BRAIDEN ACOUSTICS LTD

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

NOISE IMPACT ASSESSMENT

Prepared For :	Fan Rescue	Date :	6 Jul 2022
Site :	Unit L2, Circle Square, Manchester	Report No. :	11029revA

1 INTRODUCTION

Braiden Acoustics has been commissioned by Fan Rescue to undertake an acoustic survey at the site of Unit L2, Circle Square, Manchester in order to assess the kitchen ventilation so that it conforms to condition 20 of planning application 111025/FO/2016/C1 which states:

> *20) Prior to occupation of the development 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 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)*

1.1 AIM

This report shall assess potential noise from the kitchen ventilation systems so that it conforms to the criterion given in condition above.

2 DESCRIPTION OF SITE

The site is the former BBC building and grounds which is bounded by Oxford Road, Charles Street, Princess Street and Brancaster Road. The development has now been constructed with high rise buildings that comprises of residential accommodation, office and commercial uses at ground floor level. An overview of the Circle Square development can be seen in Figure 1.

The proposed unit is within the southern unit of Vita Living shown in Figure 1, and occupies ground and mezzanine levels shown in Figure 2.

Figure 1
Overall site layout of Circle Square

Figure 2
Floor plans for ground and mezzanine levels

2.1 SITE LOCATION AND SURROUNDING USES

The site is within a mixed uses development where the nearest residents are situated on the floor above.

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2.2 PROPOSED USE

It is proposed that the main trading area and kitchen for the restaurant are at ground floor. The kitchen ventilation system will vent to atmosphere via the louvres at high level.

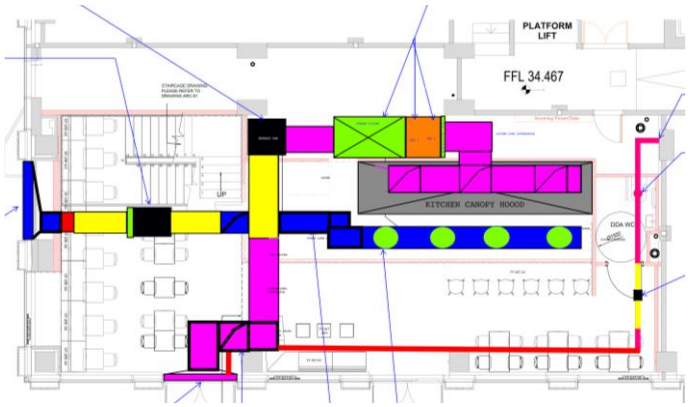

Figure 3
Ground floor layout showing kitchen ventilation systems

2.2.1 Opening hours

Monday to Saturday	08:00 – 23:00
Sunday	09:00 – 23:00.

2.2.2 Building services

The kitchen ventilation comprises of kitchen extract and intake ducts.

Kitchen Extract

Fan: Helios 560GBD EC
Silencer: TBC by Braiden Acoustics

Kitchen Intake

Fan: Helios 450GBD EC
Silencer: TBC by Braiden Acoustics

The kitchen extract / intake ventilation system will only operate during opening hours.

2.2.3 Sound system

As the proposed use is for a restaurant, then any sound system will be modest and only play 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

The Council's comments, stated in Section 1, do not specify any acoustic criteria that have to be met. In lieu of this, proposed noise levels at the nearest resident will be report and commented upon.

4 Measurement Details

A site visit measured external background noise levels during the day and night time periods.

4.1 Background noise monitoring

In order to assess the noise levels from the plant, background noise levels have been taken at the rear of the site, on the flat roof.

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

4.1.1 The 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."*

In order to obtain a worse case methodology, noise measurements were made at a relatively quiet time of week.

The noise levels were measured at the rear of the site and are representative of the noise levels of the nearby residential dwellings.

4.1.2 Monitoring details

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

Weather: 8-12- ° C; <5ms^{-1} wind; ~40 - 60% cloud; no precipitation.

