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Lioncourt Homes

Assessment of noise at the land at Tatenhill Lane, Branston, Burton Upon Trent, DE14 3EZ proposed residential development

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CONTENTS

1.0 SUMMARY

The site is a little noisy, due almost entirely to traffic on the A38. Daytime levels are slightly higher than during our assessment in 2007 and night time levels are slightly lower, but overall conclusions and recommendations are unchanged.

During the 2007 application process, it was queried by planners whether there was any significant impact from storage yard to the southeast. We confirmed at the time that there was essentially zero impact and we can confirm the same again here. There will inevitably be activity at times but we understand this to be infrequent and short-lived.

BS8233 internal criteria for "reasonable" conditions are easily met with partly open windows apart from living rooms closest to, and in full view of, the A38. BS8233 internal criteria for "desirable" conditions are easily met with closed windows and open non-acoustic vents. Criteria for desirable conditions are easily met with basic 1.8m garden fencing.

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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 situation can be interpreted.

The NPPF's main statement on noise is to be found in paragraph 123:-

123. Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

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	Unacceptable Adverse Effect	Prevent

Perception	Examples of Outcomes	Increasing Effect Level	Action
	deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory		

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, BS8233, etc.) and the potential impact on wildlife.

3.2 <u>BS8233/WHO Guide</u>

BS8233 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 BS8233 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 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 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 big.

7. So, the composite SRI or R, combined with the area 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

5.1 Site Times and Personnel

The measurements were carried out by Mark Pickering of ADC Acoustics.

Daytime measurements were carried out on 22nd and 23rd June between approximately 23:00 and 01:00 to represent what was likely to be a noisier time of night and 07:00 to 09:00 the following morning to represent rush hour as a worst case assumption for daytime levels.

5.2 Instrumentation

Instrumentation used was a Rion N28. This is a precision grade sound level meter which holds a current calibration certificate and which was field-calibrated before and after the measurements with no drift noted. The meter was set up to measure 30 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 positions were as shown on the following plan.

The microphone was 1.5 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	:	80 to 100%
Temperature	:	15 to 16 Celsius
Wind	:	negligible

6.0 RESULTS AND DISCUSSIONS

The noise was entirely dominated by traffic on the A38. As we found in our 2007 assessment, there was noise at all from the Storage yard tithe southeast. There will inevitably be activity at times but we understand this to be infrequent and short-lived.

6.1 Basic Results

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

Time	Position	Index	dB(A)
Overall Rush Hour	1	Leq	**57**
		Lmax	**71**
		L90	**54**
	2	Leq	**54**
		Lmax	**63**
		L90	**52**
Overall Early Night	1	Leq	**49**
		Lmax	**56**
		L90	**46**
	2	Leq	**46**
		Lmax	**58**
		L90	**42**

6.2 Assessments

The above results give the following assessments.

In terms of BS8233, 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.

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	22 dB	17 dB
	2	19 dB	14 dB
Bedrooms	1	19 dB	14 dB
	2	16 dB	11 dB
Outdoor Living Areas	1	7 dB	2 dB
	2	4 dB	0 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

The reductions suggested for outdoor living areas will easily be achieved with the most basic 1.8m garden fencing and any screening provided by site layout. Garden fencing will also screen rear ground floor rooms and the screening provided by site layout will also benefit all rooms other than those directly facing the A38. However, this is not built into the calculations below.

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 plots apart from living rooms closets to and directly facing the A38. Criteria for BS8233 “Desirable” conditions will need

closed windows. This 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 or a whole house-type system which does not require any wall or window vents.

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	Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 2	Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

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

Façade	Time	Index	**dB(A)**
Position 1	Rush	Leq	**35**
	Night	Leq	**28**
		Lmax	**36**
Position 2	Rush	Leq	**32**
	Night	Leq	**25**
		Lmax	**38**

All BS8233 criteria for “Desirable” conditions are met. 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 an unrestricted lines of site to the main sources and that the development itself will not provide any screening to its own properties.

