

**THE BRUNSWICK PUBLIC HOUSE, 97 PICCADILLY, MANCHESTER
PROPOSED CONVERSION OF UPPER FLOORS TO HOTEL GUEST ROOMS**

NOISE IMPACT ASSESSMENT

On behalf of:
Inventive Design Associates

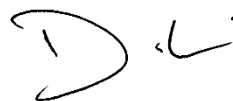
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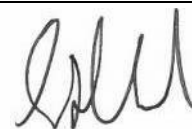
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CONTENTS

1.0	INTRODUCTION	4
2.0	ADOPTED ACOUSTIC DESIGN CRITERIA	6
3.0	NOISE MEASUREMENTS	8
4.0	SOUND LEVEL DIFFERENCE TESTING	11
5.0	NOISE ASSESSMENT & MITIGATION SCHEME	12
6.0	SUMMARY	15
	FIGURE 1 – SITE LOCATION & NOISE MEASUREMENT POSITIONS	16
	FIGURE 2 – PROPOSED SITE LAYOUT	17
	APPENDIX I: NOISE UNITS & INDICES	18
	APPENDIX II: NOISE SURVEY RESULTS	20
	APPENDIX III: SAMPLE NOISE BREAK-IN CALCULATIONS	23

1.0 INTRODUCTION

- 1.1 Hepworth Acoustics Ltd was commissioned by Inventive Design Associates to carry out a noise impact assessment in connection with a proposed planning application for conversion of the upper floors of the Brunswick public house, 97 Piccadilly, Manchester to form new hotel guest rooms and manager's flat.
- 1.2 The building, which is listed, is located at the corner of Piccadilly and Paton Street, near Piccadilly station in Manchester city centre as indicated in Figure 1. The existing building is three storeys with the trading area and kitchen of the Brunswick public house occupying the ground floor, with part of the first floor occupied by the existing manager's flat. The remainder of the upper floors are vacant. We understand that the separating floors within the building, including between the ground floor trading area and first floor, are formed of timber joists with lath and plaster or plasterboard ceilings, timber floorboards and no cavity infill.
- 1.3 Proposals are for conversion of the upper floors to form 15 new hotel guest bedrooms across a mix of room types including standard guest rooms, en-suite rooms and multi-room suites, and a new manager's/tenant's flat. No new external plant or equipment is proposed at this stage.
- 1.4 The assessment has been based on the layout drawings as provided by Inventive Design Associates. The proposed layout of the development is shown in Figure 2.
- 1.5 The noise assessment has included:
- An inspection of the site and surrounding area;
 - Adopting appropriate acoustic criteria for the development;
 - A baseline noise survey to establish the existing noise climate outside the outward looking elevations during weekday and weekend periods;
 - Indicative sound level difference testing to establish the existing sound insulation of the separating floor between the ground floor public house trading area and the first floor;
 - Measurement of Brunswick public house trading noise levels during a typical busy period; and
 - Recommendation of appropriate mitigation measures.

- 1.6 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 ADOPTED ACOUSTIC DESIGN CRITERIA

Control of Noise Ingress to Hotel Guestrooms

2.1 Manchester City Council have clear guidance on appropriate acoustic design criteria for new residential developments, but they do not require any specific noise criteria for proposed new hotels – instead recognising that hotel operators often have their own brand standards and/or rely on appropriate acoustic conditions to provide a good guest experience.

2.2 We are not aware of any specific brand standards in terms of acoustics that are to be applied to this development, so in the absence of any other guidance we have referred to the Manchester City Council planning guidance for dwellings which is based upon the guidance from British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings* to adopt desirable target acoustic criteria. On this basis, we recommend that the following criteria are achieved wherever possible in order to provide guests with a good standard of noise control:

Daytime noise levels no higher than 35 dB $L_{Aeq,16hour}$

Night-time noise levels no higher than 30 dB $L_{Aeq,8hour}$

Night-time peaks of noise to be controlled to generally within 45 dB L_{AFmax} (this applies to the 15th highest L_{AFmax} during any one night) at the bedhead.

2.3 In addition, for residential developments structurally connected to entertainment premises, Manchester City Council require noise transmission through separating floors/walls to be controlled to be 'inaudible'/'virtually inaudible' as follows:

'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}), respectively'.

2.4 This would be a desirable target criterion for the control Brunswick trading noise transmission to hotel guest rooms above.

