MAX FORDHAM

100 & 88 Gray's Inn Road, 127 Clerkenwell Road

Noise Impact Assessment

Issue 01

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Max Fordham LLP
42/43 Gloucester Crescent
London
NW1 7PE

T 020 7267 5161

maxfordham.com

ISSUE HISTORY

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1.0 INTRODUCTION

Max Fordham LLP (MFLLP) has been appointed to provide advice in relation to acoustic matters for the proposed development at 100 and 88 Gray's Inn Road. MFLLP Acoustics Team is a full member of the Association of Noise Consultants (ANC).

The 100 & 88 Gray's Inn Road, 127 Clerkenwell Road (100 GIR) proposed development comprises the construction of an eight-story office building with ground floor retail accommodation. The development includes an external roof top plant area for air source heat pumps and a chiller, and, air handling units within the building.

The 100GIR includes terraces for general office breakout use during the day from Monday to Friday. The roof top terrace and front terrace is also for tenants to use during evening from Monday to Friday.

The proposed development at 88 Gray's Inn Road (88 GIR) comprises the refurbishment of an existing building into flats and an open plan office space. The development includes an enclosed plant area with air source heat pumps.

The objective of this report is to assess the likely impact of the proposed development at the nearest identified noise sensitive receptors.

The site is not influenced by identifiable vibration source. The site is sufficiently distant from the tube underground routes and no other vibration source was identified during the site visit. Thus, the site is considered acceptable in relation to vibration and no further investigation has been undertaken.

1.1 The Site

The proposed development is in the borough of Camden at the junction between Gray's Inn Road and Clerkenwell Road. Gray's Inn Road is on the west side of the development while Clerkenwell Road is on the north side. The south and partially the east side of the development are enclosed by surrounding residential buildings.

The main noise sources affecting the site are traffic on Clerkenwell Rd and Gray's Inn Rd. During the site inspection, it was noted that Clerkenwell Rd has a higher level of traffic respect to Gray's Inn Rd.

The North and West façades of the development, facing respectively Clerkenwell Rd and Gray's Inn Rd, are exposed to higher noise levels respect to the façades facing the yard area to the South/East of the development.

The buildings surrounding the South/East part of development provide screening from traffic noise. An aerial image of the proposed development site and surrounding noise sources are shown on Figure 1.

The following are the nearest residential properties identified:

- to the North of the development, on the opposite side of Clerkenwell Rd
- to the South of the development, in the internal yard to the South/West.

Figure 1 - Aerial image site showing proposed development, noise sensitive receivers (NSRs). Image taken from Google Earth.

2.0 ASSESSMENT CRITERIA

2.1 National Planning Policy

National Planning Policy Framework
Planning Policy Guidance Note 24 (PPG24), which was generally used for overall guidance to planners regarding environmental noise, particularly for residential sites, was replaced in March 2012 by the more general advice given in the National Planning Policy Framework (NPPF).

The NPPF (last update, July 2021) states in paragraph 174e), that planning policies and decisions should contribute to and enhance the natural and local environment by "preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability." Furthermore, it states in paragraphs 185 and 187 that planning policies and decisions should:

- mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life [paragraph 185 a)],
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason [paragraph 185 b)], and
- 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 [paragraph 187].

Noise Policy Statement for England
The NPPF document also refers to the Noise Policy Statement for England (March 2010). The Noise Policy Statement for England (NPSE) sets out (paragraph 1.6) the long-term vision of Government noise policy: "Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

The NPSE also states: "Excessive noise can have wide-ranging impacts on the quality of human life, health (for example owing to annoyance or sleep disturbance) and use and enjoyment of areas of value such as quiet places and areas with high landscape quality."

The NPSE also cites (in the Explanatory Note section) the following three aims:

- First aim of the NPSE: 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.
- Second aim of the NPSE: 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.
- Third aim of the NPSE: 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 NPSE also states (paragraph 2.2) that "examples of noise management can be found in many areas including reducing noise source; the use of the land use and transport planning systems, compensation measures, the statutory nuisance and licensing regimes and other related legislation."

The NPSE (in the Explanatory Note section) also introduces guidance to assist in defining the adverse impacts:

- NOEL – No Observed Effect Level: this is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to noise.
- LOAEL – Lowest Observed 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.

These categories are discussed further in the Planning Practice Guidance section below.

The NPSE acknowledges (paragraph 2.15) that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations.

Planning Practice Guidance
The government's Planning Practice Guidance web pages provide advice of various issues, including noise (https://www.gov.uk/guidance/noise--2). The noise advice (March 2014, last update July 2019) states in the context of considering when noise is relevant to planning, "noise needs to be considered when new development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced)." (Paragraph: 001, Reference ID: 30-001-20190722, Revision date: 22-07-2019.)

The Planning Practice Guidance pages also include more explanation of the effect level categories noted above, providing an explanatory Noise Exposure Hierarchy Table, which explores how actions such as a requirement for noise mitigation, or prevention of a development, might be assessed with respect to whether noise levels are considered above the category thresholds. The Noise Exposure Hierarchy Table (Paragraph: 005, Reference ID: 30-005-20190722, Revision date: 22-07-2019) is reproduced here:

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

In summary, with respect to National Planning Policy, neither the Planning Practice Guidance pages, nor the National Planning Policy Framework or Noise Policy Statement for England documents, provide quantitative advice such as the use of absolute noise limits. Thus, authorities still generally interpret and express national and local non-quantitative policies by issuing quantitative noise-related planning conditions.

2.2 BS 8233:2014

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* provides guidance on sound insulation, indoor ambient noise levels and room acoustics. This standard will apply to the internal noise levels delivered in the new student study bedrooms (rooms for residential purposes).

Noise levels from environmental noise ingress, under normal background ventilation conditions, shall not exceed the limits given in Table 1. These noise levels shall be provided with windows closed with whatever ventilation method is adopted providing normal background ventilation.

Table 1 - BS8233 recommended internal noise levels (note, noise ingress due to external noise sources only).

Location	$L_{Aeq,16hr}$ Daytime (07:00 – 23:00)	$L_{Aeq,8hr}$ Night-Time (23:00 – 07:00)
Living Room	35dB	-
Dining Room	40dB	-
Bedroom	35dB	30dB

BS 8233:2014, "Guidance on sound insulation and noise reduction for buildings", gives a recommended upper noise limit for "traditional external areas that are used for amenity space, such as gardens" of 50 dB $L_{Aeq,T}$ with an upper limit of 55 dB $L_{Aeq,T}$.

2.3 BS 4142:2014

BS 4142:2014 "Methods for Rating and Assessing Industrial and Commercial Sound" addresses the likelihood of adverse impact from noise generated by plant equipment. In the standard, a noise rating is determined and compared with the existing local background sound level, and several cumulative acoustic feature corrections to the noise rating are available to apply where appropriate. For example, if the noise includes a distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristic, then additional cumulative penalties individually ranging from 0 to 9 dB may be applied depending on the type of noise.

BS 4142:2014 seeks to determine a "representative" background sound level, stating that "…the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods".

The assessment of the impact depends upon the margin by which the rating level of the specific sound source exceeds the background sound level but also promotes a consideration of the context in which the sound occurs when making an assessment. BS 4142:2014 states that an initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level, while considering the following points:

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) 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.

Note then, a BS 4142:2014 assessment may deduce a low impact where the specific sound level is approaching the background sound level, and thus may conclude that the specific noise is acceptable.

2.4 ProPG (2017)

The ProPG: Planning & Noise – Professional Practice Guidance on Planning & Noise (ProPG), issued May 2017, provides guidance on a recommended approach to the management of noise within the planning system in England. It was published in associated with the Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health.

The guidance incorporates a noise risk assessment as well as design guidance for internal noise levels and noise levels in external amenity areas, and assessments of other relevant issues.

The guidance in the ProPG applies to new residential development that will be exposed predominantly to airborne noise from transportation sources.

It proposed a two-stage approach:

- Stage 1 – an initial noise risk assessment of the Proposed Development site; and
- Stage 2 – a systematic consideration of four key elements comprising:
    - 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".

An "Acoustic Design Statement" should be prepared and delivered as part of the approach and should be commensurate to the corresponding level of risk determined in Stage 1.

The initial noise risk assessment is summarised in Figure 1 of the ProPG document and is reproduced in Figure 2.

