2 Rugby Chambers
London, WC1N 3QU

Commercial Noise Impact Assessment
Report

Client:
The Governing Body of Rugby School
c/o Tandem Property Asset Management LLP
1st Floor, 11-15 Wigmore Street
London, W1U 1PF

Date:
9 June 2024

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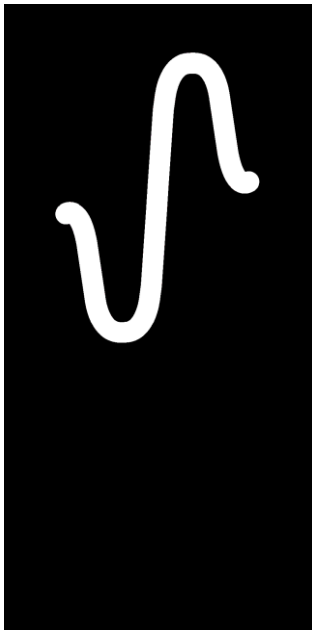

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Document Control

Revision	Date	Author	Description
0	09-06-2024	AJ	-

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Date	09-06-2024

Executive Summary

A change of use (office to residential) is proposed under the General Permitted Development Order at 2 Rugby Chambers on Rugby Street in London. As part of the prior approval process, an assessment of impacts of noise from commercial premises is required. The building lies opposite the Rugby Tavern Public House, and it is commercial noise from the operation of this premises that impacts onto the development.

Jameson Acoustics Limited has been commissioned to undertake a noise impact assessment to assist with the prior approval process. The assessment seeks to demonstrate that commercial noise impacts (from a nearby public house) can be sufficiently mitigated to achieve acceptable acoustic conditions within new dwellings.

The assessment proposes suitable internal noise criteria for habitable rooms with windows closed (normal ventilation conditions) and open (summertime rapid ventilation conditions). These criteria are based on a review of relevant industry design guides and the requirements of the Camden Council.

The assessment finds that, in order to satisfy the proposed criteria, additional noise reduction measures would be required to the proposed south-facing living rooms (i.e. those directly opposite the public house). Two options are proposed; 1- the introduction of secondary glazing with 'staggered openings', and 2- the introduction of mechanical cooling to the affected apartment living rooms to remove reliance on openable windows.

The criteria and recommendations herein shall be subject to the approval of Camden Council.

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Contents

1.0 Introduction

A change of use (office to residential) is proposed under the General Permitted Development Order at 2 Rugby Chambers on Rugby Street in London. As part of the prior approval process, an assessment of impacts of noise from commercial premises is required. The building lies opposite the Rugby Tavern Public House, and it is commercial noise from the operation of this premises that impacts onto the development.

Jameson Acoustics Limited has been commissioned to undertake a noise impact assessment to assist with the prior approval process. The assessment seeks to demonstrate that commercial noise impacts can be sufficiently mitigated to achieve acceptable acoustic conditions within new dwellings.

For a description of the acoustic terminology used herein, please see Appendix A.

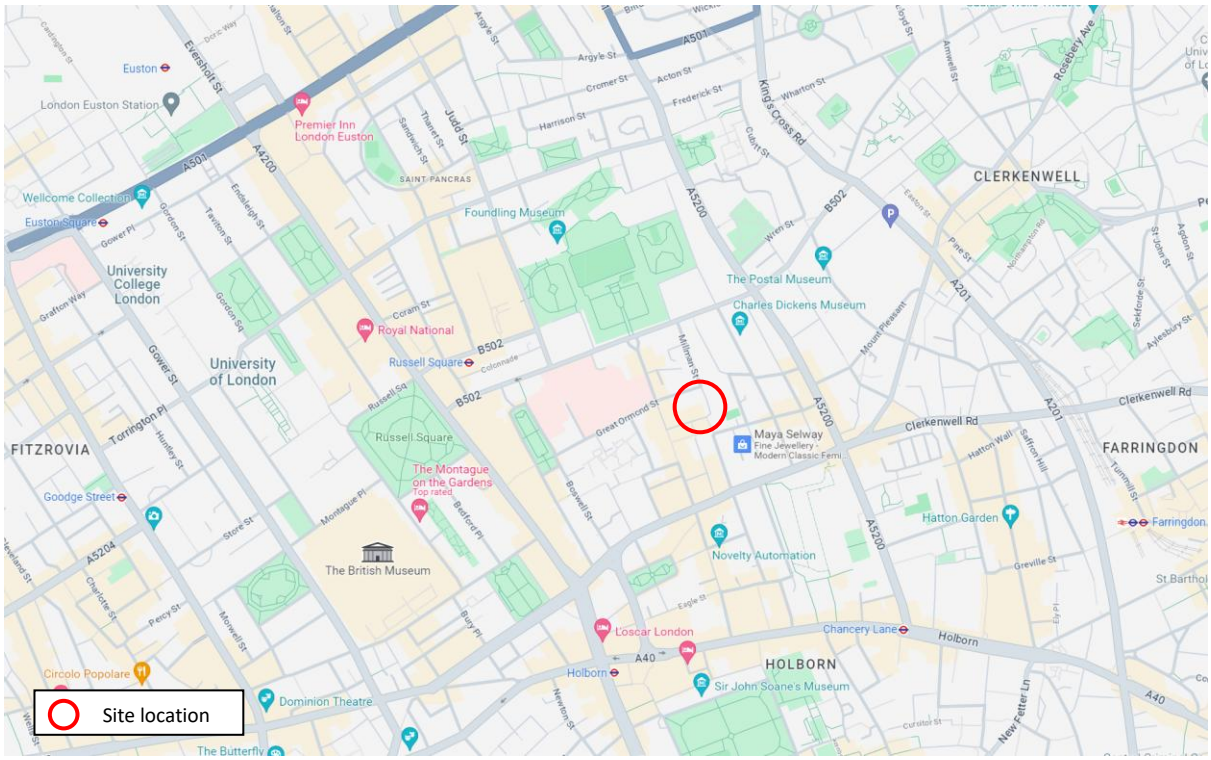
2.0 Objectives

- To review the latest national and local planning policies/requirements and relevant design standards and good practice guides that will inform the noise impact assessments.
- To carry out a manned noise survey on a busy Saturday afternoon/evening period at the Rugby Tavern Public House.
- Based on the survey data, to assess associated commercial noise impacts onto the proposed (residential use) development. The assessment shall evaluate resultant noise levels from commercial operations within proposed apartments (considering windows open and closed). These shall be compared against LPA or good practice design guide targets to determine acceptability.
- To provide guidance on any additional façade noise reduction measures that may be required to achieve acceptable acoustic conditions inside the proposed new apartments.

