

Report VA3814.211029.NIA

55 Russell Street, Reading

Noise Assessment For Prior Approval

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**Holloway Cook Limited
Epping House
55 Russell Street
Reading Berkshire
RG1 7XG**

01962 461016
0203 8650332
mail@ventaacoustics.com

registered company no. 10139494

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Attachments

VA3814/SP1	Indicative Site Plan
VA3814/TH1 - TH4	Environmental Noise Time Histories
Appendix A	Acoustic Terminology

1. Introduction

An application is to be made for the change of use of 55 Russell Street, Reading to residential use under the General Permitted Development Order.

Venta Acoustics has been commissioned by Holloway Cook Limited to undertake an assessment of the current environmental noise impact on the site and provide recommendations of acoustic mitigation where required in support of the application.

An environmental noise survey has been undertaken to determine the noise levels incident on the site. These levels are then used to undertake an assessment of the likely impact in accordance with the requirements of the GPDO.

GPDO applications only take into consideration commercial and industrial noise sources affecting potential new receivers, with all other noise sources, such as traffic, excluded from consideration in the application.

However, for the purposes of the client and to provide good acoustic design (as recommended by the ProPG guidance) an assessment of the external building fabric performance has been undertaken with regards to road noise against BS8233 and the WHO Guidelines, which can be utilised in the scheme should the developer wish to do so. It should be highlighted, that this is advisory and not a requirement of the GPDO application.

All staff at Venta Acoustics are fully qualified and members of the Institute of Acoustics, the recognised UK professional body for acoustics, noise and vibration professionals and are fully competent to undertake noise assessments.

2. Design Criterion and Assessment Methodology

2.1 The National Planning Policy Framework (2021)

The revised *National Planning Policy Framework* (NPPF), published in July 2021, sets out the Government's planning policies for England, superseding all previous planning policy statements and guidance.

In respect of noise, the NPPF states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing developments from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution.

Hence, Paragraph 185 states that *planning policies and decisions should also ensure new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- a) *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*
- b) *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*

In regards to the term adverse impact, reference is made to the Noise Policy for England:

2.2 Noise Policy Statement for England (2010)

The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy: to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

This vision is supported by the following aims:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.*

The terms “significant adverse” and “adverse” are related to the following concepts:

- No Observed Effect Level (NOEL) - the level below which no effect on health and quality of life can be detected.
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The guidance acknowledges that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations, but will be different for different noise sources, receptors and times.

In order to enable assessment of impacts in line with these requirements, reference should be made to other currently available guidance.

2.3 WHO Guidelines for Community Noise (1999)

The guidance in this document details suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this document are shown in Table 2.1.

Criterion	Environment	Design range $L_{Aeq,T}$ dB
Maintain speech intelligibility and avoid moderate annoyance, daytime and evening	Living Room	35 dB
Prevent sleep disturbance, night time	Bedrooms	30 dB

Table 2.1 – Excerpt from WHO

[dB ref. 20µPa]

This guidance also states:

For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times a night (Vallet & Vernet 1991).

2.4 BS8233:2014

BS8233 *Guidance on sound insulation and noise reduction for buildings* provides guidance as to desirable internal ambient noise levels for different areas within residential buildings.

The relevant section of the standard is shown below in Table 2.2.

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

Table 2.2 – Excerpt from BS8233:2014 - Indoor ambient noise levels for dwellings

[dB ref. 20µPa]

3. Site Description

As illustrated on attached site plan VA3814/SP1, the building is located to the east of Russell Road in an established residential area. There is an access road leading to parking to the rear of the site.

All surrounding properties are believed to be residential with no commercial or industrial uses identified in the immediate surrounds. The nearest identified commercial noise source is a tyre shop on the corner of Russell Street and Tilehurst Road some 100m to the south.

4. Environmental Noise Survey

4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Thursday 22nd and Monday 26th July 2021 at the location shown in site plan VA3766/SP1. This location was chosen to be representative of the ambient and background noise level incident upon the proposed new noise sensitive receiver.

Continuous 5-minute samples of the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} sound pressure levels were undertaken at each of the measurement locations.

The weather during the survey period was generally dry with light winds, with some rain on the Saturday night. The background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-11586-E0	UCRT20/1565	29/6/20
Larson Davis calibrator	CAL200	13069	UCRT20/1562	26/6/20

Table 4.1 – Equipment used for the tests

The calibration of the sound level meters was verified before and after use with no significant calibration drift observed.

