BRAIDEN ACOUSTICS LTD

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

ACOUSTIC SURVEY FOR PLANNING (RESTAURANT)

Prepared For :	Loungers UK Ltd	Date :	10 Apr 2019
Site :	Unit 3, Manchester Business School, Booth St West, Manchester	Report No. :	10731

1 INTRODUCTION

Braiden Acoustics has been commissioned by Loungers UK Ltd to undertake an acoustic survey at the site of Unit 3, Manchester Business School, Booth St West, Manchester to help discharge noise conditions of planning application 106594/FO/2014/C1 for the following proposal:

> *Refurbishment and reconfiguration of existing Manchester Business School and University Precinct Buildings to include the remodelling of the ground floors, demolition of existing link between Precinct Centre and Crawford House, provision of improved and extended retail space for Class A1(Shop), Class A2 (Financial and Professional Services) and Class A3 (Restaurant and Cafe Use), the creation of additional useable floorspace including a 4 storey extension to Higher Chatham Street, public realm improvements including pavement widening, removal of existing glazed roof to precinct centre and creation of 2 storey extension above.*

Loungers UK Ltd have taken Unit 3 within the new development so this is a retrospective acoustic survey in order to discharge the following noise conditions:

> *12) Before development commences a scheme for the acoustic insulation of any externally mounted ancillary equipment to ensure that it achieves a background noise level of 5dB below the existing background (La90) in each octave band at the nearest noise sensitive location shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the equipment. The approved scheme shall be implemented prior to occupancy of each part of the development as described in condition 17 and shall remain operational thereafter.*
>
> *Reason - To safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 of the Core Strategy and saved UDP policies DC26.*
>
> *13) Before use of each of the ground floor retail (Use Class A1, A2 or A3) commences each unit shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as local planning authority.*
>
> *Reason - To safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 of the Core Strategy and saved UDP policies DC26*
>
> *16) Before use of each of the ground floor retail (Use Class A1, A2 or A3) units commences a scheme for the acoustic insulation of any externally mounted ancillary equipment to ensure that it achieves a background noise level of 5dB below the existing background (La90) in each octave band at the nearest noise sensitive location shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the equipment. The approved scheme shall be implemented prior to occupancy of each unit.*
>
> *Reason - To safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 of the Core Strategy and saved UDP policies DC26*

Conditions 12 and 16 are essentially the same in that they seek to ensure noise from external plant is within acceptable limits. Condition 15 deals with noise break out.

1.1 AIM

This report will address all the relevant noise sources and receivers and suggest mitigation, where necessary to ensure the noise conditions above can be discharged.

2 DESCRIPTION OF SITE

The proposed restaurant is within the ground floor of the newly developed Manchester Business School on the southern elevation.



Figure 1
Street view of site

2.1 SITE LOCATION AND SURROUNDING USES

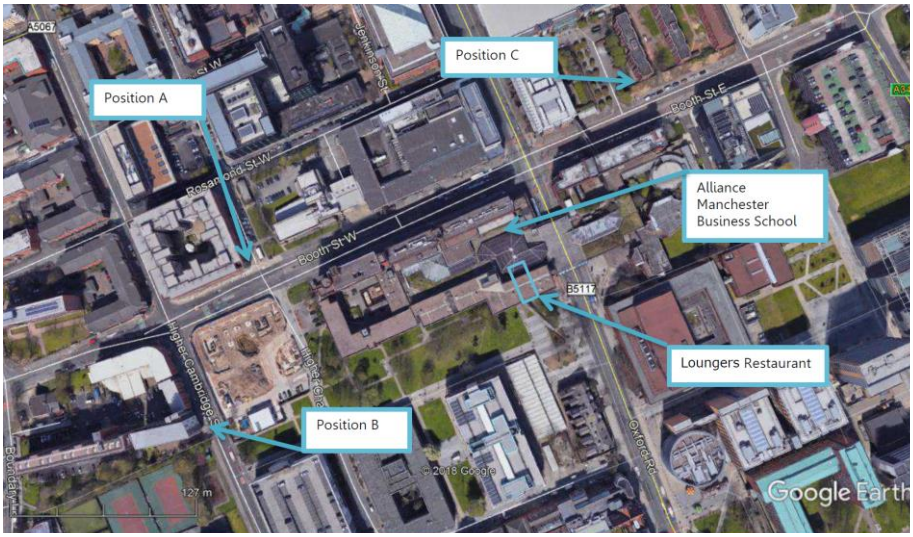


Figure 2
Site location and surrounding uses and nearest residents

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The site forms part of Alliance Manchester Business School which is part of Manchester University and is bounded by Booth Street West to the north, Oxford Road to the east and Higher Chatham Street to the west. There is a landscaped area directly to the south of the site. The site is approximately 1km from Manchester City Centre and around 400m from the inner ring round A57(M), the Mancunian Way.

