BRAIDEN ACOUSTICS LTD

Innovation Forum // 51 Frederick Road // Salford // Manchester // M6 6FP

ACOUSTIC SURVEY FOR PLANNING

Client : St Joseph Ltd Date : 3 Oct 2013

Site : 26a Lever Street, Northern Quarter, Manchester Report No. : 10226

1 INTRODUCTION

Braiden Acoustics have been commissioned by St Joseph Ltd to undertake an acoustic survey at the site of 26a Lever Street, Northern Quarter, Manchester in order to support a planning application for a change of use.

The planning application seeks permission to change the use to a bar. From the Council's guidelines [3] it states:

> *Noise surveys are normally required where there is a planning application for a development that has the potential to cause noise disturbance to existing residential or other noise sensitive properties.*

1.1 AIM

The objective is to assess noise levels related to the site, in order to determine whether there is any loss of amenity for nearby 'sensitive receptors'. Where necessary, mitigation measures have been recommended.

2 DESCRIPTION OF SITE

The site part of the basement of a five storey building on the corner of Lever Street and Stevenson Square in the Northern Quarter district of Manchester city centre.

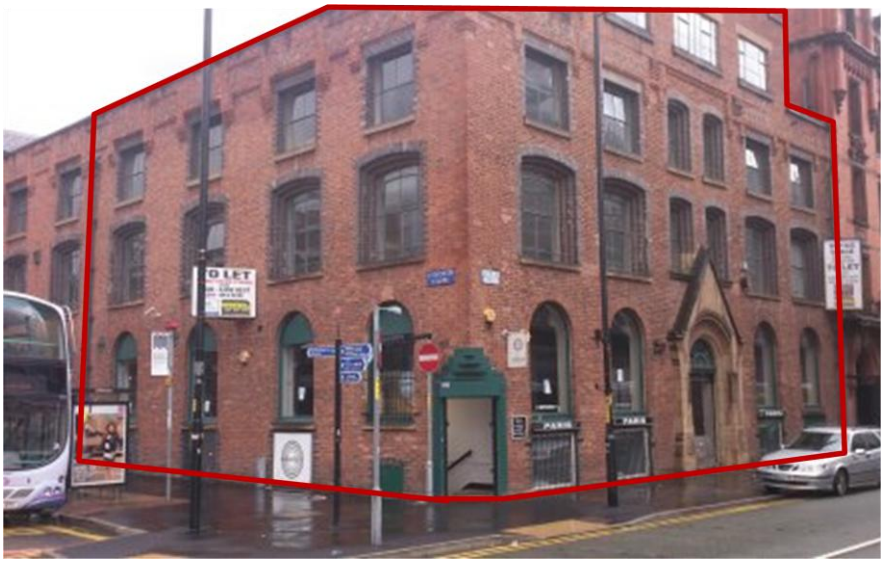


Figure 1
Front of site with boundary shown

The entrance to the site is on the corner of Lever Street and Stevenson Square, as shown in Figure 1. The proposed site occupies the majority of the basement that faces Lever Street as depicted in Figure 2.

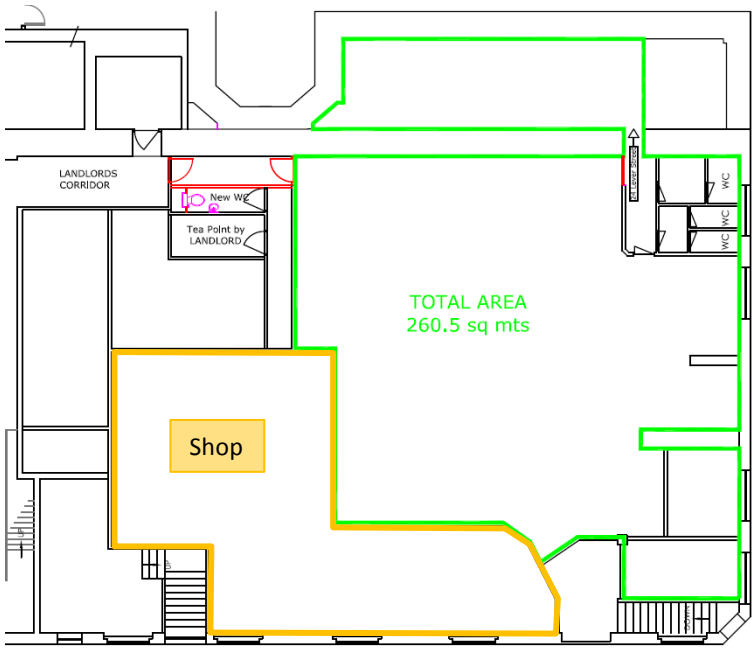


Figure 2
Plan of basement of 26a Lever Street

2.1 NEIGHBOURING USES

The proposed site is currently next to a shop on the basment floor. The upper floors of the building are currently office space.

