PO Box 1030, Warrington, Cheshire WA4 9FJ
t. 01925 723333 www.adcacoustics.co.uk

ARR/PPN/C/3172.01

18th September 2020

Casey Group

Reassessment of noise at the land at Bank Bridge Road, Clayton, Manchester, M11 4ER for proposed residential development

Prepared for :-

One Manchester
Lovell House
6 Archway
Manchester
M15 5RN

Prepared by :-

Andrew Raymond

ADC Acoustics is a trading name of Acoustic Design & Control Limited
Registered Office: One City Place, Queens Road, Chester, CH1 3BQ Registered in England and Wales 5117653

CONTENTS

1.0 SUMMARY

2.0 INTRODUCTION

3.0 ASSESSMENT STANDARDS

3.1 NPPF, NPSE and NPPG
3.2 BS 8233
3.3 Planning Condition 22

4.0 GUIDE TO MODELLING

5.0 SURVEY DETAILS

6.0 RESULTS AND DISCUSSIONS

6.1 Basic Results
6.2 Assessment
6.3 Mitigation

7.0 CONCLUSIONS/RECOMMENDATIONS

Appendix 1: Definition of Acoustic Terms
Appendix 2: Calculation Details

1.0 SUMMARY

This report updates the assessment of the site on behalf of the original developer One Manchester and the report dated 24th February 2020, reference ARR/PPN/C/2889.01.

Since that assessment, the site layout has changed and has led to some very subtle differences to the calculations but basic conclusions are unchanged.

Based on the original survey, daytime levels are fairly high around the perimeters fronting onto the main roads, but lower further into the site, ignoring the screening effect of the proposed houses themselves. Levels are significantly lower at night.

Outdoor living areas are likely to present levels within BS 8233 criteria for “desirable” conditions without mitigation, apart from 2 to 4 plots where some very basic fencing would be beneficial.

Facades (particularly living rooms) facing the roads are likely to require closed windows to achieve BS 8233 criteria for “reasonable” and “desirable” conditions. Living rooms fronting onto Bank Bridge Road/Bank St will also require upgraded glazing and Acoustic vents. Acoustic specifications for glazing and vents are given.





A R Raymond

P J Durell

2.0 INTRODUCTION

In 2019, ADC carried out an assessment of the site on behalf of the original developer One Manchester and issued a report dated 24th February 2020, reference ARR/PPN/C/2889.01. The report formed the basis of planning condition 22a.

Since that assessment, the site layout and plot numbers have changed and this report provides an updated assessment.

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 situation can be interpreted.

The NPPF's main statement on noise is to be found in paragraph 180:-

180 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(footnote here refers to NPSE – see below);

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 182 is also relevant:-

182 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 in a table as reproduced below.

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, 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 BS4142, BS 8233, etc.) and the potential impact on wildlife.

3.2 BS 8233

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 are very similar to those of the WHO Guide to Community Noise

Table 4 of BS 8233 gives 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 $L_{Aeq,16hour}$	30 dB $L_{Aeq,16hour}$

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 $L_{Aeq,16hour}$	45 dB $L_{Aeq,16hour}$

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}.

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 BS 8233 more explicitly specifies the assessment periods as 16 hour and 8 hour for daytime and night time respectively.

3.3 Planning Condition 22

The condition is in two parts, which are discussed below, along with the associated "Reason":-

a) *The development hereby approved shall be completed in accordance with the noise assessment prepared by ADC Acoustics ref ARR/PPN/C/2889.01, stamped as received by the City Council, as Local Planning Authority, on the 6th March 2019, in relation to the acoustic treatment of the residential accommodation of the development hereby approved.*

This condition is clear enough, although the site layout and house designs have changed since our original report. This assessment updates the assessment with the new layout and designs.

b) Prior to the first occupation of the development hereby approved, a noise insulation verification report, shall be submitted to and approved in writing by the Local Planning Authority. The approved scheme shall then be implemented prior to the first occupation of the accommodation.

We believe that this condition requires that the design, as updated and confirmed in this assessment (see comments on part a above), is verified as being part of the specific design (final architect's drawings) and that is it implemented as per the drawings.

Reason - In order to limit the outbreak of noise from the commercial premises pursuant to policies SP1 and DM1 of the Core Strategy (2007) and saved policy DC26 of the Unitary Development Plan for the City of Manchester (1995).

This is presumably written in error as there is no commercial development associated with the site.

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 x log(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 x log(RT/0.163/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 or 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 generous 5 dB allowance for this.

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

5.0 SURVEY DETAILS

The original report dated 24th February 2019 shows all the survey details. The survey was not repeated as it should still be valid, but mostly because the current covid situation is likely to give unrepresentative e results. However, the main measurement positions are reproduced below for convenience.



Positions 1, 2, 3 and 4 were chosen to correspond to the most exposed facades of plots 12/13, plots1/2, plots 30/31 and plots 43/44 respectively.

The microphone was 1.5 m above ground and well away from other reflecting surfaces.

6.0 RESULTS AND DISCUSSIONS

The noise at all positions was dominated at all times by traffic on Bank Bridge Road/Bank St and, to a much lesser extent, Tartan St. Distant traffic was audible during the night.

