



PREPARED: Wednesday, 01 February 2023

101 OXFORD ROAD, READING NOISE IMPACT ASSESSMENT

CONTENTS

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	1
3.0	DESCRIPTION OF SITE	1
4.0	RELEVANT STANDARDS AND GUIDANCE	2
5.0	SURVEY EQUIPMENT AND PROCEDURES	2
6.0	SURVEY RESULTS	3
7.0	DISCUSSION	3
8.0	CONCLUSIONS	5

LIST OF ATTACHMENTS

AS12906/SP1	Site Plan
AS12906/TH1-TH6	Environmental Noise Time Histories
APPENDIX A	Acoustic Terminology

Project Ref:	AS12906	Title:	101 Oxford Road, Reading
Report Ref:	AS12906.230118.R1	Title:	Noise Impact Assessment
Client Name:	Mr Babar Butt		
Project Manager:	Michael Symmonds		
Report Author:	Michael Symmonds		
Clarke Saunders Acoustics Winchester SO22 5BE		This report has been prepared in response to the instructions of our client. It is not intended for and should not be relied upon by any other party or for any other purpose.	

1.0 EXECUTIVE SUMMARY

- 1.1 Planning permission is sought for a single dwelling to the rear of 101 Oxford Road, Reading.
- 1.2 Clarke Saunders Acoustics (CSA) has conducted an acoustic assessment of the suitability of the site to be used for residential purposes, resulting in specifications being provided for external building fabric elements, with reference to the desirable conditions within BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* (BS8233).
- 1.3 Glazing and trickle ventilator specifications are provided in Table 7.1, which confirm appropriate internal noise levels can be achieved within the future dwelling.
- 1.4 The overheating strategy should be able to rely on openable windows for rooms with windows on the western façade, however, an alternative strategy should be adopted for rooms with windows only located on the eastern façade.

2.0 INTRODUCTION

- 2.1 Planning permission is sought for a single dwelling to the rear of 101 Oxford Road, Reading.
- 2.2 CSA has been appointed to conduct an acoustic assessment of the suitability of the site to be used for residential purposes.
- 2.3 Environmental noise survey data will be used to advise of external building fabric specifications, in order to achieve appropriate internal acoustic conditions.
- 2.4 Comments will also be provided on the feasibility of relying on ventilation provided by openable windows in an overheating scenario, with reference to Approved Document O of Building Regulations.

3.0 DESCRIPTION OF SITE

- 3.1 The site is situated on a street lined with terraced houses, with the eastern façade facing Howard Street and, beyond this, the A329, located in a deep cutting. On the other side of the A329 is student accommodation and a hotel. To the west of the site is the Providence Chapel, which holds services throughout the week.
- 3.2 The proposals comprise a three-storey dwelling, with living areas at ground floor and bedrooms on the first and second floor. The first-floor bedrooms are single aspect, whilst one second-floor bedroom is double aspect with dormer windows and the other has rooflights in the western side of the roof.
- 3.3 A plan of the site and local area is provided at AS12906/SP1.

4.0 RELEVANT STANDARDS AND GUIDANCE

4.1 INTERNAL AMBIENT NOISE LEVELS (BS8233)

- 4.1.1 BS8233 confirms desirable internal noise levels to be achieved within future dwellings, which are provided in the following table.

ACTIVITY	LOCATION	07:00 TO 23:00	23:00 TO 07:00
Resting	Living Room	35dB $L_{Aeq,16hr}$	-
Dining	Dining Room	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$

Table 4.1 – BS8233 desirable internal noise targets

- 4.1.2 The World Health Organisation's Guidelines for Community Noise comments on night-time noise maxima, resulting in a typically adopted target of L_{AFmax} 45dB not being exceeded in bedrooms more than 10-15 times per night.

4.2 APPROVED DOCUMENT O

- 4.2.1 Building Regulations Approved Document O – *Overheating* (ADO) came into effect in June 2022.
- 4.2.2 ADO will require the developer to comply with the requirements to mitigate overheating as follows:

“3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).”

3.3 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).

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.”

5.0 SURVEY EQUIPMENT AND PROCEDURES

- 5.1 A survey of the existing ambient noise levels was undertaken approximately 3.5m above local ground level at the position shown in the site plan.
- 5.2 Sound level meters were set to record synchronous measurements of consecutive 5 - minute L_{Aeq} , L_{Amax} , L_{A90} and L_{A10} sound pressure levels between 15:30 hours on Wednesday 18th January and 14:55 hours on Monday 23rd January 2023.
- 5.3 Attended measurements were also taken at the position directly overlooking the A329, to aid in determining the noise levels at second floor level.

5.4 The following equipment was used during the course of the survey:

- Rion sound level meter type NA28;
- Norsonic sound level meter type 118;
- Rion sound level calibrator type NC74;
- Norsonic sound level calibrator type 1251.

