

Report VA4509.230228.NIA

13-16 Market Place, Reading

Noise Impact Assessment

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Attachments

VA4509/SP1	Indicative Site Plan
VA4509/TH1-TH8	Environmental Noise Time Histories
Appendix A	Acoustic Terminology

1. Introduction

It is proposed to partially demolish and redevelop the site with commercial use at ground floor level and residential dwellings from first to fourth floor level at 13-16 Market Place, Reading.

Venta Acoustics has been commissioned by Danks Badnell to undertake an assessment of the current environmental noise impact on the site and provide recommendations of acoustic mitigation where required in support of an application for planning permission.

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 National Planning Policy Framework with reference to relevant standards, guidance and the planning requirements of Reading Borough Council.

Outline mitigation measures are considered and an appraisal of the requirements of external building fabric elements are provided where appropriate.

2. Guidance and Legislation

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).

For outdoor living areas, it is stated that:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB LAeq on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB LAeq. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.

For sleep disturbance, i.e. in bedrooms at night, the NOEL can, therefore, be taken as anything below 30dB(A), whilst the onset of the LOAEL occurs at 30dB(A) and above. The SOAEL cannot be inferred from this information.

During daytime periods, for avoidance of annoyance, the NOEL relates to anything up to 50dB(A) (typically applied to external areas, such as gardens), whilst the onset of the LOAEL occurs at 50dB(A) and above.

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 LAeq, 16 hour	-
Dining	Dining Room	40 dB LAeq, 16 hour	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq, 16 hour	30 dB LAeq, 8 hour

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

[dB ref. 20µPa]

For external areas the standard states the following:

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 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments.

However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

2.5 Reading Borough Council Requirements

The Council have advised that they would require an assessment of noise and vibration transmission from the ground floor Class E use to the upper floors to ensure that future residents are suitably protected from the commercial noise.

2.6 BS4142:2014+A1:2019

British Standard BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations comprising mechanical and/or electrical plant and equipment;

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation. A correction factor is added to this level to account for the acoustic character of the sound as follows:

Tonality – A correction of up to 6dB depending on the prominence of tones;

Impulsivity - A correction of up to 9dB depending on the prominence of impulsivity;

Other sound characteristics - A 3dB correction may be applied where a distinctive acoustic character is present that is neither tonal nor impulsive;

Intermittency - A 3dB correction may be applied where the specific sound has identifiable on/off conditions.

An estimate of the impact of the source is obtained by subtracting the typical background noise level from the corrected Specific Sound Level.

- Typically, the greater this difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB could be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context.

3. Site Description

As illustrated on attached site plan VA4509/SP1, the building is to the east of Market Place with the front of the building overlooking Market Place and the rear of the building overlooking a small access road accessed via Abbey Square.

Market Place is predominantly commercial and retail in nature, with some residential uses overlooking Market Place.

The dominant noise source expected to affect the site is road traffic noise

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 Friday 24th and Monday 27th February 2023 at the locations shown in site plan VA4509/SP1. These locations were chosen to be representative of the background noise level at the proposed new dwellings.

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. 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-12202-E0	UCRT23/1146	1/2/23
NTi Class 1 Integrating SLM	XL2	A2A-15993-E0	UCRT21/1390	22/3/21
Larson Davis calibrator	CAL200	19816	44622-19816-CAL200	2/3/22

Table 4.1 – Equipment used for the survey

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

4.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA4509/TH1-4 for position 1 and VA4509/TH5-8 for position 2.

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

Monitoring Period	L _{Aeq,T}	
	Position 1	Position 2
07:00 – 23:00 hours	61 dB	52 dB
23:00 – 07:00 hours	56 dB	49 dB

Table 4.2 – Average ambient noise levels at measurement locations

[dB ref. 20µPa]

The typical night time L_{Amax} events were recorded to be in the order of 76dB L_{Amax,fast} at the front, falling to 64dB L_{Amax,fast} at the rear of the building.

5. Commercial Noise Assessment

Investigation of the surrounding area was made during the site visits. No nearby commercial or industrial noise sources were identified that directly affect this site.

There is a small Tesco supermarket located at 4-5 Market Place, but deliveries to this business are via an enclosed underground carpark/loading bay accessed to the rear of the site, and so would not affect the building.

Inspection of the time histories show a typical diurnal pattern for noise in a city centre location, with noise levels falling during the evening into the night-time as traffic reduces, and then increasing in the morning around the time of the morning rush hour.

6. Internal Noise Assessment

A review of the Danks Bagnell drawings for the proposed scheme has been undertaken with the intent of achieving the internal noise levels from average and maximum noise levels stated in BS8233 and the WHO Guidelines.

6.1 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 6.1 – Assumed sound reductions performances of non-glazed elements

6.2 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 6.2 below.

Glazing Reference	Required Glazing SRI, dB	Ventilator Performance, dB
Front – Living Rooms	R_w 30	$D_{n,e,w}$ 30
Front – Bedrooms	R_w 32	$D_{n,e,w}$ 33
Rear	$<R_w$ 27	Non acoustic trickle vent

Table 6.2 – Required minimum sound reduction indices for glazing and ventilators

At the rear of the site, it is expected that high quality thermal double glazing would meet the required sound reduction performance.

In order that windows may remain closed to maintain the internal noise levels, it is expected that attenuated means of background ventilation will be required. If trickle vents are used the performance shown in Table 6.2 will be required. The figures stated are for a single vent per room. If multiple vents are required, then the performance requirement shown in Table 6.2 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.

It is important that the performance shown in Table 6.2 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.

The ventilator performances provided would need to be achieved with the vents open. Should this performance not be achievable, a mechanical ventilation solution may be required.

Passive ventilators alone may not provide sufficient air flow for summer overheating, which should be evaluated by a suitably qualified thermal engineer.

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.

6.3 Areas of External Amenity

There look to be a few balconies located to the rear of the building. In this area, external noise levels comply with the World Health Organisation guideline value for external amenity of $L_{Aeq,16hour}$ 55dB. No mitigation measures are deemed necessary in relation to external noise levels.