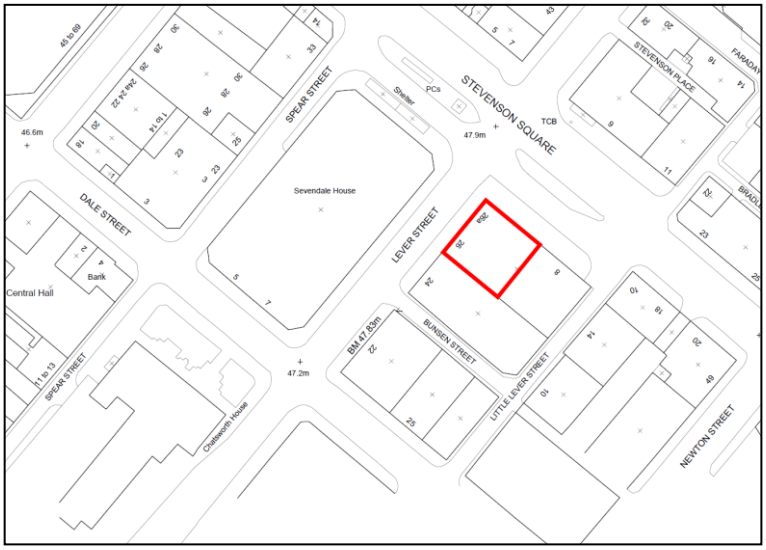


Figure 3
Site location and surrounding uses

The site is situation within a predominantly commercial area of Manchester city centre.

2.1.1 Nearest sensitive receptor (NSR)

The nearest residential dwellings are Chatsworth House some 100m south west of the site – see Figure 3 – and are therefore too far from the site to be sensitive receptors. The nearest receptors are non-residential units on the basement floor and ground floor of 26 Lever Street.

2.2 EXISTING USE

The site is currently a vacant unit.

2.3 PROPOSED USE

The intended use of the space is for a bar.

2.3.1 External mechanical services

There is to be one external condenser for air conditioning – this is shown in Figure 4 in red. The condenser unit will face onto a cobbled roadway next to Little Lever Street and be housed internally.

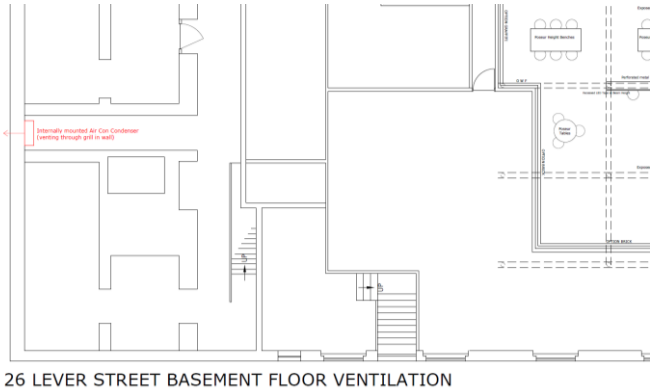


Figure 4
Proposed rear elevation

2.3.2 Amplified music

There are no precise details of the sound system at this stage, although there will only be 'background' music during offices hours.

2.3.3 Hours of use

1600 – 0300hrs daily

3 ACOUSTIC CRITERIA AND METHODOLOGY

There are several potential noise issues with the proposed site:

1. noise egress from amplified music
2. noise egress due to external mechanical services
3. noise transmission through the party wall and floor.

In order to assess the various issues mentioned above, it has been necessary to undertake a background noise survey. This background noise study is the baseline for a BS 4142 type assessment where 'industrial' noise is compared to the background noise at the nearest receptor.

3.1 NOISE INDICES

Several different acoustic parameters are used to describe noise limits, so a brief overview of the pertinent indices will be given here. Real world noise levels, especially environmental noise, fluctuate depending on the noise source, so single figure descriptors are used for a more convenient description.

$L_{A90,T}$ Level that is exceeded for 90% of the measurement time, *T* – known as the *background noise level*. This descriptor indicates the 'noise-floor' i.e. the underlying noise level.

$L_{Aeq,T}$ Equivalent continuous noise level for a given time period, *T*. This can be seen as the average noise level.

$L_{Amax,T}$ Maximum noise level within time period, *T*.

The 'A' subscript denotes that the noise level is A-weighted which is a correction to approximate to the human hearing response; hence give a more 'realistic' value.

3.2 BRITISH STANDARDS

3.2.1 BS 4142

BS 4142 "Method for rating industrial noise affecting mixed residential and industrial areas"[1] assesses industrial noise with regards to residential dwellings. The guidance is commonly used to compare the average noise from an industrial source only (specific noise level), L_{Aeq}, to the background noise level, L_{A90}, at the nearest sensitive receptor.

A 5dB 'penalty' is added to the specific noise level if the noise source has a 'character' that can draw attention that may be described as tonal, intermittent or impulsive. When added to the specific noise level it forms the rating level.

The background level is then compared to the rating level. It is usual that the rating level due to the source should be below the background noise level at the nearest sensitive receptor; indeed BS 4142 states:

> *"If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely"*

It is now usual for a Local Planning Authority (LPA) to require that their criterion be met in each octave band, so that issues of low frequency noise can be mitigated for at the planning stage.

