



REPORT REFERENCE:

SA - 4317

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

British Standard 8233: 2014

CLIENT:

Francis Construction

SITE:

Brooklands Garage, 330 Tilehurst Road, Reading

SURVEY DATES:

26th February to 2nd March 2016

Report By	
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1 EXECUTIVE SUMMARY

1.1 Instruction

Sound Advice Acoustics Ltd have been instructed by Francis Construction to undertake a background noise survey to British Standard 8233:2014 to determine the impact of existing noise sources on the proposed accommodation scheme at Brooklands Garage, 330 Tilehurst Road, Reading.

1.2 Scope of Report

The measurements will be undertaken in accordance with ISO 1996 – Part 2: 2007 to determine the existing background noise levels and British Standard 8233: 2014 will be used to determine the impact of existing traffic on the internal noise environment within the proposed residential dwellings. This report aims to establish the following:

- Existing background noise levels within the area;
- Assess the potential internal noise levels on the proposed rooms;
- Provide specifications for the ventilation and window glazing with the proposed rooms.
- Review any commercial surround noise and make appropriate assessments if required.

1.3 Summary of Results

1.3.1 Background Noise Levels

A 120 hour background noise survey was undertaken from 26th February – 2nd March 2016 at one position (front of site) in order to establish the underlying background noise levels. The maximum day time levels were found to be $L_{Aeq, 16 \text{ hour}}$ 62.7 dB and the maximum night time levels were found to be $L_{Aeq, 8 \text{ hours}}$ 55.7 dB at position 1.

Assessment Position	Date Start	Date Finish	Daytime LAeq	Night Time LAeq
Position 1 Front	26/02.2016	02/03/2016	62.7	55.7

1.4 Conclusions

The development should be designed with a 4mm glass / 16mm air gap / 4mm glass double glazed windows and an acoustic through frame slot vent or similarly approved to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

Levels have been recorded and assessments made in accordance with the relevant standards. Internal criteria's have been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

2 INTRODUCTION

Sound Advice Acoustics Ltd has been instructed by Francis Construction to carry out the relevant noise assessments and calculations at Brooklands Garage, 330 Tilehurst Road, Reading. It is proposed that the existing buildings are to be demolished and new build flats built.

Ambient noise levels were measured between 26th February – 2nd March 2016. This report by Sound Advice Acoustics Ltd gives the results of these measurements and an assessment in accordance with government planning guidelines and relevant standards together with mitigation measures as required.

With regards to external ambient noise, environmental noise levels are to be monitored at the site in accordance with British Standard 7445: 2003 'Description and measurement of environmental noise assessments and calculation made in accordance with BS 8233: 2014 Sound Insulation and Noise Reduction for Buildings Code of Practice.

BS 8233: 2014 set the following parameters as target levels that should be designed to within rooms such as Living Rooms and Bedrooms.

Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important		
Objective	Typical situations	Design Range $L_{Aeq,t}$ dB
Typical noise levels for acoustic privacy in shared spaces	Living room	35 – 40
NOTE: See Noise control in building services [28] and BS EN ISO 3382.		

Indoor ambient noise levels for dwellings			
Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB L_{Aeq} 16 HOUR	--
Dining	Dining Room / Area	40 dB L_{Aeq} 16 HOUR	--
Sleeping (daytime resting)	Bedroom	35 dB L_{Aeq} 16 HOUR	30 dB L_{Aeq} 8 HOUR

Calculations and assessments are therefore to be carried out in order to satisfy the above requirements of BS8233: 2014.

References and evaluations are to be made to the National Planning Policy Framework 2012 (NPPF) and the Noise Policy Statement for England 2010 (NPSE). The purpose of this document is to include all aspects of environmental noise within assessments i.e. environmental noise, neighbour noise and neighbourhood noise. Noise is to be considered alongside other relevant issues relating to the site and should not be considered in isolation, according to the NPSE.

There are several key phrases within the NPSE aims and these are discussed below.

2.1 “Significant adverse” and “adverse”

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

2.2 NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

2.3 LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

2.4 SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

In addition, calculations are to be made for the predicted daytime noise levels within the outdoor living area and assessments made against the recommended levels within the World Health Organisation’s ‘Guidelines for Community Noise’. In order to evaluate these levels accurately, the 3D modelling software CADNA A is to be adopted for the purpose of this assessment. It should be noted that the land to the north of this proposed development is also being developed for residential housing and therefore the proposed layout is to be superimposed onto the CADNA A model in order to accurately calculate resultant façade levels to be used within the BS 8233: 2014 calculations.

Finally, assessments and references are to be made to the World Health Organisation Night Time Noise Guidance 2009.

