, linen store, store and 1No. existing bedroom to provide a communal laundry, a communal kitchen and two communal lounges, and a change of use from C1-Hotel to Sui Generis - HMO for 46 persons residing in a single building.”*

Comments from the Environmental Protection Team have been submitted on the planning application with respect to acoustic matters and addressed by this acoustic design statement are provided below:

“[...] due to the longer-term occupancy of the rooms, noise from the A2 is also a consideration that needs to be taken into account. A noise impact assessment is therefore recommended and ideally this needs to be undertaken prior to determination of the application as mitigation measures are likely to be needed. Noise inside the HMO rooms needs to comply with levels in BS8233:2014.

It may be that due to noise levels, windows will need to be kept closed and mechanical ventilation needed. This would also address the air quality issue.”

A systematic assessment of the relevant acoustic aspects of the residential development is provided in relation to health and well-being effects such as annoyance, interference with occupant activities and sleep disturbance. The assessments and subsequent recommendations are based on average noise levels across the daytime (07:00 to 23:00) and night-time (23:00 to 07:00) periods as well as maximum noise levels during the night-time, as described in current guidance and standards. This acoustic design statement reports:

- the [environmental noise survey](#),
- the [assessment for the presence of prominent tones](#),
- the assessments of [noise risk](#) and [noise impact](#) of the outdoor noise environment upon inhabitants with respect to ventilation and overheating,
- the [sound insulation specifications for the facades](#) of the residential development to secure suitable internal noise levels.

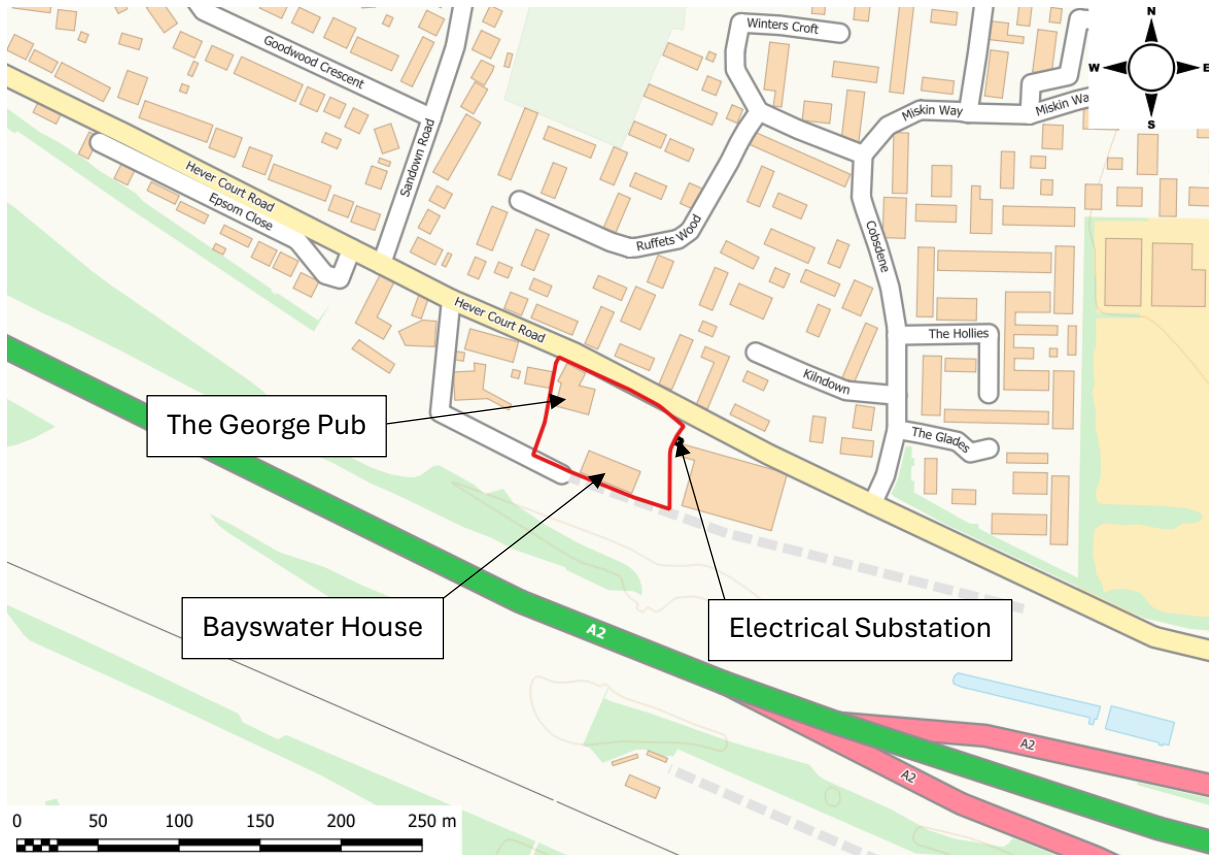
This acoustic design statement has been based on the drawings listed in the table below.

Table 6.1: Table of reference drawings for the proposed development.

Title	Project	Number	Revision	Date
Existing Site Plan	NA	HCR-01	A	11-12-2024
Existing Floor Plan	NA	HCR-02	A	11-12-2024
Existing Elevations	NA	HCR-03	A	11-12-2024
Proposed Site Plan	NA	HCR-04	C	25-04-2025
Proposed Floor Plan	NA	HCR-05	E	15-05-2025
Proposed Elevations	NA	HCR-06	A	11-12-2024

7 Site Description

The site is located at Bayswater House, Hever Court Road, Gravesend, Kent, DA12 5UQ. A site context plan is presented below showing the site and The George public house within the red boundary line and the immediately surrounding area.



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Figure 7.1: Site Context Plan.

The boundaries of the site are, generally, defined by Hever Court Road to the North at the front of the site, the Best Western Manor Hotel and Suites to the East of the site, the asphalt footpath connecting to Hever Court Road to the South at the rear of the site with landscaped buffer and the A2 beyond, and The George public house and associated parking area to the West.

The site is currently used as a house of multiple occupation, with some rooms currently occupied and others undergoing refurbishment.

An electrical substation is located North-East of Bayswater House, generally within the boundary of the Best Western Manor Hotel & Suites. There were no observable noise emissions around the East boundary of the site during site attendance or evident from the noise survey.

Noise sources affecting the site were identified to be predominantly road traffic noise from the A2 (Watling Street) at the rear of the site, and Hever Court Road at the front of the site. Parking activity is also present in front of the site for residents of Bayswater House and The George. No outdoor activity from patrons at The George was observed during the survey period.

8 Guidance Policies and Standards

The principle guidance used to prepare this acoustic design statement are:

- Professional Practice Guidance on Planning & Noise - New Residential Development ([ANC, IOA, CIEH 2017](#)).
- Acoustics, Ventilation and Overheating - Residential Design Guide ([ANC 2020](#)).

These collectively provide the current approach on assessments and management of noise for new residential developments, encompassing planning, development, design and commissioning. These documents consolidate information from over 90 sources and the key sources relevant to this acoustic design statement are listed below in hierarchical order, with overarching guidance or policies followed by supplementary documents, standards and other guidance.

Planning Policy:

- The National Planning Policy Framework ([MHCLG 2025](#)).
- Planning practice guidance on noise ([MHCLG 2019a](#)) and design ([MHCLG 2019b](#)).
- The Noise Policy Statement for England ([DEFRA 2010](#)).
- Gravesham Local Plan Core Strategy (Adopted September 2014) - Policy CS19: Development and Design Principles ([Gravesham Borough Council 2014](#)).

Guidance relating to the current Building Regulations, regulatory system, and design:

- The Building Regulations 2010 Approved Document F: Ventilation – Volume 1: Dwellings ([DLUHC, HMG 2021](#)).
- The Nationally Described Space Standard ([DCLG 2016](#)).
- BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* ([BSI 2014](#)).
- BS 4142:2017+A1:2019 *Methods for rating and assessing industrial and commercial sound* ([BSI 2019](#)).
- BS EN ISO 12354-3:2017 *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound* ([BSI 2017](#)).

Scientific guidance and research relating to design and the impact of noise on health and well-being:

- NANR116 Open-Closed Window Research Report on sound insulation through ventilated domestic windows ([Waters-Fuller et al. 2007](#)).
- The World Health Organizations' Environmental Noise Guidelines for the European Region ([WHO 2018](#)).

9 Summary of Environmental Noise Survey

The environmental noise survey was carried out at the site between 12:24 BST on Thursday 22 May 2025 and 14:31 BST on Friday 23 May 2025. The sound levels were measured at the microphone locations illustrated in the figure below.



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Figure 9.1: Site block plan showing the microphone locations.

The measurement locations are described in the table below with duration, start and end times. Additional information on the noise measurements is presented in the [site survey record section in the appendix](#).

Table 9.1: Summary of measurement locations.

Measurement Location	Measurement Description	Start	Stop	Approximate Duration
1	1st floor front of Bayswater House	Thu 22/05/25 12:24:25 BST	Fri 23/05/25 14:20:19 BST	26 hours
2	1st floor rear of Bayswater House	Thu 22/05/25 12:42:12 BST	Fri 23/05/25 14:31:16 BST	26 hours

The photographs of the measurement locations are presented below.



Figure 9.2: Photographs showing measurement location 1.

