



Environmental Noise Assessment

Report No: 2501167NR

Client: Mr. Arjhan Rai

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CONTENTS

0. EXECUTIVE SUMMARY	3
1. LEGISLATION, POLICY AND GUIDANCE	3
2. SITE DESCRIPTION	4
3. ENVIRONMENTAL NOISE SURVEY	4
4. ASSESSMENT	5
5 CONCLUSION	8

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

APPENDIX B – MEASUREMENT EQUIPMENT

APPENDIX C – NOISE MEASUREMENT LOCATIONS

APPENDIX D – NOISE SURVEY RESULTS

APPENDIX E – ATTENUATION CALCULATION SHEETS

APPENDIX F – LIMITATIONS

1. Executive Summary

Mr Arjhan Rai has commissioned Peak Acoustics, Ltd. to assess environmental noise emissions at 547 Oxford Road, Reading, RG301HJ. This is to determine the prevailing noise conditions at the site, and the viability of developing a ground floor extension at the rear of the property, with regard to exposure to environmental noise.

Prevailing noise at the site is due to road traffic (engine/exhaust and aerodynamic noise) from Wantage Road. In order to assess these emissions, a noise survey was undertaken during daytime (15:00 – 23:00, 07:00 – 10:00) and night-time (23:00 -07:00) hours on the 16th – 17th February 2016.

Environmental noise emissions at the site have been taken over a 11-hour daytime period and an 8-hour night-time period at a representative location. Daytime noise levels were measured at their highest and façade-corrected at **48.8dB L_{Aeq, 16hr}**, and night-time noise **42.8dB L_{Aeq, 8hr}/70.4dB L_{AFmax}**.

Using 4/12/4mm double-glazing and acoustic treated trickle vents, these figures would be reduced to levels of **15.1dB L_{Aeq, 16hr}** daytime, **10.2dB L_{Aeq, 8hr}** and **43.2dB L_{AFmax}** night-time, internally within dwellings as a result of façade insulation.

In accordance with the rigorous calculation method in BS8233:2014, properties with the recommended glazing and ventilation systems would see living room and bedroom noise levels within the “**GOOD**” category. This would place daytime and night-time internal noise levels within the NPSE category “**No Observable Effect Level**”.

All the standards, legislation, guidance and methods followed to carry out this assessment report are described in Section 1.

2. Legislation, Policy and Guidance

2.1 Noise Policy Statement for England

2.2 British Standards 8233:2014

2.3 National Planning Policy Framework 2012 (NPPF)

2.4 Noise Criteria Framework

3. Site Description

3.1 Existing Site Conditions

Currently the site is a small driveway at the rear of a disused ground floor flat.

3.2 Proposed Site Conditions

It is proposed to erect a ground floor extension to the rear of a ground floor residential dwelling. The flat will be extended by about 4m. This noise report considers the resultant noise impact of traffic noise from nearby roads and comments on the viability of the development with regards to environmental noise.

A site location plan can be found in **Appendix C**.

4. Environmental Noise Survey

Daytime (15:00 – 23:00, 07:00 – 10:00) and night-time (23:00-07:00) noise measurements have been carried out on the 16th – 17th February 2016. This is to determine the likelihood of noise nuisance during both diurnal periods, and is inclusive of both morning and evening “rush hour” periods.

4.1 Source Under Investigation

The noise climate was dominated by traffic and included engine/exhaust and aerodynamic noise from Oxford Road. A secondary noise source was noted as residents of adjacent properties.

4.2 Measurement Equipment

A Class 1 sound level meter was used to determine on-site environmental noise sound pressure levels. A class 1 microphone was mounted within an outdoor environmental measurement kit in order to mitigate the effects of meteorology (wind, cold, humidity). Calibration was carried out before and after any measurements. Equipment and calibration information may be found in more detail in **Appendix B**.

4.3 Weather Conditions

Weather conditions were deemed acceptable for such measurements and were recorded as thus:

Weather Conditions

Meteorology	5°C, cloudy
Wind Speed	5.4ms ⁻¹
Humidity	76%
Precipitation	0mm

4.4 Measurement location

Noise levels were recorded on-site outside a ground floor window, approximately 4m from the proposed extension. The measurement location is shown in **Appendix C**.

