

DMG-230625

30th June 2026



J C Brennan

Assessment of noise at the land off Church
Avenue, Middleton, M24 2UA for proposed
residential development

Prepared for :-

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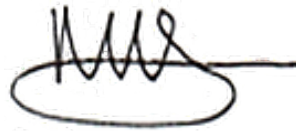
1.0 **SUMMARY**

The dominant noise source during the daytime was traffic from the surrounding roads, primarily the A664, with occasional vehicles passing along Church Avenue. For the early nighttime, the primary noise source shifted to more distant road traffic, most likely from the M62, along with the occasional sound of low-flying aircraft overhead.

All BS 8233 criteria for desirable conditions are easily met based on an assumption of ventilation via opening windows. No further mitigation is required.



A R Raymond



M A Pickering

2.0 INTRODUCTION

Eco Technology Lcz Ltd was asked to carry out an independent assessment of the above site with regards to its suitability for residential development from a noise perspective.

This report begins by summarising assessment standards and, where appropriate, discusses alternative interpretations.

After a brief statement of survey details we discuss basic results and the resulting assessment, along with any mitigation which might be implied. We sum-up and conclude at the end, along with brief recommendations.

3.0 ASSESSMENT STANDARDS

3.1 NPPF, NPSE and NPPG

The National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the National Planning Practice Guidance (NPPG) provide nothing in the way of quantitative criteria but instead provide general policy aims and statements and some guidance on how certain situations can be interpreted.

The NPPF's main statement on noise is to be found in paragraph 198:-

198. 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 life⁷²;
 - 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; and
 - c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

Paragraph 200 is also relevant:-

200. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

The NPPF refers to the NPSE which sets out the following aims:-

1. *avoid significant adverse impacts on health and quality of life;*
2. *mitigate and minimise adverse impacts on health and quality of life;*
and
3. *where possible, contribute to the improvement of health and quality of life.*

It also introduces the concepts of:

- *NOEL – No Observed Effect Level. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*
- *LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.*
- *SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.*

SOAEL is clearly something the policy seeks to avoid in aim 1. Aim 2 represents situations between SOAEL and LOAEL, and seeks to minimise and mitigate the effects.

The NPPG section on noise adds some further detail, much of it reproducing the NPPF and NPSE, but some useful qualitative guidance is provided Noise Exposure Hierarchy, as follows:-

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

It also makes the point that the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation, including the level of the noise in absolute terms and how it might compare with the underlying background noise, the impulsiveness or intermittence pattern of the noise, its spectral content, and the time of day. It discusses in very general terms the issues to consider when introducing noise sources to existing noise sensitive area, new residential development in areas affected by existing noise sources (most of which have their own specific guidance, such as BS 4142, BS 8233, etc.) and the potential impact on wildlife.

3.2 BS8233 and WHO

BS 8233 was updated in March 2014. Its guidance is primarily intended for new buildings, but the criteria are routinely referred to for putting general noise climates into context.

The criteria in Table 4 of BS 8233 are based on WHO guidance and give the desirable criteria for indoor ambient noise levels for dwellings as follows:-

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB L_{Aeq} , 16 hour	-
Dining	Dining Room	40 dB L_{Aeq} , 16 hour	-
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} , 16 hour	30 dB L_{Aeq} , 8 hour

The standard does not explicitly state criteria for bedroom noise in terms of dB L_{Amax} but the WHO Guidelines for Community Noise (or similar) are widely used with a recommendation that the noise inside bedrooms should not typically exceed 45 dB L_{Amax} , for instance no more than 10 to 15 times a night.

BS 8233 goes on to state that, where necessary, the criteria can be relaxed by up to 5 dB and still achieve reasonable conditions.

Note that the standard accepts the widely used rule of thumb that, for a partly open window, the levels just outside will be 15dB higher than those just inside. Other more recent research suggests a difference of 13 dB. The latter brings us to an external equivalent of the above table, as follows:-

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	48 dB L_{Aeq} , 16 hour	-
Dining	Dining Room	53 dB L_{Aeq} , 16 hour	-
Sleeping (daytime resting)	Bedroom	48 dB L_{Aeq} , 16 hour	43 dB L_{Aeq} , 8 hour

Garden area criteria are 50 dB L_{Aeq} and 55 dB L_{Aeq} being considered desirable and reasonable respectively.

3.3 Local Authority

As far as we are aware no planning conditions have been proposed.

4.0 GUIDE TO MODELLING

Full details of calculations are given in Appendix 2. The basic approach is as follows.

1. The external noise break-in is based on the level of external noise just outside the façade(s), the area of the façade(s), the sound insulation properties of the façade(s) and the internal absorption of the room.