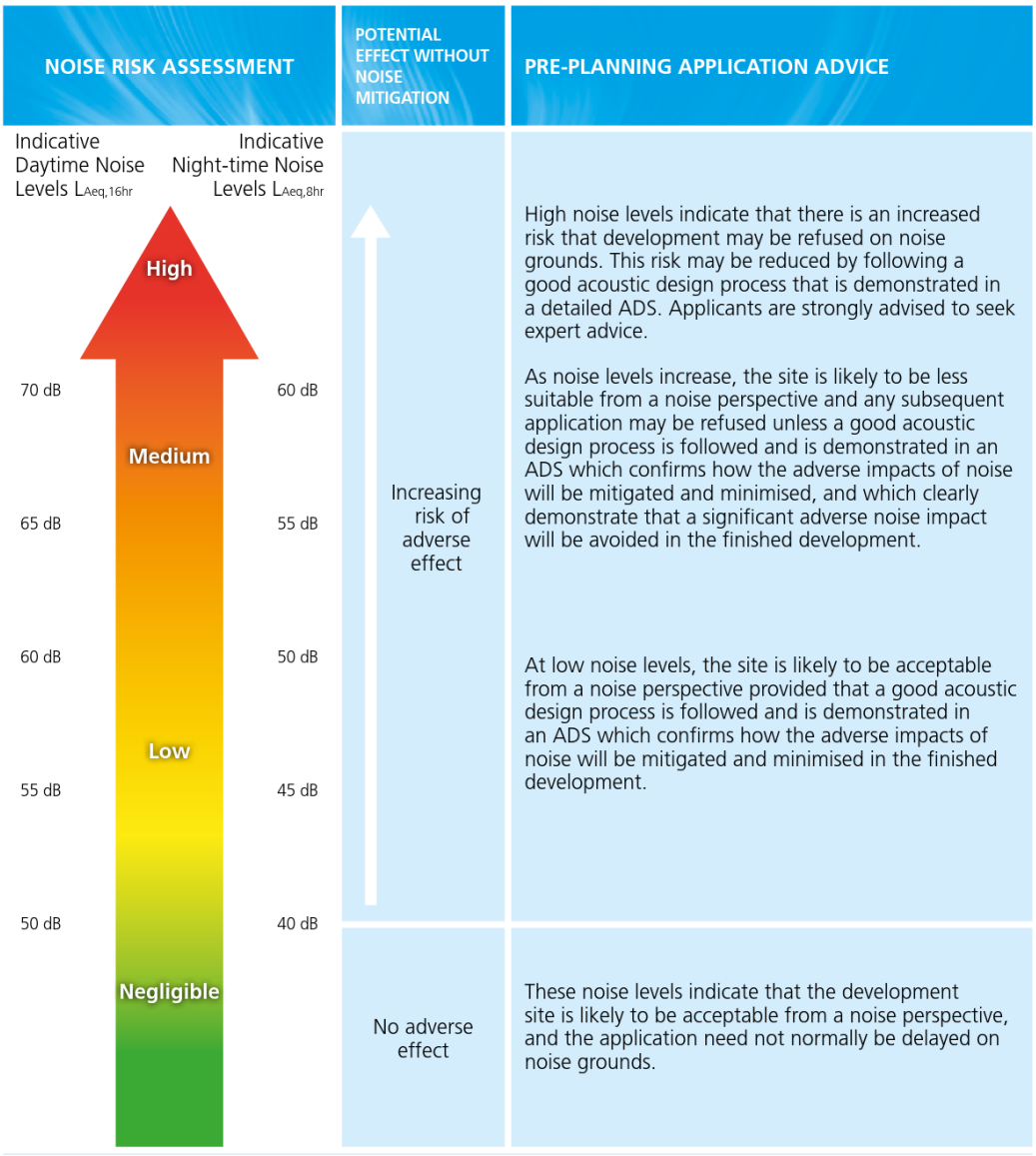

Figure 2 - Figure 1 of the ProPG document, reproduced in full, summarising the Initial Site Noise Risk Assessment process

Element 2 - Internal "Noise Level Guidelines"
ProPG Element 2 - Internal "Noise Level Guidelines" are consistent with the internal noise level targets in BS 8233:2014, although there is an additional guideline target for individual noise events such that events do not normally exceed 45 dB L_{AFmax} more than 10 times a night.

2.5 AVO Guide (January 2020)

The *Acoustics Ventilation and Overheating: Residential Design Guide"* (January 2020) published by the Association of Noise Consultants, provides guidance for the assessment of acoustics with consideration given to ventilation and overheating designs.

Internal noise levels advised by BS 8233:2014 should be achieved whilst providing Approved Document F whole dwelling ventilation. However, the AVO Guide considers it reasonable however to allow higher levels of internal ambient noise from transport sources when higher rates of ventilation are required in relation to the overheating condition.

The basis for this is that the overheating condition occurs for only part of the time, and that during this period, the occupant may accept a trade-off between acoustic and thermal conditions as they have some control over their environment.

A two-level assessment procedure is recommended to estimate the potential impact on occupants in the case of the overheating condition. The Level 1 site risk assessment is based on external free-field noise levels and the assumed scenario of a partially open window used to control overheating. Where a "High" risk is identified, a Level 2 assessment is recommended. The AVO Level 1 assessments are shown in Figure 3.

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition

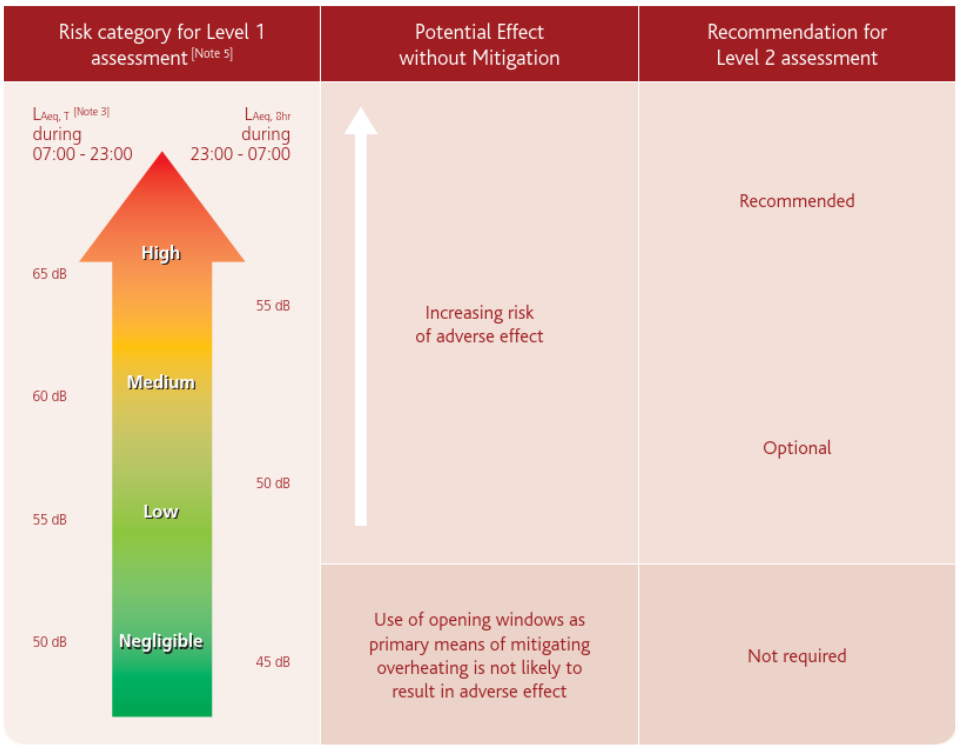

Figure 3 - Reproduction of Table 3-2 of the AVO Guide, showing the Level 1 site risk assessment.

2.6 Approved Document Part O (2021)

The recently introduced Building Regulations Approved Document O (Overheating) has various non-ventilation requirements/guidance that should be satisfied as part of a compliant overheating control strategy. With regards to noise it states:

"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

1. *40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am)*
2. *55dB $L_{AF,max,}$ more than 10 time a night (between 11pm and 7am)"*

These noise levels are not presented as limits to be met within bedrooms, merely as the levels which noise is likely to cause occupants to sacrifice their thermal comfort to manage their acoustic comfort. It references the use of the ANC *'Acoustics, Ventilation and Overheating: Residential Design Guide*' (2020).

The industry response to how the noise statements in Approve Document O will be implemented by Building Control, is not yet clear. However, we comment below on the likely effect on this scheme.

2.7 Local Authority – Camden

Camden Local Plan 2017
Following is the relevant extracts from the Camden Local Plan 2017.

"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."

The document also includes an assessment of Entertainment Noise which includes the assessment of human voices). Table D of the document, shown on Figure 4, reports the assessment metrics.

Table D: Noise levels applicable to proposed entertainment premises (customer noise)

Noise sensitive receptor	Assess-ment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	56dB to 60dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 61dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Evening	The higher of 50dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	51dB to 55dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 56dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field)	Night	The higher of 45dB $L_{Aeq,5min}$ Or 10dB below existing $L_{Aeq,5min}$ Without entertainment noise	46dB to 50dB $L_{Aeq,5min}$ Or 9dB to 3dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 51dB $L_{Aeq,5min}$ Or 2dB below existing $L_{Aeq,5min}$ Without entertainment noise

Figure 4 - Table D of the Camden Local Plan 2017 for the assessment of entertainment noise.

3.0 NOISE SURVEY

3.1 Procedure

To establish the noise environment, two unattended long-term measurements and one attended noise measurement where undertaken. Locations are marked on Figure 1.

- Long-term measurement L1 was undertaken to measure the noise from Clerkenwell Road and background noise of NSR1.
- Attended short term S1 was undertaken to identify the noise level difference between Gray's Inn Road and Clerkenwell Road, thus inform the environmental noise model.
- Long-term noise measurement L2 was undertaken to measure the representative background noise for NSR2, NSR3 and NSR4.

Figure 5 - Aerial image site showing proposed development, noise sensitive receivers (NSRs), and measurement locations (L1 & L2).

The measurement was made with a Norsonic 140 precision sound level analyser. This equipment complies with BS EN IEC 61672 class 1. The meter uses a Norsonic 1225 free-field response microphone and NOR 1209 microphone pre-amplifier. A field calibration of the sound level meter was completed at the beginning and end of measurements with a Norsonic 1251 sound calibrator, complying with BS EN IEC 60942 class 1.

