Acoustic assessment of proposed new mechanical services equipment

Camden Town Brewery, London

Client: Zx Ventures

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0. SUMMARY

0.1. ACA Acoustics Limited has been commissioned to assess the acoustic impact of proposed new mechanical services equipment to be installed at Camden Town Brewery, London.

0.2. The assessment is required to provide evidence that noise emissions from the equipment will not be detrimental to the amenity of nearby noise-sensitive properties and complies with the requirements of London Borough of Camden Council.

0.3. A sound level survey was carried out over nominally a 24-hour period between 25th and 26th April 2019. Whilst on site, the author considered the sound climate during the daytime periods to be low, and comprised primarily of rail and road traffic and non-associated mechanical equipment in the vicinity. Lowest background sound levels were measured at a position equivalent to that of the rear of 50 Prince of Wales Road were LAF90 49dB during the period of the proposed equipment's operation.

0.4. Calculations using manufacturer's sound level data for the new equipment confirm that with benefit of acoustic treatment as detailed within this report, the rating level of the new equipment to rear windows of 50 Prince of Wales Road will not exceed LAr 39 dB when assessed in accordance with BS 4142:2014. This is at least 10dBA below the measured background sound level during the proposed equipment operating period of 13:00 – 00:00 hours.

0.5. Noise from the proposed new equipment, with benefit of acoustic mitigation proposed will not be disturbing or detrimental to the amenity of any nearby residential occupants.

1. INTRODUCTION

New mechanical services equipment is to be installed at Camden Town Brewery, London.

ACA Acoustics Limited has been commissioned to carry out an assessment of noise emissions from the proposed mechanical plant and, where necessary, make recommendation to reduce sound levels to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of the sound level survey and assessment.

2. ACOUSTIC CRITERIA

London Borough of Camden Council's policies relating to noise are set out in Appendix 3 of the Local Plan, which provides detailed noise thresholds to determine the potential acoustic impact of new developments.

In Summary, London Borough of Camden requires an assessment to be carried out in accordance with British Standard 4142:2014 and the results compared against noise-related conditions set out in Table C of the Appendix, as shown in Table 1 below:

Existing Noise Sensitive Receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Dwellings	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	Rating level 10dB below background	Rating level between 9dB below and 5dB above background	Rating level greater than 5dB above background
Dwellings	Outside bedroom window (façade)	Night	Rating level 10dB below background and no events exceeding 57dB LAmax	Rating level between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	Rating level greater than 5dB above background and/or events exceeding 88dB LAmax

Table 1: London Borough of Camden Noise Limits

The terms "LOAEL" and "SOAEL" are defined as the "Lowest Observed Adverse Effect Level" and "Significant Observed Adverse Effect Level" in the Planning Practice Guidance – Noise (PPG-N) and Noise Policy Statement for England (NPSE). The NPSE and PPG-N both require that significant adverse impacts are avoided and that where the impact lies somewhere between the LOAEL and SOAEL all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life, whilst considering the guiding principles of sustainable development as set out in the National Planning Policy Framework.

The scope of BS 4142:2014 advises that "*this British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature … to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*". BS 4142:2014 is commonly used to assess the potential for loss of amenity due to noise from mechanical services equipment and is considered appropriate for this application.

The assessment method of BS 4142:2014 corrects the specific sound level from the source under investigation to account for characteristics that could make the sound more intrusive to obtain a rating level. This rating level is compared against the prevailing background sound level outside the noise-sensitive property. Section 11 of BS 4142:2014 provides a commentary of the assessment result and advises that:

a) The greater the difference between the rating level and the background sound level, the greater the magnitude of the impact;
b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context;
d) The lower the rating level is 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.

Assessment result criteria shown within Appendix A of Camden's Local Plan are more stringent than those set out in the British Standard and can therefore be taken to ensure a robust assessment. Compliance with the "Green" criteria or lower half of the "Amber" range will generally ensure no loss of amenity to nearby residents, albeit, the context of the development must also be considered on a project-by-project basis which can alter the initial assessment result. This is discussed in more detail in Section 4 below.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

New mechanical equipment is proposed to the rear flat roof area during the refurbishment and development at Camden Town Brewery, London.

Closest residential properties have been identified as residential windows to the rear of 50 Prince of Wales Road.

Proposed operating times of the equipment is understood to be between 13:00 – 00:00 hours.

4. SOUND LEVEL SURVEY

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

The background sound level survey measurement position was selected at ground floor level at a position equivalent to 50 Prince of Wales Road. Existing background sound levels are raised due to rail activity and non-associated mechanical services equipment in the area, most notably that serving the train station nearby.

