ACAACOUSTICS

Acoustic assessment of a proposed residential development at 2 Garden Lane, Royston

Report Reference: 180203-R001

Date: March 2018

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Site Address:	2 Garden Lane Royston SG8 9EH
Client:	TDC New Homes Limited
Report Reference:	180203-R001

Revision:	**Revision Date:**	**Author:**	**Checked:**
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0. SUMMARY

- ACA Acoustics Limited has been commissioned to assess external noise intrusion to a proposed new residential development at 2 Garden Lane, Royston. The assessment is required by the Local Planning Authority, North Hertfordshire District Council, to assist their discharge of a noise-related planning condition for the development.

- A sound level survey was carried out at the development site over nominally a 48-hour period between 14th and 16th February 2018. Whilst on site, the author considered the sound climate during the daytime to comprise primarily of high-volume traffic on Barkway Road to the front of the site.

- Measured sound levels at the front of the site, overlooking Barkway Road, are $LAeq_{16\ hour}$ 68dB during the daytime and $LAeq_{8\ hour}$ 61dB overnight. Short-term individual noise events overnight do not regularly exceed a level of LAfmax 82dB. Short-term measurements to the rear of the existing building, further removed and screened from traffic on Barkway Road indicate that levels at this position are typically 8dBA lower than those to the front of the site.

- A scheme for sound insulation of the building envelope has been developed such that internal sound levels during the daytime do not exceed LAeq 35dB within living rooms. Sound levels at night shall not exceed LAeq 30dB and LAfmax 45dB to bedrooms. These levels correspond with recommended limits set out in BS 8233:2014 and World Health Organisation guidelines. Details of the outline sound insulation scheme are provided within this report.

- It is the author's opinion that, allowing for the recommended acoustic specification for façade envelope elements set out in this report, internal sound and vibration levels within the new residential units should not be detrimental to the amenity of future occupants and condition 6 of planning permission 17/02482/1 may be discharged.

1. INTRODUCTION

ACA Acoustics Limited has been commissioned to carry out a survey and assessment of external sound levels to a proposed residential development at 2 Garden Lane, Royston and, where necessary, to make recommendations for a suitable sound mitigation scheme.

The objective of the assessment is to determine the impact that existing noise sources would have on the proposed residential units.

This report presents results of the sound level survey and assessment along with a scheme for sound insulation such that suitable internal sound levels are achieved.

2. ACOUSTIC CRITERIA

Planning permission has been granted for the demolition of an existing dwelling and garage and erection of a new three-storey development comprising eight two-bedroom apartments along with associated ancillary areas, reference 17/02482/1.

Condition 6 of the Decision Notice relates to noise and requires:

Prior to the commencement of the development the developer shall carry out a noise assessment in accordance with relevant guidance and standards and a scheme for sound insulation and noise control measures shall be submitted for the Council's written approval.

The approved scheme shall be implemented in accordance with the approved details in order to achieve the following internal noise targets:
Bedrooms (23:00 to 07:00hrs) 30dB LAeq (8hour) and 45dB LAmax (f)
Living rooms (07:00 to 23:00hrs) 35dB LAeq (16hour)
Dining room/area (07:00 to 23:00hrs) 40dB LAeq (16 hours).
Once implemented, the scheme of measures shall be maintained in accordance with the approved details.

The specified criteria correspond with guidelines set out in British Standard 8233:2014 and World Health Organisation document and are therefore considered suitable to protect the amenity of future residents.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

The development site is at 2 Garden Lane, Royston, Hertfordshire. The site is currently of a residential dwelling, detached garage, and associated gardens.

The north of the site faces onto the A10 Barkway Street. Residential dwellings border the site to the east, south and west. The surrounding area is almost exclusively of residential dwellings.

Proposals are for the demolition of the existing dwelling and garage and erection of a new three-storey development comprising eight two-bedroom apartments. Drawing showing layout of the proposed development, provided by the client, is shown in Figure 1 below.



Figure 1: Site layout plan

4. SOUND LEVEL SURVEY

To assess the impact of existing sound sources, a sound level survey was conducted at the development site to determine levels incident on the proposed residential units.

The site was considered secure and therefore an unattended survey was carried out over nominally a 48-hour period between 14th and 16th February 2018. Sound level measurements were recorded in consecutive 15-minute samples of overall LAeq, LAfmax, and L90 values along with other statistical indices.

A single measurement position was used for the survey at northern boundary of the site overlooking the boundary wall to Barkway Street. In addition to the unattended measurements, during the visit to site on 16th February a short-term sound level survey was also conducted at a position towards the front of the existing dwelling, screened from Barkway Street and considered equivalent of sound levels incident on this façade of the new dwellings.