3.2.2 BS 8233: 1999

BS 8233:1999 "Sound insulation and noise reduction for buildings" [2] gives guidance on, among other things, acceptable internal noise levels within buildings. Table 6 within the Standard gives relevant internal noise levels for unoccupied spaces for various room types – the relevant section from Table 6 from BS 8233 is shown below in Table 1.

Criterion	Typical situations	Design range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable conditions for study and work requiring concentration	Library, cellular office, museum	40	50
	Staff room	35	45
	Meeting room, executive office	35	40
Reasonable speech or telephone communications	Department store	50	55
	Cafeteria, canteen, kitchen	50	55
	Wash-room, toilet	45	55
	Corridor	45	55

Table 1
Indoor ambient noise levels in spaces when they are unoccupied (taken from Table 5 from BS 8233)

3.3 COUNCIL CRITERIA

The Council have criteria, for noise levels from various sources, which follow the BS 4142 assessment methodology and are described in their planning document [3].

3.3.1 Noise egress due to amplified music

When considering the potential impact of a proposal for an entertainment venue consultants should consider the overall noise level (LAeq) and the 63 Hz and 125 Hz octave band noise levels (Leq). [...]

The target noise criteria here should be 10dB (LAeq) below the existing LA90 in each octave band.

Applicants and consultants should note that although a particular business model may require a "chilled out" or "acoustic" venue Planning Approval for an entertainment venue will remain in place as long as the development exists. Subsequent owners or tenants may wish to provide much louder entertainment in the future. For this reason applicants and consultants should predict the noise impact of a proposed entertainment venue using noise levels that are representative of those found in "typical" venues of the kind being applied for. Consultants should provide their rational for using particular noise levels and reference the source of the noise levels used during their predictions.

3.3.2 Noise egress due to mechanical services

The Council's criterion for noise from fixed plant and equipment is 5dB below background at the nearest sensitive receptor, as confirmed by Rick Knightley, Environmental Health Office from Manchester City Council.

3.3.3 Internal sound transmission

From the Council's planning document [3] it is necessary to consider the following:

Consultants should demonstrate that the structure of the development will be sufficient to adequately contain the noise generated within the development. In doing so consultants should consider:

- *"Flanking" noise;*
- *"Structure borne" noise;*
- *The overall level of noise (LAeq) generated by the use in question and any tonal or impulsive characteristics that the noise may contain; and*
- *The acoustic properties of the development (Including the construction of party floors and/or walls, windows and doors, ventilation systems, and structural columns.)*

4 MONITORING DETAILS

A background noise survey has been carried out almost over a 24 hour period during midweek so to capture the potentially quietest time of the week when the site would be operating. This is done to ensure the noise survey will be representative of the environment at the most "sensitive" times when the venue is likely to have its greatest impact.

4.1 MEASURING EQUIPMENT

The test equipment used was calibrated before and after measurements, with negligible deviation (<0.1dB). Details of the measuring equipment are shown in Table 2.



Equipment Description	Manufacturer	Type Number	Serial No:	Calibration Due	Calibration Certification Number
Class 1 Integrating Real Time 1/3 Octave sound analyzer	NTi	XL2	A2A-04827-D2	01/12/2013	n/a[1]
Calibrator	Bruel and Kjaer	4231	1762167	25/10/2013	10043
Microphone	NTi	MA220	1860	01/12/2013	n/a[1]

Table 2
Details of test equipment

4.2 MONITORING LOCATION

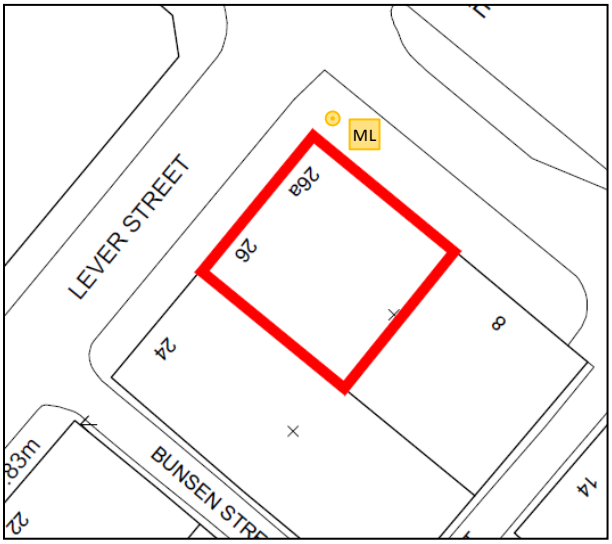


Figure 5
Monitoring location, ML

Monitoring took place near the corner of Lever Street and Stevenson Square from a first floor window. The microphone was approximately 1m from the façade as depicted in Figure 5.

4.3 MONITORING RESULTS

The monitoring results summarised in Table 3 are for the times when the site is due to be open, including an hour before the proposed opening time of 4pm.

Date	Weather	Location	Time		Time Period	$L_{A90,5min}$ dB (lowest)	L_{Aeq} dB	L_{Amax} dB	Noise Climate
			Start	Finish					
Tues – Wed 24-25/09/2013	10 - 17°C <5ms[-1] wind ~50% cloud	ML	15:00	18:00	Office & site open	58.4	66.5	89.8	road traffic esp. buses, patrons
		ML	18:00	03:00	site open only	51.7	64.7	98.8	road traffic esp. buses, patrons

Table 3
Summary of environmental noise measurements.