Control of Plant & Equipment Noise

- 2.5 It is noted that the proposals do not include any new external plant/equipment and there are no existing noise sensitive premises in the immediate vicinity in any case. As such, no acoustic design criteria are warranted in respect of plant/equipment.

3.0 NOISE MEASUREMENTS

Baseline Environmental Noise Survey

- 3.1 External noise measurements were carried out by installing automated data-logging sound analysers with microphones mounted onto poles protruding approximately 1m from the façade of the building through partially open existing second floor windows as shown in Figure 1 and described as follows:
- a) On the Piccadilly elevation; and
 - b) On the Paton Street elevation.
- 3.2 Back Piccadilly to the rear is a very lightly trafficked road with noise levels no higher than on Paton Street. For the purposes of this assessment, we have adopted the Paton Street noise levels as a robust representation of the corresponding values that will prevail outside windows overlooking Back Piccadilly. There are no proposed bedrooms windows that will overlook the lightwell at the centre of the building.
- 3.3 The noise measurements were carried out from around 10:30 on Friday 3 March 2023, with the equipment collected on the morning of Tuesday 7 March 2023. It is however noted that the noise measurements ceased just before midnight on Sunday 5 March on the Piccadilly elevation and in the early hours of Tuesday 7 March on the Paton Street elevation. Nevertheless, measurements comprised both weekday and weekend periods at both locations.
- 3.4 Noise measurements were taken as a series of consecutive 5-minute periods. Weather conditions during the survey were generally dry, partially overcast, generally calm and cold (with daytime temperatures of 4 – 6°C and night-time temperatures between around 2 – 3°C) and so suitable for the noise survey. Details of the equipment used for the noise measurements are shown in Appendix II. Calibration checks were carried out both before and after the survey with no variance in levels noted. Frequency analysis was also carried out.
- 3.5 The full results of the noise survey are shown in Appendix II.
- 3.6 Table 1 summarises the measured range of daytime and night-time noise levels at the site over the course of the noise survey.

Table 1: Summary of measured ambient noise levels (dB)

Location	Daytime (07:00-23:00)	Night-time (23:00 – 07:00)	
	L_{Aeq}	L_{Aeq}	15 th highest L_{Amax}
a) Piccadilly elevation	66 – 69	65	82 – 84
b) Paton Street elevation	62 – 65	61 – 62	75 – 81

- 3.7 The noise climate at the site is dictated by road traffic noise on Piccadilly (including regular buses), Paton Street and Back Piccadilly, along with noise from pedestrians.
- 3.8 As one would expect, noise levels were highest on Piccadilly, with noise levels on the less busy Paton Street being around 4 dB lower.
- 3.9 The following octave band L_{eq} and L_{Fmax} noise levels have been adopted for design purposes in respect of existing external noise ingress to hotel guest rooms.

Table 2: Adopted daytime octave band external ambient noise levels in dB $L_{eq,07:00-23:00}$

Location	Octave Band Centre Frequency (Hz)							A
	63	125	250	500	1k	2k	4k	
a) Piccadilly elevation	72	66	65	64	64	64	56	69
b) Paton Street elevation	71	64	62	60	60	59	52	65

Table 3: Adopted night-time octave band external ambient noise levels in dB $L_{eq,23:00-07:00}$

Location	Octave Band Centre Frequency (Hz)							A
	63	125	250	500	1k	2k	4k	
a) Piccadilly elevation	70	63	63	61	61	58	53	65
b) Paton Street elevation	68	61	60	58	58	55	51	62

Table 4: Adopted night-time octave band external ambient noise levels in dB L_{Fmax}

Location	Octave Band Centre Frequency (Hz)							A
	63	125	250	500	1k	2k	4k	
a) Piccadilly elevation	85	83	80	80	80	76	72	84
b) Paton Street elevation	84	75	75	74	75	74	74	81

Brunswick Public House Trading Noise Measurements

- 3.10 The proximity of Piccadilly railway station to the premises and its location on the main pedestrian route between the station and the city centre and its main attractions means that the Brunswick is busiest when there is an influx of visitors to the city arriving via the station.

