

Acoustic Consultancy Report

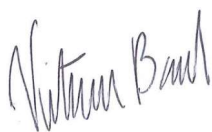
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Acoustic Report

Report Prepared For

Rmv Architecture
70 School Road
31 October 2023

Report Author

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Contents

i) Executive Summary	4
ii) Document History	4
1. Introduction.....	5
2. Noise Monitoring	5
2.1. Site Description.....	5
2.2. Measurements	5
2.3. Survey Results	6
2.3.1. Average L_{Aeq}	6
2.3.2. L_{AFMax}	6
2.4. Sound Insulation	6
3. Criteria.....	7
3.1. Sound Insulation	7
3.1.1. Approved Document E	7
3.1.2. Criteria	7
3.2. Internal Ambient Noise Levels	8
3.2.1. BS8233:2014.....	8
3.2.2. World Health Organisation (WHO) Guidelines for Community Noise (1999)	8
4. Airborne Sound Insulation between Spaces.....	9
4.1. Element Sound Reduction Indices	9
4.2. Airborne Sound Insulation between Flats.....	10
4.3. Airborne Sound Insulation between Internal Partitions within Flats.....	10
4.4. Airborne Sound Insulation of Doors.....	10
4.5. General Notes	10
5. Flanking Sound Transmission	11
6. Reverberation in Corridors and Stairwells.....	11
6.1. Approved Document E requirements	11
7. Internal Ambient Noise Assessment	11
7.1. Façade noise Break-In	11

7.2. Calculated Internal Ambient Noise Levels	12
8. Conclusion	13
Appendix A: Site Plan.....	14
Appendix B: Floor Plan	15
Appendix C: Measurement Data	16
Appendix D: Calculation	18

i) Executive Summary

It is proposed that an existing first floor commercial unit be converted into two residential dwellings, situated above the existing ground floor commercial unit of 70 School Road, in Reading.

A noise survey has been undertaken and the data assessed against Local Authority criteria to determine the sites suitability to accommodate the residential development.

The building envelope has been reviewed in order to assess its sound reduction performance in terms of internal noise level requirements set out in BS8233:2014.

The separating floor and wall have been reviewed to assess its sound reduction performance in terms of the requirements provided in Approve Document Part E.

Mitigation has been specified within the report, where necessary.

It is strongly recommended that testing be carried out pre-completion to ensure that all assessed measures have been met by the new construction. Please contact LCP to discuss provision of testing services if they are not already accounted for.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	31 st October 2023	Initial Issue	VB	MB

1. Introduction

It is proposed that an existing first floor commercial unit be converted into two residential dwellings, situated above the existing ground floor commercial unit of 70 School Road, in Reading.

A noise survey has been undertaken and the data assessed against Local Authority criteria to determine the sites suitability to accommodate the residential development.

The building envelope has been reviewed in order to assess its sound reduction performance in terms of internal noise level requirements set out in BS8233:2014.

The separating floor and wall have been reviewed to assess its sound reduction performance in terms of the requirements provided in Approve Document Part E.

2. Noise Monitoring

2.1. Site Description

The site layout and measurement positions are shown in Appendix A.

2.2. Measurements

The noise monitoring took place from the 24th October 2023 to the 26th October 2023. Two unattended noise measurements positions obtained noise data across a 48-hour period at both the front (MP1) and rear (MP2) façades on the first storey of 70 School Road. The predominant noise source was frequent road traffic, including busses, along School Road and other road networks in the vicinity. In addition, voices from members of the public using the pavement along School Road was audible at both measurement positions.

The measurement periods were considered sufficient to establish the highest noise levels at the site. The weather conditions monitored during the survey are shown in the following table.

Table 1: Weather Conditions at Measurement Location

Weather	Value		
	24/10/23	25/10/23	26/10/23
Average Wind Speed	1m/s	1m/s	1m/s
Wind Direction	North-east	South	North
Cloud Cover	40%	60%	40%
Max. Temperature	15°C	13°C	14°C
Min. Temperature	7°C	6°C	10°C
Precipitation	None	None	None

2.3. Survey Results

2.3.1. Average L_{Aeq}

The average noise levels during the day and night-time period are shown in the following table. Measurement data can be found in Appendix C. Values are façade levels.

Table 2: Averaged measured noise levels, dB re 2×10^{-5} Pa

Description	Indices	Octave Band Centre Frequency (Hz)								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Average day time sound pressure level – MP1 (front façade)	$L_{Aeq,16hr}$	72	62	62	60	64	61	54	47	67
Average night-time sound pressure level – MP1 (front façade)	$L_{Aeq,8hr}$	65	55	53	53	57	55	50	44	61
Average day time sound pressure level – MP2 (rear façade)	$L_{Aeq,16hr}$	64	58	55	51	53	49	40	31	56
Average night-time sound pressure level – MP2 (rear façade)	$L_{Aeq,8hr}$	56	50	46	44	47	44	37	30	50

2.3.2. L_{AFMax}

Table 3: Tenth Highest L_{AFMax} at night, dB re 2×10^{-5} Pa

Description	Indices	dB(A)
MP1 - 10 th highest night-time maximum	L_{AFMax}	79
MP2 - 10 th highest night-time maximum	L_{AFMax}	68

2.4. Sound Insulation

An airborne test on the existing precast concrete floor was undertaken between the ground and first floor commercial units. The results will be used within the assessment in Section 4. It is worth noting there was a hole within existing precast concrete floor, which will undermine the acoustic performance and should be sealed during the redevelopment. The results for the airborne test are provided in table 4.

Table 4: Airborne sound insulation test results

Element	Source Room	Receiving Room	$D_{nT,w}+C_{tr}$ (dB)
Floor	Ground floor commercial unit	First floor commercial unit	34

3. Criteria

3.1. Sound Insulation

3.1.1. Approved Document E

The criteria given in Tables 1a and 1b of Approved Document E: 2003 are shown in the following table.

Table 5: Approved Document E Criteria

	Minimum Airborne Sound Insulation Values $D_{nT,w} + C_{tr}$	Maximum Impact Sound Insulation Values $L_{nT,w}$
<i>Purpose Built Dwelling houses and flats</i>		
Walls	45	-
Floors and stairs	45	62
<i>Dwelling houses and flats formed by material change of use</i>		
Walls	43	-
Floors and stairs	43	64
<i>Purpose built rooms for residential purpose</i>		
Walls	43	-
Floors and stairs	45	62
<i>Rooms for residential purpose formed by material change of use</i>		
Walls	43	-
Floors and stairs	43	64

3.1.2. Criteria

The Environment Health Team of Reading Council have requested the following sound insulation criteria for a residential premises above a commercial space.

