



BRAIDEN ACOUSTICS LTD

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

NOISE IMPACT ASSESSMENT

Prepared For : Defaqto Leisure Ltd

Date : 31 May 2024

Site : 39 - 41 Thomas St, Northern Quarter

Report No. : 11289revA

1 INTRODUCTION

Braiden Acoustics Ltd has been commissioned by Defaqto Leisure Ltd to undertake an acoustic survey at the site of 39 - 41 Thomas St, Northern Quarter in order to support a planning application for the change of use to a café / bar, including the installation of 2no. external condenser units.

1.1 AIM

This report shall determine the noise sources and receivers, their baseline noise thresholds and assess according to relevant standards and guidance.

2 DESCRIPTION OF SITE

The site is a three-storey brick building within a terraced row of commercial properties on Thomas Street in the Northern Quarter district of Manchester city centre.



Figure 1
Site Edge Red

2.1 SITE LOCATION AND SURROUNDING USES

The site is at 39-41 Thomas Street which is in the heart of the Northern Quarter, and as such, the surrounding area is primarily commercial in use.

On the south west boundary of the property is Thomas Street. Flanking the site is The Bay Horse public house to the north west and Terrace café/bar to the south east (also owned by the applicant). Directly to the rear is another commercial use, Ad Hoc Wine Shop, with a rooftop outdoor terrace as part of Terrace café/bar.

The wider area of Thomas Street, Edge Street and High Street are all predominantly commercial uses.

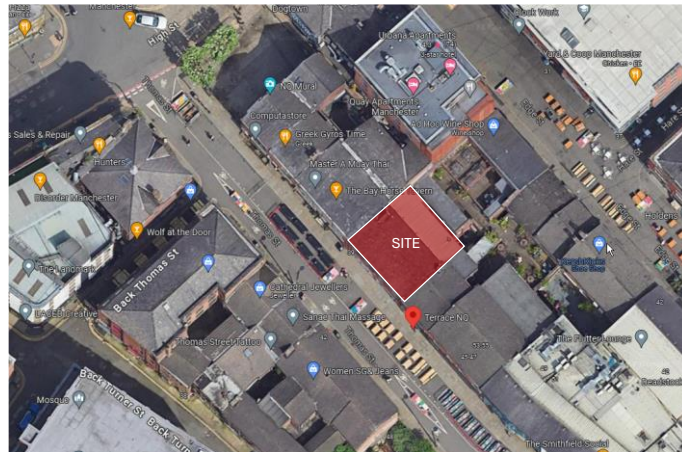


Figure 2
Site location and surrounding uses

2.1.1 Nearest sensitive receivers

There are apartments to the north of the site known as Bollin House, which is five-storey mixed use building with commercial use at ground floor and residential on the floors above.

NB It should be noted that there are no habitable windows on the south-eastern elevation of Bollin House.**

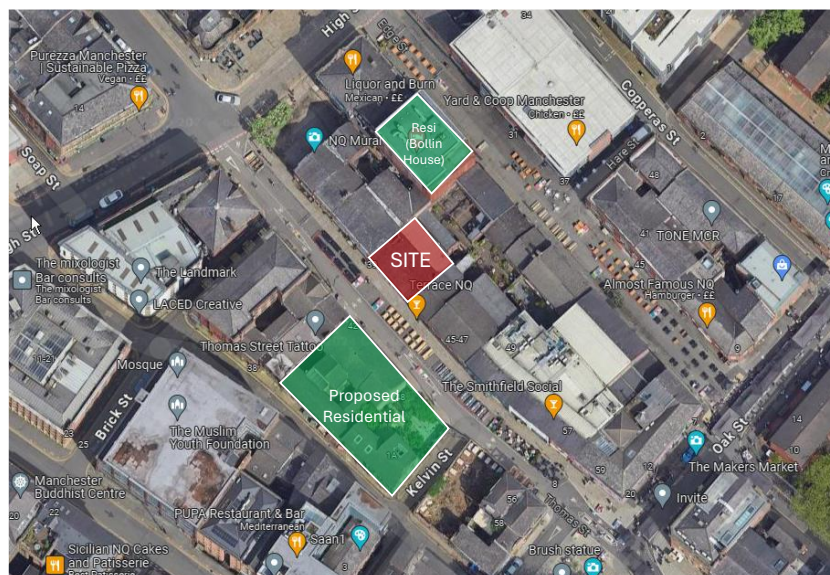


Figure 3
Site location in relation to nearby sensitive receivers

The parcel of land to the south, known as 42-50 Thomas Street and 7 Kelvin Street, has been earmarked for potential residential use, although technical issues have delayed the planning process. The original planning application related to the site is 113475/FO/2016 "External alterations and repair and change of use of the upper floors of Grade II listed 7 Kelvin Street and the erection of a linked 4/5 storey building following the demolition of numbers 42 to 48 Thomas Street to provide 20 no. dwellings (Class C3) (8 x 1 bed and 12 x 2 bed) with ground floor and basement shop / restaurant (Class A1 or A3) use; and storage space for 20 cycles."

2.2 PROPOSED USE

It is proposed to have a bar on ground and first floors with storage on the second floor.



