Report VA3585.210407.NIA

Dodo, 111 High Street, Cheltenham

Noise Impact Assessment

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VA3585/SP1	Indicative Site Plan
VA3585/TH1-TH2	Environmental Noise Time Histories
Appendix A	Acoustic Terminology
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1. Introduction

It is proposed to install a new kitchen supply and extract system to service the new restaurant at ground floor level at 111 High Street, Cheltenham.

Venta Acoustics has been commissioned to undertake an assessment of the potential noise impact of these proposals in support of an application for planning permission.

An environmental noise survey has been undertaken to determine the background noise levels at the most affected noise sensitive receptors. These levels are used to undertake an assessment of the likely impact with reference to the planning requirements of Cheltenham Borough Council.

2. Design Criterion and Assessment Methodology

2.1 Cheltenham Borough Council Requirements

It is understood that Cheltenham Borough Council require that noise emissions from plant is assessed in accordance with BS4142:2014 in relation to the local background noise level as assessed at the most affected noise sensitive receivers.

2.2 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 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.

2.3 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 2.1.

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

3. Site Description

As illustrated on attached site plan VA3585/SP1, the site building is located within a mixed commercial and residential area.

The most affected noise sensitive receiver is expected to be the receiver at the end of Grosvenor Terrace South.

Existing building services plant was noted on the adjacent delivery yard.

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 8th and Monday 11th July 2020 at first floor level at the location shown in site plan VA3585/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.

4.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA3585/TH1-2.

The background noise level is determined by traffic with some contribution from nearby plant.

The typical background noise levels measured were:

Monitoring Period	Minimum $L_{A90,5min}$
07:00 – 23:00 hours	40 dB
23:00 – 07:00 hours	40 dB

Table 4.2 – Minimum background noise levels **[dB ref. 20 µPa]**

5. BS4142 Noise Impact Assessment

5.1 Proposed plant

The following plant is proposed for installation with the fan motors located internally, and the supply fan grille terminating at high ground floor level, with the extract duct running up the rear of the building and terminating at roof level at the location indicated on site plan VA3585/SP1.

Plant Item	Quantity	Proposed Model	Notes
Supply Fan	1	S&P TCBBx2/4-500	Operates During The Day Only
Extract Fan	1	S&P TCBBx2/4-500	

Table 5.1 – Indicative plant selections assumed for this assessment.

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

Plant Item	Octave Band Centre Frequency (Hz) Sound Power Level, L_w (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
S&P TCBBx2/4-500 - Exhaust	48	78	87	85	87	81	74	67	90
S&P TCBBx2/4-500 – Supply	65	76	87	88	90	84	77	70	93

Table 5.2 – Advised plant noise data used for the assessment.

5.2 Recommended Mitigation Measures

The atmospheric side ductwork for the fans will need to be fitted with attenuators providing the minimum insertion losses shown in Table 5.3.

Attenuation Component	Octave Band Centre Frequency (Hz) Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Extract Attenuator	0	1	6	18	17	12	9	7
Supply Attenuator	0	0	4	13	11	9	6	5

Table 5.3 – Minimum attenuator insertion losses

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). Attenuators should be fitted as close to the fan as possible, and attached to the ductwork using flexible connections.

For the extract attenuator, it is recommended that a Melinex lined silencer is used to prevent grease impregnation into the acoustic media which may degrade the performance realised over time.

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.

5.3 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 2.2.

Noise Source	Subjective Description	Allocated Corrections
Fan noise	Generally broadband with potential for some tonality, constant operation when in use with slow run up.	Tonality: +4dB Impulsivity: 0dB Intermittency: 0dB

Table 5.4 – Acoustic character corrections

These penalties are applied to the specific noise level in section 5.4 to obtain the rating noise level.

5.4 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.

Table 5.5 the assessment from the new plant on the most affected façade of the nearest receiver.

Results		Relevant Clause	Commentary
Specific Sound Level	L_{Aeq} 35dB		Please see calculations in Appendix B
Assume 100% on time	0dB	7.2	
Acoustic feature correction	+4 dB	9.2	+4 dB for tonality
Rating level	L_{Ar} 39 dB	9.2	
Day time background sound level	L_{A90} 40 dB	8	
Excess of rating over background sound level	-1 dB	11	
Assessment indicates low adverse impact		11	Depending on context

Table 5.5 – BS4142 Assessment

5.5 Context

The site is located within an area of mixed commercial and residential use.

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

5.6 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 library 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.

5.7 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 5.5 would result in internal noise levels that achieve the guidelines shown in Table 2.1.

6. 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.