3 SITE LOCATION

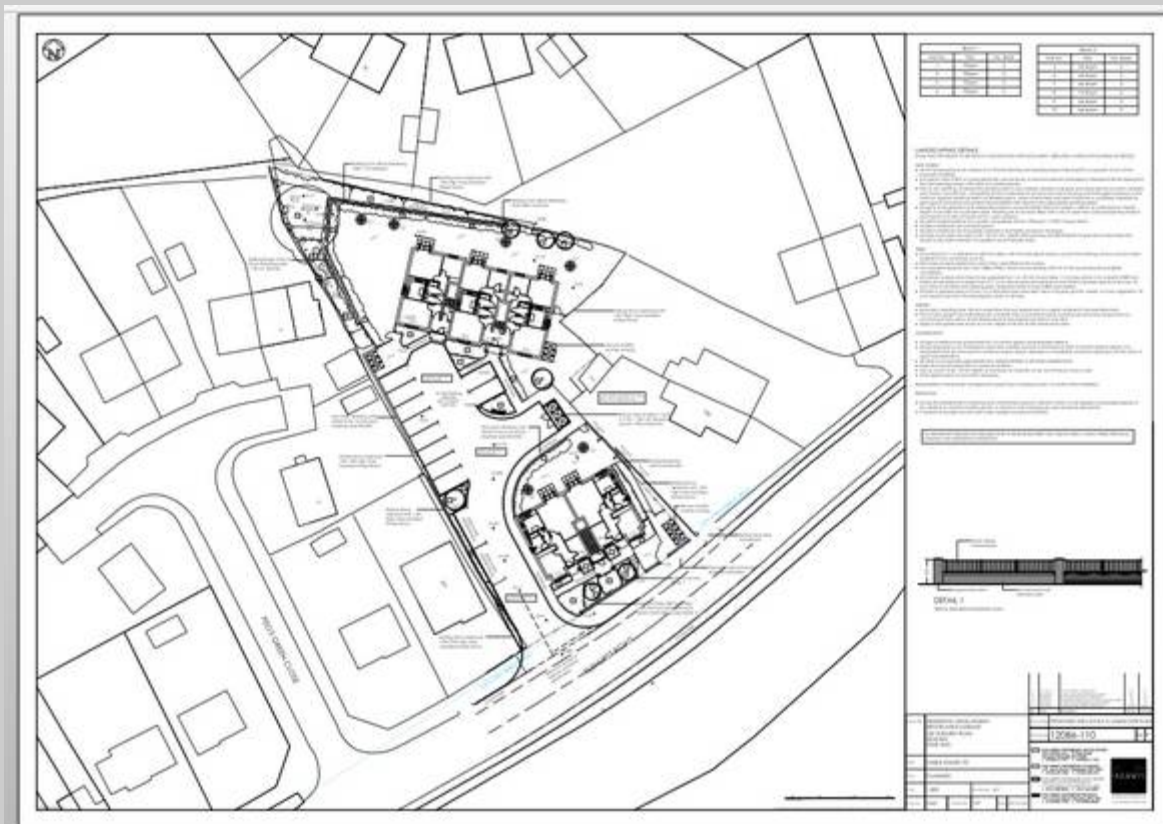
Position of Site in Wider Area

The site is located in Reading. The dominant noise source is road traffic noise.



3.1 Proposed Development

The proposed development is shown below.



4 PROCEEDURE

External noise levels were recorded over a typical period and analysis date extrapolated between 07:00 hrs 26th February – and 07:00 hrs on 2nd March 2016 at positions 1 as detailed on the attached plan sketch layout.

Position 1 was located at the front façade of the site in order to capture the noise levels associated with the nearby roads. Sample measurements were recorded over continuous 5 minute samples and from this data the hourly LAeq daytime values have been evaluated. Sound Pressure Levels were recorded on the following setting along with a full octave band frequency analysis measured simultaneously and between 31.5 Hz and 16.0 kHz.

<u>Daytime 07:00 – 23:00</u>		<u>Night Time 23:00 – 07:00</u>	
L _{Aeq} 1 HOUR dB	L _{A10} 1 HOUR dB	L _{Aeq} 5 MINUTES dB	L _{A10} 5 MINUTES dB
L _{AMAX} 1 HOUR dB	L _{A50} 1 HOUR dB	L _{AMAX} 5 MINUTES dB	L _{A50} 5 MINUTES dB
L _{AMIN} 1 HOUR dB	L _{A90} 1 HOUR dB	L _{AMIN} 5 MINUTES dB	L _{A90} 5 MINUTES dB

Calculations have been made in accordance with BS 8233: 2014 ‘Sound Insulation and Reduction of Buildings - Code of Practice’. Recommendations were made for any additional acoustics measures to conform to these standards.

