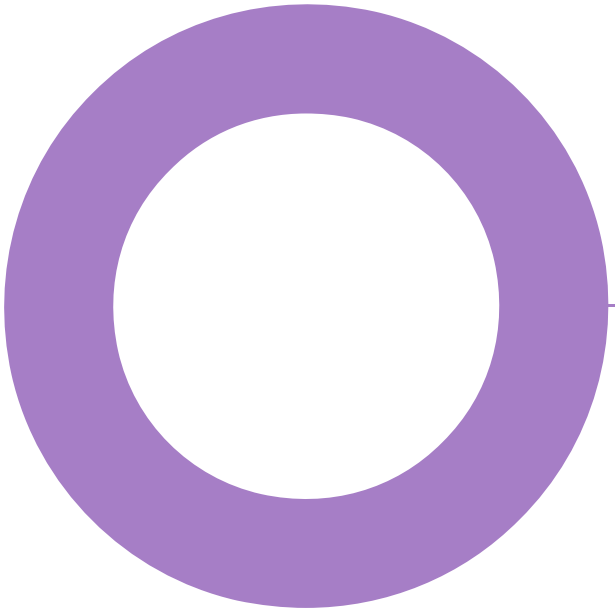
HOARE LEA

35 High Holborn. London.
Takenaka Europe.

ACOUSTICS
NOISE IMPACT ASSESSMENT

REVISION 01 – 17 MAY 2024



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	08/05/2024	Draft issue for comment.	PT	KJ	BJ
01	17/05/2024	Final issue	PT	KJ	BJ

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Contents.

Executive summary

There are proposals to refurbish and reconfigure the existing office provision at 35 High Holborn, London WC1V 6AE. Works will include the replacement of existing building services plant with new equipment at roof level. This report serves to present a noise impact assessment of the proposed plant and has been produced in support of the planning application.

An environmental sound survey has been undertaken to determine baseline sound levels at the site. The results of this survey have been used to inform the assessment and establish noise limits in line with the London Borough of Camden's local planning requirements.

The assessment concludes that with the incorporation of appropriate noise control measures, such as in-line attenuation to ductwork and acoustic screens, plant noise can be controlled to 6 – 8 dB below prevailing background sound levels at the nearest noise-sensitive receivers. This aligns with the Amber noise thresholds of the Camden Local Plan and would be considered indicative of a low impact in the context of BS 4142.

The proposals are therefore considered compliant with the strategic objectives of Camden's Policy A4 which seeks to prevent "*development likely to generate unacceptable noise and vibration impacts".* On the basis, that plant noise can be controlled through a suitably worded condition and the plant arrangement will continue to be reviewed as the design progresses, planning permission should not be refused on the grounds of noise.

1. Introduction.

Proposals are in place to refurbish and reconfigure the commercial office building at 35 High Holborn, London WC1V 6AE. Works will include the replacement of existing building services plant and the installation of new equipment at roof level.

Noise from this equipment has the potential to disturb existing noise-sensitive receivers in the local area and will therefore need to be controlled. An environmental survey has been undertaken to determine baseline sound levels at the site and establish plant noise limits in line with the London Borough of Camden's planning policy. An assessment of the proposals is presented herein to demonstrate that the limits and Camden's planning objectives can be achieved.

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

2. Site context.

The development site is located on High Holborn in Central London and within the London Borough of Camden.

Surrounding buildings typically comprise commercial retail units at ground floor level with offices above. The nearest noise sensitive receivers to the proposed plant have been identified as the mixed-use buildings at 33 and 37 – 39 High Holborn, directly to the east and west of the site respectively.

An environmental sound survey was undertaken a single rooftop position, set back from High Holborn with measurements captured in 15-minute samples between Thursday 25th and Tuesday 30th April 2024. Data from this location are considered representative of typical background sound levels experienced at the nearest noise sensitive receivers and to have been measured under free-field conditions.

The local sound environment was observed to be dominated by road traffic noise from High Holborn with underlying contributions from building services plant serving neighbouring buildings.

Figure 1 provides an illustration of the measurement location (blue) in relation to the site (pink), a summary of the relevant survey results and the location of the nearest noise-sensitive receivers (purple).