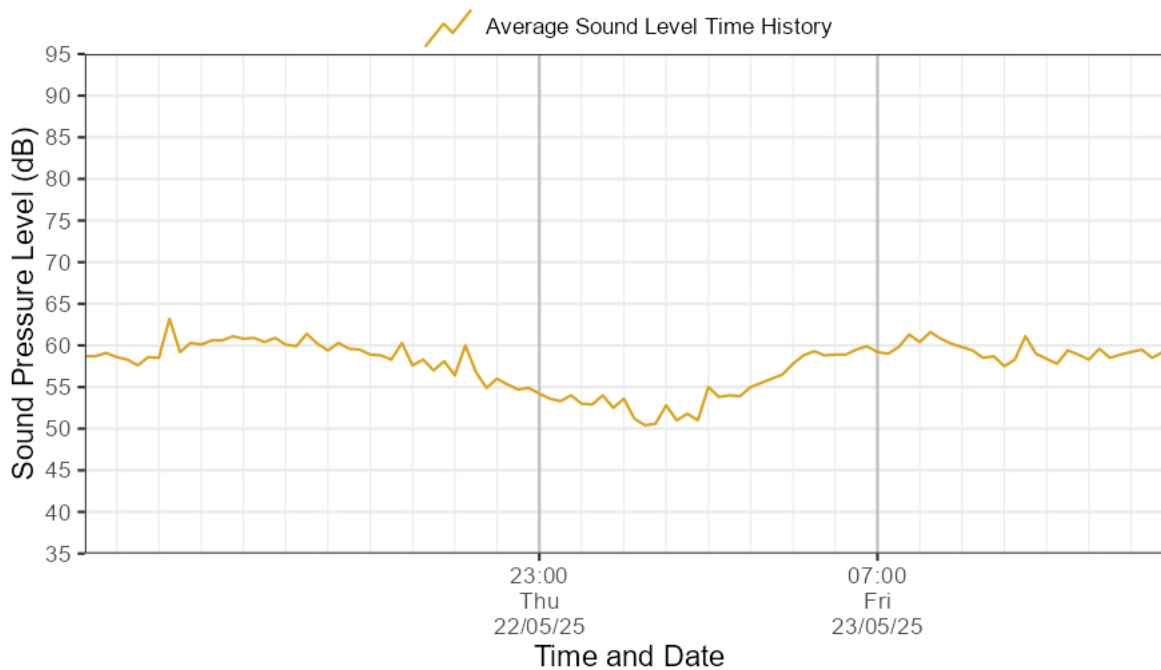


Figure 9.3: Photographs showing measurement location 2.

9.1 Graphs

The measured noise levels are presented in the following figures with respect to the time periods and measurement parameters of interest in relation to the acoustic design statement and current guidance. X-axis (Time and Date) minor grid lines are on the hour and the major grid lines and corresponding labels are on the times of 23:00 and 07:00 to reflect the epochs of the relevant time periods pertaining to the assessments.

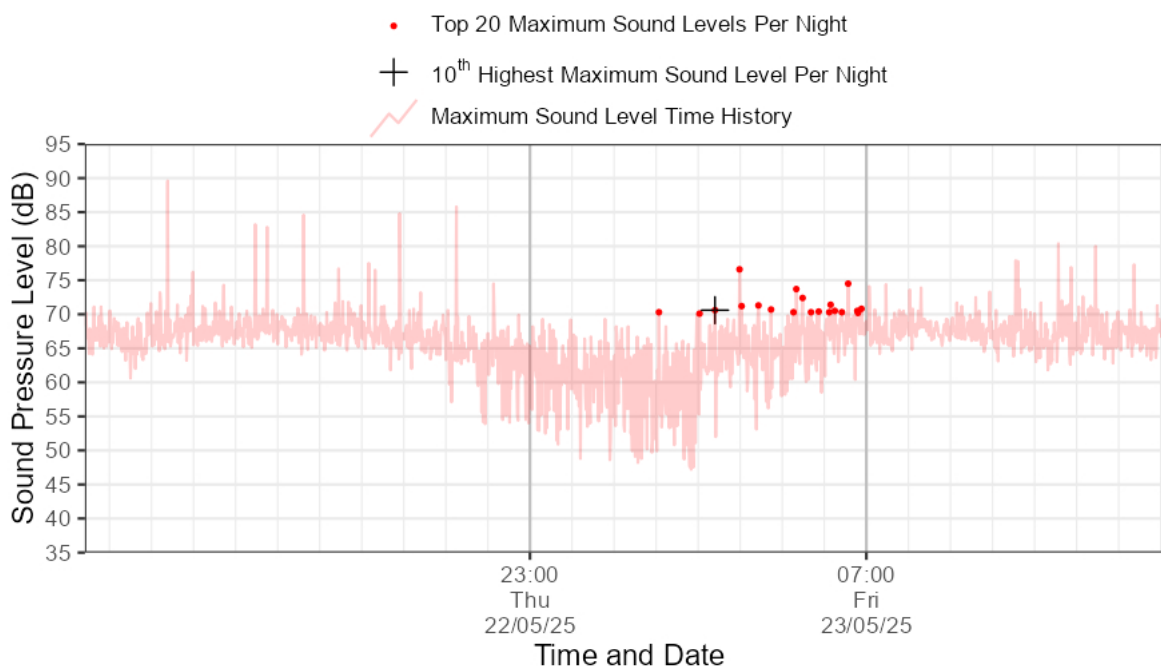
Average Sound Level ($L_{Aeq, 15min}$) at
Measurement Location 1: 1st floor front of Bayswater House



Courtesy of KataSoniKa®

Figure 9.4: Average sound levels at measurement location 1.

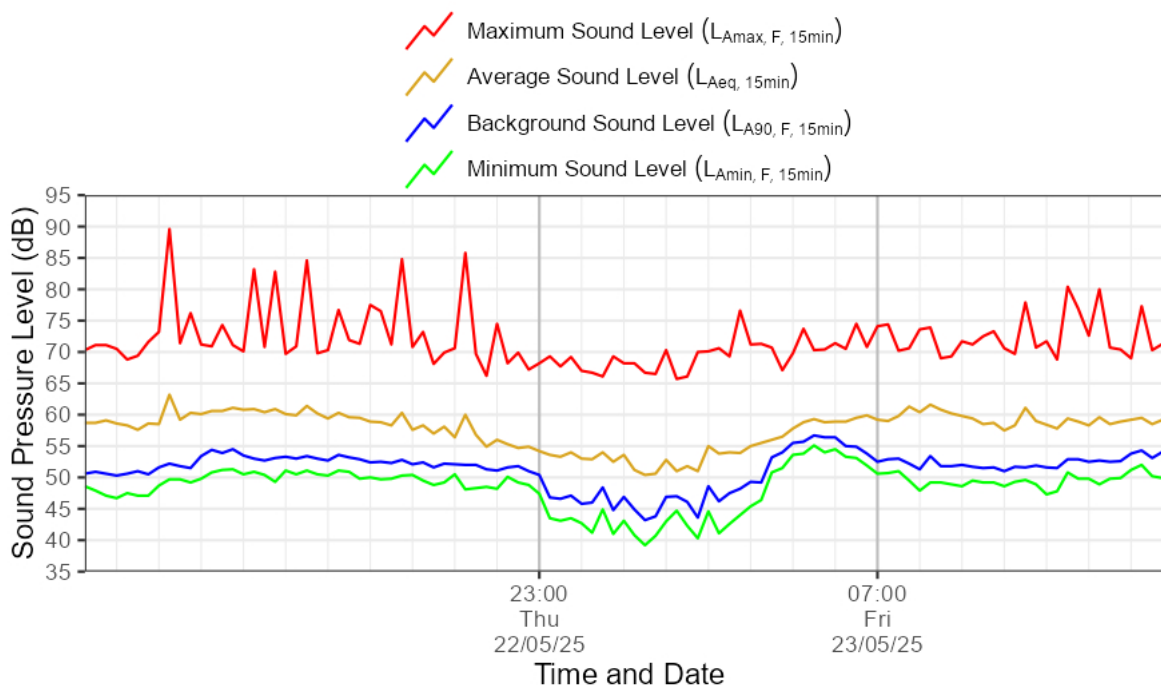
Maximum Sound Level ($L_{Amax, F, 1min}$) at
Measurement Location 1: 1st floor front of Bayswater House



Courtesy of KataSoniKa®

Figure 9.5: Maximum sound levels at measurement location 1.

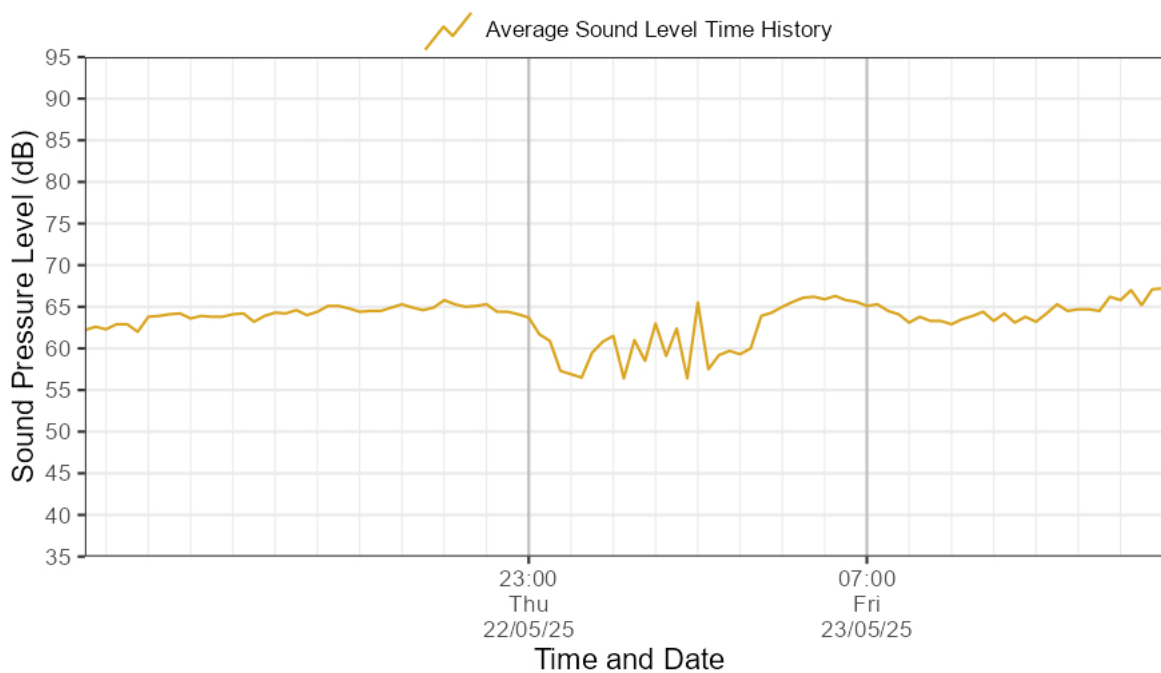
15 minute Time History at
Measurement Location 1: 1st floor front of Bayswater House



Courtesy of KataSoniKa®

Figure 9.6: Sound levels at measurement location 1.

