

Report VA3460.201211.DOA

229c London Road, Reading

DEFRA Odour Assessment

14 December 2020

**Reading Pizza
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VA3460/SP1 Indicative Site Plan

1. Introduction

An evaluation of the existing kitchen extract system servicing the kitchen at Reading Pizza, 229c London Road, Reading has been requested by the Council's Environmental Health Department. This kitchen is intended for use to prepare a range of food including pizza, peri peri chicken, burgers, kebabs and chips.

As part of the planning requirements an odour assessment is required following the Defra *Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems* (January 2005)/ EMAQ+ *Control of Odour and Noise from Commercial Kitchen Exhaust Systems* (2018) guidance to demonstrate to the Local Authority that odour can be controlled so as to not cause nuisance to nearby residences.

2. Site Description and Proposed Installation

Whilst on site undertaking the environmental noise survey, observations were made with regards to the nearest residences and routing of the ductwork for the kitchen extract system.

The nearest affected receptor is at second floor level approximately 4m from the kitchen discharge.

2.1 Odour Assessment

A risk assessment of the proposals has been undertaken in accordance with the EMAQ+ *Control of Odour and Noise from Commercial Kitchen Exhaust Systems* (2018) Appendix 3: Risk Assessment for Odour, updates and supersedes the DEFRA document *Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems* (2005).

This uses the factors summarised in the following table to assess the potential for odour negatively impacting nearby residences.

Impact Risk	Odour Control Requirement	Significance Score*
Low to Medium	Low level odour control	Less than 20
High	High level odour control	20 to 35
Very high	Very high level odour control	more than 35

* based on the sum of contributions from dispersion, proximity of receptors, size of kitchen and cooking type:

Criteria	Score	Score	Details
Dispersion	Very poor	20	Low level discharge, discharge into courtyard or restriction on stack.
	Poor	15	Not low level but below eaves, or discharge at below 10 m/s.
	Moderate	10	Discharging 1m above eaves at 10 -15 m/s.
	Good	5	Discharging 1m above ridge at 15 m/s.
Proximity of receptors	Close	10	Closest sensitive receptor less than 20m from kitchen discharge.
	Medium	5	Closest sensitive receptor between 20 and 100m from kitchen discharge.
	Far	1	Closest sensitive receptor more than 100m from kitchen discharge ¹ .
Size of kitchen	Large	5	More than 100 covers or large sized take away.
	Medium	3	Between 30 and 100 covers or medium sized take away.
	Small	1	Less than 30 covers or small take away ¹ .
Cooking type (odour and grease loading)	Very high	10	Pub (high level of fried food), fried chicken, burgers or fish & chips. <i>Turkish, Middle Eastern or any premises cooking with solid fuel</i>
	High	7	Vietnamese, Thai, Indian, <i>Japanese, Chinese, steakhouse</i>
	Medium	4	Cantonese, <i>Italian, French, Pizza (gas fired),</i>
	Low	1	Most pubs (<i>no fried food, mainly reheating and sandwiches etc</i>), <i>Tea rooms</i> ¹

Note 1: A planner may take a pragmatic view when assessing whether certain low risk kitchens require any odour abatement to be fitted. In reaching this decision the Planner may consider the nature of the food being cooked and/or the size of kitchen and/or its location.

Figure 2.1 – DEFRA/EMAQ+ Appendix 3 risk tables

Following review of the drawings and using the criteria shown in Figure 2.1, a score has been provided for each element of the system, including level of discharge, proximity of receptors, size of kitchen and cooking type.

The score for the system is as below when based upon Appendix 3: Risk Assessment for Odour.

Criteria	Score	Notes
Dispersion	15	Discharge is below eaves.
Proximity of receptors	10	The closest receptor is approximately 4 m from the kitchen discharge
Size of kitchen	5	Medium take away
Cooking type	10	Pizza, burgers, chicken, kebabs, chips
Total Score	40	Very High Impact Risk – Very high level odour control required

Table 2.1 – Odour assessment

The score afforded indicates that the system will require a very high level of odour control to mitigate odour levels to an acceptable score.

3. Mitigation

It is unknown what measures the extraction system currently incorporates. However, to meet the requirements of the guidance, the type of odour abatement system that complies is as below, taken directly from the DEFRA/EMAQ+ Guidance and must be to a very high level of control.

3.1 Recommended Levels of Mitigation from DEFRA/EMAQ+ Guidance

Odour arrestment plant performance

Very high level odour control may include:

1. Fine filtration or ESP followed by carbon filtration (carbon filters rated with a 0.4 –0.8 second residence time).

or

2. Fine filtration or ESP followed by carbon filtration and by counteractant/neutralising system to achieve the same level of control as 1.

3. Fine filtration or ESP followed by UV ozone system to achieve the same level of control as 1.

In some instances where very high levels of control are required combinations or sacrificial levels of filtration may be employed.

Maintenance must be carried out to ensure these performance levels are always achieved.