4.5 Survey Results

Results from the measurement intervals are summarised in the tables below. Full measurement details and information can be found in **Appendix D**.

Results of measurements are as follows:

Measured Levels on 16th-17th February 2016

	L _{Aeq, T} (dB)	L _{AFmax} (dB)
Daytime	51.8	-
Night-time	45.8	73.4

Levels were measured directly at the façade, and therefore require a correction to convert to free-field values. Levels measured close to a sound-reflective surface measure the effects of pressure anti-nodes, and are deemed higher than free-field values. A -3dB façade correction, as per Watson & Downey (2008, p117) has been applied, in order to proceed with internal level calculations.

Values are therefore corrected as:

	L _{Aeq, T} (dB)	L _{AFmax} (dB)
Daytime (15hr)	48.8	-
Night-time (8hr)	42.8	70.4

4.6 Subjective Impressions

The noise climate on site was predominately due to noise from road traffic sources. A secondary noise source was noted as pedestrians.

5. Assessment

This section of the report identifies proposed specification of the property, and adjudges its suitability for the reduction of environmental noise. Assessment is made according to BS8233:2014, with reference to continuous noise during daytime periods (between 15:00 – 23:00, 07:00 – 10:00) and night-time (between 23:00-07:00) continuous and maximum noise.

External Noise Analysis

Measured noise levels are identified graphically in **Appendix D** and are typical of a noise climate dominated by traffic noise due to the noticeable decrease across the night and early morning. L_{Amax} peaks are likely caused by emergency vehicle sirens or HGVs.

5.1 Internal Noise Levels – Insulation Guide

Internal noise levels have been calculated in order to demonstrate that the proposed development can achieve suitable internal noise levels inside rooms, when appropriate glazing and ventilation systems are used.

In order to describe the likely internal exposure to environmental noise at the site, Peak Acoustics, Ltd. use suggested data from BS8233:2014 on standard construction materials. This will include all elements of the exposed living room and bedroom façades closest to the noise sources.

Values are given according to two key areas covered by BS8233:2014, which are listed as the following:

- Living rooms between hours of 07:00 and 23:00;
- Bedrooms between hours of 23:00 and 07:00.

For the purposes of this assessment, daytime levels are assessed in living room spaces, night-time levels are assessed in bedrooms. Sizes are nominally given as:

- Living room 5m x 4m x 2.4m
- Bedroom 3m x 4m x 2.4m

The building envelope is assumed as having standard construction, with façade materials and elements, such as:

- External wall Concrete block & Brickwork Leaves with $\geq 75\text{mm}$ Cavity
- Tiled, Pitched roof with Mineral Wool and Plaster Ceiling
- 4/12/4mm pane double glazing
- Acoustic trickle ventilators

The following are Sound Reduction Indices of the specifications identified previously:

Sound Reduction Index of the external wall, dB (R_w)

Frequency Band (Hz)	125	250	500	1000	2000
R_w of External wall	43	54	42	48	53

Sound Reduction Index of the roof, dB (R_w)

Frequency Band (Hz)	125	250	500	1000	2000
R_w of Roof	28	34	40	45	49

Sound Reduction Index of glazing, dB (R_w) 4/12/4(mm)

Frequency Band (Hz)	125	250	500	1000	2000
R_w of Glazing	24	20	25	34	37

Level Difference ($D_{n,e}$) acoustic trickle vent (4000mm^2), dB

Frequency Band (Hz)	125	250	500	1000	2000
$D_{n,e}$ of Ventilation	41	40	35	48	53

This report determines values based on the assumption that ventilation is **NOT from open windows**, but from auxiliary methods of external ventilation, in this case passive, acoustic trickle ventilators.

Summary calculations are made following the BS8233:2014 Rigorous Design Calculation shown in **Section 1** and are shown in greater detail in **Appendix E**.

5.2 Daytime Internal Noise Levels

Considering the insulation with the addition of acoustic trickle ventilators and 4/12/4mm double glazing, daytime environmental noise internally would be reduced from **48.8dB $L_{Aeq, 12hr}$** to interior levels of **15.1dB $L_{Aeq, 16hr}$** .

