



Environmental Noise Assessment

Report No: IB2903163NR
Client: Mr. Stuart Kenny
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1. Executive Summary

Mr. Stuart Kenney has commissioned Peak Acoustics Ltd. to assess environmental noise emissions at 138 Salisbury Road, Reading, RG30 1BN. This is to determine the prevailing noise conditions at the site, and the viability of the demolition of the property currently situated on site and the erection of a residential dwelling, with regard to its exposure to environmental noise.

Prevailing noise at the site is due to nearby traffic from Cow Lane and a railway line situated to the rear of the property. In order to assess these emissions, a noise survey was undertaken during daytime (07:00 – 23:00) and night-time (23:00 -07:00) hours on the 21st – 22nd April 2016.

Environmental noise emissions at the site have been taken over a 13-hour daytime period and an 8-hour night-time period at representative locations. Daytime noise levels at the front of site were measured as **57.5dB L_{Aeq, 16hr}**, with night-time levels measured as **52.9dB L_{Aeq, 8hr}**, and **72.7dB L_{AFmax}**. Daytime noise levels at the rear were measured and corrected as **58.5dB L_{Aeq, 16hr}**, with night-time levels measured as **56.2dB L_{Aeq, 8hr}**, and **81.9dB L_{AFmax}**.

Using 4/12/4mm double-glazing and hit & miss trickle vents at the front, these figures would be reduced to **27.5dB L_{Aeq, 16hr}** daytime, **22.3dB L_{Aeq, 8hr}** and **43.6dB L_{AFmax}** night-time, internally within dwellings as a result of façade insulation.

Using 10/12/6mm double-glazing and acoustic treated trickle vents at the rear, these figures would be reduced to **21.2dB L_{Aeq, 16hr}** daytime, **19.6dB L_{Aeq, 8hr}** and **44.0dB 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”.

2. Legislation, Policy and Guidance

[1] Noise Policy Statement for England

[2] British Standards 8233:2014

3. Site Description

3.1. Existing Site Conditions

A residential dwelling is currently situated on site at the end of a cul-de-sac adjacent to Cow Lane. A railway line is situated to the east at the rear of the property.

3.2. Proposed Site Conditions

It is proposed to demolish the current property and erect a two storey residential dwelling.

3.3. Subjective Impressions

The noise climate was fairly quiet with intermittent rail noise from passing trains. Near-field road traffic was noted as a primary noise source at the front of the property. There was a noticeable decrease in road noise at the rear of the site due to acoustic shadowing from the building.

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

4. Environmental Noise Survey

Daytime (13:40 – 12:50) and night-time (23:00 – 07:00) noise measurements have been carried out on 21st – 22nd April 2016. This is to determine the likelihood of noise nuisance, and is inclusive of both morning and evening “rush hour” periods.

4.1. Measurement Equipment

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

4.2. Weather Conditions

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

21 st April 2016		22 nd April 2016	
Climate	10°C, partly cloudy	Climate	8°C, cloudy
Wind Speed	4.9ms ⁻¹ , E	Wind Speed	4.2ms ⁻¹ , E
Humidity	61%	Humidity	62%
Precipitation	0mm	Precipitation	0mm

4.3. Measurement location

Noise levels were recorded on-site at two locations. Outside a front ground floor window and outside a rear 1st floor window. The measurement locations are shown in **Appendix C**.

4.4. 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:

<i>Measured Levels</i>		
	L_{Aeq, T} (dB)	L_{AFmax} (dB)
Daytime (front)	57.5	-
Night-time (front)	52.9	72.7
Daytime (rear)	61.5	-
Night-time (rear)	59.2	84.9

The rear measured levels are subject to a -3dB façade correction due to measurements being obtained within 1m of a reflective surface. The corrected results are tabulated below:

<i>Corrected Levels</i>		
	L_{Aeq, T} (dB)	L_{AFmax} (dB)
Daytime (front)	57.5	-
Night-time (front)	52.9	72.7
Daytime (rear)	58.5	-
Night-time (rear)	56.2	81.9

5. Assessment

This section identifies the necessary specification for building envelope materials to reduce environmental noise within the proposed dwelling.

