



Noise Assessment

Report No: 1711151NR

Client: Mr. Ahamad Ibrahimkhil

Date of Issue: 10th December 2015

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Executive Summary

Arcadia Design has commissioned Peak Acoustics, Ltd. on behalf of Mr. Ahamad Ibrahimkhil to assess environmental noise emissions at proposed flats above a commercial unit. The site is located on 8 Union Street, Reading, RG1 1EU. This is to determine the prevailing conditions at the site and to determine the suitability for internal residential development with regard to environmental noise exposure.

Environmental noise emissions at the site have been taken over a 72-hour weekend period, in order to ensure noise from patrons, pedestrians and entertainment are included. Levels were measured at their highest in the 24-hour period between Saturday 5th December and Sunday 6th December 2015. Daytime noise levels were measured and corrected for façade reflections at **58.5dB L_{Aeq, 16hr}**, and night-time noise levels have been measured and façade corrected at **59.4dB L_{Aeq, 8hr}**.

Peak Acoustics recommends a minimum glazing specification of 6/12/6mm double-glazed units within living room and bedroom areas of the site. Ventilation should be undertaken using proprietary powered, attenuated ventilators, compliant with Approved Document Part F. Using such a method to glaze and ventilate the property, internal levels should be reduced to **28.6dB L_{Aeq, 16hr}** during the day and **28.8dB L_{Aeq, 8hr}** at night.

Using the Rigorous Calculation Method within BS8233:2014, internal noise levels at all façades should be reduced to levels within the “GOOD” design criteria. These would be defined as “NOEL – No Observed Effect Level” within the NPPF framework, therefore providing appropriate daytime and night-time living amenity. Outdoor living area areas are not proposed at the site, currently.

Modelling the sound insulation of the partition floor at the site, a concrete raft with suspended, acoustic tile ceiling below, reaches airborne sound insulation levels of **60dB D_{nT, w}**. This is deemed sufficient insulation to protect “Confidential/Sensitive” receptors above from “High” source room noise below. Further work to protect noise from the commercial unit is not considered necessary.

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

1. Legislation, Policy and Guidance

1.1 Noise Policy Statement for England (2010)

1.2 British Standards 8233:2014

1.3 National Planning Policy Framework 2012 (NPPF)

1.4 Reading Borough Council Requirements

In their correspondence Ref. EP/532002 dated 22nd October 2015, Ms. Jodie Wilson of Reading Borough Council details requirements for the acoustic performance of the building:

- Internal bedrooms (23:00-07:00) <30dB $L_{Aeq, 8hr}$
- Internal living rooms (07:00-23:00) <35dB $L_{Aeq, 16hr}$
- External balconies/gardens/terraces <50dB L_{Aeq} with 55dB L_{Aeq} limit.

These broadly correspond to BS8233 and WHO guidelines on internal and external noise levels, and the BS8233 methodology has been selected.

2. Site Description

2.1 Existing Site Conditions

The site is a currently vacant first floor unit above a commercial ground floor unit, presently occupied by a nail bar and beauty salon.

Union Street is a busy alleyway in the heart of the town, linking Broad Street and Friar Street. Although no road traffic is able to travel it, there are a large proportion of ground floor commercial enterprises, including greengrocers, fish mongers and cafés.

2.2 Proposed Site Conditions

It is proposed to convert the existing first floor unit into a set of residential flats, and extend a further floor above to develop residential flats at second floor level.

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

3. Environmental Noise Survey

An environmental noise survey has been conducted over a 72-hour weekend period between 13:40 on Friday 5th December and 13:05 Monday 7th December 2015. The highest value of daytime and night-time noise has been selected for consideration when determining glazing and ventilation details.

3.1 Source under Investigation

The primary source of noise at the site is from pedestrians' raised voices, from a nearby small sound system servicing the café adjacent and potentially from evening and night-time patrons of nearby bars and restaurants.

3.2 Measurement Equipment

A Class 1 sound level meter was used to determine on-site environmental noise sound pressure levels. 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**.

3.3 Weather Conditions

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

Weather Conditions	
Meteorology	5°C, dry, overcast
Wind Speed	2.1m•s ⁻¹ W
Humidity	86%
Precipitation	0mm

3.4 Measurement location

Exterior measurement was undertaken at first floor level, approximately 1.2m above the ground. It was installed at a representative location at the façade, directly overlooking the alley below.

The measurement location is shown in **Appendix C**.