BS8233:2014 suggests a “**Good**” guideline of 30dB $L_{Aeq, 16hr}$ for resting conditions, with a “**Reasonable**” limit of 40dB $L_{Aeq, 16hr}$.

The above standard of construction would place the internal levels in living rooms as below 30dB, therefore in the “Good” category.

5.3 Night-time Internal Noise Levels

Considering the insulation with the addition of acoustic trickle ventilators and 4/12/4mm double glazing specified above, night-time environmental noise in bedrooms would be reduced from **42.8dB $L_{Aeq, 8hr}$** to interior levels of **10.2dB $L_{Aeq, 8hr}$** with maximum individual noise events reduced from **70.4dB L_{AFmax}** to **43.2dB L_{AFmax}** .

BS8233:2014 suggests a “Good” guideline of 30dB $L_{Aeq, 8hr}$ for sleeping conditions, with a “Reasonable” limit of 35dB $L_{Aeq, 8hr}$. Individual noise events (Measured with fast time-weighted Maximum) should not normally exceed 45dB L_{AFmax} (as in BS8233:1999).

The above standard of construction would place the internal continuous levels in bedrooms as below 30dB and maximum noise level as below 45dB L_{AFmax} , therefore in the “Good” category.

6. Effect Level and Exposure Outcomes

A summary on internal noise levels and their respective BS8233 classifications can be found below:

Internal Space	Noise Parameter	Internal Noise Level	BS8233 Classification
Living Room	Daytime $L_{Aeq, 16hr}$	15.1	“GOOD”
Bedroom	Night-time $L_{Aeq, 8hr}$	10.2	“GOOD”
Bedroom	Night-time L_{AFmax}	43.2	“GOOD”

In accordance with the NPSE-based framework identified in **Section 1**, the proposed development can be categorised as “**NOEL – No Observable Effect Level**” for the proposed dwellings at the site, and all dwellings within this proposed envelope can be deemed such. In the professional opinion of Peak Acoustics, Ltd., no observable adverse effects on residents’ health would likely arise as a result of the proposed development at the site.

The specification outlined above for bedrooms and living rooms should be sufficient to satisfy the NPSE/BS8233:2014 policy of reducing to negligibility the impact of noise on human health.

5 Conclusion

Peak Acoustics, Ltd. has been appointed by **Mr. Arjhan Rai** to carry out a noise survey to determine existing noise from nearby road traffic and design potential mitigation for a proposed ground floor residential extension.

The noise assessment has been carried out in accordance with BS8233:2014 and the Noise Policy Statement for England.

This report describes the noise survey carried out by Peak Acoustics and the subsequent analysis undertaken in order to meet the accepted criteria outlined in Section 1. An internal noise level assessment has been formulated for living rooms and bedrooms, along with a recommended building, glazing and ventilation specification in order to achieve internal noise levels detailed in Section 4.

For all living rooms and bedrooms at the proposed dwellings, the $L_{Aeq, 16hr}$ (Daytime) and $L_{Aeq, 8hr}$ (Night-time) internal noise levels are categorised within the “Good” design range in accordance to BS8233:2014; the L_{AFmax} levels calculated within bedrooms at night time are within the “Good” design guideline specified by BS8233:1999.

NOEL – NO Observed Effect Level – Internal noise levels would be within the “Good” standard outlined in BS8233:2014 where calculations are carried out assuming that windows are closed and supplementary means of acoustic trickle ventilation is provided.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples common environments and their typical noise levels.

Noise Level	Environment
0 dB (A)	Threshold of hearing
20 to 30 dB (A)	Quiet bedroom at night
30 to 40 dB (A)	Living room during the day
40 to 50 dB (A)	Typical office
50 to 60 dB (A)	Inside a moving car
60 to 70 dB (A)	Typical high street
100 to 110 dB (A)	Fire alarm at 1 metre away
140 dB (A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level (2×10^{-5} Pa – threshold of hearing).

dB(A) – A-weighted decibel. A-weighting is a correction factor applied to decibel values in order to give a more accurate representation of human hearing, which compensates for the varying sensitivity of the human ear with frequency.

$L_{Aeq, h}$ – The equivalent continuous sound level over a stated period. Quantifies a fluctuating sound level over a given period as the RMS-averaged sound level in which the same amount of acoustic energy is contained over. This can be deemed the “average sound level” over a given period. A-weighting applies.

