

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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34-36 King Street, Manchester

Noise survey and plant noise egress assessment

London, Manchester, Edinburgh, Birmingham, Belfast, Leeds

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D	26 May 22	Updates following comments from EHO	Christian Clark	James Atha
E	6 Jun 22	Added plant information	Jules Cochard	Mark Howarth

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Summary

Sandy Brown has been commissioned by Beaconsfield Estates LLP to provide acoustic advice in relation to the proposed development at 34-36 King Street, Manchester, M2 6AZ.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was performed between 12:30 on 24 February 2022 and 11:00 on 1 March 2022.

Based on the requirements of Manchester City Council and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed:

- $L_{Aeq,15min}$ 44 dB during the daytime (0700-2300)
- $L_{Aeq,15min}$ 40 dB during the night (2300-0700)
- $L_{Aeq,15min}$ 46 dB during normal office hours (0800-1800 Monday to Friday).

These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied, and the limits will be more stringent than those set.

An assessment of the proposed plant items associated with the development has been carried out. The proposed plant items are expected to comply with the 'normal office hours' limitations. As such, the proposed plant should be switched off outside these hours.

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1 Introduction

Sandy Brown has been commissioned by Beaconsfield Estates LLP to provide acoustic advice in relation to the proposed development at 34-36 King Street, Manchester, M2 6AZ.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises and to set appropriate limits for noise egress from building services plant.

This report presents the survey method and results, and a discussion of acceptable limits for noise emissions from building services plant.

A plant noise egress assessment has been carried out.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1.



Figure 1 Aerial view of site (courtesy of Google Earth Pro)

2.2 Adjacent premises

The site is adjacent to 30 King Street to the west (highlighted in yellow in Figure 1) and 40-42 King Street to the east (highlighted in blue in Figure 1). Both premises are mixed commercial and offices.

The site is also close to 19-23 King Street (commercial – highlighted in orange in Figure 1) and 25 King Street (commercial – highlighted in cyan in Figure 1) to the North, and Dalton Place (offices – highlighted in green in Figure 1) to the South.

3 Development proposals

Six condensers are proposed to the rooftop plant deck, with the layout shown in Figure 2.

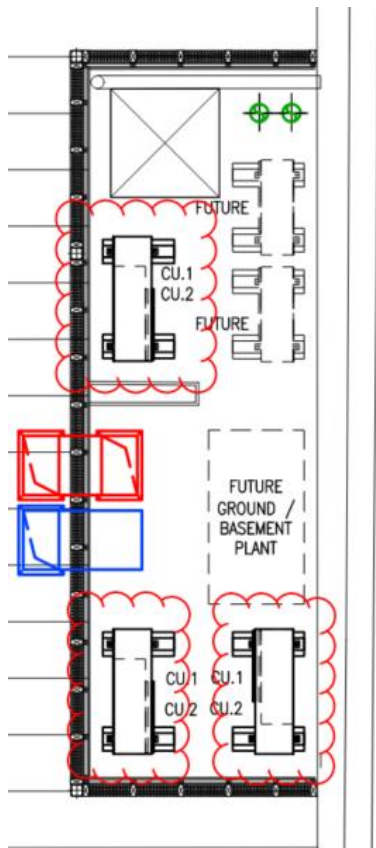


Figure 2 Location of condensers on the rooftop plant deck

It is noted that there is allowance for future plant items adjacent to the condensers on the plant deck. Additional plant items would require further assessment to ensure that plant noise egress criteria are met.

4 Building services noise egress criteria

4.1 Standard guidance

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at nearby noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

4.2 Local Authority criteria

Manchester City Council (MCC) provides guidance in relation to plant noise emissions in their *Planning and Noise Technical Guidance* document dated December 2015. The following is stipulated:

'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.'

5 Noise survey method

5.1 Measurements

Unattended noise monitoring was undertaken at the site over 5 days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements were taken over 15 minute periods between 12:30 on 24 March 2022 and 11:00 on 1 March 2022. The equipment was installed by Daniel Shaw and collected by Christian Clark.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided in Figure 3. This location was chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.



Figure 3 Photograph showing the unattended noise logger location

5.2 Weather conditions

Weather conditions during the survey are described in Appendix A.

