



FORMER JOHN LEWIS DEPOT, LETCOMBE STREET, READING
(ALSO KNOWN AS JLP MILL LANE)

NOISE IMPACT ASSESSMENT

AUGUST 2024

Audit sheet.

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Contents.

Audit sheet.	2
Contents.	3
Executive summary	4
1. Introduction.	5
2. Basis of assessment.	5
3. Site description.	7
4. Environmental sound survey.	8
5. Plant noise assessment.	10
6. Control of external noise.	14
7. Conclusion	15
Appendix A – Glossary of acoustic terms.	16
Appendix B – Environmental sound survey details.	18

Executive summary

There are proposals to demolish the former John Lewis Depot at Letcombe Street, Reading, RG1 2HN, also known as Mill Lane. The warehouse has become surplus to requirements, and there are proposals to replace this with a new residential building with amenity spaces on the ground floor.

A noise impact assessment has been carried out to accompany the planning application for the development advising of provisions to enable compliance with the local authority requirements and to demonstrate that appropriate acoustic conditions can be provided for the residents of the new development.

An environmental sound survey has been undertaken to establish the prevailing background sound levels experienced around the site and at the nearest noise sensitive receptors. Results from the survey have been used to set noise limits to be achieved by the proposed building services plant installed and to establish the sound insulation performance requirement for the building façade.

An initial plant noise limit assessment concludes that with the incorporation of appropriate noise control measures, such as acoustic enclosures, appropriate plant noise limits in line with Reading Borough Council policy and BS 4142 can be achieved.

An initial façade assessment demonstrated that suitable internal sound levels can be achieved with commercially available acoustically rated double-glazed systems coupled with a relatively conventional external wall build-up.

The strategies for ventilation and control of overheating have been developed mindful of external noise levels, which are too high to enable a simple strategy based on opening windows. The current proposals include a mechanical ventilation and heat recovery (MVHR) unit with an integrated cooling coil to provide both ventilation and heat relief, therefore avoiding the need to rely on opening windows for thermal comfort. Windows will be physically capable of being opened to enable user-choice for future residents.

On the basis of this assessment, noise can be controlled to appropriate limits which have been defined in line with Reading Borough Council Policy EN17 and BS 4142, through the use of relatively conventional mitigation measures. As such, noise should not pose an obstacle in granting planning permission for the scheme.

1. Introduction.

There are proposals to demolish the former John Lewis Depot at Letcombe Street, Reading, RG1 2HN, also known as Mill Lane. The warehouse has become surplus to requirements, and there are proposals to replace this with a new residential building with amenity spaces on the ground floor.

This noise impact assessment accompanies a planning application for:

“Demolition of the existing building and redevelopment of the site comprising erection of a new building for up to 215 build to rent residential dwellings (Use Class C3) together with flexible commercial/community space (Use Class E/F1/F2), residents’ facilities, landscaping, public realm, amenity space, cycle parking and disabled car parking”

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. Early assessments of the façade sound insulation requirements and impact of noise on relief of overheating on the proposed development have also been carried out.

This report summarises the survey and provides details of the above assessments in support of the planning application for the development. A glossary of acoustic terms used in this report is provided in Appendix A.

2. Basis of assessment.

The assessment has been carried out in accordance with the following policy and guidance:

- National Planning Policy Framework (NPPF), 2023
- Reading Borough Council Local planning policies, including the November 2019 Local Plan
- ProPG: Planning & Noise Professional Practice and Guidance on Planning and Noise (ProPG)
- British Standard 4142:2014 Methods for rating and assessing industrial and commercial sound (BS4142)
- British Standard 8233:2014 Guidance of sound insulation and noise reduction for buildings (BS8233)
- Approved Document O Overheating (ADO)
- Association of Noise Consultants “Acoustics Ventilation and Overheating residential design guide” (AVOG)

2.1 British Standard 4142:2014 + A1: 2019.

British Standard (BS) 4142 provides an objective method for rating the likelihood of complaint from industrial and commercial operations. It is commonly used to assess the noise impact of fixed plant installations.

The assessment is based on the subtraction of the measured background noise level from the rating level of the noise source. The rating level is the source noise level (either measured or predicted) corrected for tone or character (if necessary). The difference is compared to the following criteria to evaluate the impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact.
- A difference of around +5 dB indicates is likely to be an indication of an adverse impact.
- Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact.

2.2 British Standard 8233:2014

British Standard (BS) 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’ is the current British Standard providing guidance for acoustic requirements within buildings. The standard advises appropriate criteria and limits for different building types including dwellings as in Table 1.

Table 1: BS 8233:2014 internal design criteria for dwellings.

Activity	Location	Day (07:00 to 23:00)	Night (23:00 to 07:00)
Resting	Living rooms	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room / Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS 8233 Section 7.7.2 Note 7 advises that 'reasonable' living conditions can be achieved for levels up to 5dB greater than those given in Table 1 above.

In addition to the above, the guidance in ProPG recommends that internal noise levels from individual events should not normally exceed L_{AFmax} 45 dB within bedrooms more than 10 times a night. This aligns with World Health Organization guidelines.

For gardens and terraces, BS 8233 states that it is desirable that the steady noise level does not exceed 50 dB $L_{Aeq,T}$ whilst a level of 55dB $L_{Aeq,T}$ would be acceptable in noisier environments. The standard notes that, in certain situations where development might be desirable, higher noise levels may be acceptable and the development should seek to minimise sound levels as far as practicable but should not be prohibited.

2.3 Overheating guidance.

Part O of the Building Regulations requires that noise must be assessed in relation to risk of overheating in homes, with criteria given in Approved Document O (ADO).

ADO requires that noise inside bedrooms at night must not exceed 40 dB L_{Aeq} , or 55 dB L_{Amax} (more than 10 times per night) with windows open. These values represent a 10 dB relaxation on recommended levels within BS 8233.

However, ADO does not provide any criteria during the daytime. The Acoustics Ventilation and Overheating Residential Design Guide (AVOG) provides further guidance on the acceptability of internal noise levels when windows are open for overheating purposes during the day.

Guidance has been provided for instances of outcomes corresponding to the ranges of internal ambient noise levels in terms of $L_{Aeq,T}$ during the daytime (07:00 – 23:00).