Measurement at location L1 was taken between 12:45pm on Thursday the 24th and 10:30am on Monday the 28th of September 2020 (~94 hours). Weather during the measurement was observed to be mostly dry and calm. The location is considered representative of the noise environment for the façades exposed to higher noise levels and for the residential properties on the opposite to Clerkenwell Rd Figure 6 shows the photographs of L1 measurement equipment from Clerkenwell Rd perspective and from the roof perspective.

Figure 6 - Photographs showing measurement equipment at location L1 from Clerkenwell Rd and roof perspectives.

An unattended noise survey at location L2 was taken between Thursday 1st and Monday 5th of October 2020. During the measurement period rains and strong winds occurrences weere observed. Due the uncertainty of the data the survey has been repeated between 10:00am on Thursday the 24th of June and 10:00am on Thursday the 1st of July 2021 (168 hours). Figure 7 shows the photograph of the measurement equipment at this location.

Figure 7 - Photograph showing measurement equipment at location L2.

3.2 Traffic Levels During COVID-19 Pandemic

The noise survey at L1 was undertaken while the impact on transportation due to the COVID-19 pandemic was still present. Figure 8 shows the use of transport in Great Britain since the 2nd of March 2020 for all motor vehicles and London Bus. For motor vehicles, values are expressed as percentages average of the equivalent week in the first week of February 2020. For London Bus values are percentages average of the equivalent of the third week of January 2020. Note, data on TfL Buses is not available from Sunday 19th April to 8th June due to the change in boarding policy. Transport data is provided by the government department for Transport statistics.

At the time of the survey the traffic levels were returned to similar level to the pre-pandemic period. Motor vehicle traffic levels were back to over 90% while London Bus levels were back to nearly 60%. The noise levels are expected to be marginally reduced by these traffic levels respect to normal, pre-COVID, levels. The difference is deemed to be negligible in the context of the assessments to be undertaken and noise levels can be considered representative.

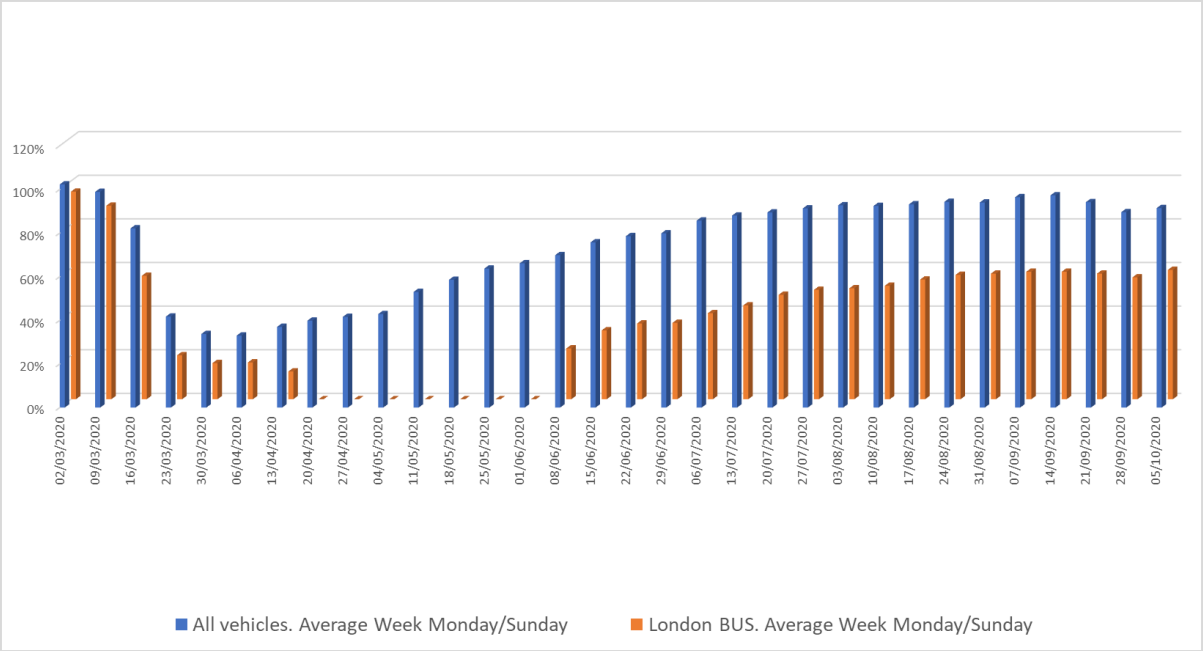

Figure 8 - Average traffic level per week from the 2nd of March to the 9th October 2020.

3.3 Noise Survey Results

Representative Background Noise Levels

In selecting a background level, we note that BS 4142:2014 seeks to determine a "representative" background sound level, stating that "…the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods". A definitive method of selecting a representative background sound level is not prescribed in BS 4142:2014, although an example is presented where the modal value is selected from a statistical analysis of LA90 data.

Based on past experience, a reasonable approach to defining an overall representative value is to consider the 40th percentile value of the $L_{AF90,15min}$ data periods, which accounts for potentially unrepresentative high values and untypical events, while usually representing values near the median of the remaining 'valid' distribution.

Representative Loudest Noise Events

The histogram in Figure 9 shows maximum measured noise levels (L_{Afmax}) during the noise survey. From the histograms it can be noticed the number of noise events and the intensity is the less consistent noise parameter respect to ambient noise and background noise, thus a statistical approach is used to avoid overestimating or underestimating typical night-time loud noise events. This is done by counting the number of $L_{Afmax,5mins}$ events that are occurring during all the measurement periods (night-time periods) and then dividing by the number of periods (nights). Appendix 8.1 and 8.2 presents the statistical distribution of background noise levels measured at L1 and L2 respectively.

Location 1 (L1) - 24th to 28th September 2020

The noise profile for the full measurement period from Thursday 24th to Monday 28th of September 2020 is shown in Figure 9.

Noise levels are higher during the daytime period (07:00-23:00) and gradually decrease towards the night-time period (23:00-07:00). There is a fast increase in noise levels from 6am to 8am during the weekdays. During the weekend noise levels are lower than during the working week and the quietest night measured is between Sunday and Monday. The occasional spikes occurring during nigh-time period are most likely related to emergency services or/and loud motorcycles. This noise profile is typical of an urban area.

The single figure values for each day and for entire noise survey period at L1 are reported in Table 2.

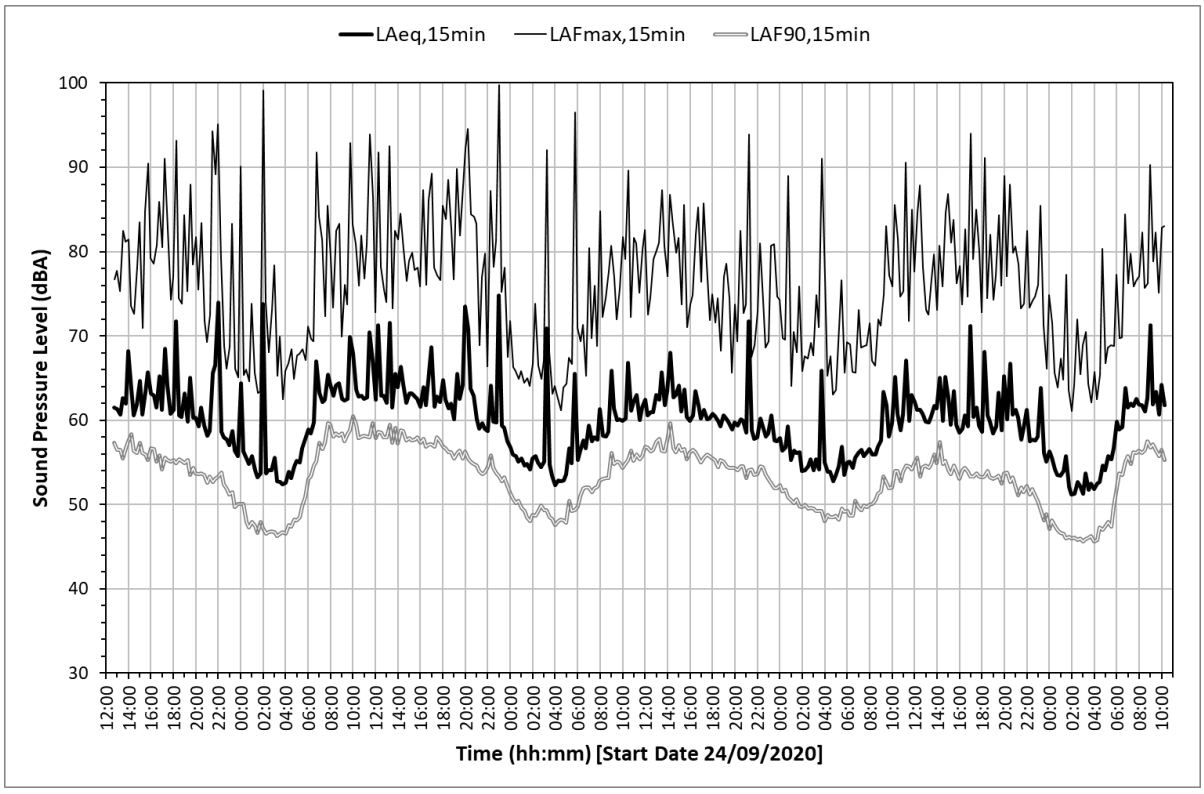

Figure 9 - Location L1 noise survey measurements profile.

