

Acoustic assessment of proposed new mechanical services equipment serving Bill's Restaurant, Reading

Report Reference: 170713-R001A

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Client: Bill's Restaurants Limited

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0. SUMMARY

- ACA Acoustics Limited have been commissioned to assess noise emissions from proposed mechanical services equipment at Bill's Restaurant, Reading.
- The assessment is required to provide evidence that noise emissions from the new plant is not detrimental to the amenity of nearby noise-sensitive occupants and complies with Reading Borough Council's acoustic requirements. In accordance with criteria issued by Reading Borough Council on other similar projects in the vicinity, noise from the new equipment should be designed to not exceed a level 10dBA below the prevailing background sound level at 1m from the closest noise-sensitive receptors.
- Based on Reading Borough Council's criteria and a sound level survey undertaken by ACA Acoustics, noise from the new equipment shall be designed to not exceed a level of LAeq 31dBA at any time during opening times of the new restaurant.
- Calculations using manufacturer's sound level data for the new mechanical equipment, allowing for the benefit of noise mitigation treatments as set out in this report, are summarised in the table below.

Assessment Location	Required Criteria	Calculated Cumulative Equipment Sound Level
Closest noise-sensitive receptor	LAeq ≤ 31dB	LAeq 29dB

Table 1: Summary assessment result

- Calculated levels for all new plant operating simultaneously is at least 12dBA below the lowest measured background sound level during operating times of the new restaurant and complies with the requirements of Reading Borough Council.
- The author considers that sound levels from the new mechanical equipment should not be detrimental to the amenity of any noise-sensitive occupiers in the vicinity and no additional noise control treatments would be required, beyond the scheme set out in this report.

1. INTRODUCTION

New mechanical services equipment is to be installed to serve Bill's Restaurant, Chain Street, Reading.

ACA Acoustics Limited has been commissioned to carry out an assessment of noise from the new mechanical equipment and, where necessary, make recommendation to reduce noise levels to ensure compliance with the Local Authority's acoustic requirements.

This report presents results of the assessment to support the planning application.

2. ACOUSTIC CRITERIA

Based on previous developments within the area, it is anticipated that noise levels from new mechanical equipment will need to be controlled to not exceed a criterion of 10dBA below the prevailing background sound level in the vicinity of nearby noise-sensitive properties. At this level noise from the new equipment should not increase the prevailing background sound level and would not be detrimental to the amenity of nearby residents.

The criterion is likely to be applicable over a period of 60 minutes during the daytime and 15 minutes overnight, to correspond with BS 4142:2014 Methods for rating and assessing industrial and commercial sound and is to be measured at a position 1m external to noise sensitive facades (typically outside residential windows).

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

The restaurant is at Chain Street, Reading. Existing mechanical equipment is to be replaced with the proposed equipment.

Equipment selections and layout have been taken from the Chapmans Ventilation drawing number 011-086-01 Rev A and 011-086-03 Rev B, provided by the client, and include extract and supply fans, along with associated ancillaries. The equipment is to be installed to the roof of the restaurant, with the fans installed externally.

Based on discussions with the client, the author understands closest noise-sensitive receptors are residential flats at 60 St Mary's Butts, approximately 55m from the location of the equipment.

Drawing showing the location of the proposed mechanical equipment location on the restaurant roof is provided in Figure 1 below:



Figure 1 - Drawing showing proposed mechanical equipment location

4. SOUND LEVEL SURVEY

To assess sound levels from the mechanical services equipment it is necessary to establish sound levels in the vicinity. Details of the sound level survey carried out by ACA Acoustics Limited are provided below.

The sound level survey measurement position was selected to roof to the Bill's Restaurant, and, although at a distance from the nearest residential properties, it is considered that the acoustic climate at the survey position was equivalent, if not lower than that of the nearest residential property, due to screening from the nearby roads. The site was considered secure, and therefore an unattended survey was carried out between the 7th – 8th August 2017 to beyond the latest potential operating times of the new equipment. The weather was calm and dry over the assessment period.