2. The first input to the calculation process is the area of the exposed façade. Where more than one façade is exposed, then they can all be entered. The room depth is also entered so as to derive the room volume. Where the room is not a straight forward rectangular shape, an “effective depth” is sometimes entered so as to derive the approximate room volume. Judgement may occasionally be used if the room is not simple, such as a very unusual shape or a multi-use room such as a through-kitchen/dining room/living room, or studio-style area.
3. The reverberation time (RT) is entered. Usually this is a standardised 0.5 seconds and represents the absorption properties of the room.
4. Two corrections result from the above inputs. Firstly, we have the Area Correction. Put simply, the greater the exposed area, the more noise will break in. The correction is $10 \times \log(\text{Effective Area})$ and is usually a positive number. Note that the “Effective Area” takes account of the method of modelling vents – see later. The Room Correction takes account of the room absorption (more absorption reduces the noise) and the room volume (a larger volume disperses, and so reduces, the noise). The correction is $10 \times \log(\text{RT}/0.163/\text{Volume})$ and is usually a negative number.
5. These corrections, together with the sound insulation properties of the façade(s) give us the basic outside-to-inside level difference. The sound insulation properties of the façade(s), known as the Sound Reduction Index (SRI or just R) are effectively the sound insulation of 1m^2 of material (apart from vents – see later). Of course, a façade is usually made up of more than one element – windows and walls for instance. The overall SRI or R is referred to as the Composite SRI or composite R and is related to the SRI or R of the individual elements and their respective areas. SRI or R figures are usually based on laboratory tests and therefore somewhat idealised.
6. An additional complication is that performance data for vents is generally standardised to 10m^2 . The area of a vent is therefore usually entered as 10m^2 , even though its actual area will usually be nowhere near that much.
7. So, the composite SRI or R, combined with the areas and room corrections gives us the basic level difference to be expected under perfect (laboratory) conditions. However, actual site conditions are affected by workmanship, which can never be guaranteed to be perfect, and flanking paths (noise paths other than straight through the façade(s)). We add a 3 dB allowance for this.
8. Finally we have to enter any differences between the measurement position and the façade being modelled. If the measurements were made in free field conditions, then a façade effect of up to +3 dB is necessary.

9. The process is repeated in octave bands across the frequency range to derive the predicted internal levels.

5.0 SURVEY DETAILS

5.1 Site Times and Personnel

The measurements were carried out by Mark Pimlett of Eco Technology Lcz Ltd.

Measurements were carried out on 25th June 2025 between approximately 14:00 hours and 18:00 hours to represent rush hour and between 2300 hours and 0100 hours, representing what was likely to be a noisier time of night.

5.2 Instrumentation

Instrumentation used was a Rion NL-52 Class I sound level meter which holds a current calibration certificate and which was field-calibrated as necessary with no drift noted. The meter was set up to measure continuous 5 minute samples in terms of dB L_{eq} , dB L_{max} and dB L_{90} in overall A-weighted terms, and in octave bands across the frequency range. See Definition of Acoustic Terms in Appendix 1.

5.3 Measurement Positions

The main measurement position was as shown on the following plan.



The microphone was 1.3 m above ground and well away from other reflecting surfaces.

5.4 Survey Conditions

We have no reason to believe that the conditions we found on the survey were anything other than representative of normal conditions.

Weather conditions were as follows:-

Rain	:	none, dry roads
Cloud	:	30 to 40%
Temperature	:	18 to 25 Celsius
Wind	:	<1.6m/s from the west direction

