

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Nightingale Centre Extension, Wythenshawe Hospital

Noise survey and plant noise egress limits

London, Manchester, Edinburgh, Birmingham, Belfast, Leeds

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Summary

Sandy Brown has been commissioned by AFL Architects to provide acoustic advice in relation to the proposed single storey extension to the existing Nightingale Centre, Wythenshawe Hospital.

An environmental noise survey was previously performed between 15:30 on 6 December 2019 and 15:45 on 9 December 2019. The methodology and measurement results were reported in 19503-R02-A *Noise survey report and plant noise egress limits report* dated 12 December 2019.

Verification measurements have been carried out in June 2023 to validate the previous noise survey results which are detailed in this report. The measurement results indicate that the average background day noise levels in June 2023 are 2 dB higher than the average background day noise level during the December 2019 noise survey.

This is not considered a significant increase in day background levels. On this basis, it is considered that the measurements carried out in December 2019 are still relevant.

The representative background sound levels measured during the December 2019 survey were $L_{A90,15 \text{ min}}$ 50 dB during the daytime and $L_{A90,15 \text{ min}}$ 44 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 does not exceed $L_{Aeq,15 \text{ min}}$ 45 dB during the daytime, and $L_{Aeq,15 \text{ min}}$ 39 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.

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1 Introduction

Sandy Brown has been commissioned by AFL Architects to provide acoustic advice in relation to the proposed single storey extension to the existing Nightingale Centre, Wythenshawe Hospital.

As part of this, an environmental noise survey was performed in December 2019, 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. The methodology and measurement results were reported in 19503-R02-A *Noise survey report and plant noise egress limits report* dated 12 December 2019.

Verification measurements have been carried out in June 2023 to validate the previous noise survey results which are detailed in this report.

The measurement results indicate that the average background day noise levels in June 2023 are 2 dB higher than the average background day noise level during the December 2019 noise survey.

This is not considered a significant increase in day background levels and measurements carried out in December 2019 are still relevant.

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 location in relation to its surroundings is outlined in yellow in Figure 1, and is proposed to form an extension to the Nightingale Centre highlighted in orange.



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

The site is located off Southmoor Road, Wythenshawe which runs to the south. Tilson Road runs to the north with other internal hospital roads to the south.

2.2 Adjacent premises

The surrounding premises is mostly commercial with the site being part of Wythenshawe Hospital. Nearby hospital buildings are highlighted in green in Figure 1. To the north of the site are offices and industrial units located on Tilson Road, highlighted in blue in Figure 1. To the north west of the site highlighted in pink is a nurse, Kids Allowed. Also to the north west are two buildings highlighted in light blue which are understood not to be residential, however the use is unknown.

3 Development proposals

The development proposed is a single storey extension to the existing Nightingale Centre. It will comprise of mainly consulting and examination rooms with a plant room and Ultrasound rooms to the north of the building. The extension will be joined to the existing building via a link at ground level.

Due to the uses of the building, it is assumed that it will operate during normal working hours and not during the night.

A screenshot of the proposed site plan development from AFL Architects are provided in Figure 2 for reference.



Figure 2 Excerpt of proposed site plan drawing BIA-AFL-01-00-DR-A-90100 - Proposed Site Plan - P4

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 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 Local Authority criteria

Manchester City Council (MCC) in Planning and Noise Technical Guidance October 2022 states the following for fixed plant/equipment:

'The noise assessment should be based on BS 4142, and any application for fixed plant, equipment or machinery must demonstrate that:

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.'

4.3 HTM 08-01

In line with guidance provided in HTM 08-01, noise from health care premises should be considered and external criteria agreed with the Local Authority and include differences allowed for emergency equipment. *'The following provisions apply with the most stringent taking precedence:*

- *Noise levels at the site boundary should meet reasonable standards required by the local authority or other relevant body.*
- *Noise outside the 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).*
- *Open external areas should be protected. Noise from services should not exceed the existing daytime background noise level or 50 dB L_{A90} , whichever is the higher. This limit should be achieved in any areas normally occupied by staff (except maintenance staff, notwithstanding the requirements of the Control of Noise at Work Regulations 2005) or the public (for example open courtyards and accessible landscaped areas). This means that noisy plantrooms should not face normally occupied external areas unless adequate acoustic control is provided.*

A relaxation of acoustic criteria for emergency situations and sporadic events (for example standby generators and helicopter flights) can be considered. This is subject to agreement by the local authority or other relevant body.

5 Noise survey method

The 2019 survey included unattended and attended noise measurements.

The 2023 survey included attended sample measurements to verify the 2019 survey measurement results.

5.1 Unattended measurements – December 2019

Unattended noise monitoring was undertaken at the site over 4 days.

Details of the equipment used and weather conditions were reported in 19503-R02-A *Noise survey report and plant noise egress limits report* dated 12 December 2019.