- For $L_{Aeq,T} \leq 35$ dB it is expected that noise can be heard, but does not cause any change in the behaviour
- For $35 < L_{Aeq,T} \leq 50$ dB, there is a range of outcomes, with limited behavioural change at lower noise levels and significant impact at higher levels. However, the precise impact at various levels is not clearly defined.
- For $L_{Aeq,T} > 50$ dB it is expected that noise will cause a material change in behaviour e.g., having to close windows most of the time *because of noise*.

2.4 Local planning policy.

2.4.1 Reading Borough Council Local Plan, November 2019.

The Reading Borough Council Local Plan, adopted in November 2019, sets out policies and proposals for future development and spatial planning requirements in Reading up to 2036.

2.4.1.1 Policy EN17: Noise generating equipment.

Policy EN17 states the following:

"Where noise generating equipment is proposed, the noise source specific level (plant noise level) should be at least 10 dBA below the existing background level as measured at the nearest noise sensitive receptor."

3. Site description.

The site location in the context of its surroundings is shown in Figure 1. It is located within the Abbey Ward in Reading, highlighted in pink. The site is bound by Mill Lane and the A329 to the north, Crossland Road to the south and east, and Letcombe Street to the west.

The surrounding buildings of the site are typically residential or hotel use. These comprise a mix of existing receptors (Premier Inn Reading Central, Hello Student Accommodation, and residential properties at Townsend House and along Deansgate Road), and future receptors (highlighted in yellow in Figure 1).



Figure 1 Site context.

© Google Maps.

4. Environmental sound survey.

An environmental sound survey was undertaken between 12th and 20th December 2023 to establish prevailing sound levels at the site to inform the design and subsequent noise impact assessments. A summary overview of the measurement positions and the pertinent sound level data is provided in Figure 2.

Long-term unattended monitoring was undertaken at two locations, L1 and L2, using a Class 1 Sound Level Meter. Measurements comprised contiguous 15-minute samples over a period of 9 days. The measurement positions were located at ground level. Position L1 overlooked Mill Lane and A329 and position L2 overlooked Crossland Road and the student accommodation.

The intent of the measurement L1 was to establish ambient sound levels experienced by the north façade of the site. The sound levels at this position were dominated by the road traffic on Mill Lane and A329 with occasional pedestrian activities and aircraft.

The measurements at position L2 were intended to measure existing ambient and background sound levels experienced by the southwest side of the site. Position L2 is deemed to be suitably representative of the background sound levels experienced by the nearest noise sensitive receptor. The sound levels at this position were dominated by the road noise from Letcombe Street and Crossland Road including occasional pedestrian activities and aircraft. Occasional distant construction works were heard during the survey at this location.

Measurements at Position L1 are considered representation of free-field conditions. Sound level data at Position L2 was measured at approximately 1 m from the building façade, and therefore are regarded as façade levels.

Short-term measurements were carried out at six positions around the site at ground level. The locations of these short-term measurements are shown in Figure 2. The measurements were undertaken as hand-held samples positioned at a height of 1.2 m over 10-minutes period.

Note that all presented values in the image are free-field levels, meaning the measured data at L2 has been corrected by -3 dB.

The following long-term results are presented:

- Average ambient sound level measured, $L_{Aeq,T}$ during the day ($T=16hr$) and night ($T=8hr$)
- 10th highest sound event L_{Amax} ,
- Typical background sound level, $L_{A90,15min}$.

Background sound levels have been defined following a statistical analysis as recommended within BS 4142. The cumulative 10th percentile of measured L_{A90} values has been deemed to be typically representative of background sound conditions.

For the short-term results, the following values are presented:

- Average ambient sound level measured, $L_{Aeq,10 min}$
- Highest sound event L_{Amax} per measurement position
- Lowest background sound level, $L_{A90,10min}$ per measurement position.