The outdoor noise levels across the site can therefore be considered to fall between the LOAEL and SOAEL levels, generally being below the level that is expected to cause significant annoyance.

7. Commercial to Residential Sound Insulation Review

Due to the breadth and variety of potential uses that fall within Class E, it is not practical to second guess all potential uses, and to protect from the most extreme examples, such as a night-club, which

may not even be possible, and would incur considerable cost for the applicant whilst potentially not being necessary.

Instead, it is recommended that the building is constructed in a manner that provides a high level of sound insulation that would protect future residents from the majority of noisier uses, such as restaurants and takeaways. However, the leasehold should include a requirement that if a loud use, such as a pub or a gym wanted to lease the ground floor space, then they would have to implement suitable noise mitigation works, and undertake sound insulation testing to demonstrate compliance with this requirement, so maintain the protection to future residents.

7.1 Floor Construction

The floor construction between ground and first floor level at the front of the building is currently formed of a deep (approximately 300mm) joist, located at a great ceiling height.

It is assumed that the rest of the floors will be constructed in a lightweight construction.

A construction such as the following should be implemented to maximise the performance of the compartment floor.

- New floating floor system installed over floor deck
- 22mm T+G deck
- 22mm concrete particle board
- Existing joists
- 200mm mineral wool between joists
- Ceiling lining suspended on metal frame system with Mason UK LDS isolating hangers (or equivalent);
- Minimum cavity depth – 500mm. 100mm medium density ($\approx 40\text{kg/m}^3$) mineral wool batts in cavity
- New isolated suspended ceiling lining comprising 2 no. layers 15mm dense plasterboard (minimum mass 11kg/m^2 per board), joints staggered and skimmed

These proposals, and associated flanking detailing, are illustrated in the following figure.

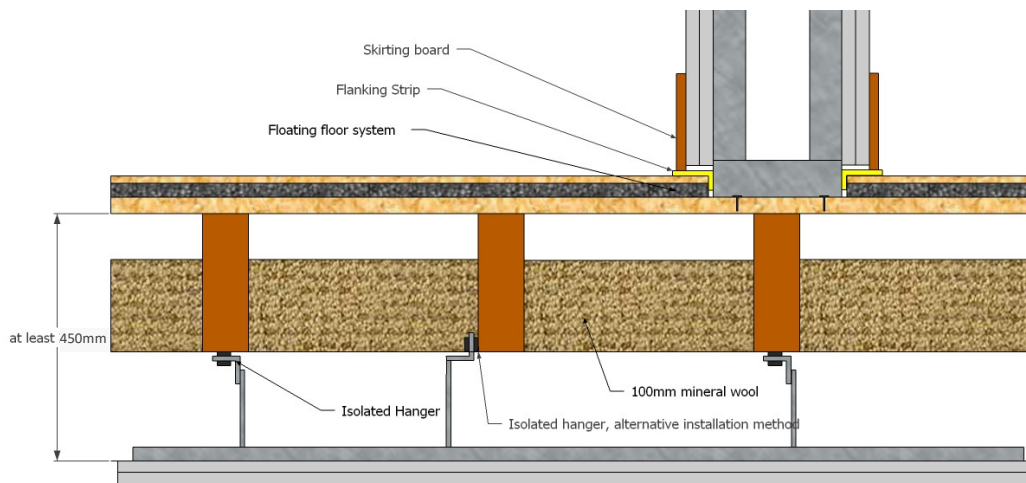


Figure 7.1 – Proposed ground floor / first floor construction

Improvements to sound insulation within existing building constructions often poses a substantial design and workmanship challenge. Given the high standard of sound insulation required to control high noise levels noise to a standard suitable for residential occupation in the adjacent spaces, very careful control of flanking sound will be delivered to ensure that the sound insulation performance of the above ceiling construction is not significantly degraded.

Continuous walls and columns at ground and first floors will be independently drylined to control flanking sound transmission. The lining constructions are as follows:

- Independent studwork, 10mm standoff from wall;
- 2 no. 12.5mm gypsum board drylining (density $\geq 10 \text{ kg/m}^2$ per board);
- $\geq 70\text{mm}$ cavity between inside of lining and wall / column;
- Cavity filled with mineral wool batts (density $\geq 40 \text{ kg/m}^3$).

Should downlighters be installed, these must not penetrate the ceiling, and instead be installed within a secondary ceiling hung below the new construction.

The proposed floor / ceiling construction, in combination with the associated flanking detailing, is expected to be capable of delivering an airborne sound insulation performance of around $D_{nT,w} + C_{tr} 55\text{-}60 \text{ dB}$.

Noise levels typical for a busy restaurant, with low level ambient music providing modest low frequency content, would typically be around $L_{Aeq} 75\text{-}80 \text{ dB}$.

On this basis, transmitted levels of noise into residential rooms above will be in the region of $L_{Aeq} 18 \text{ dB} / \text{NR10}$, which would not be expected to disturb the residents above.

Should a heavyweight construction be proposed for the new construction, the use of a 200mm dense concrete slab with isolated ceiling below would be expected to provide a similar level of protection.

Should a louder use, such as a gym or a pub wish to occupy the space, it is recommended that they need to demonstrate to the leaseholder that noise from their demise will be controlled to less than $L_{Aeq} 20dB/NR15$ in the apartments above. The tenant should undertake the works to achieve this, and provide evidence of sound insulation or commissioning tests showing that noise levels when they are operational do not exceed these levels.

8. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the prevailing noise climate in the locality of 13-16 Market Place, Reading in support of a planning application for the proposed development of new residential dwellings.