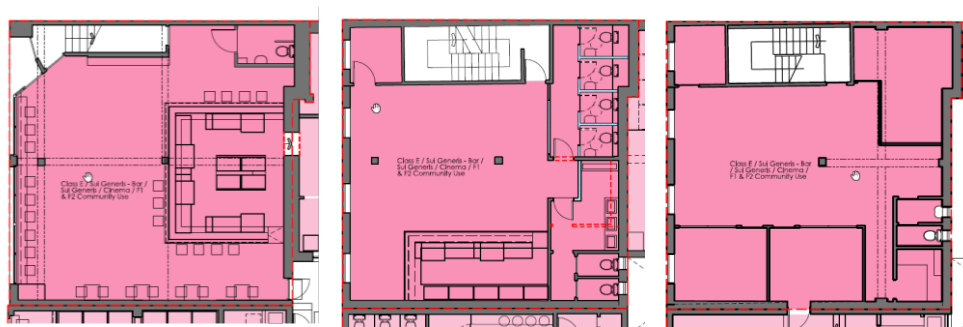


Figure 4
Ground, First and Second floor proposed layouts

2.2.1 Opening hours

The proposed opening hours will be the same as Terrace, next door:

Friday	12 pm–3 am
Saturday	12 pm–3 am
Sunday	12 pm–1 am
Monday	12 pm–1 am
Tuesday	12 pm–1 am
Wednesday	12 pm–1 am
Thursday	12 pm–2 am

2.2.2 Building services

There will be 2no. condenser units for air conditioning, located in the small inner courtyard where the condensers for Terrace are located.

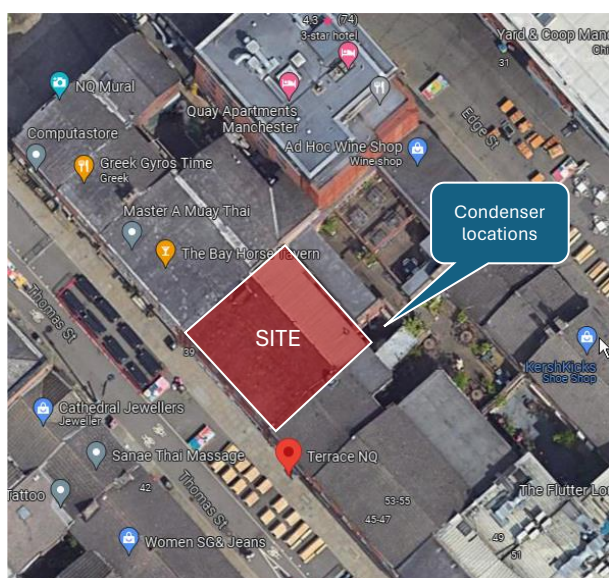


Figure 5
Condenser units' location

The external units are as follows:



1no.	Mitsubishi	PUZ-M100VKA2	54 dB Lp@1m (Heating)
1no.	Mitsubishi	SUZ-M71VAR1	51 dB Lp@1m (Heating)

2.2.3 Sound system

Details of the sound system have yet to be finalised but recommendations will be given later in this report.

3 ACOUSTIC CRITERIA AND METHODOLOGY

3.1 BS 4142

BS 4142:1999 “Method for rating industrial noise affecting mixed residential and industrial areas” [1] assesses industrial noise with regards to nearby residential dwellings. The guidance is commonly used to compare the equivalent noise from an industrial source only (specific noise level), L_{Aeq} , to the background noise level, L_{A90} , at the nearest sensitive receptor (NSR).

This Standard has been recently updated, BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” [2]. Whereas the old standard added 5dB ‘penalty’ to the Specific Noise Level (SNL) if the noise source has a ‘character’ that can draw attention that may be described as tonal, intermittent or impulsive, the new standard gives clearer guidance on noise ‘character’. Furthermore, the previous Standard gave only one 5 dB penalty whereas the new Standard may not. When added to the specific noise level it forms the rating level. The new Standard gives the guidance for the following types of noise character:

Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.

NOTE 1 The prominence of tonal or impulsive sound from a source can be masked by residual sound. In many cases the amount of masking varies as the residual sound changes in level and possibly character. The source’s tonal and/or impulsive characteristics could also vary with time.

Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention.

Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.



Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Once a penalty for noise character is added to the Specific Noise Level then this is termed 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:

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level.

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is

that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3.2 BS 8233: 2014

The British Standard BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings” gives guidance on recommended indoor ambient noise levels for residential dwellings.

Room	Criterion	$L_{Aeq,T}$	
		night	day
Bedroom	Sleeping	30	35
Dining Room/Area	Dining	--	40
Living Room	Resting	--	35

Table 1

Recommending indoor ambient noise level thresholds from anonymous noise (taken from Table 4, BS 8233:2014)

Internal levels are simply predicted by the subtraction of the estimated sound reduction index (SRI) of the building façade from the external free field noise measurements. When considering the SRI of a particular façade it is usual to only consider the glazing as this is the weakest element acoustically.

3.3 COUNCIL NOISE CRITERIA

The Council have guidance for noise criteria and assessment methodologies that are described in their planning document [3]. It states:



The guidance aims to provide help and advice in relation to noise in a planning context to encourage good acoustic design. It outlines what is expected in relation to current guidance and policy with the aspiration that new developments achieve the highest possible standards without compromising the health and wellbeing of people that live and work within the City of Manchester.