The following equipment was used during the survey; the sound level meters were calibrated before the survey and checked after with no deviation noted.

Equipment	Serial Number	Calibration Certificate
NTi Audio sound level meter type XL2 Class 1, complete with weatherproof and lockable outdoor environmental kit	A2A-06294-E0	160915
NTi Audio sound level meter type XL2-TA Class 1 complete with weatherproof and lockable outdoor environmental kit	A2A-12174-E0	42691
Castle calibrator type 4226. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	1551589	044039/68679

Table 1: Equipment used

The following weather conditions were recorded at the start and end of the survey. It is noted that there was rainfall and strong winds during the evening of 14th to 15th February, which may adversely impact the measured sound levels during that evening. This is shown in the measurement results, where levels during the second evening are lower than those recorded during the first.

Time	Temperature	Wind Speed m/s	Wind Direction	Precipitation mm
13:00 14th February	7 °C	7	South	0
12:00 16th February	8 °C	4	West	0

Table 2: Recorded meteorological conditions

Results of the survey are shown in Figure 2. Summary of the daytime and night time sound level survey results are shown in tabular form in Table 3 below.

Date	Daytime (07:00 – 23:00) LAeq	Night Time (23:00 – 07:00) LAeq	Night Time (23:00 – 07:00) Typical LAfmax
14th February 2018	69dB	62dB	83dB
15th February 2018	68dB	61dB	81dB
16th February 2018	68dB	-	-
Average over survey period	**68dB**	**61dB**	**82dB**

Table 3: Summary sound level survey results



Figure 2: Sound level survey results

During the author's visits to site the dominant sound sources were observed to be regular traffic on Barkway Street.

Sound levels measured at the front of the existing property were measured typically 8dBA lower than levels measured simultaneously in the logging survey.

5. FAÇADE ACOUSTIC ASSESSMENT

A scheme for sound insulation is necessary to ensure sound levels inside rooms of the new residential apartments are reasonable and comply with specified criteria of planning condition 6.

A computer model has been set up using the measured sound levels incident on the façade of the flats along with anticipated façade elements. The computer model is based on the calculation procedures outlined in BS EN ISO 12354-3:2000 and BS 8233:2014.

Confirmation of the acoustic performance of the building envelope elements used in the calculation model is provided below. *Note that consideration of non-acoustic aspects including, but not limited to, Building Regulations Approved Documents and structural calculations are outside the scope of ACA Acoustics Limited and should be considered by others accordingly*.

Performance specification for windows/doors and the roof has been provided in 'Zones'. Location of the zones are shown in Figure 3 on the following page; Zone 1 is shown in blue, facing towards Barkway Street and Zone 2 is coloured in red, facing towards Garden Lane.

Description	Rw (dB)	Rw + C'tr (dB)	Typical Construction
Façade Walls	60	53	100mm facing brickwork, minimum 50mm cavity and 100mm medium density blockwork with plasterboard or wet plaster to the inner face
Windows/doors to Living Rooms – Zone 1	38	32	Acoustic double-glazing with laminated or toughened panes, such as 6.8-22-4 or similar
Windows/doors to Bedrooms – Zone 1	40	36	Acoustic double-glazing with laminated or toughened panes, such as 8.8-16-6.8 or similar
Windows to Living Rooms – Zone 2	35	30	Thermal double-glazing, such as 4-24-4 configuration or similar
Windows to Bedrooms – Zone 2	35	30	Thermal double-glazing, such as 4-24-4 configuration or similar
Roof/Ceiling – Zone 1	58	50	Pitched tile/slate mansard roof with minimum 100mm mineral wool insulation in the loft cavity and two layers 15mm plasterboard on MF system with resilient hangers or joists independent to the rafters
Roof/Ceiling – Zone 2	46	39	Pitched tile/slate mansard roof with minimum 100mm insulation between the rafters and ceiling of two layers 15mm plasterboard

Table 4: Acoustic performance specification for facade elements

Note that the constructions provided are typical and variations on the specification would be acceptable, so long as the installed detail achieved the specified sound insulation performance. The specification provided for glazed elements is for the window/door as a complete unit, including

frames and seals, and it is recommended the successful glazing supplier confirm their unit supplied will comply with the specified performance.