7.0 CONCLUSIONS/RECOMMENDATIONS

BS8233 internal criteria for “reasonable” conditions are easily met with partly open windows apart from living rooms closest to, and in full view of, the A38. BS8233 internal criteria for “desirable” conditions are easily met with closed windows and open non-acoustic vents. Criteria for desirable conditions are easily met with basic 1.8m garden fencing.

The calculations are based on basic 1.8m fencing to rear gardens, and 4+20+4 thermal double glazing and non-acoustic vents (assumed open) to habitable rooms. This is essentially concluding that no specific mitigation is necessary and there should be no need for noise related planning conditions.

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	07:00	Leq	**58**	59	50	46	53	56	47	39	33
		Lmax	**71**	74	66	60	65	70	59	60	54
		L90	**54**	51	43	42	49	53	44	30	19
	07:30	Leq	**57**	58	50	46	52	55	46	38	33
		Lmax	**66**	73	67	58	63	63	56	56	52
		L90	**54**	50	43	41	49	52	43	30	20
	08:00	Leq	**57**	61	51	46	52	55	48	41	30
		Lmax	**71**	75	69	64	70	68	59	56	52
		L90	**54**	53	44	41	48	52	45	32	18
	08:30	Leq	**57**	60	49	45	52	55	47	43	37
		Lmax	**71**	73	65	57	66	68	60	64	61
		L90	**54**	53	43	41	48	52	45	31	18
2	07:00	Leq	**55**	57	47	42	50	53	44	37	31
		Lmax	**61**	72	63	53	57	58	50	53	49
		L90	**52**	52	43	39	47	51	42	30	22
	07:30	Leq	**54**	55	48	42	49	52	44	35	29
		Lmax	**61**	64	61	54	57	57	51	52	45
		L90	**52**	52	43	39	47	50	41	29	20
	08:00	Leq	**55**	58	49	44	50	53	45	38	31
		Lmax	**65**	67	63	59	64	59	54	54	52
		L90	**53**	54	45	41	47	51	44	31	20
	08:30	Leq	**54**	58	47	43	50	52	45	36	29
		Lmax	**63**	66	59	58	58	60	52	49	44
		L90	**52**	54	44	40	47	50	43	31	20

Night Time Measurements

Position	Time	Index	**dB(A)**	63	125	250	500	1k	2k	4k	8k
1	23:00	Leq	**49**	55	44	38	45	48	38	23	17
		Lmax	**56**	64	53	46	53	54	45	35	33
		L90	**47**	47	37	34	42	45	35	20	15
	23:30	Leq	**49**	54	42	37	46	48	38	22	15
		Lmax	**56**	63	51	45	53	54	44	30	19
		L90	**46**	46	36	33	42	45	35	19	15
	00:00	Leq	**49**	53	42	41	46	47	38	21	15
		Lmax	**56**	63	51	50	53	54	43	28	15
		L90	**46**	45	36	35	42	44	35	18	15
	00:30	Leq	**48**	53	40	36	45	46	36	20	15
		Lmax	**56**	63	50	44	54	53	43	28	19
		L90	**44**	45	34	32	41	43	33	17	15
2	23:00	Leq	**46**	52	40	35	42	45	34	19	13
		Lmax	**55**	62	50	48	52	54	42	36	30
		L90	**43**	46	36	31	38	41	32	16	12
	23:30	Leq	**46**	51	39	34	42	45	34	18	12
		Lmax	**55**	60	48	44	51	54	43	35	26
		L90	**43**	45	35	31	38	41	31	15	12
	00:00	Leq	**46**	50	39	39	41	44	33	18	12
		Lmax	**55**	62	50	56	50	52	42	31	21
		L90	**42**	45	35	31	37	41	30	14	12
	00:30	Leq	**45**	51	38	33	41	43	33	22	18
		Lmax	**63**	61	45	43	57	61	53	46	41
		L90	**40**	46	35	30	36	39	29	15	12