3.3.1 Residential Developments

Section 3.6.1.1 of the Council's guidance states:

Manchester City Council has adopted the following internal noise limits for residential properties:

- **Bedrooms**
 - **30 dB LAeq (night time - 23.00 - 07.00)**
 - **45 dB LAmax,F (individual noise events should not normally exceed by more than 15 times)**
- **Living Rooms (daytime - 07.00 - 23.00) 35 dB LAeq**
- **Gardens and terraces (daytime - 07.00 - 23.00) 55 dB LAeq**

3.3.2 Entertainment Venues

For music and other 'entertainment noise', it is low frequencies that can be most problematic; hence the use of octave bands.

3.3.2.1 Internal noise transmission

For noise levels with 'connected' habitable rooms (especially bedrooms) Section 3.6.1.2 of the Council's guidance states:

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

The levels above are for habitable rooms in the same or adjacent building. However, these criteria can also be applied to structurally separate residential properties.

3.3.2.2 External noise transmission

For noise break out from a venue's façade(s) then the following criterion should be adhered to:

'Entertainment noise (LAeq) should be controlled to 10dB below the background noise level (LA90) without the entertainment noise present, in each octave band at the nearest noise sensitive location'.

3.3.3 Noise and Vibration from Fixed Plant / Equipment

Section 3.6.1.5.1 of the Council's planning guidance states:

Any noise assessment needs to consider not only the overall level of noise emitted but also its particular characteristics. The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate 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 (LAeq) below the typical background (LA90) level at the nearest noise sensitive location'.

By designing the sound pressure level of any plant items to generate a noise impact of at least 5dB below the existing background level, any plant noise impact should be of a negligible level which should not give rise to complaints from users or occupiers of existing noise-sensitive usages.



4 MEASUREMENT DETAILS

A site visit measured external Background Noise Levels.

4.1 BACKGROUND NOISE MONITORING

In order to assess potential noise from the proposed site, Background Noise Levels have been taken at first floor level of 39-41 Thomas Street. Noise levels measured here are representative of those at the proposed dwellings across Thomas Street, as well as those at Bollin House.

Background noise measurements were made in line with Section 8 – Background sound level, of BS4142:2014.

4.1.1 Measurement Time Interval, T_m

The Measurement Time Interval, T_m is given (in BS4142:2014 Section 3.6) as:

total time over which measurements are taken

For measuring background noise levels, Section 8.1.3 of BS 4142:2014 states:

“Ensure that the measurement time interval is sufficient to obtain a representative value of the background sound level for the period of interest. This should comprise continuous measurements of normally not less than 15 min intervals, which can be contiguous or disaggregated.”

A site visit measured external background noise levels.

4.1.2 Monitoring details

Personnel: John Braiden, BSc & MSc Acoustics, MIOA.

Weather: 16 - 21- °C; <5ms⁻¹ wind; ~40 - 60% cloud; no precipitation.

Equipment: NTi XL2 integrated real time analyser & B&K 4231 calibrator.

Date: Thursday 16th May 2024.

The sound level meter was calibrated before after the measurements with no drift reported.

Monitoring was unmanned.

4.1.3 Monitoring location

The location of the monitoring was at 1m from a first-floor window facing Thomas Street. shown in Figure 6.

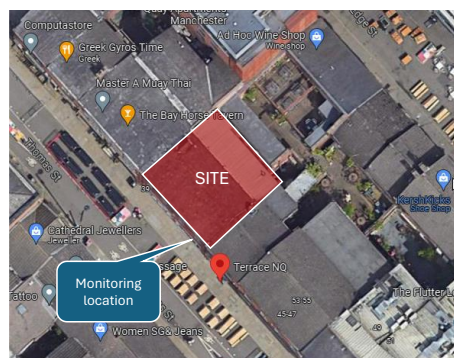


Figure 6
Background Noise monitoring location

The monitoring location was representative of the nearest sensitive receptors.



4.1.4 Monitoring times

Monitoring took place on a Thursday evening until almost 13:00 the next day.

4.1.5 Monitoring results

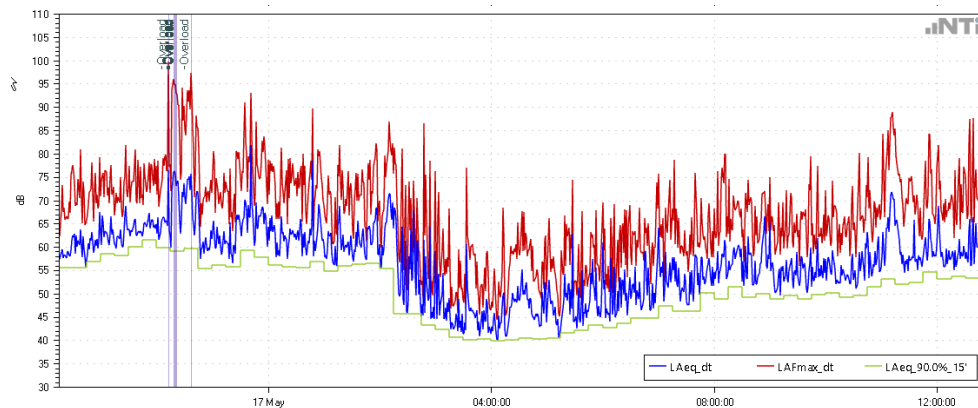


Figure 7
Measured noise levels

The noise climate in the immediate area is primarily from patrons of the various commercial uses. There is no road traffic noise from directly outside the site, as this part of Thomas Street is now pedestrianised (apart from deliveries to the commercial establishments on Thomas Street). There is noise, however, from the wider road network and the general 'hub bub' of city centre activities.