Table 6: Criteria, dB

Sound Insulation	Criteria
Floor - Airborne	$\geq 55 D_{nT,w} + C_{tr}$

Sound Insulation	Criteria
Wall - Airborne	$\geq 43 D_{nT,w} + C_{tr}$

3.2. Internal Ambient Noise Levels

3.2.1. BS8233:2014

Guidance is provided in BS8233:2014, this is shown in the following table:

Table 7: BS8233 Indoor ambient noise levels for dwellings, dB $L_{Aeq,T}$

Activity	Location	Time period	
		07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 $L_{Aeq,16 \text{ hour}}$	-
Dining	Dining Room/area	40 $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 $L_{Aeq, 16 \text{ hour}}$	30 $L_{Aeq, 8 \text{ hour}}$

The levels provided in the above table assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern an appropriate alternative period may be used.

The measured levels are considered to follow normal diurnal fluctuations.

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

BS8233:2014 also states that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

3.2.2. World Health Organisation (WHO) Guidelines for Community Noise (1999)

The WHO's 'Guidelines for Community Noise' gives the following relevant noise criteria:

Table 8: Guideline values for community noise, from Guidelines for Community Noise (WHO, 1999)

Specific Environment	$L_{Aeq, T}$ dB	Time Base (hours)	$L_{Amax, fast}$ dB
Outdoor living area (serious annoyance, daytime and evening)	55	16	-

Specific Environment	L _{Aeq, T} dB	Time Base (hours)	L _{Amax, fast} dB
Outdoor living area (moderate annoyance, daytime and evening)	50	16	-
Dwelling, indoors	35	16	-
Inside bedrooms	30	8	45
Outside bedrooms	45	8	60

A secondary criterion of 45dB L_{Amax} is also considered in relation noise. WHO only considers it appropriate to provide a criterion for the internal L_{Amax} level during the night-time period as it is a useful parameter to assess sleep disturbance. It is recommended that internal noise levels should not exceed 45dB L_{Amax} during the night and the document states that:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10 – 15 times per night'

4. Airborne Sound Insulation between Spaces

4.1. Element Sound Reduction Indices

The assessment outlined in this report uses the construction details shown below. Sound reduction data for the constructions were obtained where possible from manufacturers; otherwise data was obtained from computer models using a proprietary package called INSUL using the advised constructions and assumptions based on the supplied drawings. The assessment is based on the drawings detailed in Appendix B.

Table 9: Element sound reduction performances, dB R_w

Element	Description	Octave Band Centre Frequency						
		63	125	520	500	1k	2k	4k
Floor	Floor finish; existing concrete slab*; 100mm suspended light steel grid at 600mm centres with 100mm Rockwool (density 40kg/m ³); two layers of 15mm Wallboard.	34	54	53	60	68	75	81
Wall	Two layers of 15mm SoundBloc; 70mm steel stud and resilient rail at 600mm centres; two layers of 15mm SoundBloc.	17	30	45	55	63	54	62

*There is a hole within the existing concrete slab which is required to be completely sealed.

4.2. Airborne Sound Insulation between Flats

The sound insulation requirements of separating partitions between resting/sleeping spaces have been assessed against the criteria Approved Document E.

Table 10: Internal element sound reduction performances, dB $D_{nTw} + C_{tr}$

Element	Source Room	Receive Room	Criteria	Calculated
Floor	Ground floor commercial space	First floor bedroom	≥ 55	55
Floor	Ground floor commercial space	First floor living area	≥ 55	55
Wall	First floor living area	First floor living area	≥ 43	44

4.3. Airborne Sound Insulation between Internal Partitions within Flats

Approved Document E also requires that all internal partitions within suites shall achieve the minimum SRI shown in the table below.

Table 11: Corridor partition sound insulation performances, dB R_w

Location	Partition SRI
Internal apartment partitions (wall and floor)	40

4.4. Airborne Sound Insulation of Doors

Approved Document E also requires that all doors to flats/rooms for residential purpose achieve the minimum SRI shown in the table below.

Table 12: Door sound insulation performances, dB R_w

Element	Element SRI
Doors to flats/rooms for residential purpose	29

It should also be ensured that any door has a good perimeter sealing (including the threshold, where practical).

Noisy parts of the building should preferably have a lobby, double door or high performance doorset to contain the noise.

4.5. General Notes

It is recommended that recessed sockets on both sides of any partition are not located 'back-to-back'.

It is further recommended that where recessed sockets are installed, putty pads are used to cover the backs of socket assemblies and the connection with the outer leaf of the partition in order that the sound insulation integrity of the partition is maintained.

Pipes and ducts that penetrate a floor separating habitable rooms in different flats should be enclosed, with a material having a mass per unit area of at least 15kg/m^2 , for their full height in each flat.

All wall and floor penetrations for pipes and ducts should be adequately insulated so that no gaps or holes are left that may undermine the partition.

5. Flanking Sound Transmission

Flanking sound transmission refers to indirect transmission where sound is transmitted via flanking walls/floors or along any path other than the direct path. This transmission can occur through a structure (e.g. vibration transmitted along flanking walls/floors) or through a void (e.g. airborne sound transmitted along an external wall cavity).

In order for the construction to be fully effective, care should be taken to correctly detail the junctions between the separating walls and floors and other elements such as roofs, external walls, internal walls and separating floors and walls.

Where necessary cavities should be stopped with a flexible closer/cavity stops at appropriate wall and floor junctions. Flanking strips are also recommended, where necessary, and all due care should be taken when installing a resilient layer to ensure that a bridge is not created between the resilient layer and the base or surrounding walls.

6. Reverberation in Corridors and Stairwells

6.1. Approved Document E requirements

There are two methods of complying with requirement E3. The requirements for E3 only apply to common areas that give access to a flat or dwelling (i.e. common corridors or halls).

Method A

For entrance halls, corridors or hallways an area equal to or greater than the floor area should be covered with a Class C absorber (rated in accordance with BS EN ISO 11654:1997).

For stairwells or stair enclosure the equivalent area of the stair treads, upper surface of the intermediate landings (excluding ground floor) and the ceiling of the top floor should be covered with a Class D absorber. Alternatively, 50% of this area should be covered with a Class C absorber.

Method B

For entrance halls, provide a minimum of 0.20 m^2 of absorption area (see Appendix A) per cubic metre of volume.

For corridors and hallways provide a minimum of 0.25 m^2 total absorption area per cubic metre of volume.

7. Internal Ambient Noise Assessment

7.1. Façade noise Break-In

The assessment outlined within this section uses the recommended glazing performance shown in table 13.

Table 13: Sound Reduction Index data used, dB

Description	Octave Band Centre Frequency (Hz)							Rw	Rw+Ctr
	63	125	250	500	1k	2k	4k		
Front façade glazing	-	25	27	38	48	47	55	41	35
Rear façade glazing	-	20	21	33	40	36	48	35	29

*Data provided by Pilkington Glazing.