The site was considered secure and therefore an unattended survey was carried out over nominally a 24-hour period between 25th and 26th April 2019. The survey was conducted typically following procedures set out in BS 4142:2014.

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

Equipment	Serial Number
NTi Audio sound level meter type XL2-TA Class 1 complete with weatherproof and lockable outdoor environmental kit	A2A-10964-E0
Castle calibrator type 4226. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	1551589

Table 2: Equipment used

The following weather conditions were recorded at the start of the survey.

Time	Temperature	Wind Speed m/s	Wind Direction	Comments
15:30 25th March	13 °C	2	South East	Dry with light cloud and light breeze

Table 3: Recorded meteorological conditions

Results of the survey are shown in Figure 1 on the following page.

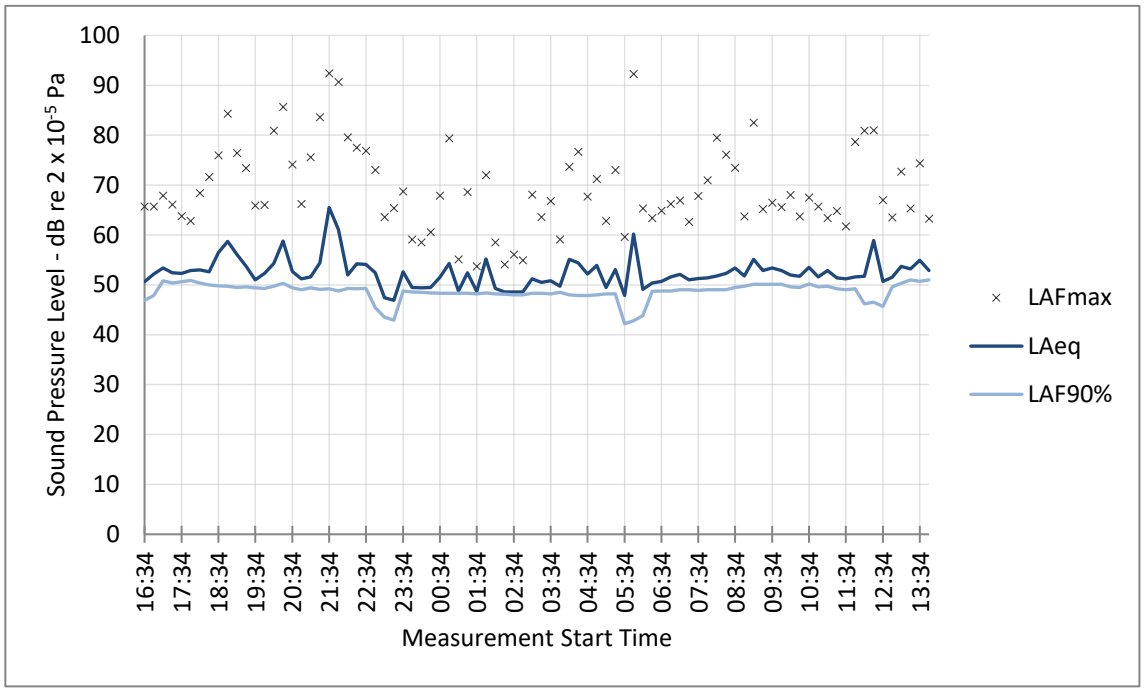


Figure 1: Unmanned sound level survey results

In accordance with BS 4142:2014, the prevailing background sound level is not necessarily taken to be the lowest recorded values, but rather the level that best represents the typical background sound level in the area over a defined period. A statistical analysis of the measured background sound levels has been carried out, generally following suggested guidance contained in Section 8 of the Standard. Distribution of the measured LA90 sound levels during anticipated operating times of the new equipment are shown below.

