JOSTEC

BUILDING REGULATIONS COMPLIANCE SERVICES

REPORT TITLE: BS8233:2104 ASSESSMENT OF 9 HIGH STREET, DARTFORD, DA1 1DT

REPORT REFERENCE: 23455

ISSUED TO: HOLKHAM TRADING LTD

ISSUED BY: JAMES FLITTON

DATE: 23 October 2023

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1.0 Introduction

1.01 JosTec has been commissioned to undertake a noise impact survey and assessment for 9 High Street, Dartford, DA1 1DT

1.02 The methodology used for this assessment will be BS8233 as this is a proposed newly converted development within the designated area.

1.03 The report will look at the existing external noise levels and calculation for internal levels in accordance with BS8233 standard.

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2.0 Development Description

2.0.1 The proposed converted dwellings are on the corner of High Street and Lowfield street in the centre of Dartford.

2.0.2 The development lies in a mainly retail area with the proposed dwellings themselves being positioned above retail outlets. There is also a market that takes place on the High Street below some of the main dwelling windows.

2.0.3 The main noise source likely to disrupt the inhabitants of the new dwellings is the traffic in the pedestrianised area during deliveries etc, but mainly passing patrons during the busier shopping hours.

2.0.4 With the above sources in mind the monitoring took place at the front (overlooking High Street and the main market area) out of the second-floor window (due to access restrictions)

2.1 Locations of Monitors

2.1.1 One Type 1 sound level meter was installed at second-floor level within the new building. The meter was positioned out of the windows to ascertain the façade levels to the existing building.

2.1.2 Figure 1 & 2 shows the area where the monitor was installed.

2.1.3 All locations are displayed on site map in figure 3

Figure 1

Figure 2

2.1.4 Measurements were made in 15 minute periods, on 1 second averaging, to allow for the removal of anomalies and increased accuracy. The data was averaged into $L_{Aeq16hr}$ daytime and L_{Aeq8hr} night-time with data also recorded for L_{AMax} in both day and night periods for the BS8233:2014 assessment.

2.1.5 The monitoring was conducted using 1 x Type 1 Svantek 307 sound level meters, outdoor case with batteries and outdoor microphone protection.

2.1.6 The measurements were taken by a fully qualified engineer with AMIOA status with the institute of Acoustics.

2.1.7 All measurements were taken after a field calibration was undertaken to ensure accuracy and repeatability of measurements.

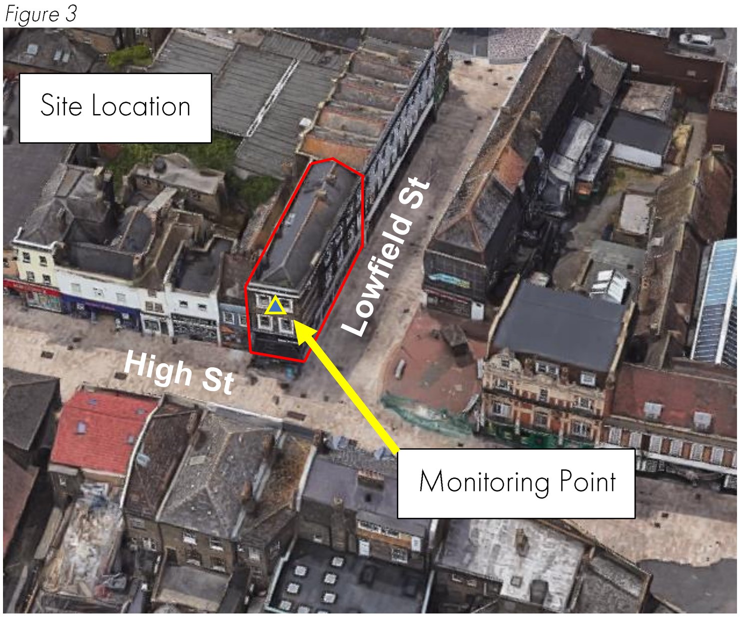
2.1.8 Further data such as wind speed, wind direction, rainfall intensity, temperature and cloud cover were all recorded at the beginning and end of the assessment at the monitoring location.

2.1.9 Any anomalies (such as noise by the engineer during setup and collection of the kit) were removed from the survey for a true reflection of the ambient levels in the vicinity. This was done by recording audio throughout the survey at each location and listening back through the files during the analysis process to confirm what was recorded manually during the survey.

