SANDY BROWN

Consultants in Acoustics, Noise & Vibration

16308-R01-A

9 August 2016

20 Fountain Street, Manchester

Acoustic planning report

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Version	Date	Comments	Author	Reviewer
A	9 Aug 16		Luis Ruivo	Mark Howarth

Summary

Sandy Brown Associates LLP (Sandy Brown) has been commissioned by Bruntwood to provide an acoustic planning report in relation to a proposed restaurant fit-out on the ground floor of 20 Fountain Street, Manchester.

An environmental noise survey has been carried out to determine the existing background sound levels in the area and setting appropriate plant noise limits in line with the requirements of Manchester City Council (MCC).

The noise survey was performed between 10:30 on 28 July 2016 and 18:15 on 1 August 2016.

The representative background sound levels measured during the survey were $L_{A90,15\ min}$ 55 dB during the daytime and $L_{A90,15min}$ 51 dB at night.

Based on the requirements of MCC and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15min}$ 50 dB during the daytime, and $L_{Aeq,15min}$ 46 dB during the night. These limits are cumulative, and apply with all plant operation under normal conditions. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied, and the limits will be more stringent than those set.

Noise egress due to amplified sound within the proposed development should also be limited to $L_{Aeq,15min}$ 45 dB during the daytime, and $L_{Aeq,15min}$ 41 dB during the night at the nearest noise sensitive premises. Octave band limits also apply.

Based on the measured sound insulation performance between the ground floor premises, the adjacent commercial premises, the offices above, and the ambient noise level in the office space, internal noise limits have been set for the restaurant. The limits would be suitable for a typical restaurant with background music. If the restaurant operator would like to operate with higher levels of sound, sound enhancement works will be required or operational times agreed with the office tenants.

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1 Introduction

Sandy Brown Associates LLP (Sandy Brown) has been commissioned by Bruntwood to provide an acoustic planning report in relation to a proposed restaurant fit-out on the ground floor of 20 Fountain Street, Manchester.

An environmental noise survey has been carried out, the purpose of which is to establish the existing background sound levels in the vicinity of the site and nearby noise sensitive premises.

The background sound levels measured during the survey are used as the basis for setting limits for noise emission from proposed building services plant and amplified sound in line with the requirements of Manchester City Council (MCC).

This report presents the survey method, results of the environmental noise survey and sound insulation tests, as well as a discussion of acceptable limits for noise emission from building services plant and amplified sound.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is outlined in red in Figure 1.

20 Fountain Street is located at the intersection of Marble Street and Fountain Street, Manchester. The building consists of office accommodation on the upper floors with existing retail units at ground floor.



Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Adjacent premises

The site is located within a commercial area of Manchester city centre. To the northeast, the site is adjoined to another commercial unit on ground level. The upper floors of the building are entirely composed of office suites, as is the adjacent Lowry House to the northwest of the site and the upper floors of the retail and office building across the site on Marble Street. The nearest noise sensitive receivers during the daytime are the offices at Lowry House to the northwest and the office and retail units directly across Marble Street, highlighted in green in Figure 1.

As it is understood that Fountain Street is a completely commercial area of the city centre, the nearest residential receivers to the site are understood to be significantly screened from the site by the surrounding buildings, as well as being located more than 200 m away from the site. As such, these have not been deemed sensitive receivers for noise egress from plant at the 20 Fountain Street site.

3 Method

3.1 Environmental noise survey

Details of the equipment used, the noise indices, and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

Unattended noise monitoring was undertaken at the site over 5 days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises. The measurements were performed over 15 minute periods between 10:30 on 28 July 2016 and 18:15 on 1 August 2016. The equipment was installed and collected by Luis Ruivo.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter ‘L’. A photograph showing the measurement location is provided Figure 2. This location was chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises. The microphone was located approximately 1 m from the roof floor and approximately 3 m from the nearest reflective surface.