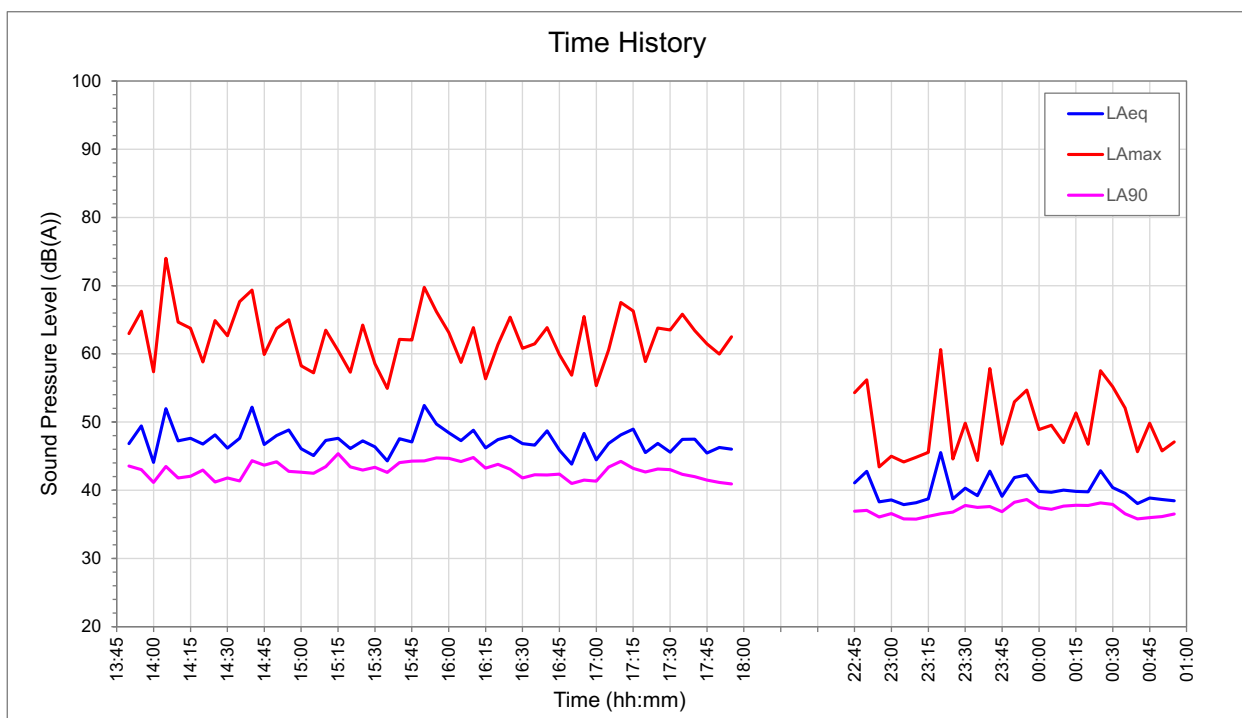
6.0 RESULTS AND DISCUSSIONS

The dominant noise source during the daytime was traffic from the surrounding roads, primarily the A664, with occasional vehicles passing along Church Avenue. Light gusts of wind occasionally rustled the nearby trees, producing minor noise. The church bell in the vicinity chimed at 15-minute intervals, and vocal wildlife was notably active within the site.

For the early nighttime, the primary noise source shifted to more distant road traffic, most likely from the M62, along with the occasional sound of low-flying aircraft overhead.

6.1 Basic Results

Full details are given in Appendix 2. They can be viewed graphically over time as follows:-



A summary of overall levels is as follows:-

Time Period	Index	dB(A)
Overall Non-Rush Hour Daytime	Leq	48
	Lmax	65
	L90	43
Overall Rush Hour	Leq	47
	Lmax	63
	L90	43
Overall Early Nighttime	Leq	41
	Lmax	53
	Lmax*	57
	Lmax**	55
	L90	37

* and ** are the levels exceeded 10 and 15 times respectively (8 hour night equivalent). Otherwise logarithmic means

6.2 Assessments

The above results give the following assessments.

In terms of BS 8233/WHO, we are mainly concerned with the dB(A) L_{eq} values, or the dB L_{Aeq} levels. See definition of Acoustic terms in Appendix 1. The current version of BS8233 no longer has night time criteria in terms of dB(A) L_{max} values, or dB L_{Amax} values, but some local authorities still like to see them presented and assessed to WHO guidelines or similar.

In order to meet criteria, the measured levels appear to suggest that sound insulation will need to be designed to control external noise break-in as follows:

<i>Position</i>	<i>Environment</i>	<i>Reductions for BS8233 desirable* criteria</i>	<i>Reductions for WHO-Type Criteria</i>
Main	Living Rooms	13 dB L_{Aeq}	-
	Bedrooms	11 dB L_{Aeq}	12 dB L_{Amax}
	Outdoor Living Areas	0 dB L_{Aeq}	-

Note that these figures do not include any façade effect which might be applicable

* BS 8233 considers a 5 dB relaxation would still provide *reasonable* conditions

Note, of course, that these assertions are based upon the assumption that night-time noise levels are represented by measurements around midnight and that daytime noise levels are represented by measurements around rush hour or mid afternoon, whichever is the noisiest. In other words, they should represent a worst-case.

6.3 Mitigation

For outdoor living areas (usually rear gardens) the measured levels already meet BS 8233 criteria for *desirable* condition. The presence of buildings and garden fencing will only make this less.

Moving on to break-in to habitable rooms, a partly open window can be expected to provide about 15 dB reduction. This will be sufficient to achieve BS8233 criteria for “reasonable” conditions to all rooms. Again the presence of buildings and garden fencing will only make this less. A summary of mitigation (or building elements assumed in our calculations) is as follows:-

<i>Façade</i>	<i>Room Type</i>	<i>Make-Up on Which Calculations are Based</i>
Rear Façade	Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Study/Bed 4	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Front Façade	Lounge	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Bed 2	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

NB. R_w should come with a negative C_{tr} term, usually around -5 dB, eg. 35 dB R_w and -5 dB C_{tr} is 30 dB $R_w + C_{tr}$

The rooms are used as worst case examples as they are exposed on two facades and/or have large window areas and/or short room depths. Other rooms on the same façade with the same glazing and vent specification can be expected to perform better

Full calculation details are shown in Appendix 2 and a summary of predicted internal noise levels is as follows:-

<i>Façade</i>	<i>Room Type</i>	<i>Time</i>	<i>Index</i>	<i>dB(A)</i>
Rear Façade	Dining Kitchen	Rush	Leq	26
			Lmax	39
	Study/Bed 4	Night	Leq	22
Front Façade	Lounge	Rush	Leq	26
			Lmax	39
	Bed 2	Night	Leq	20
			Lmax	37

We can see that predicted levels are all well within all criteria.

