

REPORT TITLE: NOISE ASSESSMENT FOR PROPOSED FLATS AT
75-77 LONDON STREET, READING, BERKSHIRE RG1 4QA

REPORT REF: 15149-002

ISSUED TO: Shennai Group
75-77 London Street
Reading
Berkshire
RG1 4QA

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SUMMARY

- This report presents results of an acoustic assessment based on site surveys conducted by Philip Acoustics in order to support planning application for proposed upper floor residential flats.
- A scheme for sound insulation including scheme for sound insulation to proposed residential flats from external traffic noise as well as operational noise limits for entertainment noise in ground floor Function Rooms.

1. INTRODUCTION

Philip Acoustics has been commissioned to undertake an noise survey and assessment for six proposed new conversion flats at first and second floor level at 75-77 London Street, Reading, Berkshire RG1 4QA. The noise survey and assessment will include;

- Noise measurement survey results of external traffic noise on London Street.
- Sound insulation test results between ground floor venue area and proposed residential area.
- Recommendations for noise insulation measures including glazing and vents for flats to meet Reading Borough and national BS8233:2014 standards for internal noise levels.
- Recommendations for operational noise limits in the ground floor venue to mitigate potential noise ingress from music in the venue to the upper floor flats.

2. SITE DESCRIPTION

The site is on the South side of London Road (A327) Reading. The buildings along London Street are a mixture of commercial, offices and residential use.

The proposal is for six new residential flats formed by conversion of part of an existing building over first and second floor levels. Note that the proposed flats are towards the front (London Street) side of the building and that the venue is towards the rear including function rooms at ground floor to the rear which have music on when weddings are held there. Architect's plan drawings for the proposed development are provided in Appendix A.

3. READING BOROUGH & NATIONAL NOISE POLICY

3.1 National Planning Policy & Guidance

It is noted that National Planning Policy Guidance including PPG24 has been withdrawn by The Department for Environment, Food and Rural Affairs (DEFRA) and replaced by the Noise Policy Statement for England (referred to as NPSE) and the National Planning Policy Framework (referred to as NPPF). NPSE was published in March 2010 and NPPF was published in March 2012.

Both of these national policy documents are "high level" documents that define noise management aims, objectives and outcomes in terms of achieving sustainable development rather than numerically defining or categorising acceptable noise levels as included in PPG24. For example, stated aims of NPSE include:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.*

Paragraph 2.8 of NPSE states that *"In the longer term, the Government hopes that existing policies could be reviewed (on a prioritised basis), and revised if necessary, so that the policies and any noise management measures being adopted accord with the vision, aims and principles of the NPSE"*.

3.2 BS8233

BS8233:2014 which replaced BS8233:1999 advises it is desirable that internal ambient noise levels to within residential dwellings do not exceed the guideline values shown below taken from Table 4 of BS8233:2014:

- Living Rooms: $\leq 35\text{dB } L_{Aeq,16\text{hr}}$ daytime 07:00-23:00;
- Bedrooms: $\leq 30\text{dB } L_{Aeq,8\text{hr}}$ night-time 23:00-07:00; (with no $L_{A\text{fmax}}$ requirement)

Note that this is only relevant for “anonymous” environmental sources, for this site means road traffic noise, the limits for music noise levels from the adjoining venue are not anonymous in nature and will therefore be set much lower in Section 4.

3.3 Reading Borough Council Noise Policy

As part of the Reading Borough Local Development Framework, within the Core Strategy (adopted January 2008), Policy CS34 concerns Pollution and Water Resources and policy DM4 within the Sites and Detailed Policies Document (adopted October 2012) concerns safeguarding amenity.

3.31 Core Strategy Policy CS34 (January 2008)

“Development will only be permitted where it will not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development.

Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.”

3.32 Local Development Framework Policy

As part of the Reading Borough Local Development Framework, within the Sites and Detailed Policies Document (adopted October 2012), Policy DM4: Safeguarding Amenity concerns Pollution and Water Resources and includes noise policy of Reading Borough Council.