L_{A90} – The sound level exceeded 90% of the time. Typically used to describe background noise the L_{90} is regarded as the ‘average minimum level’ and quantifies the common sound level of a fluctuation sound field i.e. the sound level that occurs 90% of the time. Alternatively L_{10} describes the sound level exceeded 10% of the time and therefore quantifies the ‘average maximum level’ of sound which is often used during the calculation of road traffic noise. A-weighting applies.

L_{AFmax} – The maximum fast-measured, A-weighted sound pressure level. This effectively describes the highest noise level recorded at an instant in time, over a given time period. It is used to measure individual, short-lived noise events that may not have a significant effect on the L_{Aeq} of that period.

APPENDIX B - MEASUREMENT EQUIPMENT

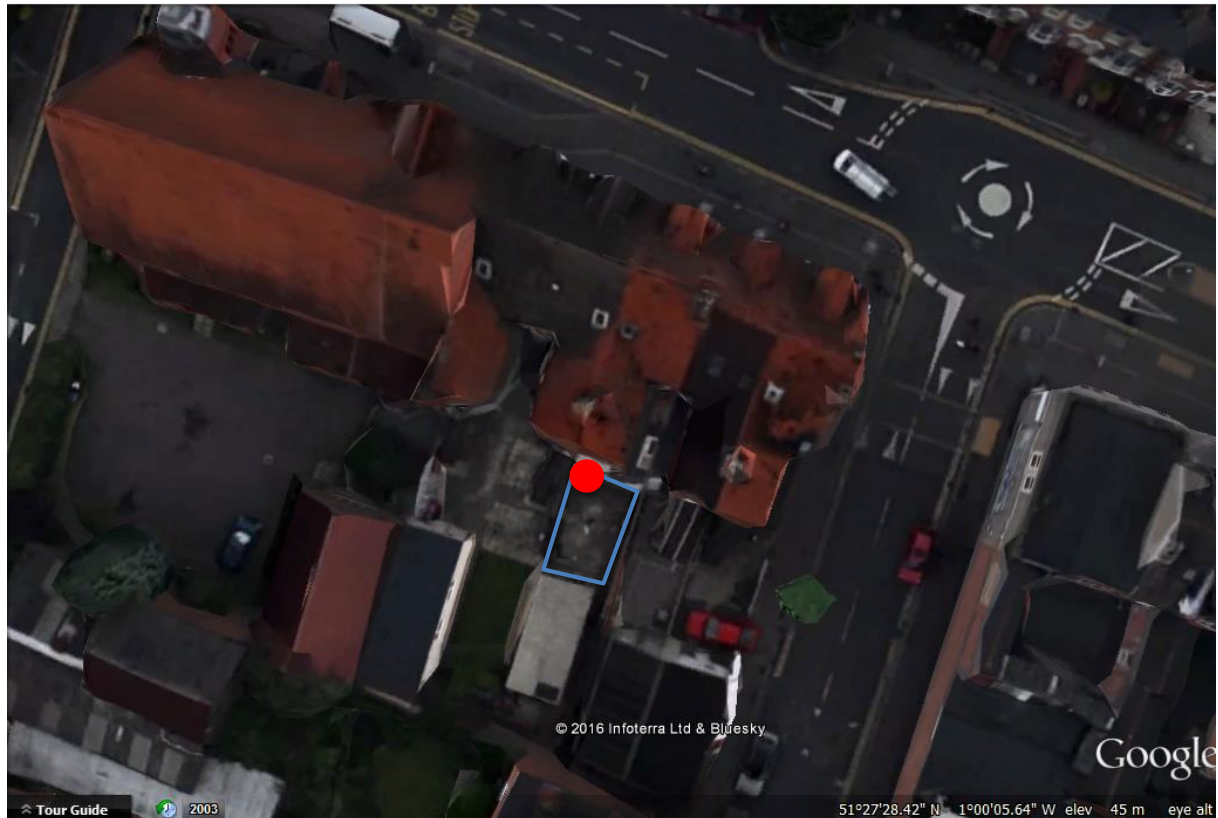
Manufacturer	Type	Name	Serial Number
Svantek	Sound Level Meter	971	41980
Svantek	Class 1 Microphone	SV18	44331
Svantek	Class 1 Calibrator	SV31	32507

