

JOSTEC

BUILDING REGULATIONS COMPLIANCE SERVICES



REPORT TITLE. SECHIDA REPORTING. ASSESSMENT OF
LATION MEASURES FOR
MAINTENANCE USE. MAINTENANCE AT
173-175 FRIAR STREET, READING

REPORT REFERENCE. 2704

ISSUED TO: JTSCH
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DATE: 14th 2022

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2.	DESCRIPTION
3.	NOISE ASSESSMENT CRITERIA
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- A noise survey and assessment has been carried out by JOSTEC for 173-175 Essex Street, Reading RG1 1UE
- The noise assessment is to be submitted to Reading Borough Council as part of a planning application
- Day and night period noise to the development is predicted to be below the maximum acceptable level
- The development site is not exposed to exceptional noise levels or noise from aircraft
- Results of the noise survey are used to assess the need for noise insulation measures for the development. The scheme, which includes sound insulation measures, is verified by composite sound reduction index calculation of the overall building envelope.

1 INTRODUCTION

JosTec has been commissioned to undertake a noise survey and assessment for a proposed commercial/residential development at 1/2

The scheme of noise insulation measures for the development including consideration of any proposed acoustic performance of the proposed ground floor residential first floor level for glazing and any other measures within the residential accommodation is required to protect the amenity of future residents. This report presents results of a noise survey and assessment of the site.

- Description of the development.
- Review of noise limit criteria.
- Noise survey including subjective observations.
-

2 DEVELOPMENT

The development site is located in a high street with a mixture of ground floor retail/commercial businesses with residential accommodation on upper floors.

The development includes a new ground floor commercial unit and a new unit to be converted commercial and residential space including ground floor retail space with units above first floor level. A location plan and drawings of the proposed development are included in Appendix A.

Overall noise levels are measured towards the front of the development and are typical of a high street location. They comprise principally of contributions from pedestrian traffic on the High Street, traffic on the High Street, The Hubbus and surrounding roads, and other commercial activities associated with nearby businesses. Noise levels to be measured on the development are measured to be on a hybrid of the building structure and the High Street. Further details on noise levels and sources are provided in Section 4.2 of this report.

NOISE ASSESSMENT CRITERIA

Potential sources of noise affecting the potential residential accommodation located on upper floors of the proposed development include:

1. Noise transfer from the commercial units
2. Noise transfer via the ground/first floor and
3. Ambient environmental noise

Similar developments in Reading Borough and other local authorities have approved and employed the methodology and guideline noise levels given in the table below, which are considered relevant to this development:

- BS 4142: 2014 + A1: 2019
"Methods for rating and assessing industrial and commercial sound"
- BS 6871: 2014
"Acoustic design for noise reduction for buildings"

Guideline criteria for noise standards appropriate to the noise sources listed above are outlined in section 4.2.

2.1 Commercial Plant Equipment Noise Criteria

BS 4142: 2014+A1: 2015 "Methods for rating and assessing industrial and commercial sound" is the standard used by Reading Borough Council to assess noise from commercial plant equipment. BS 4142 describes an indication of the impact according to the numerical difference between the rating level of the equipment and the background sound level, which is assessed at 1m distance from the nearest non-associated residential window.

Whilst the exact nature of the ground floor uses and their requirements for plant equipment is unknown at the time of writing, the BS 4142 indication of impact criteria is nonetheless relevant in the assessment of any potential commercial plant equipment at this development area is summarised in Table 1.

Rating level - background	Indication of impact
+10dB	Significant adverse impact
+5dB	Adverse impact
≤0dB	Low impact

Table 1: BS 4142 rating level indication

As a result of the BS 4142 rating level indicated in Table 1, the Council would not require a more stringent requirement such that the rating level be at a specified level below the background sound level, e.g., Rating level < Background sound level + 5dB or 10dB.

From experience with similar plant noise assessments carried out within Reading Borough Council it is anticipated that a Rating level of < Background sound level + 10dB criterion may be considered a potential maximum noise requirement used to assess any potential commercial plant noise is summarised below in Table 2 together with the BS 4142 indication of impact criteria.

Rating level - background sound level	Indication of impact
+10dB	Significant adverse impact
+5dB	Adverse
≤0dB	Low impact
-10dB	Reading Borough Council requirement

Table 2: BS 4142 rating level indication together with Reading Borough Council requirement

It is recommended to ensure that the Rating level of the plant equipment is below the Reading Borough Council noise requirements prior to installation of any plant equipment.

2.2 Separation – Floor Commercial/First Floor Residential Noise

The current minimum standards for airborne sound insulation performance requirements for floors in new build/conversion residential properties given in Part E of Building Regulations for England and Wales (BRPV1) are a benchmark by which to set more stringent criteria.

Current BREVV minimum airborne sound insulation performance for floors in new build properties is $D_{nT,w} + C_{tr} \geq 45$ dB, to which local authorities often add 5dB and in some cases a further 10dB improvement may be required for the residents' business.