6 Noise survey results

A graph showing the results of the unattended measurements is provided in Appendix B.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 1. Stated measurements are free-field.

Table 1 Ambient noise levels measured during the unattended survey

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{Aeq,16h}$ (dB)	$L_{Aeq,8h}$ (dB)
Thursday 24 February 2022	53 ^[1]	50
Friday 25 February 2022	53	51
Saturday 26 February 2022	53	51
Sunday 27 February 2022	52	50
Monday 28 February 2022	54	49
Tuesday 1 March 2022	53 ^[1]	-
Average	53	50

^[1] Measurement not made over full period due to monitoring start and end time (the measurement on 24 February 22 was over 10 hours, and on 1 March 22 over 4 hours); not included in the average.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Daytime and night-time statistical analysis of representative values for the site are given in Figure 4 and Figure 5.

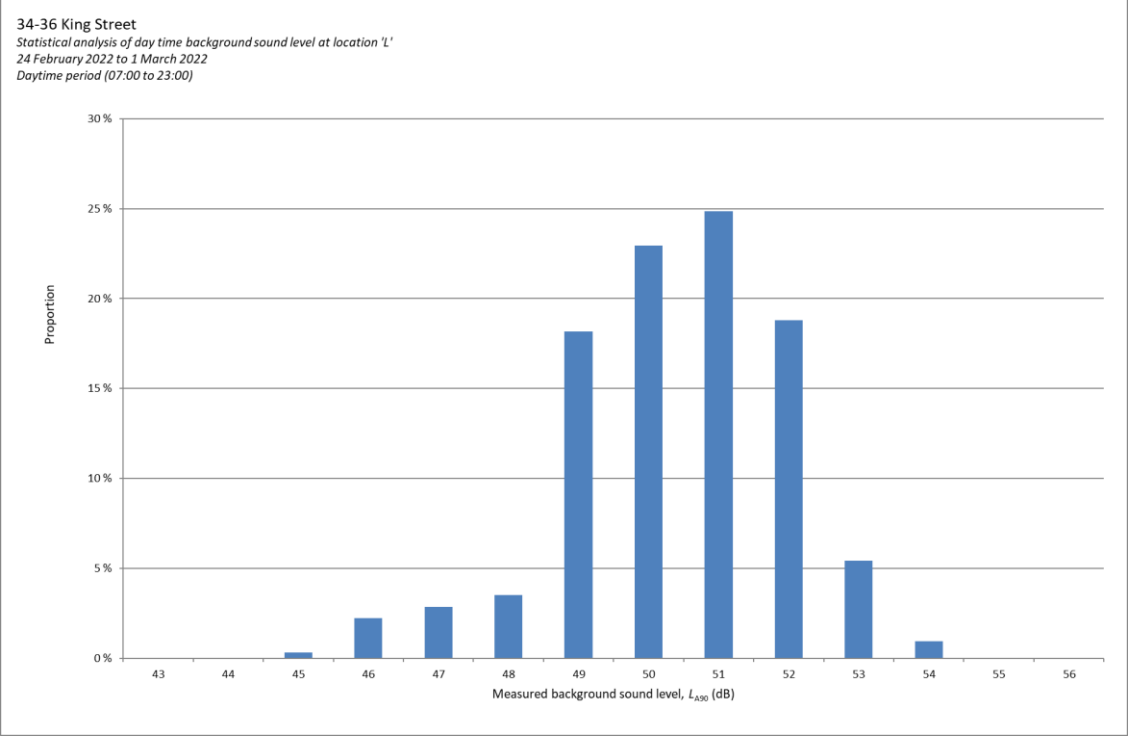


Figure 4 Daytime statistical analysis of background sound levels at location 'L'