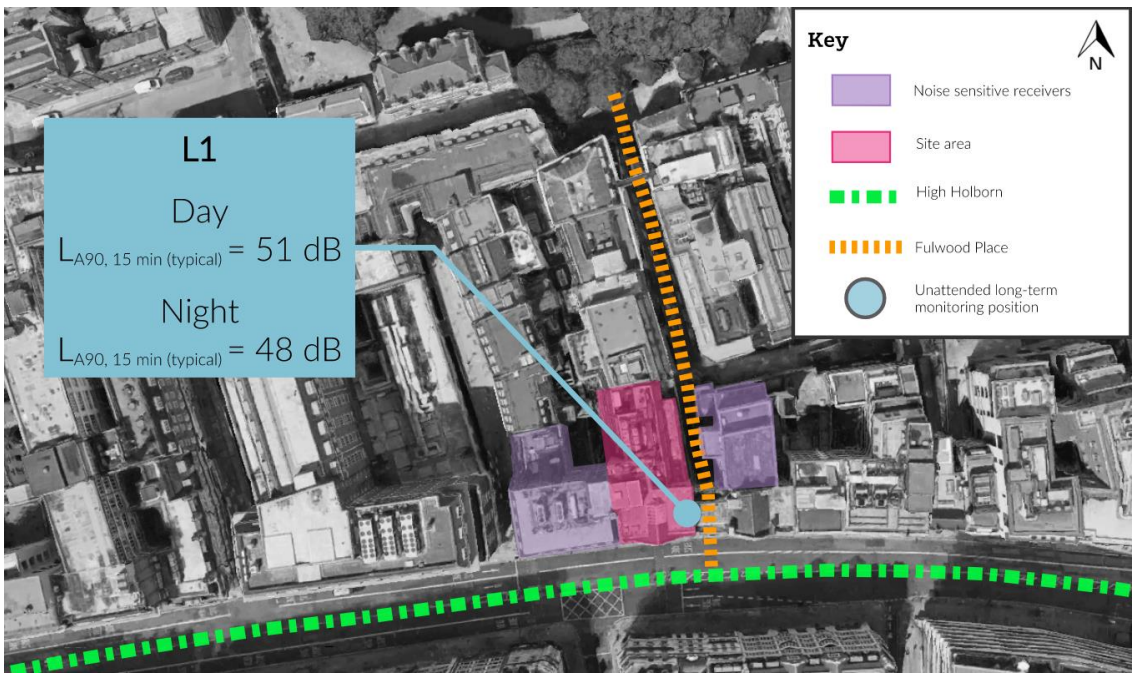


Figure 1 Site context (image from Google Earth).

3. Plant noise assessment.

3.1 Assessment criteria.

The London Borough of Camden have established a series of noise thresholds with which to assess external noise emissions from new building services plant. These are defined within Appendix 3 of the Local Plan and apply to the cumulative rating level, established in accordance with BS 4142: 2014, when assessed at the nearest noise sensitive façade and compared to prevailing background sound levels.

These thresholds are re-presented in Table 1 alongside project specific design limits derived from the survey data.

Table 1 Camden's noise thresholds

Category	Description	Threshold	Project specific limits.
Green	where noise is considered to be at an acceptable level.	Rating level 10 dB below background.	Day: ≤ 41 dB $L_{Ar,Tr}$ Night: ≤ 38 dB $L_{Ar,Tr}$
Amber	where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.	Rating level between 9 dB below and 5 dB above background.	Day: 42 – 56 dB $L_{Ar,Tr}$ Night: 39 – 53 dB $L_{Ar,Tr}$
Red	where noise is observed to have a significant adverse effect.	Rating level greater than 5 dB above background.	Day: ≥ 57 dB $L_{Ar,Tr}$ Night: ≥54 dB $L_{Ar,Tr}$

Separate to Camden's planning guidance, the assessment methodology of British Standard 4142: 2014 offers the following conclusions when the rating level is compared to background sound levels:

- A difference of around + 10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context;
- A difference of around + 5 dB is likely to be an indication of an adverse impact, depending upon the context; and
- When the rating level does not exceed background sound levels, this is indication of a low impact, depending upon the context.