BS 8233:2014 (BS 8233:2014), Section 7.5 Internal noise, Table 7.5.1, sets out a range of minimum airborne sound insulation $D_{nT,w}$ values (note: these are not $D_{nT,w} + C_{tr}$ values) for partitioning structures broadly dependent on the noise activity sensitivity and activity requirements for each room type shown below in Table 2.

Private requirement	Activity noise in source room	Noise sensitivity of receiving		
		Low sensitivity	Medium	High
Mode	Very high	45	50	57
	High	45	45	50
	Typical	42	42	45
	Low	42	42	45
Mode	Very high	45	50	57
	High	42	42	45
	Typical	42	37	42
	Low	42	No rating	42
Not p	Very high	45	50	57
	High	42	42	45
	Typical	42	37	42
	Low	42	42	45

At $D_{nT,w} \geq 55$ dB, it is often difficult to obtain on site and room differences requiring these levels should be avoided wherever practical.

Table 2 – Example of minimum internal noise levels (dB $D_{nT,w}$)

It is recommended to seek the advice of Reading Borough Council for their specific airborne sound insulation performance criteria for the separation ground/first floor prior to design and construction.

3.3 Ambient Environment – Guidance

Regarding the assessment of ambient environment the methodology and guideline noise levels shown in BS 6841:2014 section 7.7.2 *Guidance for use by local authorities* including borough Council and is considered appropriate for use in this assessment and report.

As set out in BS 6841:2014 it is desirable that ambient noise levels inside residential dwellings do not exceed the guideline values shown below in Table 4:

Area	Room	23:00 to 07:00 (Night period)	23:00 to 07:00 (Night period)
Living room	Bedroom	$\leq 25 \text{ dB LAeq,8h}$	
Dining room	Dining room / Kitchen	$\leq 40 \text{ dB LAeq,8h}$	
Garage	Garage	$\leq 35 \text{ dB LAeq,8h}$	$\leq 30 \text{ dB LAeq,8h}$

Table 4 – Indoor ambient noise levels for dwellings

It is noted that regular individual noise events can cause sleep disturbance and that a guideline value may be set in terms of SEL or L_{Amax} depending on the character and number of events per night. Whilst this guidance relates principally to night period noise from aircraft and trains it is nonetheless considered appropriate to apply an L_{Afm} criterion for bedrooms during the night period for this development.

Specific numerical guidance on night period L_{Afm} values for noise into bedrooms is provided in the pre-2014 L_{Afm} guidance for bedrooms (BS8233:1996) and BS8233:2014. Notwithstanding the guidance with World Health Organisation noise Guideline values, the L_{Afm} values for bedrooms during the night period are 45 dB LAeq,8h for bedrooms during the night period.

As the L_{Afm} criterion is applied to bedrooms, noise should not regularly exceed L_{Afm} 45 dB , it is not intended that the requirement be applicable to infrequent night period very high noise level events such as the siren of passing emergency vehicles.

NOISE SURVEY

In order to assess the effectiveness of the mitigation measures proposed for the development, it is necessary to determine the existing noise levels at the site. To obtain background information on the noise environment, a noise survey was carried out to represent typical positions. Details of the noise survey carried out by Jostec are provided in the Noise Survey Report.

1 Noise Survey Details

A noise survey has been carried out at the development site using a logging type sound level meter from Thursday 2nd March 2022 to Saturday 5th March 2022. The weather was mostly dry and calm/light wind conditions during the day and also the night time of the survey.

A primary long term monitoring noise survey position was selected at ground floor level on the front facade of the development looking over the pedestrianised Town Hall Square. This location was chosen as a representative worst case position for passing pedestrian/vehicular traffic on Fia Street/Market Place, and the development.

The position was achieved by establishing the sound level meter on a tripod/pole arrangement external to the building level at a height of 1.5m above ground level. The noise levels were recorded at the facade levels. Measurements were recorded in terms of continuous 5 minute samples of principally broadband $L_{A1/90}$, L_{Ae} and L_{A1-90} values together with L_{7-9} values over the day.

Additional short term monitoring positions were set up around the site with equipment positioned 1.5m above ground level to assess variations in noise levels at other positions relative to levels at the primary position.

Long term monitoring positions are shown in Appendix A.

4.2 Noise Instrumentation

Details of the instrumentation used for the noise survey are provided in Appendix B. Sound level meters were calibrated before and after measurements using a certified calibrator. Significant drift in the readings was not observed.

4.2 Noise Survey Results & OI

Noise levels to the development site comprise principally of contributions from passing traffic on Town Hall Square, road traffic on Fildes Street, the road network surrounding streets, activity associated with commercial activities in the locality, but distant road traffic on surrounding roads. Noise levels rise steadily from the quietest locations, where they remain at their highest until the late evening / night, and are at their lowest between approximately 04:00 and 05:00.

Background level measurements taken at the rear of the development were a 2 dB lower than those recorded concurrently at the primary measurement position. This variation is due to local background noise survey data recorded at the primary measurement position.