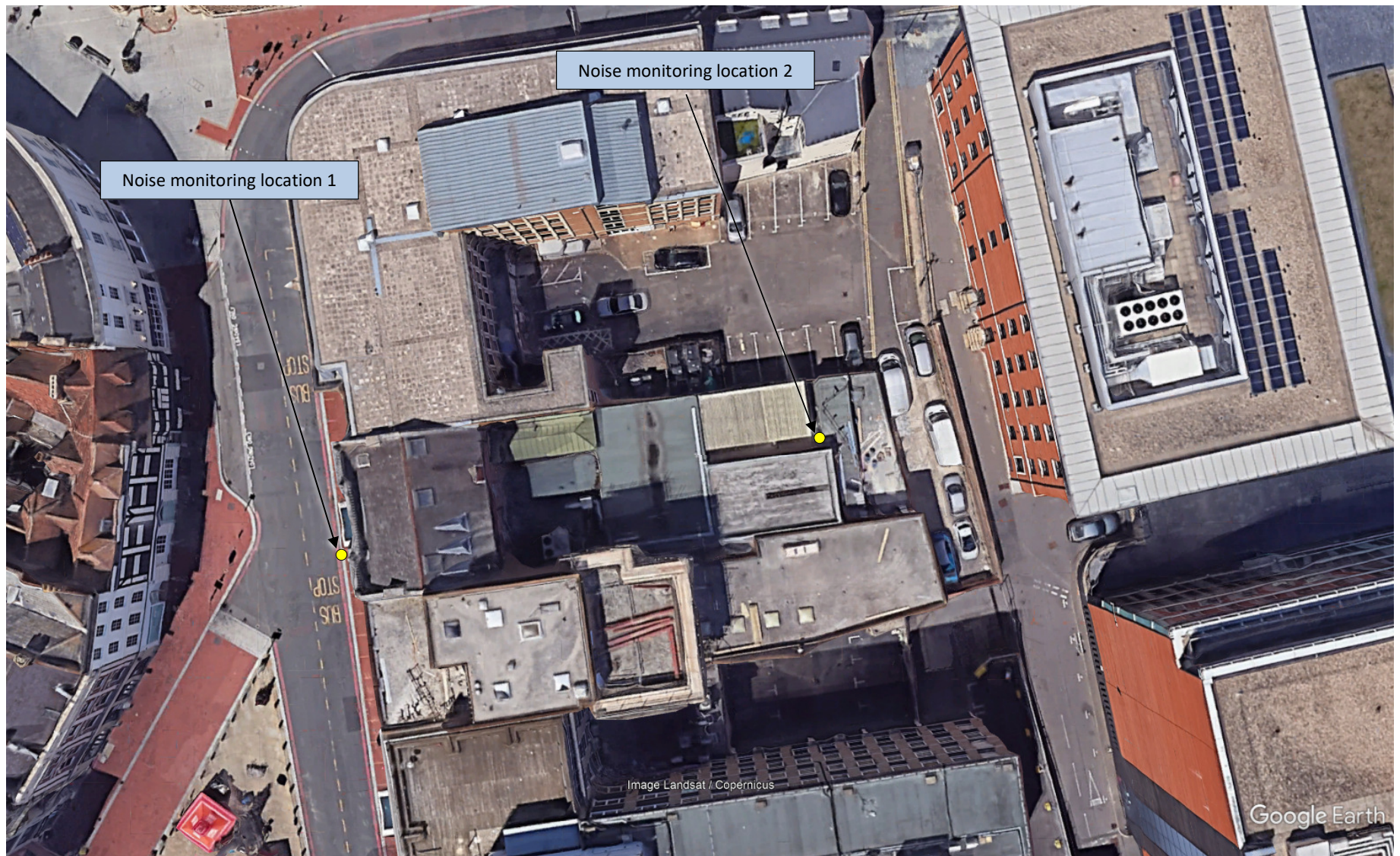
The measured levels have been assessed against the National Planning Policy Framework and currently available standards and guidance documents including World Health Organisation *Guidelines for Community Noise* (1999) and BS8233:2014 *Guidance on sound Insulation and noise*.

Appropriate external and internal noise criteria have been considered to minimise adverse impacts on health and quality of life as a result of the new development. Appropriate mitigation measures have been outlined including proprietary thermal double-glazing and trickle vents.

A discussion of the sound insulation between the ground floor commercial use and first floor residential uses has been included, along with recommendations to suitably protect future residents through the floor.

With the above measures adopted, the proposed scheme is not expected to experience a significant adverse noise impact and the site is considered acceptable for the proposed residential use.