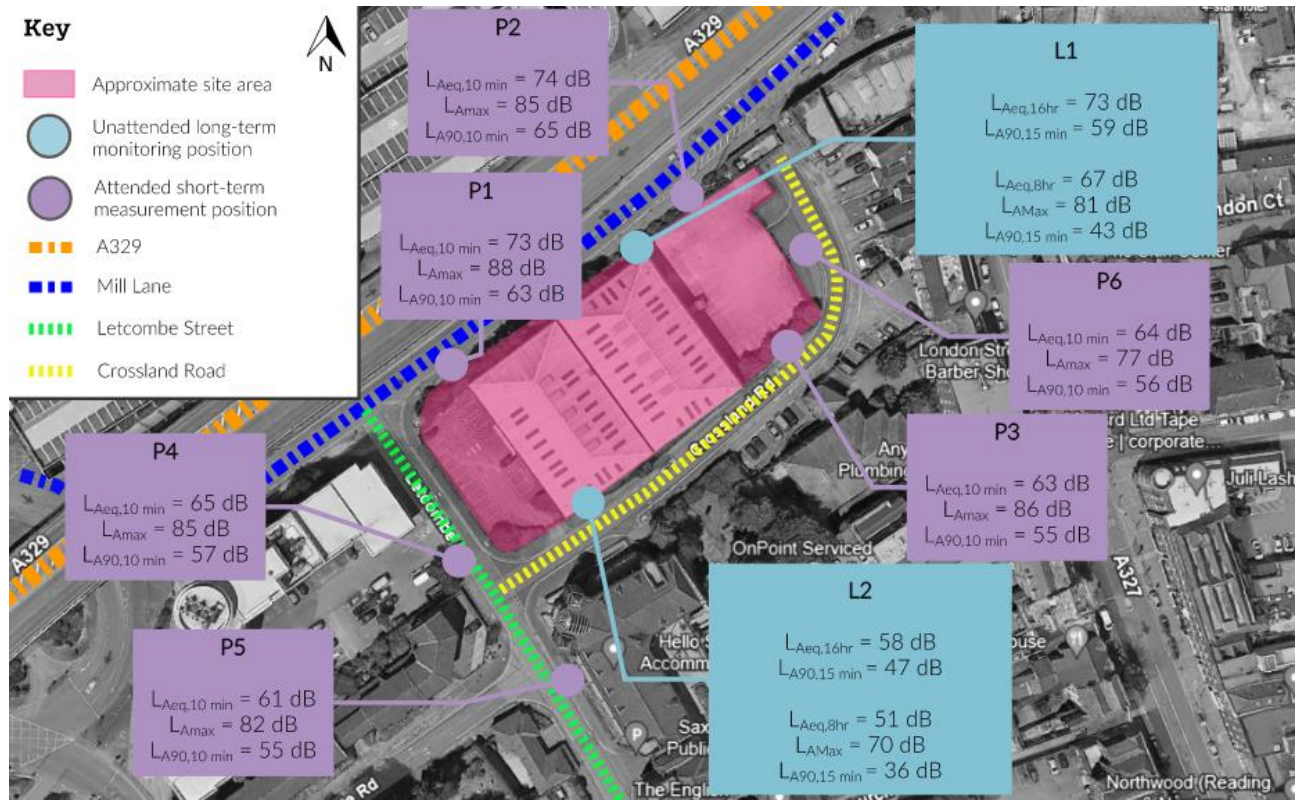


Figure 2 Summary of environmental sound survey results.

© Google Maps.

Full details of the survey including equipment details and results have been provided in Appendix B.

5. Plant noise assessment.

5.1 Plant noise emission limits.

Plant noise emission limits have been defined based on the results of the environmental sound survey and requirements from Reading Borough Council's policy EN17. These are stated in Table 2. The limits are defined as 'Rating levels' as described in BS 4142 and will therefore need to account for character corrections (e.g. for tonality, impulsivity, intermittency) as per the standard.

The limits apply at 1 m from the façade of the nearest noise receptors and relate to the cumulative noise of all new externally located mechanical plant, or plant connected to atmosphere operating simultaneously at design duty. The limits are given as free-field values.

Table 2 Plant noise emission limits.

Time period	Typical measured free-field background sound level ¹ , L _{A90,15min} (dB)	Adopted criterion as difference between rating noise limit and background sound level (dB)	Plant noise limit at 1m from nearest noise sensitive receptor, L _{A,r,Tr} (dB)
Daytime (07:00 – 23:00)	47	-10	37
Night-time (23:00 – 07:00)	36	See below	30

At night, background sound levels are low. Achieving a rating noise level fully 10 dB below the prevailing background sound levels will result in very low rating levels which will be impractical to realise.

According to BS 4142, a rating level not exceeding the background sound level will result in a low impact, depending on the context. The proposed nighttime limit of 30 dB L_{A,r,Tr} will be lower than the background sound levels and so could be considered a 'low impact' according to the standard.

Considering the context in which the noise is occurring, BS 8233 advises that an *internal* sound level of 30 dB L_{Aeq,8hrs} is required to facilitate resting and sleeping. Given that an open window will typically provide between 9-12 dB reduction from outside to inside, the resulting internal sound level will be significantly lower than required for resting and sleeping, even during periods when windows are open (18-21 dB L_{A,r,Tr}). When windows are closed, the internal sound levels will be negligible.

Therefore, when considering the context, a rating level limit of 30 dB L_{A,r,Tr} at night is considered a 'low impact' when assessed in line with BS 4142. Whilst not fully compliant with the numeric performance standard set out in policy EN17, it is considered that this could be acceptable to Reading Borough Council at night, considering the context.

5.2 Proposed noise generating equipment and embedded mitigation.

The main items of normally operating noise generating plant comprises 3no. Air Source Heat Pumps (ASHPs). The proposed ASHPs are located at the highest roof level of the proposed development.

Since the building is residential in nature, the equipment is expected to operate during both the daytime and night-time.

Preliminary equipment selections have been provided by the project mechanical engineer, which have a sound power level of 84 dBA. Initial assessments identified that attenuation measures would be required in order to satisfy the limits in Table 2. As such, allowance has been made within the design for acoustic enclosures to each unit.

Space allowance has been made for an enclosure by Allaway Acoustics, as shown in Figure 3, which can provide a sound reduction of approximately 11 dB(A).