5. Results

The measured sound levels are shown as time-history plots on the attached charts VA3814/TH1-4.

The average and background noise levels for the Daytime and Night-time periods, as measured at the automated monitoring position were:

Monitoring Period	L _{Aeq,T}	L _{A90, typical}
07:00 – 23:00 hours	60 dB	44 dB
23:00 – 07:00 hours	54 dB	33 dB

Table 5.1 – Average ambient and typical background noise levels at measurement locations [dB ref. 20µPa]

¹ The typical L_{A90} value is taken as the 10th percentile of all L_{A90} values measured during the relevant period

6. Commercial Noise Assessment

The noise impact of the nearest commercial premises identified, the tyre fitment centre 100m to the south, has been assessed following the methodology of BS4142: 2014 *Methods for rating and assessing industrial and commercial sound*.

6.1 Source Noise Data

The following noise levels are attributed to activities in and around the workshops:

Noise Source	Measurement Distance	Measured L _{Aeq}	Notes
Wheel Gun	20m	61dB	Works take place inside building
Angle Grinder	10m	70dB	10dB loss applied as used inside
Car manoeuvring out of garage	5m	63dB	-
Air Wrench	10m	58dB	10dB loss applied as used inside

Table 6.1 – Measured and library data noise sources used for assessment

6.2 Acoustic Character Correction

The subjective method of allocating corrections to the sound source has been used following the methodology provided in BS4142:2014.

Noise Source	Subjective Description	Allocated Corrections
Wheel Gun	Clearly perceived impulsive character with intermittent characteristics. High pitched but not tonal at the proposed new dwellings.	Tonality: 0dB Impulsivity: +6dB Intermittency: +3dB
Angle Grinder	Expected to be slightly perceptible above background and intermittent and impulsive in use.	Tonality: +2dB Impulsivity: 0dB Intermittency: +3dB
Car manoeuvring out of garage	Intermittent, not tonal and not impulsive	Tonality: 0dB Impulsivity: 0dB Intermittency: +3dB
Air Wrench	Impulsive noise from occurring intermittently	Tonality: 0dB Impulsivity: +6dB Intermittency: +3dB

Table 6.2 – Acoustic character corrections

These penalties are applied to the specific noise level in section 6.3 to obtain the rating noise level.

6.3 Rating Noise Level and Assessment

The rating noise levels at the assessment locations are compared against the relevant background noise levels to assess the notional significance of the noise impact as follows. Operations are adjusted to the appropriate on times.

6.3.1 Wheel Gun

Results		Relevant Clause	Commentary
Source Sound Levels	61dB @ 20m	7.3.4	Library Data
Distance Loss (100m)	-14dB	7.3.5	Assumed a point source
Screening	-5 dB		No line of sight due to intermediate buildings
Specific Sound Level	L_{Aeq} 42dB		
Assume operation 2mins	-15dB	7.2	Not in constant operation
Acoustic feature correction	+9 dB	9.2	+6 dB for Impulsivity, +3dB for intermittency
Rating level	L_{Ar} 36 dB	9.2	
Day time background sound level	L_{A90} 44 dB	8	
Excess of rating over background sound level	-8 dB	11	
Assessment indicates low adverse impact		11	Depending on context

Table 6.3 – BS4142 Assessment of wheel gun in workshop

6.3.2 Angle Grinder

Results		Relevant Clause	Commentary
Source Sound Levels	70dB @ 10m	7.3.4	Library Data
Distance Loss (100m)	-20dB	7.3.5	Assumed a point source
Screening	-5 dB		No line of sight due to intermediate buildings
Specific Sound Level	L _{Aeq} 45dB		
Assume operation 5mins	-11dB	7.2	Used occasionally
Acoustic feature correction	+5 dB	9.2	+2 for tonality, +3dB for intermittency
Rating level	L _{Ar} 39 dB	9.2	
Day time background sound level	L _{A90} 44 dB	8	
Excess of rating over background sound level	-5 dB	11	
Assessment indicates low impact		11	Depending on context