6.1 Basic Results

Full details are given in Appendix 2. A summary of overall levels is as follows:-

Time	*Position*	*Index*	***dB(A)***
Overall Rush Hour	1	Leq	**61**
		Lmax	**77**
		L90	**50**
	2	Leq	**61**
		Lmax	**75**
		L90	**53**
	3	Leq	**60**
		Lmax	**73**
		L90	**52**
	4	Leq	**56**
		Lmax	**74**
		L90	**50**
Overall Early Night	1	Leq	**51**
		Lmax	**66**
		L90	**41**
	2	Leq	**50**
		Lmax	**65**
		L90	**35**
	3	Leq	**48**
		Lmax	**65**
		L90	**40**
	4	Leq	**48**
		Lmax	**63**
		L90	**41**

6.2 Assessments

The above results give the following assessments.

In terms of BS 8233, 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 BS 8233 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.

The measured levels appear to suggest that sound insulation will need to be designed to control external noise break-in as follows:

Environment	*Position*	*Required Reductions*	
		Desirable	*Reasonable*
Living Rooms	1	26 dB	21 dB
	2	26 dB	21 dB
	3	25 dB	20 dB
	4	21 dB	16 dB
Bedrooms	1	21 dB	16 dB
	2	20 dB	15 dB
	3	18 dB	13 dB
	4	18 dB	13 dB
Outdoor Living Areas	1	11 dB	6 dB
	2	11 dB	6 dB
	3	10 dB	5 dB
	4	6 dB	1 dB

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

Only plots 1 and 25 have outdoor living areas (essentially rear gardens) backing on to the surrounding roads, although it could be argued that plots 13 and 66 also have to some degree. Even the most basic 1.8 m high garden fencing can be expected to provide around 5 dB reduction, and the presence of any of the proposed houses between an outdoor living area and the roads should easily achieve the reduction well in excess of 10 dB. We can very confidently conclude, therefore, that outdoor living areas are extremely unlikely to require any mitigation, other than basic 1.8m garden fencing to Plots and 25, and perhaps to plots 13 and 66, which was probably proposed anyway. The fences do not need to be high spec – theoretically a surface density of 525kg/m^2 should be adequate for a fence providing a 10 dB reduction, which is roughly equivalent to 5 mm timber. Any reasonable fence would be far thicker than this just to be able to stand up. The important thing is there should be no gaps, including an allowance for shrinkage and warping.

Moving on to external noise break-in to habitable rooms, a partly open window can be expected to provide about 15 dB reduction. This will be insufficient to achieve BS 8233 criteria for “reasonable” conditions for any living rooms facing the surrounding roads, although it should be sufficient for living rooms of all other facades and plots. In fact, BS 8233 criteria for “desirable” conditions, should be achievable with a partly open window for most living rooms which do not overlook surrounding roads.

For the most exposed living rooms, ie. those overlooking the surrounding roads, windows will need to be assumed shut.

Night time levels are significantly lower and BS 8233 criteria for “reasonable” conditions should be achievable in all bedrooms with a partly open window. BS 8233 criteria for “desirable” conditions are only likely to be achievable on the most exposed facades with windows closed.

In all cases closed windows implies that ventilation will be required such that occupants have the realistic option of keeping windows shut. This can be achieved using active or passive ventilation which provides a suitable sound insulation. This could take the form of ventilation through acoustic or non-acoustic vents or a whole house-type system which does not require any wall or window vents.

Note that this assessment provides the specification for the acoustic performance of vents. Ventilation requirements should be determined by others.

A summary of mitigation (or building elements assumed in our calculations) is as follows:-

Façade	*Room Type*	*Make-Up on Which Calculations are Based*
Position 1	B2x Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 2	B2x Living Room	Walls: Traditional Masonry Glazing: 32 dB Rw eg. 6+18+4 Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 3	B2x Living Room	Walls: Traditional Masonry Glazing: 32 dB Rw eg. 6+18+4 Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 4	B2x Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

Note that the table provides the acoustic specifications (such as R_w for windows and $D_{n,e,w}$ for vents) to meet appropriate criteria. The glazing build-ups and vent models which are also shown are *examples* and many other options achieving the same acoustic performance are available.

Full calculation details are shown in Appendix 2 and a summary of predicted internal noise levels is as follows (windows closed and vents open):-

Façade	*Room Type*	*Time*	*Index*	***dB(A)***
Position 1	B2x Living Room	Rush	Leq	**35**
	A1 Bedroom	Night	Leq	**29**
			Lmax	**44**
Position 2	B2x Living Room	Rush	Leq	**35**
	A1 Bedroom	Night	Leq	**29**
			Lmax	**44**
Position 3	B2x Living Room	Rush	Leq	**34**
	A1 Bedroom	Night	Leq	**28**
			Lmax	**45**
Position 4	B2x Living Room	Rush	Leq	**34**
	A1 Bedroom	Night	Leq	**27**
			Lmax	**43**

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.

The following plan should help to visualise what mitigation is required to.



Note that mitigation applies only to habitable rooms.