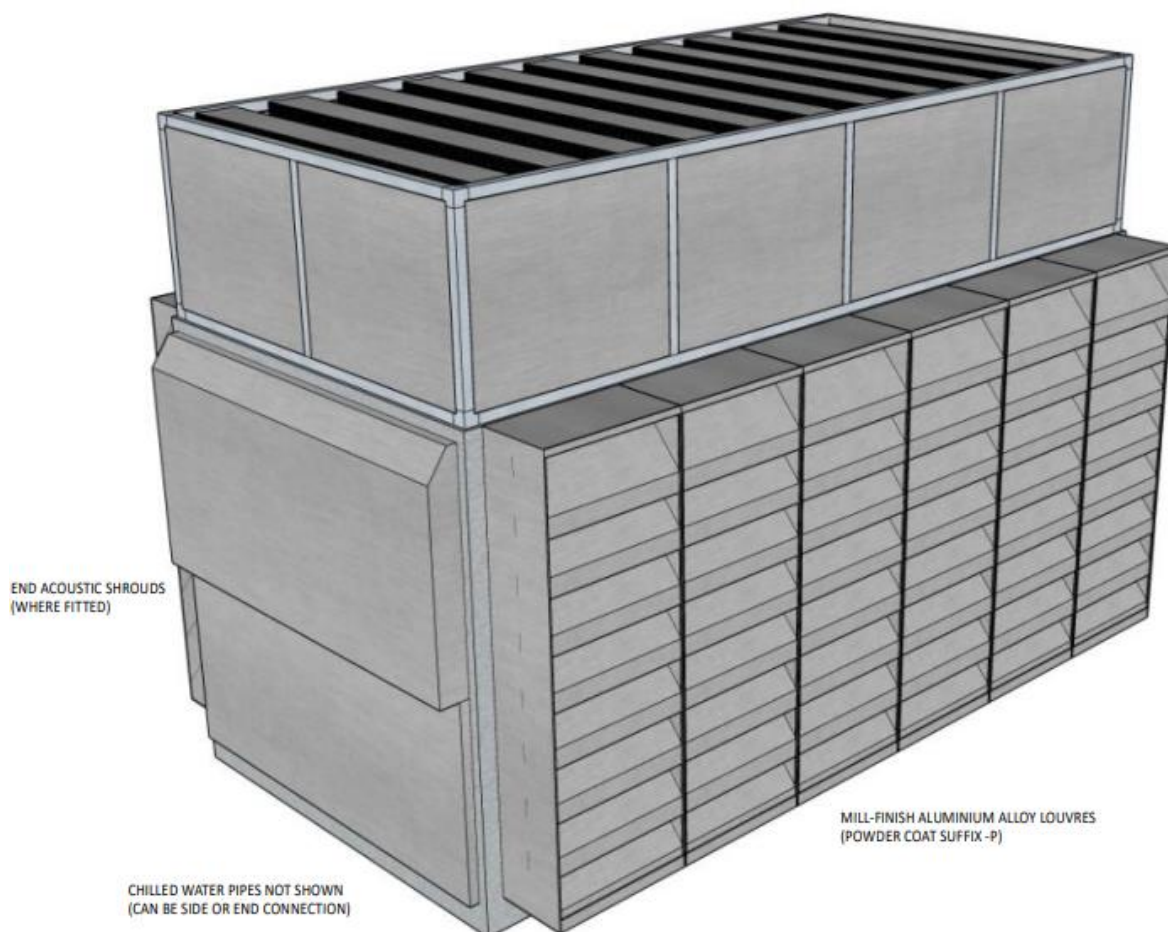


Figure 3 Allway Acoustics AA206S enclosure.

Whilst it is recognised that there will be ventilation plant, this will be provided by Mechanical Ventilation with Heat Recovery (MVHR) units locally within each apartment. As such, the units will inherently be controlled to low noise levels so as not to disturb occupants within the apartment itself. This will be achieved by inbuilt silencers within the MVHR ductwork.

5.3 Assessment.

An assessment has been undertaken to predict the plant noise levels at the various noise sensitive receivers identified in Figure 1. The most noise-affected of these was found to be the Premier Inn. A summary of the assessment to this receptor is presented below.

The assessment is based on all units run simultaneously at their full design duty which is considered representative of a reasonable worst-case scenario.

A summary of the assessment is given in Table 3 and Table 4. The summary, which is presented in broadband terms, has been informed by detailed octave band calculations.

No BS 4142 character penalties have been considered appropriate as part of the assessment. The manufacturer's data does not identify any obvious tonality. ASHPs are not typically 'impulsive', and new equipment would not be expected to have obvious on/off conditions owing to "soft-start" procedures.

Table 3 Plant noise assessment summary to the Premier Inn during daytime and night-time.

Calculation step	Predicted level of plant noise at Premier Inn.		
	Unit 1	Unit 2	Unit 3
Sound power level, dB L _{WA}	84	84	84
Tolerance, dB	+3	+3	+3
Distance attenuation ¹ , dB (Distance, m)	-38 (32)	-38 (32)	-38 (32)
Edge of building screening losses ² , dB	-12	-12	-13
Acoustic package attenuation ² , dB	-11	-11	-11
Resultant sound pressure level per unit, dB L _{pA}	26	26	25
Combined specific noise level, dB L _{pA}	30		
BS 4142 acoustic character penalties, dB	0		
Rating level achieved, dB L _{Ar,Tr}	30		
Notes:			
1) Assuming hemispherical point source propagation.			
2) In-built acoustic 'screening' provide by the building massing between the noise source and receiver. Losses calculated using ISO 9613-2. The presented figure is a dB(A) approximation based upon detailed octave band calculations.			

Table 4 Comparison of predicted rating level and noise emission limits

Calculation step	Assessment	
	Daytime (07:00-23:00)	Night (23:00-07:00)
Rating level achieved, dB $L_{Ar,Tr}$	30	30
Proposed daytime and night-time plant noise emission limits, dB $L_{Ar,Tr}$	37	30
Difference, dB	-7	0
Assessment	Achieves limit	Achieves limit

Based upon this assessment, noise from the ASHPs is expected to achieve the proposed noise limits derived in line with the Reading's policy EN17 during the day and a 'low impact' according to BS 4142 at night.

5.4 Emergency building services equipment.

Life safety plant would not normally be expected to meet the same rating level requirements on the basis that they are only operated for short periods for testing, or in an emergency scenario. It is commonly accepted that testing should only take place for limited periods (normally up to one hour) during working hours Monday to Friday and excluding bank holidays and weekends.

It is common practice to apply a 'relaxed' requirement whereby noise from emergency plant (life safety generators, smoke extract fans) is controlled to a level no more than 10 dB above the prevailing background sound level during periods when the equipment is periodically tested. This would result in a noise limit of 57 dB $L_{A,T,r}$ at 1 m from the façade of the nearest noise sensitive receivers.

Emergency plant for the proposed development comprises 4no. smoke extract fans at roof level. At this stage, equipment selections are not sufficiently developed to enable assessments to be undertaken. However, it is expected that noise can be controlled through the use of appropriately specified in-duct silencers designed to achieve the above noise limit.

6. Control of external noise.

External noise will need to be controlled to achieve appropriate sound levels both internally within apartments, and within external amenity spaces.

6.1 Façade design.

The façade will be designed to achieve internal sound levels in line with BS 8233, as set out in section 2.2. The apartments will be served by Mechanical Ventilation with Heat Recovery (MVHR) units to provide background ventilation rates in line with Approved Document F of the Building Regulations, avoiding the need for trickle vents.

Based upon the results of the noise survey, achieving these internal sound levels will require the most noise exposed facades of the building to be designed to achieve the sound reduction performances given in Table 5.

Table 5 Sound insulation values of proposed facade construction.

Period (applicable rooms)	Parameter	Measured external noise level	Internal sound level requirement	Façade sound reduction performance required
Daytime (Living rooms and bedrooms)	Ambient – $L_{Aeq,16hr}$	73 dB	35 dB	$R_w + C_{tr}$ 38 dB
Night (Bedrooms only)	Ambient – $L_{Aeq,8hr}$	67 dB	30 dB	$R_w + C_{tr}$ 37 dB
	Maximum noise events – $L_{A_{fmax}}$	81 dB	45 dB	$R_w + C_{tr}$ 36 dB

The requirements are moderately high but can be achieved with commercially available double glazed window systems in combination with relatively conventional external wall constructions, lightweight or masonry. The sound insulation performance requirements on less noise-exposed parts of the façade will be lower.

