HOARE LEA

# 26 Red Lion Square.
# London.
# Railpen.

**ACOUSTICS**
NOISE IMPACT ASSESSMENT

REVISION 01 – 29 NOVEMBER 2024

## Audit sheet.

| Rev. | Date | Description of change / purpose of issue | Prepared | Reviewed | Authorised |
|---|---|---|---|---|---|
| 00 | 08/11/24 | Draft issue | BMD | KJ | BJ |
| 01 | 29/11/24 | Issue | BMD | KJ | BJ |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |



Project number: 10/15488
Document reference: REP-1015488-5A-BD-20241108-Noise Impact Assessment-Rev01.docx

## Contents.

## Executive summary.

The Proposed Development seeks to redevelop the existing office building at 26 Red Lion Square (WC1R 4HQ), in the London Borough of Camden, to provide refurbished Cat A office space.

A noise impact assessment has been carried out to accompany the planning application for the development advising of provisions to enable compliance with London Borough of Camden's (LBoC) requirements.

**Existing sound environment.**
An environmental sound survey was carried out at the site in June 2022 to establish typical baseline conditions in the vicinity of the site. An additional sound survey was undertaken in July 2024 to validate the original survey data. The 2024 survey indicated that sound levels in the vicinity of the site have not significantly changed since the original 2022 survey.

**Control of external sound break in.**
The existing façade will be removed and replaced with a new façade system throughout the scheme.

The measured external sound levels from the environmental sound survey have been used to help develop the building envelope specification for new areas of façade.

Suitable internal sound levels are expected to be achieved with a relatively standard façade system incorporating acoustic double glazing.

The building will be fully mechanically ventilated with comfort cooling provided by fan coil units (FCUs). Therefore, there will be no reliance on windows or other openings on the façade to provide ventilation and cooling.

**Building services noise control.**
Noise generated from building services will need to be controlled externally to neighbouring noise sensitive residential buildings. Based on the measured background sound levels, external plant noise limits have been derived in line with London Borough of Camden policy.

Outline guidance has been provided on the type of acoustic mitigation measures that will be required to achieve the plant noise limits. Allowance has been made in the design for acoustic attenuation packages to the ASHPs, acoustic screening around the full perimeter of the rooftop plant area and in duct attenuators to the atmosphere side connections of all ventilation plant.

Based on the initial selections, an assessment of the noise breakout from the rooftop ASHPs has been provided. The assessment shows that with appropriate acoustic mitigation measures, noise breakout from the ASHPs can be controlled in line with the London Borough of Camden policy.

Acoustic mitigation measures will also be required for the life safety generator located within the basement plant area, including a full acoustic attenuation package to the generator set and in duct attenuation of any atmosphere connections.

**Level 7 roof terrace.**
As part of the proposed development, a new roof terrace will be formed at Level 7, along the Red Lion Square elevation of the building.

The potential for noise breakout from the terrace will need to be controlled through appropriate management of the space. A suitable management plan will be put in place with measures to limit noise build-up on the terrace (e.g. no amplified music, restricted hours of use etc.).

**Conclusions.**
The assessments presented in this report demonstrate that LBoC's planning requirements, with regards to noise emissions, can be achieved and external noise ingress can be controlled through conventional façade constructions. It is therefore considered that noise should not pose an obstacle in the granting of planning permission.

# 1. Introduction.

Proposals are in place to redevelop the existing office building at 26 Red Lion Square (WC1R 4HQ), in the London Borough of Camden, to provide refurbished Cat A office space.

An environmental sound survey has been undertaken to quantify the existing ambient and background sound levels at the site and experienced by nearby noise sensitive receptors.

The survey data has been used to establish the design constraints on noise emissions from the operation of plant as well as to determine the required sound insulation performances for the building envelope to achieve suitable internal sound levels.

This report summarises the survey and provides details of the above assessments in support of the planning application for the development.

As this report contains technical terminology, a glossary of terms is provided in Appendix A.

# 2. Acoustic design standards.

Guidance on acoustic design relevant to the development is available from a variety of references including but not limited to the following:

- London Borough of Camden's local policy
- British Council for Offices 'Guide to Specification', 2019;
- British Standard 8233:2014 'Guidance on sound insulation and noise reduction in buildings';
- CIBSE, Guide A, 2015;
- BREEAM Refurbishment and Fit out (RFO), 2014;
- The WELL building standard.

## 2.1 London Borough of Camden's planning policy.

London Borough of Camden's (LBoC) planning policy in regard to noise and vibration is provided in the following policy documents:

- Camden Local Plan (2017)
- Camden Planning Guidance – *Amenity* (2021)

Appendix 3 of Camden's Local Plan document sets out the following guidance on noise from industrial and commercial sources:

*"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)."*

# 3. Site description.

The site is located at 26 Red Lion Square, within the London Borough of Camden. The existing office building currently located on the site will be refurbished as part of the proposed works.

The site is bound to the north by Theobalds Road and to the west by Old North Street. Red Lion Square and gardens lie to the south of the site.

The surrounding buildings are a mix of office / commercial properties and residential dwellings. Conway Hall, a music venue lies directly adjacent to the existing building to the east. The proposed site, its surroundings and the nearest noise sensitive residential receptors are shown in Figure 1.