Measurement Summary

Time	Position	Index	**dB(A)**	63	125	250	500	1k	2k	4k	8k
Overall Rush Hour	1	Leq	**57**	59	50	46	52	55	47	40	34
		Lmax	**71**	74	67	61	67	68	59	60	57
		L90	**54**	52	43	41	49	52	44	31	19
	2	Leq	**54**	57	48	43	50	52	45	37	30
		Lmax	**63**	69	62	57	60	59	52	52	48
		L90	**52**	53	44	40	47	51	43	30	20
Overall Early Night	1	Leq	**49**	54	42	38	45	47	37	22	16
		Lmax	**56**	63	51	47	53	54	44	31	27
		L90	**46**	46	36	34	42	44	35	19	15
	2	Leq	**46**	51	39	36	41	44	34	19	14
		Lmax	**58**	61	49	51	53	57	48	41	35
		L90	**42**	46	35	31	37	41	30	15	12

Required Reductions fro BS8233 Guidelines

Environment	Position	Required Reductions	
		Desirable	Reasonable
Living Rooms	1	22 dB	17 dB
	2	19 dB	14 dB
Bedrooms	1	19 dB	14 dB
	2	16 dB	11 dB
Outdoor Living Areas	1	7 dB	2 dB
	2	4 dB	0 dB

Mitigation Summary

Façade	Room Type	Make-Up on Which Calculations are Based
Position 1	Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 2	Living Room	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Bedroom	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

Predicted Summary

Façade	Time	Index	**dB(A)**	63	125	250	500	1k	2k	4k	8k
Position 1	Rush	Leq	**35**	47	30	28	33	32	23	17	6
	Night	Leq	**28**	42	23	22	27	25	15	0	-12
		Lmax	**36**	51	32	30	35	32	22	9	0
Position 2	Rush	Leq	**32**	45	28	25	30	29	21	13	1
	Night	Leq	**25**	39	20	19	23	22	12	-3	-13
		Lmax	**38**	49	30	34	35	35	26	19	8

Break-in

Position 1 *Living Room*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.00 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	4.00 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	10.00 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	20.00 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	30.00 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	7.00 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	3.00 m2		**-**	15	24	20	25	35	38	35	32
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	20.00 m2		**-**	20	28	26	28	32	32	32	37
Level Difference (Reverberant only)			**-**	-17	-25	-22	-24	-29	-29	-29	-33
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**35**	47	30	28	33	32	23	17	6
	Night	Leq	**27**	41	23	21	26	24	14	-2	-13
		Lmax	**34**	51	32	29	33	30	20	8	-1

Position 2 *Living Room*			**dB(A)**	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	4.00 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	4.00 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	10.00 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	20.00 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	30.00 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	7.00 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	3.00 m2		**-**	15	24	20	25	35	38	35	32
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	20.00 m2		**-**	20	28	26	28	32	32	32	37
Level Difference (Reverberant only)			**-**	-17	-25	-22	-24	-29	-29	-29	-33
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**32**	45	28	25	30	29	21	13	1
	Night	Leq	**24**	39	19	18	22	21	10	-4	-14
		Lmax	**36**	49	29	34	34	33	24	18	7

Position 1 *Bedroom*			***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	2.70 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	2.70 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	6.75 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	16.75 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	20.25 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)			**-**	-8	-8	-8	-8	-8	-8	-8	-8
Walls: Traditional Masonry	4.95 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.80 m2		**-**	15	24	20	25	35	38	35	32
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	16.75 m2		**-**	21	28	26	27	31	31	31	37
Level Difference (Reverberant only)			**-**	-17	-24	-22	-23	-27	-27	-27	-33
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**36**	48	31	29	34	33	25	18	6
	Night	Leq	**28**	42	23	22	27	25	15	0	-12
		Lmax	**36**	51	32	30	35	32	22	9	0

Position 2 *Bedroom*			***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	2.70 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	2.70 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	6.75 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	16.75 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	20.25 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)			**-**	-8	-8	-8	-8	-8	-8	-8	-8
Walls: Traditional Masonry	4.95 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.80 m2		**-**	15	24	20	25	35	38	35	32
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	16.75 m2		**-**	21	28	26	27	31	31	31	37
Level Difference (Reverberant only)			**-**	-17	-24	-22	-23	-27	-27	-27	-33
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**33**	45	29	26	31	30	22	15	2
	Night	Leq	**25**	39	20	19	23	22	12	-3	-13
		Lmax	**38**	49	30	34	35	35	26	19	8