7.0 CONCLUSIONS/RECOMMENDATIONS

The noise at all positions was dominated at all times by traffic on Bank Bridge Road/Bank St and, to a much lesser extent, Tartan St. Distant traffic was audible during the night.

Daytime levels are fairly high around the perimeters fronting onto the roads, but lower further into the site, ignoring the screening effect of the proposed houses themselves. Levels are significantly lower at night.

Outdoor living areas are likely to present levels within BS 8233 criteria for “desirable” conditions.

Facades (particularly living rooms) facing the roads are likely to require closed windows to achieve BS 8233 criteria for “reasonable” and “desirable” conditions. Living rooms fronting onto Bank Bridge Road/Bank St will also require upgraded glazing and Acoustic vents. Acoustic specifications for glazing and vents are given.

We would suggest that a condition requiring details of sound insulation and ventilation to be submitted and approved will be an adequate control for Planners. This report updates the assessment of the site on behalf of the original developer One Manchester and the report dated 24th February 2020, reference ARR/PPN/C/2889.01.

Since that assessment, the site layout has changed and has led to some very subtle differences to the calculations but basic conclusions are unchanged.

Based on the original survey, daytime levels are fairly high around the perimeters fronting onto the main roads, but lower further into the site, ignoring the screening effect of the proposed houses themselves. Levels are significantly lower at night.

Outdoor living areas are likely to present levels within BS 8233 criteria for “desirable” conditions without mitigation, apart from 2 to 4 plots where some very basic fencing would be beneficial.

Facades (particularly living rooms) facing the roads are likely to require closed windows to achieve BS 8233 criteria for “reasonable” and “desirable” conditions. Living rooms fronting onto Bank Bridge Road/Bank St will also require upgraded glazing and Acoustic vents. Acoustic specifications for glazing and vents are given.

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 is really should be stated. The threshold of human hearing is a sound pressure of 20μPa or a sound power of 1pW.

A sound pressure level or SPL should be expressed in dB(re. 20μPa). 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 given 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 exceed 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 exceed 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 form 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

Daytime Measurements

Position	*Time*	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
1	16:20	Leq	**60**	67	59	54	53	57	54	47	36
		Lmax	**79**	79	71	65	69	72	73	75	60
		L90	**51**	61	55	48	46	48	43	33	23
	16:25	Leq	**60**	69	60	55	53	57	54	43	34
		Lmax	**73**	81	70	68	63	70	67	54	50
		L90	**51**	63	55	47	45	48	43	34	24
	16:30	Leq	**60**	68	59	55	54	57	53	45	37
		Lmax	**73**	81	73	70	68	69	66	59	52
		L90	**52**	61	54	48	46	49	44	35	26
	17:02	Leq	**61**	67	59	55	53	58	54	44	34
		Lmax	**74**	80	78	64	65	72	68	58	51
		L90	**50**	61	54	47	45	48	42	33	21
	17:07	Leq	**62**	68	59	55	54	59	55	44	35
		Lmax	**72**	80	69	64	63	70	64	57	48
		L90	**51**	62	55	48	45	48	42	32	22
	17:12	Leq	**60**	66	59	54	53	57	53	42	33
		Lmax	**73**	79	70	66	65	70	67	55	48
		L90	**50**	61	54	48	44	47	41	30	19
	17:36	Leq	**62**	66	61	54	54	59	56	44	36
		Lmax	**77**	80	80	65	66	73	71	59	51
		L90	**50**	61	54	47	45	48	41	32	22
	17:41	Leq	**63**	69	71	57	56	60	56	46	39
		Lmax	**79**	90	93	74	72	71	66	61	55
		L90	**51**	61	54	47	45	48	42	34	23
	17:46	Leq	**61**	66	62	54	54	58	55	46	38
		Lmax	**74**	83	82	66	67	71	67	59	52
		L90	**49**	60	54	46	44	46	40	30	19
	18:10	Leq	**61**	67	61	55	54	58	55	44	37
		Lmax	**75**	81	80	70	71	70	67	60	56
		L90	**49**	60	55	46	45	46	39	28	19
	18:15	Leq	**63**	65	60	59	59	59	55	47	38
		Lmax	**82**	80	78	82	80	77	74	69	60
		L90	**50**	60	53	47	45	47	41	29	20
	18:20	Leq	**58**	64	57	52	51	55	50	39	31
		Lmax	**71**	76	73	67	67	68	64	54	48
		L90	**49**	60	53	46	45	46	40	29	19
2	16:45	Leq	**61**	70	61	56	54	58	52	44	36
		Lmax	**71**	86	72	68	65	68	62	56	54
		L90	**51**	57	52	48	44	49	45	34	22
	16:50	Leq	**61**	69	64	60	56	58	53	46	37
		Lmax	**75**	83	81	75	71	70	66	61	54
		L90	**54**	58	55	51	48	51	47	37	26
	16:55	Leq	**61**	68	62	56	54	58	53	49	37
		Lmax	**75**	79	78	70	65	67	66	71	57
		L90	**53**	59	54	51	47	51	46	35	25
	17:19	Leq	**62**	68	61	57	55	59	54	47	39
		Lmax	**71**	81	73	66	64	69	63	61	57
		L90	**56**	60	55	52	49	53	49	39	29
	17:24	Leq	**61**	67	61	58	54	59	53	45	38
		Lmax	**70**	80	73	71	64	66	62	56	59
		L90	**55**	58	53	51	48	52	48	36	26
	17:29	Leq	**60**	67	61	56	53	58	52	45	38
		Lmax	**70**	82	73	64	63	68	60	57	62
		L90	**53**	59	54	50	46	51	46	35	26
	17:53	Leq	**61**	68	62	61	56	57	52	45	38
		Lmax	**78**	85	82	81	75	71	66	62	56
		L90	**52**	58	52	48	45	49	44	35	24
	17:58	Leq	**60**	66	61	56	54	57	52	44	37
		Lmax	**69**	79	77	66	66	66	60	53	49
		L90	**54**	60	54	51	47	50	47	38	28
	18:03	Leq	**60**	67	63	57	53	57	52	44	36
		Lmax	**72**	81	81	75	61	65	60	59	52
		L90	**51**	56	51	48	45	48	45	34	25
	18:28	Leq	**58**	63	59	55	52	56	51	43	34
		Lmax	**70**	75	75	67	68	65	59	57	48
		L90	**51**	55	51	49	45	49	44	33	23
	18:33	Leq	**58**	63	56	54	50	56	50	40	32
		Lmax	**68**	75	70	70	58	64	59	50	45
		L90	**49**	53	48	45	42	46	42	31	19
	18:38	Leq	**63**	66	72	66	55	58	53	49	45
		Lmax	**82**	81	91	84	72	74	74	70	71
		L90	**51**	56	52	49	45	49	44	33	21

