

ARR/C/3555.01

29th August 2022

Onward Homes

Assessment of noise at the land at the
former Whitefield Day Centre, M45 6DP
for proposed residential development

Prepared for :-

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1.0 **SUMMARY**

The noise affecting the site was dominated at all times by middle-distance traffic such as from Bury New Road and the M60. The latter was particularly audible at night. There was very little local traffic.

During the afternoon and rush hour there was significant contribution from children playing and nearby off road motorbikes.

There was also some faintly audible noise from the Albert Close Trading Estate during the day, but only in the form of occasional vehicles moving around. There was no noise at all from the trading estate during the night.

BS 8233 criteria for “desirable” conditions should be achieved in outdoor living areas without mitigation, and within habitable rooms with partly open windows. With basic double glazed windows closed and non-acoustic trickle vents open, the internal levels are likely to be substantially below all criteria.

Although no mitigation is necessarily, with basic domestic garden fencing, noise affecting outdoor living areas and ground floor rooms should be further reduced.



A R Raymond



P J Durell

2.0 **INTRODUCTION**

ADC 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 185:-

185. 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 life⁶⁵;
 - 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 187 is also relevant:-

187. 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. Quantitatively, however, the design criteria are little changed – just expressed differently to reduce ambiguity in certain situations.

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 $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,8hour}$	30 dB $L_{Aeq,8hour}$

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. This 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	50 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	55 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	50 dB $L_{Aeq,8hour}$	45 dB $L_{Aeq,8hour}$

It 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 new version 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.

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

Note that the new version of BS8233 more explicitly specifies the assessment periods as 16 hour and 8 hour for daytime and night time 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 Pickering of ADC Acoustics.

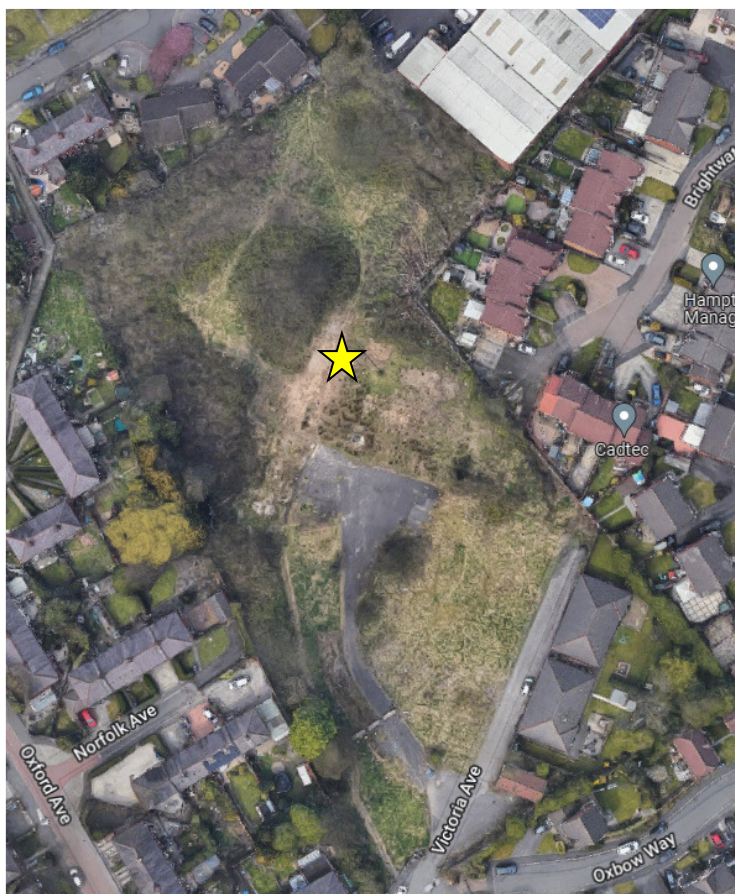
Measurements were carried out on 19th August from 15:30 to shortly after 18:00 to capture afternoon rush hour, and from shortly before 23:00 to shortly after 01:00 to capture what was likely to be a noisier time of night.

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 by the yellow star on the following plan.



The position was chosen to be as close as possible to the Albert Close Trading Estate, as other sources of noise such as middle distance traffic on the M60 and Bury New Road affect the site fairly uniformly. However, the site itself was heavily overgrown and the position shown above was as close as we could get.