4. Conclusion

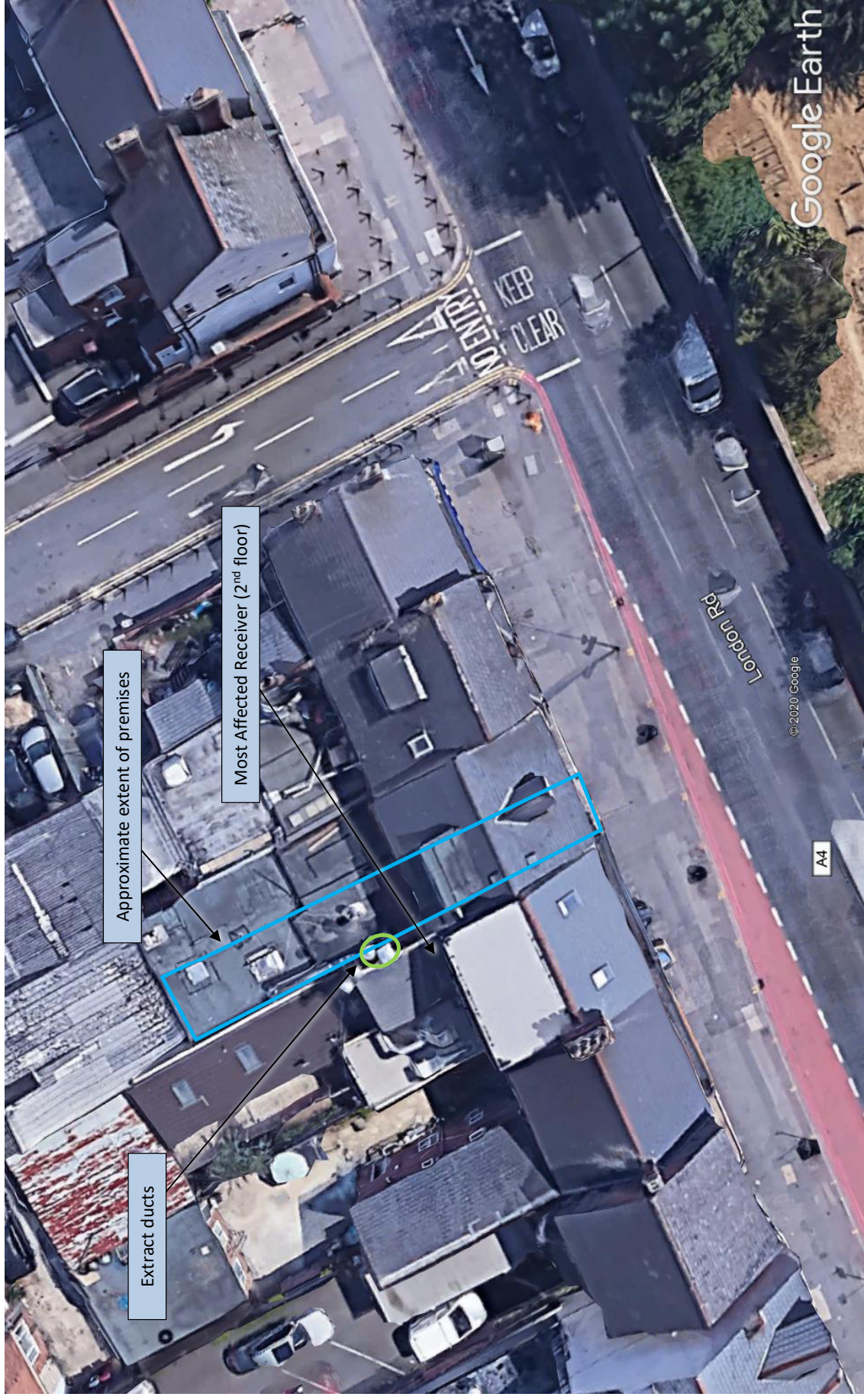
An assessment has been undertaken in accordance with Defra *Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems* (January 2005)/Appendix 3 of EMAQ+ *Control*

of Odour and Noise from Commercial Kitchen Exhaust Systems (2018), based upon observations made during the site visit.

Provided the recommended mitigation measures are adopted, the guidance would indicate that nuisance would not occur due to the kitchen extract system.

Care should be taken to ensure the system is maintained and cleaned in accordance with the manufacturers' guidance, especially regarding filtration.

Jamie Duncan



Report VA3460.201211.NIA

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Noise Impact Assessment

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VA3460/TH1-TH4	Environmental Noise Time Histories
Appendix A	Acoustic Terminology
Appendix B	Acoustic Calculations
Appendix C	Sample Complaint Form

1. Introduction

An application is being made (ref. 201541) for a variation of the hours of use of the premises at 229c London Road, Reading, from the original consent ref. 050540/FUL.

Venta Acoustics has been commissioned by Reading Pizza 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 Borough Council.

An evaluation of the sound insulation performance between the ground floor and the upper floor has been undertaken, and recommendations provided to ensure the amenity of residents is not impacted.