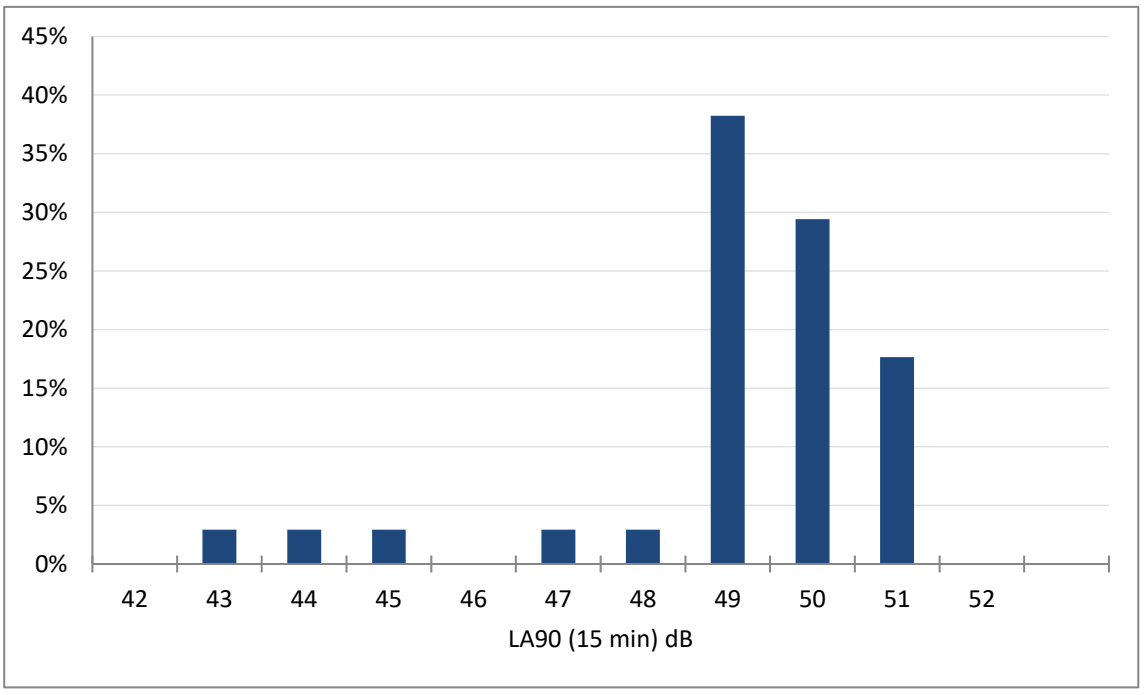


Figure 2: Statistical analysis of measured LA90 sound levels between 13:00 – 00:00

Figure 2 confirms that background sound levels are LA90 49dB or higher for 85% of the assessment period. The existing noise climate is dominated by non-associated mechanical services equipment serving the nearby railway. This can clearly be seen in the graph in Figure 1, where the LA90 sound level remains almost flat where the fan operated almost constantly over the full 24-hours, switching off for a short period three times during the assessment times before coming back on shortly after. The proposed new noise source would be similar in character to the existing climate. Achieving a rating level for the new plant of LAr 39dB, 10dBA below the representative background sound level, would still be at least 4dBA below the lowest measured sound level and significantly below the level where BS 4142:2014 considers there is a low likelihood of adverse impact. The author therefore proposes that a representative background sound level of LA90 49dB is appropriate to use as the basis for setting criteria within the assessment.

5. ACOUSTIC ASSESSMENT

The development includes the installation of new mechanical equipment to the rear of the property. Confirmation of the equipment models used in the assessment is provided in Table 4 below.

Description	Equipment Model	Quantity
Kitchen Extract Fan	Flakt Woods Estoc Targe 80-630-3	1
Supply Fan	Flakt Woods Estoc Targe 102-630-3	1
General Extract Fan	Systemair K250L	1
Toilet Extract Fan	Systemair K200L	1
A/C Condenser	Toshiba RAV-SM1603AT-E	2

Table 4: Proposed new mechanical equipment used in the assessment

Sound emissions from the mechanical equipment can be determined from manufacturer's published data.

A computer model has been used to calculate the noise contribution from the proposed plant to outside nearest noise-sensitive windows. Environmental corrections are calculated using the assessment method of ISO 9613-2:1996.

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

Receptor Location	Calculated Equipment Sound Level
Top floor residential windows	39dBA

Table 5: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Assessment of the calculated specific sound levels in accordance with BS 4142:2014 is provided in Table 6 below

Description	External receiver	Relevant Clause	Commentary
Calculated specific sound level to noise-sensitive windows	LAeq 39dB	7.1 7.3.6	New plant operating. Refer calculation sheets in Appendix A

Background sound level	LA90 49dB	8.1.3 8.3	Measured background sound level during period of proposed equipment operating
Acoustic feature correction	+0dB	9.2	The calculated specific sound level is more than 10dBA below the background sound level therefore no acoustic characteristics will be audible.
Rating level	LAr 39dB	9.2	
Excess of rating level over background sound level	**-10dB**	**11**	**Assessment indicates negligible likelihood of adverse impact**

Table 6: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Table 6 shows the cumulative rating level of the proposed new equipment will be at least 10dBA below the representative background LA90 sound level to outside the closest noise-sensitive properties.