The following equipment was used during the survey; the sound level meter was calibrated before and checked after the survey measurements with no change noted:

Equipment	Serial Number	Calibration Certificate
NTi Audio sound level meter type XL2 Class 1 complete with weatherproof and lockable outdoor environmental kit	A2A-12174-E0	42691
Castle calibrator type 4226. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	1551589	044039/68679

Table 2: Equipment used

The existing equipment was operating, and so measured results during these times have been excluded from the assessment. Lowest LA90 levels were taken after the equipment was turned off, at around 23:00hrs, until 00:00hrs. Whilst the equipment was off, levels primarily consist of traffic noise in the vicinity, along with non-associated mechanical services equipment. The lowest background sound level measured past the time the proposed equipment will power off was LA90 41dB. The values recorded by ACA Acoustics Limited are used as basis for acoustic design such that sound levels from the proposed new equipment are ≤ 31 dB(A) at the selected noise-sensitive receptor location.

Confirmation of the background sound level used in the assessment is shown in Table 3 below.

Survey Date	Existing Measured Background LA90, 15 min
7th – 8th August 2017	41dB

Table 3: Summary sound level survey results

5. ACOUSTIC ASSESSMENT

The development includes the installation of a new kitchen extract fan and supply fan. Confirmation of the equipment models used in the assessment is provided in Table 4 below.

Description	Equipment Model
EF1 Kitchen Extract Fan	FlaktWoods Estoc Targe 102-630-3
AHU1	Systemair MUB 062 630 D4-A2

Table 4: Proposed new mechanical equipment

Sound emissions from the mechanical equipment can be determined from manufacturer's published data. Note that alterations in equipment selections may be possible, so long as sound power levels for the new items do not exceed levels used in the calculation model.

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows. The model incorporates losses within the ductwork system based on the calculation method of CIBSE Guide B5 *Noise and vibration control for HVAC* along with environmental corrections set out in ISO 9613-2:1996.

The cumulative calculated sound level from the plant to the receptor location with all plant operating is shown in Table 5. Summary print-outs from the calculation models are included in Appendix A.

Assessment Location	Required Criteria	Calculated Plant Sound Level
Closest noise-sensitive receptor	$L_{Aeq} \leq 31\text{dB}$	$L_{Aeq} 29\text{dB}$

Table 5: Summary assessment results

Calculated sound levels outside the closest potential noise-sensitive receptors are 12dBA below the lowest measured background sound level. During earlier daytime periods the criteria will be higher and thus calculated levels would be even further below the specified limits during these times.

Discussion of suitable noise mitigation measures, as included within the calculations, is provided in Section 6 of this report.

6. RECOMMENDATIONS FOR NOISE CONTROL TREATMENTS

Note that consideration of non-acoustic aspects including, but not limited to structural calculations, airflow and pressure drop, and construction material are outside the scope of ACA Acoustics Limited and should be considered by others accordingly. Alternative methods of attenuation to those detailed below may be acceptable, for example relocation of noisy equipment to other, less sensitive, areas of the development. Full details of any alternative scheme, including working drawings and expected attenuation should be submitted and approved prior to manufacture.

6.1 Duct Mounted Attenuators

The assessment includes the benefit of duct-mounted attenuators installed to the atmospheric side of the new kitchen extract fan and main supply fan. Schedule of minimum dynamic insertion loss performance for the attenuators along with description of typical silencer to comply with the specified performance is provided in Appendix B. Cross-sectional area of the attenuators is shown in the calculation sheets in Appendix A. Note that the dimensions and free-area shown are nominal and the successful supplier should confirm their own selections to meet the minimum specified insertion loss performance.

The duct-mounted attenuators are readily available from most acoustic hardware suppliers, including Allaway Acoustics Limited (Contact Chris Williams – Tel: 01992 550825).

It is important airflow regenerated noise from the atmospheric terminal does not increase the cumulative sound level at nearby noise-sensitive properties. Suitable airflow velocity is dependent on the profile of the louvre used and should be verified with the manufacturer accordingly.