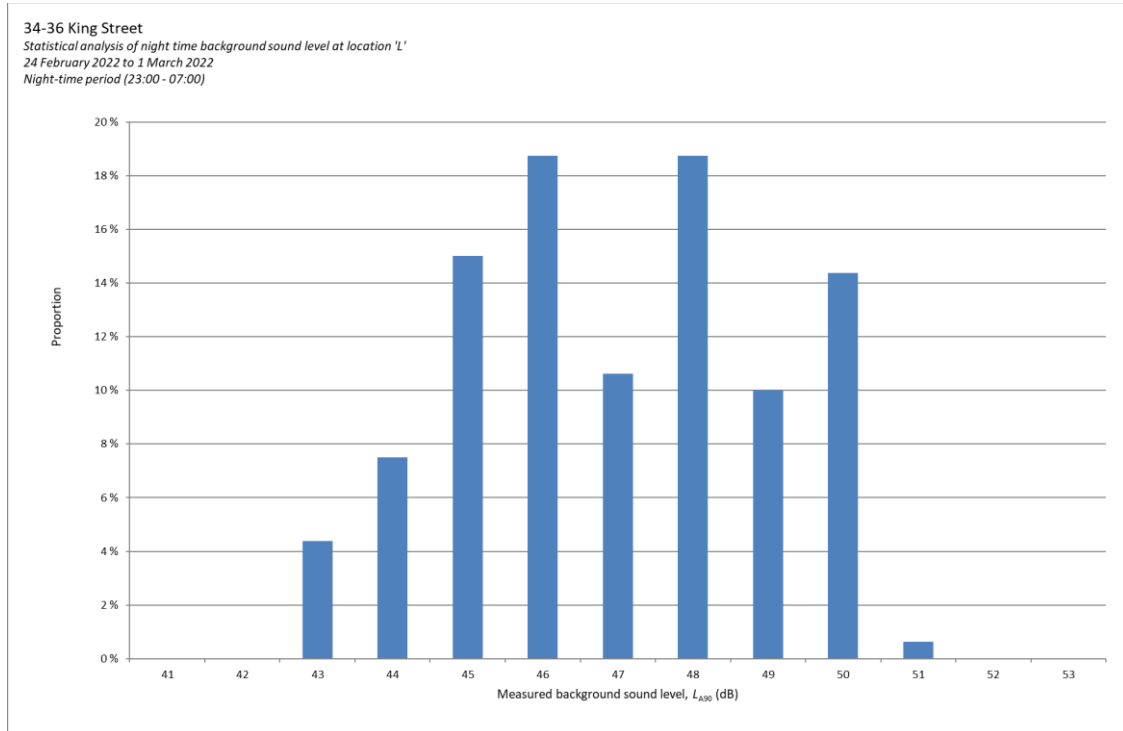


Figure 5 Night-time statistical analysis of background sound levels at location 'L'

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 49 dB during the daytime and $L_{A90,15min}$ 45 dB at night.

6.1.1 Office hours (8:00-18:00 Monday to Friday)

Representative background sound levels have been determined using statistical analysis of the continuous measurements during standard office hours (8:00-18:00 Monday to Friday).