While Camden's green category is considered the ideal target for plant noise, the limits are not always practical to achieve in densely populated areas. Designing to the amber thresholds is considered acceptable if steps to reduce noise as much as practicable have been taken.

Ensuring that plant noise does not normally exceed background sound levels would further reduce the risk of noise complaints as this would be a likely indication of a low impact when assessed in accordance with BS 4142.

3.2 Descriptions of plant proposals.

New items of external plant will consist of one Air Handling Unit (AHU) on Level 6 and nine VRF heat pumps on the roof level, as shown in Figure 2 and Figure 3. An existing VRF unit will also be relocated to the Level 05 rooftop.

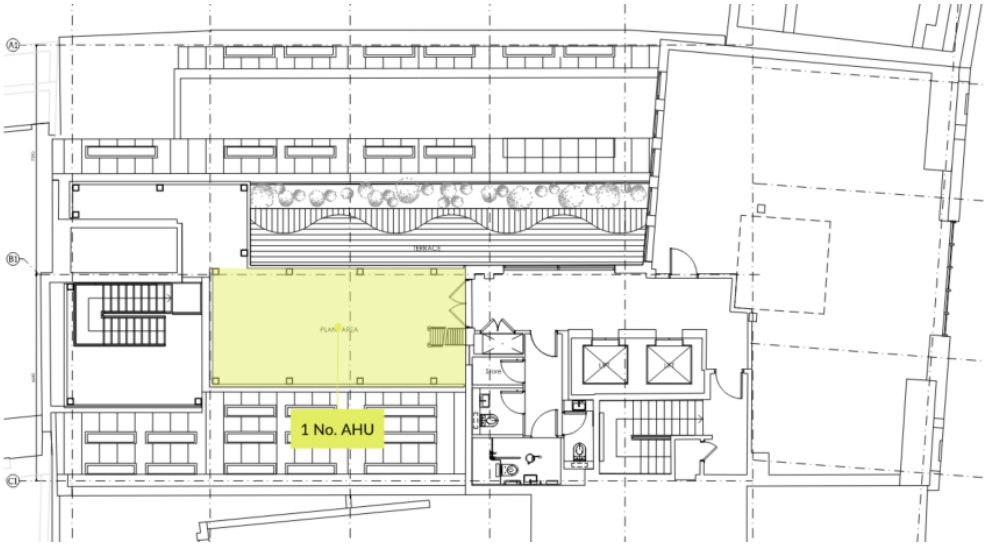


Figure 2 Proposed plant layout (level 06)

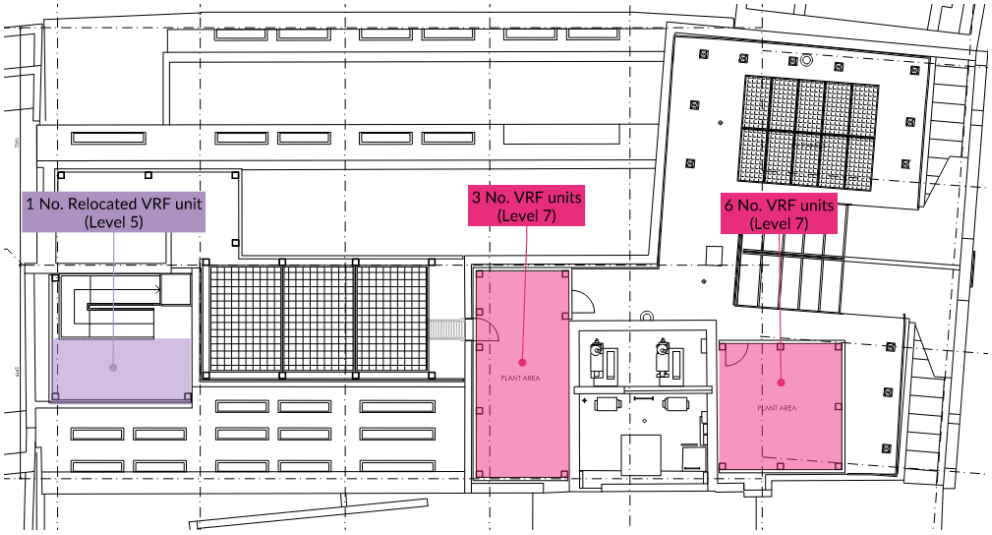


Figure 3 Proposed plant layout (roof level).

