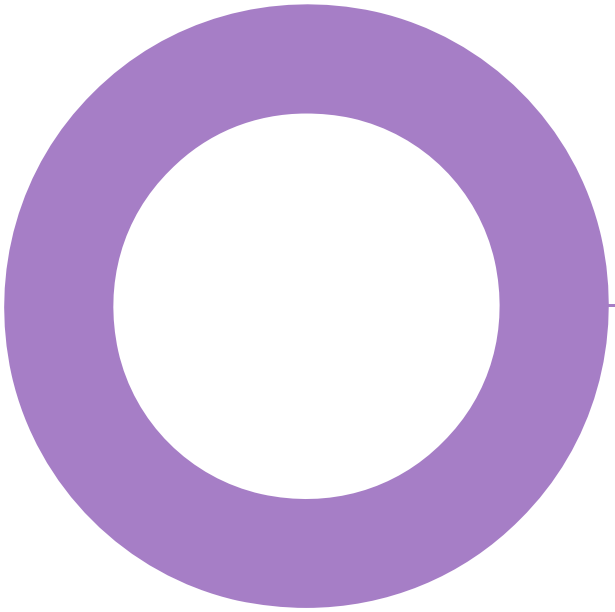
HOARE LEA

254 Blackfen Road. Sidcup.

ACOUSTICS
NOISE IMPACT ASSESSMENT – RESIDENTIAL CONVERSION, GROUND FLOOR FLATS

REVISION 02 – 03 OCTOBER 2023



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	21/09/2023	First issue			
01	22/09/2023	Incorporation of client comments			
02	03/10/2023	Incorporation of client comments			

This document has been prepared for apavi only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

Project number: 10/14974
Document reference: REP-1014974-5B-CS-20230922-Noise impact assessment - Ground floor-Rev2.docx

Contents.

Executive summary.

This report pertains to the proposals for 4no. flats on the ground floor of the existing commercial retail unit; 3no. studio flats and 1no. 2-bed flat.

An environmental sound survey has been carried out to determine the noise levels to be used for the noise impact assessment.

Suitable internal noise levels that fall below BS 8233:2014/ProPG thresholds can be achieved with double-glazing and trickle vents.

Partially open bedroom windows are considered to be feasible as a method for the relief of overheating at night.

The concrete party floor between the existing daytime commercial use and the proposed residential spaces is capable of achieving the required airborne sound insulation standards set out in E1 of the Building Regulations 2010 Part E Schedule 1.

1. Introduction.

This report pertains to the proposals for 4no. flats on the ground floor of the existing commercial retail unit; 3no. studio flats, and 1no. 2-bed flat.

Results of an environmental sound survey have been used to derive minimum acoustic performances for enhanced façade constructions, and to comment on the suitability of natural ventilation and overheating strategies with regards to internal noise levels. Advice is also provided regarding internal sound insulation performances.

A glossary of technical terms used within this report is provided in Appendix A.

2. Site description and environmental noise survey.

The area of the site is characterised by predominantly residential, along with commercial, properties.

An environmental sound survey was undertaken from Wednesday 30th August – Monday 11th September 2023. This comprised long-term sound level monitoring at two external locations at first floor level. The measurements overlooking Wellington Avenue to the east (position 1) are considered façade levels, while measurements at position 2 are free-field levels. Measurements were taken in 100ms contiguous samples.

A summary of the measurement positions in relation to site is given in Figure 1. All levels are presented as free-field levels i.e., a -3 dB correction has been applied to results at position 1. Note that the typical maximum has been defined as the level that is exceeded, on average, more than 10 times per night.

The noise survey includes all sources of environmental noise, including road traffic and any noise from nearby commercial activity. The noise environment is dominated by road traffic noise.

Selected data has been omitted from the results due to unrepresentative events which were documented by the existing occupants. These included periods of operation of the building services plant near position 2 (which have since been removed), as well as periods where shipping containers were being removed from the courtyard area in the middle of site.

Further details of the survey results, as well as details of all equipment used can be found in Appendix B.

