



Residential Noise Assessment

Site Address: Alexander House, 205-207 Kings Road, reading, RG1 4LS

Client Name: Archi-tekt Partnership

Project Reference No: NP-009307



Authorisation and Version Control

Revision	Date	Reported By	Checked By
01	15/05/2023	P Soler, MSc, MIOA, MIET	S Chesney, MSc, MIOA

Amendment History

Revision	Summary of Amendments
01	--

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Delivering sustainable development by promoting good health and well-being through effective management of noise.

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for the proposed residential extension ('the Proposed Development') at Alexander House, 205-207 Kings Road, Reading, RG1 4LS ('the Site'). The proposed development is for the Construction of a new residential floor above the existing roof level to create new residential use Class C3 to comprise 8 no. residential units. The site is subject to traffic noise from Kings Road and its surrounding network.

A noise survey has been undertaken to establish the prevailing sound levels at the proposed development. The findings have been subsequently used to assess the suitability of the site for residential use. Measures required to mitigate noise impacts for the proposed development have been assessed in accordance with the relevant performance standards, legislation, policy, and guidance.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Standards, Legislation, Policy & Guidance

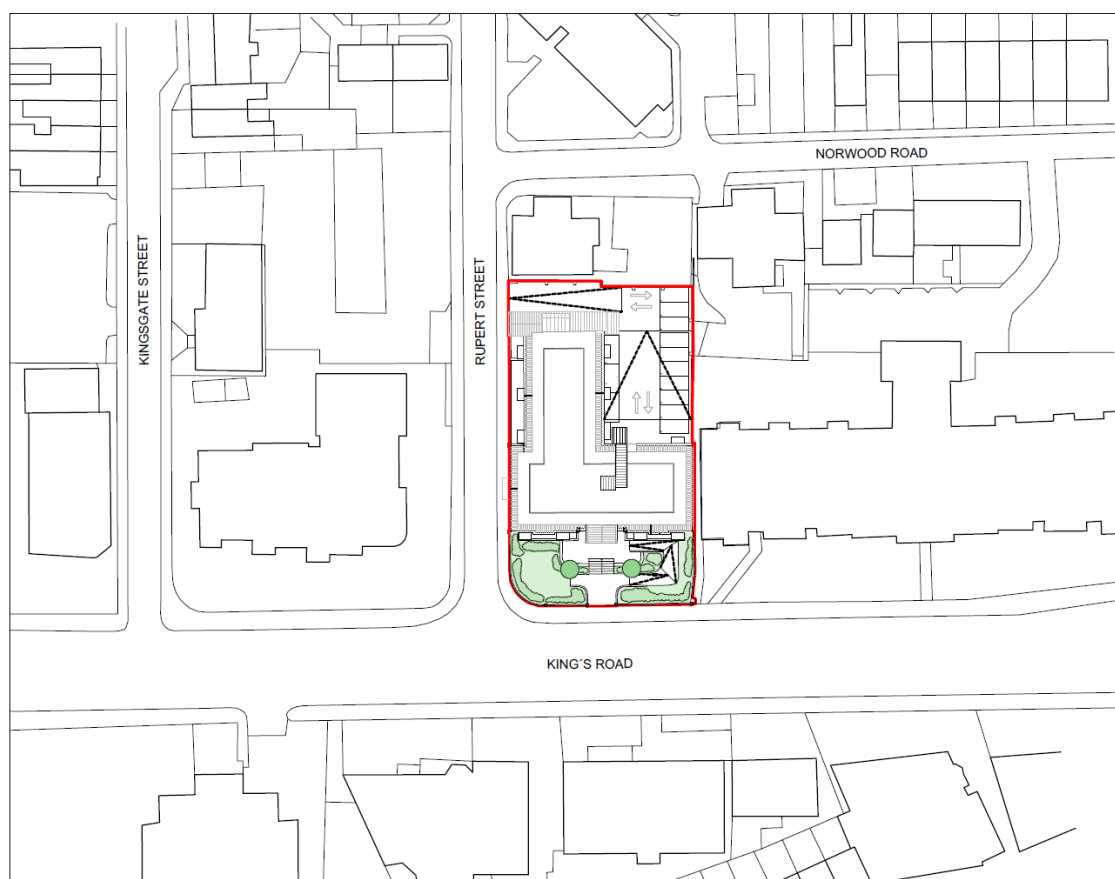
The following performance standards, legislation, policy, and guidance have been considered to ensure good acoustic design in the assessment:

- The Local Planning Authorities (LPA) conditional approval; specifically, 'Condition 7'.
- National Planning Policy Framework (2021)
- Noise Policy Statement for England (2010)
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings'
- ProPG: 'Planning and Noise 2017' (including supplementary documents 1 & 2).
- Approved Document O: Overheating (2021)
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide)

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

Proposal Brief

This proposal seeks the construction of a new residential floor above the existing roof level to create a new residential use Class C3 to comprise 8 no. residential units. The proposed third storey is slightly set back from the alignment of the existing façade, providing some amenity space in the form of private terraces all around the development site. In addition, the proposal includes a new roof terrace that offers communal amenity space for all residents. The figure below shows the Proposed Development.



LOCATION PLAN

Drawing Ref No. Proposed Location Plan from 'Aqua Architects'

Figure 1 – Proposed Development

Local Planning Authority

The LPA's conditional approval has the following relevant condition:

210902 / Construction of new residential floor above existing roof level to create new residential use Class C3 to comprise 8 residential units:

"Condition 7

No development shall commence on site until a detailed scheme, informed by an assessment of the current noise environment, for protecting the dwellings from the external noise environment of the area has been submitted to and approved, in writing, by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014 and that the individual noise events do not exceed 45 dB LA,max,F more than 10 times a night. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded.

Thereafter, the development shall not be carried out other than in accordance with the approved scheme which shall be completed before any part of the accommodation hereby approved is occupied.

REASON: These details are required due to insufficient information being contained within this submission and in order to safeguard the amenity of occupants in accordance with Policies EN16 and CC8 of the Reading Borough Local Plan 2019."

2. Environmental Noise Survey

Measurement Methodology

The following table outlines the measurement dates and particulars.

Location	Survey Dates	Measurement Particulars
MP1	28/04/2023 – 02/05/2023	Equipment mounted on a scaffolding pole at first-floor level and 1m distance from the building façade on Kings Road.
MP2	28/04/2023 – 02/05/2023	Equipment mounted on a lamp post at a height of 3.5m on Rupert Street

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



Figure 2 – Measurement Locations and Site Surroundings

Context & Subjective Impression

The site is located at 205-207 King's Road, RG1 4LS, Reading. The site is a corner plot which is bounded on the South by King's Road, on the West by Rupert Street, on the North by a low-rise residential property and parking space, and on the East with a residential block.