7. Conclusion

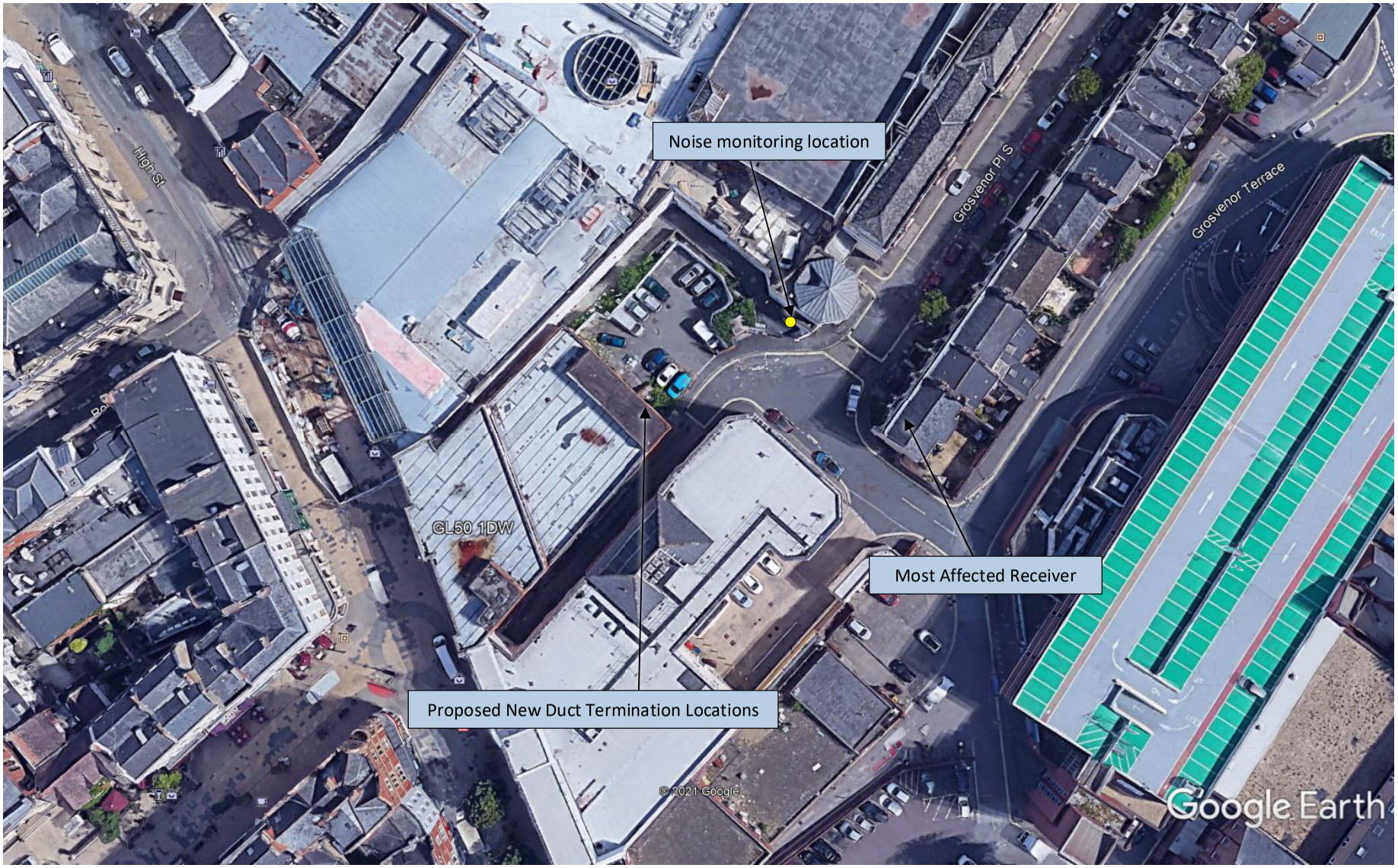
A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of Dodo, 111 High Street, Cheltenham in support of a planning application for the proposed introduction of new building services plant.

This has enabled noise emission limits to be set at the most affected noise sensitive receiver such that the proposed installation meets the requirements of Cheltenham Borough Council.

The cumulative noise emission levels from the proposed plant have been assessed to be compliant with the plant noise emission limits, with necessary mitigation measures specified.