4.1.5.1 Background noise levels

Background Noise levels, L_{A90} , in the area were consistently around or above 55dB throughout the evening and into the night until around 2pm when the noise levels dropped noticeably as the surrounding commercial uses closed.

The typical Background Noise Levels for the day and night periods were determined using histograms.

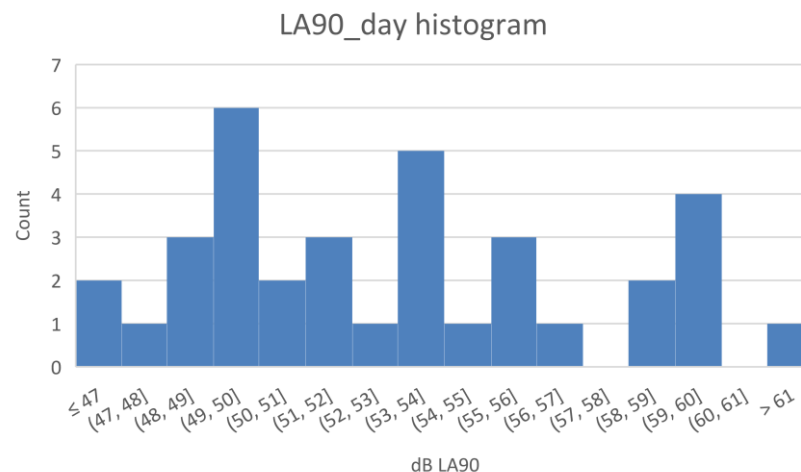


Figure 8
Histogram of daytime BNLs

The typical Background Noise Level for the daytime (07:00 – 23:00) is 50 dB L_{A90} .

Noise monitoring took place on a Thursday evening when the proposed bar will be open until 2am. Therefore, the relevant night time period is 23:00 – 02:00.



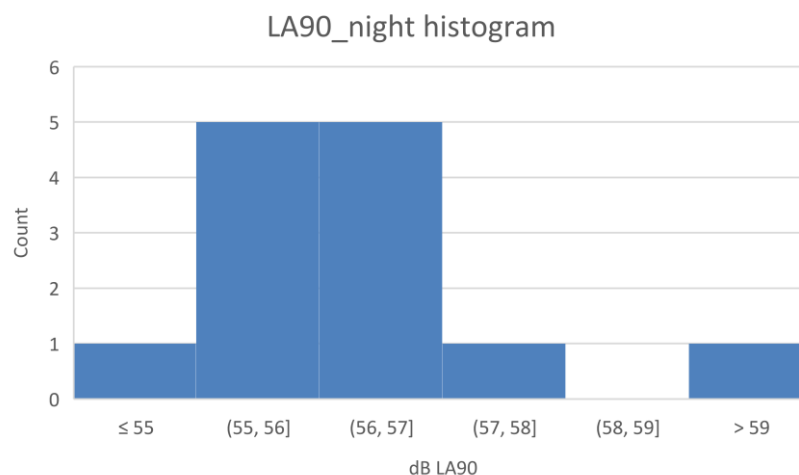


Figure 9
Histogram of nighttime BNLs

The typical Background Noise Level for the nighttime (23:00 – 02:00) is 56 dB L_{A90} .

The higher Background Noise Level at night reflects the night time economy in and around the Northern Quarter.

5 ACOUSTIC ASSESSMENT

There will be two noise sources to assess:

1. Noise breakout from the venue via the front façade and
2. Noise from external plant.

5.1 NOISE BREAKOUT FROM FRONT FAÇADE

Using the more recent and relevant Background Noise Levels, internal noise levels of the cafe/bar have been calculated using a detailed methodology.

The measured Background Noise represents the noise level at the nearest potential residential dwelling as shown in Figure 10. From the octave band data, 10dB is deducted (MCC criterion) to form the target noise level at the nearest resident. Distance attenuation and the sound reduction of the glazing / brickwork¹ are used to calculate the maximum permitted noise levels within the site. There are also corrections for an internal reverberant noise level being transferred to an external free field level.

Eqn (1) is a standard break out calculation from a reverberant room to outside [4:p97] to account for the fact that the external level is known (10dB below L_{A90}) and the unknown is the internal reverberant noise level.