Jamie Duncan MIOA



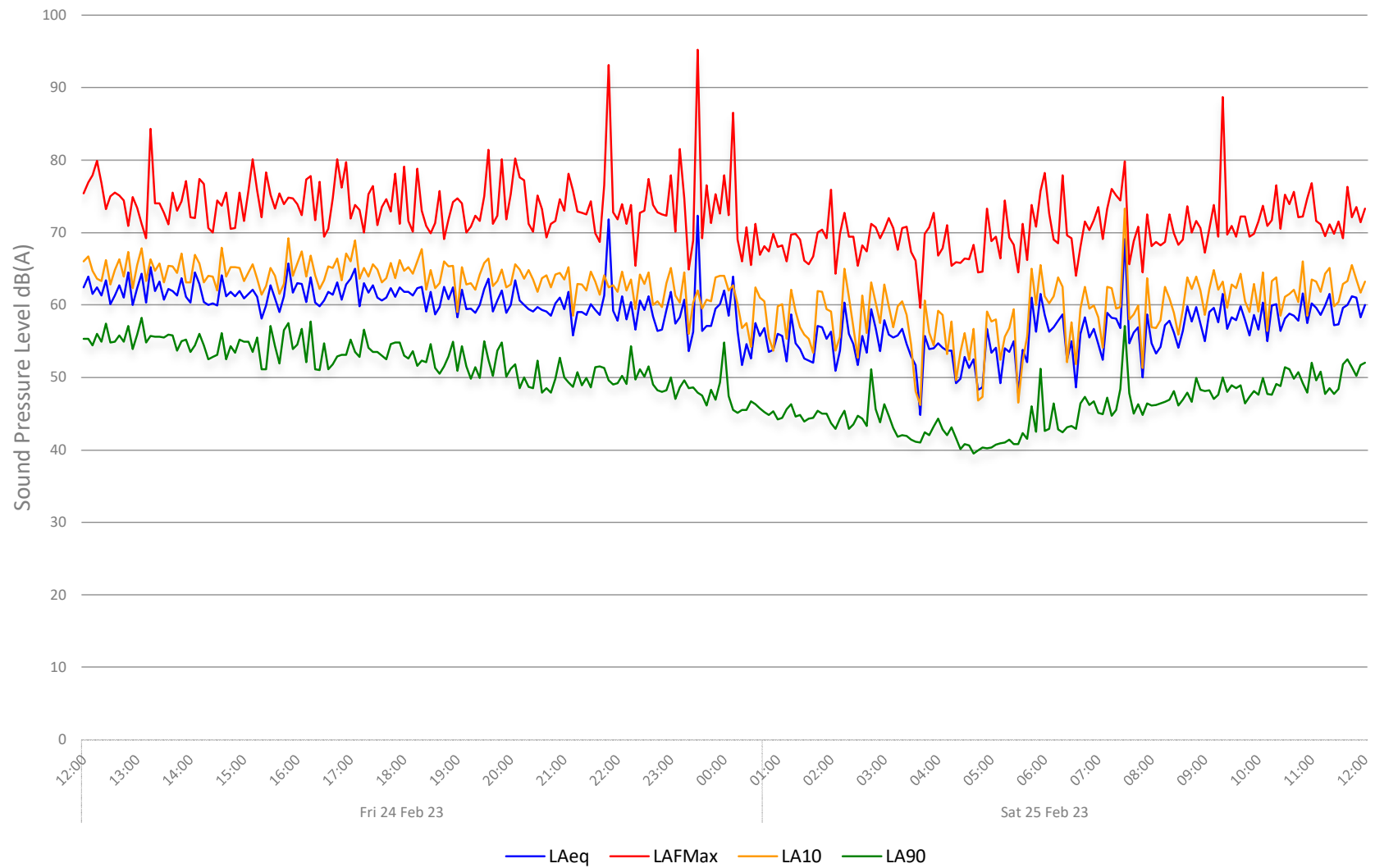
13-16 Market Place, Reading

Environmental Noise Time History: 1

Position 1

 **VENTA** ACOUSTICS

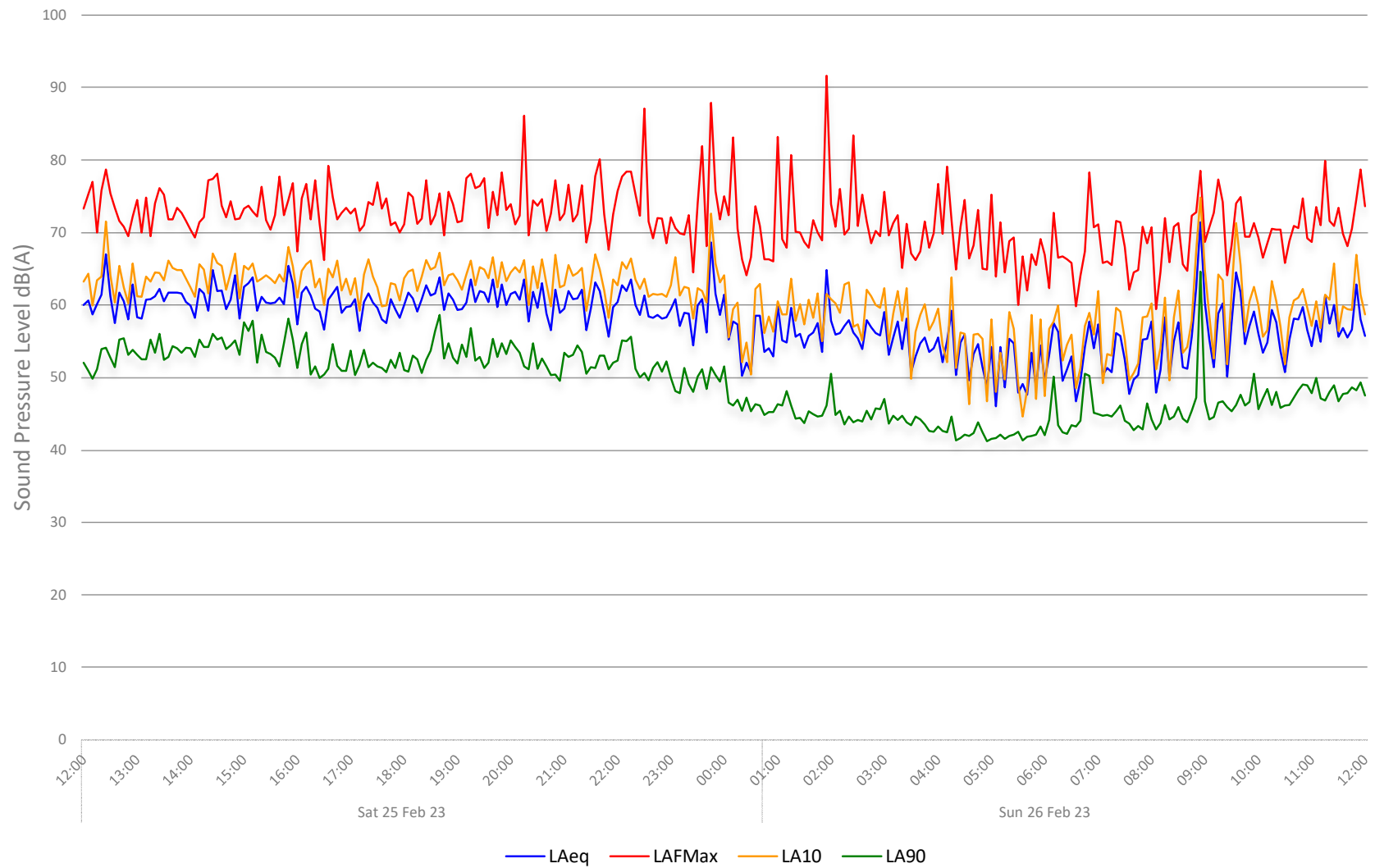
Figure VA4509/TH1



13-16 Market Place, Reading
Environmental Noise Time History: 2
Position 1