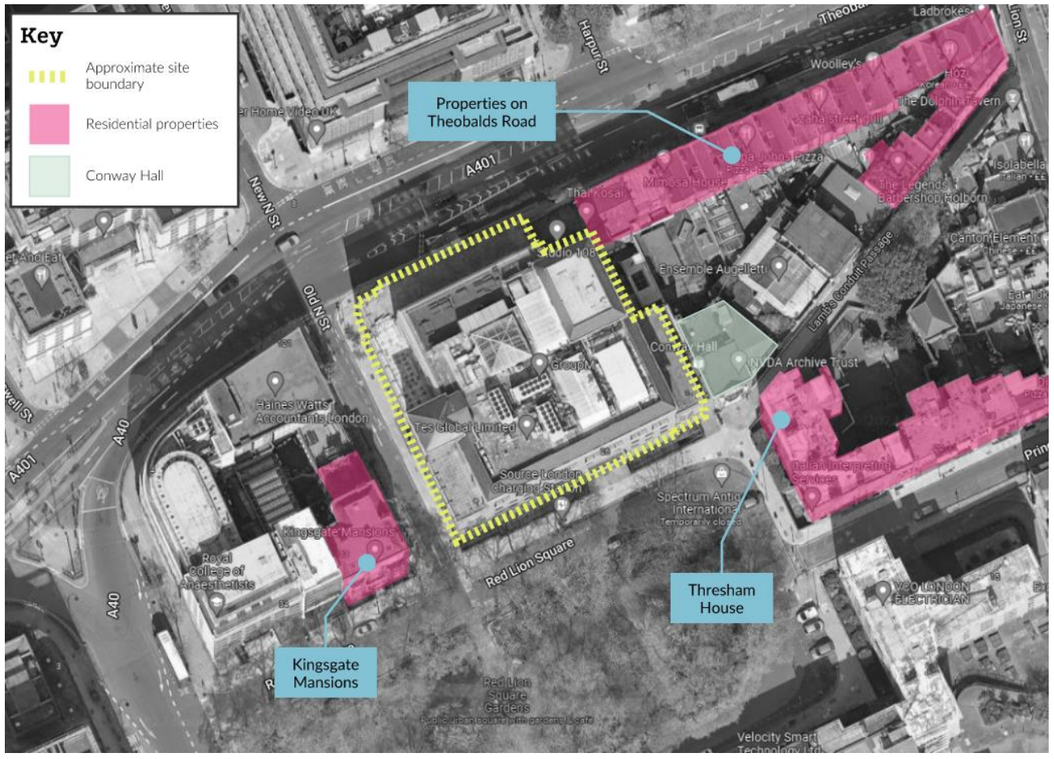


Figure 1 Site and its surroundings

## 3.1 Proposed development.

The works will include the refurbishment and recladding of the existing building with an extension at fourth floor adjacent to Theobalds Road and associated works. New F&B units and meeting rooms will be introduced at the ground and basement levels, a new entrance will be added to the Theobalds Road façade and a new terrace will be created at Level 7.

## 4. Environmental sound survey.

An environmental sound survey was carried out at the site in June 2022 to establish typical baseline conditions in the vicinity of the site.

An additional sound survey was undertaken between Friday 26th and Wednesday 31st July 2024 to validate the original survey data. The survey comprised of six days of unattended automatic noise measurements at two positions and a series of attended short term measurements at various positions to understand the variability of sound across the site. The 2024 survey indicated that sound levels in the vicinity of the site have not significantly changed since the original 2022 survey.

### 4.1 Measured external sound levels.

A summary of the measurement locations and survey results is presented in Figure 2 below. The data presented for the long-term unattended measurements is taken from the more recent 2024 survey, while the data presented for the short-term attended measurements is a combination of the 2022 and 2024 survey data.

The long-term unattended measurements recorded consisted of fifteen-minute samples of ambient sound levels ($L_{Aeq,15min}$ in dB), background noise levels ($L_{A90,15min}$ in dB) and the noise levels exceeded for 1% of the measurement period ($L_{A01,15min}$ in dB).

Further details of the survey work undertaken, including the equipment information and detailed results, are provided in Appendix B.

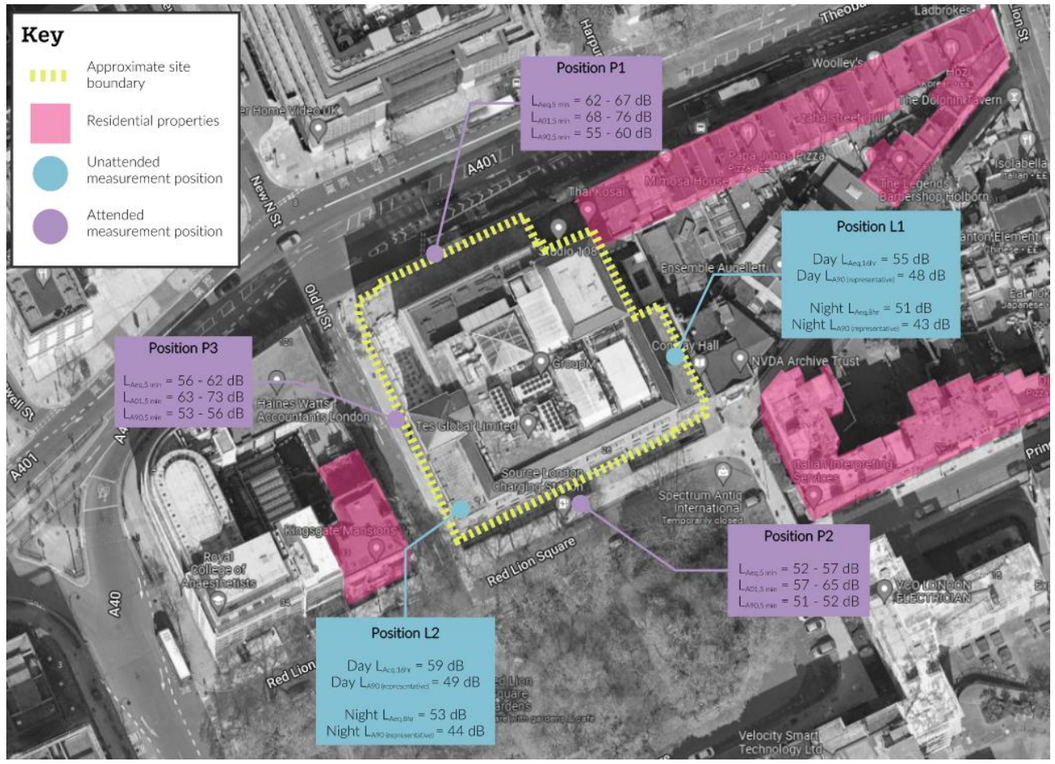


Figure 2 Sound survey measurement locations and summary of measured results.