5.5 The calibration of the sound level meters was verified before and after use. No significant calibration drift was detected.

5.6 There were sufficient periods of dry weather with light to moderate winds during the survey, which provided suitable conditions for the measurement of environmental noise.

5.7 Environmental noise survey measurements were made following procedures in BS 7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2- Acquisition of data pertinent to land use*.

6.0 SURVEY RESULTS

6.1 Figures AS12906/TH1-TH6 shows the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels as time histories at the Howard Street monitoring position.

6.2 Road traffic noise from the A329 constitutes the predominant noise source present on site, with occasional contributions from vehicles on Howard Street.

6.3 The measured free-field average noise levels for the 'Daytime' and 'Night-time' periods shown in Table 6.1, alongside the typical highest L_{AFmax} during the night-time period, derived as the 90th percentile of the night-time L_{AFmax} dataset.

POSITION	MONITORING PERIOD	AVERAGE $L_{Aeq,T}$	TYPICAL MAXIMUM L_{AFMAX}
1	07:00 - 23:00 hours	70 dB	-
	23:00 - 07:00 hours	63 dB	74 dB

Table 6.1 – Typical maximum and average free-field noise levels

[dB ref. 20 μ Pa]

6.3.1 Analysis of the data measured at both long-term and attended positions demonstrated that the noise levels at second floor level could be up to 5dB higher than those tabulated above.

7.0 DISCUSSION

7.1 EXTERNAL BUILDING FABRIC

7.1.1 This review is based on the submitted site and dwelling layouts available at the time of writing, targeting the internal noise levels set out in Table 4.1.

7.1.2 It has been assumed that non-glazed elements, i.e. traditional brick and block external walls, will provide a minimum sound insulation performance of at least R_w 51 dB, when tested in accordance with ISO 10140-2:2010 or equivalent test standard.

7.1.3 The monitoring position, which was at on the site boundary at a height of circa 3.5m, had approximately the same line of sight to the A329 as the future first floor level windows, which will be set back from the site boundary. The use of these measured noise levels to

determine the first-floor façade specifications is, therefore, appropriate without corrections.

- 7.1.4 A correction of +5dB has been applied to calculate the second-floor façade specifications, owing to the increased line of sight to the A329.
- 7.1.5 On the basis of the measured noise levels, the required minimum acoustic performance of glazing and ventilation systems has been determined. This assessment has considered both the daytime and night-time average and typical maximum noise levels in habitable rooms.
- 7.1.6 Suitable internal noise levels in noise-sensitive rooms can be achieved based on the minimum sound insulation specifications for glazed and ventilation facade elements of the plots given in Table 7.1.

ROOM	GLAZING SINGLE FIGURE WEIGHTED SOUND REDUCTION	VENTILATOR PERFORMANCE
Second Floor (East)	$R_w \geq 36\text{dB}$	$D_{n,e,w} \geq 45\text{dB}$
First and Ground Floor (East)	$R_w \geq 34\text{dB}$	$D_{n,e,w} \geq 42\text{dB}$
West (all floors)	$R_w \geq 30\text{dB}$	$D_{n,e,w} \geq 35\text{dB}$

Table 7.1 – Acoustic facade performances

- 7.1.1 These specifications are the minimum acoustic requirement for each identified area, based on the site layout. These would allow the dwelling to meet the aspirational targets both in terms of average daytime and night-time noise levels, and typical noise maxima set out in in paragraph 4.1.2, with windows closed and vents open.
- 7.1.2 For costing purposes only, example glazing configurations, for which CSA has library test data showing it being capable of achieving each specification, are 6mm glass-12 mm airspace -8 mm glass; 8 mm glass -12 mm airspace -10 mm glass; and 4 mm glass -12 mm airspace-4 mm glass, respectively.
- 7.1.3 The ventilator performances on the east façade would likely require ‘through-wall’ ventilators, as opposed to window trickle ventilators. It is noted that the second floor bedroom, which is exposed to the highest noise levels, has windows on the east and west facades. Ventilators can, therefore, be installed on the quieter east façade.
- 7.1.4 The ventilator performance figures provided are for a single vent per room (2000mm²). If multiple vents are required, then the performance requirement shown in Table 7.1 will increase by a value equal to $+10\log(N)$, with N being the total number of vents serving the room.