2.1.1 Nearest sensitive receptors

The nearest residents have been determined as locations A, B and C in Figure 2.

Location A	135m from site
Location B	185m from site
Location C	demolished.

The nearest office is directly opposite some 40m away from the front façade.

2.2 PROPOSED USE

It is proposed to occupy the ground floor area as shown in Figure 3.

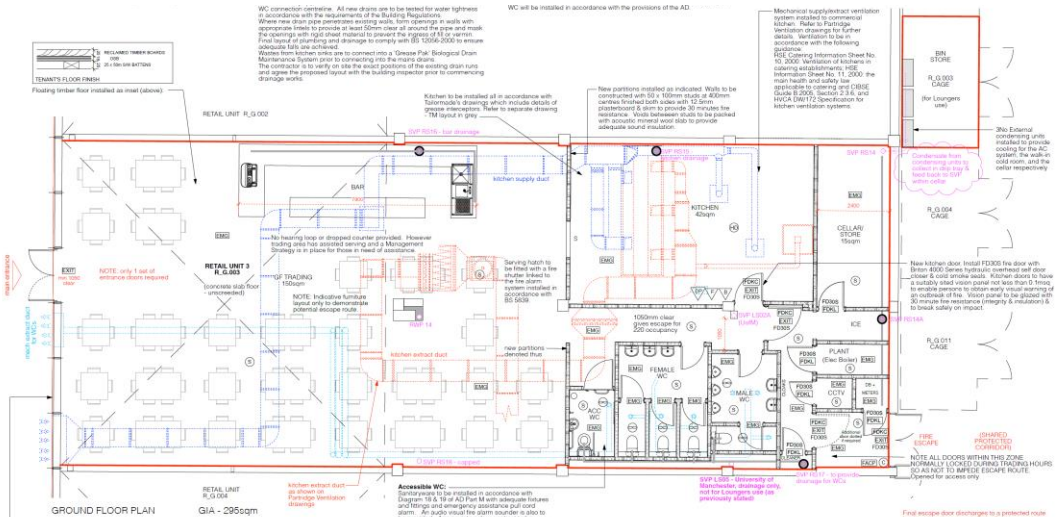


Figure 3
Proposed restaurant and external plant

2.2.1 Opening hours

Sunday to Wednesday	09:00 – 23:00
Thursday to Saturday	09:00 – 00:00

(Last food orders at 22:00)

2.2.2 Building services

The external plant comprises of kitchen extract and intake ventilation as well as three condenser units.

2.2.2.1 Kitchen Ventilation

There will be kitchen extract and intake ducted ventilation systems which will mostly be routed internally via the ground floor at higher level where the intake shall terminate at the front of the unit and the extract connect to the building's riser and then terminate on the plant deck on the roof; as can be seen in Figure 3 and Figure 4.

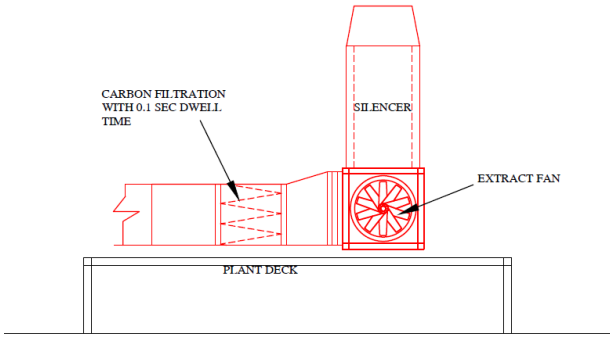


Figure 4
Section view of rooftop kitchen extract fan

Kitchen Extract
System Air MUB/T 062 630D4

Kitchen Intake
SPP500 4/4/3

The kitchen extract / intake ventilation system will only operate during opening hours and turned off approximately an hour before closing.