[1] Sound Level Meter and Microphone under 2 years old.

Time history of the measured noise levels are shown in Figure 6. The nearest sensitive receptors are the offices on the ground floor of 26 Lever Street – it is assumed that they will operate 0800 – 1800 hrs. Therefore, there will only be two hours when the site and offices will be occupied at the same time.

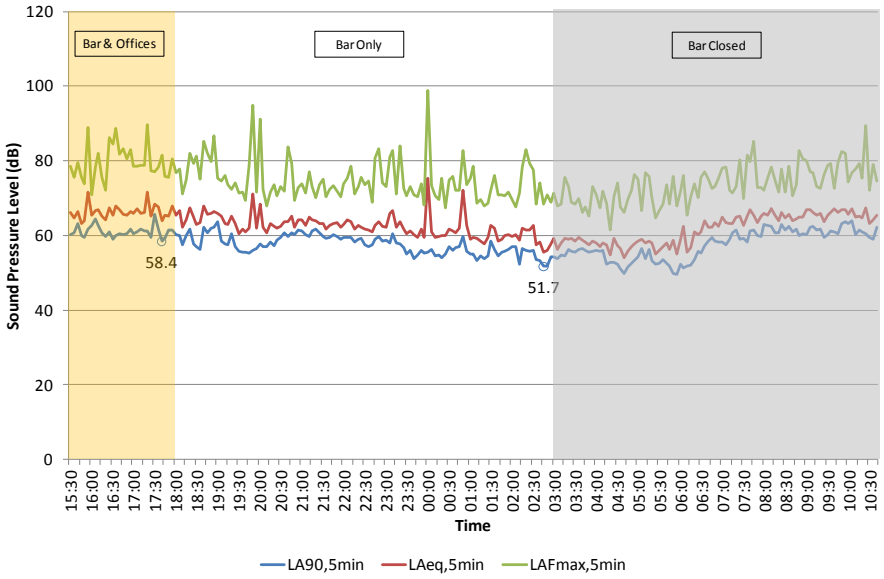


Figure 6
Time history of noise levels measured at the monitoring location

Octave band data is used for the noise break out calculations from the site. The lowest L_{A90} value is used when the site and the offices would be occupied – this is at 1740 hrs.

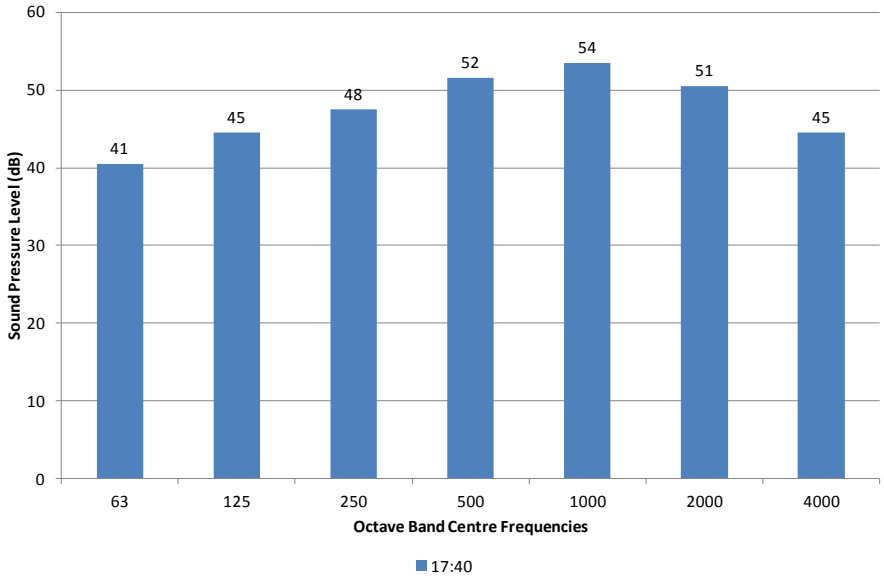


Figure 7
Octave band data for the quietest period when the site and offices are occupied at 17:40hrs

5 ACOUSTIC ASSESSMENT

From the measured noise levels stated in the last section, the following has been assessed:

- noise break out via the windows and doors;
- noise transmission via party wall and floor.

5.1 NOISE BREAK OUT

There are potentially two pathways for noise break out from the proposed site

1. via the internal doorways
2. via the windows on Lever Street.

5.1.1 Noise break out via the doorways

The doorways of the existing shop and proposed bar are both at basement level. The proposed site currently has an acoustic lobbied door system. This is to be retained and will minimise noise egress from the bar to the nearby shop, via their respective doorways. The acoustic lobbied doors must be well sealed and have working self-closing systems so that there is always one door closed at any one time, therefore containing any noise within the site.