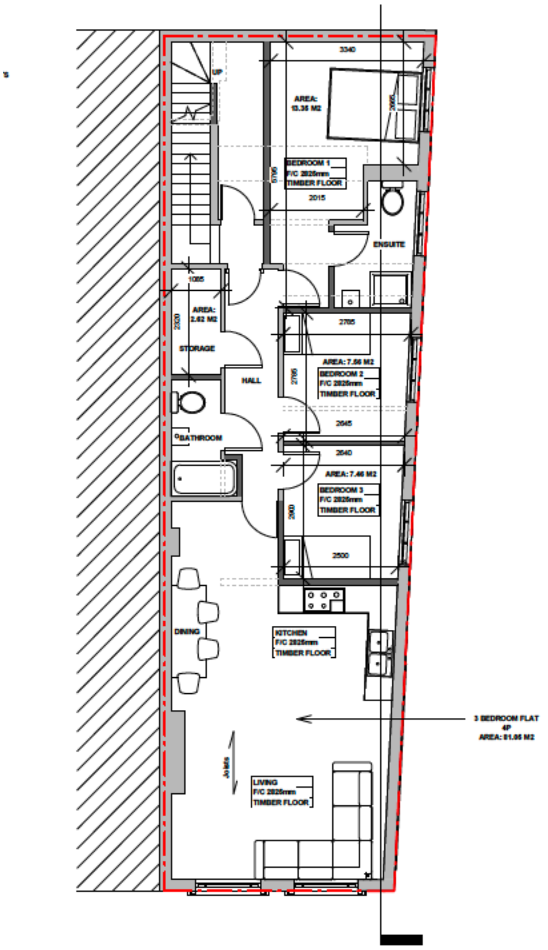
2.2.10 Care was taken to inform any residents in the area that audio recording was taking place.

2.2 Plan Views of Site with Designated Work Areas

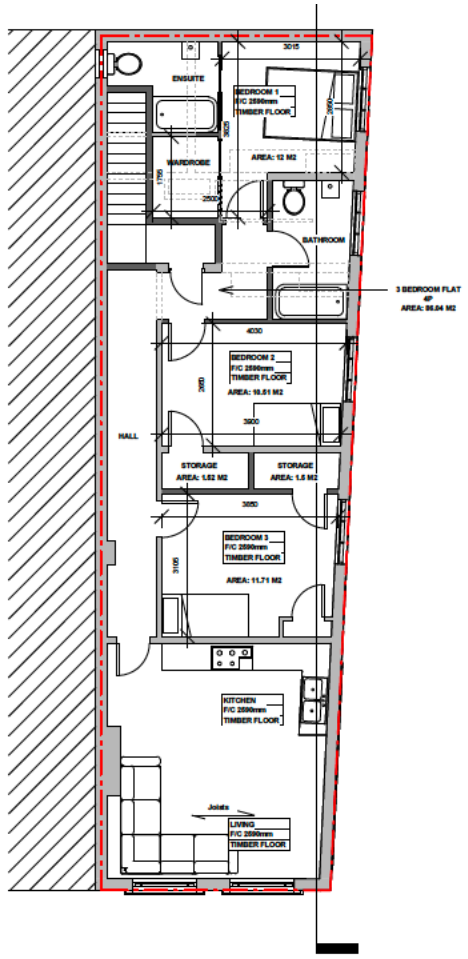
Figure 3



2.3 Proposed Site Layout (example floor)



3 Proposed First Floor
1 : 100



4 Proposed Second Floor
1 : 100

3.0 Noise Assessment Criteria

3.0.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 174 of the NPPF states the following:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability."

Paragraph 185 goes on to mention:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"

3.0.2 The NPPF reinforces the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life;
- and where possible, contribute to the improvement of health and quality of life."

3.0.3 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.0.4. It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

- The effect may be determined by reference to guideline noise values. British Standard (BS) 8233:2014 and World Health Organisation (WHO) "Guidelines for Community Noise" contain such guidelines.
- Another method is to compare the resultant noise level against the background noise level (L_{A90}) of the area. This is the method employed by BS 4142:2014 to

determine the likelihood of complaint from noise of an industrial nature. It is best suited to the assessment of steady or pseudo-steady noise.