The long term measurement equipment at Positions L1 and L2 were located at fourth floor roof level. The attended measurements at Position P1, P2 and P3 were undertaken at ground floor level, during weekday daytime periods.

Measurement positions were all at a height of approximately 1.2 metres above ground/roof level. All positions are considered to be free-field; with the exception of attended measurement Position P1. Appropriate façade corrections (-3 dB) have been applied to the measured sound levels from this position.

Background sound levels measured at Position L1 are considered representative of the neighbouring residential properties to the east of the site, and background sound levels measured at Position L2 are considered representative of the neighbouring residential properties to the west and south of the site.

# 5. Control of external noise intrusion.

## 5.1 Internal ambient sound levels.

Internal ambient sound levels within offices are advised not to exceed those set out in Table 1. These are established industry standards, based on guidance provided in BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and the British Council for Offices *Guide to specification* (BCO, 2019).

It is recommended that the BCO criteria are adopted as the project specific requirements. It should be noted that BCO refers to the target levels in terms of a noise rating (NR), which fall within the BS 8233 design ranges.

Table 1 Internal ambient sound level criteria

| Location | BS 8233 recommended internal ambient sound levels, dB $L_{Aeq,T}$ | BCO recommended Noise Rating |
|---|---|---|
| Cellular offices / Meeting rooms | 35 - 45 | NR 35 |
| Speculative offices | 40 - 50 | NR 38 |
| Open plan offices | 45 - 50 | NR 40 |
| Reception / Circulation | 45 - 50 | - |
| F&B Unit / Gym | 45 - 50 | - |
| Pavilion | 45 - 50 | |

In addition to this, BCO recommends controlling noisier events, occurring over short periods of time, to a limit of 55 dB $L_{A01,1hr}$ within open-plan offices, and 50 dB $L_{A01,1hr}$ within cellular offices and meeting rooms.

### 5.1.1 Control of rain noise.

For compliance with BCO, the roof and terrace build-ups need to control noise from rain to 60 dB $L_{Aeq,T}$ in all office spaces during periods of heavy rain.

## 5.2 Façade design.

It is understood that the existing façade will be removed and replaced with a new façade system throughout the scheme.

It is recommended that the façade sound insulation of the office areas is designed to achieve cellular office / meeting room standards as set out in Section 5.1, so as to provide a degree of flexibility for the future tenant fit-outs (assuming that the future tenants may wish to locate cellular / meeting spaces along the façades of the building).

At this stage, initial outline calculations have been undertaken based on the level differences between the external measured sound levels, and the proposed internal ambient sound level criteria. Based on the assessment, the new building envelope should provide the minimum sound reduction performances set out in Table 2 for different areas.

Table 2 Façade system sound reduction performance requirements for office areas

| Façade location | Minimum required façade sound reduction performance, dB $R_w + C_{tr}$ |
|---|---|
| Theobalds Road | 32 |
| Old North Street | 27 |
| Red Lion Square | 22 |

These performances apply to the façade as a whole (windows, doors and solid elements). However, the sound reduction performance of the façades will generally be governed by the glazing and window / door systems. These elements should therefore be designed to achieve the sound reduction performances set out in Table 2 as a minimum.

The solid elements of the façade should be designed to 10 dB above the recommended performance for the windows / doors.

The required sound reduction performances for windows / external doors are not particularly onerous and are expected to be achieved with a standard acoustic double-glazing configuration.

At this stage, the recommendations in Table 2 are based on single figure level difference only. The specification for the sound insulation performance of the new façade will be reviewed and developed as the design progresses with more detailed calculations undertaken.

## 5.3 Ventilation strategy.

The building will be fully mechanically ventilated with fresh air and extract ventilation to be provided via a centralised system and comfort cooling provided by fan coil units (FCUs) on each floor. As such, occupants will not be reliant on opening windows to provide adequate background ventilation or cooling.

Noise from ventilation and cooling equipment will need to be controlled to achieve appropriate internal sound levels.

# 6. Building services noise.

Noise emissions from any new building services equipment introduced as part of the development will need to be controlled to minimise the impact on the local sound environment as required by the local authority.

## 6.1 External plant noise emission limits.

### 6.1.1 Plant noise emission limits – Normal operating plant.

Based on the results of the environmental sound survey, plant noise emission limits at the nearest residential properties have been derived in line with local authority noise policy for both daytime and night-time periods.

These limits apply to the cumulative noise level of all plant operating simultaneously at design duty at one metre from the nearest relevant noise sensitive façade.

Table 3 Plant noise emission limits - At 1m from nearest residential receptor

| Residential receiver location | Period | Typical background sound levels measured, $L_{A90,15min}$ (dB) | Plant noise rating level, $L_{Ar,Tr}$ (dB) |
|---|---|---|---|
| East of site | Daytime (07:00 – 23:00) | 48 | 38 |
| | Night-time (23:00 – 07:00) | 43 | 33 |
| West of site | Daytime (07:00 – 23:00) | 49 | 39 |
| | Night-time (23:00 – 07:00) | 44 | 34 |

Building services plant that is tonal or has other strong characteristics such as a distinguishable hiss or hum, or that operates intermittently will require a rating penalty derived in line with BS 4142 as required by the local authority.

### 6.1.2 Plant noise emission limits - Life safety/ emergency plant.

It is normally accepted that life safety plant (e.g., generators, smoke extract fans, etc.) operate to a relaxed limit compared to normally operating plant.