Figure 2 Photograph of environmental noise measurement location

3.2 Sound insulation and ambient noise level measurements

Sound insulation measurements were undertaken by Luis Ruivo on 1 and 2 August 2016 from the proposed restaurant ground floor unit to the adjacent commercial unit on the ground floor and to the office space on level 1 (considered to be the worst case receptor). Ambient noise levels were also measured in the level 1 office space on 2 August 2016 by Luis Ruivo. Both sets of measurements were completed late in the afternoon after workers had left the office and the adjacent commercial unit was at a low occupancy.

The location of the sound insulation test is shown in Figure 3.

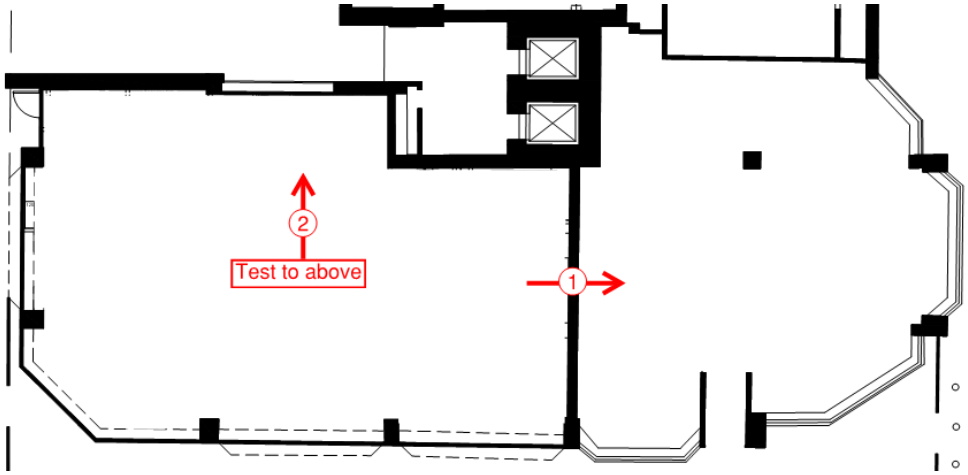


Figure 3 Location of sound insulation test

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of road traffic noise from Fountain Street and existing building services plant from 20 Fountain Street.

Less significant noise sources included air traffic noise and distant pedestrian activity.

4.2 Environmental noise results

A graph showing the results of the measurements is provided in Appendix B. The day and night-time ambient noise levels measured during the survey are presented in Table 1.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 28 July 2016	57*	56
Friday 29 July 2016	58	57
Saturday 30 July 2016	58	57
Sunday 31 July 2016	57	55
Monday 1 August 2016	58*	-
Average	58	57

* Measurement not made over full period due to monitoring start and end time (the measurement on 28 July 2016 was over 11.5 hours, and on 1 August 2016 over 11 hours); these measurements are not included in the average.

The minimum background sound levels measured during the survey are given in Table 2.

Table 2 Minimum background sound levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Thursday 28 July 2016	52*	48
Friday 29 July 2016	53	50
Saturday 30 July 2016	50	50
Sunday 31 July 2016	50	47
Monday 1 August 2016	52*	-

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 47 dB at night.

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, day and night time typical levels have been quantified using statistical analysis from the continuous logging measurements. Daytime and night time statistical analysis of representative values for the site are given in Figure 4 and Figure 5.

