330 Gray's Inn Road London

Environmental Noise Survey and Acoustic Design Statement Report

26609/ADS2

28 February 2023

For:
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Document Control

Rev	Date	Comment	Prepared by	Authorised by
1	28/02/2023	Minor changes following client's and design team's comments		
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Hann Tucker Associates

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Contents

Attachments

1.0 Introduction

We have previously prepared an Environmental Noise Survey and Acoustic Design Statement Report submitted together with planning application of project **The Royal National Throat, Nose and Ear Hospital, 330 Gray's Inn Road**. The planning permission was granted dated 20 July 2022 subject to conditions. Since then, the project proposal has undergone minor amendments and therefore this report has been updated accordingly, to be accompanied with the forthcoming planning application under Section 73 for **The Royal National Throat, Nose and Ear Hospital, 330 Gray's Inn Road.**

2.0 Objectives

To undertake an environmental noise survey to establish the existing L_{Amax}, L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at selected accessible positions.

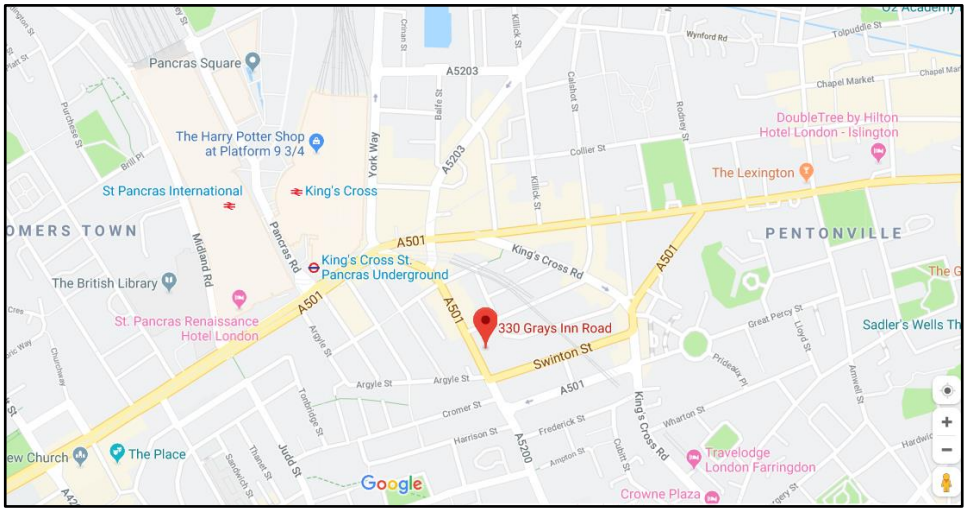
To create a 3D computer noise model of the proposed scheme and surrounding area.

Based on the results of the survey, to calibrate the noise model and use the results to undertake a noise assessment to assess the suitability of the site for residential use in accordance with the Noise Policy Statement for England (NPSE), National Planning Policy Framework (NPPF), Planning Practice Guidance (ProPG), British Standard BS8233:2014 and Local Authority requirements.

3.0 Site Description

3.1 Location

The site is located at 330 Gray's Inn Road, London. The location is shown in the Location Map below.



Location Map © Google 2019

The site falls within the jurisdiction of Camden Council.

3.2 Description

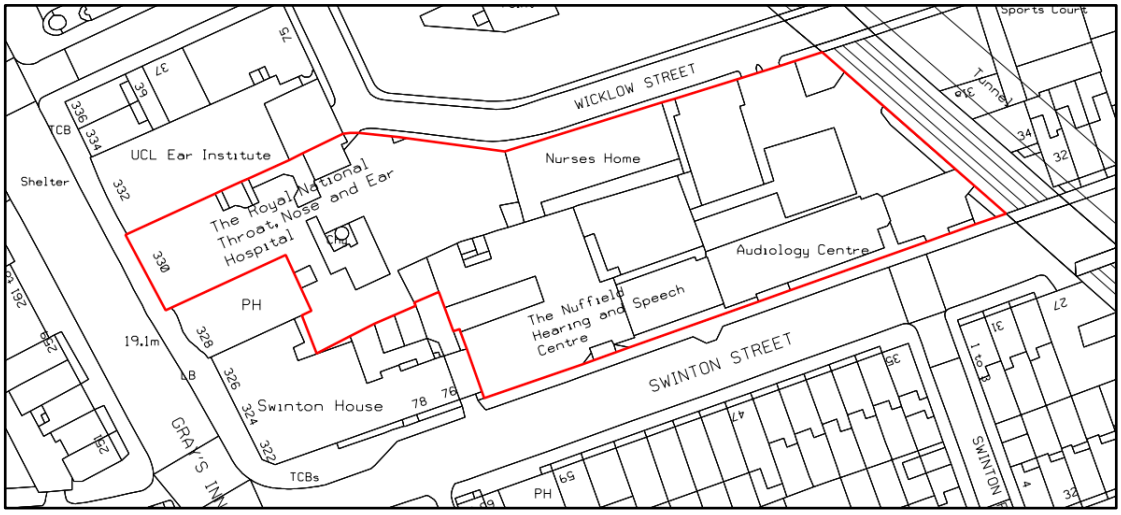
The site is bound to the north in part by the UCL Ear Institute and in part by Wicklow Street and railway cuttings to the east; Swinton Street to the south and Gray's Inn Road runs along the site's western boundary. The site sits towards the centre of the growing Knowledge Quarter within the eastern section of the area.

The site is immediately adjoined by Swinton House and the Water Rats public house to the south on Gray's Inn Road, and to the north by UCL Centre for Auditory Research Ear Institute and 334-336 Gray's Inn Road to north.

Within the immediate vicinity the prevailing development is characterised by a mix of commercial, residential and hotel uses.

The site is currently occupied by a number of buildings which have previously made up the Royal National Throat, Nose and Ear (RNTNE) Hospital. The former hospital comprised a number of departments occupying buildings of different scales and ages. The hospital is now closed and services have transferred to the new Royal National ENT and Eastman Dental Hospitals on Huntley Street, London, WC1E 6DG.

See Site Plan showing site boundary (in red) below.



Site Plan (Reproduced from Pre App documentation).

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Methodology

The survey was undertaken by Luke Rendell MSc, Ba(Hons), MIOA and assisted by Bo Ding Phd, MSc, BSc(Hons), MIOA.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 14:00 hours on 2 July 2019 to approximately 14:00 hours on Monday 7 July 2019 at Positions 1-4 and from approximately 13:30 hours on 9 July 2019 to approximately 13:30 hours on 12 July 2019 at Position 5.

During the periods we were on site the wind conditions were calm. The sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions remained the same. These conditions are considered suitable for obtaining representative measurement results.

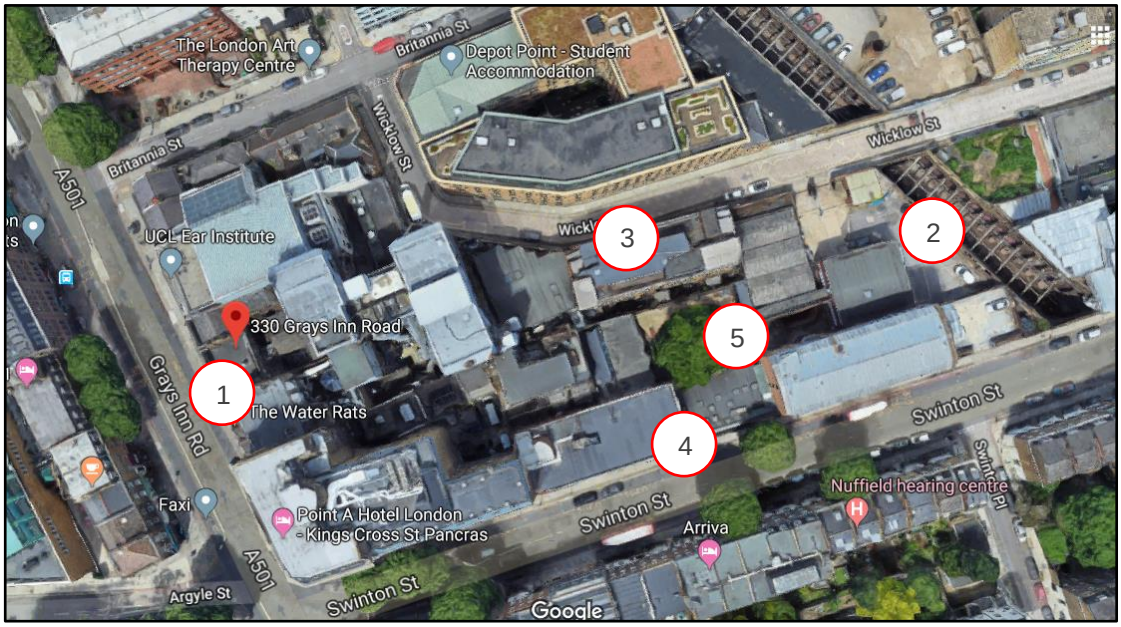
Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

5.2 Measurement Positions

The noise level measurements were undertaken at 5No. positions as described in the table below.

Position No	Description
1	The sound level meter was located externally at first floor flat roof level at the western edge of the site. The microphone was mounted to a pole and positioned at 1m from the building façade, overlooking Gray's Inn Road at first floor slab level, approximately 3m horizontally from the roadside.
2	The sound level meter was located externally at the eastern edge of the site in the external service yard/staff car park. The microphone was attached to a pole and mounted to the boundary fence approximately 3m above ground level. The top of the boundary fence leans over the railway line such that the microphone had a clear line of sight to trains on both railway tracks.
3	The sound level meter was located externally to the north of the site at fourth floor roof level. The microphone was attached to the handrail at 1.2m above fourth floor level overlooking Wicklow Street.
4	The sound level meter was located externally to the south of the site at third floor roof level. The microphone was mounted to a pole and positioned at 1m from the façade of the building at 3rd floor level.
5	The sound level meter was located externally in the central courtyard. The microphone was attached to railings at a height of approximately 1.5m above ground level. This position was screened from road and rail traffic.

The positions are shown on the plan below.



Plan showing measurement positions © Google 2019.

5.3 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Position 1 Type 1 ½" Condenser Microphone	PCB	377B02	139312	Calibration on 20/06/2018
Position 1 Preamp	Larson Davis	PRM902	5161	Calibration on 20/06/2018
Position 1 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3443	Calibration on 20/06/2018
Position 2 Type 1 ½" Condenser Microphone	ACO Pacific	7052E	67983	Calibration on 06/02/2019
Position 2 Preamp	Svantek	SV18	71464	Calibration on 06/02/2019
Position 2 Type 1 Data Logging Sound Level Meter	Svantek	971	80233	Calibration on 06/02/2019
Position 3 Type 1 ½" Condenser Microphone	PCB	377B02	132146	Calibration on 09/07/2018
Position 3 Preamp	Larson Davis	PRM902	4215	Calibration on 09/07/2018

Description	Manufacturer	Type	Serial Number	Calibration
Position 3 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3838	Calibration on 09/07/2018
Position 4 Type 1 ½" Condenser Microphone	PCB	377B02	122885	Calibration on 09/07/2018
Position 4 Preamp	Larson Davis	PRM902	3692	Calibration on 09/07/2018
Position 4 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3444	Calibration on 09/07/2018
Position 5 Type 1 ½" Condenser Microphone	PCB	377B02	51311	Calibration on 20/06/2018
Position 5 Preamp	Larson Davis	PRM902	3203	Calibration on 20/06/2018
Position 5 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3053	Calibration on 20/06/2018
Type 1 Calibrator	Bruel & Kjaer	4231	2610161	Calibration on 19/09/2018

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant changes were found to have occurred (no more than 0.1 dB).

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. Each microphone was fitted with a windshield.

6.0 Results

The results have been plotted on Time History Graphs 26609/TH1 to 26609/TH5 enclosed presenting the 5 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at Positions 1-4 and the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at Position 5 throughout the duration of the survey.

The following table presents the measured $L_{Aeq,T}$ noise levels during the survey:

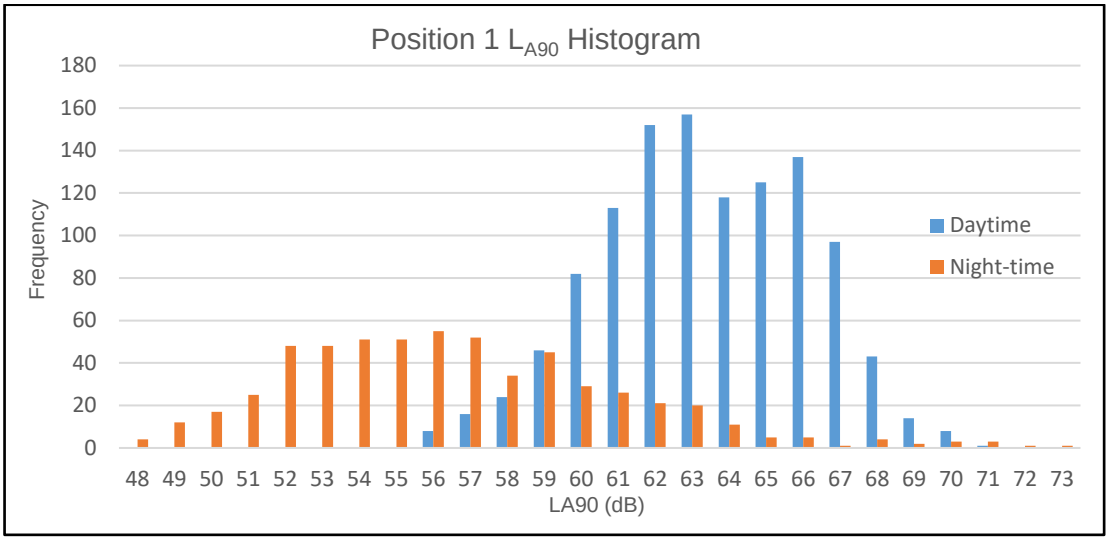
Position	Measured $L_{Aeq,T}$ Noise Level (dB re 2 x 10^{-5} Pa)	
	Daytime (07:00 – 23:00) Hours, $L_{Aeq,16hr}$	Night-Time (23:00 – 07:00) Hours, $L_{Aeq,8hr}$
1	74	73
2	73	68
3	58	55
4	67	65
5	54	52

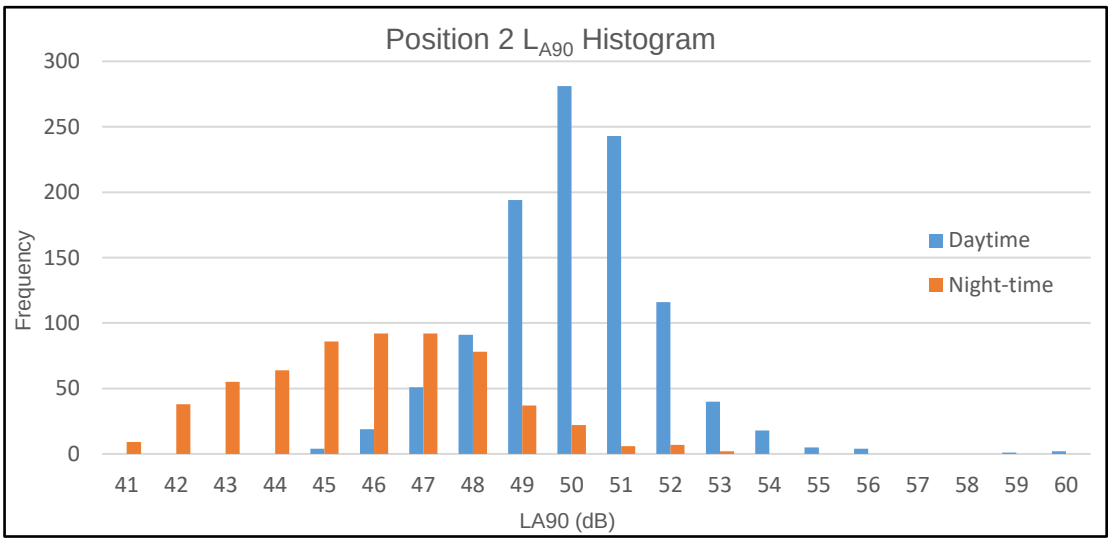
The typical highest L_{Afmax} noise level from the train line at night, measured at Position 2 was found to be 92dBA.

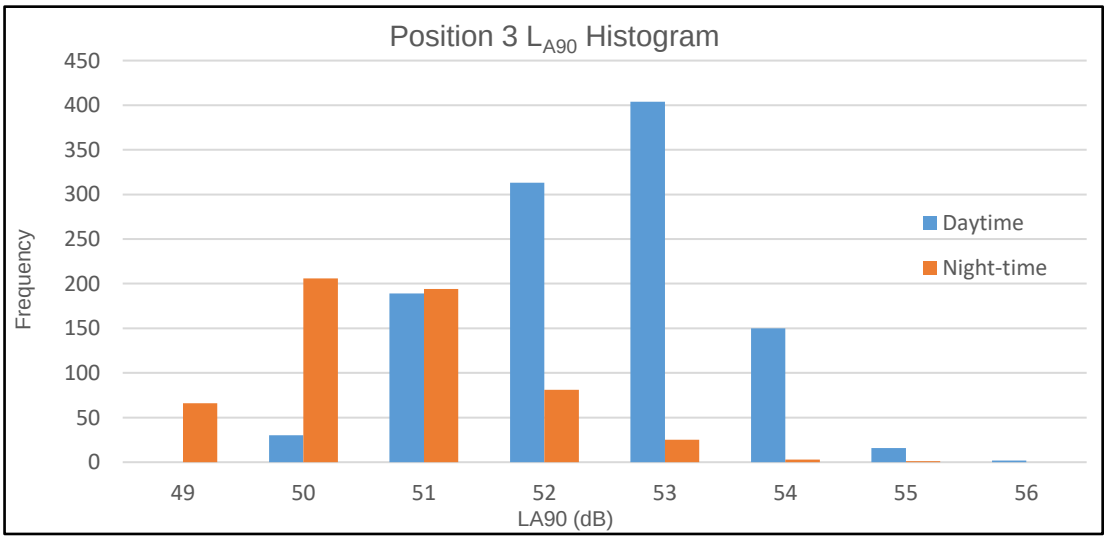
BS4142:2014 states:

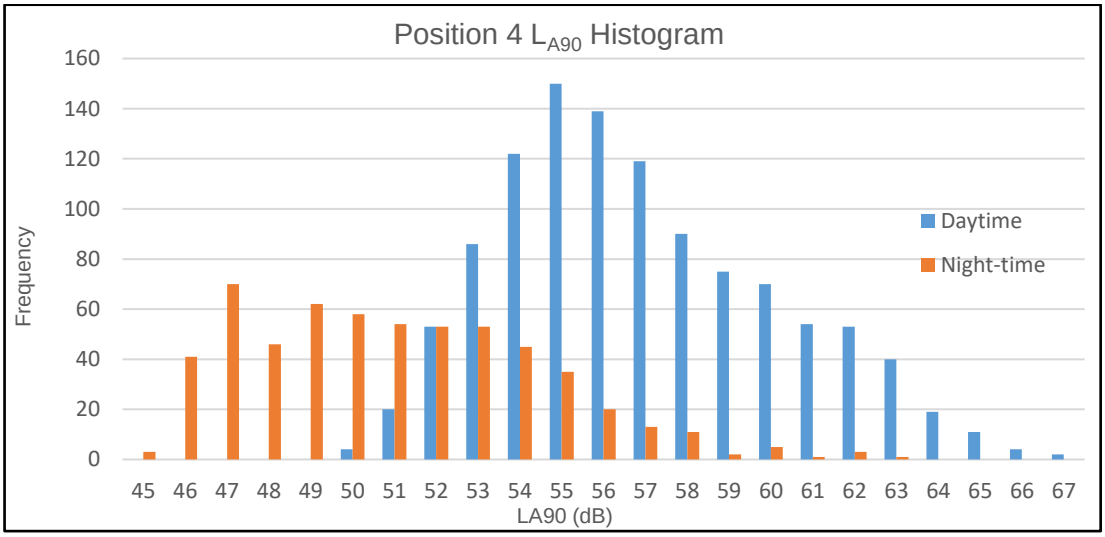
'*To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value.'*

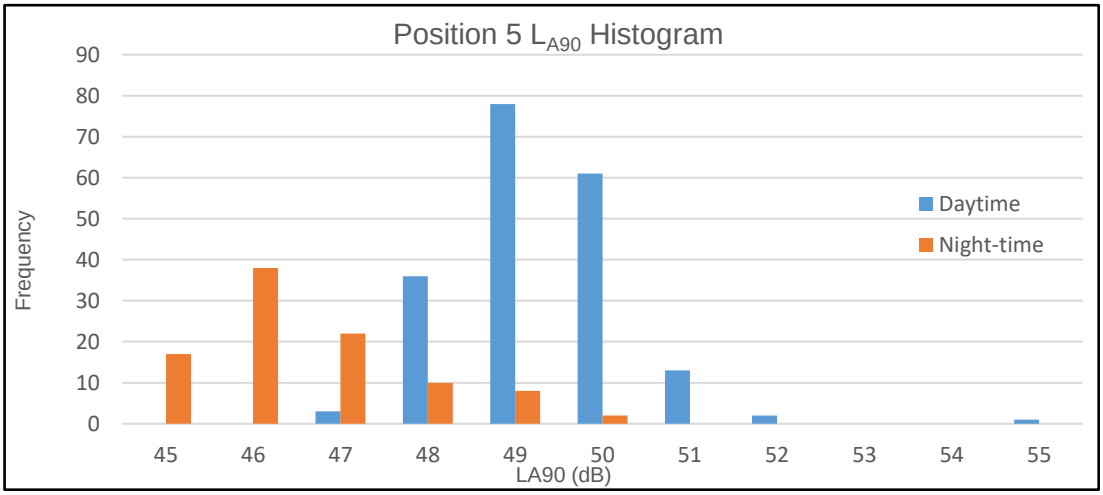
Based on the above, and as per the example given in BS4142:2014 Figure 4, histograms showing the frequency of background L_{A90} noise levels at each position are presented below;


Position 1 L_{A90} Histogram
Frequency
LA90 (dB)
Daytime
Night-time


Position 2 L_{A90} Histogram
Frequency
LA90 (dB)
Daytime
Night-time


Position 3 L_{A90} Histogram
Frequency
LA90 (dB)
Daytime
Night-time





Based on the above histograms, the following table presents the representative measured L_{A90} background noise levels during the survey:

Position	Representative Measured L_{A90} Background Noise Level (dB re 2 x 10^{-5} Pa)	
	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
1	62	52
2	50	45
3	53	50
4	55	47
5	49	46

The following table presents the lowest measured L_{A90} background noise levels during the survey:

Position	Lowest Measured L_{A90} Background Noise Level (dB re 2 x 10^{-5} Pa)	
	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
1	56	48
2	45	41
3	50	49
4	50	45
5	47	45

7.0 Discussion Of Noise Climate

During the periods we were on site the dominant noise sources at Position 1 and 2 were road traffic noise from Gray's Inn Road and the train line respectively. The noise climate at Position 3 was a mixture of train noise, and road traffic from Swinton Street and the surrounding road network. At Position 4 the noise climate was a combination of road traffic noise from Wicklow Street and Gray's Inn Road and train noise, and at Position 5 the noise climate was made up of distant road traffic and railway noise and plant associated with the existing hospital buildings.

8.0 Relevant Planning Policies and Guidance

8.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which 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."

That vision is supported by the following NPSE noise policy aims which are reflected in three of the four aims of planning policies and decisions in paragraph 123 of the NPPF (see paragraph 8.2 (b) below):

"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; and*
- *where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level
This is 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
This is the level above which adverse effects on health and quality of life can be detected.

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

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

8.2 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised February 2019):

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

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

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

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

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

The NPPF document does not refer to any other documents or British Standards regarding nose other than the NPSE.

Paragraph 2 of the NPPF states that "planning law required that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."

Paragraph 12 of the NPPF states that "The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed."

8.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on Noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

8.4 The London Plan (2021)

The London Plan was published March 2021.

Policy D14 Noise states:

A. *"In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:*

1) *avoiding significant adverse noise impacts on health and quality of life*
2) *reflecting the Agent of Change principle as set out in Policy D13*
3) *mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses*
4) *improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)*
5) *separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation*
6) *where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles*
7) *promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

B. *Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations.*

3.14.1 *The **management of noise** is about encouraging the right acoustic environment, both internal and external, in the right place at the right time. This is important to promote good health and a good quality of life within the wider context of achieving sustainable development. The management of noise should be an integral part of development proposals and considered as early as possible. Managing noise includes improving and enhancing the acoustic environment and promoting appropriate soundscapes. This can mean allowing some places or certain times to become noisier within reason, whilst others become quieter. Consideration of existing noise sensitivity within an area*

is important to minimise potential conflicts of uses or activities, for example in relation to internationally important nature conservation sites which contain noise sensitive wildlife species, or parks and green spaces affected by traffic noise and pollution. Boroughs, developers, businesses and other stakeholders should work collaboratively to identify the existing noise climate and other noise issues to ensure effective management and mitigation measures are achieved in new development proposals.

