37 Grays Inn Road
London

Environmental Noise Survey and Acoustic Design Statement Report

25769/ADS1/Rev1

27 February 2019

For:
Unlock Democracy
c/o Fresson & Tee
6th floor, Queens House
55-56 Lincoln's Inn Fields
London
WC2A 3LJ

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

Head Office: Duke House, 1-2 Duke Street, Woking, Surrey, GU21 5BA (t) +44 (0) 1483 770 595
Manchester Office: First Floor, 346 Deansgate, Manchester, M3 4LY (t) +44 (0) 161 832 7041
(w) hanntucker.co.uk (e) enquiries@hanntucker.co.uk

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Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	16/07/2018	-	Giovanni De Rienzo Senior Consultant BSc(Hons), AMIOA	Gareth Evans Associate BSc(Hons), MIOA
1	27/02/2019	Revised following latest proposals as set out in Fresson & Tee email dated 20/02/2019.		
			Giovanni De Rienzo Senior Consultant BSc(Hons), AMIOA	Gareth Evans Associate BSc(Hons), MIOA

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Attachments

1.0 Introduction

New residential dwellings are proposed on the 1st, 2rd, 3rd and, 4th floors of 37 Grays Inn Road, London. Retail A1/A2/A3 use is proposed at basement and ground floor levels.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and noise impact assessment in order to determine the suitability of the site for residential use.

This report presents the methodology and findings of our noise survey and assessment in the context of national planning policies and the policy of the Local Authority.

As part of the development, new items of building services plant are proposed. Plant noise emission criteria have been set in accordance with the requirements of the Local Authority.

2.0 Objectives

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

Based on the results of the survey, to undertake a noise assessment to determine 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.

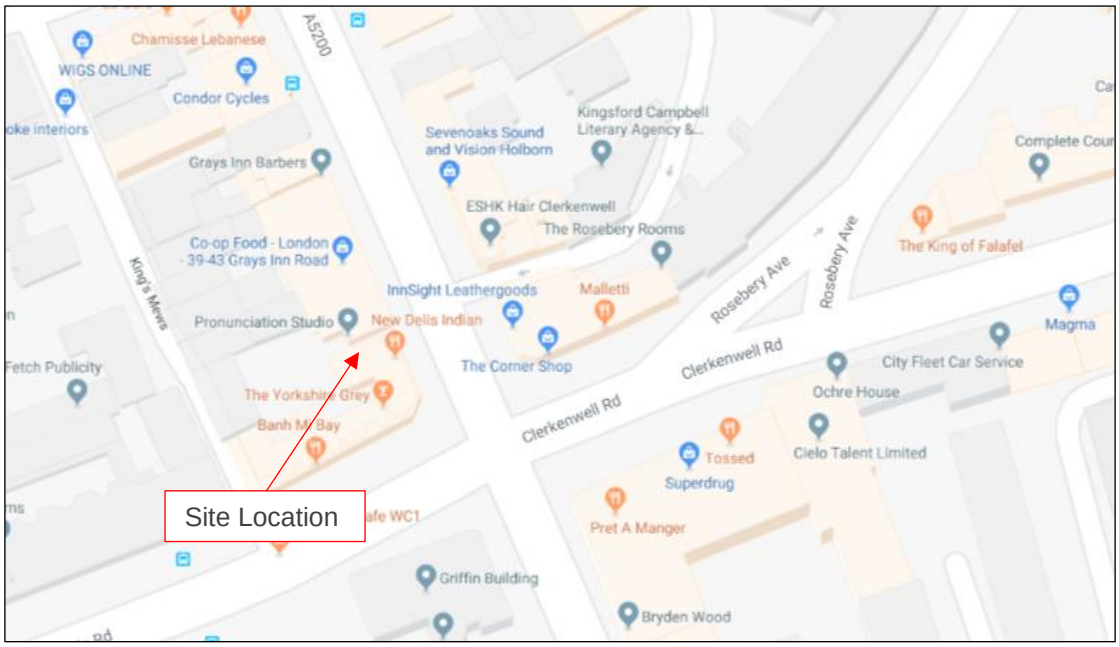
To advise on noise control measures, if required, with reference to the requirements of the Local Authority.

To undertake a plant noise assessment in line with the requirements of the Local Authority.

3.0 Site Description

3.1 Location

The site is located at 37 Grays Inn Road, London, and falls within the jurisdiction of London Borough of Camden. The location is shown in the Location Map below.



Location Map (Map data ©2018 Google)

3.2 Description

The site is bordered to the east by Grays Inn Road, to the north by communal gardens, and to either side by adjacent terraced building consisting of commercial use at lower floors and residential dwellings at upper floors.

The site is shown in the Site Plan below.

Site Plan (Imagery ©2018 The GeoInformation Group, Map data ©2018 Google)

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 G. De Rienzo BSc(Hons) AMIOA.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 11:15 hours on 4 July 2018 to 11:15 hours on 5 July 2018.