Analysis of these representative values for the site are given in Figure 6/

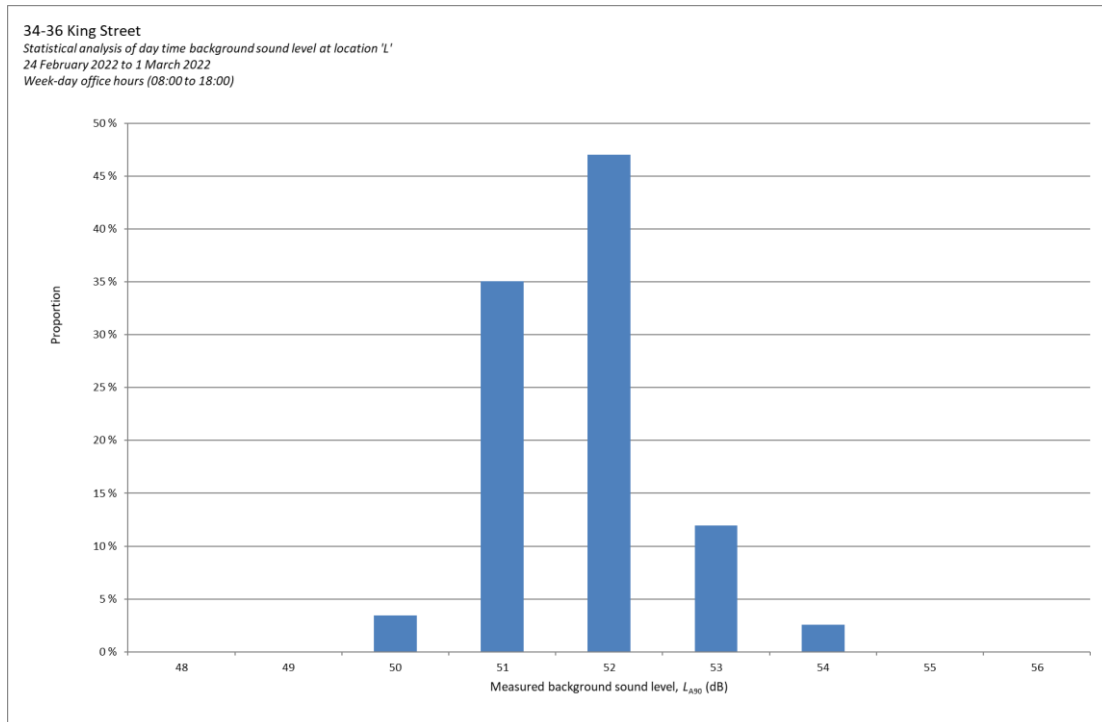


Figure 6 Weekday statistical analysis of background sound levels at location 'L'

7 Basic limits

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 2.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as free-field levels. In this case these limits would apply at the noise sensitive premises identified in section 2.2.

Table 2 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Daytime (07:00-23:00)	44
Night-time (23:00-07:00)	40
Office-hours (08:00-18:00 Monday to Friday)	46

^[1] The limits set out in Table 2 do not include any attention catching features. Penalty corrections for attention catching features may be significant and will need to be considered as the building services design progresses. This is discussed in Appendix C.

It is understood that the condensers are only proposed to operate during the daytime. Therefore, only the daytime plant noise limits apply at nearby noise sensitive premises.

8 Plant noise assessment

8.1 Proposed plant

Six condensers are proposed to the plant deck. Noise data for the units have been taken from Mitsubishi datasheets and are provided in Table 3. This data assumes the plant items are to operate at full capacity whilst in use and that the calculations are based on the 100% capacity, and is such a worst-case scenario when considering plant noise egress.

It is understood that the HVAC System will be set on an automatic timer to only run between 08.00 hrs and 18.00 hrs. Also, all tenants are required to ensure that the HVAC System is never manually operated between the hours of 18.01 hrs and 07.59 hrs. The HVAC system will be maintained by the managing agent, Ridley Thaw LLP, to comply with current statutory legislation and furthermore.

Table 3 Noise data for the proposed condenser units

Unit reference	Quantity	Sound power level, L_w (dB)	Sound pressure level L_{Aeq} (dB)							
			Octave-band centre frequency (Hz)							
			63	125	250	500	1000	2000	4000	8000
Mitsubishi PUZ-M100VKA	3	70	59	55	54	51	48	45	40	31

Mitsubishi	3	59	51	52	50	44	41	39	32	36
SUZ-										
M35VA										

8.2 Predicted noise egress levels

The calculation of noise levels at the nearest noise sensitive premises takes into account the following:

- Attenuation due to distance and screening from the building edge/parapet
- The location of the plant and directivity due to reflection from nearby surfaces

The above calculations are provided in full in Appendix D

The predicted noise levels for normally operating plant at the nearest noise sensitive premises are summarised in Table 4.

Table 4 Predicted noise egress from rooftop plant at the nearest noise sensitive premises

Location	Maximum sound pressure level at 1 m from noise sensitive premises, L_{Aeq} (dB)
40-42 King Street	46
Dalton Place	39
30 King Street	38
19-23 King Street	35
25 King Street	35

The predicted plant noise egress levels meet the weekday 'office hours' criteria at 40-42 King Street, and meet all the criteria at all other noise sensitive premises.

As such, the plant will be limited to only operate during normal office hours (8:00-18:00), and will be switched off outside these hours.

8.2.1 Attention catching characteristics

Regarding intermittency, the specific sound level of each plant items is predicted to be at least 5 dB below the representative background sound level and as such any intermittency is not expected to be readily distinctive against the residual acoustic environmental. Therefore, no corrections for intermittency are considered to be appropriate.

Regarding tonality, only octave band noise data has been provided so it is difficult to accurately assess any tonal characteristics. The available data provided does not indicate that any highly perceptible tones are likely and as the specific sound level for each plant item is at least 5 dB below representative background sound level, tonal characteristics are not expected to be highly perceptible at the receptor. As such no corrections for tonality are considered to be appropriate.