- 3.11 For this reason, the Brunswick is busiest in the middle of the day on weekends (e.g. late morning/lunchtime on Saturdays). As such, the busiest periods at the Brunswick coincide with periods when hotel guest rooms will not be sensitive to noise.
- 3.12 Mid-late evening trading periods, including weekends, are much less busy and much less noisy with the Brunswick often being used as a 'first-stop' for those arriving into the city centre at Piccadilly station. For the purposes of determining a robust set of trading noise levels to use as a basis for determining any sound insulation enhancements, Hepworth Acoustics visited the Brunswick during the early-mid evening on a Friday to measure the typical highest trading noise levels during periods that can be considered potentially sensitive for hotel guests.
- 3.13 A series of short-term spatially averaged noise measurements were taken in the Brunswick trading area at around 20:00 on Friday 17 March 2023 using a B&K 2260 'Type 1' sound analyser (serial no. 2467016) that was check-calibrated before and after the measurements with no variance observed. The noise levels were found to be due to a mix of pre-recorded music played at a fairly modest level over the in-house PA system and from customers' voices. The measured noise levels were as follows:

Table 5: Measured Brunswick public house trading noise levels in dB L_{eq}

Period	Octave Band Centre Frequency (Hz)							A
	63	125	250	500	1k	2k	4k	
Friday, mid-evening	75	80	74	78	74	69	63	79

- 3.14 It should be noted that the hotel guest rooms will be owned/managed by the same organisation as the Brunswick (meaning that ground floor trading noise levels are under control of the managers of the hotel).

4.0 SOUND LEVEL DIFFERENCE TESTING

- 4.1 Indicative airborne sound level difference testing has been carried out between the Brunswick public house trading area and two separate first floor spaces above to establish the existing acoustic separation between the ground and first floor.
- 4.2 The testing was carried out by generating high levels of pink noise within the Brunswick trading area using sound sources and loudspeakers. The source noise levels were measured in the ground floor trading area and the corresponding transmitted noise levels were measured in the first-floor spaces. Background noise levels (i.e. the prevailing noise levels in the absence of the transmitted noise) were also measured on the first floor. The testing was carried out to the existing Brunswick office located on the first floor at the corner of Piccadilly and Paton Street, and to the existing manager's flat bedroom/living room on the first floor on the Piccadilly elevation.
- 4.3 The first-floor rooms used in the testing featured painted plastered walls and ceiling, and thin contract carpet, and were furnished.
- 4.4 The testing was undertaken with B&K 2250 'Type 1' sound analyser (serial no. 3011706). The analyser was checked calibrated before and after the measurements with no variance noted.
- 4.5 The measured in-situ airborne sound insulation values were generally similar and fairly modest, reflective of the existing timber joist floor construction. For the purposes of this assessment, the following have been adopted, being the lower (but only marginally) of the two sets of measurements:

Table 6: Measured sound level differences (dB)

Description	Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Between Brunswick trading area & existing first floor office	24	29	37	45	51	53	60

- 4.6 The measured sound level differences are fairly low and reflective of the timber joist floor construction.

5.0 NOISE ASSESSMENT & MITIGATION SCHEME

Control of Ingress of External Noise

- 5.1 The measured external noise levels are, as one would expect given the busy city centre location, fairly high. The existing single-glazed sliding sash windows provide only very modest levels of sound insulation and so significant enhancements will be required. We understand that the existing windows are to be retained/refurbished and secondary glazing installed. Our recommendations on this basis are set out below, with sample supporting noise break-in calculations shown in Appendix III. The calculations have taken into account the external noise levels, details of the building envelope and, for assessment of peaks of noise, the distance from the windows to proposed bedhead locations.

Glazing

- 5.2 For all guest bedrooms and habitable rooms within the manager's flat, we recommend sound insulation enhancements to ensure that the windows provide a minimum laboratory airborne sound insulation performance of $38 \text{ dB } R_w + C_{tr}$:

- The existing windows to be refurbished/made good, with seals checked/replaced where necessary in order to optimise the sound insulation performance;
- Installation of secondary glazing formed as follows:
 - Minimum 6mm thick glass mounted in substantial, well-sealed separate frames (e.g. Selectaglaze); and
 - Minimum 100mm (ideally at least 150mm cavity) between the glass of the existing windows and the glass of the new secondary glazing.

Ventilation

- 5.3 We understand that there will be no ventilation openings in the outward facing external elevations. Nevertheless, we would recommend that any ventilation connections to habitable rooms provide a minimum laboratory sound insulation of $43 \text{ dB } D_{n,e,w}$.