The existing building located on the site, Alexander House, is a detached two story building with a basement, pitched roof loft floors, front garden and a rear patio.

The acoustic environment is deemed to be moderate to high in level and the noise profile is dominated by road traffic noise emissions from Kings Road and its surrounding network at the front facades. However, the noise profile at the rear is deemed low in level and dominated by sporadic traffic noise from Norwood Road.

During the monitoring set-up and collection, there were some construction works being undertaken on site. However, NOVA Acoustics Ltd was informed that no works were carried out during the weekend.

Environmental Noise Survey Results

The following section outlines the measured sound levels during the survey. The 'typical' $L_{AFmax,1min}$ value is determined by that which is not normally exceeded more than 10 times during the night-time. The time history results can be found in Appendix D.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$ dB)						$L_{Aeq,T}$ (dB)	'Typical' $L_{AFmax,1min}$ (dB)
		125	250	500	1k	2k	4k		
MP1	$L_{eq,16hr}$ (Day)	64	63	61	66	64	52	69	--
	$L_{eq,8hr}$ (Night)	47	40	47	47	47	47	66	79
MP2	$L_{eq,16hr}$ (Day)	64	62	59	60	57	46	64	--
	$L_{eq,8hr}$ (Night)	56	54	54	56	52	40	59	76

Table 2 – Sound Level Results Summary

3. Noise Modelling

The environmental noise survey has allowed the sound levels at the proposed development to be modelled within SoundPlan 8.2. The modelling particulars are outlined in Appendix F.

The proposed development has been separated into façade colours for the purpose of the specification of building elements and mitigation measures.

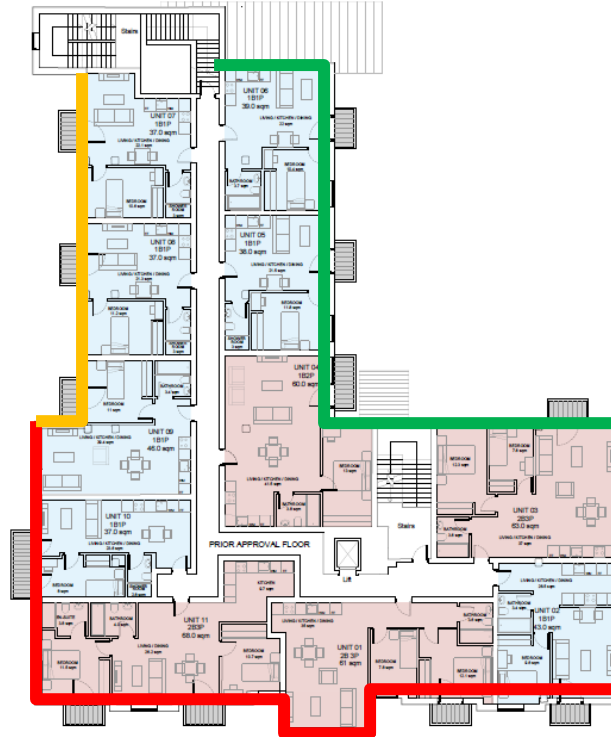


Figure 3 – Site Map Layout

The sound maps showing the daytime $L_{Aeq,T}$, night-time $L_{Aeq,T}$ and night time $L_{AFmax,1min}$ sound levels incident upon the Proposed Development can be seen in the figures below.

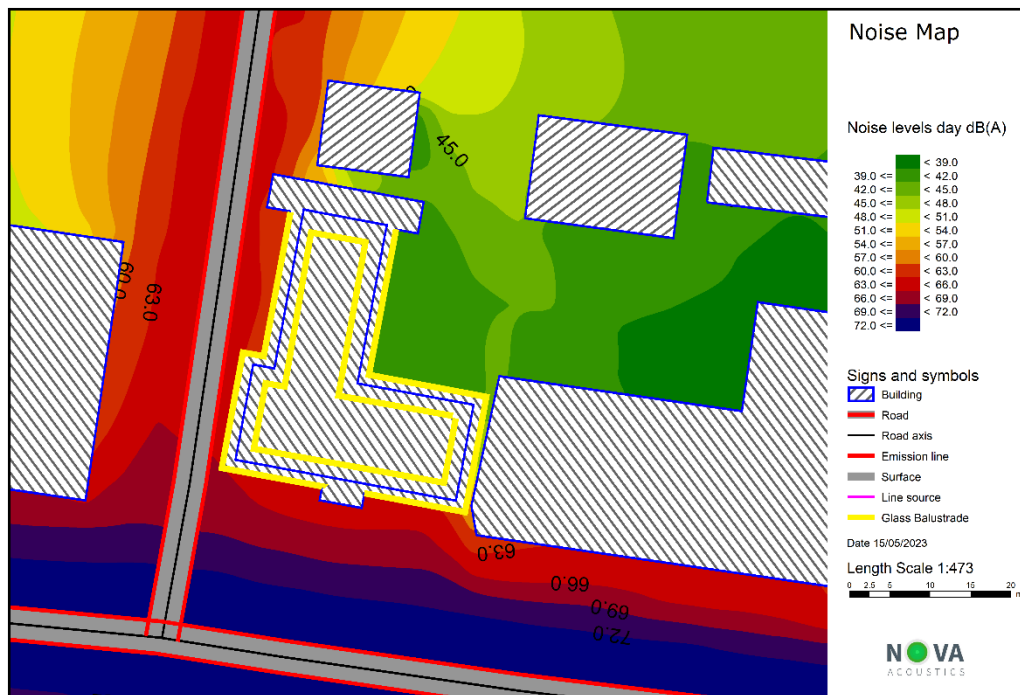


Figure 4 – $L_{Aeq,16hr}$ Ambient Sound Map (1.5m Grid Map Height)