5.1. 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. It is also typical of noise climates by a railway with intermittent peaks in noise from passing trains which are more prominent at the rear of the property.

5.2. 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 (Front)
- Hit & miss trickle ventilators (Front)
- 10/12/6 (Rear)
- Acoustic treated trickle ventilators (Rear)

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	41	45	45	54	58

Sound Reduction Index of the roof, dB (R_w)

Frequency Band (Hz)	125	250	500	1000	2000
R_w of Roof	27	37	43	48	52

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 ($D_{n,e}$) hit and miss trickle vent (4000mm^2), dB

Frequency Band (Hz)	125	250	500	1000	2000
$D_{n,e}$ of Ventilation	34	27	37	35	34

Sound Reduction Index of glazing, dB (R_w) 10/12/6(mm)

Frequency Band (Hz)	125	250	500	1000	2000
R_w of Glazing	26	27	34	40	38

Level Difference ($D_{n,e}$) acoustic treated trickle vent, 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, hit & miss trickle ventilators/acoustic treated 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**.

5.3. Daytime Internal Noise Levels

Considering the insulation with the addition of 4/12/4mm glazing and hit & miss trickle vents at the frontal facade, daytime environmental noise internally would be reduced from **57.5dB $L_{Aeq, 16hr}$** to interior levels of **27.5dB $L_{Aeq, 16hr}$** .

Considering the insulation with the addition of 10/12/6mm glazing and acoustic treated trickle vents at the rear façade, daytime environmental noise internally would be reduced from **58.5dB $L_{Aeq, 16hr}$** to interior levels of **21.2dB $L_{Aeq, 16hr}$** .

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

5.4. Night-time Internal Noise Levels

Considering the insulation with the addition of 4/12/4mm glazing and hit & miss trickle vents at the frontal facade, night-time environmental noise in bedrooms would be reduced from **52.9dB $L_{Aeq, 8hr}$** to interior levels of **22.3dB $L_{Aeq, 8hr}$** with maximum individual noise events reduced from **72.7dB L_{AFmax}** to **43.6dB L_{AFmax}** .

Considering the insulation with the addition of 10/12/6mm glazing and acoustic treated trickle vents at the rear façade, night-time environmental noise in bedrooms would be reduced from **56.2dB $L_{Aeq, 8hr}$** to interior levels of **19.6dB $L_{Aeq, 8hr}$** with maximum individual noise events reduced from **81.9dB L_{AFmax}** to **44.0dB 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.

5.5. External Amenity Space Noise Level

Measured and corrected noise levels at the rear give a daytime level of **58.5dB L_{Aeq}** in the external amenity space. This is 3.5dB above the upper guideline for noise in an external amenity space, however it is often the case that the external amenity noise guidelines cannot be achieved for external amenity spaces directly adjacent to a railway line. A compromise should be considered because of this and thus should allow the development of external amenity space, if proposed as part of the development.

6. Effect Level and Exposure Outcomes

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

Internal Space	Noise Parameter	Internal Noise Level	BS8233 Classification
Living Room (Front)	Daytime $L_{Aeq, 16hr}$	27.5dB	GOOD
Bedroom (Front)	Night-time $L_{Aeq, 8hr}$	22.3dB	GOOD
Bedroom (Front)	Night-time L_{AFmax}	43.6dB	GOOD
Living Room (Rear)	Daytime $L_{Aeq, 16hr}$	21.2dB	GOOD
Bedroom (Rear)	Night-time $L_{Aeq, 8hr}$	19.6dB	GOOD
Bedroom (Rear)	Night-time L_{AFmax}	44.0dB	GOOD
External Space	Noise Parameter	External Noise Level	BS8233 Classification
Garden (Rear)	Daytime $L_{Aeq, 16hr}$	58.5dB	>55dB (UPPER GUIDELINE)

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

Mr. Stuart Kenney has commissioned Peak Acoustics Ltd. to assess environmental noise emissions at 138 Salisbury Road, Reading, RG30 1BN. This is to determine the prevailing noise conditions at the site, and the viability of the demolition of the property currently situated on site and the erection of a residential dwelling, with regard to its exposure to environmental noise.