7.0 **CONCLUSIONS/RECOMMENDATIONS**

The dominant noise source during the daytime was traffic from the surrounding roads, primarily the A664, with occasional vehicles passing along Church Avenue. For the early nighttime, the primary noise source shifted to more distant road traffic, most likely from the M62, along with the occasional sound of low-flying aircraft overhead.

All BS 8233 criteria for desirable conditions are easily met based on an assumption of ventilation via opening windows. No further mitigation is required.

Our only recommendation is that you issue this report to Planners and the Officer are encouraged to contact us directly with any queries.

Appendix 1

Definition of Acoustic Terms

The Decibel

The decibel is the basic unit of noise measurement and is denoted dB. Technically, it is a means of expressing the difference in noise level between the measured noise and a standard level of noise. Most often the threshold of human hearing is used as the standard reference but it really should be stated. The threshold of human hearing is a sound pressure of $20\mu\text{Pa}$ or a sound power of 1pW .

A sound pressure level or SPL should be expressed in dB(re. $20\mu\text{Pa}$). A sound power level or SWL should be expressed in dB(re. 1pW). If the reference levels are omitted, it will often (but not always) be safe to assume that they are referenced to the threshold of human hearing.

A-Weighting and dB(A)

The human hearing system responds differently to different frequencies. The A-weighting system takes account of this by emphasising mid and high frequencies more than low frequencies to give an overall level. An A-Weighted noise level, therefore, reflects the way normal, healthy hearing would perceive the overall level of the noise. The basic unit is dB(A), although other systems of expressing an A-weighted level are discussed below.

Other weighting systems, such as C-Weighting, denoted dB(C), reflect the human hearing system's response at higher noise levels.

Equivalent Continuous Sound Level, L_{eq}

This is a kind of mean noise level.

The unit is dB L_{eq} . For A-weighted levels the unit is dB(A) L_{eq} or, in more modern units, dB L_{Aeq} . The Noise at Work Regulations use $L_{\text{eq(s)}}$ which refers to a sample level.

Maximum Level, L_{max}

This is the maximum level reached (usually for a fraction of a second) in the measurement period.

The unit is dB L_{max} . For A-weighted levels the unit is dB(A) L_{max} or, in more modern units, dB L_{Amax} .

Statistical (Percentile) Levels, L_n

During a measurement of fluctuating noise, it is often useful to establish the levels exceeded for a percentage of the time. L_n is the index representing the level exceeded for $n\%$ of the measurement period.

The unit is dB L_n . For A-weighted levels, the unit is dB(A) L_n or, in more modern units, dB L_{An} .

Common examples are as follows :-

dB L_{A90} is the A-weighted level exceeded for 90% of the time and is often used to describe the underlying background noise.

dB L_{A50} is the A-weighted level exceeded for 50% of the time. Mathematically, it is the median, another kind of average.

dB L_{A10} is the A-weighted level exceeded for 10% of the time and has traditionally been used to describe the intermittent highs in the noise climate such as passing cars or aircraft.

Frequency Analysis

Here the audible frequency range is divided up into bands and the noise level is expressed in each frequency band from low pitches to high pitches.

Octave Band analysis is where the frequency range is divided into 8 bands from 63 Hz to 8kHz, or sometimes into 10 bands from 31.5 Hz to 16kHz.

1/3 Octave Band analysis provides more detailed subdivision into 24 bands from 50 Hz to 10kHz, or sometimes into 30 bands from 20Hz to 20kHz.

Narrow Band analysis takes this further with the possibility of many thousands of bands, possibly only 1Hz wide, or even less.

In all types of frequency analysis, the level in each band can be expressed in terms of L_{eq} , L_{max} , L_n , etc. as defined above.