Table 2 - Summary of the noise levels measured during the long-term noise survey at location L1.

Period	Ambient Noise Level, dB L_{Aeq}	Min. Background Noise Level, dB L_{A90}	Representative[(1)] Background, dB $L_{A90,40th}$	Representative[(2)] Loudest Event, dB $L_{AFMax,5min}$
Daytime (07:00-23:00)	63.6	49.3	54.4	-
Night-Time (23:00 – 07:00)	60.1	45.6	48.3	73.0

(1) 40th percentile value of measurement period.

(2) Value not exceeded on average more than 10 times per night.

Location 2 (L2) – 24th June to 1st July 2021

The noise profile for the full measurement period from Thursday the 24th of June to Thursday the 1st of July 2021 is shown in Figure 10.

The distance of L2 from the two main roads, Clerkenwell Rd and Gray's Inn Rd, and the shielding provided by the buildings, reduces the impact from traffic noise.

Noise source from activities in the surrounding area are less constant than traffic and can have large variations depending on the activity.

The single figure values for each day and for entire noise survey period at L2 are reported in Table 3.

When deriving representative noise conditions at L2, the periods of the survey that are significantly affected by the weather have been discounted. See Figure 10 highlighted areas.

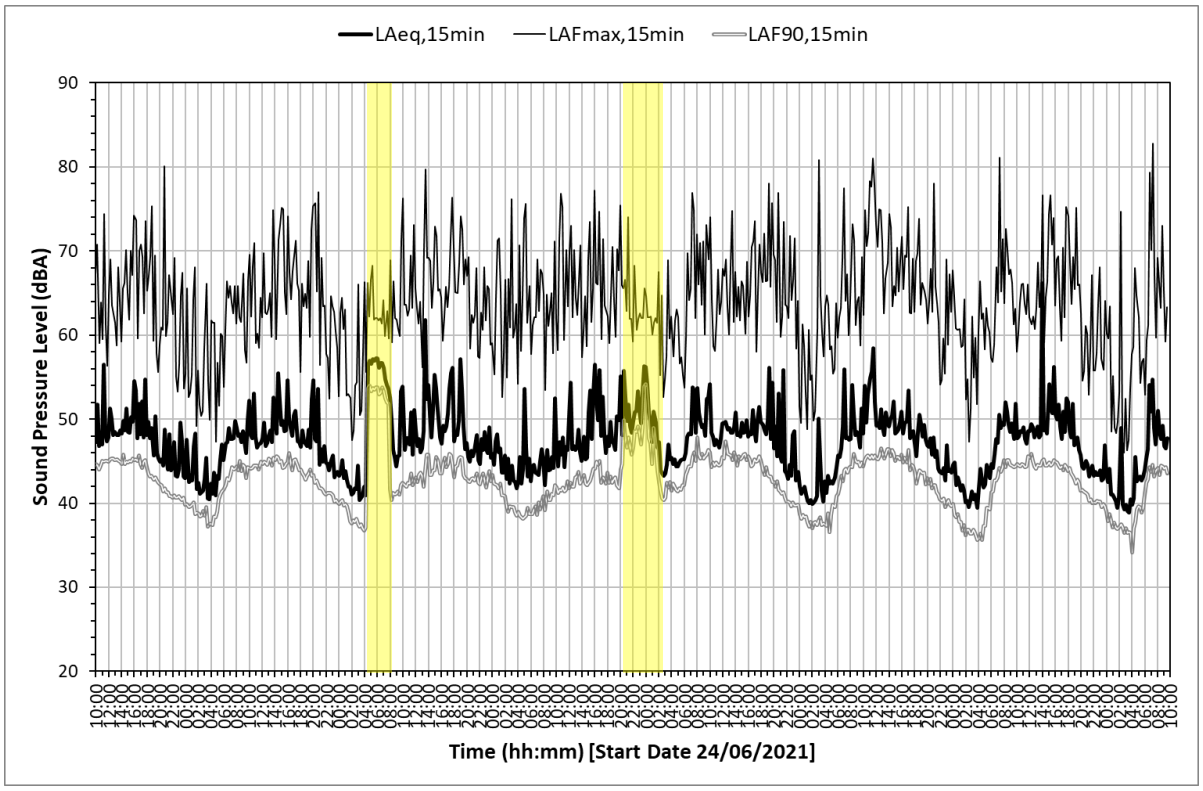

Figure 10 - Location L2 noise survey measurements profile. Highlighted is the data excluded from analysis.

Table 3 - Summary of the noise levels measured during the long-term noise survey at location L2.

Period	Ambient Noise Level, dB L_{Aeq}	Min. Background Noise Level, dB L_{A90}	Representative[(1)] Background, dB $L_{A90,40th}$	Representative[(2)] Loudest Event, dB $L_{AFMax,5min}$
Daytime (07:00-23:00)	50.3	38.6	43.5	-
Night-Time (23:00 – 07:00)	44.6	34.1	38.7	64.0

[(1)] 40th percentile value of measurement period.

[(2)] Value not exceeded on average more than 10 times per night.

4.0 NOISE IMPACT ASSESSMENT – MECHANICAL PLANT

Plant Noise Limits
Table 4 and Table 5 notes the plant noise limits, in line with the local authority requirement for design criterion outlined in Section 2.7.

Table 4 notes the plant noise limits for NSR1 on the opposite side of Clerkenwell Road, while Table 5 notes the plant noise limits for the NSRs within the noise protected area to the South and South/East sides of the development.

The limits are such that the total plant noise rating level 1 m from the façade of the nearest noise sensitive receiver (NSR) shall be 10 dB below the representative background.

It should be highlighted that the night-time limits for NSR2, NSR3 and NSR4 are very low and onerous, particularly in an urban context such as this.

For context, the older BS4142:1997 standard has the following note:

"NOTE. For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low."

Table 4 - Plant noise limit for NSR1.

Period	Adopted Representative Background Sound Level, dBA	Plant noise rating sound level limit at 1 m from NSR, $L_{Aeq,15min}$
Day (07:00-23:00)	54.4	44.4
Night (23:00-07:00)	48.3	38.3

Table 5 - Plant noise limits for NSR2, NSR3, and NSR4.

Period	Adopted Representative Background Sound Level, dBA	Plant noise rating sound level limit at 1 m from NSR, $L_{Aeq,15min}$
Day (07:00-23:00)	43.5	33.5
Night (23:00-07:00)	38.7	28.7

External Mechanical Plant
Figure 11 shows the aerial image of the proposed development with the associated plant areas containing high noise generating plant equipment in relation to the identified NSRs.

An external plant area with air source heat pumps (ASHPs) and a chiller is located on the roof top of the 100GIR building. While an enclosed plant area serving 88GIR is located at ground/first level on the North side of the 88GIR building.

To assess the impact of external plant equipment an environmental noise model using industry standard software SoundPLAN has been created. Figure 12 shows images of the model showing NSR points and plant area on the roof of 100GIR and the plant room of 88GIR.

Figure 11 - Aerial image site showing location of external plant and noise sensitive receivers (NSRs).

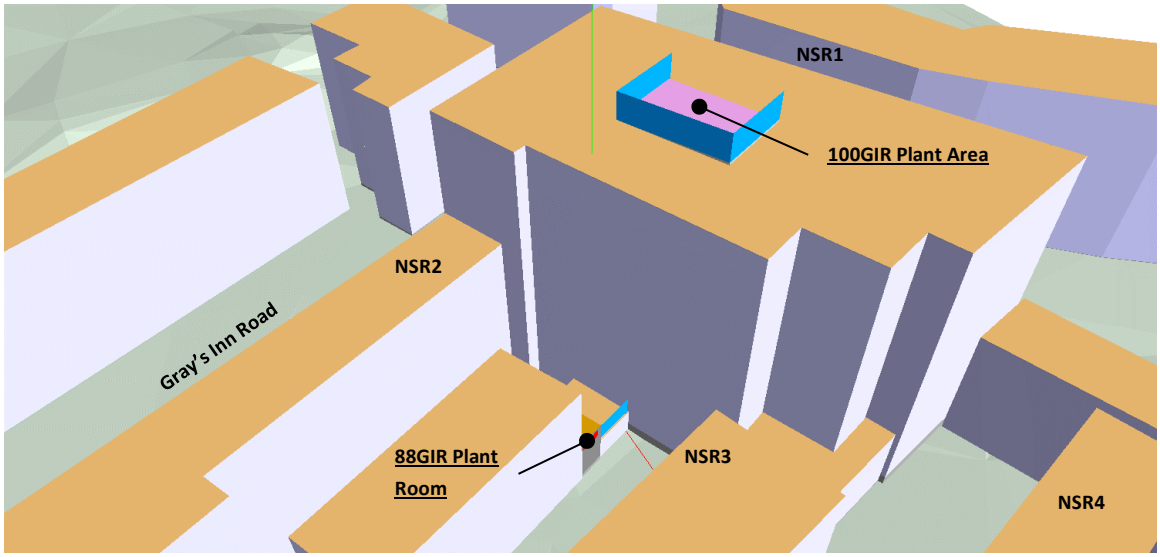

Figure 12 - Representative image of the 3D environmental noise model.