Prevailing noise at the site is due to nearby traffic from Cow Lane and a railway line situated to the rear of the property. In order to assess these emissions, a noise survey was undertaken during daytime (07:00 – 23:00) and night-time (23:00 -07:00) hours on the 21st – 22nd April 2016.

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 BS8233:2014. Levels within external amenity spaces are 3.5dB above the upper guideline specified by BS8233:2014.

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 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	Class A Sound Meter	971	40305
Svantek	Class A Pre-amp	SV18	41651
Svantek	Class A Calibrator	SV31	08571
Svantek	Class A Sound Meter	SV31	08571
Svantek	Class A Pre-amp	971	41980
Svantek	Class A Calibrator	SV18	44331

Calibration Information

Svantek 971	Level (dB)
Calibrator Reference Level	114.0
Level/Deviation Before Measurement (dB)	113.58 / 0.42
Level/Deviation After Measurement (dB)	113.52 / 0.48

Svantek 971	Level (dB)
Calibrator Reference Level	113.0
Level/Deviation Before Measurement (dB)	112.51 / 0.49
Level/Deviation After Measurement (dB)	112.47 / 0.53

APPENDIX C – Noise Measurement Location

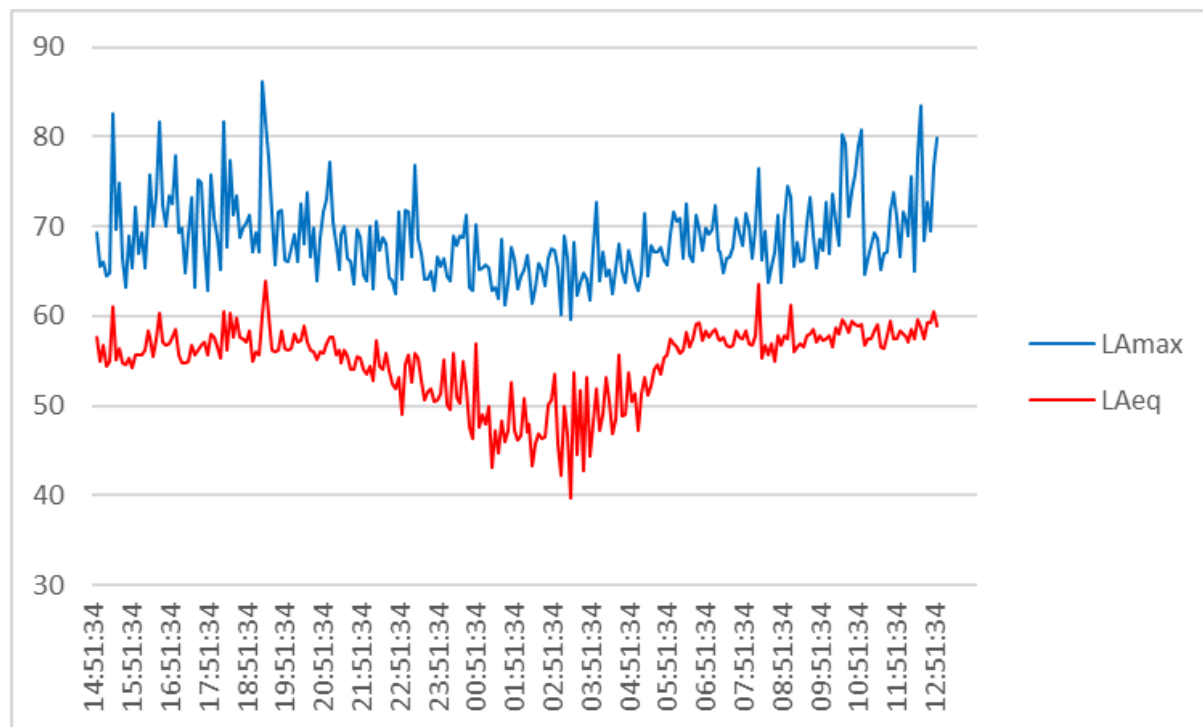
Measurement Location and site location



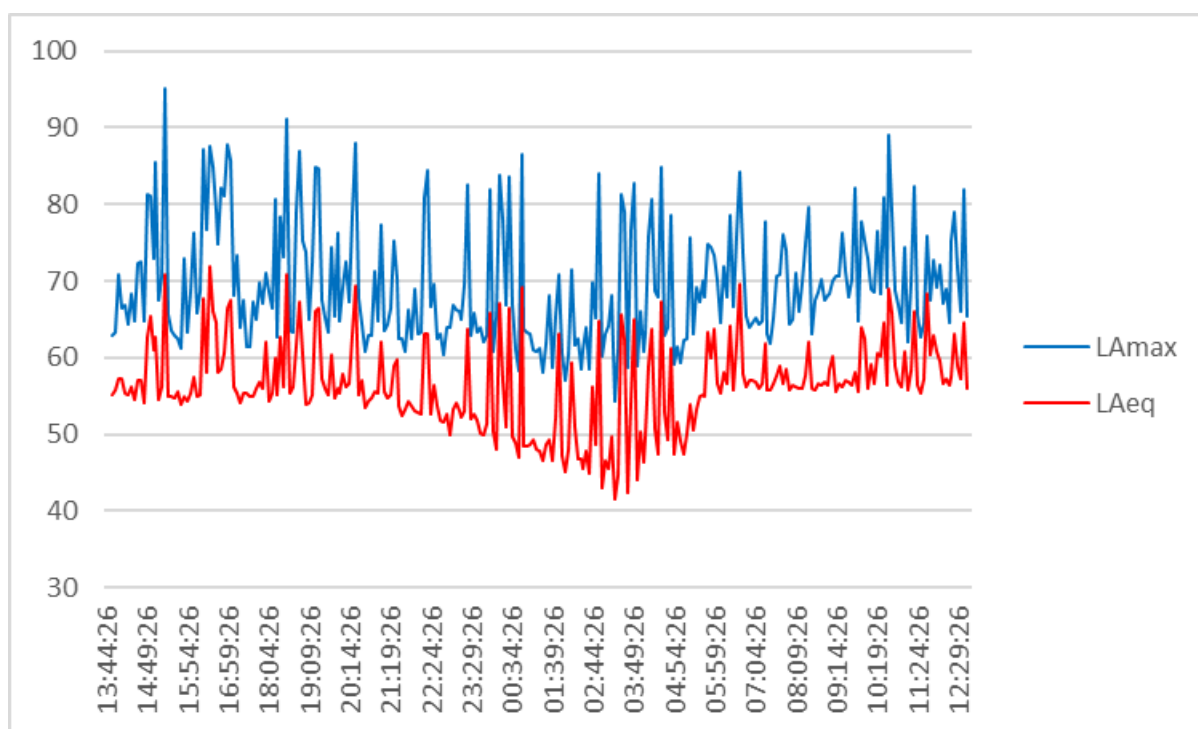
- *Front Measurement Location*
- *Rear Measurement Location*

APPENDIX D – Noise Survey Results

Environmental Noise Measurements, 21st – 22nd April 2016 (Front)



Environmental Noise Measurements, 21st – 22nd April 2016 (Rear)



APPENDIX E – Attenuation Calculation Sheets

BS8233 Rigorous Design Calculation – Internal Daytime Noise (Front)

	125	250	500	1000	2000
Leq1	60.2	55.4	53.2	54.0	48.9
Dne	34	27	37	35	34
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	20.0				

	125	250	500	1000	2000
A	60	55	53	54	49
B	0.00041	0.00208	0.00021	0.00033	0.00041
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	28.56620	23.93084	30.49469	33.81348	33.40373
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	32.5	32.3	23.6	21.1	16.4
A weight	-16	-9	-3	0	1
L _{Aeq2}	16.5	23.3	20.6	21.1	17.4
Leq2 (SN)	35.9				
L _{Aeq2} (SN)	27.5				