¹ The composite SRI calculation in BS 8233, Eqn. G.1, is used to determine the overall façade Sound Reduction Index (SRI).



$$SPL_{int,rev} = SPL_{ext} + SRI - 10 \log S + A_{dist} + 14 \quad (1)$$

where SPL_{ext} = external open air sound pressure level (SPL), dB

$SPL_{int,rev}$ = internal reverberant SPL, dB

SRI = sound reduction index of building element, dB

S = area of building element, m²

A_{dist} = attenuation due to distance, dB

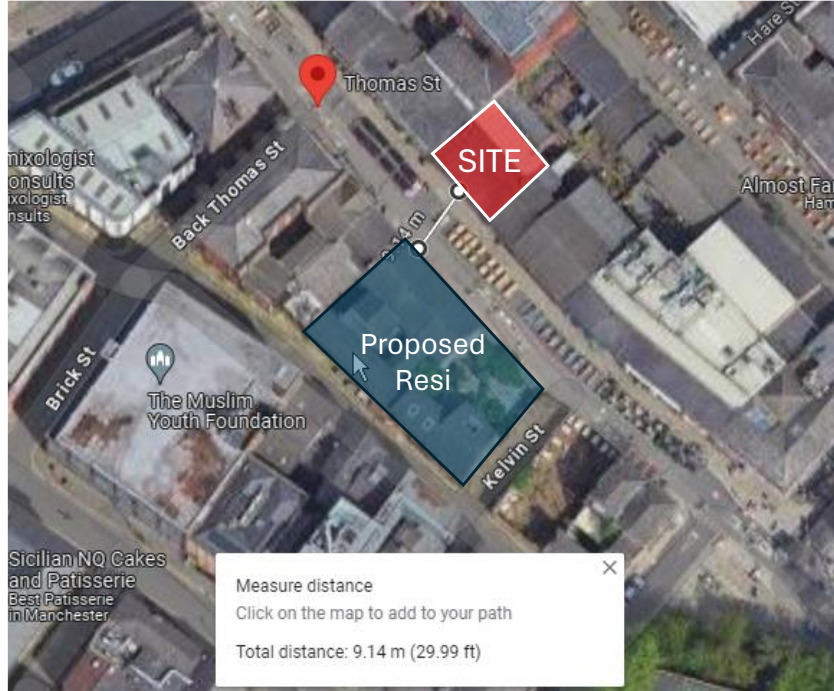


Figure 10
View showing proximity of nearest resident on Thomas Street to proposed site.

5.1.1 Distance attenuation, A_{dist}

There will be attenuation due to distance, of the noise break out from the façade of the site to the residents opposite. However, the façade is too big to be considered a point source and not long enough to be thought of as a line source. Therefore, it is a plane source where the distance attenuation is calculated using Eqn (2) [4]

$$A_{dist,plane} = 10 \log_{10} \left(\frac{b/\pi}{a/\pi} \right) + 20 \log_{10} \left(\frac{r}{b/\pi} \right) \quad (2)$$

where a = shorter façade length, m
 b = longer façade length, m
 r = source – receiver distance, m

5.1.2 Sound Reduction Index (SRI) of facade

The façade of the first two floors of the proposed site (top floor is only for storage etc.) is comprised of brickwork and glazing, so a composite Sound Reduction Index has been determined using a modified version of Equation G.1 in BS 8233.



$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{0+}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{it}}{S} 10^{\frac{-R_{it}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3 \quad (3)$$

NB It is recommended to improve that acoustic performance of all exterior glazing for the ground and first floor windows AND doors (see Mitigation)**

The exterior wall build up is approximately:

- 100mm brick
- 100mm cavity with 50mm of insulation
- 100mm concrete block
- plaster / render finish.

5.1.3 Internal noise levels

Using the above methodology, assuming all windows and doors are closed, and factoring the upgraded glazing, the maximum permitted internal noise levels are shown in Figure 11 with the full calculation shown in the Appendix².

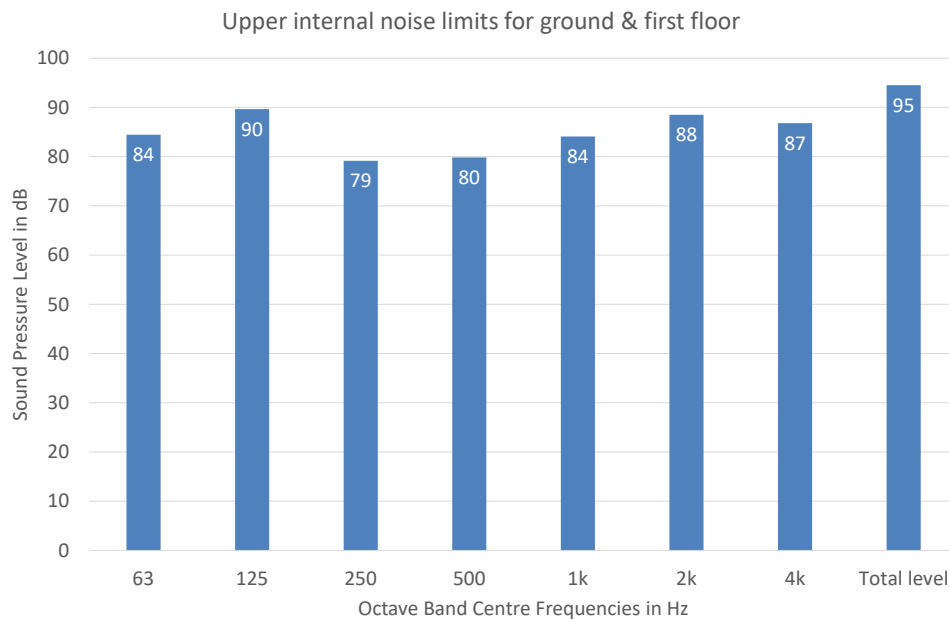


Figure 11
Maximum permitted noise levels within the cafe/bar

The new noise threshold limits within the ground floor and first floor of the proposed bar are shown in Figure 11 above.

