SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Advanced Scanning & Imaging Centre Development, The Christie Hospital

Planning noise report

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Summary

Sandy Brown has been commissioned IHP to provide acoustic advice in relation to the proposed development at the Christie NHS Foundation Trust.

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 15 December 2022 and 16:15 on 19 December 2022.

The representative background sound levels measured during the survey were $L_{A90,15mins}$ 52 dB during the daytime and $L_{A90,15mins}$ 48 dB at night.

Based on the requirements of the 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 (exclusive of receptors within the hospital campus) does not exceed $L_{Aeq,15min}$ 50 dB during the daytime, and $L_{Aeq,15min}$ 46 dB during the night. These have been corrected relative to the measured free-field background sound levels by the addition of 3 dB (as per the guidance provided in BS 8233:2014 Section G.2.1).

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.

For buildings within the hospital campus, appropriate plant noise egress limits will be set with input from Hospital stakeholders, as part of the design process.

The measurement results will also be used to inform the facade sound insulation strategy.

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1 Introduction

Sandy Brown has been commissioned IHP to provide acoustic advice in relation to the proposed development at the Christie NHS Foundation Trust.

The purpose of survey 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.
- Determine the ambient noise levels in the vicinity of the site to inform the facade sound insulation strategy.

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

2 Site description

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

The proposed Advanced Scanning and Imaging Centre Development will replace the existing Holt building (shown in red). The development faces onto Wilmslow Road (red dashed line) and is near to Cotton Lane (blue dashed line).



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

2.1 Adjacent premises

Referring to Figure 1, the main noise sensitive premises adjacent to the development are:

- Manchester Muslim Preparatory School (shown in orange) to the east
- Residential properties to the east (shown in cyan)
- Mixed-use commercial and residential properties on Wilmslow Road (shown in dark blue) to the north
- Withington Dental Care Centre (shown in magenta) to the north.

Other adjacent premises are the main Christie NHS Foundation Trust campus (shown in green) to the south and west of the development, the Manchester Cancer Research Centre (shown in blue) to the south-east and the residential and commercial properties on Wilmslow Road (shown in yellow) to the south. Maggie's centre is also shown in purple to the south-east.

3 Development proposals

The proposed development is set over four storeys with three levels of hospital facilities and a floor as a dedicated plant room. There is a roof top plant deck with a plant room. The hospital facilities include CT scanners, consultation areas, wards and single bedrooms along with ancillary office space.

The main potential noise source is building services plant serving the building. The plant strategy along with outline mitigation measures are set out to minimise impact on existing noise sensitive premises around the development.

4 Building services noise egress criteria

External plant noise will need to be controlled to ensure that appropriate limits are achieved outside noise sensitive receptors within the scheme, within the hospital campus and also outside the hospital campus.

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 sound 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 HTM 08-01

Health Technical Memorandum 08-01 (HTM 08-01) is commonly adopted for healthcare schemes and provides acoustic criteria. HTM 08-01 requires the following:

1. Noise outside buildings should be controlled to allow the internal noise criteria to be achieved (with windows or trickle vents open for ventilation if the space is naturally ventilated).
2. Open external areas should be protected. Noise from services should not exceed the existing daytime background noise level or L_{A90} 50 dB, whichever is the higher.

It is understood that large plant rooms/areas are proposed to level 3 of the building. These are in close proximity to overlooking facades within The Christie campus. Suitable limits are discussed in Section 7.1.2 to meet with the HTM 08-01 requirements.

4.3 Local Authority criteria

Manchester City Councils' plant noise egress criteria will be applicable at noise sensitive receptors outside the hospital campus.

Manchester City Council typically stipulate the following criteria for plant noise egress:

"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 (LAeq) below the typical background (LA90) level at the nearest noise sensitive location."

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 4 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 12:45 on 15 December 2022 and 16:15 on 19 December 2022.

The rooftop measurement position used during the survey is indicated in Figure 2, denoted by the letter 'L'. The rooftop of the Holt building was chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises. The microphone was positioned approximately 15 m from the ground and approximately 2 m from the rooftop in the free-field.



Figure 2 Unattended measurement location - Holt building rooftop

Photographs showing the unattended measurement location are provided in Figure 3 and Figure 4.