From the downloaded recorded results, the daytime and night time periods were assessed and used within the above calculations as L_{Aeq} 16 HOUR dB levels for daytime and L_{Aeq} 8 HOUR dB levels for night time. These are detailed within this report. All data averaged throughout the day has been done so on a logarithmic basis to give accurate L_{Aeq} 16 Hour dB daytime and L_{Aeq} 8 Hour dB night time noise levels.

5 APPARATUS

The equipment was calibrated using a sound pressure level of 114.0 dB at an octave band centre frequency of 1000Hz with reference to $2 \times 10^{-5} \text{ Nm}^{-2}$ before and after the tests and the equipment set to have no inaccuracy greater than 0.2dB.

All the following equipment was calibrated in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service (UKAS) on the following dates. Calibration schedules are implemented within Sound Advice Acoustics Ltd in accordance with UKAS directive LAB 23.

5.1 118 noise meter s/n 11831471 environmental testing

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Norsonic	140	<u>1403140</u>	2 YEARS	27.05.2014	27.05.2016
12.5mm Microphone (with windshield)	Norsonic	1220	<u>52260</u>	2 YEARS	27.05.2014	27.05.2016
Microphone Pre – Amplifier	Norsonic	1201	<u>30233</u>	2 YEARS	27.05.2014	27.05.2016

Full calibration certificates are available upon request.

6 ENVIRONMENTAL CONDITIONS

START OF TEST	26 th February 2016
Temperature	6.5°C
Relative Humidity	72%
Average Wind Speed	<0.5 m/s
Cloud Cover	Clear
Road Surface	Dry
Atmospheric Pressure	1010mb

END OF TEST	2 nd March 2016
Temperature	7.0 ^o C
Relative Humidity	42%
Average Wind Speed	<0.5 m/s
Cloud Cover	Moderate
Road Surface	Dry
Atmospheric Pressure	990mb

* Wind speed, temperature and relative humidity were all recorded using standard equipment supplied by RS Components, Hedge End, Southampton and are taken as an average over the designated time period.

7 RESULTS

$L_{Aeq,t}$ -	The equivalent A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.
$L_{A90,t}$ -	The A weighted sound pressure level that is exceeded for 90% of the time period 5 minutes night time and 1 hourly daytime.
$L_{A50,t}$ -	The A weighted sound pressure level that is exceeded for 50% of the time period 5 minutes night time and 1 hourly daytime
$L_{A10,t}$ -	The A weighted sound pressure level that is exceeded for 10% of the time period 5 minutes night time and 1 hourly daytime
L_{Amax} -	The maximum A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.
L_{Amin} -	The minimum A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.

7.1 Downloaded results, and averages.

26 th – 27 th February 2016 – POSITION 1																
Date / Time	L_{Aeq}	L_{max}	L_{min}	L_{A10}	L_{A50}	L_{A90}	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE L_{Aeq} 16 HOUR	61.8	75.9	46.9	64.8	60.5	52.4	64.3	68.8	59.2	55.9	55.5	58.8	55.0	46.7	38.0	27.1
23:00 - 07:00																
NIGHT TIME AVERAGE L_{Aeq} 8 HOUR	54.5	68.7	38.3	58.9	46.3	41.0	56.7	60.9	54.7	50.1	49.0	51.3	47.4	39.8	32.3	17.5

27 th – 28 th February 2016 – POSITION 1																
Date / Time	L_{Aeq}	L_{max}	L_{min}	L_{A10}	L_{A50}	L_{A90}	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE L_{Aeq} 16 HOUR	61.7	74.1	47.8	65.0	60.3	52.2	70.4	68.8	60.9	56.7	55.8	58.8	54.7	45.3	37.5	28.5
23:00 - 07:00																
NIGHT TIME AVERAGE L_{Aeq} 8 HOUR	54.4	68.7	38.9	58.9	46.3	41.2	64.1	61.6	54.5	49.0	48.5	51.1	47.3	41.8	36.3	19.5

28 th – 29 th February 2016 – POSITION 1																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE L _{Aeq} 16 HOUR	60.9	75.3	46.4	64.3	59.1	50.8	69.7	67.4	59.3	55.3	55.2	58.0	53.9	44.2	35.0	24.0
23:00 - 07:00																
NIGHT TIME AVERAGE L _{Aeq} 8 HOUR	54.7	70.8	41.0	58.4	49.3	43.2	58.4	61.4	52.4	49.7	49.4	51.5	47.7	40.5	33.9	18.2

29 th February – 1 st March 2016 – POSITION 1																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE L _{Aeq} 16 HOUR	61.1	72.8	45.6	64.4	60.0	51.3	64.2	68.4	58.5	55.6	55.2	58.2	54.3	45.3	37.7	29.4
23:00 - 07:00																
NIGHT TIME AVERAGE L _{Aeq} 8 HOUR	55.7	71.4	40.2	59.3	50.0	43.2	56.6	60.6	54.7	50.1	49.2	52.0	49.0	45.2	39.8	26.8