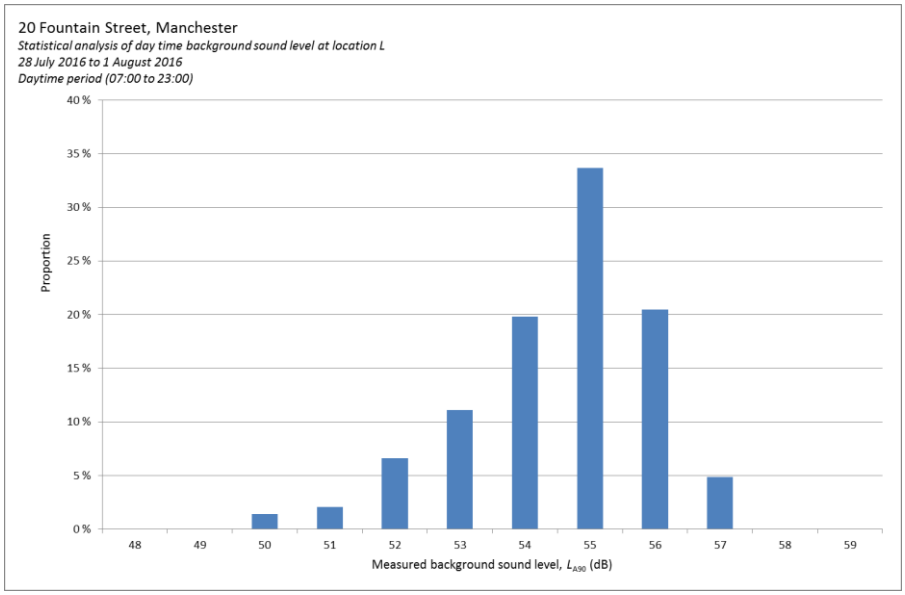


Figure 4 Statistical analysis of representative day time background noise levels

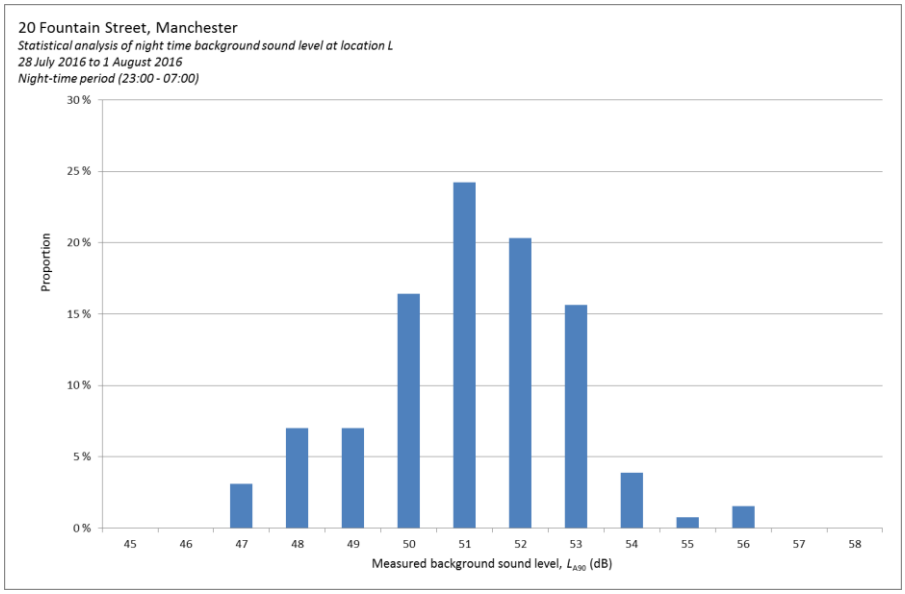


Figure 5 Statistical analysis of representative night time background noise levels

From this analysis, the representative background sound level measured during the survey was $L_{A90,15min}$ 55 dB during the day time and $L_{A90,15min}$ 51 dB during the night time. Average spectra relating to these are presented in Table 3.

Table 3 Representative background noise spectra measured during day time

	$L_{90,15min}$ (dB) per octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Daytime (07:00 – 23:00)	59	57	55	52	50	45	39	31
Night time (23:00 – 07:00)	53	52	51	47	45	41	37	30

4.3 Sound insulation results

The measured performance of the floor separating the ground floor unit and the adjacent first floor offices is D_w+ C_{tr} 53 dB.

The measured performance of the wall separating the ground floor units was limited by background noise but was at least D_w + C_{tr} 50 dB. This is considered to be a sufficient degree of sound insulation for demise walls between a retail unit and a restaurant unit.

