Report VA3558.210520.NIA1.2

10 & 12 Oxford Road, Reading

Noise Impact Assessment

21 May 2021

Fan Rescue
39 Deer Park Way
Waltham Abbey
EN9 3YN

VENTA ACOUSTICS

01962 461016
0203 8650332
mail@ventaacoustics.com

registered company no. 10139494

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1. Introduction

It is proposed to install a new kitchen supply and extract system to service the premises at 10 & 12 Oxford Road, Reading.

Venta Acoustics has been commissioned by Fan Rescue to undertake an assessment the potential noise impact of the proposals on nearby residential receivers to support the planning application to Reading Borough Council.

An environmental noise survey was undertaken to determine the background noise levels at the site as well as the sound levels generated by the surrounding premises. These levels were then used to undertake an assessment of the likely impact with reference to the methodology in BS4142:2014 *Methods for rating and assessing industrial and commercial sound* and BS8233: 2014 *Guidance on sound insulation and noise reduction for buildings.*

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 BS4142 assessments.

2. Site Description

As illustrated on attached site plan VA3558/SP1, the site is located in a block of buildings with commercial buildings at ground floors and residential flats on the upper floors.

The most affected noise sensitive receivers are expected to be the flats directly overlooking the rear roofed area, above the premises.

3. Design Criterion and Assessment Methodology

3.1 Reading Borough Council Requirements

Condition 3 of Reading Borough Council's consent (ref 210287) states:

> *3. No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by the Local Planning Authority. The assessment shall be carried out for in accordance with BS4142:2014 methodology. The predicted specific sound level (LAeq,TR) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive facade shall be at least 10dB below the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The predicted rating level, LAr,Tr (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to the nearest noise-sensitive façade (habitable window of a dwelling) shall not exceed the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in*

operation. The plant shall thereafter only be installed in accordance with the assessment and shall thereafter be maintained so that it operates to the same standard.

3.2 BS4142:2014

British Standard BS4142:2014 *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 industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and;
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

The Standard is therefore suited to this assessment.

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation in terms of a L_{Aeq} value over a one-hour period during daytime operation (07:00-23:00 hours) and a fifteen-minute period during night-time operation (23:00-07:00 hours).

A correction factor is added to this level to account for the acoustic character of the sound. This is determined as follows when using the subjective assessment methodology:

Tonality - For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be allocated as a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity - A correction of up to +9dB can be applied for sound that is highly impulsive considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be allocated as a penalty of 3 dB for impulsivity which is just perceptible at the receiver, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics - Where the specific sound contains characteristics that are neither tonal nor impulsive, but are otherwise startling, disturbing or incongruous with the residual acoustic environment, a penalty of +3 dB can be applied.

Intermittency - When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.

An initial estimate of the impact of the source is then obtained by subtracting the typical background noise level, in terms of a LA90 value over the relevant period of operation, 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.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

3.3 BS8233:2014

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

The relevant section of the standard is shown below in Table 3.1.

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

Table 3.1 - Excerpt from BS8233: 2014 **[dB ref. 20µPa]**

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 Wednesday 10th and Friday 12th February 2021 at the location shown in site plan VA3558/SP1. This location was chosen to be representative of the background noise level at the most affected noise sensitive receivers.

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

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	UCRT21/1102	21/1/21
Larson Davis calibrator	CAL200	13069	UCRT20/1562	26/6/20

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.

5. Results

The measured sound levels are shown as time-history plots on the attached charts VA3558/TH1-3.

The background noise level is determined by road noise in the surrounding area, with plant noise dominating for some periods of the day.

The typical background noise levels measured were:

Monitoring Period	Typical[1] $L_{A90,5min}$
07:00 – 23:00 hours	45 dB
23:00 – 07:00 hours	35 dB

Table 5.1 – Typical background noise levels **[dB ref. 20 µPa]**

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

6. BS4142 Noise Impact Assessment

6.1 Proposed plant

The following fans are proposed for installation within the kitchen, with the flues exiting through the roof at the rear of the property and terminating at low level above the roof in the locations indicated on site plan VA3560/SP1.