During the periods we were on site the wind conditions were calm. The sky was generally clear. We understand that generally throughout the survey period the weather conditions were similar to this. 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 Position

The noise level measurements were undertaken at 2No. positions as described in the table below.

Position No	Description
1	The microphone was attached to a pole approximately 1 metre above from the window on the 2nd floor overlooking Grays Inn Road.
2	The microphone was attached to a pole approximately 1 metre above from the window on the 2nd floor at the rear of the property overlooking the lightwell.

Plan Showing Unmanned Measurement Position (Imagery ©2018 The GeoInformation Group, Map data ©2018 Google)

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	ACO Pacific	7052E	52450	Calibration on 21/03/2018
Position 1 Preamp	Svantek	SV12L	30424	Calibration on 21/03/2018
Position 1 Type 1 Data Logging Sound Level Meter	Svantek	957	28035	Calibration on 21/03/2018
Position 2 Type 1 ½" Condenser Microphone	PCB	377B02	107842	Calibration on 30/08/2017
Position 2 Type 1 Preamp	Larson Davis	PRM902	4199	Calibration on 30/08/2017
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3541	Calibration on 30/08/2017
Type 1 Calibrator	Larson Davis	CAL200	3082	Calibration on 03/07/2017

The sound level meters, 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 0.1dB).

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

6.0 Results

The results have been plotted on Time History Graphs 25769/TH1.1 and 25769/TH1.2 enclosed presenting the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at the measurement position throughout the duration of the survey.

6.1 L_{eq} Noise Levels

In order to compare the results of our survey with the relevant guidelines it is necessary to convert the measured $L_{Aeq(15\ minute)}$ noise levels into single figure daytime $L_{Aeq(16\text{-}hour)}$ (07:00-23:00 hours) and night-time $L_{Aeq(8\text{-}hour)}$ (23:00-07:00 hours) levels.

The daytime $L_{Aeq(16\text{-}hour)}$ and night-time $L_{Aeq(8\text{-}hour)}$ noise levels are presented in the tables below.

Position	Daytime $L_{Aeq(16\text{-}hour)}$ (07:00 – 23:00) Hours	Night-Time $L_{Aeq(8\text{-}hour)}$ (23:00 – 07:00) Hours
1	70	66
2	66	59

N.B. The above levels have been corrected for façade reflections where appropriate, for comparison with the free field levels.

6.2 L_{90} Noise Levels

The lowest $L_{A90\ (15\ min)}$ measurements recorded during the survey are presented in the table below:

Position	Lowest Measured $L_{A90(15min)}$ Background Noise Level (dB re 2 x 10^{-5} Pa)	
	Daytime (07:00 – 23:00) Hours	Night-Time (23:00 – 07:00) Hours
1	59	49
2	58	58

7.0 Discussion Of Noise Climate

During the periods we were on site the dominant noise sources was noted to be road traffic from Grays Inn Road at Position 1, and existing plant noise within the lightwell at Position 2.

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. 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 aims which are reflected in three of the four aims for 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 acknowledge 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 aims listed in paragraph (b) 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 National Planning Policy Framework (NPPF) was published in March 2012 and replaced the previous national planning guidance document Planning Policy Guidance 24: *Planning and Noise* (PPG24).

The main reference to noise within the NPPF is at paragraph 123, reproduced below:

> *"123. Planning policies and decisions should aim to:*
>
> - *Avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;*
> - *Mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions;*
> - *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;[28] and*
> - *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

The reference numbers 27 and 28 point respectively to the Explanatory Note to the NPSE and the provisions of the Environmental Protection Act 1990 *"and other relevant law".*

The spirit of the Localism Act and the NPPF would suggest that of the guidelines cited, it is guidelines adopted as policy by the Local Planning Authority (if such exist) that should prevail, at least until the Government publishes relevant technical guidance under the NPPF.

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.		
		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.		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.		Prevent

8.4 The London Plan

The London Plan, published in 2011 with minor revisions in 2013, 2015 and 2016, provides an overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. The Plan brings together the Mayor's strategies, including policy on a range of environmental issues, such as climate change, air quality, noise and waste. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

Policy 7.15 specifically relates to noise and states:

"Development proposals should seek to reduce noise by:

a) *Minimising the existing and potential; adverse impacts of noise on, from, within, or in the vicinity of, development proposals;*

b) *Separating new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or internal layout in preference to sole reliance on sound insulation;*
c) *Promoting new technologies and improving practices to reduce noise at source."*

London Plan – Housing Supplementary Planning Guidance

The Housing SPG 2016 highlights the elements of the London Plan that are relevant to housing development, and where applicable, provides more detail. The SPG states:

"Noise – Baseline

Standard 5.3.1 (and Policy 7.15) – The layout of adjacent dwellings and the location of lifts and circulation spaces should seek to limit the transmission of noise to sound sensitive rooms within dwellings.