Figure VA4509/TH2



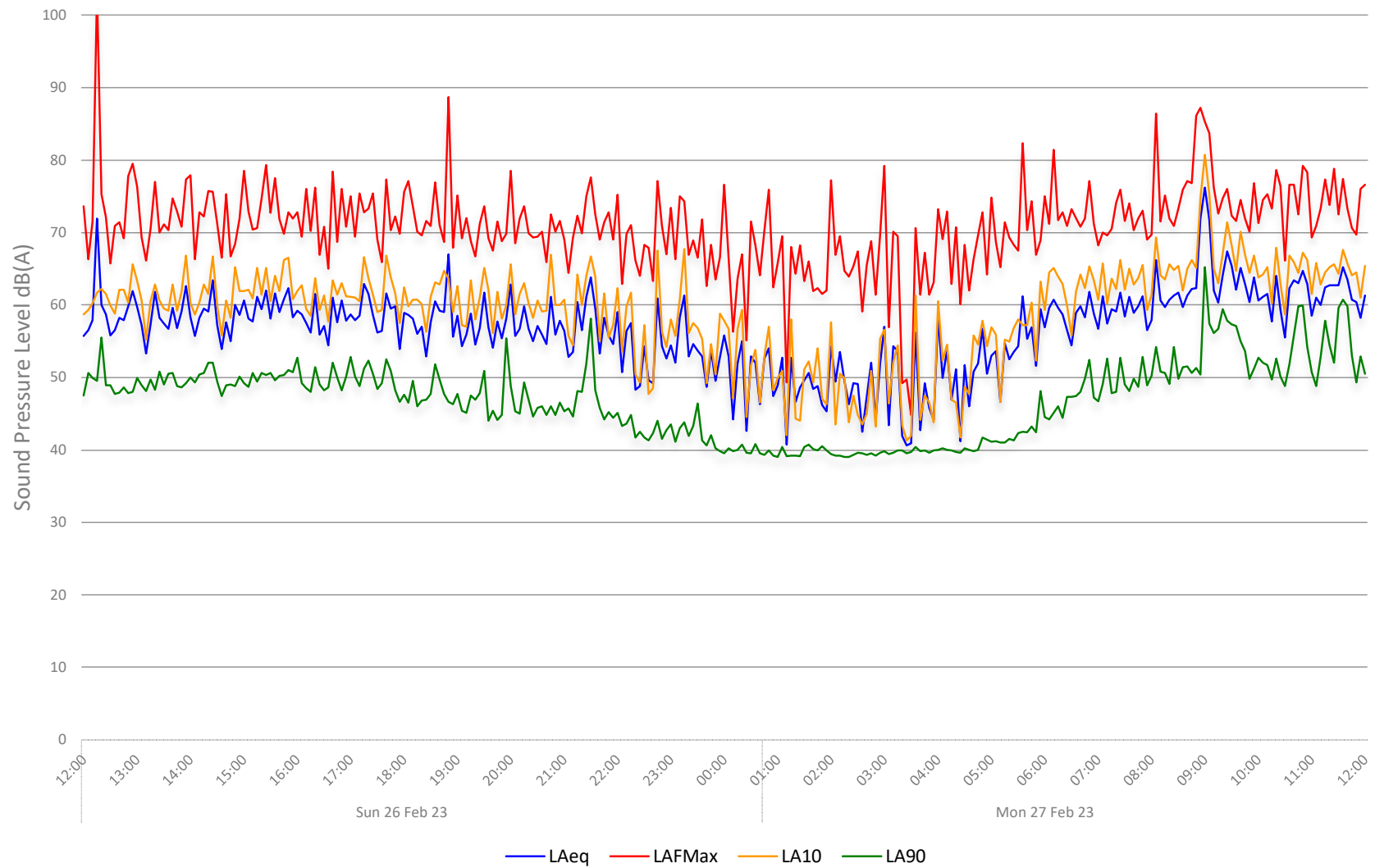
13-16 Market Place, Reading

Environmental Noise Time History: 3

Position 1

 **VENTA** ACOUSTICS

Figure VA4509/TH3



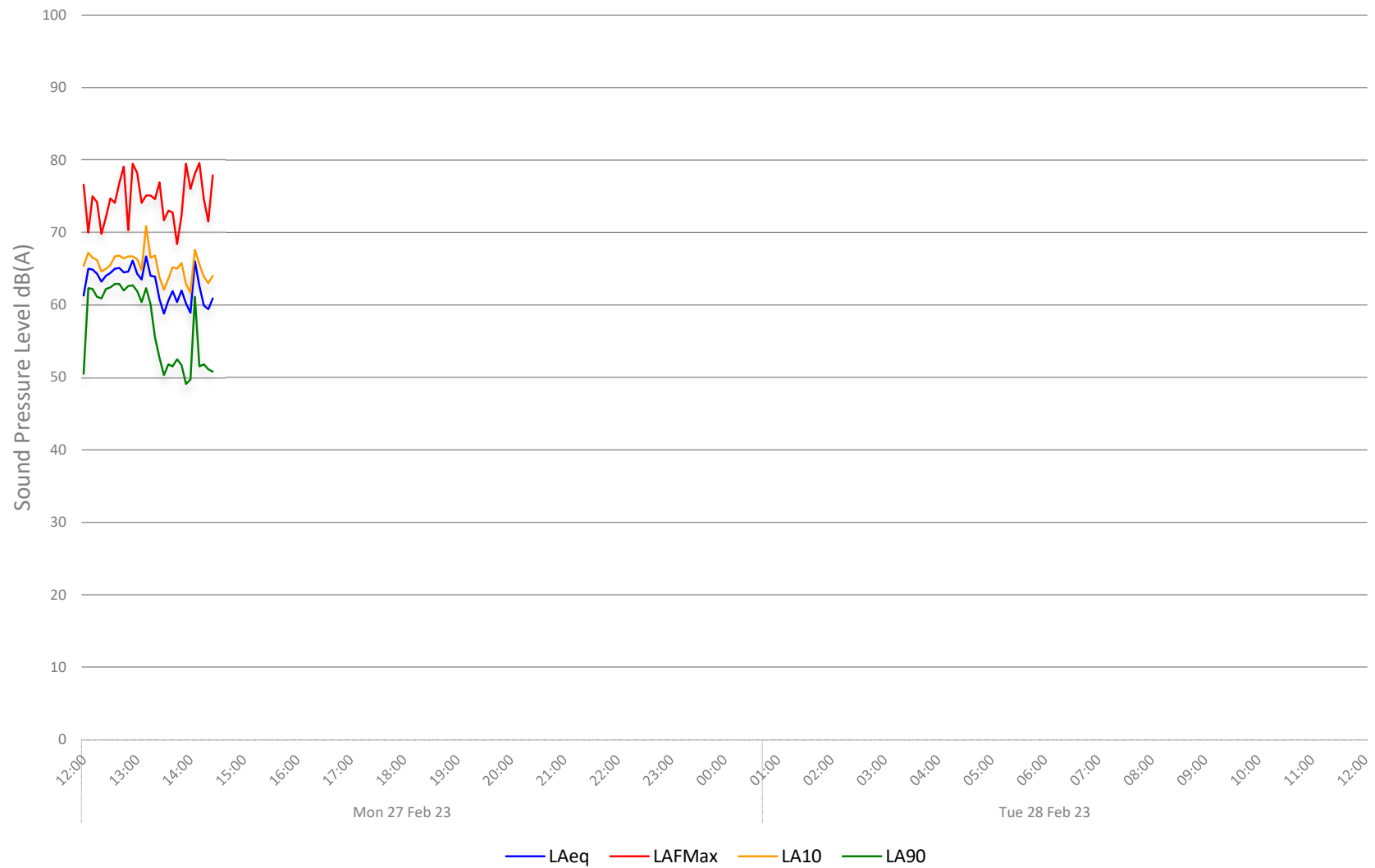
13-16 Market Place, Reading

Environmental Noise Time History: 4

Position 1