1 st – 2 nd March 2016 – POSITION 1																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE L _{Aeq} 16 HOUR	62.7	79.1	47.9	65.8	61.4	53.1	64.7	68.6	60.0	56.4	56.2	59.2	56.1	51.0	45.0	34.3
23:00 - 07:00																
NIGHT TIME AVERAGE L _{Aeq} 8 HOUR	55.0	68.5	38.5	59.0	49.7	41.4	56.3	60.6	51.4	47.4	48.0	51.6	48.3	43.7	38.4	22.1

The following noise levels have been corrected for the highest recorded façade levels and used within the BS 8233: 2014 calculations

26 th February – 2 nd March 2016 – POSITION 1																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME																
AVERAGE	62.7	79.1	47.9	65.8	61.4	53.1	64.7	68.6	60.0	56.4	56.2	59.2	56.1	51.0	45.0	34.3
L _{Aeq} 16 HOUR																
23:00 - 07:00																
NIGHT TIME																
AVERAGE	55.7	71.4	40.2	59.3	50.0	43.2	56.6	60.6	54.7	50.1	49.2	52.0	49.0	45.2	39.8	26.8
L _{Aeq} 8 HOUR																

8 DISCUSSION OF RESULTS

It can be seen from the attached graph and downloaded results that the external noise levels have followed the expected path and remained fairly constant throughout the day. The levels then gradually dropped off as the evening progressed and began to rise when morning traffic levels increased.

9 RECOMMENDATIONS

For the purpose of this assessment, the corresponding façade levels will be used within the BS 8233: 2014 calculations in order to evaluate the worst case scenario and select the correct window specification.

Therefore, in order to achieve the required noise levels of $L_{Aeq\ 16\ HOUR}$ 35 dB for habitable rooms daytime and $L_{Aeq\ 8\ HOUR}$ 30 dB for Bedroom at night within the proposed, the following additional acoustic measures have been calculated.

It should be noted that the calculations have been made with the proposed windows closed. Additional calculations were made for the top floor due to the influence of sound transmission into the various rooms via the roof / ceiling i.e. an increased impeding façade. Inputted levels into the calculation sheets have been corrected for distance attenuation and free field in accordance with the aforementioned British Standard.

9.1 Calculation Procedure to BS 8233: 2014

The following calculations have been carried out in order to determine the required window and ventilation specification in order to meet the requirements of BS 8233: 2014.

9.2 Ground Floor Bedroom 1

Proposed Window Configuration			4 / 16 / 4 with acoustic through frame slot vent			
Leqff	The equivalent continuous sound pressure level outside the room elements under consideration					
A0	The reference absorption area of 10m2 and is independent of frequency					
Sf	The total façade area of the room in question					
Swi	The area of the windows in the room					
Sew	The area of the external wall of the room					
Srr	The area of the ceiling of the room (if applicable)					
S	The total area of the elements through which sound enters the room					
Dne	The insulation value of the trickle ventilator (if applicable)					
Rwi	The sound reduction index of the window					
Rew	The sound reduction index of the external wall					
Rrr	The sound reduction index of the ceiling/roof (if applicable)					
A	The equivalent absorption area of the receiving room where A=0.163V/T					
Formula	$Leq2=Leqff+10\log[A0/S*10^{(-Dne/10)}+Swi/S*10^{(-Rwi/10)}+Sew/10*10^{(-Rew/10)}+Srr/S*10^{(-Rrr/10)}]+10\log(S/A)+3$					
	Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000
Sf	12.5	12.5	12.5	12.5	12.5	12.5
Sr	0	0	0	0	0	0
Swi	2	2	2	2	2	2
Sew	10.5	10.5	10.5	10.5	10.5	10.5
Srr	0	0	0	0	0	0
S	12.5	12.5	12.5	12.5	12.5	12.5
A0	10	10	10	10	10	10
V	29	29	29	29	29	29
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	9	9	9	9	9	9
Daytime Leqff	60.0	56.4	56.2	59.2	56.1	51.0
Night time Leqff	54.7	50.1	49.2	52.0	49.0	39.8
Dne	40.0	38.0	37.0	34.0	37.0	38.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0
Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)			L _{Aeq} 16 HOUR		32.1	dB(A)
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)			L _{Aeq} 8 HOUR		25.1	dB(A)