Structure-borne sound transfer via the wall mounted screens and speakers in the adjacent retail unit was noted on site when in close proximity to the demise wall tested. However, the levels were faint and are not considered to have an adverse impact within the context of the noise levels expected in the space once the restaurant unit is operational.

The associated sound insulation graphs for these measurements are shown in Appendix C.

4.4 Ambient level results

The measured internal L_{Aeq} within the office was 43 dB. The spectral data associated with this is given in Table 4.

Table 4 Measured ambient levels in level 2 offices

	Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
L_{eq} (dB)	49	41	41	39	40	30	23	18

5 Assessment criteria

5.1 Building services noise egress

5.1.1 Standard guidance

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

5.1.2 Local Authority criteria

MCC guidance states that:

> *'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.*

5.2 Amplified sound

5.2.1 Amplified sound egress

MCC guidance document *Planning & Noise Technical Guidance*, dated December 2015 states that:

> *Entertainment noise (L_{Aeq}) should be controlled to 10dB below the background noise level (L_{A90}) without the entertainment noise present, in each octave band at the nearest noise sensitive location*

5.2.2 Amplified sound transfer

In relation to mixed use developments, MCC requires an assessment of noise transfer through the building. As the upper levels of the development are offices (and not residential) there are no specific criteria. In relation to residential MCC states:

> *'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'.*

Although MCC gives no criteria for noise transfer to offices, it is recommended that amplified sound be controlled to be 10 dB below the representative ambient noise level in the offices and limited within the 63 Hz and 125 Hz octave-centre frequency bands as described above.

6 Building services noise egress

6.1 Basic limits

Based on the MCC criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 5.

Table 5 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Daytime (07:00-23:00)	50
Night-time (23:00-07:00)	46

The limits set out in Table 5 do not include any allowance for attention catching features. The penalties for attention catching features may be significant, and will need to be considered as the building services design progresses. This is discussed further in Section 6.2.

6.2 Attention catching features

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit below those set out above, based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

- 15 dB in the low frequency one-third octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency one-third octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency one-third octave bands (500 Hz to 10000 Hz)

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

6.3 Assessment

At this stage, no information is available in relation to the proposed installation of building services plant, and this will need to be assessed in detail as the design progresses. However, all plant items will be designed to achieve the plant noise limits set out above, including any corrections for attention catching features.

7 Amplified sound

7.1 Amplified sound egress

Based on the criteria detailed in section 5.2.1 and the measurement results, the sound level resulting from amplified sound egress at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 6.

Given the close proximity of the proposed outdoor seating areas to the nearest office premises, it is not recommended that amplified music systems be used in the external areas.

From on-site observations is understood that the office suites on the upper floors of 20 Fountain Street do not rely on openable windows as part of their ventilation strategy and the limits have been set on the basis of the office windows being closed.

Table 6 Amplified sound limits at 1 m from the nearest noise sensitive premises

	Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Day time (07:00-23:00)	49	47	45	42	40	35	29	21
Night time (23:00-07:00)	43	42	41	37	35	31	27	20

7.2 Internal limits

The recommended internal amplified sound limits in the bar/restaurant areas are set out in Table 7.

These are based on the existing sound insulation provided by the floor below the office, the criteria given in Section 5.2, and the anticipated performance of the existing building envelope.

These limits would typically be suitable for uses such as restaurants with background music. However, these limits would not be suitable for high levels of amplified music (eg DJs or live music).

Table 7 Maximum amplified sound limits in restaurant / bar areas

	Octave-band centre frequency (Hz)						
	63	125	250	500	1000	2000	4000
Noise limit in proposed development	78	78	79	83	85	78	77

If it is considered desirable to increase these limits the tenant would need to undertake enhancement works to increase the sound insulation of the floor above the unit.

One possible solution for enabling higher noise levels to be accommodated within the restaurant and bar areas would be to have a relaxation to the limits outside of office hours. This would not however be possible if the offices can be used at any time. Noise egress to the atmosphere would also need further consideration if this approach is adopted.