2.2.2.2 External Condenser units

There will be 3no. condenser units located at ground floor level, to the rear, within the bin store as shown in Figure 3 in the top right hand corner.

Air Conditioning condenser
PUHZ-ZRP125VKA2

Cold Room condenser
Danfoss OP-MPH-M018

Cellar Condenser
J&E Hall JCC2 – 40E

2.2.3 Sound system

As the proposed use is for a restaurant, then any sound system will be modest and only playing background music.

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:

> *"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 CRITERIA

3.3.1 External plant noise

It is usual for Councils to adhere to a BS4142:2014 for industrial noise. Manchester council are no different and state that:

> *... Rating [sic] noise level of 5dB below the existing background (La90) in each octave band at the nearest noise sensitive location*

3.3.2 Noise break out

The condition referring to noise break out just simply says:

> *...each unit shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises*

Therefore, there is no specific methodology and noise threshold to adhere to regarding noise break out.

4 MEASUREMENT DETAILS

As the site is in operation, then it was thought pertinent to take internal noise levels during a Friday afternoon / evening period.

4.1 INTERNAL NOISE MONITORING

Noise monitoring of the typical internal noise took place whilst visiting the site. The sound level meter was placed on a table with the microphone only 20cm from the table surface. Whilst the close proximity of the microphone to a potentially reflecting surface is not ideal, it was felt that this would give 'worst case scenario' result.

4.1.1 Monitoring details

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

Weather: n/a.

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

Date: Fri 05/04/2019

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

Monitoring was manned.

4.1.2 Monitoring results

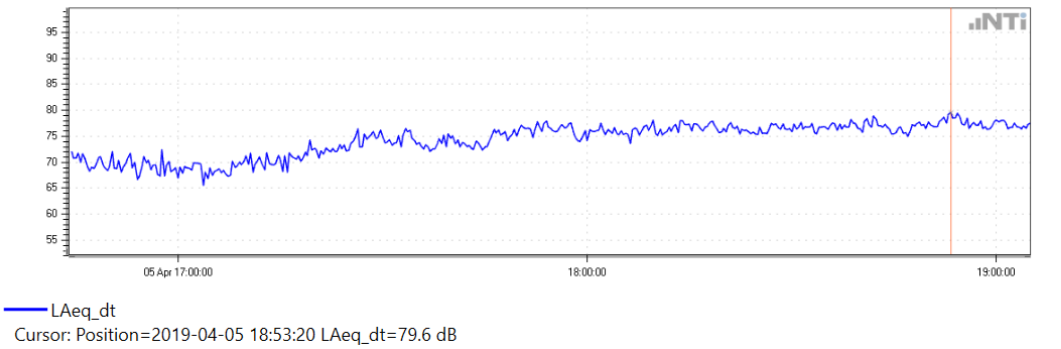


Table 2
Summary of internal noise monitoring results

The maximum internal noise level was 79.6dB(A) so an upper limit of 80 dB(A) is assumed.