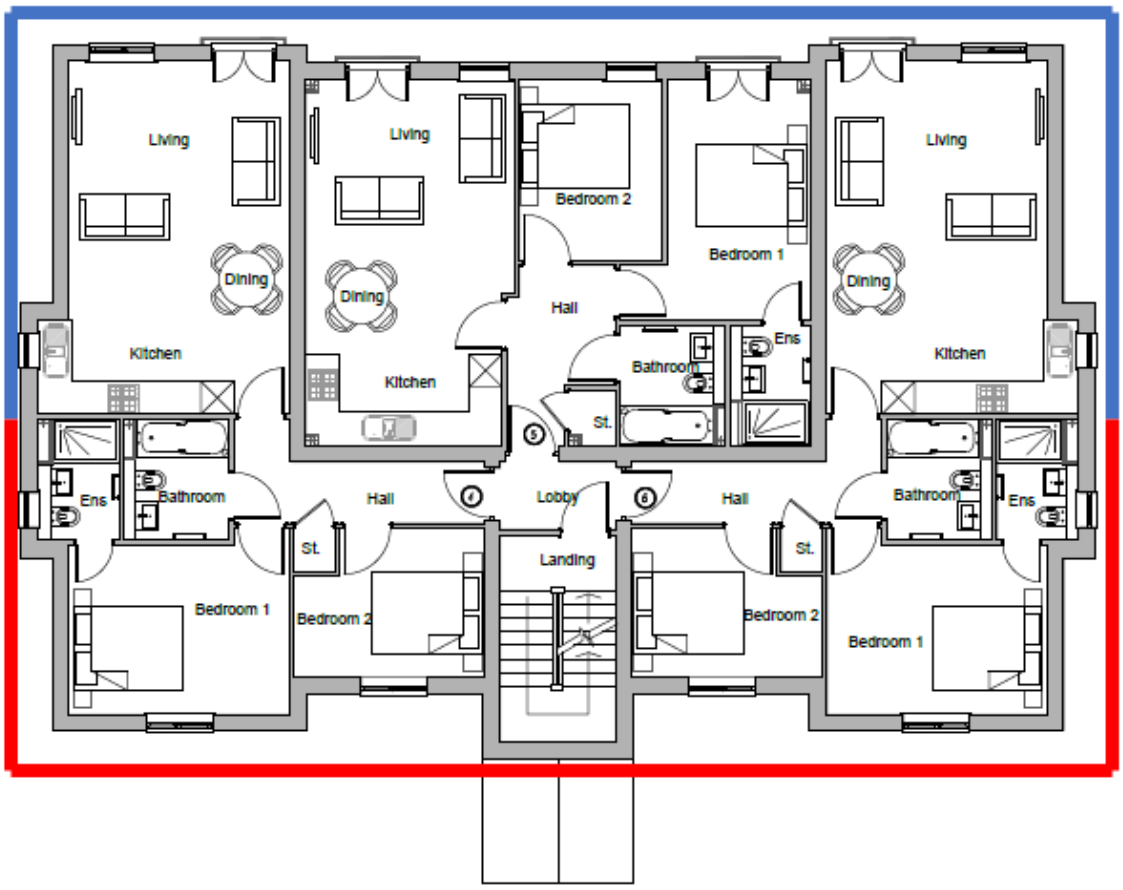


Figure 3: Sound insulation performance specification zones

It is usual to satisfy internal sound level criteria whilst achieving the background ventilation rate defined by Approved Document F of the Building Regulations, rather than for the purge ventilation rate. It is therefore anticipated that it will be necessary to incorporate an acoustic ventilation scheme into the design such that residents can achieve background ventilation without necessarily needing to open windows.

Values in Table 5 below show a specification schedule of ventilator sound insulation performance for the development, used in the computer model. Note that there are many different passive ventilators including through-wall type and those built into the window frame. If the Dn,e,w performance is not lower than that shown in Table 5 then any alternative ventilator may be used.

Description	Dn,e,w (dB)	Typical Construction
Living rooms to Zone 1	42	Acoustic ventilator such as Passivent's Acoustic Window Vent ALdB 450-40 WS or similar
Bedrooms to Zone 1	50	Very high-performance vent such as Caice's Acoustic Ventilator or through-wall type vents
Living rooms and bedrooms to Zone 2	37	Acoustic ventilator such as Passivent's Acoustic Overglass or similar

Table 5: Specification for ventilator Element Normalized Level Difference - Dn,e,w (dB)

Should the client prefer, ventilation may be provided by mechanical systems, such as MVHR or MEV. Suppliers including Titan or Vent Axia would be able to offer suitable ventilation systems for residential purposes. It is important that any self-noise (i.e. noise from the fans) and external noise intrusion through the ducted system must not cause internal sound levels to exceed the design requirements. To achieve these limits, it is recommended that the overall noise from any mechanical ventilation system will need to be no higher than LAeq 25dB to allow for accumulation of noise sources. Suitable MVHR systems must also incorporate summer bypass mode to minimise the potential for overheating during summer months.