It is proposed that any mechanical or electrical plant equipment specifically designed for emergency use (and allowance for testing) is to achieve 10 dB above the measured typical background sound levels. This is specified on the basis that the plant is only tested for short periods on weekdays between 09:00 and 17:00

Table 4 Life safety plant noise emission limits.

| Residential receiver location | Period | Typical background sound levels measured, $L_{A90,15min}$ (dB) | Plant noise rating level, $L_{Ar,Tr}$ (dB) |
|---|---|---|---|
| East of site | Daytime (07:00 – 23:00) | 48 | 58 |
| West of site | Daytime (07:00 – 23:00) | 49 | 59 |

## 6.2 Noise emission from building services plant.

At this stage, the building services design is still being developed and the plant selections for the various items of building services plant are still progressing. It is understood that the main items of external building services plant and internal plant ducted to atmosphere are as per Table 5.

Spatial provision is also made at roof level for future office tenant VRF plant.

Table 5 Main items of external building service equipment.

| Location | Internal and external plant items |
|---|---|
| Basement | – 1no. office air handling unit [AHU] (intake and exhaust ducted to louvres at ground level)<br>– 1no. WC air handling unit [AHU] (intake and exhaust ducted to louvres at ground level)<br>– Life safety generator (intake and exhaust ducted to louvres at ground level)<br>– Basement smoke extract fans |
| Roof plant area (Level 07) | – 2no. air source heat pumps [ASHPs]<br>– 2no. office air handling unit [AHU]<br>– Smoke extract fans<br>– Provision for future tenant VRF plant |

### 6.2.1 Key noise generating equipment - Air source heat pumps.

The main source of external noise-generating equipment to be introduced as part of the development will be two air source heat pumps (ASHPs) located within the Level 7 roof plant area. Significant attenuation measures will be required to enable the noise limits to be achieved. At this stage, allowance has been made within the design for:

- High performance proprietary ASHP attenuation packages. Initial space planning has been based upon Allaway's AA301S package (see Figure 3).
- Full solid acoustic screen around the roof plant area to a height at least 4 m above the FFL of the roof.
- If mechanically it is required to draw air through sections of the plant screen, then these sections will need to be formed of suitably rated acoustic louvres (c.300 mm deep).
- Suitably rated anti-vibration mounting of all ASHPs.

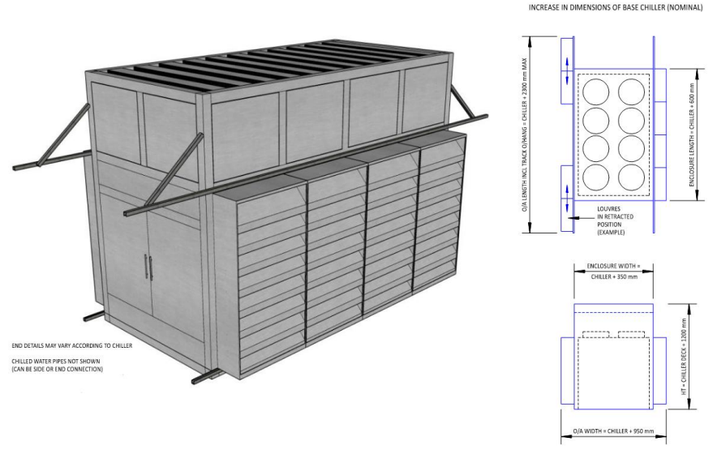


Figure 3 Example acoustic enclosure for ASHPs, (Source: Allaway Acoustic's AA301S)

Based on the current plant selections, the latest mechanical layouts and the noise control provisions set out above, an assessment has been undertaken of the noise breakout from the proposed ASHPs to the nearest residential receptors.

The assessments to each receptor are set out in Table 6 and Table 7. While the building may continue to operate during night-time periods, the required duty of the ASHPs would be significantly reduced during these periods and it is understood that only one unit would be operational. This is reflected in the assessment in Table 7.

The character of the existing noise climate in the vicinity of the site is primarily formed of road traffic noise and plant noise from roof plant on the surrounding existing buildings (including the existing plant on 26 Red Lion Square). As such, the new plant items are not expected to change the existing character of the noise at the nearest receptors and no character corrections have been taken in the assessment.

Building services equipment will likely be installed by incoming office tenants as part of their fit outs (spatial provision has currently been made within the roof plant area). As the overall building services noise limits set out in Section 6.1 are cumulative limits to be achieved by all plant associated with the development, an allowance has been made within the assessment for the future contribution of the office tenant plant.

On the basis that the overall plant noise limit is evenly apportioned between the landlord plant and the future tenant plant, the assessment has considered plant noise emission limits 3 dB lower than the cumulative plant noise emission limits.

It can be seen from Table 6 and Table 7 that, with the proposed noise mitigation measures, noise breakout from the ASHPs can be controlled to achieve both the daytime and night-time plant noise limits at the nearest residential receptors.