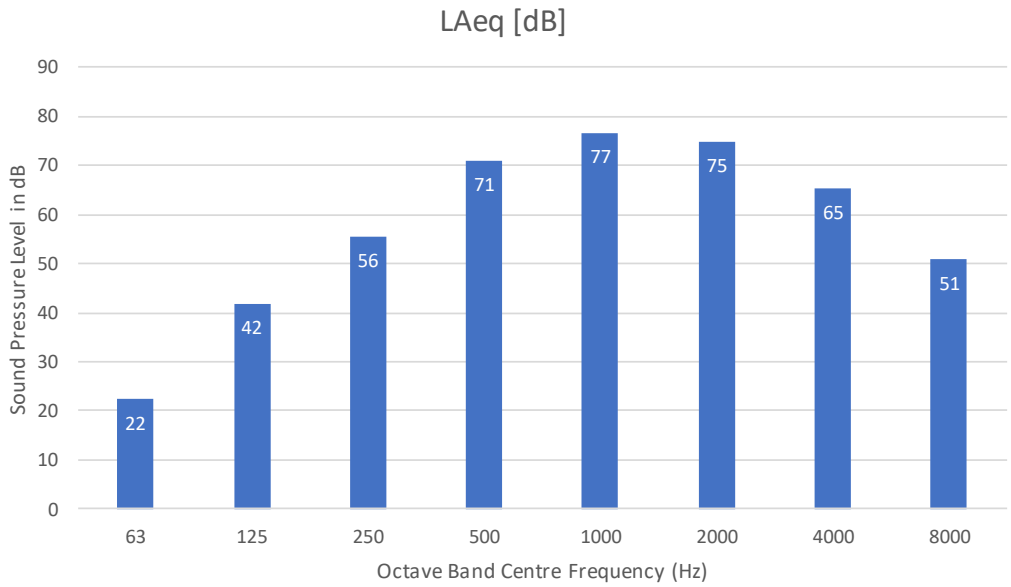


Figure 5
Octave band centre frequencies for highest internal noise level

The octave band data shows that there are no predominant low frequencies, as would be expected from a restaurant / café style venue.

5 ACOUSTIC ASSESSMENT

The potential noise sources are:

1. noise from the various plant,
2. noise break out.

5.1 PREVIOUS NOISE ASSESSMENT

As part of the original planning application for the redevelopment of the Alliance MBS (Manchester Business School), there was a noise survey conducted by BDP Acoustics.

The report highlights the three nearest residential receptors (mentioned in Section 2.1.1), one of which has now been demolished.

The report gives upper limits for the Rating Level at the nearest residential dwelling based upon the lowest single-figure background noise levels; assuming 24 hour operation.

Measurement Position	*Lowest measured night time (02:00 – 03:00) $L_{A90,\ 5\ minutes}$, dB*	*BS4142:1997 plant noise rating level (dB)*
A	40	35
B	37	32
C	41	36

Figure 6
Rating Level noise limits at nearest residents

Location A 135m from site 43 dB attenuation

Location B 185m from site 45 dB

Location C demolished.



Figure 7
Site location and nearest residents

5.2 EXTERNAL PLANT NOISE ASSESSMENT

There are three locations for the external plant:

1. Kitchen extract on the rooftop plant deck
2. Kitchen intake on the front elevation via a high level louvre
3. Condensers within the rear bin store.

5.2.1 Kitchen extract

The kitchen extract fan, MUB/T 062 630, will be located on the plant deck, on the roof, with a silencer and then a cowl – as shown in Figure 4.

The closest residential building is 135m away, as shown in Figure 7.

Even when direct line of sight is assumed, the noise level due to the kitchen extract is very low at the nearest resident and well within the noise criterion of 35dB. Due to the virtually non-existent noise level at the nearest resident, there has been no BS4142 penalty.

MBS Lounge	Duct Calculation	Kitchen Extract	Octave band centre frequency							
Quantity	Description	Details	63	125	250	500	1000	2000	4000	Total level
	Sound Pressure Level @ Xm	SWL data used	n/a	n/a	n/a	n/a	n/a	n/a	n/a	57.5
	Sound Power Level of unit	MUB/T 062 630D4 IE2, LwA	75.0	77.0	81.0	83.0	82.0	79.0	74.0	88.3
	A weighting	no	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	PLENUM Insetion Loss	no								
0 m	Duct Length in metres	Rectangular 600 x 600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0	Number of bends	500 mm bend without absorber	0	0	0	0	0	0	0	
0 mm	Branch area	10log(branch mm2/duct mm2)	0	0	0	0	0	0	0	
	Silencer attenuation (1)	720sq 1800l silencer	-7	-9	-16	-36	-48	-28	-17	
	Silencer attenuation (2)	no silencer or n/a	0	0	0	0	0	0	0	
	Silencer attenuation (2)	none or n/a	0	0	0	0	0	0	0	
	Att due to end reflection	500 mm end reflection	-8	-4	-1	0	0	0	0	
	Louvre attenuation	no acoustic louvre or n/a	0	0	0	0	0	0	0	
	Sound power at termination		60.0	64.0	64.0	47.0	34.0	51.0	57.0	68.3
Q 1	Directivity**	0 surfaces	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
135 m	Distance Attenuation	20*log10(r)	-42.61	-42.61	-42.61	-42.61	-42.61	-42.61	-42.61	
	Air absorption	15°C; 80% humidity	-0.01	-0.04	-0.15	-0.32	-0.55	-1.12	-3.20	
	Numerical correction	SPL = SWL - 20log(r) +DI - 11	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	
δ 0	Barrier	no	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	SPL(A) at NSR	$L_{pA,NSR}$	**6.4**	**10.4**	**10.2**	**0.0**	**0.0**	**0.0**	**0.2**	**14.7** dB
	Background Noise Level @ NSR	LA90 @ A	0	0	0	0	0	0	0	**35**