100GIR ASHPs Plant – Roof Top
The plant area on the roof top of 100GIR road contains the following exposed equipment:

- No.3 ASHPs
- No.1 Chiller

A noise barrier which includes part of the roof top structure acts as a noise control solution. The ASHPs are likely to require acoustic casing as a noise control solution.

To establish the sound power noise emission limits a representative set of spectrum noise data from the plant equipment in the plant area has been generated. Table 6 shows the sound power levels assumed and used in the model.

Table 6 - 100GIR plant area sound power assumed.

Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	dBA
ASHPs x3, Lw[(1)]	101	97	94	80	77	72	71	88
Chiller, Lw[(2)]	78	84	86	83	79	77	71	85
Total Plant Area, Lw	101	97	94	85	81	78	74	90

(1) Inferred from similar unit with acoustic casing.
(2) Inferred from similar unit.

The grid map noise propagation from the roof plant area of 100GIR to the top floor of the noise sensitive receivers is shown on Figure 13. The BS4142 assessment is shown on Table 7 during daytime.

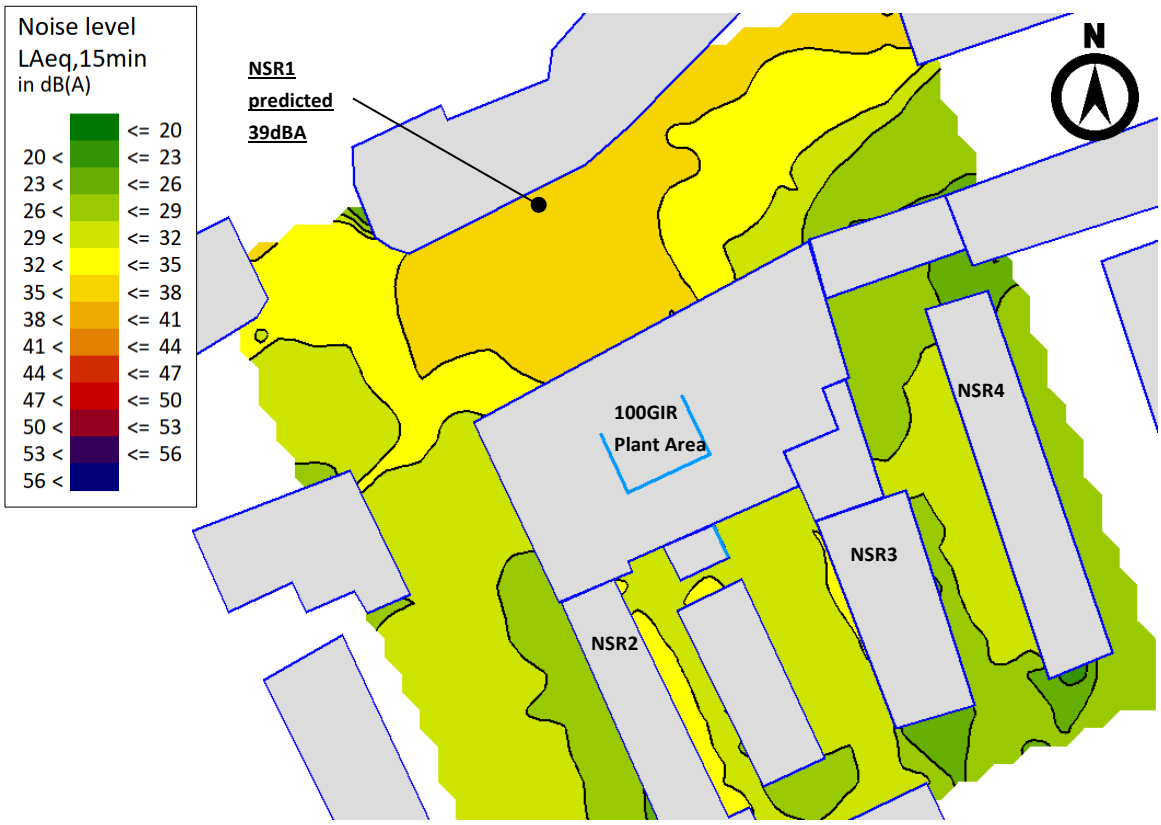

Figure 13 - Daytime plant noise propagation from 100GIR roof top plant area.

Table 7 - BS4142 assessment of 100GIR roof top plant area during daytime period.

Receiver	$L_{Ap,15min}$	$L_{Ar,T}$[(1)]	L_{A90}	Difference	BS4142 assessment
NSR1	40[(2)]	40	54.4	-14.4	Low impact
NSR2	33	33	43.5	-10.5	Low impact
NSR3	33	33	43.5	-10.5	Low impact
NSR4	<32	32	43.5	-11.5	Low impact

[(1)]no noise character correction is expected from the plant area. I.e. no impulse, no intermittency, no tonality.
[(2)]noise separately calculated due to window at higher level respect to noise grid map.

It is understood that the office building and the related plant is intended to operate only during the daytime. Mechanical plant noise from the external plant area on the roof top of 100GIR is within the proposed target during daytime at all identified NSRs.

If the plant is required to operate during night-time period, it will have to operate at lower duties such to meet the night-time targets.

100GIR Internal AHU
The AHUs within the building are distributed throughout the floor of the building with openings on the South side at ground floor level and on the East side at other floor levels. Due to the size and distribution of the openings the plant equipment the contribution to the mechanical plant noise at each NSR identified is marginal. Noise control solutions such as in duct attenuators are to be selected to not contribute to the noise originated from the external plant equipment.

88GIR Internal ASHPs
The ASHPs of the 88GIR plant area are enclosed in a room and ducted to the atmosphere through attenuators as a noise control solution. Figure 14 shows the concept.

The plant room includes two ducted ASHP. The sound power at the intake and exhaust openings has been inferred from similar units and a suitable attenuator has been incorporated for noise control. Table 8 shows the sound power calculation for the intake opening, while Table 9 shows the calculation for the exhaust opening.

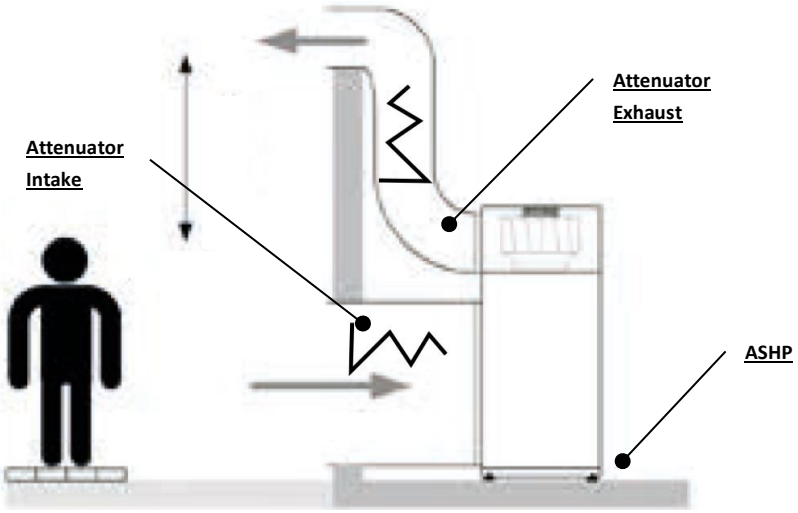

Figure 14 - 88GIR noise control solution concept.

Table 8 - 88GIR plant intake sound power calculations.

Component	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	dBA
Intake Lw	73	77	80	78	73	70	65	79
No.2 Units	76	80	83	81	76	73	68	82
Attenuator	-6	-10	-19	-38	-41	-33	-23	-
Bends, duct, end reflection loss	-3	-3	-3	-3	-3	-3	-3	-
Lw, Intake	61	61	55	34	26	31	36	49

Table 9 - 88GIR plant exhaust sound power calculations.

Component	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	dBA
Intake Lw	80	84	87	85	80	77	71	86
No.2 Units	84	88	91	89	84	81	76	90
Attenuator	-11	-15	-29	-55	-55	-49	-29	-
Bends, duct, end reflection loss	-3	-3	-3	-3	-3	-3	-3	-
Lw, Exhaust	63	63	52	24	19	22	36	52

The grid map noise propagation from the plant room openings of 88GIR to the first floor of the noise sensitive receivers is shown on Figure 15. The BS4142 assessment is shown on Table 10 during night-time.