Policy 7.15 Reducing Noise and Enhancing Soundscapes requires development proposal to seek to reduce noise and manage the effects of noise. It is another important aspect of retreat and privacy in a dwelling. Noise from the street and adjoining properties can cause stress, sleep disturbance and friction between neighbours as recognised in the NPPF154.

2.3.35 All dwellings should be built with acoustic insulation and tested to current Building Regulations standards 155. However, acoustic insulation should not be relied upon as the only means of limiting noise and the layout and placement of rooms within the building should be considered at an early stage in the design process to limit the impact of external noise on bedrooms and living rooms. The impact of noise should also be considered in the placement of private external spaces."

8.5 Local Planning Policy

The Local Plan was adopted by Camden Council on 3 July 2017 and has replaced the Core Strategy and Camden Development Policies documents as the basis for planning decisions and future development in the borough.

8.5.1 External noise Sources

"Special consideration will need to be given to noise sensitive developments that are proposed in areas which are, or expected to become, subject to levels of noise likely to have an adverse effect. The threshold of acceptability of the noise will primarily depend on two factors: the intended use of the noise sensitive development and the source of the noise experienced, or likely to be experienced.

Dominant Noise Source	*Assessment Location*	*Design Period*	*LOAEL (Green)*	*LOAEL to SOAEL (Amber)*	SOAEL (Red)
Anonymous noise such as general environmental noise, road traffic and rail traffic	*Noise at 1 metre from noise sensitive façade/free field*	*Day*	*<50dBL$_{Aeq,16hr*}$*	*50dB to 72dBL$_{Aeq,6hr*}$*	>72dBL$_{Aeq,16hr*}$
		Night	*<45dBL$_{Aeq,8hr3}$ <40dBL$_{Aeq,8hr**}$*	*45dB to 62dBL$_{Aeq,8hr*}$ >40dBL$_{night**}$*	>62dBL$_{Aeq,8hrs*}$
	Inside a bedroom	*Day*	*<35dBL$_{Aeq,16hr}$*	*35dB to 45dBL$_{Aeq,16hr}$*	>45dBL$_{Aeq,16hr}$
		Night	*<30dBL$_{Aeq,8hr}$ 42dBL$_{Amax,fast}$*	*30dB to 40dBL$_{Aeq,16hr}$ 40dB to 73dBL$_{Amax,fast}$*	>40dBL$_{Aeq,8hr}$ >73dBL$_{Amax,fast}$
	Outdoor living space	*Day*	*<50dBL$_{Aeq,16hr}$*	*50dB to 55dBL$_{Aeq,6hr}$*	>55dBL$_{Aeq,16hr}$
Non-anonymous Noise	*See guidance note on non-anonymous noise*				

**LAeq, T values specified for outside a bedroom window are façade levels.*

***Lnight values specified for outside a bedroom window are free field levels.*

The levels given above are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises. The Council will also take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration."

8.5.2 Internal Noise Sources

The Local Plan details noise criteria within its Appendices and gives the following guidance for entertainment noise (including leisure premises, amplified or unamplified music, footfall, human activity and other general activity). The following criteria are given:-

For entertainment and plant noise rating curves should be measured as a 15 minute linear L_{eq} at the octave band centre frequencies.

Room	Noise Rating Curve	Design period
Bedrooms	NR25	23.00 – 07.00
All habitable rooms	NR35	07.00 – 23.00

8.5.3 Plant Noise Criteria

The site comes under the jurisdiction of Camden, which outlines its requirements as below in *Camden Local Plan 2017: Appendix 3*

Note: NOAL – No Observed Effect Level, LOAEL- Lowest Observed Averse Effect Level, SOAEL – Significant Observed Adverse Effect Level.

"…a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion.

Existing Noise Sensitive Receptor	***Assessment Location***	***Design Period***	***LOAEL (Green)***	***LOAEL to SOAEL (Amber)***	***SOAL (Red)***
*Dwellings***	*Garden used for main amenity (free field) and Outside living or dining window (façade)*	*Day*	*'Rating level' 10dB below background*	*'Rating level' 9dB below and 5dB above background*	*'Rating level' greater than 5dB above background*
*Dwellings **		*Night*	*'Rating level' 10dB below background and no events exceeding 57dBL_{Amax}*	*'Rating level' 9dB below and 5dB above background or noise events between 57dB and 88dBL_{Amax}*	*'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}*

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.*

***Levels are given for dwellings, however, levels are use specific and different levels will apply dependant on the use of premises"*

Based on the above criterion we therefore propose the following future plant noise emission criteria should be achieved (with all relevant plant operating simultaneously) at 1 metre from the nearest noise sensitive facades based on the minimum measured L_{A90} noise level.

Description	Noise Emission Limit (dB re 2 x10^{-5} Pa)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Residential windows on Gray Inn Road	49 dBA	39 dBA
Residential windows within the lightwell to the rear of 37 Grays Inn Road	48 dBA	48 dBA

8.6 World Health Organisation Guidelines on Community Noise

BS8233:2014 is based upon the current World Health Organisation (WHO) guidance "*Guidelines on Community Noise".* A summary of the noise guidelines relevant to the proposed development is presented in the table below.