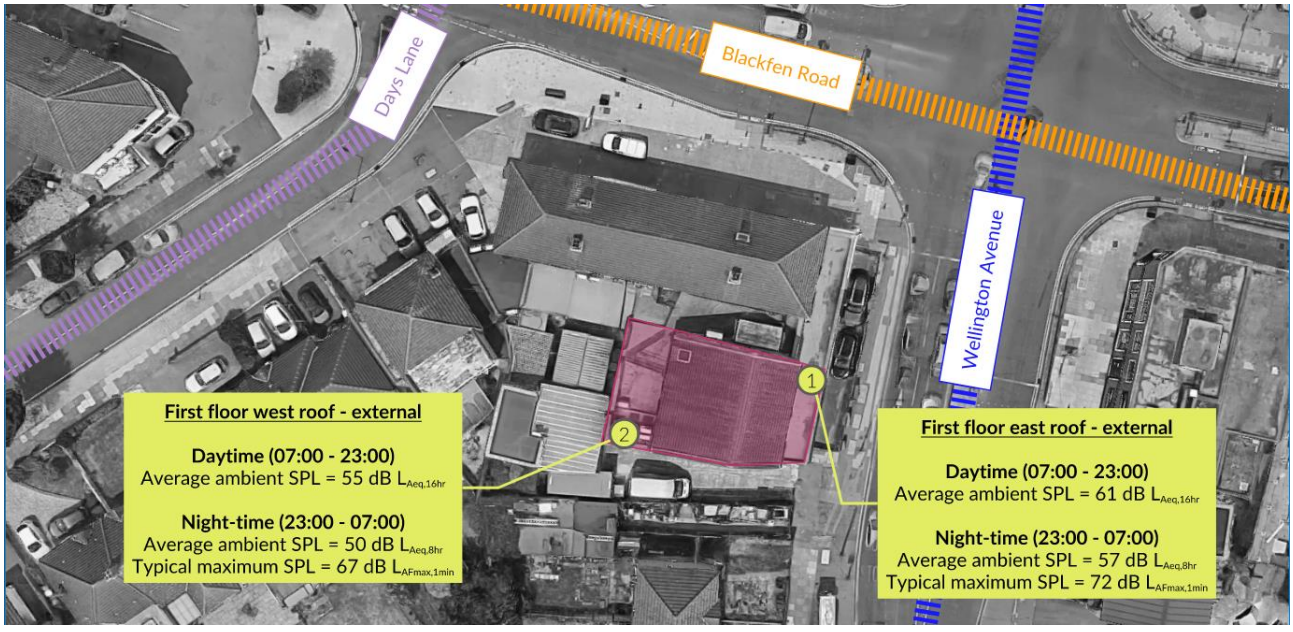


Figure 1 Summary of environmental sound survey (image from Google Maps) – all levels are presented as free-field.

3. Basis of assessment.

Appropriate, well-established guidance on the assessment of noise and acoustic design relevant to the development is available from several references including, but not limited to, the following:

- London Borough of Bexley (LBB) Planning Requirements (October 2015),
- National Planning Policy Framework (NPPF, 2021),
- Building Regulations: Approved Document E (ADE, 2010),
- Building Regulations: Approved Document F (ADF, 2010),
- Building Regulations: Approved Document O (ADO, 2021),
- Acoustics Ventilation and Overheating (AVO) Residential Design Guide (January 2020),
- ProPG: Planning & Noise – New Residential Development (May 2017),
- British Standard 8233: 2014 *"Guidance on sound insulation and noise reduction for buildings"*.

3.1 Internal noise level criteria.

3.1.1 BS 8233/ProPG.

BS 8233:2014/ProPG provide guidance on suitable internal noise levels for residential uses from external noise ingress with windows closed. These are summarised in Table 1.

Table 1 Internal sound level limits for external noise ingress.

Space	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Dining rooms	40 dB $L_{Aeq,16hr}$	N/A
Living rooms	35 dB $L_{Aeq,16hr}$	N/A
Bedrooms	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB L_{AFmax}*

*This should be exceeded no more than 10 times per night.

3.1.2 Building Regulations: Approved Document O.

ADO provides relaxed criteria for internal noise levels in spaces which are subject to overheating:

"Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. *40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).*

b. *55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am)."*

4. Control of external noise ingress.

Sound from external sources in the local environment will need to be controlled to suitable internal levels within the proposed development. The sound reduction performances of the building envelope depend on the external noise levels incident upon the façades and the internal sound criteria.

4.1 Façade assessment.

There are 3no. flats with a studio layout. As such, these are each considered one continuous space and the more onerous bedroom criteria has been applied throughout. The remaining 2-bed flat has separate bedrooms and living rooms and so these rooms have been considered separately.

It is understood that the solid masonry walls, comprising 9-inch brick, are to be retained and that there is scope to replace the existing glazed façade elements, and introduce new windows.

It is understood that the flats are to be naturally ventilated and the assessment has been undertaken assuming the installation of trickle vents. The ventilation strategy would need to be determined by others in accordance with the requirements of Approved Document F.

There is 1no. window per room, and it has been assumed that there are 2no. trickle vents per window. Each trickle vent is assumed to have an equivalent area of 4000 mm^2. This will need to be reviewed by others as part of the ventilation strategy.

The minimum recommended sound insulation performances for closed windows and open vents to achieve the internal levels given by BS 8233:2104/ProPG are summarised in Table 2. The measurement results from position 1 have been used in the assessment of the studio flat nearest Wellington Avenue (flat 1). Position 2 results have been used in the assessment of the flats furthest from the road (flats 2, 3 & 4). These levels include contributions from all environmental noise sources, including road traffic and nearby commercial noise sources.

The performances apply to the entire window system including the glazing, frames, and seals.