**Table 6 Assessment of ASHP noise breakout during daytime periods (07:00-23:00)**

| Calculation Step | Receptor | | |
|---|---|---|---|
| | Kingsgate Mansions | Properties on Theobalds Road | Tresham House |
| Sound power level, dB $L_{wA}$ | 89 | 89 | 89 |
| Tolerance, dB | 3 | 3 | 3 |
| No. units | 2 | 2 | 2 |
| Additions due to multiple units, dB | 3 | 3 | 3 |
| Losses from attenuation pack (AA301S)*, dB | -15 | -15 | -15 |
| Approx. distance to receiver, m | 20 | 43 | 44 |
| Distance attenuation**, dB | -34 | -41 | -41 |
| Losses from screening*, dB | -12 | -17 | -13 |
| Resultant rating level at receptor, dB $L_{Ar,Tr}$ | 34 | 23 | 26 |
| Apportioned landlord daytime plant noise emission limits, dB $L_{Ar,Tr}$ | 36 | 35 | 35 |
| Compliant? | Yes | Yes | Yes |

*Approximation based on full octave band calculations

**Based on hemispherical point source propagation

**Table 7 Assessment of ASHP noise breakout during night-time periods (23:00-07:00)**

| Calculation Step | Receptor | | |
|---|---|---|---|
| | Kingsgate Mansions | Properties on Theobalds Road | Tresham House |
| Sound power level, dB $L_{wA}$ | 89 | 89 | 89 |
| Tolerance, dB | 3 | 3 | 3 |
| No. units | 1 | 1 | 1 |
| Additions due to multiple units, dB | 0 | 0 | 0 |
| Losses from attenuation pack (AA301S)*, dB | -15 | -15 | -15 |
| Approx. distance to receiver, m | 20 | 43 | 44 |
| Distance attenuation**, dB | -34 | -41 | -41 |
| Losses from screening*, dB | -12 | -17 | -13 |
| Resultant rating level at receptor, dB $L_{Ar,Tr}$ | 31 | 20 | 23 |
| Apportioned landlord night-time plant noise emission limits, dB $L_{Ar,Tr}$ | 31 | 30 | 30 |
| Compliant? | Yes | Yes | Yes |

*Approximation based on full octave band calculations

**Based on hemispherical point source propagation

### 6.2.2 External noise control measures.

For the other items of plant, it is anticipated that the plant noise limits can be achieved provided the following noise control measures are incorporated within the scheme:

- Low noise equipment selected where possible.
- All fan intake and exhaust connections (including any emergency smoke fans) to be fitted with in duct sound attenuators. Space allowance has been made within the mechanical services design.
- Acoustically rated louvres provided to internal plant areas where ventilation is required via the façade.
- All equipment to be provided with suitably rated anti-vibration mounts,

Acoustic mitigation measures may also be required for the future tenant plant, as part of the tenant fit out.

### 6.2.3 Life safety generator.

Initial proposals are for a new life safety generator to be located within the existing generator plant room at basement level, with intake/discharge via louvres onto the public realm at ground floor level, with the exhaust flue ducted to the roof. At this stage, equipment selections are not sufficiently developed to enable assessments to be undertaken. However, it is expected that in order to achieve the proposed emergency plant noise limits, set out in Section 6.1.2, the life safety generator will require the following acoustic mitigation measures:

- A full acoustic enclosure to the generator set within the room.
- Induct attenuators to the intake and extract ductwork, and exhaust flue.
- The life safety generator will also need to be installed on appropriate anti-vibration mounts.

## 7. Noise breakout from roof terraces.

As part of the proposed development, a new roof terrace will be formed at Level 7, along the Red Lion Square elevation of the building.

Noise breakout from the terrace will be controlled through appropriate management of the space. A suitable management plan will be put in place with measures to limit noise build-up on the terrace (e.g. no amplified music, restricted hours of use etc.).

# Appendix A – Glossary of acoustic terminology.

### Sound.
Sound is physically a regular and order oscillation of air molecules that travels away from a source of vibration and creates fluctuating positive and negative acoustic pressure. When acoustic pressure acts on any solid object it causes microscopic deflections in the surface so that it can manifest in both air and structure.

### Noise.
Noise is subjectively sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcome to the receiver.

### Sound pressure level.
Sound pressure level is stated on many of the charts herein. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

### Decibel (dB).
The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

### Octave and Third Octave Bands.
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

### A-Weighting
The 'A' weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted value would be written as dB(A).

### Equivalent continuous sound pressure level.
The equivalent continuous sound pressure level ($L_{eq}$) is a parameter defined as the equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal. The $L_{eq,T}$ can be seen to be an "average" sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an 'A' weighted noise level in dB(A). It is commonly used to describe all types of environmental noise sources.

### Frequency.
Frequency is a term that is regularly used. It is the number of acoustic pressure fluctuations per second (also know is the 'pitch' of a sound). Hertz (Hz) is the unit normally employed to measure the frequency of sound, equal to cycles per second of acoustic pressure fluctuations. The frequency limits of audibility of a healthy human ear are generally accepted as being from 20 Hz to 20,000 Hz.

### Background Noise Level $L_{90}$.
The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period '$T$'. It is a statistical parameter and cannot be directly combined to other acoustic parameters. It is generally used to describe the prevailing background noise level or underlying noise level.

### Rating Level.
The specific noise level of the source plus any adjustment for characteristic features of the noise.

### Reverberation Time, T.
The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

### Airborne Single Number Quantity Weighting.
This is a weighting procedure defined in BS EN ISO 717, Part 1 for converting third octave band $R$, $R'$, $D$ and $D_{nT}$ values to a single number quantity denoted as $R_w$, $R'_w$, $D_w$ or $D_{nT,w}$. It is a decibel value.

### Impact Single Number Quantity Weighting.
This is a weighting procedure defined in BS EN ISO 717, Part 2 for converting third octave $L'_{nT}$ values to a single number quantity denoted as $L'_{nT,w}$. It is a decibel value.

# Appendix B – Environmental sound survey.

**Equipment.**

The equipment used for the short-term and long-term surveys are detailed below in Table 8 and Table 9 respectively. All the equipment was calibrated before and after the survey was taken: no significant drift was observed.