8 Conclusion

A noise survey has been carried out to determine the existing background sound levels in the vicinity of the site and surrounding noise sensitive premises. The representative background sound levels were $L_{A90,15min}$ 55 dB during the day, and $L_{A90,15min}$ 51 dB during the night.

On the basis of the requirements of MCC, the noise egress contributions of building services plant at the worst affected existing noise sensitive premises shall not exceed 5 dB below the representative background levels measured.

These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent than those set out above. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features indicated in Section 6.2 will be applied, and the limits will be more stringent than those set out above.

External noise egress due to amplified sound within the proposed development should be limited to no more than 10 dB below the representative background levels at the nearest noise sensitive premises.

Internal amplified sound limits have also been advised for the bar and restaurant areas during office hours. The limits would be suitable for a typical restaurant with background music. If the restaurant operator would like to operate with higher levels of sound, they would need to carry out sound enhancement works or agree operational times with the office tenants on the first floor of 20 Fountain Street above.

Octave band limits also apply to all operational amplified sound egress from the proposed restaurant unit.

Appendix A

Survey details

Equipment

A Rion NL-52 sound level meter was used to undertake the environmental noise measurements. For the sound insulation tests and ambient noise level tests, a Norsonic 118 sound level meter was used. The calibration details for the equipment used during the measurements are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/00932326	Rion	24 Feb 17	1502114
Microphone	UC-59/035549	Rion	24 Feb 17	1502114
Pre-amp	NH-25/32354	Rion	24 Feb 17	1502114
Calibrator	NC-74/34125432	Rion	24 Feb 17	1502110
Sound level meter	Nor118/31754	Norsonic	2 Mar 17	08241
Microphone	40AF/62396	Gras	2 Mar 17	08241
Pre-amp	1206/30873	Norsonic	2 Mar 17	08241
Calibrator	1251/31322	Norsonic	20 Feb 17	08208
Noise source	MR1	Neutrik	N/A	N/A
Loudspeaker	EON 15 G2	JBL	N/A	N/A

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meter used in this survey are available upon request.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