6.2 Acoustic Panelled Enclosure

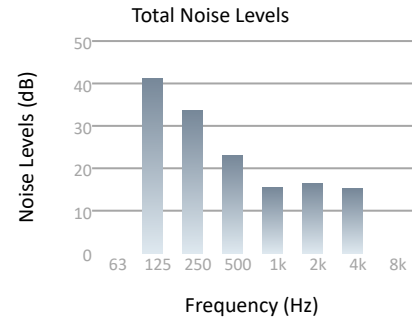
It is advised that the extract and supply fans are housed within acoustic panelled enclosures. These would typically be formed from 50mm thick acoustic panels incorporating 18swg steel outer casing, 50mm mineral wool insulation and perforated steel inner casing. The enclosure should be enlarged such that the flexible connections are housed internally within the enclosure. Apertures in the panels where the duct penetrates the enclosure should be sealed airtight with foam strips and a non-hardening flexible mastic.

Any transformation sections between the fans and new attenuators should be formed with double-skinned casings, or alternatively the transformation section also be installed within the enclosure.

APPENDIX A

Acoustic Calculations

Project Name	Bill's Reading
Project Reference	170713
Reference	Nearest residential property
Description	
Noise Limit	31
dBA	29.4



Noise Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
EF1 Breakout	1	-	26.2	16.2	0.1	-7	-14.3	-24.6	-34.2
AHU1 Breakout	1	37.2	25.2	15.2	5.1	-7	-12.3	-20.6	-
EF1 Discharge	1	-	35.3	30.1	21.1	15	16.2	14.9	4.2
AHU1 Inlet	1	50.9	39.6	30.7	18.5	5.9	3.7	2.9	-

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Calculation Sheet

EF1 Breakout to Nearest residential property

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - EF1 Breakout									
Sound Power Levels		-	82.0	79.0	69.0	70.0	64.0	57.0	50.0
Noise Control Treatments									
Treatment - Acoustic panelled enclosure									
Attenuated Lw		-	65.0	55.0	39.0	32.0	25.0	16.0	11.0
ISO 9613 Calculation									
Horiz. Distance (m)	55.0								
Source Height (m)	6.0								
Receiver Height (m)	6.0								
Barrier - No Barrier									
Distance to Barrier (m)	-								
Barrier Height (m)	-								
Screening at (m)	-								
Q Factor - Plane									
Direct Lp		-	25.2	15.1	-0.9	-8.0	-15.3	-25.6	-35.2
ISO 9613 Calculation - Reflections									
Type of Reflecting Surface - Flat hard walls									
Q Factor - Plane									
Source Height (m)	6.0								
Reflecting Height (m)	6.0								
Barrier - No Barrier									
Distance to Barrier (m)	-								
Barrier Height (m)	-								
Screening at (m)	-								
Reflected Lp		-	19.5	9.4	-6.6	-13.7	-21.0	-31.3	-40.7
Cumulative Lp at Receiver									
External Receiver									
External Receiver - Nearest residential property									
Sound Pressure, Lp:		-	26.2	16.2	0.1	-7.0	-14.3	-24.6	-34.2

Calculation Sheet

AHU1 Breakout to Nearest residential property

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - AHU1 Breakout									
Sound Power Levels		89.0	81.0	78.0	74.0	70.0	66.0	61.0	-
Noise Control Treatments									
Treatment - Acoustic panelled enclosure									
Attenuated Lw		76.0	64.0	54.0	44.0	32.0	27.0	20.0	- Row A
ISO 9613 Calculation									
Horiz. Distance (m)	55.0								
Source Height (m)	6.0								
Receiver Height (m)	6.0								
Barrier - No Barrier									
Distance to Barrier (m)	-								
Barrier Height (m)	-								
Screening at (m)	-								
Q Factor - Plane									
Direct Lp		36.2	24.2	14.1	4.1	-8.0	-13.3	-21.6	-
ISO 9613 Calculation - Reflections									
Type of Reflecting Surface - Flat hard walls									
Q Factor - Plane									
Source Height (m)	6.0								
Reflecting Height (m)	6.0								
Barrier - No Barrier									
Distance to Barrier (m)	-								
Barrier Height (m)	-								
Screening at (m)	-								
Reflected Lp		30.5	18.5	8.4	-1.6	-13.7	-19.0	-27.3	-
Cumulative Lp at Receiver									
External Receiver									
External Receiver - Nearest residential property									
Sound Pressure, Lp:		37.2	25.2	15.2	5.1	-7.0	-12.3	-20.6	-