Plant Item	Quantity	Proposed Model	Notes
Extract Fan	1	Helios 560 GBW/4	Located within Kitchen
Supply Fan	1	Airflow 102 H2WL/4	Located within Kitchen

Table 6.1 – Indicative plant selections assumed for this assessment.

Consulting the manufacturers' datasheets, the following noise emissions levels are attributed to the proposed plant items:

Plant Item	Octave Band Centre Frequency (Hz) Power Level, L_w (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Helios 560 GBW/4	97	87	82	79	77	73	69	62	82
Airflow 102 H2WL/4	69	79	75	71	72	70	69	68	77

Table 6.2 – Advised plant noise data used for the assessment.

6.2 Recommended Mitigation Measures

The atmospheric side ductwork of the extract and supply fans should be fitted with attenuators provided the minimum insertion losses shown in Table 6.3.

Attenuation Component	Octave Band Centre Frequency (Hz) Acoustic Louvre Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Extract Fan Attenuator 1 – Acoustica CP03-C*P-0560-2D	4	9	17	27	29	28	23	23
Extract Fan Attenuator 2 – Acoustica CP03-C*P-0560-2D	4	9	17	27	29	28	23	23
Supply Fan Attenuator - Acoustica CP03 CAP-0355-2D	3	10	15	22	29	30	29	22

Table 6.3 – Atmospheric side attenuation requirements

Should the above insertion loss by achieved using multiple silencers, these should be separated from each other by a distance of minimum 3-4 x D, where D is the largest internal dimension of the duct work (e.g. D is 0.5m, so a minimum of 1.5-2m apart).

Please note that the above recommendations relate to acoustic issues only. It is recommended that professional advice confirming the suitability of these measures be sought from others with regards to issues such as airflow, structural stability and visual impact.

6.2.1 Structureborne Noise

All plant and ductwork should be fitted with anti-vibration mounts in accordance with the manufacturer guidelines.

The extract fan will have a dominant case frequency of 50-60Hz. To mitigate this, the fan motor should be mounted on rubber or neoprene mounts with a minimum deflection of 5mm, which would provide 95% isolation efficiency, considerably more than the recommended minimum of 90% isolation.

The fan should be attached to the ductwork on either side using flexible coupling to minimise vibration transfer to the ductwork. Ductwork should be attached to the building using isolated fixings, with either a rubber or neoprene isolator with a minimum deflection of 1mm, which would provide 90% isolation, considerably more than would be required considering the reduced energy transmitted to the ductwork.

The above measures are to control structureborne noise and re-radiated noise to other areas of the building to considerably below current internal noise levels and hence would be considered acceptable.

6.3 Acoustic Character Correction

The subjective method of allocating corrections to the sound source has been used following the methodology provided in BS4142:2014 and summarised in section 3.2.

Noise Source	Subjective Description	Allocated Corrections
Fans	Constant operation during opening hours, slow start, slight tonal content	Tonality: +4dB Impulsivity: 0dB Intermittency: 0dB

Table 6.4 – Acoustic character corrections

These penalties are applied to the specific noise level in section 6.4 to obtain the rating noise level.

6.4 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.

Table 6.5 shows the assessment to the most affected window of the overlooking flats.

Results		Relevant Clause	Commentary
Specific Sound Level	L_{Aeq} 22 dB		As calculated in Appendix B
Assume 100% on time	0 dB	7.2	
Acoustic feature correction	4 dB	9.2	+4dB for tonality
Rating level	L_{Ar} 26 dB	9.2	
Background sound level	L_{A90} 35 dB	8	
Excess of rating over background sound level	-9 dB	11	
Assessment indicates low adverse impact		11	Depending on context
Context		Urban setting overlooking large amount of plant already servicing adjacent buildings.	

Table 6.5 – BS4142 Assessment

A low impact is indicated by the assessment.