Position	*Time*	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
3	16:20	Leq	**63**	71	63	59	55	61	56	47	41
		Lmax	**73**	83	71	70	70	66	65	63	61
		L90	**54**	60	53	49	47	51	46	38	31
	16:25	Leq	**64**	71	67	61	56	62	57	47	42
		Lmax	**76**	85	83	76	76	69	66	62	62
		L90	**56**	61	55	52	48	54	49	38	29
	16:30	Leq	**63**	68	63	59	58	61	56	45	38
		Lmax	**79**	79	74	73	80	74	68	63	55
		L90	**53**	61	55	49	46	50	44	35	27
	16:55	Leq	**54**	65	56	48	49	51	43	33	26
		Lmax	**63**	70	64	57	62	57	55	49	43
		L90	**49**	60	51	43	44	46	38	26	17
	17:00	Leq	**53**	65	57	48	48	50	42	41	34
		Lmax	**66**	72	69	68	59	57	53	60	56
		L90	**48**	60	51	43	44	45	37	28	20
	17:05	Leq	**53**	65	57	48	49	51	42	39	32
		Lmax	**65**	71	67	65	61	57	54	58	53
		L90	**48**	60	51	43	44	46	38	27	19
	17:30	Leq	**55**	65	57	53	53	51	43	46	41
		Lmax	**74**	72	67	75	73	66	62	66	62
		L90	**48**	60	51	44	44	46	38	25	14
	17:35	Leq	**54**	64	58	54	52	50	41	29	22
		Lmax	**72**	69	68	73	72	67	53	51	39
		L90	**48**	60	50	43	43	45	37	23	13
	17:40	Leq	**55**	64	57	53	52	50	42	43	38
		Lmax	**73**	71	67	74	73	67	59	64	59
		L90	**48**	60	51	43	44	45	37	24	14
	18:04	Leq	**52**	63	57	47	47	49	41	27	17
		Lmax	**53**	66	60	51	46	50	43	30	26
		L90	**48**	59	53	44	44	46	38	25	14
	18:09	Leq	**64**	69	65	61	56	61	55	47	38
		Lmax	**72**	78	78	70	65	69	63	62	51
		L90	**55**	59	55	53	48	52	47	37	28
	18:14	Leq	**63**	69	62	61	56	61	55	44	36
		Lmax	**72**	78	73	73	65	68	63	63	52
		L90	**53**	58	52	50	46	50	45	35	25
4	16:37	Leq	**51**	64	55	46	45	49	42	36	28
		Lmax	**65**	72	65	65	65	57	54	52	44
		L90	**48**	60	52	43	44	46	38	27	16
	16:42	Leq	**57**	63	54	54	53	54	45	43	39
		Lmax	**78**	71	62	76	73	76	67	69	65
		L90	**49**	60	51	43	44	46	39	26	15
	16:47	Leq	**55**	63	55	52	53	51	43	39	34
		Lmax	**77**	72	66	69	77	74	60	54	49
		L90	**49**	60	52	43	44	47	39	29	20
	17:13	Leq	**51**	62	54	44	44	47	41	43	37
		Lmax	**65**	74	69	64	58	57	52	59	57
		L90	**48**	59	51	42	43	45	38	27	18
	17:18	Leq	**52**	64	56	44	44	49	42	41	34
		Lmax	**62**	71	68	53	51	55	51	58	53
		L90	**49**	60	52	43	43	46	39	27	15
	17:23	Leq	**52**	63	53	46	47	50	44	37	31
		Lmax	**76**	72	65	73	73	72	67	65	57
		L90	**49**	60	51	42	43	46	39	25	14
	17:47	Leq	**58**	66	61	53	51	54	51	42	35
		Lmax	**70**	79	76	65	68	62	63	55	56
		L90	**51**	60	54	47	45	49	43	34	24
	17:52	Leq	**58**	66	60	54	53	54	51	43	35
		Lmax	**76**	79	72	72	77	68	67	58	50
		L90	**53**	60	54	48	46	50	46	36	25
	17:57	Leq	**58**	66	61	54	52	54	51	43	35
		Lmax	**74**	79	74	70	75	66	65	57	54
		L90	**52**	60	54	48	45	49	44	35	25
	18:21	Leq	**57**	65	62	55	49	53	50	41	32
		Lmax	**70**	79	81	73	65	60	58	59	54
		L90	**50**	59	52	46	44	48	43	30	19
	18:26	Leq	**57**	65	59	53	47	54	50	42	33
		Lmax	**67**	80	72	64	54	62	59	61	52
		L90	**48**	58	51	43	43	45	38	25	15
	18:31	Leq	**56**	64	62	56	47	53	49	40	31
		Lmax	**69**	77	77	75	60	60	57	60	52
		L90	**50**	58	54	47	44	47	42	30	18