Appendix 2

Measurement and Calculation Details

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
13:50	Leq	47	52	45	43	42	43	38	38	36
	Lmax	63	65	60	59	53	52	56	57	58
	L90	44	49	39	37	41	41	34	26	19
13:55	Leq	49	54	44	40	44	46	38	41	39
	Lmax	66	69	58	53	58	62	52	60	59
	L90	43	49	39	36	40	41	33	25	17
14:00	Leq	44	53	40	36	41	41	35	28	29
	Lmax	57	67	49	42	46	49	49	50	54
	L90	41	48	37	34	39	39	30	20	14
14:05	Leq	52	53	43	39	43	48	48	36	31
	Lmax	74	67	62	59	62	65	72	53	49
	L90	43	49	39	36	40	41	33	25	18
14:10	Leq	47	53	43	38	42	44	40	38	31
	Lmax	65	64	59	53	58	62	54	56	50
	L90	42	48	38	35	39	39	31	24	16
14:15	Leq	48	52	52	48	45	43	38	35	27
	Lmax	64	63	70	67	58	55	52	56	50
	L90	42	48	38	35	39	40	31	22	15
14:20	Leq	47	53	47	42	42	42	39	38	30
	Lmax	59	64	63	59	55	49	52	50	46
	L90	43	47	37	36	40	41	32	25	17
14:25	Leq	48	52	46	43	46	44	40	35	28
	Lmax	65	67	61	58	66	59	52	49	46
	L90	41	48	37	34	38	39	31	21	15
14:30	Leq	46	53	44	41	42	42	36	38	38
	Lmax	63	67	60	54	53	48	53	58	59
	L90	42	48	38	35	39	39	31	22	15
14:35	Leq	48	51	44	39	41	42	35	42	43
	Lmax	68	61	59	52	46	47	49	65	64
	L90	41	47	37	34	39	39	31	23	15
14:40	Leq	52	53	48	46	46	46	39	47	45
	Lmax	69	63	65	63	57	61	53	66	63
	L90	44	49	40	38	42	42	33	24	15
14:45	Leq	47	53	42	39	43	43	39	35	34
	Lmax	60	67	51	49	54	51	52	54	54
	L90	44	48	39	37	41	41	33	22	16
14:50	Leq	48	53	42	40	43	44	39	40	38
	Lmax	64	63	55	54	50	52	55	60	58
	L90	44	49	39	37	41	42	34	24	16
14:55	Leq	49	51	42	43	45	47	39	33	27
	Lmax	65	62	57	65	63	61	54	51	47
	L90	43	47	37	36	40	40	32	22	15

Time Period	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
15:00	Leq	46	52	42	39	42	43	38	35	28
	Lmax	58	65	55	46	47	50	52	54	46
	L90	43	47	37	36	40	40	32	26	19
15:05	Leq	45	51	44	41	43	42	35	28	21
	Lmax	57	68	60	55	51	49	53	44	40
	L90	43	48	38	36	40	40	31	22	16
15:10	Leq	47	51	42	39	43	44	39	35	27
	Lmax	63	66	59	50	60	58	58	55	44
	L90	43	48	38	36	41	41	33	24	17
15:15	Leq	48	54	43	42	45	45	38	31	24
	Lmax	60	69	53	58	58	52	54	53	39
	L90	45	48	40	38	43	43	34	24	18
15:20	Leq	46	53	49	40	43	43	36	28	22
	Lmax	57	67	63	49	51	50	52	49	37
	L90	43	48	39	36	41	41	32	24	17
15:25	Leq	47	51	42	38	43	45	37	33	30
	Lmax	64	63	58	54	57	61	57	53	55
	L90	43	47	38	36	41	41	32	24	18
15:30	Leq	46	52	45	42	43	43	38	29	22
	Lmax	59	62	60	57	54	52	53	47	37
	L90	43	48	39	36	40	41	33	24	16
15:35	Leq	44	50	40	36	41	42	34	29	21
	Lmax	55	62	51	45	50	52	47	43	40
	L90	43	47	37	35	40	40	31	21	15
15:40	Leq	48	53	43	40	44	45	38	31	25
	Lmax	62	64	52	48	57	61	50	48	43
	L90	44	49	39	37	41	42	33	25	19
15:45	Leq	47	53	44	42	43	44	40	32	26
	Lmax	62	64	54	58	55	53	59	46	46
	L90	44	49	39	37	42	42	34	27	20
15:50	Leq	52	55	43	39	43	44	38	48	49
	Lmax	70	71	59	51	51	52	49	66	67
	L90	44	49	39	37	42	42	34	26	19
15:55	Leq	50	54	47	44	47	48	37	30	24
	Lmax	66	65	59	58	63	64	54	51	41
	L90	45	50	42	39	42	42	33	25	19
16:00	Leq	48	54	49	46	46	45	38	31	24
	Lmax	63	67	71	62	59	54	57	54	40
	L90	45	50	39	38	42	42	34	24	17
16:05	Leq	47	52	46	41	43	44	36	38	35
	Lmax	59	65	58	53	52	53	44	54	51
	L90	44	49	39	38	41	42	33	25	18
16:10	Leq	49	56	48	43	44	45	36	42	39
	Lmax	64	69	62	58	55	60	49	56	57
	L90	45	51	42	39	42	43	33	23	15
16:15	Leq	46	53	47	42	43	43	36	31	25
	Lmax	56	65	61	57	54	49	44	49	44
	L90	43	49	40	38	41	41	33	23	17
16:20	Leq	47	53	43	39	42	44	39	39	31
	Lmax	61	63	54	49	49	53	55	57	51
	L90	44	49	39	36	40	41	35	26	18
16:25	Leq	48	53	44	41	43	45	40	36	29
	Lmax	65	67	57	56	58	64	52	56	50
	L90	43	49	39	37	40	41	33	25	17
16:30	Leq	47	54	43	41	41	42	40	39	32
	Lmax	61	72	53	56	52	51	57	53	47
	L90	42	49	39	35	39	40	32	21	15
16:35	Leq	47	54	45	46	43	42	37	36	30
	Lmax	61	63	59	66	57	51	49	53	51
	L90	42	50	40	35	39	40	32	24	17
16:40	Leq	49	56	47	43	44	46	40	37	31
	Lmax	64	67	59	57	57	61	54	55	52
	L90	42	50	39	35	39	40	33	25	16
16:45	Leq	46	55	47	41	41	42	39	35	28
	Lmax	60	67	59	60	50	49	54	54	44
	L90	42	50	40	36	39	40	32	22	14
16:50	Leq	44	53	44	36	40	41	35	34	22
	Lmax	57	62	65	48	49	46	46	53	43
	L90	41	48	37	33	38	39	31	21	14
16:55	Leq	48	52	48	42	45	46	36	29	17
	Lmax	65	71	64	58	62	64	52	50	32
	L90	41	48	39	35	38	39	31	19	14