BS 4142:2014 requires an assessment to consider the context of the development, rather than simply adhering to numerical values. Considering the calculated numerical value of the specific sound, allowing a reduction through partially open windows of 15dBA, as recommended in BS 8233:2014, sound levels inside the neighbouring dwellings due to the proposed new equipment will be approximately 24dBA. This is below guideline levels for sleeping in bedrooms of LAeq 30dB, set out in BS 8233:2014 and is further confirmation that sound levels from the new mechanical equipment should not be detrimental to the amenity of any noise-sensitive receptors in the vicinity.

The author considers that the context of the assessment does not alter the initial estimate of the impact, and that sound levels from the new mechanical equipment should not be detrimental to the amenity of any residential occupiers in the vicinity.

6. NOISE AND VIBRATION 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

It is recommended that attenuators are installed to the atmospheric side and room side of the kitchen extract fan and supply AHU, along with the atmospheric side of the general and W/C extract fans. Insertion loss performance for the required attenuators is included in a schedule in Appendix B of this report.

Where practical it is recommended that the attenuators should be incorporated into the fan casing. Where this is not possible then the attenuators should be installed as close-as-possible to the fans. Any transformation sections or adjoining ductwork between the fans and attenuator should be manufactured with double-skin casings.

6.2 Acoustic Panelled Enclosure

It is advised that the supply fan is housed within an acoustic panelled enclosure. This 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 fan and attenuator should be formed with double-skinned casings, or alternatively the transformation section also be installed within the enclosure.

6.3 Acoustic Screen

It is recommended an acoustic screen is formed to the rear of the timber visual louvres surrounding the equipment. A suitable screen would be constructed using minimum 10mm thick close-boarded timber. The timber should be overlapping, tongue and groove, or tightly butted and sealed.

The screen should extend at least 0.75m above the height of the condensers and the kitchen extract fan, and should extend down in contact with the floor with no gaps.

Proposed location of the new screen is included in Figure 3 below:

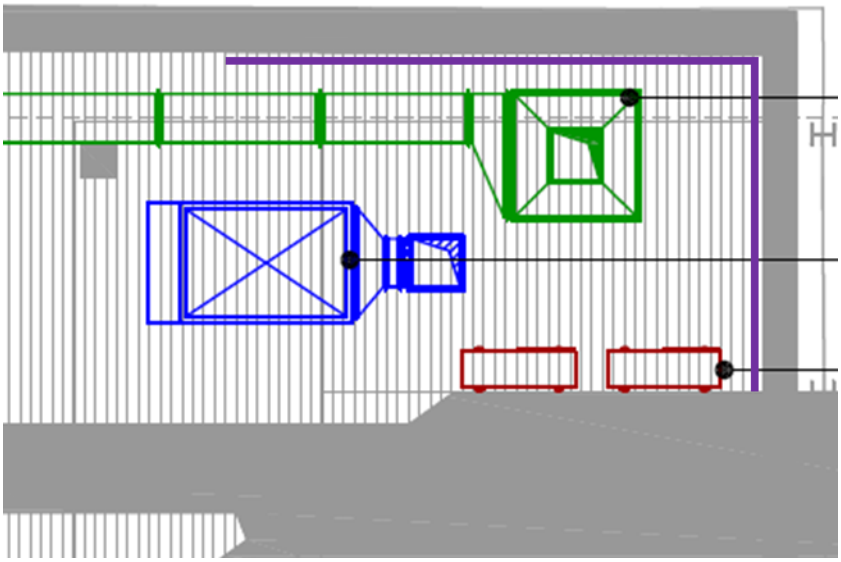


Figure 3: Proposed acoustic screen location (highlighted in purple)

7. CONCLUSION

A planning application is to be submitted for the installation of new mechanical services equipment at Camden Town Brewery, London.

ACA Acoustics have undertaken sound level surveys in the vicinity and assessment of noise from the proposed equipment using manufacturer's published acoustic data.

Calculated rating level for the new plant is at least 10dBA below the representative measured background sound level. This achieves criteria as specified by London Borough of Camden Council.

It is the author's opinion that the proposed new mechanical services equipment will not be detrimental to the amenity of nearby residential occupants.