Sound Insulation between Ground Floor Trading Area and First Floor

- 5.4 Using the measured Brunswick trading noise levels as set out in Table 5 and the measured sound level differences between the ground floor trading area and first floor spaces above, it is possible to determine the likely resulting trading noise levels in the first-floor spaces in the absence of any sound insulation enhancements. Table 7 sets out the calculation:

Table 7: Calculation of Brunswick public house trading noise levels in first floor spaces in dB L_{eq}

Period	Octave Band Centre Frequency (Hz)							A
	63	125	250	500	1k	2k	4k	
A. Brunswick trading noise	75	80	74	78	74	69	63	79
B. Existing sound level difference	24	29	37	45	51	53	60	
Calculated noise level (A – B)	51	51	37	33	23	16	3	37

- 5.5 Table 7 indicates that without sound insulation enhancements, the Manchester City Council noise criteria of 47 dB and 41 dB in the 63 Hz and 125 Hz octave bands respectively will be exceeded by 4 – 10 dB. As such, sound insulation enhancements are warranted.

Recommendations

- 5.6 The necessary sound insulation enhancements between the ground floor trading area and the first-floor guest rooms/manager's flat can be achieved in two main ways:
- By installing a new mass-barrier acoustic ceiling within the ground floor trading areas of the Brunswick; or
 - Installing a new raised acoustic floor within first floor spaces.
- 5.7 If a new mass-barrier ceiling is the chosen solution, we would make the following outline recommendations:
- Two layers of 15mm Gyproc SoundBloc (or equivalent);
 - Mounted via a MF system suspended via proprietary acoustic hangers (e.g. Gyproc GAH1 or equivalent);
 - Forming a minimum 250mm cavity between the underside of the existing ceiling and the top side of the new ceiling;

- The cavity to be partially filled with a minimum of 100mm of mineral wool (density at least 16 kg/m³)
- There must be no penetrations in the ceiling, and it must be effectively sealed at the perimeter and at columns etc.

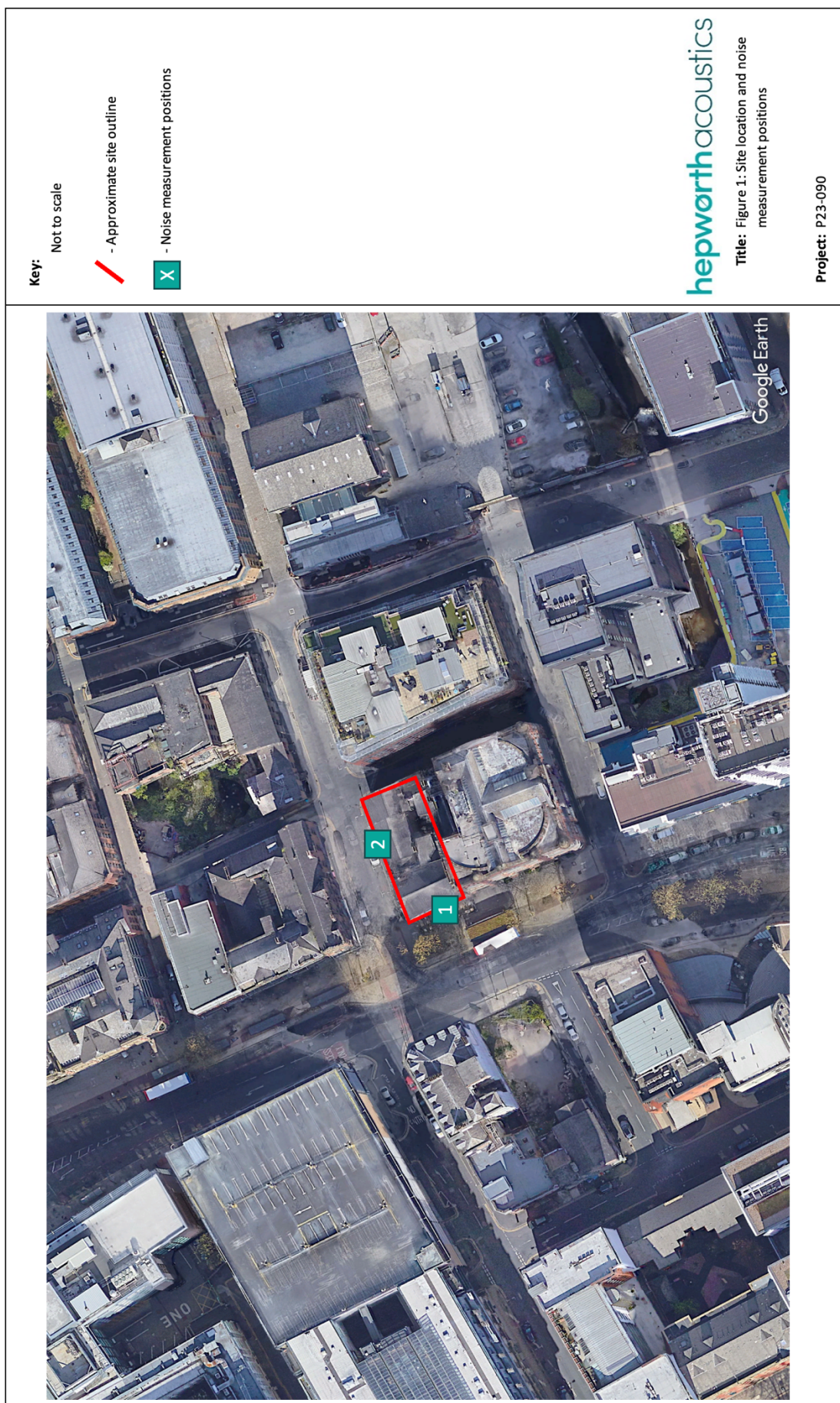
5.8 If a raised acoustic floor system is preferable, we would make the following outline recommendations:

- New floor to be formed of flooring particle board, underlined with cement particle board or plasterboard where necessary in order to form a surface mass of at least 25 kg/m²;
- Mounted via a suitable raised acoustic floor system (such as Monarfloor Acoustic Cradle System) forming a minimum 150mm floor void;
- The cavity to be partially filled with a minimum of 100mm of mineral wool (density at least 33 kg/m³); and
- Be installed fully in line with the manufacturer's guidance (including use of appropriate perimeter flanking strips etc.).

5.9 Since it will be necessary to consider the internal sound insulation design for the hotel guest rooms and manager's flat in due course to meet the requirements of Part E of the Building Regulations, we recommend that the precise specification of the necessary sound insulation enhancements are not finalised at this stage. Instead, it will be possible to secure the necessary improvements with a suitably worded planning condition which requires the details of the proposed enhancements to be submitted to the Local Planning Authority for approval.

6.0 SUMMARY

- 6.1 Hepworth Acoustics Ltd was commissioned by Inventive Design Associates to carry out a noise impact assessment in connection with a proposed planning application for conversion of the upper floors of the Brunswick public house, 97 Piccadilly, Manchester to form new hotel guest rooms and manager's flat.
- 6.2 The assessment has included measurement of existing environmental noise levels at the site over a Friday to Monday period; sound level difference testing between the ground floor trading area of the Brunswick and first floor spaces; and measurements of typical weekend evening trading noise levels in the Brunswick.
- 6.3 The measured external noise levels are, as one would expect given the busy city centre location, fairly high. The existing single-glazed sliding sash windows provide only very modest levels of sound insulation and so secondary glazing will be required in order to control the ingress of external noise.
- 6.4 The sound level difference testing and trading noise measurements have indicated that some sound insulation enhancements to the separating floor between the Brunswick trading area and proposed hotel guest rooms and manager's flat above are warranted.
- 6.5 Since it will be necessary to consider the internal sound insulation design for the hotel guest rooms and manager's flat in due course to meet the requirements of Part E of the Building Regulations, we recommend that the precise specification of the necessary sound insulation enhancements are not finalised at this stage. Instead, it will be possible to secure the necessary improvements with a suitably worded planning condition which requires the details of the proposed enhancements to be submitted to the Local Planning Authority for approval.





Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The indices used in this report are described below.

$L_{Aeq,T}$ This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, $L_{Aeq,T}$ is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{AFmax} This is the maximum A-weighted noise level that was recorded during the measurement period in terms of 'Fast' time weighting.

$L_{A90,T}$ This is the A-weighted noise level exceeded for 90% of the time period. $L_{A90,T}$ is used as a measure of background noise.