Calculation Sheet

EF1 Discharge to Nearest residential property

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - EF1 Discharge									
Sound Power Levels	-	90.0	89.0	87.0	87.0	86.0	82.0	72.0	
Silencer									
Attenuator - EF1 Attenuator									
Width (m)	1.0								
Height (m)	1.0								
% Free Area (%)	35.0								
Face Velocity (m/s)	8.0								
	-	-11.0	-14.0	-18.9	-21.9	-16.0	-12.0	-8.0	
Bend Loss									
Levels after bend	-	77.0	72.0	65.1	62.1	67.0	67.0	61.0	
Rect Unlined Duct Losses									
Levels after duct	-	76.6	71.7	65.0	62.1	66.9	66.9	60.9	
End Reflection - Rect Flush									
	-	-3.5	-1.3	-0.4	-0.1	0.0	0.0	0.0	
External Grille Directivity									
Radiating Lw	-	70.5	65.3	56.4	50.4	51.9	51.9	45.9	Row A
ISO 9613 Calculation									
Direct Lp	-	33.7	28.5	19.5	13.4	14.6	13.3	2.7	
	-	-36.8	-36.9	-36.9	-37.0	-37.3	-38.6	-43.2	
ISO 9613 Calculation - Reflections									
Reflected Lp	-	30.2	24.9	16.0	9.8	11.0	9.7	-1.2	
	-	-40.4	-40.4	-40.5	-40.6	-40.9	-42.3	-47.1	
Cumulative Lp at Receiver									
External Receiver									
External Receiver - Nearest residential property									
Sound Pressure, Lp:	-	35.3	30.1	21.1	15.0	16.2	14.9	4.2	

Calculation Sheet

AHU1 Inlet to Nearest residential property

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - AHU1 Inlet									
Sound Power Levels		100.0	92.0	89.0	85.0	81.0	77.0	72.0	-
Silencer									
Attenuator - AHU1 Attenuator									
Width (m)	1.0								
Height (m)	1.0								
% Free Area (%)	35.0								
Face Velocity (m/s)	8.6								
		-5.0	-10.0	-15.0	-20.8	-26.1	-22.4	-16.9	-
Rect Unlined Duct Losses									
Levels after duct		94.4	81.6	73.7	64.1	54.8	54.5	55.0	-
		-0.6	-0.4	-0.3	-0.1	-0.1	-0.1	-0.1	-
End Reflection - Rect Flush									
		-6.5	-2.9	-1.0	-0.3	-0.1	0.0	0.0	-
External Grille Directivity									
Radiating Lw		86.1	74.8	66.0	53.8	41.3	39.5	40.0	- Row A
ISO 9613 Calculation									
Direct Lp		49.3	38.0	29.1	16.9	4.3	2.1	1.3	-
		-36.8	-36.8	-36.9	-36.9	-37.0	-37.3	-38.6	-
ISO 9613 Calculation - Reflections									
Reflected Lp		45.8	34.5	25.6	13.4	0.8	-1.5	-2.3	-
		-40.4	-40.4	-40.4	-40.5	-40.6	-40.9	-42.3	-
Cumulative Lp at Receiver									
External Receiver									
External Receiver - Nearest residential property									
Sound Pressure, Lp:		50.9	39.6	30.7	18.5	5.9	3.7	2.9	-

APPENDIX B

Typical Noise Control Treatments



Bill's Reading

Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
EF1 Attenuator		600L 35% Free Area c/w Melinex	6	11	14	19	22	16	12	8
AHU1 Attenuator		600L 35% Free Area	5	10	15	21	28	24	18	11
Acoustic panelled enclosure		50mm Thick Panel	13	17	24	30	38	39	41	39