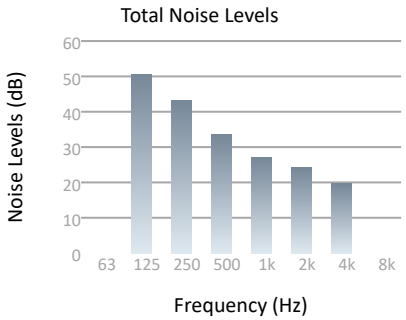
APPENDIX A

Acoustic Calculations

ACA acoustics

Camden Town Brewery

Project Name	Camden Town Brewery
Project Reference	190408
Reference	50 Prince of Wales Road
Description	
Noise Limit	39
dBA	39



Noise Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Kitchen Extract Fan Breakout	1	-	48	41	31	25	21	14	7
Kitchen Extract Fan Discharge	1	-	42	31	17	9	12	11	9
Supply Fan Breakout	1	-	36	26	11	4	-3	-12	-19
Supply Fan Inlet	1	-	36	32	15	7	16	16	14
CU1	1	39	38	30	26	18	10	3	-5
CU2	1	39	38	30	26	18	10	3	-5
General Extract Fan Breakout	1	25	9	15	17	9	11	6	-
General Extract Fan Discharge	1	34	29	27	9	1	1	-7	-
Toilet Extract Fan Breakout	1	8	6	11	17	11	13	8	-
Toilet Extract Fan Discharge	1	27	30	26	11	1	-1	-4	-
Kitchen Extract Fan Inlet	1	-	39	34	14	5	7	2	-4
Supply Fan Outlet	1	-	31	22	8	0	2	-3	-10

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Calculation Sheet

Kitchen Extract Fan Breakout to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Kitchen Extract Fan Breakout									
Sound Power Levels		**-**	**83.0**	**77.0**	**69.0**	**66.0**	**65.0**	**61.0**	**57.0**
Noise Control Treatments									
Treatment - none									
		-	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Directivity									
DI Index - Corner									
		-	*9.0*	*9.0*	*9.0*	*9.0*	*9.0*	*9.0*	*9.0*
Adiv - Geometrical Divergance									
		-	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*
Aatm - Atmospheric Absorption									
		-	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.2*	*-0.6*	*-2.2*
Agr - Ground Attenuation									
		-	*-1.8*	*-0.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Abar - Barrier Attenuation									
Barrier - Single Barrier									
Distance to Barrier (m)	1.0								
Barrier Height (m)	5.8								
Screening at (m)	4.9								
		-	*-5.4*	*-7.8*	*-10.8*	*-13.2*	*-15.9*	*-18.7*	*-20.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**-**	**48.2**	**40.7**	**30.6**	**25.1**	**21.3**	**14.1**	**7.2**

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Calculation Sheet

Kitchen Extract Fan Discharge to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Kitchen Extract Fan Discharge									
Noise Levels		**-**	**98.0**	**92.0**	**88.0**	**85.0**	**82.0**	**77.0**	**71.0**
Silencer									
Attenuator - Kitchen Extract Discharge									
Attenuator									
Width (m)	0.7								
Height (m)	0.7								
% Free Area (%)	45.0								
Face Velocity (m/s)	7.5								
		-	*-16.0*	*-21.0*	*-29.7*	*-33.1*	*-21.9*	*-16.9*	*-11.0*
Rect Unlined Duct Losses									
		-	*-0.2*	*-0.3*	*-0.2*	*-0.2*	*-0.2*	*-0.2*	*-0.2*
End Reflection - Rect Flush									
		-	*-4.5*	*-1.7*	*0.1*	*1.7*	*0.1*	*0.0*	*0.0*
External Grille Directivity									
Width (m)	0.4								
Height (m)	0.4								
Angle (°)	90.0								
		-	*-2.0*	*-4.3*	*-7.3*	*-10.6*	*-14.0*	*-15.0*	*-15.0*
ISO 9613 Calculation									
Horiz. Distance (m)	19.0								
Source Height (m)	6.0								
Receiver Height (m)	4.0								
Q Factor - Freefield									
		-	*-33.6*	*-33.6*	*-33.7*	*-33.7*	*-33.8*	*-34.2*	*-35.9*
ISO 9613 Barrier Attenuation									
		-	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**-**	**41.7**	**31.1**	**17.3**	**9.2**	**12.2**	**10.7**	**9.0**