7.2 OVERHEATING

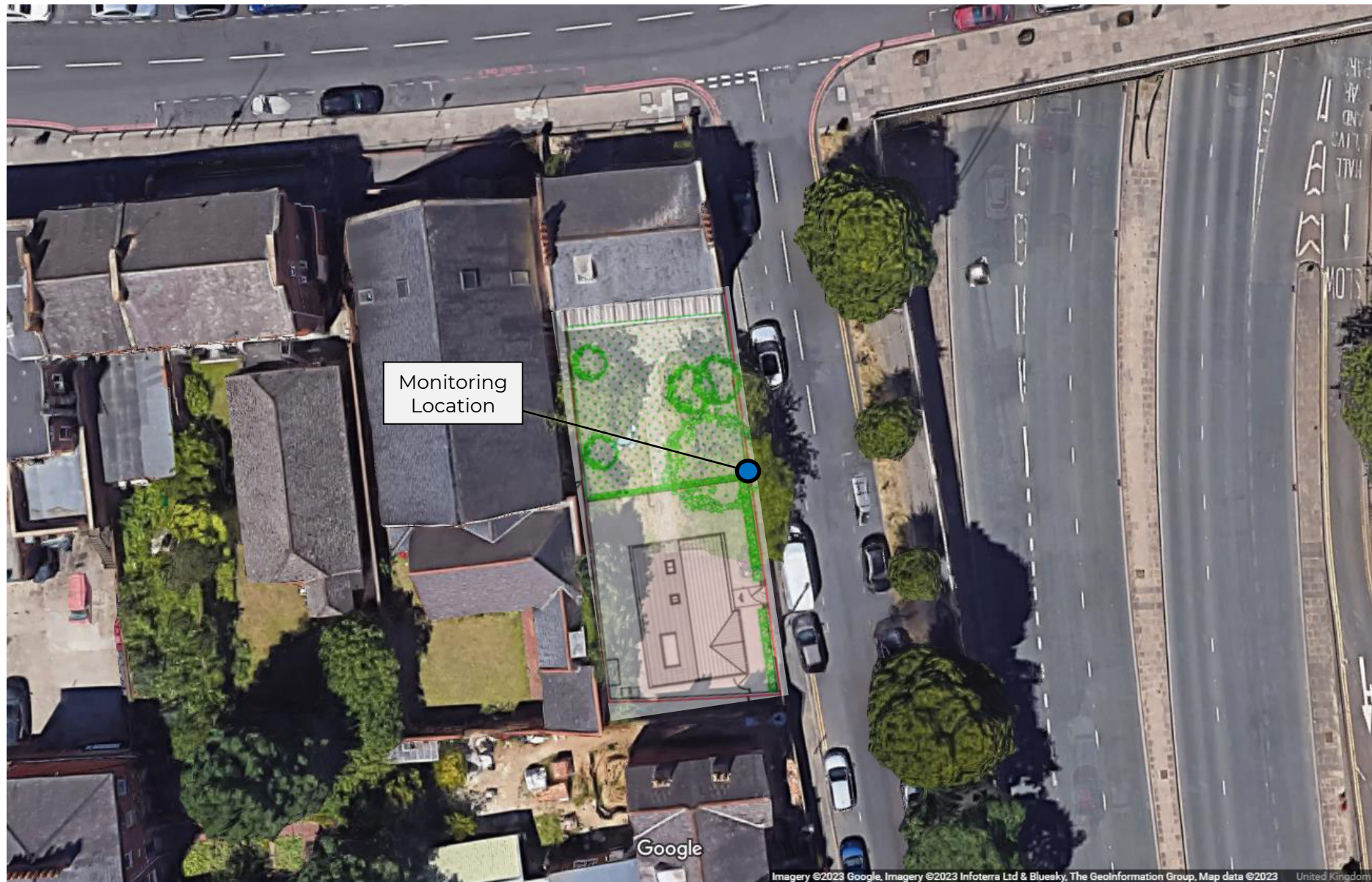
- 7.2.1 ProPG states that a building envelope, with windows open, will typically achieve a reduction in noise level from outside to inside of between 10dB and 15dB.
- 7.2.2 Assuming a loss of 15dB for a partially open window, noise levels within rooms with an eastern window open are likely to exceed the aspirational design targets set out in paragraph 4.2.2.
- 7.2.3 The overheating strategy should not, therefore, rely on the eastern windows being open. An alternative method for increased ventilation rates should be implemented in these rooms.
- 7.2.4 When western facing windows are open, the internal noise levels are expected to be commensurate with the design targets, due to the increased distance and self-screening associated with the built form of the proposed development.
- 7.2.5 There is no reason why windows could not be opened as a matter of personal preference or for purge ventilation, since no such internal noise criteria are applicable for these scenarios.