² The full calculation has used unweighted noise levels.



5.1.3.1 Lobbied door system

There is currently a lobbied door system which will be retained. The door which has direct access to the ground floor will be fixed, sealed and acoustic glazing installed, as per the glazing mitigation for the front façade.

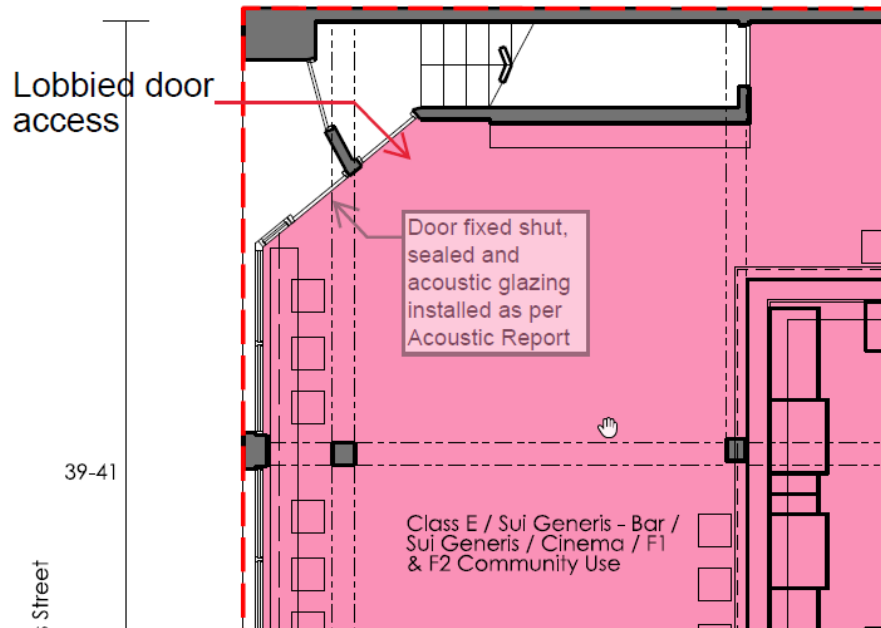


Figure 12
Ground floor showing lobbied door system

5.1.3.2 Door seals

The lobbied doors will have acoustic seals including threshold seals. Integrity Acoustic Door Seal Range are available from Lorient Polyproducts Ltd (Tel: 01626 834 252). Recommended Lorient products are given below.

151212 Perimeter Batwing Seal

IS8020i Automatic Threshold Seal

184130 Threshold Plate 40mm wide x 4mm high

The two lobbied doors are shown in Figure 12 above.

5.1.3.3 Sound system

The exact details of the music system are not known at this stage; however it is advised that the speakers should be smaller and more frequently distributed in the bar rather than one or two large speakers in one place. This is so that the audience receive more of the direct sound of their local loudspeaker and hence the overall sound level need not have to overcome the reverberation noise floor. In addition to this, smaller speakers are less able to produce potentially problematic low frequencies.

The speakers should be resiliently isolated from the walls and ceiling. Such a product can be purchased from Powerdrive Drum Company Limited - <http://www.mypowerdrive.com>.

5.1.4 Mitigation summary

The noise breakout calculation above assumes that all windows and doors are closed. Therefore, to ensure breakout noise is kept to a minimum, then the following mitigation is recommended:



- All ground floor and first windows and doors shall remain closed.
- All glazing on the ground and first floor (windows and doors) shall be upgraded to Saint Gobain glazing of 4 (6) 10.8³ where the 10.8mm glass is laminated and on the outer face.
- The door that has direct access to the ground floor shall be fixed shut, sealed and the glazing replaced with the same glazing configuration as the front façade.
- The lobbied door system will be employed to ensure that any access point has at least one door closed at any one time.
- An alternative ventilation scheme will be proposed (see next Section for noise assessments for AC condenser units) so that windows and doors need not be opened for ventilation.
- The internal face of the exterior wall should be checked for any gaps and cracks etc. in the mortar. If need be, boards must be removed. The inner face of the exterior wall should have a minimum of 10mm render / plaster or the inner face repointed, whichever is more effective for sound insulation.
- The sound system should have the following specifications:
 - Loudspeakers should be smaller and frequently (i.e. more speakers rather than fewer) distributed around the space.
 - No loudspeakers should have a driver diameter larger than 150mm / 6".
 - No subwoofers to be used.
 - Ideally, anti-vibration mounts should be used.

5.2 BS4142 ASSESSMENTS

The two proposed condensers will be in the internal courtyard in between 41 and 43 Thomas Street, as shown in Figure 5.

The nearest sensitive receptor (NSR) to the inner courtyard is the rear elevation of Bollin House some 16m away.

NB It should be noted that Bollin House is now 'serviced apartments' for rent, known as Quay Apartments Manchester. As such, tenants are short term and less likely to be sensitive to noise.**

³ The current double-glazed units need to be checked to see what size windows can be accommodated by the in-situ frames.





Figure 13
Condenser location in relation to nearest sensitive receptor

For all units operating simultaneously there will be a BS4142 assessment.