Equipment is only normally expected to operate when the building is occupied during the day. However, the VRF equipment does have the potential to briefly operate a defrost mode overnight if external temperatures drop below a set threshold (approximately -5° C).

For the purposes of this assessment, 50% of the VRF units have been assumed to be operational at any one point overnight to reflect this potential operating scenario. In practice, this will be limited to the coldest times of the year.

Noise level data for the proposed equipment has been taken from manufacturers' data for indicative selections and is summarised in Table 2.

Table 2 Plant noise data.

Equipment	No.	Sound pressure level at 1 metre (dB L_{pA})
Relocated VRF heat pump	1	57
AHU (casing breakout) *	1	55
VRF heat pump	1	64
	1	69
	1	64
	4	67
	2	59
Note(s): All values relate to a single unit operating at its design duty. *Sound pressure level calculated from a sound power level of 63 dB L_{wA} and assuming hemispherical propagation.		

Each plant area will be surrounded by acoustic screens or solid walls which will terminate at or above the installed height of the equipment, inclusive of anti-vibration mountings, to obstruct a direct line of sight.

Acoustic louvres achieving the sound reduction indices in Table 3 should be used in locations where airflow is required to enable the efficient operation of equipment.

Table 3 Minimum sound insulation performance recommended for acoustic louvres.

Sound reduction indices (R dB) at octave band centre frequency (Hz)								Example product
63	125	250	500	1000	2000	4000	8000	
6	6	9	13	21	20	16	13	Caice SS 300 acoustic louvre.

Allowance has also been made within the design for in-line attenuation to the AHU fresh air intake and exhaust to control fan external noise emissions to 65 dB L_{pA} at 1 metre.

3.3 Assessment.

Plant noise emissions have been predicted at the nearest noise-sensitive receivers based upon the proposals outlined in Section 3.2 and the calculation method set out in ISO 9613-2. The nearest noise-sensitive receivers are commercial buildings and are therefore only considered sensitive when they are occupied during the day.

A summary of the noise levels predicted at each receiver is presented in Table 4.

Table 4 Predicted plant noise at each receiver.

Time	Typical background sound level (dB L_{A90})	37 – 39 High Holborn	33 High Holborn	Comment	Camden noise threshold.
Day (07:00 – 23:00)	51	45	43	6 - 8 dB below	Amber

The noise output from the proposed equipment is generally expected to be broadband without any noticeable impulsive qualities nor obvious on/off conditions owing to “soft start” procedures. Furthermore, the local sound environment is already heavily influenced by plant noise and the proposed equipment is not expected to be readily identifiable against the background.

Consequently, no penalty corrections are considered necessary, and the sound levels above can also be taken as the rating levels.

With the predicted rating levels ranging between 6 to 8 dB below prevailing background sound levels at the nearest noise-sensitive receivers, the proposals fall within Camden’s Amber Noise threshold. In the context of BS 4142, this would be considered indicative of a low impact.

It can therefore be concluded that the proposals achieve strategic objectives of Camden’s Policy A4 which seeks to prevent “*development likely to generate unacceptable noise and vibration impacts”* and planning permission should not be refused on the grounds of noise.

Appendix A – Glossary of acoustic terms.

Sound
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Sound pressure
Sound Pressure is the force (N) of sound on a surface area (m^2) perpendicular to the direction of the sound. The SI-units for Sound Pressure are Nm^{-2} or Pa (Pascal).

Sound is measured with microphones responding proportionally to the sound pressure – p. The power is proportional to the square of the sound pressure.

Sound pressure level
The human ear has an approximately logarithmic response to sound pressure over a very large dynamic range. The lowest audible sound pressure approximately 2×10^{-5} Pa (2 ten billionths of an atmosphere, the threshold of audibility) and the highest is approximately 200 Pa (threshold of pain).