 **VENTA** ACOUSTICS

Figure VA4509/TH4



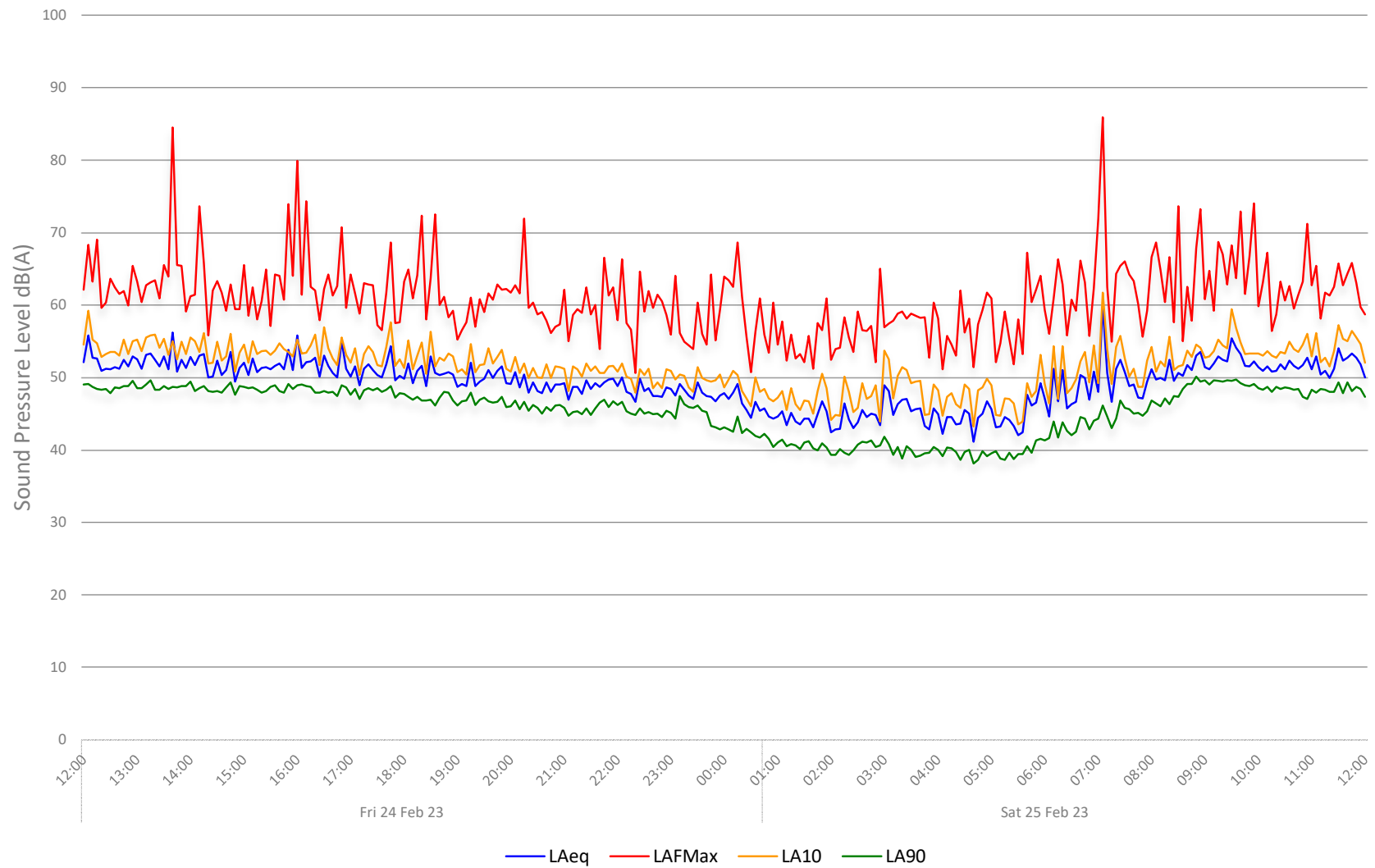
13-16 Market Place, Reading

Environmental Noise Time History: 9

Position 2

 **VENTA** ACOUSTICS

Figure VA4509/TH9



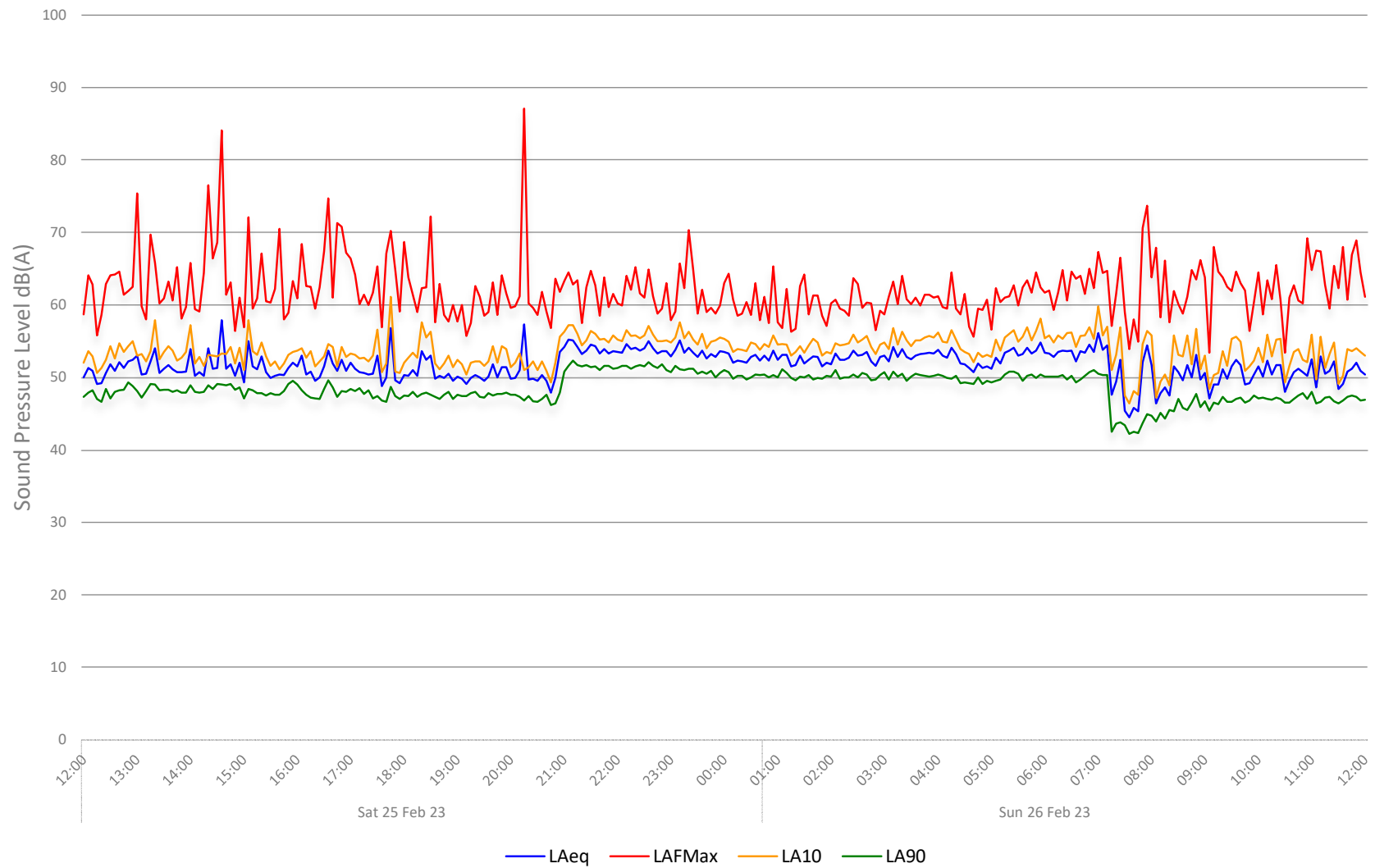
13-16 Market Place, Reading

Environmental Noise Time History: 10