1no.	Mitsubishi	PUZ-M100VKA2	54 dB Lp@1m (Heating)
1no.	Mitsubishi	SUZ-M71VAR1	51 dB Lp@1m (Heating)

The following will be taken into account for the assessment:

- Number of reflecting surfaces
- Shielding / barrier
- Distance attenuation
- Acoustic characteristics such as, intermittency, tonality and impulsivity.

BS 4142 Noise Assessment		
Description	Value / Item	dB
Specific Noise Level at 1m	SUZ-M71VA	51
Specific Noise Level at 1m	PUZ-M100VKA2	54
Total Specific Noise Level @ 1m		56
No. of nearby surfaces	3	9
Barrier	yes	-10
Distance	16	-24
Total Specific Noise Level @ NSR		31
BS 4141		
Tonality	0/2/4/6	0
Impulsivity	0/3/6/9	0
Intermittency	0/3	3
Rating Noise Level		34
Background Noise Level (day)	L _{A90}	50
Rating minus Background		-16

Table 2
BS 4142 ALL condensers operating simultaneously



Table 5 shows that the Rating Level for all condensers is 34 dB. This is 16dB below the typical day time Background Noise Level of 50 dB L_{A90} and hence well within relevant noise threshold.

6 CONCLUSION

An acoustic survey has taken place at 39 - 41 Thomas St, Northern Quarter to assess potential noise sources.

Typical Background Noise Levels for the day and night periods are as follows:

Daytime 50 dB L_{A90}

Nighttime 56 dB L_{A90}

The nearest potential noise sensitive receptors are Bollin House on Edge Street and the proposed residential development at 42 – 50 Thomas Street.

The noise impact assessment has revealed the following acoustic mitigation:

- All ground floor and first windows and doors shall remain closed.
- All glazing on the ground and first floors (windows and doors) shall be upgraded to Saint Gobain glazing of 4 (6) 10.8⁴ where the 10.8mm glass is laminated and on the outer face.
- The door that has direct access to the ground floor shall be fixed shut, sealed and the glazing replaced with the same glazing configuration as the front façade.
- A lobbied door system will be employed to ensure that any access point has at least one door closed at any one time.
- An alternative ventilation scheme will be so that windows and doors need not be opened for ventilation.
- The internal face of the exterior wall should be checked for any gaps and cracks etc. in the mortar. If need be, boards must be removed. The inner face of the exterior wall should have a minimum of 10mm render / plaster or the inner face repointed, whichever is more effective for sound insulation.
- The sound system should have the following specifications:
 - Loudspeakers should be smaller and frequently (i.e. more speakers rather than fewer) distributed around the space.
 - No loudspeakers should have a driver diameter larger than 150mm / 6".
 - No subwoofers to be used.
 - Ideally, anti-vibration mounts should be used.

The BS4142 assessment of the two external condenser units has determined that no acoustic mitigation is required for the external plant.

Pending the recommendations of this report, the amenity of the local residents will be safeguarded.

⁴ The current double-glazed units need to be checked to see what size windows can be accommodated by the in-situ frames.



7 REFERENCES

- [1] BS 4142: 1997
Method for Rating industrial noise affecting mixed residential and industrial areas
British Standards Institute, 1997.
- [2] BS 4142: 2014
Methods for rating and assessing industrial and commercial sound
British Standards Institute, 2014.
- [3] Environmental Protection
Planning & Noise - Technical Guidance
Manchester City Council, Dec 2015.
- [4] R. Watson & O. Downey
The Little Red Book of Acoustics
Blue Tree Acoustics, 2008.