Table 8 Details of equipment used for short-term attended measurements

| Location | Manufacturer | Component | Model | Serial number | Date of most recent calibration | Calibration certificate |
|---|---|---|---|---|---|---|
| P1 & P2 (2022)<br><br>P1, P2 & P3 (2024) | Brüel & Kjær | Sound Level Meter | 2250 | 3004050 | 03/11/2023 | UCRT23/2427 |
| | | Pre-amplifier | 4189 | 3245822 | 03/11/2023 | UCRT23/2427 |
| | | Microphone | ZC0032 | 29334 | 03/11/2023 | UCRT23/2427 |
| | | Calibrator | 4231 | 2445715 | 25/09/2024 | UCRT24/2277 |
| P3 & internal measurement (2022) | Rion | Sound Level Meter | NA-28 | 01260201 | 10/02/2022 | UCRT20/1165 |
| | | Pre-amplifier | UC-59 | 00281 | 10/02/2022 | UCRT20/1165 |
| | | Microphone | NH-23 | 60104 | 10/02/2022 | UCRT20/1165 |
| | | Calibrator | NC - 74 | 34172704 | 10/08/2022 | UCRT22/1990 |

Table 9 Details of equipment used for long-term unattended measurements

| Location | Manufacturer | Component | Model | Serial number | Date of most recent calibration | Calibration certificate |
|---|---|---|---|---|---|---|
| L1 (2024) | Rion | Sound Level Meter | NL-52 | 00710469 | 12/01/2024 | UCRT24/1061 |
| | | Pre-amplifier | UC-59 | 19733 | 12/01/2024 | UCRT24/1061 |
| | | Microphone | NH-25 | 11012 | 12/01/2024 | UCRT24/1061 |
| L2 (2024) | Rion | Sound Level Meter | NL-52 | 00810564 | 12/01/2024 | UCRT24/1062 |
| | | Pre-amplifier | UC-59 | 19955 | 12/01/2024 | UCRT24/1062 |
| | | Microphone | NH-25 | 11107 | 12/01/2024 | UCRT24/1062 |
| L1 & L2 (2024) | Rion | Acoustic Calibrator | NC-74 | 34557134 | 03/11/2023 | UCRT23/2424 |

**Results.**

**Long-term unattended measurements**

A summary of the ambient sound levels measured is presented in Table 10. The results of the unattended measurements have been calculated into daytime ($L_{Aeq,16hr}$) and night-time ($L_{Aeq,8hr}$) equivalent levels.

Highlighted cells show days where the measurement was not a full 16-hour period.

Table 10 Ambient sound pressure levels measured at position L1

| Date | Ambient sound pressure levels measured (dB) at position L1 | |
|---|---|---|
| | Day Time (07:00 - 23:00) $L_{Aeq,\ 16hr}$ | Night-Time (23:00 - 07:00) $L_{Aeq,\ 8hr}$ |
| 26/07/2024 | 54 | 50 |
| 27/07/2024 | 54 | 50 |
| 28/07/2024 | 53 | 51 |
| 29/07/2024 | 54 | 50 |
| 30/07/2024 | 55 | 49 |
| 31/07/2024 | 57 | - |

Table 11 Ambient sound pressure levels measured at position L2

| Date | Ambient sound pressure levels measured (dB) at position L2 | |
|---|---|---|
| | Day Time (07:00 - 23:00) $L_{Aeq,\ 16hr}$ | Night-Time (23:00 - 07:00) $L_{Aeq,\ 8hr}$ |
| 26/07/2024 | 57 | 53 |
| 27/07/2024 | 59 | 53 |
| 28/07/2024 | 55 | 52 |
| 29/07/2024 | 57 | 53 |
| 30/07/2024 | 57 | 52 |
| 31/07/2024 | 57 | - |

Time histories of the $L_{Aeq}$, $L_{A90}$ and $L_{A01}$ from the unattended measurements recorded at positions L1 and L2 are shown in Figure 4 and Figure 5.