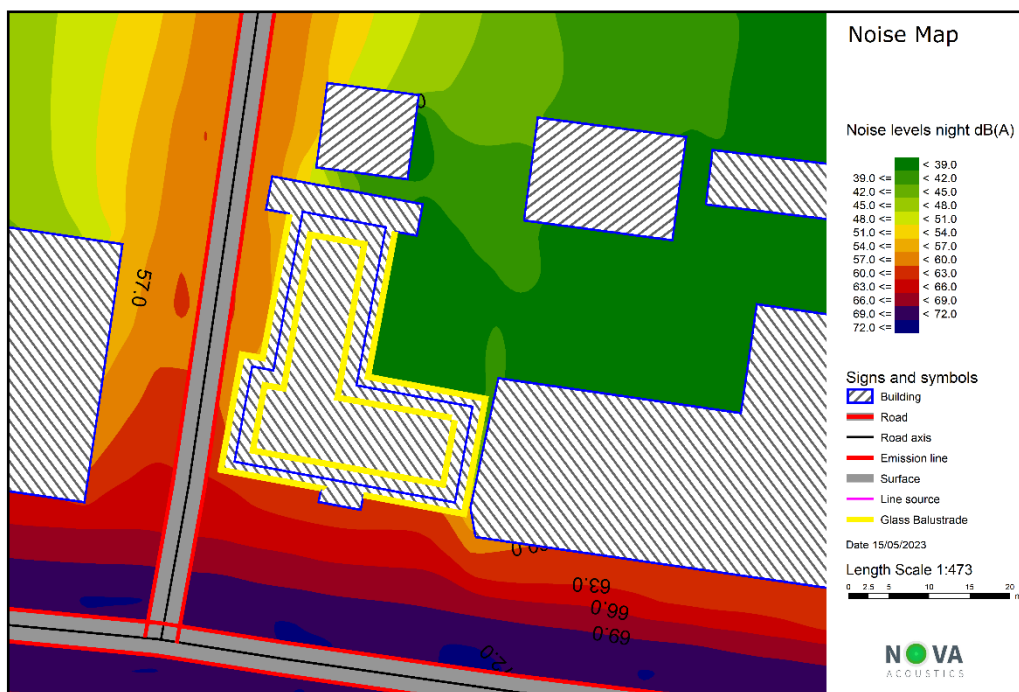


Figure 5 – $L_{Aeq,8hr}$ Ambient Sound Map (1.5m Grid Map Height)

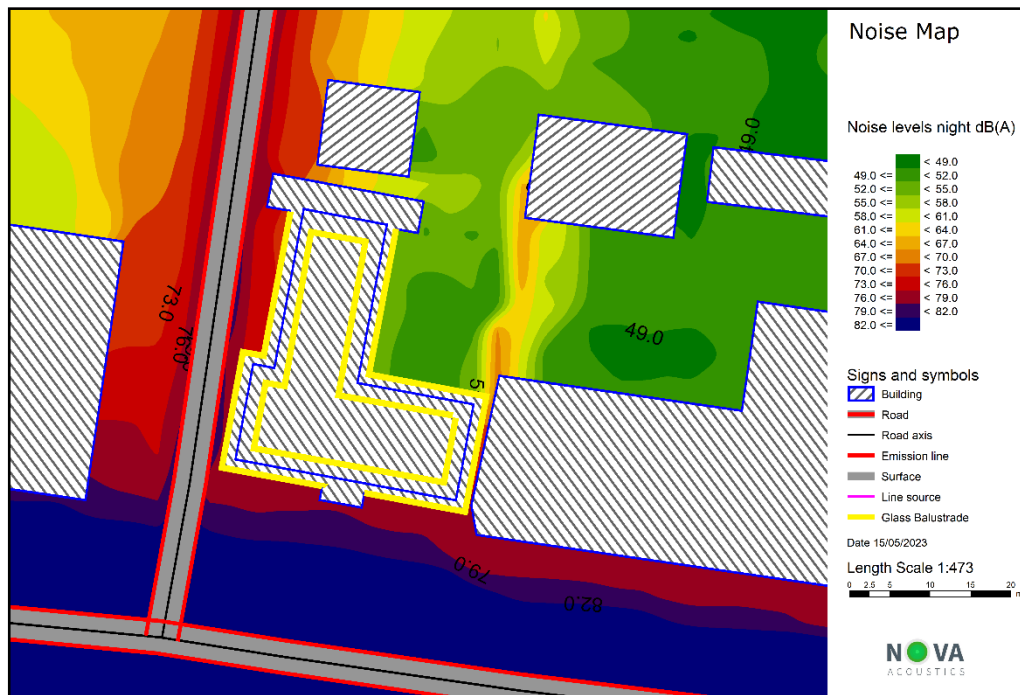


Figure 6 – $L_{AFmax, 1min}$ Sound Map (1.5m Grid Map Height)

4. Noise Break-in Assessment and Sound Insulation Scheme

Internal Noise Level Criteria

The noise profile of the area is predominantly “anonymous” steady state noise sources e.g., traffic noise from Kings Road. The following table outlines the internal and external acoustic design criteria used in the following assessment.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB L_{AFmax} *

*Note 1: The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.

*Note 2: ProPG:2017 which is relevant to ‘New Residential’ states; “In most circumstances in noise sensitive rooms at night (e.g., bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability, and regularity of noise events”.

Note 3: BS8233:2014 states: “Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved”.

Note 4: BS8233:2014 states: “The levels shown in Table 4 (criteria shown above) are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

Note 5: BS8233:2014 states: “If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Table 3 – Acoustic Design Criteria

The measured sound levels at the proposed development are assessed against the relevant criteria and a sound insulation scheme is provided to achieve a good internal acoustic environment.

Glazing and Background Ventilation Specification

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria. The calculations considering the following sound insulation scheme can be found in Appendix E.

Rooms	Description	Octave Frequency Band (Hz, dB)						Overall (dB)	Overall (dB)
		125	250	500	1k	2k	4k		
Living Rooms	10mm Glass / (6 - 16 mm) Cavity / 6mm Glass	23	24	24	32	37	37	35 (R _w)	31 (R _w + C _{tr})
	Greenwoods 2500EA.AC1 (Through Frame Trickle Vent)	41	40	37	47	43	46	42 (D _{ne})	40 (D _{ne} + C _{tr})
Bedrooms	10mm Glass / (6 - 16 mm) Cavity / 6mm Glass	23	24	24	32	37	37	35 (R _w)	31 (R _w + C _{tr})
	Greenwoods MA3051 (Through Wall Ventilation)	46	45	50	55	65	67	55 (D _{ne})	52 (D _{ne} + C _{tr})

Table 4 – Glazing and Ventilation Specification – Red Façade

Rooms	Description	Octave Frequency Band (Hz, dB)						Overall (dB)	Overall (dB)
		125	250	500	1k	2k	4k		
Living Rooms & Bedrooms	10mm Glass / (6 - 16 mm) Cavity / 6mm Glass	23	24	24	32	37	37	35 (R _w)	31 (R _w + C _{tr})
	Greenwoods 2500EA.AC1 (Through Frame Trickle Vent)	41	40	37	47	43	46	42 (D _{ne})	40 (D _{ne} + C _{tr})

Table 5 – Glazing and Ventilation Specification – Amber Façade

Rooms	Description	Octave Frequency Band (Hz, dB)						Overall (dB)	Overall (dB)
		125	250	500	1k	2k	4k		
Living Rooms & Bedrooms	4mm Glass / (6 - 16 mm) Cavity / 4mm Glass	21	17	25	35	37	31	29 (R _w)	25 (R _w + C _{tr})
	Titon Standard Vent + C25 (Through Frame Trickle Vent)	36	38	36	32	37	39	35 (D _{ne})	33 (D _{ne} + C _{tr})