9 Conclusion

The representative background sound levels from the noise survey were $L_{A90,15min}$ 49 dB during the day, $L_{A90,15min}$ 45 during the night, and $L_{A90,15min}$ 51 dB during normal office hours (Monday to Friday 0800-1800).

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises are L_{Aeq} 44 dB during the day, L_{Aeq} 40 dB during the night, and L_{Aeq} 46 dB during normal office hours.

These limits are cumulative, and apply with all plant operating under normal conditions. No corrections for tonal or attention catching features have been applied within the assessment. If the plant contains any of these in practice, a penalty will be applicable.

An assessment of the proposed plant items associated with the development has been carried out. As long as the plant is switched off outside of the normal office hours (Monday to Friday 0800-1800), the proposed plant items are expected to comply with the relevant noise limits.

Appendix A

Survey details

Equipment

The unattended noise measurements were taken using a Rion NL-52 sound level meter.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/00932326	Rion	16 Mar 23	TCRT21/1182
Microphone	UC-59/05549	Rion	16 Mar 23	TCRT21/1182
Pre-amp	NH-25/32354	Rion	16 Mar 23	TCRT21/1182
Calibrator	NC-74/34125432	Rion	16 Mar 23	TCRT21/1181

[1] Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meter used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures*.

Weather conditions

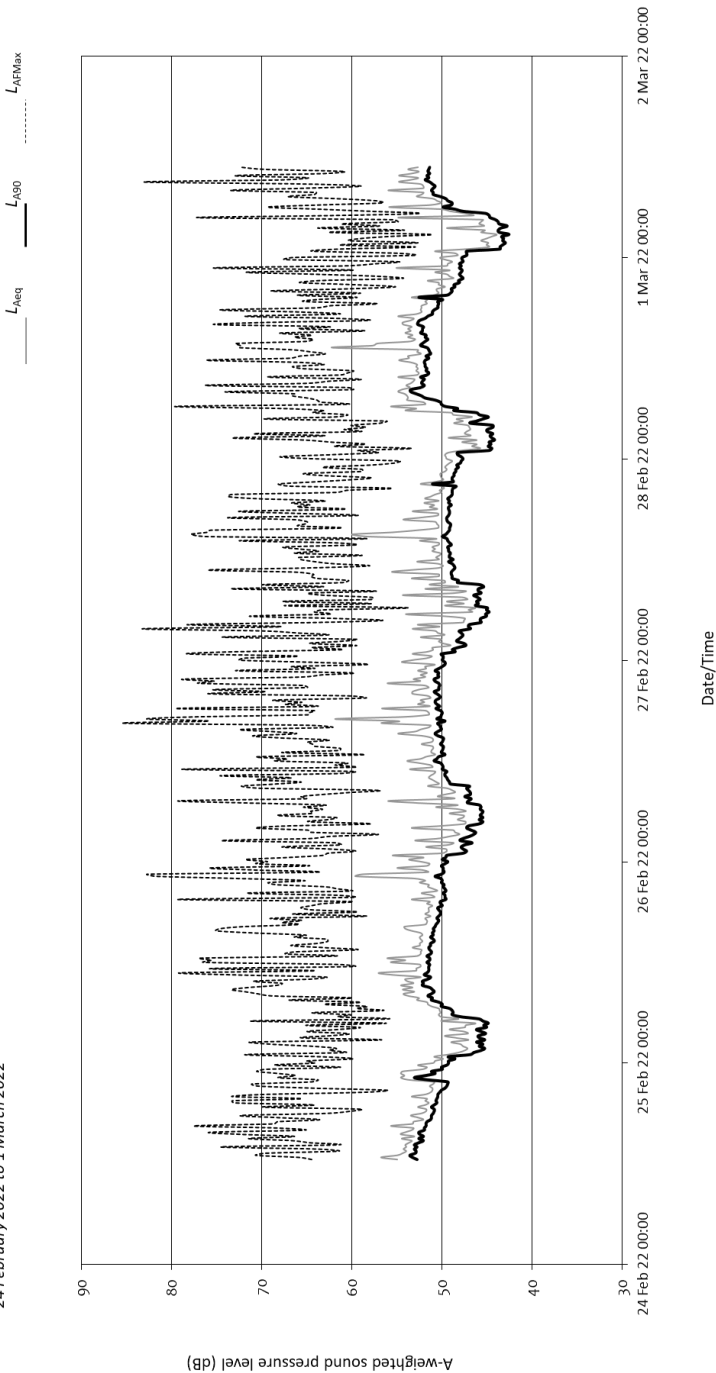
During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 2°C at night and 10°C during the day, and the wind speed was less than 10 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location 'L'

