SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Hardwicke Building

Noise survey and plant noise egress limits

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Version	Date	Comments	Author	Reviewer
A	29 Apr 21		Nicolas Lum	Steven Wheeler

Summary

Sandy Brown has been commissioned by The Honourable Society of Lincoln's Inn to provide acoustic advice in relation to the proposed modifications of the Hardwicke Building, New Square, Holborn, London WC2A 3UJ.

The proposed works include moving building services plant from the basement up to the rooftop tank room. This will require external louvres to be cut into the roof and side walls of the tank room.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was performed between 12:45 on 31 March 2021 and 13:00 on 12 April 2021.

The representative background sound levels from the noise survey were $L_{A90,5min}$ 41 dB during the day, and $L_{A90,5min}$ 39 during the night.

The measured background sound levels are considered to be lower than is representative. This is due to the restrictions imposed in response to the COVID-19 pandemic including reduced road, air and pedestrian traffic.

The historic data from noise surveys conducted in nearby developments have been used to determine the noise climate around the site, according to guidance by the Association of Noise Consultants and the Institute of Acoustics.

Based on the requirements of the affected Local Authorities, and the results of the noise survey / historical data, 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 $L_{Aeq,5min}$ 39 dB during the daytime, and $L_{Aeq,5min}$ 36 dB during the night.

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.

At this stage, no information is available in relation to the proposed plant. This will need to be assessed as the design progresses.

Contents

1 Introduction

Sandy Brown has been commissioned by The Honourable Society of Lincoln's Inn to provide acoustic advice in relation to proposed the modification of the Hardwicke Building, New Square, Holborn, London WC2A 3UJ.

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.

2 Site description

2.1 The site and its surrounding

The site is located within the London Borough of Camden (LBC) and is in proximity of a number of residential buildings, office buildings and retail spaces.

The border between LBC and the City of London (CoL) runs along Chancery Lane, which is to the east of the site. The border to the London Borough of Westminster is towards the south of Carey Street, which lies to the south of the site.

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

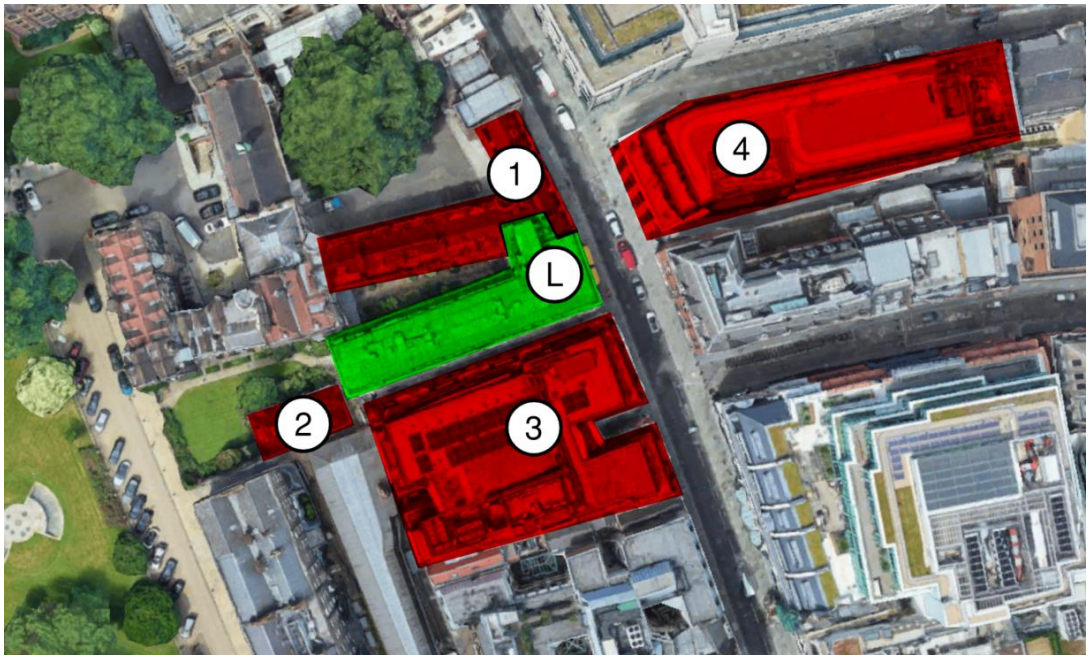


Figure 1 Aerial view of site (courtesy of Google Earth Pro)

The Hardwicke building contains barrister's chambers with residential apartments on the top floor.