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Calculation Sheet

Kitchen Extract Fan Inlet to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Kitchen Extract Fan Inlet									
Sound Power Levels		**-**	**91.0**	**93.0**	**84.0**	**80.0**	**78.0**	**75.0**	**69.0**
Silencer									
Attenuator - Kitchen Extract Inlet									
Attenuator									
Width (m)	0.7								
Height (m)	0.7								
% Free Area (%)	45.0								
Face Velocity (m/s)	7.5								
		-	*-10.0*	*-14.0*	*-19.9*	*-21.8*	*-14.9*	*-12.0*	*-8.0*
Rect Unlined Duct Losses									
		-	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*
Breakout Lw Rev B									
		-	*-11.0*	*-14.0*	*-19.0*	*-22.0*	*-25.0*	*-30.0*	*-32.0*
ISO 9613 Calculation									
Horiz. Distance (m)	19.0								
Source Height (m)	6.0								
Receiver Height (m)	4.0								
Q Factor - Plane									
		-	*-30.6*	*-30.6*	*-30.7*	*-30.7*	*-30.8*	*-31.2*	*-32.9*
ISO 9613 Barrier Attenuation									
		-	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**-**	**39.3**	**34.2**	**14.3**	**5.4**	**7.1**	**1.7**	**-4.0**

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Calculation Sheet

Supply Fan Breakout to 50 Prince of Wales Road

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - Supply Fan Breakout								
Sound Power Levels	**-**	**82.0**	**79.0**	**69.0**	**70.0**	**64.0**	**57.0**	**50.0**
Noise Control Treatments								
Treatment - Supply Fan Enclosure								
	-	*-17.0*	*-24.0*	*-30.0*	*-38.0*	*-39.0*	*-41.0*	*-39.0*
Dc - Directivity								
DI Index - Corner								
	-	*9.0*	*9.0*	*9.0*	*9.0*	*9.0*	*9.0*	*9.0*
Adiv - Geometrical Divergance								
	-	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*
Aatm - Atmospheric Absorption								
	-	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.2*	*-0.6*	*-2.2*
Agr - Ground Attenuation								
	-	*-1.8*	*-0.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Abar - Barrier Attenuation								
	-	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver								
External Receiver - 50 Prince of Wales Road								
Sound Pressure, Lp:	**-**	**35.6**	**26.5**	**11.4**	**4.3**	**-2.8**	**-12.2**	**-18.8**

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Calculation Sheet

Supply Fan Inlet to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Supply Fan Inlet									
Sound Power Levels		**-**	**82.0**	**86.0**	**81.0**	**83.0**	**85.0**	**80.0**	**72.0**
Silencer									
Attenuator - Supply Fan Inlet									
Attenuator									
Width (m)	0.8								
Height (m)	0.8								
% Free Area (%)	100.0								
Face Velocity (m/s)	2.6								
		-	*-12.0*	*-19.0*	*-28.0*	*-35.0*	*-26.0*	*-21.0*	*-13.0*
Rect Unlined Duct Losses									
		-	*-0.4*	*-0.3*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*
End Reflection - Rect Flush									
		-	*-2.1*	*-0.7*	*-0.2*	*-0.1*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
		-	*-3.8*	*-6.7*	*-10.0*	*-13.4*	*-15.0*	*-15.0*	*-15.0*
ISO 9613 Calculation									
Horiz. Distance (m)	19.0								
Source Height (m)	5.0								
Receiver Height (m)	4.0								
Q Factor - Junction									
		-	*-27.6*	*-27.6*	*-27.6*	*-27.7*	*-27.8*	*-28.2*	*-29.8*
ISO 9613 Barrier Attenuation									
		-	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**-**	**36.1**	**31.7**	**15.1**	**6.8**	**16.1**	**15.7**	**14.1**

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Calculation Sheet

Supply Fan Outlet to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Supply Fan Outlet									
Sound Power Levels		**-**	**90.0**	**89.0**	**87.0**	**87.0**	**86.0**	**82.0**	**72.0**
Silencer									
Attenuator - Supply Fan Outlet									
Attenuator									
Width (m)	0.7								
Height (m)	0.7								
% Free Area (%)	45.0								
Face Velocity (m/s)	7.5								
		-	*-10.0*	*-15.0*	*-21.9*	*-26.9*	*-21.0*	*-17.0*	*-10.0*
Breakout Lw Rev B									
		-	*-18.0*	*-21.0*	*-26.0*	*-29.0*	*-32.0*	*-37.0*	*-39.0*
ISO 9613 Calculation									
Horiz. Distance (m)	19.0								
Source Height (m)	6.0								
Receiver Height (m)	4.0								
Q Factor - Plane									
		-	*-30.6*	*-30.6*	*-30.7*	*-30.7*	*-30.8*	*-31.2*	*-32.9*
ISO 9613 Barrier Attenuation									
		-	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**-**	**31.4**	**22.4**	**8.4**	**0.4**	**2.2**	**-3.2**	**-9.9**