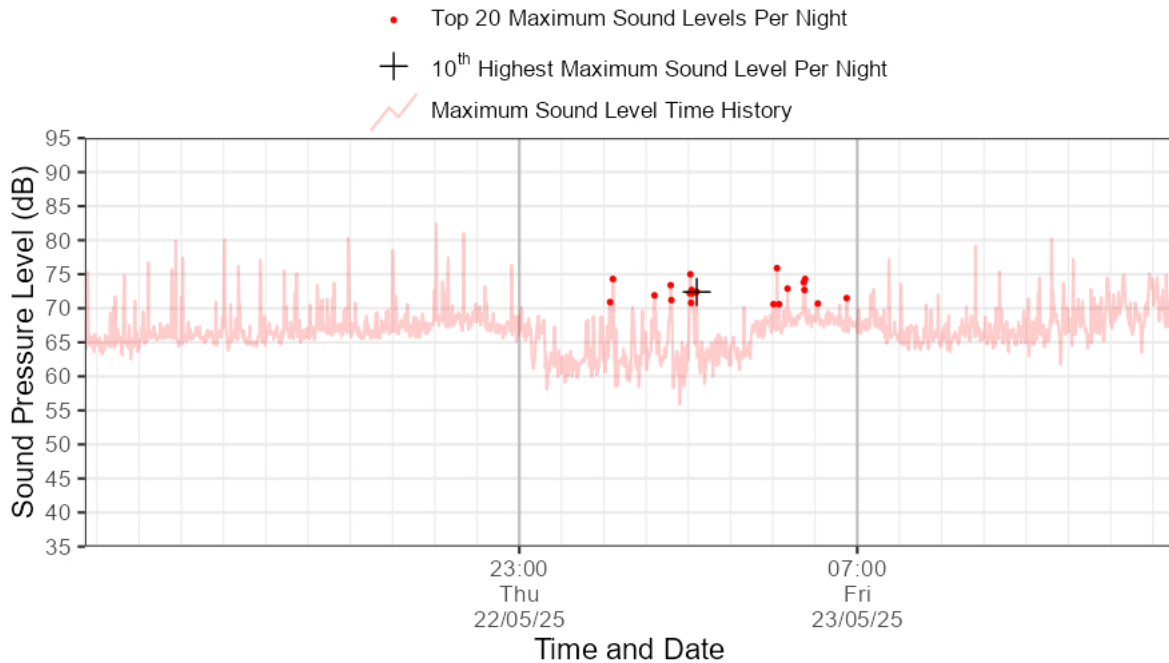
Average Sound Level ($L_{Aeq, 15min}$) at
Measurement Location 2: 1st floor rear of Bayswater House



Courtesy of KataSoniKa®

Figure 9.7: Average sound levels at measurement location 2.

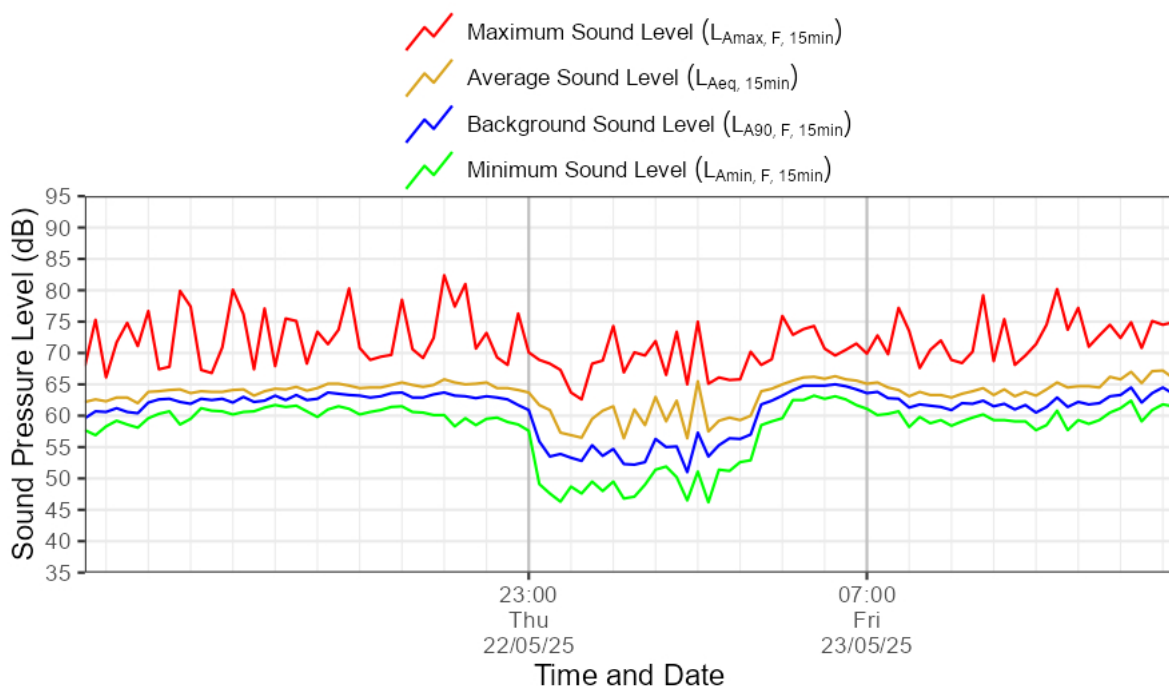
Maximum Sound Level ($L_{Amax, F, 1min}$) at
Measurement Location 2: 1st floor rear of Bayswater House



Courtesy of KataSoniKa®

Figure 9.8: Maximum sound levels at measurement location 2.

15 minute Time History at
Measurement Location 2: 1st floor rear of Bayswater House



Courtesy of KataSoniKa®

Figure 9.9: Sound levels at measurement location 2.

9.2 Assessment for the Presence of Prominent Tones

The assessment for the presence of a prominent, discrete-frequency spectral component (tone) has been carried out in accordance with the British Standard 4142 one-third octave method (BSI 2019, p. 52, Annex C). The one-third octave frequency bands have been compared for each 1-minute period of average sound levels at the measurement locations over the survey period.

The figures below summarise the assessment over all 1-minute average sound level data at the measurement locations by showing the total amount of time that a tone has been identified in each one-third octave frequency band. X-axis minor grid lines are every 15 minutes and the bars are shown stacked.

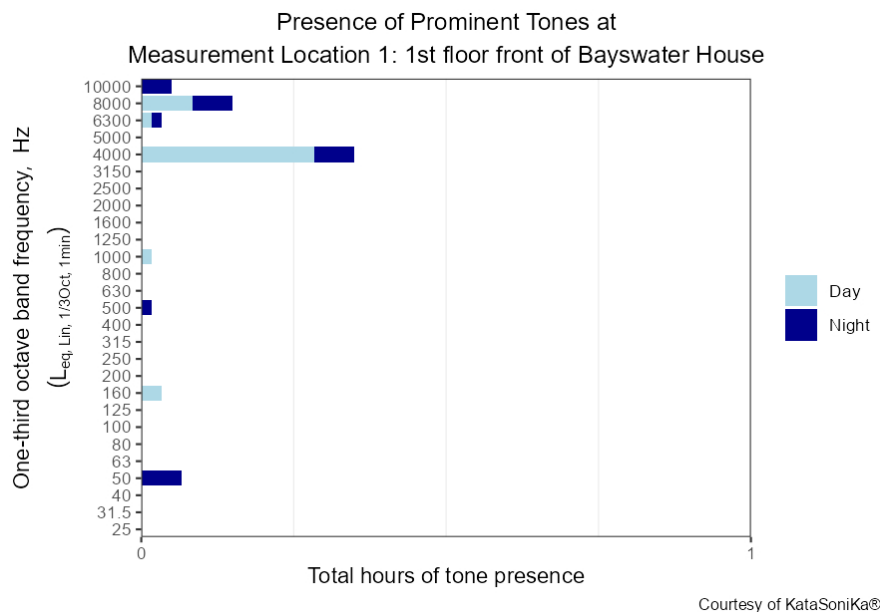


Figure 9.10: Presence of prominent tones at measurement location 1.

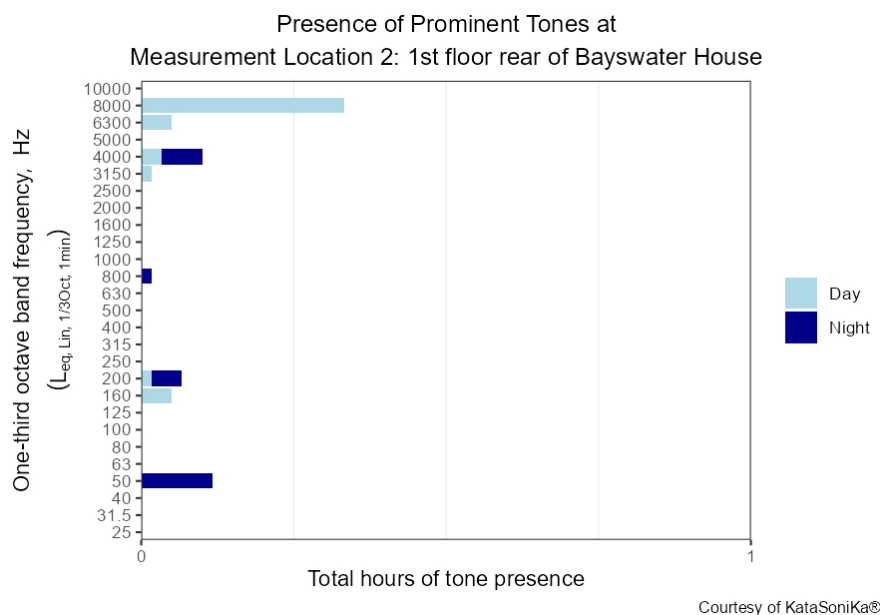


Figure 9.11: Presence of prominent tones at measurement location 2.

9.3 Summary tables

The measured noise levels are presented in the table below with respect to the time periods and measurement parameters of interest in current guidance.

