

Report VA3173.200221.NIA

20 Market Place, Reading

Noise Impact Assessment

21 February 2020

Fan Rescue

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Attachments

VA3173/SP1	Indicative Site Plan
VA3173/TH1-TH2	Environmental Noise Time Histories
Appendix A	Acoustic Terminology
Appendix B	Acoustic Calculations

1. Introduction

It is proposed to install a new extract fan to service the new kitchen at 20 Market Place, Reading.

Venta Acoustics has been commissioned by Fan Rescue 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 Reading City Council.

2. Design Criterion and Assessment Methodology

2.1 Requirements of the Local Authority

It is understood that Reading City Council require that noise from any plant has a rating level, $L_{Ar,Tr}$, at least 10dB below the existing background noise level at the nearest noise sensitive receivers.

The assessment is to be undertaken with reference to BS4142:2014.

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 VA3173/SP1, the site building is located within a parade of shops on Market Place with residential flats above and a service area / carpark to the rear.

The proposal is to house the extract fan within the premises and have the extract flue routed up the rear of the building to terminate above eaves level.

The plant will operate between 07:00 and 23:00 hours daily.

The most affected noise sensitive receivers are expected to be the apartments directly adjacent to the flue location.

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 13th and Friday 14th February 2020 at first floor level at the location shown in site plan VA3173/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-15892-E0	FL-19-121	14/3/19
Larson Davis calibrator	CAL200	13049	UCRT19/1501	18/4/19

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 VA3173/TH1-2.

The background noise level is determined by road on the surrounding streets and building services plant servicing the surrounding buildings.

The typical background noise levels measured were:

Monitoring Period	Typical ¹ $L_{A90,5min}$
07:00 – 23:00 hours	48 dB
23:00 – 07:00 hours	44 dB

Table 4.2 – Typical background noise levels [dB ref. 20 μ Pa]

¹ The typical L_{A90} value is taken as the 90th percentile of all L_{A90} values measured during the relevant period.

4.3 Plant Noise Emission Limits

On the basis of the measured noise levels and the planning requirements of the Local Authority, and considering that it is not expected that tonal noise will be generated by the proposed plant units, the following plant specific sound levels should not be exceeded at the most affected noise sensitive receivers:

Monitoring Period	Design Criterion (L _{Aeq})
07:00 – 23:00 hours	38
23:00 – 07:00 hours	34

Table 4.3 – Specific sound pressure levels not to be exceeded at most affected noise sensitive receivers

5. Predicted Noise Impact

5.1 Proposed plant

The following plant is proposed for installation, with the fan located within the premises and the flue routed up the rear of the building to terminate above eaves level.

Plant Item	Quantity	Proposed Model	Notes
Extract Fan	1	50 maXfan Compac	Located within the ground floor unit. Operation between 07:00 and 23:00

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) Power Level, L _p @1m, L _w (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
50 maXfan Compac	85	79	90	89	86	86	81	79	92

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

5.2 Recommended Mitigation Measures

To achieve the planning requirements, it is recommended that attenuation providing the following cumulative sound reduction should be included in the duct system on the atmospheric side of the system.

Attenuation required	Octave Band Centre Frequency (Hz) Sound attenuators Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Cumulative Attenuation	6	14	26	50	52	50	30	20

Table 5.3 – Recommended attenuation to ventilation openings.

Should the above insertion loss be 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).

For the purposes of the assessment, two attenuators, each 1500mm long, have been indicated. However, alternative configurations may be available from suppliers.

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 Predicted noise levels

The cumulative noise level at the most affected noise sensitive receiver, 1 meter away from the duct run location and 2m from the duct termination, has been calculated on the basis of the above information and assuming the recommended mitigation measures, with reference to the guidelines set out in ISO 9613-2:1996 *Attenuation of sound during propagation outdoors - Part 2: General method of calculation*.

A summary of the calculations are shown in Appendix B.

Predicted Cumulative Noise Level	Design Criterion
L_{Aeq} 36 dB	L_{Aeq} 38 dB

Table 5.4 – Predicted cumulative noise level at most affected noise sensitive receiver and design criterion.

5.4 BS4142 Assessment

The context of the site is in a busy urban setting. The introduction of a new extract system, with a specific noise level at least 10dB below the existing background, is not expected to change the local acoustic or draw attention to be perceived as characterful within this context.

As no acoustic character penalties are considered appropriate, the rating level is L_{Aeq} 36dB, being 12dB below the daytime background noise level. The BS4142 assessment would therefore indicate a low impact.

5.5 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.

5.6 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 5.4 would result in internal noise levels that achieve the guidelines shown in Table 2.1.

6. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 20 Market Place, Reading 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 Reading City Council.