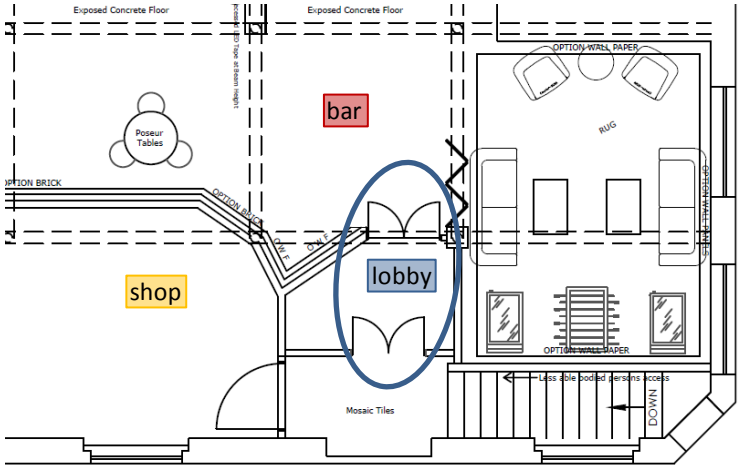


Figure 8
Entrance to 26a Lever Street showing shop entrance and lobbied site entrance.

5.1.2 Noise break out via the windows

At the Lever Street façade there are four windows with one currently blocked off as it is used as a lavatory. All of the Lever Street windows are double-glazed – this was confirmed by a site visit. To ensure minimal sound leakage the existing windows should be checked for gaps / cracks etc. especially around the seals (and the seals themselves). These windows will be also be blocked up from the inside using plasterboard or a similar material.

Assuming the above, the basic calculation to determine the internal sound pressure level (SPL) and/or the required glazing sound reduction index (SRI) is [4]:

$$SPL_{int} = SPL_{ext} + SRI_{glazing} + 6 \text{ dB} \quad (1)$$

As a worst case, only the glazing sound reduction shall be used in the calculations. However, in reality, the windows will be boarded up so their overall sound reduction performance is likely to be higher.

In addition to this, any distance attenuation (A_{dist}) is taken into account. The distance between the source and receiver is denoted as 'r'.

$$A_{dist} = 10 \log r \ \text{dB} \qquad (2)$$

Finally, directivity due reflections from surfaces is accounted for in the calculations. The noise level from a source will be different if it radiates in free air than if is against a surface, for example, the side of a building. This is because the sound energy is concentrated in a particular direction. In order to account for the concentrated directivity a Directivity Index (DI) is used and is described by:

$$DI = 10 \log_{10}(Q) \qquad (3)$$

where $Q = 1$ → no surfaces, i.e. free field

$Q = 2$ → 1 surface, i.e. side of building

$Q = 4$ → 2 surfaces, i.e. junction of side of building and ground

$Q = 8$ → 3 surfaces, i.e. junction of side of building , ground and wall (in a corner)

Noise break out via the windows on Lever Street has used the lowest octave band data when the site and offices would be operating – as shown in Figure 7.

The SRI of the glazing has been taken from the Pilkington document [5] using standard double glazing of 4/12/4mm. The boarding up of the windows has not be taken into account to give a 'worst case' methodology.

No distance attenuation has been used due to the proximity of the basement and ground floor windows – this can be seen in Figure 1.

For the directivity – a Q value of 4 has been used as there are 2 surfaces: the building façade and the floor.

The full calculation can be seen in the Appendix A3.

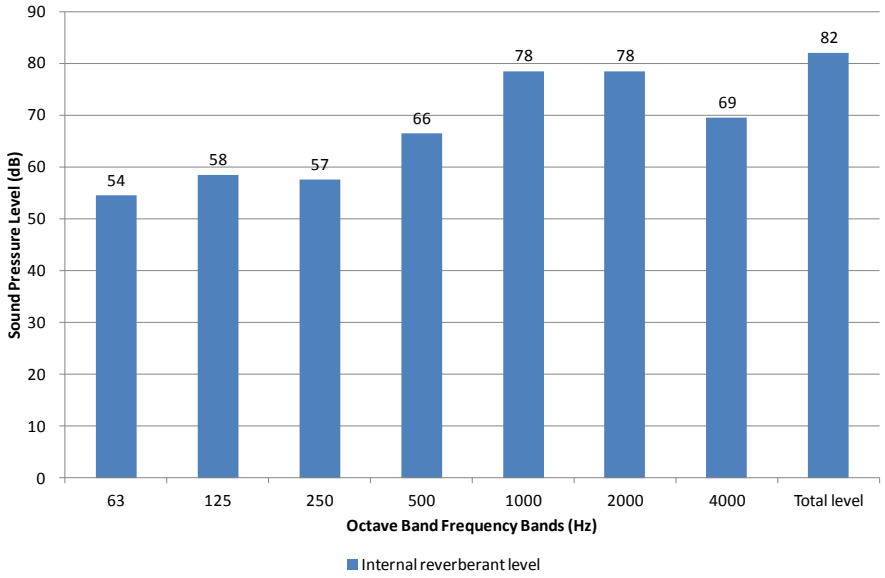


Figure 9
Maximum permitted internal noise levels during office hours

The overall calculated level of 82 dB(A) is the level that would be expected for a bar operating with background music – if anything the noise levels may be lower. At this time, 1600 – 1800 hrs, it is advised to only use smaller loudspeakers that cannot produce potentially problematic low frequencies. Once the office workers have left, large loudspeakers can be permitted.