3.0 Site Description

3.1 Location

The site is located on Rugby Street in the borough of Camden and falls under the jurisdiction of Camden Council. See Location Plan below.



Location Plan (© maps.google.co.uk)

3.2 Description

The building, currently office use, is located on the corner of Rugby Street and Millman Street. The area is predominantly residential. The Rugby Tavern Public House is located across Rugby Street to the south and benefits from an outdoor terrace to the east on a tree-lined pedestrian passage. Each day the terrace area is temporarily sectioned off with tables and chairs put out. During our visit, there were enough chairs to sit circa 24 people although, at times during our visit, other patrons would stand in the area (e.g. to smoke).

Outdoor benches are provided to the front of the pub by the entrance door on Rugby Street. Again, during our visit these benches were used by patrons as a smoking area.

The first floor of the public house is used as a restaurant. During our visit, we were told that windows to the restaurant space are always kept closed during operation and only opened early in the day to purge.

The front elevation of the public house/restaurant is approximately 13 metres from the nearest façade of the proposed development. The centre of the outdoor terrace is approximately 16 metres from the nearest façade of the proposed development.

The public house and restaurant opening hours are:

- Mon-Sat : 11:30 – 23:00 hr (outdoor seating area closed/removed at 22:00 hr)
- Sun : 11:30 – 22:30 hr (outdoor seating area closed/removed at 22:00 hr)

As noted above, the outdoor terrace is closed (tables, chairs and barriers removed) at 22:00hr daily. The restaurant kitchen closes at 21:30 Mon-Sat and 19:00 Sun.

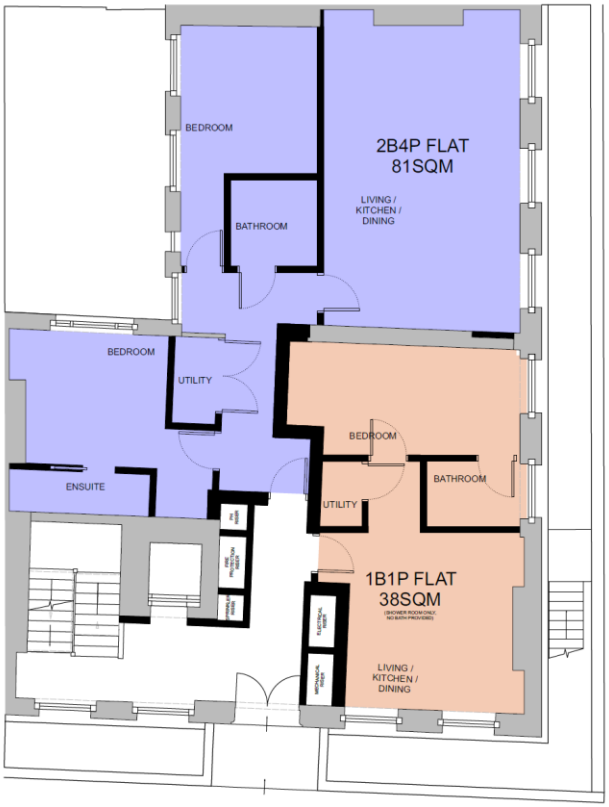
NB: The Public House only plays background music inside the venue. This music noise is inaudible outside of the building.

See Site Plan below.

Satellite Plan (© maps.google.co.uk)

The proposed development will see a change of use from office to residential, with apartments at all levels (lower ground to level 4). At each level, the layouts show apartment living rooms on the south elevation facing the Rugby Tavern. See below the proposed lower ground floor layout and typical ground/upper floor layouts (equivalent layouts at each level).

Proposed Lower Ground Floor Plan



Typical proposed ground and upper floor layout

4.0 Planning Policy, Legislation & Assessment Guides

4.1 National & Local Planning Policy

National planning policies are set out in the following:

- Noise Policy Statement for England [NPSE], 2010;
- National Planning Policy Framework [NPPF], 2021;
- National Planning Practice Guidance – Noise [PPGN], 2019.

In addition, the following local (Greater London) strategic documents have been considered:

- London Environmental Strategy [LES]: Fourth Progress Report, 2024;
- The London Plan, 2021;
- London Housing Supplementary Planning Guidance [SPG], 2016.

These documents provide a qualitative approach to noise assessments. See Appendix B for a detailed description of each.

The London Borough of Camden (LBC) refer to the Local Plan *Appendix 3: Noise Thresholds* in relation to noise assessments. Guidance is provided for 'entertainment' noise sources, which include "amplified and unamplified music, **human voices**, footfall and vehicle movements, and other general activity". The following table summarises LBC's criteria for entertainment noise impacts inside residential buildings.

Room	Noise Rating Level	Period
Bedrooms	NR 25 $L_{eq,5min}$	Night-time (23:00-07:00 hr)
All Habitable Rooms	NR 35 $L_{eq,5min}$	Daytime (07:00-23:00 hr)

4.2 Assessment Guides

For planning and noise, the following industry standards and assessment guides shall be considered.

- ProPG: Planning & Noise, 2017;
- BS 8233: 2014 '*Guidance on sound insulation and noise reduction for buildings'*;
- World Health Organisation [WHO] Environmental Noise Guidelines, 2018;
- Acoustics, Ventilation & Overheating [AVO] Residential Design Guide, 2020.

