SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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St Andrew's House

Noise survey and plant noise assessment

London, Manchester, Edinburgh, Birmingham, Belfast

post@sandybrown.com
www.sandybrown.com

Sandy Brown Ltd
Registered in England & Wales No. 13227735

Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	19 Feb 21	First issue	Patrick Smith	Valerie Van den Hende
B	14 May 21	Updated plant assessment	Patrick Smith	Valerie Van den Hende
C	9 June 21	Amended enclosure locations to reflect final design	Patrick Smith	Jason Swan

Summary

Sandy Brown has been commissioned by Buro Four to provide acoustic advice in relation to proposed refurbishments at St Andrew's House (SAH).

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was performed between 10:55 on 10 February 2021 and 09:40 on 16 February 2021.

The representative background sound levels from the noise survey were $L_{A90,15min}$ 48 dB during the day, and $L_{A90,15min}$ 46 dB during the night.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises would be $L_{Aeq,15min}$ 38 dB during the daytime, and $L_{Aeq,15min}$ 36 dB during the night-time.

However, during the survey period social distancing and lockdown measures were in place due to the COVID-19 pandemic. A review of historical survey data at a similarly representative location to the rear of 17 Charterhouse Street indicates that this may have resulted in lower-than-normal noise levels being recorded. On this basis it may be appropriate to relax the criteria derived from the noise survey by a small amount.

A criterion of $L_{Aeq,15min}$ 40 dB (daytime and night-time) is proposed. This is a non-standard situation, and the proposed limits will need to be agreed with the Local Authority.

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.

Noise egress due to the new plant equipment has been assessed in line with BS 4142 and advice provided regarding mitigations to comply with the proposed limits.

Mitigating measures include fitting attenuator kits to the new condensers and implementing recommended enclosure constructions.

The assessment indicates that, with the recommended mitigations, the proposed criteria will be achieved.

Contents

1 Introduction

Sandy Brown has been commissioned by Buro Four to provide acoustic advice in relation to proposed refurbishments at St Andrew's House (SAH).

As part of the works new external building services plant is proposed in two new rooftop enclosures.

An environmental noise survey has been conducted to establish the existing background sound levels and set appropriate limits for noise egress from new building services plant.

This report presents the survey method and results, recommends noise egress limits for the new plant and outlines the proposed plant installation and measures to achieve these limits.

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)

St Andrew's House (blue) is located in a courtyard behind 17 Charterhouse Street and 140 Saffron Hill (pink), all of which are part of a single site currently being redeveloped as a headquarters for Anglo American and De Beers.

The site is surrounded on all sides, by 17 Charterhouse Street to the south, 140 Saffron Hill to the north and east, and by adjacent buildings in Ely Place (red) to the west. The site is accessed via a passageway from Saffron Hill and does not front directly onto any roads. The east facade faces the 17 Charterhouse Street/140 Saffron Place courtyard, whilst the west facade faces the rear of Ely Place.

SAH is a multi-use building which primarily houses temporary accommodation available for use by staff and visitors to the associated office complex. Residential rooms are arranged over four floors (Ground Floor to Level 3), with a meeting room and access to the roof terraces on Level 4. The Ground Floor also features offices, storage and meeting rooms.

2.2 Adjacent premises

To the south and west of SAH are offices on 17 Charterhouse Street and 140 Saffron Hill, all of which are part of the same development for Anglo American and De Beers. The 140 Saffron Hill building also partially extends around the northern end of SAH.

Also to the north are the rear of several commercial properties on Bleeding Heart Yard.

To the west, SAH faces onto the rear facades of properties on Ely Place. Ely Place is an historic street, originally constituting largely residential properties (alongside a church and public house on the west side of the road). The majority of these properties have subsequently been redeveloped for commercial use as offices and it is understood that only the property at the northern end of the street remains a residential use. This property (highlighted red in Figure 1) is considered to be the nearest noise sensitive premises.

At the nearest point, the rear facade of the Ely Place residential property is approximately 4 m from the facade of SAH, however the buildings are stepped back above ground floor level at a distance of approximate 14 m (as is the case at the most affected windows on the sensitive property).