BS8233 Rigorous Design Calculation – Internal Night-time Noise (Front)

	125	250	500	1000	2000
Leq1	52.8	49.3	48.7	50.0	44.6
Dne	34	27	37	35	34
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	53	49	49	50	45
B	0.00041	0.00208	0.00021	0.00033	0.00041
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	28.77792	23.95923	30.62488	33.84829	33.41631
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	24.9	26.2	19.0	17.0	12.1
A weight	-16	-9	-3	0	1
LAeq2	8.9	17.2	16.0	17.0	13.1
Leq2 (SN)	29.4				
LAeq2 (SN)	22.3				

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

	125	250	500	1000	2000
Leq1	63.3	63.8	75.3	66.7	61.0
Dne	34	27	37	35	34
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	63	64	75	67	61
B	0.00041	0.00208	0.00021	0.00033	0.00041
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	28.77792	23.95923	30.62488	33.84829	33.41631
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	35.4	40.7	45.6	33.7	28.5
A weight	-16	-9	-3	0	1
LAeq2	19.4	31.7	42.6	33.7	29.5
Leq2 (SN)	47.3				
LAeq2 (SN)	43.6				

BS8233 Rigorous Design Calculation – Internal Daytime Noise (Rear)

	125	250	500	1000	2000
Leq1	59.5	55.2	53.2	53.0	50.4
Dne	41	40	35	48	53
Rwi	26	27	34	40	38
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	20.0				

	125	250	500	1000	2000
A	60	55	53	53	50
B	0.00008	0.00010	0.00033	0.00002	0.00001
C	0.00047	0.00037	0.00007	0.00002	0.00003
D	0.00006	0.00003	0.00003	0.00000	0.00000
E	0.00017	0.00007	0.00007	0.00001	0.00000
	-	-	-	-	-
F	31.05825	32.44237	33.04848	43.29867	44.03106
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	29.3	23.6	21.0	10.6	7.2
A weight	-16	-9	-3	0	1
LAeq2	13.3	14.6	18.0	10.6	8.2
Leq2 (SN)	30.9				
LAeq2 (SN)	21.2				

BS8233 Rigorous Design Calculation – Internal Night-time Noise (Rear)

	125	250	500	1000	2000
Leq1	59.1	53.6	51.9	50.8	47.4
Dne	41	40	35	48	53
Rwi	26	27	34	40	38
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	59	54	52	51	47
B	0.00008	0.00010	0.00033	0.00002	0.00001
C	0.00047	0.00037	0.00007	0.00002	0.00003
D	0.00006	0.00003	0.00003	0.00000	0.00000
E	0.00010	0.00004	0.00004	0.00000	0.00000
	-	-	-	-	-
F	31.44147	32.64800	33.28576	43.61808	44.17865
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	28.5	21.8	19.5	8.1	4.1
A weight	-16	-9	-3	0	1
LAeq2	12.5	12.8	16.5	8.1	5.1
Leq2 (SN)	29.8				
LAeq2 (SN)	19.6				

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

	125	250	500	1000	2000
Leq1	80.0	77.2	77.6	73.7	70.1
Dne	41	40	35	48	53
Rwi	26	27	34	40	38
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	80	77	78	74	70
B	0.00008	0.00010	0.00033	0.00002	0.00001
C	0.00047	0.00037	0.00007	0.00002	0.00003
D	0.00006	0.00003	0.00003	0.00000	0.00000
E	0.00010	0.00004	0.00004	0.00000	0.00000
	-	-	-	-	-
F	31.44147	32.64800	33.28576	43.61808	44.17865
G	-2.12188	-2.12188	-2.12188	-2.12188	-2.12188
leq2	49.4	45.4	45.2	31.0	26.8
A weight	-16	-9	-3	0	1
LAeq2	33.4	36.4	42.2	31.0	27.8
Leq2 (SN)	52.0				
LAeq2 (SN)	44.0				

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.