2. Design Criterion and Assessment Methodology

2.1 Reading Borough Council Requirements

Reading Borough Council's Environmental Health Department have been consulted on the application and have raised the following concerns.

Applications which include noise generating plant when there are nearby noise sensitive receptors should be accompanied by an acoustic assessment carried out in accordance with BS4142:2014 methodology. As the application is to extend the hours into times of the night when the background noise levels are lower, the potential for loss of amenity due to noise from the extraction system is significantly increased.

I also have concerns regarding noise from activities taking place within the premises affecting the flats above, and no information has been submitted regarding the sound insulation in place within the building. Noise from customers and delivery drivers coming and going late at night also has the potential to affect the amenity of the nearby residents, and is difficult to control.

A noise assessment has not been submitted with the application and therefore I cannot determine the likely noise impact of the proposal and whether the proposals are acceptable. I therefore recommend refusal unless a noise assessment can be submitted and considered by us before the application is determined.

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 VA3460/SP1, the site building is located within a terrace of shops containing several takeaways, with apartments above.

The most affected noise sensitive receiver is expected to be the flat above the shop at 229a London Road

Existing building services plant was noted on several of the neighbouring rooftops.

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 4th and Monday 7th December 2020 at first floor level at the location shown in site plan VA3460/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-11586-E0	UCRT20/1565	29/6/20
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 VA3460/TH1-4.

The background noise level is determined by existing rooftop plant associated with the premises and other shops in the terrace, and traffic noise when the plant is not operating.

The typical background noise levels measured were:

Monitoring Period	Typical ¹ L _{A90,5min}
07:00 – 23:00 hours	50 dB
23:00 – 07:00 hours	42 dB
03:00 – 04:00 hours	31 dB

Table 4.2 – Typical background noise levels

[dB ref. 20 µPa]

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

5. Noise Impact

5.1 Existing Plant

The following plant is installed at the rear first floor roof level at the location indicated on site plan VA3460/SP1.

The photograph below shows the two fan systems associated with the premises (the two leftmost duct runs outlined in green) with a residential window shown in the background at 2nd floor level. The ducts to the right are associated with another premises.



Figure 5.1 – Premises fan ducts

Measurements on site made with both the fans running at operational duty showed the noise level at 1m from the duct to be L_{eq} 62dB(A). This correlates well with the time history data which shows a level of 60dB(A) at the monitor located just less than 2m from the duct.

The motor for the right hand of the two ducts in question (outlined in green above) is located externally, just above roof level, with the motor for the left hand duct located internally in kitchen below.

With the motors operating during their currently consented hours up to 23:00, noise would be L_{Aeq} 52dB at the nearest residential window, 3m from the ductwork. This is before any acoustic penalties are applied under BS4142 and being 2dB higher than the background noise level, may not meet with the current requirements of Reading Borough Council in its current form.

It should be noted that the original consent from 2005 does not specify a required noise level to be achieved, rather that details would need to be agreed with the Council regarding noise and odour, but it is understood that details were not submitted at this stage.

5.2 Recommended Mitigation Measures

The following measures are based upon reducing noise levels, along with their associated noise penalties under BS4142, to result in a low impact at 04:00 when noise levels are lowest, just before the end of the newly applied operations.

Due to the low noise requirement outside the window, it is recommended that the external fan motor is either enclosed, or preferably, relocated internally. If it is to be enclosed, the enclosure would need to be constructed from an independent brickwork construction and fully sealed to the duct to avoid noise breakout.

The atmospheric side of both fans should be fitted with attenuators to reduce the noise levels to a lower level, providing the minimum insertion loss shown in Table 5.1. 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.

Attenuation Component	Octave Band Centre Frequency (Hz)							
	Minimum Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Attenuator	14	27	21	23	31	33	34	23

Table 5.1 – Minimum attenuator insertion loss

Should the above insertion loss be achieved using multiple silencers, these should be separated from each other by a distance of minimum $3-4 \times D$, 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.

5.2.1 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. BS4142 Noise Impact Assessment

6.1 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	Although having a distinctive sound, not expected to be tonal, slow ramp up and turn off would not be impulsive, stays on for duration of working day so not intermittent.	Tonality: 0dB Impulsivity: 0B Intermittency: 0dB Other Character: +3dB

Table 6.1 – Acoustic character corrections

These penalties are applied to the specific noise level in section 6.2 to obtain the rating noise level.

6.2 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 6.2 shows the assessments for the fans on the most affected façade of the most affected noise sensitive receiver. Full calculations are attached in Appendix B.