The immediately adjacent buildings on all sides are at least as high as SAH, and except for the buildings on Bleeding Heart Yard extend one storey or more above the SAH roof level. Sight lines to further buildings are heavily screened.

There is a significant quantity of existing operational building services plant located on the rooftops of the adjacent premises on all sides, both below the SAH roof height (eg, on first floor rooftops above rear extensions to Ely Place) and above (on the higher level rooftops of the surrounding buildings).

3 Development proposals

Refurbishments are planned to SAH to improve the quality of accommodation. The proposed refurbishments include upgrades to the building services to replace existing gas boilers with more environmentally friendly electric heating and ventilation plant.

New external building services plant will be accommodated in four purpose built enclosures on the roof and may operate 24 hours per day.

3.1 Proposed plant

There are six rooftop plant enclosures proposed:

- Four existing enclosures which will be sealed to the atmosphere and contain hybrid branch controllers which do not generate significant noise.
- Two new louvred enclosures to house new condenser units. These enclosures are open to the atmosphere and do not feature a roof.

The locations of the enclosures are shown in Figure 2.

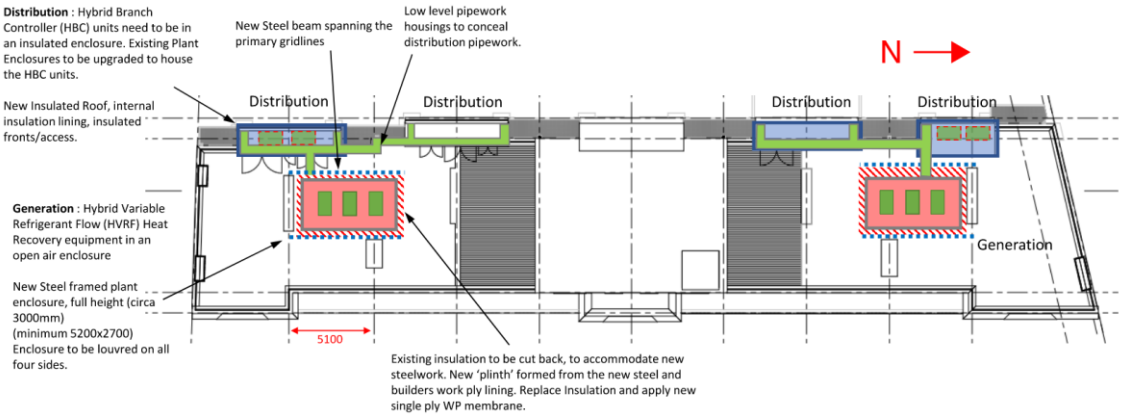

Figure 2 Location of rooftop plant enclosures (new enclosures highlighted red)

The new south enclosure is to contain 2x Mitsubishi PURY-EM350YNW-A1 condensers and 1x Mitsubishi PURY-EM450YNW-A1 condenser.

The new north enclosure is to contain 2x Mitsubishi PURY-EM350YNW-A1 condensers and 1x Mitsubishi QAHV-N560YA-HPB condenser.

3.1.1 Noise data

Manufacturer noise data for the proposed condensers is presented in Table 1.

Table 1 Manufacturer noise data for proposed condensers

	Sound pressure level at 1 m from unit (dB) at octave-band centre frequency (Hz)								
Unit	63	125	250	500	1k	2k	4k	8k	dBA
PURY-EM350YNW-A1	72	71	64	62	57	54	52	48	64
PURY-EM450YNW-A1	84	71	71	69	63	61	56	51	70
QAHV-N560YA-HPB	71	58	59	56	52	48	44	39	58

Manufacturer attenuation kits are available for the condensers, to achieve an average attenuation of 8 dB when the full kit is installed. The spectral performance of the attenuation kits is presented in Table 2.

Table 2 Attenuator kit performance

Attenuation (dB) at octave-band centre frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
3	5	7	8	10	10	8	7

4 Building services noise egress criteria

4.1 BS 4142

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 (see Appendix D).

4.2 Local Authority criteria

In relation to the assessment of noise emissions from installed building services plant the London Borough of Camden's (LBC) *Camden Local Plan, Adoption version* (June 2017) states the following:

> *…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 10dB below background (15dB if tonal components are present) should be considered as the design criterion.*

5 Noise survey method

The survey included unattended and attended noise measurements.