Copy of acoustic calculations for daytime and night time noise intrusion into sample rooms is provided in Appendix A. Summary results are confirmed in Table 6 below and demonstrate that intrusive sound levels within rooms of the proposed residential units will comply with criteria set out in planning condition 6.

Plot / Room	Calculated Internal Sound Level		Criteria
	LAeq	LAfmax	
Flat 4, Living Room	35dB	-	LAeq ≤ 35dBA
Flat 5, Living Room	34dB	-	LAeq ≤ 35dBA
Flat 5, Bedroom 1	24dB	45dB	LAeq ≤ 30dBA LAfmax ≤ 45dBA
Flat 7, Living Room	33dB	-	LAeq ≤ 35dBA
Flat 7, Bedroom 1	24dB	44dB	LAeq ≤ 30dBA LAfmax ≤ 45dBA

Table 6: Summary internal sound levels within sample habitable rooms

6. CONCLUSION

North Hertfordshire District Council has granted planning permission, reference 17/02482/1, for the demolition of an existing dwelling and construction of eight new two-bedroom flats at 2 Garden Lane, Royston, subject to various conditions.

ACA Acoustics have undertaken sound level surveys in the vicinity and calculated sound intrusion through the façade to the new dwellings. Calculated internal sound levels comply with criteria set out in planning condition 6 of the Decision Notice.

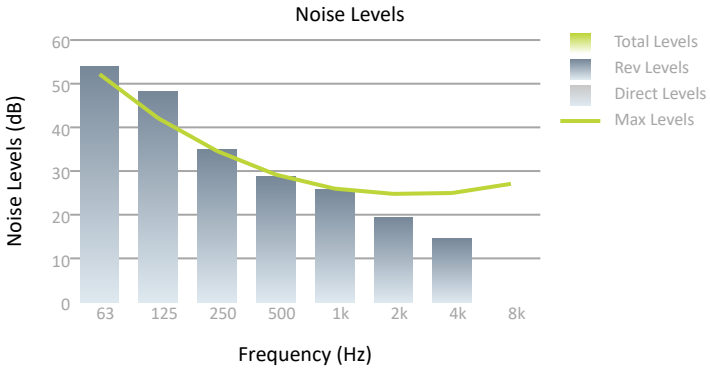
It is the author's opinion that, allowing for the recommended acoustic specification for façade envelope elements set out in this report, internal sound and vibration levels within the new residential units should not be detrimental to the amenity of future occupants and condition 6 of planning permission 17/02482/1 may be discharged.

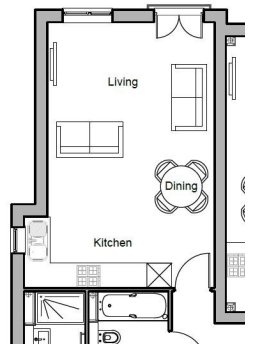
APPENDIX A

Acoustic Calculations

2 Garden Lane, Royston, SG8 9EH

Reference	Flat 4, Living Room
Description	Living Room
Room Type	Domestic Living Room
Maximum Permissible Lp	35dB(A)
Calculated Sound Level	35dB(A)
Calculated Tmf T60 (s)	0.48
Volume (m^3)	66.6





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq,ff	1	54	48	35	29	26	19	15	-

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Calculation Sheet

Flat 4, Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	**68.0**									
Octave Band Frequencies										
Leq,ff		**72.0**	**70.0**	**66.0**	**64.0**	**64.0**	**60.0**	**55.0**	**49.0**	**Row A**
Facade Wall Element										
		-38.9	*-41.9*	*-45.9*	*-45.9*	*-54.9*	*-58.9*	*-60.9*	*-65.9*	
Facade Glazed Element										
		-26.5	*-30.1*	*-39.9*	*-44.9*	*-50.6*	*-52.3*	*-52.5*	*-*	
Facade Door Element										
		-26.2	*-29.8*	*-39.6*	*-44.6*	*-50.3*	*-52.0*	*-52.2*	*-*	
Ventilators										
		-38.3	*-40.3*	*-43.3*	*-46.3*	*-44.3*	*-46.3*	*-45.3*	*-46.3*	
Cumulative Lp										
Result		**48.9**	**43.4**	**30.5**	**24.7**	**21.7**	**15.8**	**11.5**	**-**	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*	
Room Corrections										
		5.1	*4.8*	*4.4*	*4.0*	*4.0*	*3.6*	*3.0*	*-*	
Internal Receiver Noise										
Internal Receiver Noise - Flat 4, Living Room **Reverberant Field, LPrev:**		**54.0**	**48.2**	**34.9**	**28.7**	**25.7**	**19.3**	**14.6**	**-**	