Table 6 – Glazing and Ventilation Specification – Green Façade

Any other window or ventilation specification capable of providing this attenuation will be suitable provided the glazing suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

5. Open Window Noise Break-In Assessment

Internal Noise Levels with Open Windows Criteria

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

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

Table 7 – AVO Guide Open Window Criteria

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

Open Window Assessment

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

Façade	External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
Red	69 L _{Aeq,16hr} (Day)	53	+16	63	+6
	66 L _{Aeq,8hr} (Night)	48	+18	55	+11
	79 L _{AFmax} (Night)	58	+21	78	+1
Amber	64 L _{Aeq,16hr} (Day)	53	+11	63	+1
	59 L _{Aeq,8hr} (Night)	48	+11	55	+4
	74 L _{AFmax} (Night)	58	+16	78	-4
Green	50 L _{Aeq,16hr} (Day)	53	-3	63	-13
	47 L _{Aeq,8hr} (Night)	48	-1	55	-8
	56 L _{AFmax} (Night)	58	-2	78	-22

Table 8 – Open Window Assessment

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

However, for the Green Façade the external noise levels do not exceed the AVO Guides 'Windows Open Often' criteria which means that windows can be used as the primary means of ventilation to mitigate overheating.

6. External Noise Level Assessment

The following section analyses the external amenity area noise levels across the site. The proposed scheme provides three forms of amenity space.

- The existing front garden (not included in the assessment) that faces King's Road, which will remain as a garden.
- Proposed private terraces for the apartments on the third floor (Ext 1), being a minimum width of 1 meter.
- A communal roof terrace (Ext 2) on top of the third floor with a total floor area of 306m².

The external amenity area sound levels are summarised in the table below. The below assessment considers the proposed installation of glass balustrades for the private terraces and roof terraces. A minimum height of 1m has been assumed and the balustrade must be closed with no holes or gaps and provide a minimum of 10 kg/m².

Description	L _{Aeq,16hr} Noise Level (dB)	BS8233:2014 Criteria (dB)	Exceedance (dB)
Ext 1 – Red Façade	69	50 – 55 L _{Aeq,16hr}	+14
Ext 1 – Amber Façade	58		+3
Ext 1 – Green Façade	50		-5
Ext 2 – Rooftop	52-58		+3

Table 9 – BS8233 External Amenity Area Noise Level Assessment

As can be seen in Table 8 above, the recommended external noise levels will only be achieved for private terraces along the Green Façade. The criteria are slightly exceeded for private terraces along the Amber Façade and for certain areas of the communal rooftop terrace. However, the private terraces along the red façade significantly exceed the recommended criteria.

An initial study has been undertaken to further reduce noise levels within the rooftop terrace, the outcomes of which would require a significant increase to the height (2m height) of the balustrade to achieve the criteria across the entirety of the space. However, this is considered an onerous mitigation strategy for limited acoustic gain.

With regards to noise within external amenity spaces, BS8233 states the following:

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

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

Therefore, noise levels within private amenity space is not considered to be paramount at the site given the communal space provided on the rooftop. Due to the location of the development site, and distance from transportation links, it is not possible to achieve the criteria across the entirety of the rooftop terrace. However, this is achieved in the northern areas of the rooftop terrace and is considered to be a suitable amenity space for all residents.

7. Conclusion and Action Plan

The proposed development has been assessed against the acoustic design criteria and a sound insulation scheme has been provided to ensure the criteria has been achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The proposed glazing and background ventilation system, or a suitable alternative, should be installed as shown in Section 5.
2. For Green Façades, the external noise levels do not exceed the AVO Guides 'Windows Open Often' criteria which means that windows can be used as the primary means of ventilation to mitigate overheating.
3. For Amber and Red Façades, the external noise levels exceed the AVO Guides 'Rarely Open' criteria which means that windows cannot be used for the primary means of ventilation and an alternate ventilation strategy is required that is capable of a higher rate of ventilation. A mechanical extract ventilation system should be installed to provide 'Whole Dwelling Ventilation' in accordance with Approved Document F.

The findings of this report will require written approval from the Local Authority prior to work commencing.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T , has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for $N\%$ of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10 \log_{10}(p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy, and guidance.

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

Paragraph 185 states:

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

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes, and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

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

To achieve this vision the Statement identifies the following three aims:

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

- Avoid significant adverse impacts on health and quality of life.
- Mitigate and minimise adverse impacts on health and quality of life.
- Where possible, contribute to the improvement of health and quality of life.

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 ‘Guidance on Sound insulation and noise reduction for buildings’

BS8233 provides guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, ‘WHO Guidelines on Community Noise, 1999’. The Guidelines on Community Noise (1999) document defines community noise to include noise from “industries” and “construction”. The desirable criteria levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$ 45 dB L_{AFmax}^*

Table 10 – BS8233:2014 Internal Ambient Noise Level Criteria

**ProPG:2017 states that's good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 time a night within noise sensitive rooms such as bedrooms. However, where it is not reasonably practicable to achieve the guideline then the judgment of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number distribution, predictability, and regularity of noise events.*

It is noted, however, that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the 'LOAEL' as defined in the NPSE in Appendix B.

B.4 – ProPG: Planning and Noise (2017)

ProPG Planning and Noise published May 2017 by the Association of Noise Consultants (ANC) was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. ProPG aims to encourage better acoustic design of new residential developments promoting good health and wellbeing through the effective management of noise. It therefore outlines four key elements which should be considered in the assessment of noise:

- Element 1 – demonstrating a “Good Acoustic Design Process”.
- Element 2 – observing internal “Noise Level Guidelines”.
- Element 3 – undertaking an “External Amenity Area Noise Assessment”; and
- Element 4 – consideration of “Other Relevant Issues”.

The ProPG supplementary document 2 provides the following 'Good Acoustic Design' hierarchy of noise management measures which LPAs should encourage. These are shown below, In descending order of preference:

Order of Preference	Noise Management Measure
1	Reduction of the noise generated at source by redesign, relocation, or containment. *
2	Maximising the spatial separation of noise source(s) and receptor(s).
3	Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
4	Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.
5	Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
6	Using the layout of the scheme to reduce noise propagation across the site.
7	Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms.
8	Using the building envelope to mitigate noise to acceptable levels.