3.0.5 British Standard 8233:2014 is principally intended to assist in the design of new dwellings; however, the Standard does state that it may be used in the assessment of noise from new sources being brought to existing dwellings.

3.0.6 The WHO guideline values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological or physiological effect.

The WHO/BS 8233 guideline noise values are summarised in the following table:

Table 1

Guidance Document	L_{AeqT}	L_{AMax}	Outcome
World Health Organisation "Community Noise 2000"	55dB		Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	50dB		Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	35dB		Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	30dB		Sleep disturbance, night-time (indoors)
		60dB	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
		45dB	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)
BS 8233:2014 "Sound Insulation and noise reduction for buildings"	55dB		Upper limit for external steady noise. (gardens and patios).
	50dB		Desirable limit for external steady noise. (gardens and patios).
	LAeq 16 hours = 35 dB		Resting, living room day. (Internal – steady noise)
	LAeq 16 hours = 40 dB		Dining, dining room day. (Internal – steady noise)

	L_{Aeq} 16 hour = 35 dB		Sleeping, bedroom day (Internal – steady noise)
	L_{Aeq} 8 hours = 30 dB		Sleeping, bedroom day (Internal – steady noise)

3.0.7 For L_{AeqT} criteria the time base (T) given in the documents is 16 hours for daytime limits and 8 hours for night time limits. All surveys are conducted on 1 hour daytime and 15 minute night values – based on 1 second readings on a Type 1 sound level meter. The readings are taken every 5 mins for noise to allow the elimination of erroneous data if required.

3.0.8 The WHO guidelines are also concerned with the L_{AMax} for night-time sleep disturbance. The guideline states:

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

3.0.9 On this basis, for the purpose of assessing night-time L_{AFmax} noise events, it is considered appropriate to adopt the 10th highest L_{AFmax} noise event occurring in a typical night-time (23:00 – 07:00) period.

3.0.10 Audio recordings are taken throughout the measurements to allow for further assessments on high levels. Listening to the audio and performing tonal analysis will allow anomalies to be removed from the data, if required.

4.0 Results

4.1 Noise Assessment

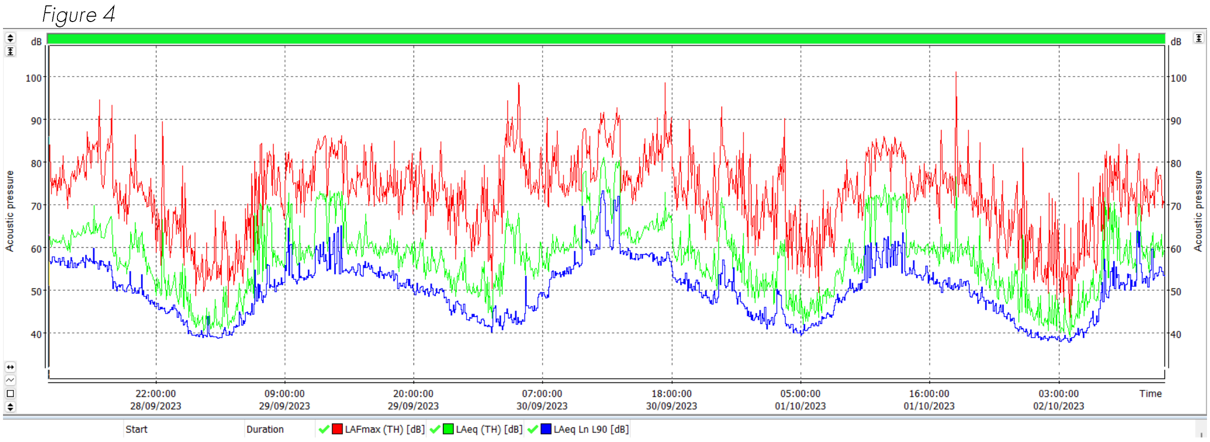
Table 2

Location High St	L_{Aeq_16hr}	L_{Aeq_8hr}	L_{Amax} (10th highest)
Day 13.04pm 28/09/23	58.7dBA		
Night 23.00pm 28/09/23		50.6dBA	75.5dBA