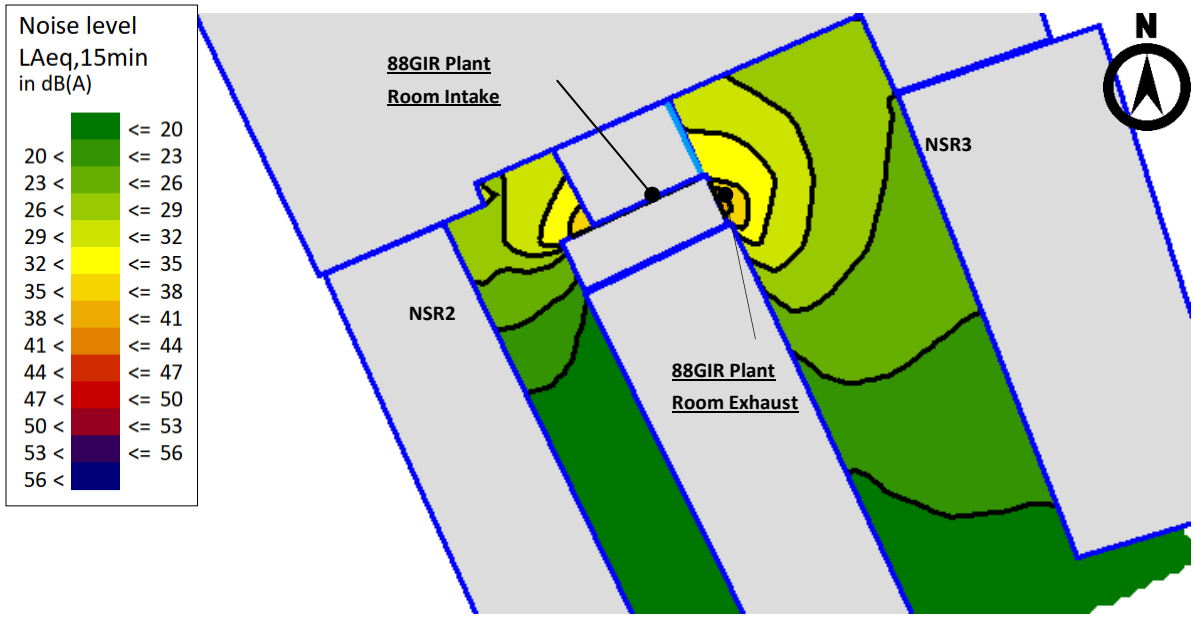

Figure 15 - Night-time plant noise propagation from 88GIR plant room openings.

Table 10 - BS4142 assessment of 88GIR plant room openings during night-time period.

Receiver	$L_{Ap,15min}$	$L_{Ar,T}$[(1)]	L_{A90}	Difference	BS4142 assessment
NSR2	28	28	38.7	-10.7	Low impact
NSR3	25	25	38.7	-13.7	Low impact

[(1)] *no noise character is expected from the plant area. No impulse, no intermittency, no tonality.*

Mechanical plant noise from the plant room on the North side of 88GIR is within the proposed target during daytime at all identified NSRs. During daytime the contribution of the 88GIR plant room to the 100GIR plant noise is marginal as each plant affects the NSRs façades at different points.

The noise level from 88GIR plant room in the courtyard to the East side of 88GIR is at least 10dB below daytime background noise level and well below the BS8233 upper noise limit of 50dBA for external amenity areas. Thus, no adverse impact in the courtyard amenity area is expected.

5.0 NOISE IMPACT ASSESSMENT – RESIDENTIAL

The proposed ventilation strategy for all residential dwelling includes mechanical ventilation with heat recovery to offer efficient whole dwelling fresh air ventilation whilst reducing heat loss especially in winter. And natural ventilation, using openable windows and doors to allow air flow, particular to mitigate summertime overheating.

ProPG assessment
The ambient noise level measured in location L2 is considered representative of the noise environment of 88GIR. The values are in the negligible level during daytime and negligible low during night-time.

The proposed building 100GIR will further increase screening of traffic noise from Clerkenwell Road and the proposed mechanical ventilation will avoid the requirement to open windows for ventilation. BS 8233 internal noise level are achieved without further acoustic requirements.

AVO assessment
The ambient noise levels meet the Part O requirements and following AVO guidance open windows as primary means of mitigating overheating is not likely to result in adverse effect.

Noise events during night-time are higher than expected. Maximum noise levels measured during night-time at L1 is 73 dB L_{Afmax}, while the ambient noise level is 63.6 dB L_{Aeq}, a difference of 9.4dB. While the level difference between the L_{Afmax} and L_{Aeq} measured at L2 is 19.4dB. Maximum noise level events generated by the main noise source, Clerkenwell Road, predicted using the 3D environmental noise model shows the level at L2 should be 54.9 dB L_{Afmax}.

The proposed development is not under or affected by known flight paths, thus the origin of the noise must originate from nearer non-transport related noise source. Mechanical noise is excluded since no plant equipment is in direct proximity. The two other noise source identified are activities in the car park on the East side of NSR3 to the East of the development and activities in the backyard area of The Griffin “Adult Entertainment” pub. Figure 16 shows the locations in relation to the development.

The proposed development of 100GIR building would create a more than sufficient screening from noises generated in the areas highlighted in Figure 16. Within these assumptions the L_{Afmax} noise levels would be within the Part O requirements and following the AVO assessment open windows as primary means of mitigating overheating is not likely to result in adverse effect.

Figure 16 - Locations of possible L_{Afmax} noise events measured at L2.

6.0 OFFICE TERRACES

The 100GIR includes terraces for general office breakout use during the day from Monday to Friday. The roof top terrace and front terrace is also for tenants to use during evening from Monday to Friday. No music reproduction will be allowed on the terraces.

There are two large terraces, the roof top terrace with an area of 348m^2 and the 2nd floor terrace on the South East corner of the building with an area of 102m^2. Figure 17 shows the locations of these terraces in the environmental noise model. The figure also shows the medium size terrace, 80m^2, on the North side of the building.

To predict the noise from conversations on the terraces the following has been assumed:

- Occupancy of 1.5 m^2 per person (standard assumed in exhibition spaces for person standing)
- Normal raised voice conversation (60 dB L_{Aeq} at 1 meter)
- 50% of persons speaking at one time (conservative)

With the above assumptions the sound power of the terrace areas has been derived. The sound powers for each area source shown on Figure 18 are shown on Table 11.

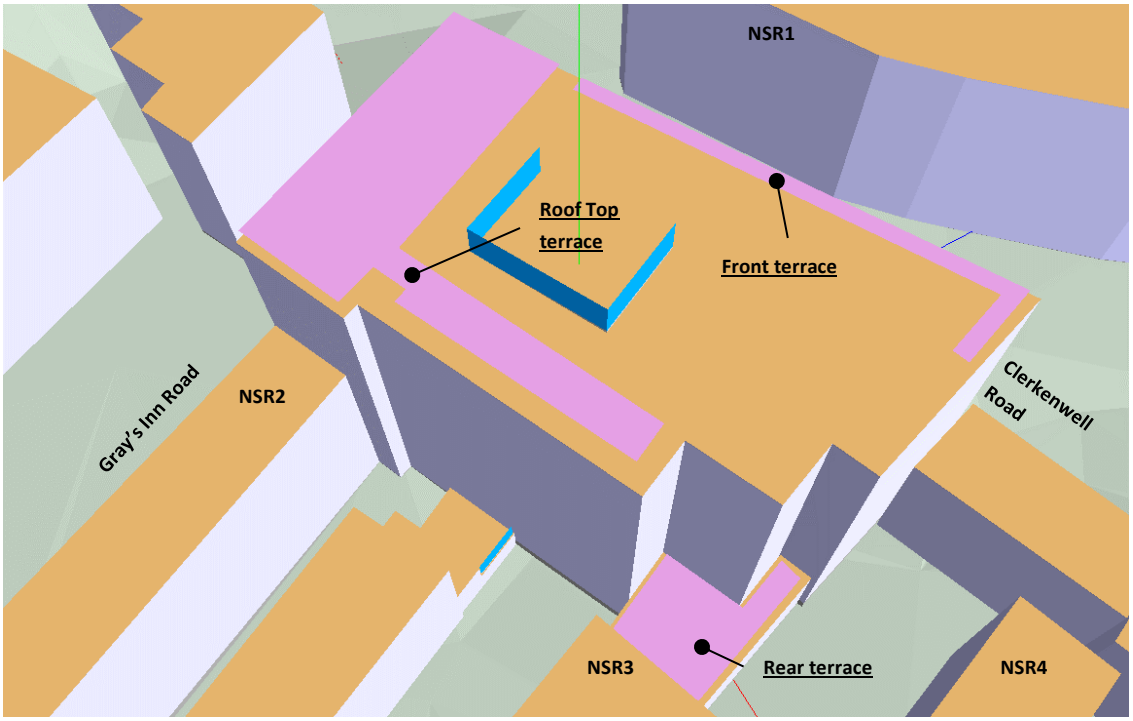

Figure 17 - Image of the environmental noise model showing terrace noise sources.

Table 11 - Roof terrace inferred noise levels.

Terrace	Floor Area	Occupancy	L_w derived
Roof top terrace	348.6 m^2	232.4	91.7 dBA
Rear terrace	102.5 m^2	68.3	86.3 dBA
Front terrace	80.6 m^2	53.7	85.3 dBA

There are other smaller terraces on the rear side the building. These have been omitted from the study since their impact would be negligible respect to the larger terraces.

The proposed operational times for the terraces are:

- 08:00 - 19:00 for the terraces on the rear of the building on the South and South/East façades.
- 09:00 - 23:00 for the roof top terrace and the terrace overlooking Clerkenwell Road.

Figure 18 shows noise propagation from the terraces, while Figure 19 shows the propagation from only the Roof top and the Front terrace.

To assess the impact of noise from activities, such as social conversations, taking place on the terraces the entertainment noise requirements, which include human voice, outlined in the Camden Local Plan 2017 are used. Table 12 shows the assessment based on noise predictions, the threshold outlined on Table D of the Camden Local Plan (2.7), and the PPG Noise Exposure Hierarchy Table (2.1).

Table 12 - Assessment of conversation noise from terraces.