Table 6.4 – BS4142 Assessment of angle grinder in workshop

6.3.3 Car Manoeuvring

Results		Relevant Clause	Commentary
Source Sound Levels	63dB @ 5m	7.3.4	Library Data
Distance Loss (100m)	-26dB	7.3.5	Assumed a point source
Screening	-5 dB		No line of sight due to intermediate buildings
Specific Sound Level	L _{Aeq} 32dB		
Assume operation 10mins	-8dB	7.2	
Acoustic feature correction	+3 dB	9.2	+3dB for intermittency
Rating level	L _{Ar} 27 dB	9.2	
Day time background sound level	L _{A90} 44 dB	8	
Excess of rating over background sound level	-17 dB	11	
Assessment indicates low impact		11	Depending on context

Table 6.5 – BS4142 Assessment of car manoeuvring out of the workshop

6.3.4 Air Wrench

Results		Relevant Clause	Commentary
Source Sound Levels	58dB @ 10m	7.3.4	Library Data
Distance Loss (100m)	-20dB	7.3.5	Assumed a point source
Screening	-5 dB		No line of sight due to intermediate buildings
Specific Sound Level	L _{Aeq} 33dB		
Assume operation 10mins	-8dB	7.2	Used occasionally
Acoustic feature correction	+9 dB	9.2	+6 dB for Impulsivity, +3dB for intermittency
Rating level	L _{Ar} 34 dB	9.2	
Day time background sound level	L _{A90} 44 dB	8	
Excess of rating over background sound level	-10 dB	11	
Assessment indicates low impact		11	Depending on context

Table 6.6 – BS4142 Assessment of air wrench in workshop

6.4 Context

The BS4142 standard aims to cover a wide variety of situations under the same base assessment methodology and so has some inherent shortcomings. To allow for this, the guidance encourages consideration of the site context as a means of adapting the base assessment to specific scenarios.

This is a proposal to introduce new residential elements in an established residential neighbourhood with no immediate commercial uses. The nearest commercial use is at a significant distance located on a busy road

The existing residential elements mean that the proposals would not introduce any new restrictions on the existing business.

The assessment indicates a low impact from the nearest commercial uses.

6.5 Uncertainty

This section considers the variable in the assessment that may cause variations within the final results and describes how these have been addressed.

- Use of Class 1 sound level meters is considered to reduce instrument error to insignificant levels as compared with environmental variations. The calibration of the instrumentation was confirmed before and after the noise surveys.
- The measurement location was selected to be representative of the background noise levels expected to be experienced by the proposed dwellings without being unduly influenced by extraneous noise sources.
- Where library data has been used, propagation calculations have been used to correct noise levels to the relevant distance at the receiver.
- Given the resultant noise impact levels being well below the background noise levels, reasonable levels of uncertainty in the predictions are unlikely to change the findings of the assessment.

Overall, the uncertainty is considered to have been minimised to a suitable range so as not to risk significant variations in the impact assessment of typical operations.

7. Traffic Noise Assessment

GPDO applications only take into consideration commercial and industrial noise sources affecting potential new receivers, and does not include for traffic noise.

However, for the purposes of the client and provide good acoustic design (as recommended by the ProPG guidance) an assessment of the external building fabric performance has been undertaken with regards to road noise against BS8233 and the WHO Guidelines, which can be utilised in the scheme should the developer wish to do so. It should be highlighted, that this is advisory and not part of, or a requirement of, the GPDO application.

A review of the architectural drawings for the proposed scheme has been undertaken.

7.1.1 Sound Reduction Performances of Building Elements

It has been assumed that all the non-glazed elements, i.e. walls and roof systems, will be capable of providing the following minimum sound insulation performance, when tested in accordance with BS EN ISO 10140-2:2010 *Acoustics - Laboratory measurement of sound insulation of building elements – Part 2: Measurement of airborne sound insulation*.

Building Element	Single figure weighted sound reduction index, dB
Masonry	R _w 51

Table 7.1 – Assumed sound reductions performances of non-glazed elements

7.1.2 Sound Reduction Performance of Windowsets and Vents

The monitoring data along with the architectural drawings have been used to calculate the required sound insulation performance for the windowsets (glazing and frame combination) and open ventilators for the building. These are summarised in Table 7.2 below.

Glazing Location	Required Glazing SRI, dB	Ventilator Performance, dB
Front (West)	R _w 30	D _{n,e,w} 31
Rear (South)	R _w 27	D _{n,e,w} 31

Table 7.2 – Required minimum sound reduction indices for glazing and ventilators

It is important that the performance shown in Table 7.2 are achieved by the entire windowset including frames, ventilators, seals, etc. Glass performance alone would not be likely to show compliance with the specification as the other elements typically provide the weakest noise transmission path.