In accordance with normal acoustic measurement and assessment procedures, measured 1m free field noise survey levels are presented in the following table, which are generally higher than levels measured away from buildings (free field values). Complete details of the noise survey in terms of L_{Aeq} , L_{Ae} and L_{Afm} values are provided in graphical format in Appendix C. Summary average day and night period location calibrated equivalent free field L_{Aeq} , L_{Ae} and L_{Afm} values are shown in Table 5 below.

Location	Time Period	$L_{Aeq,T}$ (dB)	$L_{Ae,T}$ (dB)	$L_{Afm,T}$ (dB)
Location #1. Front Entrance, 1/3-1/3 Fildes Street	Daytime - 23:00 Nighttime 23:00 - 07:00	60.0	58.5	56.0
Location #2. Rear Entrance, 1/3-1/3 Fildes Street	Daytime - 23:00 Nighttime 23:00 - 07:00	60.0	57.7	55.0

Table 5: Summary average noise levels for day

In order to accurately assess the $L_{Amax,T}$ criterion for environmental noise, a statistical analysis of the noise data from the development is required. The 95th percentile ($L_{Amax,T}$) is used to establish the maximum sound pressure level that is exceeded on average (95th percentile) and is shown below in figure 1:

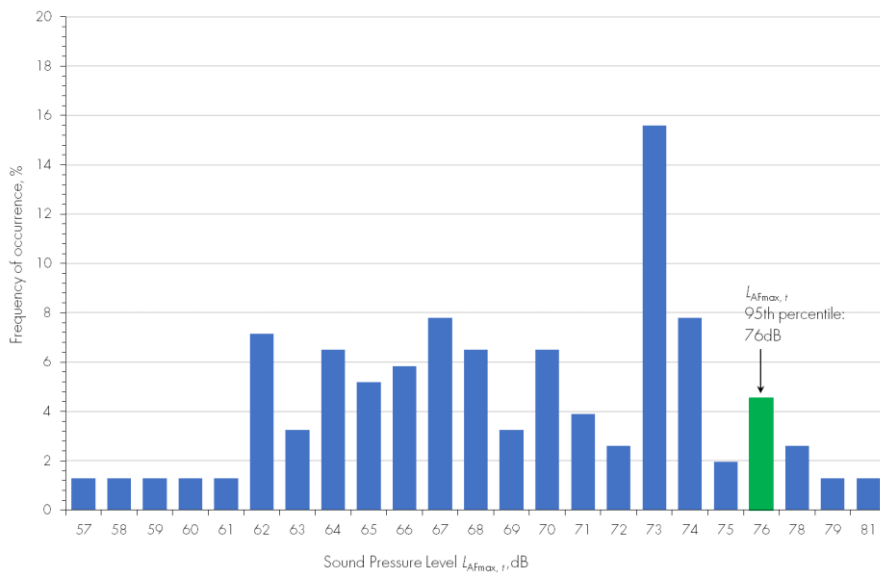


Figure 1: frequency of occurrence of sound maximum sound pressure levels

Based on the maximum night period value of $L_{Amax,T}$ of 76dB, it is exceeded 5% of the time.

Table 6 below shows the average day and night period L_{eq} values taken from Table 5 together with the statistically occurring highest $L_{Amax,T}$ value used in the calculations for the building sound insulation performance rating of 3.

Period	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)
Day 07:00 - 22:00	51.7	-
Night 22:00 - 07:00	53.5	61

Table 6: Day and night period average and maximum sound pressure levels used in calculations

5. NOISE ASSESSMENT

It can be seen that day and night period levels are moderate and the site is suitable for the proposed development providing that an appropriate specification of noise insulation is implemented to ensure compliance with the noise criteria as detailed in section 3.

5.1 Commercial Plant Equipment Assessment

The measured or calculated sound pressure levels for the proposed development will need to be compared to the relevant background sound level during hours of operation of the equipment and its noise impact assessed at the nearest residential windows.

Representative minimum background sound levels were determined for day and night periods. L_{AEC} levels for the proposed development (Location #2, worst case scenario) have been assessed and checked using the statistical analysis method detailed in Note 4, Section 0.1.4 of BS 4142. Statistical analysis of the background sound level results is shown in Figures 2 & 3 below and attached.