9.3 Ground Floor Bedroom 2

Proposed Window Configuration			4 / 16 / 4 with acoustic through frame slot vent			
Leqff	The equivalent continuous sound pressure level outside the room elements under consideration					
A0	The reference absorption area of 10m2 and is independent of frequency					
Sf	The total façade area of the room in question					
Swi	The area of the windows in the room					
Sew	The area of the external wall of the room					
Srr	The area of the ceiling of the room (if applicable)					
S	The total area of the elements through which sound enters the room					
Dne	The insulation value of the trickle ventilator (if applicable)					
Rwi	The sound reduction index of the window					
Rew	The sound reduction index of the external wall					
Rrr	The sound reduction index of the ceiling/roof (if applicable)					
A	The equivalent absorption area of the receiving room where A=0.163V/T					
Formula	$Leq2=Leqff+10\log[A0/S*10^{(-Dne/10)}+Swi/S*10^{(-Rwi/10)}+Sew/10*10^{(-Rew/10)}+Srr/S*10^{(-Rrr/10)}]+10\log(S/A)+3$					
	Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000
Sf	5	5	5	5	5	5
Sr	0	0	0	0	0	0
Swi	1	1	1	1	1	1
Sew	4	4	4	4	4	4
Srr	0	0	0	0	0	0
S	5	5	5	5	5	5
A0	10	10	10	10	10	10
V	17	17	17	17	17	17
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	5	5	5	5	5	5
Daytime Leqff	60.0	56.4	56.2	59.2	56.1	51.0
Night time Leqff	54.7	50.1	49.2	52.0	49.0	39.8
Dne	40.0	38.0	37.0	34.0	37.0	38.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0
Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)			LAeq 16 HOUR		33.5	dB(A)
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)			LAeq 8 HOUR		26.5	dB(A)

9.4 First Floor Bedroom 1

Proposed Window Configuration		4 / 16 / 4 with acoustic through frame slot vent				
Leqff	The equivalent continuous sound pressure level outside the room elements under consideration					
A0	The reference absorption area of 10m2 and is independent of frequency					
Sf	The total façade area of the room in question					
Swi	The area of the windows in the room					
Sew	The area of the external wall of the room					
Srr	The area of the ceiling of the room (if applicable)					
S	The total area of the elements through which sound enters the room					
Dne	The insulation value of the trickle ventilator (if applicable)					
Rwi	The sound reduction index of the window					
Rew	The sound reduction index of the external wall					
Rrr	The sound reduction index of the ceiling/roof (if applicable)					
A	The equivalent absorption area of the receiving room where A=0.163V/T					
Formula	$Leq2=Leqff+10\log[A0/S*10^{(-Dne/10)}+Swi/S*10^{(-Rwi/10)}+Sew/10*10^{(-Rew/10)}+Srr/S*10^{(-Rrr/10)}]+10\log(S/A)+3$					
	Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000
Sf	6	6	6	6	6	6
Sr	11	11	11	11	11	11
Swi	2	2	2	2	2	2
Sew	4	4	4	4	4	4
Srr	11	11	11	11	11	11
S	17	17	17	17	17	17
A0	10	10	10	10	10	10
V	27	27	27	27	27	27
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	9	9	9	9	9	9
Daytime Leqff	60.0	56.4	56.2	59.2	56.1	51.0
Night time Leqff	54.7	50.1	49.2	52.0	49.0	39.8
Dne	40.0	38.0	37.0	34.0	37.0	38.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0
Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)			L _{Aeq} 16 HOUR	33.0	dB(A)	
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)			L _{Aeq} 8 HOUR	26.2	dB(A)	

9.5 First Floor Bedroom 2

Proposed Window Configuration			4 / 16 / 4 with acoustic through frame slot vent			
Leqff	The equivalent continuous sound pressure level outside the room elements under consideration					
A0	The reference absorption area of 10m2 and is independent of frequency					
Sf	The total façade area of the room in question					
Swi	The area of the windows in the room					
Sew	The area of the external wall of the room					
Srr	The area of the ceiling of the room (if applicable)					
S	The total area of the elements through which sound enters the room					
Dne	The insulation value of the trickle ventilator (if applicable)					
Rwi	The sound reduction index of the window					
Rew	The sound reduction index of the external wall					
Rrr	The sound reduction index of the ceiling/roof (if applicable)					
A	The equivalent absorption area of the receiving room where A=0.163V/T					
Formula	$Leq2=Leqff+10\log[A0/S*10^{(-Dne/10)}+Swi/S*10^{(-Rwi/10)}+Sew/10*10^{(-Rew/10)}+Srr/S*10^{(-Rrr/10)}]+10\log(S/A)+3$					
	Octave Band Centre Frequency (Hz)					
	125	250	500	1000	2000	4000
Sf	7	7	7	7	7	7
Sr	8	8	8	8	8	8
Swi	1	1	1	1	1	1
Sew	6	6	6	6	6	6
Srr	8	8	8	8	8	8
S	15	15	15	15	15	15
A0	10	10	10	10	10	10
V	19	19	19	19	19	19
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	6	6	6	6	6	6
Daytime Leqff	60.0	56.4	56.2	59.2	56.1	51.0
Night time Leqff	54.7	50.1	49.2	52.0	49.0	39.8
Dne	40.0	38.0	37.0	34.0	37.0	38.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0
Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)			LAeq 16 HOUR		33.7	dB(A)
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)			LAeq 8 HOUR		26.8	dB(A)