It is therefore convenient to express the sound pressure as a logarithmic decibel scale related to this lowest human audible sound, where:

$$L_p = 10 \log\left(\frac{p^2}{{p_{ref}}^2}\right) = 10 \log\left(\frac{p}{p_{ref}}\right)^2 = 20 \log\left(\frac{p}{p_{ref}}\right)$$

Where: L_p = sound pressure level (dB)

p = sound pressure (Pa)

p_{ref} = 2×10^{-5} – reference sound pressure (Pa)

In accordance with the logarithmic scale, doubling the sound pressure level gives an increase of 6 dB.

Decibel (dB)
The decibel is the unit used to quantify sound pressure levels as well as the sound intensity and power levels.

In accordance with the logarithmic scale, 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 Pa). Subjectively, this increase would correspond to a doubling of the perceived loudness of the sound.

Frequency
The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz) or cycles per second.

Octave and third-octave bands
An octave is an interval between two points where the frequency at the second point is twice the frequency of the first.

There are many methods of describing the frequency content of 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 and 315 Hz for the same 250 Hz octave band.

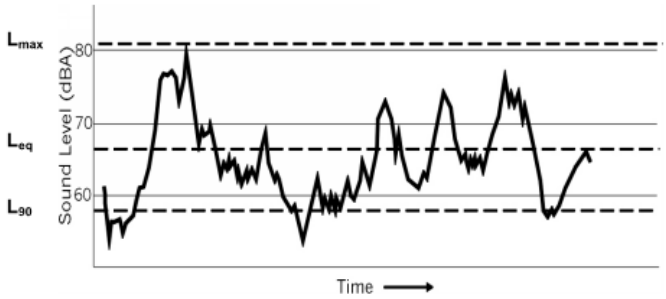
A-Weighting
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting. This is a correction term applied to the frequency 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 dBA or including A within the parameter term.

Noise units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as five minutes, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation, the same period of noise can be described by several different levels. The most common of these are described below.



$L_{eq,T}$

The $L_{eq,T}$ 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 thought of as 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 dBA and is commonly used to describe all types of environmental noise sources.

$L_{90,T}$

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 parameter and is generally used to describe the prevailing background sound level.

$L_{max,T}$

The $L_{max,T}$ is a parameter defined as the maximum noise level measured during the specified period 'T'.

Specific Noise Level, $L_{Aeq,Tr}$

This is the equivalent continuous A-weighted sound pressure level at the assessment position due to a specific noise source operating over a given time interval.

Free Field

A measurement taken in the free field is at least 3 m from reflecting vertical surfaces and 1.2 m from the ground.

Appendix B – Environmental sound survey details.

Methodology.

Measurements were undertaken in accordance with BS 7445:2003 *Description and measurement of environmental noise*. The weather conditions during the survey were appropriate for environmental sound measurements, with sunny and generally calm conditions.

Measurement equipment details.

All measurement equipment was calibrated before and after the survey. No significant drift was observed. Details of the equipment used for the survey has been provided in Table 5.

Table 5 Details of equipment used for the environmental sound survey.

Location	Instrumentation description	Manufacturer	Model	Serial number	Date of calibration	Calibration certificate number
L1	Sound Level Meter	Rion	NL - 32	01161938	27/09/2022	UCRT22/2153
	Microphone	Rion	UC-53A	311043	27/09/2022	UCRT22/2153
	Pre-amp	Rion	NH-21	21976	27/09/2022	UCRT22/2153
	Acoustic Calibrator	Rion	NC - 74	34172704	04/08/2023	UCRT23/2030

Results.

Time histories of the L_{Aeq} and L_{A90} recorded throughout the survey period are shown in Figure 6.

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

The typical background sound levels are taken as the level exceeded for 90% of the time.

Figure 4 Statistical analysis of background sound pressure levels at L1 - daytime.