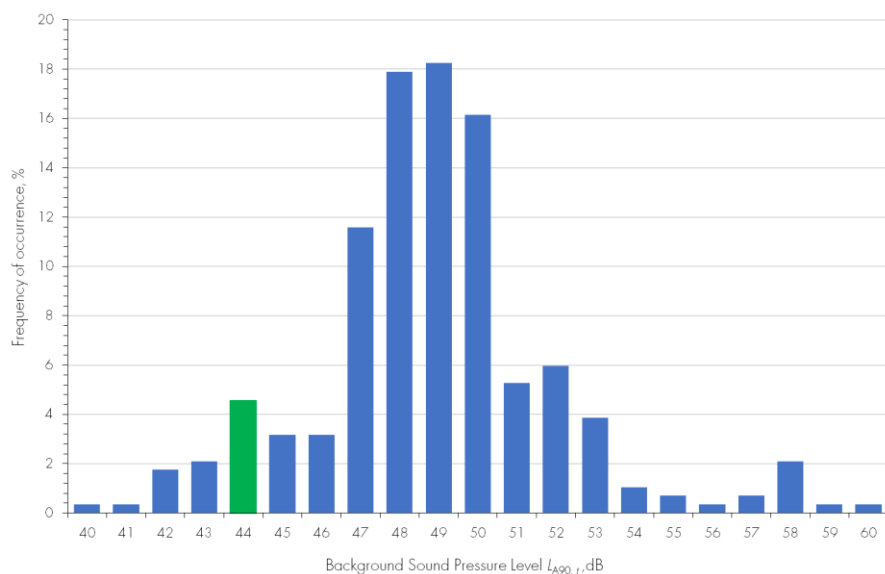


Figure 2. Frequency of occurrence of day

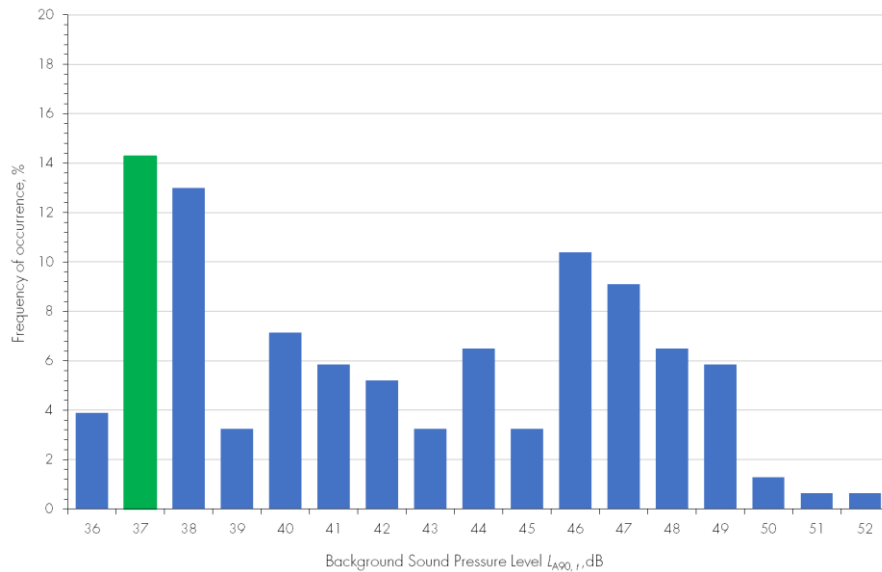


Figure 2 Frequency of occurrence of night period background sound level

Representative minimum background sound level values for day and night periods are provided below in Table 7:

	Day period 07:00 – 23:00	Night period 23:00 – 07:00
Sound level $L_{A90,1}$	44dB	37dB

Table 7: Representative minimum background sound levels for day and night periods

For proposed development involving residential units, values in Table 7 may be used to determine the equipment rating level in Table 2. Note that where plant equipment is operational in both day and night periods, the lower night period representative minimum background sound level value should be used in assessment.

It is recommended to verify any additional local or site specific requirements with the relevant Parish Council prior to the installation of any equipment.

Separating Ground/First Floor Noise Assess

Where ground and first floor residential accommodation will need to include sufficient sound insulation to protect the amenity of residents and will largely depend on the nature of the commercial development.

The BS 6871 metric of maximum risk $L_{nT,w}$ values detailed in Section 5.2 Table 2 may be used to aid selection of the floor construction and it is recommended to seek the advice of Reading Borough Council for any specific noise considerations and construction.

5.2 Building Envelope Sound Insulation Scheme Assessment

For this development the scheme of noise insulation measures to protect against noise to inside the residential dwellings relates to the acoustic design and specification of elements of the residential building which includes the separation between the ground floor residential accommodation, external walls, ground roof/ceiling:

Each the addition of Reading Borough Council for approval of sound insulation measures to ground/first floor prior to design and construction.

The external walls and roof/ceiling structures to the development will by default provide a relatively high level of noise insulation and therefore as for most residential sites the dominant

by following the rigorous calculation procedures outlined in Section G.2 of Annex G (informative) of British Standard BS 8233:2014 a specification for acoustic performance has been set for the measures for the whole residential building. This is assessed item by item in Sections 5.2.1 to 5.2.4 of the accompanying pages.

Acoustic calculations are provided for day and night period noise intrusion into the living/dining room and the bedroom of the loft apartment, selected as representing worst case scenario rooms with the highest noise levels to masonry roof/ceiling system and so highest incident noise levels. Copies of calculations are provided in Appendix D.

The calculations use a spreadsheet calculation based on Section G.2 of Annex G (informative) of British Standard BS 8233:2014 and BS EN 12354-3:2006. This form of spreadsheet is used in accordance with standard industry practices.

The calculations confirm that with the proposed noise insulation measures the predicted noise levels into rooms of the development comply with BS 8233:2014 guideline values as detailed in Section 3.3 Table 4.

5.2 External walls

External walls of the proposed development are understood to be traditional solid masonry external walls.