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

Date: Thursday 24th March 2022

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

Monitoring was manned.

4.1.3 Monitoring locations

The location of the monitoring was 1.2m from local ground and at least 3m from any other surface and is denoted by the blue arrow in Figure 4

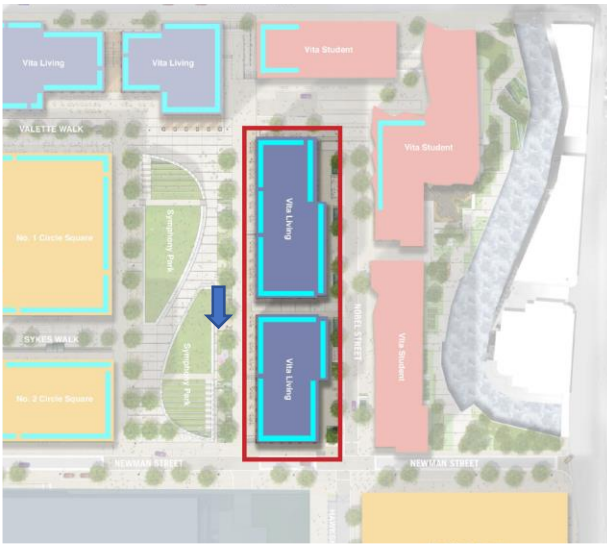

Figure 4
Monitoring location

4.1.4 Monitoring times

Monitoring took place late at a mid-week late evening when background noise levels would be relatively quiet. Monitoring was manned and took place for 15 minutes just after wen the restaurant would be shut – 23:10 – 23:25.

4.1.5 Monitoring results

The background noise level[1] for the measurement period was 54.5 dB L_{A90}.

5 Acoustic assessment

5.1 External plant noise assessment

Duct noise calculations have included the fans' sound power level, type and length of duct, bends, attenuators and end reflection.

[1] the noise data were lost due to a malfunction with the sound level meter.

Noise propagation has taken account for distance and barrier attenuation due to any shielding, where appropriate.

The assessment location is the nearest residential window above the louvre. It must be noted that there is a ledge above the louvres that creates a barrier between the louvre and the residential windows above.

Full noise propagation calculations are shown in the Appendix.

The supply and extract ducts will be assessed separately.

BS 4142 Noise Assessment SUPPLY	Value	dB
Total Specific Noise Level @ NSR		29
BS 4141		
Tonality	0/2/4/4	0
Impulsivity	0/3/6/9	0
Intermittency	0/3	3
Rating Noise Level		**32**
LAF90_day		54
Rating minus Background		**-22**
Target Met?		✓

Table 2
BS4142 assessment – Supply

The BS4142 assessment shows that the Rating Level of the supply duct, at the nearest resident, is a 22 dB less than the background and hence within acceptable limits.

*****NB In order to achieve the Specific Noise Level given in then the following silencer should be installed on the atmosphere side of the fan***

Acoustica R02 - 4 – 1500

The assessment was repeated for the extract duct

BS 4142 Noise Assessment Extract	Value	dB
Total Specific Noise Level @ NSR		25
BS 4141		
Tonality	0/2/4/4	0
Impulsivity	0/3/6/9	0
Intermittency	0/3	3
Rating Noise Level		**28**
LAF90_day		54
Rating minus Background		**-26**
Target Met?		✓

Table 3
BS4142 assessment – extract

The BS4142 assessment shows that the Rating Level of the night time operating plant , at the nearest resident, is also 26 dB less than the background, thus also within acceptable limits.

*****NB In order to achieve the Specific Noise Level given in then the following silencer should be installed on the atmosphere side of the extract fan***

Acoustica R02 - 4 – 1500 (Mel)

5.1.1 Anti-vibration

All external plant attached to the building must be done so using anti-vibration mounts.