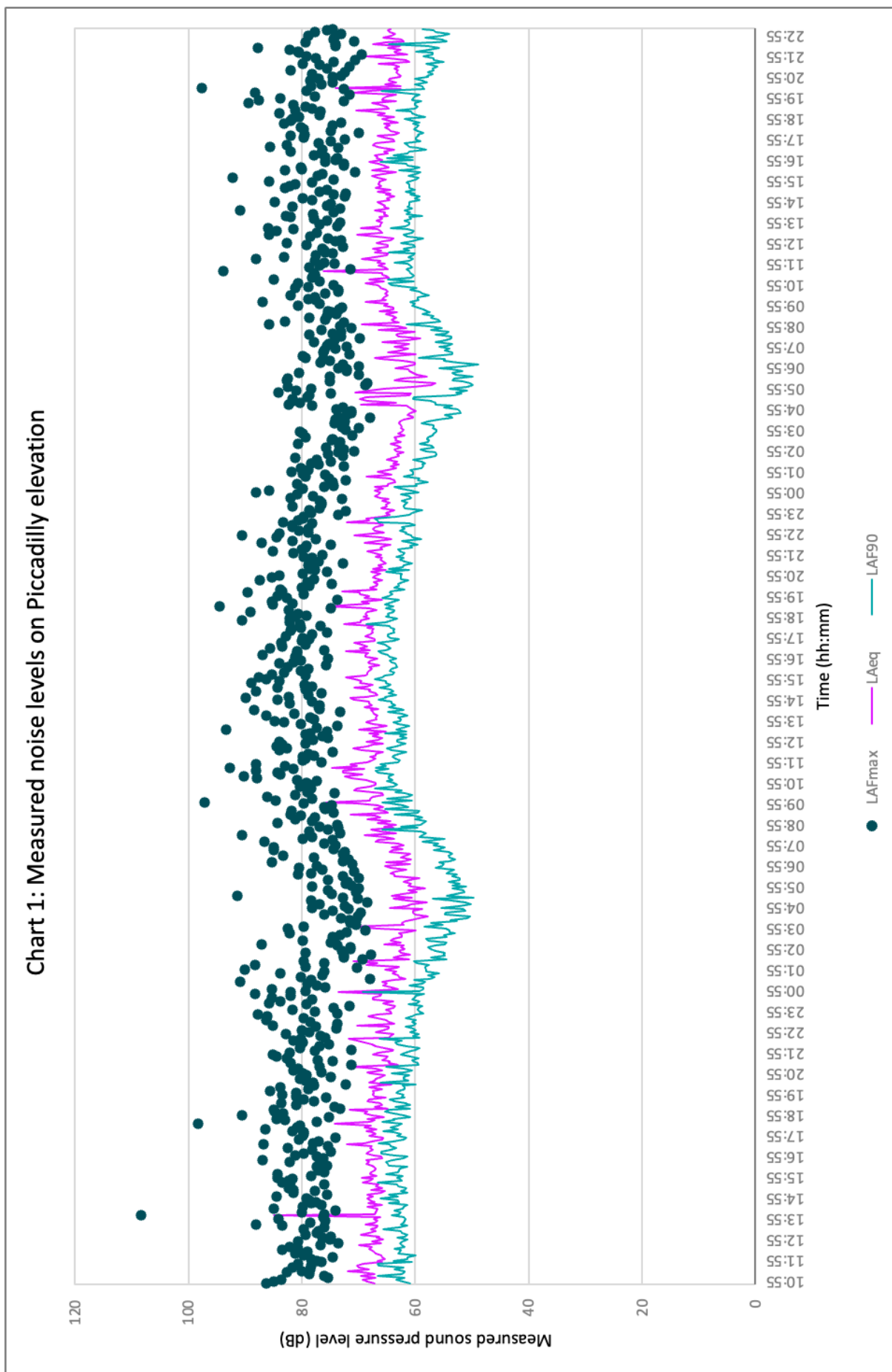
D This is the Level Difference and is a field measurement of the airborne sound insulation between adjacent spaces. As well as being field measurement, this term and all other D terms below therefore include on-site conditions other than direction noise transmission through, for example, a wall (flanking transmission).