As the design is developed, detailed calculations will be undertaken to refine the performance requirements considering glazing percentages, room dimensions etc. However, based upon this initial assessment, external noise can be controlled to suitable internal sound levels throughout the scheme.

6.2 Overheating.

The strategy to remove heat from inside apartments has been developed mindful of the impact of noise.

Traditionally, open windows have been considered a simple and effective means of relieving overheating, but this significantly reduces the sound insulation performance offered by the building envelope.

Several factors will affect the level of attenuation provided by open windows. Depending upon the level of opening typically required for overheating purposes, it is possible that the sound reduction through a façade with an open window may range from 9 to 12 dB.

Based upon the measured external noise levels, it is unlikely that suitable internal sound levels will be achieved through a simple open window overheating strategy throughout the majority of the scheme.

Therefore, an alternative strategy has been developed that avoids the need to rely upon opening windows. The current design allows for an enhanced MVHR unit with an integrated cooling coil to temper the incoming fresh air and provide lower internal temperatures in line with ADO.

Windows will remain capable of being physically openable, giving the user the option of opening a window should they prefer, or for the purposes of purge ventilation (removing fumes/burnt food smells etc).

6.3 External amenity areas.

BS 8233 advises that for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 - 55 dB $L_{Aeq,T}$. However, the standard also recognises that these levels may not be achievable in all circumstances.

In section 7.7.3.2, it advises that in higher noise areas, such as city centres and urban areas adjoining strategic transport networks, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but that planning permission should not be prohibited.

For residential flats and apartment blocks, where normal external amenity space might be limited or not available, BS 8233 notes that other locations, such as balconies, roof gardens and terraces, provide important outdoor space and that specification of noise limits in these areas is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise should not affect these activities.

External noise levels on the private balconies will be higher than the desirable BS 8233 range. However, in addition to the private balconies, two communal courtyards are provided at ground floor overlooking Crossland Road, which will be quieter.

Current external noise levels along Crossland Road are 58 dB $L_{Aeq,16hr}$, and so only just above the 50-55 dB range. The future courtyards will be more heavily screened from Mill Lane and Church Street by the massing of the new development and will be set back further from Crossland Road. It is therefore expected that large parts of these courtyards will experience sound levels of 55 dB L_{Aeq} or lower.

7. Conclusion

The assessment has concluded that noise associated with the proposed development can be controlled to appropriate levels.

Noise from new building services plant can be controlled to achieve environmental noise limits defined in line with Reading Borough Council policy EN17 during the day and a 'low impact' in accordance with BS 4142 at night.

External noise can be controlled to suitable internal sound levels within the apartments with relatively conventional façade constructions and commercially available double glazed window systems.

Whilst external noise levels within private balconies will be higher than desirable, quieter communal amenity spaces are provided for use by residents.

On the basis of this assessment, noise can be controlled to suitable levels in line with Reading Borough Council's policy and appropriate British Standards. Consequently, noise should not pose an obstacle in the granting of planning permission.

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 (m²) 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:

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

Where:

L_p = sound pressure level (dB)

p = sound pressure (Pa)

$p_{\text{ref}} = 2 \times 10^{-5}$ – 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

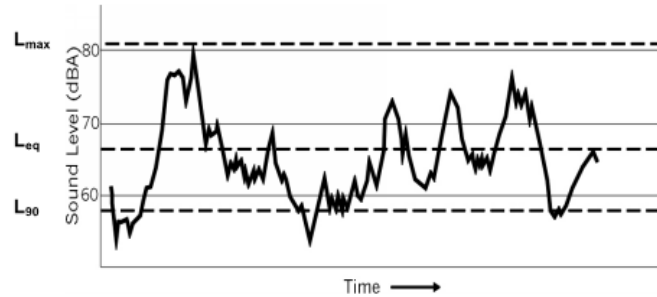
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting. This is a correction term applied to the frequency range in 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, $L_{Aeq,T}$

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 long-term measurements were appropriate for environmental sound measurements, with no significant precipitation or strong winds.

Measurement equipment details.

All measurement equipment were calibrated before and after the survey. No significant drift was observed. Details of the equipment used for the survey has been provided in Table 6.

Table 6 Details of equipment used for the environmental sound survey.

Item	Description	Manufacturer	Model	Serial number	Calibration date	Calibration certificate number
Attended short-term measurements	Sound Level Meter	Rion	NA-28	01260201	10/02/2022	UCRT20/1165
	Microphone	Rion	UC-59	00281	10/02/2022	UCRT20/1165
	Pre-amp	Rion	NH-23	60104	10/02/2022	UCRT20/1165
	Calibrator	Rion	NC-74	34172704	04/08/2023	UCRT23/2030
Attended short-term measurements	Sound Level Meter	Brüel & Kjær	2250	3004050	03/11/2023	UCRT23/2427
	Microphone	Brüel & Kjær	4189	3245822	03/11/2023	UCRT23/2427
	Pre-amp	Brüel & Kjær	ZC0032	29334	03/11/2023	UCRT23/2427
	Calibrator	Brüel & Kjær	4231	2445715	22/09/2023	UCRT23/2216
Unattended long-term-term measurements (position L1)	Sound Level Meter	Rion	NL-52	00710469	14/01/2022	CONF012204
	Microphone	Rion	UC-59	19733	14/01/2022	CONF012204
	Pre-amp	Rion	NH-25	11012	14/01/2022	CONF012204
	Calibrator	Rion	NC - 74	34557134	03/11/2023	UCRT23/2424
Unattended long-term-term measurements (position L2)	Sound Level Meter	Rion	NL-52	00810564	14/01/2022	CONF012203
	Microphone	Rion	UC-59	19955	14/01/2022	CONF012203
	Pre-amp	Rion	NH-25	11107	14/01/2022	CONF012203
	Calibrator	Rion	NC-74	34557134	14/11/2022	UCRT21/2390

Long-term measurement results.

A summary of the measured ambient and background noise level results is presented in Table 7 and Figure 4, respectively, for location L1, and Table 8 and Figure 5, respectively, for location L2. Measurements at L1 are free-field noise levels.

Measurements at L2 are representative of a façade position. The data shown within this appendix is the raw data. For the purposes of assessment, a -3 dB correction has been applied to convert façade levels to free field sound data.

Time history plots are shown in Figure 6 and Figure 7 for location L1 and L2 respectively.