Table 11 – Hierarchy of Noise Management Measures

*Not from ProPG

B.5 – Approved Document O: Overheating (2021)

Approved Document O states the following in relation to noise:

1. In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).
2. Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.
 - a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
 - b. 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).
3. Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020).B.6 - Acoustics Ventilation and Overheating – Residential Design Guide 2020

B.6 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233:2014 should be achieved considering adequate ventilation as defined by Building Regulations 'Approved Document F' ('ADF') whole dwelling ventilation. However, for a whole dwelling ventilation system such as MVHR it is considered reasonable to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

The 'Institute of Acoustics' ('IOA') and the 'Association of Noise Consultants' ('ANC') have published 'The AVO Guide: 2020' document 2020. It provides guidance for those acousticians involved in the design of buildings to prevent noise ingress to and achieve reasonable internal levels. This provides valuable guidance on ventilation and overheating in support of the "Good Acoustic Design" principle advocated by ProPG. Along with guidance showing an acoustic assessment during the overheating condition, the AVO Guide (2020) provides a framework that has a two-level assessment procedure to estimate the potential impact on occupants:

Level 1 Risk Assessment

AVO 'Level 1' risk assessment criteria guide based on external free field ambient noise levels for dwellings relying on purge ventilation (e.g., opening windows) to prevent summertime overheating. AVO Guide Table 3-2 detailed in the figure below. To assess the possibility of overheating it is reasonable to relax the BS 8233:2014 internal ambient noise levels from opening a window by 5 decibels (5 dB). Also, it is assumed that a partially open window will provide a sound reduction of 13 dB. Therefore, to achieve internal noise levels in line with BS 8233:2014 the façade external noise levels should fall inside the levels shown in Table 3-2.

Risk category for Level 1 assessment ^[Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
LAeq,T ^[Note 3] during 07:00 - 23:00 LAeq,8hr during 23:00 - 07:00 65 dB 60 dB 55 dB 50 dB High Medium Low Negligible 55 dB 50 dB 45 dB	↑ Increasing risk of adverse effect	Recommended Optional Not required
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	

Table 3-2 of AVO Guide (2020)

Figure 7 – AVO Guide Level 1 Risk Category

The AVO Guide (2020) seeks to determine the level of risk associated with overheating in a new residential development based on the existing noise climate. The AVO risk categories are detailed in the table below with clearer categorisation.

Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥ 63 dB $L_{Aeq,16hour}$	≥ 55 dB $L_{Aeq,8hour}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62 dB $L_{Aeq,16hour}$	52 – 54 dB $L_{Aeq,8hour}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56 dB $L_{Aeq,16hour}$	49 – 51 dB $L_{Aeq,8hour}$	Low Risk	
≤ 53 dB $L_{Aeq,16hour}$	≤ 48 dB $L_{Aeq,8hour}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 12 – AVO Guide (2020) Level 1 Risk Assessment

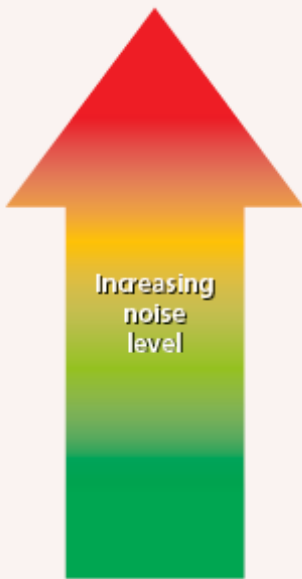
Level 2 Risk Assessment:

A 'Level 2' assessment of noise is recommended where a dwelling using purge ventilation (e.g., open windows) reaches Level 1 'High Risk' or 'Medium Risk'. The Level 2 assessment guidance comments that where internal ambient noise levels are >50 dB $L_{Aeq,16hr}$ (day) or >42 dB $L_{Aeq,8hr}$ (night) then the outcome might be that the noise causes a material change in behaviour, e.g., having to keep windows closed for the majority of the time, or there is the potential for sleep disturbance.

To conduct a Level 2 assessment, the following minimum information is required:

- Statement of the overheating criteria being applied.
- Description of the provisions for meeting the stated overheating criteria. This should include, where relevant, the area of façade opening.
- Details of the likely internal ambient noise levels whilst using provisions for mitigating overheating, and the method used to predict these.
- Estimation of how frequently and for what duration such provisions are required to mitigate overheating.
- Consideration of the effect of individual noise events.
- Assessment of the adverse effect on occupants.

The figure below outlines the AVO Guide (2020) guidance for a Level 2 assessment of noise from transport sources relating to the Overheating Condition.

Internal ambient noise level [Note 2]			Examples of Outcomes [Note 5]	
$L_{Aeq,T}$ [Note 3] during 07:00 – 23:00 [Note 6]	$L_{Aeq,sh}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 [Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{A, Fmax}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. Having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.
 Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. [Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{A, Fmax}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response [Note 9]. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

Table 3-3 of AVO Guide (2020)