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

These WHO guidelines are based, in almost all cases, on the lower threshold below which the occurrence rates of any particular effect can be assumed to be negligible.

The internal and external noise level criteria presented in BS8233:2014 for residential dwelling are generally consistent with the WHO guidelines, although some differences are apparent. For instance the WHO guidelines refer to research that suggests *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night."* (Vallet & Vernet, 1991). The current version of BS8233 does not identify a specific L_{AFmax} level although it suggests that a guideline value may be set using that parameter depending on the character and number of individual noise events per night.

8.7 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.

8.7.1 Internal Areas

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 - 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."

8.7.2 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."

8.8 ProPG : Planning & Noise : 2017

8.8.1 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".

8.8.2 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.

8.8.3 The two sequential stages of the overall approach are:

- Stage 1 – an intital nosie risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.

8.8.4 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".

8.8.5 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).

9.0 Proposed Design Target Internal Noise Levels

On the basis of BS8233:2014, and the Local Authority guidelines, we propose the following internal noise levels be adopted as design targets in the proposed habitable rooms in order to mitigate the external noise levels to achieve the lowest observed adverse effect level (LOAEL):

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: For this site the $L_{Aeq,T}$ noise parameter alone is considered to be sufficient (with reference to Note 4 of Section 7.7.2 of BS8233:2014) given the character of the noise climate we have measured.

For entertainment noise (including leisure premises, amplified or unamplified music, footfall, human activity and other general activity). The following criteria are given:-

"For entertainment and plant noise rating curves should be measured as a 15 minute linear L_{eq} at the octave band centre frequencies."

Room	Noise Rating Curve	Design period
Bedrooms	NR25	23.00 – 07.00
All habitable rooms	NR35	07.00 – 23.00

10.0 External Noise Sources

Provision exists to provide additional sound insulation as required. The following noise mitigation measures are proposed:

- The external envelope of the proposed residences will incorporate suitably specified glazing, so as to achieve the proposed criteria summarised above.

We understand that double glazing with mechanical ventilation will be used throughout.

We have predicted the levels that would be achievable in the worst-case dwellings overlooking Grays Inn Road.

Our assessment is based upon the proposed façade achieving a minimum performance of R_w36dB, which could be achieved using conventional thermal double glazing comprising 8.4mm acoustic laminated glass/12mm cavity/6mm glass.

The enclosed Acoustic Specification for Glazing to Residential Facades details our recommended minimum octave band sound reduction indices (SRI's). In all cases, it is essential that the system is tested in accordance with BS EN ISO 10140-2:2010 and that the quoted minimum sound reduction specifications are met by the system as a whole, including frames, ventilators etc. as appropriate - not just the glass.

The specified octave band SRI's are based upon typical glazing configurations. It is acknowledged that alternative SRI shapes may also comply with the internal noise criteria but these would need to be reviewed by ourselves.

Our assessment indicates the following noise levels may be expected within the proposed worst case dwellings.

Daytime LAeq(16-hour)	Night-time LAeq(8-hour)
34 dBA	30 dBA

11.0 Plant Noise Assessment

11.1 Proposed Tenant Plant

We understand that the following plant is proposed to serve the ground and basement level retail spaces.

Plant Description	Quantity	Make	Model
Air Handling Unit	1	Nuaire	XBC45
Extract Fan	1	Nuaire	DES-E2
Condenser	1	Daikin	LREQ16AY1

We understand that provision should be allowed for a kitchen extract fan should the basement/ground floor commercial space include this need.

11.2 Plant Noise Data

We understand the manufacturer's noise data for the equipment to be as follows:

Plant Description	Sound Power Level (dB re 10^{-12} W) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Air Handling Unit Induct Intake	83	75	75	64	64	62	54	45
Air Handling Unit Induct Discharge	88	81	85	71	72	72	66	64
Air Handling Unit Casing Radiated	74	65	62	47	45	44	40	29
Extract Fan Induct Outlet	72	64	62	53	50	51	47	46
Extract Fan Breakout	53	47	43	37	30	29	26	23

Plant Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 10 metre (dBA)
Condenser	42