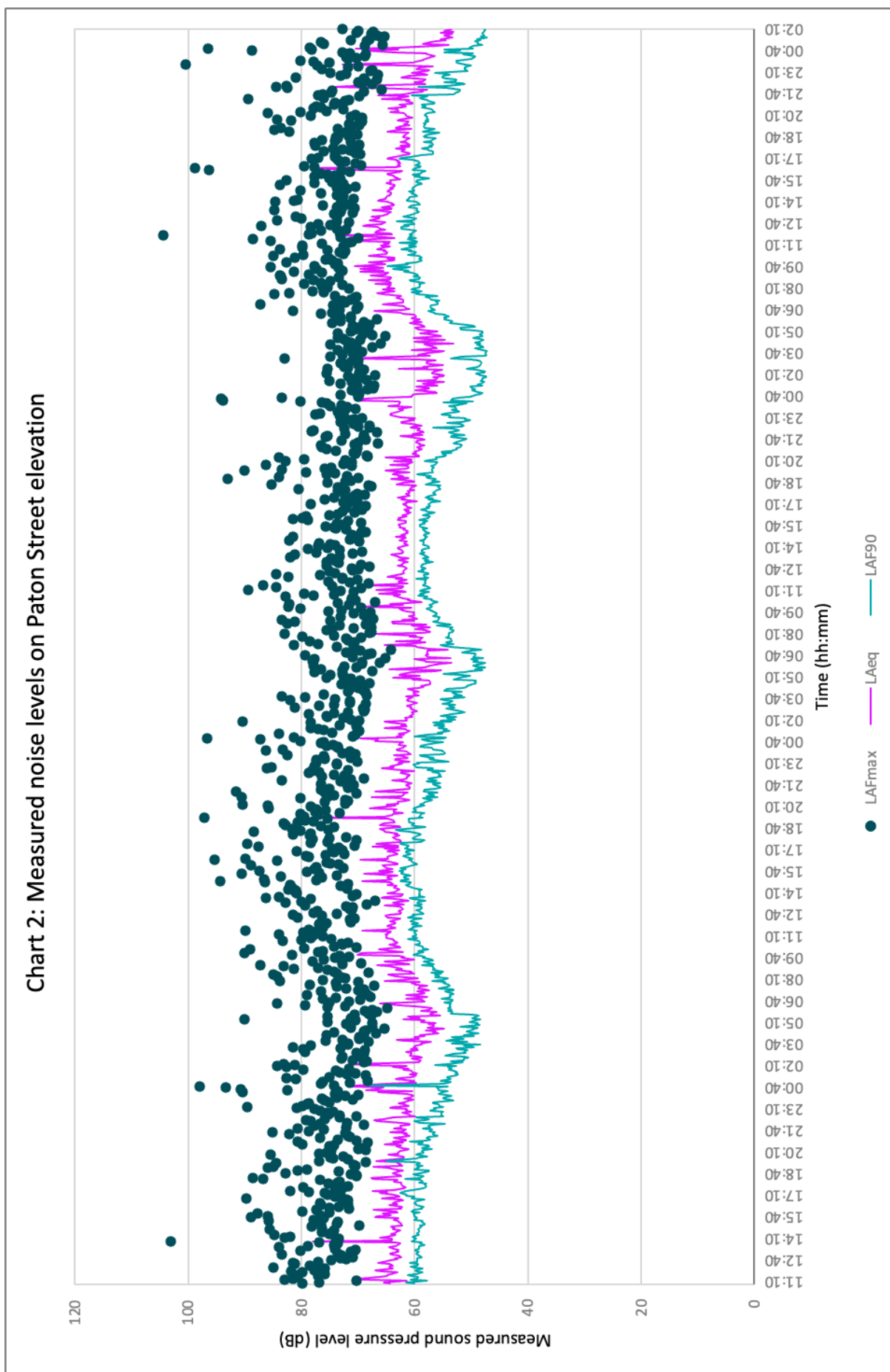
$D_{n,e,w}$ This is the weighted element normalized level difference as measured in a laboratory, and is a measure of the sound insulation properties of small building elements such as ventilators.