Calibration Information

Svantek 971	Level (dB)
Calibrator Reference Level	114.0
Level/Deviation Before Measurement (dB)	113.46/0.54
Level/Deviation After Measurement (dB)	113.54/0.46

APPENDIX C – Noise Measurement Location

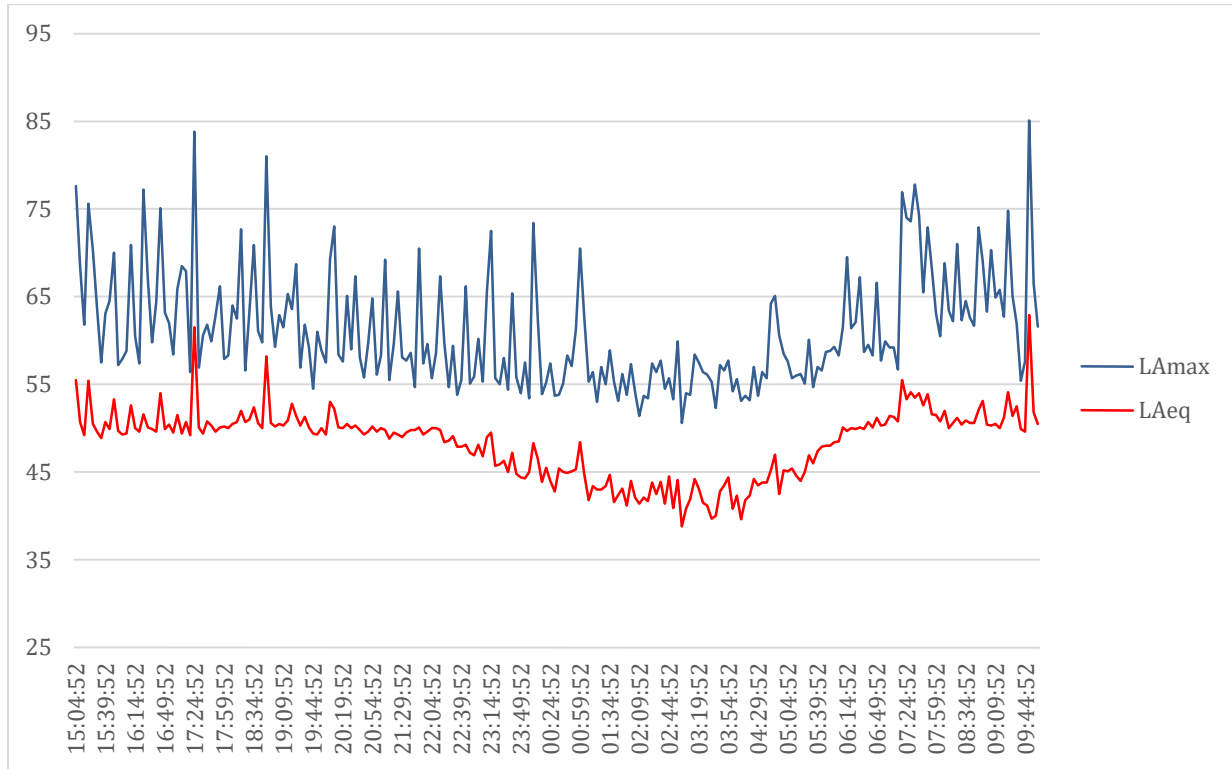
Measurement Location and site location



-  *Measurement Location*
-  *Site Location*

APPENDIX D – Noise Survey Results

Environmental Noise Measurements, 16th-17th February 2016, Graphical Form



APPENDIX E – Attenuation Calculation Sheets

BS8233 Rigorous Design Calculation – Internal Daytime Noise

	125	250	500	1000	2000
Leq1	54.5	50.0	46.8	48.5	44.0
Dne	41	40	35	48	53
Rwi	24	20	25	34	37
Rew	41	45	45	54	58
Rrr	27	37	43	48	52
A	20	20	20	20	20
Sf	9.6		S	10	
Sw1	1.8		A0	10	
Sew	7.8				
Srr	20.0				