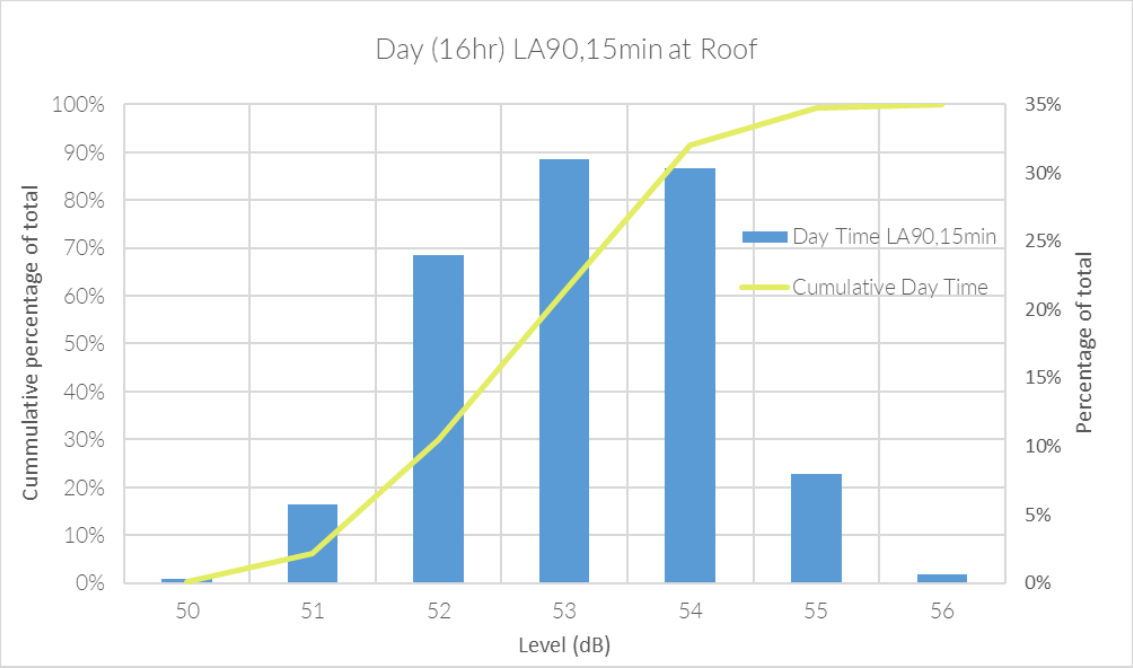
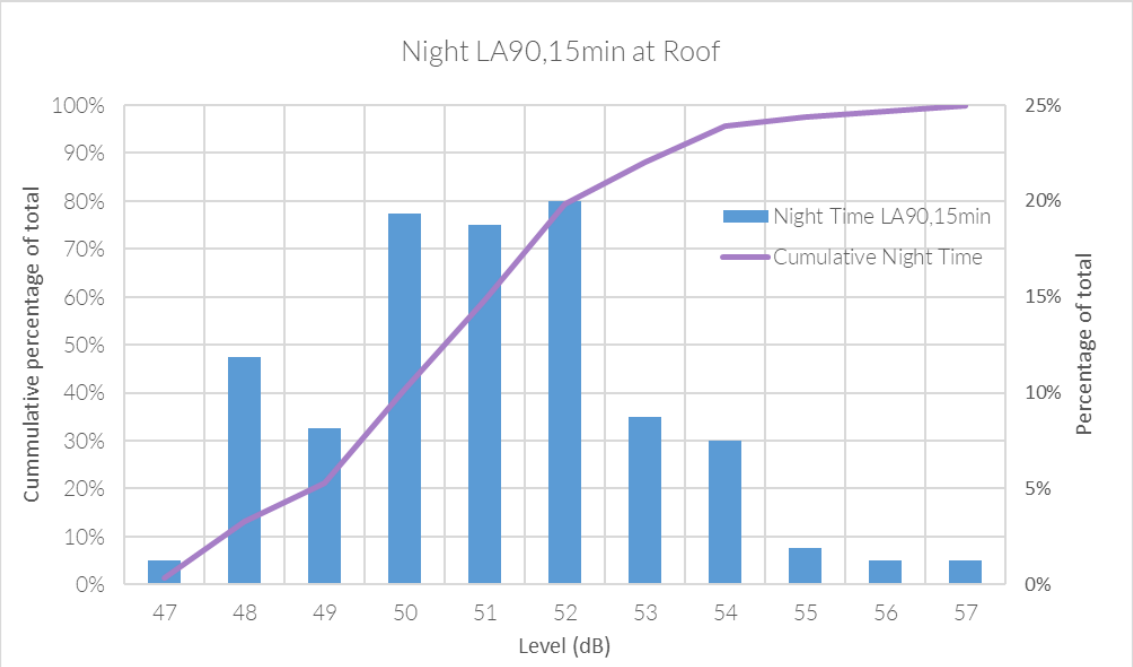


Figure 5 Statistical analysis of background sound pressure levels at L1 - night-time.