5.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 6 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 10:55 on 10 February 2021 and 09:40 on 16 February 2021. The equipment was installed and collected by Patrick Smith.

The measurement position used during the survey is indicated in Figure 3, denoted by the letter 'L'. A photograph showing the measurement location is provided in Figure 4. This location was chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises, and was located at a distance such that existing roof top plant serving SAH was not distinctly audible above other background sources.

The microphone was mounted on a tripod at a height of approximately 1.5 m above the floor (extending above the roof top edge wall) and at 1 m from the building facade.

5.2 Attended measurements

Attended sample measurements were taken by Patrick Smith at 10 locations around the site. These are indicated in Figure 4 as positions 1 to 10. The attended measurements were carried out on 10 February 2021, over 2-minute periods.

At each position the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 1 m from any other reflective surface. Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.

Figure 3 Measurement locations (image courtesy of Google Earth Pro)

Figure 4 Monitoring equipment setup at location 'L'

5.3 Weather conditions

Weather conditions during the survey are described in Appendix A.

6 Noise survey results

6.1 Observations

The dominant noise sources observed at the site during the survey were building services plant equipment located on the rooftops of adjacent buildings and intermittent construction activities (daytime only) on the 17 Charterhouse Street site.

At the northern end of the building there was significant noise from a rattling fan associated with plant on the rooftop of the Ely Place property opposite position 4 (see Figure 5). There was also an audible hissing noise noted from plant on the rooftop of 140 Saffron Hill.

Figure 5 Noisy fan on rooftop of Ely Place

At the southern end of the building there was a substantial quantity of plant located on lower level rooftops at the rear of Ely Place. This was dominant at the south west corner (position 2) but was not specifically notable above the general background noise at other measurement locations on this side of the building.

Figure 6 Plant equipment on the Ely Place rooftops to the south west of position 2

Less significant noise sources included road traffic and aircraft. Noise from existing building services serving SAH was audible only in proximity (less than 3 m) to the rooftop enclosures and vents.

6.2 Noise measurement results

6.2.1 Unattended 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 3.

Measured minimum background sound levels are given in Table 4.

All measurements at position 'L' are facade levels.

Table 3 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 10 February 2021	-	48
Thursday 11 February 2021	53	47
Friday 12 February 2021	52	47
Saturday 13 February 2021	49	47
Sunday 14 February 2021	50	48
Monday 15 February 2021	51	45
Average	51	47

Table 4 Minimum background sound levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Wednesday 10 February 2021	45[1]	45
Thursday 11 February 2021	45	45
Friday 12 February 2021	45	45
Saturday 13 February 2021	45	45
Sunday 14 February 2021	46	46
Monday 15 February 2021	43	43
Tuesday 16 February 2021	47[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 $L_{A90,15min}$ 43 dB during the daytime and $L_{A90,15min}$ 43 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 presented in Appendix C.

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 48 dB during the daytime and $L_{A90,15min}$ 46 dB at night.

6.2.2 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 5.

All measurements were free-field except where noted.

Table 5 Noise levels and key noise sources from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,2min}$	L_{AFmax}	$L_{A90,2min}$	
1	10:36	52	59	51	Ely Place rooftop plant, intermittent construction noise
2	10:38	58	70	57	Ely Place rooftop plant, dominated by plant items to the south west, intermittent construction noise
3	10:44	50	64	48	Non-specific plant noise from SAH and adjacent buildings, intermittent construction noise
4[1]	10:50	52	58	51	Rattling fan from Ely Place rooftop plant, intermittent construction noise
5	10:52	55	62	54	Rattling fan from Ely Place rooftop plant, intermittent 'hiss' from adjacent rooftop plant to the north, existing SAH plant noise faintly audible with intermittent tonal element, intermittent construction noise

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,2min}$	L_{AFmax}	$L_{A90,2min}$	
6[2]	10:54	54	57	54	Repeat of measurement 5 with noted hiss from adjacent plant and SAH plant tone present throughout measurement
7	10:55	57	74	55	Rooftop plant to the north (including 'hiss'), tone from existing SAH plant very faintly audible, intermittent construction noise
8	11:12	59	73	49	Intermittent construction noise, anonymous plant noise and aircraft
9[1]	11:15	51	55	51	Plant noise from adjacent buildings
10[1]	11:19	51	56	48	Existing SAH plant (ground level plant enclosure) and rattling fan audible from Ely Place rooftop plant

[1] Measurement at 1 m from the building facade.