	125	250	500	1000	2000
A	55	50	47	49	44
B	0.00008	0.00010	0.00033	0.00002	0.00001
C	0.00075	0.00188	0.00059	0.00007	0.00004
D	0.00006	0.00003	0.00003	0.00000	0.00000
E	0.00017	0.00007	0.00007	0.00001	0.00000
	-	-	-	-	-
F	29.75015	26.83874	29.94003	39.88502	43.25861
G	-3.09098	-3.09098	-3.09098	-3.09098	-3.09098
leq2	24.7	23.1	16.8	8.5	0.7
A weight	-16	-9	-3	0	1
LAeq2	8.7	14.1	13.8	8.5	1.7
Leq2 (SN)	27.4				
LAeq2 (SN)	18.1				

BS8233 Rigorous Design Calculation – Internal Night-time Noise

	125	250	500	1000	2000
Leq1	50.5	43.7	40.9	42.5	37.9
Dne	41	40	35	48	53
Rwi	24	20	25	34	37
Rew	41	45	45	54	58
Rrr	27	37	43	48	52
A	16	16	16	16	16
Sf	9.6		S	10	
Sw1	1.8		A0	10	
Sew	7.8				
Srr	12.0				

	125	250	500	1000	2000
A	51	44	41	43	38
B	0.00008	0.00010	0.00033	0.00002	0.00001
C	0.00075	0.00188	0.00059	0.00007	0.00004
D	0.00006	0.00003	0.00003	0.00000	0.00000
E	0.00010	0.00004	0.00004	0.00000	0.00000
	-	-	-	-	-
F	30.03040	26.89437	30.05440	40.02765	43.38181
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	21.3	17.7	11.7	3.4	-4.6
A weight	-16	-9	-3	0	1
LAeq2	5.3	8.7	8.7	3.4	-3.6
Leq2 (SN)	23.3				
LAeq2 (SN)	13.2				

BS8233 Rigorous Design Calculation – Internal Night-time Noise, Maxima

	125	250	500	1000	2000
Leq1	80.8	78.5	73.9	69.0	65.9
Dne	41	40	35	48	53
Rwi	24	20	25	34	37
Rew	41	45	45	54	58
Rrr	27	37	43	48	52
A	16	16	16	16	16
Sf	9.6		S	10	
Sw1	1.8		A0	10	
Sew	7.8				
Srr	12.0				

	125	250	500	1000	2000
A	81	79	74	69	66
B	0.00008	0.00010	0.00033	0.00002	0.00001
C	0.00075	0.00188	0.00059	0.00007	0.00004
D	0.00006	0.00003	0.00003	0.00000	0.00000
E	0.00010	0.00004	0.00004	0.00000	0.00000
	-	-	-	-	-
F	30.03040	26.89437	30.05440	40.02765	43.38181
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	51.6	52.5	44.7	29.9	23.4
A weight	-16	-9	-3	0	1
LAeq2	35.6	43.5	41.7	29.9	24.4
Leq2 (SN)	55.5				
LAeq2 (SN)	46.2				

APPENDIX F – Limitations to this Report

This report requires a physical investigation of the site with an appropriate number of measurements in order to provide quantifiable information concerning the type and magnitude of noise affecting the site. The objectives have been limited to identifying sources of noise in order to carry out a suitable assessment for the proposed development.

The number and duration of noise measurements have been strategically selected to give reasonably representative information on the environment within the agreed time. Also, measurement locations have been limited to the areas unoccupied by any building that are easily accessible without imposing any form of risk to Peak Acoustics staff.

With any sampling, the number of samples and methods of sampling and measuring cannot exclude the existence of ‘hotspots’ where noise or vibration levels may transpire to be significantly more than those actually measured due to previously unknown or unrecognised sources of noise and vibration. Additionally, sources of noise or vibration may be irregular or fluctuate in intensity to an unpredictable degree and consequently may not be present in full intensity for some of the survey period or the entire survey period.

The report does not consider the effects of long-distance meteorological effects such as refraction (due to temperature inversions, wind propagation). All measurements taken on site are subject to a margin of uncertainty of $\pm 1\text{dB}$ due to manufacturer’s specification of equipment.