Night Time Measurements

Position	*Time*	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
1	23:01	Leq	**53**	60	50	47	45	50	47	36	27
		Lmax	**69**	75	66	61	61	66	62	54	43
		L90	**43**	55	47	41	39	40	32	23	15
	23:06	Leq	**56**	62	53	48	48	53	50	40	32
		Lmax	**69**	73	65	60	61	66	63	54	46
		L90	**43**	55	46	41	39	40	32	23	17
	23:11	Leq	**52**	58	50	46	44	49	46	35	27
		Lmax	**68**	70	65	60	59	65	62	50	42
		L90	**42**	55	46	40	38	39	32	23	16
	23:35	Leq	**45**	58	49	43	41	42	36	27	22
		Lmax	**55**	69	58	52	48	52	46	40	38
		L90	**42**	55	47	40	39	39	31	22	15
	23:40	Leq	**45**	57	48	42	40	41	35	28	25
		Lmax	**57**	68	58	56	49	52	47	49	48
		L90	**42**	54	46	40	38	39	31	22	16
	23:45	Leq	**54**	60	59	47	46	50	47	38	30
		Lmax	**68**	74	70	60	61	60	63	58	50
		L90	**42**	55	46	40	39	39	31	23	17
	00:08	Leq	**47**	57	48	44	42	45	39	29	24
		Lmax	**65**	75	59	60	58	62	58	44	42
		L90	**41**	51	45	39	38	38	30	19	15
	00:13	Leq	**51**	55	49	46	44	48	43	32	24
		Lmax	**69**	69	62	62	63	66	62	53	42
		L90	**41**	51	45	39	38	38	30	19	15
	00:18	Leq	**44**	53	48	43	40	41	35	29	24
		Lmax	**61**	70	67	62	55	57	51	47	44
		L90	**40**	50	44	39	38	37	29	18	15
	00:42	Leq	**43**	54	47	42	39	40	33	26	22
		Lmax	**58**	74	65	60	54	48	46	48	44
		L90	**40**	49	44	38	37	37	29	17	14
	00:47	Leq	**43**	52	47	41	39	39	33	25	21
		Lmax	**55**	62	58	52	54	50	44	38	42
		L90	**39**	49	44	38	37	36	28	18	15
	00:52	Leq	**49**	55	51	48	42	46	42	32	25
		Lmax	**68**	71	68	68	59	64	61	50	43
		L90	**39**	49	43	38	36	36	28	17	14
2	23:18	Leq	**52**	55	50	49	45	50	44	36	31
		Lmax	**66**	70	65	65	60	63	57	52	58
		L90	**37**	48	41	34	34	33	26	18	13
	23:23	Leq	**52**	57	54	49	45	49	45	37	30
		Lmax	**66**	73	70	66	59	63	59	50	52
		L90	**36**	48	40	34	34	33	27	20	15
	23:28	Leq	**51**	54	49	47	43	49	43	35	27
		Lmax	**66**	71	65	63	59	64	57	48	44
		L90	**36**	48	40	34	34	32	26	20	15
	23:52	Leq	**51**	51	47	46	45	48	45	35	26
		Lmax	**66**	71	64	60	62	64	59	50	41
		L90	**35**	46	39	34	33	32	24	18	13
	23:57	Leq	**49**	51	45	44	42	47	40	32	26
		Lmax	**65**	66	61	61	59	63	54	52	46
		L90	**35**	45	39	34	32	31	24	18	14
	00:02	Leq	**52**	58	50	47	44	49	44	37	30
		Lmax	**66**	72	66	63	58	64	58	57	47
		L90	**37**	47	40	35	35	34	27	22	17
	00:25	Leq	**51**	56	50	48	45	48	45	37	30
		Lmax	**66**	75	64	62	61	63	59	51	46
		L90	**34**	44	38	33	31	29	23	17	13
	00:30	Leq	**52**	57	53	49	45	49	46	37	31
		Lmax	**66**	75	70	64	59	63	59	54	51
		L90	**34**	45	39	33	31	31	24	16	13
	00:35	Leq	**50**	56	51	48	45	48	43	36	29
		Lmax	**66**	72	71	65	61	63	57	54	47
		L90	**33**	44	39	33	31	29	22	17	14
	00:59	Leq	**48**	55	48	43	41	45	40	33	30
		Lmax	**63**	75	68	57	53	59	53	47	57
		L90	**33**	43	37	31	31	28	22	15	13
	01:04	Leq	**45**	50	45	42	40	43	36	28	24
		Lmax	**64**	70	64	59	59	62	53	47	44
		L90	**33**	43	39	32	32	28	22	16	12
	01:09	Leq	**38**	47	41	36	36	34	29	24	19
		Lmax	**53**	61	51	50	51	46	44	44	39
		L90	**33**	43	38	32	31	28	21	15	12