Table 9.2: Summary of measured noise levels at the site.

Measurement Location	Daytime Average (07:00 - 23:00)	Night-time Average (23:00 - 07:00)	10 th Highest Night-time Maximum (23:00 - 07:00)	Highest Night-time Maximum (23:00 - 07:00)
1	59 dB $L_{Aeq,16hr}$	56 dB $L_{Aeq,8hr}$	71 dB $L_{Amax,F,1min}$	77 dB $L_{Amax,F,1min}$
2	65 dB $L_{Aeq,16hr}$	63 dB $L_{Aeq,8hr}$	72 dB $L_{Amax,F,1min}$	76 dB $L_{Amax,F,1min}$

The typical free-field noise levels outside the facades of the development are estimated based on the measured noise levels and presented in the table below.

Table 9.3: Summary of noise levels upon the facades of the development.

Facade Description	Daytime Average (07:00 - 23:00)	Night-time Average (23:00 - 07:00)	10 th Highest Night-time Maximum (23:00 - 07:00)	Highest Night-time Maximum (23:00 - 07:00)
Front	56 dB $L_{Aeq,16hr}$	53 dB $L_{Aeq,8hr}$	68 dB $L_{Amax,F,1min}$	74 dB $L_{Amax,F,1min}$
Rear	62 dB $L_{Aeq,16hr}$	60 dB $L_{Aeq,8hr}$	69 dB $L_{Amax,F,1min}$	73 dB $L_{Amax,F,1min}$

10 Assessments of Noise Risk and Noise Impact

The assessments in this section relate to the following ventilation conditions:

1. general ventilation conditions, and,
2. overheating conditions where occupants require increased ventilation.

These assessments are strictly in accordance with the principle guidance documents which do not take into account any acoustic features of sound, such as tones, where present.

A **tone noise risk assessment** is proposed based on the principles of Professional Practice Guidance on Planning & Noise - New Residential Development (ANC, IOA, CIEH 2017, p. 9, Figure 1, p. 34, para. A.19) and the threshold of hearing based on free-field listening conditions described in ISO 389-7:2019 (ISO 2019) and equal loudness contours described in ISO 226:2023 (ISO 2023) for the one-third octave bands where tones have been found to be present.

10.1 Initial Noise Risk Assessments

The initial noise risk assessments provide an indication of likely adverse effects from noise at the residential development. This assessment summarises the relative importance of how noise will affect the development, both in terms of the likely impacts upon occupants if left completely unmitigated, and the extent of noise mitigation that would be required in order to reduce the potential for adverse effects upon occupants.

The initial noise risk assessment categorises the development site into either negligible, low, medium, or high outcomes based on the unrounded measured noise levels accounting for free-field conditions to remove the sound reflections from the existing facades upon the measurement positions, as applicable.

All outcomes will lead to recommendations for noise mitigation in order to provide suitable noise levels at the development and avoid adverse effects on occupants.

10.1.1 Ventilation Noise Risk

The ventilation noise risk assessment is based on Professional Practice Guidance on Planning & Noise - New Residential Development (ANC, IOA, CIEH 2017, p. 9, Figure 1, p. 34, para. A.19) and the measured noise levels.

The criteria for the ventilation noise risk categories are presented in the following table.

Table 10.1: Criteria for initial noise risk assessment during general ventilation conditions.

Noise Risk	Daytime	Night-time	Night-time Noise Events
High	70 dB $L_{Aeq,16hr}$	60 dB $L_{Aeq,8hr}$	Over 20 occurrences above 80 dB $L_{Amax,F,1min}$
Medium	60 dB $L_{Aeq,16hr}$	50 dB $L_{Aeq,8hr}$	Not provided in guidance
Low	50 dB $L_{Aeq,16hr}$	40 dB $L_{Aeq,8hr}$	Not provided in guidance
Negligible	Below 50 dB $L_{Aeq,16hr}$	Below 40 dB $L_{Aeq,8hr}$	Under 10 occurrences above 60 dB $L_{Amax,F,1min}$

The initial noise risk assessment for general ventilation conditions is summarised for each criterion at each measurement position in the table below.

Table 10.2: Summary of initial noise risk assessment for general ventilation conditions.

Measurement Location	Daytime	Night-time	Noise Events	Overall Noise Risk
1	Low	Medium	Not Negligible	Medium
2	Medium	High	Not Negligible	High

The overall ventilation noise risk at the development is high based on the highest noise risk category over all measurements.

10.1.2 Overheating Noise Risk

The overheating noise risk assessment is based on Acoustics, Ventilation and Overheating - Residential Design Guide (ANC 2020, p. 22, Table 3-2, p. 43, para. B.49) and the measured noise levels.

The criteria for the overheating noise risk categories are presented in the following table.

Table 10.3: Criteria for initial noise risk assessment during overheating conditions.

Noise Risk	Daytime	Night-time	Night-time Noise Events
High	65 dB $L_{Aeq,16hr}$	55 dB $L_{Aeq,8hr}$	Highest occurrence is 80 dB $L_{Amax,F,1min}$ or above
Medium	58 dB $L_{Aeq,16hr}$	53 dB $L_{Aeq,8hr}$	Not provided in guidance
Low	53 dB $L_{Aeq,16hr}$	48 dB $L_{Aeq,8hr}$	Not provided in guidance
Negligible	Below 53 dB $L_{Aeq,16hr}$	Below 48 dB $L_{Aeq,8hr}$	Under 10 occurrences above 58 dB $L_{Amax,F,1min}$

The initial noise risk assessment for overheating is summarised for each criterion at each measurement position in the table below.

Table 10.4: Summary of initial noise risk assessment for overheating conditions.

Measurement Location	Daytime	Night-time	Noise Events	Overall Noise Risk
1	Low	Medium	Not Negligible	Medium
2	Medium	High	Not Negligible	High

The overall overheating noise risk at the development is high based on the highest noise risk category over all measurements.

10.1.3 Tone Noise Risk

The proposed criteria for the tone noise risk categories are presented in the following table.

Table 10.5: Proposed criteria for initial tone noise risk assessment during daytime or night-time.

Noise Risk	Daytime or Night-time
High	There is more than 1 hour total (cumulative) tone presence in any 24-hour period for each one-third octave band and the external tone noise level is significantly above the threshold of hearing such that internal noise levels without tones can only be achieved with either (1) mechanical ventilation and heat recovery (MVHR) systems, or (2) open windows or background ventilators with the highest sound insulation performance available on the market.
Medium	There is more than 1 hour total (cumulative) tone presence in any 24-hour period for each one-third octave band and the external noise level of tone is above the threshold of hearing.
Low	There is more than 1 hour total (cumulative) tone presence in any 24-hour period for each one-third octave band and the external noise level of tone is below the threshold of hearing.
Negligible	There is less than 1 hour total (cumulative) tone presence in any 24-hour period for each one-third octave band.

The overall tone noise risk at the development is negligible based on the [assessment for the presence of prominent tones](#), therefore, a tone noise impact assessment is not required.

10.2 Noise Impact Assessments for Types of Rooms

The noise impact assessments for types of rooms consider the proposed development in outline (i.e. the design of each room is not taken into account) and shows whether a suitable internal acoustic environment is likely to be achieved with open windows for each habitable room type during general ventilation and overheating conditions, if and where it occurs. If the noise impact assessment tables show that the internal acoustic environment is not suitable, alternative means of ventilation (such as mechanical ventilation) are recommended.

The determination and occurrence(s) of overheating conditions (i.e. an overheating assessment) is outside the scope of this acoustic design statement.

The proposed/granted development is generally described as single aspect dwellings, therefore, there are no recommendations to make any changes to the layout or orientation of the habitable rooms because they are already considered to be optimum.

10.2.1 Ventilation Noise Impact

The target internal noise levels for the residential development during general ventilation conditions (as described in The Building Regulations 2010 Approved Document F: Ventilation – Volume 1: Dwellings ([DLUHC, HMG 2021](#))) are established from Professional Practice Guidance on Planning & Noise - New Residential Development ([ANC, IOA, CIEH 2017, p. 13](#), Figure 2) and presented summarily in the table below.

Table 10.6: Target internal noise levels during general ventilation conditions.

Habitable room	Daytime Average	Night-time Average	10 th Highest Night-time Maximum
Living	35 dB L _{Aeq,16hr}	NA	NA
Dining	40 dB L _{Aeq,16hr}	NA	NA
Bedroom	35 dB L _{Aeq,16hr}	30 dB L _{Aeq,8hr}	45 dB L _{Amax,F,1min}

Reasonable internal noise conditions can still be achieved if the internal ambient noise levels (L_{Aeq,T}) are up to 5 dB above these targets.

The noise impact assessment for types of rooms during general ventilation is based on open window research ([Waters-Fuller et al. 2007](#)) which has determined the following:

- an open window area of 0.05 m² (an opening depth of up to 5 cm depending on the opening style) is considered appropriate for background ventilation, and
- the noise reduction for the different styles of open window tested with a free open area of 0.05 m² ranges from 12 to 18 dB(A); the middle of the range is 15 dB(A), the median is 16.0 dB(A) and the mean is 15.7 dB(A).

A suitable internal acoustic environment with open windows during general ventilation is expected where the difference between the noise levels outside the facades of the development (based on the [measured sound levels](#) and the [corrections to each facade](#)) and the target internal noise levels is less than or equal to the average (mean) noise reduction through an open window of 16 dB(A).

The tables below summarise whether a suitable internal acoustic environment is expected with open windows during ventilation conditions for each room type present at the development.

Table 10.7: Open window suitability (ventilation): Front.

Habitable room	Daytime	Night-time
Bedroom	Not suitable	Not suitable

Table 10.8: Open window suitability (ventilation): Rear.

Habitable room	Daytime	Night-time
Bedroom	Not suitable	Not suitable

Where the internal acoustic environment is not suitable with open windows during general ventilation, alternative means of ventilation are recommended.

10.2.2 Overheating Noise Impact

The potential impact of road traffic noise on occupants during overheating may be estimated based on the internal ambient noise level guidance provided in the Acoustics, Ventilation and Overheating - Residential Design Guide ([ANC 2020, p. 23](#), Table 3-3). The potential impacts are categorised in terms of the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL) with regards to the Noise Policy Statement for England ([DEFRA 2010, pp. 8–9](#)) as described within the noise exposure hierarchy table from Planning practice guidance on noise ([MHCLG 2019a](#)).