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	:	50 to 100%
Temperature	:	13 to 19 Celsius
Wind	:	generally negligible, occasionally just-perceptible from the west

6.0 RESULTS AND DISCUSSIONS

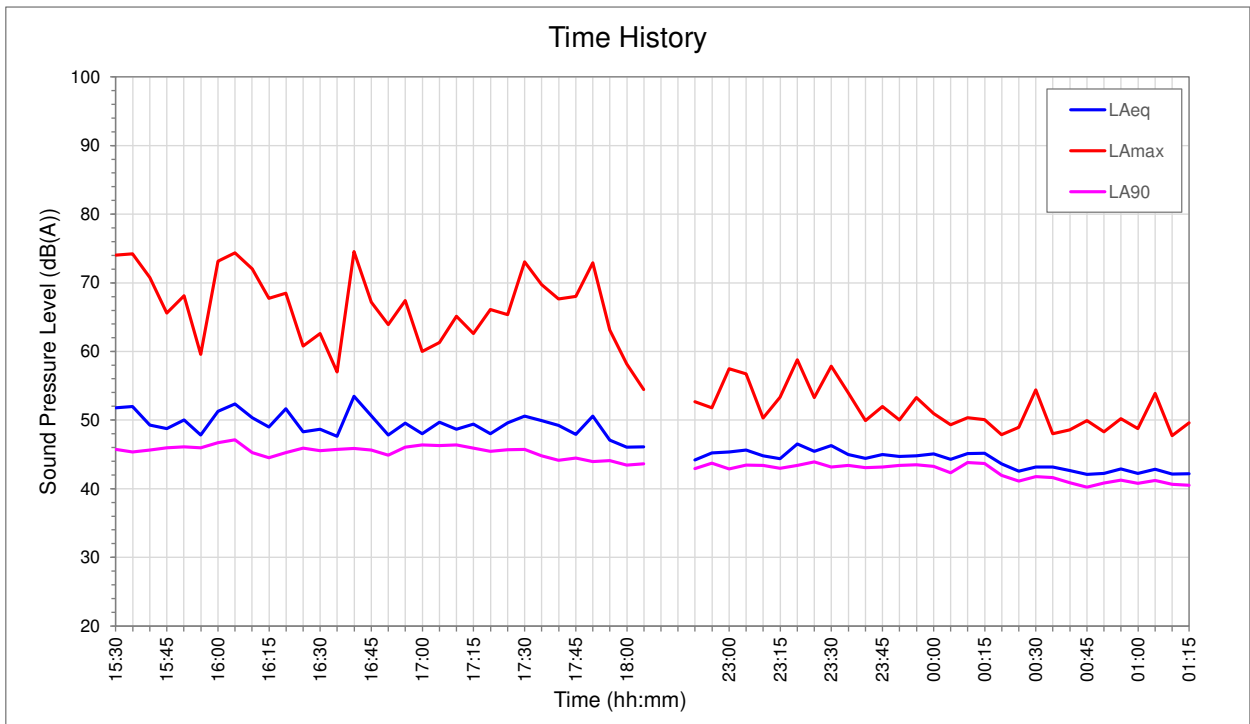
The noise affecting the site was dominated at all times by middle-distance traffic such as from Bury New Road and the M60. The latter was particularly audible at night. There was very little local traffic.

During the afternoon and rush hour there was significant contribution from children playing and nearby off road motorbikes.

There was also some faintly audible noise from the Albert Close Trading Estate during the day, but only in the form of occasional vehicles moving around. There was no noise at all from the trading estate during the night.

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 Rush Hour	Leq	50
	Lmax	69
	L90	46
Overall Early Night Time	Leq	44
	Lmax	53
	L90	43

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 new 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:

Position	Environment	Reductions for BS8233 desirable* criteria	Reductions for WHO-Type Criteria
1	Living Rooms	15 dB L_{Aeq}	-
	Bedrooms	14 dB L_{Aeq}	8 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. In other words, they should represent a worst-case.

6.3 Mitigation

For outdoor living areas (usually rear gardens) the levels are acceptable as they are. Even if there is a slightly greater influence from the trading estate for plots closer than the measurement position, the simplest of 1.8 to 2.0 m domestic timber fences should more than compensate for any potential uncertainty.

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 “desirable” conditions. As discussed for outdoor living areas in the previous paragraph, any potentially great influence of the trading estate on the closest plots to it should be more than mitigated by basic domestic fencing.

A summary of elements assumed in our calculations is as follows:-

<i>Façade</i>	<i>Room Type</i>	<i>Make-Up on Which Calculations are Based</i>
Plot 15 and similar (A5)	Living Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Front Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Plot 30 and similar (B1)	Living Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Front Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Plot 1 and similar (C1)	Living Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Rear Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

The rooms used for the calculations are worst case examples as they are exposed on two façades and/or have larger window areas, and/or shorter room depths, etc. Other rooms on the same façades 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 (windows closed and vents open) is as follows:-

<i>Façade</i>	<i>Room Type</i>	<i>Time</i>	<i>Index</i>	<i>dB(A)</i>
Plot 15 and similar (A5)	Living Dining Kitchen	Rush	Leq	30
	Front Bedroom	Night	Leq	24
			Lmax	35
Plot 30 and similar (B1)	Living Dining Kitchen	Rush	Leq	29
	Front Bedroom	Night	Leq	25
			Lmax	35
Plot 1 and similar (C1)	Living Dining Kitchen	Rush	Leq	30
	Rear Bedroom	Night	Leq	24
			Lmax	34

As open windows can be expected to achieve criteria, it is not surprising that predicted levels are within all criteria.