Results		Relevant Clause	Commentary
Source Sound Levels	62dB @ 1m	7.3.4	As measured on site
Distance Loss (3m)	-10dB	7.3.5	Assumed a point source
Attenuator loss	-24dB		From loss in Table 5.1
Specific Sound Level	L _{Aeq} 28dB		
Assume 100% on time	0dB	7.2	Constant operation
Acoustic feature correction	+3dB	9.2	+3dB for characteristics
Rating level	L _{Ar} 31dB	9.2	
Night-time (03:00 – 04:00) background sound level	L _{A90} 31dB	8	
Excess of rating over background sound level	0dB	11	
Assessment indicates low adverse impact		11	Depending on context

Table 6.2 – BS4142 Assessment

6.3 Context

The site is located within an area with multiple food premises and takeaways, all with their associated plant to the rear.

At a greater distance, there is London Road, a busy main road.

It is understood from the applicant that some of the surrounding businesses are permitted to operate until 03:00.

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

6.4 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, including a weekend period.
- Source data was of particular noise sources was measured on site at the receiver. These measurements were undertaken in a manner that best represented noise emissions from the source to the assessment locations without being unduly influenced by extraneous noise sources. This methodology minimised the uncertainty introduced in sound propagation calculations. Although measurements of source noise levels were undertaken during a single visit, little variation is expected in the noise levels attributed.

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. Sound Insulation to Above

7.1 Sound Insulation Test

Investigative airborne sound insulation tests were undertaken on 4th December 2020 in general accordance with BS EN ISO 140 *Acoustics – Measurement of sound insulation in buildings and of building elements Part 4: Field measurements of airborne sound insulation between rooms*.

High volume 'pink' noise was generated from a loudspeaker in the shop, positioned so as to obtain a diffuse sound field within the spaces. A spatial average of the resulting one-third octave band noise levels was obtained within both the source and the receive rooms.

In order to correct for room reverberant characteristics, the reverberation time (RT) was measured in the receive rooms using an interrupted broadband noise source and the RT function of the NTi XL2 sound level meter. Six microphone positions and two loudspeaker positions were used to obtain average results.

Background noise levels were measured in the receive rooms in order to correct the received noise measurements for the influence of the prevailing noise climate as in accordance with BS EN 140 part 4.

The prevailing background noise in the building was due to traffic on the nearby roads.

The following equipment was used for the sound insulation tests.

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
Electro Voice	ZLX-12P-EX	095208361761760076	-	-
Unbranded WAV player	-	-	-	-

Table 7.1 – Equipment used for the tests

7.2 Test Results

Due to access to the apartment not being possible, it was not possible to evaluate the level of noise breaking through the floor from the shop element of the premises. However, a test was undertaken to the shared hallway for the two apartments above, which is open to the stairway that runs up the side of the shop.

The sound insulation of the floor between ground and first floor hallway level provided a performance of $D_{nT,w} + C_{tr}$ 36 (45-9). This was controlled entirely by noise flanking through the

staircase wall, with the floor subjectively providing a much better performance, although this could not be separated out due to the lack of access to the apartments.

7.3 Discussion and Recommendations

The sound insulation performance is relatively poor and considering the later hours of use, the construction would need to be upgraded to control noise breakout to above.

The layout of the takeaway has the entire kitchen located under the flat roof area to the rear of the shop, with only the shop element located under the apartments.

As part of COVID 19 restrictions, there is currently a clear partition between kitchen and the front of the shop which although not continuous, does help keep the two areas acoustically separate to some degree.

As most noise associated with the shop is likely to be voices from patrons or delivery drivers, the low frequency C_{tr} value is not of such concern as the weighted standardised level difference $D_{nT,w}$. The measured level of $D_{nT,w}$ 45dB provides an average level of sound insulation performance to speech frequencies.

To uprate the performance of the floor, it is recommended that the existing ceiling is removed with 100mm mineral wool (density 10-33kg/m³) installed between the joists. A secondary ceiling should be installed on isolated hangers (such as Gypframe GAH1 or similar) creating a void of minimum 200mm depth. The ceiling should comprise 2 layers of dense 15mm plasterboard (minimum mass per board 11kg/m²), joints staggered, taped and skimmed.

With the above measures in place, noise from people talking is expected to be controlled to be NR15 in the apartments and hence would be expected to be inaudible.

To aid with the control of noise, it is recommended that the premises agrees to operate following guidance provided in a noise management plan, detailed in this report, to be agreed with the Council.

8. Noise Management Plan

The following noise management plan includes many measures that would be recommended for adoption by management of the premises. This plan address noise from operations and customers/delivery staff. These measures are intended to minimise the noise impact on the neighbours.

8.1 Potential Noise Sources

The management understand that the identification and recognition of potential causes of disturbance assists greatly in planning to avoid disturbances to the surroundings.

The following noise sources have been identified in relation to the proposed operation of the premises:

- Noise from the use of the premises
- Noise from customers
- Noise from delivery drivers inside
- Noise from staff/customers externally

8.2 Management Controls

The responsibility for the management controls will be assumed by the manager. Other members of staff may assume the role in the future following suitable training.

To minimise noise break-out from the premises, the external door to the premises will be kept closed during the evening and night-time, except when being used for immediate access and egress.

It is recommended that after midnight, only delivery drivers and collections are permitted, with no customers permitted to eat in the premises.