NSR	Period	Noise Target	Noise Prediction	Response	Action
NSR1	Daytime (07:00-19:00) Evening (19:00-23:00)	55 dBA 50 dBA	<50 dBA <50 dBA	Present and not intrusive	No specific measures required
NSR2	Daytime (07:00-19:00) Evening (19:00-23:00)	55 dBA 50 dBA	<55 dBA <45 dBA	Present and not intrusive	No specific measures required
NSR3	Daytime (07:00-19:00) Evening (19:00-23:00)	55 dBA 50 dBA	55 dBA <45 dBA	Present and not intrusive	No specific measures required
NSR4	Daytime (07:00-19:00) Evening (19:00-23:00)	55 dBA 50 dBA	55 dBA <45 dBA	Present and not intrusive	No specific measures required

Noise level generated by maximum occupancy of the terrace are within the threshold of the assessment metrics at al NSRs.

The rear terrace has the greatest impact on the surrounding buildings due to: proximity to the NSRs and enclosed acoustic environment on the South/East side of 100GIR. NSR3 and NSR4 are just within the threshold during daytime. It is expected noise to be present and not intrusive; no specific measures are required as activity on these terraces is limited to daytime only (08:00-19:00).

The roof top terrace and front terrace are more distant from NSRs being in a more open-air environment. This limits the noise impact on NSRs and noise levels are comfortably below the evening threshold. The expected response to noise from these terraces is: noise is present and not intrusive; thus, no specific measures are required.

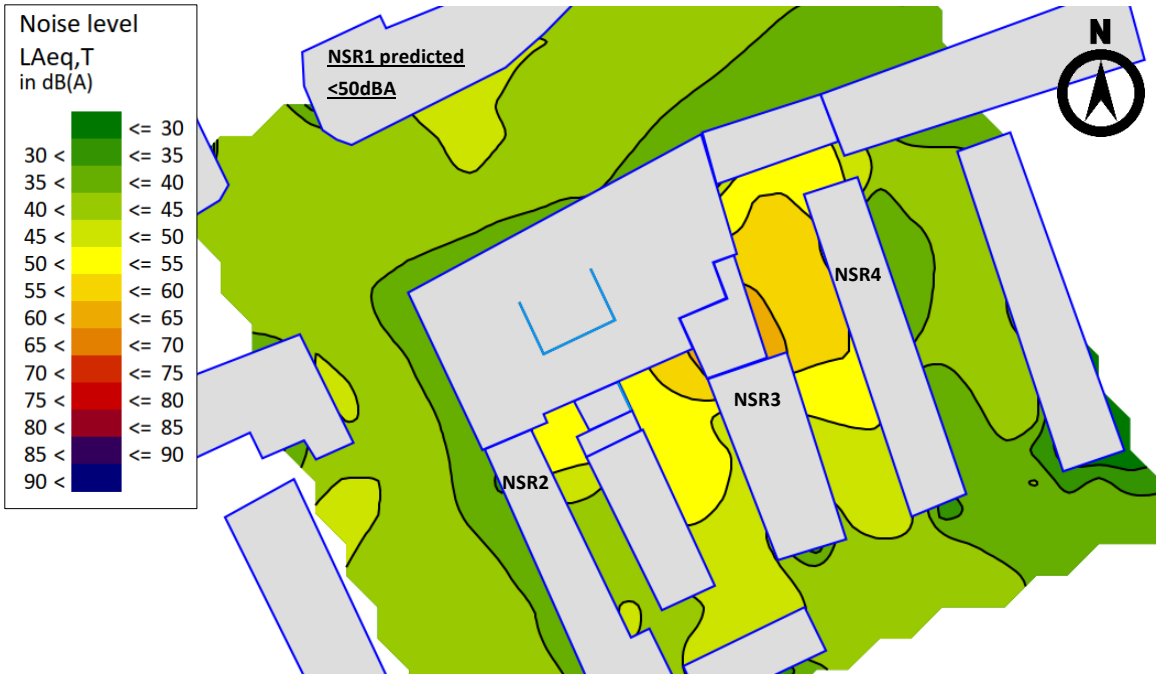

Figure 18 - Daytime (08:00-19:00) conversation noise from terraces.

Figure 19 - Evening period (19:00-23:00) conversation noise from roof top and front terraces.

7.0 SUMMARY

The proposed development comprises the construction of a new office building, 100GIR, on the North side of the development and the part conversion to residential of the existing building, 88GIR, to the South of the development.

The site is not influenced by identifiable vibration source. The site is sufficiently distant from the tube underground routes and no other vibration source was identified during the site visit. Thus, the site is considered acceptable in relation to vibration and no further investigation has been undertaken.

Two long term unattended noise survey were undertaken at the site of the proposed development to determine typical average (L_{Aeq}), background (L_{A90}), and noise events (L_{Afmax}) sound levels in the noise environment surrounding the site.

The first noise survey, L1, was undertaken at the North side of the existing building between 24th and the 28th of September 2020. This survey aimed at identifying noise levels from the main traffic noise source of Clerkenwell Road. The impact of the Covid pandemic on traffic noise levels has been investigated and assessed as negligible. The location is considered representative for the noise sensitive receivers on the opposite side of Clerkenwell Road.

The second noise survey, L2, survey was repeated due to adverse weather conditions. The repetition of the survey was undertaken between the 24th of June and the 1st of July 2021. The survey aimed to identify the noise environment in the residential area screened by main noise source on the South/East side of the existing buildings. The location is considered representative for the noise sensitive receptors in the residential area to the South/East of the development and for the noise environment affecting the residential part of the development.

The adopted representative background sound levels were taken as the lower of the 40th percentile and modal $L_{A90,15min}$ measurements. The adopted representative L_{Afmax} is the value not exceeded on average more than 10 times per night.

Noise survey results, in terms of average (L_{Aeq}), background sound levels (L_{A90}) and night-time noise events (L_{Afmax}) are shown on Table 13.

Table 13 - Summary of long-term noise survey's results.

Measurement Location	Period	Ambient Noise Level, dB L_{Aeq}	Background sound level, $L_{A90,15min}$	Noise events (10 time per night), $L_{Afmax,5min}$
L1	Daytime (7am-11pm)	63.6	54.4	-
L1	Night-time (11pm-7am)	60.1	48.3	73.0
L2	Daytime (7am-11pm)	50.3	43.5	-
L2	Night-time (11pm-7am)	44.6	38.7	64.0

It has been noted that the background noise levels measured at L2 are very low and onerous particularly in an urban context such as this.

Plant noise upper limits, in accordance with the Local Plan 2017, are given in terms of noise rating level and specific sound level, defined according to BS 4142:2014 methodology.

These upper limits for noise sensitive receivers are shown on Table 14.

Table 14 - Summary of plant noise upper noise limits at identified noise sensitive receivers.

Identified noise sensitive receivers	Period	Background sound level, $L_{A90,15min}$	Plant Noise Rating Level Upper Limit, $L_{Ar,Tr}$
Opposite side of Clerkenwell Road	Daytime (7am-11pm)	54.4 dB	44.5 dB
Opposite side of Clerkenwell Road	Night-time (11pm-7am)	48.3 dB	38.3 dB
Residential area to the South/East of the development.	Daytime (7am-11pm)	43.5 dB	43.5 dB
Residential area to the South/East of the development.	Night-time (11pm-7am)	38.7 dB	28.7 dB

The most significant items of plant equipment for the proposed office development, 100GIR, are air source heat pumps (ASHPs) and the chiller unit on the roof top of the building. A noise barrier and acoustic attenuation encasings are implemented as noise control solutions.

The 100GIR building will include air handlings units. These are within the building and distribute between the floors in the buildings. Induct attenuators are implemented to avoid noise from these units contributing to the noise level from the air source heat pumps.

The most significant items of plant equipment for the proposed residential conversion, 88GIR, are air source heat pumps (ASHPs) in the plant area to the North of the 88GIR building. As noise control solutions the ASHPs are enclosed in a plant room and ducted with attenuators to the atmosphere.

To assess the impact of the plant equipment noise at noise sensitive receivers a 3D environmental noise model has been created. The model shows that using representative noise spectrum for the plant equipment with proposed noise control solutions the targets of rating level 10dB below background noise levels outlined in Table 14 are met. No noise character correction is expected from the plant area. The noise level prediction respect to background also represents a low impact under a BS 4142:2014 assessment. It is therefore considered unlikely that noise from plant will have an adverse impact.

Daytime noise levels in the courtyard to the East of 88GIR are comfortably below external amenity noise guidance limits and no adverse impact is expected.

The assessment of ambient noise measured at L2 representative of the environment of the residential conversion of 88GIR shows that open windows strategy for ventilation and overheating is not likely to result in adverse effect following AVO guidance and Part O requirements.

The measured L_{Afmax} events at L2 have been assessed as not representative of the noise impacting on the residential building. The difference between ambient noise levels and loud events measured at L1, survey exposed to the major noise source and investigation of the 3D environmental model show that the representative noise L_{Afmax} events measured at L2 are not likely to result in adverse effect following AVO guidance and Part O requirements whit the open windows strategy for ventilation and overheating.

The 100GIR includes terraces for general office breakout use during the day from Monday to Friday. The roof top terrace is also to be used for tenants use during the day and evening from Monday to Friday. The proposed use for the rear terraces is between 08:00 and 19:00, while for the top terrace and front terrace is between 09:00 and 23:00.