The unattended measurements were taken over 15 minute periods between 6 December 2019 and 9 December 2019. The equipment was installed and collected by Kane Mitchell.

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.

The logging location was 1 m from the facade of the building and as such can be considered to be a facade level. It was protruding out of a first floor window approximately 5.5 m above ground level.



Figure 3 Photograph of noise monitoring location, facade measurement

5.2 Attended measurements

5.2.1 Attended measurements- December 2019

Attended sample measurements were taken by Kane Mitchell at 4 locations around the site. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out on 9 December 2019, over 5 minute periods.

At each position the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 3.5 m from any other reflective surface. Photographs of the attended measurement locations are presented in Figure 4. Details of the equipment used and weather conditions were reported in 19503-R02-A *Noise survey report and plant noise egress limits report* dated 12 December 2019.



Figure 4 Photographs of attended locations 1-4, free field measurements (L-R)- December 2019

5.2.2 Attended measurements- June 2023

Attended sample measurements were taken by Jose M. Gonzalez at 5 locations around the site. These are indicated in Figure 1 as positions 1 to 5. The attended measurements were carried out on 29 June 2023, over 5 minute periods.

At each position the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 3 m from any other reflective surface. Photographs of the attended measurement locations are presented in. 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 Photographs of attended locations 1-5, free field measurements (L-R)- December 2023

5.3 Weather conditions

Weather conditions during the survey are described in Appendix A.

6 Noise survey results – December 2019

6.1 Observations

The dominant noise source observed at the site during the survey was road traffic noise from vehicles passing along Southmoor Road.

Less significant noise sources included intermittent noise from the industrial units to the north of the site, air traffic and pedestrians.

6.2 Noise measurement results

6.2.1 Unattended measurement results

A graph showing the results of the unattended measurements in December 2019 is provided in Appendix B.

Ambient noise levels measured during the unattended survey are presented in Table 1.

Table 1 Ambient noise levels measured during the unattended survey

Date	Day (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 6 Dec 2019	56 ^[1]	51
Saturday 7 Dec 2019	56	53
Sunday 8 Dec 2019	56	52
Monday 9 Dec 2019	55 ^[1]	-
Average	56	52

^[1] Measurement not made over full period due to monitoring start and end time (the measurement on 6 December 2019 was over 8 hours, and on 9 December 2019 over 15 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 6 and Figure 7.

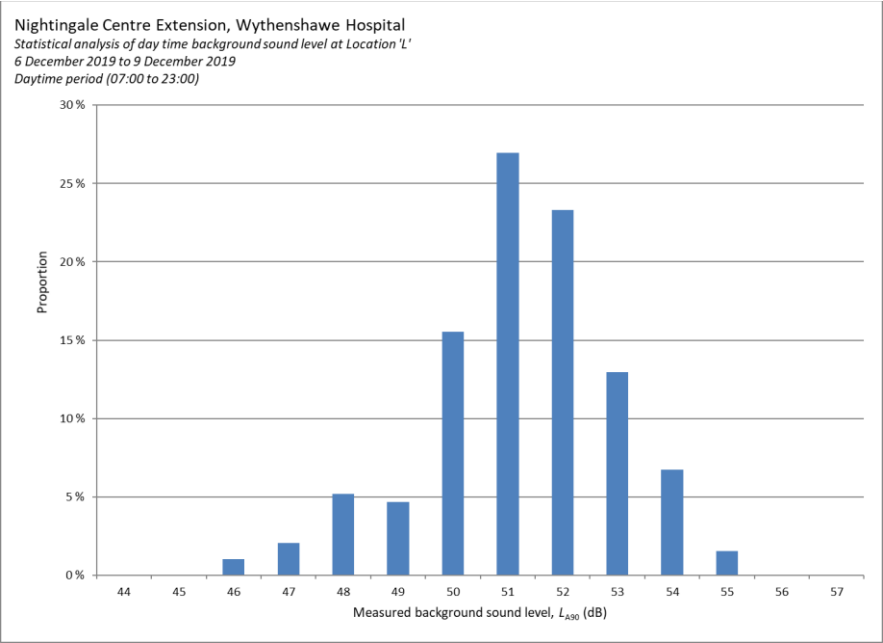


Figure 6 Statistical analysis of day background sound levels at Location 'L'- December 2019