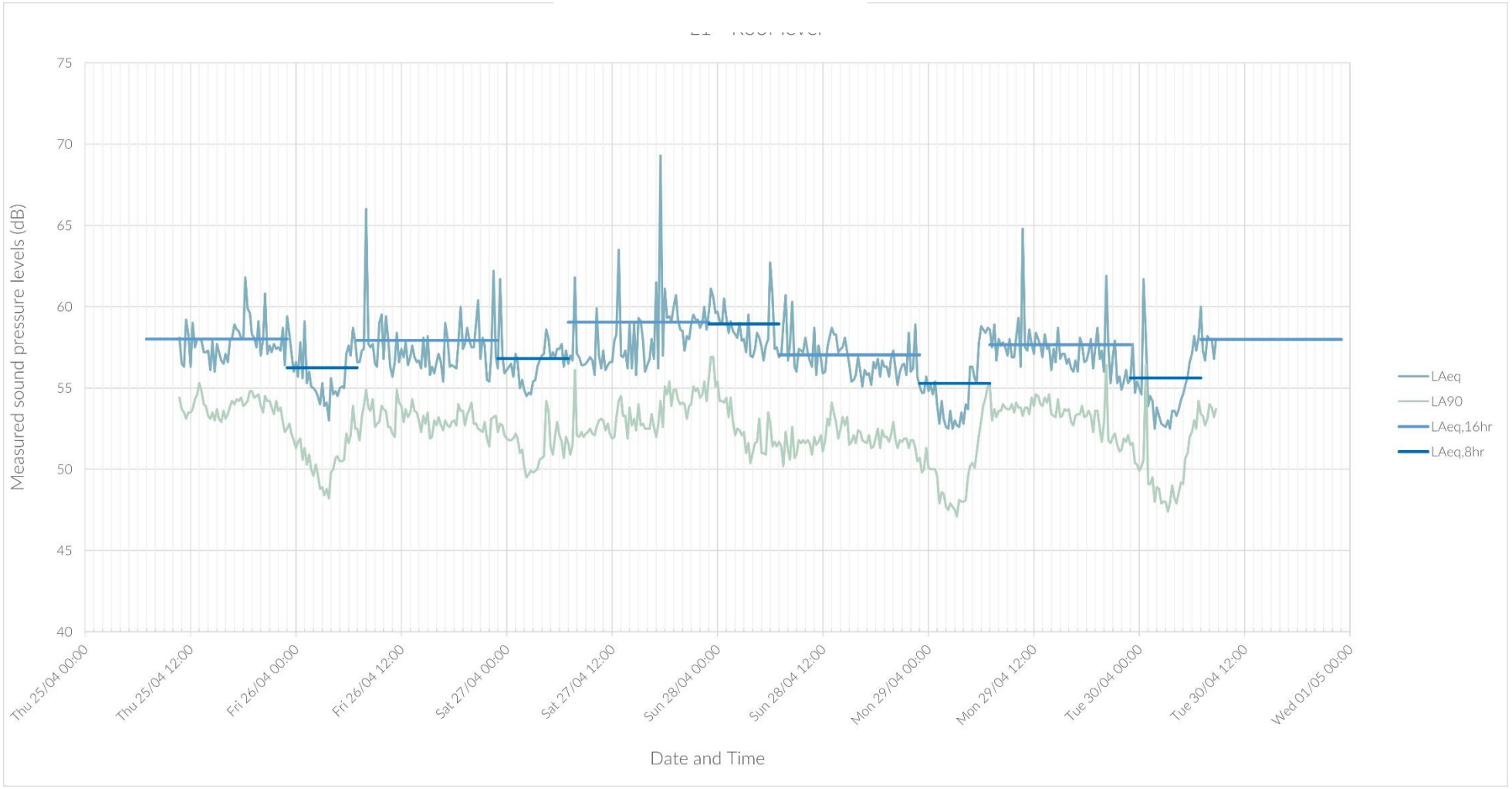


Figure 6 Time-history of long-term measurement results taken at L1.

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