Description	Sound Reduction index $R_{w,dB}$					
	125	160	200	250	315	400
Traditional solid masonry	7	14	17	20	23	26

Table 5.2: Sound insulation performance

5.3 Glazing

Suitable sound insulation performance of all windows or internal doors may be achieved with moderate acoustic performance double glazing type 4-star-ap-4, typically $\geq R_{w,dB}$.

Description	Sound Reduction index $R_{w,dB}$					
	125	160	200	250	315	400
4-star-ap-4 double glazing ≥ 30	7	7	9	25	25	35

Table 5.3: Double glazing insulation performance

5.3.3 Ventilation

It is anticipated that a ventilation system will need to be provided for the proposed development, such that residents of the proposed development are able to have access to mechanical ventilation without needing to open windows.

This is ordinarily achieved through use of either passive type mechanical ventilators or purpose built room or whole house type mechanical ventilation system; the distinction between the two is generally being determined by the reasons.

It is sometimes required by a Local Planning Authority that where a residential development site is in a potentially noise sensitive area, or is subject to listed buildings, that the building's sound insulation measures shall include provision of mechanical ventilation. However, in locations that are not subject to especially high noise levels, a status of low noise, passive ventilators provide a moderately good level of sound insulation, usually sufficient to comply with the need for mechanical ventilation.

Specification options for either passive ventilators or mechanical ventilation are provided below. It is recommended the developer seeks prior approval with Reading Borough Council, whichever approach is chosen.

Passive Ventilators

Values in Table 10 show a specification for acoustic performance passive type ventilators suitable for the requirements of the development.

Description	Octave Band Centre frequency (Hz)					
	Sound Pressure Level $L_{p,e}$ dB					
	125	160	200	250	315	400
High acoustic performance ventilator ($L_{p,e} \leq 34$)	38	3	34	41	44	4
Moderate acoustic performance mechanical ventilator ($L_{p,e} \leq 33$)	52	52	4	35	35	52

Table 10: Specification for ventilator sound insulation performance

Option 2: Mechanical Ventilation

This option is typically either a "whole-house" heat recovery type mechanical ventilation system or

mechanical ventilation systems by default have relatively high sound insulation performance (i.e. reduce noise from outside to inside), typically $> D_{n,e,w}$ 45dB and would readily reduce external noise to comply with the internal noise requirements. If a mechanical ventilation system is used then the acoustic specification is that self noise of the system must not exceed the internal noise requirements.

To achieve the requirements it is recommended that the system noise level will need to be circa at least 30dB lower than the day and night period requirements to allow for the accumulation of noise sources.

Therefore it is recommended that the system noise level $L_{n,e}$ must be no more than 30dB for living/dining areas and 35dB for bedrooms during the night period.

Where the self-noise of the system could potentially exceed these limits then noise of the systems would be sufficiently reduced typically by using acoustic treatment or a type flexible ducting between the system unit and the room grilles.

5.2 Performance

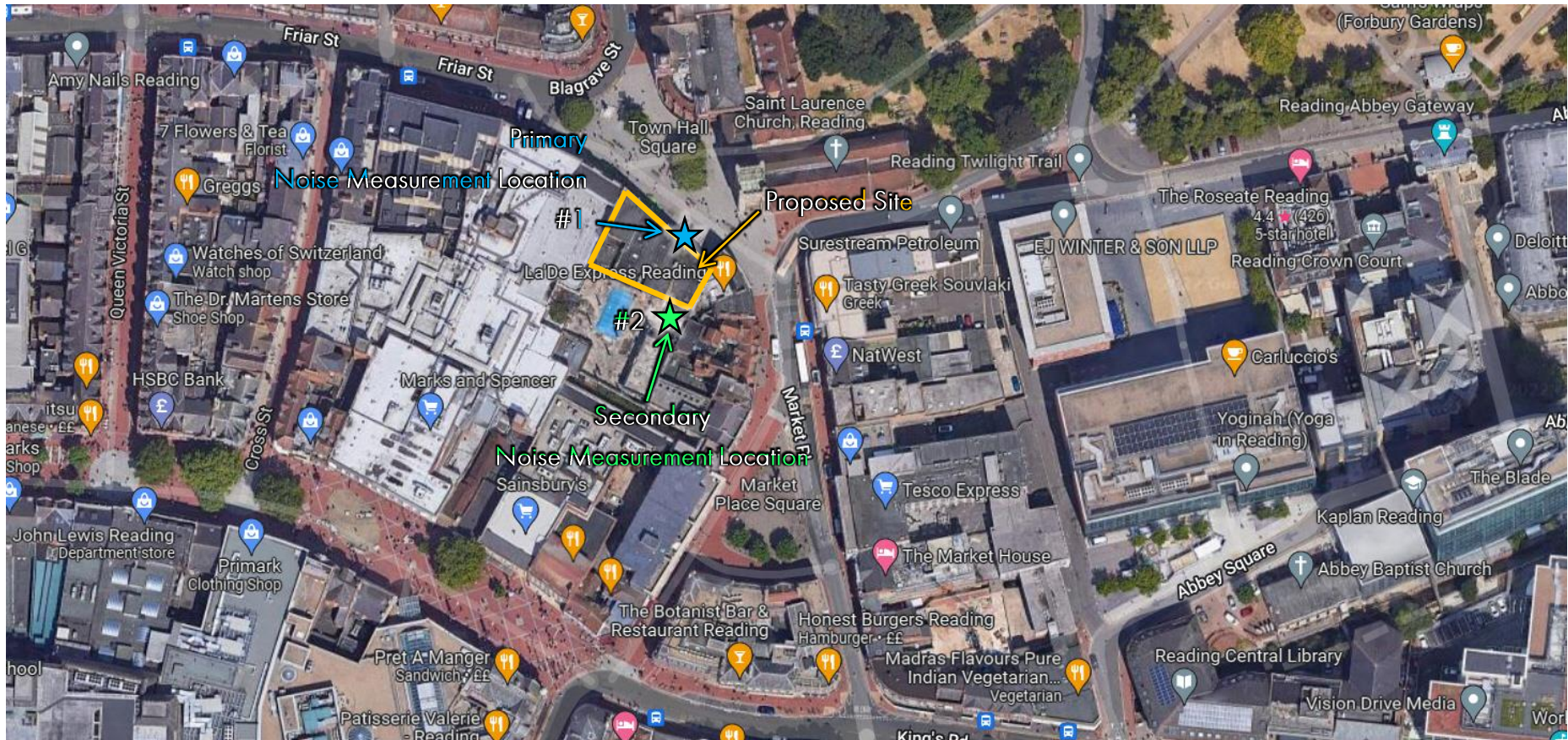
The roof structure and associated ceilings are to be area flat/pitched position area type with double layer plasterboard.