Position	*Time*	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
3	23:01	Leq	**50**	55	50	46	43	47	43	33	24
		Lmax	**62**	70	60	60	55	59	57	48	40
		L90	**41**	51	44	37	39	38	30	17	12
	23:06	Leq	**51**	58	55	49	44	48	44	35	27
		Lmax	**64**	77	73	62	58	58	56	50	52
		L90	**41**	51	44	37	39	39	30	16	12
	23:11	Leq	**49**	57	52	47	43	46	42	32	23
		Lmax	**63**	71	66	59	56	59	56	47	47
		L90	**41**	51	44	37	39	38	31	17	12
	23:33	Leq	**52**	62	64	50	43	47	43	32	24
		Lmax	**71**	79	86	69	57	57	54	44	45
		L90	**41**	51	45	37	39	38	30	18	13
	23:38	Leq	**51**	54	50	45	42	48	45	34	24
		Lmax	**64**	66	60	57	51	60	60	50	43
		L90	**41**	50	44	37	39	38	30	18	14
	23:43	Leq	**43**	54	45	37	40	40	34	27	25
		Lmax	**60**	66	53	47	52	52	57	51	50
		L90	**41**	51	43	35	38	38	29	15	12
	00:06	Leq	**42**	53	46	37	39	39	32	21	16
		Lmax	**52**	62	54	47	44	48	44	41	36
		L90	**40**	50	43	35	38	36	27	16	12
	00:11	Leq	**44**	55	48	39	39	41	36	27	23
		Lmax	**58**	67	65	61	54	50	49	47	43
		L90	**40**	51	43	35	38	37	29	16	12
	00:16	Leq	**44**	54	48	38	39	41	36	24	18
		Lmax	**55**	63	62	45	47	53	47	40	34
		L90	**41**	51	43	35	38	38	29	15	12
	00:39	Leq	**45**	53	45	37	40	39	35	39	35
		Lmax	**72**	61	57	54	57	56	62	69	66
		L90	**39**	50	42	34	37	36	26	13	12
	00:44	Leq	**41**	54	46	35	38	38	31	23	19
		Lmax	**53**	63	57	45	48	49	46	43	39
		L90	**38**	50	42	34	36	35	26	13	12
	00:49	Leq	**47**	52	44	34	39	40	41	39	40
		Lmax	**58**	55	46	37	42	48	53	51	52
		L90	**40**	49	43	33	37	37	28	17	13
4	23:17	Leq	**51**	57	50	46	43	48	44	34	28
		Lmax	**68**	68	66	72	63	60	61	57	50
		L90	**42**	51	44	38	39	40	32	21	14
	23:22	Leq	**52**	62	55	48	43	50	46	36	26
		Lmax	**63**	78	70	59	52	59	57	46	39
		L90	**42**	52	44	38	39	39	31	16	12
	23:27	Leq	**50**	55	49	44	42	47	43	32	23
		Lmax	**60**	69	63	56	49	57	54	46	39
		L90	**41**	51	44	37	39	39	31	18	13
	23:50	Leq	**51**	58	51	46	42	48	44	35	27
		Lmax	**68**	75	66	64	57	63	62	58	51
		L90	**41**	51	45	37	39	38	31	18	12
	23:55	Leq	**49**	58	50	43	42	46	43	33	25
		Lmax	**65**	73	67	55	50	61	60	50	45
		L90	**41**	51	44	37	39	38	30	16	12
	00:00	Leq	**49**	56	49	44	41	46	42	31	22
		Lmax	**62**	69	63	55	48	59	58	48	39
		L90	**41**	50	44	37	39	37	29	17	13
	00:22	Leq	**43**	55	47	37	40	41	34	22	14
		Lmax	**52**	67	60	44	43	48	44	34	27
		L90	**41**	51	44	35	38	38	30	16	12
	00:27	Leq	**44**	54	46	37	40	41	35	23	18
		Lmax	**54**	67	55	50	48	50	47	38	36
		L90	**41**	51	43	35	38	38	29	16	12
	00:32	Leq	**45**	54	48	44	42	41	33	26	23
		Lmax	**60**	65	65	63	57	57	43	41	41
		L90	**40**	51	43	35	38	36	27	15	12
	00:55	Leq	**43**	53	46	36	39	40	34	22	16
		Lmax	**57**	63	56	47	56	51	50	41	37
		L90	**39**	50	43	34	37	37	27	14	12
	01:00	Leq	**42**	52	45	36	38	39	32	24	21
		Lmax	**52**	64	52	44	44	47	45	44	44
		L90	**39**	49	42	34	37	37	27	14	12
	01:05	Leq	**43**	53	46	36	39	40	34	29	25
		Lmax	**58**	65	58	55	52	50	47	53	47
		L90	**39**	50	43	34	37	37	28	14	12