2.2 Adjacent premises

The site is highlighted in green in Figure 1, with nearby residential receptors in red and nearby residential buildings.

The nearest noise sensitive receptors are as follows:

1. XXIV Old Buildings: barrister's chambers with residential accommodation on the top floor (within LBC)
2. New Square: barrister's chambers with residential accommodation on the top floor (within LBC)
3. 4 Star Yard: retail spaces with residential accommodation at the upper levels (within LBC)
4. 38 Chancery Lane: commercial office with residences at the upper levels (within CoL).

3 Development proposals

The proposed works are to move building services plant from the basement up to the rooftop tank room. This will require external louvres to be cut into the roof and side walls of the tank room.

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

4.2.1 LBC

The site is located within The LBC which considers residential spaces, schools and hospitals to be noise sensitive. Appendix 3 of London Borough of Camden *Local Plan* (2017) states that:

"Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion."

4.2.2 CoL

There are nearby noise sensitive receptors located in the City of London, which considers residential spaces, hotels, serviced apartments and offices to be noise sensitive. Policy DM 15.7 of the City of London *Local plan* (2015) states that:

"Although the City is busy and densely built up, there nevertheless needs to be protection from excessive noise for the general business environment, quiet areas, such as open spaces, and noise-sensitive uses, such as hospitals and housing, and the City's ambient noise levels should not increase. For example, heating and ventilation plant should be designed so that it does not adversely affect nearby open spaces which are valued for their quiet environment. The level of noise emitted from any new plant should be below the background level by at least 10dBA."

5 Noise survey

5.1 Method

Unattended noise monitoring was undertaken at the site over 13 days.

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

The unattended measurements were taken over 5-minute periods between 12:45 on 31 March 2021 and 13:00 on 12 April 2021. The equipment was installed and collected by Nicolas Lum.

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 2. The microphone was located 1.2 m above roof level and was in a free-field condition.

This location was chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.

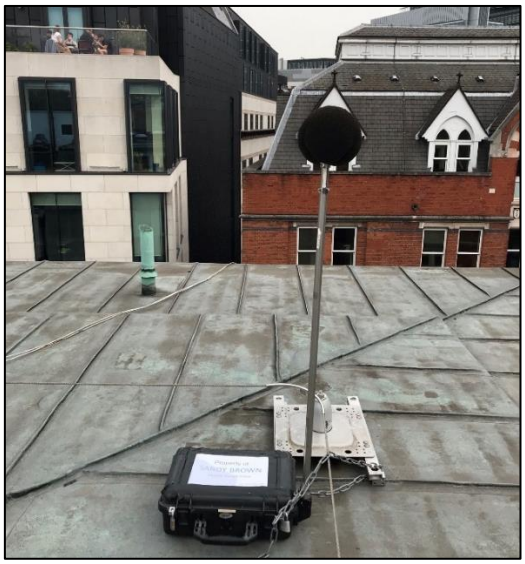


Figure 2 Photo of noise monitoring position 'L'

5.2 Weather conditions

Weather conditions during the survey are described in Appendix A.

5.3 Observations

The dominant noise sources observed at the site during the survey were from existing building services plant on the Hardwicke Building roof as shown in Figure 3.

Figure 3 Existing building services plant on Hardwicke Building roof

Less significant noise sources included pedestrians at ground level and traffic noise from A40 High Holborn and Chancery Lane.

The noise climate was considered to be quieter than would typically be expected. This was because the noise survey was undertaken during the country-wide Covid-19 restrictions. The background noise levels during the restrictions are unlikely to be representative of normal conditions. It is generally accepted that lockdown noise levels will be lower due to travel restrictions and the closure of the majority of commercial premises etc.

5.5 Noise measurement 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. The microphone was located in a free-field condition.

Measured minimum background sound levels are given in Table 2.

Table 1 Ambient noise levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Wednesday 31 March 2021	-[1]	49
Thursday 1 April 2021	49	44
Friday 2 April 2021	47	43
Saturday 3 April 2021	57	42
Sunday 4 April 2021	47	45
Monday 5 April 2021	46	45
Tuesday 6 April 2021	50	45
Wednesday 7 April 2021	49	46
Thursday 8 April 2021	50	45
Friday 9 April 2021	50	44
Saturday 10 April 2021	48	44
Sunday 11 April 2021	47	47
Monday 12 April 2021	-[1]	-
Average	49	45

[1] Measurement not made over full period due to monitoring start and end time (the measurement on 31 March 2021 was over 10 hours, and on 12 April 2021 over 6 hours); not included in the average.