Description	Sound Reduction index $R_{w,dB}$					
	125	250	500	1K	2K	K
Insulated flat roof & suspended ceiling	27	27	27	40	57	67

Table - roof & ceiling sound insulation performance

APPENDIX

Site Location Map



DIA A

Drawings Of The Proposed First Floor



DIV A

Details Of The Development

SECOND FLOOR



APPENDIX A

Development:
Proposed Third Floor



APPENDIX

Drawings of the
proposed fourth floor



DIA A

Description Of The

Proposed Fifth Floor



DIA A

DESCRIPTION OF THE
PROPOSED FRONT ELEVATION



Proposed Front Elevation

1:100



Project Name
123-456789 Street,
City, State, Zip

Client Name
Project Location
Address Line

Project Name
Project Location

Drawn By	Drawn Date
John Doe	12/12/2022
John Doe	12/12/2022

APPENDIX

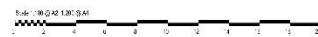
DESCRIPTION OF THE

PROPOSED REAR ELEVATION



Proposed Rear Elevation

1:100



NOTES

1. The building is a proposed rear elevation of the building.

2. The building is a proposed rear elevation of the building.

3. The building is a proposed rear elevation of the building.

DATE	BY	FOR
10/10/2022	JOSTEC	1:100
10/10/2022	JOSTEC	1:100

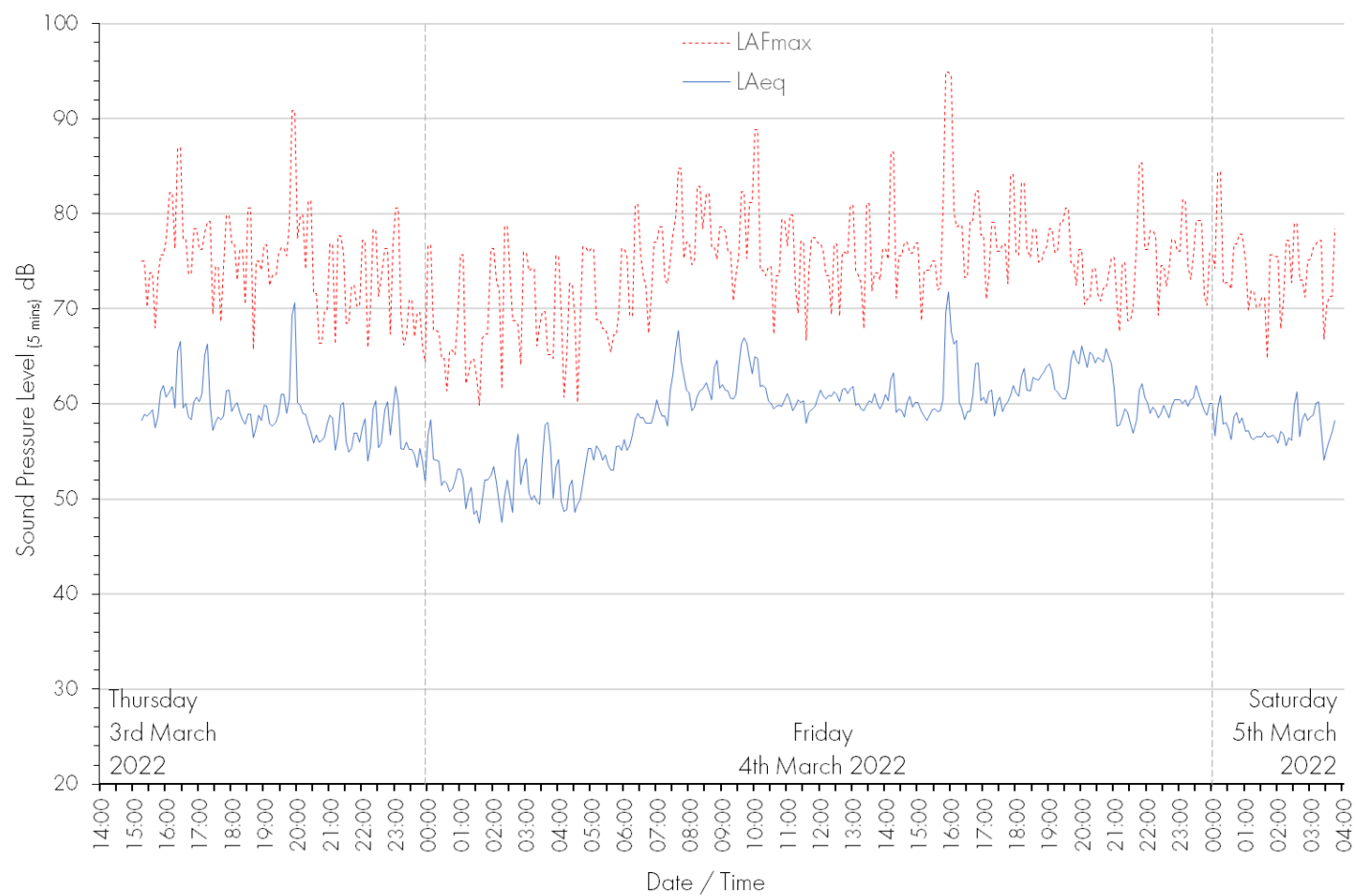
APPENDIX D

Noise Survey Instrumentation

- Svantek Class 1 noise monitoring station model 207 serial number 75090 with integrated pre-amplifier plus ST30 microphone serial number 78375 in weatherproof outdoor environmental kit and tripod arrangement
- Brüel Kjaer type 2270 Class 1 sound level meter number 100020 with type 2C microphone serial number 14457 and type 4109 microphone serial number 2700
- Brüel Kjaer calibrator type 4021 serial number 3001014 (UKAS-certified)

APPENDIX C

NOISE SURVEY RESULTS



APPEN

Building Envelope Acoustic Calculations

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 41, bedroom

NOISE CONDITION : Daytime 16 hour Leq 58.7dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	58.7	58	55	55	54	52	48
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	3.6	Traditional solid 9" brick					
Windows	1.2	4-20-4 double glazing, Rw32dB					
Doors	0.0	None to room					
Roof & associated ceiling	15.6	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	1	Moderate acoustic performance ventilator ≥ Dn,e,w 33dB					
Element Sound Reduction Index:							
Element	Area (m²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	3.6	39	44	51	58	63	68
Windows	1.2	22	21	27	38	46	25
Doors	0.0						
Roof & associated ceiling	15.6	27	37	43	49	57	61