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Calculation Sheet

General Extract Fan Breakout to 50 Prince of Wales Road

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - General Extract Fan Breakout **Sound Power Levels**	**60.0**	**49.0**	**54.0**	**55.0**	**47.0**	**49.0**	**45.0**	**-**
Noise Control Treatments								
Treatment - none	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	-
Dc - Directivity								
DI Index - Plane	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	-
Adiv - Geometrical Divergance	*-40.5*	*-40.5*	*-40.5*	*-40.5*	*-40.5*	*-40.5*	*-40.5*	-
Aatm - Atmospheric Absorption	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.3*	*-1.0*	-
Agr - Ground Attenuation	*3.0*	*-2.6*	*-1.3*	*0.0*	*0.0*	*0.0*	*0.0*	-
Abar - Barrier Attenuation	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	-
External Receiver								
External Receiver - 50 Prince of Wales Road **Sound Pressure, Lp:**	**25.4**	**8.9**	**15.1**	**17.4**	**9.3**	**11.2**	**6.5**	**-**

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Calculation Sheet

General Extract Fan Discharge to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - General Extract Fan Discharge									
Sound Power Levels		**84.0**	**80.0**	**80.0**	**69.0**	**68.0**	**65.0**	**57.0**	**-**
Silencer									
Attenuator - General Extract Fan Attenuator									
Width (m)	0.6								
Height (m)	0.6								
% Free Area (%)	100.0								
Face Velocity (m/s)	1.4								
		-6.0	*-10.0*	*-15.0*	*-22.0*	*-27.0*	*-21.0*	*-17.0*	*-*
Rect Unlined Duct Losses									
		-0.2	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-*
End Reflection - Rect Flush									
		-13.2	*-8.1*	*-4.0*	*-1.4*	*-0.4*	*-0.1*	*0.0*	*-*
External Grille Directivity									
Width (m)	0.2								
Height (m)	0.2								
Angle (°)	90.0								
		0.6	*-1.0*	*-2.3*	*-4.7*	*-7.8*	*-11.1*	*-14.5*	*-*
ISO 9613 Calculation									
Horiz. Distance (m)	30.0								
Source Height (m)	5.0								
Receiver Height (m)	4.0								
Q Factor - Junction									
		-31.6	*-31.6*	*-31.6*	*-31.6*	*-31.7*	*-31.8*	*-32.5*	*-*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**33.7**	**29.2**	**27.0**	**9.1**	**1.1**	**0.8**	**-7.2**	**-**

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Calculation Sheet

Toilet Extract Fan Breakout to 50 Prince of Wales Road

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - Toilet Extract Fan Breakout **Sound Power Levels**	**43.0**	**46.0**	**50.0**	**55.0**	**49.0**	**51.0**	**47.0**	**-**
Noise Control Treatments								
Treatment - none	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	-
Dc - Directivity								
DI Index - Plane	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	-
Adiv - Geometrical Divergance	*-40.5*	*-40.5*	*-40.5*	*-40.5*	*-40.5*	*-40.5*	*-40.5*	-
Aatm - Atmospheric Absorption	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.1*	*-0.3*	*-1.0*	-
Agr - Ground Attenuation	*3.0*	*-2.6*	*-1.3*	*0.0*	*0.0*	*0.0*	*0.0*	-
Abar - Barrier Attenuation	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	-
External Receiver								
External Receiver - 50 Prince of Wales Road **Sound Pressure, Lp:**	**8.4**	**5.9**	**11.1**	**17.4**	**11.3**	**13.2**	**8.5**	**-**

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Calculation Sheet

Toilet Extract Fan Discharge to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - Toilet Extract Fan Discharge									
Sound Power Levels		**77.0**	**82.0**	**80.0**	**70.0**	**64.0**	**61.0**	**59.0**	**-**
Silencer									
Attenuator - Toilet Extract Fan Attenuator									
Width (m)	0.6								
Height (m)	0.6								
% Free Area (%)	100.0								
Face Velocity (m/s)	1.4								
		-6.0	*-10.0*	*-15.0*	*-22.0*	*-27.0*	*-21.0*	*-17.0*	*-*
Rect Unlined Duct Losses									
		-0.2	*-0.1*	*-0.1*	*0.0*	*1.0*	*0.3*	*0.0*	*-*
End Reflection - Rect Flush									
		-15.0	*-9.7*	*-5.1*	*-1.9*	*1.0*	*0.6*	*0.2*	*-*
External Grille Directivity									
Width (m)	0.2								
Height (m)	0.2								
Angle (°)	90.0								
		2.5	*-0.7*	*-1.7*	*-3.8*	*-6.7*	*-10.0*	*-13.4*	*-*
ISO 9613 Calculation									
Horiz. Distance (m)	30.0								
Source Height (m)	5.0								
Receiver Height (m)	4.0								
Q Factor - Junction									
		-31.6	*-31.6*	*-31.6*	*-31.6*	*-31.7*	*-31.8*	*-32.5*	*-*
ISO 9613 Barrier Attenuation									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**26.9**	**29.9**	**26.4**	**10.7**	**0.7**	**-1.0**	**-3.7**	**-**