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

Jamie Duncan MIOA


Noise monitoring location
Most Affected Receiver
Proposed New Duct Termination Locations
High St
Grosvenor Pl S
Grosvenor Terrace
GL50 1DW
© 2021 Google
Google Earth

Dodo, 111 High Street, Cheltenham

Environmental Noise Time History: 1

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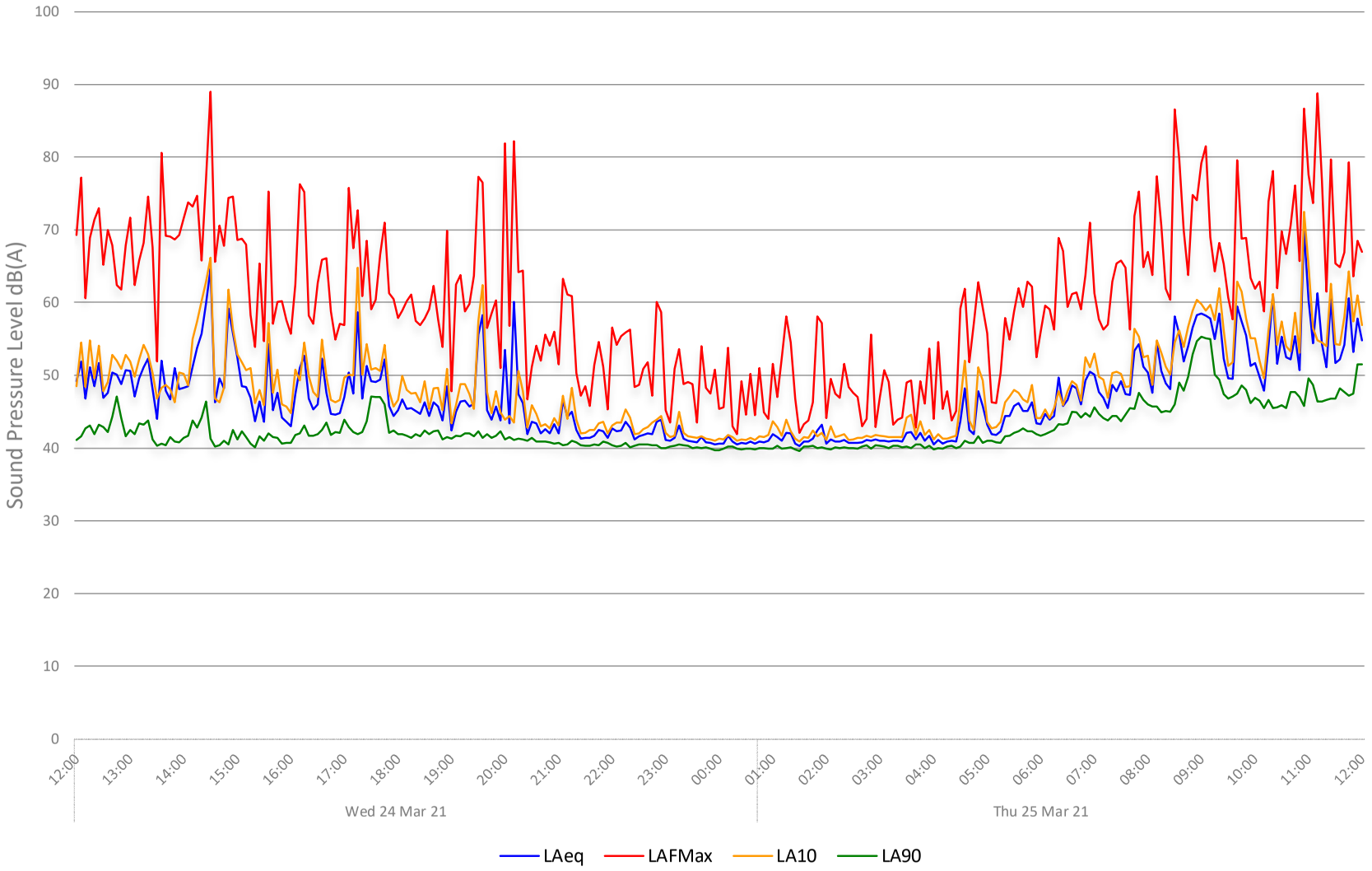
Figure VA3585/TH1



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Environmental Noise Time History: 2