The estimate of potential impact during overheating during the daytime period (07:00 - 23:00) is based on a 16-hour average which reflects a situation where a habitable room is generally occupied for the entire period with overheating conditions present throughout the time it is occupied. Overheating during the night-time period (23:00 - 07:00) is based on an 8-hour average, where occupants are sleeping and overheating conditions are present throughout this time period.

Table 10.9: LOAEL criteria to estimate the potential impact of noise during overheating.

Habitable room	Daytime Average	Night-time Average	10 th Highest Night-time Maximum
Living	40 dB L _{Aeq,16hr}	NA	NA
Dining	45 dB L _{Aeq,16hr}	NA	NA
Bedroom	40 dB L _{Aeq,16hr}	35 dB L _{Aeq,8hr}	45 dB L _{Amax,F,1min}

Table 10.10: SOAEL criteria to estimate the potential impact of noise during overheating.

Habitable room	Daytime Average	Night-time Average	Highest Night-time Maximum
Living	50 dB L _{Aeq,16hr}	NA	NA
Dining	50 dB L _{Aeq,16hr}	NA	NA
Bedroom	50 dB L _{Aeq,16hr}	42 dB L _{Aeq,8hr}	65 dB L _{Amax,F,1min}

In cases between the LOAEL and SOAEL criteria, the Acoustics, Ventilation and Overheating - Residential Design Guide (ANC 2020, p. 23, Table 3-3) states with reference to the noise exposure hierarchy table in Planning practice guidance on noise (MHCLG 2019a):

“At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time.”

The noise exposure hierarchy table in Planning practice guidance on noise (MHCLG 2019a) states that between the LOAEL and SOAEL, the likely average response of those affected is that the noise is present, intrusive and adverse effects may be observed. The guidance states that in such circumstances, action should be taken to mitigate and reduce the noise to a minimum. Therefore, in cases between the LOAEL and SOAEL criteria, it is recommended that alternative means of mitigating overheating should be considered.

The Acoustics, Ventilation and Overheating - Residential Design Guide (ANC 2020, p. 19, para. 3.24) considers that a sound reduction of 13 dB(A) through an open window is representative of typical domestic rooms with simple facade openings of around 2% of the floor area (for the minimum floor area of 7.5 m² in accordance with The Nationally Described Space Standard (DCLG 2016, p. 4, para. 10c), 2% of the floor area equates to 0.15 m²).

A suitable internal acoustic environment with open windows during overheating conditions is expected where the difference between the noise levels outside the facades of the development (based on the [measured sound levels](#) and the [corrections to each facade](#)) and the LOAEL and

SOAEL criteria is less than or equal to the average noise reduction through an open window of 13 dB(A).

The tables below summarise whether it is suitable to use open windows for mitigating overheating with the expected level of adverse effects from noise, generally for each room type present at the development.

Table 10.11: Open window suitability (overheating): Front.

Habitable room	Daytime	Night-time
Bedroom	Conditionally suitable (Between LOAEL & SOAEL)	Conditionally suitable (Between LOAEL & SOAEL)

Table 10.12: Open window suitability (overheating): Rear.

Habitable room	Daytime	Night-time
Bedroom	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)

Where the internal acoustic environment is not suitable with open windows during overheating conditions, alternative means of ventilation are recommended.

10.3 Noise Impact Assessments for Specific Rooms

The noise impact assessment for specific rooms takes the designs of individual rooms into account based on the calculations described in BS EN ISO 12354-3:2017 (BSI 2017) with the [room data and corresponding style of window opening in the appendix](#) and the statistically derived octave band sound insulation ratings for the specified style of window opening from open window research (Waters-Fuller et al. 2007). This methodology is expected to provide more technically accurate predictions of the ventilation and overheating noise impacts for each room than the [noise impact assessments for types of rooms](#).

The calculations are conservatively based on all non-structural facade elements (i.e. open windows and vents, where applicable) being equal and the dominant contributors to the internal noise level, per room and per period, and the average of the results of the following frequency resolution of measured sound levels to account for uncertainty associated with this input data and calculation methodology:

- Broadband / Overall
- 125 Hz to 2 kHz Octaves
- 63 Hz to 2 kHz Octaves
- 125 Hz to 4 kHz Octaves
- 63 Hz to 4 kHz Octaves

The ventilation and overheating noise impact assessments for individual rooms at the development are presented in the tables below.

Table 10.13: Open window suitability (ventilation)

Habitable room	Daytime	Night-time
Bedroom 1	Not suitable	Not suitable
Bedroom 2	Not suitable	Not suitable
Bedroom 3	Not suitable	Not suitable
Bedroom 4	Not suitable	Not suitable
Bedroom 5	Not suitable	Not suitable
Bedroom 6	Not suitable	Not suitable
Bedroom 7	Not suitable	Not suitable
Bedroom 8	Not suitable	Not suitable
Bedroom 9	Not suitable	Not suitable
Bedroom 10	Not suitable	Not suitable
Bedroom 11	Not suitable	Not suitable
Bedroom 12	Not suitable	Not suitable
Bedroom 13	Not suitable	Not suitable
Bedroom 14	Not suitable	Not suitable
Bedroom 15	Not suitable	Not suitable
Bedroom 16	Not suitable	Not suitable
Bedroom 17	Not suitable	Not suitable
Bedroom 18	Not suitable	Not suitable
Bedroom 19	Not suitable	Not suitable
Bedroom 20	Not suitable	Not suitable
Bedroom 21	Not suitable	Not suitable
Bedroom 22	Not suitable	Not suitable
Bedroom 23	Not suitable	Not suitable
Bedroom 24	Not suitable	Not suitable
Bedroom 25	Not suitable	Not suitable
Bedroom 26	Not suitable	Not suitable
Bedroom 27	Not suitable	Not suitable
Bedroom 28	Not suitable	Not suitable
Bedroom 29	Not suitable	Not suitable
Bedroom 30	Not suitable	Not suitable
Bedroom 31	Not suitable	Not suitable
Bedroom 32	Not suitable	Not suitable
Bedroom 33	Not suitable	Not suitable
Bedroom 34	Not suitable	Not suitable
Bedroom 35	Not suitable	Not suitable
Bedroom 36	Not suitable	Not suitable
Bedroom 37	Not suitable	Not suitable
Bedroom 38	Not suitable	Not suitable
Bedroom 39	Not suitable	Not suitable
Bedroom 40	Not suitable	Not suitable
Bedroom 41	Not suitable	Not suitable
Bedroom 42	Not suitable	Not suitable
Bedroom 43	Not suitable	Not suitable
Bedroom 44	Not suitable	Not suitable
Bedroom 45	Not suitable	Not suitable
Bedroom 46	Not suitable	Not suitable

Table 10.14: Open window suitability (overheating)

Habitable room	Daytime	Night-time
Bedroom 1	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 2	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 3	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 4	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 5	Suitable (Below LOAEL)	Not suitable (Above SOAEL)
Bedroom 6	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 7	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 8	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 9	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 10	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 11	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 12	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 13	Suitable (Below LOAEL)	Not suitable (Above SOAEL)
Bedroom 14	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 15	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 16	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 17	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 18	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 19	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 20	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 21	Suitable (Below LOAEL)	Not suitable (Above SOAEL)
Bedroom 22	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 23	Suitable (Below LOAEL)	Not suitable (Above SOAEL)
Bedroom 24	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 25	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 26	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)

Habitable room	Daytime	Night-time
Bedroom 27	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 28	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 29	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 30	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 31	Suitable (Below LOAEL)	Not suitable (Above SOAEL)
Bedroom 32	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 33	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 34	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 35	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 36	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 37	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 38	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 39	Suitable (Below LOAEL)	Not suitable (Above SOAEL)
Bedroom 40	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 41	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 42	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 43	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 44	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 45	Conditionally suitable (Between LOAEL & SOAEL)	Not suitable (Above SOAEL)
Bedroom 46	Suitable (Below LOAEL)	Not suitable (Above SOAEL)

Where the internal acoustic environment is not suitable with open windows during general ventilation or overheating conditions, if and where it occurs, alternative means of ventilation are recommended.

11 Recommended Facade Sound Insulation Specifications

The following tables provide a set of sound insulation specifications for each of the ventilation system types described in The Building Regulations 2010 Approved Document F: Ventilation – Volume 1: Dwellings (DLUHC, HMG 2021, p. 14, Table 1.6). The specifications have been calculated based on BS EN ISO 12354-3:2017 (BSI 2017). The set of specifications meet the [target internal noise levels during general ventilation conditions](#).

The specifications are based on the highest calculated single number rating specification, per room and per period, from the following frequency resolution of measured sound levels to account for uncertainty associated with this input data and calculation methodology:

- Broadband / Overall
- 125 Hz to 2 kHz Octaves
- 63 Hz to 2 kHz Octaves
- 125 Hz to 4 kHz Octaves
- 63 Hz to 4 kHz Octaves
- 125 Hz to 2 kHz One-third Octaves
- 63 Hz to 2 kHz One-third Octaves
- 125 Hz to 4 kHz One-third Octaves
- 63 Hz to 4 kHz One-third Octaves

For each of the ventilation system types, the specifications are optimised based on a balanced medium of all facade elements (i.e. windows, vents, facade walls and roof, where applicable) being equal contributors to the internal noise level for each room.

Further optimisations may be carried out, if required, however, it should be noted that decreasing the specification of one particular facade element will require an increase to the specification of the other facade elements and there are practical limitations to the extent of calculating a sought minimal specification for the preferred facade element(s).

The specifications are given for each facade element (facade wall, window, roof and vent, where applicable) for each habitable room and all specification parts must be met in order to meet the [target internal noise levels during general ventilation conditions](#) levels during all periods of the daytime and night-time.

The specifications for background ventilators (i.e. trickle vents) are provided for each vent based on the following:

- With one vent allocated to every room for a natural ventilation system type with background ventilators and intermittent extract fans or a continuous mechanical extract ventilation system type.
- With no vents allocated for a mechanical ventilation with heat recovery system type.