Figure 8 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Location Plans

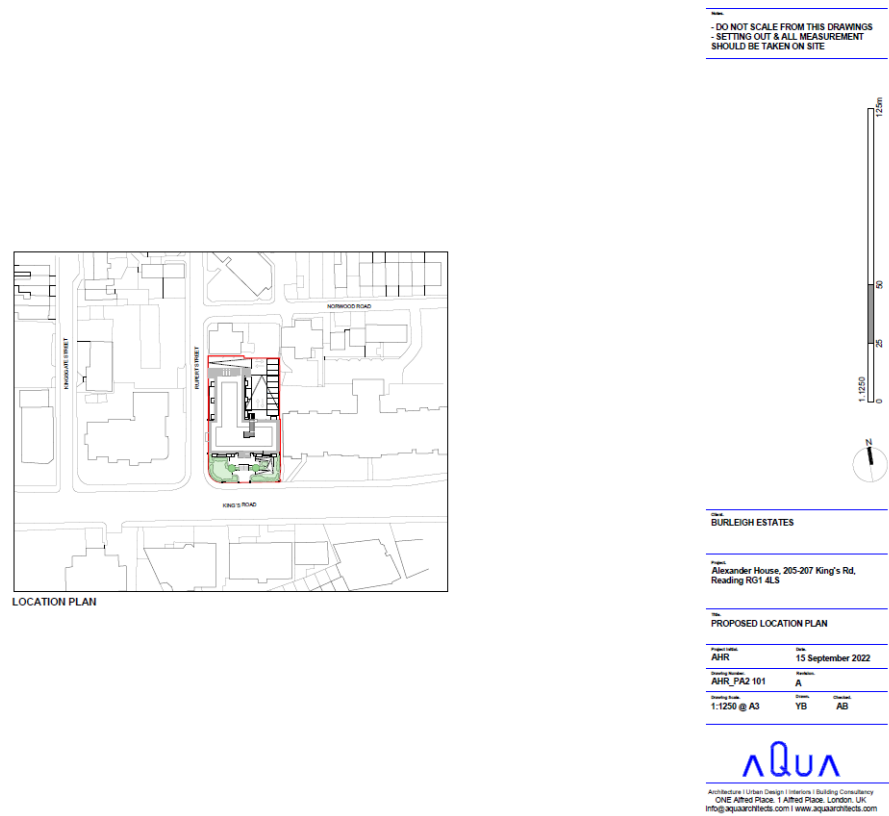


Figure 9 – Location Plans



Figure 10 – Proposed Second Floor

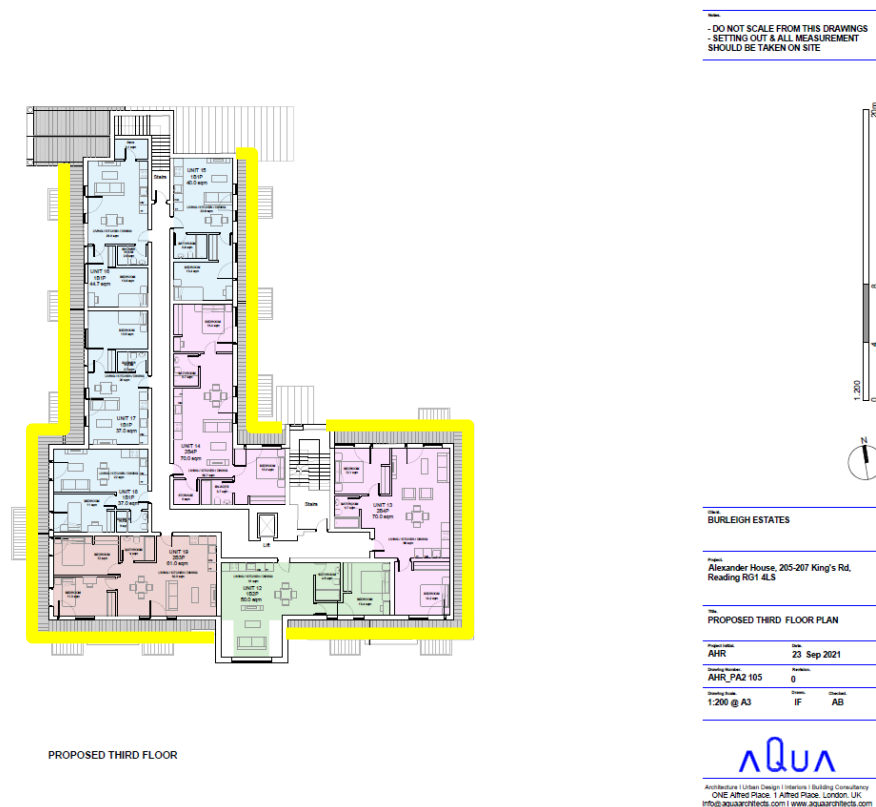
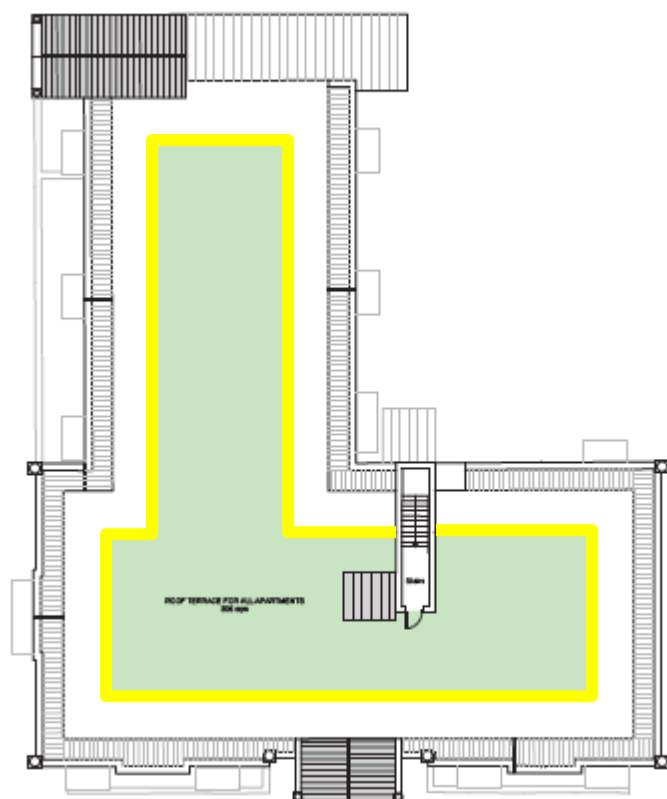


Figure 11 – Proposed Third Floor



Proposed communal roof terrace. Proposed terrace floor plan.