A culture of neighbourly consideration will be encouraged amongst customers and drivers through the use of signs and polite reminders from staff.

Due to the lack of parking on London Road, customers and drivers are expected to access and leave the premises on foot via London Road.

Where delivery drivers park around the corner on a side road, they should be reminded prior to arrival and departure that they are in a mixed commercial and residential area, and should not rev engines, sound horns, have loud music playing and should close car doors and boots quietly.

The access to the site is via London Road. Should staff, customers or delivery drivers want to smoke, staff should encourage them to move away from the front of the store, towards the road, and keep

voices down due to the nearby neighbours. Signs will be installed reminding customers and staff of the amenity of neighbours.

Servicing of the store such as delivery of produce, etc, would only occur during normal daytime hours, not the night-time.

8.2.1 Music Noise

Due to the proposed late hours of use, the store should not have any music playing in the premises.

8.3 Neighbour Relations

The management will endeavour to maintain a friendly, open and informative relationship with the nearby residents to allow concerns to be raised and addressed without hostility. Residents will be made aware of planned events with a reasonable notice period and concerns regarding these will be noted and acted upon.

8.4 Complaints Procedure

A phone number and email address will be provided to nearby residents to allow efficient notification of the premises if noise levels are causing a disturbance. Clear instructions would be given to those likely to answer on these procedures for handling complaints.

A complaint action procedure will be produced and made available to staff who will be instructed to follow it on receiving a complaint.

A timed and dated log will be kept in the office of all complaints, including actions taken and responses given. Other information recorded in the complaints log will include the approximate number of customers and staff present at the time of the complaint, and any specific activities or conditions which were noteworthy at the time. A sample complaint log sheet is attached at Appendix C. Any other notes or email communications should be copied and a record kept in the complaint log folder.

All complaints will be addressed promptly, with a response/explanation as well as any future actions or improvements that can be implemented.

9. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 229c London Road, Reading, as part of application to extend the operating hours of the premises.

The measured noise levels have been assessed against BS4142:2014 *Methods for rating and assessing industrial and commercial sound* for the existing building services on the rear flat roof.

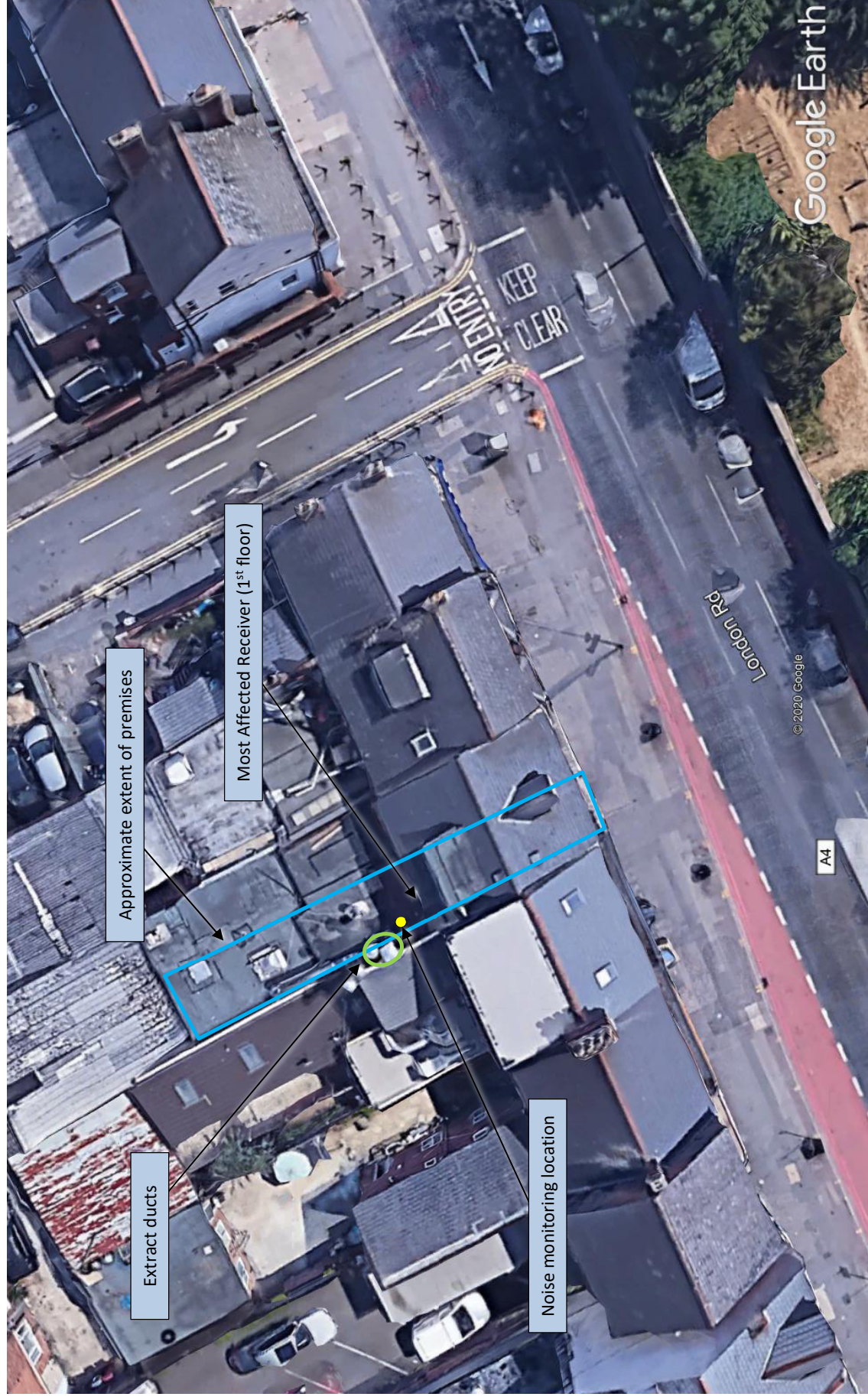
When assessed using BS4142, noise from most activities on site have been shown to have a low impact, with suitable mitigation measures implemented.