[2] 30 second measurement.

7 Noise egress limits

7.1 Basic limits

Based on the criteria set out in Section 4 and the measurement results presented above, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 6.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels.

Table 6 Basic 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)[1]
Daytime (07:00-23:00)	38
Night-time (23:00-07:00)	36

[1] The limits set out in Table 6 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 D.

7.2 Historical surveys

During the survey period social distancing and lockdown measures were in place due to the COVID-19 pandemic. This may have resulted in lower-than-normal noise levels being recorded during the survey, eg, due to reduced road traffic and largely unoccupied offices in the surrounding buildings (resulting in reduced building services duties).

The Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA) have published advice in *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* (version 6, January 2021). Within this guidance it is recommended that noise surveys still be conducted where safe to do so within government guidelines. However, it is acknowledged that current surveys may not be representative of typical conditions and that the use of other data sources (such as historical surveys) may be appropriate in some cases.

Previous noise survey data collected in the area has been reviewed to establish the robustness of the baseline noise predictions.

Mach Acoustics conducted a noise survey at a rooftop location to the rear of 17 Charterhouse Street in July 2017. The measurement location was approximately 20 m to the south east of position 'L' used in this survey, but was considered to be representative of noise levels at SAH and the associated sensitive properties. Details of the survey are outlined in Mach Acoustics report *17 Charterhouse Street, London Assessment – BS 4142:2014* (available on the London Borough of Camden planning portal).

The representative background noise levels derived by Mach Acoustics and outlined in their report were L_{A90} 53 dB during the daytime and L_{A90} 52 dB at night. From this data plant limits were set outside the nearest sensitive premises at L_{Aeq} 43 dB daytime and L_{Aeq} 42 dB night-time.

The levels reported by Mach Acoustics and the associated plant limits set for day and night-time operation respectively were 5 dB and 6 dB higher than those derived from Sandy Brown's recent noise survey. This indicates that COVID-19 restrictions have likely resulted in lower-than-normal background noise levels and that Sandy Brown's survey may not be representative of noise levels under more typical conditions.

7.3 Recommended limits

Historical data indicates that restrictions due to the COVID-19 pandemic may have resulted in lower-than-normal levels being recorded during the survey. On this basis, subject to agreement by the Local Authority, it is suggested that it would be appropriate to relax the criteria proposed in Table 6 by a small amount.

In consideration of the age of the previous survey it is possible there has been some general reduction in noise levels in the area during the intervening period. For this reason, it may not be appropriate simply to adopt the previous limits set out in the Mach Acoustics report, however it is recommended that a compromise somewhere between these limits and those presented in Table 6 would be reasonable.

On this basis, limiting levels due to the operation of the new plant at 1 m from the nearest sensitive property are proposed in Table 7.

Table 7 Proposed 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)[1]
Daytime (07:00-23:00)	40
Night-time (23:00-07:00)	40

[1] The limits set out in Table 6 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 D.

This is a non-standard situation, and the proposed limits will need to be agreed with the Local Authority.

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 would need to be applied, and the limits would be more stringent than those set (see Appendix D).

8 Plant noise assessment

8.1 Proposed acoustic mitigation measures

To achieve the proposed L_{Aeq} 40 dB limit all condensers are to be fitted with the full Mitsubishi attenuation kits (top hat and side panels) to achieve an average attenuation of 8 dB.

Additionally, to mitigate noise levels to adjacent office spaces including the SAH Level 4 meeting, the sides of the enclosures are to extend at least as high as the top of the tallest

condenser unit (including top hat attenuators). An acoustic louvre should be specified to achieve a minimum attenuation as detailed in Table 8.

Table 8 Acoustic louvre minimum attenuation requirements

Acoustic louvre minimum attenuation (dB) at octave-band centre frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
5	7	11	12	13	14	12	9

8.2 Noise egress assessment

The nearest windows on the Ely Place residential property are approximately 19 m from the north enclosure and 39 m from the south enclosure. The windows to the rear of this property are partially screened from the south enclosure by the facade of the adjacent office building (which extends approximately 2 m deeper to the rear) and the facade of the Level 4 massing at the centre of SAH.