DM4: Safeguarding Amenity

“Development will not cause a significant detrimental impact to the living environment of existing or new residential properties, in terms of:

*Privacy and overlooking;
Access to sunlight and daylight;
Visual dominance and overbearing effects of a development;
Noise and disturbance;
Artificial lighting;
Vibration;
Dust and fumes;
Smell; or
Crime and safety.*

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy.

As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable.

Where an otherwise acceptable development could change its character to a use that would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes."

4. EXTERNAL NOISE SURVEY & SOUND INSULATION TEST

Details of survey instrumentation used for the noise surveys and sound insulation tests are provided in Appendix B.

4.1 External Noise Survey Details and Procedure

To assess the impact of existing noise sources, noise samples were recorded at the development site generally in accordance with the principles of BS7445 *Parts 1-3 Description and Measurement of Environmental Noise*".

The noise measurement survey was carried out using logging type sound level meter from 12:00 on 16 February to 12:00 17 February to include a full 24 hour period; the weather included dry and light wind conditions during the day and also the night-time periods.

Noise measurements were recorded in terms of 5 minute samples of L_{Aeq} and L_{Amax} values for the measurement periods. Samples of octave band values were also obtained to provide frequency content information of noise levels to assist with acoustic calculations to design acoustic glazing and ventilators of the development.

4.2 Instrumentation

Details of the noise survey instrumentation used are provided in Appendix C. The sound level meters were calibrated before and after the survey measurements using the UKAS certified calibrator.

4.3 Measurement Results and Observations

Complete results of the noise survey are provided in graphical format in Appendix D. The results also show which values are extrapolated to allow calculation of L_{Aeq} (16 hours) (07:00 to 23:00, daytime) and L_{Aeq} (8 hours) (23:00 to 07:00 night-time). Summary overall L_{Aeq} results in terms of daytime and night-time periods are shown in Table 1

Description		Period L_{Aeq}
75-77 London Street (2 nd Floor façade)	Daytime period 07:00-23:00	68.1 dB (16 hour)
	Night time period 23:00-07:00	61.9 dB (8 hour)

Table 1: L_{Aeq} noise levels for daytime and night periods at site façade

Subjectively noise at the site is predominantly due to frequent traffic along London Street with frequent buses. To the rear of the development as well as road traffic, there is some noise contribution from units serving the kitchen and function rooms on the roof to the rear.

4.2 Sound Insulation Test

To determine the level of sound insulation of the existing separating floor between the ground floor venue area of the building which has amplified music at regular hosted wedding banquets and proposed first floor residential flats at the front above, tests were done by playing a very loud white noise source in the ground floor venue area whilst measuring the noise inside the venue area and also in the existing first floor above.

The tests determine the sound insulation performance of the existing structure and include any effect of flanking transmission paths. The tests are important as they will be the basis for setting operational noise limits for amplified music within the wedding venue in order to protect the amenity of future residents.

The tests were carried out on 16 February 2016 for the sound insulation from the rear ground floor venue to the front first floor proposed residential.

Measurements were recorded generally in accordance with procedures outlined in BS EN ISO 140-4:1998 *“Acoustics – Measurement of sound insulation in buildings and of building elements – Part 4: Field measurements of airborne sound insulation between rooms.”*

Results of the sound insulation tests in terms of Level Difference D dB values are provided in graphical format in Appendix C. Summary of the results in terms of lowest measured individual octave band performance for all tests are shown in Table 2.

Description	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Existing ground to first separating floor structure (lowest performance octave band values)	≥48	≥62	≥62	65*	65*	65*	70*

Table 2: Estimated Sound insulation between ground to first floor (Level Difference D dB)

*This are estimates since SI test underestimate due to existing doors - proposed wall

High levels of background noise in proposed first floor residential area means estimates of minimum performance were inferred for 63 to 250Hz bands. The fact that double doors were leaking high frequency during the tests means that 500Hz to 4kHz are estimates of proposed structure (no double doors in the proposed converted scheme).

5 Noise Assessment

5.1 Noise Assessment of External Noise Ingress

The noise levels in table 3 are from the noise survey in terms of $L_{Aeq,16\text{ hours}}$: (07:00-23:00, daytime) and $L_{Aeq,8\text{ hours}}$: (23:00-07:00, night time).