Trickle vents will provide ventilation to each habitable room, one vent for each window system. The advised trickle vent acoustic performance shown below.

Table 14: Sound Reduction Index data used, dB

Description	Octave Band Centre Frequency (Hz)							Dn,e
	63	125	250	500	1k	2k	4k	
Trickle vent	25	33	40	45	56	67	75	50

7.2. Calculated Internal Ambient Noise Levels

The predicted internal ambient noise levels are shown in the table below. Calculations use the glazing and trickle vent sound reductions shown in the table above.

Calculations can be seen in Appendix E.

Table 15: Predicted indoor ambient noise levels, dB $L_{Aeq, T}$

Location	Predicted Noise Level	BS8233 Design	
		07:00 – 23:00	23:00 – 07:00
Living area	33 $L_{Aeq,16hr}$	35 $L_{Aeq,16hr}$	-
	32 $L_{Aeq,16hr}$	35 $L_{Aeq,16hr}$	-
Bedroom (front façade)	25 $L_{Aeq,8hr}$ 43 L_{Amax}	-	30 $L_{Aeq,8hr}$ 45 L_{Amax}
Bedroom (rear façade)	34 $L_{Aeq,16hr}$	35 $L_{Aeq,16hr}$	-

Location	Predicted Noise Level	BS8233 Design	
		07:00 – 23:00	23:00 – 07:00
Bedroom (rear façade)	25 $L_{Aeq,8hr}$ 43 L_{Amax}	-	30 $L_{Aeq,8hr}$ 45 L_{Amax}

8. Conclusion

This It is proposed that an existing first floor commercial unit be converted into two residential dwellings, situated above the existing ground floor commercial unit of 70 School Road, in Reading.

A noise survey has been undertaken and the data assessed against Local Authority criteria to determine the sites suitability to accommodate the residential development.

The building envelope has been reviewed in order to assess its sound reduction performance in terms of internal noise level requirements set out in BS8233:2014.

The separating floor and wall have been reviewed to assess its sound reduction performance in terms of the requirements provided in Approve Document Part E.

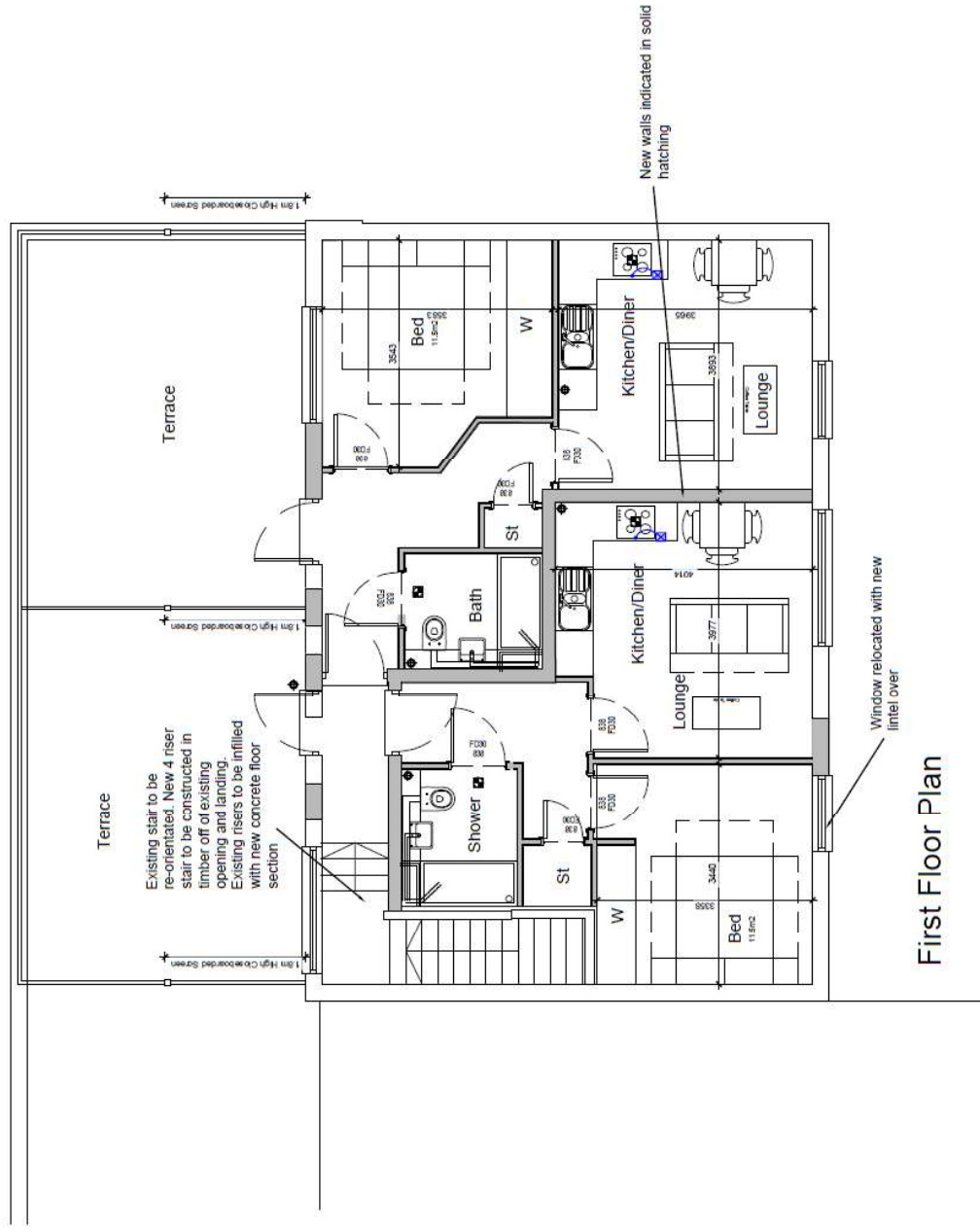
Mitigation has been specified within the report, where necessary.

It is strongly recommended that testing be carried out pre-completion to ensure that all assessed measures have been met by the new construction. Please contact LCP to discuss provision of testing services if they are not already accounted for.