6.5 Context

The site is located in a city centre location. To the rear roof area of the premise there is existing plant serving the surrounding buildings. .

Within this context, the estimated impact of the sound sources is expected to remain valid or be slightly reduced.

6.6 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 a Class 1 sound level meter 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 background measurements were undertaken under suitable weather conditions over a period designed to include reasonable temporal variations in background noise levels. The measurement location was selected to be representative of the background noise levels expected to be experienced by the nearby dwellings without being unduly influenced by extraneous noise sources.
- Where manufacturer data has been used, propagation calculations have been used to correct noise levels to the relevant distance at the receiver.

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

7. Comparison to Requirements of Condition 3

The condition requires that the specific sound level is at least 10dB below the existing background noise level, with the rating level equal or less than the existing background noise level.

Table 7.1 shows that these requirements have been met.

Background noise level	Specific Sound Level	Difference	Rating Level	Difference
L_{A90} 35 dB	$L_{Aeq, TR}$ 22 dB	-13 dB	$L_{Ar, Tr}$ 26 dB	-9 dB

Table 7.1 – Comparison of specific sound and rating levels to background

8. Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 6.5 would result in internal noise levels that achieve the guidelines shown in Table 3.1.

9. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 10 & 12 Oxford Road, Reading.

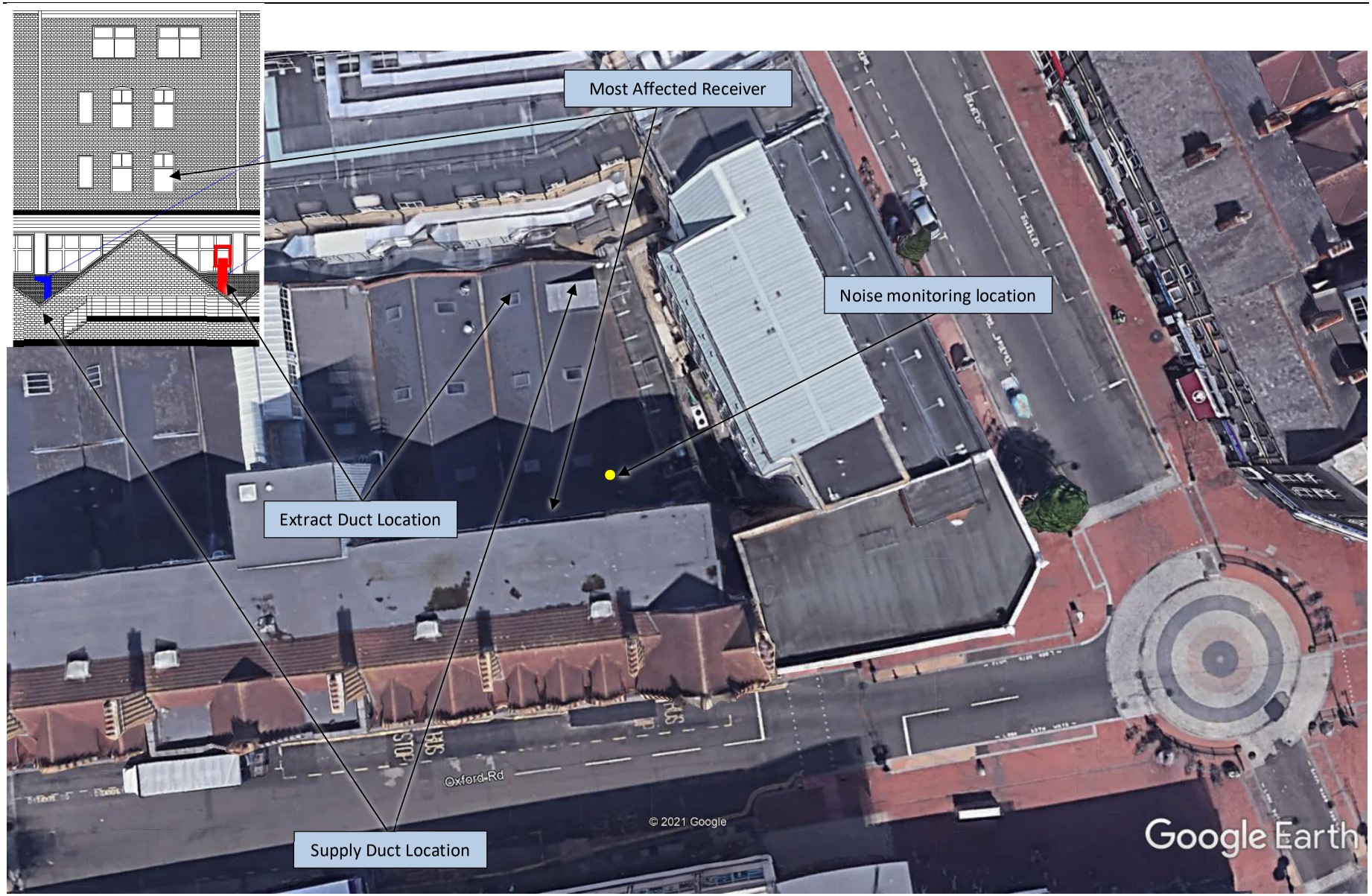
The measured noise levels have been assessed against BS4142:2014 *Methods for rating and assessing industrial and commercial sound* and BS8233: 2014 *Guidance on sound insulation and noise reduction for buildings*.