Table 7 Summary of long-term ambient measurements at L1.

Date	Ambient sound pressure levels measured (dB) at position L1 - Mill Lane	
	Day Time (07:00 - 23:00) $L_{Aeq, 16hr}$	Night Time (23:00 - 07:00) $L_{Aeq, 8hr}$
12/12/2023	73	67
13/12/2023	73	67
14/12/2023	73	68
15/12/2023	73	67
16/12/2023	72	67
17/12/2023	72	66
18/12/2023	73	66
19/12/2023	73	67
20/12/2023	73*	N/A

*Incomplete measurement period.

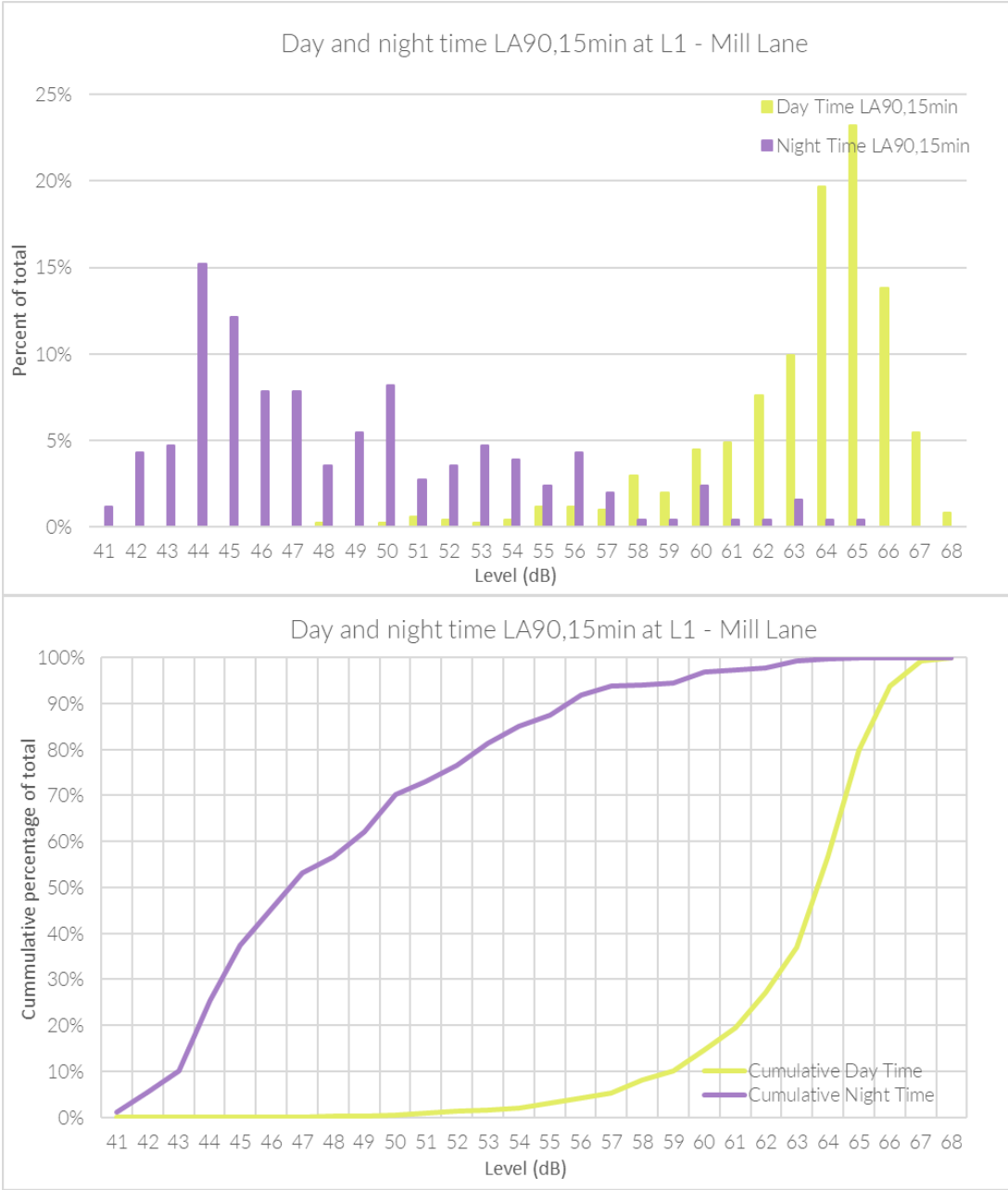


Figure 4 Statistical analysis of background sound pressure levels at L1.

Table 8 Summary of long-term ambient measurements at L2.

Date	Ambient sound pressure levels measured (dB) at position L2 – Crossland Road	
	Day Time (07:00 - 23:00) $L_{Aeq, 16hr}$	Night Time (23:00 - 07:00) $L_{Aeq, 8hr}$
12/12/2023	61	54
13/12/2023	62	54
14/12/2023	61	55
15/12/2023	60	54
16/12/2023	60	54
17/12/2023	59	53
18/12/2023	60	54
19/12/2023	61	54
20/12/2023	63*	N/A

*Incomplete measurement period.