*3.14.2 The **Agent of Change Principle** places the responsibility for mitigating impacts from existing noise-generating activities or uses on the new development. Through the application of this principle existing land uses should not be unduly affected by the introduction of new noise sensitive uses. Regard should be given to noise-generating uses to avoid prejudicing their potential for intensification or expansion.*

*3.14.3 The management of noise also includes promoting **good acoustic design of the inside of buildings**. Section 5 of BS 8223:2014 provides guidance on how best to achieve this. The Institute of Acoustics has produced advice Pro:PG Planning and Noise (May 2017) that may assist with the implementation of residential developments. BS4214 provides guidance on monitoring noise issues in mixed residential/industrial areas.*

*3.14.4 Deliberately **introducing sounds** can help mitigate the adverse impact of existing sources of noise, enhance the enjoyment of the public realm, and help protect the relative tranquillity and quietness of places where such features are valued. For example, playing low-level music outside the entrance to nightclubs has been found to reduce noise from queueing patrons, leading to an overall reduction in noise levels. Water features can be used to reduce the traffic noise, replacing it with the sound of falling water, generally found to be more pleasant by most people.*

*3.14.5 Heathrow and London City Airport Operators have responsibility for noise action plans for airports. Policy T8 Aviation sets out the Mayor's approach to **aviation-related development**.*

*3.14.6 The definition of **Tranquil Areas, Quiet Areas and spaces of relative tranquillity** are matters for London boroughs**.** These are likely to reflect the specific context of individual boroughs, such that Quiet Areas in central London boroughs may reasonably be expected not to be as quiet as Quiet Areas in more residential boroughs. Defra has identified parts of Metropolitan Open Land and local green spaces as potential Quiet*

Areas that boroughs may wish to designate."

8.5 London Plan Sustainable Design and Construction SPG

The London Plan Sustainable Design and Construction SPG provides additional information in the following key areas:

- The sources of noise;
- Ways to mitigate noise emitted by developments;
- Ways to mitigate the impact of noise on developments; and
- Some detailed design considerations.

8.6 Local Planning Policy

The site falls under the jurisdiction of Camden Council. We understand Camden have imposed the following noise conditions related to this development:

"3 Fixed Mechanical Plant Noise

The external noise level emitted from plant, machinery or equipment at the development hereby approved shall be lower than the lowest existing background noise level by at least 10dBA, by 15dBA where the source is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity.

Reason: To safeguard the amenities of neighbouring noise sensitive receptors in accordance with the requirements of policies A1 and A4 of the London Borough of Camden Local Plan 2017.

4 Emergency Plant

Noise emitted from the emergency plant and generators hereby permitted shall not increase the minimum assessed background noise level (expressed as the lowest 24 hour $L_{A90,\ 15\ mins}$) by more than 10dB one metre outside any premises.

The emergency plant and generators hereby permitted may be operated only for essential testing, except when required by an emergency loss of power.

Testing of emergency plant and generators hereby permitted may be carried out only for up to

one hour in a calendar month, and only during the hours 09.00 to 17.00hrs Monday to Friday and not at all on public holidays.

Reason: To safeguard the amenities of neighbouring noise sensitive receptors in accordance with the requirements of policies A1 and A4 of the London Borough of Camden Local Plan 2017.

6 Internal Noise – Compliance

The design and structure of the development shall be of such a standard that it will protect residents within it from existing external noise so that they are not exposed to levels indoors of more than 35dB $L_{Aeq\ 16\ hrs}$ daytime and of more than 30dB $L_{Aeq\ 8hrs}$ in bedrooms at night."

Reason: To ensure that the amenity of occupiers of the development site is not adversely affected by noise in accordance with the requirements of policies D1, A1 and A4 of the London Borough of Camden Local Plan 2017.

8.7 World Health Organisation

The current Environmental Noise Guidelines 2018 for the European Region (ENG) supersede the Guidelines for Community Noise from 1999 (CNG). Nevertheless, the ENG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) remain valid.

A summary of the guidance from the ENG and CNG is shown in the table below.

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

With regard to single-event noise indicators, Section 2.2.2 of the WHO Environmental Noise Guidelines 2018 state:

"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 ($L_{A,max}$) 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."

8.8 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

8.8.1 Internal Areas - Residentials

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	***Location***	***Desirable Internal Ambient Criteria***	
		07:00 – 23:00	***23:00 to 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 $L_{Aeq,8hour}$*

Note 1 The above table provides recommended levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

Note 2 The levels shown in the above table 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 the above table.

Note 3 These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks nigh or News Year's Eve.

Note 4 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.

Note 5 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.

If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

Note 6 Attention is drawn to the Building Regulations.

Note 7 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."

8.8.2 External Amenity Areas

BS823:2014 Section 7.7.3.2 titled "Design criteria for external noise" 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 $L_{Aeq,T}$[1], with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

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

8.9 ProPG : Planning & Noise : 2017

8.9.1 The primary goal of the ProPG is to assist the delivery of sustainable 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".

8.9.2 This 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.

8.9.3 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.

8.9.4 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- 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".

8.9.5 The ProPG considers suitable guidance on internal noise levels found in "BS8233:2014: Guidance on sound insulation and noise reduction for buildings". Table 4 in Section 7.7.2 of the standard suggests that "in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values". The standard states (Section 7.7.1) that "occupants are usually more tolerant of noise without a specific character" and only noise without such character is considered in Table 4 of the standard.

Activity	Location	07:00 – 23:00 Hours	23:00 – 07:00 Hours
Resting	Living Room	35dB $L_{Aeq,16hr}$	-
Dining	Dining Room / Area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,16hr}$ 45dB $L_{Amax,F}$

NOTE 1 the Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table 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 L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 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 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 (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise

levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10dB, they are likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (See Section 3.D).

Figure 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue).

8.10 Office Areas

We have undertaken an investigation of the "industry standards" for design parameters currently used for quality commercial office developments, using a wide range of reference documents. The following table summarises the findings of our investigation:

Design Reference Documents	Office Area Type	
	Small/Cellular	Large/Open-Plan
BCO 2014	NR35 L_{eq}	Open Plan NR40 L_{eq} Speculative NR38 L_{eq}
BCO 2019 (Draft)	NR35 L_{eq}	Open Plan NR40 L_{eq} Speculative NR38 L_{eq}
CIBSE Spec	NR30-35 L_{eq}	NR35 L_{eq}
BS8233: 2014	35-40 dB $L_{Aeq,T}$	45-50 dB $L_{Aeq,T}$
	(NR30-45 L_{eq} equiv approx)	(NR40-45 L_{eq} equiv approx)
BREEAM	Achieve noise levels that comply with BS8233:2014	

- Note: L_{Aeq} – 5dB = NR (approx)
- Note: The BCO speculative office criterion is a compromise between the ideals for open plan and cellular offices.

Also, BCO 2014 states $L_{Amax(fast)}$ noise intrusion levels should not normally be more than 55dBA in open plan/speculative offices or 50dBA in cellular offices, whilst BCO 2019 states "*In addition, to avoid speech interference, regular individual noise events (for example scheduled aircraft or passing trains) should not normally be more than 55 dB $L_{A01,1\ hour}$ in open plan/speculative offices or 50 dB $L_{A01,1\ hour}$ in cellular offices/meeting rooms.*"

9.0 Proposed Design Target Internal Noise Levels

On the basis of the above we propose the following internal noise levels be adopted as design targets in the proposed habitable rooms, hotel guestrooms, and office areas:

9.1 Residential and Hotel

Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (Daytime Resting)	Bedroom/Guestroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Note: For the majority of the site the $L_{Aeq,T}$ noise parameter alone is considered to be sufficient given the character of the noise climate we have measured. This is consistent with Section 2.2.2 of The World Health Organisation Environmental Noise Guidelines for the European Region and Note 4 of Section 7.7.2 of BS8233:2014). For the eastern side of the site where the noise climate includes noise from train passbys L_{Amax} noise levels should also be considered.

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target noise levels may be relaxed (subject to the requirements of any planning conditions) by up to 5 dB and reasonable internal conditions still achieved.

9.2 Office

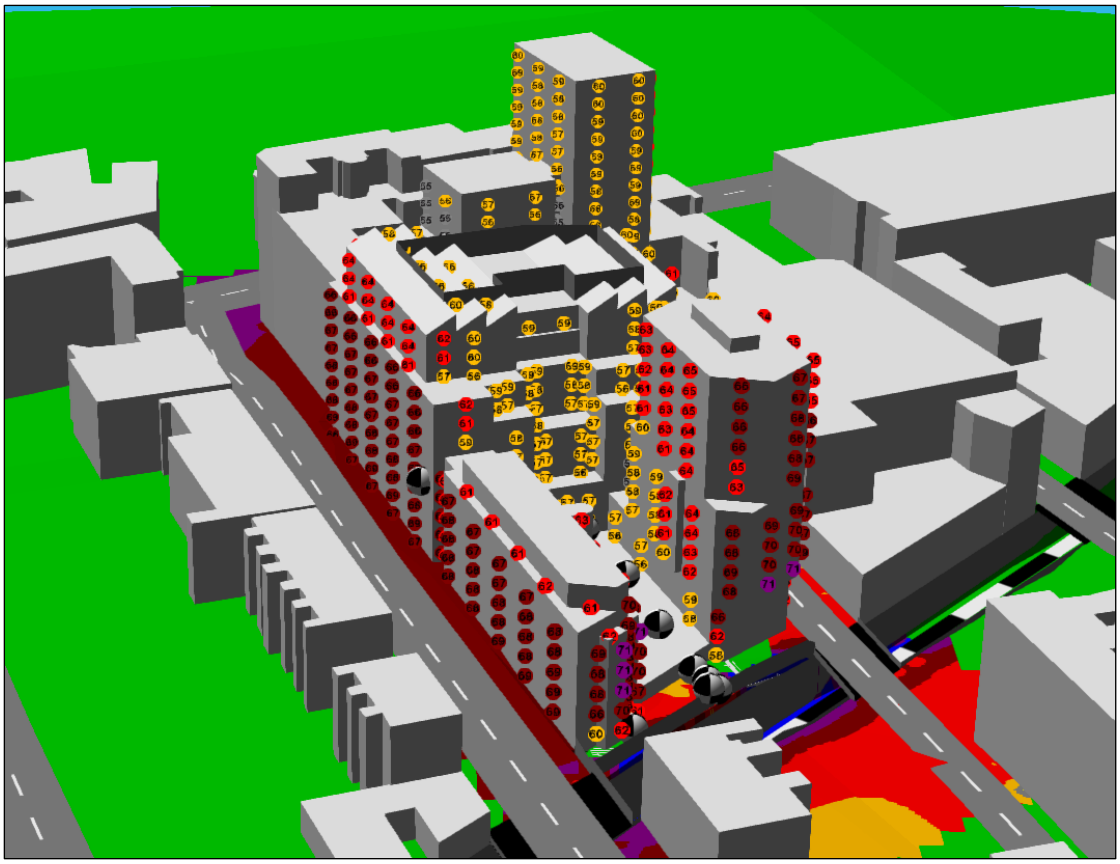
The proposed office building comprises speculative office accommodation so, based on the above and with particular reference to BCO guidance, we propose external noise intrusion levels should, after attenuation by the composite building envelope, not exceed NR38 L_{eq} and 55dB $L_{A01,1hour}$ in office areas when fitted out to a Cat A level of finish and measured in accordance with the Association of Noise Consultants Guidelines for Noise Measurements in Buildings – Part 2: Noise from External Sources 2013 and the time period T is 8 hours between 09:00 and 17:00.

10.0 3D Noise Modelling

A 3D noise model of the proposed scheme and surrounding transportation network has been built using the CadnaA 2022 noise mapping software.

The model, shown below, is based on the latest information received from Allford Hall Monaghan Morris Architects including:

- Drawings number 18116_00_(00)_114, 18116_00_(00)_100M;
- SketchUp Model no. 230109 of Proposed Scheme.

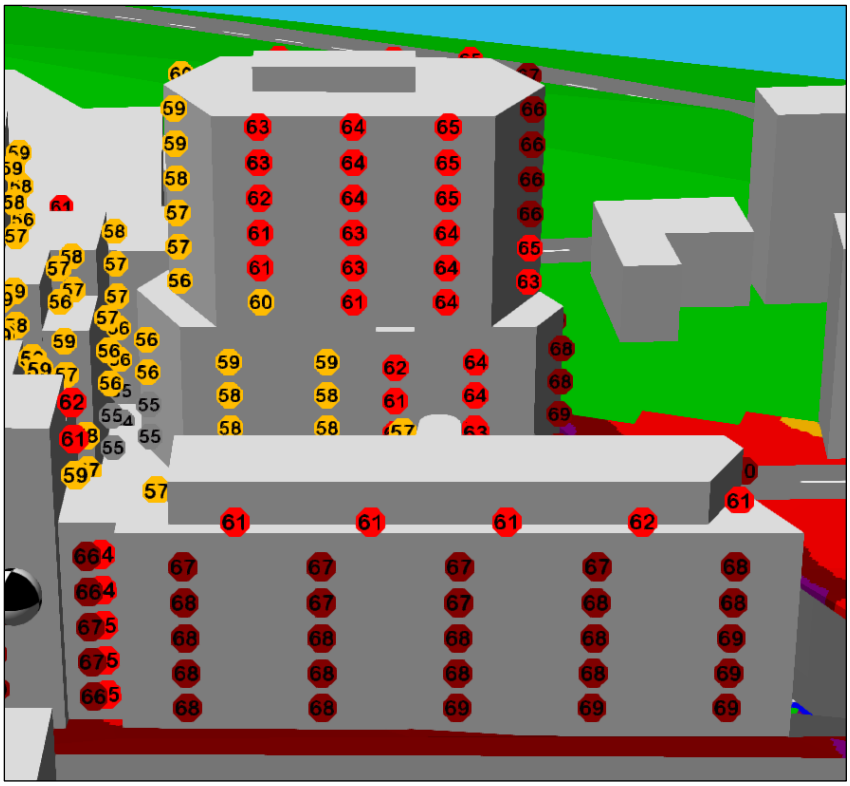


CadnaA 3D Noise Model of Proposed Scheme

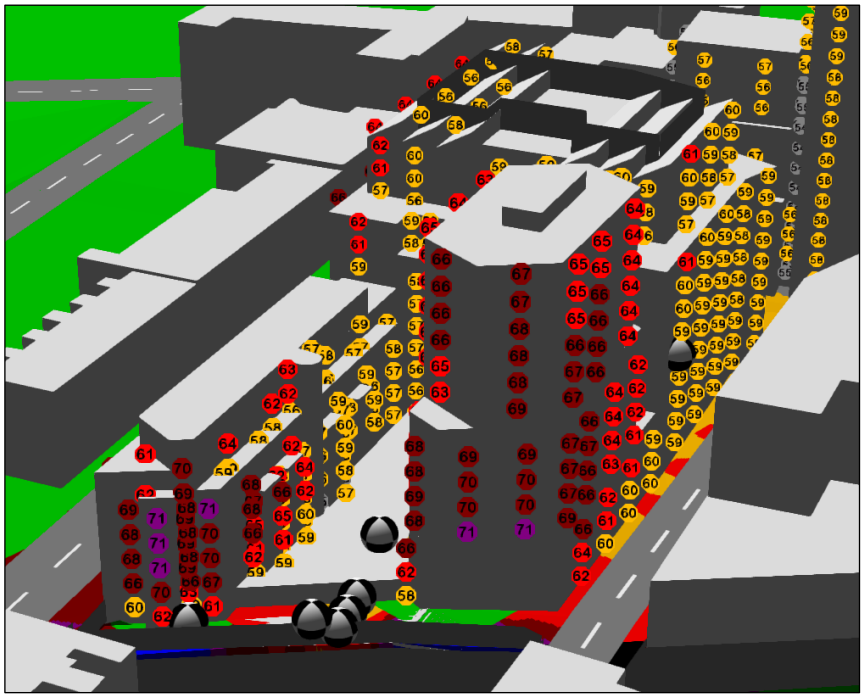
10.1 Results of 3D Noise Modelling

The daytime and night-time L_{Aeq} incident noise levels predicted by the 3D model are shown in the images below. In addition predicted L_{Afmax} levels due to the trainline, incident on the residential buildings at night-time have also been presented:

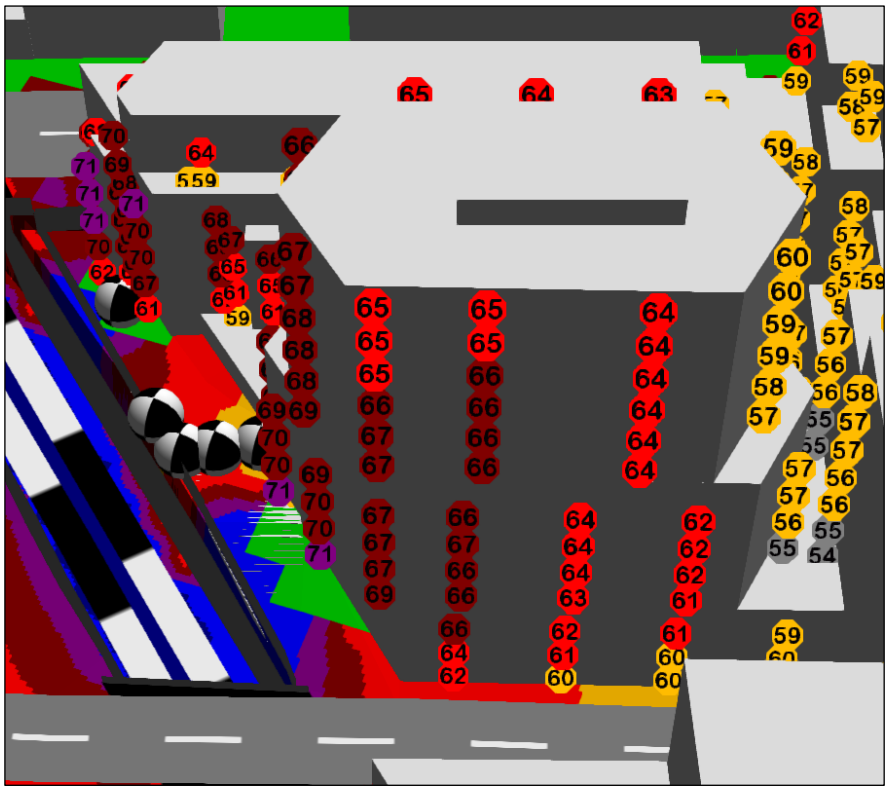
10.1.1 Residential Daytime L_{Aeq}



Daytime $L_{Aeq,16hours}$ – Southern Facades of Residential Blocks

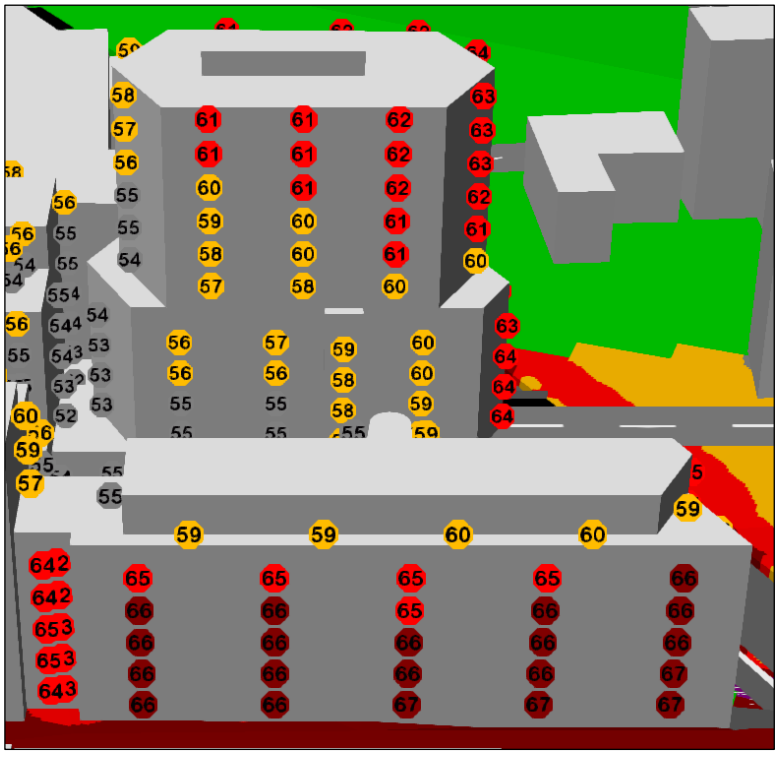


Daytime $L_{Aeq,16hours}$ – Eastern & Northern Facades of Residential Blocks

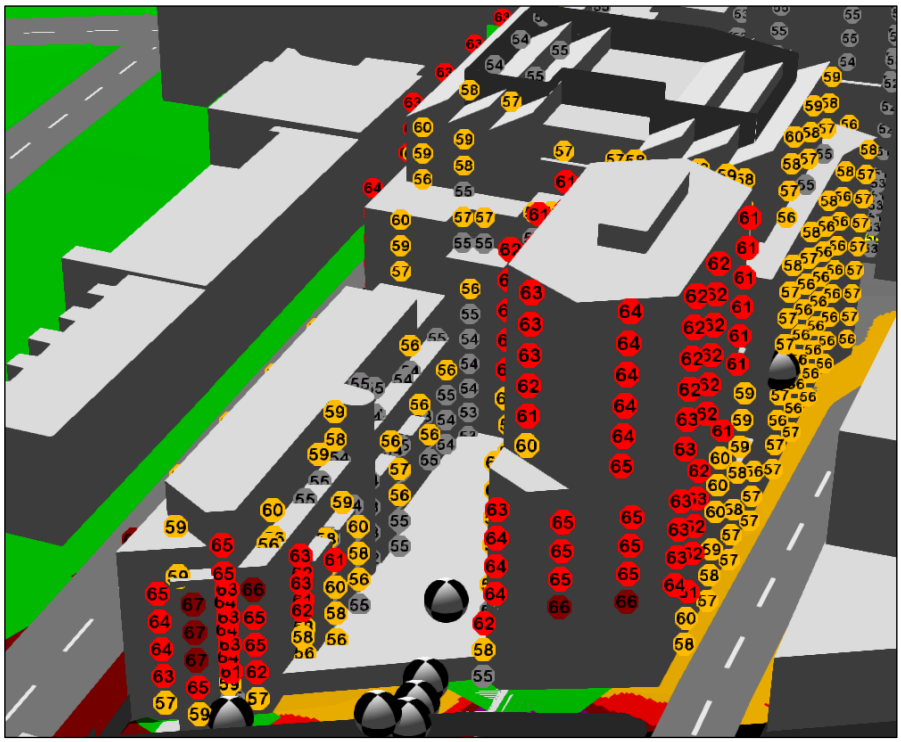


Daytime $L_{Aeq,16hours}$ – Northern Facades of Taller Residential Block

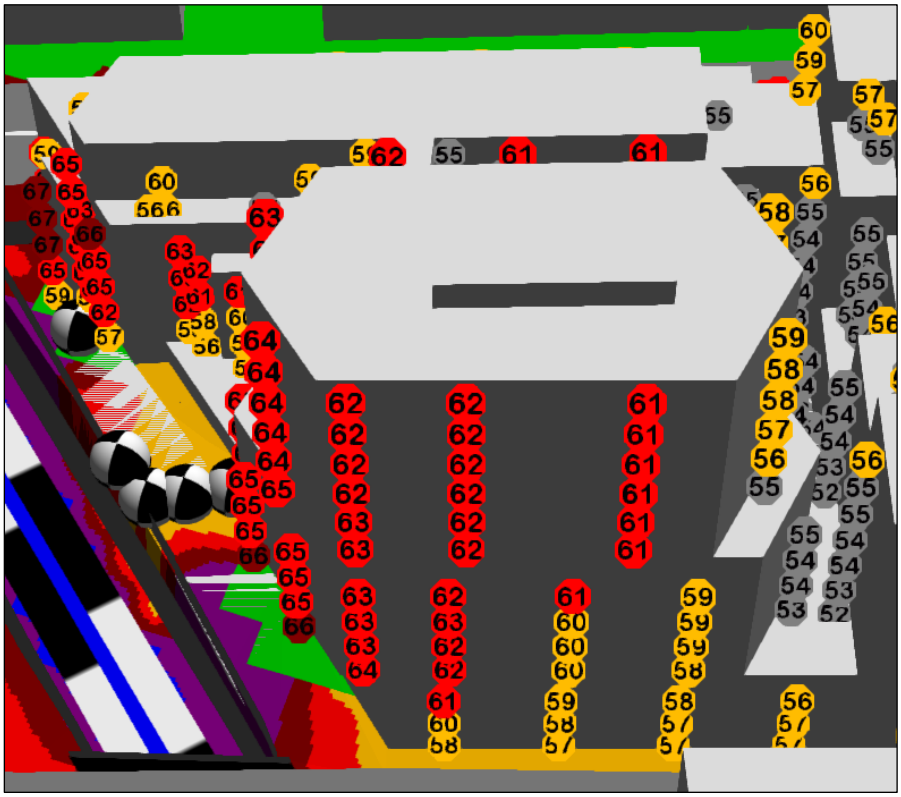
10.1.2 Residential – Night-time L_{Aeq}



Night-time $L_{Aeq,8hours}$ – Southern Facades of Residential Blocks

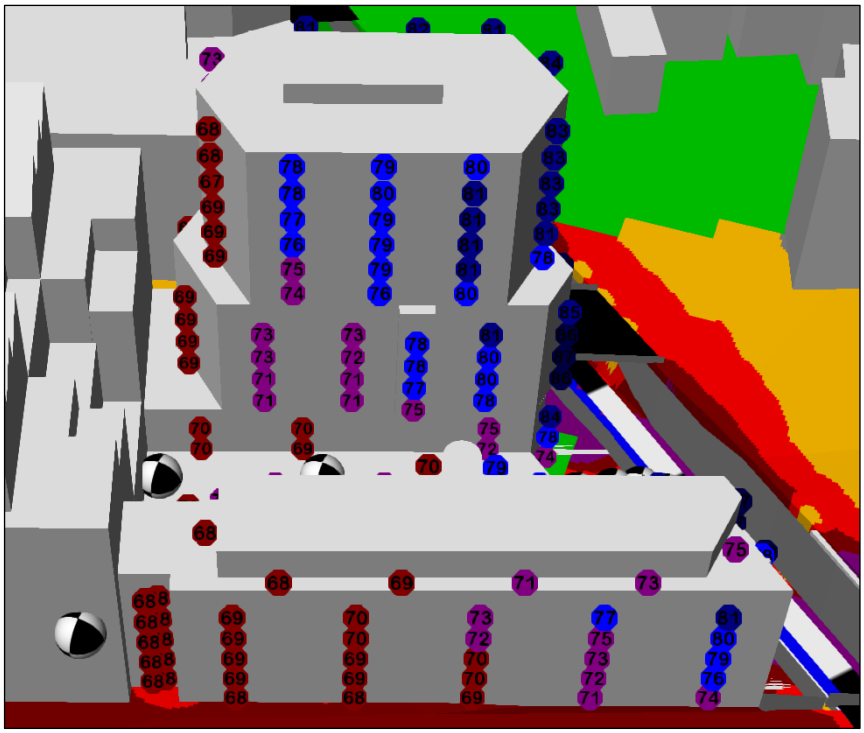


Night-time $L_{Aeq,8hours}$ – Eastern & Northern Facades of Residential Blocks

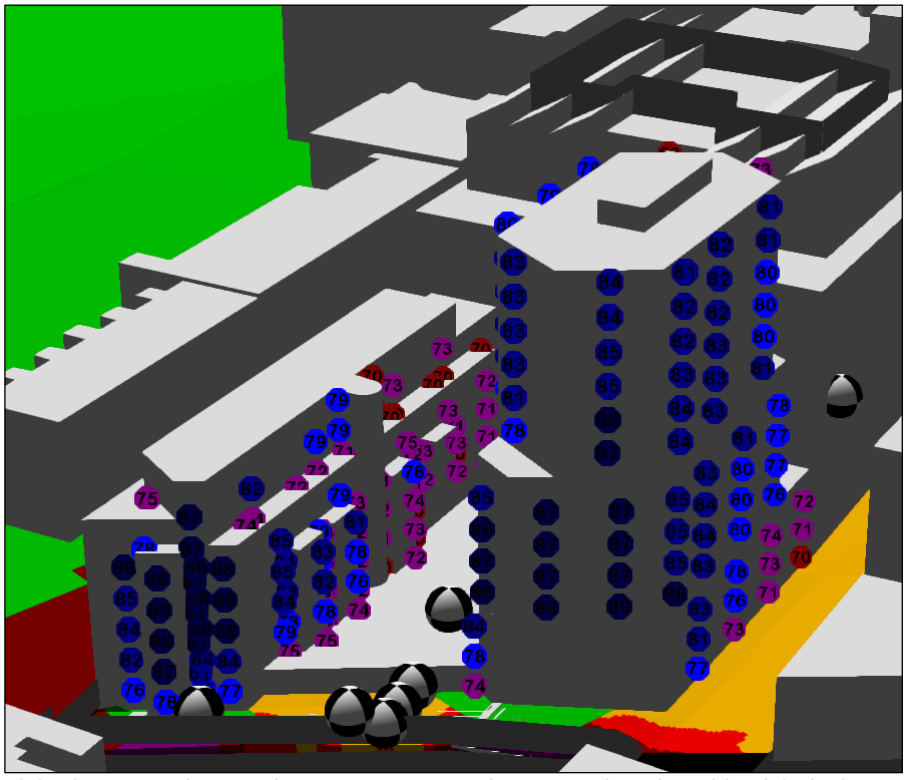


Night-time $L_{Aeq,8hours}$ – Northern Facades of Taller Residential Block

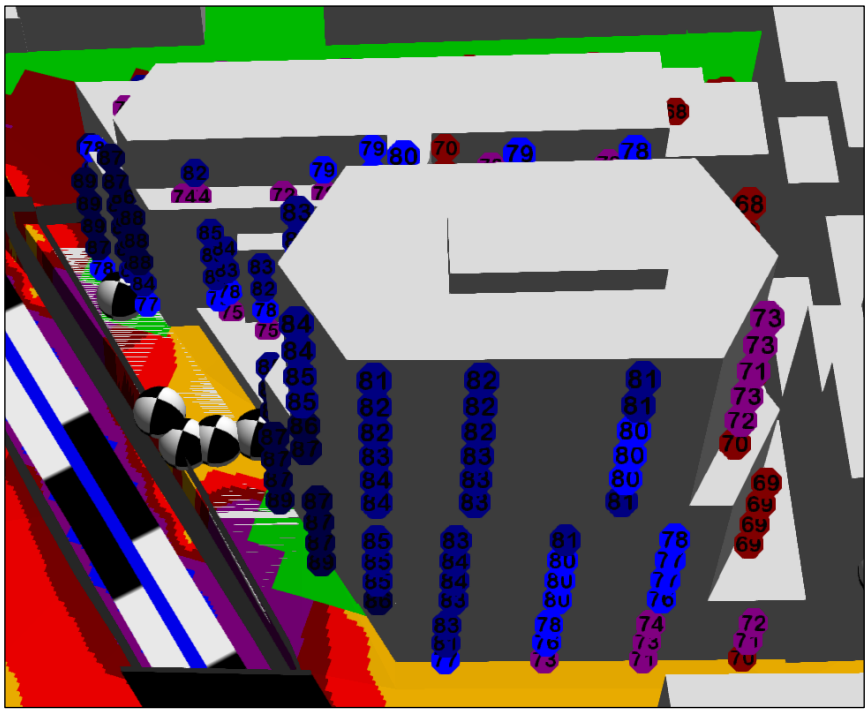
10.1.3 Residential – Night-time Railway L_{Afmax}



Night-time L_{Afmax} from Trains – Southern Facades of Residential Blocks

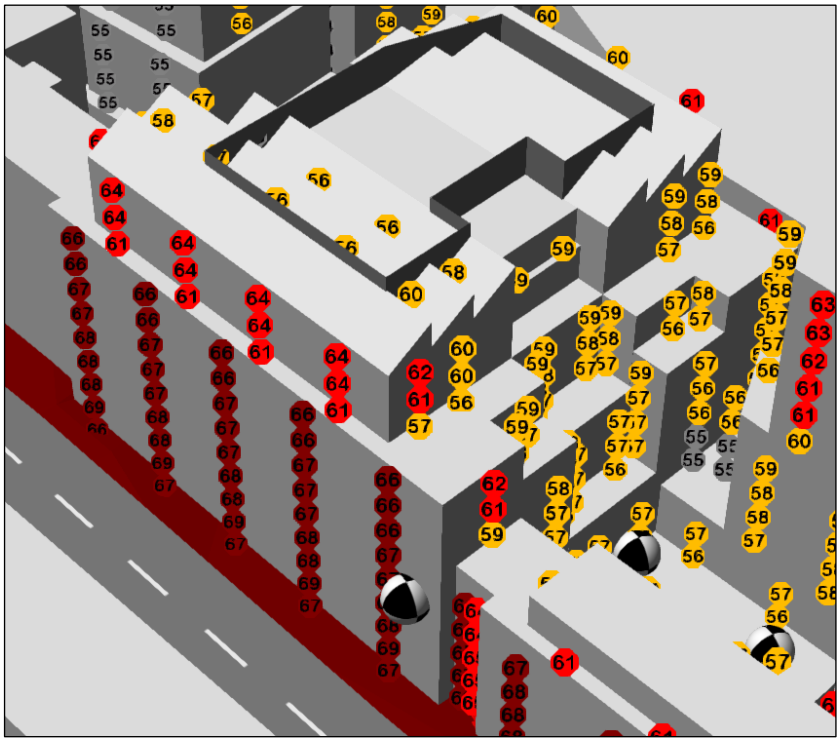


Night-time L_{Afmax} from Trains – Eastern & Northern Facades of Residential Blocks

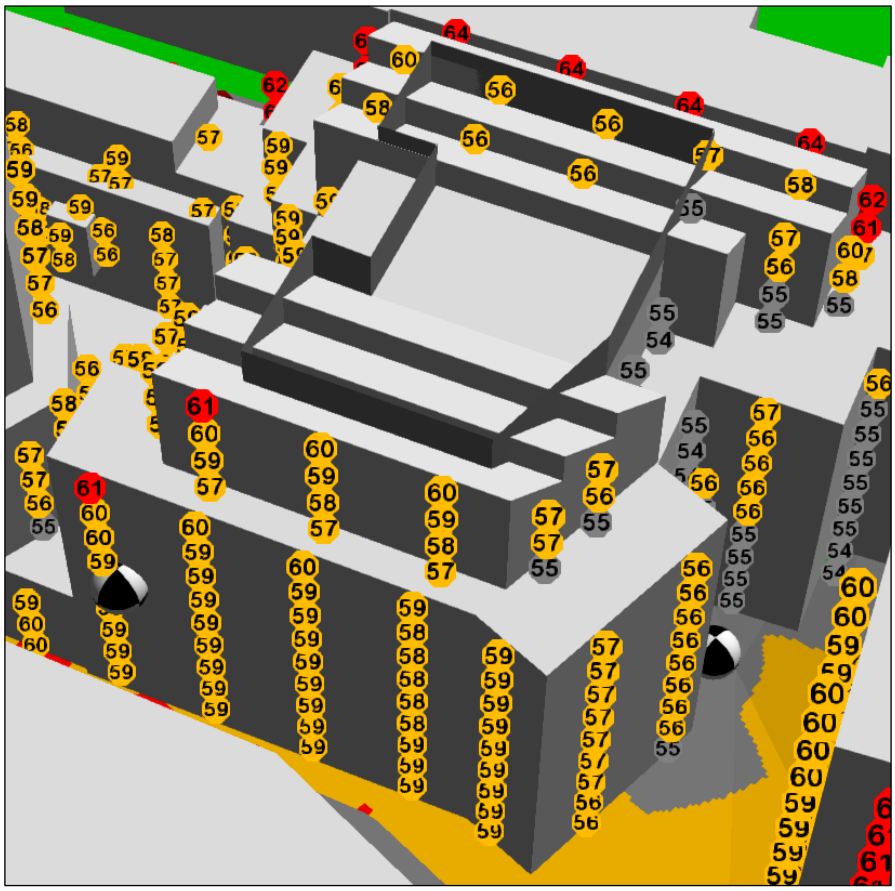


Night-time L_{Afmax} from Trains – Northern Facades of Taller Residential Block

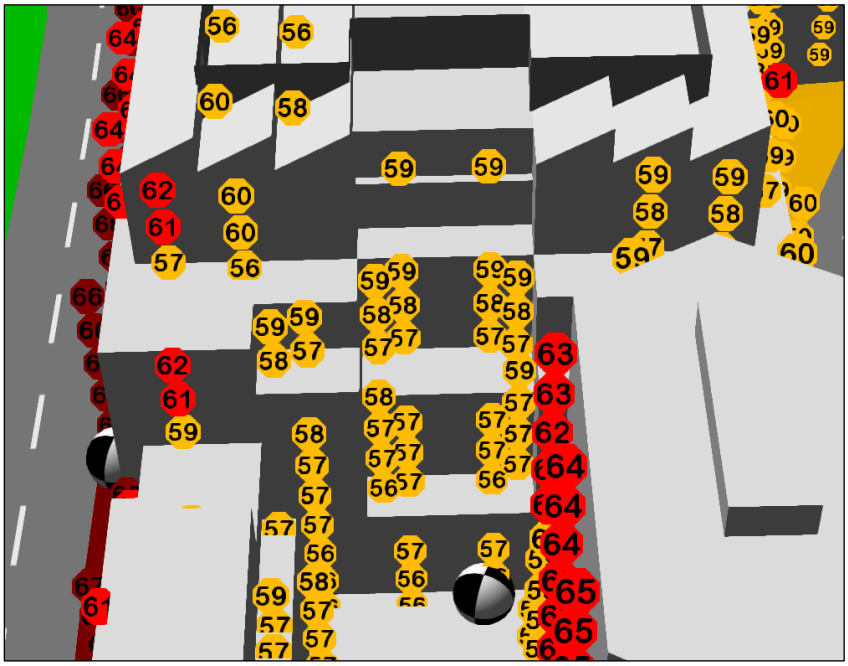
10.1.4 Office



Daytime $L_{Aeq,16hours}$ – Southern and Eastern Facades of Office

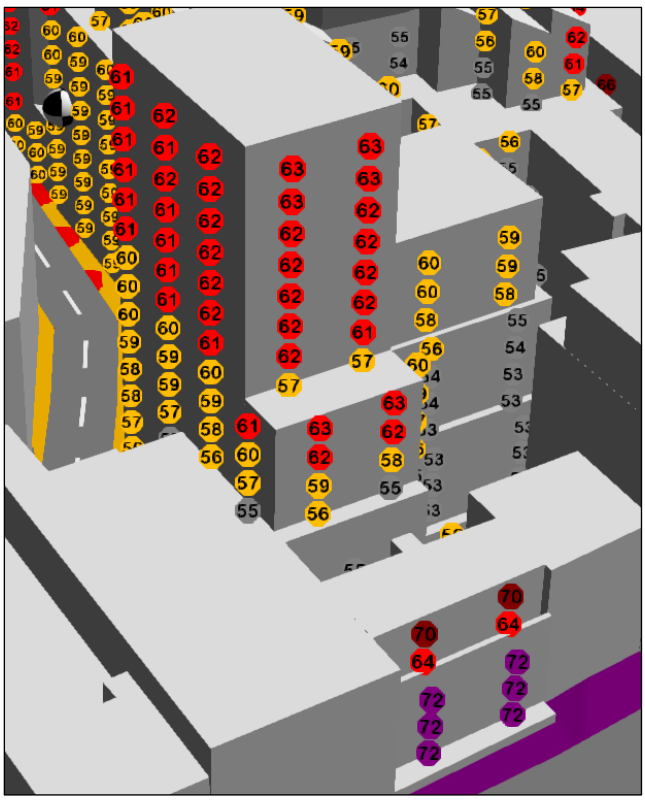


Daytime $L_{Aeq,16hours}$ – Northern and Western Facades of Office

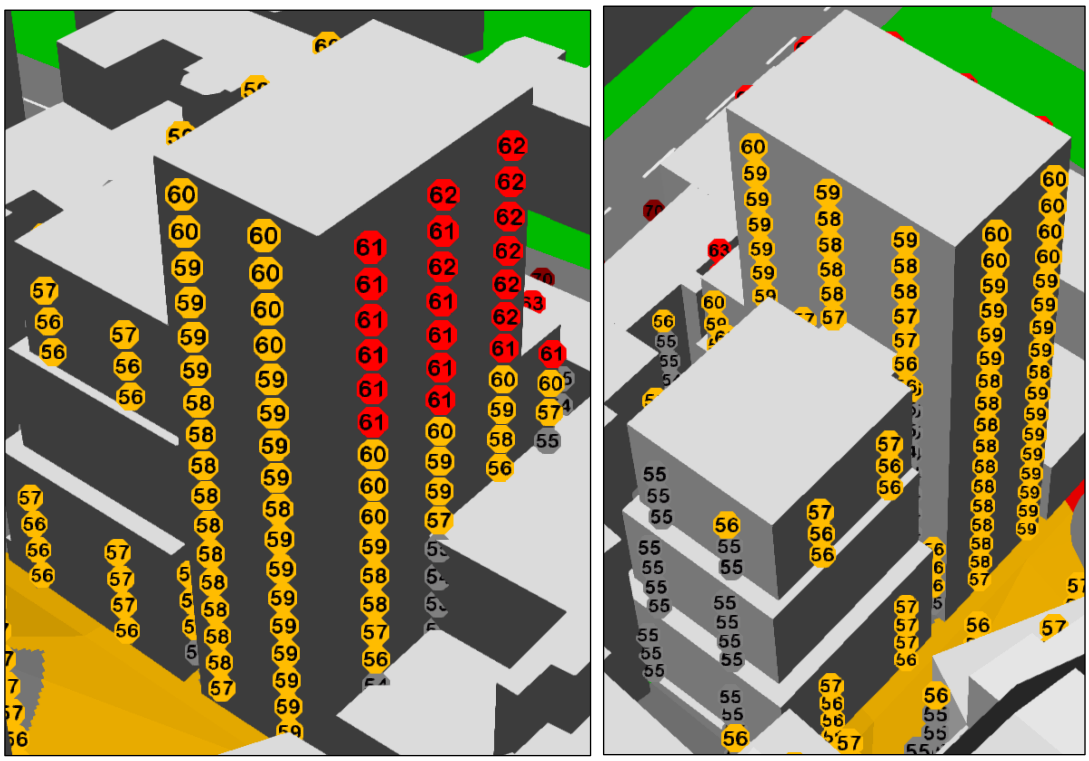


Daytime $L_{Aeq,16hours}$ – Western Facade of Office

10.1.5 Hotel - Daytime

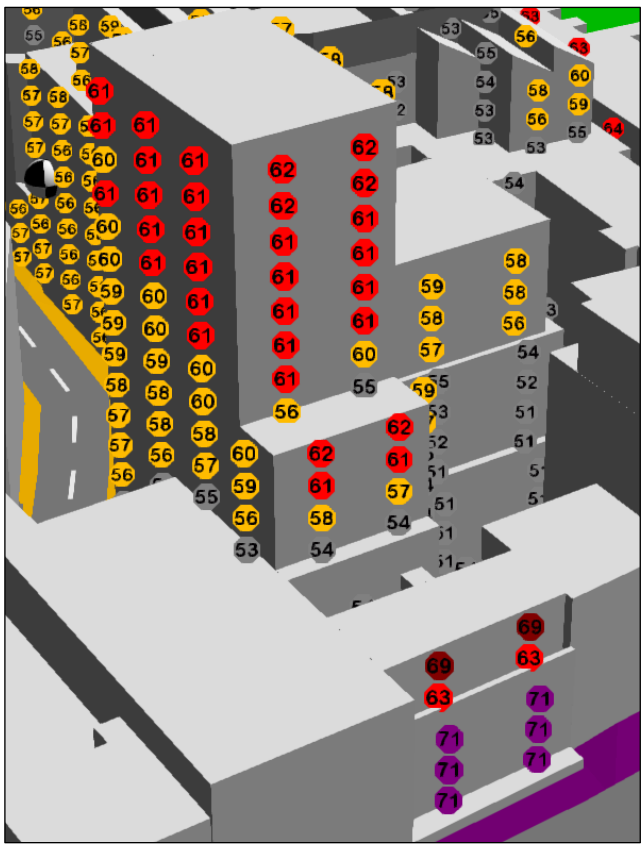


Daytime $L_{Aeq,16hours}$ – Western Facade of Hotel

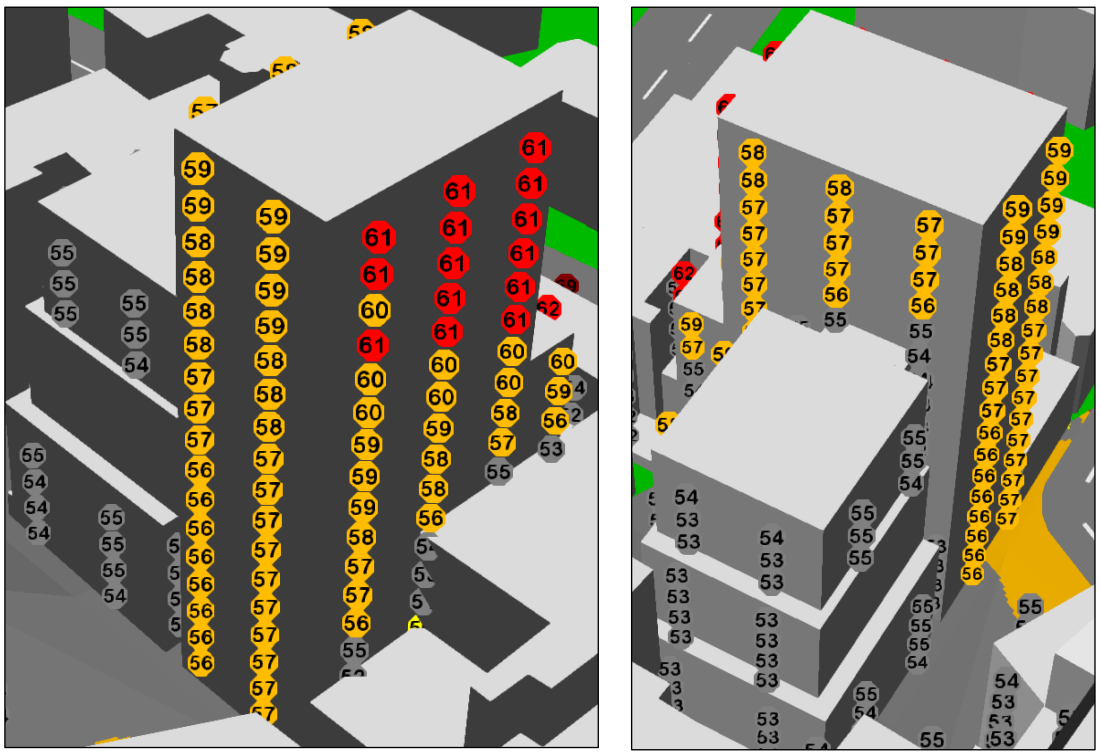


Daytime $L_{Aeq,16hours}$ – Northern & Eastern Facades (Left) and Southern Facades (Right) of Hotel

10.1.6 Hotel – Night-time



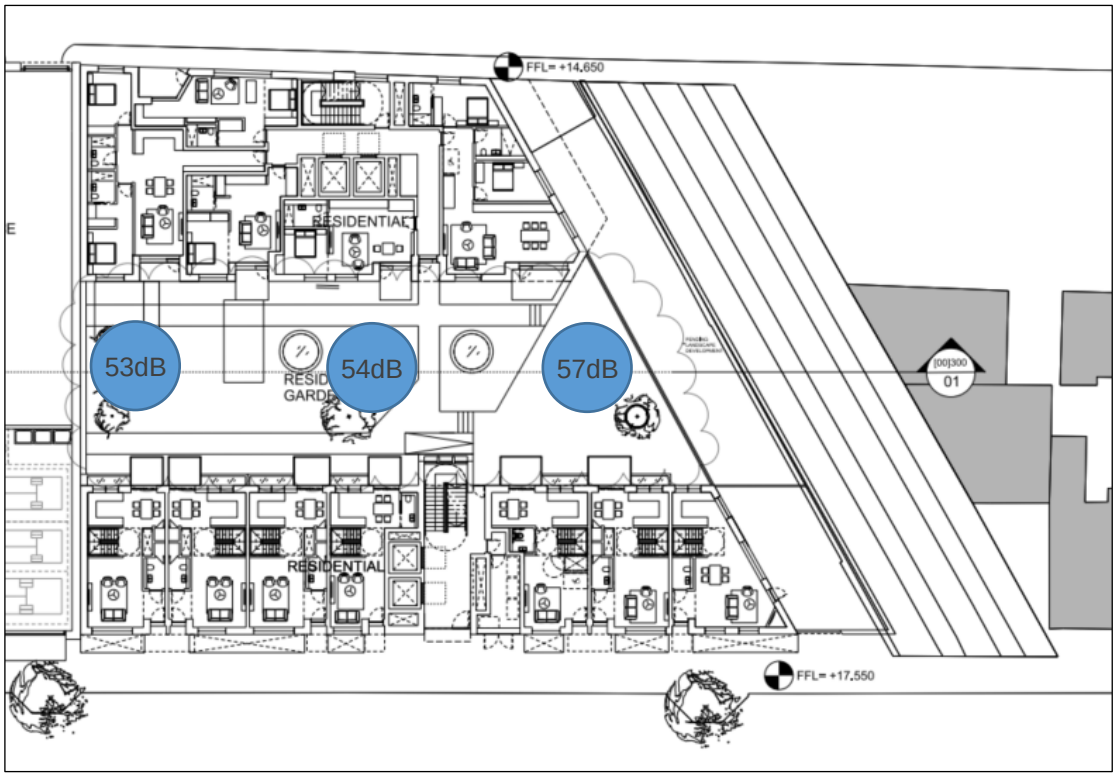
Night-time $L_{Aeq,8hours}$ – Western Facade of Hotel



Night-time $L_{Aeq,8hours}$ – Northern & Eastern Facades (Left) and Southern Facades (Right) of Hotel

10.1.7 Residential External Amenity Area

The image below shows the levels predicted by the model throughout the residential garden, at a height of 1.5m above ground, with the proposed 2.6m barrier heights along the boundary with the train line.



Predicted Daytime $L_{Aeq,16hour}$ noise levels throughout residential garden.

11.0 Preliminary Residential Façade Acoustic Requirements

11.1 L_{Aeq} Noise Levels

Preliminary sound insulation calculations have been undertaken to specify the minimum sound insulation performance of the façade elements to meet the internal L_{Aeq} noise criteria. These will need to be confirmed with detailed calculations at the design stage.

Our calculation methods follow those outlined in BS 8233:2014. Our calculations are based on the following assumptions:

- Minimum façade performance R_w+C_{tr} 45dB.
- Room volumes and window areas as shown on plans received to date.
- Typical furnishings including beds, sofas, chairs etc.

Based on the above and the results of the noise modelling presented in Section 10, we would propose the following minimum preliminary acoustic performance specifications for windows and ventilators to the residential apartments in order to satisfy the proposed internal noise limits.

Night-time $L_{Aeq,8hr}$ Incident Noise Level (with reference to Section 10.1.2)*	Preliminary Minimum Sound Reduction Specification	
	Window, $R_w + C_{tr}$	Ventilator, $D_{nEw} + C_{tr}$
≤67	38	43
≤63	34	40
≤57	28	34

*based on measurement results and criteria, glazing proposed to achieve night-time internal noise criteria will automatically ensure the daytime L_{Aeq} is also achieved.