Of course, these assessments are very robust as they use what are likely to be the noisier times of day and night, assume all facades have a unrestricted lines of sight to the main sources and that the development itself will not provide any screening to its own properties.

7.0 CONCLUSIONS/RECOMMENDATIONS

BS 8233 criteria for “desirable” conditions should be achieved in outdoor living areas without mitigation, and within habitable rooms with partly open windows. With basic double glazed windows closed and non-acoustic trickle vents open, the internal levels are likely to be substantially below all criteria.

Although no mitigation is necessarily, with basic domestic garden fencing, noise affecting outdoor living areas and ground floor rooms should be further reduced.

Our only recommendation is that you issue this report o planners and invite officers 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 $L_{eq(s)}$ 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_{A_n} .

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

Measurement Summary

Position	Time	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Main	Overall Rush Hour	Leq	50	53	50	46	47	47	40	34	27
		Lmax	69	73	70	63	65	66	62	56	49
		L90	46	48	41	38	43	43	33	25	19
	Overall Early Night	Leq	44	49	42	40	42	42	32	21	16
		Lmax	53	59	54	54	51	47	43	38	33
		L90	43	46	38	35	40	41	30	16	13

Required Reductions

Position	Environment	Reductions for BS8233 desirable* criteria	Reductions for WHO-Type Criteria
Main	Living Rooms	15 dB L _{Aeq}	-
	Bedrooms	14 dB L _{Aeq}	8 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
Plot 15 and similar (A5)	Living Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Front Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Plot 30 and similar (B1)	Living Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Front Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Plot 1 and similar (C1)	Living Dining Kitchen	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Rear Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

Predicted Summary

Façade	Room Type	Time	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Plot 15 and similar (A5)	Living Dining Kitchen	Rush	Leq	30	43	33	32	29	24	17	12	1
			Lmax	35	49	37	39	33	25	21	16	6
	Front Bedroom	Night	Leq	24	38	25	25	24	19	9	-1	-11
Plot 30 and similar (B1)	Living Dining Kitchen	Rush	Leq	29	42	32	31	27	22	15	11	0
			Lmax	35	48	37	40	33	25	21	16	7
	Front Bedroom	Night	Leq	25	38	25	26	24	20	10	-1	-10
Plot 1 and similar (C1)	Living Dining Kitchen	Rush	Leq	30	43	33	32	29	25	17	12	1
			Lmax	34	47	36	39	32	25	20	16	6
	Rear Bedroom	Night	Leq	24	37	24	24	23	19	9	-1	-12

Living Room Break-in

Plot 15 and simialr (A5) Living Dining Kitchen		dB(A)	63	125	250	500	1k	2k	4k	8k
Width of Exposed Façade 1	4.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	3.20 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	7.20 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	3.20 m	-	-	-	-	-	-	-	-	-
Element Area	18.00 m2	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	28.00 m2	-	-	-	-	-	-	-	-	-
Room Volume	32.00 m3	-	-	-	-	-	-	-	-	-
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)		-	-10	-10	-10	-10	-10	-10	-10	-10
Walls: Traditional Masonry	13.70 m2	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	4.30 m2	-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2	-	23	28	26	26	29	29	29	36
Composite SRI	28.00 m2	-	20	27	24	29	33	33	32	37
Level Difference (Reverberant only)		-	-16	-22	-20	-24	-29	-29	-28	-32
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	30	43	33	32	29	24	17	12
	Night	Leq	25	39	25	26	24	19	9	-1
		Lmax	35	49	37	41	33	25	20	16

Plot 30 and similar (B1) Living Dining Kitchen		dB(A)	63	125	250	500	1k	2k	4k	8k
Width of Exposed Façade 1	3.20 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	5.90 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m	-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m	-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	9.10 m	-	-	-	-	-	-	-	-	-
Element Height	2.50 m	-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	5.90 m	-	-	-	-	-	-	-	-	-
Element Area	22.75 m2	-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	32.75 m2	-	-	-	-	-	-	-	-	-
Room Volume	47.20 m3	-	-	-	-	-	-	-	-	-
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	17.35 m2	-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	5.40 m2	-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2	-	23	28	26	26	29	29	29	36
Composite SRI	32.75 m2	-	20	27	24	29	34	34	33	37
Level Difference (Reverberant only)		-	-17	-23	-21	-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	29	42	32	31	27	22	15	11
	Night	Leq	23	38	24	25	22	18	7	-3
		Lmax	34	48	36	40	31	23	19	14

