

Acoustic Consultancy Report

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Acoustic Report

Report Prepared For

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i) Executive Summary

A residential development has reached completion at 930 Oxford Road, in Reading.

A noise survey has been undertaken to determine whether the noise levels within the premises of the new development meet the guidance taken from BS8233:2014.

Both internal and external commissioning measurements have met the guidance from BS8233:2014.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	16/05/2018	Initial Issue	RM	VB
2	06/06/2018	Revised Internal Measurements	RM	JN

1 Introduction

A residential development has reached completion at 930 Oxford Road, in Reading.

A noise survey has been undertaken to determine whether the noise levels within the premises of the new development meet the guidance taken from BS8233:2014. The results from the noise survey are provided within this report.

2 Calibration

The measurement equipment (as detailed at the end of Appendix A) was calibrated prior to and after obtaining measurements.

The recorded calibration gain adjustment levels were as follows:

Table 1: Calibration gain adjustment levels (114 dB at 1 kHz), dB re 2×10^{-5} Pa

Date	Sound Level Meter (serial number)	Before	After
11/05/2018	27152	-0.64	-0.65
04/06/2018	11207	+1.73	+1.69

3 Design criterion

3.1 BS8233:2014

Guidance is provided in BS8233:2014, this is shown in the following table:

Table 2: BS8233 Indoor ambient noise levels for dwellings, dB $L_{Aeq,T}$

Activity	Location	Time period	
		07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 $L_{Aeq,16 \text{ hour}}$	-
Dining	Dining Room/area	40 $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 $L_{Aeq, 16 \text{ hour}}$	30 $L_{Aeq, 8 \text{ hour}}$

The levels provided in the above table assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern an appropriate alternative period may be used.

The measured levels are considered to follow normal diurnal fluctuations.

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

BS8233:2014 also states that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

3.2 World Health Organisation (WHO) Guidelines for Community Noise (1999)

The WHO's 'Guidelines for Community Noise' gives the following relevant noise criteria:

Table 3: Guideline values for community noise, from Guidelines for Community Noise (WHO, 1999)

Specific Environment	$L_{Aeq, T}$ dB	Time Base (hours)	$L_{Amax, fast}$ dB
Outdoor living area (serious annoyance, daytime and evening)	55	16	-
Outdoor living area (moderate annoyance, daytime and evening)	50	16	-
Dwelling, indoors	35	16	-
Inside bedrooms	30	8	45
Outside bedrooms	45	8	60

A secondary criterion of 45dB L_{Amax} is also considered in relation noise. WHO only considers it appropriate to provide a criterion for the internal L_{Amax} level during the night-time period as it is a useful parameter to assess sleep disturbance. It is recommended that internal noise levels should not exceed 45dB L_{Amax} during the night and the document states that:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10 – 15 times per night'

3.3 Local Authority Condition

CONDITION 1. No development shall take place until a detailed scheme, informed by an assessment of the current noise environment, for protecting the dwelling from the external noise environment of the area has been submitted to and approved, in writing, by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwelling are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS 8233:2014.

Table 4: BS8233 ambient noise levels for dwellings, dB $L_{Aeq, T}$

Room	Design Criteria	Upper limit
Bedrooms (23:00 to 07:00)	<30dB $L_{Aeq, 8 \text{ hour}}$	-
Living rooms (07:00 to 23:00)	<40dB $L_{Aeq, 16 \text{ hour}}$	-
Gardens & Balconies	<50dB $L_{Aeq, T}$	<55dB $L_{Aeq, T}$

4 Noise Measurement Results

4.1 Internal Ambient Noise

The results from the internal ambient noise survey are shown in the table below.

Table 5: Averaged measured internal noise levels, dB re 2×10^{-5} Pa

Location	Time period	Criteria dB	Result dB
Bedroom area	07:00 -23:00	40 $L_{Aeq,16hr}$	28
	23:00 – 07:00	30 $L_{Aeq,8hr}$	24

4.2 External Ambient Noise

The results from the external measurements taken in the rear garden are shown in the table below.