3.5 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 façade measurements are as follows:

	Daytime ($L_{Aeq, 16hr}$)	Night-time ($L_{Aeq, 8hr}$)
Friday-Saturday	60.9	60.8
Saturday-Sunday	61.5	62.4
Sunday-Monday	61.4	59.8

Levels from the Saturday-Sunday measurement period has been selected, in order to show the worst-case noise emission at the site. Measured levels are subject to a 3dB negative façade correction, in order to convert them to free field values.

	$L_{Aeq, T}$ (dB)
Daytime (16hr)	58.5
Night-time (8hr)	59.4

Noise levels are assessed according to internal criteria within BS8233:2014, and are considered in detail in **Section 4**.

4. Assessment

This section of the report identifies current 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 (all hours between 07:00-23:00) and night-time (all hours between 23:00-07:00) continuous and maximum noise.

Levels of internal noise are calculated and assessed according to BS8233:2014 guidance target levels for amenity within daytime and night-time living spaces (living rooms and bedrooms, respectively).

4.1 Recommended Façade Specification

Recommended specification for façade insulation is as follows:

- Existing brick/block wall;
- Existing flat concrete roof;
- 6/12/6mm double-glazed window units;
- Powered, attenuated ventilation, Part F compliant.

Each of these elements of the façade contributes to the overall resistance to external sound. Values of sound resistance for the above specification is as follows:

Sound Reduction Index of External Wall, dB (R_{ew}) – Brick/Block Wall

Frequency Band (Hz)	125	250	500	1000	2000
External Wall	46	44	50	58	64

Sound Reduction Index of Roof, dB (R_{rr}) – Flat concrete roof

Frequency Band (Hz)	125	250	500	1000	2000
Roof/Ceiling	39	40	49	53	57

Sound Reduction Index of Glazing, dB (R_{wi}) – 6/12/6(mm)

Frequency Band (Hz)	125	250	500	1000	2000
Double-Glazing	20	19	29	38	34

Level Difference of Ventilation, dB ($D_{n,e}$) – Powered Attenuated Ventilation

Frequency Band (Hz)	125	250	500	1000	2000
Ventilation	42	48	52	58	65

Open windows would only provide between 10-15dB R_w and would not be sufficient to reduce noise to levels below the “GOOD” standard, as specified by Reading Borough Council. Ventilation should therefore be provided via alternative methods, in this case using powered ventilation systems, reducing the need for open windows within the properties. Windows may still be required to open for safety reasons, or for vapour purging.

4.2 Internal Noise Levels

Internal noise levels have been calculated in accordance with the Rigorous Calculation Method within BS8233:2014, accounting for façade reduction from the external wall, roof, glazing and ventilation. Full calculation sheets are shown in **Appendix E**.

4.2.1 Daytime Internal Noise Levels

Daytime noise levels are likeliest to affect ground floor living rooms and dining areas. This section assesses the suitability of the building envelope specification for each façade, outlined in Section 4.1 with regard to the insulation of noise.

Living rooms within first floor flats would see daytime noise levels reduced from 58.5dB $L_{Aeq, 16hr}$ to **28.6dB $L_{Aeq, 16hr}$** .

BS8233 describes noise levels incident at this façade below 30dB as providing “GOOD” daytime resting conditions.

4.2.2 Night-time Internal Noise Levels

Night-time noise is likely to affect residents within bedrooms at the site, located at first floor level.

Levels of external noise inside bedrooms at the front floor would be reduced from 59.4dB $L_{Aeq, 8hr}$ / to **28.8dB $L_{Aeq, 8hr}$** .

Continuous noise levels are within the 30dB criterion for “GOOD” sleeping conditions.

Rooms at upper floors can be described as “GOOD” also, as their siting is slightly further from the noise sources outlined in Section 3. Due to the large proportion of reflected sound present at the site, identical specification should be sought for proposed new dwellings at second floor level.

4.2.3 Partition Floor Performance

The site is located above a commercial unit, and there is some potential for breakout of commercial noise from below. Observing activity within the commercial unit, it is deemed to be a “High” source room activity noise. For “Confidential/Sensitive” receptors, this requires the partition floor to have a minimum airborne sound insulation value of 52dB $D_{nT, w}$.

The build-up at the site has been modelled using Insul® v8.0.8 sound insulation modelling software. The following build-up has been determined for purposes of assessment:

- 152mm solid concrete raft partition floor
- 100mm lightweight suspended ceiling with 19mm acoustic ceiling tile

Insul® assesses this partition floor as having a sound insulation value of **60dB $D_{nT, w}$** .