Plot 1 and similar (C1)			dB(A)	63	125	250	500	1k	2k	4k	8k
<i>Living Dining Kitchen</i>											
Width of Exposed Façade 1	3.10 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	7.80 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	2.60 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	13.50 m		-	-	-	-	-	-	-	-	-
Element Height	2.50 m		-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	7.06 m		-	-	-	-	-	-	-	-	-
Element Area	33.75 m ²		-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	53.75 m ²		-	-	-	-	-	-	-	-	-
Room Volume	54.70 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	28.17 m ²		-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	5.58 m ²		-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	20.00 m ²		-	23	28	26	26	29	29	29	36
Composite SRI	53.75 m ²		-	21	27	25	29	33	33	33	38
Level Difference (Reverberant only)			-	-16	-23	-20	-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	30	43	33	32	29	25	17	12	1
	Night	Leq	25	39	25	25	24	20	9	-1	-11
		Lmax	35	49	37	40	33	25	21	16	7

Bedroom Break-in

Plot 15 and similar (A5)			dB(A)	63	125	250	500	1k	2k	4k	8k
<i>Front Bedroom</i>											
Width of Exposed Façade 1	3.10 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	3.70 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	6.80 m		-	-	-	-	-	-	-	-	-
Element Height	2.50 m		-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	3.70 m		-	-	-	-	-	-	-	-	-
Element Area	17.00 m ²		-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	27.00 m ²		-	-	-	-	-	-	-	-	-
Room Volume	28.68 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)			-	-10	-10	-10	-10	-10	-10	-10	-10
Walls: Traditional Masonry	14.45 m ²		-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	2.55 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	27.00 m ²		-	21	28	25	29	33	33	33	38
Level Difference (Reverberant only)			-	-17	-23	-21	-24	-28	-29	-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	30	42	33	31	28	24	17	12	0
	Night	Leq	24	38	25	25	24	19	9	-1	-11
		Lmax	35	49	37	39	33	25	21	16	6

Plot 30 and similar (B1)			dB(A)	63	125	250	500	1k	2k	4k	8k
<i>Front Bedroom</i>											
Width of Exposed Façade 1	3.10 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	0.00 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	3.10 m		-	-	-	-	-	-	-	-	-
Element Height	2.50 m		-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	3.40 m		-	-	-	-	-	-	-	-	-
Element Area	7.75 m2		-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	17.75 m2		-	-	-	-	-	-	-	-	-
Room Volume	26.35 m3		-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s		-	-	-	-	-	-	-	-	-
Element Area Correction			-	12	12	12	12	12	12	12	12
Room Correction 10 x Log (RT/0.163/V)			-	-9	-9	-9	-9	-9	-9	-9	-9
Walls: Traditional Masonry	4.67 m2		-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	3.08 m2		-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		-	23	28	26	26	29	29	29	36
Composite SRI	17.75 m2		-	20	26	23	27	31	31	31	36
Level Difference (Reverberant only)			-	-17	-23	-20	-24	-28	-28	-28	-32
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	30	42	33	32	29	25	18	13	1
	Night	Leq	25	38	25	26	24	20	10	-1	-10
		Lmax	35	48	37	40	33	25	21	16	7

Plot 1 and similar (C1)			dB(A)	63	125	250	500	1k	2k	4k	8k
<i>Rear Bedroom</i>											
Width of Exposed Façade 1	3.40 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	0.00 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		-	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		-	-	-	-	-	-	-	-	-
Total Exposed Façade Width	3.40 m		-	-	-	-	-	-	-	-	-
Element Height	2.50 m		-	-	-	-	-	-	-	-	-
Effective Room Depth (re. Exposed façade 1)	3.50 m		-	-	-	-	-	-	-	-	-
Element Area	8.50 m2		-	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	18.50 m2		-	-	-	-	-	-	-	-	-
Room Volume	29.75 m3		-	-	-	-	-	-	-	-	-
Assumed RT	0.50 s		-	-	-	-	-	-	-	-	-
Element Area Correction			-	13	13	13	13	13	13	13	13
Room Correction 10 x Log (RT/0.163/V)			-	-10	-10	-10	-10	-10	-10	-10	-10
Walls: Traditional Masonry	6.52 m2		-	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.98 m2		-	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		-	23	28	26	26	29	29	29	36
Composite SRI	18.50 m2		-	21	27	25	28	31	32	31	37
Level Difference (Reverberant only)			-	-18	-24	-22	-25	-29	-29	-28	-34
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	29	41	31	30	28	24	17	12	0
	Night	Leq	24	37	24	24	23	19	9	-1	-12
		Lmax	34	47	36	39	32	25	20	16	6