Table 6: Averaged measured external noise levels, dB re 2×10^{-5} Pa

Location	Time period	Criteria dB	Upper limit dB	Result dB
Garden	07:00 -23:00	<50dB $L_{Aeq,T}$	<55dB $L_{Aeq,T}$	54

5 Conclusion

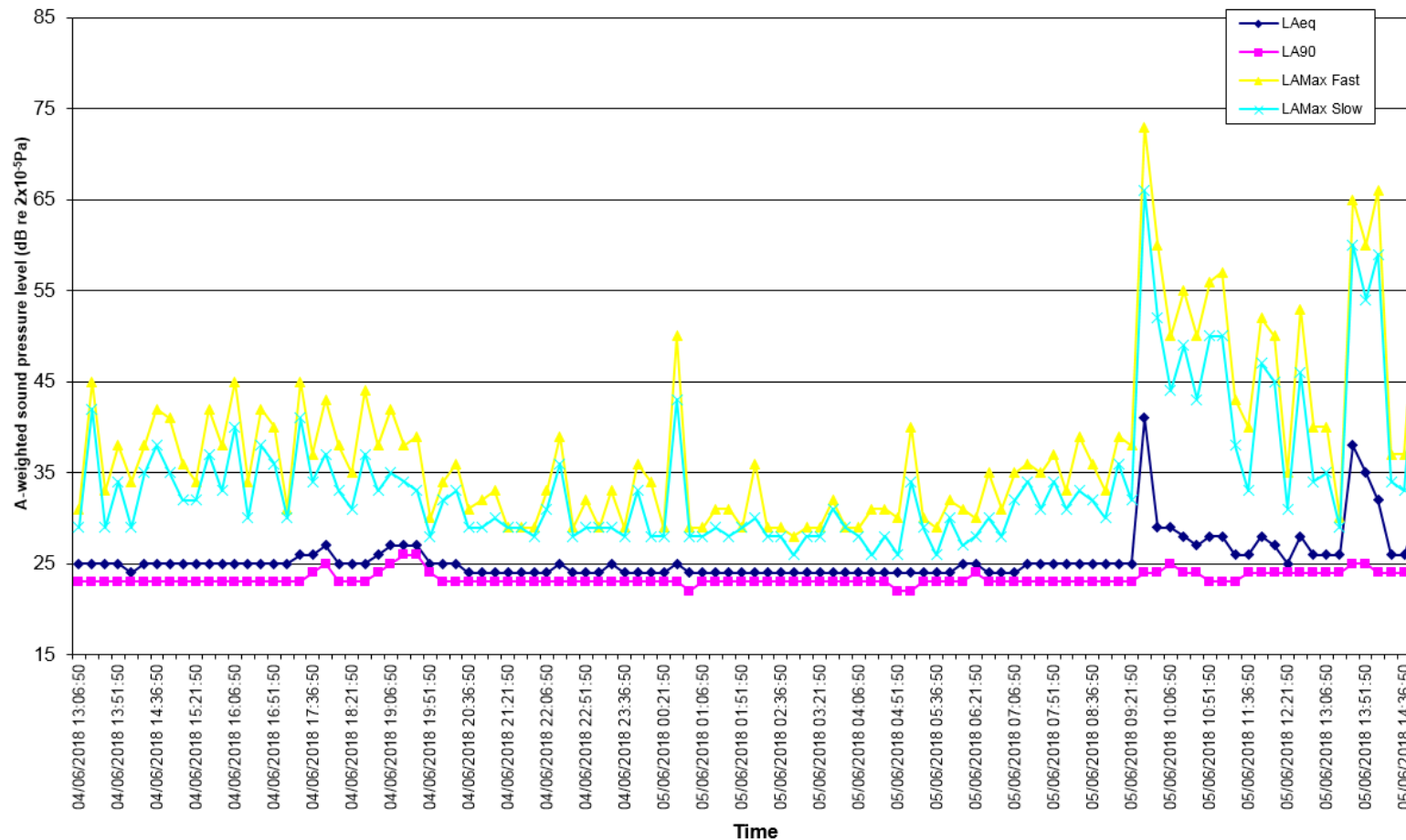
A residential development has reached completion at 930 Oxford Road, in Reading.