The daytime and night time equivalent free-field noise levels, along with the corresponding external free-field L_{Amax} not normally exceeded.

Description		L_{Aeq} (Free-Field)	L_{Amax} (Typical Free-Field)
London Road façade Measured	Daytime period 07:00-23:00	65.1 dB (16 hour)	87 dB
	Night time period 23:00-07:00	58.9 dB (8 hour)	78 dB

Table 3: Equivalent free-field L_{Aeq} ground floor noise levels and corresponding L_{Amax}

5.2 Noise Assessment of Potential Music Ingress

Noise limits for operational entertainment noise is calculated in Table 4. The calculation is done by utilising the sound insulation performance measured in Table 2 in conjunction with background levels to set an operational noise level such that is 5dB below background noise in each octave band.

Result of the assessment is provided in Table 4.

Description	Overall dBA	Octave Band Centre Frequency Hz Lin dB					
		63	125	250	500	1k	2k
(a) Internal noise levels proposed bedrooms $L_{eq,(5\text{ min})}$	25	36	27	23	20	20	18
(b) Background noise in first floor residential $L_{90,(5\text{ min})}$	18	29	20	16	13	13	11
(c) Target music ingress limit = (b) – 5 dB	13	24	15	11	8	8	6
(d) Sound Insulation between venue and residential	-	48	62	62	65	65	65
(e) Noise limit in venue = (c) + (d)	78	72	77	73	73	73	71

Table 4: Calculation of operational noise limit in Function Rooms

6 Scheme of Noise Insulation Measures & Noise Limits

6.1 Scheme of Noise Insulation Measures

By following the rigorous calculation procedures outlined in Section G.2 of Annex G (informative) of BS8233:2014 a specification for the sound insulation performance of windows has been established as well as an item by item scheme for noise mitigation (sound insulation) measures for the whole residential building

Copy of example acoustic calculations for daytime and night-time noise intrusion into a “worse case” sample living room and bedrooms are provided in Appendix E. The sample living rooms and bedrooms are:

- Flat 4, Living/Kitchen – London Road façade
- Flat 4, Bedroom – London Road façade

The calculations use a spreadsheet calculation based on Section G.2 of Annex G (informative) of British Standard BS8233:2014 and BS EN 12354-3:2000, this form of spreadsheet is used by many acoustic consultancy practices..

The example calculations provided in Appendix E are based on using standard double glazing to living rooms and bedrooms but with acoustic passive ventilation. However, if secondary glazing is used then noise levels into rooms of the flats would also comply as these have, by default, higher sound insulation performance and in that case standard ventilation could be used.

6.11 External Walls

External walls of the proposed conversion flats are proposed to be formed by existing 9” brick (solid masonry) walls and internal plasterboard linings of typically 1 x layers 12.5mm plasterboard.

Values in Table 4 show the expected sound insulation performance for this type of external wall. This form of composite structure wall construction provides a high level of sound insulation.

Description	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Wall Sound Insulation Performance (dB)	41	45	49	57	65*	65*

** Note: SI values limited to upper values 65dB. Higher figures might be obtained at these frequencies but are not quoted.*

Table 4: Masonry wall typical sound insulation performance

6.12 Glazing

Table 5 shows specification of glazing sound insulation performance for different parts of the development.

The performance figures for living rooms and bedrooms in correspond to either asymmetric double glazed system or secondary glazing, details are provided on the following page:

Description	Octave Band Centre Frequency (Hz)						Comments
	125	250	500	1k	2k	4k	
Living Rooms (<i>includes kitchen & dining areas in open plan living areas</i>) and Bedrooms	20	23	32	36	39	40	Standard double glazing $R_w \geq 35$ dB such as 6/18/4 or use any secondary glazing
All Other Room Types	No special acoustic performance requirement						Standard "off the shelf" double glazing will provide typically R_w 30dB and will be more than sufficient

Table 5: Specification for glazing sound insulation performance Sound Reduction Index R dB

Asymmetric double glazing such as 6/18/4 configuration (6mm glass – 18mm air gap – 4mm glass) with overall R_w of 35 dB is typical of the type that would be capable of compliance with the performance figures in BS 8233:2014 for living rooms and bedrooms.