Table 2 Minimum window sound reduction performances for the scheme.

Space	Window system sound insulation	Ventilator sound insulation
Studio flat 1	$R_w + C_{tr}$ 29 dB	$D_{ne,w}$ 38 dB
Studio flat 2	$R_w + C_{tr}$ 25 dB	$D_{ne,w}$ 30 dB
Studio flat 3	$R_w + C_{tr}$ 25 dB	$D_{ne,w}$ 30 dB
Flat 4 bedroom	$R_w + C_{tr}$ 29 dB	$D_{ne,w}$ 34 dB
Flat 4 living room	$R_w + C_{tr}$ 29 dB	$D_{ne,w}$ 30 dB

The above glazing performances can be indicatively achieved with 4 mm glazing, 12 mm cavity, 6 mm glazing. The ventilator performances can be achieved acoustically rated trickle vents.

4.2 Overheating.

For windows that do not have direct line-of-sight with Wellington Avenue, the measured external noise levels (which include all environmental noise sources, including road traffic and nearby commercial noise sources) are such that use of partially open bedroom windows is considered to be feasible as a method for the relief of overheating at night, considering guidance as given in the AVO Guide, subject to design development.

Requirements with respect to overheating in accordance with Approved Document O not related to noise will need to be determined by others.

5. Internal sound insulation.

The following section provides a high-level qualitative assessment of these existing constructions with respect to the airborne and impact sound insulation performance required by Approved Document E (ADE).

Hoare Lea carried out a visual inspection of the existing building to determine the base build-up of the separating walls and floors that will form the dwellings formed by material change of use on 11th September 2023.

5.1 Building regulations criteria.

It is a statutory requirement that internal building elements be designed in full compliance with requirements E1 of the Building Regulations 2010 Part E Schedule 1, as a minimum. The normal way to satisfy these requirements is to achieve the performance standards given in Approved Document E (ADE).

The residential apartments at the development will be classed as "dwelling-houses and flats formed by material change of use" under ADE.

Under requirement E1, the required sound insulation values between apartments as well as between apartments and other areas of the building would be satisfied by achieving the minimum performance standards set out in Table 3 below.

Table 3 Minimum ADE sound insulation performance standards - Dwelling-houses and flats formed by material change of use flats

Purpose built dwelling-houses and flats	Airborne sound insulation dB $D_{nT,w} + C_{tr}$	Impact sound insulation dB $L'_{nT,w}$
Party Walls	≥ 43	-
Party Floors & stairs	≥ 43	≤ 64

ADE states that a higher standard of sound insulation may be required between spaces used for normal domestic purposes and non-domestic purposes and that in these situations the appropriate level of sound insulation will depend on the noise generated in the non-domestic space.

5.2 Separating wall.

A separating wall between the apartments and the ground floor commercial units providing a sound insulation performance in the region of $D_{nT,w} + C_{tr}$ 50 – 55 dB would provide sufficient airborne sound insulation performance for a similar daytime use of the current ground floor commercial space.

5.3 Existing floors.

The existing floor between the ground floor and first floor of the building will form the party floor between the proposed ground floor residential apartments and the existing commercial space at first floor level.

The existing floor is understood to be a solid concrete plank construction, varying in depth between approximately 250 mm and 400 mm.

This construction should be capable of achieving the required airborne sound insulation standards set out in Section 5.1. This level of airborne sound insulation performance should be suitable for the current daytime use of the adjacent commercial space. A suitably rated resilient layer will need to be incorporated in the separating floor build up to provide sufficient impact sound insulation performance for the current daytime use of the adjacent commercial space.

5.4 Existing flanking walls.

The existing external walls are understood to be formed of solid brick construction (~220 mm thick). The existing external walls should be capable of adequately controlling flanking noise across party walls (where party walls abut the façade) and floors subject to careful detailing and good workmanship.

Appendix A – Glossary of acoustic terminology.

Sound.

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

The Sound Pressure.

The 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 the 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.

The 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 x 10^{-5}Pa (2 ten billionths of an atmosphere) and the highest is approximately 100Pa.

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 x 10-5 – reference sound pressure (Pa)*

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

Decibel (dB).

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

In accordance with the logarithmic scale, an increase of 10dB 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 the 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 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 250Hz and 500Hz.

Third octave bands provided a fine resolution by dividing each octave band into three bands. For examples, third octave bands would be 160Hz, 250Hz and 315Hz for the same 250Hz octave band.

A-Weighting.

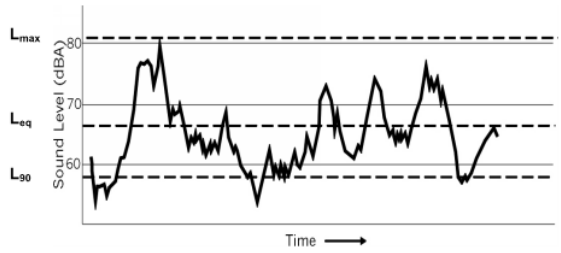
The A-weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

An A weighted value would be written as dB(A) 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 dB(A) 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 noise level.