Measurement Summary

Time	*Position*	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Overall Rush Hour	1	Leq	**61**	67	63	55	54	58	54	45	35
		Lmax	**77**	82	83	73	72	72	69	66	57
		L90	**50**	61	54	47	45	47	41	32	22
	2	Leq	**61**	67	64	59	54	58	52	46	38
		Lmax	**75**	82	82	76	69	69	66	64	61
		L90	**53**	58	53	50	46	50	46	35	25
	3	Leq	**60**	67	62	57	54	58	52	44	37
		Lmax	**73**	78	74	72	72	67	62	62	57
		L90	**52**	60	53	48	46	49	44	34	25
	4	Leq	**56**	65	59	53	50	52	48	41	35
		Lmax	**74**	77	74	71	72	69	63	61	57
		L90	**50**	60	53	45	44	47	41	31	20
Overall Early Night	1	Leq	**51**	58	52	45	43	48	44	34	28
		Lmax	**66**	72	65	61	59	62	60	52	44
		L90	**41**	53	45	39	38	38	30	21	15
	2	Leq	**50**	55	50	47	44	48	43	35	29
		Lmax	**65**	72	67	63	59	62	57	52	51
		L90	**35**	46	39	33	33	31	24	18	14
	3	Leq	**48**	56	55	44	41	44	41	34	31
		Lmax	**65**	72	75	61	54	56	56	58	55
		L90	**40**	50	43	36	38	38	29	16	12
	4	Leq	**48**	57	50	44	41	45	41	31	24
		Lmax	**63**	71	64	62	55	58	57	51	45
		L90	**41**	51	44	36	38	38	30	17	12

Required Reductions for BS8233 Guidelines

Environment	*Position*	*Required Reductions*	
		Desirable	*Reasonable*
Living Rooms	1	26 dB	21 dB
	2	26 dB	21 dB
	3	25 dB	20 dB
	4	21 dB	16 dB
Bedrooms	1	21 dB	16 dB
	2	20 dB	15 dB
	3	18 dB	13 dB
	4	18 dB	13 dB
Outdoor Living Areas	1	11 dB	6 dB
	2	11 dB	6 dB
	3	10 dB	5 dB
	4	6 dB	1 dB

Mitigation Summary

Façade	*Room Type*	*Make-Up on Which Calculations are Based*
Position 1	B2x Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 2	B2x Living Room	Walls: Traditional Masonry Glazing: 32 dB Rw eg. 6+18+4 Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 3	B2x Living Room	Walls: Traditional Masonry Glazing: 32 dB Rw eg. 6+18+4 Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450
	A1 Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 4	B2x Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	A1 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*
Position 1	B2x Living Room	Rush	Leq	**35**	55	44	39	31	26	20	15	5
	A1 Bedroom	Night	Leq	**29**	46	34	30	24	24	21	11	0
			Lmax	**44**	61	47	46	39	39	36	29	16
Position 2	B2x Living Room	Rush	Leq	**35**	54	45	40	29	24	18	7	0
	A1 Bedroom	Night	Leq	**29**	43	32	31	24	24	19	12	1
			Lmax	**44**	61	49	47	40	39	33	29	23
Position 3	B2x Living Room	Rush	Leq	**34**	55	42	38	29	24	18	6	-1
	A1 Bedroom	Night	Leq	**28**	45	37	29	22	21	17	11	3
			Lmax	**45**	60	57	45	35	33	33	35	27
Position 4	B2x Living Room	Rush	Leq	**34**	53	40	37	30	27	23	17	6
	A1 Bedroom	Night	Leq	**27**	45	32	28	22	22	18	8	-4
			Lmax	**43**	60	46	47	36	35	33	28	17

Living Room Break-in

Position 1 *B2x Living Room*				***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.90	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	8.60	m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50	m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.70	m										
Element Area	21.50	m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	31.50	m2		**-**	-	-	-	-	-	-	-	-
Room Volume	45.33	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	15.90	m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	5.60	m2		**-**	15	21	17	25	35	37	31	31
Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450	10.00	m2		**-**	34	45	44	36	40	42	55	55
Composite SRI	31.50	m2		**-**	21	28	24	32	40	42	38	38
Level Difference (Reverberant only)				**-**	-18	-24	-21	-29	-37	-39	-35	-35
Façade relative to Measurement Position	0	dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5	dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush		Leq	**35**	55	44	39	31	26	20	15	5
	Night		Leq	**25**	45	32	29	20	16	10	4	-2
			Lmax	**40**	60	46	45	35	30	25	21	14