8.0 CONCLUSIONS

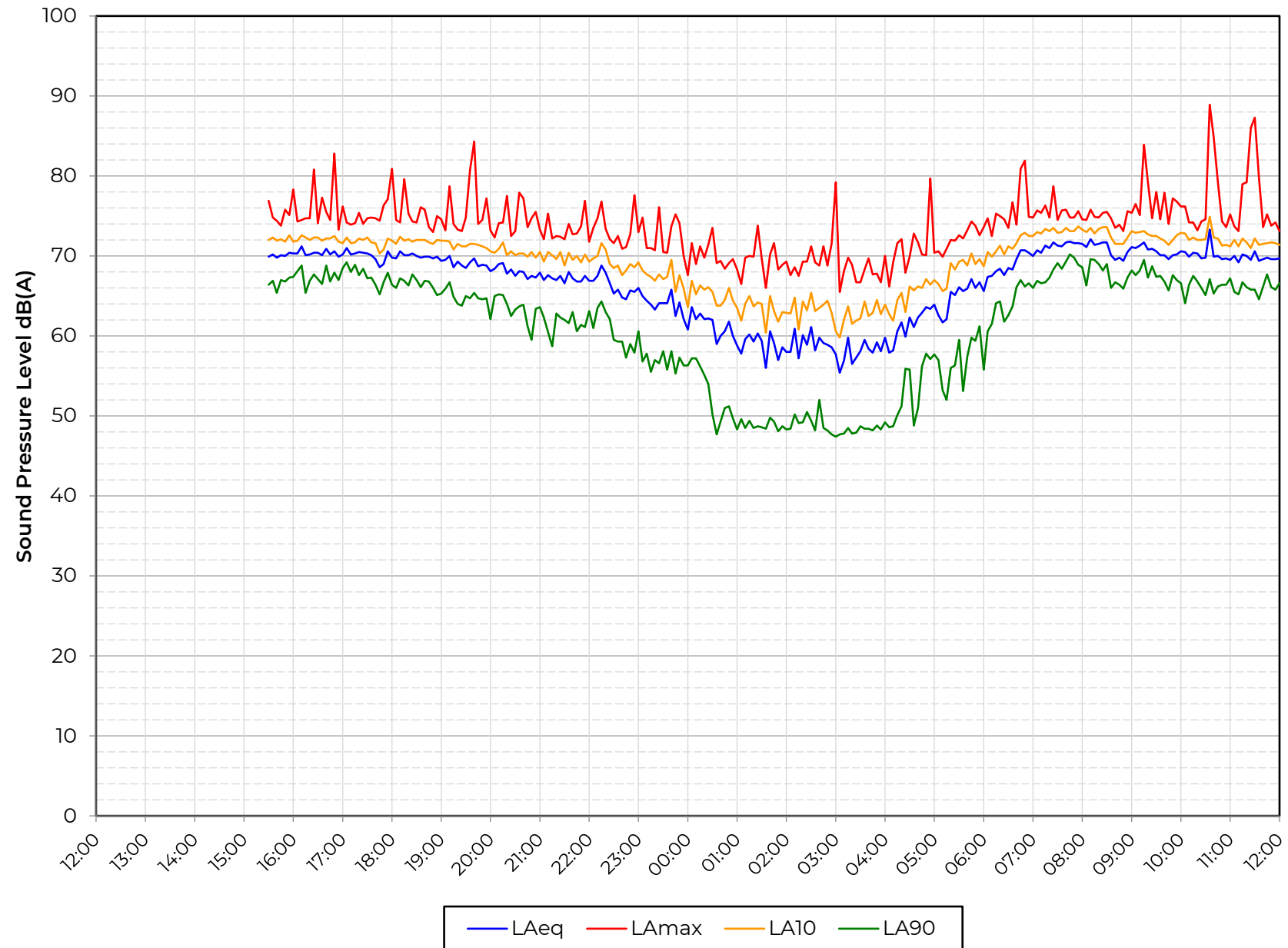
- 8.1 Clarke Saunders Acoustics (CSA) has been appointed to conduct an acoustic assessment of the suitability of the land to the rear of 101 Oxford Road, Reading, to be used for residential purposes.
- 8.2 The acoustic performance of external building fabric elements has been considered, with specifications for glazing and trickle ventilators provided, targeting the desirable internal ambient noise levels identified in BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*.
- 8.3 The overheating strategy should be able to rely on openable windows for rooms with windows on the western façade, however, an alternative strategy should be adopted for rooms with windows only located on the eastern façade.