7.1 Ventilation

In order to maintain the internal noise levels, the ventilation scheme for the dwellings should ensure that the appropriate air changes can be achieved, in line with Part F of the building regulations and with consideration of summer overheating, without reliance on windows being open.

It is expected that attenuated means of background ventilation will be required. If trickle vents are used the performance shown in Table 7.2 will be required. The figures stated are for a single vent per room. The ventilator performances provided would need to be achieved with the vents open.

If multiple vents are required, then the performance requirement shown in Table 7.2 will increase by a value equal to $+10\log(N)$, with N being the total number of vents serving the room.

It should be noted that there is no reason why windows could not be opened as a matter of personal preference or for purge ventilation.

With the above recommendations implemented, the noise levels within the proposed dwellings would be expected to be in line with recommendations given in the WHO 1999 and BS8233:2014 guidance. Internal noise levels can therefore be considered to be between the NOEL the LOAEL levels.

8. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the noise climate in the locality of 55 Russel Street, Reading.

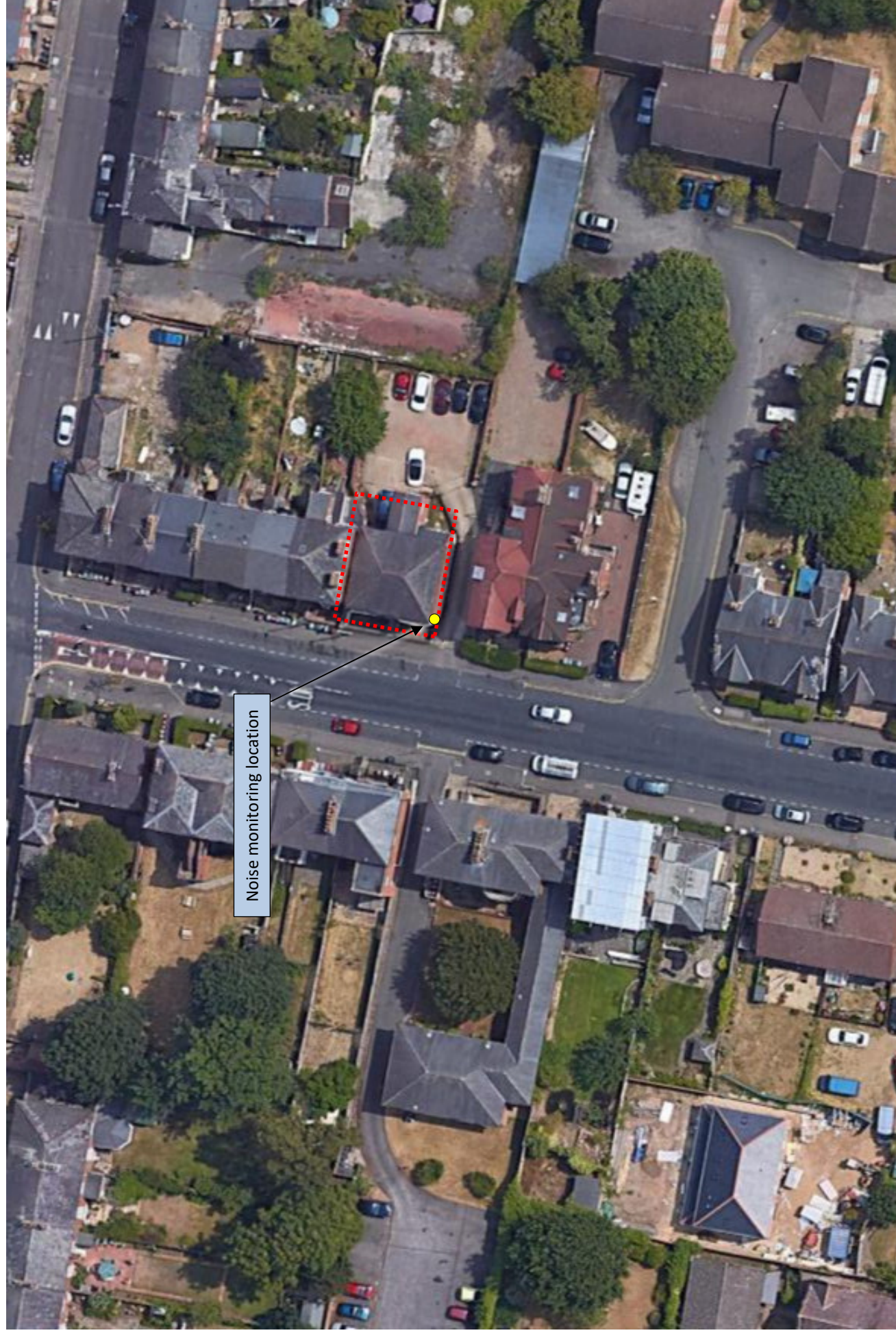
The measured noise levels have been assessed against BS8233: 2014 *Guidance on sound insulation and noise reduction for buildings* and the World Health Organisation *Guidelines for Community Noise* (1999), with adjustments made to the noise source in accordance with the guidance in ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