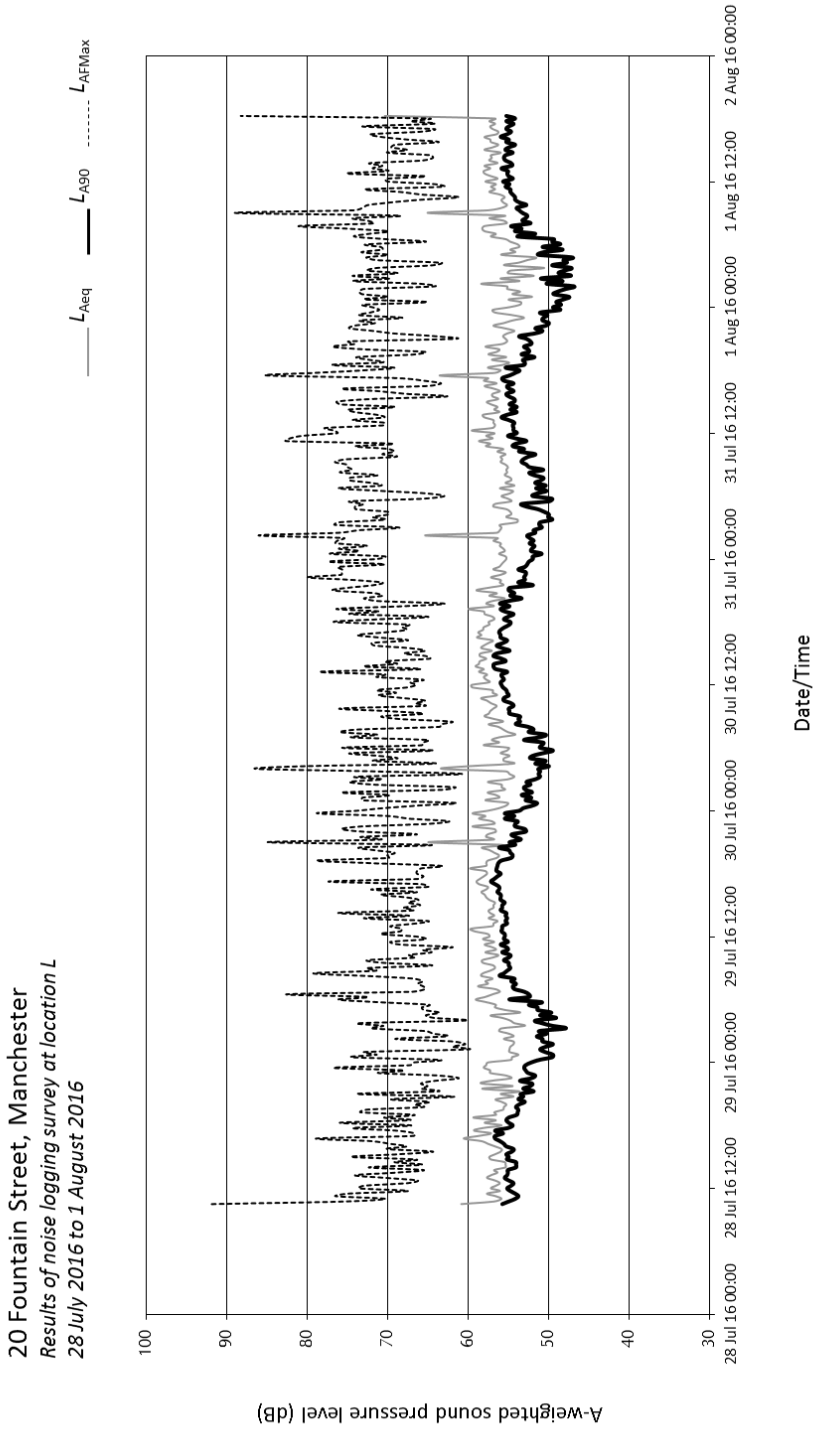
Weather conditions

During the unattended noise measurements between 28 July 2016 and 1 August2016, weather reports for the area indicated that temperatures varied between 10°C at night and 19°C during the day, and the wind speed was generally less than 5 m/s. Some periods of light rain occurred during the measurement period, but these have not been considered to have adversely affected the measurements.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at location L


20 Fountain Street, Manchester
Results of noise logging survey at location L
28 July 2016 to 1 August 2016
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
28 Jul 16 00:00
28 Jul 16 12:00
29 Jul 16 00:00
29 Jul 16 12:00
30 Jul 16 00:00
30 Jul 16 12:00
31 Jul 16 00:00
31 Jul 16 12:00
1 Aug 16 00:00
1 Aug 16 12:00
2 Aug 16 00:00
Date/Time

Appendix C

Sound insulation test performance graphs

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Level difference according to ISO 140-4