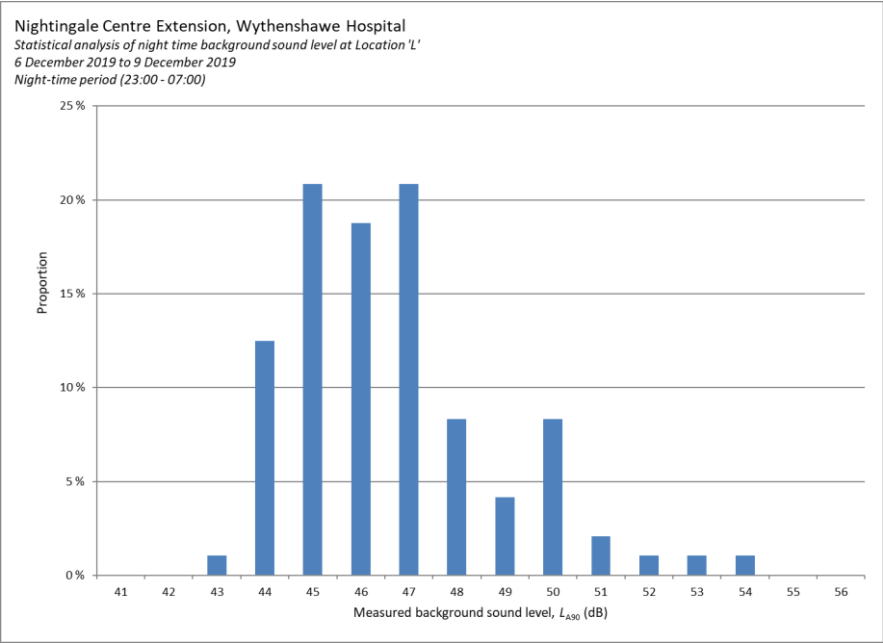


Figure 7 Statistical analysis of night background sound levels at Location 'L'- December 2019

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

6.2.2 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 2. All measurements can be considered free field.

Table 2 Noise levels and key noise sources from attended measurements- December 2019

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	13:30	50	69	48	Traffic along Southmoor Road, vehicles within Hospital car park and intermittent noise from industrial units to the north
	13:35	53	75	48	As above
	13:40	50	63	47	As above
	14:45	51	69	48	As above
	14:50	51	69	48	As above
	14:55	49	60	47	As above
2	13:45	52	70	48	Traffic along Southmoor Road, vehicles within Hospital car park and intermittent noise from industrial units to the north
	13:50	52	70	48	As above
	13:55	51	72	48	As above
	15:00	52	69	50	As above
	15:05	53	72	49	As above
	15:10	55	73	49	As above
3	14:00	51	71	48	Traffic along Southmoor Road and vehicles within Hospital car park
	14:05	53	71	49	As above

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
3	14:10	53	73	49	As above
	15:15	51	65	48	As above
	15:20	51	63	49	As above
	15:25	57	80	49	As above
4	14:15	67	83	56	Constant traffic along Southmoor road
	14:20	66	82	58	As above
	14:25	68	83	58	As above
	15:30	68	81	52	As above
	15:35	69	84	56	As above
	15:40	68	80	53	As above

7 Noise survey results – June 2023

7.1 Observations

The dominant noise source observed at the site during the survey was road traffic noise from vehicles passing along Southmoor Road.

Less significant noise sources included intermittent noise from the industrial units to the north of the site, aircrafts overhead, cars driving on car park, and pedestrians talking.

The measurements were carried out at similar time of the day and measurement locations (1 to 4) with a view of replicating the 2019 survey.

7.2 Noise measurement results

7.2.1 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 3. Measurement positions 1 to 4 can be considered free field. Measurement position 5 is considered to include facade reflections and is comparable to measurement position L from the previous survey.

Table 3 Noise levels and key noise sources from attended measurements- June 2023

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	13:30	48	60	48	Dominated by distant road traffic on Southmoor Road, with contributions from distant industrial activities (drilling, saw cutting, reverse beeping, metal dropping), and aircrafts overhead. Less significant contributions from cars driving on car park, distant ice cream van song, tree leaves moving and car and building slamming doors
	13:35	53	70	53	
	13:40	52	79	52	
	14:45	48	71	48	As above
2	14:51	53	68	53	Dominated by distant road traffic on Southmoor Road, with contributions from distant industrial activities (hammering, saw cutting, reverse beeping, metal dropping), and aircrafts overhead. Less significant contributions from cars driving on car park, car slamming doors and pedestrians passing by talking
	14:57	47	65	47	
	13:46	49	62	49	
	13:51	48	57	48	
	13:56	46	54	46	

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
2	15:03	47	57	47	As above
	15:09	48	57	48	
	15:14	48	58	48	As above
3	14:02	51	64	51	Dominated by distant road traffic on Southmoor Road, with contributions from distant industrial activities (saw cutting, metal dropping, reverse beeping) and aircraft overhead. Less significant contributions from cars driving on car park, distant siren and car horn
	14:07	54	70	54	
	14:12	49	71	49	
	15:19	47	55	47	Dominated by distant road traffic on Southmoor Road, with contributions from distant industrial activities (drilling, reverse beeping). Less significant contributions as above
	15:25	48	64	48	
	15:35	48	59	48	
	14:19	64	77	64	Dominated by distant road traffic on Southmoor Road, with contributions from aircraft overhead. Less significant contributions from car slamming door
	14:25	67	81	67	
	14:30	66	82	66	
4	15:41	66	84	66	Dominated by distant road traffic on Southmoor Road,
	15:46	66	79	66	
	15:51	66	79	66	