5.2 INTERNAL NOISE TRANSMISSION

Sound reduction values for the party floor and wall have been determined. Design of the partitions shall take into account these acoustic minimum limits.

5.2.1 Via party wall

The noise level within the bar, when the adjacent commercial premises are occupied, should be no more than 82 dB(A). The noise level within the shop is taken from Table 1 assuming the 'Department Store' category and using the 'good' standard – 50 dB(A). Therefore, the party wall between the shop and bar should have an overall sound reduction index of

$$32 \text{ dB(A) } D_{nTw.}$$

5.2.2 Noise transmission via party floor

Above the site, at ground floor level, the site has permission to currently operate as offices. Using the 'cellular offices' category from Table 1 and again using the 'good' critierion, the internal noise level within the offices should be no more than 40 dB(A). Therefore the sound reduction index of the party floor should be at least:

$$42 \text{ dB(A) } D_{nTw.}$$

Within 26 Lever Street there are structural columns. However, these are a solid cast iron construction and are not likely to transmit the relatively modest noise levels shown in Figure 9. Therefore, structure borne noise via the structural columns should not be a problem.

5.3 NOISE DUE TO EXTERNAL MECHANICAL SERVICES

Details of the external air conditioning condenser are not known currently. However, the siting of the unit has been designed to be discreet in both visual and aural aspects.

5.4 NOISE DUE TO EXTERNAL PATRONS

Noise from patrons has been minimised as there are no designated external areas. Qualified door staff shall ensure that patrons leave the area in an orderly fashion.

6 DISCUSSION

Many measures are recommended to ensure noise egress from the proposed site is minimised in accordance with Manchester City Council's acoustic criteria.

6.1 MUSIC SYSTEM

Due to the permitted noise levels within the bar, only small loudspeakers should be used (loudspeakers drivers should be no more than 6" in diameter). Braiden Acoustics must be consulted on the type and placement of the music system, especially regarding loudspeakers. Loudspeakers should *not* be placed on the structural columns.

After 1800hrs, subwoofers may be used as there will be no sensitive receptors nearby.

6.2 EXTERNAL PLANT NOISE

Once details of the external mechanical unit are known, then it can be assessed fully. However, its location is behind an exterior wall (see Appendix A1) so there will be a shielding effect. In addition, only a modest unit will be used so it is highly likely that there will be no issue regarding noise.

6.3 External Access Doors

The existing lobby door system will be used for the front entrance. The larger the distance between the inner and exterior door will reduce the likelihood of both doors being open simultaneously; hence preventing noise leaking from the open doors.

Any other external doors, such as fire doors, need to be acoustically sealed. Braiden Acoustics should be consultant about such products.

6.4 Windows

Windows must remain closed at all times. All glazing must be checked for gaps, cracks etc and 'made good' and replaced where necessary. All glazing must be well sealed to ensure minimum sound leakage.

6.5 Walls

Party and external walls need to checked for integrity and made good where necessary, in particular re-pointing brickwork.

The party wall at basement floor should perform at least 32 dB D_{nTw}. The is an 'on-site' value. Braiden Acoustics should be consulted so that any design meets this criterion.

6.6 Floor

The party wall should have a minimum acoustic rating for 42 dB D_{nTw} – again, this is an 'on-site' value. Braiden Acoustics should be consulted so that any design meets this criterion.

6.7 Disposal of waste

All waste should be disposed of quietly, especially the tipping of glass which should be avoided during office hours.

6.8 Building methodology regarding acoustics

All installation and refurbishment work should be conducted with care. It should be ensured that all service penetrations should be well sealed and all gaps filled to all adjoining and exterior partitions with appropriate building methods so to not reduce the sound insulation of the property. In short, air gaps should be avoided at all costs to minimise sound leakage.

6.9 Staff Management

It is recommended that management closely liaise with staff to ensure that patrons leaving the premises do so quietly with the nearby residents in mind.

6.10 Worst case methodology

Wherever possible, a worst-case methodology has been used to ensure that any acoustic issues have been dealt with stringently. The target noise level at the nearest receptor is based on the most sensitive time when the site would be operating. As the calculations are based on this target noise level then the amenity of the receptors, regarding noise, should be safeguarded.

7 Conclusion

An acoustic survey has taken place at 26a Lever Street, Northern Quarter, Manchester to support a planning application for a change of use to bar.

Maximum noise levels at the nearest receptors have been determined and these form the basis for noise break out.

The permitted internal noise level of the site has been determined from the noise break out calculations. Due to these noise levels, only small loudspeakers (no more than 6" diameter drive units) should be used during office hours. After offices hours, bigger loudspeakers can be used.

With adequate internal noise levels, noise transmission via the party wall will be minimised. The party wall must have a minimum sound reduction value of 32 dB D_{nTw} and the party floor must be at least 42 dB D_{nTw}.