$L_{max,T}$

The $L_{max,T}$ is a parameter defined as the maximum noise level measured during the specified period 'T'. Fast and slow time constant are usually employed for airborne and structure-borne noise, respectively.

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 3.5m from reflecting vertical surfaces and 1.2m from the ground.

Façade

A measurement is influenced by the reflection of sound from the façade of a building within 3.5m. A façade measurement is made 1m in front of the vertical building surface.

R_w

A single-number quantity which characterizes the airborne sound insulation of a material or building element in the laboratory. See BS EN ISO 717-1: 1997.

Appendix B – Environmental sound survey details.

Methodology.

All measurements were undertaken in accordance with BS 7445-1: 2003 *Description and measurement of environmental noise. Guide to quantities and procedures.*

Sound level data from the east façade on the 1st floor roof is considered to have been measured under façade reflected conditions and can be adjusted to free-field conditions by applying a -3dB correction.

Equipment details.

Table 4 details the equipment used during the long term and short-term measurements. All equipment were used within their respective dates of calibration and calibration certificates are available upon request. All sound level meters and microphones were calibrated before and after the measurements and no significant calibration drift was observed.

Table 4: Measurement equipment details.

Position	Manufacturer	Description	Model	Serial no.	Calibration date / Certificate reference
1 & 2	Rion	Sound Level Meter	NL-52	00710469	14/01/2022 CONF012204
		Microphone	UC-59	19733	
		Pre-amp	NH-25	11012	
		Acoustic calibrator	NC-74	34172704	04/08/2023 UCRT23/2030

Long-term measurements results.

Measurements were undertaken at position 1 from 30th August – 5th September 2023, while measurements at position 2 were undertaken from 5th – 11th September 2023. Measurements undertaken at position 1 were deemed façade measurements and have been corrected to free-field levels (-3 dB) for use in this report.

Periods of unrepresentative noise levels have been identified and omitted from the data. These periods and the reasons for omission are given in Table 5.

Table 5 Periods of data omission.

Position	Date	Time	Reason
1	Saturday 02/09/2023	18:45 – 19:00	Anomalous maximum level (106 dBA)
	Tuesday 05/09/2023	09:15 – 10:00	Shipping containers being collected from courtyard
2	Wednesday 06/09/2023	09:45 – 10:30	
		11:30 – 12:30	
	Thursday 07/09/2023	09:45 – 10:00	
		14:15 – 15:15	Building services plant operational
	Friday 08/09/2023	13:45 – 15:00	
		15:45 – 16:45	
	Saturday 09/09/2023	09:45 – 17:00	

Table 6 Summary of ambient sound pressure levels at position 1 – corrected by -3 dB to free-field levels.

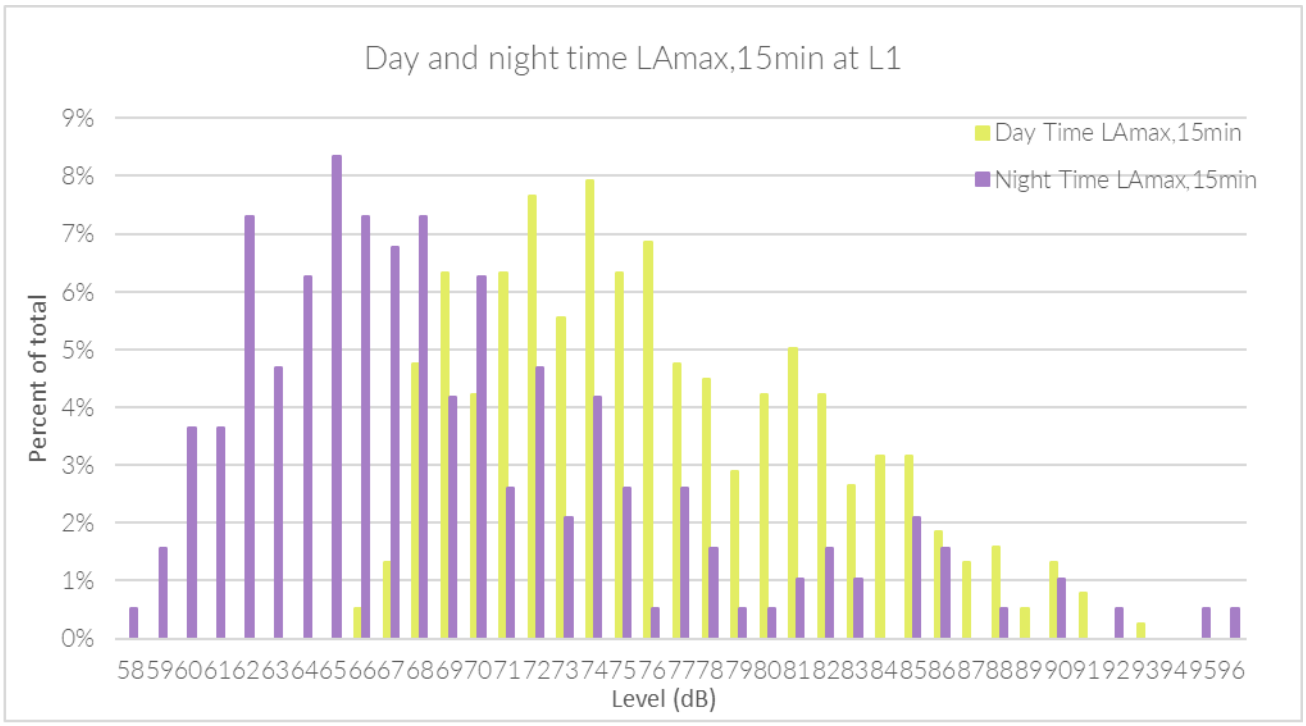
Date	Ambient sound pressure levels, dB	
	Daytime (07:00 – 23:00) $L_{Aeq,16hr}$	Night-time (23:00 – 07:00) $L_{Aeq,8hr}$
Wednesday 30/08/2023	59*	54
Thursday 31/08/2023	60	55
Friday 01/09/2023	61	55
Saturday 02/09/2023	61	57
Sunday 03/09/2023	60	57
Monday 04/09/2023	60	55
Tuesday 05/09/2023	60*	-