Example glazing configurations commensurate with achieving the sound insulation performances outlined in the table above are as follows:

- $R_w + C_{tr}$ 38 dB: High performance acoustic double glazed system e.g. 10/16/6.8 mm;;
- $R_w + C_{tr}$ 34 dB: Acoustic double glazed system e.g. 10/16/6.4 mm;
- $R_w + C_{tr}$ 28 dB: Thermal double glazed system e.g. 4/16/6 mm;

Example ventilation solutions commensurate with achieving the sound insulation performances outlined in the table above are as follows:

- $D_{nEw} + C_{tr}$ 40-43: Acoustic in-wall ventilator (based on 1no. per room), or alternatively, mechanical ventilation in the form of MVHR could be provided;
- $D_{nEw} + C_{tr}$ 34: Acoustic trickle ventilator (based on 1 x 2,500mm^2 free area per room);

The preliminary performance specifications included within the table above are based on the provision of 1no. ventilator only per habitable room. If additional numbers of ventilators are required to achieve the ventilation rates, the performance requirement for the individual ventilators will need to increase. The table below provides guidance on the increase in performance specification required for additional numbers of ventilators.

Number of Ventilators	Performance Increase on Preliminary Specifications Stated Above
1	+0 dB
2	+3 dB
3	+5 dB
4	+6 dB

Note: At detailed design stage octave band acoustic specifications will need to be developed,

and it will be essential that the prospective glazing/cladding system suppliers can demonstrate compliance with these specifications, rather than simply offering generic glazing configurations as described above.

11.2 L_{Afmax} Noise Levels

The above preliminary specifications are designed to achieve suitable average L_{Aeq} internal noise levels. However, typically high L_{Afmax} noise levels inside worst case residential bedrooms during train passbys with the highest spec glazing configuration stated in Section 11.1 above would likely be approximately 52dBA, 10dB above the LOAEL criterion of 42dBA L_{fmax} stated by Camden Council.

In order to meet the LOAEL criterion of 42dBA L_{fmax} stated by Camden Council, we would propose the following minimum preliminary acoustic performance specifications for windows and ventilators:

Typically High Night-time L_{Afmax} Incident Noise Level (with reference to Section 10.1.3)	**Preliminary Minimum Sound Reduction Specification**	
	Window, $R_w + C_{tr}$	**Ventilator, $D_{nEw} + C_{tr}$**
≤89	46	Mechanical Ventilation required
≤84	46	49
≤82	40	49
≤77	36	42
≤75	34	40
≤70	29	35

The performances outlined in the table above are based on the building fabric achieving a minimum sound insulation performance of $R_w + C_{tr}$ 45 dB, which would be expected to be achieved by the provision of a typical lightweight façade system with internal plasterboard linings comprising 2no. layers of Soundbloc. The exception is the highest specification which is based on the building fabric achieving a minimum sound insulation performance of $R_w + C_{tr}$ 50 dB, which is based on a masonry façade.

Example glazing configurations commensurate with achieving the sound insulation performances outlined in the table above are as follows:

- $R_w + C_{tr}$ 46 dB: High performance acoustic secondary glazing e.g. 10/200/6 mm;
- $R_w + C_{tr}$ 40 dB: Acoustic secondary glazing e.g. 10/100/6 mm;
- $R_w + C_{tr}$ 36 dB: High performance acoustic double glazed system e.g. 10/16/6.8 mm;;
- $R_w + C_{tr}$ 34 dB: Acoustic double glazed system e.g. 10/16/6.4 mm;

- $R_w + C_{tr}$ 29 dB: Thermal double glazed system e.g. 4/16/6 mm;

Example ventilation solutions commensurate with achieving the sound insulation performances outlined in the table above are as follows:

- $D_{nEw} + C_{tr}$ 49: Highest performing Acoustic in-wall ventilator (e.g. Greenwood MA301) (based on 1no. per room), or alternatively, mechanical ventilation in the form of MVHR could be provided;
- $D_{nEw} + C_{tr}$ 40-42: Acoustic in-wall ventilator (based on 1no. per room), or alternatively, mechanical ventilation in the form of MVHR could be provided;
- $D_{nEw} + C_{tr}$ 35: Acoustic trickle ventilator (based on 1 x 2,500mm^2 free area per room);

The preliminary performance specifications included within the table above are based on the provision of 1no. ventilator only per habitable room. If additional numbers of ventilators are required to achieve the ventilation rates, the performance requirement for the individual ventilators will need to increase. The table below provides guidance on the increase in performance specification required for additional numbers of ventilators.

Number of Ventilators	Performance Increase on Preliminary Specifications Stated Above
1	+0 dB
2	+3 dB
3	+5 dB
4	+6 dB

11.3 Ventilation & Overheating Assessment

11.3.1 Initial Assessment

The above presents solutions to satisfy the proposed internal ambient noise limits within dwellings during normal ventilation conditions where windows are closed but ventilators (to meet Part F minimum ventilation requirements) are operational.

Openable windows are likely to be required for rapid ventilation (i.e. to assist in expelling smoke from burnt toast or paint fumes), which would only be required for a short amount of time during which acoustic conditions would not be a concern.

Where openable windows will be relied upon to assist with summer cooling to prevent overheating, ‘reasonable’ internal acoustic conditions should be maintained. ‘Reasonable’ limits would arguably be within 5-10 dB of the normal condition BS 8233 limits; 5 dB being ideal in

line with BS 8233 and 10 dB being an absolute maximum above which an onset in serious annoyance might occur, also corresponding to SOAEL as defined by Camden Council.

BS 8233:2014 states that: “If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB…”. This is the difference between inside and outside noise levels and therefore 3dB would need to be added to the incident noise levels presented in Section 10.

Based on the above, openable windows would be considered commensurate with achieving the respective internal noise criteria for a 5dB relaxation of BS8233 limits and SOAEL as set by Camden Council where the daytime free field ambient noise levels are not more than L_{Aeq} 52 dB and L_{Aeq} 57 dB respectively, and night-time noise levels are not more than L_{Aeq} 47 dB and L_{Aeq} 52 dB respectively.

Based on the above and with reference to the predicted incident noise levels shown in Section 10, reasonable internal ambient noise levels are not likely to be achieved in the residential units with windows open. As such, openable windows as a form of mitigation for summertime overheating may not be viewed as appropriate by Camden Council.

11.4 Building Regulations Approved Document O

Building Regulations Approved Document O relates to setting standards for overheating in new residential buildings. It aims to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures.

Requirement O1 of Approved Document O is met by designing and constructing the building to achieve both of the following:

a. Limiting unwanted solar gains in summer.

b. Providing an adequate means of removing excess heat from the indoor environment.

Sections 3.2 to 3.4 of this document relate to noise and state the following:

“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).

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).

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).*

With reference to the above and Sections 10.1.2 and 10.1.3, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

11.4.1 ANC AVO Guide Assessment

The ANC Acoustics Ventilation and Overheating (AVO) Residential Design Guide 2020 recommends a two-level noise assessment procedure when assessing the overheating condition.

Level 1 Assessment

The Level 1 assessment is based on an approximate sliding scale of external free-field noise levels. For this site the determining parameter is the night-time $L_{Aeq,8hour}$ noise levels as follows:

Approximate External Free-field Night-time $L_{Aeq,8hour}$	Risk Category	Level 2 Assessment
<45dB	Negligible	Not Required
45-55dB	Low/Medium	Optional
>55dB	Medium/High	Recommended

With Reference to Section 10.1.2 a level 2 assessment is recommended for the vast majority of the proposed residential apartments, with only a very small proportion of the proposed apartments predicted to have incident night-time noise levels below 55dBA. None of the proposed apartments fall into the 'not required' category for Level 2 assessments.

Level 2 Assessment

The level 2 assessment is based on internal noise levels during the overheating condition. Were open windows relied upon to deal with overheating then as per BS8233:2014 the sound insulation would be reduced to approximately 15 dB. This is the difference between inside and outside noise levels and therefore 3dB would need to be added to the incident noise levels presented in Section 10. The numbers presented in the following table, adapted from the ANC AVO guide include both of these corrections for easy referencing against the values presented in Section 10.

Façade incident noise level		**Examples of Outcomes**	
Night-time (23:00-07:00 hours) $L_{Aeq,8hr}$	**Night-time (23:00-07:00 hours) L_{Afmax}**		
>54dB	>77dB	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.
42-54dB	57-77dB	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.
<42dB	<57dB	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. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

With reference to the above and Sections 10.1.2 and 10.1.3 the vast majority of the proposed residential apartments are predicted to be in the top category i.e. were open windows relied upon to deal with overheating, then during this time noise would likely cause a material change in behaviour to occupants, generally resulting in windows being kept closed the majority of the time.

This assessment therefore concurs with the initial assessment carried out in Section 11.1.1; Openable windows as a form of mitigation for summertime overheating are not recommended from a noise perspective on this project.

12.0 Preliminary Hotel Façade Acoustic Requirements

We understand mechanical ventilation is proposed for the Hotel. This section therefore assumes that noise ingress through the mechanical ventilation systems are suitably attenuated where necessary.

We understand that no hotel guest bed-rooms are directly overlooking Gray's Inn Road as these are to be event/meeting and F&B spaces. We understand the majority of the rooms are to be set back from Gray's Inn Road, for which the requirements are less onerous.

Preliminary sound insulation calculations have been undertaken to specify the minimum sound insulation performance of the façade elements to meet the internal noise criteria for environmental noise (for music noise intrusion see the attached Project Technical Memorandum relating to The Water Rats). These will need to be confirmed with detailed calculations at the design stage.

Based on the results of the noise modelling presented in Section 10, we would propose the following minimum preliminary acoustic performance specifications for guestroom windows to the hotel in order to satisfy the proposed internal noise limits.

Night-time $L_{Aeq,8hr}$ Incident Noise Level (with reference to Section 10.1.6)	**Preliminary Minimum Sound Reduction Specification**
	Window, $R_w + C_{tr}$
≤69	40
≤62	33
≤60	31
≤58	29

The performances outlined in the table above are based on the building fabric achieving a minimum sound insulation performance of $R_w + C_{tr}$ 45 dB, which would be expected to be achieved by the provision of a typical lightweight façade system with internal plasterboard linings comprising 2no. layers of plasterboard. The exception is the highest specification (R_w+C_{tr} 40dB window) which is based on a masonry façade.

Example glazing configurations commensurate with achieving the sound insulation performances outlined in the table above are as follows:

- $R_w + C_{tr}$ 40 dB: Acoustic secondary glazing e.g. 10/100/6 mm;
- $R_w + C_{tr}$ 33 dB: Acoustic double glazed system e.g. 10/16/6.4 mm;

- $R_w + C_{tr}$ 31 dB: Acoustic double glazed system e.g. 10/16/6 mm;
- $R_w + C_{tr}$ 29 dB: Thermal double glazed system e.g. 4/16/6 mm;

13.0 Preliminary Office Façade Acoustic Requirements

13.1 Windows Open

The recommended internal L_{eq} noise criterion for the office space is NR38. This equates to approximately 42dBA (based on the spectra measured during the noise survey.

Based on a level difference of 15dBA between internal noise levels and external façade levels, the above is likely only to be achievable where predicted external free field levels are no more than 54dBA. With reference to Section 10.1.4 this applies only to a small number of office windows overlooking the courtyard to the west, and therefore open windows would not be considered a suitable background ventilation strategy on this project.

13.2 Windows Closed

Preliminary sound insulation calculations have been undertaken to specify the minimum sound insulation performance of the façade elements to meet the internal noise criteria. These will need to be confirmed with detailed calculations at the design stage.

Based on the results of the noise modelling presented in Section 10, we would propose the following minimum preliminary acoustic performance specifications for windows and ventilators to the office in order to satisfy the proposed internal noise limits.

Preliminary Minimum Sound Reduction Specification	
Window, $R_w + C_{tr}$	**Ventilator, $D_{nEw} + C_{tr}$**
28	32

An example glazing configuration commensurate with achieving the sound insulation performance outlined in the table above is a thermal double glazed system e.g. 4/16/6 mm.

An example ventilation solution commensurate with achieving the sound insulation performance outlined in the table above would be 1No. standard hit and miss trickle ventilator (2,500mm^2 free area) per approximately 4m length of façade.

14.0 External Residential Amenity Area

Noise levels in external amenity areas should ideally not be above the range of 50-55dB $L_{Aeq,16hr}$, as stated in BS8233:2014. However it should be noted that BS8233:2014 states: *"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."*

BS8233:2014 also states: *" 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."*

The design has achieved the lowest practicable noise levels by screening the residential garden from the roads by the buildings and from the railway by the proposed 2.6m high barrier. Whilst it is not possible to achieve 55dB $L_{Aeq,16hour}$ at the outer edge of this area, predicted noise levels are at or below 55dB $L_{Aeq,16hour}$ in at least 75% of the space.

In addition, the noise survey Position 5 concurs with this prediction by demonstrating that when an external amenity area is screened on all sides from road and rail noise, daytime $L_{Aeq,16hour}$ noise levels within a central external amenity area can be below 55dBA on this site.

Regarding residential balconies BS8233:2014 states: *"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.".* On this basis it would not be appropriate to set noise limits for the residential balconies on this project.

15.0 Summary

It is thus demonstrated that acceptable internal noise levels are achievable in the worst case areas of the proposed development.

The predicted worst case internal noise levels with windows partially opened exceed the

proposed target levels (as is often the case). The minimum mitigation available to future occupants would be to close their window. Ventilation (incorporating suitable acoustic attenuation) will be provided to comply with the requirements of the Building Regulations Approved Document F whole dwelling ventilation. The occupants will thus have the option of keeping windows closed for most of the time and opening windows for purge ventilation.

This form of mitigation is supported within the Pro:PG which advises the following:

2.34 Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with façade openings used to provide *"whole dwelling ventilation"* in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.

2.35 It should also be noted that the internal noise level guidelines are generally not applicable under *"purge ventilation"* conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

The external envelope of the proposed residences will incorporate suitably specified glazing so as to achieve the proposed design target internal noise levels presented above.

Where ventilation is provided through the façade it shall be suitably acoustically attenuated to ensure the achievement of the proposed target internal noise levels is not compromised.

16.0 External Plant Noise Emission

16.1 Criteria

The planning conditions imposed by Camden Council are as set out in Section 8.6. Our interpretation is that Planning Conditions 3 and 4 only apply to neighbouring premises, not the noise-sensitive receptors at our own development. This is subject to confirmation by LBC.

On the basis of this and the results of the environmental noise survey presented in Section 6.0,

we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive window.

Position	Noise Emission Limit (dBA)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
1	46	38
2	35	31
3	40	39
4	40	35
5	37	35

The above criteria are to be achieved with all of the proposed plant operating simultaneously.

If plant contains tonal or impulsive characteristics the external design criteria should be reduced by 5dBA.

For life safety standby plant, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive window.

Position	Noise Emission Limit (dBA)	
	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
1	66	58
2	55	51
3	60	59
4	60	55
5	57	55

It should be noted that the above are subject to the final approval of the Local Authority.

16.2 Assessment

16.2.1 Plant Proposal

We understand the following plant is currently proposed at the roof of the office block:

- Air Source Heat Pump: 4no. units, 24/7 operation. Sound Power 94 dBA, Sound Pressure Level 61 dBA @10m
- Generators: 2no. units, Sound Pressure Level: 80dBA @ 1m

The above noise levels have been provided by the manufacturers and are taken to be the measured operational noise levels.

16.2.2 Plant Noise Impact Assessment

The following table summarise our predictions of atmospheric noise emissions from the plant to the nearest neighbouring noise sensitive window, which is Arriva Hotel located at the opposite side of our proposed office block.

ASHPs

	Sound Pressure Level (dBA)
Plant Noise Level	61dBA @ 10m
Quantity Correction	+6
Distance Correction	-9
Barrier Correction	-20
Façade Reflection	+3
Calculated Noise Level at Receptor	43
Criteria	35
Exceedance	8

Our calculations show that, based on the current proposal, without any mitigation measures, the predicted noise level from ASHP at Arriva Hotel should be 8 dBA above the criteria. Therefore, further mitigation measures would be required. This could include re-selecting the units, installing a screen, or enclosing the plant in an acoustic enclosure.

Generators

	Sound Pressure Level (dBA)
Plant Noise Level	80dBA @ 1m
Quantity Correction	+3
Distance Correction	-16
Barrier Correction	-15
Façade Reflection	+3
Calculated Noise Level at Receptor	55
Criteria	55
Exceedance	0

Our calculations indicate that the proposed generators should be capable of achieving the requirements of the Local Authority.

17.0 Agent of Change

For separate assessments dealing with agent of change relating to the adjacent uses of The Water Rats public house and music venue, and the UCL Ear Institute, see the attached Project Technical Memorandums.

18.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the site.

A 3D noise model of the scheme has been built and calibrated based upon the information received to date and the results of the environmental noise survey.

The environmental noise impact upon the proposed dwellings has been assessed in the context of national and local planning policies.

Appropriate target internal L_{Aeq} noise levels have been proposed. Mitigation advice, including the use of suitably specified glazing and acoustically attenuated ventilation, have been recommended to reduce to a minimum the adverse impact on health and quality life arising from environmental noise.

Plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the Local Authority's planning conditions. An assessment has been carried out to determine the plant noise emissions at the nearest neighbouring noise sensitive window.

The assessment shows the site, subject to appropriate mitigation measures, is suitable for residential development in terms of noise.

Appendix A

The acoustic terms used in this report are defined as follows:

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. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — 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

It should be noted that 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 just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

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

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

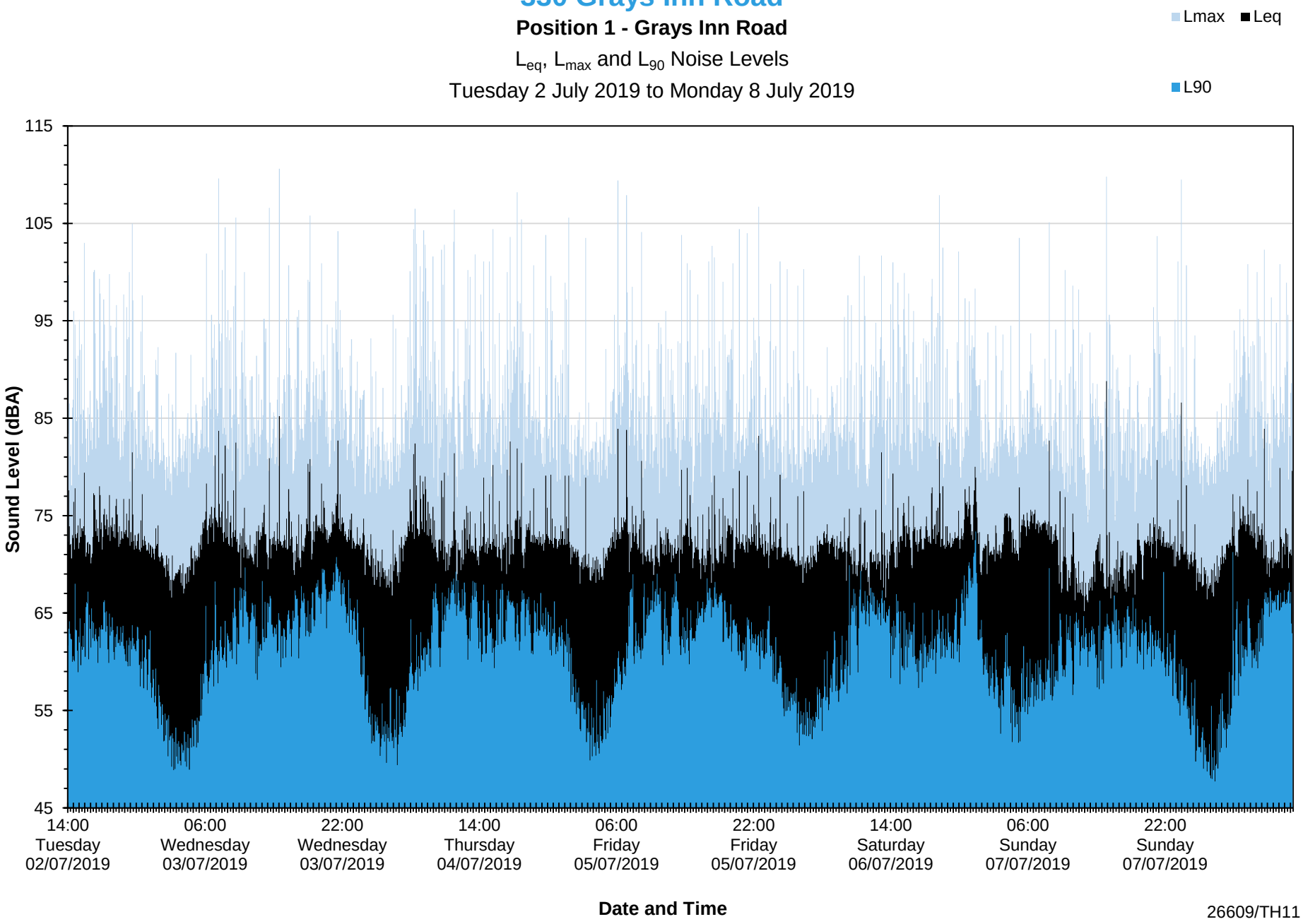
L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