Sound insulation tests and a review of the required construction between the takeaway and the apartments have been carried out to ensure suitable acoustic separation between the uses is achieved.

Provided the recommendations in the report are adopted, the construction is expected control noise to a level so that residents are not affected by the operations of the takeaway.

To assist with this, a noise management plan has been suggested for the premises to operate within to have a feedback process in conjunction with their neighbours and Reading Borough Council.

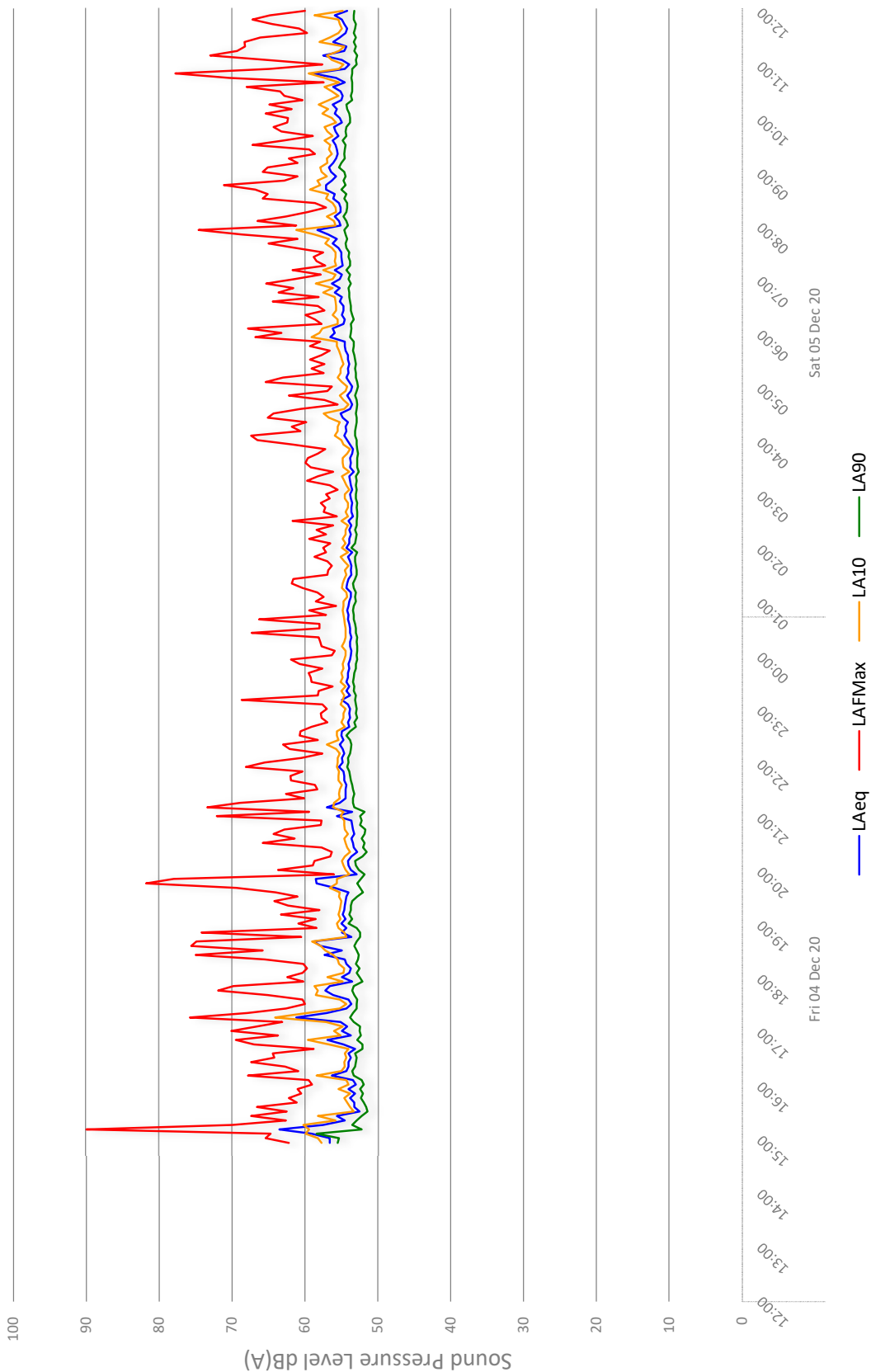
Jamie Duncan MIOA



229c London Road, Reading
Environmental Noise Time History: 1



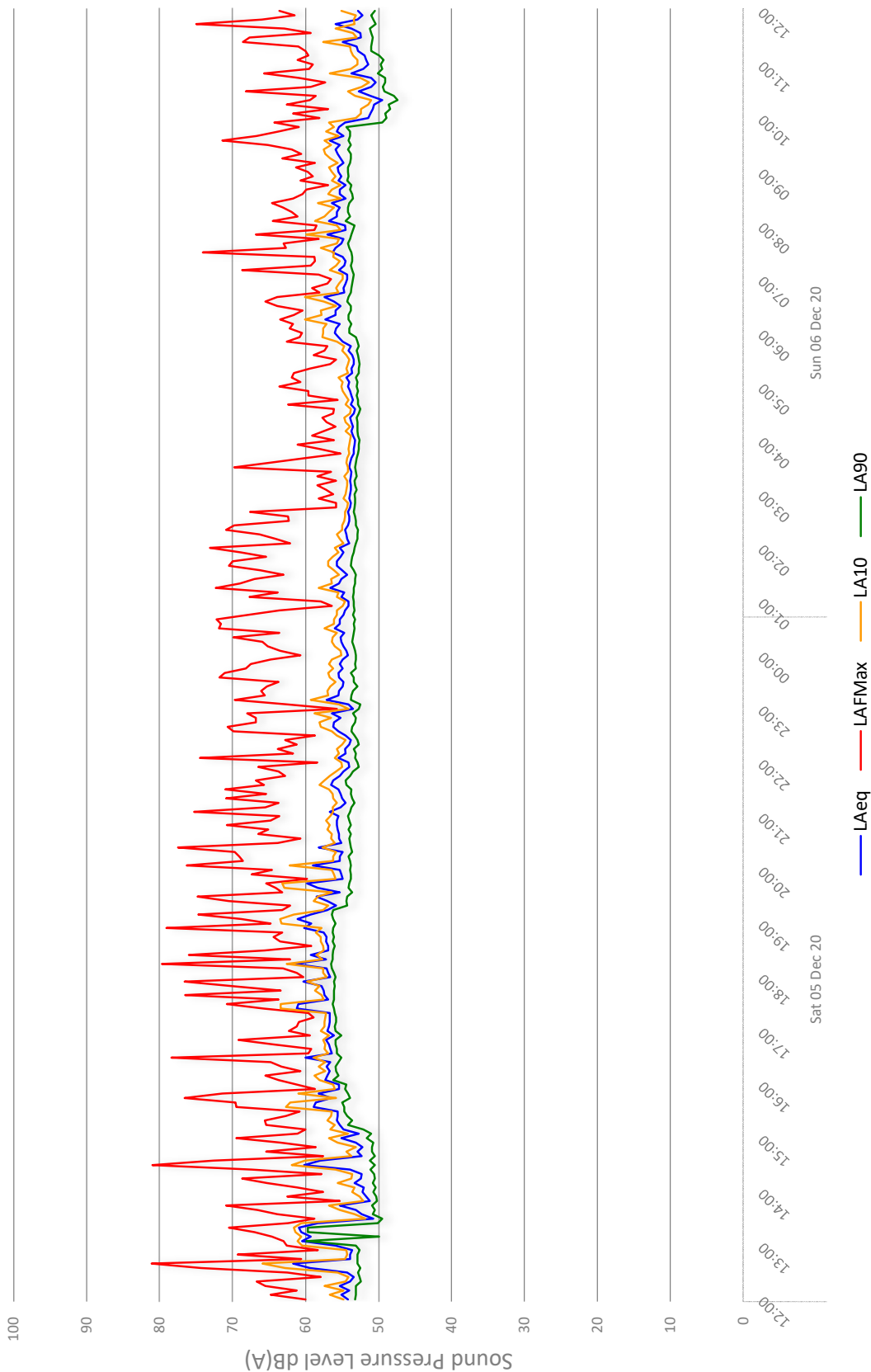