*Incomplete measurement period.

Table 7 Summary of ambient sound pressure levels at position 2 – presented as free-field levels.

Date	Ambient sound pressure levels, dB	
	Daytime (07:00 – 23:00) $L_{Aeq,16hr}$	Night-time (23:00 – 07:00) $L_{Aeq,8hr}$
Tuesday 05/09/2023	54*	49
Wednesday 06/09/2023	55	50
Thursday 07/09/2023	57	49
Friday 08/09/2023	54	50
Saturday 09/09/2023	54	49
Sunday 10/09/2023	54	48
Monday 11/09/2023	56*	-

*Incomplete measurement period.



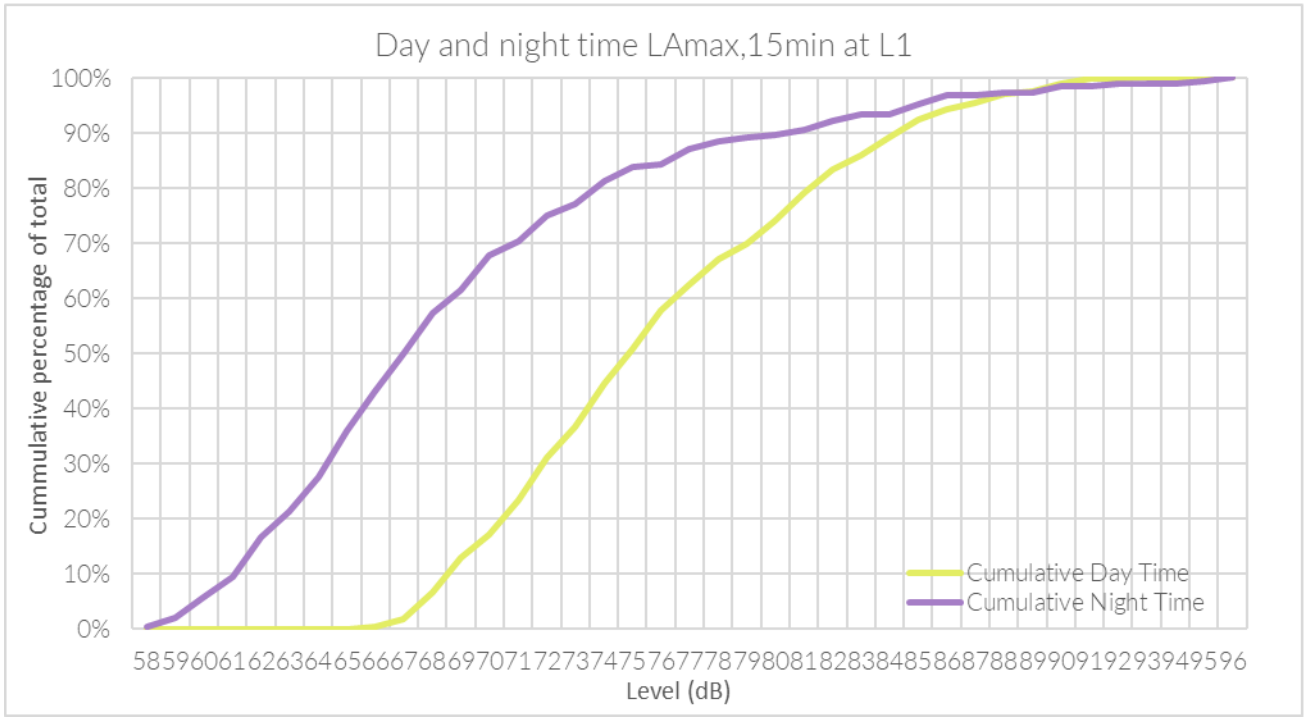
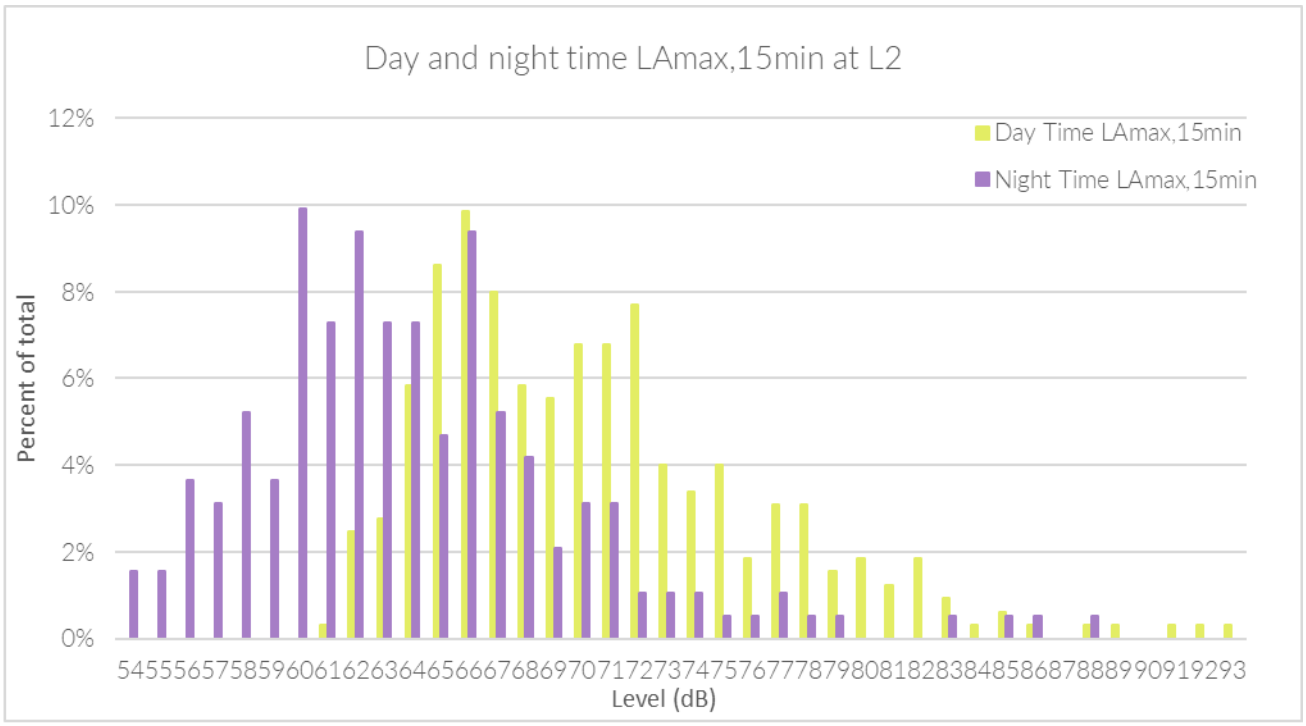


Figure 2 Statistical analysis of maximum sound pressure levels at position 1 (corrected by -3 dB to free-field levels).