However, there are many permutations of possible configurations and different double glazing manufacturers and suppliers will tend to use their own preferred configurations regarding glass thickness and airgap size. Providing that the overall R_w performance and the individual octave band performance is not less than those specified in Table 4 then any alternative configuration can be used. Details for several possible glazing suppliers that Philip Acoustics is aware of as supplying good quality acoustic performance glazing for residential developments are included in Appendix G.

For all room types other including living rooms or bedrooms, the performance requirement and any normal good quality double glazing system (typical R_w 30dB) will be more than sufficient. Note that although rear and side façades of the development away from Oxford Road are significantly less affected by traffic noise, due to the potential for noise from local music venues, asymmetric double glazing is specified for living rooms and bedrooms for flats in these areas as well.

The windows frames for all living rooms and bedrooms will need to have effective acoustic seals all round. Effective seals are rubber or neoprene beaded "P" type that compresses all around on closure of the windows. Plastic or brush type weathering seals are not classed as effective acoustic seals.

6.13 Ventilation

Values in Table 6 show a specification schedule of ventilator sound insulation performance for Living rooms and bedrooms of the development. Note that it would be acceptable to use mechanical ventilation providing overall self-noise from any system is no higher than L_{Aeq} 25dB.

Description	Octave Band Centre Frequency (Hz)						Comments
	125	250	500	1k	2k	4k	
Living Rooms (<i>includes kitchen & dining areas in open plan living areas</i>) and Bedrooms	43	42	36	37	40	45	High insulation performance proprietary acoustic ventilator typically $\geq D_{n,w}$ 38dB such as Rytons '9x3' Acoustic AirLiner Set with Hit & Miss Ventilator
Other rooms	No special acoustic performance requirement						Standard trickle ventilators can be used, would typically provide $\geq D_{n,w}$ 30dB

Table 6: Specification for glazing sound insulation performance Sound Reduction Index R dB

The ventilator acoustic performance requirement for living rooms and bedrooms corresponds to a high performance ventilator with several specialised ventilator suppliers able to provide an appropriate product. Ventilators all other rooms can be standard non-acoustic type.

Details for several possible ventilator suppliers that Philip Acoustics is aware of as supplying high performance acoustic ventilators for residential developments are included in Appendix G.

6.14 Roof and Ceilings

Roof/ceilings above the new roof extension flats are proposed to be formed by a timber frame structure with a layer of plywood and a waterproof membrane finish. On the inside there will be a layer of insulation and at least a single 12.5mm plasterboard layer. This will provide more than adequate sound insulation to rooms on the third floor.

Values in Table 7 show the expected sound insulation performance for this type of m roof structure.

Description	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Roof Sound Insulation Performance (dB)	27	37	43	48	52	55

Table 7: Timber frame roof typical sound insulation performance

6.2 Noise Limits in Function Rooms

To protect the amenity of future residents of proposed new flats on first and second floors, noise limits have been established in Section 5.2 of this report. The main concern for noise ingress is low frequency noise from music, particularly the 63Hz and 125Hz octave bands. Therefore the limits established in 5.2 have been adjusted slightly and are recommended as follows;

Description	Overall dBA	Octave Band Centre Frequency Hz Lin dB					
		63	125	250	500	1k	2k
Noise levels in Function Rooms not to be Exceeded L_{eq}	80	65	65	70	70	70	75