When assessed using BS4142, noise from most activities on site have been shown to have a low impact, with mitigation measures incorporated.

The noise levels have been shown to meet the requirements of condition 3 of the consent for the scheme.

The proposed scheme is not expected to have a significant adverse noise impact and the relevant planning requirements have been shown to be met.

Jamie Duncan MIOA


Most Affected Receiver
Noise monitoring location
Extract Duct Location
Supply Duct Location
Oxford Rd
© 2021 Google
Google Earth

10&12 Oxford Road, Reading

Environmental Noise Time History: 1

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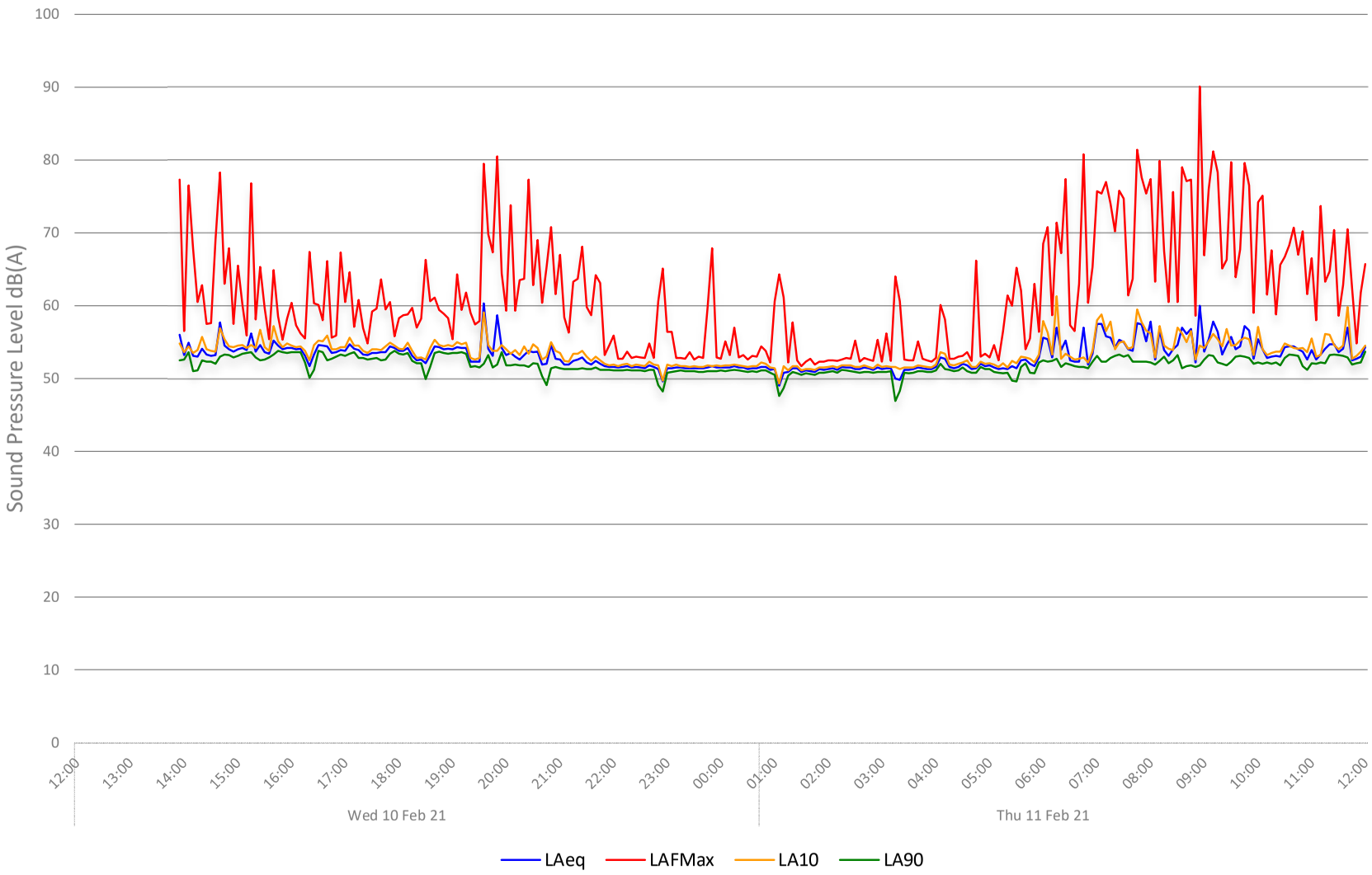
Figure VA3558/TH1