Position 2

 **VENTA** ACOUSTICS

Figure VA4509/TH10



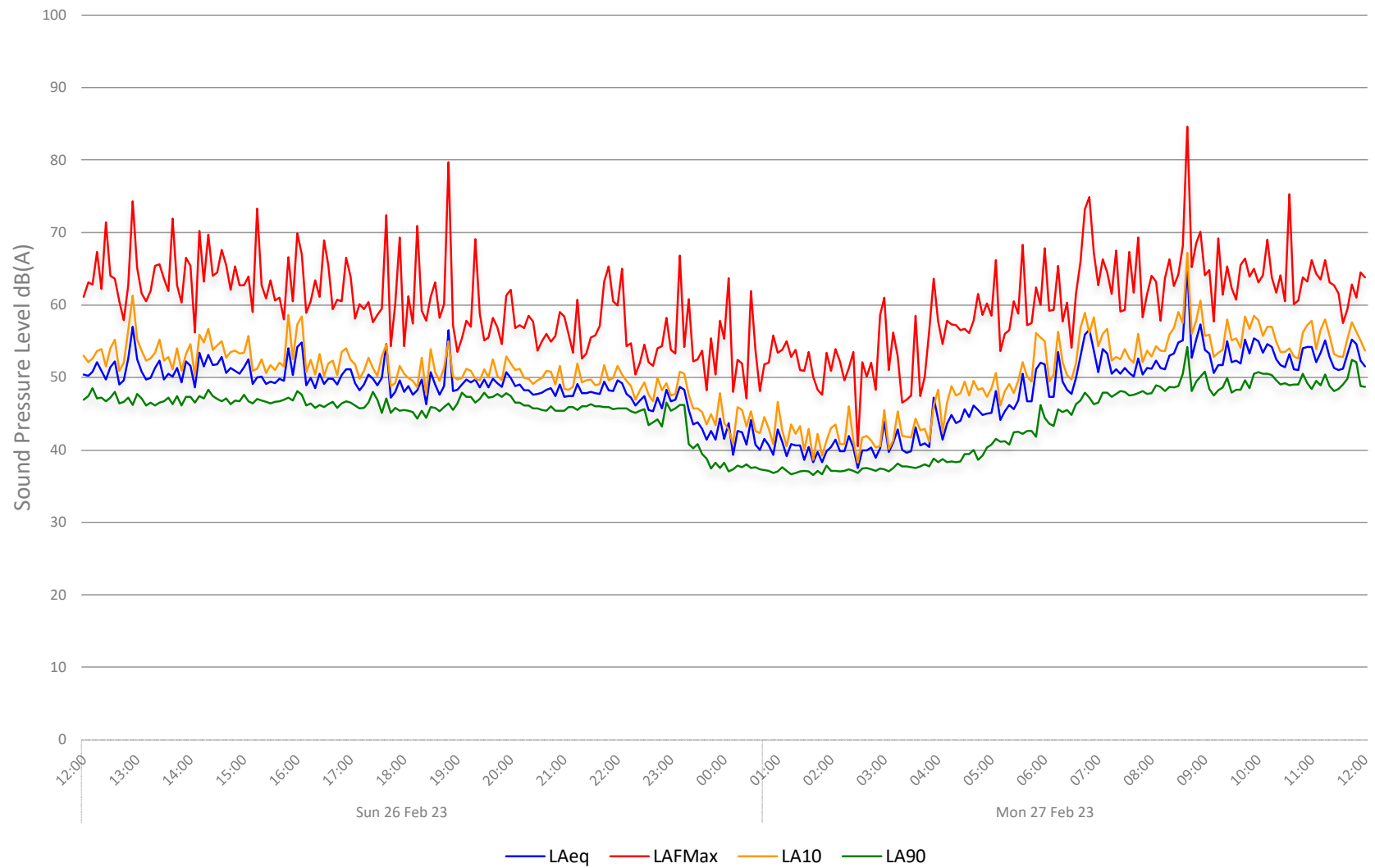
13-16 Market Place, Reading

Environmental Noise Time History: 11

Position 2

 **VENTA** ACOUSTICS

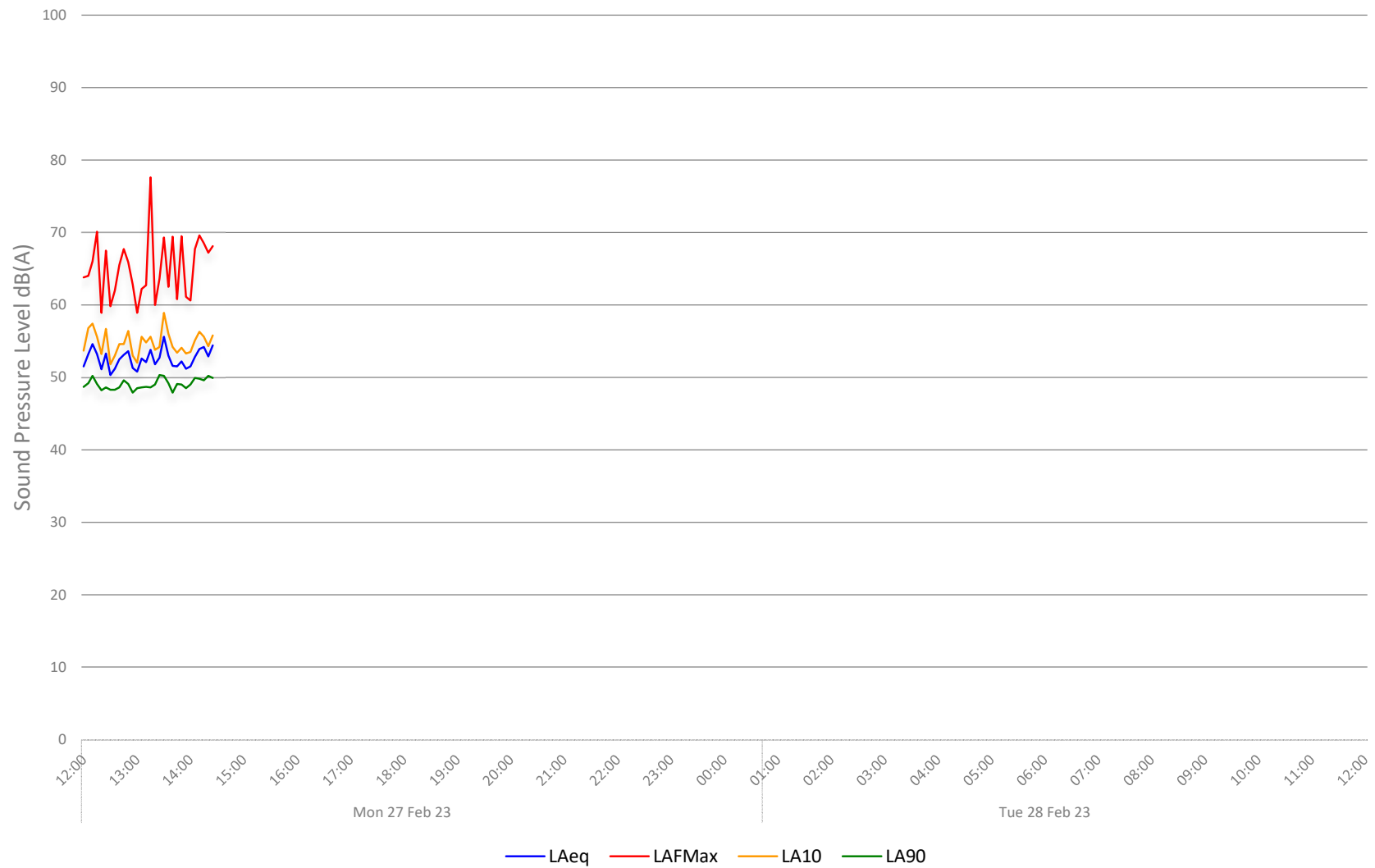
Figure VA4509/TH11



13-16 Market Place, Reading
Environmental Noise Time History: 12
Position 2



Figure VA4509/TH12



APPENDIX A

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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APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

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