Appendix II: Noise Survey Results

Date(s):	Friday 3 – Tuesday 7 March 2023
Equipment	2 x NTi XL2 'Class 1' sound level meters (s/n: A2A-20361-E0 & A2A-20228-E0) with associated calibrators and environmental outdoor monitoring kits
Weather	Dry, partially overcast, generally calm and cold (with daytime temperatures of 4 – 6°C and night-time temperatures between around 2 – 3°C)

Charts overleaf





Appendix III: Sample noise break-in calculations

BS8233 Calculation of Noise BreakinThe expected precision of this calculation is ± 2 dB

Project Number	P23-090
Site	Brunswick public house - upper floor hotel guest rooms
Period	Night
Plot/Room	Room 12 - Piccadilly elevation
Consultant	DQ

hepworthacoustics

Version 8.0 February 2019

Term	Term Description	Value
S_f	Facade area (incl. window) (m ²)	14.6
S_{wi}	Area of the windows (m ²)	3.8
S_{ce}	Area of the ceiling (m ²)	
S_{ew}	Area of the external wall (m ²)	10.8
S	Area of facade and roof	14.6
x	Room Dimension x	6.0
y	Room Dimension y	3.3
z	Room Dimension z	2.4
	Facade correction	0.0
r	Distance to window / vent (m)	2.90
V	Volume of Room (m ³)	48

SRI of ceiling/roof not present in calculation

	63 - 8k	BS 8233	NR
L_{Amax}	38.8	38.4	35

	63 - 8k	BS 8233	NR
L_{Aeq}	28.0	26.5	22

RT	Receiving Room RT
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standard rev times for a furnished room from worked example in BS 8233, V=35m³

Octave Band Centre Frequency								
63	125	250	500	1000	2000	4000	8000	T_{ref}
0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Octave Band Centre Frequency								dBA	NR	BS8233
63	125	250	500	1000	2000	4000	8000			
85	83	80	80	80	76	72	70	84	79	83
70	63	63	61	61	58	53	52	65	60	65

$D_{n,e}$	SRI of the vent	Ryttons 150mm Acoustic Aircore (Code: AAC635)	34	42	35	35	52	61	64	64	43 -1;-3
R_{wi}	SRI of the window	6:100:4mm	20	26	34	44	56	53	52	55	45 -2;-7
R_{ew}	SRI of the external wall	BS8233 Example - Brick and block external wall	36	40	44	45	51	56	60	60	51 -1;-4
A	Equivalent Absorption Area		13	15	19	22	22	20	19	19	
		10 x log (S/A)	1	0	-1	-2	-2	-1	-1	-1	

BS8233 Calculation of Noise BreakinThe expected precision of this calculation is ± 2 dB

Project Number	P23-090
Site	Brunswick public house - upper floor hotel guest rooms
Period	Night
Plot/Room	Room 09 - Paton Street elevation
Consultant	DQ

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Version 8.0 February 2019

Term	Term Description	Value
S_f	Facade area (incl. window) (m ²)	16.1
S_{wi}	Area of the windows (m ²)	4.0
S_{ce}	Area of the ceiling (m ²)	0.0
S_{ew}	Area of the external wall (m ²)	12.1
S	Area of facade and roof	16.1
x	Room Dimension x	6.0
y	Room Dimension y	4.0
z	Room Dimension z	2.4
	Facade correction	0.0
r	Distance to window / vent (m)	2.90
V	Volume of Room (m ³)	58

SRI of ceiling/roof not present in calculation

	63 - 8k	BS 8233	NR
L_{Amax}	33.6	32.6	29

	63 - 8k	BS 8233	NR
L_{Aeq}	24.7	23.0	18

RT	Receiving Room RT
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standard rev times for a furnished room from worked example in BS 8233, V=35m³

Octave Band Centre Frequency								
63	125	250	500	1000	2000	4000	8000	T_{ref}
0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Octave Band Centre Frequency								dBA	NR	BS8233
63	125	250	500	1000	2000	4000	8000			
84	75	75	74	75	74	74	70	81	78	79
68	61	60	58	58	55	51	46	62	57	62

$D_{n,e}$	SRI of the vent	Ryttons 150mm Acoustic Aircore (Code: AAC635)	34	42	35	35	52	61	64	64	43 -1;-3
R_{wi}	SRI of the window	6:100:4mm	20	26	34	44	56	53	52	55	45 -2;-7
R_{ew}	SRI of the external wall	BS8233 Example - Brick and block external wall	36	40	44	45	51	56	60	60	51 -1;-4
A	Equivalent Absorption Area		15	18	23	26	26	25	23	23	
		10 x log (S/A)	0	-1	-2	-2	-2	-2	-2	-2	