Appendix A: Site Plan

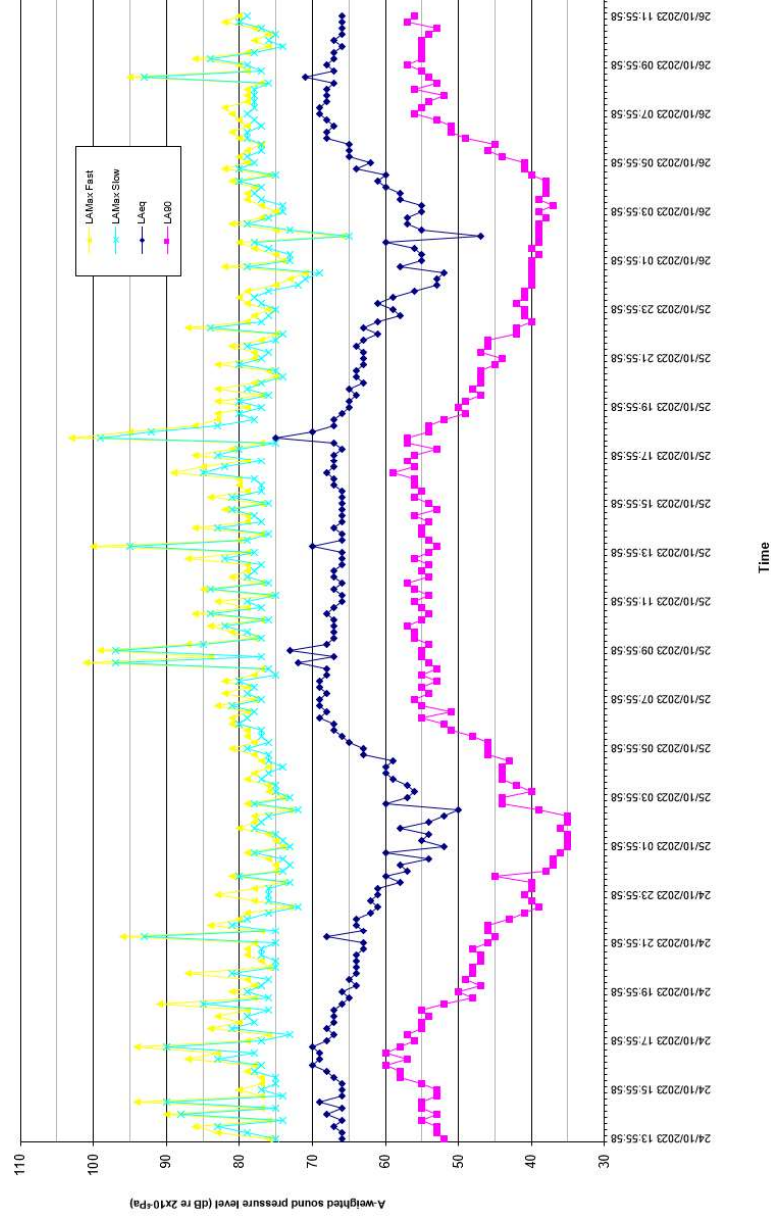


Appendix B: Floor Plan



Appendix C: Measurement Data

Front façade – MP1:

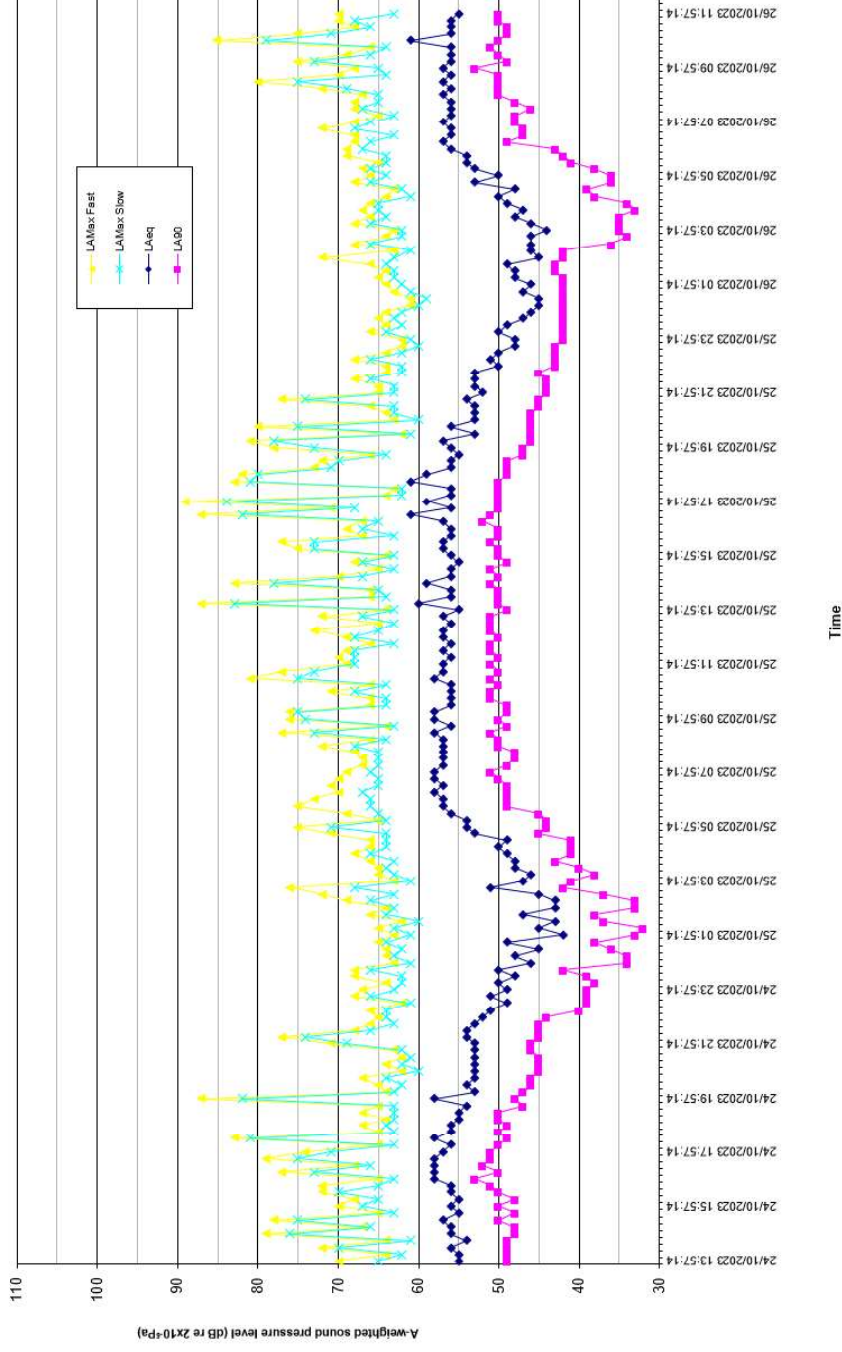


Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11207 (next cal due 27/07/25) Start gain +1.86 End gain +1.70
- Svantek pre-amplifier SV12L S/N: 49860 with GRAS microphone capsule 40AE S/N: 215511

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10890 (next cal due 19/01/24) complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Rear façade – MP2:



Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11205 (next cal due 08/04/25) Start gain +0.83 End gain +0.45
- Svantek pre-amplifier SV12L S/N: 13245 with GRAS microphone capsule 40AE S/N: 75181

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10890 (next cal due 19/01/24) complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix D: Calculation

Front façade noise break-in - Living room (day) L_{Aeq} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	72	62	62	60	64	61	54	47	67
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Facade Length (m)	2.55	Façade Area (S)	10	10	10	10	10	10	10	10	
Facade Width (m)	3.98	Volume (V)	41	41	41	41	41	41	41	41	
Façade Area	10.14	S/V	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Room Length (m)	4.01	10log(S/V)	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Room Height (m)	2.55	11	11	11	11	11	11	11	11	11	
Room Width (m)	3.98	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-
Volume	40.71	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	-
Tmf	0.50	L2	75	65	64	62	66	63	56	49	69
Sound Reduction		R	26	31	33	43	53	53	61	61	46
Flanking/Tolerance			5	5	5	5	5	5	5	5	
L2 Room Lp			55	39	37	24	18	15	0	-7	33
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	-1	-5	2	-5	-7	-7	-19	-24	-2
L2 = L1-R+10log(S/V)+11+10logT											
Partition Dimensions and Material Data:											
Description		Area	Units	ctave Band Centre Frequency (Hz)							R _w
				63	125	250	500	1000	2000	4000	
Wall		7.39	m ²	40	47	47	49	59	69	79	56
Glazing		2.751	m ²	20	25	27	38	48	47	55	41
Composite Sound Reduction Index				26	31	33	43	53	53	61	46
Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	72	62	62	60	64	61	54	47	67
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Room Length (m)	4.01	Volume (V)	41	41	41	41	41	41	41	41	
Room Height (m)	2.55	10log(V)	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	
Room Width (m)	3.98	21	21	21	21	21	21	21	21	21	
Volume	40.71	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	
Tmf	0.50	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	
Sound Reduction		Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			50	32	24	17	10	-4	-19	-20	25
L2 = L1-Dne-10logV+21+10logT											
Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L2 Room Lp façade and vent			56	40	37	25	19	15	0	-6	33
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	1	-4	2	-4	-6	-6	-19	-24	-1

Front façade noise break-in – Bedroom (day) L_{Aeq} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	72	62	62	60	64	61	54	47	67
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Facade Length (m)	2.55	Façade Area (S)	9	9	9	9	9	9	9	9	
Facade Width (m)	3.44	Volume (V)	35	35	35	35	35	35	35	35	
Façade Area	8.77	S/V	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Room Length (m)	4.01	10log(S/V)	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Room Height (m)	2.55	11	11	11	11	11	11	11	11	11	
Room Width (m)	3.44	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-
Volume	35.21	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	-
Tmf	0.50	L2	75	65	64	62	66	63	56	49	69
Sound Reduction		R	27	32	34	44	54	54	62	62	47
Flanking/Tolerance			5	5	5	5	5	5	5	5	
L2 Room Lp			53	37	35	23	17	14	-2	-9	31
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	-3	-6	0	-6	-8	-8	-21	-26	-4

$$L2 = L1 - R + 10\log(S/V) + 11 + 10\log T$$

Partition Dimensions and Material Data:

Description	Area	Units	octave Band Centre Frequency (Hz)							R_w
			63	125	250	500	1000	2000	4000	
Wall	7.24	m ²	40	47	47	49	59	69	79	56
Glazing	1.5327	m ²	20	25	27	38	48	47	55	41
Composite Sound Reduction Index			27	32	34	44	54	54	62	47

Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	72	62	62	60	64	61	54	47	67
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Room Length (m)	4.01	Volume (V)	35	35	35	35	35	35	35	35	
Room Height (m)	2.55	10log(V)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	
Room Width (m)	3.44	21	21	21	21	21	21	21	21	21	
Volume	35.21	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	
Tmf	0.50	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	
Sound Reduction		Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			51	32	25	18	11	-3	-18	-19	26

$$L2 = L1 - Dne - 10\log V + 21 + 10\log T$$

Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L2 Room Lp façade and vent			55	38	35	24	18	14	-1	-8	32
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	0	-5	0	-5	-7	-8	-21	-26	-3

Front façade noise break-in – Bedroom (night) L_{Aeq} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	65	55	53	53	57	55	50	44	61
Directivity correction	0		Correction	0	0	0	0	0	0	0	-
Facade Length (m)	2.55	Façade Area (S)	9	9	9	9	9	9	9	9	
Facade Width (m)	3.44		Volume (V)	35	35	35	35	35	35	35	
Façade Area	8.77	S/V	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Room Length (m)	4.01	10log(S/V)	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Room Height (m)	2.55	11	11	11	11	11	11	11	11	11	
Room Width (m)	3.44	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-
Volume	35.21	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	-
Tmf	0.50	L2	68	58	55	55	59	57	52	46	63
Sound Reduction		R	27	32	34	44	54	54	62	62	47
Flanking/Tolerance			5	5	5	5	5	5	5	5	
L2 Room Lp			46	30	26	16	10	8	-6	-12	23
	20	NR	51	39	31	24	20	17	14	13	30
		Excess	-6	-9	-5	-9	-10	-9	-20	-24	-7
L2 = L1-R+10log(S/V)+11+10logT											
Partition Dimensions and Material Data:											
Description		Area	Units	ctave Band Centre Frequency (Hz)							R _w
				63	125	250	500	1000	2000	4000	
Wall		7.24	m ²	40	47	47	49	59	69	79	56
Glazing		1.5327	m ²	20	25	27	38	48	47	55	41
Composite Sound Reduction Index				27	32	34	44	54	54	62	47
Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	65	55	53	53	57	55	50	44	61
Directivity correction	0		Correction	0	0	0	0	0	0	0	-
Room Length (m)	4.01	Volume (V)	35	35	35	35	35	35	35	35	
Room Height (m)	2.55		10log(V)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	
Room Width (m)	3.44	21	21	21	21	21	21	21	21	21	
Volume	35.21	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	
Tmf	0.50	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	
Sound Reduction		Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			44	25	16	11	4	-9	-22	-22	19
L2 = L1-Dne-10logV+21+10logT											
Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L2 Room Lp façade and vent			48	31	26	17	11	8	-5	-11	25
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	-7	-12	-9	-12	-14	-14	-25	-29	-10