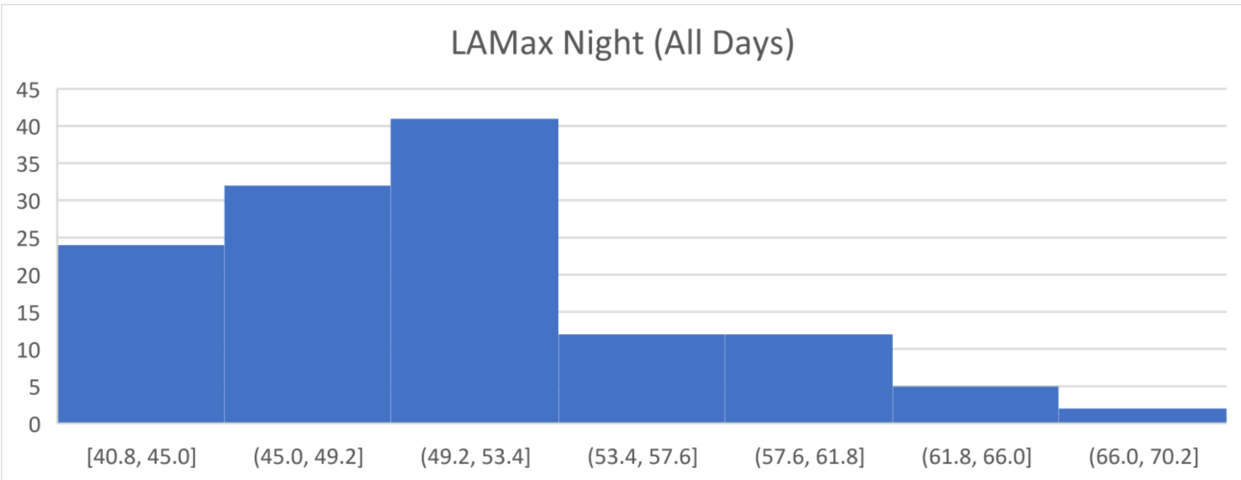
4.1.1

Comments: Mainly patron noise. No tonal features

Figure 4



4.2 L_{AMax} Night period histogram



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4.3 Comparison of Results to BS8233

Table 4

Location	L_{AeqT} (16hr Day & 8hr Night)	L_{AMax}	BS8233 & WHO Internal noise	BS8233 & WHO External Noise	Difference to L_{Aeq} (internal/external)	Difference to Max (internal)
Front (High Street)						
Day (0700-2300)	59dBA		35dBA	55dBA	(+23dBA/ +4dBA)	-
Night (2300-0700)	51dBA	76dBA (10th Highest)	30dBA (45dBA L_{AMax})	(60dBA L_{AMax})	(+21dBA)	(+31dBA)

5.0 Observations and Further Discussions

5.0.1 The measured LAeq values for both the day and the night periods are shown in table 4. The day period at the front of existing property is 23dBA above the limit for indoor noise levels.

5.0.2 The night value at the front is 21dBA above the recommended value for internal noise to prevent sleep disturbance.

5.0.3 BS8233 assumes that a standard double-glazed window will provide up to 15dB reduction when open (with some council guidelines leaning on the side of caution and assuming a 10dB reduction). Either option would mean that any glazed window in the building cannot be relied upon as the source of ventilation without the chance of sleep disturbance being had by the inhabitants of the proposed dwellings to the front of the building. Trickle/acoustic vents will therefore be required at the front of the property; to avoid the need to open windows to ventilate.

5.0.4 The L_{AMax} value to prevent the likelihood of sleep disturbance is set at 60dBA external and 45dBA internal. Based on the highest value from the tenth-highest daily value measured during the weekend the reading for L_{AMax} night at the front of the property was 76dBA. This value is 31dB above the required value externally for sleep disturbance. This therefore increases the required specification of the glazing.

5.0.5 These figures will now be checked against the calculation methodology in BS8233 annex G to provide exact specifications for glazing and ventilation in section 6.

5.1 BS8233 Calculation Sheet

(front living area)

	Overall dBA	Octave Band Frequency (Hz)					
Time Period		125	250	500	1000	2000	4000
Leq,ff	58.7	45	50	55	53	48	45

Room Details	(m)	(Living Area)
Height	2.2	
Width	4.6	
Length	6.5	
Sample Room Volume	65.78	
Sample Room Surface Area	48.84	

Element	Area/No.of	Element Specification
External Wall	10.12	Traditional solid 9" brick
Windows	4.5	4 mm / (6 - 16 mm) / 4 mm
Ceiling	29.9	
Ventilation	2	Standard acoustic trickle ventilator typically ≥ Dn,e,w 35dB