Figure 8
Wells Lounge extract calc

5.2.2 Kitchen intake

The intake louvre (shown in red in Figure 9) has only partial line of sight to the nearest resident (shown in green). There is no direct line of sight to the residential building on Booth St West.

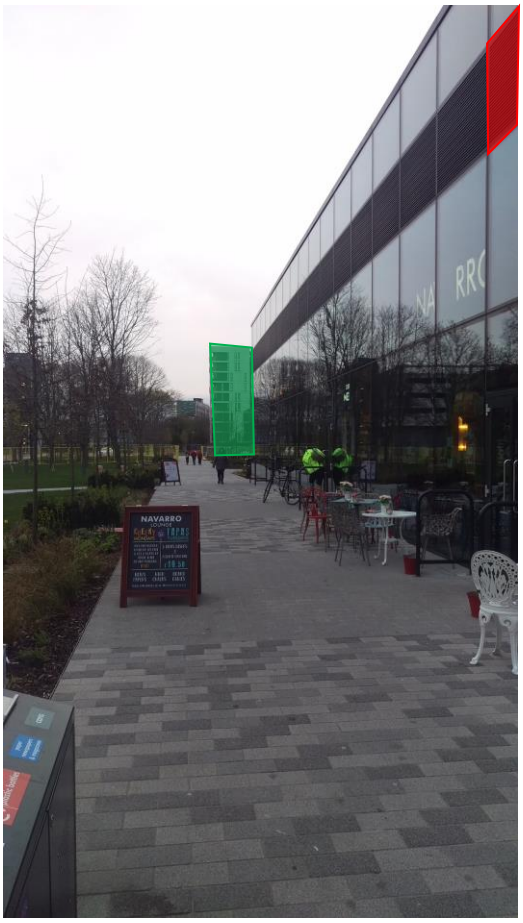


Figure 9
Front of site and nearest resident within partial line of sight

Assuming only grazing incidence, the sound pressure level at the residence shown in Figure 9 is calculated in Figure 10.

Wells Lounge		Duct Calculation	Kitchen Supply	Octave band centre frequency								
Item	Quantity	Description	Details	63	125	250	500	1000	2000	4000	Total level	
		Sound Pressure Level @ Xm	SWL data used	n/a	n/a	n/a	n/a	n/a	n/a	n/a	57.5	
		Sound Power Level of unit	SPP 500/4-3, Lw in	76.0	76.0	83.0	81.0	79.0	76.0	71.0	87.3	
		A weighting	yes	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0		
		PLENUM Insetion Loss	no									
	1.3 m	Duct Length in metres	Rectangular 600 x 600	-0.8	-0.8	-0.5	-0.2	-0.2	-0.2	-0.2		
	0	Number of bends	500 mm bend without absorber	0	0	0	0	0	0	0		
	0 mm	Branch area	10log(branch mm2/duct mm2)	0	0	0	0	0	0	0		
		Silencer attenuation (1)	068-0500-2DEP	-7	-10	-12	-21	-26	-26	-24		
		Silencer attenuation (2)	068-0500-2DEP	-7	-10	-12	-21	-26	-26	-24		
		Silencer attenuation (2)	none or n/a	-7	-10	-12	-21	-26	-26	-24		
		Att due to end reflection	1000 mm end reflection	-4	-1	0	0	0	0	0		
		Louvre attenuation	no acoustic louvre or n/a	0	0	0	0	0	0	0		
		Sound power at termination		24.0	28.1	37.9	14.6	0.8	-1.0	-0.2	38.5	
	Q 2	Directivity**	1 surface	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	13 m	Distance Attenuation	20*log10(r)	-22.28	-22.28	-22.28	-22.28	-22.28	-22.28	-22.28		
		Air absorption	15°C; 80% humidity	0.00	0.00	-0.01	-0.03	-0.05	-0.11	-0.31		
		Numerical correction	SPL = SWL - 20log(r) +DI - 11	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00		
	δ -2.6	Barrier	no	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		SPL(A) at NSR	$L_{pA,NSR}$	**0.0**	**0.0**	**7.7**	**0.0**	**0.0**	**0.0**	**0.0**	**10.7**	**dB**
		Background Noise Level @ NSR	$L_{A90,NSR}$	0.0	2.3	10.3	17.6	20.9	20.9	21.1	**26.5**	

Figure 10
Noise calculation for kitchen intake

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Due to the significant distance, no BS4142 penalties are relevant and it is shown that the resultant noise level is odB.