Table 2 Minimum background sound levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{A90,5min}$ (dB)	Night (23:00 – 07:00) $L_{A90,5min}$ (dB)
Wednesday 31 March 2021	38[1]	37
Thursday 1 April 2021	41	38
Friday 2 April 2021	40	38
Saturday 3 April 2021	38	36
Sunday 4 April 2021	39	39
Monday 5 April 2021	39	40
Tuesday 6 April 2021	42	40
Wednesday 7 April 2021	41	39
Thursday 8 April 2021	41	39
Friday 9 April 2021	39	36
Saturday 10 April 2021	40	40
Sunday 11 April 2021	40	40
Monday 12 April 2021	44[1]	-

[1] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,5min}$ 38 dB during the daytime and $L_{A90,5min}$ 36 dB at night.

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.

From this analysis, the representative background sound levels measured during the survey were $L_{A90,5min}$ 41 dB during the daytime and $L_{A90,5min}$ 39 dB at night.

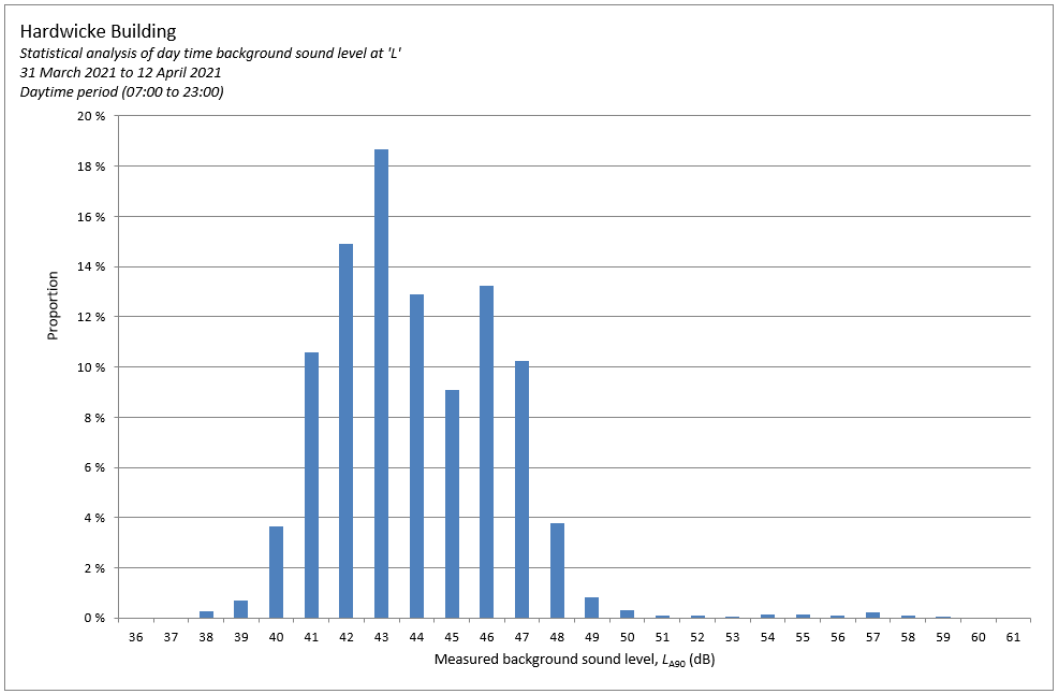


Figure 4 Daytime statistical analysis

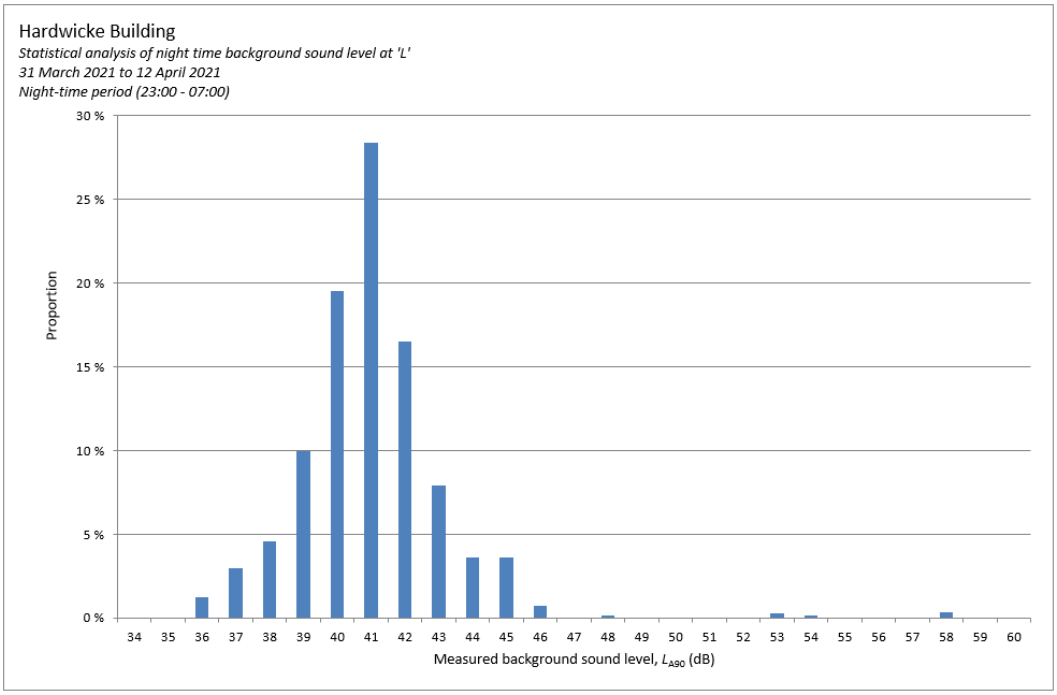


Figure 5 Night-time statistical analysis

6 Review of historic noise survey data

6.1 Current guidance

The measured background noise levels are considered to be lower than expected. This is likely due to the restrictions imposed in response to the COVID-19 pandemic, including reduced road, air and pedestrian traffic. The Association of Noise Consultants (ANC) in conjunction with the Institute of Acoustics (IOA) released a document on 16 April 2020 (most recent revision 12 January 2021) titled *Joint guidance on the impact of COVID-19 on the practicality and reliability of baseline sound level surveying and the provision of sound & noise impact assessments.* This guidance document suggests that, as it may be difficult to obtain representative background noise levels, other approaches may have to be taken to establish an appropriate robust estimate of the existing background noise levels, such as using information from previous local surveys and noise maps.

6.2 Historic noise survey data

Publicly available historic noise data from other surveys in the vicinity of the site has been reviewed. The details of these surveys are summarised below. The approximate measurement locations for each survey are shown in Figure 6.