34-36 King Street
Results of noise logging survey at Location 'L'
24 February 2022 to 1 March 2022



Appendix C

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

Appendix D

Plant noise egress calculations

Comments	Octave band centre frequency (Hz)								Rating 1	Rating 2
	63	125	250	500	1k	2k	4k	8k		
22072 - 34-36 King Street										
Assessment of plant noise egress										
Condenser spectra										
PUZ-M100VKA										
Provided SWL (broadband)									L _W =	70.0
Provided SPL (spectral)	59.0	55.0	54.0	51.0	48.0	45.0	40.0	31.0	L _A =	53.5
Corrected SWL spectrum	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5	L _W =	70.0
SUZ-M35VA										
Provided SWL (broadband)									L _W =	59.0
Provided SPL (spectral)	51.0	52.0	50.0	44.0	41.0	39.0	32.0	36.0	L _A =	47.6
Corrected SWL spectrum	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4	L _A =	59.0
Unit groupings for calculation:										
Unit 1 = NW unit (2 stacked condensers)										
Unit 2 = SW unit (2 stacked condensers)										
Unit 3 = SE unit (2 stacked condensers)										

Partial screening by edge of building	-5.5	-5.9	-6.7	-8.1	-10.0	-12.6	-15.5	-18.5		
PUZ-M100VKA Lp at receptor (dB)	42.4	37.9	36.1	31.8	26.8	21.3	13.4	1.4	L _A =	33
Unit 3										
SUZ-M35VA Lw (dB)	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4		
Distance correction to 6.8 m	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	37.9	38.9	36.9	30.9	27.9	25.9	18.9	22.9	L _A =	35
PUZ-M100VKA Lw (dB)	75.5	75.5	75.5	75.5	75.5	75.5	75.5	75.5		
Distance correction to 6.8 m	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5	-27.5		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening by edge of building	-5.0	-5.0	-5.0	-5.1	-5.2	-5.3	-5.6	-6.2		
PUZ-M100VKA Lp at receptor (dB)	49.0	45.0	43.9	40.9	37.8	34.7	29.4	19.8	L _A =	43
Total Lp at receptor (dB)	52.2	48.9	47.3	43.4	39.8	36.5	30.6	27.8	L _A =	46

Assessment of plant noise egress to Dalton Place

Distance (unit 1)	22	m
Distance (unit 2 and 3)	19	m

Unit 1										
SUZ-M35VA Lw (dB)	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 22 m	-37.8	-37.8	-37.8	-37.8	-37.8	-37.8	-37.8	-37.8		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	27.6	28.6	26.6	20.6	17.6	15.6	8.6	12.6	L _A =	24
PUZ-M100VKA Lw (dB)	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 22 m	-37.8	-37.8	-37.8	-37.8	-37.8	-37.8	-37.8	-37.8		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0		
PUZ-M100VKA Lp at receptor (dB)	38.7	34.7	33.7	30.7	27.7	24.7	19.7	10.7	L _A =	33
Unit 2										
SUZ-M35VA Lw (dB)	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 19 m	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	28.8	29.8	27.8	21.8	18.8	16.8	9.8	13.8	L _A =	25
PUZ-M100VKA Lw (dB)	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 19 m	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0		
PUZ-M100VKA Lp at receptor (dB)	39.9	35.9	34.9	31.9	28.9	25.9	20.9	11.9	L _A =	34
Unit 3										
SUZ-M35VA Lw (dB)	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 19 m	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	28.8	29.8	27.8	21.8	18.8	16.8	9.8	13.8	L _A =	25
PUZ-M100VKA Lw (dB)	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 19 m	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6	-36.6		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0		
PUZ-M100VKA Lp at receptor (dB)	39.9	35.9	34.9	31.9	28.9	25.9	20.9	11.9		
Total Lp at receptor (dB)	44.6	41.3	40.1	36.7	33.7	30.8	25.6	20.4	L _A =	39