Field measurement of airborne sound insulation between rooms

File ref: **16308/DM**

Test date: **1 Aug 16**

Client: **Bruntwoood**

Job name and address: **20 Fountain Street, Manchester**

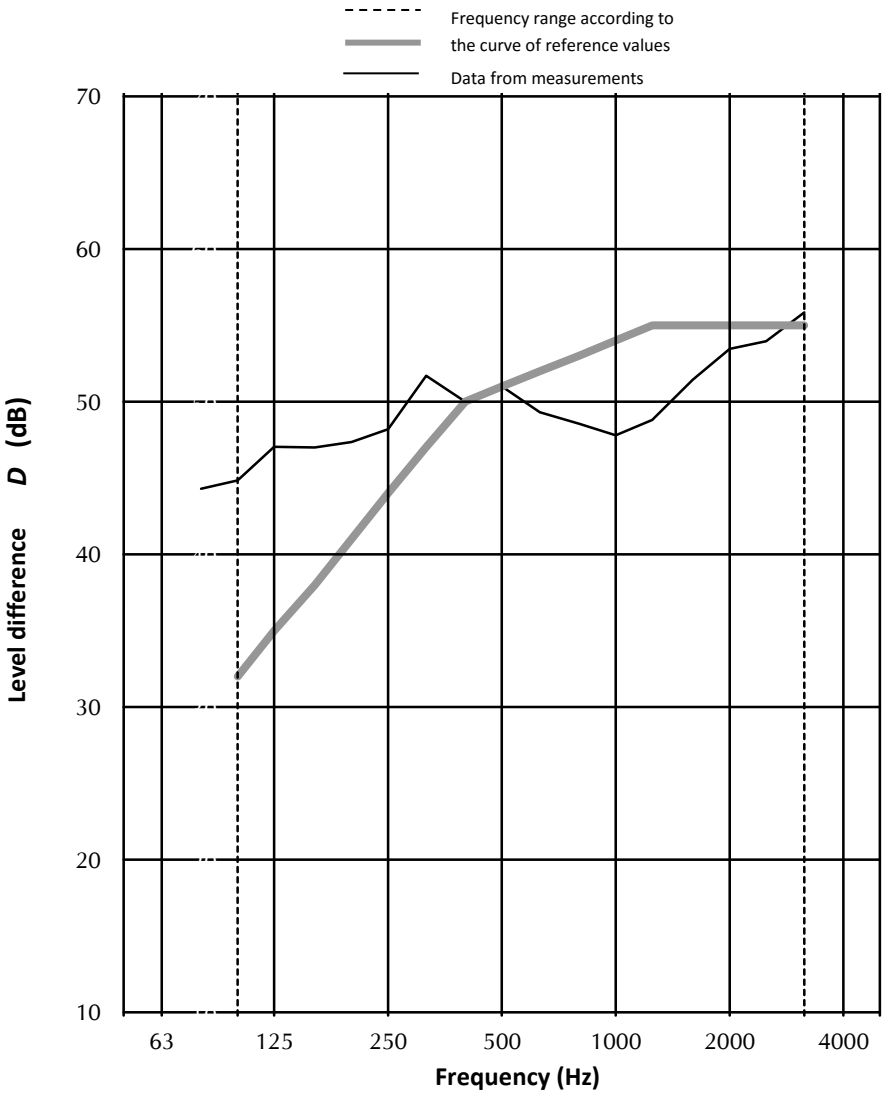
Test rooms and direction: **Ground floor unit to adjacent ground floor unit (Betfred)**

Construction details: **Unknown construction with drywall lining on both sides**

Frequency (Hz)	D (1/3 octave, dB)	
50		
63		
80	44.3	
100	44.9	B
125	47.1	B
160	47.0	B
200	47.4	B
250	48.2	B
315	51.7	B
400	50.0	B
500	51.0	B
630	49.3	B
800	48.6	B
1000	47.8	B
1250	48.8	B
1600	51.5	B
2000	53.5	B
2500	54.0	B
3150	55.9	B
4000		
5000		

"F" indicates where source room sound pressure levels in that frequency band differed by more than 6 dB from source room sound pressure levels in an adjacent band.

"B" indicates where receiving room sound pressure levels in that frequency band were within 6 dB of the background noise levels and are the the limit of measurement



Evaluation based on field measurement results obtained by an engineering method

Rating according to ISO 717-1

D_w $(C;C_{tr})$ = **51 (0 ; -1) dB**

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Level difference according to ISO 140-4