Figure VA3460/TH1



229c London Road, Reading
Environmental Noise Time History: 2



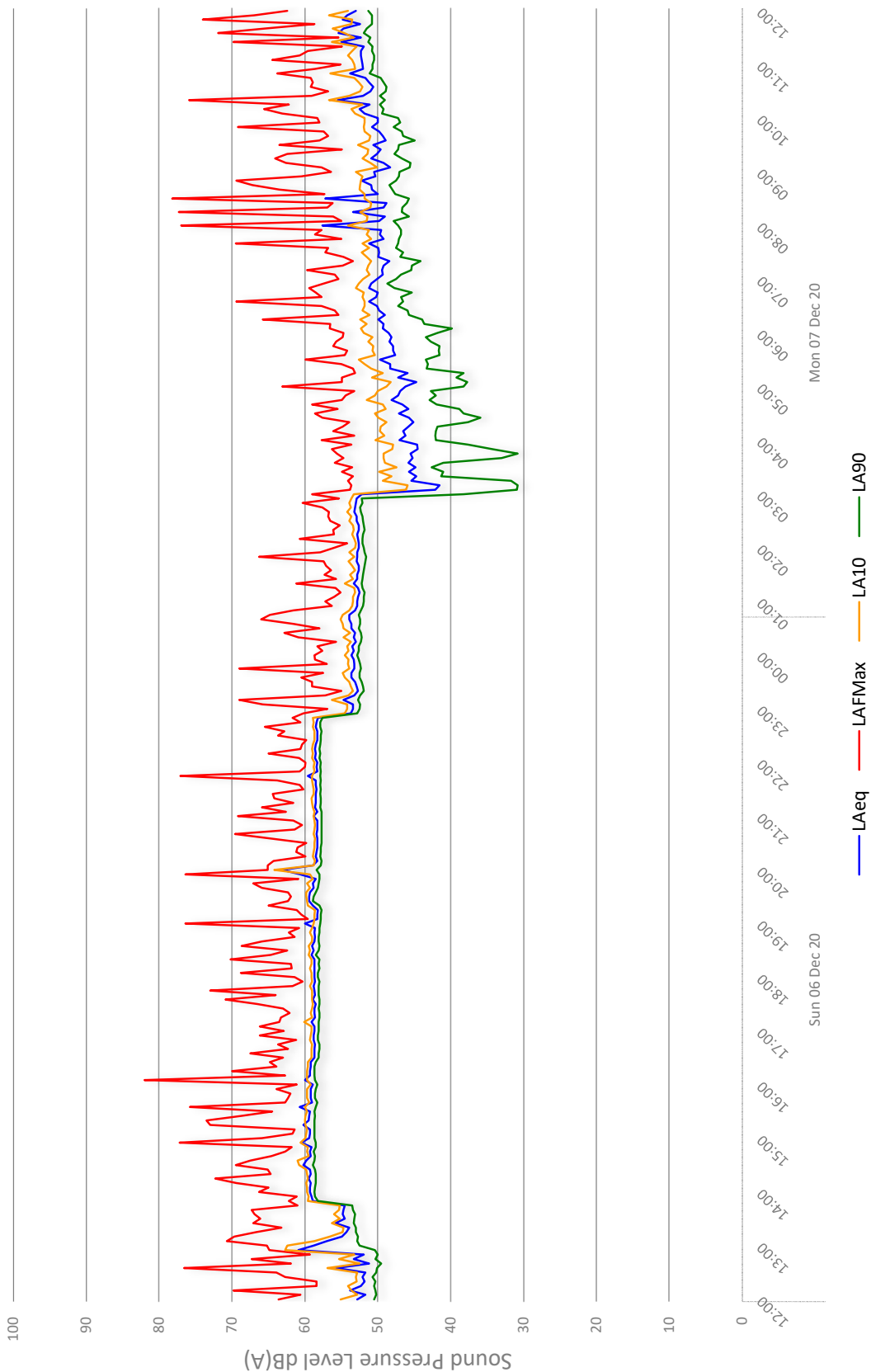
Figure VA3460/TH2



229c London Road, Reading
Environmental Noise Time History: 3



Figure VA3460/TH3



229c London Road, Reading
Environmental Noise Time History: 4



Figure VA3460/TH4



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.
R	<i>Sound Reduction Index.</i> Effectively the <i>Level Difference</i> 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
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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

VA3460 - 229c London Road, Reading

Noise Impact Assessment

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Extract Fans	Lp @ 1m	67	72	65	57	57	53	46	39	62
Melindex faced attenuator		-14	-27	-21	-23	-31	-33	-34	-23	
Distance Loss	To 3m	-10	-10	-10	-10	-10	-10	-10	-10	
Level at receiver		43	35	34	24	16	10	3	7	28

BS4142 Assessment					
BS4142 Character Corrections		Rating Levels		Expected Impact	
Tonality	0	Specific Sound Level	28	Low impact	
Impulsivity	0	Corrected SSL	31		
Intermittency	0	Background (Night)	31		
Other characteristics	3				
Total	3	Difference	0		

Appendix C

Sample Noise Complaint Log Sheet

Date	Time	Staff Name	No. of Staff & Customers	Complainant			Details			Response Details ¹
				Name	Address	Phone/email	Description ¹	Duration	Solution?	

¹ Attach noted and email correspondence as appropriate