Buildings on Ely Place are one storey taller than SAH and top storey windows will overlook the enclosures. For the most affected windows there is expected to be a direct line of sight to the condenser units over the top of the enclosure walls, it is therefore assumed that no significant attenuation is provided to these locations by the enclosure and direct transmission via the top of the enclosure is dominant.

Calculations have been carried out to assess the resulting noise levels at the most affected location at the rear of Ely Place and are presented in Table 9.

The calculations have been undertaken with octave-band data, but are presented in Table 9 as single figure weighted decibel values for clarity. The full spectral calculations are available on request.

The results indicate that, with the proposed mitigations, the recommended criterion will be achieved.

Table 9 Noise egress assessment to rear of closest properties on Ely Place

Reference	South enclosure	North enclosure
Cumulative noise level (dBA) for enclosure (all condensers pre-attenuation at 1 m)	74	68
Losses from manufacturer attenuator kits (dB)	*-8*	*-8*
Distance attenuation (dB)	*-32*	*-24*
Screening by adjacent building (dB)	*-3*	*0*
Facade correction (dB)	*+3*	*+3*
Level per enclosure at receiver (dBA)	34	39
Total level at receiver (dBA)	40	
Proposed criterion (dBA)	40	
Excess above criterion	None	

9 Conclusion

The representative background sound levels from the noise survey were $L_{A90,15min}$ 48 dB during the day, and $L_{A90,15min}$ 46 dB during the night.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises would be $L_{Aeq,15min}$ 38 dB during the daytime, and $L_{Aeq,15min}$ 36 dB during the night-time.

However, during the survey period social distancing and lockdown measures were in place due to the COVID-19 pandemic. A review of historical survey data at a similarly representative location to the rear of 17 Charterhouse Street indicates that this may have resulted in lower-than-normal noise levels being recorded. On this basis it may be appropriate to relax the criteria derived from the noise survey by a small amount.

A criterion of $L_{Aeq,15min}$ 40 dB (daytime and night-time) is proposed. This is a non-standard situation, and the proposed limits will need to be agreed with the Local Authority.

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.

Noise egress due to the new plant equipment has been assessed in line with BS 4142 and advice provided regarding mitigations to comply with the proposed limits.

Mitigating measures include fitting attenuator kits to the new condensers and implementing recommended enclosure constructions.

The assessment indicates that, with the proposed mitigations, the recommended criteria will be achieved.

Should the Local Authority raise any objections to the proposed criteria the assessment would need to be revised and additional mitigations may be required.

Appendix A

Survey details

Equipment

The unattended and attended noise measurements were taken using a Rion NL-52 sound level meter and a Brüel & Kjær 2250 sound level meter, respectively.

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-52/00375679	Rion	9 Jul 21	TCRT19/1541
Microphone	UC-59/11168	Rion	9 Jul 21	TCRT19/1541
Pre-amp	NH-25/65806	Rion	9 Jul 21	TCRT19/1541
Calibrator	SV30A/10576	Svantek	9 Jul 21	TCRT19/1539
Sound Level Meter	2250/3011196	Brüel & Kjær	13 Mar 21	UCRT19/1318, UCRT19/1319
Microphone	4189/3060575	Brüel & Kjær	13 Mar 21	UCRT19/1318
Pre-amp	ZC0032/25430	Brüel & Kjær	13 Mar 21	UCRT19/1318
Calibrator	4231/3017675	Brüel & Kjær	13 Mar 21	UCRT19/1316

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters 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 attended noise measurements, the weather was generally clear and dry. Light rain occurred on 15 and 16 February, however there were sufficient periods unaffected by rain throughout the survey and the data does not indicate that rain noise during these periods has had any significant effect on the results of the assessment.