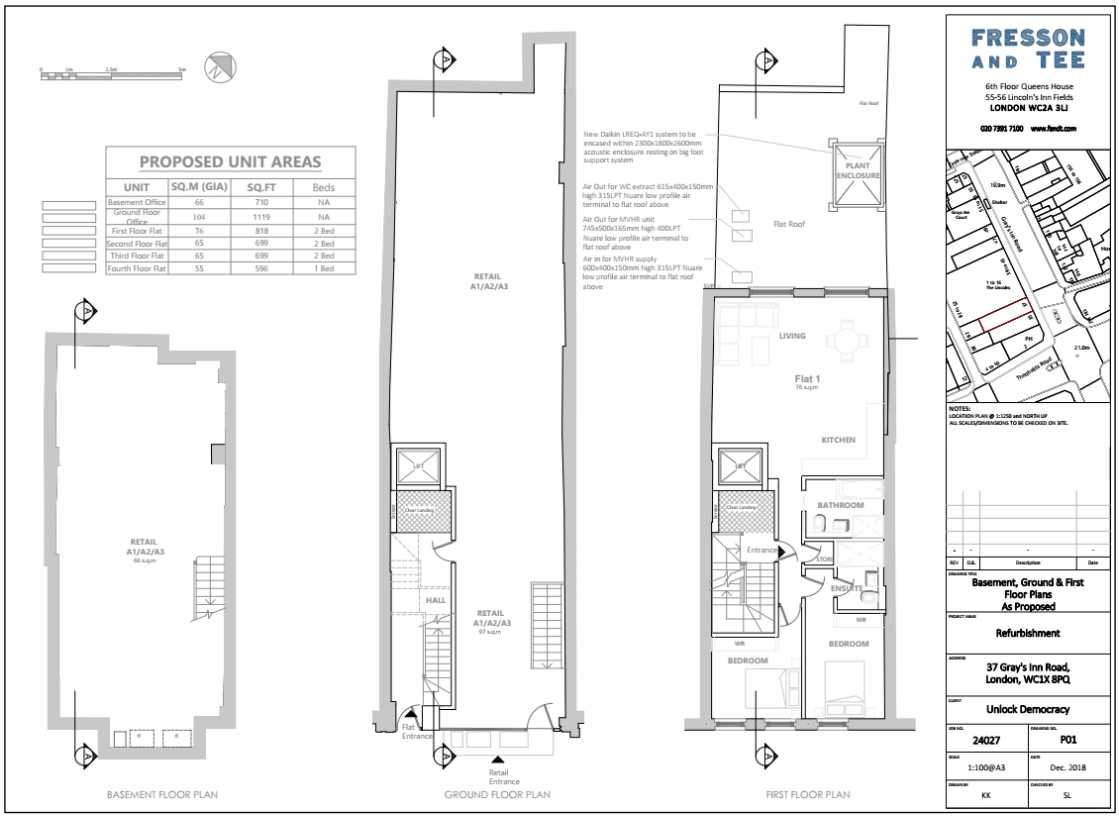
11.3 Location of Plant and Nearest Noise Sensitive Window

We understand all tenant plant will be located on the rear 1st floor flat roof. With this in mind we believe the nearest noise sensitive windows will be located at the 1st floor residential window of 37 Grays Inn Road.

The air handling unit and WC extract fan are proposed to be located internally and ducted to the flat roof.

The 1st and 2nd floor windows will be partially shielded by a 1700mm high terrace screen. See plan below.

At this point no kitchen extract fan has been selected, however we understand from our communications with Quinn Ross that this ductwork would likely run up the rear façade of the building and terminate at roof level.



Drawing provided by Fresson & Tee

11.4 Mitigation Measures

11.4.1 Attenuators

In order to control plant noise emissions in line with the proposed criterion, we recommend installing atmospheric side attenuators on the AHU intake and discharge meeting the following minimum insertion losses.

Description	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Air Handling Unit Induct Intake	4	7	13	19	23	23	16	13
Air Handling Unit Induct Discharge	6	13	25	37	44	43	30	20

Provision should be made for kitchen extract attenuation where necessary.

11.4.2 Acoustic Enclosure

The condenser unit should be located within an acoustic enclosure capable of achieving 49dBA when measured at 1 metre in any direction from the enclosure.

See attached our Acoustic Specification for Condenser Acoustic Enclosures.

11.5 Plant Noise Impact Assessment

11.5.1 Proposed Plant

We understand that the proposed units will be operational during daytime hours only.

The following tables summarise our predictions of atmospheric noise emissions to the nearest noise sensitive residential window.

	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Air Handling Unit Induct Intake	83	75	75	64	64	62	54	45	
Proposed Attenuator Loss	-4	-7	-13	-19	-23	-23	-16	-13	
Distance Correction (SWL to SPL)	-16	-16	-16	-16	-16	-16	-16	-16	
Screening Correction	-5	-5	-6	-7	-8	-10	-12	-13	
Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor	61	50	43	25	20	16	13	6	39

	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Air Handling Unit Induct Discharge	88	81	85	71	72	72	66	64	
Proposed Attenuator Loss	-6	-13	-25	-37	-44	-43	-30	-20	
Distance Correction (SWL to SPL)	-16	-16	-16	-16	-16	-16	-16	-16	
Screening Correction	-5	-5	-6	-7	-8	-10	-12	-13	
Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor	64	50	41	14	7	6	11	18	40

	Sound Pressure Level (dB re 2x10^{-5} Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Extract Fan Induct Outlet	72	64	62	53	50	51	47	46	
Distance Correction (SWL to SPL)	-16	-16	-16	-16	-16	-16	-16	-16	
Screening Correction	-5	-5	-6	-7	-8	-10	-12	-13	
Façade Reflection	+3	+3	+3	+3	+3	+3	+3	+3	
Calculated Noise Level at Receptor	54	46	43	33	29	28	22	20	39

	dBA
Enclosed Condenser Unit	49
Distance Correction	-7
Screening Correction	-6
Façade Reflection	+3
Calculated Noise Level at Receptor	39

11.5.2 Limiting Noise levels

The following limiting noise levels should be met by the kitchen extract fan.