A noise survey has been undertaken to determine whether the noise levels within the premises of the new development meet the guidance taken from BS8233:2014.

Both internal and external commissioning measurements have met the guidance from BS8233:2014.

Appendix A: Measurement Data

Internal:



Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11207
- Svantek pre-amplifier SV12L S/N: 49860 with GRAS microphone capsule 40AE S/N: 215511

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10893 complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

External:

No	Date & time	Elapsed time	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	L _{Aeq}
1	11/05/2018 15:08:26	00:15:00	64	55	52	50	49	43	34	27	53
2	11/05/2018 15:23:26	00:15:00	63	55	53	50	49	45	36	28	53
3	11/05/2018 15:38:26	00:15:00	63	55	52	50	51	49	37	27	55
4	11/05/2018 15:53:26	00:15:00	63	54	53	50	48	42	35	26	52
	Average=		63	55	53	50	49	46	36	27	54

Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svanetek 959 Sound Level Meter S/N: 27152
- Svanetek pre-amplifier SV12L S/N: 25151 with GRAS microphone capsule 40AE S/N: 158102

Calibration checks were made prior to and after completion of measurements using a Svanetek SV30A calibrator, S/N: 10893.complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix B: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

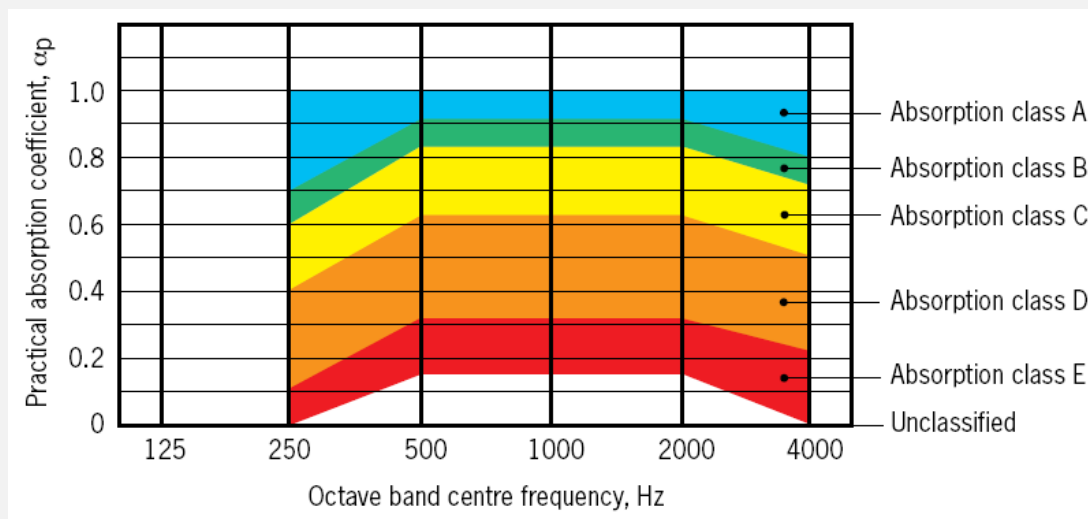
'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified.

The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB $\neq$ 60 dB

30 dB + 30 dB = 33 dB

$D_{nTw} + C_{tr}$

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply $L1 - L2$.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw} .

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
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L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
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L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.
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NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf} , RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to 2×10^{-5} Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise.

The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

A basic example to illustrate the assessment of difference in noise levels follows.

A background noise survey is undertaken that yields a lowest background noise level of L_{A90} 30 dB.

As the existing background noise level is low, a rating level for new plant noise of $L_{Aeq, T}$ 30 dB is set.

After calculation, the plant noise is predicted to achieve $L_{Aeq,T}$ 30 dB at the nearest residential property.

After the addition of the plant predicted noise level (or Rating Level), the new overall ambient noise level will be 33 dB. The background noise level measured originally will therefore be increased by 3 dB. In terms of the subjective impression of an increase of this order, the change in levels will be 'just perceptible'.

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.