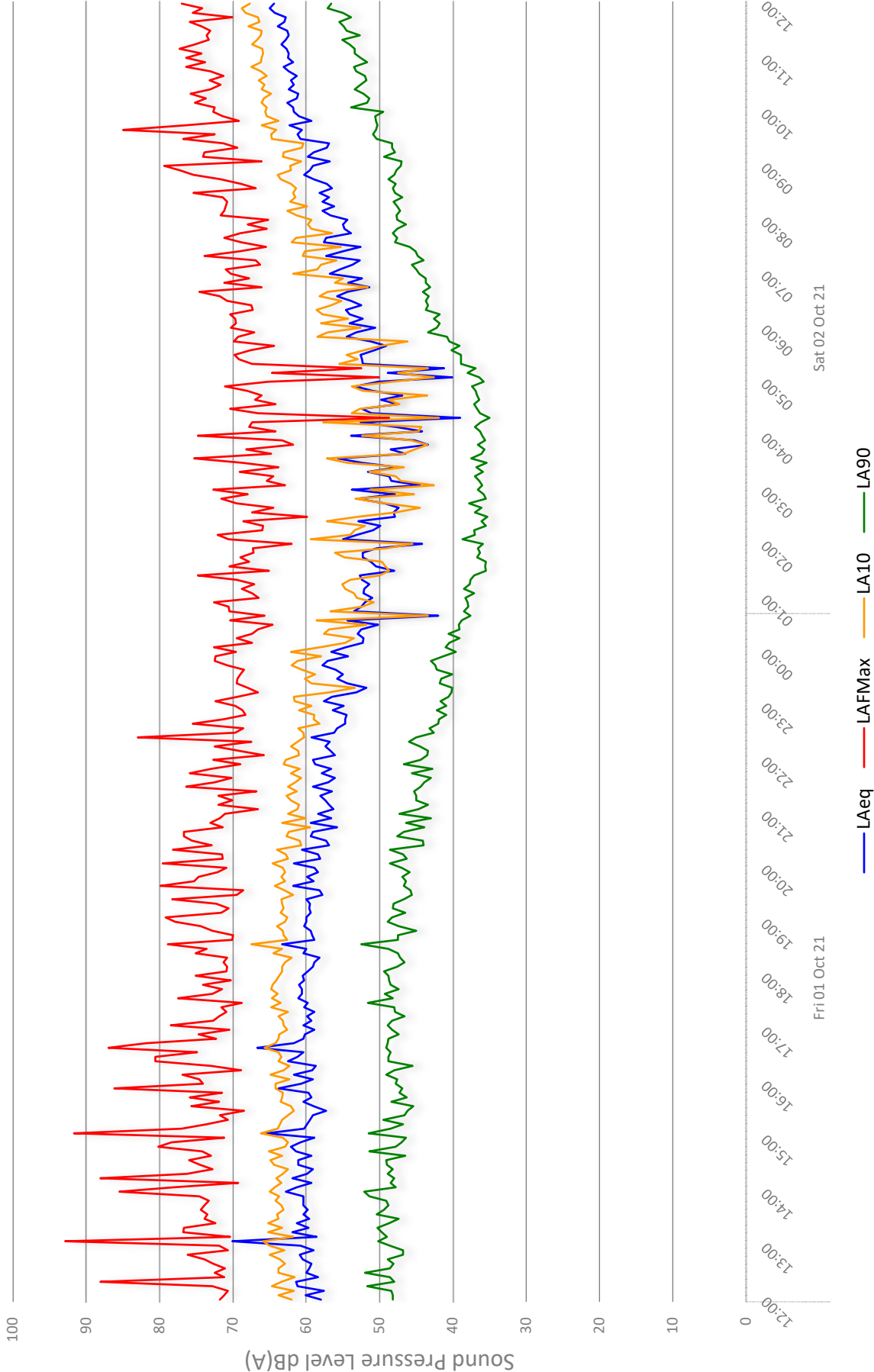
There are no commercial noise sources in the immediate locality. The noise impact of the nearest identified commercial use has been assessed and found to have a low impact.