330 Grays Inn Road

Position 1 - Grays Inn Road

L_{eq}, L_{max} and L_{90} Noise Levels

Tuesday 2 July 2019 to Monday 8 July 2019



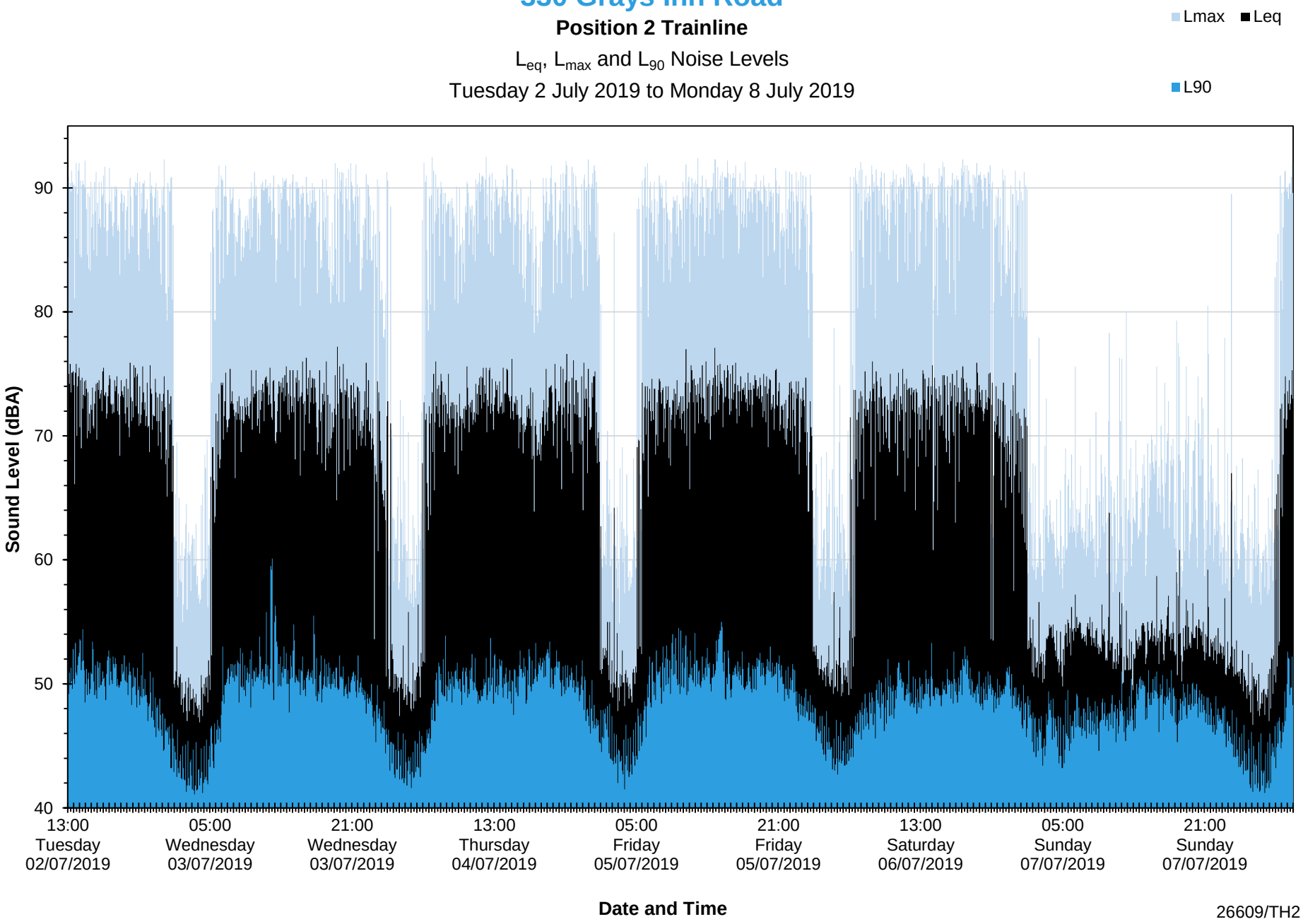
26609/TH11

330 Grays Inn Road

Position 2 Trainline

L_{eq}, L_{max} and L_{90} Noise Levels

Tuesday 2 July 2019 to Monday 8 July 2019



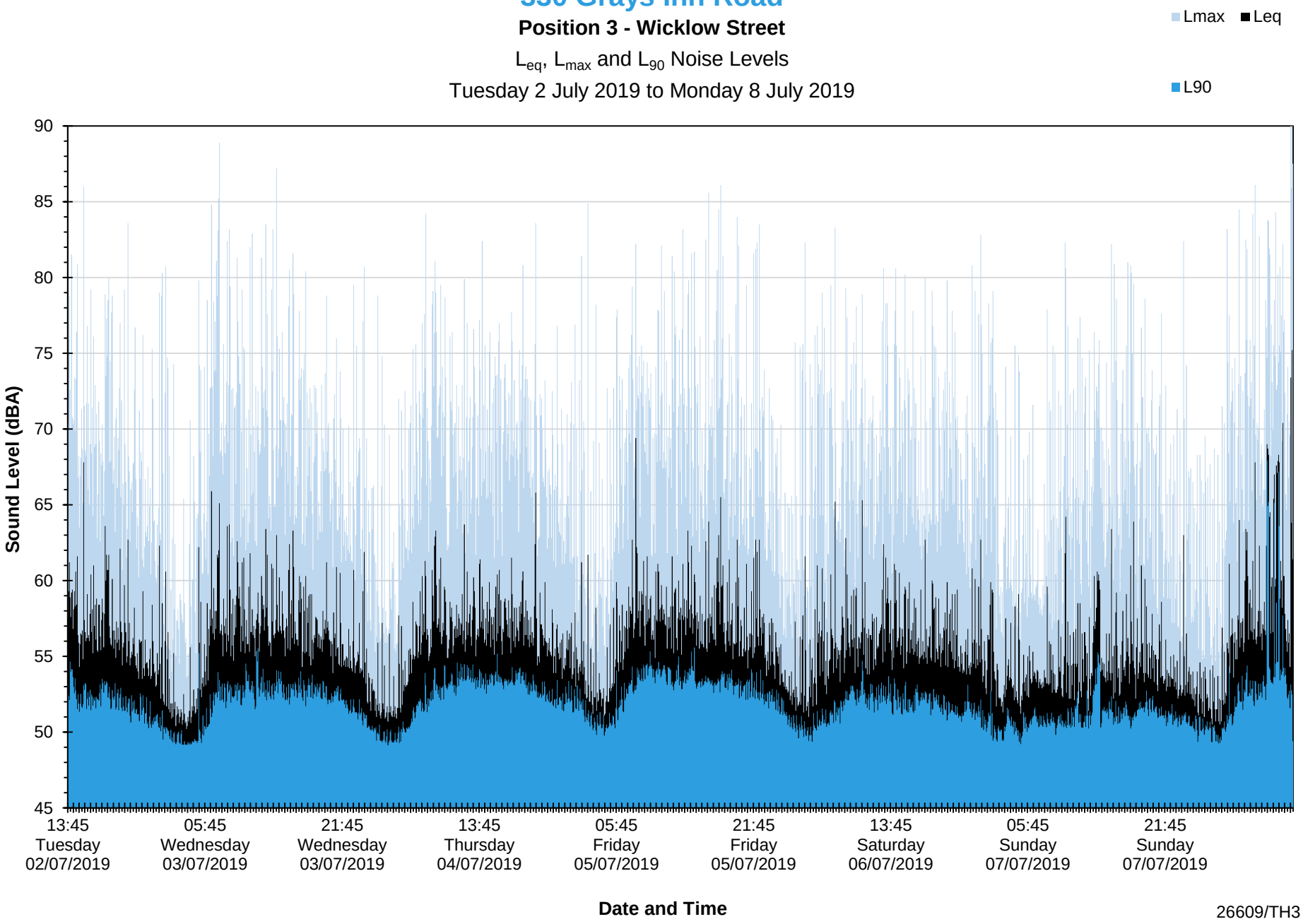
26609/TH2

330 Grays Inn Road

Position 3 - Wicklow Street

L_{eq}, L_{max} and L_{90} Noise Levels

Tuesday 2 July 2019 to Monday 8 July 2019



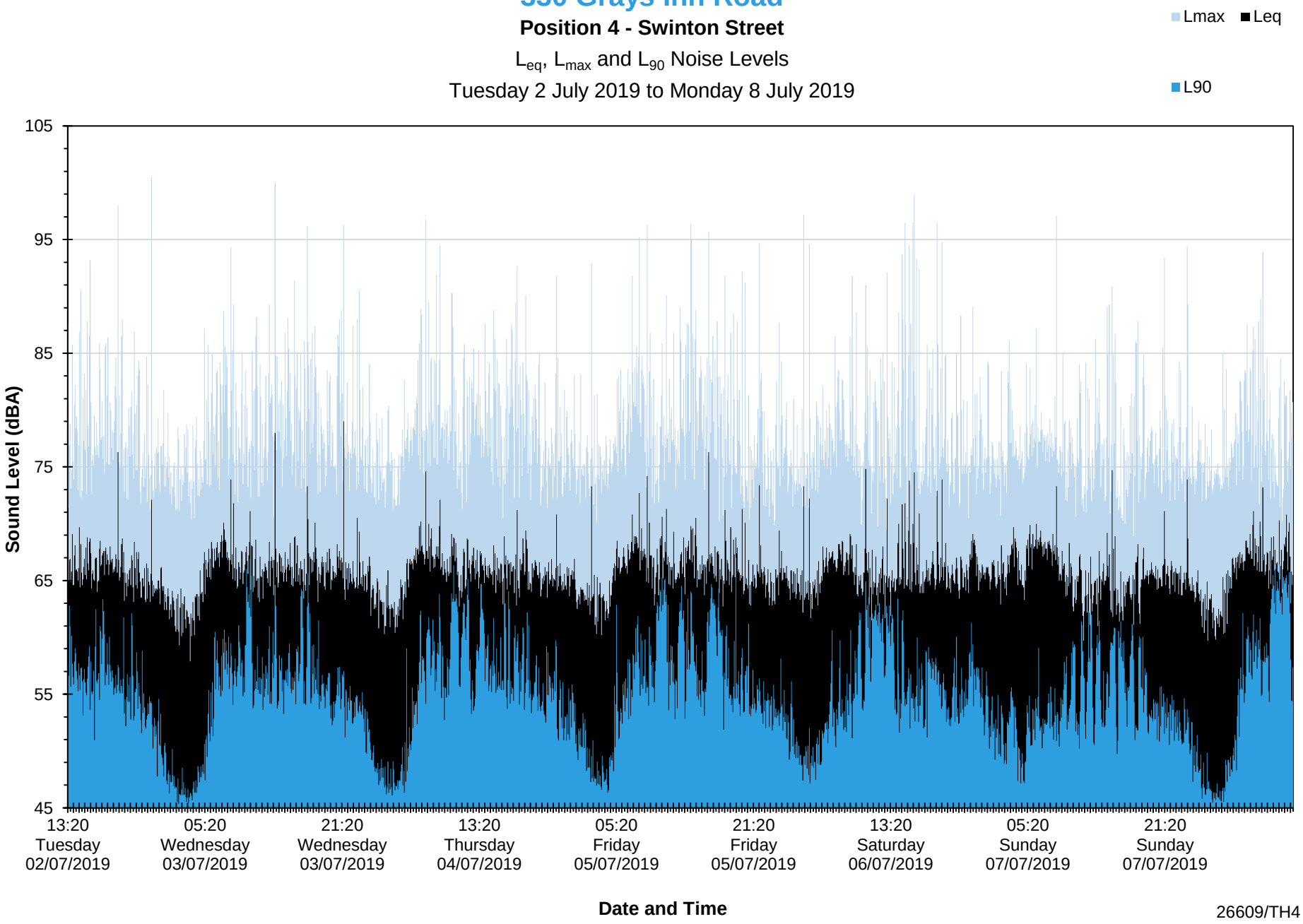
26609/TH3

330 Grays Inn Road

Position 4 - Swinton Street

L_{eq}, L_{max} and L_{90} Noise Levels

Tuesday 2 July 2019 to Monday 8 July 2019



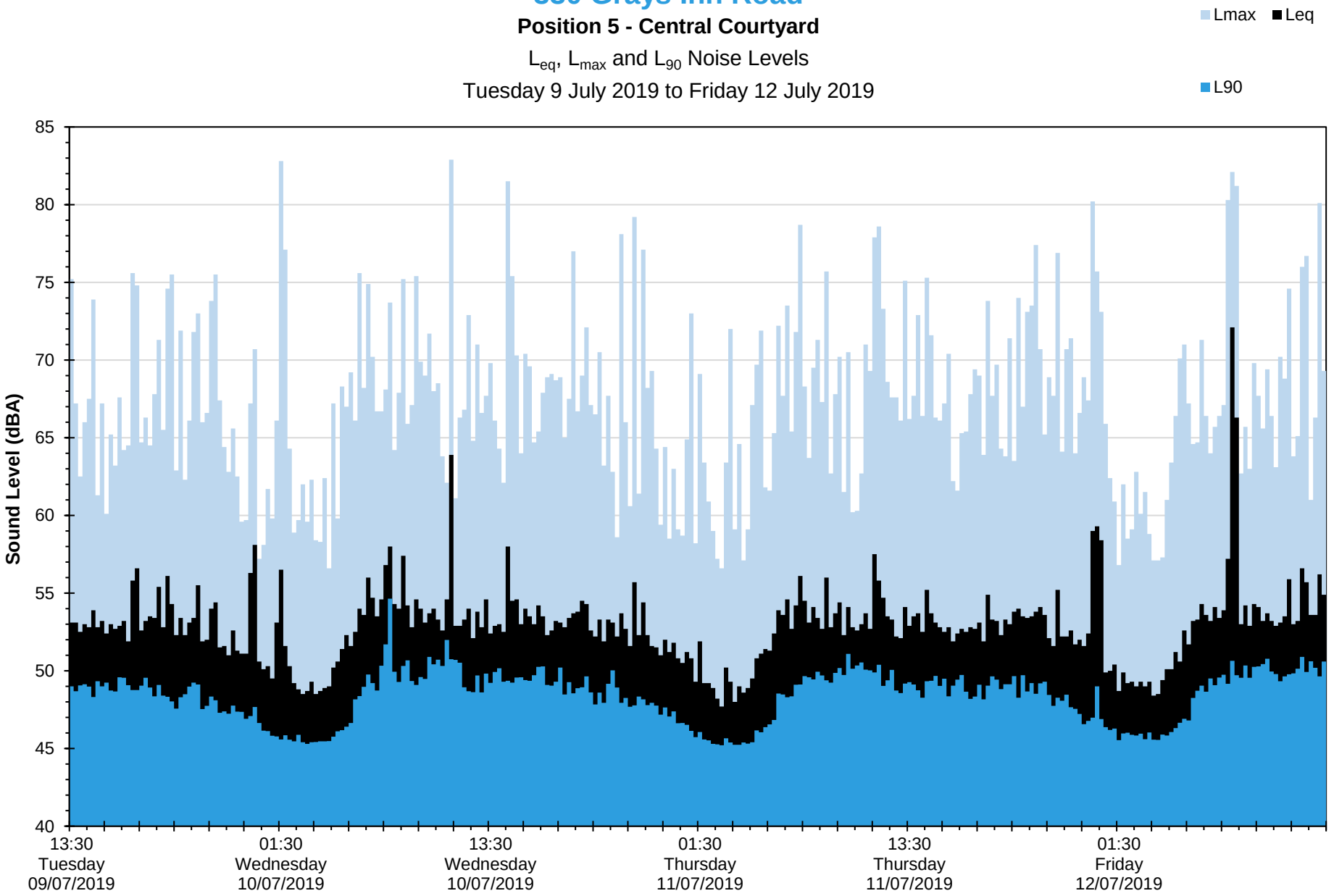
26609/TH4

330 Grays Inn Road

Position 5 - Central Courtyard

L_{eq}, L_{max} and L_{90} Noise Levels

Tuesday 9 July 2019 to Friday 12 July 2019



26609/TH5

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Lorraine M. Gregory (Company Secretary)

PROJECT TECHNICAL MEMORANDUM

JOB TITLE	:	330 Grays Inn Road
REF	:	HT: 26609/PTM2
DATE	:	23 March 2021
FROM	:	Luke Rendell
ISSUED TO	:	nmorris@groveworld.co.uk rjacobson@groveworld.co.uk aneal@geraldeve.com shardy@geraldeve.com mhart@ahmm.co.uk

RE: Noise/Vibration Transfer to/from UCL Ear Institute

We understand that Camden and the GLA have requested details of the 330 Grays Inn Road proposals with respect to the principal of 'agent of change' regarding the adjacent UCL Ear Institute. Our planning stage assessment with regards to this principal is as follows:-

1.0 Legislation & Guidance

1.1 NPPF

Paragraph 182 of the National Planning Policy Framework states:

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

1.2 The London Plan 2021

Policy D13 (Agent of Change) in The London Plan 2021 (March 2021) states:

Policy D13 Agent of Change

A The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance-generating uses in a sensitive manner when new development is proposed nearby.

B Development should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.

C New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.

D Development proposals should manage noise and other potential nuisances by:

1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area
2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations
3) separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.

E Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed.

3.13.1 For a long time, the responsibility for managing and **mitigating the impact of noise** and other nuisances on neighbouring residents and businesses has been placed on the business or activity making the noise or other nuisance, regardless of how long the business or activity has been operating in the area. In many cases, this has led to newly-arrived residents complaining about noise and other nuisances from existing businesses or activities, sometimes forcing the businesses or other activities to close.

3.13.2 The **Agent of Change principle** places the responsibility for mitigating the impact of noise and other nuisances firmly on the new development. This means that where new developments are proposed close to existing noise-generating uses, for example, applicants will need to design them in a more sensitive way to protect the new occupiers, such as residents, businesses, schools and religious institutions, from noise and other impacts. This could include paying for soundproofing for an existing use, such as a music venue. The Agent of Change principle works both ways. For example, if a new noise-generating use is proposed close to existing noise-sensitive uses, such as residential development or businesses, the onus is on the new use to ensure its building or activity is designed to protect existing users or residents from noise impacts.

3.13.3 The Agent of Change principle is included in the National Planning Policy Framework, and **Planning Practice Guidance** provides further information on how to mitigate the adverse impacts of noise and other impacts such as air and light pollution.[36]

3.13.4 The Agent of Change principle predominantly concerns the impacts of noise-generating uses and activities but **other nuisances** should be considered under this policy. Other nuisances include dust, odour, light and vibrations (see Policy SI 1 Improving air quality and Policy T7 Deliveries, servicing and construction). This is particularly important for development proposed for co-location with industrial uses and the intensification of industrial estates (see Part D4 of Policy E7 Industrial intensification, co-location and substitution). When considering co-location and intensification of industrial areas, boroughs should ensure that existing businesses and uses do not have unreasonable restrictions placed on them because of the new development.

3.13.5 Noise-generating **cultural venues** such as theatres, concert halls, pubs, night-clubs and other venues that host live or electronic music should be protected (see Policy HC5 Supporting London's culture and creative industries). This requires a sensitive approach to managing change in the surrounding area. Adjacent development and land uses should be brought forward and designed in ways which ensure established cultural venues remain viable and can continue in their present form without the prospect of licensing restrictions or the threat of closure due to noise complaints from neighbours.

3.13.6 As well as cultural venues, the **Agent of Change principle should be applied to all noise-generating uses and activities** including schools, places of worship, sporting venues, offices, shops, industrial sites, waste sites, safeguarded wharves, rail and other transport infrastructure.

3.13.7 Housing and other **noise-sensitive development** proposed near to an existing noise-generating use should include necessary acoustic design measures, for example, site layout, building orientation, uses and materials. This will ensure new development has effective measures in place to mitigate and minimise potential noise impacts or neighbour amenity issues. Mitigation measures should be explored at an early stage in the design process, with necessary and appropriate provisions secured through planning obligations.

3.13.8 Ongoing and longer-term management of mitigation measures should be considered, for example through a **noise management plan**. Policy T7 Deliveries, servicing and construction provides guidance on managing the impacts of freight, servicing and deliveries.

3.13.9 Some **permitted development**, including change of use from office to residential, requires noise impacts to be taken into consideration by the Local Planning Authority as part of the prior approval process. Boroughs must take account of national planning policy and guidance on noise, and therefore the Agent of Change principle would apply to these applications.

3.13.10 **Noise and other impact assessments** accompanying planning applications should be carefully tailored to local circumstances and be fit for purpose. That way, the particular characteristics of existing uses can be properly captured and assessed. For example, some businesses and activities can have peaks of noise at different times of the day and night and on different days of the week, and boroughs should require a noise impact assessment to take this into consideration. Boroughs should pay close attention to the assumptions made and methods used in impact assessments to ensure a full and accurate assessment.

3.13.11 Reference should be made to Policy D14 Noise which considers the impacts of noise-generating activities on a wider scale and Policy SI 1 Improving air quality which considers the impacts of existing air pollution. **Further guidance** on managing and mitigating noise in development is also provided in the Mayor's London Environment Strategy.

2.0 Assessment & Discussion

2.1 Noise/Vibration Transfer from The Ear Institute

The Ear Institute is not considered to be a use of significant noise or vibration generation and therefore is extremely unlikely to have an adverse effect on the proposed hotel. The noise/vibration sensitive activities undertaken at The Ear Institute generally preclude the generation of noise and vibration levels high enough to be of concern even within their own building, let alone in adjacent buildings. Hann Tucker Associates have previously visited The Ear Institute to measure levels of background noise/vibration and we can confirm that the measured levels were generally low, and unlikely to be of concern to neighbouring properties.

The only potential sources of noise generation we are aware of are the external plant associated with The Ear Institute. We understand this comprises 2No. items of cooling plant to the rear, and laboratory extract flues which are currently mounted to the west facade of 330 Grays Inn Road.

The 330 Grays Inn Road proposals have mitigated against potential noise from the chillers by avoiding windows on the closest areas of façade to the cooling plant as shown on the image below.

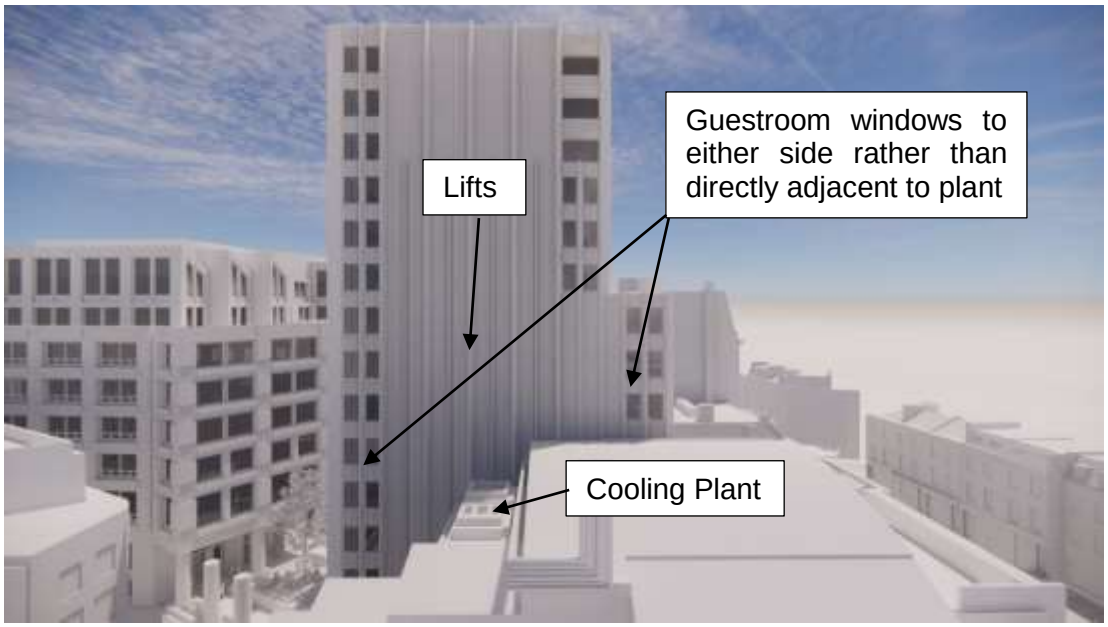


Image Courtesy of AHMM

This has been achieved by locating the guestrooms such that the internal areas behind the closest piece of façade to the chillers are lifts rather than guestrooms.

In addition, the majority of guestroom windows are located on alternative facades, and mitigation is provided in the form of mechanical ventilation, rather than relying on open windows or trickle vents for ventilation. During the design phase noise levels from the chillers will be checked to ensure that the façade design provides adequate mitigation.

Noise levels from the flues are likely to be low and are unlikely to be of concern given that as shown on the Exhaust Dispersion Design Review ref 2003680 by RWDI they are proposed to be relocated a further 15m away from the proposed hotel guestrooms for air quality reasons. In addition the design has provided mitigation in the form of mechanical ventilation, rather than relying on open windows or trickle vents for ventilation. During the design phase noise levels from the flues will be checked to ensure that the façade design provides adequate mitigation.

To summarise, the general operation of The Ear Institute should not cause adverse impact to the proposed hotel, and any impact associated with plant noise emissions should be suitably mitigated by the current design proposals. Plant noise levels will be checked during the design phase to ensure that the façade design provides adequate mitigation.

2.2 Future Noise/Vibration Transfer into The Ear Institute

The proposed use is that of a hotel, which is not a use type associated with significant generation of noise/vibration. In terms of the general operation of the hotel, it is unlikely to be

significantly different to the previous use as a hospital in terms of the noise/vibration output. General movement of people is likely to be similar and therefore unlikely to be a concern, and in addition, external plant noise emissions from the hotel will be designed to comply with the Local Authority Requirements or any planning conditions they may impose.

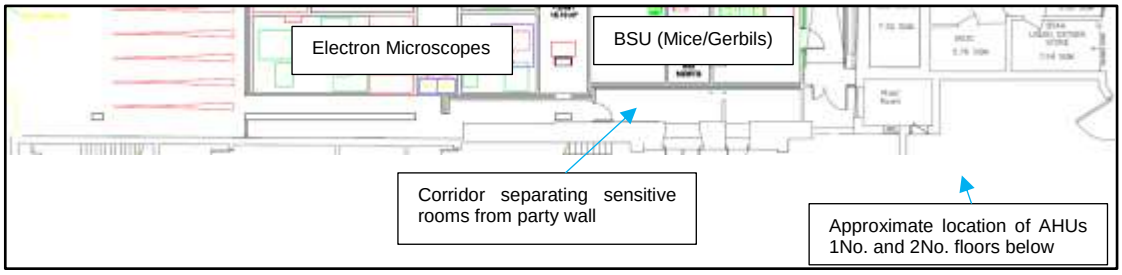
Our assessment has therefore focused on the specific areas or plant items which are proposed to be located adjacent to the party wall with The Ear Institute as follows:

2.2.1 Basement Plant

We understand the basement of the Ear Institute is the floor below Grays Inn Road ground level. The proposed 330 Grays Inn Road Basement 1 and Basement 2 are therefore to be 1No. and 2No. floors below the Ear Institute respectively. The only plant proposed to be located in rooms directly against the party wall line with The Ear Institute are AHU H1 (Basement 2), and AHU H3 (Basement 1) shown in the plans below.

Left: Basement 2, Right: Basement 1 (XCO_2)

The approximate horizontal location of these with respect to the basement of the Ear Institute (1No. and 2No. floors above respectively) are indicated on the plan below.



Plan showing AHU location relative to Noise Sensitive rooms (UCL Estates)

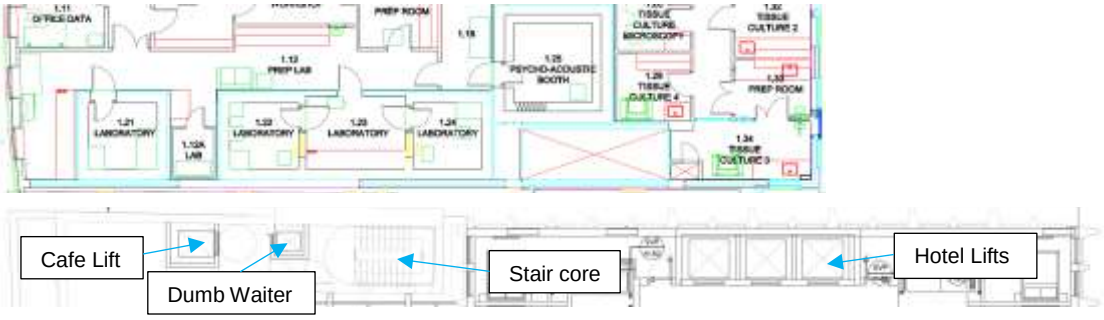
The AHUs will be fully ducted and therefore the only noise in the rooms should be breakout noise through the casing of the units. Given the vast amount of solid structure and several air

cavities between the noise/vibration sensitive rooms within The Ear Institute and the plantrooms (which are to be located 1No. and 2No. floors vertically below the sensitive rooms, and also at least two rooms away horizontally including the party wall), airborne noise transfer is unlikely to be a concern.

In order to control structureborne noise transfer from the units they should be installed with anti-vibration mounts that provide a minimum of 98% isolation efficiency when in situ.

2.2.2 Lifts & Dumbwaiters

The proposed location of the lifts and the dumbwaiter is shown on the plan below, which is lined up approximately with the plan showing the closest sensitive Laboratory rooms within The Ear Institute.



Top: Ear Institute Level 1 Layout (UCL Estates), Bottom: Typical layout on party wall line (XC02)

Lifts can be sources of noise and vibration transfer to nearby areas and therefore as mitigation the lift contractors will be made contractually responsible for complying with the attached Acoustic Specification for Lift/Dumbwaiter installations with respect to all lift and dumbwaiter installations in the Hotel.

2.2.3 Footfall

Footfall noise/vibration within the hotel is likely to be similar to that within the previous hospital, or indeed that within the Ear Institute itself. The closest location of likely footfall to sensitive Ear Institute rooms is likely to be the stair core shown above. However mitigating factors include the thickness of the party wall, the likely low levels of foot traffic on the stairs, and that the closest laboratory rooms are isolated box-in-box constructions designed to deal with the footfall noise/vibration from the adjacent corridor within the Ear Institute itself, which is closer than the proposed staircore.