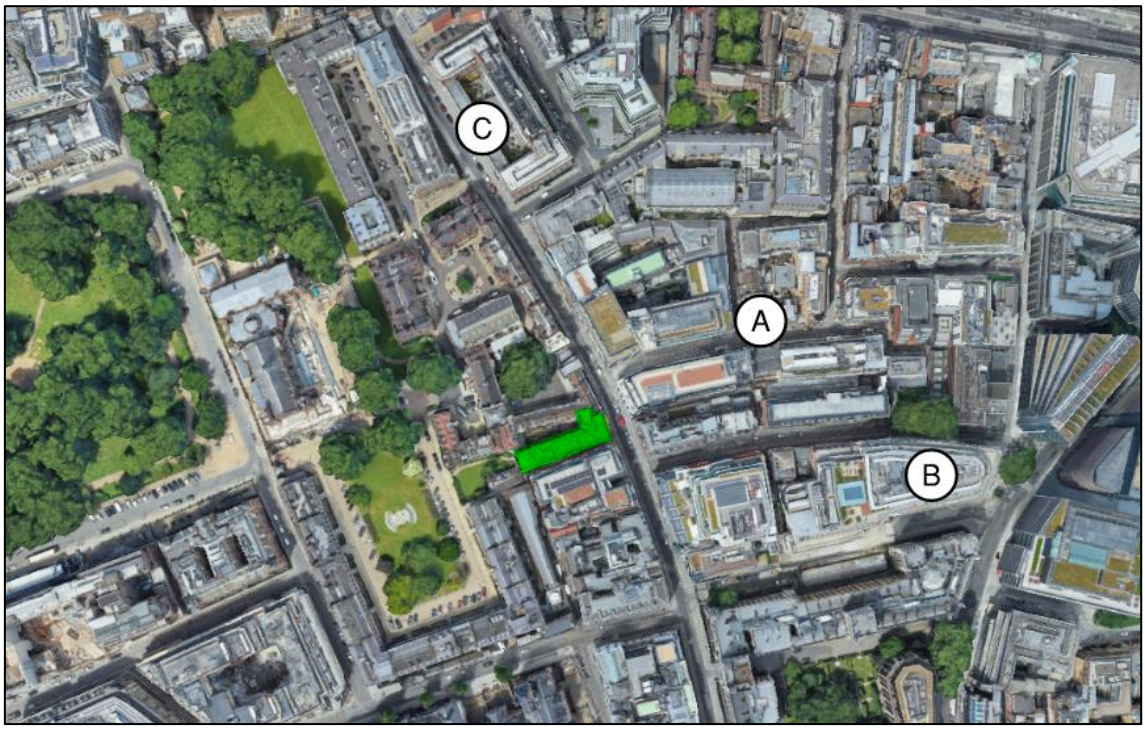


Figure 6 Historical noise survey measurement locations

6.2.1 (A) KP Acoustics, 9-13 Cursitor Street, 6 March 2017 (COL 17/00487)

An environmental noise survey report was produced by KP Acoustics in 2019 to determine the ambient noise climate at 9-13 Cursitor Street, in order to set plant noise limits. The location relative to the site is shown as 'A' in Figure 6.

The measurements were taken on the roof of the building and in a facade condition. The lowest background noise levels measured during the survey were $L_{A90,5min}$ 47 dB during the daytime and $L_{A90,5min}$ 42 dB at night.

6.2.2 (B) KP Acoustics, 7 Rolls Building, 25 July 2019 (COL 19/00594)

An environmental noise survey report was produced by KP Acoustics in 2019 to determine the ambient noise climate at 7 Rolls Building, Fetter Lane, in order to set plant noise limits. The location relative to the site is shown as 'B' in Figure 6.

The measurements were taken on the roof of the building and in a free field condition. The lowest background noise levels measured during the survey were $L_{A90,5min}$ 50 dB during the daytime and $L_{A90,5min}$ 47 dB at night.

6.2.3 (C) Acoustics Plus, 53-64 Chancery Lane, 9 March 2017 (COL 17/00174)

An environmental noise survey report was produced by Acoustics Plus in 2017 to determine the ambient noise climate at 53-64 Chancery Lane, in order to set plant noise limits. The location relative to the site is shown as 'C' in .

The measurements were taken on the 7th floor roof terrace of the building and in a facade condition. The lowest background noise levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 49 dB at night.

6.3 Summary

The background noise levels recorded during each survey have been corrected for facade noise levels and are summarised in Table 3.

Table 3 Summary of measured background noise levels from available survey data

Noise survey	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Hardwicke Building	$L_{A90,5min}$ 44 dB	$L_{A90,5min}$ 42 dB
(A) 9-13 Cursitor Street	$L_{A90,5min}$ 47 dB	$L_{A90,5min}$ 42 dB
(B) 7 Rolls Building	$L_{A90,5min}$ 53 dB	$L_{A90,5min}$ 50 dB
(C) 53-64 Chancery Lane	$L_{A90,15min}$ 50 dB	$L_{A90,15min}$ 49 dB
Average	L_{A90} 49 dB	L_{A90} 46 dB

6.4 Basic limits

Based on the above criteria, measurement results and historic noise data, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 4.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels. These have been corrected relative to the measured free-field background noise levels by the addition of 3 dB. In this case these limits would apply at all nearby receptors noted in Section 0

Table 4 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, $L_{Aeq,5min}$ (dB)
Daytime (07:00-23:00)	39
Night-time (23:00-07:00)	36

[1] The limits set out in Table 4 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.

6.5 Plant noise assessment

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features. At this stage, no information is available in relation to the proposed plant. This will need to be assessed as the design progresses.

7 Conclusion

The representative background sound levels from the noise survey were $L_{A90,5min}$ 41 dB during the day, and $L_{A90,5min}$ 39 during the night.

The historic data from noise surveys conducted in nearby developments have been used to determine the noise climate around the site according to guidance by the Association of Noise Consultants and the Institute of Acoustics.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises are $L_{Aeq,5min}$ 39 dB during the day, and $L_{Aeq,5min}$ 36 dB during the night.

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

At this stage, no information is available in relation to the proposed plant. This will need to be assessed as the design progresses.