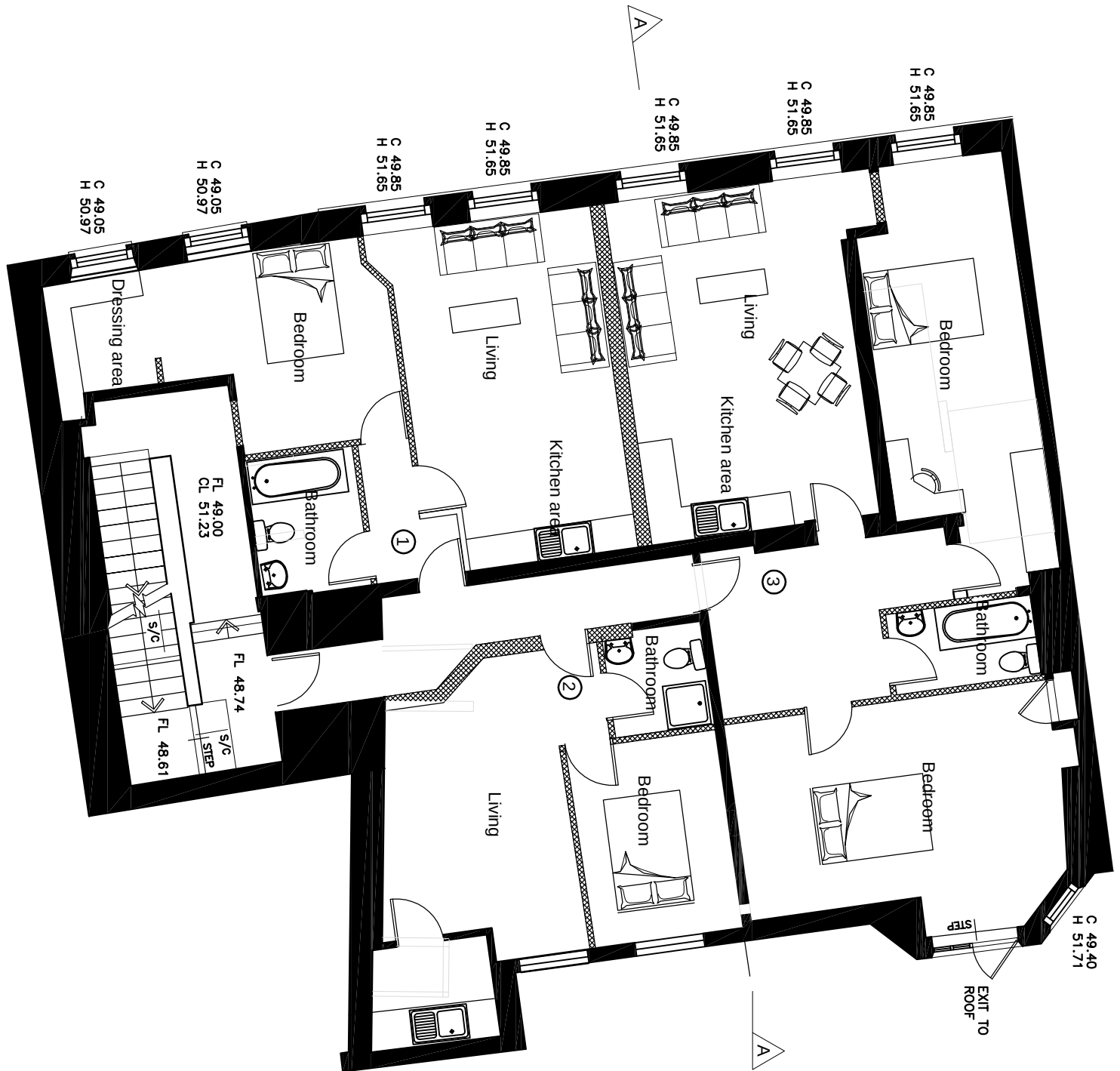
Table 8: Showing noise limits in Function Rooms to protect amenity of proposed flats

6.3 Noise from Units on Rear Roof

Some screening and/or silencers maybe required screening to the condenser units servicing the banquet hall and attenuators to the ducting servicing the kitchen to the rear of the proposed flats on the flat roof may be required. These treatments (if necessary) can be readily done and are not considered an inhibiting factor to planning proposal. The noise levels to the rear are in any case low levels of noise.