Assessment of plant noise egress to 19-23 King Street / 25 King Street

Distance (unit 1)	30	m
Distance (unit 2 and 3)	33	m

Unit 1

<u>SUZ-M35VA Lw (dB)</u>	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 28 m	-40.5	-40.5	-40.5	-40.5	-40.5	-40.5	-40.5	-40.5		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	24.9	25.9	23.9	17.9	14.9	12.9	5.9	9.9	L _A =	22

<u>PUZ-M100VKA Lw (dB)</u>	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 28 m	-40.5	-40.5	-40.5	-40.5	-40.5	-40.5	-40.5	-40.5		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0		
PUZ-M100VKA Lp at receptor (dB)	36.0	32.0	31.0	28.0	25.0	22.0	17.0	8.0	L _A =	30

Unit 2

<u>SUZ-M35VA Lw (dB)</u>	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 31 m	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	24.0	25.0	23.0	17.0	14.0	12.0	5.0	9.0	L _A =	21

<u>PUZ-M100VKA Lw (dB)</u>	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 31 m	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0		
PUZ-M100VKA Lp at receptor (dB)	35.1	31.1	30.1	27.1	24.1	21.1	16.1	7.1	L _A =	30

Unit 3

<u>SUZ-M35VA Lw (dB)</u>	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 31 m	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	24.6	25.6	23.6	17.6	14.6	12.6	5.6	9.6	L _A =	21

<u>PUZ-M100VKA Lw (dB)</u>	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 31 m	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Partial screening	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0		
PUZ-M100VKA Lp at receptor (dB)	35.1	31.1	30.1	27.1	24.1	21.1	16.1	7.1	L _A =	30

Total Lp at receptor (dB)	40.5	37.2	36.0	32.6	29.6	26.7	21.5	16.4	L _A =	35
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Assessment of plant noise egress to 30 King Street

Distance (unit 1)	10	m
Distance (unit 2 and 3)	12	m

Unit 1

<u>SUZ-M35VA Lw (dB)</u>	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 10 m	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	34.4	35.4	33.4	27.4	24.4	22.4	15.4	19.4	L _A =	31

<u>PUZ-M100VKA Lw (dB)</u>	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 10 m	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0	-31.0		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Rooftop screening	-7.2	-8.7	-10.9	-13.6	-16.6	-19.6	-22.6	-24.0		

PUZ-M100VKA Lp at receptor (dB)	43.3	37.8	34.6	28.9	23.0	17.0	8.9	-1.5	L _A =	31
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Unit 2

SUZ-M35VA Lw (dB)	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 12 m	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	32.8	33.8	31.8	25.8	22.8	20.8	13.8	17.8	L _A =	29

PUZ-M100VKA Lw (dB)	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 12 m	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Rooftop screening	-7.2	-8.7	-10.9	-13.6	-16.6	-19.6	-22.6	-24.0		
PUZ-M100VKA Lp at receptor (dB)	41.8	36.2	33.0	27.3	21.4	15.4	7.4	-3.1	L _A =	29

Unit 3

SUZ-M35VA Lw (dB)	62.4	63.4	61.4	55.4	52.4	50.4	43.4	47.4		
Distance correction to 12 m	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6		
Directivity correction (Q=2)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
SUZ-M35VA Lp at receptor (dB)	32.8	33.8	31.8	25.8	22.8	20.8	13.8	17.8	L _A =	29

PUZ-M100VKA Lw (dB)	75.5	71.5	70.5	67.5	64.5	61.5	56.5	47.5		
Distance correction to 12 m	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6		
Directivity correction (Q=4)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Rooftop screening	-7.2	-8.7	-10.9	-13.6	-16.6	-19.6	-22.6	-24.0		
PUZ-M100VKA Lp at receptor (dB)	41.8	36.2	33.0	27.3	21.4	15.4	7.4	-3.1	L _A =	29

Total Lp at receptor (dB)	47.6	43.6	40.8	35.0	30.5	27.3	20.1	23.2	L _A =	38
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