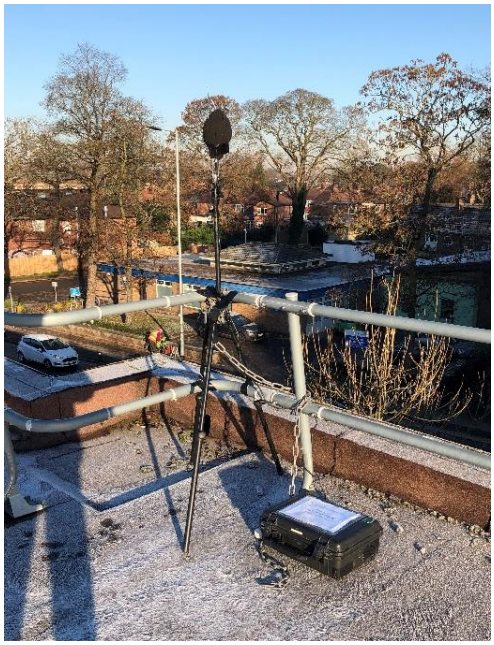


Figure 3 Unattended measurement equipment installed - Holt building rooftop



Figure 4 Unattended measurement equipment - seen from Wilmslow Road

5.2 Attended measurements

Attended sample measurements were taken at 7 locations around the site. These are indicated in Figure 5 as positions 1 to 8. The attended measurements were carried out on 19 December 2022. Measurements were obtained at ground level on the eastern side of the Holt near to Wilmslow Road, in the Nathan House courtyard and in the alley to the north of the Holt building.

Measurements at positions 1,2,5,6 and 8 were taken over 15 minutes. Measurements 3 and 4 were taken over 5 minutes and measurement 7 was taken over 1 minute.

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.

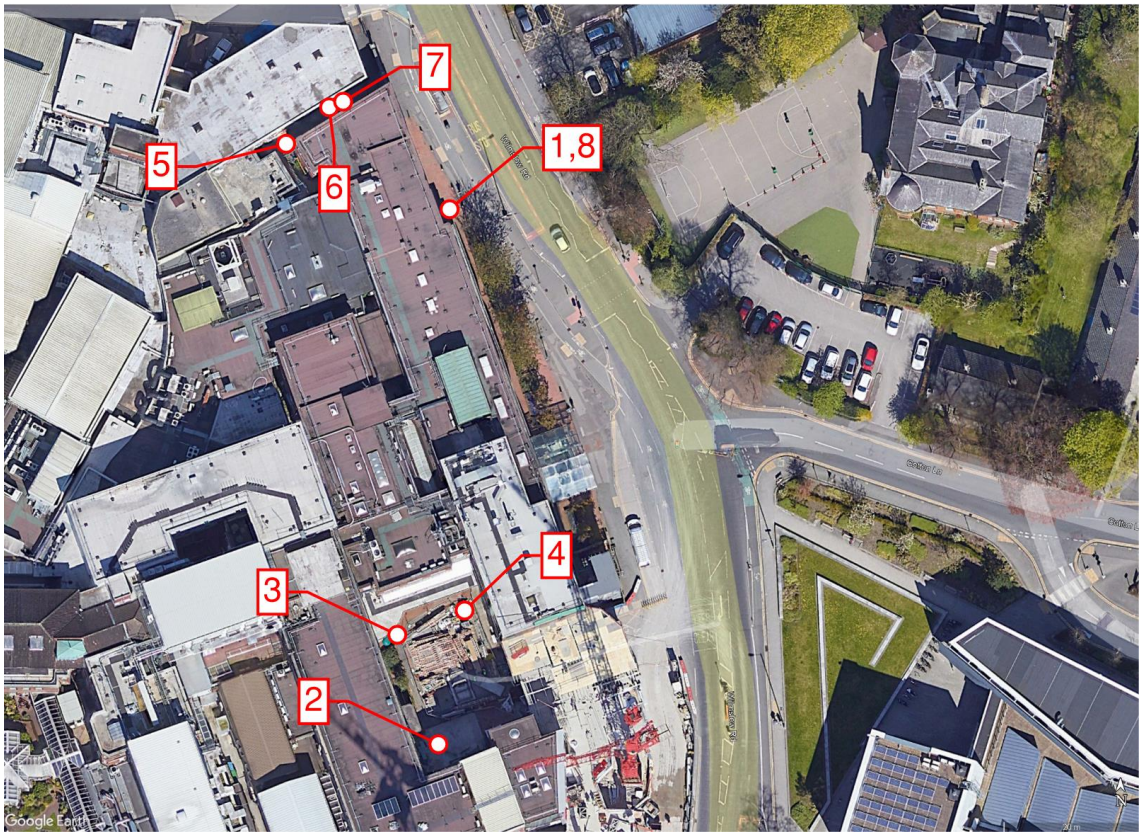


Figure 5 Attended measurement positions

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 from road traffic on Wilmslow Road, aircraft noise passing overhead, occasional construction noise from the Paterson building development and existing plant items.