APPENDIX A

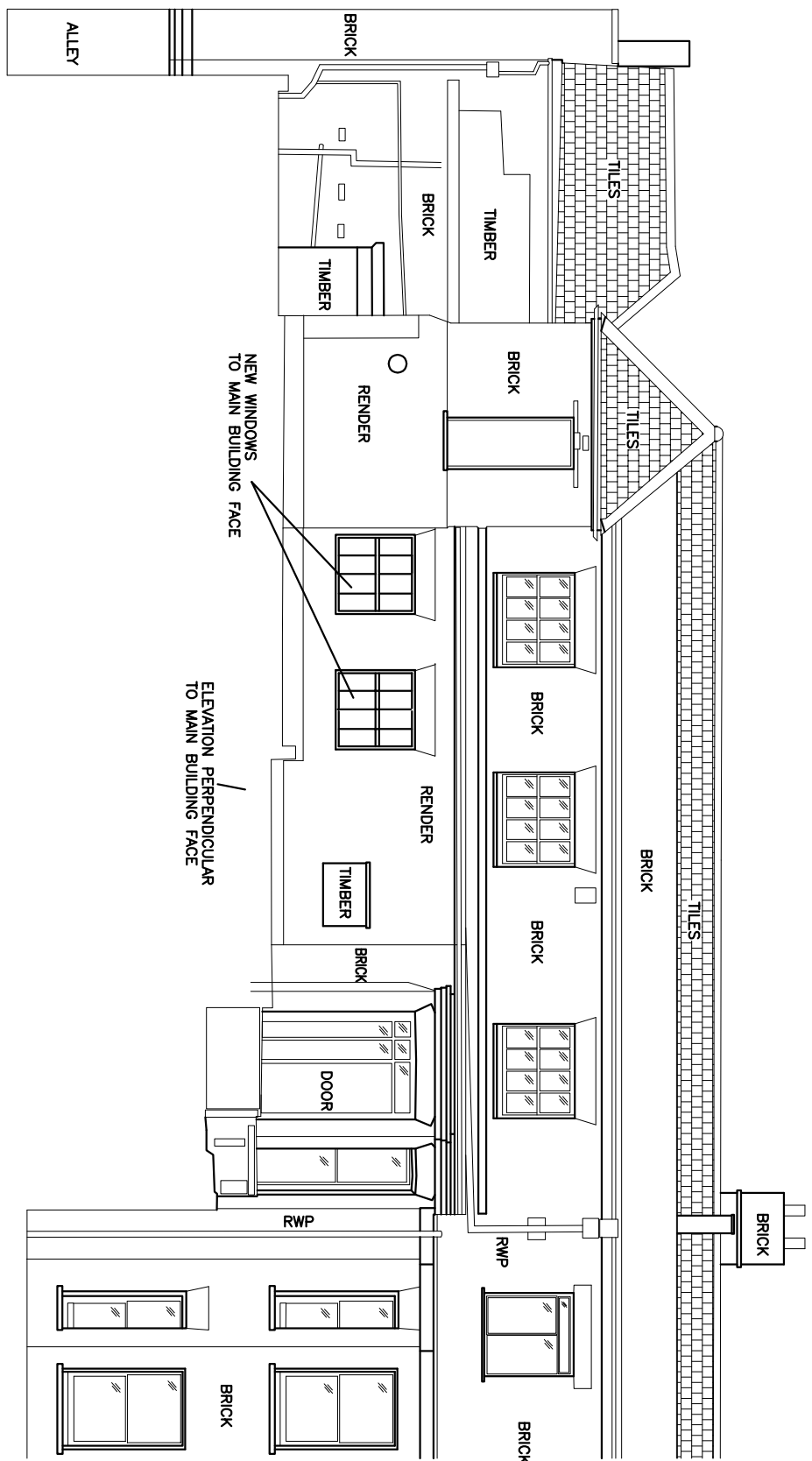
Drawings Of The Proposed Development



First Floor

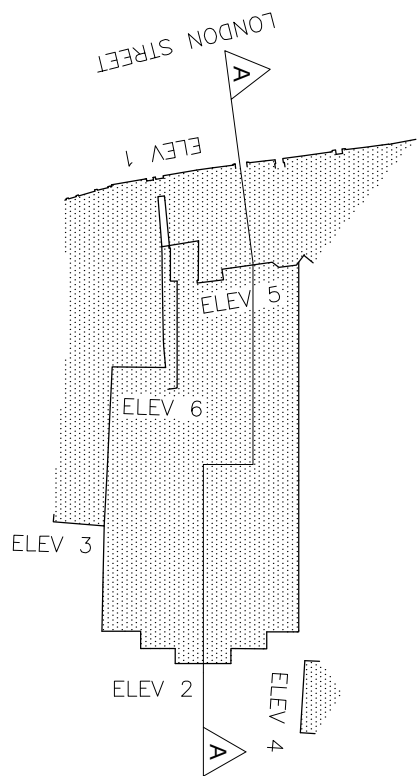


Second Floor



Elevation 5
(REAR OF TWO STOREY)