9.6 Ventilation (D_{ne})

Octave Band Frequency	125	250	500	1000	2000	4000
Acoustic through wall ventilator MA - 3051	40.0	38.0	37.0	34.0	37.0	38.0

9.7 Glazing (R_{wi})

Octave Band Frequency	125	250	500	1000	2000	4000
4mm glass / 16mm air gap / 4mm glass	21.1	19.7	31.1	38.2	41.3	38.7

9.8 Walls (R_{ew})

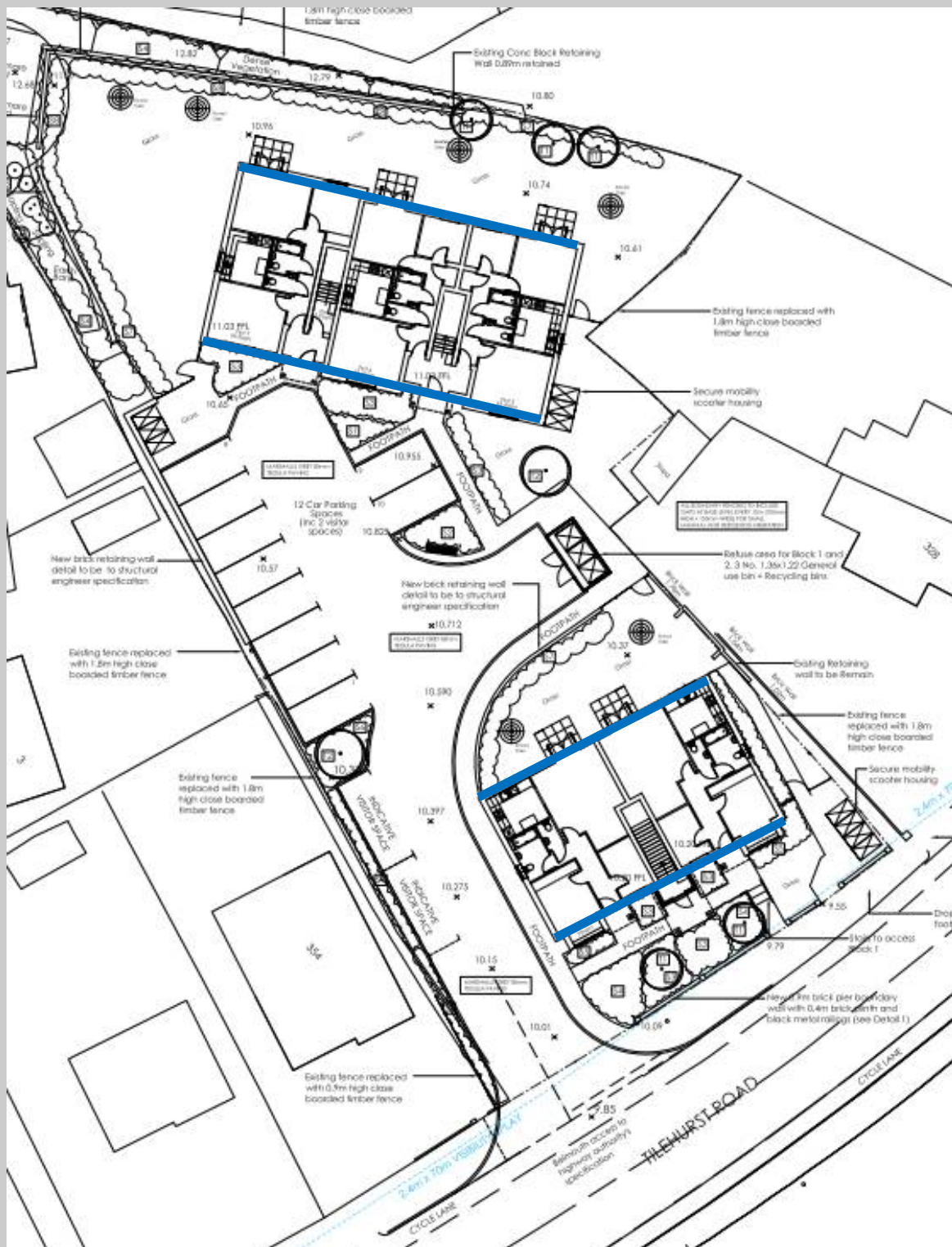
Octave Band Frequency	125	250	500	1000	2000	4000
Brick and Concrete Block	40.0	44.0	45.0	51.0	56.0	61.0