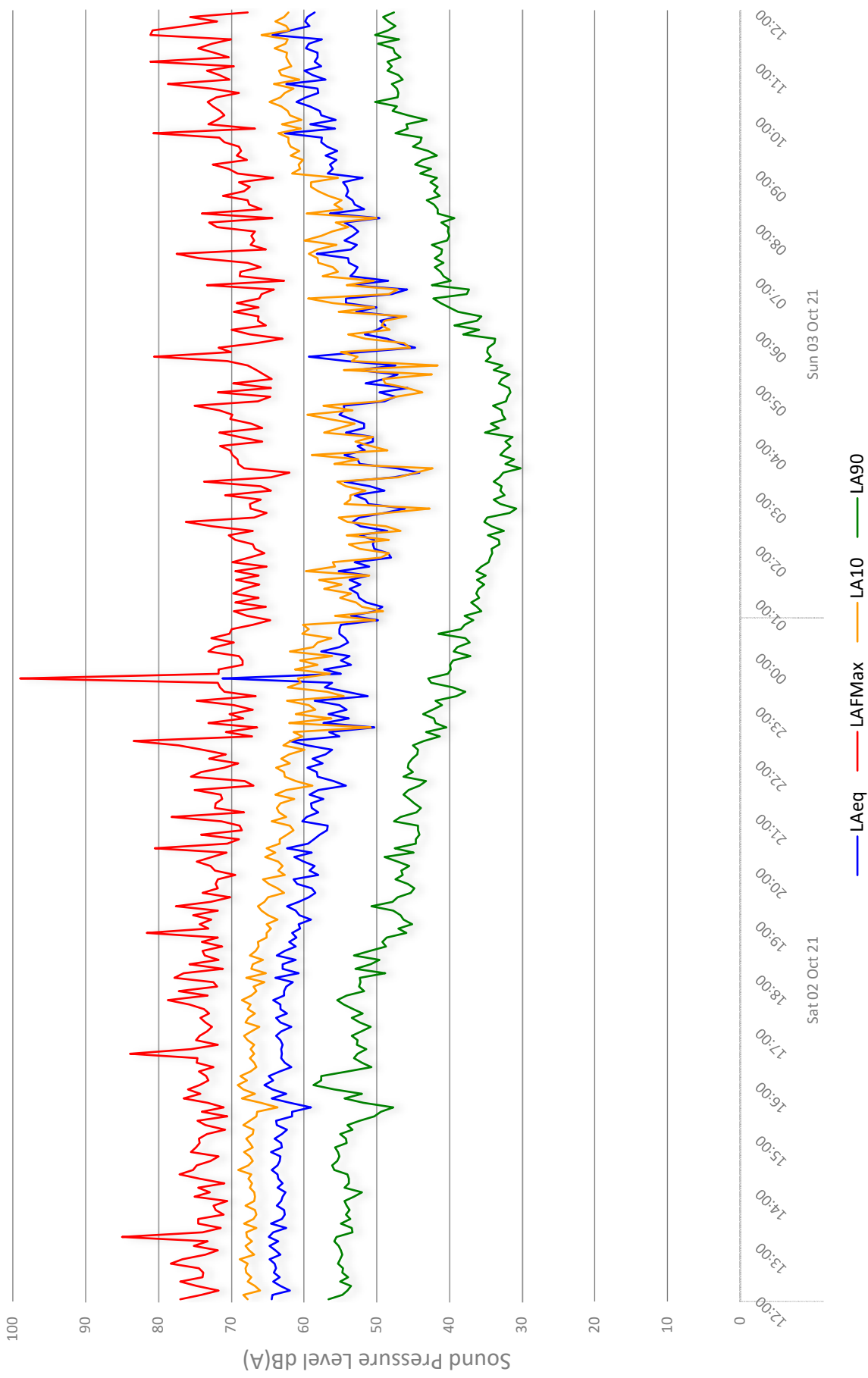
While not a requirement for GPDO applications, a review of traffic noise in the locality and recommendations of glazing to provide suitable internal noise levels has been provided.