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Calculation Sheet

CU1 to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - CU1									
Sound Power Levels		**76.0**	**76.0**	**70.0**	**69.0**	**64.0**	**59.0**	**55.0**	**51.0**
Noise Control Treatments									
Treatment - none									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity									
		5.5	*4.6*	*3.6*	*2.7*	*1.7*	*1.4*	*1.4*	*1.4*
Adiv - Geometrical Divergance									
		-36.6	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*
Aatm - Atmospheric Absorption									
		0.0	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.2*	*-0.6*	*-2.2*
Agr - Ground Attenuation									
		3.0	*-1.8*	*-0.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Abar - Barrier Attenuation									
Barrier - Single Barrier									
Distance to Barrier (m)	2.8								
Barrier Height (m)	5.8								
Screening at (m)	4.9								
		-8.6	*-4.4*	*-6.4*	*-8.9*	*-11.0*	*-13.4*	*-16.1*	*-19.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**39.3**	**37.8**	**29.7**	**26.1**	**18.0**	**10.2**	**3.1**	**-5.4**

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Calculation Sheet

CU2 to 50 Prince of Wales Road

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - CU2									
Sound Power Levels		**76.0**	**76.0**	**70.0**	**69.0**	**64.0**	**59.0**	**55.0**	**51.0**
Noise Control Treatments									
Treatment - none									
		0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Dc - Condenser Directivity									
		5.5	*4.6*	*3.6*	*2.7*	*1.7*	*1.4*	*1.4*	*1.4*
Adiv - Geometrical Divergance									
		-36.6	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*	*-36.6*
Aatm - Atmospheric Absorption									
		0.0	*0.0*	*0.0*	*0.0*	*-0.1*	*-0.2*	*-0.6*	*-2.2*
Agr - Ground Attenuation									
		3.0	*-1.8*	*-0.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Abar - Barrier Attenuation									
Barrier - Single Barrier									
Distance to Barrier (m)	2.8								
Barrier Height (m)	5.8								
Screening at (m)	4.9								
		-8.6	*-4.4*	*-6.4*	*-8.9*	*-11.0*	*-13.4*	*-16.1*	*-19.0*
External Receiver									
External Receiver - 50 Prince of Wales Road									
Sound Pressure, Lp:		**39.3**	**37.8**	**29.7**	**26.1**	**18.0**	**10.2**	**3.1**	**-5.4**

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APPENDIX B

Acoustic Mitigation Treatments

Schedule of Noise Control Treatments

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
Supply Fan Enclosure		50mm Thick Panel	13.0	17.0	24.0	30.0	38.0	39.0	41.0	39.0

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Camden Town Brewery

Attenuator Schedule

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
Kitchen Extract Discharge Attenuator		1500L 45% Free Area c/w Melinex	9.0	16.0	21.0	30.0	34.0	22.0	17.0	11.0
Kitchen Extract Inlet Attenuator		900L 45% Free Area c/w Melinex	6.0	10.0	14.0	20.0	22.0	15.0	12.0	8.0
Supply Fan Inlet Attenuator		1200L 45% Free Area	7.0	12.0	19.0	28.0	35.0	26.0	21.0	13.0
Supply Fan Outlet Attenuator		900L 45% Free Area	6.0	10.0	15.0	22.0	27.0	21.0	17.0	10.0
Toilet Extract Fan Attenuator		900L 45% Free Area	6.0	10.0	15.0	22.0	27.0	21.0	17.0	10.0
General Extract Fan Attenuator		900L 45% Free Area	6.0	10.0	15.0	22.0	27.0	21.0	17.0	10.0

Notes:
1. All dimensions in mm
2. Performance shown as static insertion loss. Dynamic insertion loss performance allowing for airflow generated noise is shown on the relevant calculation sheet.
3. Selections are nominal and the successful supplier should ensure their proposal achieves the minimum required static and dynamic insertion loss performance.

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