<i>Time Period</i>	<i>Index</i>	<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
17:00	Leq	44	53	44	39	41	41	37	29	23
	Lmax	55	68	57	53	51	49	48	45	43
	L90	41	49	38	35	38	39	31	20	14
17:05	Leq	47	54	46	44	43	43	40	34	31
	Lmax	61	66	61	58	55	50	56	52	52
	L90	43	50	40	37	41	41	33	22	14
17:10	Leq	48	52	43	40	43	44	40	38	36
	Lmax	68	61	55	50	58	60	63	61	58
	L90	44	49	39	38	41	42	34	23	16
17:15	Leq	49	52	42	38	42	42	45	39	35
	Lmax	66	62	55	47	55	52	63	58	56
	L90	43	49	38	36	40	41	33	22	15
17:20	Leq	46	52	42	38	41	42	37	33	27
	Lmax	59	60	54	46	47	55	53	49	43
	L90	43	49	38	36	40	40	32	21	14
17:25	Leq	47	53	44	41	44	44	37	29	24
	Lmax	64	64	57	61	62	60	55	48	47
	L90	43	49	39	36	41	41	32	21	14
17:30	Leq	46	52	42	40	43	42	38	29	23
	Lmax	63	63	56	54	57	53	60	53	50
	L90	43	49	38	36	41	41	32	21	14
17:35	Leq	47	53	46	42	41	42	42	38	35
	Lmax	66	65	60	59	46	52	62	60	55
	L90	42	49	38	36	40	40	32	21	14
17:40	Leq	47	51	42	38	43	45	38	37	35
	Lmax	63	66	56	47	55	60	53	56	56
	L90	42	48	37	35	39	40	32	21	14
17:45	Leq	45	54	45	39	42	41	37	36	29
	Lmax	61	65	63	51	53	47	52	58	54
	L90	41	49	38	35	39	39	31	20	14
17:50	Leq	46	51	41	36	41	41	41	36	32
	Lmax	60	64	53	43	55	48	56	53	49
	L90	41	47	37	34	38	39	32	21	14
17:55	Leq	46	51	40	36	42	44	38	28	21
	Lmax	63	63	53	53	57	60	56	48	45
	L90	41	47	36	34	38	38	31	20	14