As with the extract, the noise level is well below the allowable threshold.

5.2.3 Condensers

The condenser units are located in the neighbouring unit's bin store. However, as the bin stores are located in an internal courtyard, they have no direct line of sight to the road. Therefore, the condenser units are essentially internal to the overall building and will not be audible outside of the building; hence, an acoustic assessment for the condenser units is not necessary.



Figure 11
Site layout showing internal courtyard and condenser units' location

5.3 NOISE BREAK OUT

5.3.1 Internal noise transmission

There are no sensitive receivers above or beside unit 3. On the first floor there is a mixture of different, non-sensitive room uses, such as for storage and plant. At the front of the unit there is a double height ceiling showing as 'void' in Figure 12. There is nothing above the void area as the building steps back after the first floor.

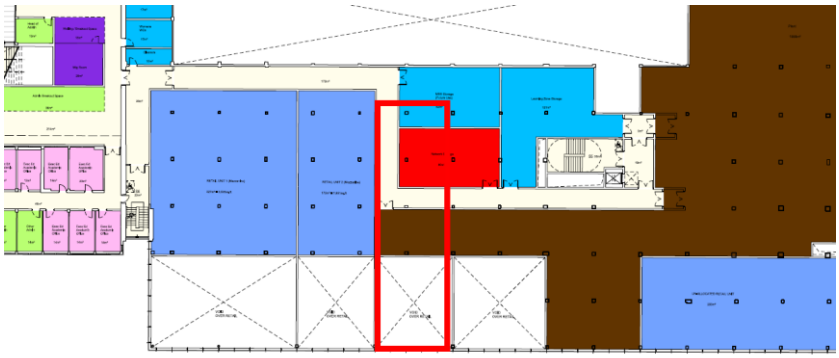


Figure 12
First floor layout showing storage above unit 3

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5.3.2 Noise break out via front façade

Internal reverberant noise has been measured and is no greater than 80 dB(A). A simple noise break-out calculation is used to determine the noise level outside and then barrier and distance attenuation is used to determine the noise level at the residence.

Noise Break Out clac	Value	dB
Internal noise level		80
Sound Reduction of glazing		-25
Int to ext correction		-6
Barrier attenuation		-5
Distance attenuation	185m	-45
Noise Level at resident		**0**

Figure 13
Noise break out calculation

Figure 13 shows that the any break out noise will not be detected at the most sensitive resident.

6 Conclusion

An acoustic survey has taken place at Unit 3, Manchester Business School, Booth St West, Manchester to assess noise levels from the proposed external plant, internal noise transfer and noise break out.

The report shows that there are no issues with regards to noise break-out and external plant noise, as levels meet the Council's criteria; therefore no additional acoustic mitigation is required.

7 References

[1] BS 4142: 1997
Method for Rating industrial noise affecting mixed residential and industrial areas
British Standards Institute, 1997.

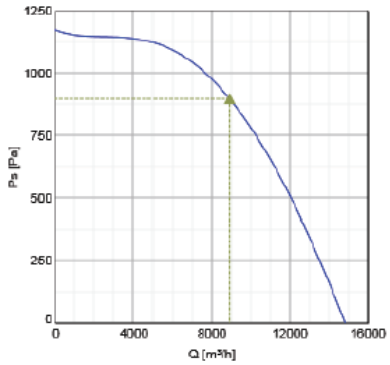
[2] BS 4142: 2014
Methods for rating and assessing industrial and commercial sound
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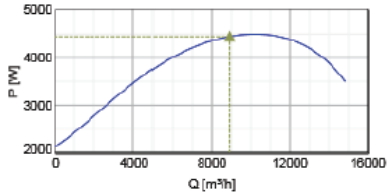
Appendix