See Appendix B for a detailed description of each.

5.0 Baseline Environmental Noise Survey

5.1 Procedure

Fully manned noise level measurements were taken between 16:45 and 22:30 hours on Saturday 18 March 2024. A fixed noise logging position was selected at 1 metre from the façade of the proposed development. Further sample handheld noise measurements were taken in and around the public house outdoor terrace, as described and illustrated below.

Position	Measurement Type	Description
1	Continuous logger	On the south elevation of the proposed development. Microphone tied to a fencing rail at the ground floor entrance of the building, 1m from the façade.
2	Handheld	Positioned centrally within the outdoor terrace space. Terrace at full capacity. Microphone in free-field conditions.
3	Handheld	On Millman St, to ascertain 'entertainment' noise levels onto the west facing elevation of the proposed development.
4	Handheld	On the corner of Millman St and Great Ormond St to obtain representative 'residual' noise levels (in the absence of 'entertainment' noise from the Rugby Tavern.

Site Plan showing measurement positions (© maps.google.co.uk)

The microphones were fitted with windshields. At Position 1, the equipment was programme to continuously log noise levels over 5-minute intervals. At Position 2-4, short sample noise level measurements were taken over periods of around 5-minutes. All equipment was set to record the relevant A-weighted broadband (dBA) and linear spectral noise level indices, including L_{eq}, L_{90}, L_{10} and L_{max}.

5.2 Instrumentation

The instrumentation used for the survey is summarised below. The sound level meters were hand-calibrated at the beginning and end of the survey periods. No significant deviations were noted.

Description	Equipment	Serial Nr	Lab Calibration Expiry	Lab Calibration Certificate Nr
Class 1 sound level meter – Position 1	Svantek 971A (with Type 7152 microphone)	124663 (82835)	11 Aug 2024	12 Aug 2022
Class 1 sound level meter – Position 2-4	Cirrus CR:171B (with MK:224 microphone)	G056718 (204055A)	8 Nov 2024	182767 (182766)
Class 1 sound calibrator	Cirrus CR:515	57570	22 Nov 2024	1153776

5.3 Weather Conditions

Weather conditions throughout the survey period were suitable to obtain representative noise level readings without being unduly influenced by weather factors. The sky was clear with patchy cloud cover, temperatures were between 17-23 degrees Celsius, road surfaces were dry and wind speeds were low (below 3 m/s).

5.4 Observed Noise Climate

During our survey, the public house was operating close to what might be considered ‘typical worst-case’. The outdoor seating area was full for the majority of the survey, including a large gathering of students, an after-wedding group and children playing. The after-wedding gathering were filling around half of the internal bar space, spilling out on the terrace and out of the front of the public house (on the benches) throughout the afternoon. The entrance door to the pub was propped open on the front elevation.

Later into the evening the internally bar remained busy, but the outdoor activity dropped (leaving only small groups gathering at the front entrance and on the terrace to smoke). The first floor restaurant was booked at 19:00 for a private event; a large table of 15-20 young males in a celebratory mood (single and cheering).

Noise levels recorded at the building frontage were considered to be dominated by outdoor speech conversations from the outdoor areas of the public house throughout the duration of the survey. This noise subsided after 22:00 hr when the outdoor terrace was closed. By 22:30 hr the noise climate was noted to comprise a mix of occasional speech conversational noise (from one to two smokers outside of the public house) and distant road traffic noise.

5.5 Results & Analysis

The uncorrected results of the noise logging survey at Position 1 have been plotted on Time History Graph 22141-1-G1 enclosed in Appendix C. The graph presents the 5-minute A-weighted (dBA) L_{eq}, L_{90} and L_{max} levels at each position throughout the duration of the survey. These values are 'façade' measurement values.

The readings taken at Positions 2-4 are summarised below.

Position	Start Time	Free-Field Noise Level (dB)		
		$L_{Aeq,5min}$	$L_{A90,5min}$	$L_{Amax,f}$
2	17:00	67	61	82
2	18:15	68	63	80
2	20:05	68	64	77
3	19:50	55	49	67
4	19:55	50	46	61
4	22:20	49	45	59

With a correction applied for façade reflections (-3 dB), the typical highest incident noise levels can be taken as 62 dB $L_{Aeq,5min}$ on the south elevation of the building, and 55 dB $L_{Aeq,5min}$ on the east elevation of the building (from Position 3). The residual noise level (taken from Position 4) can be taken as 50 dB $L_{Aeq,5min}$. By correcting for this residual (i.e. environmental) noise in each octave band, we obtain the following incident free-field 'entertainment' (only) noise level onto the south and east facing façades.

Elevation	Incident Free-Field 'Entertainment' Noise Level (dB), $L_{eq,5min}$							dB
	63	125	250	500	1k	2k	4k	$L_{Aeq,5min}$
South	-[1]	52	53	59	58	54	48	62
East	-[1]	-[1]	47	51	50	44	39	53

[1] More than 10 dB below the residual and therefore non-contributory

6.0 Achieving Internal Noise Levels

6.1 Criteria

In accordance with the documentation presented in Section 4.0, we would propose the following 'entertainment' noise criteria. Note, daytime only noise impacts need to be considered here (public house closing by 23:00 hr, outdoor terrace closed by 22:00 hr).

Room	Normal Ventilation Conditions (Windows Closed)	Summertime Ventilation
All Habitable Rooms (07:00-23:00 hr)	30 dB $L_{Aeq,5min}$ (~NR 25)	40 dB $L_{Aeq,5min}$ (~NR 35)

Consideration has been given the LBC requirement of NR 35 to habitable rooms during the day as a worst-case limit, during the summertime when windows may be partially opened for rapid ventilation to assist with the avoidance of overheating. During normal conditions – windows closed – we would propose a limit that is 5 dB below the BS 8233 internal noise level for anonymous noise sources.