Duct Breakout

	dBA
Criterion at Receptor	48
Cumulative Plant Effect	-6
Corrected Criterion	42
Limiting Duct Breakout at 1m	42

Duct Termination Grille

	dBA
Criterion at Receptor	48
Cumulative Plant Effect	-6
Corrected Criterion	42
Distance Loss	+6
Grille Loss	+3
Limiting Duct Termination at 1m	51

11.5.3 Cumulative Noise Levels at Nearest Residential Window

	dBA
Air Handling Unit Induct Intake at Window	39
Air Handling Unit Induct Discharge at Window	40
Extract Fan Induct Outlet at Window	39
Condenser At Window	39
Kitchen Extract Duct Breakout at Window	42
Kitchen Extract Duct Termination at Window	42
Total Noise Level of all Plant at Window	48

Our calculations indicate that the proposed plant, in conjunction with the propose mitigation measures, should be capable of achieving the requirements of the Local Authority outlined in Section 8.5.3.

11.6 Residential Ventilation System

11.6.1 Proposed Operating House

The proposed MVHR system will serve the future residential dwellings. The plant will therefore run up to 24 hours a day.

11.6.2 Plant Noise Data

We understand it is proposed to install a Nuaire MRXBOXAB-EC03-OH MVHR system. Manufacturer's noise data for the proposed unit is presented below.

	Sound Power Level (dB) at Octave Band Centre Frequency							
	63	125	250	500	1k	2k	4k	8k
Inlet	48	57	60	53	49	44	33	24
Outlet	57	67	63	64	61	61	52	45

11.6.3 Mitigation Advice

We would propose that the atmospheric inlet and outlet ducts are fitted with a flexible acoustic duct. The proposed flexible duct must achieve the following insertion losses.

	Minimum Insertion Loss (dB) at Octave Band Centre Frequency							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Inlet	3	6	10	13	11	9	8	6
Outlet	4	8	13	16	12	10	10	7

The above performance should be achievable with acoustic flexible ducting, 1m in length with a diameter of circa 200mm. Please find attached a list of suitable suppliers for this equipment.

11.6.4 Noise Impact

Our calculations demonstrate that with the above mitigation measures implemented, the proposed MVHR system should be capable of achieving the requirements of Westminster City Council as set out in Section 9.3.

12.0 Conclusions

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

A detailed acoustic analysis has been undertaken to assess the sound insulation requirements of the various building fabric elements.

Based upon the results of our survey and subsequent assessment, the proposed development should be considered compliant with the local policy of the Local Authority.

Plant noise emission criteria have been set based on the requirements of the Local Authority.

A plant noise assessment has been undertaken and suitable mitigation measures proposed to achieve the requirements of the Local Authority.

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).

HT: 25769 **27 February 2019**

37 Grays Inn Road, London

Acoustic Specification for Glazing

Acoustic Performance

The complete glazing system shall achieve the following minimum sound reduction indices when tested in accordance with BS EN 10140-2:2010.

Façade	Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
All	25	26	34	45	45	49

Test Data

Fully detailed test reports from independent acoustic test authorities shall be supplied. All test reports shall be in English or, a full English translation.

Test data should include the $^1/_3$ octave band results from 100Hz to 3150Hz inclusive, together with the corresponding octave band results from 125Hz to 4000Hz inclusive.

The test report shall be provided for test samples which are representation of the complete system for the relevant facades - including frames, joints, seals, spandrel panels and opening lights and trickle vents (as appropriate). The samples proposed should be approved by Hann Tucker Associates.

SUITABLE SUPPLIERS

of

ACOUSTICALLY LINED FLEXIBLE DUCTWORK

Name & Address	Telephone Number	Contact
Rega Ventilation 21-22 Eldon Way Biggleswade Bedfordshire SG18 8NH	01767 600499	www.rega-uk.com
CCL Veloduct Ltd 10 Woodall Road Enfield Middlesex EN3 4LE	020 8344 4800	www.cclveloduct.co.uk
Interlock Products Ltd Unit 1 Burbridge Road Bordesley Green Birmingham B9 4US	0121 766 7766	www.interlockflex.com
Lindab (Tecsonic) Units 9 & 10 Carousel Way Riverside Business Park Northampton NN3 9HG	01604 788350	Sales@lindab.co.uk

37 GRAYS INN ROAD, LONDON

SPECIFICATION FOR

CONDENSER ACOUSTIC ENCLOSURES

The condenser unit shall be supplied complete with acoustic treatment which shall achieve adequate levels of attenuation to ensure that the following limiting sound pressure levels are not exceeded when measured at a distance of 1m in any horizontal or vertical direction under any load conditions.