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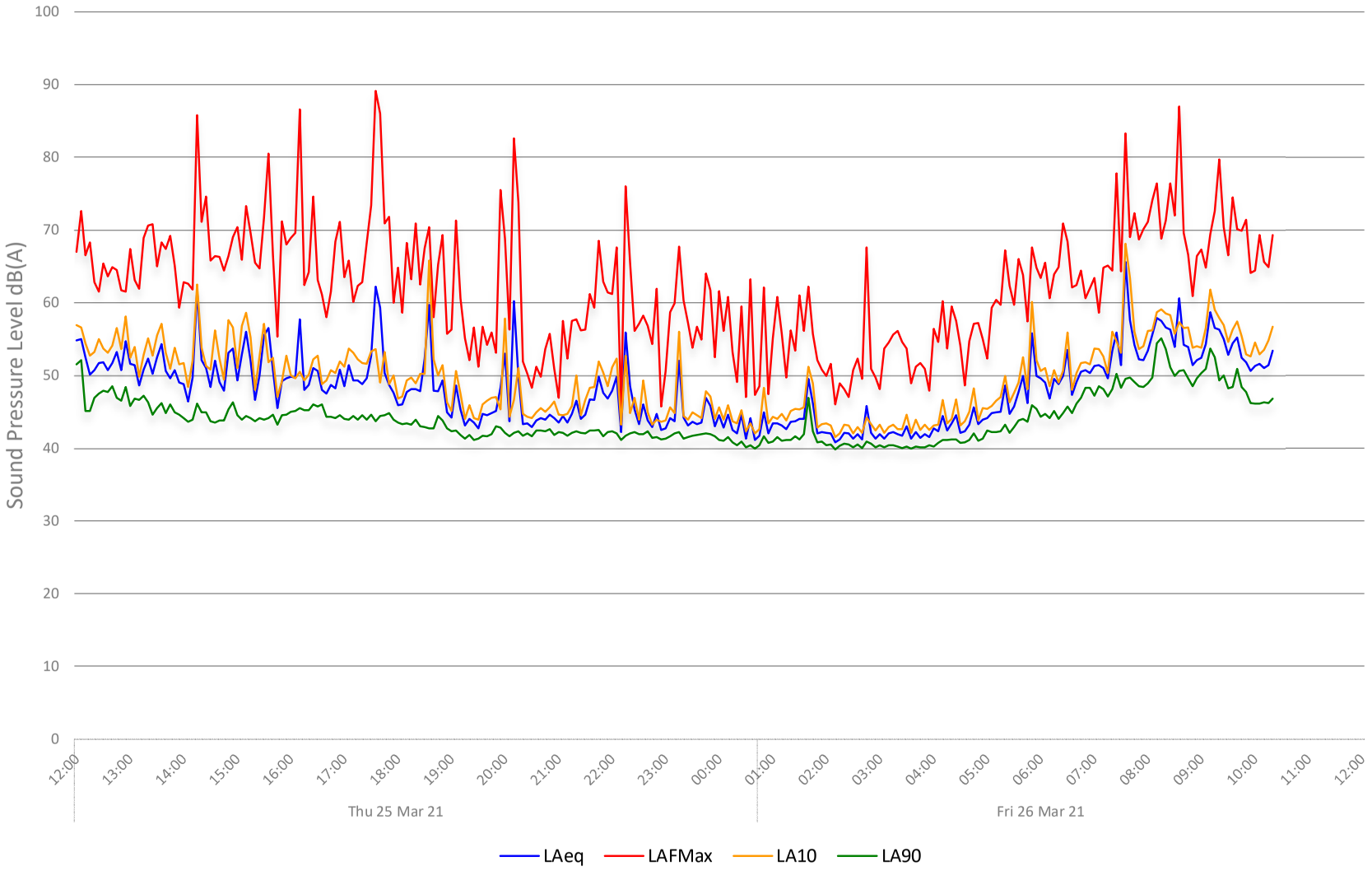
Figure VA3585/TH2



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

VA3585 - Dodo, 111 High Street, Cheltenham

Noise Impact Assessment

Extract		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
TCBBx2/4-500 - Exhaust	Lw	48	78	87	85	87	81	74	67	**90**
SIL-CZ-500 1.5D		0	-1	-6	-18	-17	-12	-9	-7	
Distance Loss	To 35m	-31	-31	-31	-31	-31	-31	-31	-31	
End reflection		-9	-5	-2	-1	0	0	0	0	
Radiation correction		-11	-11	-11	-11	-11	-11	-11	-11	
Level at receiver		**-3**	**30**	**37**	**24**	**28**	**27**	**23**	**18**	**34**

* Screening loss limited to 18dB

Supply		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
TCBBx2/4-500 - Supply	Lw	65	76	87	88	90	84	77	70	**93**
SIL-CZ-500 1D		0	0	-4	-13	-11	-9	-6	-5	
Distance Loss	To 35m	-31	-31	-31	-31	-31	-31	-31	-31	
End reflection		-9	-5	-2	-1	0	0	0	0	
Radiation correction		-8	-8	-8	-8	-8	-8	-8	-8	
Screening loss*		-8	-10	-13	-15	-18	-18	-18	-18	
Level at receiver		**9**	**22**	**29**	**20**	**22**	**18**	**14**	**8**	**27**

* Screening loss limited to 18dB

BS4142 Assessment

BS4142 Character Corrections		Rating Levels		Expected Impact
Tonality	4	Specific Sound Level	35	
Impulsivity	0	Corrected SSL	39	*Low impact*
Intermittency	0	Background (Night)	40	
Total	4	Difference	-1	