6.2 Building Envelope Acoustic Design

6.2.1 External Walls

The compositing of the external building fabric is not fully known. It comprises a solid stone (ground floor) and rendered brick (upper floors) outer layer and will be thermal insulated and lined internally to meet current residential standards. A pessimistic approach shall be taken to determining the sound reduction performance, considering a single leaf of brick, 100mm insulated cavity and a single layer of 12.5 mm plasterboard. The performance of this construction, as used in our subsequent calculations, is presented below. This is taken from an Insul software calculation with limitations for sound flanking/leakage applied.

Element	Estimated Apparent Sound Reduction, *R'* (dB) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Walls: Brick, insulated cavity, 1 x Plasterboard	28	35	40	45	50	55	55

6.2.2 Framed Window Systems

The existing windows are sliding sash-type with solid timber frames and single glazing (estimated to be circa 6 mm thick panes). With refurbished and suitably sealed timber frames, as proposed for this project, it is likely that the performance of the glass panes will dominate the sound reduction performance. Test data published by Pilkington Glass suggests the below conservative sound reduction performance figures should be achieved by a 6 mm pane of glass (31 dB R_w). A 'flanked' performance estimate has been presented to account for some leakage and reduced performance due to frame and seals based on our experience. It is this flanked performance that shall be used in our assessment.

Element	Sound Reduction, *R* (dB) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Window: 6 mm single glazing (tested)	18[1]	18	23	30	35	27	32
Window: 6 mm single glazing (flanked, sash frame)	18	18	20	25	27	23	27

[1] estimated

With sash windows open (bottom opening) the sound reduction performance can be taken from a research paper, referenced NANR116: 'Open/Closed Window Research' by the Napier University. This document presents octave band test data for various window types in the open/closed position, including bottom opening sash windows. The following table summarises the normalised element level difference for a partially open sash window, taken as providing 100,000 mm^2 free-area. For a typical window size (say 700-800 mm wide), this would equate to an opening height of circa 150-200 mm.

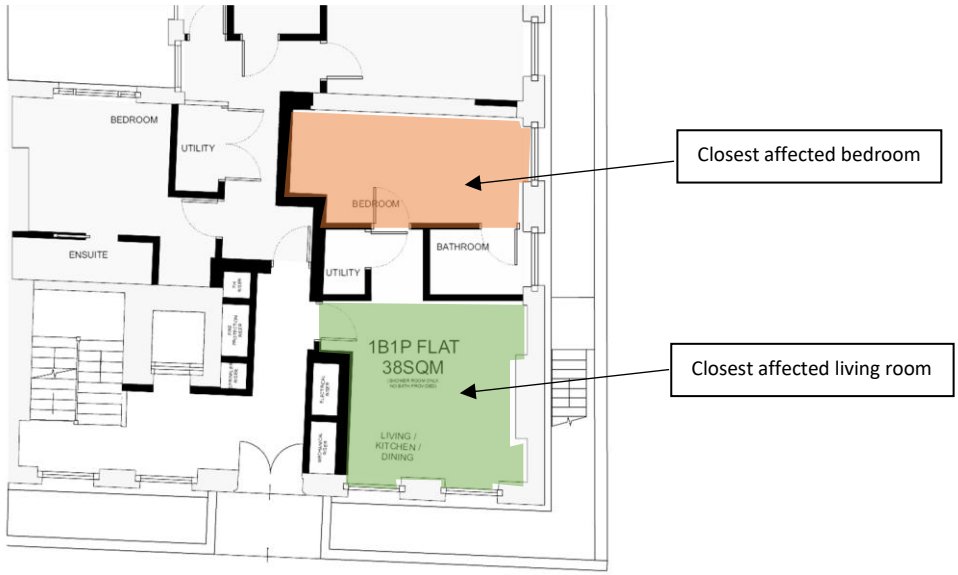
Element	Normalised Weighted Element Level Difference, $D_{n,e}$ (dB) at Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Sash Window (Open) – 150,000 mm²	24	16	13	22	12	17	17

6.2.3 Background Ventilation

Background ventilation (to Part F rates) shall be provided by means of whole-house mechanical ventilation (MVHR), meaning there will be no passive background (trickle) ventilation openings in the façade.

6.3 Assessment.

We have calculated 'entertainment' (from the public house) noise levels inside the closest living rooms and bedrooms, as highlighted below. NB: it is assumed the incident noise level onto the facades of each of these rooms does not change with height up the building, and therefore our calculations are representative of each floor level.



The following tables summarise our calculation results for noise intrusion into these rooms with windows open and closed. The full calculation sheets are presented in Appendix D.

Room	Elevation	Calculated 'Entertainment' Internal $L_{Aeq,5min}$ Noise Level (dB)	
		Window Closed	Window Open
Living Room	South	31	47
Bedroom	East	23	40

The results indicate that, for the closest bedrooms on the east elevation, noise levels fall in line with the proposed criteria under both window conditions. For the living rooms on the south elevation, noise levels exceed the proposed criteria by 1 dB with windows closed and 7 dB with windows partially open.

We would therefore recommend additional noise reduction solutions for the living rooms on the south elevation of the building.

7.0 Noise Reduction Solutions

There are two options to mitigate noise from the operation of the public house to the south facing living rooms of the proposed development.

Option 1: Introduce secondary glazing to the windows
Option 2: Introduce mechanical cooling solutions to the room

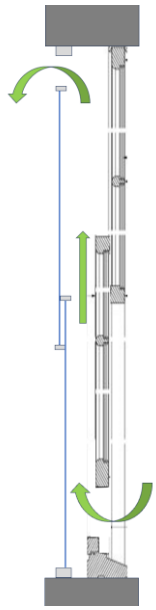
With Option 1, the solution will be sustainable and will deal with both the 1 dB exceedance of the proposed criteria when windows are closed and the 7 dB exceedance when windows are open.