Position 2 *B2x Living Room*				***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.90	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	8.60	m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50	m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.70	m										
Element Area	21.50	m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	31.50	m2		**-**	-	-	-	-	-	-	-	-
Room Volume	45.33	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	16.37	m2		**-**	23	32	41	47	49	53	58	55
Glazing: 32 dB Rw eg. 6+18+4	5.13	m2		**-**	15	21	20	26	38	37	39	39
Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450	10.00	m2		**-**	34	45	44	36	40	42	55	55
Composite SRI	31.50	m2		**-**	21	28	28	33	42	43	47	46
Level Difference (Reverberant only)				**-**	-18	-25	-24	-30	-39	-39	-43	-43
Façade relative to Measurement Position	0	dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5	dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush		Leq	**35**	54	45	40	29	24	18	7	0
	Night		Leq	**23**	42	30	27	19	14	9	-3	-9
			Lmax	**39**	59	47	43	34	29	23	14	13

Position 3 *B2x Living Room*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.90 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	8.60 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.70 m										
Element Area	21.50 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	31.50 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	45.33 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	16.37 m2		**-**	23	32	41	47	49	53	58	55
Glazing: 32 dB Rw eg. 6+18+4	5.13 m2		**-**	15	21	20	26	38	37	39	39
Vents: 40 dB Dn,e,w eg, Passivent TVALdB 450	10.00 m2		**-**	34	45	44	36	40	42	55	55
Composite SRI	31.50 m2		**-**	21	28	28	33	42	43	47	46
Level Difference (Reverberant only)			**-**	-18	-25	-24	-30	-39	-39	-43	-43
Façade relative to Measurement Position	0 dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**34**	55	42	38	29	24	18	6	-1
	Night	Leq	**23**	43	35	25	16	11	6	-5	-7
		Lmax	**41**	59	56	41	29	22	22	20	17

Position 4 *B2x Living Room*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.90 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	8.60 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.70 m										
Element Area	21.50 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	31.50 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	45.33 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	16.37 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	5.13 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	31.50 m2		**-**	20	27	24	29	33	34	33	37
Level Difference (Reverberant only)			**-**	-17	-23	-21	-25	-30	-30	-29	-33
Façade relative to Measurement Position	0 dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**34**	53	40	37	30	27	23	17	6
	Night	Leq	**26**	45	31	28	21	20	16	7	-5
		Lmax	**42**	59	46	47	35	33	31	27	17

Bedroom Break-in

Position 1 *A1 Bedroom*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	2.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	7.00 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	2.50 m										
Element Area	17.50 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	27.50 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	28.13 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	14.86 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	2.64 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	27.50 m2		**-**	21	28	25	29	33	33	33	38
Level Difference (Reverberant only)			**-**	-16	-23	-21	-24	-28	-28	-28	-33
Façade relative to Measurement Position	0 dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**40**	56	45	40	35	35	31	22	8
	Night	Leq	**29**	46	34	30	24	24	21	11	0
		Lmax	**44**	61	47	46	39	39	36	29	16

Position 2 *A1 Bedroom*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	2.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	7.00 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	2.50 m										
Element Area	17.50 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	27.50 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	28.13 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	14.86 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	2.64 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	27.50 m2		**-**	21	28	25	29	33	33	33	38
Level Difference (Reverberant only)			**-**	-16	-23	-21	-24	-28	-28	-28	-33
Façade relative to Measurement Position	0 dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**40**	56	46	43	35	34	29	23	10
	Night	Leq	**29**	43	32	31	24	24	19	12	1
		Lmax	**44**	61	49	47	40	39	33	29	23

Position 3 *A1 Bedroom*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	2.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	7.00 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	2.50 m										
Element Area	17.50 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	27.50 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	28.13 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	14.86 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	2.64 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	27.50 m2		**-**	21	28	25	29	33	33	33	38
Level Difference (Reverberant only)			**-**	-16	-23	-21	-24	-28	-28	-28	-33
Façade relative to Measurement Position	0 dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**39**	56	44	41	34	34	29	21	9
	Night	Leq	**28**	45	37	29	22	21	17	11	3
		Lmax	**45**	60	57	45	35	33	33	35	27

Position 4 *A1 Bedroom*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	2.50 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	7.00 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	2.50 m										
Element Area	17.50 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	27.50 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	28.13 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	14.86 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	2.64 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	27.50 m2		**-**	21	28	25	29	33	33	33	38
Level Difference (Reverberant only)			**-**	-16	-23	-21	-24	-28	-28	-28	-33
Façade relative to Measurement Position	0 dB		**-**	0	0	0	0	0	0	0	0
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**35**	53	41	37	31	29	25	18	7
	Night	Leq	**27**	45	32	28	22	22	18	8	-4
		Lmax	**43**	60	46	47	36	35	33	28	17