Less significant noise sources included pedestrian noise, children in the playground of the Manchester Muslim Preparatory school, noise from the crossing on Wilmslow Road and occasional emergency vehicle sirens.

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 1. The results presented in Table 1 are free-field measurements.

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)
15 Dec 2022	-	58
16 Dec 2022	63	58
17 Dec 2022	63	58
18 Dec 2022	63	56
Average	63	58

Daytime and night-time statistical analysis of representative values for the site are given in Figure 6.

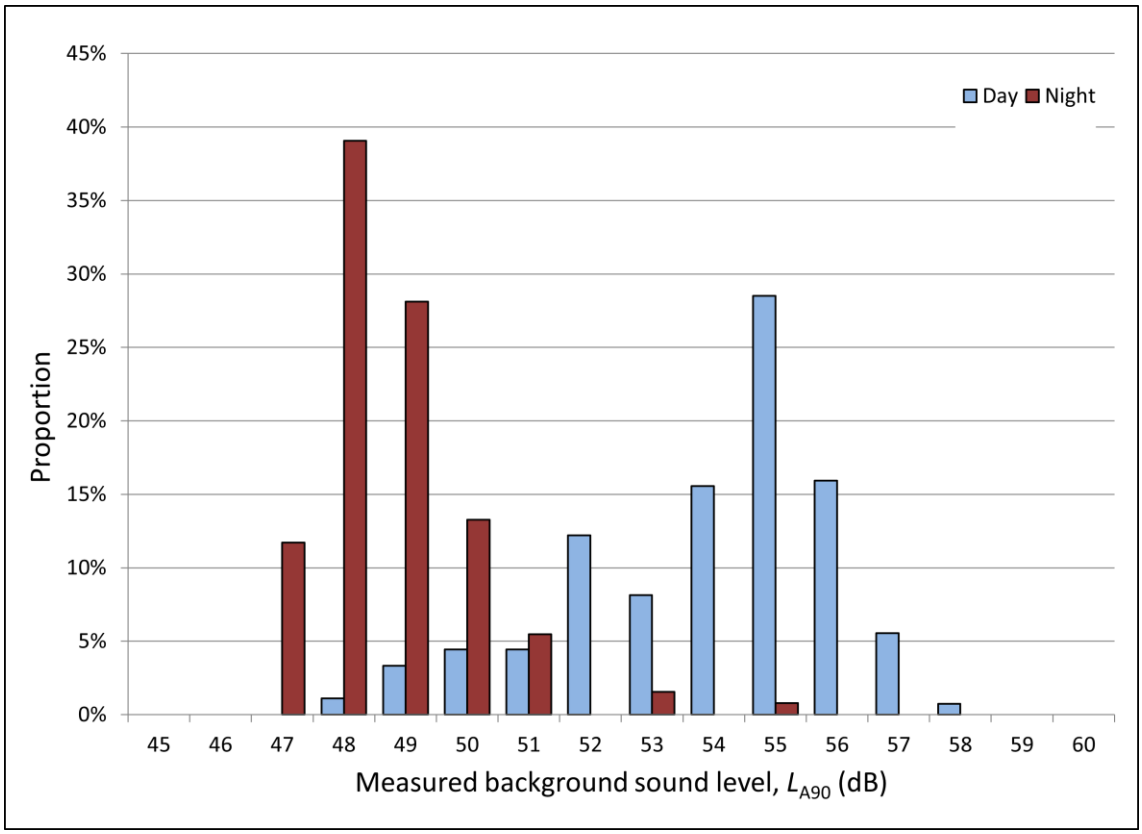


Figure 6 Day time and night-time measured background level

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 52 dB during the daytime and $L_{A90,15min}$ 48 dB at night.

6.2.2 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 2. Measurements 5,6 and 7 are facade level measurements. The remaining measurements presented in Table 2 are free-field measurements.