With Option 2, the solution may potentially require more mechanical equipment and would only deal with the 7 dB exceedance when windows are open. The 1 dB exceedance when the windows are closed can be considered negligible but ultimately the acceptance of this approach would be subject to the approval of the LBC. The implementation of mechanical cooling is widely known for 'quality' residential developments. However, the introduction of additional mechanical solutions should be considered carefully; not only with regard to cost and maintenance, but sustainability and the environment, which are factors that carry more importance under LBC's jurisdiction.

Option 1 (secondary glazing):

The solution would require the installation of secondary glazing to each living room window on the south elevation. The secondary glazing should comprise a single 6mm pane of glass in an independent aluminium-framed secondary glazing system installed internally within the window reveals. The system should be installed with a minimum void (clearance) of 50 mm from the primary window system.

The secondary glazing system shall have top and bottom sliding openings. The bottom opening will allow access to open the primary sash window. The user would then close this and slide open the top pane. This would create 'staggered openings', as shown in the Figures below.



Section showing airflow through staggered openings

Photograph showing typical sash and secondary glazed arrangement (secondary with top and bottom opening panels)

In accordance with NANR116 research paper, "a staggered window opening arrangement is 7-10 dB better than for a direct opening". Hence, under summertime conditions with windows partially open this system would be expected to provide the necessary sound reduction to satisfy the proposed design criteria.

A suitable supplier for secondary glazing would be:

Selectaglaze Limited
Contact: Ian Montgomery, or, Colin Bignal
Tel: 01727 837 271
Web: selectaglaze.co.uk

Note, this information does not constitute a recommendation.

Option 2 (mechanical cooling):

The mechanical cooling solution would need to provide sufficient cooling to all living rooms on the south elevation of the building so as to remove any reliance on openable windows as part of the overheating strategy.

Any such systems shall be designed, in conjunction with the MVHR ventilation system, to maintain acceptable (BS 8233) internal noise levels within the apartment as follows:

Living rooms (daytime) : 35 dB $L_{Aeq,16hr}$ (approx. NR 30)
Bedrooms (night-time) : 30 dB $L_{Aeq,8hr}$ (approx. NR 25)

The project's building services consultants should be able to advise on suitable systems. This could be in the form of a dedicated air conditioning system, e.g. split system (with an external condenser and internal fan coil units, fed off the MVHR supply), or a top cooled unit installed onto the MVHR unit.

8.0 Conclusions

A change of use (office to residential) is proposed under the General Permitted Development Order at 2 Rugby Chambers on Rugby Street in London. As part of the prior approval process, an assessment of impacts of noise from commercial premises is required. The building lies opposite the Rugby Tavern Public House, and it is commercial noise from the operation of this premises that impacts onto the development.

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The criteria and recommendations herein shall be subject to the approval of Camden Council.

Appendix A – Acoustic Terminology

dB Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form.

dB(A) The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted (e.g. $L_{Aeq,T}$ in dB). Noise levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is only just perceptible.

$L_{Aeq,T}$ $L_{Aeq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time measurement period, *T*.

$L_{10,T}$ L_{10} is the noise level exceeded for 10% of the measurement period *T* (i.e. the quietest 10% of the measurement) and has, for many years, been used in the assessment of road traffic noise.

$L_{90,T}$ L_{90} is the noise level exceeded for 90% of the measurement period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the 'background' noise level.

L_{max} L_{max} is the maximum sound pressure level recorded over the measurement period, *T*. L_{max} is often used in assessing scheduled environmental noise 'events' (such as train passbys), particularly at night where such events may cause sleep disturbance.

R_w The weighted sound reduction index, R_w, is a single figure description of sound reduction as defined in BS EN ISO 717-1. It is single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The R_w is calculated from sound insulation measurements taken in an acoustic laboratory. Sound insulation ratings derived from site measurements are invariably lower than the laboratory figures and are referred to as the apparent weighted sound reduction index, R'_w.

$D_{n,e,w}$ The weighted element-normalised level difference, $D_{n,e,w}$, is a single figure description of the sound insulation performance of small building elements, such as a trickle ventilator.

C_{tr} C_{tr} is correction term applied against the sound insulation single-number values (e.g. R_w) to provide a weighting against low frequency performance. The reference values used within the C_{tr} calculation are based on urban traffic noise.

Appendix B – Planning Policy & Assessment Guides

Planning Policy

- **Noise Policy Statement for England (NPSE)**

  The Noise Policy Statement for England (NPSE) launched in March 2010 states the long-term vision of Government noise policy is 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*".

  The long-term vision is supported by the following aims; through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

  - 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.

  The intention is that the NPSE should apply to all types of noise apart from noise in the workplace (occupational noise).

  The NPSE introduces a three-tier concept for the assessment of noise impacts onto a receptor:

  - **NOEL – No Observed Effect Level:** The level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

  - **LOAEL – Lowest Observable Adverse Effect Level:** The level above which adverse effects on health and quality of life can be detected.

  - **SOAEL – Significant Observed Adverse Effect Level:** The level above which significant adverse effects on health and quality of life occur.

  There are no numeric thresholds relating to each of the above. The NPSE acknowledges that the severity of noise impacts vary depending upon the type of noise, the type of receptor, the duration (on-time) of the noise, the characteristics of the noise, the time of day, the day of the week, etc.. As a result, the definition of what constitutes an SOAEL is somewhat flexible.

- **National Planning Policy Framework (NPPF)**

  The National Planning Policy Framework (NPPF) was first published in 2012 and sets out the government's planning policies for England and how these are expected to be applied.

  The latest revision of the NPPF (July 2021) states that planning system should **contribute to, and enhance**, the natural and local environment by (amongst others) "*preventing both new and existing development*

from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or ***noise pollution*** *or land stability*."

The express inclusion of noise in the NPPF means that it is a material planning consideration for local planning decisions.