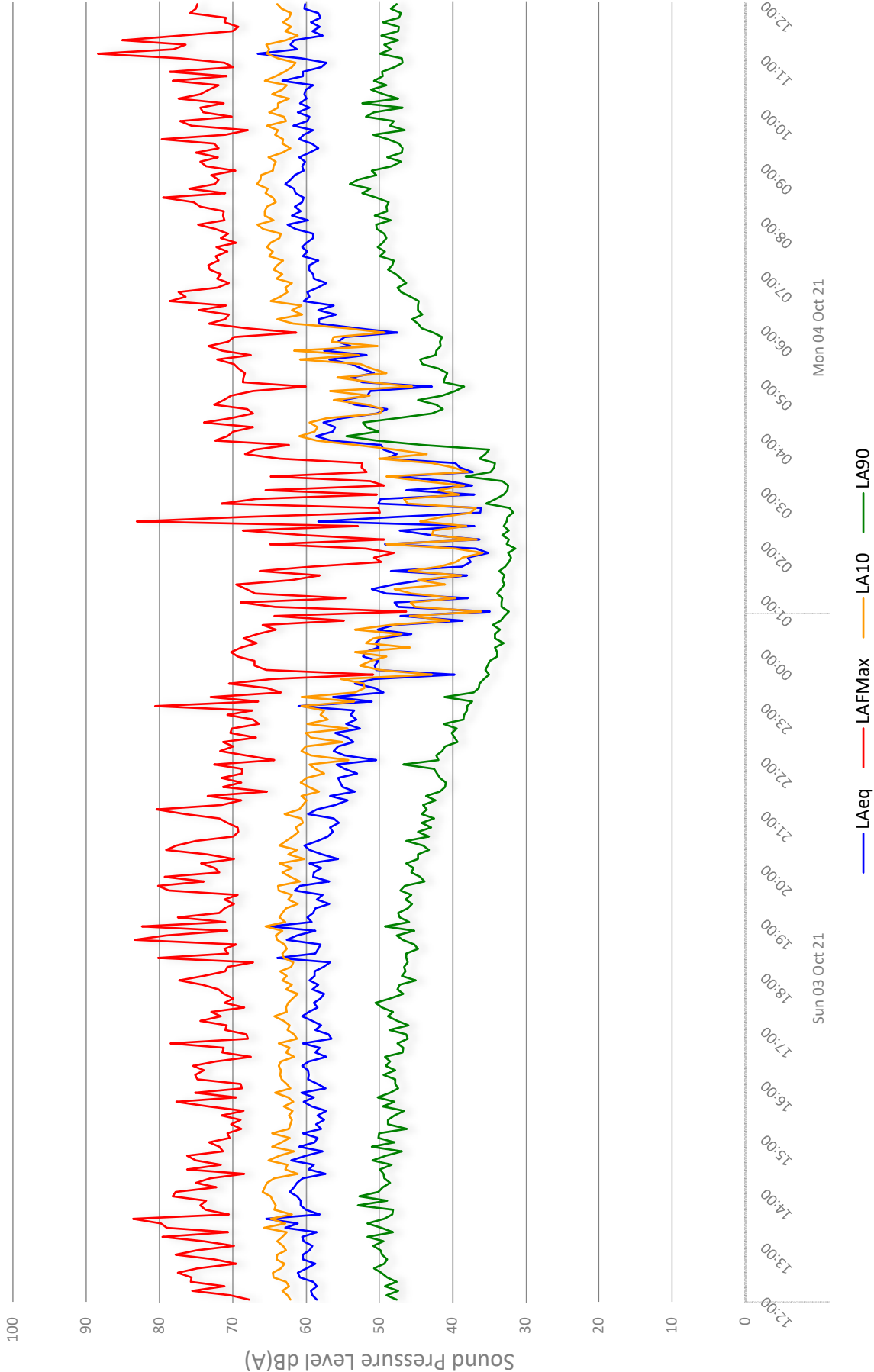
The proposed scheme is not expected to experience a significant adverse noise impact and the site is considered acceptable for the proposed residential use under the requirements of GPDO.