Field measurement of airborne sound insulation between rooms

File ref: **16308/DM**

Test date: **2 Aug 16**

Client: **Bruntwood**

Job name and address: **20 Fountain Street, Manchester**

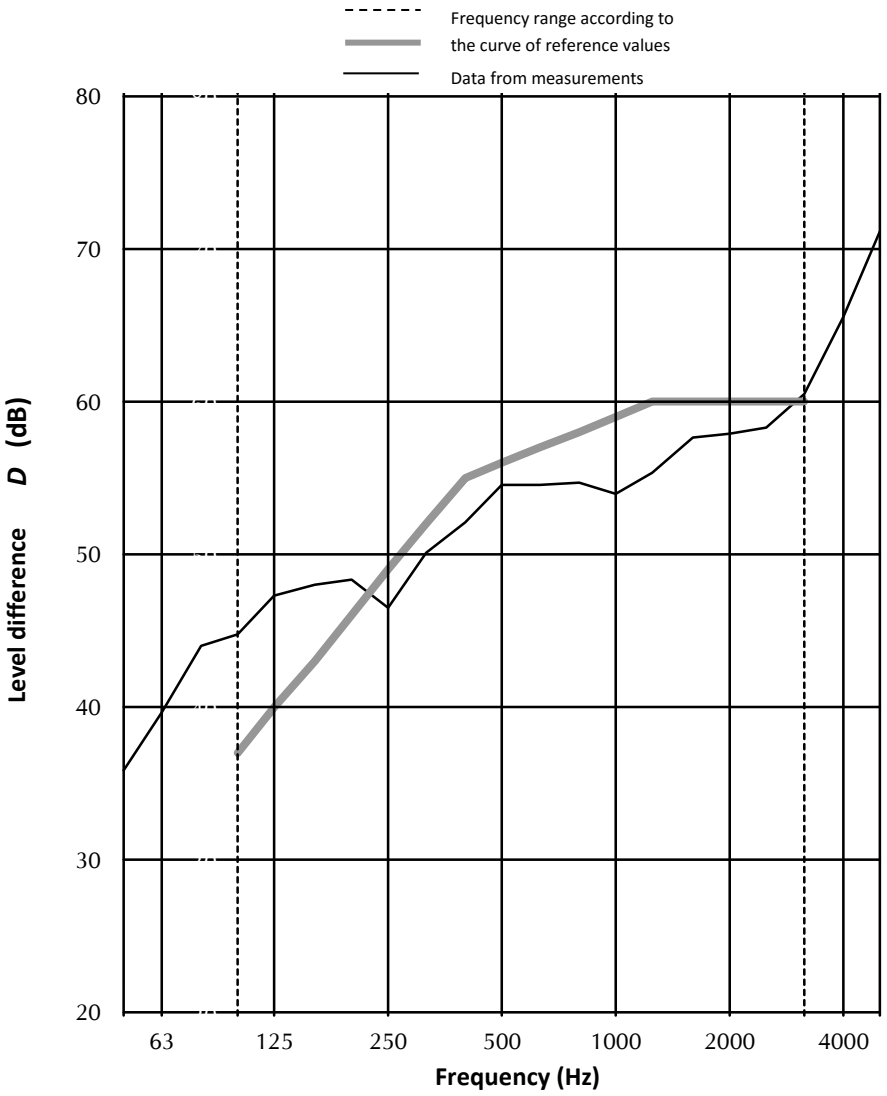
Test rooms and direction: **Ground floor unit to first floor office suite**

Construction details: **Concrete slab of unknown thickness with a carpeted raised access floor**

Frequency (Hz)	D (1/3 octave, dB)	
50	35.9	B
63	39.7	
80	44.0	
100	44.8	
125	47.3	
160	48.0	
200	48.4	
250	46.5	
315	50.1	
400	52.1	
500	54.6	
630	54.6	
800	54.7	
1000	54.0	
1250	55.4	B
1600	57.7	
2000	57.9	
2500	58.3	
3150	60.5	
4000	65.6	B
5000	71.2	B

"F" indicates where source room sound pressure levels in that frequency band differed by more than 6 dB from source room sound pressure levels in an adjacent band.

"B" indicates where receiving room sound pressure levels in that frequency band were within 6 dB of the background noise levels and are the the limit of measurement



Evaluation based on field measurement results obtained by an engineering method

Rating according to ISO 717-1

D_w $(C;C_{tr})$ = 56 (-1 ; -3) dB