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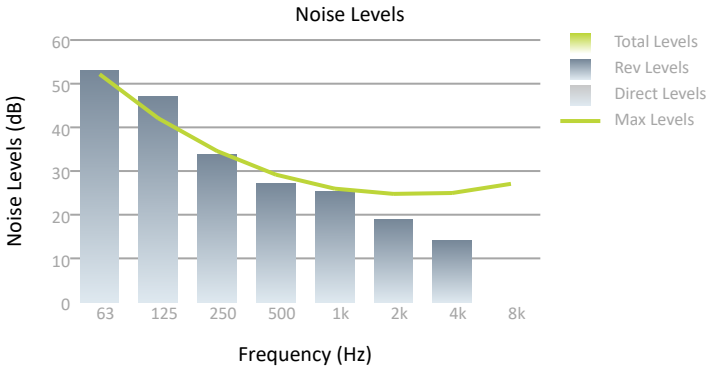
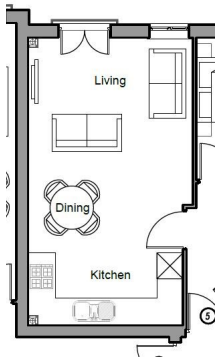
2 Garden Lane, Royston, SG8 9EH

Reference	Flat 5, Living Room
Description	Living Room
Room Type	Domestic Living Room
Maximum Permissible Lp	35dB(A)
Calculated Sound Level	34dB(A)
Calculated Tmf T60 (s)	0.48
Volume (m^3)	65.2





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq,ff	1	53	47	34	27	25	19	14	-

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Calculation Sheet

Flat 5, Bedroom 1

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Leq)										
Source dBA	**61.0**									
Octave Band Frequencies										
Leq,ff		**61.0**	**61.0**	**59.0**	**57.0**	**57.0**	**53.0**	**48.0**	**42.0**	**Row A**
Facade Wall Element										
		-38.9	*-41.9*	*-45.9*	*-45.9*	*-54.9*	*-58.9*	*-60.9*	*-65.9*	
Facade Glazed Element										
		-29.2	*-34.7*	*-38.7*	*-45.1*	*-49.3*	*-48.0*	*-52.3*	-	
Ventilators										
		-30.1	*-31.1*	*-38.1*	*-43.1*	*-54.1*	*-65.1*	*-73.1*	*-67.1*	
Cumulative Lp										
Result		**34.6**	**31.7**	**24.0**	**17.4**	**10.6**	**7.4**	**3.8**	-	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	-	
Room Corrections										
		3.7	*3.3*	*2.9*	*2.4*	*2.4*	*1.9*	*1.3*	-	
Internal Receiver Noise										
Internal Receiver Noise - Flat 5, Bedroom 1 **Reverberant Field, LPrev:**		**38.3**	**35.0**	**26.9**	**19.8**	**13.0**	**9.3**	**5.2**	-	

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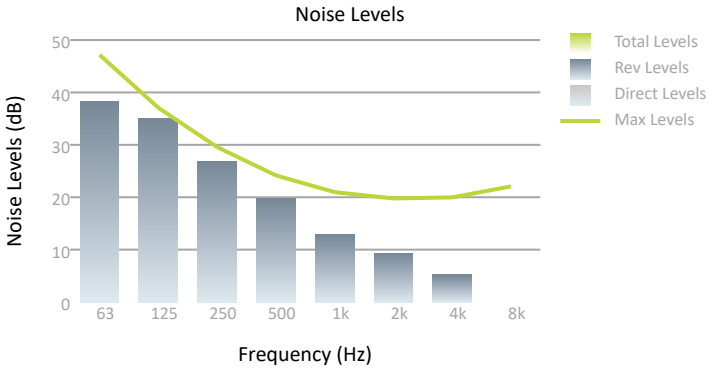
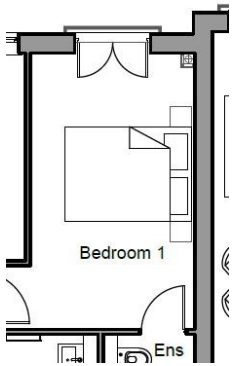
2 Garden Lane, Royston, SG8 9EH

Reference	Flat 5, Bedroom 1
Description	Bedroom
Room Type	Bedrooms - Night Time
Maximum Permissible Lp	30dB(A)
Calculated Sound Level	24dB(A)
Calculated Tmf T60 (s)	0.43
Volume (m^3)	20.8