9.9 Roof (R_{rr})

Octave Band Frequency	125	250	500	1000	2000	4000
Minimum Value	28.0	34.0	40.0	45.0	49.0	53.0

The above are minimum construction attenuation values and should alternative methods be selected; these should be equal to or greater than the above corresponding values. Calculations carried out have indicated the following specifications should be installed for this site

10 ASSESSMENT



PROPOSED VENTILATION AND GLAZING PLAN

4MM GLASS / 16MM AIR GAP / 4MM GLASS & ACOUSTIC TRICKLE VENTS

The development should be designed with a 4mm glass / 16mm air gap / 4mm glass double glazed windows and an acoustic through frame slot vent or similarly approved to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

11 NIGHT NOISE GUIDELINES EUROPE 2009

The Night Noise Guidelines 2009 make direct reference to the World Health Organisations Guidelines for Community Noise 1999 with recommended guideline criteria of L_{Aeq} 30 dB indoors for continuous noise. The document goes on to explain that sleep disturbance correlates best with L_{Amax} and effects have been observed at 42 dB or less. This is particularly true if the background noise level is low. Noise events exceeding 42 dB(A) should therefore be limited.

It should be noted that BS 8233: 2014 makes no reference to a criteria under this British Standard to L_{Amax} dB limits within bedrooms at night. The aforementioned documents are Guidelines and therefore should be used for reference purposes only.

Figure 9.5 calculates an internal bedroom level at night of $L_{Aeq\ 8\ HOUR}$ 26.8 dB. The corresponding night time external level of $L_{Aeq\ 8\ HOUR}$ 55.7 dB was calculated as detailed within this report thus giving an overall façade attenuation of 28.9 dB. Applying this to the L_{Amax} 42 dB level above results in an L_{Amax} target level of L_{Amax} 70.9 dB.

There have been several periods where this value has been exceeded within the measurement periods and therefore recommendations have been made for acoustic through frame slot vents to be installed.

12 OUTDOOR LIVING AREAS

The World Health Organisation 'Guidelines for Community Noise' gives guidance as to desirable noise levels that should be achieved within outdoor living areas such as gardens, patios and verandas etc.

Table 1: Guideline values for community noise in specific environments, details the desirable target noise levels within various areas.

Outdoor Living Area	
Serious Annoyance, daytime and evening	$L_{Aeq\ 16\ HOUR}$ 55 dB
Moderate Annoyance, daytime and evening	$L_{Aeq\ 16\ HOUR}$ 50 dB