Ventilators (Dn,e)	1	33	33	34	35	35	32
Overall Sound Reduction All Elements Combined		-26.6	-30.6	-34.5	-37.6	-38.0	-33.0
Sample Room Volume (m³):		35.9					
Sample Room Building Envelope Surface Area (m²):		20.4					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Living Room	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.40	0.40	0.35	0.30	0.30	0.30
Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	27.7	36.4	28.9	24.5	19.8	17.0	17.9

APPENDIX D

Building Envelope Ac

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 41, living/dining

NOISE CONDITION : Daytime 16 hour Leq 58.7dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	58.7	58	55	55	54	52	48
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	6.2	Traditional solid 9" brick					
Windows	1.2	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	12.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	1	High acoustic performance ventilator ≥ Dn,e,w 39dB					
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	6.2	39	44	51	58	63	68
Windows	1.2	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	12.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	38	36	34	41	49	54
Overall Sound Reduction All Elements Combined		-25.9	-28.2	-33.6	-41.6	-45.6	-46.5
Sample Room Volume (m³):		27.6					
Sample Room Building Envelope Surface Area (m²):		19.4					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	26.5	36.8	30.9	23.9	15.0	8.6	3.6

APPENDIX D

Building Envelope Ac

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 41, bedroom

NOISE CONDITION : Night-time 8 hour Leq 53.5dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	53.5	53	50	50	49	47	42
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	6.2	Traditional solid 9" brick					
Windows	1.2	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	12.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	1	High acoustic performance ventilator ≥ Dn,e,w 39dB					
Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m²) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	6.2	39	44	51	58	63	68
Windows	1.2	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	12.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	38	36	34	41	49	54
Overall Sound Reduction All Elements Combined		-25.9	-28.2	-33.6	-41.6	-45.6	-46.5
Sample Room Volume (m³):		27.6					
Sample Room Building Envelope Surface Area (m²):		19.4					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	21.2	31.6	25.7	18.7	9.7	3.3	-1.7