Table 2 Noise levels and key noise sources from attended measurements

Position	Start time	Measurement duration	Sound pressure levels (dB)			Noise sources
			L_{Aeq}	L_{AFmax}	L_{A90}	
1	15:30	15 minutes	65	87 [1]	53	Road traffic on Wilmslow Road
2	17:09	15 minutes	49	68	47	Plant items in and around Nathan House courtyard
3	17:26	5 minutes	49	58	48	Plant items in and around Nathan House courtyard
4	17:34	5 minutes	50	58	49	Plant items in and around Nathan House courtyard
5	18:03	15 minutes	58	71	51	Road traffic on Wilmslow Road, plant items on Holt building
6	18:18	15 minutes	60	78	52	Road traffic on Wilmslow Road, plant items on Holt building
7	18:34	1 minute	67	71	66	Plant item on Holt building
8	18:41	15 minutes	65	79	50	Road traffic on Wilmslow Road

[1] The L_{AFmax} value was likely caused by a car horn near to the measurement location.

7 Plant noise egress

7.1 Noise egress limits

7.1.1 Normally operating plant – Receptors outside the hospital campus

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 3.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises (exclusive of receptors within the hospital campus) and are presented as facade levels. These have been corrected relative to the measured free-field background sound levels by the addition of 3 dB (as per the guidance provided in BS 8233:2014 Section G.2.1). In this case these limits would apply at the premises identified in section 2.1.

Table 3 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)	50
Night-time (23:00-07:00)	46

[1] The limits set out in Table 3 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.

7.1.2 Normally operating plant – Within the hospital campus

For buildings within the hospital campus, appropriate plant noise egress limits for normally operating plant will be set with input from Hospital stakeholders, as part of the design process.

7.1.3 Emergency/stand-by plant

Emergency and stand-by plant would only ever operate briefly in the case of an emergency, power cut, or for routine testing, it is proposed that the noise egress limitations be relaxed for these plant items. MCC typically allow such plant to be limited to be no higher than 10 dB above the background noise level outside noise sensitive receptors (exclusive of receptors within the hospital campus).

Table 4 Emergency/stand-by noise limits at 1 m from the nearest noise sensitive premises (exclusive of receptors outside the hospital campus)

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Daytime (07:00-23:00)	65
Night-time (23:00-07:00)	60

Noise from emergency and stand-by plant will be controlled within the hospital demise.

7.2 Plant equipment strategy

The current plant equipment strategy is as follows:

- Internal plant rooms
- Rooftop plant area with a plant room, externally located generators and air source heat pumps.

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features.

Noise control measures to be considered within the design are:

- Plant room connections to atmosphere to be ducted via attenuators
- Localised screening
- Low noise equipment
- Acoustic canopies/attenuation packages to equipment
- Double-skin casings to air-handling plant
- In-duct attenuators
- Acoustic lagging and lining to ductwork
- Generator enclosures
- Select attenuators so that regenerated noise from the attenuator does not increase the resultant noise level
- Limiting airflow across louvres.

8 Conclusion

The representative background sound levels from the noise survey were $L_{A90,15min}$ 52 dB during the day, and $L_{A90,15min}$ 48 dB during the night.

Based on the requirements of the Local Authority, the relevant plant noise limits at the worst affected noise sensitive premises (exclusive of receptors within the hospital campus) are L_{Aeq} 50 dB during the day, and L_{Aeq} 48 dB during the night. These have been corrected relative to the measured free-field background sound levels by the addition of 3 dB (as per the guidance provided in BS 8233:2014 Section G.2.1).

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.

For buildings within the hospital campus, appropriate plant noise egress limits will be set with input from Hospital stakeholders, as part of the design process.

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-52/00932326	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
Sound level meter	2250/3011964	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Microphone	4189/3100176	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Pre-amp	ZC0032/26376	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Calibrator	4231/3019123	Brüel & Kjær	8 Sep 23	UCRT21/2086

[2] Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meter(s) 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