Figure 12 – Proposed Communal Roof Terrace

Appendix D – Environmental Survey

D.1 – Time History Noise Data

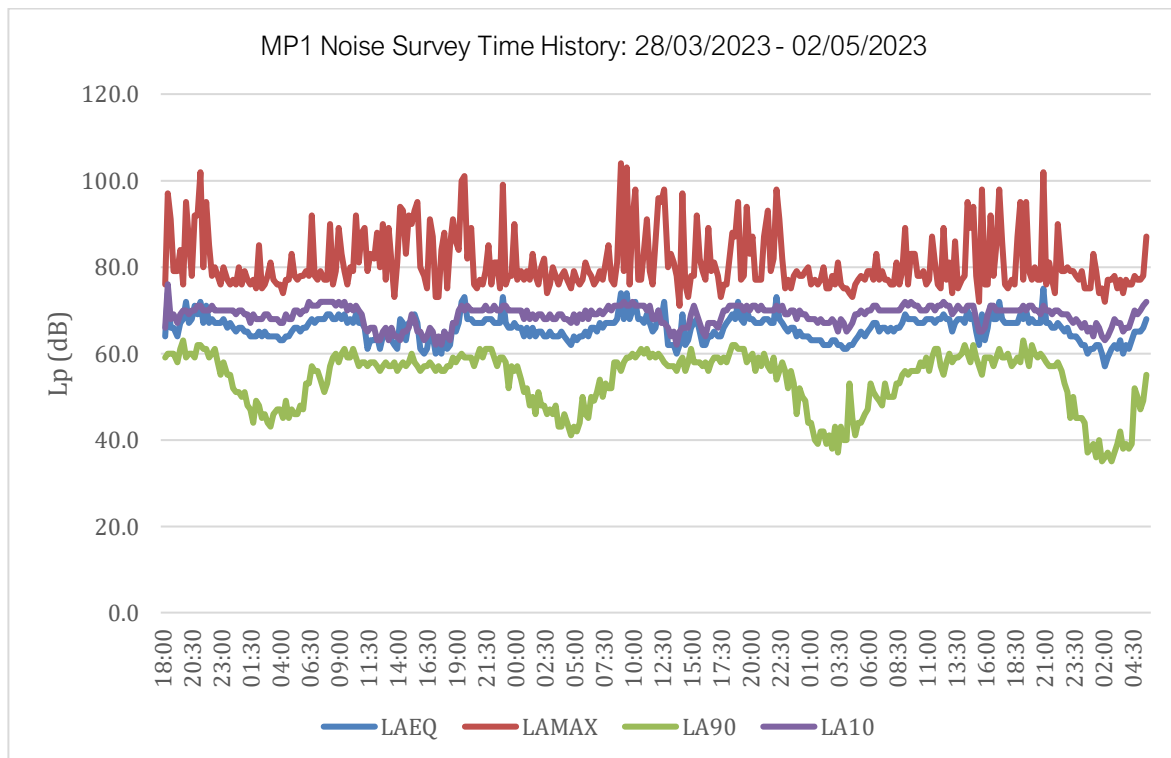


Figure 13 – MP1 Noise Survey Time History

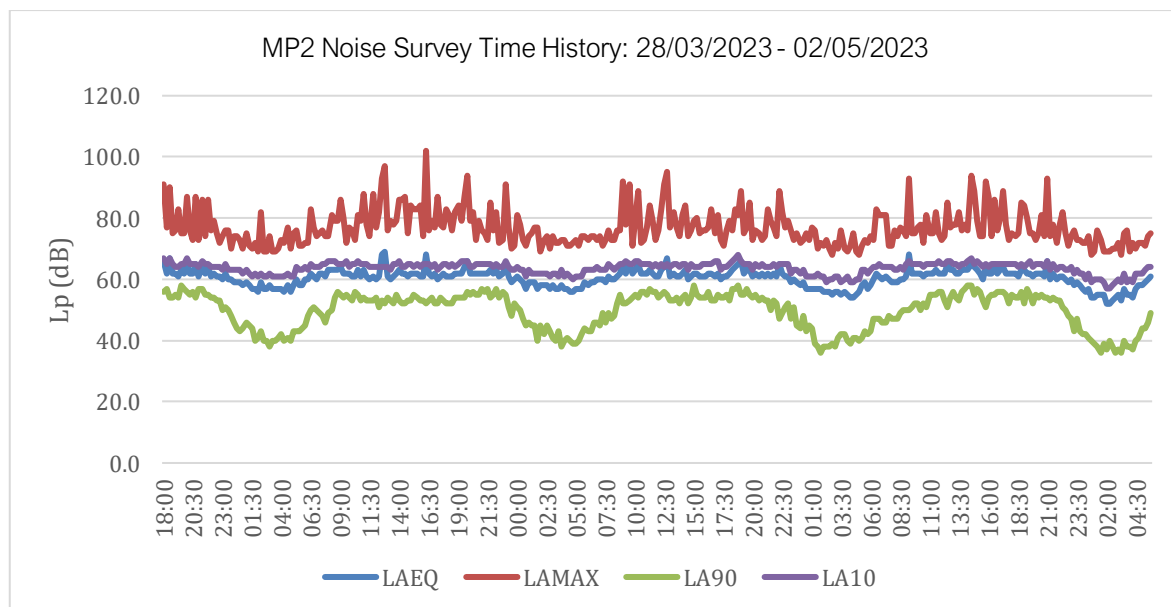


Figure 14 – MP2 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T238593	≤0.2
CESVA CB006 Class 1 Calibrator	901013	
CESVA SC420 Class 1 Sound Level Meter	T250680	≤0.2
CESVA CB006 Class 1 Calibrator	902441	

Table 13 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.2 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Armstrong (Approx. 4.2km E of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
28/04/23 – 00:00 – 23:59	10.4 – 18.2	0.0 – 0.3	S	0.0 – 2.6
29/04/23 – 00:00 – 23:59	5.9 – 20.4	0.0	SE	0.0 – 0.8
30/04/23 – 00:00 – 23:59	6.1 – 16.9	0.0	SW	0.0 – 1.7
01/05/23 – 00:00 – 23:59	9.0 – 19.2	0.0 – 0.5	S	0.0 – 3.0
02/05/23 – 00:00 – 23:59	6.4 – 16.3	0.0	E	0.0 – 1.7

Table 14 – Weather Conditions

Appendix E – Noise Break-in Calculations

The façade sound reduction and predicted internal noise levels are calculated assuming the following:

- The calculation method for façade sound reduction is in accordance with BS8233 and BS EN 12354-3.
- The reverberation time is typically 0.5 and 0.3 seconds across the relevant frequency range for a furnished living room and bedrooms in the UK, respectively.
- Windows areas and room volumes have been taken from the technical drawings provided to UK Building Compliance. Detailed details can be provided upon request.
- The acoustic performance of the façade elements is taken from the relevant manufacturer's technical information or the sound reduction has been predicted using INSUL 9.0. The roof on the third floor needs to provide a minimum sound reduction of 56 dB R_w . An example of construction build-up that would provide adequate sound reduction is:
 - o 8mm roofing slates
 - o 4mm membrane
 - o 200mm joists with resilient bar, filled with 100mm insulation (RWA45)
 - o 2no. 15mm SoundBloc plasterboard
- For background trickle ventilation a total Equivalent Area of 5000mm² per habitable room has been used in the calculations, which equates to 2 No. trickle vents (2500mm² each).

Living Room (Red Façade) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	69	70	64	63	61	66	64	52
Glazing Noise Ingress	32	44	37	36	26	26	24	5
Ventilation Noise Ingress	29	42	26	26	27	22	24	9
Wall Noise Ingress	8	25	14	11	-1	3	1	-11
Roof Noise Ingress								
Room Absorption Correction		-2	-2	-3	-3	-3	-4	-5
Total Noise Ingress	34	47	38	37	29	27	26	9
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-1	-12	-10	-2	-4	-3	0	-15

Bedroom (Red Façade) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	69	70	64	63	61	66	64	52
Glazing Noise Ingress	29	40	33	32	22	22	20	1
Ventilation Noise Ingress	17	39	17	17	10	10	-2	-16
Wall Noise Ingress	4	21	10	7	-5	-1	-3	-15
Roof Noise Ingress	15	37	17	11	4	9	7	-5
Room Absorption Correction		2	2	1	1	1	0	-1
Total Noise Ingress	33	49	38	37	27	27	24	5
NR30	35	59	48	39	33	30	26	24
Exceedance of Criteria	-2	-10	-10	-2	-6	-3	-2	-19

Bedroom (Red Façade) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	66	66	57	58	59	63	59	47
Glazing Noise Ingress	25	36	26	27	20	19	15	-4
Ventilation Noise Ingress	13	35	10	12	8	7	-7	-21
Wall Noise Ingress	0	17	3	2	-7	-4	-8	-20
Roof Noise Ingress	11	33	10	6	2	6	2	-10
Room Absorption Correction		2	2	1	1	1	0	-1
Total Noise Ingress	29	45	31	32	25	24	19	0
NR25	30	55	43	35	28	25	21	19
Exceedance of Criteria	-1	-10	-12	-3	-3	-1	-2	-19