10&12 Oxford Road, Reading

Environmental Noise Time History: 2

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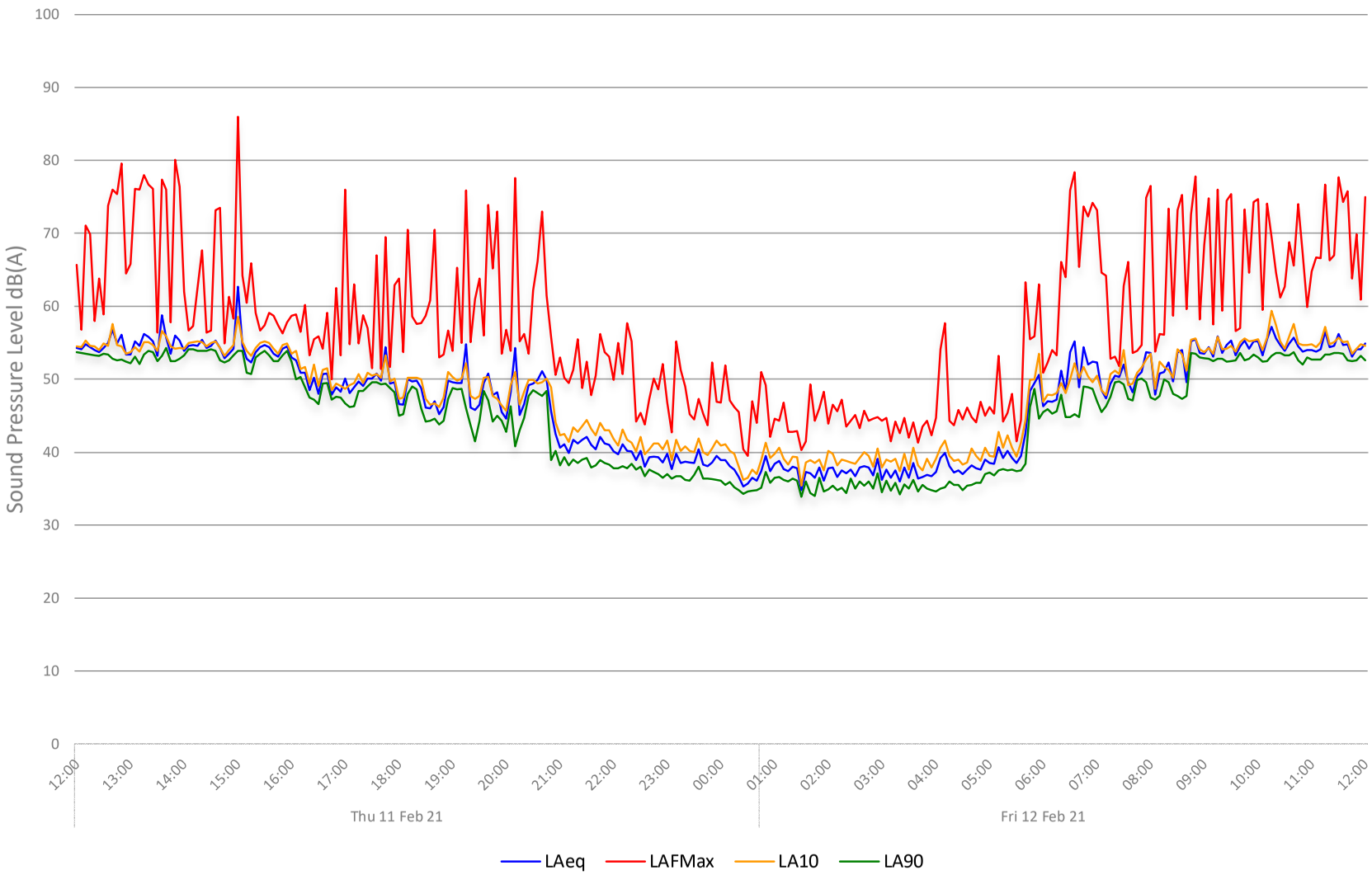
Figure VA3558/TH2