A1 EXTERNAL PLANT NOISE LEVELS

A1.1 Kitchen extract

MUB/T 062 630D4 IE2





Hydraulic data

	Working point						
	Q [m³/h]	Ps [Pa]	P [W]	n [r.p.m.]	I [A]	SFP [kW/m³/s]	U [V]
Max efficiency	▲ 8907	▲ 896	▲ 4449	1462	7.75	1.8	400

Acoustics

Mid-frequency band, Hz

630D4	Hz	Tot	63	125	250	500	1k	2k	4k	8k
LwA Inlet	dB(A)	86	73	75	79	81	80	77	72	65
LwA Outlet	dB(A)	88	75	77	81	83	82	79	74	67
LwA Surrounding	dB(A)	75	62	64	68	70	69	66	61	54

Measuring point: qv = 2,47 m3/s, Ps = 896 Pa

A1.2 Kitchen intake

MUB 062 560D4 IE2

Mid-frequency band, Hz 560D4	Hz	Tot	63	125	250	500	1k	2k	4k	8k
LwA Inlet	dB(A)	78	65	67	71	73	72	69	64	57
LwA Outlet	dB(A)	80	67	69	73	75	74	71	66	59
LwA Surrounding	dB(A)	63	50	52	56	58	57	54	49	42

Measuring point: qv = 1,79 m3/s, Ps = 717 Pa

A1.3 Cellar Conditioning Condenser

J&E Hall JCC2 – 40E[1]

[1] J5LC20C is the actual condensing unit model for the JCC2 40E cellar cooler system as confirmed by Dave Tully from J & E Hall International

Outdoor Sound pressure levels @ 1m

	1/1 Octave Sound Pressure Level (dB, ref 20µPa)							Overall A-weighted Sound Pressure Level (dBA)
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Model J5LC20C	49	48	46	45	40	35	27	49
							Total	49

A1.4 Cold Room Condenser

Danfoss OP-MPH-M018

DANFOSS
TESTING SECTION

MODEL: MPHC 018-1 (note: felt insulation) Date: 15/8/2007
COMPRESSOR: SC18MLX

Ambient: 32 °C

1/1 Octave Sound Pressure Level (dB, ref 20µPa)

After Unit Running

	Front	Back	Side comp	Side
125Hz				
250Hz				
500Hz				
1kHz				
2kHz				
4kHz				
8kHz				
A(dBA)				

	TE = -10°C			
	Front	Back	Side Comp	Side
125Hz	48.9	49.1	42.2	41.0
250Hz	47.0	44.9	47.5	46.8
500Hz	39.6	38.1	36.4	38.8
1kHz	34.6	32.7	27.5	32.3
2kHz	25.3	27.0	24.8	25.6
4kHz	25.9	26.2	27.7	23.8
8kHz	24.5	25.5	24.9	23.2
A(dBA)	42.9	41.4	42.1	42.1

Microphone position: 1m away from the unit and 1m above floor level.
For sound pressure in 10m distance you deducted 20 dB(A) from the stated value

Tested by: Zale Date: 15/8/2007	Checked by: Har KB Date: 15/8/2007	Approved by: Date:

A1.5 Air Conditioning Condenser

PUHZ-ZRP - OUTDOOR UNITS		PUHZ-ZRP125VKA2
SOUND PRESSURE LEVEL (dBA) Heating/Cooling		52 / 50
SOUND POWER LEVEL (dBA) Heating/Cooling		70
WEIGHT (kg)		116
DIMENSIONS (mm)	Width x Depth x Height	1050 x 330 + 40 x 1338
ELECTRICAL SUPPLY		220-240v, 50Hz
PHASE		Single
SYSTEM POWER INPUT (kW)	Heating/Cooling (nominal)	3.86 / 4.05
	Heating/Cooling (UK)	3.10 / 3.48
STARTING CURRENT (A)		12.0
SYSTEM RUNNING CURRENT (A) Heating/Cooling [MAX]		16.29 / 17.13 [29.3]
FUSE RATING (BS88) - HRC (A)		32
MAINS CABLE No. Cores		3
MAX PIPE LENGTH (m)		75
MAX HEIGHT DIFFERENCE (m)		30
CHARGE R410A (kg) - 30m		5.0