Bedroom (Red Façade) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	79	79	70	71	72	76	72	60
Glazing Noise Ingress	38	50	40	41	34	33	29	10
Ventilation Noise Ingress	26	49	24	26	22	21	7	-7
Wall Noise Ingress	13	30	16	15	6	9	5	-7
Roof Noise Ingress	24	46	23	19	15	19	15	3
Room Absorption Correction		2	2	1	1	1	0	-1
Total Noise Ingress	43	58	45	45	38	37	33	13
NR40	45	67	56	49	43	40	37	34
Exceedance of Criteria	-2	-9	-11	-4	-5	-3	-4	-21

Figure 15 – Noise Break-In Calculation – Red Façade

Living Room (Amber Façade) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	64	69	64	62	59	60	57	46
Glazing Noise Ingress	25	38	32	30	19	15	12	-6
Ventilation Noise Ingress	21	36	21	20	20	11	12	-2
Wall Noise Ingress	1	19	9	5	-8	-8	-11	-22
Roof Noise Ingress	12	36	17	10	2	3	0	-11
Room Absorption Correction		4	4	3	3	3	2	1
Total Noise Ingress	33	49	39	37	29	23	21	4
NR30	35	59	48	39	33	30	26	24
Exceednce of Criteria	-2	-10	-9	-2	-4	-7	-5	-20

Bedroom (Amber Façade) Day Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	64	69	64	62	59	60	57	46
Glazing Noise Ingress	27	40	34	32	21	17	14	-4
Ventilation Noise Ingress	22	38	23	22	22	13	14	0
Wall Noise Ingress	2	21	11	7	-6	-6	-9	-20
Roof Noise Ingress	11	35	16	9	1	2	-1	-12
Room Absorption Correction		3	2	2	2	2	1	0
Total Noise Ingress	33	49	40	38	29	23	21	5
NR30	35	59	48	39	33	30	26	24
Exceednce of Criteria	-2	-10	-8	-1	-4	-7	-5	-19

Bedroom (Amber Façade) Night Time Leq

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Measured Leq,T	59	63	56	54	54	56	52	40
Glazing Noise Ingress	20	34	26	24	16	13	9	-10
Ventilation Noise Ingress	17	32	15	14	17	9	9	-6
Wall Noise Ingress	-4	15	3	-1	-11	-10	-14	-26
Roof Noise Ingress	5	29	8	1	-4	-2	-6	-18
Room Absorption Correction		3	2	2	2	2	1	0
Total Noise Ingress	27	43	32	30	24	19	16	-1
NR25	30	55	43	35	28	25	21	19
Exceednce of Criteria	-3	-12	-11	-5	-4	-6	-5	-20

Bedroom (Amber Façade) Night Time Max

Item / Description	dB(A)	63	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	76	80	73	71	71	73	69	57
Glazing Noise Ingress	37	51	43	41	33	30	26	7
Ventilation Noise Ingress	34	49	32	31	34	26	26	11
Wall Noise Ingress	13	32	20	16	6	7	3	-9
Roof Noise Ingress	22	46	25	18	13	15	11	-1
Room Absorption Correction		3	2	2	2	2	1	0
Total Noise Ingress	44	60	49	47	41	36	33	16
NR40	45	67	56	49	43	40	37	34
Exceednce of Criteria	-1	-7	-7	-2	-2	-4	-4	-18

Figure 16 – Noise Break-In Calculation – Amber Façade

Living Room (Green Façade) Day Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	50	50	48	45	46	43	32
Glazing Noise Ingress	17	22	24	13	4	-1	-6
Ventilation Noise Ingress	14	12	8	7	12	4	-9
Wall Noise Ingress	-13	-5	-9	-22	-22	-25	-36
Roof Noise Ingress	-1	3	-4	-12	-11	-14	-25
Room Absorption Correction		4	3	3	3	2	1
Total Noise Ingress	25	29	30	20	19	11	0
NR30	35	48	39	33	30	26	24
Exceednce of Criteria	-10	-19	-9	-13	-11	-15	-24

Bedroom (Green Façade) Day Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	50	50	48	45	46	43	32
Glazing Noise Ingress	19	23	25	14	5	0	-5
Ventilation Noise Ingress	16	14	10	9	14	6	-7
Wall Noise Ingress	-11	-3	-7	-20	-20	-23	-34
Roof Noise Ingress	-3	2	-5	-13	-12	-15	-26
Room Absorption Correction		2	2	2	2	1	0
Total Noise Ingress	25	29	31	20	19	11	1
NR30	35	48	39	33	30	26	24
Exceednce of Criteria	-10	-19	-8	-13	-11	-15	-23

Bedroom (Green Façade) Night Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	47	44	42	42	44	40	28
Glazing Noise Ingress	14	17	19	11	3	-3	-9
Ventilation Noise Ingress	13	8	4	6	12	3	-11
Wall Noise Ingress	-16	-9	-13	-23	-22	-26	-38
Roof Noise Ingress	-7	-4	-11	-16	-14	-18	-30
Room Absorption Correction		2	2	2	2	1	0
Total Noise Ingress	21	23	24	17	17	8	-4
NR25	30	43	35	28	25	21	19
Exceednce of Criteria	-9	-20	-11	-11	-8	-13	-23

Bedroom (Green Façade) Night Time Max

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	56	53	51	51	53	49	37
Glazing Noise Ingress	23	26	28	20	12	6	0
Ventilation Noise Ingress	22	17	13	15	21	12	-2
Wall Noise Ingress	-7	0	-4	-14	-13	-17	-29
Roof Noise Ingress	2	5	-2	-7	-5	-9	-21
Room Absorption Correction		2	2	2	2	1	0
Total Noise Ingress	30	32	33	26	26	17	5
NR40	45	56	49	43	40	37	34
Exceednce of Criteria	-15	-24	-16	-17	-14	-20	-29

Figure 17 – Noise Break-In Calculation – Green Façade

Appendix F – Noise Modelling Particulars

The SoundPlan 8.2 noise model has been setup with the following inputs and assumptions:

- To accurately model the land surrounding the development the topographical data has been taken from the EAs 'National LIDAR Programme' on the DEFRA Data Services Platform.
- For the purpose of the assessment, the ground between the source and receiver is considered to consist primarily of acoustically 'soft' surfaces.
- The sound map grid height has been set to 1.5m, however, the noise levels used in the assessment will be taken from the most exposed point on each NSR façade.
- All buildings and any intervening objects have been modelled according to the technical drawings provided by the applicant, and those provided by the LIDAR data.
- A 1m high glass balustrade, with no holes or gaps and providing a minimum surface mass of 10 kg/m², has been modelled around the perimeter of the proposed terraces as shown in yellow in Appendix C.
- The noise levels presented in Table 2 have been used to calibrate the noise model.



NOVA
ACOUSTICS