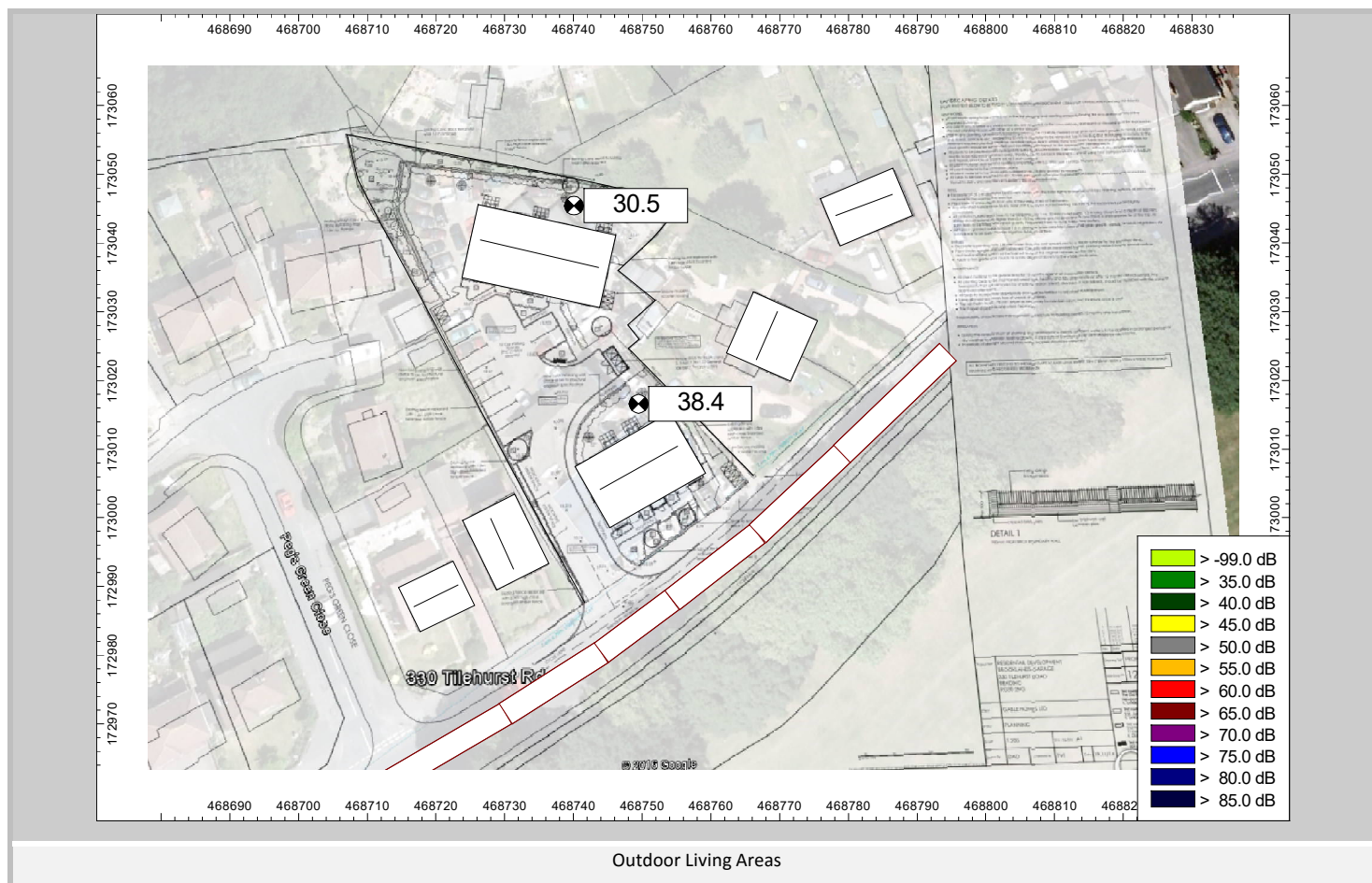
In order to evaluate the external noise levels within the proposed development, and to correctly and accurately select the precise required minimum screen heights, the 3D modelling software CADNA A is to be used. Initially, the site plan is to be overlaid onto Google Earth and then imported directly into CADNA A using the geometric co-ordinates.

From this, the monitoring positions and noise sources such as roads are added. The output noise levels from the roads are then increased until the monitored noise levels are achieved at the monitoring position. This model is then saved and used as a working 3D acoustic model of the site.

The proposed buildings are then constructed on a 3D bases and receptors placed within the garden areas.

The calculation software is then run to evaluate the garden levels within sample plots across the development.

The following CADNA A screen shots demonstrate the existing sites working 3D model. The levels at the measurement position correlate with the measured daytime average levels detailed on pages 11- 13 of this report.



The development has external living areas on the development and therefore this criteria / guideline would be appropriately considered within the proposed rear residential garden areas.

The guideline has been considered acceptable criteria for this assessment given the sites geographical location and proximity to a major trunk road. The layout has been re-designed in order to allow for acoustics and minimise the noise levels within the outdoor living spaces. The above calculation demonstrates the external living spaces surrounding the flats is likely to see noise levels in below that of the lower level guideline.

NPPF & NPSE

The National Planning Policy Framework 2012 (NPPF) and assessments to the Noise Policy Statement for England 2010 (NPSE) should be made in conjunction with each other. Paragraph 123 of the National Planning Policy Framework (NPPF) states the following:

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 Noise Policy Statement for England gives various levels of effect as detailed within this report.

With the glazing / ventilation specifications achieved within this report, the development can be implemented within the guidelines of the aforementioned documents and ensure a development conclusion of **NOEL – No Observed Effect Level**. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

13 CONCLUSION

Levels have been recorded and assessments made in accordance with the relevant standards. Internal criteria's have been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

The development should be designed with a 4mm glass / 16mm air gap / 4mm glass double glazed windows and a acoustic through frame slot vent or similarly approved to all rooms to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014.

The development proposes external living areas and therefore an assessment to the World Health Organisation's 'Guidelines for Community Noise' has been carried out. The calculations demonstrate that the external living spaces surrounding the flats is likely to see noise levels in below that of the lower level guideline.

This report and subsequent calculations and assessments have demonstrated that mitigation measures can be introduced to the site in order to ensure compliance with BS 8233: 2014 for predicted internal noise levels within dwellings and the WHO guidelines for community noise for external living areas.

Section 14 of the National Planning Policy Framework 2012 suggests that planning permission should be granted unless any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the framework taken as a whole, or specific policies in the framework indicate the application should be restricted.

Based on the calculations and assessments made within this report it is the professional opinion of Sound Advice Acoustics Ltd that the proposed development can demonstrate compliance with the National Planning Policy Framework 2012, NPPF & NPSE and that, with regards to sound, planning permission can be granted.

#END OF REPORT#