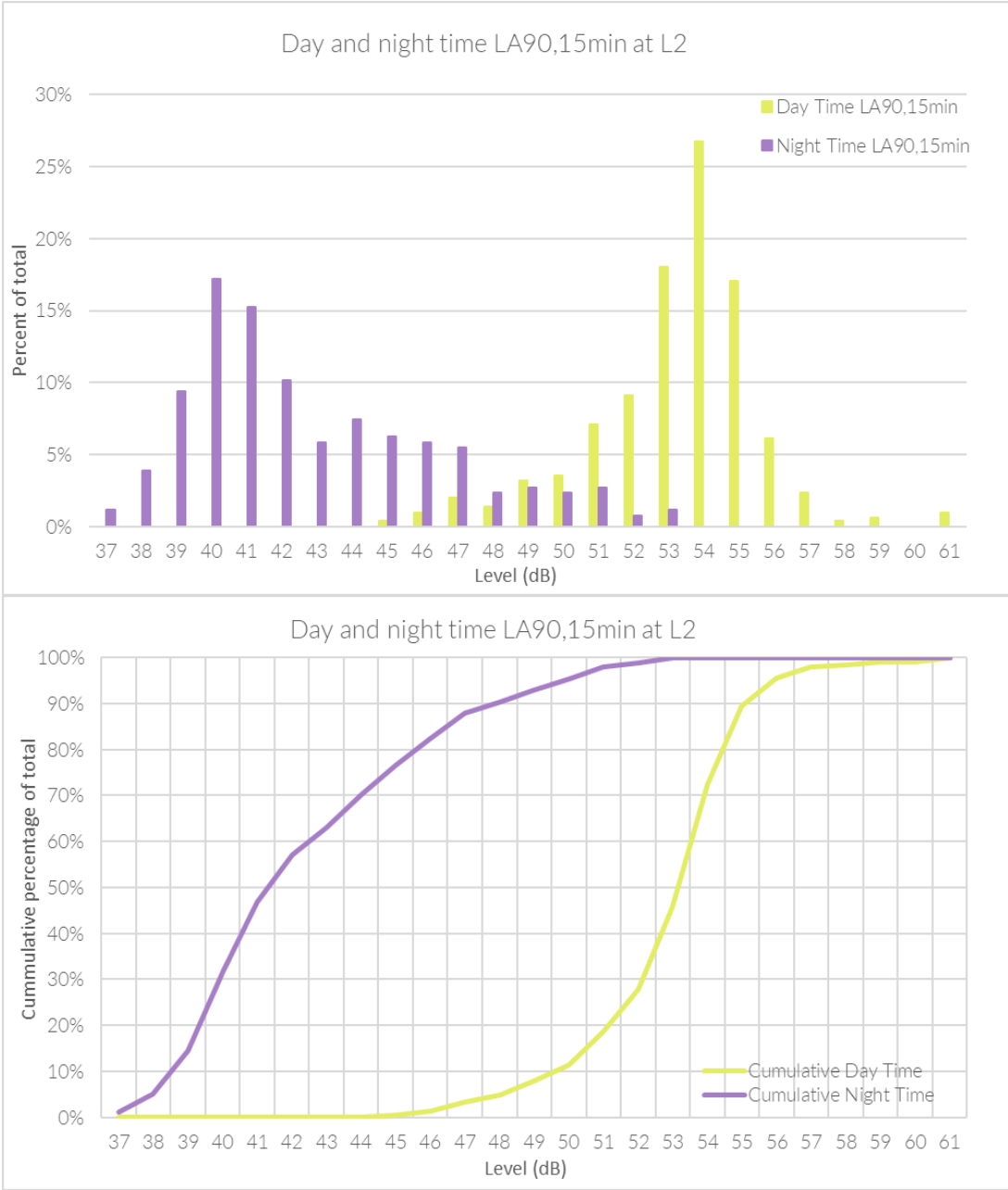


Figure 5 Statistical analysis of background sound pressure levels at L2.

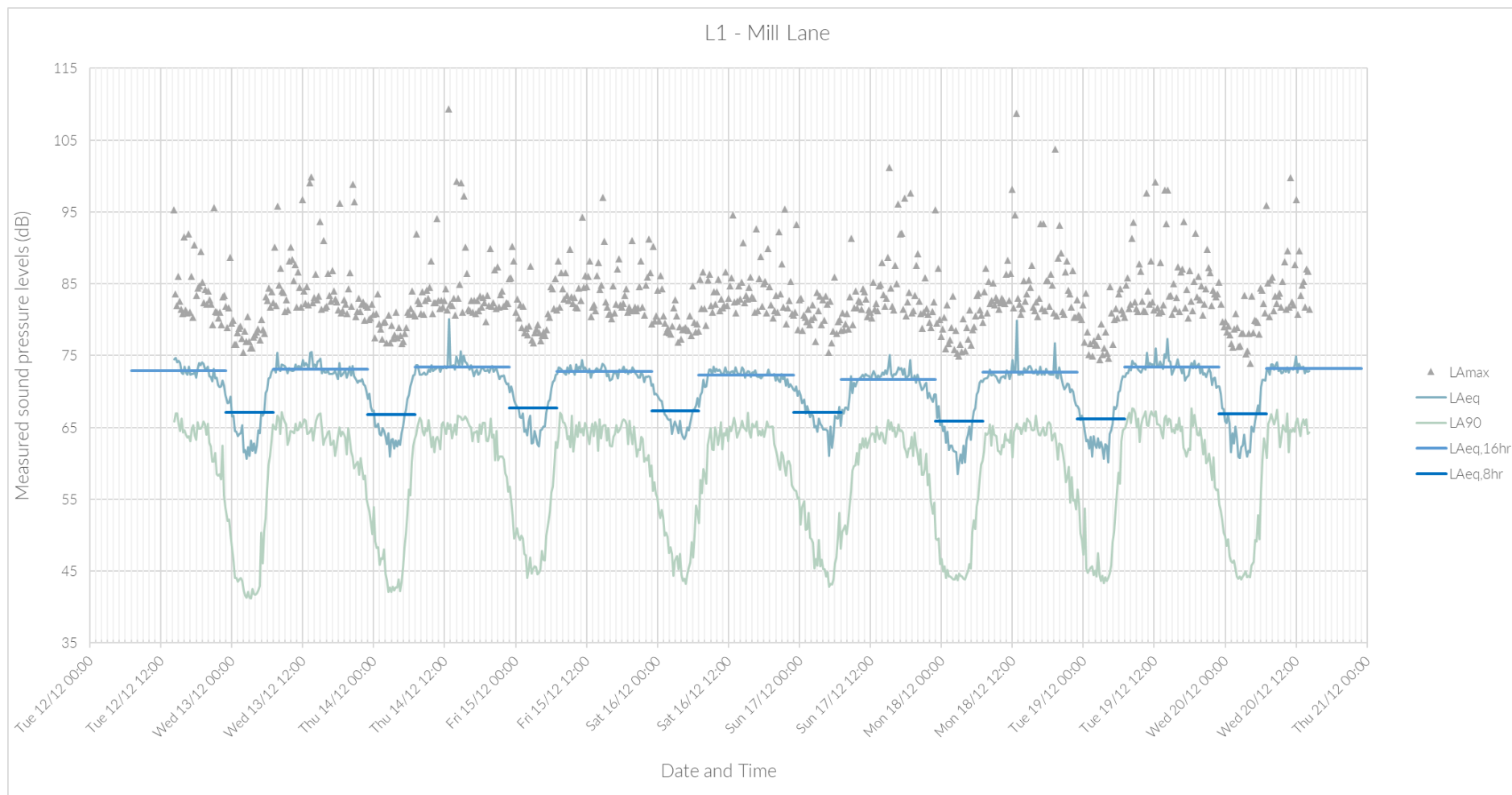


Figure 6: Graphical representation of unattended long-term monitoring results at L1.