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq,ff	1	38	35	27	20	13	9	5	-

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Calculation Sheet

Flat 5, Bedroom 1 - Lmax

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Lmax)										
Source dBA	**82.0**									
Octave Band Frequencies										
Lmax,ff		**82.0**	**82.0**	**80.0**	**78.0**	**78.0**	**74.0**	**69.0**	**63.0**	**Row A**
Facade Wall Element										
		-38.9	*-41.9*	*-45.9*	*-45.9*	*-54.9*	*-58.9*	*-60.9*	*-65.9*	
Facade Glazed Element										
		-29.2	*-34.7*	*-38.7*	*-45.1*	*-49.3*	*-48.0*	*-52.3*	-	
Ventilators										
		-30.1	*-31.1*	*-38.1*	*-43.1*	*-54.1*	*-65.1*	*-73.1*	*-67.1*	
Cumulative Lp										
Result		**55.6**	**52.7**	**45.0**	**38.2**	**30.7**	**26.4**	**17.4**	**-**	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	-	
Room Corrections										
		3.7	*3.3*	*2.9*	*2.4*	*2.4*	*1.9*	*1.3*	-	
Internal Receiver Noise										
Internal Receiver Noise - Flat 5, Bedroom 1 - Lmax **Reverberant Field, LPrev:**		**59.3**	**56.0**	**47.8**	**40.6**	**33.2**	**28.3**	**18.7**	**-**	

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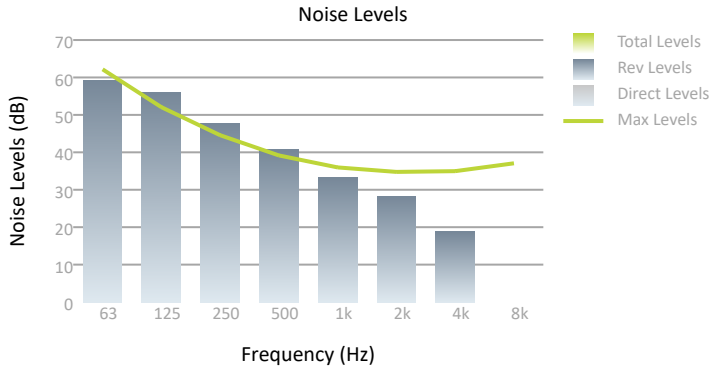
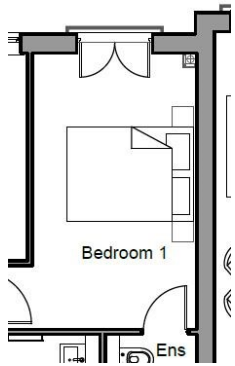
2 Garden Lane, Royston, SG8 9EH

Reference	Flat 5, Bedroom 1 - Lmax
Description	Bedroom - Lmax
Room Type	Bedrooms - LAmax
Maximum Permissible Lp	45dB(A)
Calculated Sound Level	45dB(A)
Calculated Tmf T60 (s)	0.43
Volume (m^3)	20.8





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax,ff	1	59	56	48	41	33	28	19	-

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Calculation Sheet

Flat 5, Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	**68.0**									
Octave Band Frequencies										
Leq,ff		**72.0**	**70.0**	**66.0**	**64.0**	**64.0**	**60.0**	**55.0**	**49.0**	**Row A**
Facade Wall Element										
		-40.0	*-43.0*	*-47.0*	*-47.0*	*-56.0*	*-60.0*	*-62.0*	*-67.0*	
Facade Glazed Element										
		-25.2	*-28.8*	*-38.6*	*-43.6*	*-49.3*	*-51.0*	*-51.2*	*-*	
Facade Door Element										
		-21.8	*-25.4*	*-35.2*	*-40.2*	*-45.9*	*-47.6*	*-47.8*	*-*	
Ventilators										
		-33.9	*-35.9*	*-38.9*	*-41.9*	*-39.9*	*-41.9*	*-40.9*	*-41.9*	
Cumulative Lp										
Result		**52.0**	**46.5**	**33.7**	**27.5**	**25.5**	**19.6**	**15.3**	**-**	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*	
Room Corrections										
		0.9	*0.5*	*0.1*	*-0.3*	*-0.3*	*-0.7*	*-1.2*	*-*	
Internal Receiver Noise										
Internal Receiver Noise - Flat 5, Living Room **Reverberant Field, LPrev:**		**52.9**	**47.0**	**33.8**	**27.2**	**25.2**	**18.9**	**14.1**	**-**	