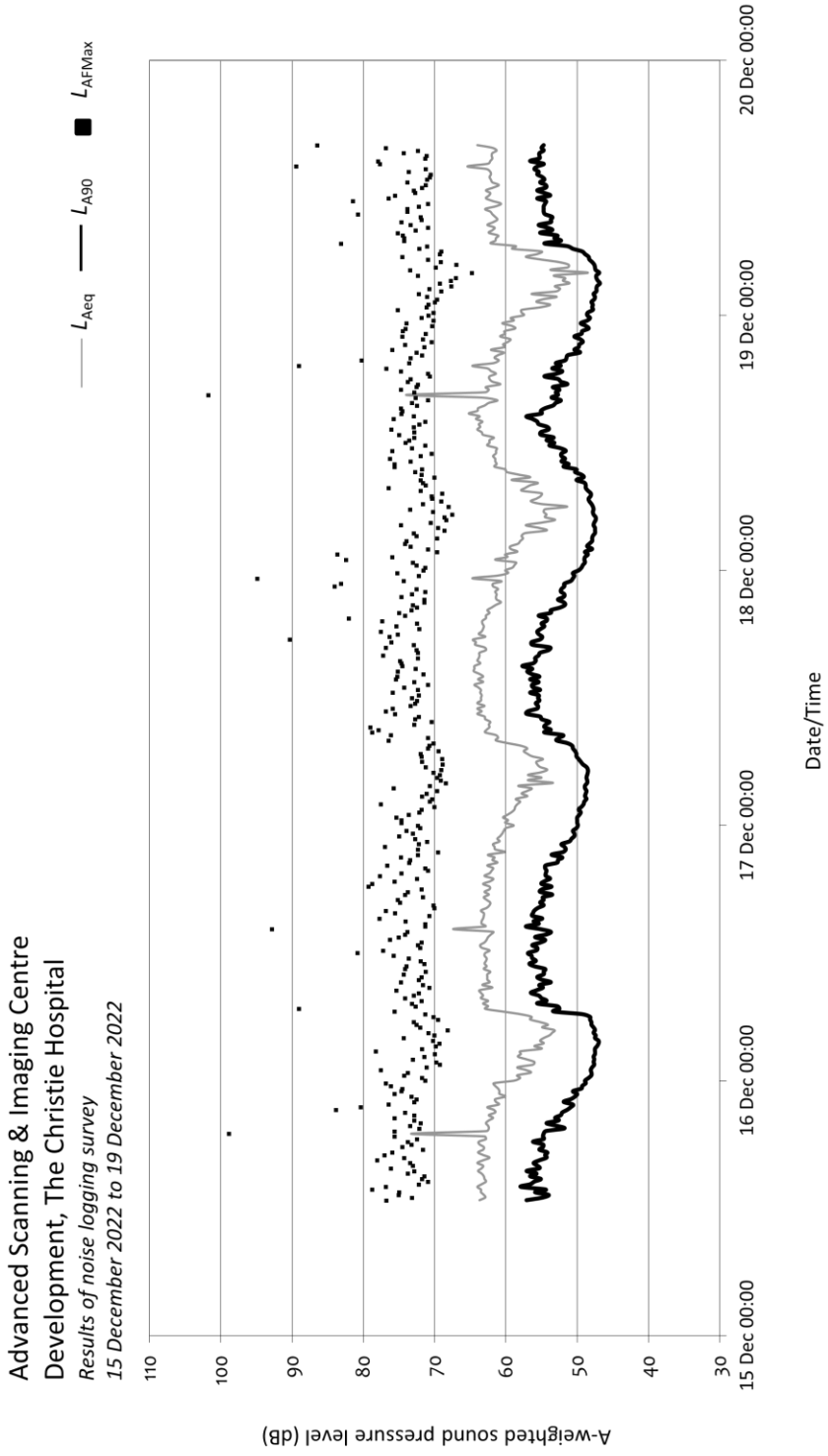
During the attended noise measurements, the weather was generally clear and dry and no rain occurred. Wind speeds were measured at each position was less than 5 m/s.

During the unattended noise measurements, weather reports for the area indicated that temperatures varied between -5°C at night and 12°C during the day, and the wind speed was less than 5 m/s.

Rain showers occurred throughout the survey however, the survey duration was sufficiently long to include periods unaffected by adverse weather and no variation in noise levels was seen to correlate with the weather. These measurements are consequently considered to have obtained a representative sample of noise data.

Appendix B

Results of unattended measurements


Advanced Scanning & Imaging Centre
Development, The Christie Hospital
Results of noise logging survey
15 December 2022 to 19 December 2022
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
15 Dec 00:00
16 Dec 00:00
17 Dec 00:00
18 Dec 00:00
19 Dec 00:00
20 Dec 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.