2.2.4 Kitchen

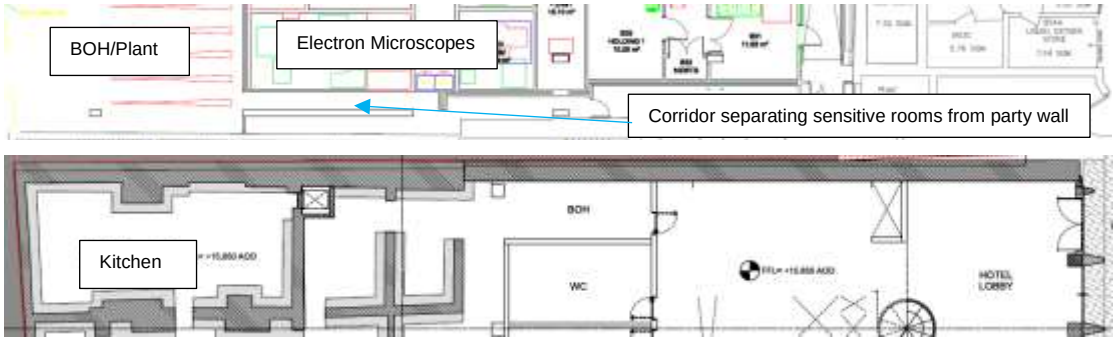
The proposed Kitchen, located on the Lower Ground floor (Ear Institute basement) as shown below could potentially be a source of impact noise e.g. from chopping/pots & pans etc. However mitigating factors include:

1) The proposed kitchen location is on the lowest floor of the building (on grade rather than on a suspended slab), and therefore not prone to vibration amplification.

2) It is separated from The Ear Institute by a thick party wall.

3) It is located such that the closest Ear Institute area is back of house space rather than noise/vibration sensitive.

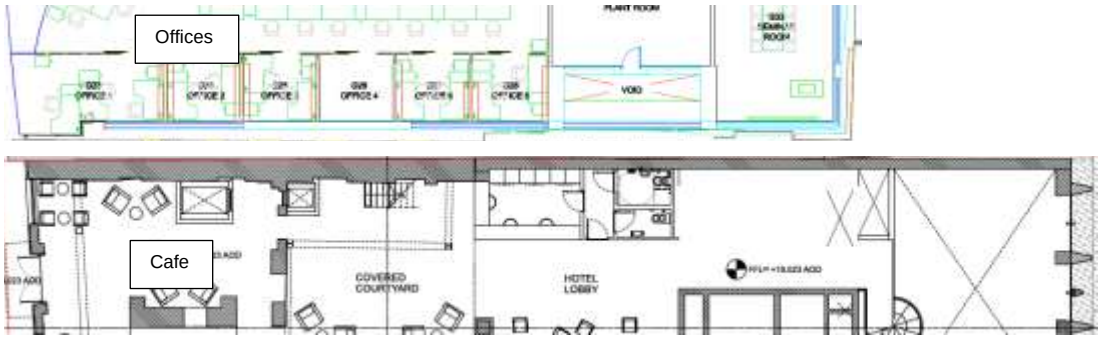
4) On the Ear Institute side there is a corridor separating the party wall from the sensitive uses, see plan below.



Top: Ear Institute Basement Layout (UCL Estates), Bottom: Lower Ground layout on party wall line (XC02)

2.2.5 Café

We understand the proposed café is adjacent to the ground floor offices within The Ear Institute as shown below. A typical masonry party wall is likely to be more than sufficient to appropriately control noise transfer between the two spaces.



Top: Ear Institute Ground floor Layout (UCL Estates), Bottom: Ground floor layout on party wall line (XC02)

In addition the WCs are located opposite The Ear Institute plantroom, and noise transfer between the two is unlikely to be cause for concern.

2.2.6 Hotel Café & Event Space

If events playing music are proposed it should be the responsibility of the hotel operator to ensure that in addition to the party wall build-up, the hotel fit-out provides any additional mitigation needed to control noise/vibration transfer from the proposed events, and that noise levels during the events are managed appropriately.

Ear Institute Level 2 Layout (UCL Estates)

3.0 Conclusions

The ‘agent of change’ principal has been set out and applied to the proposed hotel adjacent to The Ear Institute. To summarise, the general operation of The Ear Institute (which is not particularly noise/vibration generating in nature) should not cause adverse impact to the proposed hotel, and any impact associated with plant noise emissions should be suitably mitigated by the current design proposals. Plant noise levels will be checked during the design phase to ensure that the façade design provides adequate mitigation.

In terms of the noise/vibration impact of the future hotel on the ear institute, it is unlikely to be significantly different to the previous use as a hospital in terms of the noise/vibration output.

External plant noise emissions from the hotel will be designed to comply with the Local Authority Requirements or any planning conditions they may impose.

Specific areas or plant items which are proposed to be located adjacent to the party wall with The Ear Institute, and associated mitigation measures where necessary have been discussed herein.

Yours sincerely

Luke Rendell
for HANN TUCKER ASSOCIATES

330 Grays Inn Road Hotel

Acoustic Specification for Lift / Dumbwaiter Installations

Lift ride quality and performance characteristics shall not exceed the following levels:

Description	Criteria
Noise in lift car [1]	55 $L_{Amax(fast)}$
Acceleration [1]	1.0m/sec^2
Jerk [1]	1.2m/sec^3
Horizontal peak to peak vibration [1]	0.10m/sec^2 (10mg)
Vertical peak to peak vibration [1]	0.12m/sec^2 (12mg)
Vertical vibration in occupied areas [2]	0.01 m/sec^2 (1mg)
Noise in lift lobby [3, 4]	50 $L_{Amax(fast)}$
Noise from in car announcement and arrival gongs [3]	65 $L_{Amax(fast)}$
Noise into guestrooms [3, 4]	25 $L_{Amax(fast)}$
Noise into meeting/function rooms [3, 4]	30 $L_{Amax(fast)}$
Noise into café/bar/restaurant [3, 4]	35 $L_{Amax(fast)}$
Noise into lounges [3, 4]	30 $L_{Amax(fast)}$
Noise into offices [3, 4]	40 $L_{Amax(fast)}$

1 Lift ride quality and performance characteristics shall be measured and presented in accordance with BS ISO 18738-1:2012 ‘Measurement of ride quality Part 1: Lifts’. N.B. The measurement parameter for vibration is peak to peak, not peak.

2 Vibration levels shall be measured in terms of peak acceleration on the floor slabs in occupied areas based on the Wb weighting, as defined in Clause 3.3 of BS 6472-1:2008.

3 Lifts shall be operated as per Section 6.4 of BS ISO 18738-1:2012. Noise levels shall be measured at 1m from the Lift Door or Shaft Wall, as appropriate, in accordance with the Association of Noise Consultants Guideline document ANC-9701-1997 titled “Noise Measurements in Buildings”.

4 Noise levels are to be met by noise associated with any part of the lift cycle, including door operation.

For dumbwaiters and goods/vehicles/cycle lifts relaxation of the criteria for ride quality within the lift car may be acceptable, but shall be agreed by the developer or acoustic consultant in writing. No relaxation is normally acceptable within occupied office or residential areas.

No perceptible vibration or re-radiated noise shall be permitted in any building outside the Client's demise.

In order to meet the above criteria it is suggested that consideration be given to the following items.

a) All lift equipment (including the lift motor, starter electrical cabinet, car controllers, reactors and motors generators) should be suitably vibration isolated as appropriate. All connections, such as electrical grounding, shall be formed from flexible cable/conduit.

b) In the case of hydraulic lift installations, pipework shall be fitted with in-line silencers in order to effectively control noise transmission to areas outside the lift motor room via hydraulic fluid pipes.

c) All support steelwork for the installation is to be selected to avoid any resonances forced by the lift motor and the natural frequencies of steelwork should therefore fall between the dominant system frequencies. The steelwork, in particular beams supporting diverter sheaves and pulleys, should be as stiff as possible and suitably vibration isolated from the main structural building elements. The mounting arrangements for the beams should be carefully considered to ensure that the beams are not less stiff than the proposed method of isolation. To this end, long span beams should be avoided and beams should terminate as closely as possible to columns rather than other horizontal beams. The stiffness of the beam support member should be at least 3 time greater than the stiffness of the beam.

d) Rope hole penetrations shall be acoustically treated (if required) so as to ensure lift motor room noise breakout is controlled to ensure acceptable noise levels in the 'lift lobby' area as defined above.

e) The car and counterweight guides shall be so joined and fixed to their brackets that they do not deflect by more than 1.0mm under normal operating conditions, and for all panoramic passenger and goods lifts the fixings shall be at floor level only.

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Lorraine M. Gregory (Company Secretary)

PROJECT TECHNICAL MEMORANDUM

JOB TITLE : 330 Grays Inn Road

REF : HT: 26609/PTM1

DATE : 23 March 2021

FROM : Luke Rendell

ISSUED TO : nmorris@groveworld.co.uk
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RE: Noise/Vibration Transfer from The Water Rats

We understand that Camden and the GLA have requested details of the 330 Grays Inn Road proposals with respect to the principal of 'agent of change' regarding the adjacent UCL Ear Institute. Our planning stage assessment with regards to this principal is as follows:-

1.0 Introduction

Hann Tucker Associates attended 330 Grays Inn Road on 19 February 2021 to undertake measurements of noise and vibration, due to music and plant noise transfer from The Water Rats Public House.

2.0 Legislation & Guidance

2.1 NPPF

Paragraph 182 of the National Planning Policy Framework states:

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

2.2 The London Plan 2021

Policy D13 (Agent of Change) in The London Plan 2021 (March 2021) states:

Policy D13 Agent of Change

A The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance-generating uses in a sensitive manner when new development is proposed nearby.

B Development should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.

C New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.

D Development proposals should manage noise and other potential nuisances by:

1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area
2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations
3) separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.

E Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed.

3.13.1 For a long time, the responsibility for managing and **mitigating the impact of noise** and other nuisances on neighbouring residents and businesses has been placed on the business or activity making the noise or other nuisance, regardless of how long the business or activity has been operating in the area. In many cases, this has led to newly-arrived residents complaining about noise and other nuisances from existing businesses or activities, sometimes forcing the businesses or other activities to close.

3.13.2 The **Agent of Change principle** places the responsibility for mitigating the impact of noise and other nuisances firmly on the new development. This means that where new developments are proposed close to existing noise-generating uses, for example, applicants will need to design them in a more sensitive way to protect the new occupiers, such as residents, businesses, schools and religious institutions, from noise and other impacts. This could include paying for soundproofing for an existing use, such as a music venue. The Agent of Change principle works both ways. For example, if a new noise-generating use is proposed close to existing noise-sensitive uses, such as residential development or businesses, the onus is on the new use to ensure its building or activity is designed to protect existing users or residents from noise impacts.

3.13.3 The Agent of Change principle is included in the National Planning Policy Framework, and **Planning Practice Guidance** provides further information on how to mitigate the adverse impacts of noise and other impacts such as air and light pollution.[36]

3.13.4 The Agent of Change principle predominantly concerns the impacts of noise-generating uses and activities but **other nuisances** should be considered under this policy. Other nuisances include dust, odour, light and vibrations (see Policy SI 1 Improving air quality and Policy T7 Deliveries, servicing and construction). This is particularly important for development proposed for co-location with industrial uses and the intensification of industrial estates (see Part D4 of Policy E7 Industrial intensification, co-location and substitution). When considering co-location and intensification of industrial areas, boroughs should ensure that existing businesses and uses do not have unreasonable restrictions placed on them because of the new development.

3.13.5 Noise-generating **cultural venues** such as theatres, concert halls, pubs, night-clubs and other venues that host live or electronic music should be protected (see Policy HC5 Supporting London's culture and creative industries). This requires a sensitive approach to managing change in the surrounding area. Adjacent development and land uses should be brought forward and designed in ways which ensure established cultural venues remain viable and can continue in their present form without the prospect of licensing restrictions or the threat of closure due to noise complaints from neighbours.

3.13.6 As well as cultural venues, the **Agent of Change principle should be applied to all noise-generating uses and activities** including schools, places of worship, sporting venues, offices, shops, industrial sites, waste sites, safeguarded wharves, rail and other transport infrastructure.

3.13.7 Housing and other **noise-sensitive development** proposed near to an existing noise-generating use should include necessary acoustic design measures, for example, site layout, building orientation, uses and materials. This will ensure new development has effective measures in place to mitigate and minimise potential noise impacts or neighbour amenity issues. Mitigation measures should be explored at an early stage in the design process, with necessary and appropriate provisions secured through planning obligations.

3.13.8 Ongoing and longer-term management of mitigation measures should be considered, for example through a **noise management plan**. Policy T7 Deliveries, servicing and construction provides guidance on managing the impacts of freight, servicing and deliveries.

3.13.9 Some **permitted development**, including change of use from office to residential, requires noise impacts to be taken into consideration by the Local Planning Authority as part of the prior approval process. Boroughs must take account of national planning policy and guidance on noise, and therefore the Agent of Change principle would apply to these applications.

3.13.10 **Noise and other impact assessments** accompanying planning applications should be carefully tailored to local circumstances and be fit for purpose. That way, the particular characteristics of existing uses can be properly captured and assessed. For example, some businesses and activities can have peaks of noise at different times of the day and night and on different days of the week, and boroughs should require a noise impact assessment to take this into consideration. Boroughs should pay close attention to the assumptions made and methods used in impact assessments to ensure a full and accurate assessment.

3.13.11 Reference should be made to Policy D14 Noise which considers the impacts of noise-generating activities on a wider scale and Policy SI 1 Improving air quality which considers the impacts of existing air pollution. **Further guidance** on managing and mitigating noise in development is also provided in the Mayor's London Environment Strategy.

2.3 BS4142:2014

When assessing noise impact from existing plant, reference is commonly made to BS 4142: 2014 "*Methods for rating and assessing industrial and commercial sound".*

The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains "a tone, impulse or other characteristic" then various corrections can be added to the specific (source) noise level to obtain the "rating level".

BS 4142 states that: "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:

• "Typically, the greater this difference, the greater the magnitude of the impact."

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

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

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

The determination of the "rating level" and the "background level" are both open to interpretation, depending on the context.

In summary it is not possible to set plant noise emission criteria purely on the basis of BS 4142:2014. It is reasonable to infer from the above, however, that a difference of around -5dB

corresponds to “No Observed Effect Level” as defined in the Noise Policy Statement for England. It is also reasonable to infer from the above that if the plant noise rating level does not exceed the existing background noise level outside any noise sensitive residential window then the plant noise is of “low impact”.

2.4 Music Noise Intrusion

Whilst regular music noise intrusion is generally expected to be inaudible inside residential properties, a hotel is a business rather than a permanent residence, and given the central London location next to a pub/music venue, some low level of music noise intrusion may be expected/acceptable in some rooms, depending on the operator.

Nevertheless we would suggest that the design intent for structureborne music noise should be for it to be approaching inaudibility, given that it may affect a large area of the hotel.

However, it is difficult to use inaudibility as a design criterion because hearing thresholds vary from person to person, especially at low frequencies, and because it depends on the future level of background noise present in the rooms. Different hotel operators may also have different definitions by which to assess inaudibility. Therefore it is important to clearly set out a definition of inaudibility for design purposes (see Section 2.4.1 below).

Airborne noise intrusion through the façade should be controlled via the use of masonry constructions and high spec acoustic windows with secondary glazing, but we would suggest that absolute inaudibility during music events in the rooms on the loudest facades should *not* be sought at the expense of natural light (i.e. no windows). There is already a precedent set in the immediate vicinity, since the neighbouring hotel on the other side of The Water Rats has windows to the rear. The closest of these are only slightly further from the music room than the proposed windows of this scheme and whilst the type of glazing is unknown, based on the measurements presented herein, music noise is unlikely to be completely inaudible inside those rooms.

Airborne noise intrusion through the party wall should be controlled by space planning i.e. no guestrooms to be located directly against the party wall with The Water Rats music room on the ground floor.

2.4.1 Definition of Inaudibility – Structureborne Noise

It is generally agreed that a sound is unlikely to be audible if it is 10dB or more below the background. Background noise levels within hotel guestrooms are typically dominated by building services, usually fan coil units. Hann Tucker Associates have commissioned many fan

coil units in hotel guestrooms. The table below presents what we consider to be typical L_{eq} octave band background sound pressure levels in hotel guestrooms, together with the corresponding Noise Rating (NR) and dBA level.

Measured Sound Pressure Level (dB L_{eq}) at Octave Band Centre Frequency (Hz)								NR	dBA
63	125	250	500	1k	2k	4k	8k		
41	37	35	29	25	19	20	18	25	32

However, it may not be appropriate to use the above at very low frequencies close to the threshold of hearing. The University of Salford document 'Procedure for the assessment of low frequency noise disturbance', contract no. NANR45, hereby referred to simply as 'NANR45' which deals with low frequency noise complaints, sets out an L_{eq} criterion curve for assessing whether a measured levels of low frequency sound may be audible. This corresponds to 47dB and 41dB in the 63Hz and 125Hz octave bands respectively. The document also states that sound may still be audible at up to 5dB below the criterion curve (42dB and 36dB in the 63Hz and 125Hz octave bands respectively).

In addition, we would suggest that the proposed audibility criteria should also not be below the threshold of hearing defined in ISO226, and therefore the 8kHz value has been refined upwards slightly.

Based on the above for the purposes of this document we have defined inaudibility to be:

- L_{Aeq} 5dB below the criterion curve given in the University of Salford document 'Procedure for the assessment of low frequency noise disturbance', contract no. NANR45, hereby referred to simply as 'NANR45', in the 63Hz and 125Hz octave bands.
- L_{Aeq} 10dB below the assumed guestroom background building services noise levels given above in the 250Hz-4kHz octave bands.
- L_{Aeq} equal to the threshold of hearing defined in ISO226 in the 8kHz octave band.

The above corresponds to the following octave band sound pressure levels:

Proposed Audibility Criteria (dB L_{eq}) in Hotel Guestrooms at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
42	36	25	19	15	9	10	13

3.0 Methodology

3.1 Equipment

The equipment used, as detailed below, was calibrated prior to and on completion of the survey. No significant calibration drift occurred.

Equipment	Model	Serial Number	Latest Calibration	Annual Lab Calibration
Type 1 Data Logging Sound Level Meter	Bruel & Kjaer	2250	3025204	Calibration on 29/09/2020
Type 1 ½" Condenser Microphone	Bruel & Kjaer	4189	3148322	Calibration on 29/09/2020
Preamp	Bruel & Kjaer	ZC0032	27881	Calibration on 29/09/2020
Type 1 Data Logging Sound Level Meter	Svantek	971	74415	Calibration on 13/09/2019
Type 1 ½" Condenser Microphone	ACO Pacific	7052E	75073	Calibration on 19/07/2019
Preamp	Svantek	SV18	82324	Calibration on 19/07/2019
Type 1 Calibrator	Bruel & Kjaer	4231	2610161	Calibration on 21/09/2020

In addition to the sound level measurements, manned vibration measurements were also undertaken using a Svantek SV948 vibration meter, and associated SV207A tri-axial accelerometer.

3.2 Music Noise

The Water Rats arranged for a drummer and sound engineer to be present in order to replicate typical sound levels during their loudest type of events. The piece of music chosen was 'Highway to Hell' by AC/DC which was played on loop with the drummer playing along to the record, both of which were played through the Water Rats PA system.

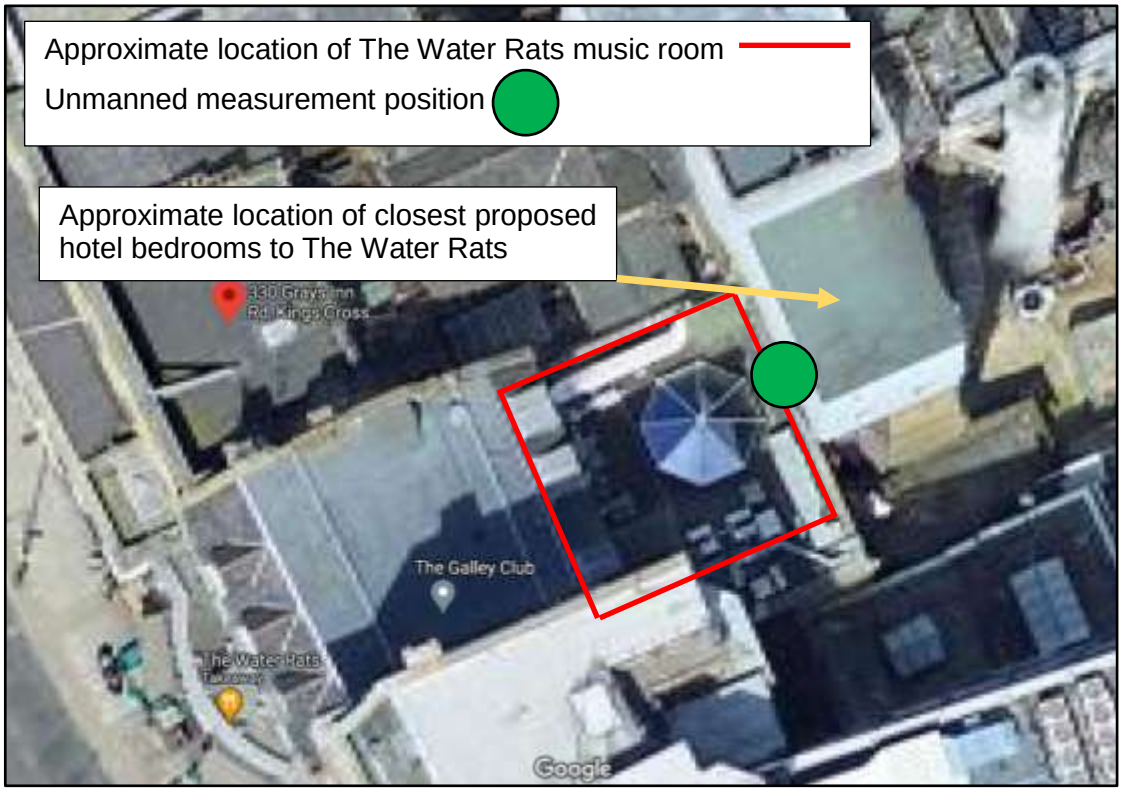
From communication with The Water Rats management we understand the sound levels achieved to be representative of one of their louder bands, with sound levels only occasionally rising slightly above this level during the very loudest events. We were also informed that The Water Rats caters for a variety of different styles of music, the sound levels associated with many of which are lower than generated during this test. We were not permitted to measure sound levels inside The Water Rats during the test.

3.3 Plant Noise

Prior to starting the music The Water Rats separately switched on their roof plant so that noise levels from that could also be taken into account.

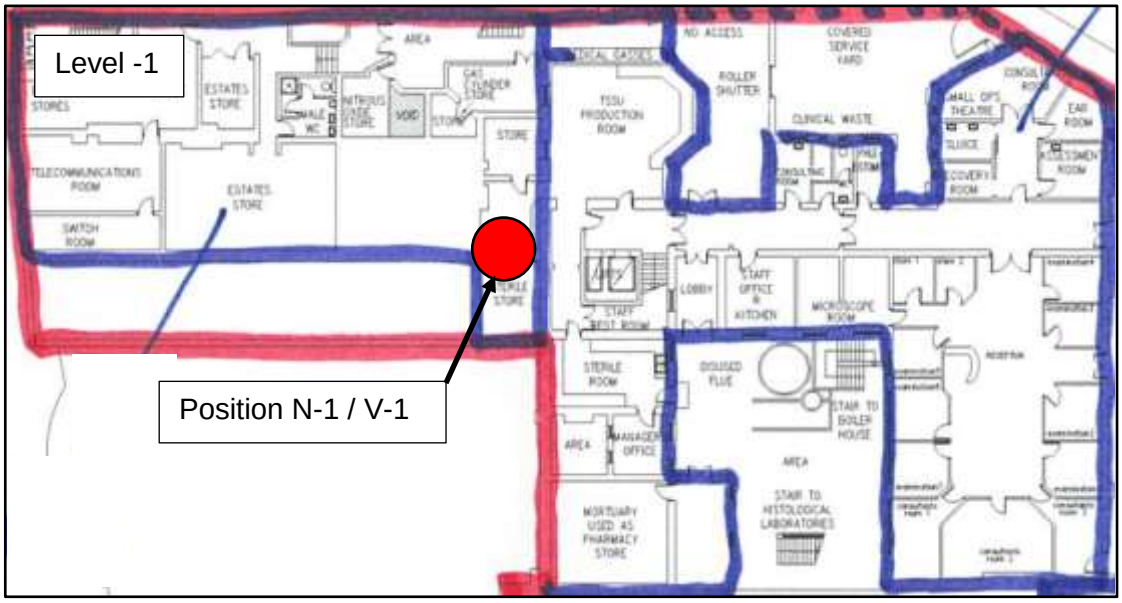
3.4 Measurement Positions

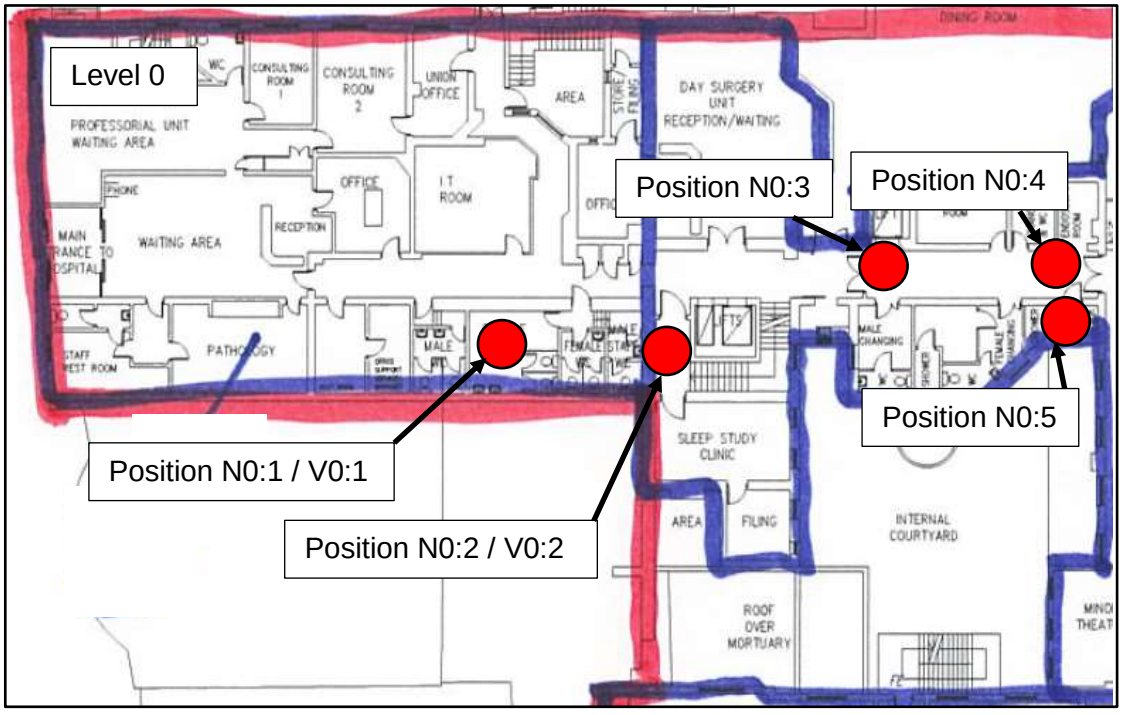
In order to measure external noise levels, an unmanned sound level meter was set up in the third floor bedroom (location of closest proposed 3rd floor guestroom to The Water Rats) with a microphone mounted to a pole and located at 1m from the façade externally, as shown below.