Noise from conversations generate during high level of occupancy in the terraces has been assessed following the local authority requirement in relation to the Planning Practice Guidance. With high level of occupancy ($1.5m^2$ per person) in all the largest terraces, no observed adverse effect is expected during the daytime period (08:00-19:00). During evening period (19:00-23:00) no observed adverse effect is expected when only the roof top and front terrace are in use; thus, no specific measure is required.

8.0 APPENDICES

8.1 L1 Noise Survey

Table 15 - Noise monitoring equipment used for noise survey at location L1.

Item	Make	Type	Serial no.	Calibration Intervals	Last Calibrated	Next Due Calibration	Calibration Certificate Number
Class 1 sound level meter	Norsonic	140	1405942	2 years	22/06/20	22/06/22	U35003
Microphone preamplifier	Norsonic	1209	15804	2 years	22/06/20	22/06/22	U35003
Microphone	Norsonic	1225	208215	2 years	22/06/20	22/06/22	35002
Calibrator	Norsonic	1251	34059	1 year	22/06/20	22/06/21	U34110

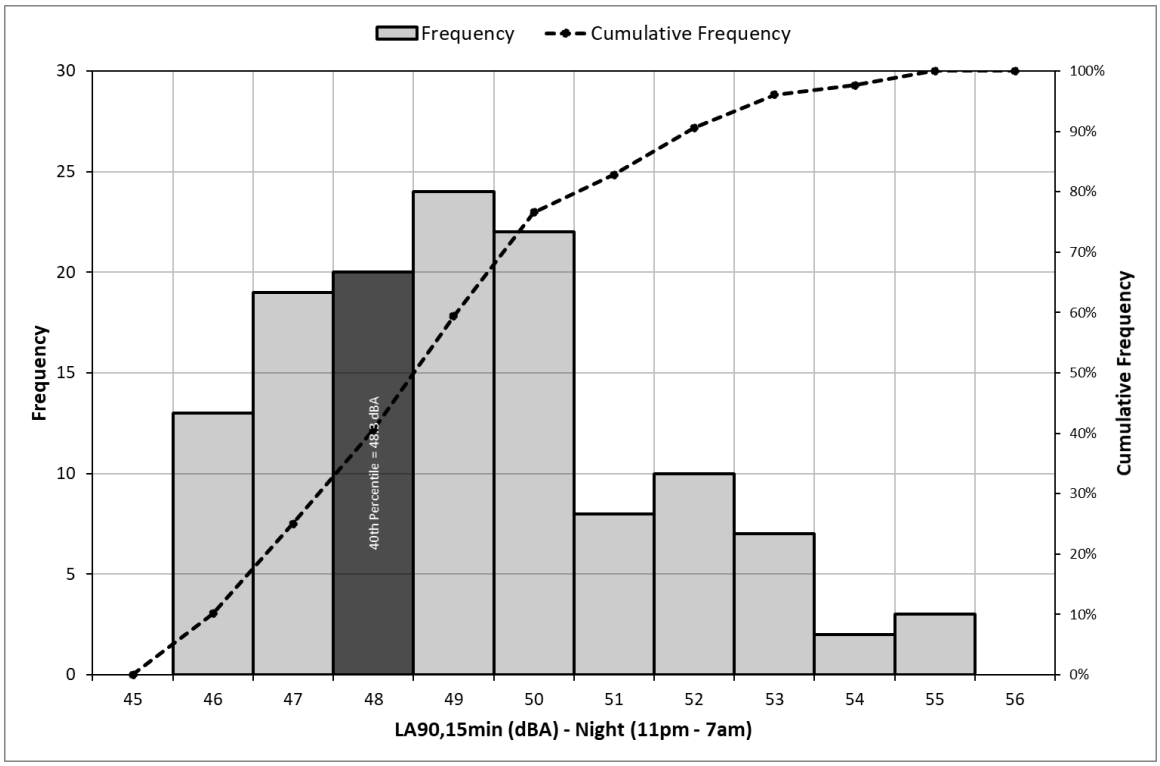

Figure 20 - Statistical distribution of background noise levels measured at L1 during night-time.

8.2 L2 Noise Survey

Table 16 - Noise monitoring equipment used for noise survey at location L2.

Item	Make	Type	Serial no.	Calibration Intervals	Last Calibrated	Next Due Calibration	Calibration Certificate Number
Class 1 sound level meter	Norsonic	140	1405942	2 years	26/02/21	26/02/23	U37205 U37206
Microphone preamplifier	Norsonic	1209	15804	2 years	26/02/21	26/02/23	U37205 U37206
Microphone	Norsonic	1225	208215	2 years	26/02/21	26/02/23	37204
Calibrator	Norsonic	1251	34059	1 year	17/12/21	17/12/22	U39785

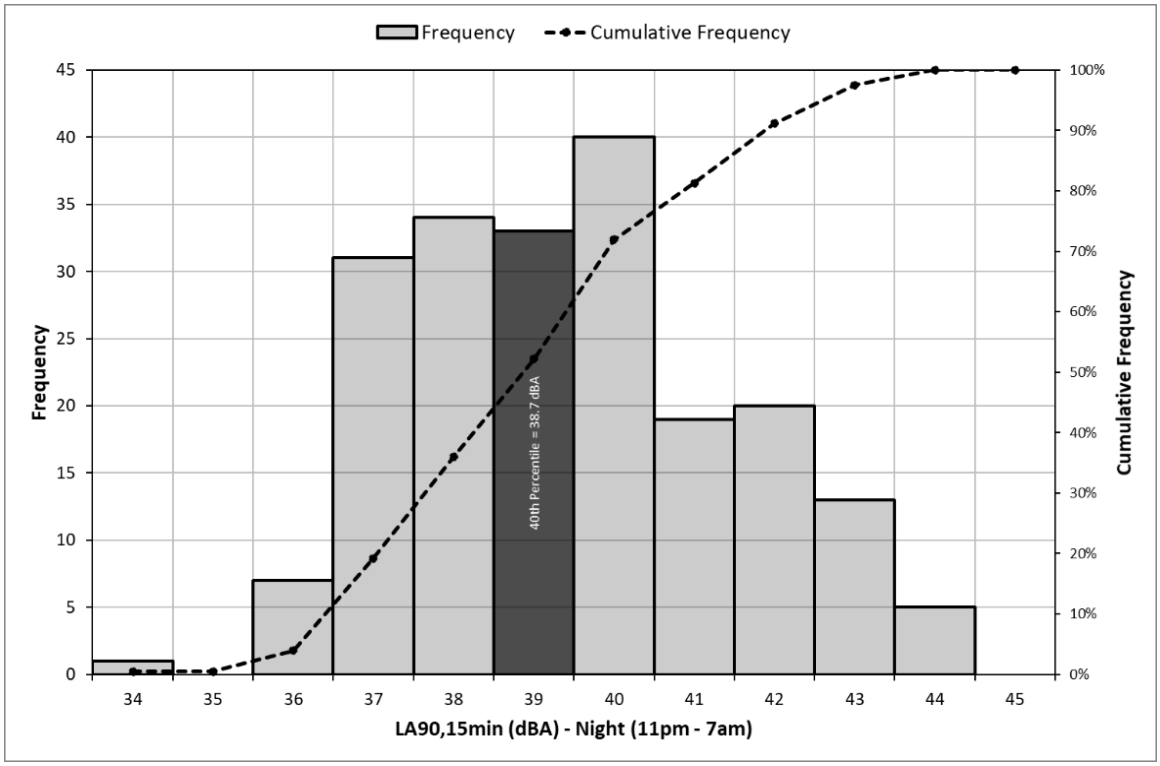

Figure 21 - Statistical distribution of background noise levels measured at L1 during night-time.

8.3 Glossary of Acoustic Terminology

SOUND POWER LEVEL, or L_W (decibels, dB)
The total amount of sound energy per unit of time generated by a particular sound source. This corresponds to a reference sound power of 10 pW.

SOUND PRESSURE LEVEL, SPL or L_P (decibels, dB)
A measure of the instantaneous sound pressure at a point in space. The threshold of hearing occurs at approximately L_P=0 dB (which corresponds to a reference sound pressure of 20 μPa).

A-WEIGHTED SOUND PRESSURE LEVEL, L_A (dBA)
A-weighted sound pressure level values are frequency-weighted in a way that approximates the frequency response of the human ear and allows sound levels to be expressed as a single figure value.

Alternative frequency-weightings are C-weighting and Z-weighting.

EQUIVALENT CONTINUOUS A-WEIGHTED SPL, $L_{Aeq,T}$ (dBA)
Energy average of the A-weighted sound pressure level over a time period, T. The level of a notional continuous sound that would deliver the same A-weighted sound energy as the actual fluctuating sound over the course of the defined time period, T.

MAXIMUM A-WEIGHTED SPL, L_{AFmax} (dBA)
Maximum A-weighted sound pressure level measured with fast time weighting.

BACKGROUND SOUND LEVEL, $L_{A90,T}$ (dBA)
The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval ,T, measured using time weighting, and quoted to the nearest whole number of decibels.

NOISE RATING LEVEL, $L_{Ar,Tr}$ (dBA)
The A-weighted specific sound level plus any adjustment for characteristic features of the sound (for example if the sound features impulsive or tonal components). Used in BS 4142:2014 assessments.

SPECIFIC SOUND LEVEL, $L_s = L_{Aeq,Tr}$ (dBA)
The equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

SPECIFIC SOUND SOURCE
The sound source being assessed.