5.2 OTHER RECOMMENDATIONS

Outside of the hours of 07:00 – 21:00 there shall be:

- no tipping of glass outside.

6 CONCLUSION

An acoustic survey has taken place at Unit L2, Circle Square, Manchester to assess noise levels from the proposed kitchen ventilation.

The assessment has revealed that additional mitigation has been recommended as part of the acoustic survey.

The following silencers should be installed on the atmosphere side of the fans:

Extract Acoustica R02 - 4 – 1500 (Mel)

Supply Acoustica R02 - 4 – 1500

Pending the recommendation above, the proposed kitchen ventilation scheme meeting the noise threshold given in Condition 20l

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.

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Appendix

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A1 CALCULATIONS

A1.1 Extract calculation

Unit L2, Circle Square		Duct Calculation	EXTRACT	Octave band centre frequency								
Item	Quantity	Description	Details	63	125	250	500	1000	2000	4000	Total level	
		Sound Pressure Level @ Xm	SWL data used	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Sound Power Level of unit	Helios Gigabox GBD 560/6/6, LwA out	60.0	60.0	62.0	69.0	67.0	66.0	61.0	73.4	
		A weighting	no	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		PLENUM Insetion Loss	no									
	1 m	Duct Length in metres	Round > 300	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	0	Number of bends	500mm round bend	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)	R02 - 4 - 1500 (Mel)	-7	-14	-20	-29	-29	-31	-29		
		Silencer attenuation (2)	no silencer or n/a	0	0	0	0	0	0	0		
		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		49.0	45.0	42.0	40.0	38.0	35.0	32.0	51.7	
		Directivity	2m @ 90° Vert	-2	-6	-7	-12	-16	-19	-20		
	1.5 m	Distance Attenuation	20*log10(r)	-3.52	-3.52	-3.52	-3.52	-3.52	-3.52	-3.52		
		Air absorption	15°C; 80% humidity	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.04		
		Numerical correction	SPL = SWL - 20log(r) +DI - 11	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00		
	δ 0.5	Barrier	yes	-8.2	-10.1	-12.4	-15.1	-17.9	-20.8	-23.7		
		SPL(A) at NSR	$L_{pA,NSR}$	**24.2**	**14.4**	**8.0**	**0.0**	**0.0**	**0.0**	**0.0**	**24.8**	**dB**

A1.2 Supply calculation

Unit L2, Circle Square		Duct Calculation	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Sound Power Level of unit	Helios Gigabox GBD 450/4/4, LwA iin	62.0	62.0	63.0	65.0	68.0	63.0	58.0	72.4	
		A weighting	no	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		PLENUM Insetion Loss	no									
	2 m	Duct Length in metres	Round > 300	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	0	Number of bends	500mm round bend	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)	R02 - 4 - 1500	-8	-16	-26	-42	-49	-49	-45		
		Silencer attenuation (2)	no silencer or n/a	0	0	0	0	0	0	0		
		Att due to end reflection	2000 mm end reflection	-1	0	0	0	0	0	0		
		Louvre attenuation	no acoustic louvre or n/a	0	0	0	0	0	0	0		
		Sound power at termination		53.0	46.0	37.0	23.0	19.0	14.0	13.0	53.9	
		Directivity	2m @ 90° Vert	-2	-6	-7	-12	-16	-19	-20		
	1.5 m	Distance Attenuation	20*log10(r)	-3.52	-3.52	-3.52	-3.52	-3.52	-3.52	-3.52		
		Air absorption	15°C; 80% humidity	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.04		
		Numerical correction	SPL = SWL - 20log(r) +DI - 11	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00		
	δ 0.5	Barrier	yes	-8.2	-10.1	-12.4	-15.1	-17.9	-20.8	-23.7		
		SPL(A) at NSR	$L_{pA,NSR}$	**28.2**	**15.4**	**3.0**	**0.0**	**0.0**	**0.0**	**0.0**	**28.5**	**dB**

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