Prior to setup of the unattended noise survey the area experienced a period of snow fall. A light dusting of snow was noted to still be present on the rooftop of SAH and a few of the surrounding buildings during equipment setup on 20 February 2021 (as is visible in several of the survey photographs). There was no settled snow at ground level and remaining snow where present on the rooftops was melting at the time. It was judged that this was not significantly affecting noise levels at the measurement position. All snow melted during the survey period and the data indicates that there was no significant effect on the results of the assessment (snow would typically be expected to result in lower noise levels, however the lowest background levels recorded during the survey are noted to be on 15 February, after the snow had melted).

During the unattended noise measurements, weather reports for the area indicated that temperatures varied between -5°C at night and 13°C during the day. Reported wind speeds for the area during the survey period varied between 2 m/s and 8 m/s, but averaged no greater than 5 m/s. Comparison between periods of relatively higher and lower wind indicates that wind did not significantly affect the results of the assessment.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at position ‘L’

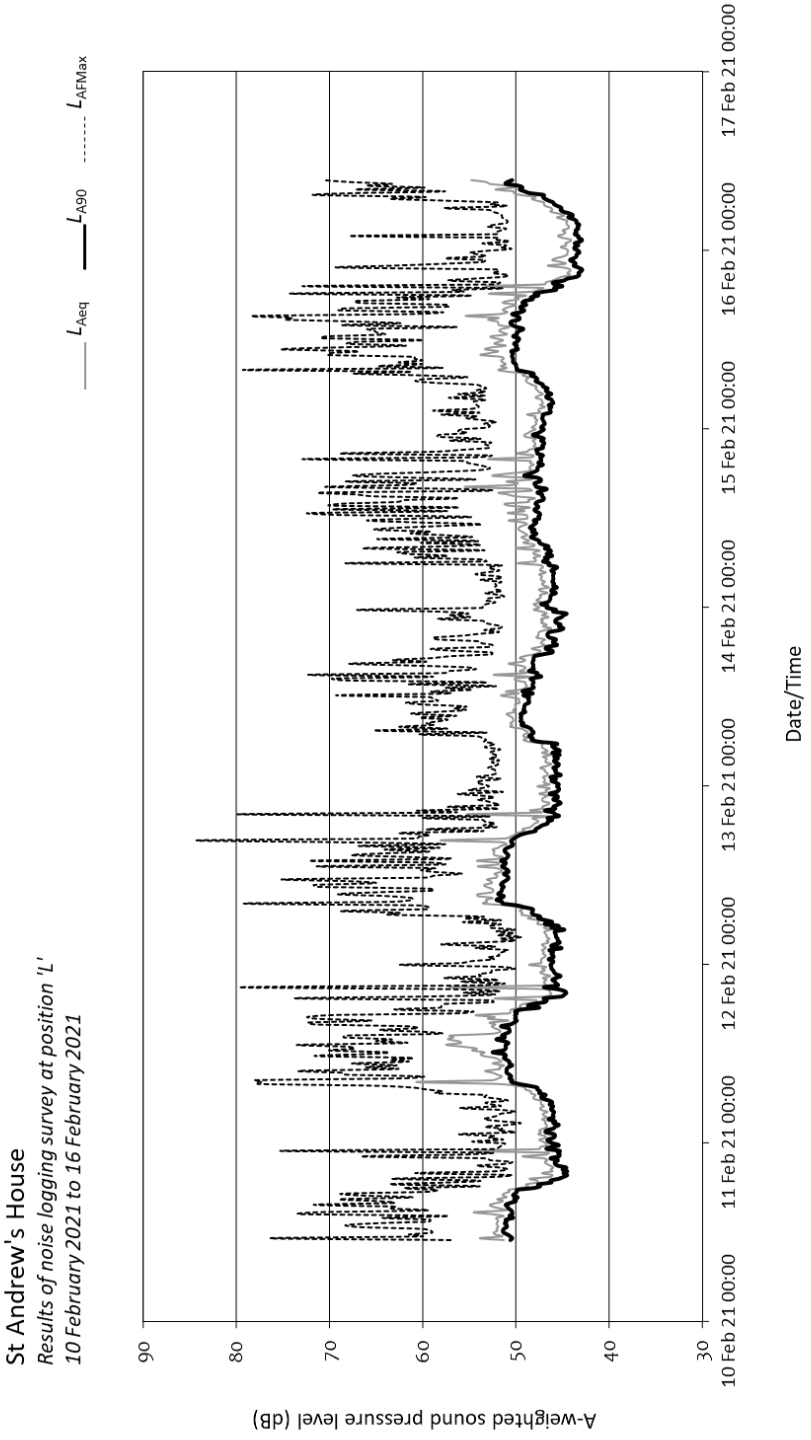

Figure 7 Results of unattended noise measurements at position 'L'