[Guidance on these specifications is provided for developers in the appendix.](#)

The window and vent specifications may be compared against product technical specifications (tested in accordance with ISO 10140 (BSI 2011) or relevant parts of the older withdrawn ISO 140 series) to determine the appropriate fittings.

Where the window specifications provided in the tables below exceed standard double glazing (i.e. 4/(6 to 16)/4) two suggestions (separated by an “or”) are provided as follows:

- The 1st suggested glazing considers a double-glazed configuration (i.e. 6/(6 to 16)/4 for all first floor rooms at the rear of the development, facing the A2).
- The 2nd suggested glazing system considers a secondary glazing system installed over “primary” standard double glazing to consist of, at least, 4mm toughened single pane glass with a 50mm cavity between the double-glazed window and the secondary glazing. This is presented as “4/(6 to 16)/4+(50)+4” where “4/(6 to 16)/4” is standard double glazing and “+(50)+4” is the secondary glazing system with any opening style.

The suggested secondary glazing system is based on acoustic performance data provided by Selectaglaze Limited.

11.1 Natural or Continuous Mechanical Extract (CME) System

Table 11.1: Specification: Natural or CME System - Facade Walls

Habitable room	Specification Part 1	Specification Part 2
All	42 dB $R_w + C_{tr}$	36 dB R_w

Table 11.2: Specification: Natural or CME System - Roof

Habitable room	Specification Part 1	Specification Part 2
All	40 dB $R_w + C_{tr}$	35 dB R_w

Table 11.3: Specification: Natural or CME System - Vents

Habitable room	Specification Part 1	Specification Part 2
Bedroom 1	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 2	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 3	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 4	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 5	27 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 6	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 7	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 8	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 9	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 10	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 11	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 12	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$

Habitable room	Specification Part 1	Specification Part 2
Bedroom 13	27 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 14	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 15	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 16	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 17	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 18	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 19	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 20	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 21	27 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 22	35 dB $D_{n,e,w} + C_{tr}$	30 dB $D_{n,e,w}$
Bedroom 23	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 24	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 25	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 26	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 27	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 28	36 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 29	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 30	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 31	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 32	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 33	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 34	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 35	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 36	36 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 37	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 38	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 39	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$
Bedroom 40	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 41	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 42	37 dB $D_{n,e,w} + C_{tr}$	31 dB $D_{n,e,w}$
Bedroom 43	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 44	37 dB $D_{n,e,w} + C_{tr}$	32 dB $D_{n,e,w}$
Bedroom 45	28 dB $D_{n,e,w} + C_{tr}$	29 dB $D_{n,e,w}$
Bedroom 46	28 dB $D_{n,e,w} + C_{tr}$	28 dB $D_{n,e,w}$

Table 11.4: Specification: Natural or CME System - Windows

Habitable room	Specification Part 1	Specification Part 2	Suggested glazing
Bedroom 1	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 2	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 3	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 4	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 5	18 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4

Habitable room	Specification Part 1	Specification Part 2	Suggested glazing
Bedroom 6	26 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 7	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 8	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 9	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 10	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 11	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 12	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 13	18 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 14	26 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 15	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 16	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 17	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 18	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 19	19 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 20	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 21	18 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 22	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 23	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 24	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 25	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 26	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 27	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 28	27 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 29	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 30	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 31	18 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 32	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 33	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 34	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 35	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4

Habitable room	Specification Part 1	Specification Part 2	Suggested glazing
Bedroom 36	27 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 37	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 38	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 39	18 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 40	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 41	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 42	28 dB $R_w + C_{tr}$	22 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 43	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 44	28 dB $R_w + C_{tr}$	23 dB R_w	6/(6 to 16)/4 or 4/(6 to 16)/4+(50)+4
Bedroom 45	19 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 46	18 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4

11.2 Mechanical Ventilation and Heat Recovery (MVHR) System

Table 11.5: Specification: MVHR System - Facade Walls

Habitable room	Specification Part 1	Specification Part 2
All	41 dB $R_w + C_{tr}$	35 dB R_w

Table 11.6: Specification: MVHR System - Roof

Habitable room	Specification Part 1	Specification Part 2
All	39 dB $R_w + C_{tr}$	34 dB R_w

Table 11.7: Specification: MVHR System – Windows

Habitable room	Specification Part 1	Specification Part 2	Suggested glazing
Bedroom 1	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 2	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 3	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 4	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 5	15 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 6	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 7	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4

Habitable room	Specification Part 1	Specification Part 2	Suggested glazing
Bedroom 8	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 9	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 10	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 11	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 12	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 13	15 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 14	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 15	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 16	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 17	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 18	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 19	16 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 20	23 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 21	15 dB $R_w + C_{tr}$	16 dB R_w	4/(6 to 16)/4
Bedroom 22	24 dB $R_w + C_{tr}$	18 dB R_w	4/(6 to 16)/4
Bedroom 23	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 24	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 25	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 26	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 27	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 28	25 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 29	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 30	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 31	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 32	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 33	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 34	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 35	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 36	25 dB $R_w + C_{tr}$	19 dB R_w	4/(6 to 16)/4
Bedroom 37	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 38	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 39	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 40	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 41	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 42	25 dB $R_w + C_{tr}$	20 dB R_w	4/(6 to 16)/4
Bedroom 43	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 44	26 dB $R_w + C_{tr}$	21 dB R_w	4/(6 to 16)/4
Bedroom 45	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4
Bedroom 46	16 dB $R_w + C_{tr}$	17 dB R_w	4/(6 to 16)/4

12 Recommended Indoor Noise Levels from Mechanical Services

The information in this section is extracted from the Acoustics, Ventilation and Overheating - Residential Design Guide (ANC 2020, pp. 25–27, Section 3).

Table 12.1: Recommended indoor noise levels from mechanical services during whole dwelling ventilation with minimum low ventilation rates.

Habitable room	Internal noise level limits
Bedrooms	26 or 30 dB L_{Aeq}

Table 12.2: Recommended indoor noise levels from mechanical services during extract ventilation with minimum high ventilation rates.

Habitable room	Internal noise level limits
Bedrooms	26 or 30 dB L_{Aeq}
Bathroom/WC/Kitchen	45 dB L_{Aeq}

When providing purge ventilation for the purpose of rapidly diluting indoor pollutants, no desirable noise levels are currently proposed based on the lack of evidence of acceptable noise levels.

Table 12.3: Recommended indoor noise levels from ventilative/comfort cooling mechanical services during overheating conditions.

Habitable room	Internal noise level limits
Bedrooms	30 ($\pm$ 5) dB L_{Aeq}

13 Conclusion

This document is an acoustic design statement to accompany a planning application for the residential development at Bayswater House, Hever Court Road, Gravesend, Kent, DA12 5UQ.

Environmental noise levels were measured at the site over a representative sample of time between 12:24 BST on Thursday 22 May 2025 and 14:31 BST on Friday 23 May 2025 and have been used to estimate the typical noise levels outside the facades of the development.

Noise risk assessments have been carried out where it has been determined that;

- the noise risk during general ventilation conditions is high,
- the noise risk during overheating conditions is high and,
- the noise risk from the presence of prominent tones is negligible, regardless of ventilation conditions.

Noise impact assessments have been carried out where it has been determined that;

- The assessment of ventilation noise impact section shows that when open windows are used for general ventilation, unsuitable internal noise levels are predicted for all bedrooms during the daytime and night-time periods.
- The assessment of overheating noise impact section shows that when open windows are used during overheating conditions (if it occurs), conditionally suitable internal noise levels are predicted for all bedrooms at the front of the development, during the daytime and night-time period. The overheating noise impact also shows that conditionally suitable internal noise levels are predicted for all bedrooms at the rear of the development during the daytime period only.
- The noise impact assessments for specific rooms based on the room data in the appendix shows that, for general ventilation, internal noise levels with open windows will be unsuitable for all bedrooms at the development during both daytime and night-time periods. During overheating conditions (if it occurs), internal noise levels with open windows will be suitable for Bedrooms 5, 13, 21, 23, 31, 39 and 46 during the daytime period only, and conditionally suitable for all other bedrooms at the development during the daytime and period only.
- An alternative means of ventilation is recommended in all cases where open windows are predicted to result in unsuitable internal noise levels, as indicated by the noise impact assessments for specific rooms.
 - Where mechanical ventilation is used as an alternative, recommended indoor noise levels from such services are provided in the relevant section. These are intended to be applicable for rooms where open windows cannot secure suitable internal noise levels (as indicated by the noise impact assessments) or in cases where such systems are desired as an additional provision for the development.

Recommended facade sound insulation specifications have been provided for all facade elements (external walls, windows, vents and roof) in order to achieve suitable internal noise levels in all noise sensitive rooms. The recommended specifications have been provided for each of the ventilation system types described in The Building Regulations 2010 Approved Document

F: Ventilation – Volume 1: Dwellings (DLUHC, HMG 2021, p. 14, Table 1.6). Additional guidance on sound insulation is provided in the appendix to assist the developer.

Manufacturers' sound insulation performance specifications for facade elements should be measured according to the relevant parts of ISO 10140 (BSI 2011) (or relevant parts of the older withdrawn ISO 140 series). These may be compared against the recommended specifications to determine suitable products.

It is recommended that the facade sound insulation design is verified once frequency based (octave or third-octave) sound insulation performance data for all relevant facade elements have been obtained - either from predictions or test reports from the product manufacturers. If sound insulation performance data cannot be obtained, the facade sound insulation design can only be verified based on noise measurements taken within the finished habitable rooms of the proposed development.

14 Appendix

14.1 Site Survey Record

14.1.1 Record of Field Calibration for Measurement Equipment

Each sound level meter was calibrated at its verified reference level and frequency, 94 dB at 1kHz, before any measurements were taken. Calibration at the end of the survey showed acceptable drift and validates the measurements taken.

Table 14.1: Field calibrations for measurement equipment.