Levels of existing airborne sound insulation are deemed sufficient, even for a “Very High” source room noise (requiring an insulation performance of 57dB $D_{nT, w}$). No further modification is considered necessary to improve airborne insulation levels of the partition floor.

4.3 NPPF Criteria Assessment

According to the NPPF, both daytime and night-time internal noise is placed within the category of “NOEL – No Observed Effect Level”. The specification for façade insulation should provide sufficient reductions to environmental noise as to protect daytime and night-time living amenity.

No outdoor living area is currently proposed at the development; assessment is therefore not deemed necessary.

5. Conclusion

Arcadia Design has commissioned Peak Acoustics, Ltd. on behalf of Mr. Ahamad Ibrahimkhil to assess environmental noise emissions at the flats above a commercial unit. The site is located on 8 Union Street, Reading, RG1 1EU. This is to determine the prevailing conditions at the site and to determine the suitability for internal residential development with regard to environmental noise exposure.

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Glazing should be replaced with 6/12/6mm double-glazed units, to remain openable for purposes of vapour purge or safety. Ventilation should be made using proprietary powered attenuated ventilators, compliant with Approved Document Part F guidelines on sufficient equivalent area servicing.

Levels of internal noise, using the given façade specification on glazing and ventilation, would be reduced to **28.6dB L_{Aeq, 16hr}** during the day and **28.8dB L_{Aeq, 8hr}** at night.

Noise levels are categorised, for both scenarios, as providing “GOOD” amenity during the daytime and night-time. Internal noise levels, furthermore, would be below the design criteria hitherto defined by Reading Borough Council.

The partition floor should have a minimum airborne sound insulation level of 52dB D_{nT, w}, in order to protect the amenity of “Confidential/Sensitive” receptors from “High” source noise, as detailed in BS8233:2014. The modelled sound insulation performance of the current partition floor is calculated at **60dB D_{nT, w}**. No further works are deemed necessary to improve airborne sound insulation performance of the existing partition floor.

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

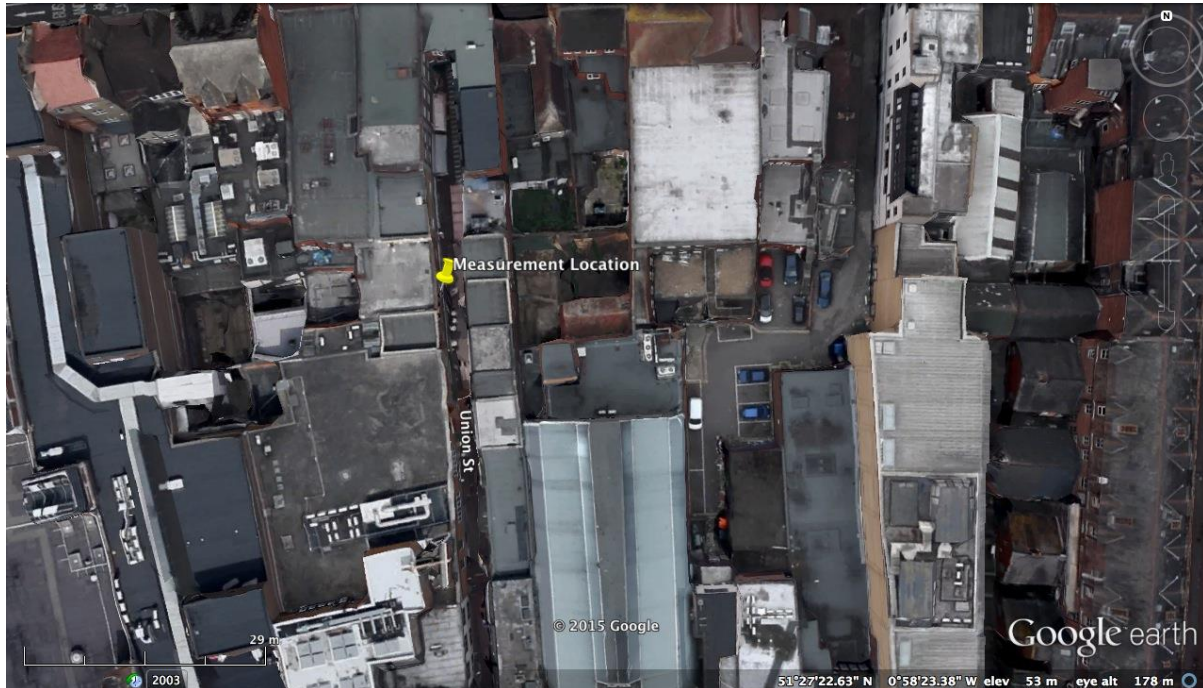
Manufacturer	Type	Name	Serial Number
Svantek	Class 1 meter	958A	34525
Svantek	Class 1 Microphone	SV18	44331
Svantek	Class 1 Calibrator	SV31	32507