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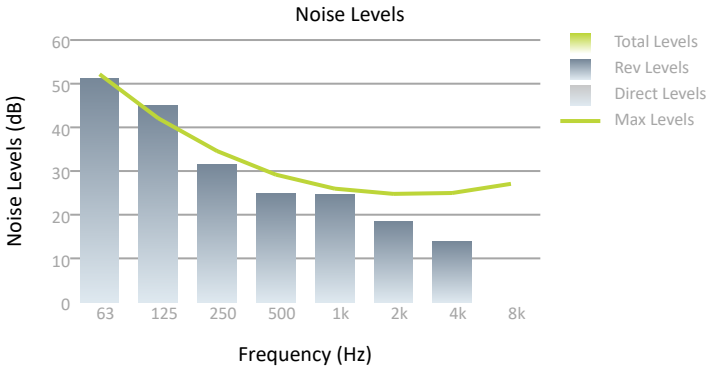
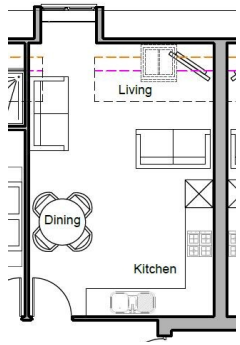
2 Garden Lane, Royston, SG8 9EH

Reference	Flat 7, Living Room
Description	Living Room
Room Type	Domestic Living Room
Maximum Permissible Lp	35dB(A)
Calculated Sound Level	33dB(A)
Calculated Tmf T60 (s)	0.48
Volume (m^3)	61.4





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq,ff	1	51	45	31	25	25	18	14	-

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Calculation Sheet

Flat 7, Living Room

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade										
Source dBA	**68.0**									
Octave Band Frequencies										
Leq,ff		**72.0**	**70.0**	**66.0**	**64.0**	**64.0**	**60.0**	**55.0**	**49.0**	**Row A**
Facade Wall Element										
		-35.6	*-41.6*	*-55.6*	*-59.6*	*-66.6*	*-74.6*	*-74.6*	*-76.6*	
Facade Glazed Element										
		-28.6	*-32.2*	*-42.0*	*-47.0*	*-52.7*	*-54.4*	*-54.6*	*-*	
Facade Roof Element										
		-32.2	*-37.2*	*-53.2*	*-61.2*	*-69.2*	*-76.2*	*-79.2*	*-81.2*	
Ventilators										
		-38.3	*-40.3*	*-43.3*	*-46.3*	*-44.3*	*-46.3*	*-45.3*	*-46.3*	
Cumulative Lp										
Result		**45.8**	**39.8**	**26.7**	**20.6**	**20.4**	**14.5**	**10.6**	**-**	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*	
Room Corrections										
		5.4	*5.1*	*4.7*	*4.3*	*4.3*	*3.8*	*3.3*	*-*	
Internal Receiver Noise										
Internal Receiver Noise - Flat 7, Living Room										
Reverberant Field, LPrev:		**51.3**	**44.9**	**31.4**	**24.9**	**24.7**	**18.4**	**14.0**	**-**	

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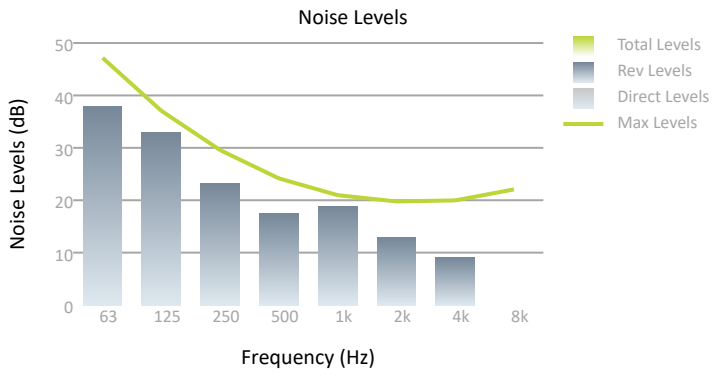
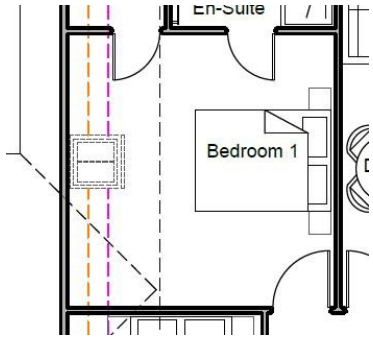
Reference	Flat 7, Bedroom 1
Description	Bedroom
Room Type	Bedrooms - Night Time
Maximum Permissible Lp	30dB(A)
Calculated Sound Level	24dB(A)
Calculated Tmf T60 (s)	0.43
Volume (m^3)	39.5





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Leq,ff	1	38	33	23	17	19	13	9	-