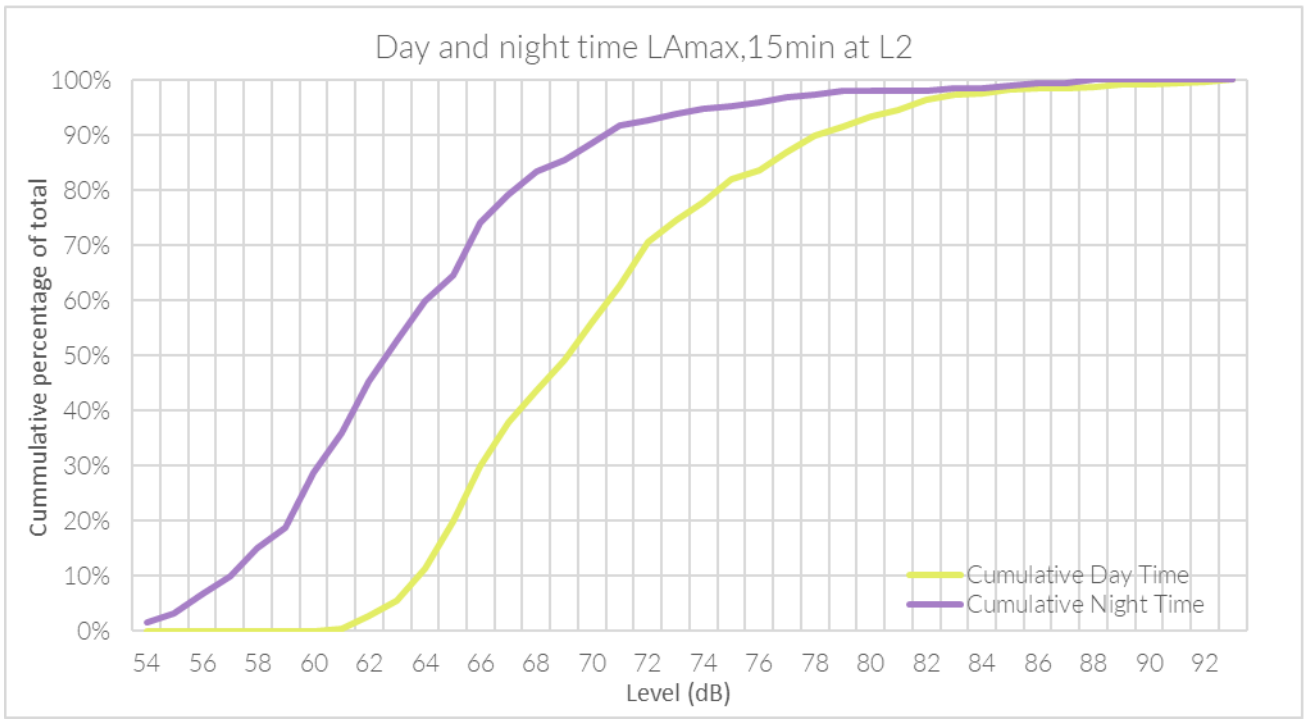


Figure 3 Statistical analysis of maximum sound pressure levels at position 2.