In order to minimise noise propagation, the following recommendations/designs will be included:

- lobbied door system to the site retained,
- the party wall must be 'made good' where necessary, e.g. repair plasterwork, and achieve a minimum of 32 dB D_{nTw}.
- the party floor made good and achieve a minimum on site value of 42 dB D_{nTw}.
- external walls 'made good' where necessary, e.g. repointing, to ensure integrity,
- windows made good ensuring air tight seals.
- a modest sound system using small loudspeakers to be installed and used during office hours.

With the above recommendations, noise break out and transmission will be minimised and in accordance with the Council's guidelines.

8 REFERENCES

[1] BS 8233:1999
Sound insulation and noise reduction for buildings - Code of practice
British Standards Institute, London, 1999.

[2] BS8233: 1997
Sound Insulation and noise reduction for buildings – Code of Practice,
British Standards Institute, 1999.

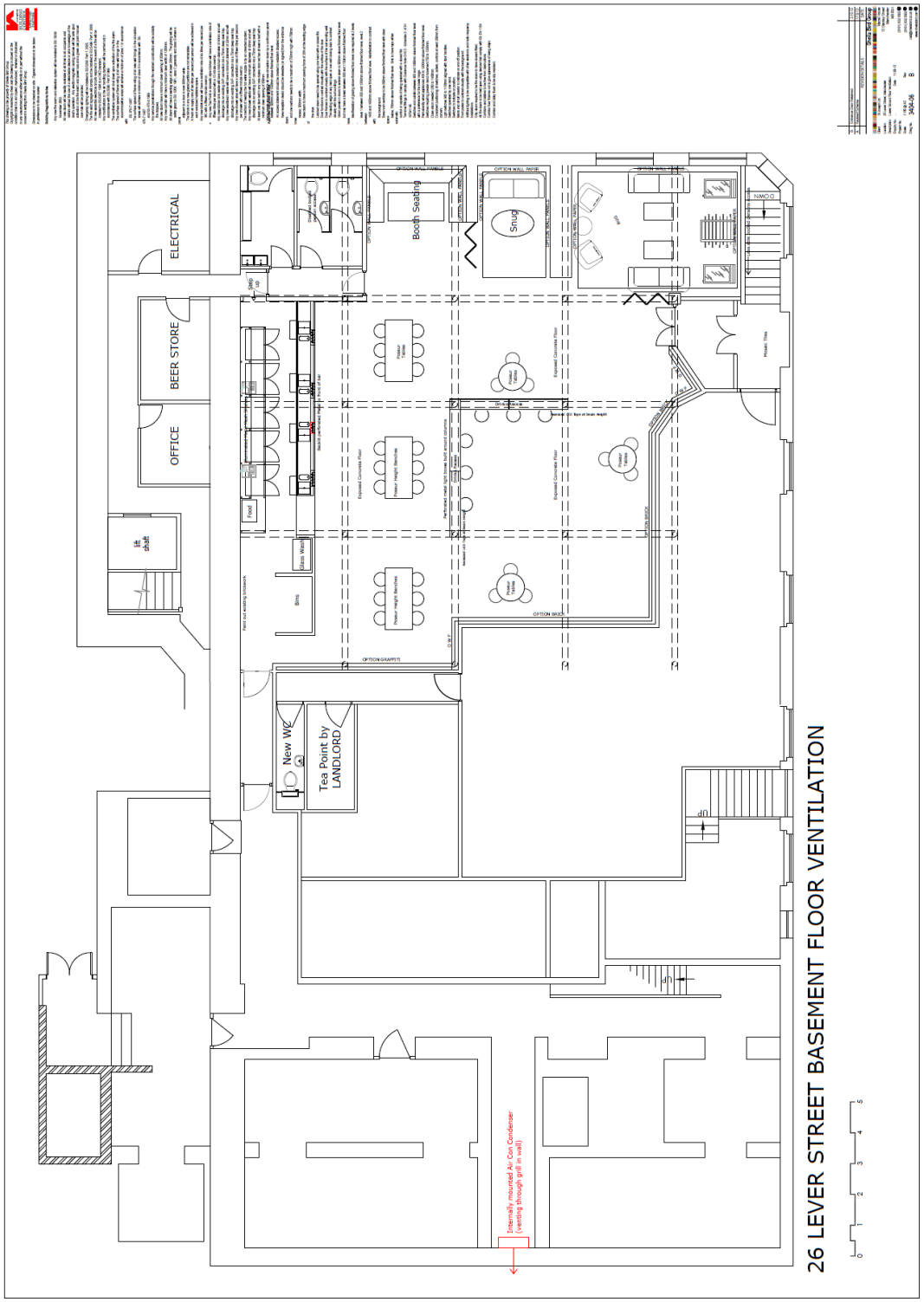
[3] Environmental and Public Protection
GD 03 - Environmental and Public Protection Information for Developers
Version: 1.00, Manchester City Council, Feb 2013.

[4] R. Watson & O. Downey
The Little Red Book of Acoustics
Blue Tree Acoustics, July 2008.

[5] Pilkington
Pilkington Optiphon
Pilkington United Kingdom Limited, October 2008.