Appendix C

Statistical analysis of background sound levels at position 'L'

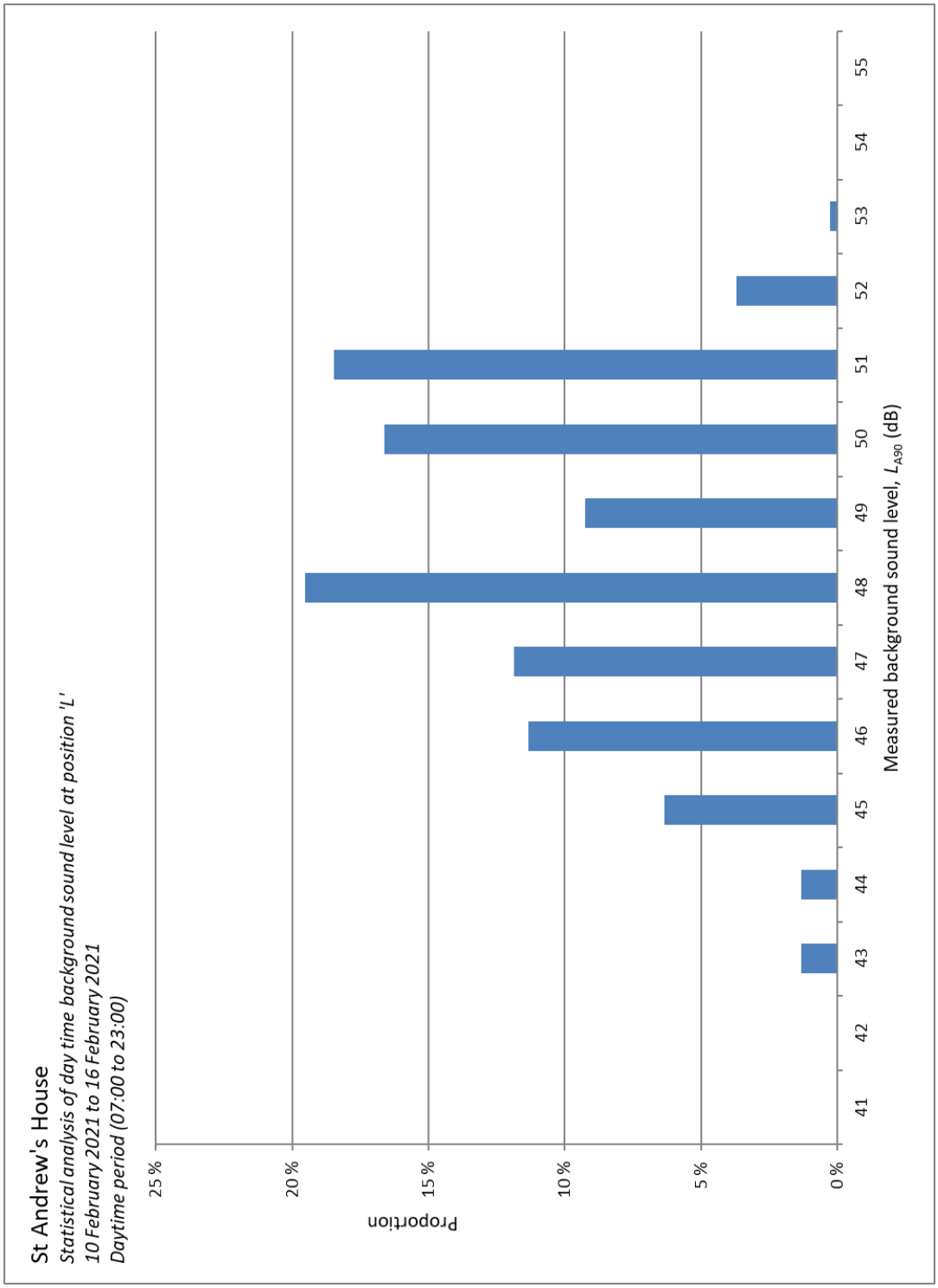

Figure 8 Statistical analysis of daytime background sound levels at position 'L'