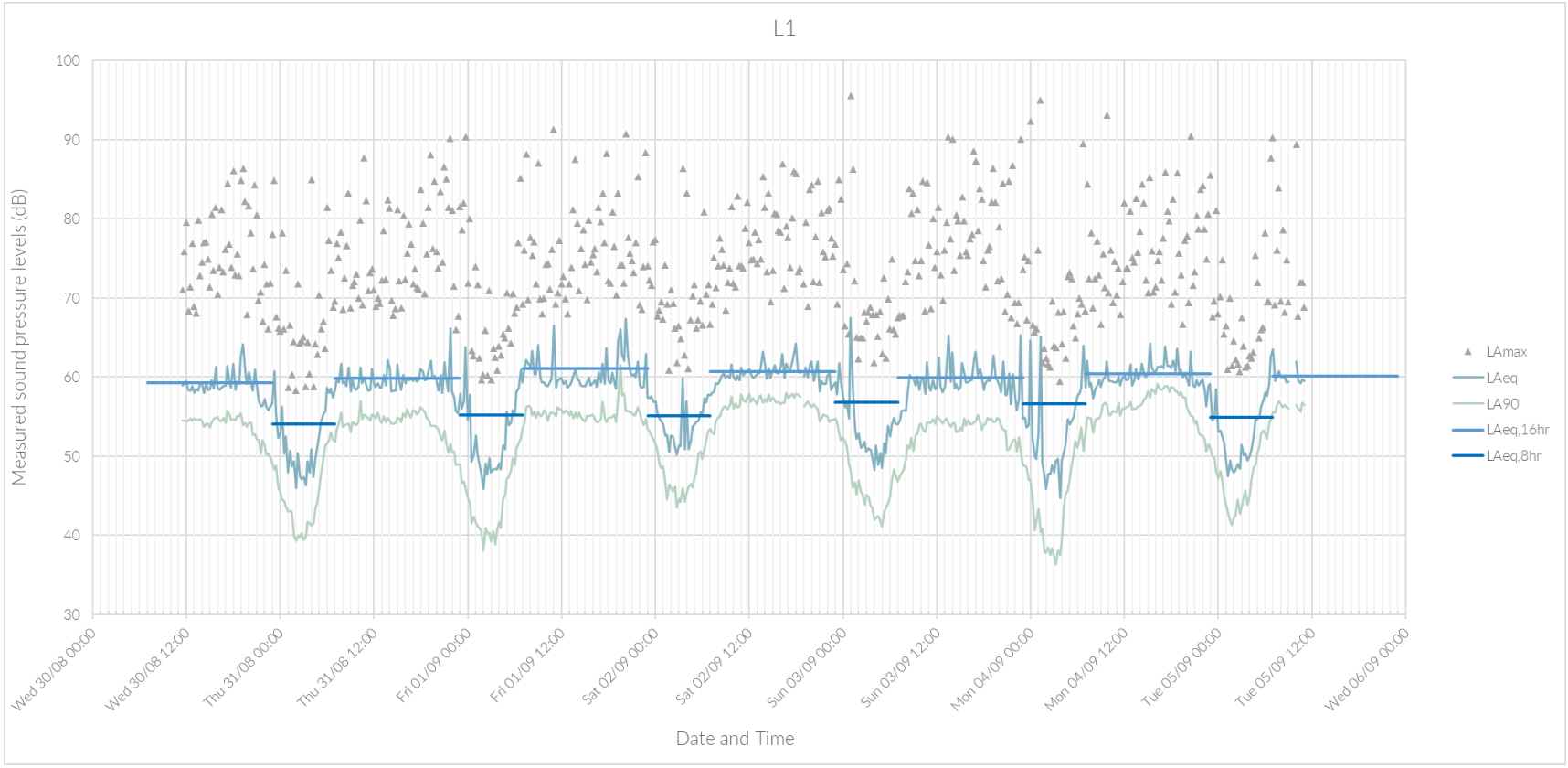


Figure 4: Time history at position 1 – east façade (corrected by -3 dB to free-field levels).

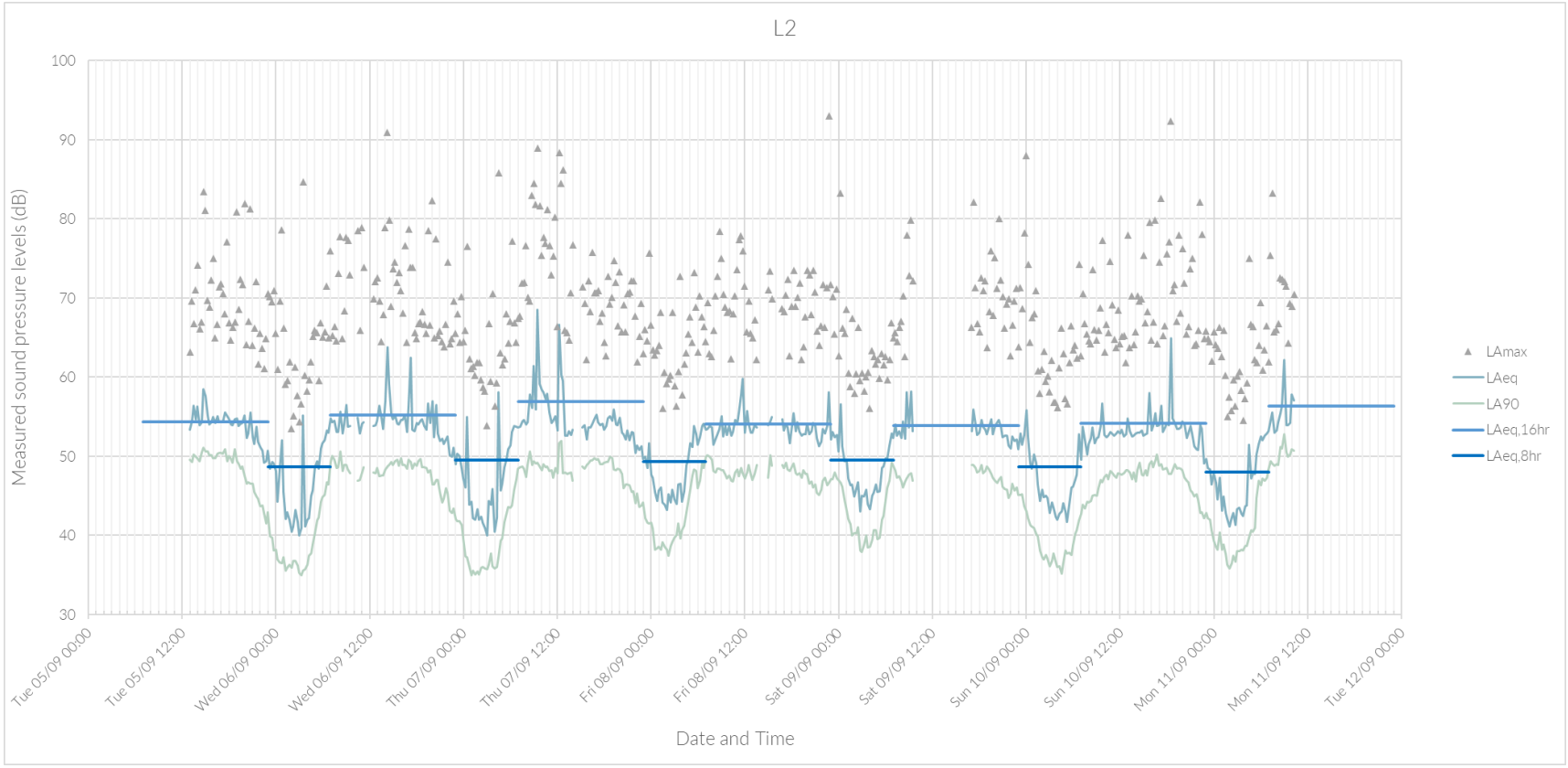


Figure 5: Time history at position 2 – west façade (free-field).

HOARE LEA

HOARELEA.COM

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