Paragraph 123 of the NPPF document states that planning policies and decisions should aim to:

"A*. Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

B*. Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*

C*. Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*

D*. Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

NPPF advises that decisions relating to planning applications should ensure "…*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."*

To achieve this, new developments should *"mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life"* and should also *"identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*."

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

- **Planning Practice Guidance on Noise (PPG)**

The National Planning Practice Guidance (PPG) is a web-based resource, launched by the Department for Communities and Local Government (DCLG) in March 2014 to support the NPPF and make it more accessible. It advises on how planning can manage potential noise impacts in new development. The guidance is regularly reviewed and updated and noise is listed as a specific category. The guidance is for ad hoc developments, as major infrastructure is covered by overarching National Policy Statements.

PPG provides the following tabulated summary of the effects of noise exposure (in terms of health and quality of life) associated with noise generating and sensitive developments.

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Assessment Guides

- **ProPG: Planning & Noise**

ProPG: Planning & Noise 'Professional Practice Guidance on Planning & Noise' was issued in May 2017 with the primary goal of assisting the delivery of sustainable residential development by promoting good health and well-being through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise.

It is applicable to noise from existing transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise). The recommended approach is also considered suitable where some industrial or commercial noise contributes to the acoustic environment provided that is "not dominant".

ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

The two sequential stages of the overall approach are:

Stage 1 – an initial noise risk assessment of the proposed development site; and
Stage 2 – a systematic consideration of four key elements.
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 considers suitable guidance on internal noise levels found in BS 8233 (see below) with the addition of an $L_{Amax,f}$ requirement for bedrooms at night, as below.

"*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,F}$ more than 10 times a night. 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*."

- **BS 8233: 2014**

British Standard 8233: 2014 '*Sound insulation and noise reduction for buildings*' presents the following desirable internal ambient noise levels for dwellings based on steady external noise sources (e.g. road traffic).

Activity	Location	Desirable Internal Ambient Noise Level	
		07:00 – 23:00	23:00 – 07:00
Resting	Living Rooms	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 $L_{Aeq,8hour}$

BS 8233 states that 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.

For outdoor living spaces, BS 8233 states:

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

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

- **World Health Organisation (WHO)**

The current WHO Environmental Noise Guidelines 2018 for the European Region supersede the 1999 Guidelines for Community Noise, although it does suggest that the 1999 values for indoor noise levels remain valid, as presented below.

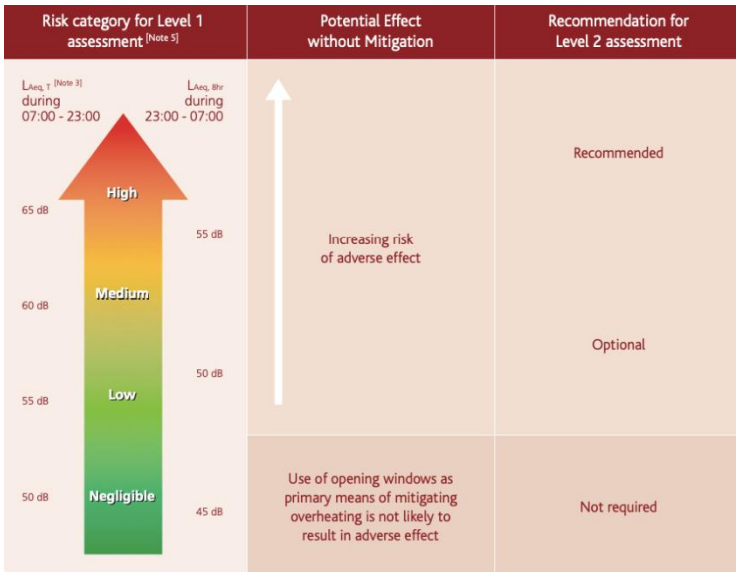
Noise Source	CNG guideline indoors all sources	ENG guideline outdoors noise from specific source only
Road traffic	35 dB $L_{Aeq,\ 16h}$	53 dB L_{den}
	30 dB $L_{Aeq,\ 8h}$	45 dB L_{night}
Railway	35 dB $L_{Aeq,\ 16h}$	54 dB L_{den}
	30 dB $L_{Aeq,\ 8h}$	44 dB L_{night}
Aircraft	35 dB $L_{Aeq,\ 16h}$	45 dB L_{den}
	30 dB $L_{Aeq,\ 8h}$	40 dB L_{night}

With regard to night-time noise "events", WHO states *"In many situations, average noise levels like the L_{den} or L_{night} indicators may not be the best to explain a particular noise effect. Single-event noise indicators – such as the maximum sound pressure level (L_{Amax}) and its frequency distribution – are warranted in specific situations, such as in the context of night-time railway or aircraft noise events that can clearly elicit awakenings and other physiological reactions that are mostly determined by $L_{A,max}$. Nevertheless, the assessment of the relationship between different types of single-event noise indicators and long-term health outcomes at the population level remains tentative. The guidelines therefore make no recommendations for single-event noise indicators."*

- **Acoustics, Ventilation & Overheating Residential Design Guide**

The Acoustics, Ventilation and Overheating Residential Design Guide (Version 1.1) was issued in January 2020 by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA). This document provides guidance on the interdependence between acoustics, ventilation and overheating.

The AVO guide recommends a two-level approach to assess the potential impact of noise ingress through windows that have been opened to mitigate overheating and also noise from any mechanical services used to provide comfort cooling. The level 1 assessment relates to incident environmental noise levels across a proposed site, it is used to define "risk categories" for each building façade based on these levels. These categories are set out below:



At planning stage the level of information required to undertake a level 2 assessment in-line with the AVO guide is often not available and a level 1 assessment, which establishes the risk categories of each proposed façade, would be most suitable.

- **BS 4142:2014**

British Standard BS 4142 looks at the assessment of noise of a commercial / industrial nature. It describes methods for rating and assessing outdoor sound of an industrial and/or commercial nature "*on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident".* In relation to this development, this includes sound from fixed installations, comprising M&E plant and equipment.