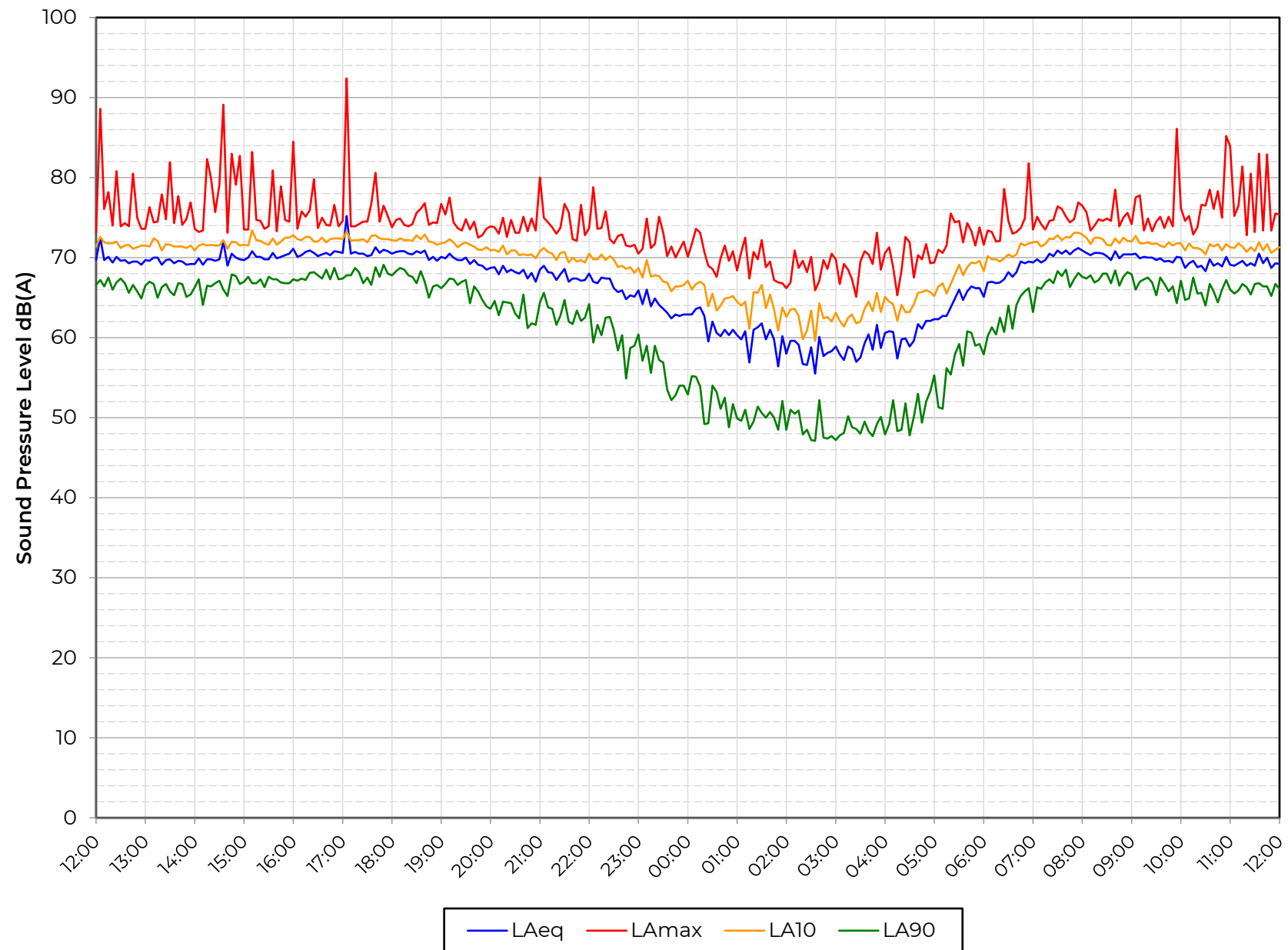
Michael Symmonds MIOA
CLARKE SAUNDERS ACOUSTICS