Time Period	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
22:45	Leq	41	49	42	41	40	37	28	20	15
	Lmax	54	63	61	54	54	48	38	35	34
	L90	37	44	36	30	36	34	25	18	13
22:50	Leq	43	48	42	44	41	38	31	20	13
	Lmax	56	56	57	59	55	50	44	30	19
	L90	37	44	35	30	37	34	24	18	13
22:55	Leq	38	47	37	31	37	35	26	19	13
	Lmax	43	57	42	36	41	41	32	22	15
	L90	36	44	35	29	36	32	23	17	13
23:00	Leq	39	49	40	32	37	35	26	19	13
	Lmax	45	60	54	41	42	41	32	23	19
	L90	37	45	36	30	36	33	24	17	13
23:05	Leq	38	46	38	32	37	35	26	19	13
	Lmax	44	57	47	42	41	41	33	25	16
	L90	36	44	35	29	35	32	24	17	13
23:10	Leq	38	47	37	31	37	35	27	19	13
	Lmax	45	60	43	37	44	41	34	22	18
	L90	36	44	35	29	35	32	24	18	13
23:15	Leq	39	46	37	32	37	36	28	20	13
	Lmax	46	56	44	40	42	43	36	26	15
	L90	36	43	35	30	36	32	24	19	13
23:20	Leq	46	49	44	47	45	41	32	20	13
	Lmax	61	64	59	63	61	54	46	32	16
	L90	37	44	36	30	36	33	24	18	13
23:25	Leq	39	47	37	34	37	36	27	19	13
	Lmax	45	58	43	42	43	41	32	23	18
	L90	37	44	35	31	36	33	24	18	13
23:30	Leq	40	48	39	35	39	37	29	20	13
	Lmax	50	56	50	49	46	47	40	27	19
	L90	38	44	36	32	37	34	25	19	13
23:35	Leq	39	48	37	32	38	36	27	18	13
	Lmax	44	58	49	37	41	42	33	22	16
	L90	37	45	35	31	37	34	24	17	12
23:40	Leq	43	48	42	43	42	39	31	22	13
	Lmax	58	56	54	59	58	52	46	41	29
	L90	38	44	36	31	37	34	25	18	13
23:45	Leq	39	45	36	33	38	36	27	19	13
	Lmax	47	56	44	45	44	44	35	24	14
	L90	37	42	34	30	37	33	25	18	13
23:50	Leq	42	49	46	39	39	39	30	20	13
	Lmax	53	58	59	49	47	50	44	29	20
	L90	38	43	35	31	37	35	26	19	13
23:55	Leq	42	47	39	41	42	38	29	20	13
	Lmax	55	54	50	55	56	48	38	23	14
	L90	39	43	35	32	38	36	26	19	13
00:00	Leq	40	46	37	34	39	37	28	19	13
	Lmax	49	60	42	43	48	45	38	24	16
	L90	37	43	35	31	37	34	25	18	13
00:05	Leq	40	46	38	32	38	37	28	19	13
	Lmax	50	64	50	41	50	45	36	29	17
	L90	37	43	35	30	37	34	25	18	13
00:10	Leq	40	46	37	33	38	37	28	20	13
	Lmax	47	59	47	41	44	45	35	25	16
	L90	38	43	34	31	37	34	26	18	13
00:15	Leq	40	46	38	33	39	37	27	19	13
	Lmax	51	60	48	40	50	49	39	29	18
	L90	38	43	34	30	37	35	25	18	13
00:20	Leq	40	50	35	32	39	37	27	18	13
	Lmax	47	61	41	37	45	44	34	24	15
	L90	38	43	33	30	37	35	25	17	12
00:25	Leq	43	47	42	41	43	38	30	19	13
	Lmax	58	62	58	58	59	48	41	28	22
	L90	38	43	34	31	38	35	25	17	12
00:30	Leq	40	47	36	34	39	37	28	18	13
	Lmax	55	56	45	46	56	52	34	22	25
	L90	38	43	34	31	37	35	25	17	12
00:35	Leq	40	46	39	37	38	36	27	18	13
	Lmax	52	56	52	55	47	49	35	23	16
	L90	37	42	33	29	36	33	24	17	12
00:40	Leq	38	48	40	34	37	34	25	18	13
	Lmax	46	61	54	45	42	41	31	23	15
	L90	36	42	33	29	36	32	23	17	12
00:45	Leq	39	46	35	31	38	36	27	18	13
	Lmax	50	62	45	40	45	48	39	27	17
	L90	36	42	32	29	36	32	24	17	12
00:50	Leq	39	47	34	32	38	35	26	18	13
	Lmax	46	60	42	43	45	42	33	22	15
	L90	36	41	31	29	36	32	24	17	13
00:55	Leq	38	44	34	31	38	35	25	20	16
	Lmax	47	56	43	37	42	45	38	32	32
	L90	37	41	32	29	36	33	23	17	13

Measurement Summary

Position	Time	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Main	Overall Daytime	Leq	48	53	45	42	44	44	39	39	38
		Lmax	65	66	61	58	58	58	59	58	57
		L90	43	48	39	36	40	41	33	24	17
	Overall Early Night	Leq	41	47	40	38	39	37	28	19	13
		Lmax	57	62	58	58	56	51	44	32	26
		L90	37	43	35	30	37	33	24	18	13

Required Reductions

Position	Environment	Reductions for BS8233 desirable* criteria	Reductions for WHO-Type Criteria
Main	Living Rooms	13 dB L_{Aeq}	-
	Bedrooms	11 dB L_{Aeq}	12 dB L_{Amax}
	Outdoor Living Areas	0 dB L_{Aeq}	-

Note that these figures do not include any façade effect which might be applicable

* BS 8233 considers a 5 dB relaxation would still provide *reasonable* conditions

Mitigation Summary

Façade	Room Type	Make-Up on Which Calculations are Based
Rear Façade	Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Study/Bed 4	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Front Façade	Lounge	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Bed 2	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

NB. R_w should come with a negative C_{tr} term, usually around -5 dB, eg. 35 dB R_w and -5 dB C_{tr} is 30 dB R_w+C_{tr}

Predicted Summary

Façade	Room Type	Time	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Rear Façade	Dining Kitchen	Rush	Leq	26	42	28	27	23	19	13	14	10
			Lmax	39	52	41	43	38	29	22	11	-1
	Study/Bed 4	Night	Leq	22	37	23	23	21	15	6	-2	-14
Front Façade	Lounge	Rush	Leq	26	41	27	26	23	20	15	15	9
			Lmax	37	50	39	41	36	27	21	9	-3
	Bed 2	Night	Leq	20	35	21	21	19	13	4	-4	-16