Measurement Location	Calibration Device	Serial Number	Measurement Equipment	Serial Number(s)	Calibration Date & Time	Calibration Factor
1	Cirrus Research CR:515	100861	ACOEM 01dB FUSION (FW 3.01), 40CD	15009, 545427	Thu 22/05/25 12:20:48 BST	0.49
1	Cirrus Research CR:515	100861	ACOEM 01dB FUSION (FW 3.01), 40CD	15009, 545427	Fri 23/05/25 14:22:19 BST	0.56
2	Cirrus Research CR:515	100861	ACOEM 01dB FUSION (FW 3.01), 40CD	15013, 545379	Thu 22/05/25 12:37:36 BST	0.49
2	Cirrus Research CR:515	100861	ACOEM 01dB FUSION (FW 3.01), 40CD	15013, 545379	Fri 23/05/25 14:35:26 BST	0.55

14.1.2 Record of Verification (Laboratory) Calibration for Equipment

All equipment has traceable calibration history valid during the relevant times of the site assessment; no greater than two years for sound level meters and no greater than one year for sound calibrators.

Calibrations have been carried out independently by University of Salford (Acoustic Calibration Laboratory) accredited by United Kingdom Accreditation Service (UKAS). The current set of calibration certificates, relevant to the measurements taken, are listed in the table below.

Table 14.2: Verification (Laboratory) Certification for equipment.

Equipment	Serial Number(s)	Certificate Scope	Date of test	Certificate Number
Cirrus Research CR:515	100861	CALIBRATION OF A SOUND CALIBRATOR	2025-02-26	07116/1
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00), Ext. Cable, PRE22, 40CD	15013, 22/06 A, 2113127, 545379	PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006	2025-03-05	07116/10

Equipment	Serial Number(s)	Certificate Scope	Date of test	Certificate Number
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00), Ext. Cable, PRE22, 40CD	15013, 22/06 A, 2113127, 545379	VERIFICATION OF A SOUND LEVEL METER / ANALYSER 1/3 OCTAVE FILTER SET MANUFACTURED TO BS EN 61260: 1996 RELATIVE ATTENUATION	2025-03-05	07116/11
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00), 40CD	15009, 545427	PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006	2025-02-28	07116/2
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00)	15009	VERIFICATION OF A SOUND LEVEL METER / ANALYSER 1/3 OCTAVE FILTER SET MANUFACTURED TO BS EN 61260: 1996 RELATIVE ATTENUATION	2025-02-28	07116/3
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00), Ext. Cable, PRE22, 40CD	15009, 22/19 A, 2214193, 545427	PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006	2025-02-27	07116/5
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00), Ext. Cable, PRE22, 40CD	15009, 22/19 A, 2214193, 545427	VERIFICATION OF A SOUND LEVEL METER / ANALYSER 1/3 OCTAVE FILTER SET MANUFACTURED TO BS EN 61260: 1996 RELATIVE ATTENUATION	2025-02-28	07116/6
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00), 40CD	15013, 545379	PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006	2025-03-03	07116/7
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00)	15013	VERIFICATION OF A SOUND LEVEL METER / ANALYSER 1/3 OCTAVE FILTER SET MANUFACTURED TO BS EN 61260: 1996 RELATIVE ATTENUATION	2025-03-04	07116/8

14.1.3 Record of Type Approval Certification for Equipment

Table 14.3: Type Approval Certification for equipment.

Equipment	Issued Date	Valid Until Date	Certificate Number	Institute
Cirrus Research CR:515	2022-11-15	2032-11-14	DE-22-M-PTB-0047	PTB
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00)	2024-12-06	2034-12-05	CH-A3-24119-00	METAS
ACOEM 01dB FUSION (FWa 3.01, FWm 3.00)	2024-03-29	2034-03-17	LNE-27092 rév. 5 du 02 avril 2024	LNE

14.1.4 Weather Data

Weather forecasts for the duration of the survey period showed that conditions would be dry with low wind speeds.

Local weather observations at the measurement location at the commencement of the noise survey were dry and calm with an occasional light breeze. A large puddle at the entrance to the parking area was noted from previous rainfall, however, ground surfaces were generally dry around the measurement location during all periods of site attendance. Weather conditions were similar at the conclusion of the noise survey.

Based on the weather forecasts, local weather observations at site and sound measurement data, no adverse weather conditions were present to affect the sound measurements to any significant degree over the duration of the survey period.

14.2 Input Data for Assessments and Calculations

A summary of the measurements and associated corrections for the facade noise levels are summarised in the table below. The data in this table has been used to derive noise levels at the facades of the development from the measured noise levels. These derived levels are used for the ventilation and overheating [noise impact assessments](#) and [recommended facade sound insulation specifications](#).

Table 14.4: Summary of measurement corrections for the facade noise levels.

Facade ID	Facade Description	Measurement Location	Free-field correction (dB)
1	Front	1	3
2	Rear	2	3

The free-field corrections have been calculated on the following basis:

- 3 dB reduction in noise levels to remove the sound reflections from the existing facades upon the measurement positions, where the microphone is positioned approximately 1 metre from the reflecting facade, in accordance with ISO 1996-2:2017 (ISO 2017, p. 14).

The calculation input data used to derive the sound insulation specifications is presented in the table on the following page with the data values presented at a precision of up to one decimal place (higher precision values for some data have been used in the calculations).

The input data has been based on the architectural drawings listed in the [introduction](#).

The opening style refers to the derived element-normalized level differences for the specified window opening based on Waters-Fuller et al. (2007) p. 23, Table 3.2, p. 62, Table 5-3, and p. 64, Table 5-5 that has been used to calculate the [noise impact assessments for specific rooms](#) in octave bands. The opening style abbreviations and corresponding descriptions are provided in the table below.

Table 14.5: Abbreviated window opening styles.

Opening style abbreviation (2007)	Opening style description
E	Top hung outward opening

Table 14.6: Input data used in the calculation of the facade sound insulation specifications and noise impact assessments for specific rooms.

Room name	Room type	Floor	Facade ID	Total facade wall length inside (m)	Floor area (m ²)	Total window area (m ²)	Floor to ceiling height (m)	Volume (m ³)	Reverberation time (s)	Facade shape influence (dB)	Opening style (2007)
Bedroom 1	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 2	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 3	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 4	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 5	Bedroom	Lower Floors	1	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 6	Bedroom	Lower Floors	2	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 7	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 8	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 9	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 10	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 11	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	42	0.5	0	E

Room name	Room type	Floor	Facade ID	Total facade wall length inside (m)	Floor area (m ²)	Total window area (m ²)	Floor to ceiling height (m)	Volume (m ³)	Reverberation time (s)	Facade shape influence (dB)	Opening style (2007)
Bedroom 12	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 13	Bedroom	Lower Floors	1	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 14	Bedroom	Lower Floors	2	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 15	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 16	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 17	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 18	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 19	Bedroom	Lower Floors	1	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 20	Bedroom	Lower Floors	2	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 21	Bedroom	Lower Floors	1	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 22	Bedroom	Lower Floors	2	12	20	1.2	2.4	48	0.5	0	E
Bedroom 23	Bedroom	Top Floor	1	12	20	1.2	2.4	48	0.5	0	E
Bedroom 24	Bedroom	Top Floor	2	3.6	17	1.2	2.4	42	0.5	0	E

Room name	Room type	Floor	Facade ID	Total facade wall length inside (m)	Floor area (m ²)	Total window area (m ²)	Floor to ceiling height (m)	Volume (m ³)	Reverberation time (s)	Facade shape influence (dB)	Opening style (2007)
Bedroom 25	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 26	Bedroom	Top Floor	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 27	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 28	Bedroom	Top Floor	2	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 29	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 30	Bedroom	Top Floor	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 31	Bedroom	Top Floor	1	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 32	Bedroom	Top Floor	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 33	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 34	Bedroom	Top Floor	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 35	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 36	Bedroom	Top Floor	2	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 37	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E

Room name	Room type	Floor	Facade ID	Total facade wall length inside (m)	Floor area (m ²)	Total window area (m ²)	Floor to ceiling height (m)	Volume (m ³)	Reverberation time (s)	Facade shape influence (dB)	Opening style (2007)
Bedroom 38	Bedroom	Top Floor	2	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 39	Bedroom	Top Floor	1	6.6	20	1.2	2.4	48	0.5	0	E
Bedroom 40	Bedroom	Top Floor	2	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 41	Bedroom	Top Floor	1	3.6	17	1.2	2.4	42	0.5	0	E
Bedroom 42	Bedroom	Top Floor	2	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 43	Bedroom	Top Floor	1	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 44	Bedroom	Top Floor	2	12	20	1.2	2.4	48	0.5	0	E
Bedroom 45	Bedroom	Top Floor	1	3.6	17	1.2	2.4	41	0.5	0	E
Bedroom 46	Bedroom	Top Floor	1	6.6	20	1.2	2.4	48	0.5	0	E

14.3 Design Factors, Methodology and Uncertainty

14.3.1 Measured and Derived Noise Levels

All values presented are rounded to the nearest 1 dB on the basis that 0.5 is rounded up; the calculations are based on the original precision of the input data and of the recorded values, and calculations are carried out at the highest software precision up to the final values which are rounded for each of the respective presented values.

The assessments carried out and sound insulation specifications derived are based on a measured sample of noise levels that are considered to be indicative of the typical noise levels at the residential development, currently and in the short-term future. The day-to-day noise levels at the development may differ and typical noise levels may change in the long-term. Therefore, if typical noise levels change in the long-term, this noise impact assessment may only be relevant as a historical reference and comparison. A prediction/projection of noise levels (i.e. from road, air, or rail traffic, as applicable) into the future is outside of the scope of this acoustic design statement.

It is suggested that the short-term is within 2 years and the long-term is from around 2-3 years, with an increasing likelihood of change to noise levels beyond 3 years. However, there is currently insufficient research depth or historical data (such as, for example, what could be derived from the existing National noise mapping and road traffic data) to establish reliable statistical projections for the site. Furthermore, whilst Professional Practice Guidance on Planning & Noise - New Residential Development (ANC, IOA, CIEH 2017, p. 23, Figure 3) suggests that an assessment of the extent of noise risk for the foreseeable future, 15 years ahead, for sites with a low or higher noise risk should be carried out, a methodology for the predictions/projections is not covered by the guidance. Any noise assessment for the foreseeable future would be bespoke and subject to a feasibility assessment.