Element SRI

		Octave Band Frequency (Hz)						Single Figure Rating
Element	Area/No.of	125	250	500	1000	2000	4000	
Walls	4	39	44	51	58	63	68	50
Windows	2	21	17	25	35	37	31	29
Ceiling	1	28	34	40	45	49	52	
Ventilation (Dn,e)	2	33	33	34	35	32	31	

Overal Sound Reduction

Calculated Internal SPL		Octave Band Frequency (Hz)					
	Overall	125	250	500	1000	2000	4000
Leq,2	30.7	11.8	24.5	28.0	21.4	17.0	17.0
Limit	35						
Value under limit	4.3						

(bedroom 3 – example bedroom)

	Overall dBA	Octave Band Frequency (Hz)					
Time Period		125	250	500	1000	2000	4000
Leq,ff	75.5	58	64	71	71	68	61

Room Details	(m)	Bedroom 3
Height	2.2	
Width	2.5	
Length	3	
Sample Room Volume	16.5	
Sample Room Surface Area	24.2	

Element	Area/No.of	Element Specification
External Wall	5.5	Traditional solid 9" brick
Windows	1.5	8 mm / (6 - 16 mm) / 6 mm Pilkington
Ceiling	7.5	
Ventilation	2	Standard acoustic trickle ventilator typically ≥ Dn,e,w 35dB

Element SRI

		Octave Band Frequency (Hz)						Single Figure Rating
Element	Area/No.of	125	250	500	1000	2000	4000	
Walls	4	39	44	51	58	63	68	50
Windows	2	20	21	33	40	36	48	35
Ceiling	1	28	34	40	45	49	52	
Ventilation (Dn,e)	2	33	33	34	35	32	31	

Overal Sound Reduction

Calculated Internal SPL		Octave Band Frequency (Hz)					
	Overall	125	250	500	1000	2000	4000
Leq,2	44.5	22.4	32.9	38.6	38.9	39.5	32.9
Limit	45						
Value under limit	0.5						

6.0 Glazing, Structural and Ventilation Recommendations

6.1 External Walls

6.1.1 External walls of the proposed building are understood to be traditional 9" brick:

Table 5

Description	Octave Band Centre Frequency (Hz) Sound Reduction Index *R* dB					
	125	250	500	1k	2k	4k
Traditional solid 9" brick	39	44	51	58	63	68

6.2 Glazing

6.2.1 Suitable sound insulation performance of all windows for the development may be achieved with higher-spec glazing to the bedroom area in comparison to the living area. The front requires a lower spec of glazing. An example product for noise reduction to the front (living area) and side (bedrooms) of the property is shown in table 6.

Table 6

Location	Description	Octave Band Centre Frequency (Hz) Sound Reduction Index *R* dB						Rw (C; Ctr)	Rw+Ctr
		125	250	500	1k	2k	4k		
Front (Living Area)	Pilkington 4 mm / (6 - 16 mm) / 4 mm	21	17	25	35	37	31	29 (-1,-4)	25dB
Side (Bedrooms)	Pilkington 8 mm / (6 - 16 mm) / 6 mm	20	21	33	40	36	48	35(-1; -6)	29dB

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6.3 Ventilation

6.3.1 It is anticipated that a basic ventilation system will be needed to be incorporated into the scheme design to reduce the impact of the L_{AMax} levels, such that residents of the properties are able to have background ventilation without necessarily needing to open windows.

Table 7

Description	Octave Band Centre Frequency (Hz) Sound Reduction Index $D_{n,e}$ dB					
	125	250	500	1k	2k	4k
Standard acoustic trickle ventilator typically ≥ Dn,e,w 35dB	33	33	34	35	32	31

7.0 Further Discussion and Conclusion

7.0.1 The glazing specification listed in section 6 would be more than suitable based on the calculation methodology in Annex G of BS8233:2014 for noise impact on bedrooms to the side of the property, and living areas to the front of the development.