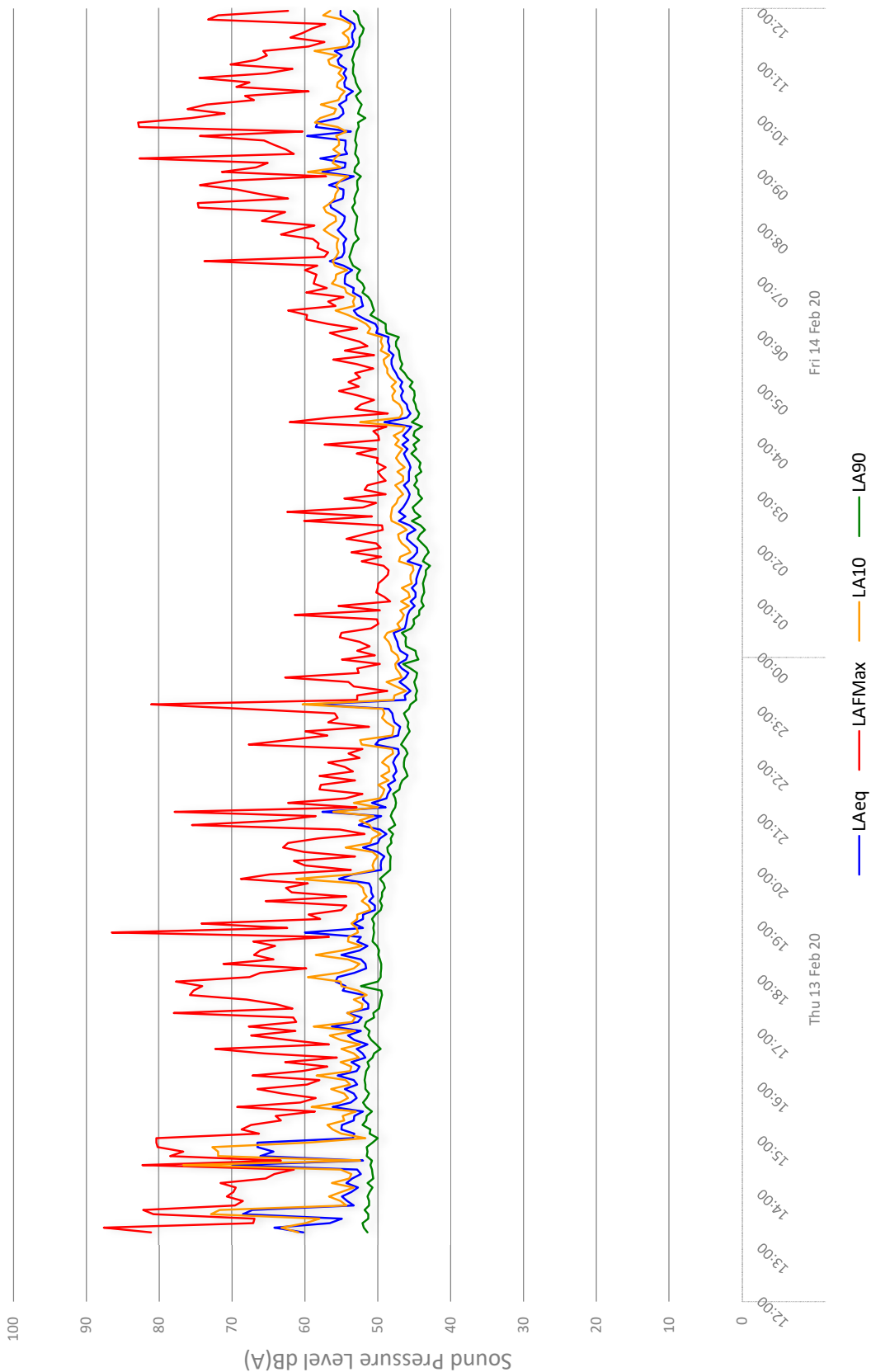
The cumulative noise emission levels from the proposed plant have been assessed to be compliant with the plant noise emission limits, with necessary mitigation measures specified.

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

Steven Liddell MIOA



Figure VA3173/TH1





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

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.

APPENDIX B

VA3173 - 20 Market Place, Reading Noise Impact Assessment

To nearest Window

<u>Extract Fan - Duct Borne</u>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Specified Outlet Sound Power	Lw	85	79	90	89	86	86	81	79	92
Indicative Attenuator (1500mm)	50% F.A	-3	-7	-13	-25	-26	-25	-15	-10	
Indicative Attenuator (1500mm)	50% F.A	-3	-7	-13	-25	-26	-25	-15	-10	
End Reflection @500mm Ø		-9	-5	-2	-1	0	0	0	0	
Directivity (Hor:0,Vert:140)		-2	-3	-7	-9	-8	-8	-8	-8	
Free Field Propagation		-11	-11	-11	-11	-11	-11	-11	-11	
Distance Loss	To 2m	-6	-6	-6	-6	-6	-6	-6	-6	
Level at receiver		52	40	38	13	9	11	26	34	36

<u>Extract Fan - Duct Breakout</u>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Specified Outlet Sound Power	Lw	85	79	90	89	86	86	81	79	92
Indicative Attenuator (1500mm)		-3	-7	-13	-25	-26	-25	-15	-10	
Indicative Attenuator (1500mm)		-3	-7	-13	-25	-26	-25	-15	-10	
Circular duct breakout		-30	-25	-26	-26	-25	-22	-36	-43	
Distance Loss	To 1m	0	0	0	0	0	0	0	0	
Hemispherical propagation		-8	-8	-8	-8	-8	-8	-8	-8	
Level at receiver		41	32	30	5	1	6	7	8	24

Cumulative Level at receiver	52	41	39	14	10	12	26	34	36
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