The assessment method is based on the difference between the measured 'background sound level' without the influence of any industrial noise source, and the 'rating level' of the industrial source, at the receiver location. The standard states that:

- "*a difference of around +10 dB or more is likely to be an indication of a significant adverse impact*";
- "*a difference of around +5 dB is of marginal significance is likely to be an indication of an adverse impact*";
- "*where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact*".

- **London Environmental Strategy**

  The Mayor of London's Environment Strategy was published in 2018. Chapter 9 of the Environment Strategy relates to Ambient Noise with the aim that "Londoners' quality of life will be improved by reducing the number of people adversely affected by noise and promoting more quiet and tranquil spaces".

  The primary objectives include:

  - Reducing the adverse impacts of noise from transport and non-transport sources;
  - Promoting good acoustic design and quiet and tranquil spaces, giving people respite from the noise of everyday city life.

  The Environment Strategy primarily relates to the control of environmental noise sources, not commercial/entertainment, and is therefore not particularly relevant to this assessment.

- **The London Plan**

  The current version of the London Plan was published in March 2021. It provides the overall Spatial Development Strategy for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years, and provides a strategic, London-wide policy context within which boroughs should set their detailed local planning policies.

  Policy D1 *London's form, character and capacity for growth* identifies assessments shall consider noise levels. Policy D14 relates more specifically to noise and advocates promoting good acoustic design of the inside of buildings with reference to BS 8233: 2014 and ProPG: Planning & Noise.

- **London Housing Supplementary Planning Guidance (SPG)**

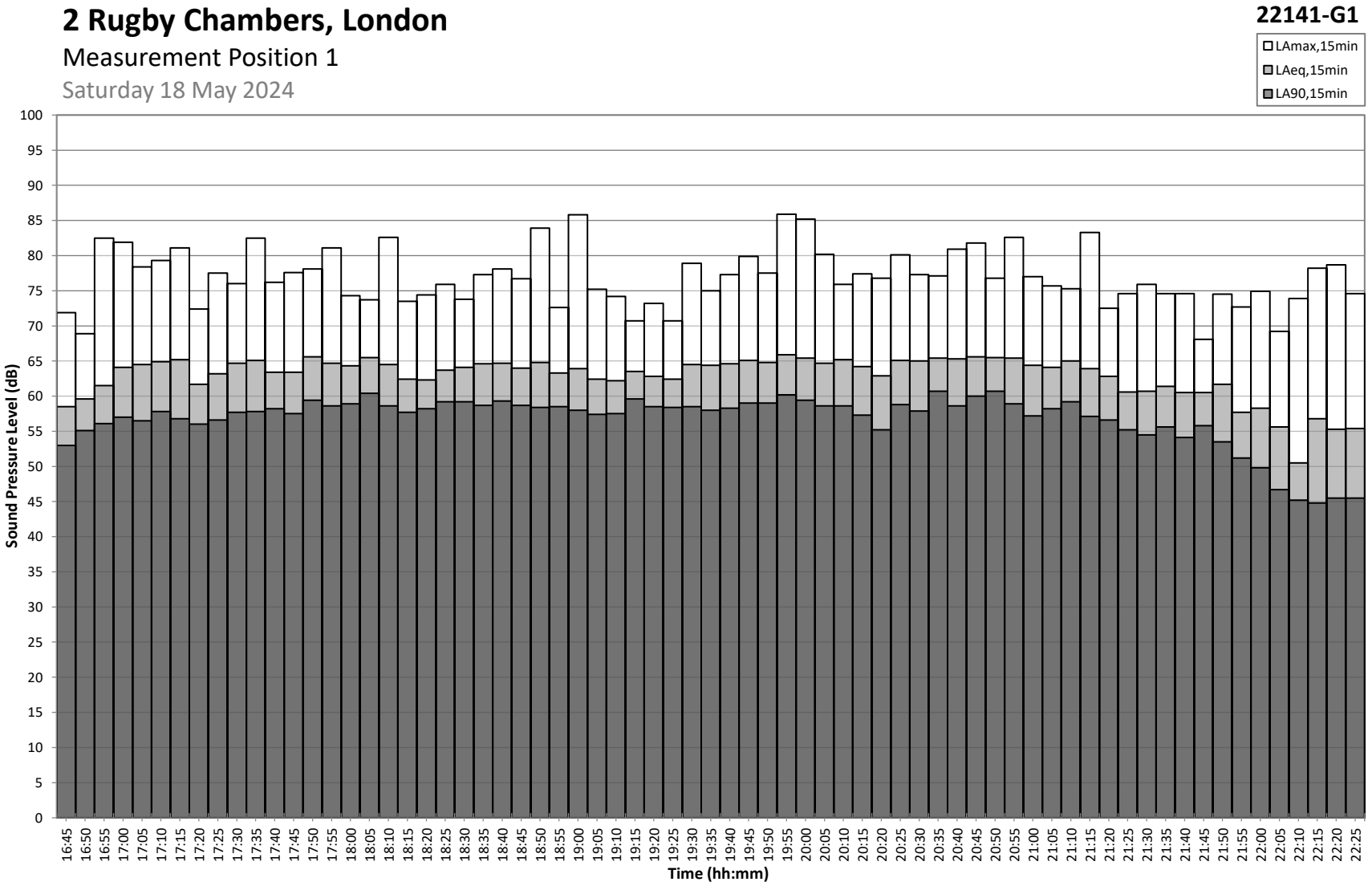
  The Mayor of London's Housing Supplementary Planning Guidance (SPG) was published in 2016 and references the key noise policy (Policy 7.15) of the former London Plan 2016. In Paragraph 1.2.57 it advises that: "*Where housing is located either above or adjacent to an established noise generating land use, appropriate design mitigation measures should be required*".