10&12 Oxford Road, Reading

Environmental Noise Time History: 3

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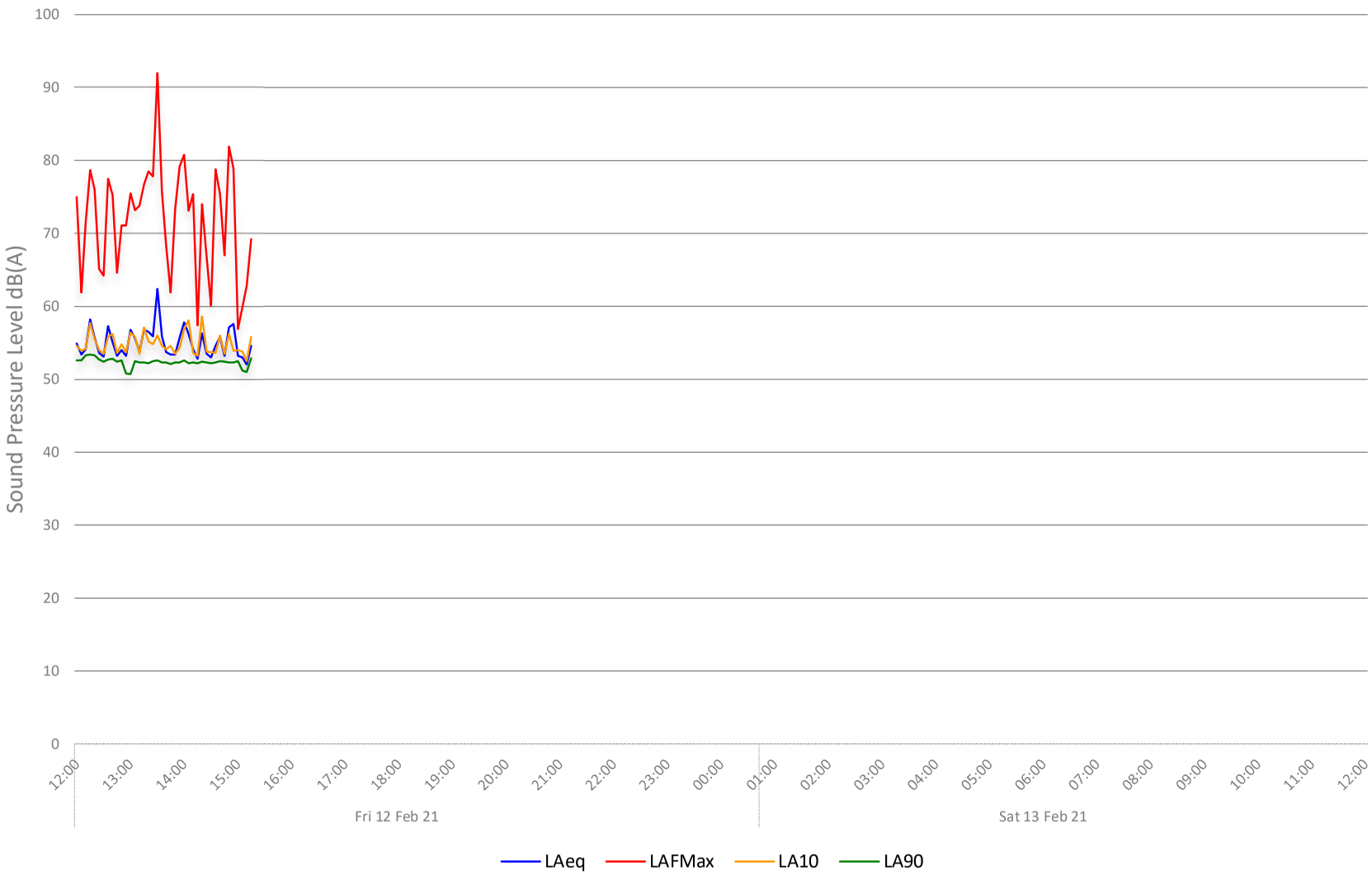
Figure VA3558/TH3



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.
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.
R	*Sound Reduction Index.* Effectively the *Level Difference* 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.

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

1.3 Human Perception of Broadband Noise

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

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

APPENDIX B

VA3558 - 10&12 Oxford Road, Reading

Noise Impact Assessment

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Helios 560 GBW/4	Lw	97	87	82	79	77	73	69	62	**82**
Acoustica CP03-C*P-0560-2D		-4	-9	-17	-27	-29	-28	-23	-23	
Acoustica CP03-C*P-0560-2D		-4	-9	-17	-27	-29	-28	-23	-23	
End reflection		-8	-4	-1	0	0	0	0	0	
Distance Loss	To 18m	-25	-25	-25	-25	-25	-25	-25	-25	
Radiation correction		-11	-11	-11	-11	-11	-11	-11	-11	
Level at receiver (specific sound level)		45	29	11	-11	-17	-19	-13	-20	20

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Airflow 102 H2WL/4	Lw	69	79	75	71	72	70	69	68	**78**
Acoustica CP03 CAP-0355-2D		-3	-10	-15	-22	-29	-30	-29	-22	
Distance Loss	To 18m	-25	-25	-25	-25	-25	-25	-25	-25	
End reflection		-11	-7	-3	-1	0	0	0	0	
Radiation correction		-11	-11	-11	-11	-11	-11	-11	-11	
Level at receiver (specific sound level)		19	26	21	12	7	4	4	10	17

	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Cumulative Level at receiver	45	31	21	12	7	4	4	10	**22**
Corrected to 15 mins / 15 mins	0	0	0	0	0	0	0	0	
Tonality penalty	4	4	4	4	4	4	4	4	
Impulsivity penalty	0	0	0	0	0	0	0	0	
Intermittency penalty	0	0	0	0	0	0	0	0	
Rating Level at Receiver	**49**	**35**	**25**	**16**	**11**	**8**	**8**	**14**	**26**