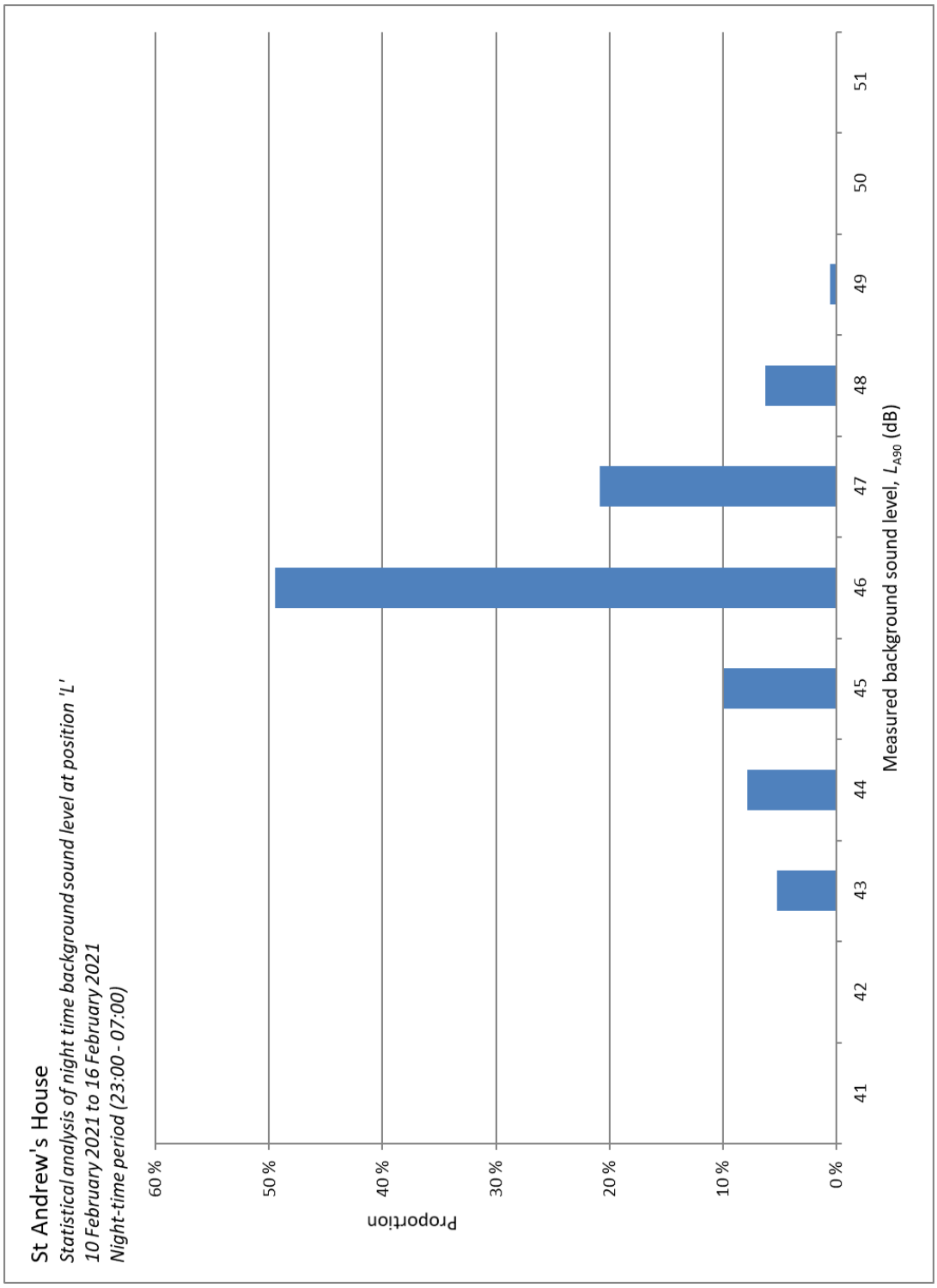

Figure 9 Statistical analysis of night-time background sound levels at position 'L'

Appendix D

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.