Datum Level 43.00m



APPENDIX B

Noise Survey Instrumentation

Site: 75-77 London Street, Reading

Reference: 15149-002 Appendix B

Date: March 2016

NOISE SURVEY INSTRUMENTATION

External Noise Survey:

- Rion sound level meter type NL-31 Class 1 serial number 00773045 plus Rion microphone type UC-53A serial number 313002 complete with weatherproof outdoor environmental kit, microphone extension lead and extension boom arrangement;
- Bruel & Kjaer calibrator type 4231 serial number 2642929 (UKAS certified).

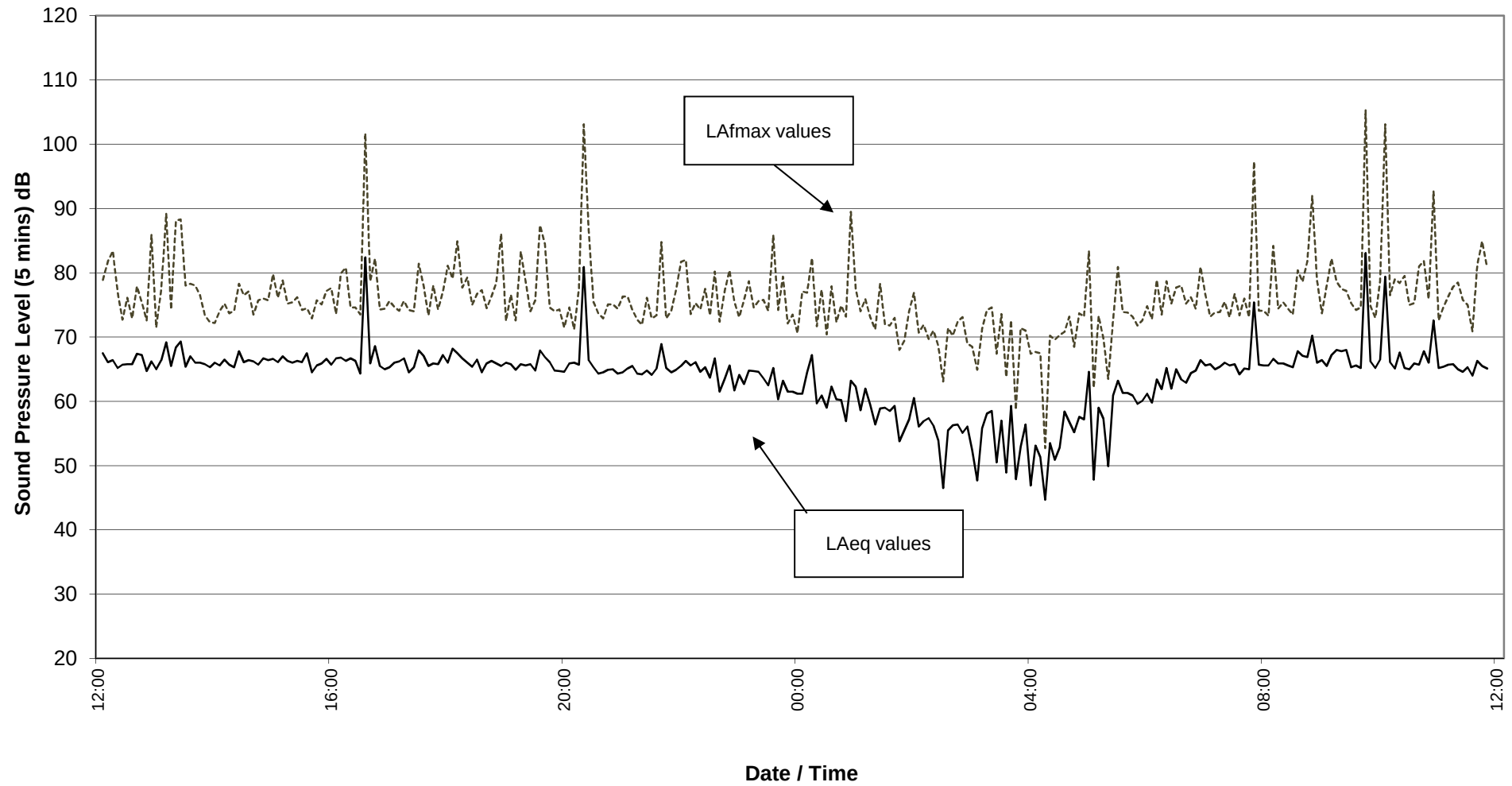
Sound Insulation Test:

Equipment Description and Serial Number	Type Number	Manufacturer	Date of Calibration Expiration	Calibration Certificate Number
Sound Level Meter, s/n 2627604 (complete with building acoustics module BZ7204 & wireless remote control unit)	2260	Bruel & Kjaer	08/07/2016	1407348
0.5" Microphone s/n 2625249	4189	Bruel & Kjaer	08/07/2016	1407348
Preamplifier s/n 4091	ZC0026	Bruel & Kjaer	08/07/2016	1407348
Calibrator s/n 2642929	4231	Bruel & Kjaer	04/07/2016	07808
Eon active loudspeaker s/n 24742 on heavy duty stand	10G2	JBL	N/A	N/A
Graphic Equalizer	1131	Crest	N/A	N/A
Qualifier software	7830	Bruel & Kjaer	N/A	N/A

APPENDIX C

Background Noise Survey Results

Raw Data Second Floor Facade Noise Level Survey Results
75-77 London Street, Reading



A P P E N D I X D

Example Acoustic Calculations

Site: 75-77 London Street, Reading
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BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM: Flat 4 Living Room; at second floor directly overlooking London Street

NOISE CONDITION: Day (07:00 to 23:00) $L_{Aeq}(16hr)$ 65dB Equivalent 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	65	67	63	60	60	58	55
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	9.5	Nine Inch Masonry wall					
Windows	0.5	Acoustic performance asymmetric double glazing typ 6/airgap/4 performance $R_w \geq 39\text{dB}$					
Doors	0	No external doors to room					
Roof / Ceiling	20	Tile with 25mm plasterboard insulated					
Ventilators	2	Proprietary acoustic type passive ventilator $D_{n,e,w} \geq 38\text{dB}$					
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	9.5	41	45	49	57	65	65
Windows	0.5	19	25	36	44	46	47
Doors	0						
Roof / Ceiling	10	27	37	43	48	52	55
Ventilators (Dn,e)	2	43	43	38	38	40	48
Overall Sound Reduction All Elements Combined		-28.5	-36.1	-36.7	-37.9	-40.2	-47.3
Sample Room Volume (m³):		45					
Sample Room Building Envelope Surface Area (m²):		20					
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	0.35	0.35	0.35	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	30.7	41.9	29.7	26.2	25.0	20.0	10.0

Site: 75-77 London Street, Reading
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BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM: Flat 4 Bedroom; at second floor directly overlooking London Street

NOISE CONDITION: Night (23:00 to 07:00) $L_{Aeq(8hr)}$ 59dB Equivalent 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	59	61	57	54	54	52	49
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	6.0	Nine Inch Masonry wall					
Windows	1.7	Acoustic performance asymmetric double glazing typ 6/airgap/4 performance Rw ≥ 39dB					
Doors	0	No external doors to room					
Roof / Ceiling	15	Tile with 25mm plasterboard insulated					
Ventilators	1	Proprietary acoustic type passive ventilator Dn,e,w ≥ 38dB					
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	6.0	41	45	49	57	60	60
Windows	0.5	19	25	36	44	46	47
Doors	0						
Roof / Ceiling	7	27	37	43	48	52	55
Ventilators (Dn,e)	1	43	43	38	38	40	48
Overall Sound Reduction All Elements Combined		-28.0	-35.6	-37.6	-39.1	-41.4	-48.2
Sample Room Volume (m³):		25					
Sample Room Building Envelope Surface Area (m²):		13.53					
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	0.25	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	23.5	36.1	23.7	17.7	16.2	11.9	2.1