7.0.2 Internal partition walls and ceilings/floors will be dealt with by building regulations and designs will be provided in a separate document at design stage

8.0 Credentials

Name	Title	Credentials
James Flitton BSc AMIOA	Acoustic Consultant	CSCS Professionally Qualified person
		Associate Member Institute of Acoustics
		IOA Diploma in Acoustics & Noise Control
		Affiliate Member of IDE
		Affiliate Member of IOR
Signed		

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Appendix A – Acoustic Terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near (LAeq,T).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A – weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B - Noise Survey Instrumentation

- Svantek Class 1 noise monitoring station model 307 serial number 75982 with integrated preamplifier plus ST30 microphone serial number 78375 in weatherproof outdoor environmental kit and tripod arrangement

- Brüel & Kjær calibrator type 4231 serial number 3001014 (UKAS-certified)

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Appendix C – Weather Conditions Chart Used

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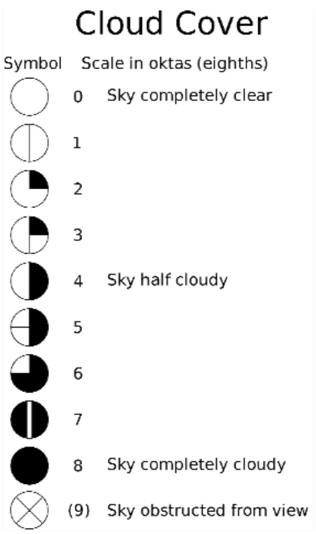
Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
		Temperature:		
		Precipitation:		
		Cloud cover (oktas - see guide)		
		Presence of fog/snow/ice		
		Presence of damp roads/wet ground		
		Wind Speed (m/s)		
		Wind Direction		
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)		

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Appendix D – BS8233 Annex G Calc Sheets

		Octave Band Frequency (Hz)					
		125	250	500	1000	2000	4000
Leq,ff	A	45	50	55	53	48	45
Dn,e		33	33	34	35	32	31
$\frac{Ao}{S}10^{\frac{-Dn,e}{10}}$	B	0.00013	0.00013	0.00010	0.00008	0.00016	0.00020
Rwi		21	17	25	35	37	31
$\frac{Swi}{Sf}10^{\frac{-Rwi}{10}}$	C	0.00353	0.00887	0.00141	0.00014	0.00009	0.00035
Rew		39	44	51	58	63	68
$\frac{Sew}{Sf}10^{\frac{-Rev}{10}}$	D	0.00007	0.00002	0.00000	0.00000	0.00000	0.00000
Rrr		28	34	40	45	49	52
$\frac{Srr}{Sf}10^{\frac{-Rrr}{10}}$	E	0.00468	0.00118	0.00030	0.00009	0.00004	0.00002
10log10(B+C+D+E)	F	-20.8	-19.9	-27.4	-35.0	-35.5	-32.4
A (furnished)		11	14	16	16	15	14
$Log10\frac{S}{A}$		0.6	0.5	0.4	0.4	0.4	0.5
Leq,2	A+F+G+3	27.8	33.5	31.0	21.4	16.0	16.0
A-weighting		-16	-9	-3	0	1	1
LAeq,2		11.8	24.5	28.0	21.4	17.0	17.0
Total	30.7						

		Octave Band Frequency (Hz)					
		125	250	500	1000	2000	4000
Leq,ff	A	58	64	71	71	68	61
Dn,e		33	33	34	35	32	31
$\frac{Ao}{S}10^{\frac{-Dn,e}{10}}$	B	0.00039	0.00039	0.00031	0.00024	0.00049	0.00061
Rwi		20	21	33	40	36	48
$\frac{Swi}{Sf}10^{\frac{-Rwi}{10}}$	C	0.00273	0.00217	0.00014	0.00003	0.00007	0.00000
Rew		39	44	51	58	63	68
$\frac{Sew}{Sf}10^{\frac{-Rev}{10}}$	D	0.00009	0.00003	0.00001	0.00000	0.00000	0.00000
Rrr		28	34	40	45	49	52
$\frac{Srr}{Sf}10^{\frac{-Rrr}{10}}$	E	0.00216	0.00054	0.00014	0.00004	0.00002	0.00001
10log10(B+C+D+E)	F	-22.7	-25.1	-32.3	-35.0	-32.4	-32.0
A (furnished)		11	14	16	16	15	14
$Log10\frac{S}{A}$		0.1	0.0	-0.1	-0.1	-0.1	0.0
Leq,2	A+F+G+3	38.4	41.9	41.6	38.9	38.5	31.9
A-weighting		-16	-9	-3	0	1	1
LAeq,2		22.4	32.9	38.6	38.9	39.5	32.9
Total	44.5						