Appendix

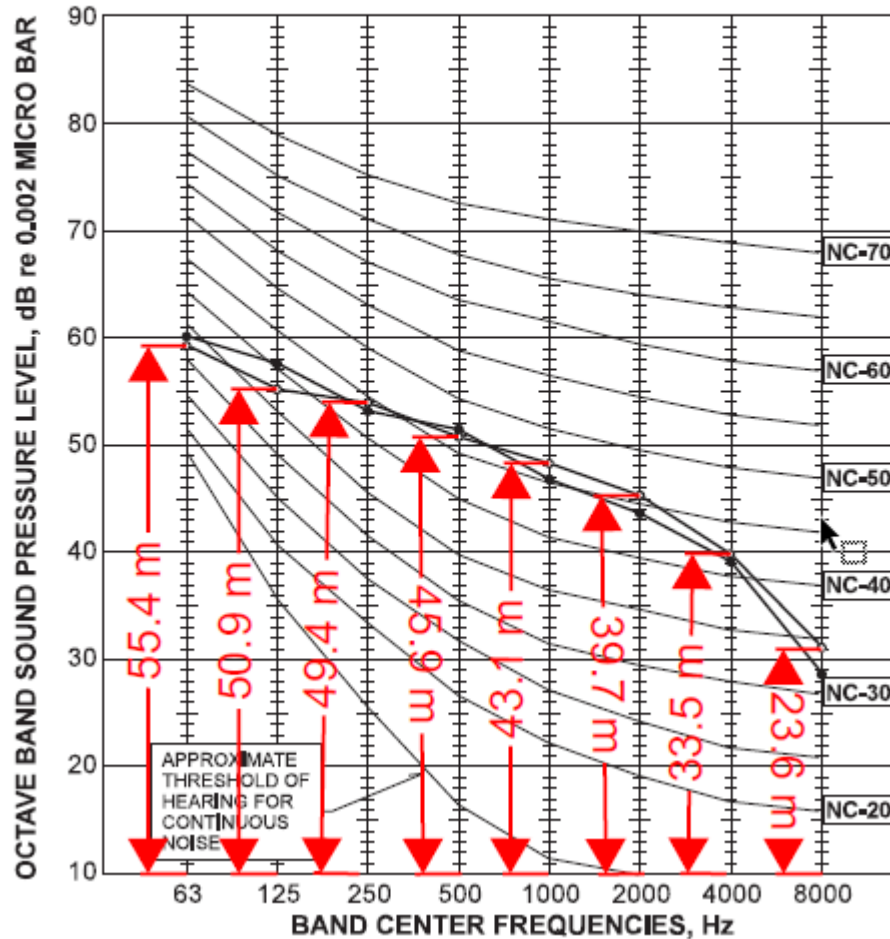


A1 CONDENSER NOISE SPECTRA

A1.1 PUZ-M100VKA

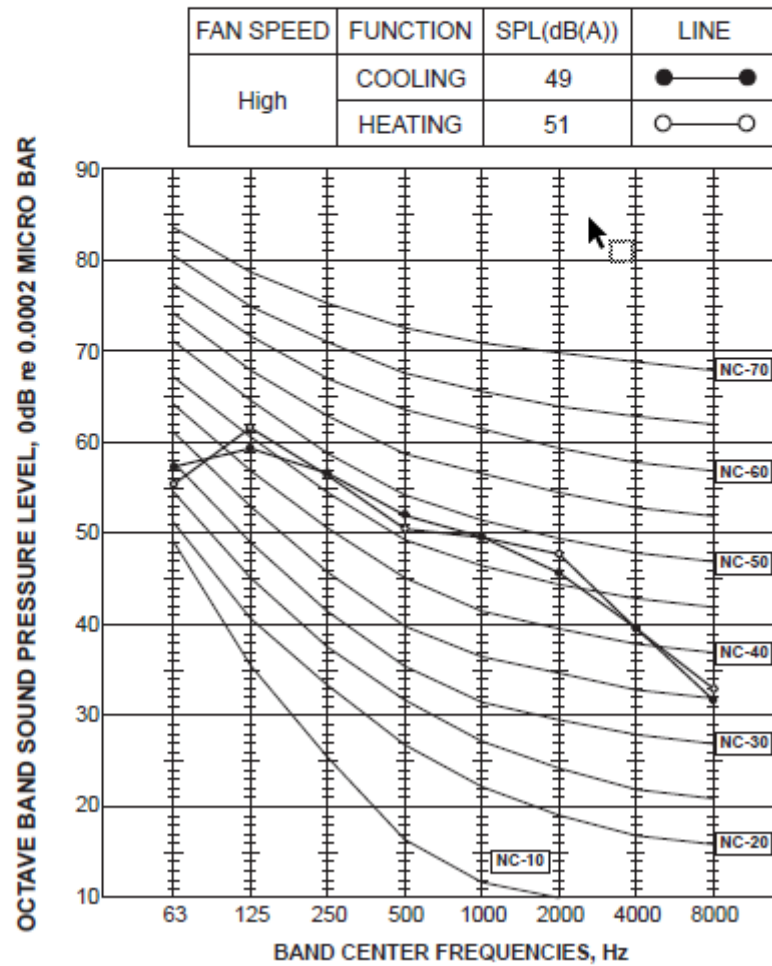
PUZ-M100VKA(-ET).TH
PUZ-M100YKA(-ET).TH

MODE	SPL(dB)	LINE
COOLING	51	
HEATING	54	



SUZ-M60VA.TH
 SUZ-M60VAR1.TH
 SUZ-M60VAR2.TH
 SUZ-M60VA-ET.TH
 SUZ-M60VA-ETR2.TH

SUZ-M71VA.TH
 SUZ-M71VAR1.TH
 SUZ-M71VA-ET.TH
 SUZ-M71VA-ETR1.TH



A2 NOISE BREAK OUT CALCULATION

39-41 Thomas St, NQ		BS 8233 Break-in calc	Front façade - noise break out (windows CLOSED)	Octave band centre frequency							Total level
Term		Description	Details	63	125	250	500	1k	2k	4k	
$L_{90, \text{façade}}$		Typical background @ NSR	L90_day_typical	56.7	55.3	49.0	47.2	44.3	41.2	35.3	
	-10 dB	MCC's criterion	below background	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	
SPL_{ext}		Target noise level at receiver		46.7	45.3	39.0	37.2	34.3	31.2	25.3	
r	10 m	Distance from S to R	plane source	12.5	12.5	12.5	12.5	12.5	12.5	12.5	
		Air absorption	15°C; 80% humidity	0.00	0.00	0.01	0.02	0.04	0.08	0.24	
δ	0 m	Barrier attenuation	none or n/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
S	54.9 m ²	Area of building element	Total area of façade	-17	-17	-17	-17	-17	-17	-17	
R_{wi}		SRI composite	Total SRI of façade	28.6	35.2	31.0	33.5	40.6	48.1	52.1	
		Numerical correction		14	14	14	14	14	14	14	
L_{int}		Internal reverberant noise level	SPL_{interior}	84.5	89.6	79.2	79.9	84.1	88.5	86.8	94.5 dB