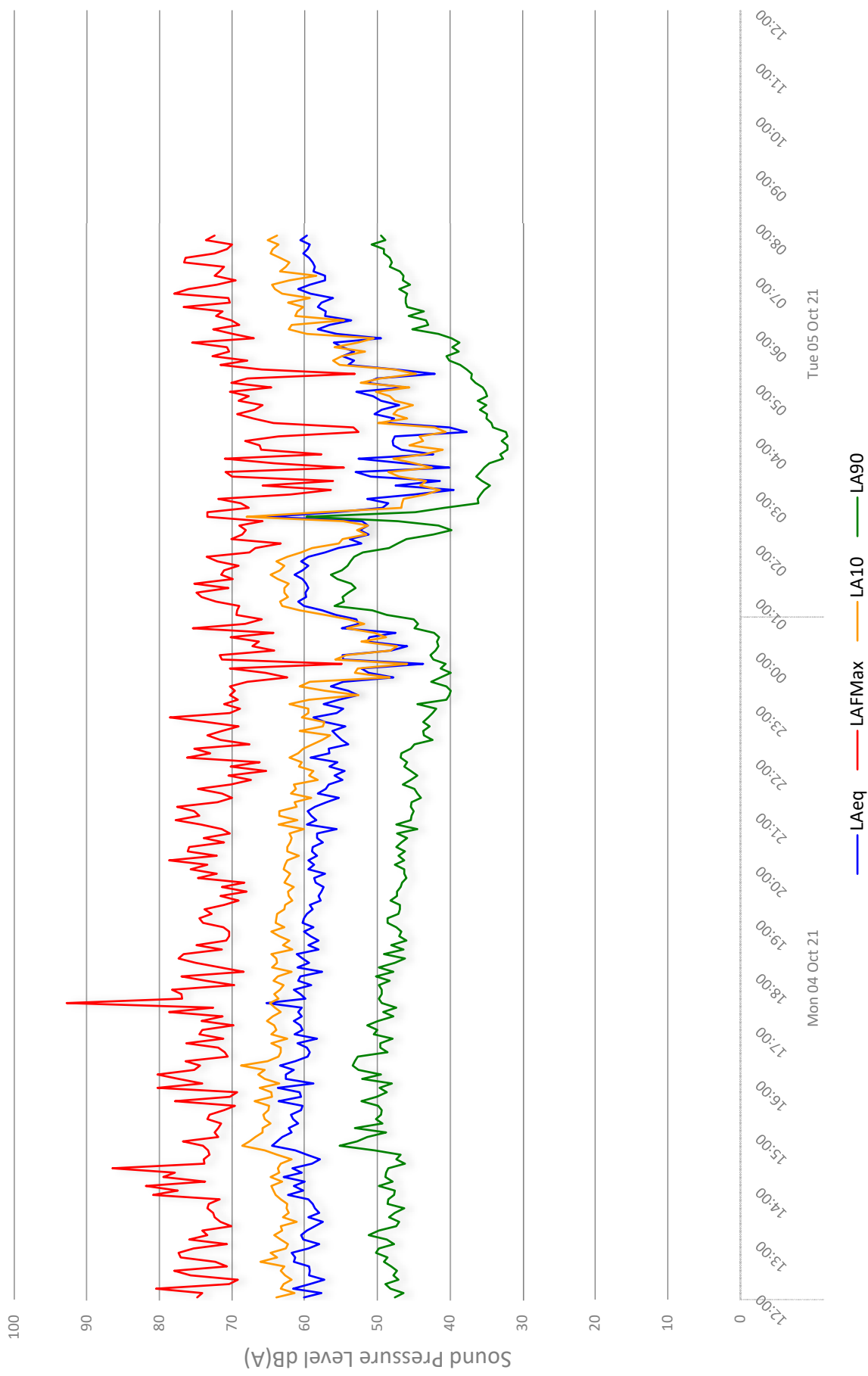
Steven Liddell MIOA











Acoustic Terminology & Human Response to Broadband Sound

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 . 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).
L_{eq} :	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.

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.

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. 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.