A-weighted Limiting Sound Pressure Level @ 1m (dB re 2 x 10^{-5} Pa)
49 dBA

Furthermore they shall not exhibit any significant tonal content.

Exceedances in excess of the measurement tolerance for a Type 1 sound level meter shall constitute a failure.

The enclosed outer panels shall be constructed from galvanized sheet steel having a minimum thickness of 1.6mm and fixed at 300mm (max) centres. The enclosure inner panels shall be constructed from punch-perforated (round-hole) galvanised sheet steel facing, having a minimum thickness of 0.7mm fixed at 300mm (max) centres. Flattened-expanded ("Expamet") sheet shall not be used, unless all edges of the sheet are mechanically fixed to the panel casing and galvanised steel cover strips are used to prevent rivet heads pulling through the perforated sheet (trapping the Expamet between two solid steel layers).

The inert, rot and vermin proof, non-hygroscopic and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 48kg/$m^{3.}$ This shall be faced with a glass fibre cloth, or other approved infill protection membrane. Panels shall be constructed and assembled so that no egress of the acoustic medium will occur under the operating conditions.

Doors, access panels, windows and ventilation ducts or electrical cable penetrations hall be treated so as to maintain the specified acoustic insulation of the assembled enclosure.

Demountable sections shall be designed to allow easy disassembly and reassembly by unskilled personnel without affecting the acoustic performance.

The supplier shall ensure that the assembled enclosure is designed and constructed to withstand site operating conditions such as wind and snow loads, roof mounted plant, etc., as appropriate, and if outside, to be suitably weatherproofed.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

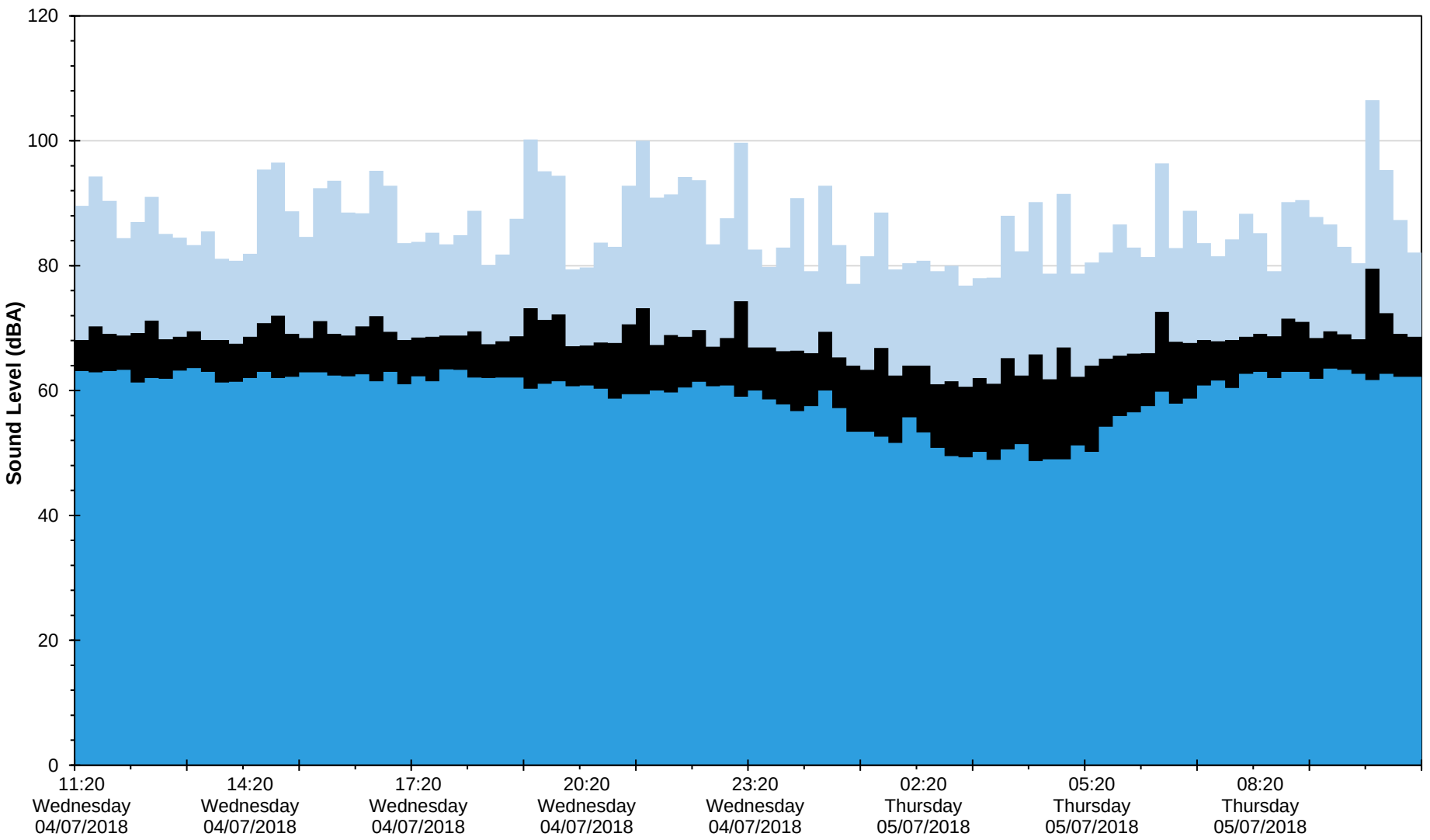
Any deviations from the above specification must be agreed by, and confirmed in writing to, Hann Tucker Associates.