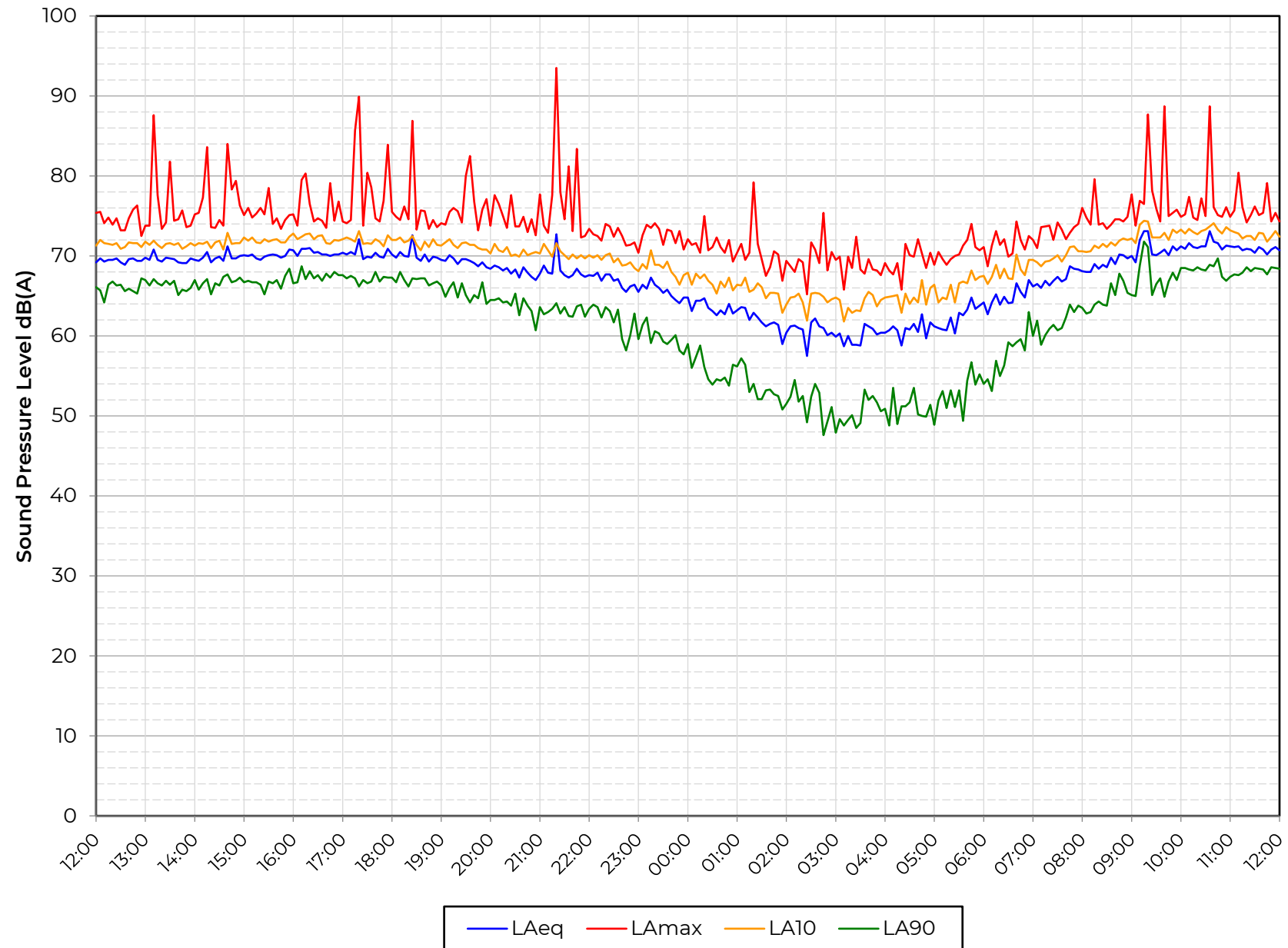
Position 1



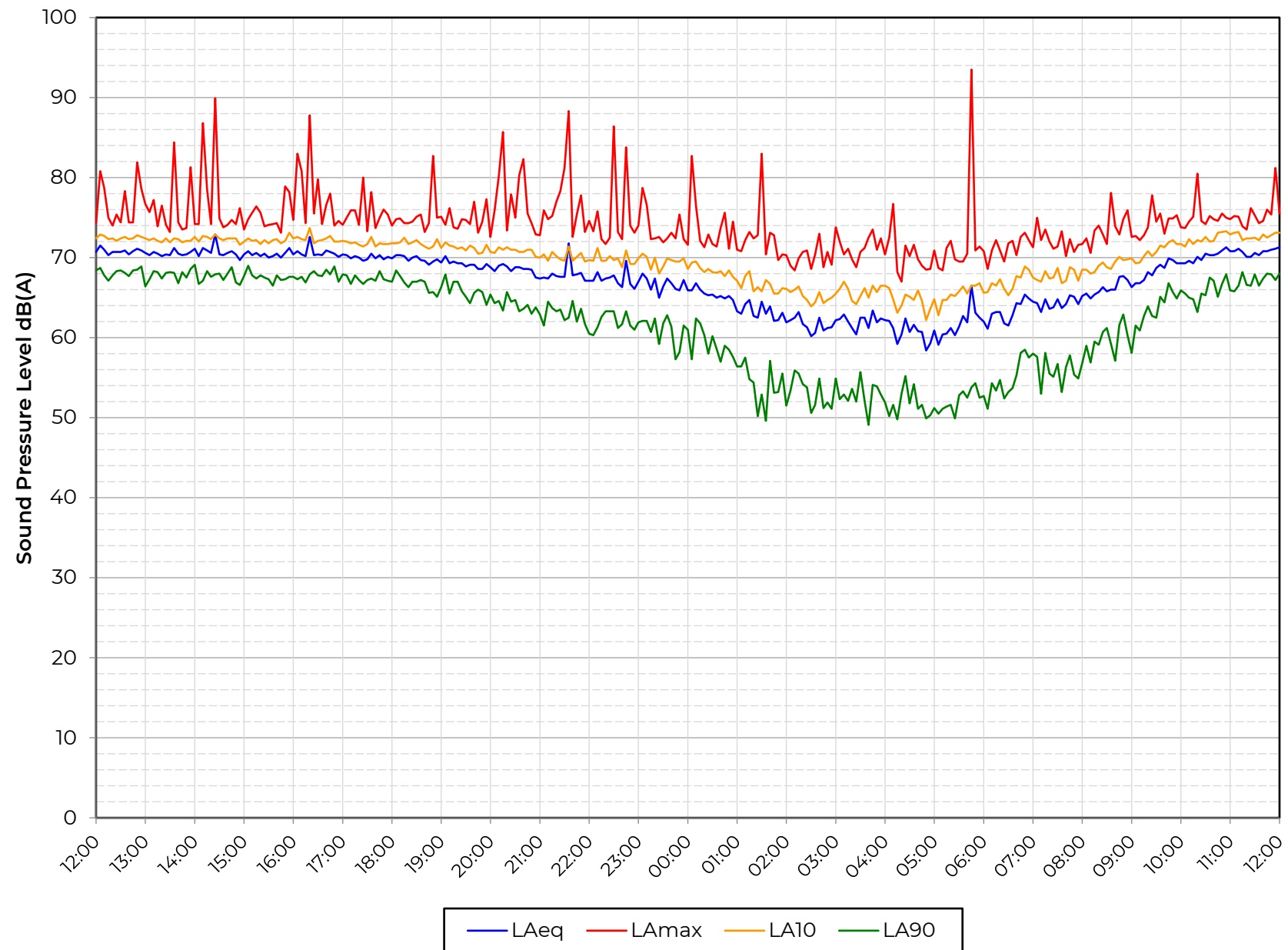
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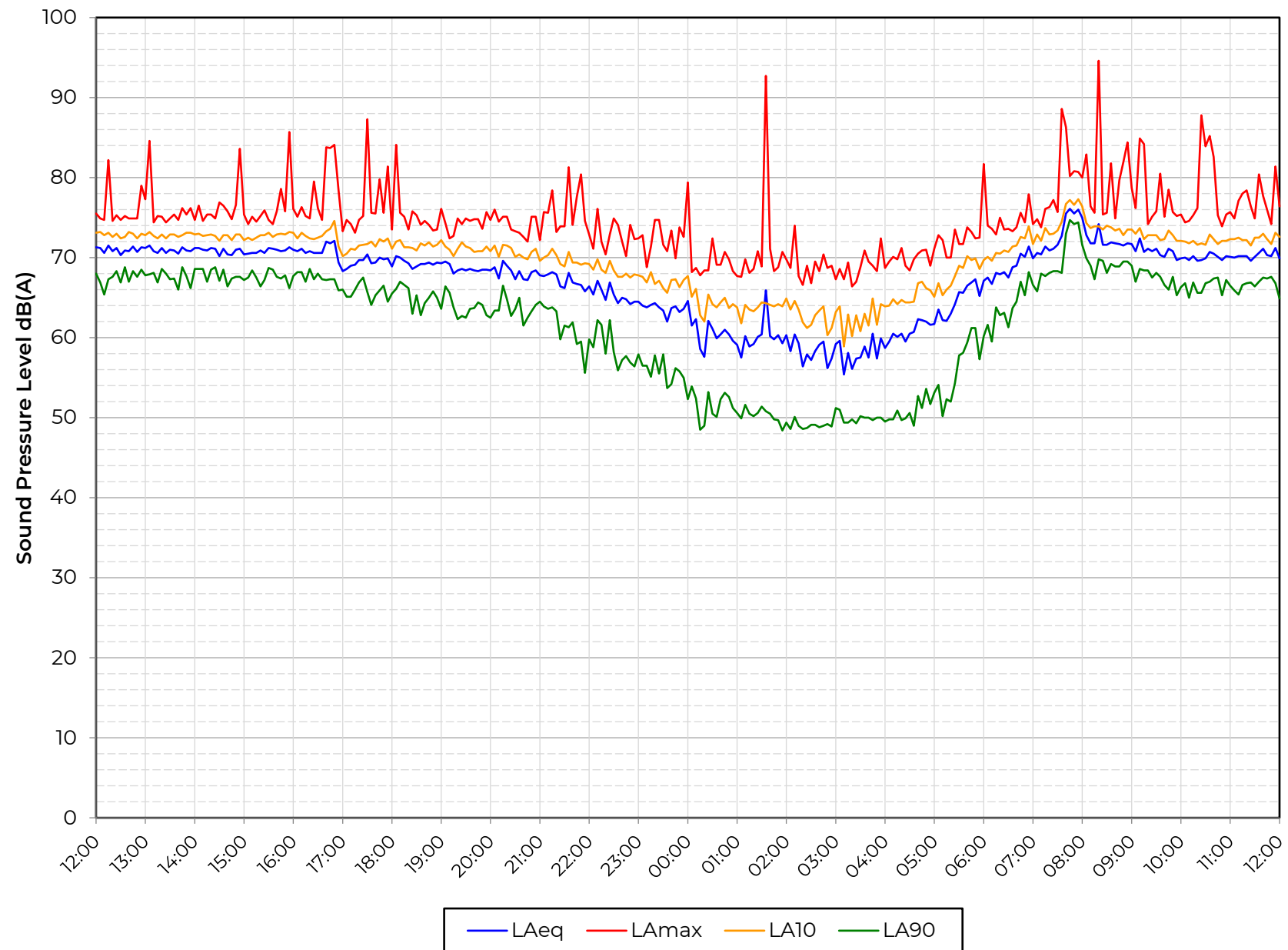
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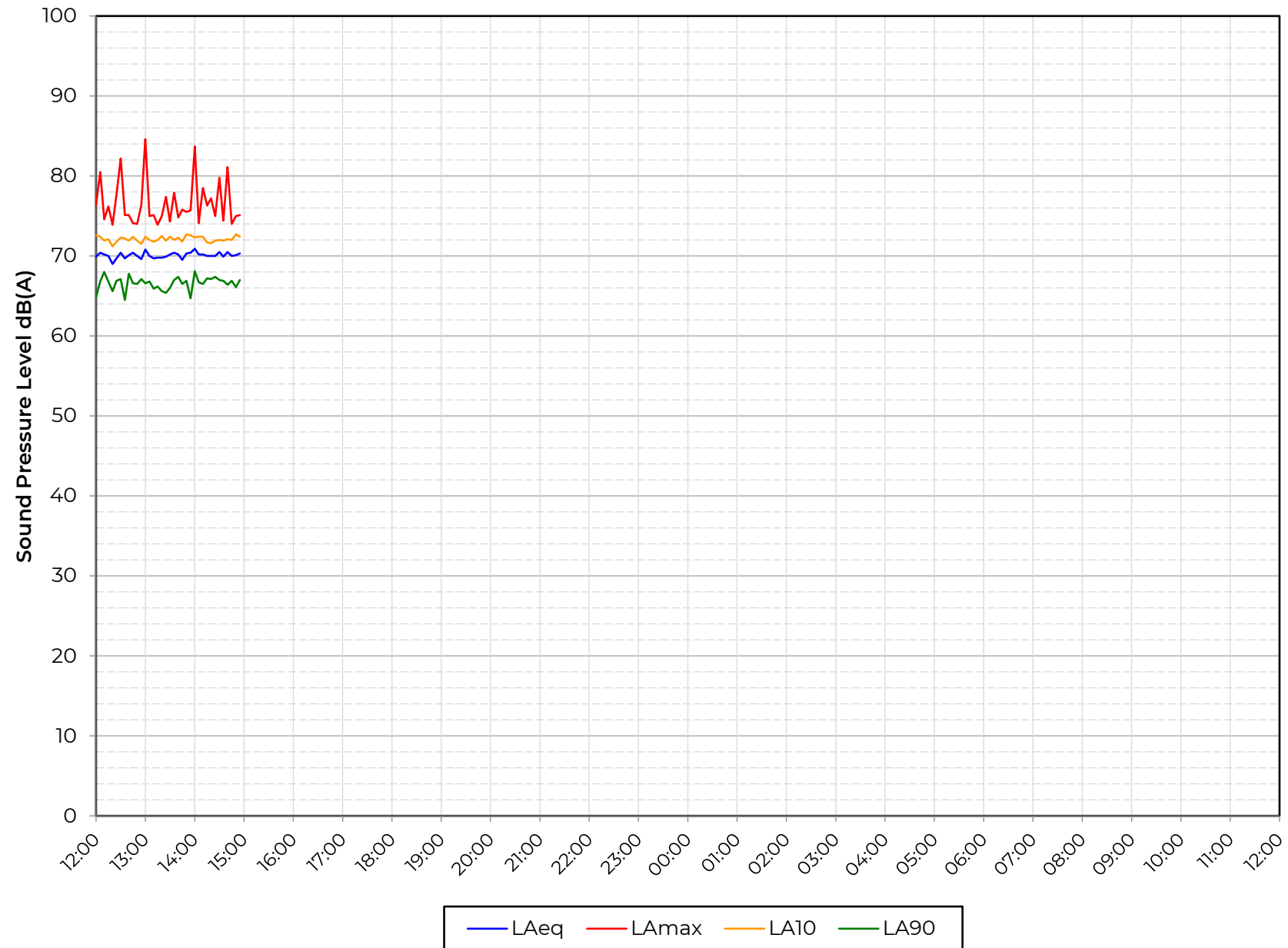
Position 1



Position 1



Position 1



1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A .
L_{eq}:	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90}:	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max}:	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.
R	<i>Sound Reduction Index</i> . Effectively the <i>Level Difference</i> of a building element when measured in an accredited laboratory test suite in accordance with the procedures laid down in BS EN ISO 10140-2:2010 and corrected for its size and the reverberant characteristics of the receive room.
R_w $D_{n,e,w}$	Value of parameter, determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1 to provide a single-figure value.
C, C_{tr}	Spectral adaptation terms to be added to a single number quantity such as $D_{nT,w}$, to take account of the sound insulation within frequency ranges of particular interest.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000
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1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above.

APPENDIX A

ACOUSTIC TERMINOLOGY AND HUMAN RESPONSE TO BROADBAND SOUND

In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.