Appendix A

Survey details

Equipment

The unattended noise measurements were taken using a RION NL-32 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-32/00623761	Rion	27 Sep 21	TCRT19/1740
Microphone	UC-53A/319233	Rion	27 Sep 21	TCRT19/1740
Pre-amp	NH-21/36669	Rion	27 Sep 21	TCRT19/1740
Calibrator	NC-74/34536129	Rion	27 Sep 21	TCRT19/1739

[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.
- $L_{ASmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a slow 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.*

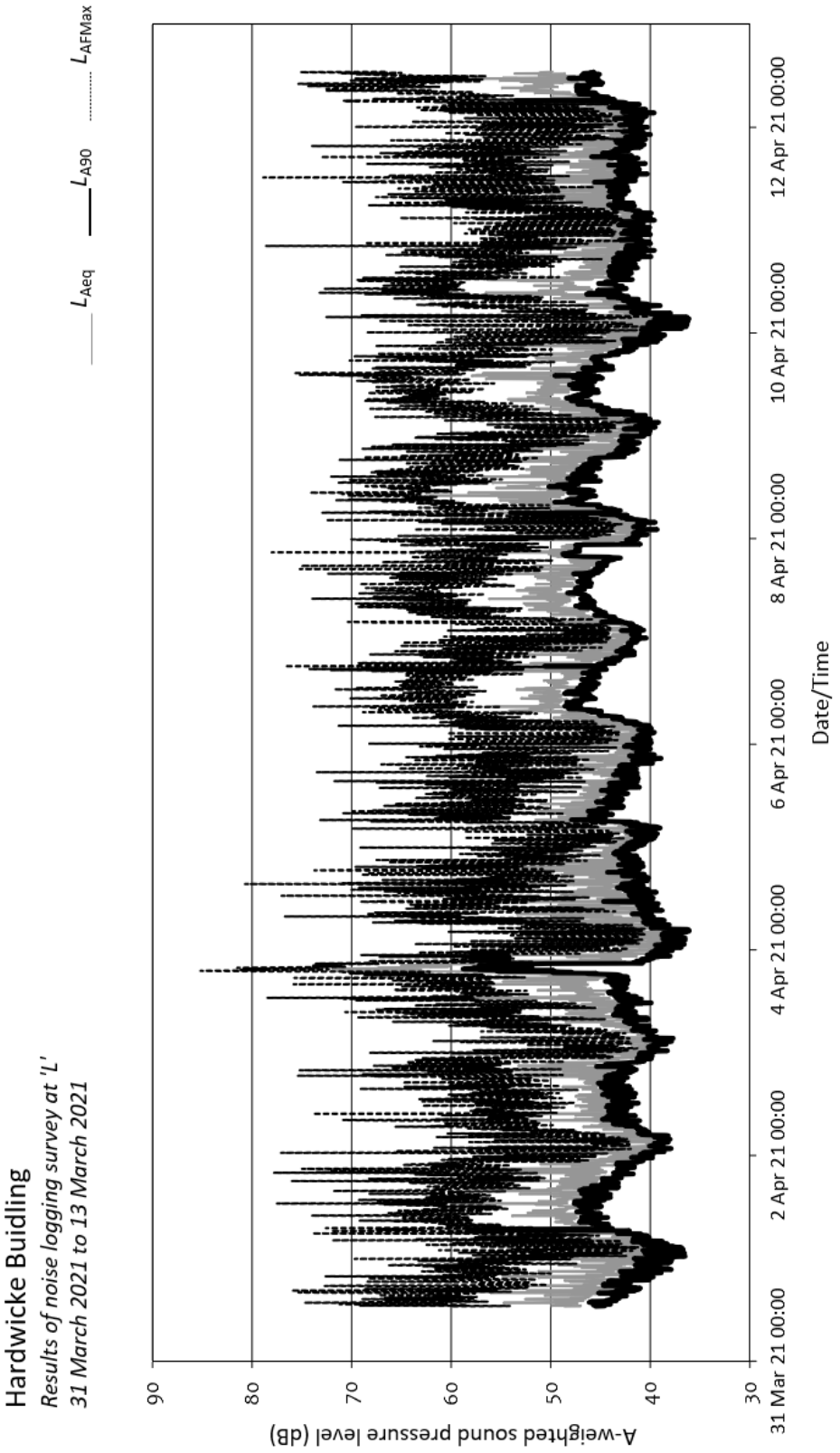
Weather conditions

During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 6°C at night and 14°C during the day, and the wind speed was less than 7 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location 'L'


Hardwicke Buidling
Results of noise logging survey at 'L'
31 March 2021 to 13 March 2021
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
90
80
70
60
50
40
30
31 Mar 21 00:00
2 Apr 21 00:00
4 Apr 21 00:00
6 Apr 21 00:00
8 Apr 21 00:00
10 Apr 21 00:00
12 Apr 21 00:00
Date/Time

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.