Calibration Information

Svantek 958A	Level (dB)
Calibrator Reference Level	114.0 dB
Pre-measurement Level (dB)	114.4dB
Post-measurement Level (dB)	114.3dB

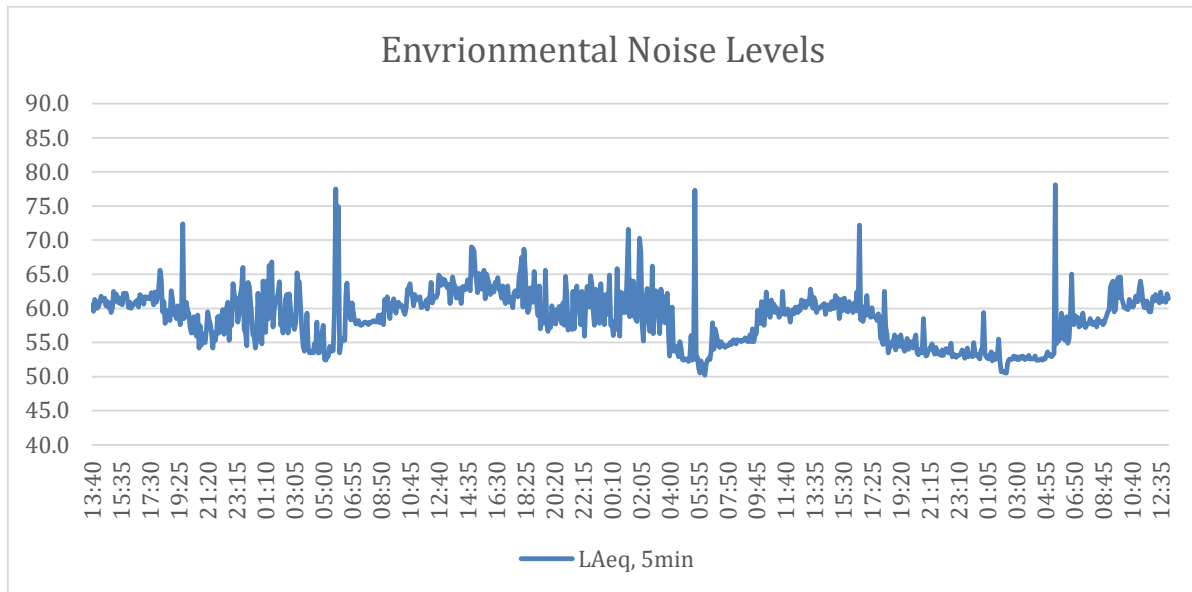
APPENDIX C – Noise Measurement Location

Measurement Location Plan



APPENDIX D – Noise Survey Results

Environmental Noise Measurements, 4th December – 7th December 2015



	Daytime (L _{Aeq} , 16hr)	Night-time (L _{Aeq} , 8hr)
Friday-Saturday	60.9	60.8
Saturday-Sunday	61.5	62.4
Sunday-Monday	61.4	59.8

APPENDIX E – BS8233 Rigorous Calculation Method Worksheets

Daytime Internal Noise Calculations

	125Hz	250Hz	500Hz	1000Hz	2000Hz
L _{eq1}	62	58.3	57.3	52.2	49
D _{n, e}	42	48	52	58	65
R _{wi}	20	19	29	38	34
R _{ew}	41	45	45	54	58
R _{rr}	39	40	49	53	57
A	11	14	16	16	15
S _f	9.6		S	10	
S _{wi}	2.4		A0	10	
S _{ew}	7.2				
S _{rr}	20.0				

	125Hz	250Hz	500Hz	1000Hz	2000Hz
A	62	58	57	52	49
B	0.00007	0.00002	0.00001	0.00000	0.00000
C	0.00250	0.00315	0.00031	0.00004	0.00010
D	0.00006	0.00002	0.00002	0.00000	0.00000
E	0.00016	0.00013	0.00002	0.00001	0.00000
F	-25.55539	-24.79839	-34.42785	-42.96503	-39.84896
G	-0.59121	-1.63857	-2.12188	-2.12188	-1.93820
L _{eq2}	38.9	34.9	23.8	10.1	10.2
A weight	-16	-9	-3	0	1
L _{Aeq2}	22.9	25.9	20.8	10.1	11.2
L _{eq2} (SN)	40.4				
L _{Aeq2} (SN)	28.6				