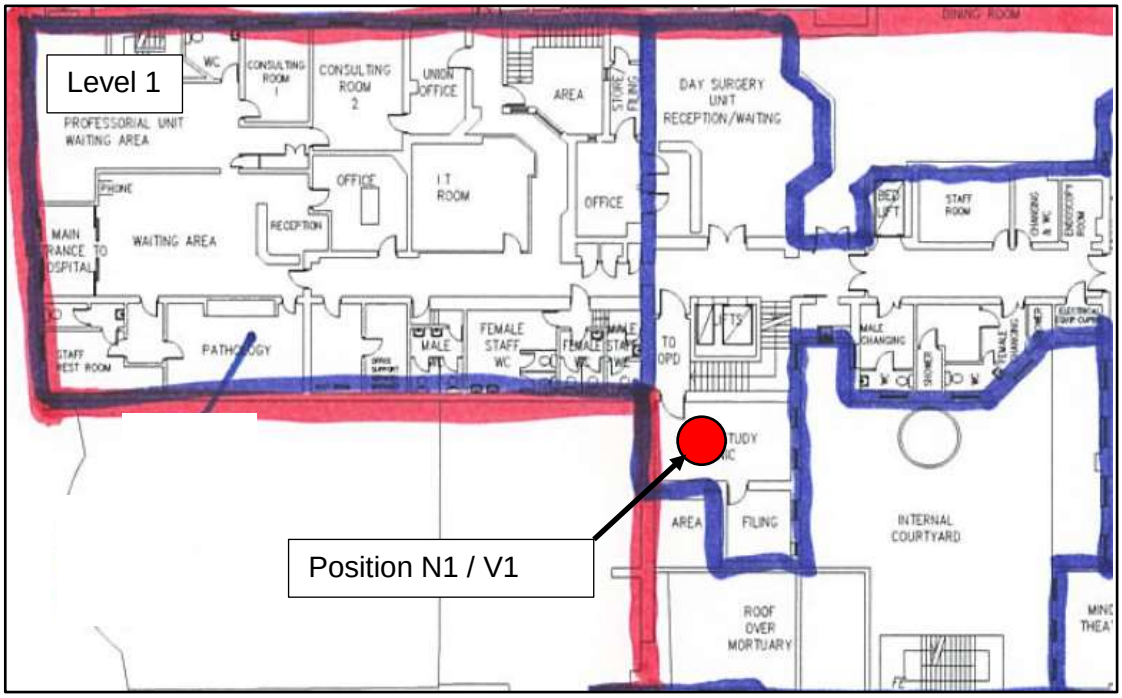


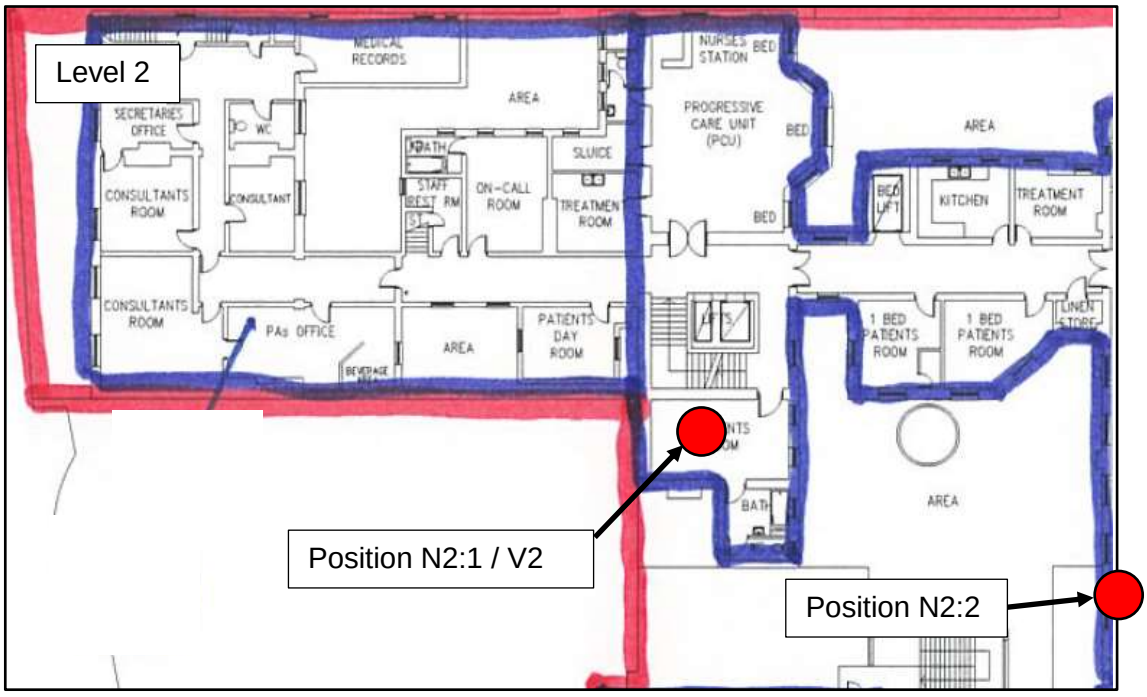
Site Plan © Google 2021

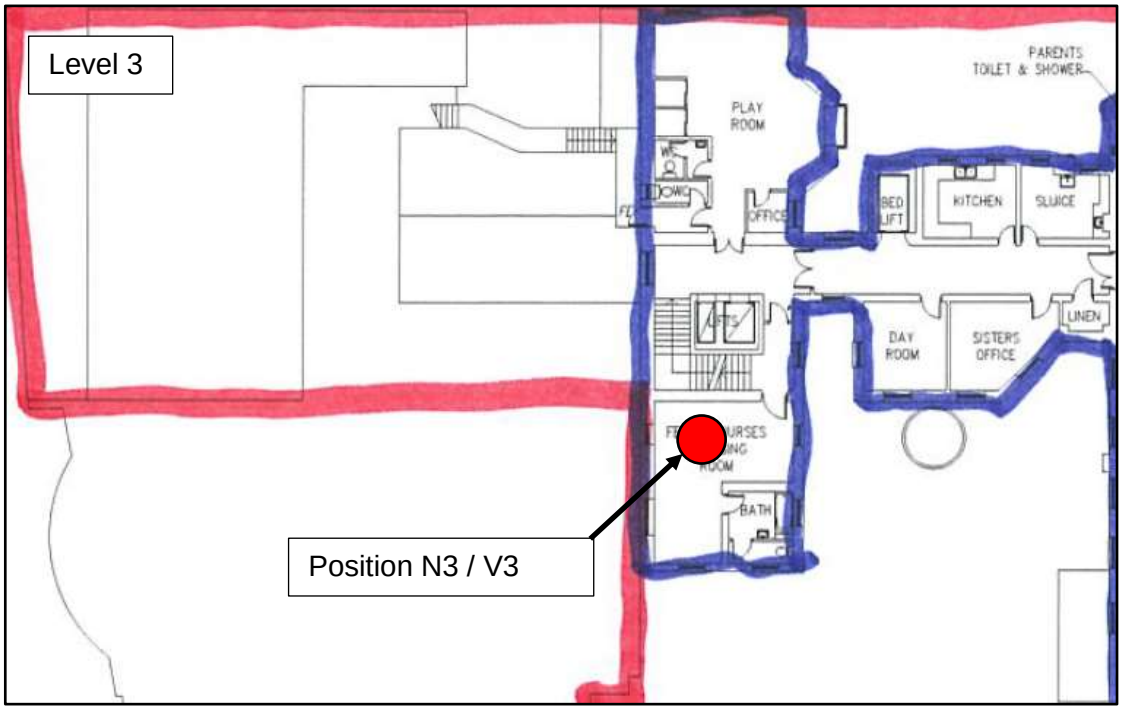
In addition, internal noise and vibration levels were measured at various locations on each floor between the basement and 4th floor level, as shown on the plans below.

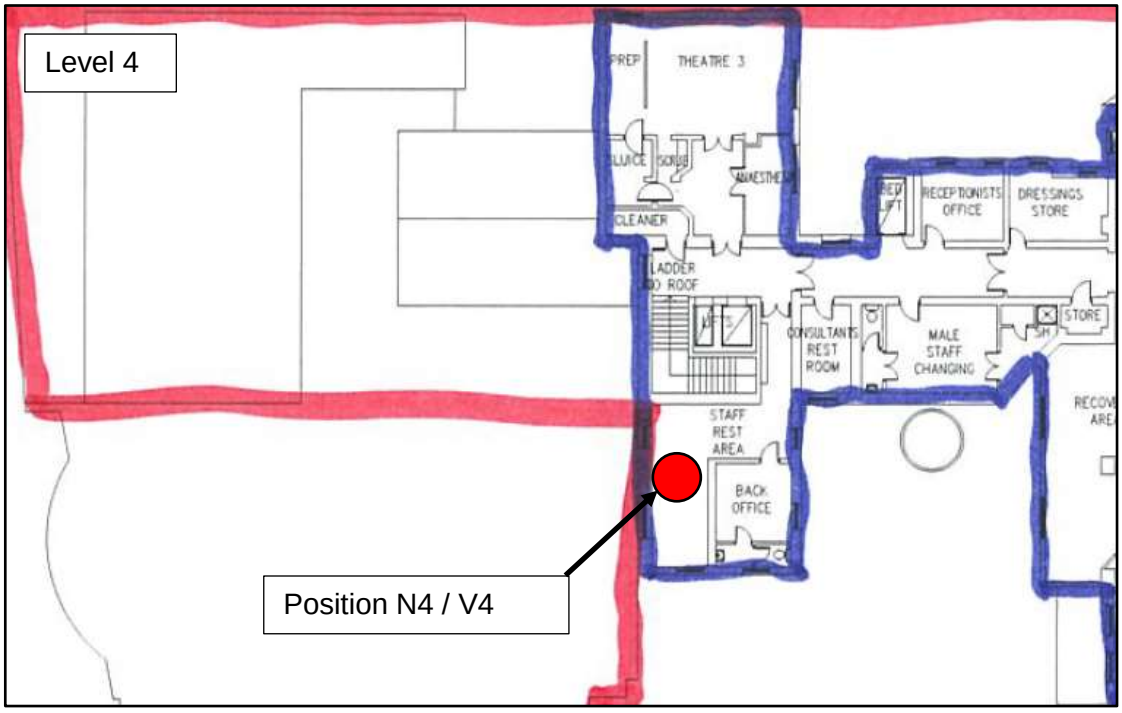

Level -1
Position N-1 / V-1


Level 0
Position N0:3
Position N0:4
Position N0:5
Position N0:1 / V0:1
Position N0:2 / V0:2


Level 1
Position N1 / V1
PROFESSORIAL UNIT WAITING AREA
CONSULTING ROOM 1
CONSULTING ROOM 2
UNION OFFICE
AREA
DAY SURGERY UNIT RECEPTION/WAITING
OFFICE
I T ROOM
OFFICE
PHONE
RECEPTION
WAITING AREA
MAIN ENTRANCE TO HOSPITAL
STAFF REST ROOM
PATHOLOGY
MALE
FEMALE STAFF WC
TO OPD
STAFF ROOM
MALE CHANGING
AREA
FILING
INTERNAL COURTYARD
ROOF OVER MORTUARY


Level 2
Position N2:1 / V2
Position N2:2
MEDICAL RECORDS
AREA
NURSES STATION
SECRETARIES OFFICE
WC
PROGRESSIVE CARE UNIT (PCU)
BED
AREA
CONSULTANTS ROOM
CONSULTANT
STAFF REST RM
ON-CALL ROOM
SLUICE
TREATMENT ROOM
KITCHEN
TREATMENT ROOM
CONSULTANTS ROOM
PAs OFFICE
AREA
PATIENTS DAY ROOM
1 BED PATIENTS ROOM
1 BED PATIENTS ROOM
AREA





For the noise measurements L_{Aeq}, L_{Afmax}, L_{A90} noise levels were measured along with octave band L_{eq} and L_{fmax} noise levels in the frequency range 63Hz-8kHz. For the vibration measurements Vibration Dose Value (VDV), and peak weighted acceleration were measured along with rms acceleration in 1/3rd octave bands from 1Hz-800Hz.

4.0 Results

4.1 Noise

4.1.1 Unmanned External Noise Measurements

The results of the unmanned external noise monitoring are presented in the attached time history graphs 26609/TH1-26609TH2 presenting the L_{Aeq}, L_{max}, and L_{90} noise levels and also the L_{eq} noise levels in the 63Hz, 125Hz, and 250Hz octave bands.

The lowest measured external background L_{90} noise level during the survey was 50dBA.

The measured external L_{eq} noise level due to The Water Rats roof plant (corrected for background) was 66dBA.

The highest measured $L_{eq,30s}$ music noise level (corrected for background) was 53dBA, comprising 78dB and 62dB in the 63Hz and 125Hz octave bands respectively. The other frequency bands were not measurable above the background.

4.1.2 Manned Noise Measurements

The results of the manned music noise measurements are presented in the table below:

Ref.	Position	Position Detail	Description	L_{eq} Sound Pressure Level (dB re2*10^{-5}Pa) at Octave Band Centre Frequency (Hz)								dBA
				63	125	250	500	1k	2k	4k	8k	
8	N3	Outside window	Background	64	58	53	51	50	49	43	31	55
25			Music	73	60	54	49	47	41	34	23	53
9	N3	Windows open	Background	50	46	41	38	36	30	22	13	41
26			Music	60	46	41	37	36	30	21	13	41
10	N3	Windows open, standing further back	Background	46	40	34	31	28	26	17	12	34
27			Music	53	42	35	29	26	22	15	12	33
5	N4	Windows closed	Background	49	39	35	32	31	25	20	17	35
28			Music	57	44	38	34	33	24	15	13	38
7	N4	Outside window	Background	64	59	56	52	51	47	38	25	55
29			Music	73	62	56	52	51	47	39	25	56
6	N4	Windows open	Background	51	53	57	47	43	38	30	20	50
30			Music	55	50	46	41	42	36	25	14	45
11	N2:1	No windows facing The Water Rats	Background	45	36	31	24	19	15	12	11	27
31			Music	63	50	38	30	25	21	16	13	38
12	N1	No windows facing The Water Rats	Background	43	38	30	25	23	18	14	13	29
34			Music	66	54	38	27	27	19	15	12	42
13	N0:2	No windows	Background	42	54	37	33	27	29	19	15	39
35			Music	69	58	43	30	36	34	26	18	46
41	N0:1	No windows	Background	42	37	27	24	18	16	13	12	27
38			Music	85	71	54	44	41	39	29	17	58

Ref.	Position	Position Detail	Description	L_{eq} Sound Pressure Level (dB re2*10^{-5}Pa) at Octave Band Centre Frequency (Hz)								dBA
				63	125	250	500	1k	2k	4k	8k	
14	N-1	No windows	Background	47	40	33	31	23	19	16	19	32
39			Music	63	49	38	28	23	20	17	18	38
51	N0:3	No windows	Background	39	38	42	33	26	25	15	11	37
42			Music	49	45	39	31	25	24	15	12	35
52	N0:4	No windows	Background	42	42	40	32	30	27	18	11	37
43			Music	43	41	40	31	32	26	18	12	37
53	N0:5	No windows	Background	43	39	37	30	25	22	13	11	33
44			Music	46	43	37	33	26	24	17	13	35

The results of the manned plant noise measurements are presented in the table below:

Ref.	Position	Position Detail	Description	L_{eq} Sound Pressure Level (dB re2*10^{-5}Pa) at Octave Band Centre Frequency (Hz)								dBA
				63	125	250	500	1k	2k	4k	8k	
2	N2:2	Outside window	Background	60	56	52	49	47	41	33	20	51
18			Plant	63	60	64	54	55	50	48	41	60
3	N2:2	Windows closed	Background	48	43	43	36	32	29	21	13	39
17			Plant	50	47	46	38	38	36	31	20	44
7	N4	Outside window	Background	64	59	56	52	51	47	38	25	55
19			Plant	66	65	68	58	60	57	54	49	65
6	N4	Windows open	Background	51	53	57	47	43	38	30	20	50
20			Plant	49	50	54	48	50	45	43	37	54
5	N4	Windows closed	Background	49	39	35	32	31	25	20	17	35
21			Plant	48	42	42	37	37	29	25	17	40
8	N3	Outside window	Background	64	58	53	51	50	49	43	31	55
22			Plant	68	69	67	59	63	58	57	53	67
9	N3	Windows open	Background	50	46	41	38	36	30	22	13	41
23			Plant	53	54	51	46	48	42	41	35	52
10	N3	Windows open, standing further back	Background	46	40	34	31	28	26	17	12	34
24			Plant	50	46	44	39	38	34	31	25	43

4.2 Vibration

The measured vertical 1/3rd octave band rms acceleration is presented in the attached graphs 26609/WR/VG1 - 26609/WR/VG4.

The measured vibration dose values (VDV) and vertical peak Wb weighted acceleration are presented in the tables below for positions that correspond to the closest proposed future hotel rooms on levels 1-4:

Floor Level	Measured VDV ($mm/s^{1.75}$)	
	Background (Music Off)	Music On
1	0.004	0.016
2	0.005	0.023
3	0.003	0.008
4	0.004	0.010

Floor Level	Maximum measured Peak Wb (mm/s^2)	
	Background (Music Off)	Music On
1	0.007	0.016
2	0.007	0.029
3	0.008	0.01
4	0.005	0.012

5.0 Assessment & Discussion

5.1 Plant Noise

We have undertaken a BS4142 assessment of the noise impact of the roof plant associated with The Water Rats, which we understand comprises a kitchen extract fan, another fan and some condenser units. The results of the assessment are presented in the table below:

Description	Sound Level (dBA)
Roof plant, measured at 1m from a 3rd floor window of 330 Grays Inn Road (proposed future hotel room location)	66
Tonality Correction	6
Rating Level	72
Background LA90	50
Excess of Rating Level over Background	22
Outcome of Assessment	Significant Adverse Impact

The assessed noise impact of the existing roof plant is ‘significant adverse impact’ and mitigation measures are therefore required.

However, the developer is willing to offer to install the necessary mitigation measures to the plant as part of the scheme in order to reduce the noise impact both to the scheme itself and also to the surrounding area.

In order to reduce the assessed outcome from ‘Significant Adverse Impact’ to ‘low impact’ at the guestroom windows noise emissions from the existing plant would need to be reduced by at least 22dBA. By comparison, were this to be a new item of plant seeking planning permission,

we understand Camden's planning requirement would be for noise levels to be 15dBA below background if tonal. In order for the existing plant to also meet this at the proposed hotel windows, noise levels would need to be reduced by around 31dBA. We would therefore recommend that mitigation measures aim to reduce noise levels from the plant by 31dBA if practicably possible. If this is not possible due to the existing nature of the plant then mitigation should achieve the greatest reduction possible, not less than 22dBA.

Potential options for mitigation include ensuring the plant is in a good state of repair and operating at the correct duty, and installation of suitably specified attenuation measures such as acoustic enclosures, acoustic lagging, and in-duct acoustic attenuators.

5.2 Music Noise

Graph 26609/TH2 shows that music noise was present externally at low frequencies, especially in the 63Hz octave band. However high levels of music noise intrusion were also measured in rooms which had no exposed facade overlooking the water rats, and the measured level of music noise at 63Hz on level 4 did not decrease when the windows were closed. In addition graphs 26609/WR/VG1-26609/WR/VG4 show elevated levels of vibration centred around the 50Hz and 63Hz 1/3rd octave bands, even for rooms not next to the party wall. Together these results indicate that as well as external noise ingress through the windows/façade and through the party wall there is likely to be a considerable component of structureborne transmission i.e. vibration travelling through the structure before being re-radiated inside the rooms as noise.

5.2.1 Airborne Noise Intrusion through the Facade

The maximum external measured $L_{eq,30s}$ music noise levels at 63Hz and 125Hz, corrected for background where necessary are as follows (external music noise was not measurable above background in the other frequency bands):

Measured External Music Noise Levels (dB re $2x10^{-5}$Pa at Octave Band Centre Frequency	
63Hz	**125Hz**
78	62

The maximum practicable mitigation proposed by the scheme is as follows:

- 350mm thick masonry façade providing a sound reduction index (SRI) of at least 37dB in the 63Hz octave band.

- Windows to comprise no more than approximately 42% of the façade area.

- Windows to be high spec acoustic laminated secondary glazing providing an SRI of at least 29dB in the 63Hz octave band. This is likely to be at the very limit of what can be achieved with secondary glazing.

Based on the above, calculated internal airborne noise levels using our in-house external building fabric software, assuming typical absorption coefficients for a bedroom (0.1 at 63Hz), are as follows:

Approximate Worst Case Internal Airborne Music Noise (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency	
63Hz	125Hz
52	26

However, the calculations indicate that internal noise levels at low frequencies may be reduced by up to 5dB if a significant quantity of sound absorption is included as part of the guestroom finishes, for example a highly absorbent acoustic ceiling comprising a 100mm thick mineral wool backing. Revised calculations based an average absorption coefficient of 0.3 at 63Hz, are as follows:

Approximate Worst Case Internal Airborne Music Noise (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency	
63Hz	125Hz
47	24

The above noise levels are 5dB above and 12dB below the definition of inaudibility set out in Section 2.4.1 at 63Hz and 125Hz respectively. However on the basis that this level at 63Hz corresponds to the value of the NANR45 criterion curve (converted to octave bands at 63Hz), and that it corresponds to a Noise Rating/Noise Criterion of NR/NC15, this is likely to represent levels of low frequency sound which, if audible, should be perceived to be very low in level and may therefore be acceptable given the context.

By comparison, the above predicted level (NC15) is far below the typical requirements of hotel operators for environmental noise intrusion. A recent hotel scheme we have worked on had the following requirement:

"In locations with noisy environments windows should limit noise transmission to NC30 inside the room."

Given the onerous level of mitigation described above, proposals to investigate the possibility of reducing the noise at source are discussed in Section 6.2. Further work will therefore be undertaken during the design stage.

5.2.2 Structureborne Noise

The measured internal music noise levels, corrected for background are presented in the table below. Windows where present were closed, and although there is likely to be some contribution from airborne noise, especially adjacent to the party wall (Position N0:1) it is likely that a considerable component to these levels is structureborne. Note that music noise at positions N0:4 and N0:5 was not considered to be reliably measurable over the existing background.

Position	Music Noise L_{eq} Sound Pressure Level (dB re $2x10^{-5}$Pa) at Octave Band Centre Frequency (Hz) (Corrected for Background)								dBA	NR
	63	125	250	500	1k	2k	4k	8k		
N4	57	43	35	-	-	-	-	-	33	27
N2:1	63	50	37	29	23	19	14	-	39	36
N1	66	54	37	-	24	-	-	-	42	39
N0:2	69	55	41	-	35	32	25	16	45	42
N0:1	85	71	54	44	41	39	29	15	60	62
N-1	63	49	36	-	-	-	-	-	38	34
N0:3	49	44	-	-	-	-	-	-	29	25
N0:4	-	-	-	-	-	-	-	-	-	-
N0:5	-	-	-	-	-	-	-	-	-	-

- Not reliably measurable over the existing background noise climate

The following table shows the exceedances of the above levels over the proposed audibility criterion curve presented in Section 2.1.1.

Position	Exceedance over Proposed Criterion Curve (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Criterion Curve	42	36	25	19	15	9	10	13
N4	15	7	10	-	-	-	-	-
N2:1	21	14	12	10	8	10	4	-
N1	24	18	12	-	9	-	-	-
N0:2	27	19	16		20	23	15	3
N0:1	43	35	29	25	26	30	19	2
N-1	21	13	11	-	-	-	-	-
N0:3	7	8		-	-	-	-	-

Based on our understanding of the scheme and the above, the worst case future proposed hotel guestroom location corresponds to Position N1 at first floor level. Positions N0:1 and N0:2

correspond to a future corridor, but are a similar distance from the party wall to the proposed restaurant.

The proposed inaudibility criterion curve presented in Section 2.1.1 applies to guestrooms where hotel guests relax and sleep, but not to the restaurant where low levels of noise intrusion may be acceptable, depending on the requirements of the operator; for example this could be masked by background music played in the restaurant itself.

Therefore, we would recommend that as a minimum the design incorporates mitigation measures capable of reducing structureborne noise transfer between The Water Rats and 330 Grays Inn Road by at least 24dB in the 63Hz octave band. Mitigation measures are discussed in Section 6.1.