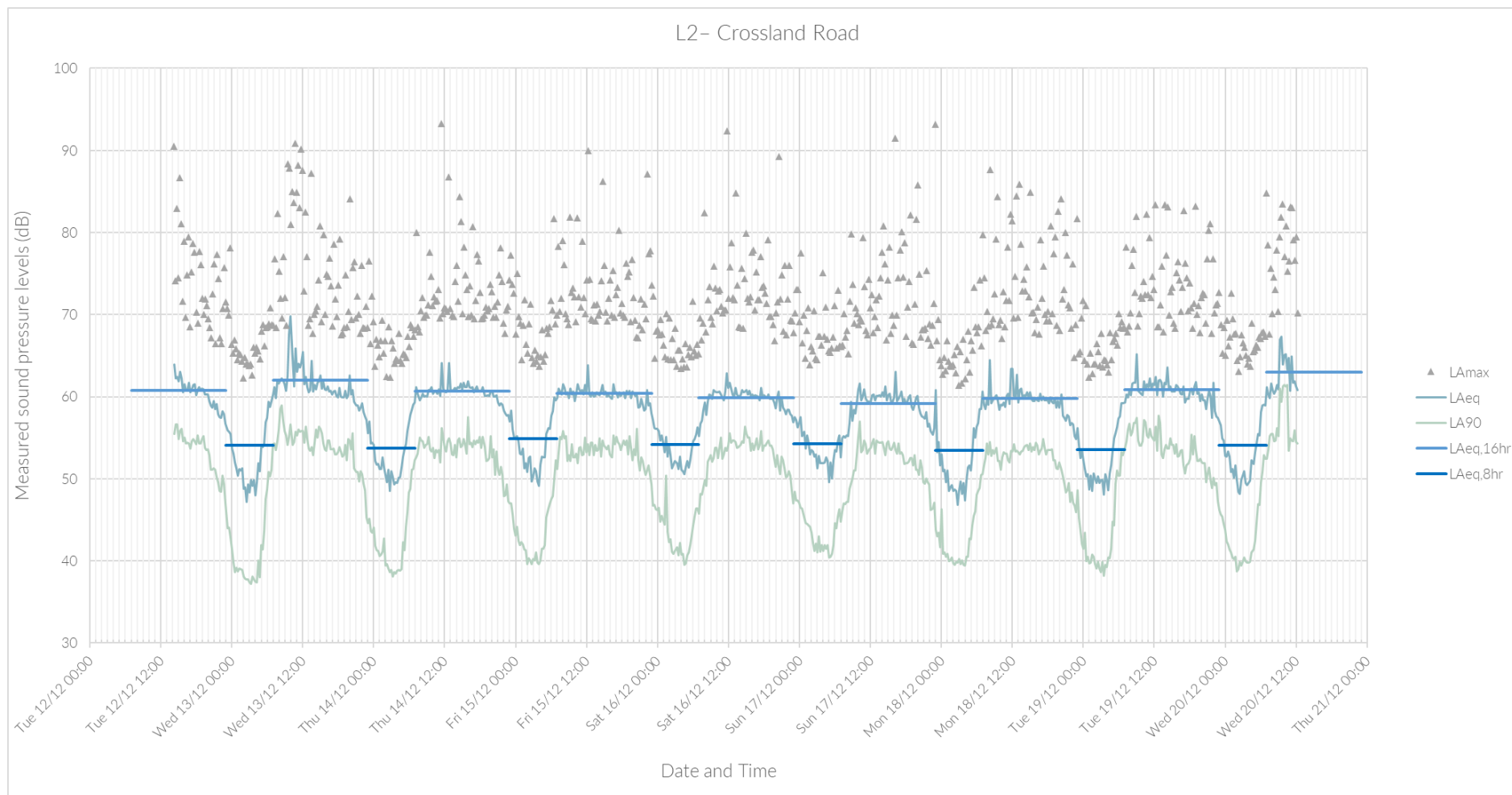


Figure 7 - Graphical representation of unattended long-term monitoring results at L2.

Short-term noise monitoring.

Short-term attended measurements were conducted to obtain typical ambient and background levels at the boundaries of the site. All measurements were undertaken at a height of 1.2 m from the ground.

The results are summarised in Table 9. All measurements are free-field noise levels.

Table 9 Summary of short-term measurements.

Position	Description	Measurement start time	Measurement Duration, T	Ambient sound pressure level, dB $L_{Aeq,T}$	Maximum sound level, dB $L_{AFmax,T}$	Background sound level, dB $L_{A90,T}$
1	Mill Lane (West)	20/12/2023 11:45	00:10:00	74	87	64
		20/12/2023 12:44	00:10:00	72	83	63
		20/12/2023 13:44	00:10:00	73	88	65
2	Mill Lane (East)	20/12/2023 11:59	00:10:00	74	85	65
		20/12/2023 13:00	00:10:00	74	85	66
		20/12/2023 14:00	00:10:00	73	83	66
3	Crossland (East)	20/12/2023 11:45	00:10:00	63	76	56
		20/12/2023 12:45	00:10:00	62	70	55
		20/12/2023 13:45	00:10:00	64	86	58
4	Premier Inn	20/12/2023 12:00	00:10:00	66	85	57
		20/12/2023 13:00	00:10:00	64	77	57
		20/12/2023 13:59	00:10:00	64	75	57
5	Student Accommodation	20/12/2023 12:15	00:10:00	61	76	55
		20/12/2023 13:14	00:10:00	61	73	55
		20/12/2023 14:15	00:10:00	61	82	55
6	Crossland	20/12/2023 11:30	00:10:00	64	71	56
		20/12/2023 12:30	00:10:00	65	77	57
		20/12/2023 13:30	00:10:00	64	72	58



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