Night-time Internal Noise Calculations

	125Hz	250Hz	500Hz	1000Hz	2000Hz
L _{eq1}	62	58.3	57.3	52.2	49
D _{n, e}	42	48	52	58	65
R _{wi}	20	19	29	38	34
R _{ew}	41	45	45	54	58
R _{rr}	39	40	49	53	57
A	11	14	16	16	15
S _f	9.6		S	10	
S _{wi}	2.4		A0	10	
S _{ew}	7.2				
S _{rr}	12.0				

	125Hz	250Hz	500Hz	1000Hz	2000Hz
A	62	58	57	52	49
B	0.00007	0.00002	0.00001	0.00000	0.00000
C	0.00250	0.00315	0.00031	0.00004	0.00010
D	0.00006	0.00002	0.00002	0.00000	0.00000
E	0.00016	0.00013	0.00002	0.00001	0.00000
F	-25.55539	-24.79839	-34.42785	-42.96503	-39.84896
G	-0.59121	-1.63857	-2.12188	-2.12188	-1.93820
L _{eq2}	38.9	34.9	23.8	10.1	10.2
A weight	-16	-9	-3	0	1
L _{Aeq2}	22.9	25.9	20.8	10.1	11.2
L _{eq2} (SN)	40.4				
L _{Aeq2} (SN)	28.6				

APPENDIX F – Partition Floor Performance

Sound Insulation Prediction (v8.0.8)

Program copyright Marshall Day Acoustics 2015

- Key No. 2539

Margin of error is generally within $R_w \pm 3$ dB

Job Name: Union St.

Job No.: 1711151

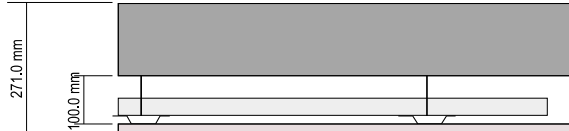
Page No.:

Notes:

Date: 8 Dec 15

Initials: DW

File Name: Ceiling-Floor Buildup.ixl



R_w	58 dB
C	-3 dB
C_{tr}	-10 dB
D_{nTw}	60 dB
	[V:50m3]
	[A:11m2]

System description

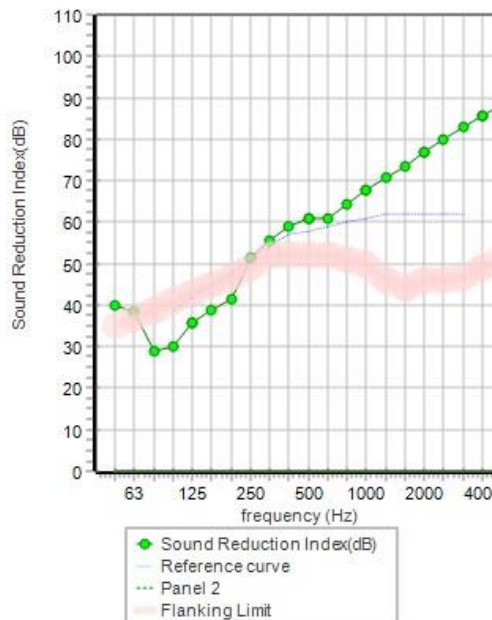
Panel 1 : 1 x 152.0 mm Concrete (ρ :2340 kg/m³, E :11GPa, η :0.04)

Cavity: Suspended light steel grid: Stud spacing 600 mm
Panel 2 : 1 x 19.0 mm Mineral fibre ceiling tile (Generic) (ρ :300 kg/m³, E :0.04GPa, η :0.03)

Mass-air-mass resonant frequency = 78 Hz

frequency (Hz)	R (dB)	R (dB)
50	40	
63	38	33
80	29	
100	30	
125	36	33
160	39	
200	42	
250	51	46
315	55	
400	59	
500	61	60
630	61	
800	64	
1000	68	67
1250	71	
1600	73	
2000	77	76
2500	80	
3150	83	
4000	86	85
5000	88	

Panel Size 2.7x4 m; Mass 361.5 kg/m²



APPENDIX G – 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.