Front façade noise break-in – Bedroom (night) L_{Amax} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	83	73	71	71	75	73	68	62	79
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Facade Length (m)	2.55	Façade Area (S)	9	9	9	9	9	9	9	9	
Facade Width (m)	3.44	Volume (V)	35	35	35	35	35	35	35	35	
Façade Area	8.77	S/V	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Room Length (m)	4.01	10log(S/V)	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Room Height (m)	2.55	11	11	11	11	11	11	11	11	11	
Room Width (m)	3.44	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-
Volume	35.21	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	-
Tmf	0.50	L2	86	76	73	73	77	75	70	64	81
Sound Reduction		R	27	32	34	44	54	54	62	62	47
Flanking/Tolerance			5	5	5	5	5	5	5	5	
L2 Room Lp			64	48	44	34	28	26	12	6	41
	36	NR	64	53	45	40	36	33	31	29	45
		Excess	0	-5	-1	-6	-8	-8	-18	-23	-4

$$L2 = L1 - R + 10\log(S/V) + 11 + 10\log T$$

Partition Dimensions and Material Data:

Description	Area	Units	Octave Band Centre Frequency (Hz)							R_w
			63	125	250	500	1000	2000	4000	
Wall	7.24	m ²	40	47	47	49	59	69	79	56
Glazing	1.5327	m ²	20	25	27	38	48	47	55	41
Composite Sound Reduction Index			27	32	34	44	54	54	62	47

Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	83	73	71	71	75	73	68	62	79
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Room Length (m)	4.01	Volume (V)	35	35	35	35	35	35	35	35	
Room Height (m)	2.55	10log(V)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	
Room Width (m)	3.44	21	21	21	21	21	21	21	21	21	
Volume	35.21	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	
Tmf	0.50	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	
Sound Reduction		Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			62	43	34	29	22	9	-4	-4	37

$$L2 = L1 - Dne - 10\log V + 21 + 10\log T$$

Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L2 Room Lp façade and vent			66	49	44	35	29	26	13	7	43
	36	NR	64	53	45	40	36	33	31	29	45
		Excess	2	-4	-1	-5	-7	-7	-18	-22	-2

Rear façade noise break-in – Bedroom (day) L_{Aeq} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	64	58	55	51	53	49	40	31	56
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Facade Length (m)	2.55	Façade Area (S)	9	9	9	9	9	9	9	9	
Facade Width (m)	3.54	Volume (V)	32	32	32	32	32	32	32	32	
Façade Area	9.03	S/V	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Room Length (m)	3.58	10log(S/V)	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	
Room Height (m)	2.55	11	11	11	11	11	11	11	11	11	
Room Width (m)	3.54	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-
Volume	32.37	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	-
Tmf	0.50	L2	68	61	58	53	55	51	42	33	59
Sound Reduction		R	18	23	24	36	43	39	51	51	37
Flanking/Tolerance			5	5	5	5	5	5	5	5	
L2 Room Lp			54	43	38	22	17	17	-4	-13	33
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	-1	-1	3	-7	-8	-5	-24	-31	-1
L2 = L1-R+10log(S/V)+11+10logT											
Partition Dimensions and Material Data:											
Description		Area	Units	ctave Band Centre Frequency (Hz)							R _w
				63	125	250	500	1000	2000	4000	
Wall		4.97	m ²	40	47	47	49	59	69	79	56
Glazing		4.061	m ²	15	20	21	33	40	36	48	34
Composite Sound Reduction Index				18	23	24	36	43	39	51	37
Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	64	58	55	51	53	49	40	31	56
Directivity correction	0	Correction	0	0	0	0	0	0	0	0	-
Room Length (m)	3.58	Volume (V)	32	32	32	32	32	32	32	32	
Room Height (m)	2.55	10log(V)	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	
Room Width (m)	3.54	21	21	21	21	21	21	21	21	21	
Volume	32.37	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	
Tmf	0.50	10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	
Sound Reduction		Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			43	29	18	9	0	-15	-32	-35	19
L2 = L1-Dne-10logV+21+10logT											
Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L2 Room Lp façade and vent			54	43	38	22	17	17	-4	-13	34
	25	NR	55	44	35	29	25	22	20	18	35
		Excess	-1	-1	3	-7	-8	-5	-24	-31	-1

Rear façade noise break-in – Bedroom (night) L_{Aeq} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)	
L1		Free Field Source Lp	56	50	46	44	47	44	37	30	50	
Directivity correction			0	0	0	0	0	0	0	0	-	
Facade Length (m)			9	9	9	9	9	9	9	9		
Facade Width (m)			32	32	32	32	32	32	32	32		
Façade Area			0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3		
Room Length (m)			-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5		
Room Height (m)			11	11	11	11	11	11	11	11		
Room Width (m)			0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-	
Volume			-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01	-	
Tmf			L2	60	53	49	46	49	46	39	32	53
Sound Reduction		R	18	23	24	36	43	39	51	51	37	
Flanking/Tolerance			5	5	5	5	5	5	5	5		
L2 Room Lp			46	35	29	15	11	12	-7	-14	25	
	20	NR	51	39	31	24	20	17	14	13	30	
		Excess	-5	-5	-1	-9	-9	-5	-21	-27	-5	
L2 = L1-R+10log(S/V)+11+10logT												
Partition Dimensions and Material Data:												
Description		Area	Units	ctave Band Centre Frequency (Hz)						R _w		
				63	125	250	500	1000	2000		4000	
Wall		4.97	m ²	40	47	47	49	59	69	79	56	
Glazing		4.061	m ²	15	20	21	33	40	36	48	34	
Composite Sound Reduction Index				18	23	24	36	43	39	51	37	
Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)	
L1		Free Field Source Lp	56	50	46	44	47	44	37	30	50	
Directivity correction			0	0	0	0	0	0	0	0	-	
Room Length (m)			32	32	32	32	32	32	32	32		
Room Height (m)			15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1		
Room Width (m)			21	21	21	21	21	21	21	21		
Volume			0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50		
Tmf			-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01		
Sound Reduction			Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			35	21	9	2	-6	-20	-35	-36	11	
L2 = L1-Dne-10logV+21+10logT												
Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)	
L2 Room Lp façade and vent			46	35	29	15	11	12	-7	-14	25	
	20	NR	51	39	31	24	20	17	14	13	30	
		Excess	-5	-4	-1	-9	-9	-5	-21	-27	-5	

Rear façade noise break-in – Bedroom (night) L_{Amax} :