Appendix

A1 Site plan showing ventilation



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A2 GLAZING DATA



Pilkington **Optiphon**™

	dB sound reduction index by octave band – Hz						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Configuration single glazing										
6.8 mm Pilkington **Optiphon**™	21	26	31	35	37	38	35(-1;-3)	35	34	32
8.8 mm Pilkington **Optiphon**™	24	28	34	38	37	43	37(-1;-4)	37	36	33
10.8 mm Pilkington **Optiphon**™	28	31	36	38	39	47	38(-1;-2)	38	37	36
12.8 mm Pilkington **Optiphon**™	30	32	37	39	41	51	39(-0;-2)	39	39	37
16.8 mm Pilkington **Optiphon**™	29	34	37	39	46	55	40(-0;-2)	40	40	38
Configuration Insulating Glass Unit (IGU), thickness in mm										
6 / 6 to 20 mm / 6.8 Pilkington **Optiphon**™	23	24	34	42	43	52	38(-2;-5)	38	36	33
6 / 6 to 20 mm / 8.8 Pilkington **Optiphon**™	24	26	40	48	46	54	41(-3;-7)	41	38	34
6 / 6 to 20 mm / 10.8 Pilkington **Optiphon**™	23	28	41	47	45	55	42(-3;-7)	42	39	35
6 / 6 to 20 mm / 12.8 Pilkington **Optiphon**™	20	29	43	47	46	49	42(-3;-8)	42	39	34
8.8 Pilkington **Optiphon**™ / 6 to 20 mm / 12.8 Pilkington **Optiphon**™	26	36	46	50	52	63	47(-2;-7)	47	45	40
16.8 Pilkington **Optiphon**™ / 6 to 20 mm / 16.8 Pilkington **Optiphon**™	29	40	45	47	54	68	48(-2;-6)	48	46	42

The above IGUs with Pilkington **K Glass**™ on one pane and a 16 mm 90 % Argon-filled cavity achieve a U value of 1.5 W/m² K
Further information on solar and thermal performance is available on the Pilkington website using the Spectrum program: www.pilkington.com/spectrum
Impact classification EN12600 Class 1(B)1 for all above Pilkington **Optiphon**™ products
$R_w(C;C_{tr})$ are in accordance with EN717-1

Non Pilkington **Optiphon**™ **glass products. Figures from BS EN 12354**

	dB sound reduction index by octave band – Hz						$R_w(C:C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Configuration single glazing										
4 mm Float Glass	17	20	26	32	33	26	29(-2;-3)	29	27	26
6 mm Float Glass	18	23	30	35	27	32	31(-2;-3)	31	29	28
8 mm Float Glass	20	24	29	34	29	37	32(-2;-3)	32	30	29
10 mm Float Glass	23	26	32	31	32	39	33(-2;-3)	33	31	30
12 mm Float Glass	27	29	31	32	38	47	34(-0;-2)	34	34	32
Configuration Insulating Glass Unit (IGU), Float glass, thickness in mm										
4 / 6 to 20 mm / 4	21	17	25	35	37	31	29(-1;-4)	29	28	25
6 / 6 to 20 mm / 6	20	18	28	38	34	38	31(-1;-4)	31	30	27
6 / 6 to 20 mm / 4	21	20	26	38	37	39	32(-2;-4)	32	30	28
10 / 6 to 20 mm / 4	24	21	32	37	42	43	35(-2;-5)	35	33	30
10 / 6 to 20 mm / 6	24	24	32	37	37	44	35(-1;-3)	35	34	32

Note that these are conservative figures and cover all products by European glass manufacturers.
R_w = Weighted sound reduction. This scale allows for the response of the human ear and could be used for determining a suitable product to reduce noise such as voices.
C = An adjustment to the R_w scale that could be used for selecting a product to reduce noise from music, radio, tv, high speed traffic and other medium to high frequencies.
C_{tr} = An adjustment to the R_w scale that could be used for selecting a product to reduce noise from urban road traffic, disco music and other noises with a large component of low frequencies.
Note that a 3 dB difference is barely discernable, 5 dB is clearly discernable and 10 dB is a doubling or halving of the noise.

A3 BREAK OUT CALCULATION

			BS 4142 calcuation	Front	nd centre frequency							
Term			Description	Details	63	125	250	500	1000	2000	4000	Total level
L_{A90}			Background Noise Level	at assessment location	40.5	44.5	47.5	51.5	53.5	50.5	44.5	
			A weighting	no	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
			Council criteria below BNL (dB)	10.00	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
$L_{A,target}$			SNL - A weighted	$SPL_{external}$	30.5	34.5	37.5	41.5	43.5	40.5	34.5	
A_{dist}	0	m	distanct attenuation	line source	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
A_{air}			Air absorption	20°C; 70% humidity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
δ	0	m	barrier	none or n/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	100%		On time	10log(on time % / 100)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DI	4	Q	Directivity	2 surfaces	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
R_{wi}			SRI glazing	4/12/4	24.0	24.0	20.0	25.0	35.0	38.0	35.0	
			Numerical correction		6	6	6	6	6	6	6	
$L_{Aeq,\ int}$			Internal reverberant level		**54**	**58**	**57**	**66**	**78**	**78**	**69**	**81.9** dB