Living Room Break-in

<i>Rear Façade</i>		<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
<i>Dining Kitchen</i>										
Width of Exposed Façade 1	6.10 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	4.30 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	4.30 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	14.70 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	4.30 m	-	-	-	-	-	-	-	-	-
Element Area	36.75 m ²	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	46.75 m ²	-	-	-	-	-	-	-	-	-
Room Volume	65.58 m ³	-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s	-	-	-	-	-	-	-	-	-
Element Area Correction		-	17	17	17	17	17	17	17	17
Room Correction 10 x Log (RT/0.163/V)		-	-13	-13	-13	-13	-13	-13	-13	-13
Walls: Traditional Masonry	28.53 m ²	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	8.22 m ²	-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m ²	-	23	28	26	26	29	29	29	36
Composite SRI	46.75 m ²	-	20	27	24	30	35	35	34	37
Level Difference (Reverberant only)		-	-17	-23	-20	-26	-31	-32	-30	-34
Allowance for flanking/workmanship		3 dB	-	3	3	3	3	3	3	3
Façade relative to Measurement Position		3 dB	-	3	3	3	3	3	3	3
Predicted Internal Levels	Rush	Leq	26	42	28	27	23	19	13	10
	Night	Leq	20	37	22	24	19	11	2	-5
		Lmax	38	52	41	44	36	25	18	8

<i>Front Façade</i>		<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
<i>Lounge</i>										
Width of Exposed Façade 1	3.80 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	4.70 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	8.50 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	4.70 m	-	-	-	-	-	-	-	-	-
Element Area	21.25 m ²	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	31.25 m ²	-	-	-	-	-	-	-	-	-
Room Volume	44.65 m ³	-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s	-	-	-	-	-	-	-	-	-
Element Area Correction		-	15	15	15	15	15	15	15	15
Room Correction 10 x Log (RT/0.163/V)		-	-12	-12	-12	-12	-12	-12	-12	-12
Walls: Traditional Masonry	17.89 m ²	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	3.36 m ²	-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m ²	-	23	28	26	26	29	29	29	36
Composite SRI	31.25 m ²	-	21	27	25	29	34	34	33	38
Level Difference (Reverberant only)		-	-18	-24	-22	-26	-30	-30	-30	-34
Allowance for flanking/workmanship		3 dB	-	3	3	3	3	3	3	3
Façade relative to Measurement Position		3 dB	-	3	3	3	3	3	3	3
Predicted Internal Levels	Rush	Leq	26	41	27	26	23	20	15	9
	Night	Leq	20	36	22	22	19	13	4	-5
		Lmax	37	51	40	42	36	26	20	8

Bedroom Break-in

<i>Rear Façade</i>		<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
<i>Study/Bed 4</i>										
Width of Exposed Façade 1	3.20 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	3.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	6.20 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	3.00 m	-	-	-	-	-	-	-	-	-
Element Area	15.50 m ²	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	25.50 m ²	-	-	-	-	-	-	-	-	-
Room Volume	24.00 m ³	-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s	-	-	-	-	-	-	-	-	-
Element Area Correction		-	14	14	14	14	14	14	14	14
Room Correction 10 x Log (RT/0.163/V)		-	-9	-9	-9	-9	-9	-9	-9	-9
Walls: Traditional Masonry	13.94 m ²	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.56 m ²	-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m ²	-	23	28	26	26	29	29	29	36
Composite SRI	25.50 m ²	-	22	28	26	29	33	33	33	38
Level Difference (Reverberant only)		-	-17	-23	-21	-24	-28	-28	-28	-33
Allowance for flanking/workmanship	3 dB	-	3	3	3	3	3	3	3	3
Façade relative to Measurement Position	3 dB	-	3	3	3	3	3	3	3	3
Predicted Internal Levels	Rush	Leq	28	42	28	26	25	23	17	11
	Night	Leq	22	37	23	23	21	15	6	-2
		Lmax	39	52	41	43	38	29	22	11

<i>Front Façade</i>		<i>dB(A)</i>	63	125	250	500	1k	2k	4k	8k
<i>Bed 2</i>										
Width of Exposed Façade 1	3.80 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	3.90 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	7.70 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	3.90 m	-	-	-	-	-	-	-	-	-
Element Area	19.25 m ²	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	29.25 m ²	-	-	-	-	-	-	-	-	-
Room Volume	37.05 m ³	-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s	-	-	-	-	-	-	-	-	-
Element Area Correction		-	15	15	15	15	15	15	15	15
Room Correction 10 x Log (RT/0.163/V)		-	-11	-11	-11	-11	-11	-11	-11	-11
Walls: Traditional Masonry	17.69 m ²	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.56 m ²	-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m ²	-	23	28	26	26	29	29	29	36
Composite SRI	29.25 m ²	-	22	28	27	30	33	34	33	39
Level Difference (Reverberant only)		-	-18	-25	-23	-26	-30	-30	-29	-35
Allowance for flanking/workmanship	3 dB	-	3	3	3	3	3	3	3	3
Façade relative to Measurement Position	3 dB	-	3	3	3	3	3	3	3	3
Predicted Internal Levels	Rush	Leq	26	40	26	24	24	21	15	9
	Night	Leq	20	35	21	21	19	13	4	-4
		Lmax	37	50	39	41	36	27	21	9