5.3 Vibration

The vibration results show that vibration is measurable above the background inside 330 Grays Inn Road when music is playing in The Water Rats. The maximum measured peak Wb weighted acceleration suggests that some tactile vibration may just be perceivable in some of the rooms in the absence of mitigation measures.

However, based on the measured VDVs at each position representative of the future worst case hotel room locations, and the pessimistic assumption of music events playing continuously at the measured levels for 4No. hours during the daytime (07:00-23:00hours) and 4No. hours during the night-time (23:00-07:00hours), the following VDVs have been calculated:

Floor Level	Calculated VDV ($mm/s^{1.75}$)	
	Daytime (07:00-23:00 hours)	Night-time (23:00-07:00 hours)
1	0.05	0.05
2	0.08	0.08
3	0.03	0.03
4	0.03	0.03

Even in the absence of mitigation measures, the above VDVs are below the range associated with ‘low probability of adverse comment’. Therefore whilst low levels of vibration may just be perceptible, tactile vibration is unlikely to be cause for concern.

6.0 Mitigation Measures

6.1 Structureborne Noise

The majority of 330 Grays Inn Road is to be demolished, with only the front of the building (which is not proposed to contain hotel rooms) to be retained. This enables mitigation measures in the form of structural separation and isolation (if required) to be incorporated into the scheme in order to achieve the reduction stated in Section 5.2.1 above.

The levels of structureborne noise and vibration presented herein were measured in the existing building at 330 Grays Inn Road. The level of structural connection between this existing building and The Water Rats is currently unknown and the extent of the works required to achieve this reduction will need to be determined at the design stage. However as a worst case the proposals have allowed for a new building which is structurally separate from both the water rats and the retained portion of 330 Grays Inn Road, and is isolated from the ground and surrounding buildings with suitably specified resilient bearings. Isolation may be omitted if further work determines it not to be required.

It may also be possible to partially reduce the structureborne transfer at source by providing suitably specified resilient mountings for the Water Rats sound system, specifically the Sub-woofers (large loudspeakers which generate the low frequencies). These are currently supported directly on the floor of the venue, and it may be possible to provide some level of reduction in structure borne noise transmission if they are isolated.

6.2 Airborne Noise Intrusion Through Facade

The indicative requirements for the façade overlooking The Water Rats based on the measured levels of music noise are presented in Section 5.2.1. These are onerous and it would be prudent to investigate if there is a way to reduce the levels of music noise incident upon the façade.

The dominant airborne noise transfer path out of The Water Rats music venue to atmosphere is not currently known. There is a large rooflight in the building above the first floor which could potentially be a weak point although the music venue is on the ground floor and the dominant transfer path is therefore not immediately obvious.

The developer would therefore like to offer an acoustic survey to The Water Rats with a view to providing it with improved external sound insulation if it is determined that a significant reduction in music noise emissions can be practicably achieved. This could potentially also benefit other nearby noise sensitive uses.

If external music noise levels can be reduced in this way, then the sound insulation requirements of the hotel façade may be reduced accordingly. The façade design will therefore be refined during the detailed design stage.

6.3 Airborne Noise Intrusion Through Party Wall

The structural decoupling discussed in Section 6.1 also provides an opportunity to redesign the party wall of the new portion of the building and associated flanking constructions to maximise the sound insulation performance. We would recommend that opening up works be undertaken on a section of the party wall to investigate the current construction of the 330 Grays Inn Road side of the wall in order to inform the design.

It is likely that increased sound insulation performance may be possible between The Water Rats and the new portion of the building (containing the guestrooms) by decoupling the two sides of the wall, by introducing an insulation filled cavity as large as is practicable, and by building the new 330 Grays Inn Road side of the party wall with a greater mass and thickness to that currently present, possibly with the introduction of further cavities.

7.0 Planning Conditions

The indicative planning stage mitigation proposals for dealing with music noise and vibration transfer from The Water Rats have been discussed herein in order to demonstrate that the site can be suitable for use as a hotel without affecting the operation of the The Water Rats. As discussed herein further work shall be undertaken during the design stage to develop these mitigation measures and Camden may expect to be provided with details of the final sound insulation and isolation treatments when available in order to protect the existing and historic use of The Water Rats as a live music venue. Therefore in granting consent it would be appropriate for a planning condition to be imposed along the following lines (based on the example condition 1 drawn from PPG24):

“Construction work shall not begin until a scheme for protecting the proposed hotel from both structureborne and airborne music noise from the Water Rats has been submitted to and approved by the local planning authority; all works which form part of the scheme shall be completed before any part of the Hotel is occupied.”

8.0 Conclusions

Hann Tucker visited site on 19 February 2021 in order to undertake noise and vibration measurements of existing noise and vibration transfer from The Water Rats public house.

Music was played through the PA system inside The Water Rats music venue including a live drummer playing to recorded music, in order to simulate the sound levels present during a typical event. Noise measurements were made externally overlooking the rear of The Water Rats, and noise and vibration measurements were made inside 330 Grays Inn Road to determine the current levels of music noise/vibration intrusion.

Assessments of structureborne music noise intrusion have been undertaken based on the measured noise levels and it has been determined that significant mitigation measures are required to achieve suitable noise levels inside guestrooms during music performances. The indicative proposals for such mitigation measures are described herein.

Assessments of external airborne music noise intrusion through the facade have been undertaken based on the measured noise levels and it has been determined that significant mitigation measures are required to achieve suitable noise levels inside guestrooms during music performances. The developer proposes to offer an acoustic survey of The Water Rats with a view to providing improved sound insulation if it is determined that a significant reduction in music noise emissions can be practicably achieved. The final requirements for the façade will depend on the outcome of this but worst case indicative façade proposals are described herein.

The results of the vibration assessment indicate that whilst vibration may just be perceptible in some areas, tactile vibration is unlikely to be cause for concern. In addition, the proposed work to reduce structureborne noise should reduce levels of tactile vibration further.

The roof plant associated with The Water Rats was also measured and an assessment has been undertaken. The results of the assessment show that mitigation measures to the plant are required, which the developer proposes to provide.

The Local Authority will likely wish to impose planning conditions to protect The Water Rats. A suggested condition for discussion with the Local Authority is included herein.

Yours sincerely

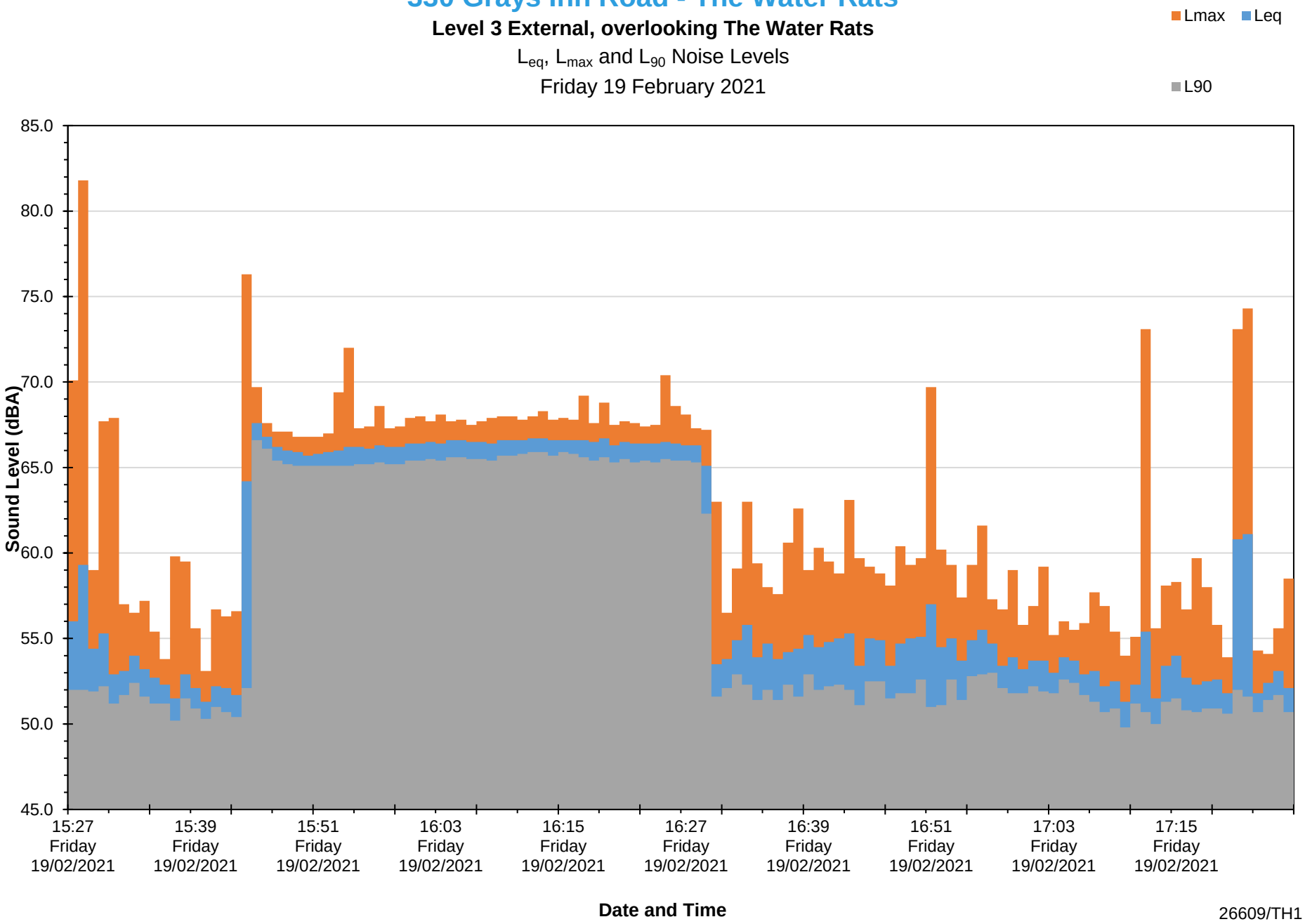
Luke Rendell
for HANN TUCKER ASSOCIATES

330 Grays Inn Road - The Water Rats

Level 3 External, overlooking The Water Rats

L_{eq}, L_{max} and L_{90} Noise Levels

Friday 19 February 2021



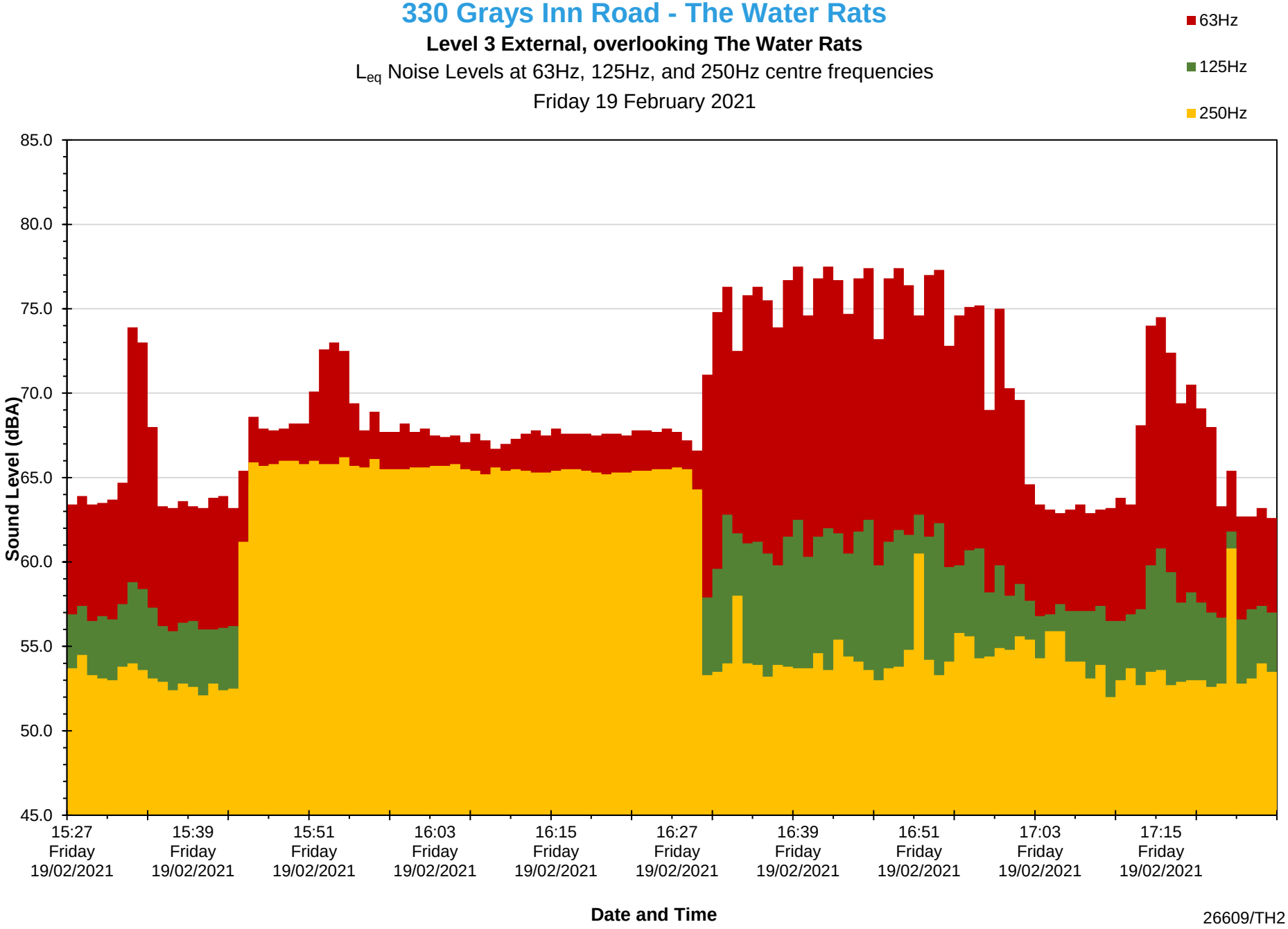
26609/TH1

330 Grays Inn Road - The Water Rats

Level 3 External, overlooking The Water Rats

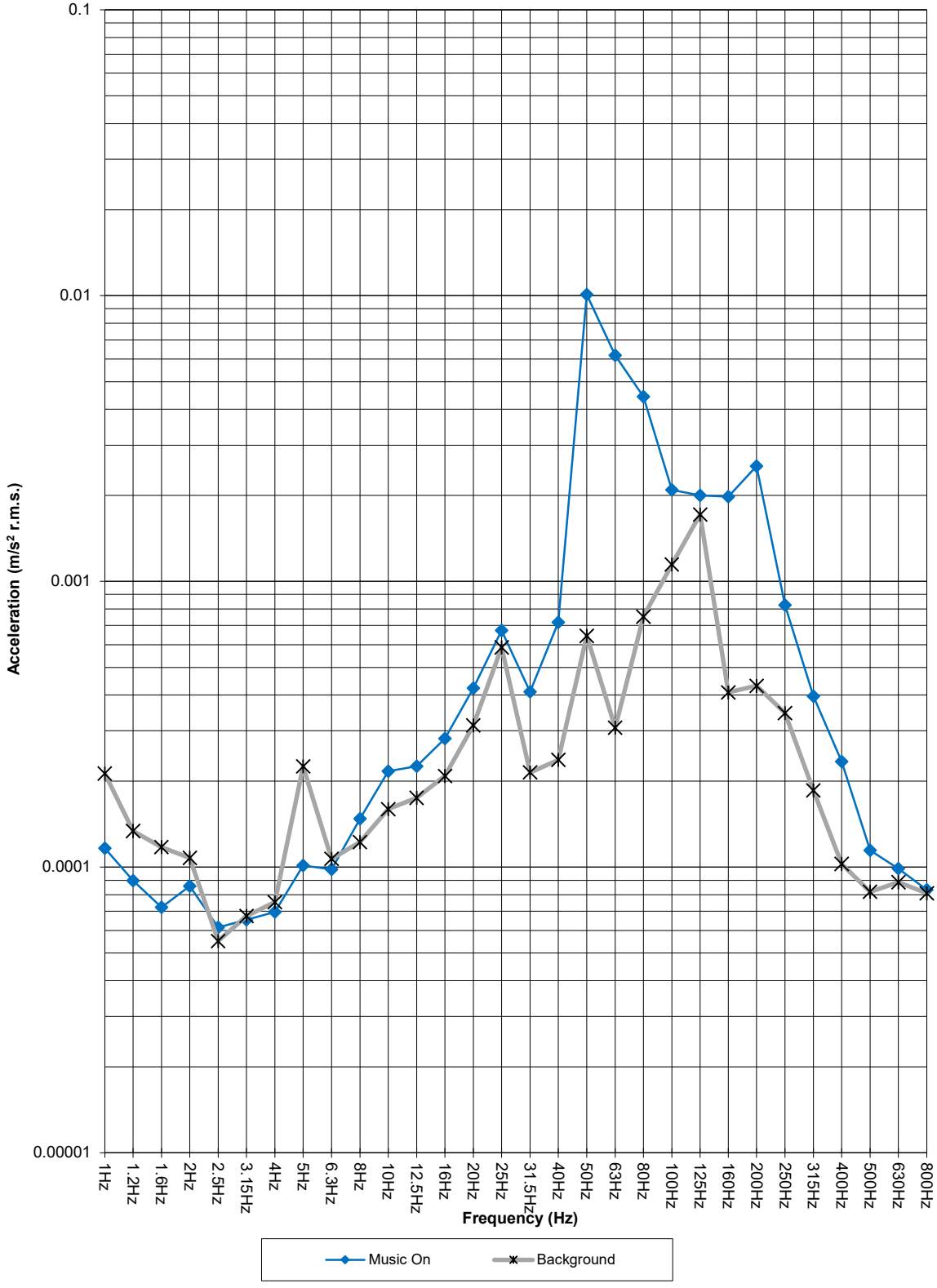
L_{eq} Noise Levels at 63Hz, 125Hz, and 250Hz centre frequencies

Friday 19 February 2021

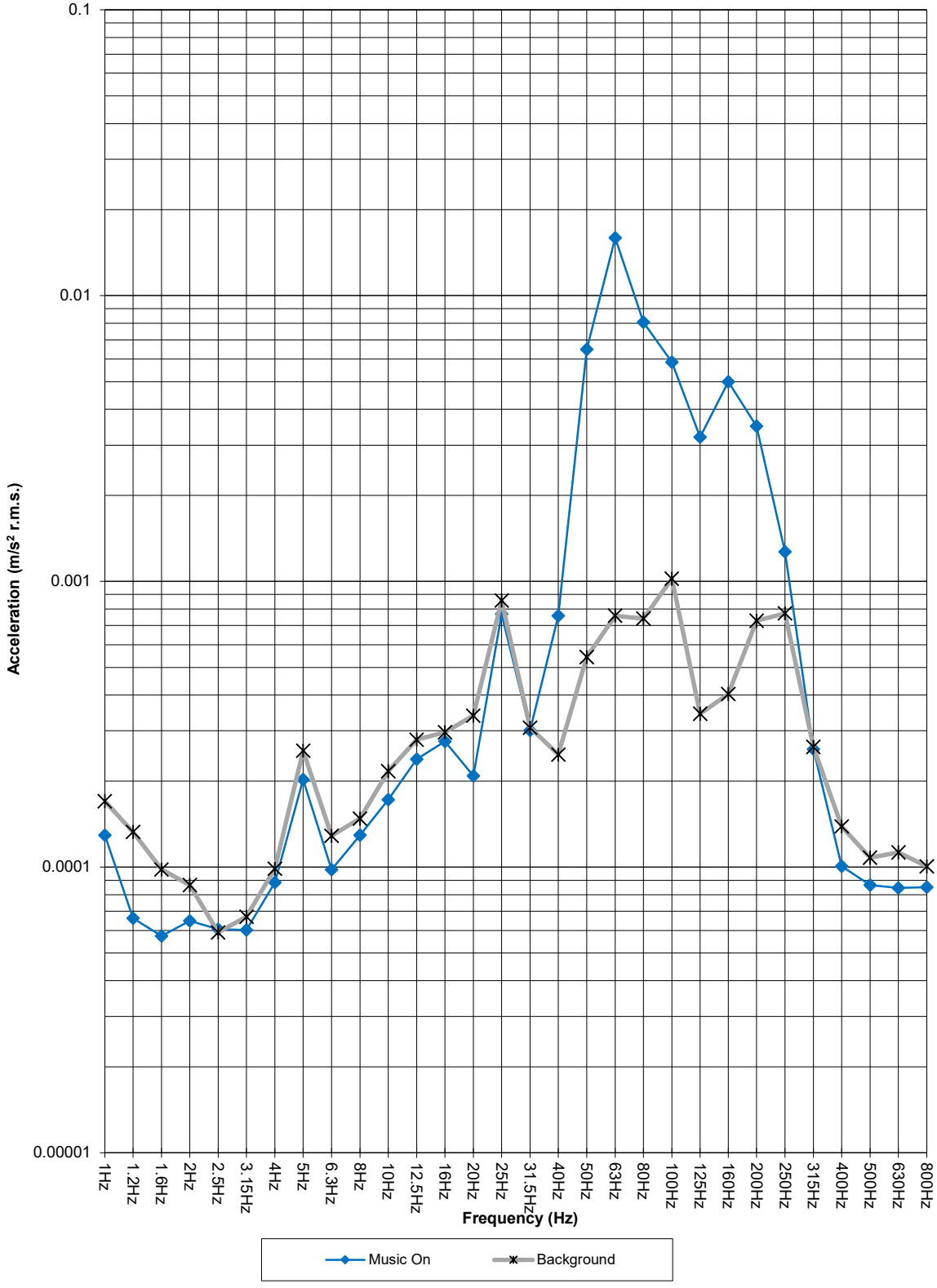


26609/TH2

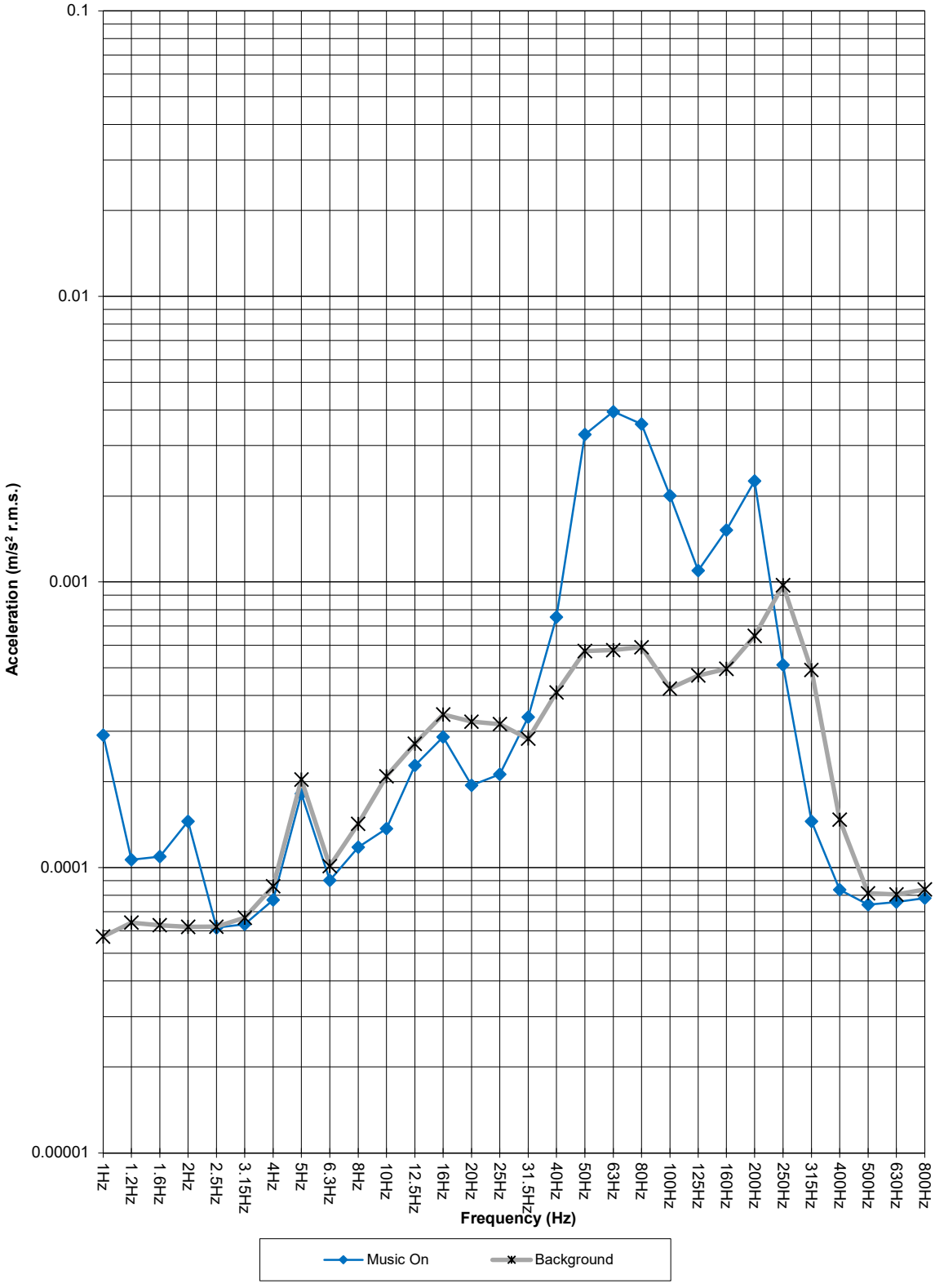
330 Grays Inn Road
Vibration Measurements (Vertical)
Level 1
19 February 2021



330 Grays Inn Road
Vibration Measurements (Vertical)
Level 2
19 February 2021



330 Grays Inn Road
Vibration Measurements (Vertical)
Level 3
19 February 2021



330 Grays Inn Road
Vibration Measurements (Vertical)
Level 4
19 February 2021