Building Envelope Ac

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 41, bedroom

NOISE CONDITION : Night-time 8 hour L_{fmax} 76dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
L _{fmax,ff}	76.0	76	72	72	71	69	65
Building Envelope Details For Sample Room:							
Element	Area (m ²) or Vent No	Element Specification / Description					
Walls	6.2	Traditional solid 9" brick					
Windows	1.2	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	12.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	1	High acoustic performance ventilator ≥ D _{n,e,w} 39dB					
Element Sound Reduction Index:							
Element	Area (m ²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	6.2	39	44	51	58	63	68
Windows	1.2	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	12.0	27	37	43	49	57	61
Ventilators (D _{n,e})	1	38	36	34	41	49	54
Overall Sound Reduction All Elements Combined		-25.9	-28.2	-33.6	-41.6	-45.6	-46.5
Sample Room Volume (m ³):		27.6					
Sample Room Building Envelope Surface Area (m ²):		19.4					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
L _{fmax,2}	43.8	54.1	48.2	41.2	32.2	25.9	20.9

APPENDIX D

Building Envelope Acoustic Calculations

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 43, bedroom

NOISE CONDITION : Daytime 16 hour Leq 55.7dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	55.7	55	52	52	51	49	45
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	14.2	Traditional solid 9" brick					
Windows	2.4	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	13.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	2	Moderate acoustic performance ventilator ≥ Dn,e,w 33dB					
Element Sound Reduction Index:							
Element	Area (m²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	14.2	39	44	51	58	63	68
Windows	2.4	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	13.0	27	37	43	49	57	61
Ventilators (Dn,e)	2	33	33	34	35	35	32
Overall Sound Reduction All Elements Combined		-25.4	-26.9	-32.6	-36.1	-36.2	-33.4
Sample Room Volume (m³):		29.8					
Sample Room Building Envelope Surface Area (m²):		29.6					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Living Room	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.40	0.40	0.35	0.30	0.30	0.30
Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	29.0	37.1	32.0	25.9	20.8	18.3	16.9

Building Envelope Ac

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 43, living/dining

NOISE CONDITION : Daytime 16 hour Leq 55.7dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	55.7	55	52	52	51	49	45
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	6.7	Traditional solid 9" brick					
Windows	2.7	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	15.6	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	2	Moderate acoustic performance ventilator ≥ Dn,e,w 33dB					
Element Sound Reduction Index:							
Element	Area (m²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	6.7	39	44	51	58	63	68
Windows	2.7	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	15.6	27	37	43	49	57	61
Ventilators (Dn,e)	2	33	33	34	35	35	32
Overall Sound Reduction All Elements Combined		-24.2	-25.7	-31.6	-35.3	-35.4	-32.7
Sample Room Volume (m³):		35.8					
Sample Room Building Envelope Surface Area (m²):		25.0					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	26.8	35.5	30.4	22.9	18.3	15.8	14.4

Building Envelope Acoustic Calculations

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 43, bedroom

NOISE CONDITION : Night-time 8 hour Leq 50.5dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	50.5	50	47	47	46	44	39
Building Envelope Details For Sample Room:							
Element	Area (m ²) or Vent No	Element Specification / Description					
Walls	6.7	Traditional solid 9" brick					
Windows	2.7	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	15.6	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	2	Moderate acoustic performance ventilator ≥ Dn,e,w 33dB					
Element Sound Reduction Index:							
Element	Area (m ²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	6.7	39	44	51	58	63	68
Windows	2.7	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	15.6	27	37	43	49	57	61
Ventilators (Dn,e)	2	33	33	34	35	35	32
Overall Sound Reduction All Elements Combined		-24.2	-25.7	-31.6	-35.3	-35.4	-32.7
Sample Room Volume (m³):		35.8					
Sample Room Building Envelope Surface Area (m²):		25.0					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	21.6	30.2	25.2	17.7	13.0	10.5	9.2

APPENDIX D

Building Envelope Acoustic Calculations

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : 5th floor front façade apartment 43, bedroom

NOISE CONDITION : Night-time 8 hour L_{fmax} 73dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,ff	73.0	73	69	69	68	66	62
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	6.7	Traditional solid 9" brick					
Windows	2.7	4-airgap-4 double glazing ≥ Rw30dB					
Doors	0.0	None to room					
Roof & associated ceiling	15.6	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings					
Ventilators	2	Moderate acoustic performance ventilator ≥ Dn,e,w 33dB					
Element Sound Reduction Index:							
Element	Area (m²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	6.7	39	44	51	58	63	68
Windows	2.7	17	17	25	35	35	35
Doors	0.0						
Roof & associated ceiling	15.6	27	37	43	49	57	61
Ventilators (Dn,e)	2	33	33	34	35	35	32
Overall Sound Reduction All Elements Combined		-24.2	-25.7	-31.6	-35.3	-35.4	-32.7
Sample Room Volume (m³):		35.8					
Sample Room Building Envelope Surface Area (m²):		25.0					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20
Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,2	44.1	52.8	47.7	40.2	35.5	33.1	31.7