It is considered that, provided that the [recommended facade sound insulation specifications](#) are met, reasonable internal noise conditions would still be achieved if the external ambient and maximum noise levels ($L_{Aeq,16hr}$, $L_{Aeq,8hr}$ and $L_{Amax,F,1min}$) increases by up to 5 dB above the [measured noise levels](#).

It must also be noted that workmanship of the facade elements and their fitting can also result in variation, either positively or negatively, to the overall “whole-facade” sound insulation performance.

If applicable, an internal noise survey with noise measurements carried out across a sufficient sample of completed habitable rooms may be used to demonstrate if suitable internal noise levels are achieved for the development.

14.3.2 Noise Impact Assessments

Sound insulation ratings for specific opening styles from open window research ([2007, p. 62, Table 5-3](#)) may be used in the calculations, however, the variation between different window units for each respective opening style was not quantified by the research. Open window sound insulation performance test data of the actual windows may also be used, however, obtaining such data from suppliers or manufacturers is not normally possible.

The paper states that “A questionnaire survey of window manufacturers and construction companies was undertaken to identify the range and styles of window units currently being installed in the UK. The response to this survey largely steered the choice of test units.” The straightforward noise reduction through an open window and the statistically derived sound insulation ratings for window openings are derived from the same test sample, therefore, it is assumed that the uncertainty associated with the derivation of both of these values is the same.

14.3.3 Ventilation

The open window research paper (2007, pp. 82–83) assumes that a partially open window is a window physically secured on a window catch which does not compress the window seals and provides an opening to allow a low level of ventilation. A partially open window would provide significantly less than 0.05 m² of free open area and can therefore provide a noise reduction higher than 19 dB(A). However, the paper states that there was a large difference between the amount of free open area for the partially open window samples and therefore the ventilation performance is assumed to show significant variation. Although measurements for partially open windows are presented, the paper does not compare, examine or conclude partially open window sound reduction performance.

Approved Document F: Ventilation – Volume 1: Dwellings (DLUHC, HMG 2021, p. 15, para. 1.52) states that “A window with a night latch position [or “partially open”] is not adequate for background ventilation due to the following. a. The risk of draughts. b. Security issues. c. The difficulty of measuring the equivalent area.”

14.3.4 Overheating

The Chartered Institution of Building Services Engineers Technical Memorandum 59 “Design methodology for the assessment of overheating risk in homes” (CIBSE 2017, p. 4, Section 4.1) states that:

“In order to allow the occupants to ‘adapt’, each habitable room needs operable windows with a minimum free area that satisfies the purge ventilation criteria set in Part F of the Building Regulations for England (NBS, 2010) [...] i.e. the window opening area should be at least 1/20th of the floor area of the room (different conditions exist for windows with restricted openings, and the same requirement applies for external doors).”

By using the minimum floor area of 7.5 m² from the Nationally Described Space Standard (DCLG 2016, p. 4, para. 10c), 1/20th of the floor area equates to 0.375 m².

Occupants are generally considered to exercise control over opening windows based on a straightforward perception of - and desired balance between - the cooling provided by opening windows and the resulting increase in internal noise. It is foreseeable that the amount by which an occupant opens a window will vary by occupant, temperature and internal noise level and the risk of adverse effects are dependent upon the duration and frequency of overheating occurrences. The current guidance recognises that there is not enough research into the relationship between these factors to establish a quantitatively holistic basis for assessment and design (i.e. tried-and-tested guidance is unavailable). However, qualitative guidance on the combined effect of internal ambient noise level and duration for the overheating situation is

provided within the Acoustics, Ventilation and Overheating - Residential Design Guide ([ANC 2020, p. 24](#), Figure 3-2, p. 35, para. A.54).

The estimate of potential impact may be different (either higher or lower) for lower occupancy profiles with shorter total duration of overheating. For example, a 3-hour averaging period may result in a more severe impact if overheating conditions are only considered to be present during peak traffic times, or may result in a less severe impact if overheating conditions are only considered to be present during lowest traffic times.

The assessment of noise impacts during the overheating condition sets out a baseline estimate and the assessment may be revised based on an overheating assessment.

14.3.5 Tonality

It should be recognised that [tone noise risk](#) assessments and tone noise impact assessments have not been formally set out in the assessment methodology described in Professional Practice Guidance on Planning & Noise - New Residential Development ([ANC, IOA, CIEH 2017](#)) and Acoustics, Ventilation and Overheating - Residential Design Guide ([ANC 2020](#)).

14.4 Guidance for Developers on Sound Insulation Values

The guidance in this appendix is intended to assist developers by providing a scale of sound insulation values for generic building elements that may be referenced with the [recommended facade sound insulation specifications](#).

14.4.1 Vents

The number of vents in a room will affect the noise level in the room. The recommended facade sound insulation specifications are based on a fixed number of vents as outlined in [the beginning of the corresponding section](#).

In order to achieve suitable internal noise levels with an additional number of vents than accounted for in this acoustic design statement, the sound insulation specifications may be increased to offset the increase in indoor noise level; as a guideline, doubling the number of vents should result in the specifications of both vents increasing by 3 dB over the values specified in this acoustic design statement. In cases where there are a high number of vents in a habitable room, the specifications of other facade elements may need to be increased or alternative means of ventilation may need to be considered.

14.4.2 Windows

The following information is extracted from BS EN 12758:2019+A1:2023 ([BSI 2023](#), pp. 12–15, Section 9) and BS EN ISO 12354-3:2017 ([BSI 2017](#), p. 13, Appendix B.2.2).

The generally accepted values of R_w and $R_w + C_{tr}$ for a range of glass products are provided [in the table following the table guide below].

- a) These tabulated values are derived from the mean value minus one standard deviation of the typically measured data. As such, they represent conservative values which may be adopted in the absence of specific data measured in accordance with ISO 10140 ([BSI 2011](#)). The values presented take into account the spread in results for nominally identical elements and can thus be considered as being on the safe side. These values can be used in cases when no other information is available and serve as an indication of what is typical for some types of products. The data represents the average result minus a standard deviation of approximately 1 dB to 2 dB.
- b) This data refers to float glass or glass products made with float glass.
- c) LAM means laminated glass.
- d) The data for laminated glasses is for one with an organic interlayer excluding acoustic interlayer. The thickness is the glass thickness only, excluding interlayer thickness.
- e) The data for insulating glass units refer to air or argon filled cavities with a width from 6 mm to 16 mm.
- f) The construction of insulating glass units is given as follow:
 - for double glazing: glass type and thickness / cavity width / glass type and thickness,
 - for triple glazing: glass type and thickness / cavity width / glass type and thickness / cavity width / glass type and thickness.

The following table is ordered from lowest to highest sound insulation values of R_w , followed by $R_w + C_{tr}$.

The information provided above is the guide which must be used to interpret the following table.

Table 14.7: Guidance on window sound insulation values for insulating glass units.

Glass type and thickness (mm)	dB $R_w + C_{tr}$	dB R_w
4/(6 to 16)/4	25	29
6/(6 to 16)/4	28	32

The suggested glazing is based on the minimum total thickness of glass (excluding gaps and laminate) as it is assumed that costs for glazing mostly scale with volume of glass; affixing a laminate interlayer is assumed to have better cost-benefits than an increase in glass thickness by 2mm and if there is an equivalent total thickness of glass between glazing with laminate and glazing without laminate, the non-laminate glazing is preferred.

14.4.3 Facade Walls

The following information is extracted from BS 8233:2014 (BSI 2014, pp. 57–61, Appendix E.4).

General, non-exhaustive guidance on the potential sound insulation performance of generic wall constructions is provided in the context of sound separation across partitions between adjacent dwellings, however, the examples given for the common types of wall constructions are useful to illustrate a scale of sound insulation values. The sound insulation values given are necessarily approximate since examples of nominally identical constructions might show variations of several decibels. Construction details and workmanship are important if the levels of sound insulation indicated are to be achieved.

37 to 43 dB R_w

- Lightweight masonry blockwork, plaster or dry lining on at least one side. Overall mass per unit area not less than 75 kg/m².

43 to 50 dB R_w

- Masonry wall, joints well filled. Either plaster or dry lining on both sides. Overall mass per unit area not less than 150 kg/m².

50 to 54 dB R_w

- Brick laid frogs up, wall nominal 200 mm thickness, weight (including plaster) not less than 380 kg/m². Plaster or dry-lined finish both sides. Brickwork joints well filled.

54 to 60 dB R_w

- Solid masonry with an overall mass per unit area of not less than 700 kg/m², fully sealed both sides.

The external wall construction may be evaluated in one-third octave or octave bands based on predicted software-based models or laboratory test data.

14.4.4 Roofs

The following information is extracted from BS 8233:2014 (BSI 2014, p. 41, Section 8.4.7).

Roofs and mansards generally have lower sound insulation than masonry facade walls and the performance of various roof types is indicated in the table below.

Table 14.8: Guidance on roof sound insulation values.

Approximate Sound insulation (dB R_w)	Description of roof
43	Tiles on felt, pitched roof with 100 mm mineral wool on plasterboard ceiling

BS 8233:2014 (BSI 2014, p. 64, Annex G.1) states:

“A traditional pitched roof with concrete tiles and a 9 mm plasterboard ceiling, covered in thermal insulating material, has an insulation of approximately 43 dB R_w .”

The following table is extracted from “Sound control for homes” (BRE, CIRIA 1993, p. 30, Table 14).

Table 14.9: Further guidance on roof sound insulation values.

Description	$R_{A(\text{traffic})}$	R_m	R_w
Pitched, tiles on felt roof, 9 mm plasterboard ceiling, 100 mm absorber on ceiling	31	39	43
Pitched, tiles on felt, wood-lath and plaster ceiling	37	43	47
Pitched, tiles on felt, wood-lath and plaster ceiling, 100 mm absorber on ceiling	38	47	51
Flat, timber-joist roof, asphalt on boarding, 12 mm plasterboard ceiling, thermal insulation	30	43	45

The roof construction may be evaluated in one-third octave or octave bands based on predicted software-based models or laboratory test data.

15 References

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