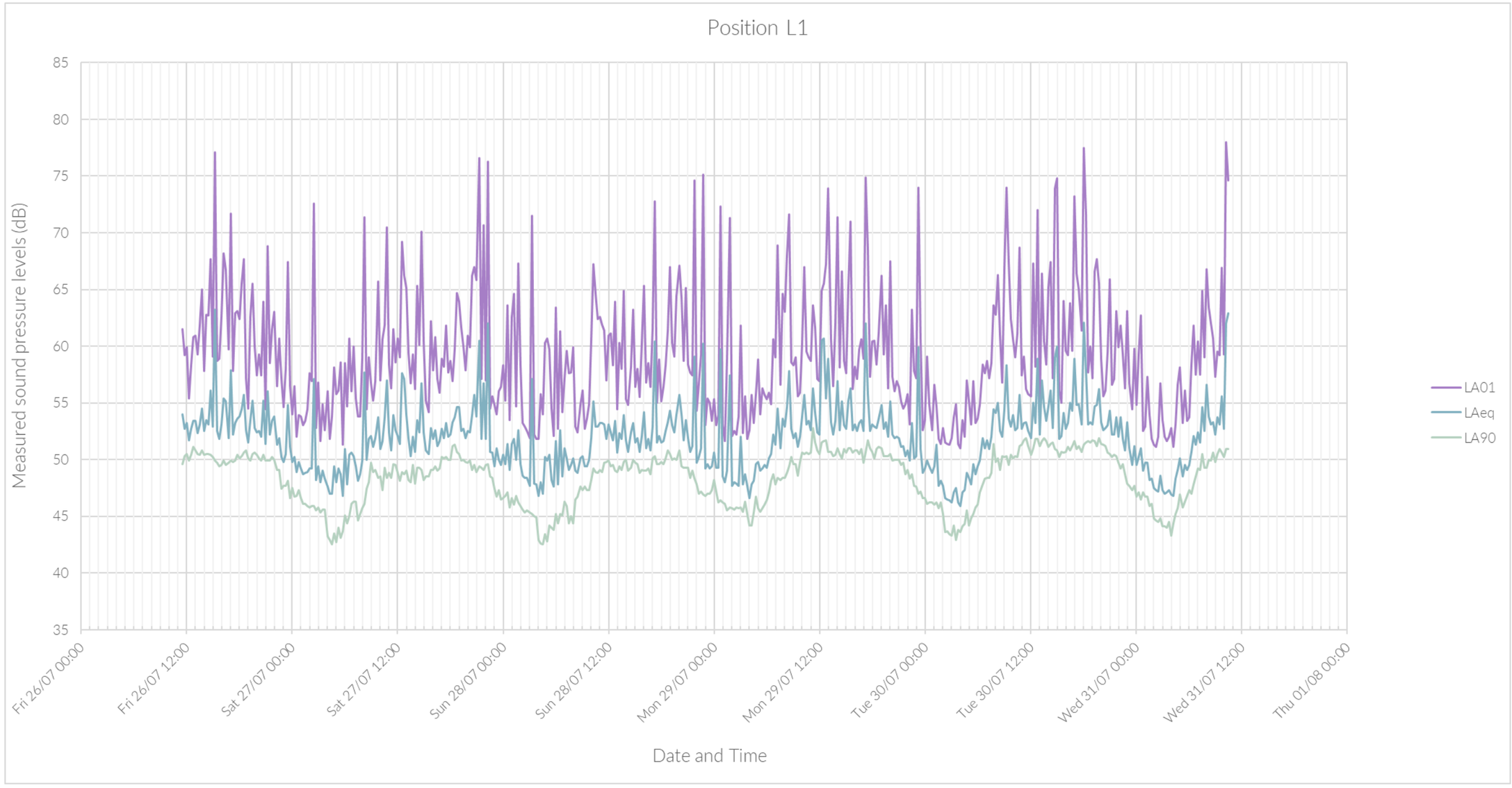


Figure 4 Time history of measured results from unattended monitoring position L1 in 15-minute time periods

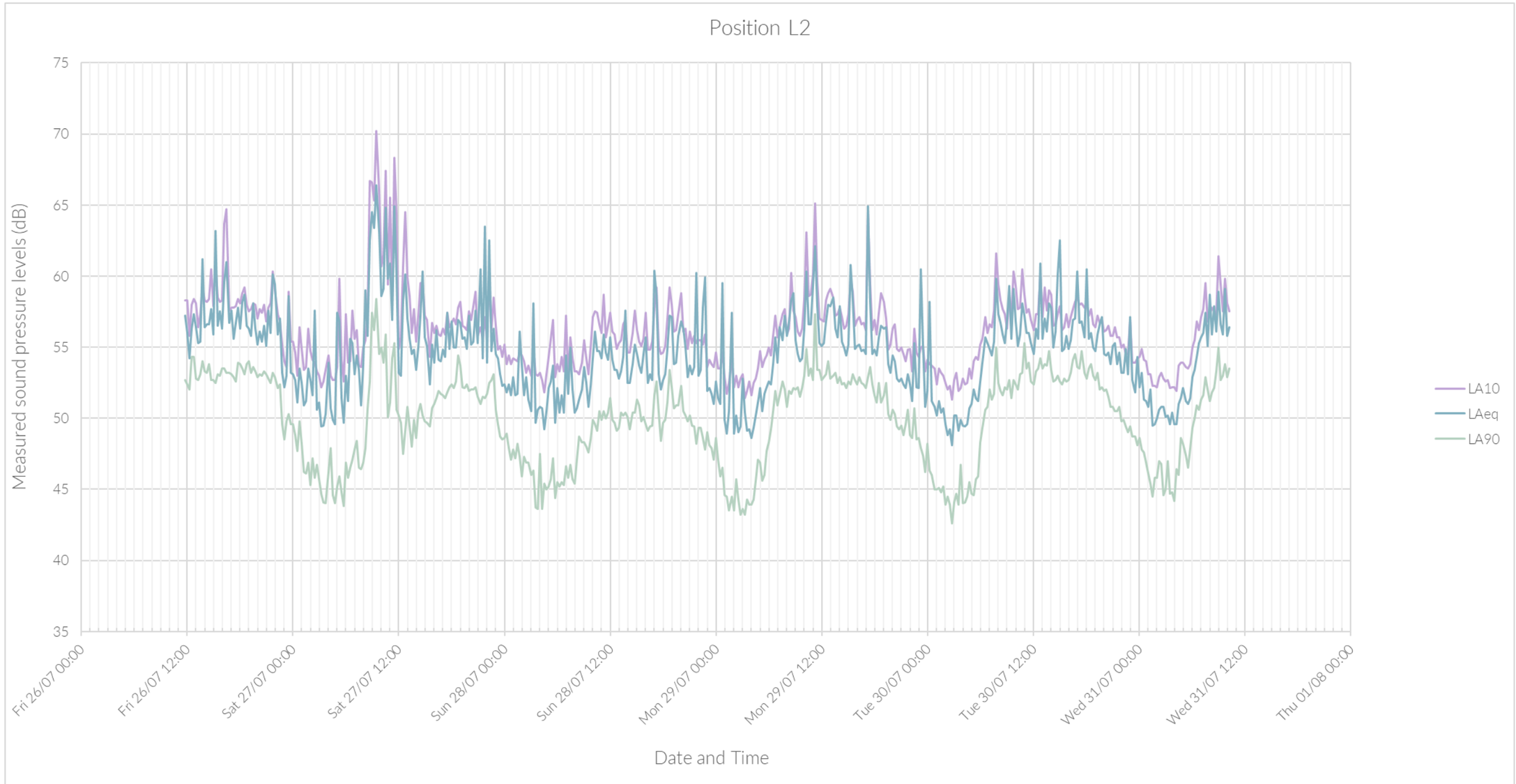


Figure 5 Time history of measured results from unattended monitoring position L2 in 15-minute time periods

**Background sound levels.**
In line with the requirements of BS 4142, in order to "*quantify what is typical during particular time periods*", statistical analysis of the measured background sound levels ($L_{A90,15min}$) has been undertaken. The periods of interest have been taken as daytime (07:00 to 23:00) and night-time (23:00 to 07:00).