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Calculation Sheet

Flat 7, Bedroom 1

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Leq)										
Source dBA	**61.0**									
Octave Band Frequencies										
Leq,ff		**61.0**	**61.0**	**59.0**	**57.0**	**57.0**	**53.0**	**48.0**	**42.0**	**Row A**
Facade Wall Element										
		-34.5	*-40.5*	*-54.5*	*-58.5*	*-65.5*	*-73.5*	*-73.5*	*-75.5*	
Facade Glazed Element										
		-40.3	*-45.8*	*-49.8*	*-56.2*	*-60.4*	*-59.1*	*-63.4*	*-*	
Facade Roof Element										
		-32.7	*-37.7*	*-53.7*	*-61.7*	*-69.7*	*-76.7*	*-79.7*	*-81.7*	
Ventilators										
		-37.5	*-39.5*	*-42.5*	*-45.5*	*-43.5*	*-45.5*	*-44.5*	*-45.5*	
Cumulative Lp										
Result		**31.7**	**27.0**	**17.8**	**12.4**	**13.9**	**8.4**	**5.2**	**-**	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*	
Room Corrections										
		6.2	*5.8*	*5.4*	*4.9*	*4.9*	*4.4*	*3.9*	*-*	
Internal Receiver Noise										
Internal Receiver Noise - Flat 7, Bedroom 1 **Reverberant Field, LPrev:**		**37.9**	**32.8**	**23.2**	**17.4**	**18.8**	**12.9**	**9.0**	**-**	

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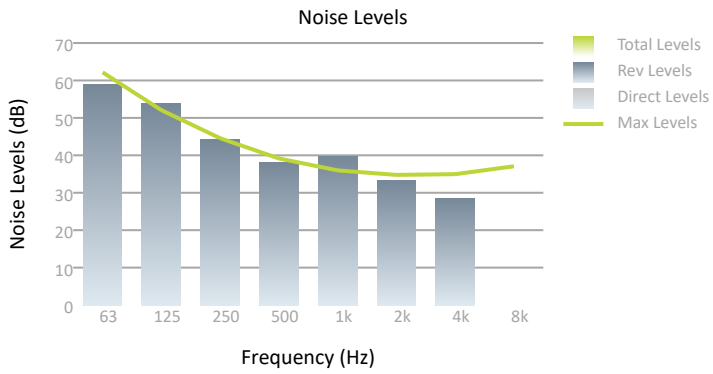
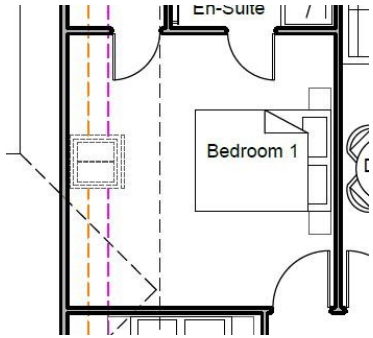
Reference	Flat 7, Bedroom 1 - Lmax
Description	Bedroom - Lmax
Room Type	Bedrooms - LAmax
Maximum Permissible Lp	45dB(A)
Calculated Sound Level	44dB(A)
Calculated Tmf T60 (s)	0.43
Volume (m^3)	39.5





Calculated Internal Sound Levels

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Lmax,ff	1	59	54	44	38	40	33	28	-

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Calculation Sheet

Flat 7, Bedroom 1 - Lmax

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Sound Level at Facade (Lmax)										
Source dBA	**82.0**									
Octave Band Frequencies										
Lmax,ff		**82.0**	**82.0**	**80.0**	**78.0**	**78.0**	**74.0**	**69.0**	**63.0**	**Row A**
Facade Wall Element										
		-34.5	*-40.5*	*-54.5*	*-58.5*	*-65.5*	*-73.5*	*-73.5*	*-75.5*	
Facade Glazed Element										
		-40.3	*-45.8*	*-49.8*	*-56.2*	*-60.4*	*-59.1*	*-63.4*	*-*	
Facade Roof Element										
		-32.7	*-37.7*	*-53.7*	*-61.7*	*-69.7*	*-76.7*	*-79.7*	*-81.7*	
Ventilators										
		-37.5	*-39.5*	*-42.5*	*-45.5*	*-43.5*	*-45.5*	*-44.5*	*-45.5*	
Cumulative Lp										
Result		**52.7**	**48.0**	**38.8**	**33.2**	**34.7**	**28.7**	**24.6**	**-**	
ISO 12354-3 Lfs Correction										
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*	
Room Corrections										
		6.2	*5.8*	*5.4*	*4.9*	*4.9*	*4.4*	*3.9*	*-*	
Internal Receiver Noise										
Internal Receiver Noise - Flat 7, Bedroom 1 - Lmax **Reverberant Field, LPrev:**		**58.9**	**53.8**	**44.2**	**38.1**	**39.6**	**33.2**	**28.5**	**-**	

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