37 Grays Inn Road

Poistion 1

L_{Aeq}, L_{Amax} and L_{A90} Noise Levels

Wednesday 4 July 2018 to Thursday 5 July 2018



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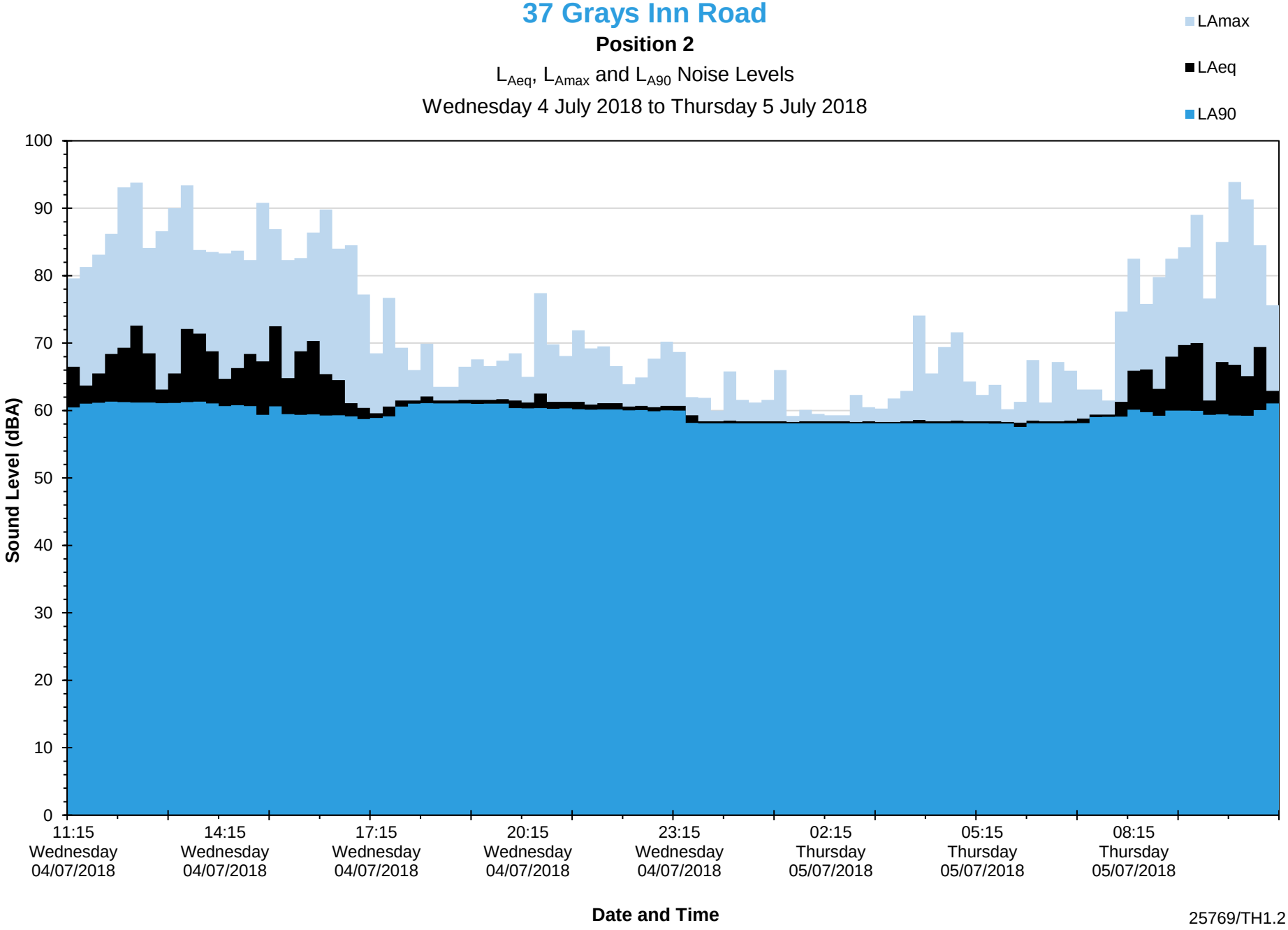
37 Grays Inn Road

Position 2

L_{Aeq}, L_{Amax} and L_{A90} Noise Levels

Wednesday 4 July 2018 to Thursday 5 July 2018



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