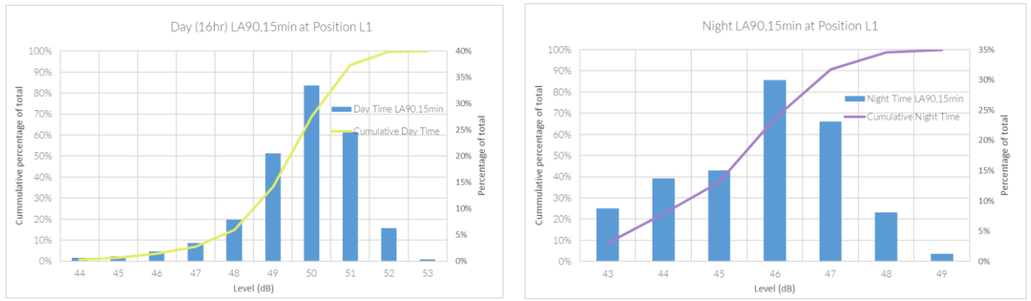


Figure 6 Statistical analysis of measured daytime (left) and night-time (right) background sound levels at Position L1

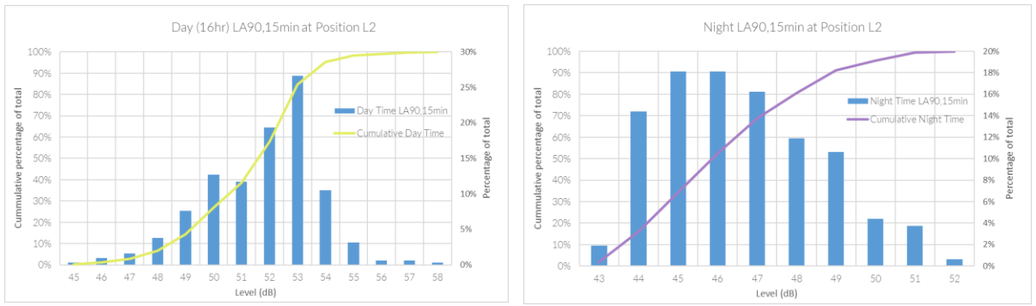


Figure 7 Statistical analysis of measured daytime (left) and night-time (right) background sound levels at Position L2

Based on taking the 10th percentile from the above statistical analysis charts, and reviewing against the time history chart included in Figure 4, the following background sound levels have been determined representative for the periods of interest for each measurement position and corresponding receptors.

Table 12 Typical background sound levels determined from statistical analysis

| Position | Period | Typical background sound level dB $L_{A90,15min}$ |
|---|---|---|
| L1 | Daytime (07:00 - 23:00) | 48 |
| | Night-time (23:00 - 07:00) | 43 |
| L2 | Daytime (07:00 - 23:00) | 49 |
| | Night-time (23:00 - 07:00) | 44 |

**Short term attended measurements.**
A summary of the external measured sound levels from the attended monitoring positions is presented in Table 13 below for both the 2022 and 2024 surveys.

Please note that the values presented position P1 in Table 13 have had a 3 dB façade correction applied, due to the proximity of the microphone position to the façade of the building at the measurement position.

Table 13 Summary of external short-term attended sound monitoring

| Position | Date & Time | Duration (hh:mm:ss) | Ambient sound pressure level, dB $L_{Aeq,T}$ | Short term noise event, dB $L_{A01,5mins}$ |
|---|---|---|---|---|
| P1 Theobalds Road | 23/06/2022 11:52 | 00:05:00 | 66 | 74 |
| | 23/06/2022 11:58 | 00:05:00 | 65 | 73 |
| | 23/06/2022 12:03 | 00:05:00 | 62 | 68 |
| | 23/06/2022 12:09 | 00:05:00 | 65 | 75 |
| | 23/06/2022 12:17 | 00:05:00 | 66 | 75 |
| | 23/06/2022 12:22 | 00:05:00 | 64 | 71 |
| | 23/06/2022 12:27 | 00:05:00 | 64 | 71 |
| | 23/06/2022 12:33 | 00:05:00 | 64 | 73 |
| | 23/06/2022 12:38 | 00:05:00 | 62 | 69 |
| | 26/07/2024 12:10 | 00:05:00 | 64 | 73 |
| | 26/07/2024 12:16 | 00:05:00 | 62 | 68 |
| | 26/07/2024 12:22 | 00:05:00 | 67 | 76 |
| P2 Red Lion Square | 23/06/2022 12:48 | 00:05:00 | 57 | 65 |
| | 23/06/2022 12:54 | 00:05:00 | 56 | 62 |
| | 23/06/2022 13:00 | 00:05:00 | 56 | 65 |
| | 26/07/2024 12:47 | 00:05:00 | 52 | 57 |
| | 26/07/2024 12:52 | 00:05:00 | 54 | 60 |
| | 26/07/2024 12:58 | 00:05:00 | 55 | 63 |
| P3 Old North Street | 23/06/2022 12:50 | 00:05:00 | 62 | 73 |
| | 23/06/2022 12:58 | 00:05:00 | 59 | 66 |
| | 23/06/2022 13:03 | 00:05:00 | 59 | 66 |
| | 26/07/2024 12:29 | 00:05:00 | 57 | 67 |
| | 26/07/2024 12:35 | 00:05:00 | 56 | 63 |
| | 26/07/2024 12:40 | 00:05:00 | 57 | 65 |

HOARE LEA

**BEN DAWSON**
PRINCIPAL ACOUSTICS ENGINEER

+44 20 3668 7361
bendawson@hoarelea.com

HOARELEA.COM

Western Transit Shed
12-13 Stable Street
London
N1C 4AB
England