Appendix C – Noise Survey Time History Graphs

2 Rugby Chambers, London

Measurement Position 1

Saturday 18 May 2024



Appendix D – Calculation Sheets

Living Room (South Elevation) - Windows Closed

$$Lp(int) = Lp(ext) + 10 \times log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_W}{S}10^{\frac{-R_W}{10}} + \frac{S_g}{S}10^{\frac{-R_g}{10}} + \frac{S_r}{S}10^{\frac{-R_r}{10}}\right) + 10 \times log_{10}(\frac{S}{A}) + 3$$

external noise level (free-field)		62	dB								
	size/no.										
wall		15.30	m2								
glazing		4.80	m2								
roof		0.00	m2								
vent		0.00	No.								
room	w (façade)/	6.7	l/	6	h/	3					
reverberation	T (s)	0.5									
corrected RT		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*		
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**		
normalised spectrum	south	*-99*	*-10*	*-9*	*-3*	*-4*	*-8*	*-14*	*-99*		
shifted spectrum		*-37*	*52*	*53*	*59*	*58*	*54*	*48*	*-37*		
Wall:	existing	*28*	*35*	*40*	*45*	*50*	*55*	*55*	*55*	**Rw**	**Config**
Glazing:	A	**18**	**18**	**20**	**25**	**27**	**23**	**27**	**27**	**31**	**6mm single glazing**
Roof:	n/a	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*	**Dne,w**	**Config**
Vent:	A	**99**	**99**	**99**	**99**	**99**	**99**	**99**	**99**	**99**	**none**
Internal Noise Levels		-60	28	27	28	25	25	15	-70	**30.6**	(63-8kHz)

Living Room (South Elevation) - Windows Open

$$Lp(int) = Lp(ext) + 10 \times log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_W}{S}10^{\frac{-R_W}{10}} + \frac{S_g}{S}10^{\frac{-R_g}{10}} + \frac{S_r}{S}10^{\frac{-R_r}{10}}\right) + 10 \times log_{10}(\frac{S}{A}) + 3$$

external noise level (free-field)		62	dB								
	size/no.										
wall		15.30	m2								
glazing		4.80	m2								
roof		0.00	m2								
vent		2.00	No.								
room	w (façade)/	6.7	l/	6	h/	3					
reverberation	T (s)	0.5									
corrected RT		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*		
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**		
normalised spectrum	south	*-99*	*-10*	*-9*	*-3*	*-4*	*-8*	*-14*	*-99*		
shifted spectrum		*-37*	*52*	*53*	*59*	*58*	*54*	*48*	*-37*		
Wall:	existing	*28*	*35*	*40*	*45*	*50*	*55*	*55*	*55*	**Rw**	**Config**
Glazing:	A	**18**	**18**	**20**	**25**	**27**	**23**	**27**	**27**	**31**	**6mm single glazing**
Roof:	n/a	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*	**Dne,w**	**Config**
Vent:	B	**24**	**16**	**13**	**22**	**12**	**17**	**17**	**17**	**-**	**open window**
Internal Noise Levels		-57	37	40	38	46	37	31	-54	**47.3**	(63-8kHz)

Bedroom (East Elevation) - Windows Closed

$$Lp(int) = Lp(ext) + 10 \times log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_w}{S}10^{\frac{-R_w}{10}} + \frac{S_g}{S}10^{\frac{-R_g}{10}} + \frac{S_r}{S}10^{\frac{-R_r}{10}}\right) + 10 \times log_{10}(\frac{S}{A})+3$$

external noise level (free-field)		53	dB						
	size/no.								
wall		6.60	m2						
glazing		2.40	m2						
roof		0.00	m2						
vent		0.00	No.						
room	w (façade)/	3	l/	6	h/	3			
reverberation	T (s)	0.5							
corrected RT		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
normalised spectrum	east	*-99*	*-99*	*-6*	*-2*	*-3*	*-9*	*-14*	*-99*
shifted spectrum		*-46*	*-46*	*47*	*51*	*50*	*44*	*39*	*-46*
Wall:	existing	*28*	*35*	*40*	*45*	*50*	*55*	*55*	*55*
Glazing:	A	**18**	**18**	**20**	**25**	**27**	**23**	**27**	**27**
Roof:	n/a	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*
Vent:	A	**99**	**99**	**99**	**99**	**99**	**99**	**99**	**99**
Internal Noise Levels		-69	-69	22	21	17	15	6	-79

Rw	Config
31	6mm single glazing
Dne,w	Config
99	none

	(63-8kHz)
22.5	

Bedroom (East Elevation) - Windows Open

$$Lp(int) = Lp(ext) + 10 \times log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{n,e}}{10}} + \frac{S_w}{S}10^{\frac{-R_w}{10}} + \frac{S_g}{S}10^{\frac{-R_g}{10}} + \frac{S_r}{S}10^{\frac{-R_r}{10}}\right) + 10 \times log_{10}(\frac{S}{A})+3$$

external noise level (free-field)		53	dB						
	size/no.								
wall		6.60	m2						
glazing		2.40	m2						
roof		0.00	m2						
vent		1.00	No.						
room	w (façade)/	3	l/	6	h/	3			
reverberation	T (s)	0.5							
corrected RT		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
normalised spectrum	east	*-99*	*-99*	*-6*	*-2*	*-3*	*-9*	*-14*	*-99*
shifted spectrum		*-46*	*-46*	*47*	*51*	*50*	*44*	*39*	*-46*
Wall:	existing	*28*	*35*	*40*	*45*	*50*	*55*	*55*	*55*
Glazing:	A	**18**	**18**	**20**	**25**	**27**	**23**	**27**	**27**
Roof:	n/a	*99*	*99*	*99*	*99*	*99*	*99*	*99*	*99*
Vent:	B	**24**	**16**	**13**	**22**	**12**	**17**	**17**	**17**
Internal Noise Levels		-66	-61	35	30	39	28	23	-62

Rw	Config
31	6mm single glazing
Dne,w	Config
-	open window

	(63-8kHz)
39.6	