Façade noise Break-in façade 1			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	74	68	64	62	65	62	55	48	68
Directivity correction	0		Correction	0	0	0	0	0	0	0	-
Facade Length (m)	2.55	Façade Area (S)	9	9	9	9	9	9	9	9	
Facade Width (m)	3.54		Volume (V)	32	32	32	32	32	32	32	
Façade Area	9.03	S/V	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Room Length (m)	3.58	10log(S/V)	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5	
Room Height (m)	2.55		11	11	11	11	11	11	11	11	
Room Width (m)	3.54	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	-
Volume	32.37		10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01
Tmf	0.50	L2	78	71	67	64	67	64	57	50	71
Sound Reduction		R	18	23	24	36	43	39	51	51	37
Flanking/Tolerance			5	5	5	5	5	5	5	5	
L2 Room Lp			64	53	47	33	29	30	11	4	43
	36	NR	64	53	45	40	36	33	31	29	45
		Excess	0	-1	2	-7	-7	-3	-20	-25	-1
L2 = L1-R+10log(S/V)+11+10logT											
Partition Dimensions and Material Data:											
Description		Area	Units	ctave Band Centre Frequency (Hz)							R _w
				63	125	250	500	1000	2000	4000	
Wall		4.97	m ²	40	47	47	49	59	69	79	56
Glazing		4.061	m ²	15	20	21	33	40	36	48	34
Composite Sound Reduction Index				18	23	24	36	43	39	51	37
Façade noise Break-in vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L1		Free Field Source Lp	74	68	64	62	65	62	55	48	68
Directivity correction	0		Correction	0	0	0	0	0	0	0	-
Room Length (m)	3.58	Volume (V)	32	32	32	32	32	32	32	32	
Room Height (m)	2.55		10log(V)	15.1	15.1	15.1	15.1	15.1	15.1	15.1	
Room Width (m)	3.54	21	21	21	21	21	21	21	21	21	
Volume	32.37	Rev time	0.65	0.60	0.55	0.50	0.50	0.50	0.50	0.50	
Tmf	0.50		10logT	-1.87	-2.22	-2.60	-3.01	-3.01	-3.01	-3.01	-3.01
Sound Reduction		Dne	25	33	40	45	56	67	75	69	50
L2 Room Lp			53	39	27	20	12	-2	-17	-18	29
L2 = L1-Dne-10logV+21+10logT											
Façade noise Break-in façade and vent			63	125	250	500	1k	2k	4k	8k	dB(A)
L2 Room Lp façade and vent			64	53	47	33	29	30	11	4	43
	36	NR	64	53	45	40	36	33	31	29	45
		Excess	1	0	2	-7	-7	-3	-20	-25	-1

Separating wall

Source Room Description	1st front living
Receive Room Description	1st front living

☐ Ceiling
☐ Ceiling Void Barrier
☐ Floor
☐ Floor Void Barrier
☐ Wall Grille
☐ Ceiling Grilles
☐ Transfer Duct
☐ Acoustic Hoods
☐ Attenuator

Ceiling R

Floor R

Source

Receiver

Room Dimensions:

Description	Value	Unit
Source Room	Length	3.997 m
	Width	4.014 m
	Height (excluding void)	2.55 m
	Ceiling / Floor Area	16.04396 m ²
	Volume	40.91209 m ³
Receive Room	Length	3.893 m
	Width	3.965 m
	Height (excluding void)	2.55 m
	Ceiling / Floor Area	15.43575 m ²
	Volume	39.36115 m ³
Partition	Height	2.55 m
	Length	3.965 m
	Area	10.11075 m ²
Void	Ceiling Void Depth	m
	Floor Void Depth	m

Sound Reduction Indices:

Description	Octave Band Centre Frequency Hz								w	Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Partition Sound Reduction Index, R	17	30	45	55	63	54	62	62	52	dB	1

Reverberation Times:

Description	Octave Band Centre Frequency Hz									Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Receive Room Reverberation Time (2) 0.5 s	0.8	0.7	0.5	0.5	0.5	0.5	0.5	0.5		s	2,3,4

Calculated Internal Noise Level and Design Criteria:

Description	Octave Band Centre Frequency Hz								A	Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Source Noise Level Pink Noise	100	100	100	100	100	100	100	100	107	dB	5
Partition Break-in Noise Level	84	70	54	44	36	45	37	37	60	dB	6
Ceiling break-in level	0	0	0	0	0	0	0	0	0	dB	6
Floor break-in level	0	0	0	0	0	0	0	0	0	dB	6
Wall grille break-in level	0	0	0	0	0	0	0	0	0	dB	6
Ducted Crosstalk Noise Level	0	0	0	0	0	0	0	0	0	dB	5
Flanking Factor 5	5	5	5	5	5	5	5	5		dB	
Receive Room Noise Level (L _{eq})	89	75	59	49	41	50	42	42	65	dB	3,6

Resultant Sound Reduction and Privacy:

Description	Octave Band Centre Frequency Hz								w	Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Level Difference, D	11	25	41	51	59	50	58	58	48	dB	1
Apparent Sound Reduction Index, R'	12	25	40	50	58	49	57	57	47	dB	6
Normalised Level Difference, DnT	13	26	41	51	59	50	58	58	48	dB	6
Ctr -4									DnTw+Ctr 44		

Reference 1	ISO 717-1 Acoustics - Rating of sound insulation in building elements	ISO	1997
Reference 2	BCO Guide - Best Practice in the specification for offices - 2005	British Council for Offices	2005
Reference 3	IOA Diploma Formula Sheet Edition 5	Institute of Acoustics	2003
Reference 4	Building Bulletin 93	Dfes	2003
Reference 5	Noise Control in Building Services SRL Ltd	Pergamon	1988
Reference 6	BS12354-1 Building Acoustics - Estimate of acoustic performance of buildings from performance of elements	Bsi	2000
Reference 7	Engineering Noise Control Bies and Hansen	Spon Press	2003

Note 1	Ceiling and floor reverberation time does not have an uplift at 63 or 125 Hz
Note 2	Standard room reverberation times include an uplift at 63 and 125 Hz as per BB93
Note 3	Reverberation time in source and receive room voids assumed to be the same.

Separating floor

Calculation Information:

Source Room Description	Ground
Receive Room Description	1st front living

☐ Ceiling
☐ Ceiling Void Barrier
☐ Floor
☐ Floor Void Barrier
☐ Wall Grille
☐ Ceiling Grilles
☐ Transfer Duct
☐ Acoustic Hoods
☐ Attenuator

Ceiling R

Floor R

Source

Receiver

Room Dimensions:

Description	Value	Unit
Source Room		
Length	11.5	m
Width	11.5	m
Height (excluding void)	3	m
Ceiling / Floor Area	132.25	m ²
Volume	396.75	m ³
Receive Room		
Length	3.89	m
Width	3.995	m
Height (excluding void)	2.55	m
Ceiling / Floor Area	15.54055	m ²
Volume	39.6284	m ³
Partition		
Height	3.89	m
Length	3.995	m
Area	15.54055	m ²
Void		
Ceiling Void Depth		m
Floor Void Depth		m

Sound Reduction Indices:

Description	Octave Band Centre Frequency Hz								w	Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Partition Sound Reduction Index, R	34	54	53	60	68	75	81	81	65	dB	1

Reverberation Times:

Description	Octave Band Centre Frequency Hz									Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Receive Room Reverberation Time (2) 0.5 s	0.8	0.7	0.5	0.5	0.5	0.5	0.5	0.5		s	2,3,4

Calculated Internal Noise Level and Design Criteria:

Description	Octave Band Centre Frequency Hz								A	Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Source Noise Level Pink Noise	100	100	100	100	100	100	100	100	107	dB	5
Partition Break-in Noise Level	69	48	48	41	33	26	20	20	46	dB	6
Ceiling break-in level	0	0	0	0	0	0	0	0	0	dB	6
Floor break-in level	0	0	0	0	0	0	0	0	0	dB	6
Wall grille break-in level	0	0	0	0	0	0	0	0	0	dB	6
Ducted Crosstalk Noise Level	0	0	0	0	0	0	0	0	0	dB	5
Flanking Factor	5	5	5	5	5	5	5	5		dB	
Receive Room Noise Level (L _{eq})	74	53	53	46	38	31	25	25	51	dB	3,6

Resultant Sound Reduction and Privacy:

Description	Octave Band Centre Frequency Hz								w	Units	Ref
	63	125	250	500	1000	2000	4000	8000			
Level Difference, D	26	47	47	54	62	69	75	75	59	dB	1
Apparent Sound Reduction Index, R'	29	49	48	55	63	70	76	76	59	dB	6
Normalised Level Difference, DnT	28	48	47	54	62	69	75	75	59	dB	6
Ctr	-4								DnTw+Ctr	55	

Reference 1	ISO 717-1 Acoustics - Rating of sound insulation in building elements	Criteria	55	1997
Reference 2	BCO Guide - Best Practice in the specification for offices - 2005	ISO		
Reference 3	IOA Diploma Formula Sheet Edition 5	British Council for Offices		2005
Reference 4	Building Bulletin 93	Institute of Acoustics		2003
Reference 5	Noise Control in Building Services SRL Ltd	Dfes		2003
Reference 6	BS12354-1 Building Acoustics - Estimate of acoustic performance of buildings from performance of elements	Pergamon		1988
Reference 7	Engineering Noise Control Bies and Hansen	Bsi		2000
		Spon Press		2003

- Note 1 Ceiling and floor reverberation time does not have an uplift at 63 or 125 Hz
- Note 2 Standard room reverberation times include an uplift at 63 and 125 Hz as per BB93
- Note 3 Reverberation time in source and receive room voids assumed to be the same.

Appendix E: Glossary

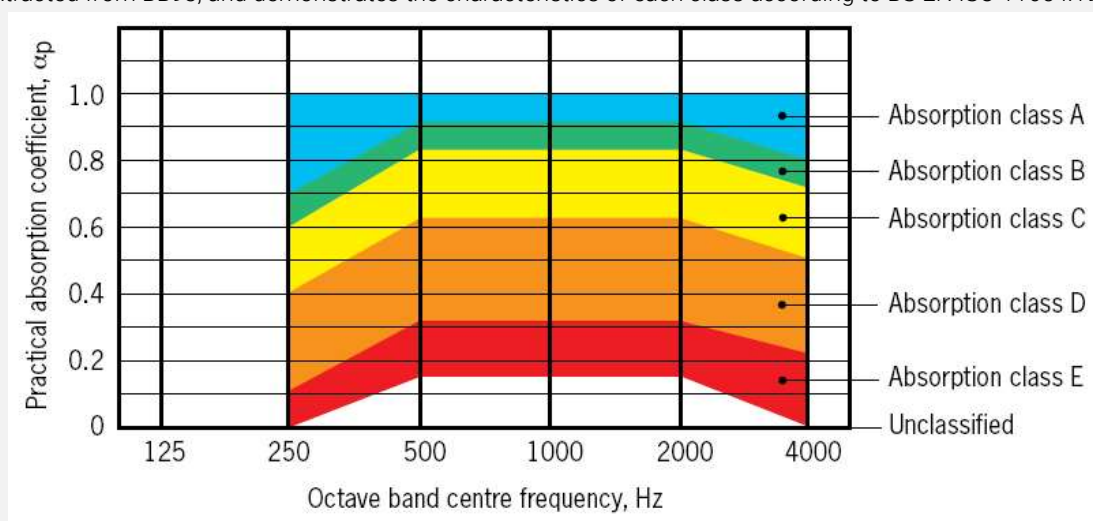
The list below details the major acoustical terms and descriptors, with brief definitions:

'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Absorption Class

In order to categorise the absorptive effects of different elements (such as ceiling tiles), classes from A to E were derived, as per BS EN ISO 11654:1997. A class 'A' absorber would be very acoustically absorptive, a Class 'E' absorber would be less absorptive and more reflective. A product that is highly reflective may not be classified. The chart shown below has been extracted from BB93, and demonstrates the characteristics of each class according to BS EN ISO 11654:1997.



Absorption Coefficient (α)

A value usually between 0 and 1 assigned to a material to indicate how acoustically absorptive it is. 0 indicates a material is entirely reflective (and therefore not absorptive), and 1 indicates a material is entirely absorptive (and therefore not reflective). Absorption coefficients are usually given for each octave band between 125Hz and 4kHz, or as an overall 'practical' coefficient.

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

$$30 \text{ dB} + 30 \text{ dB} \neq 60 \text{ dB}$$

$$30 \text{ dB} + 30 \text{ dB} = 33 \text{ dB}$$

$D_{nTw} + C_{tr}$

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply $L_1 - L_2$.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Impact Noise

Re-radiated noise as a result of impact(s) on a solid medium, such as footfalls on floors. Measured in L'_{nTw} .

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The 'A' weighted noise level exceeded for 90% of the time period T, described or measured. The '90' can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The 'A' weighted 'equivalent' noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The 'A' weighted maximum measured noise level. Can be measured with a 'slow' (1 sec) or 'fast' (0.125 sec) time weighting.

L_{Amin}

The 'A' weighted minimum measured noise level.

L'_{nTw}

The weighted, normalised impact sound pressure level measured in a receive room below a source room.

L	Is the spatially averaged impact sound pressure level measured in a receive room.
L'_{nT}	Is the normalisation of the measured impact sound pressure level to the expected (in comparison to the measured) reverberation time in the receiving room.
L'_{nTw}	Is the weighted and normalised impact sound pressure level. This value is the result of applying a known octave band weighting curve to the measured result.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf} , RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to 2×10^{-5} Pa.

Speech Intelligibility, Speech Transmission Index (STI)

Speech intelligibility is the measure of how well a speaker's voice can be heard within a given space. Speech intelligibility within a room depends on a number of factors, including reverberation time and background noise. The Speech Transmission Index or STI has emerged as the favoured method of describing speech intelligibility.

Subjective Effect of Changes in Sound Pressure Level

The table below details the subjective effects of different variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.