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
5	13:06	49	62	49	Dominated by distant road traffic on Southmoor Road, with contributions from car driving on car park and aircraft overhead. Less significant contributions from distant ice cream van song, tree leaves moving and car slamming doors
	13:11	51	64	51	
	13:16	58	74	58	
	15:58	54	74	54	Dominant sources as above, with contributions from distant industrial activities (saw cutting, reverse beeping, metal dropping)
	16:03	54	85	54	
	16:08	55	84	55	

7.3 Noise survey results comparison

A comparison between the background measurement results from the noise surveys in December 2019 and June 2023 have been carried out.

When measurements at Position 1 are compared and those taken at Position 5/L, the average day background noise levels during the June 2023 were 2 dB higher than the average background day noise level during the December 2019 noise survey.

The 2 dB difference between the June 2023 and December 2019 noise surveys is not considered a significant increase in day background levels. On this basis, it is considered that the measurements carried out in December 2019 are still relevant for the purposes of setting external noise limits for plant.

7.4 Basic limits

Based on the above criteria and the measurement results from the December 2019 unattended noise survey, 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. In this case these limits would apply at the following locations:

- Other hospital buildings
- Office units located on Tilson Road
- Nursery, Kids Allowed
- Other nearby noise sensitive buildings.

Table 4 Plant noise limits at 1 m from the nearest noise sensitive premises (based on survey December 2019)

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Daytime (07:00-23:00)	45
Night-time (23:00-07:00)	39

^[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.

In addition, in line with HTM08-01 building services should not exceed daytime background noise level of L_{A90} 50 dB in areas normally occupied by staff (except maintenance staff, notwithstanding the requirements of the Control of Noise at Work Regulations 2005) or the public (i.e. open courtyards and accessible landscaped areas).

7.5 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.

8 Conclusion

Sandy Brown has been commissioned by AFL Architects to provide acoustic advice in relation to the proposed single storey extension to the existing Nightingale Centre, Wythenshawe Hospital.

An environmental noise survey was survey was performed in December 2019, the purpose of 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. The methodology and measurement results were reported in 19503-R02-A *Noise survey report and plant noise egress limits report* dated 12 December 2019.

Verification measurements have been carried out in June 2023 to validate the previous noise survey results which are detailed in this report. The measurement results indicate that the average background day noise levels in June 2023 were 2 dB higher than the average background day noise level during the December 2019 noise survey.

This is not considered a significant increase in day background levels. On this basis, it is considered that the measurements carried out in December 2019 are still relevant for the purposes of setting external noise limits for plant.

The representative background sound levels from the unattended noise survey carried out in December 2019 were $L_{A90,15min}$ 50 dB during the day, and $L_{A90,15min}$ 44 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 are L_{Aeq} 45 dB during the day, and L_{Aeq} 39 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.

Appendix A

Survey details

Equipment

For equipment used in the noise survey carried out in December 2019, refer to Appendix A of 19503-R02-A *Noise survey report and plant noise egress limits report* dated 12 December 2019.

The attended noise measurements on 29 June 2023 were taken using a B&K 2250 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
<i>December 2019 noise survey</i>				
<i>B&K Type 2250</i>				
Sound level meter	2250/3011964	Brüel & Kjær	4 Sep 21	UCRT19/1970, UTRC19/1976
Microphone	4189/3100176	Brüel & Kjær	4 Sep 21	UCRT19/1970, UTRC19/1976
Pre-amp	ZC0032/26376	Brüel & Kjær	4 Sep 21	UCRT19/1970, UTRC19/1976
Calibrator	4231/3019123	Brüel & Kjær	3 Sep 21	UCRT19/1969
<i>NL-52C</i>				
Sound level meter	NL-52/00932326	Rion	13 Mar 21	TCRT19/1179
Microphone	UC-59/05549	Rion	13 Mar 21	TCRT19/1179
Pre-amp	NH-25/32354	Rion	13 Mar 21	TCRT19/1179
Calibrator	NC-74/34125432	Rion	13 Mar 21	TCRT19/1178
<i>June 2023 noise survey</i>				
<i>B&K Type 2250</i>				
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

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Pre-amp	ZC0032/26376	Brüel & Kjær	8 Sep 23	UCRT21/2089, UCRT21/2090
Calibrator	4231/3019123	Brüel & Kjær	8 Sep 23	UCRT21/2086

[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

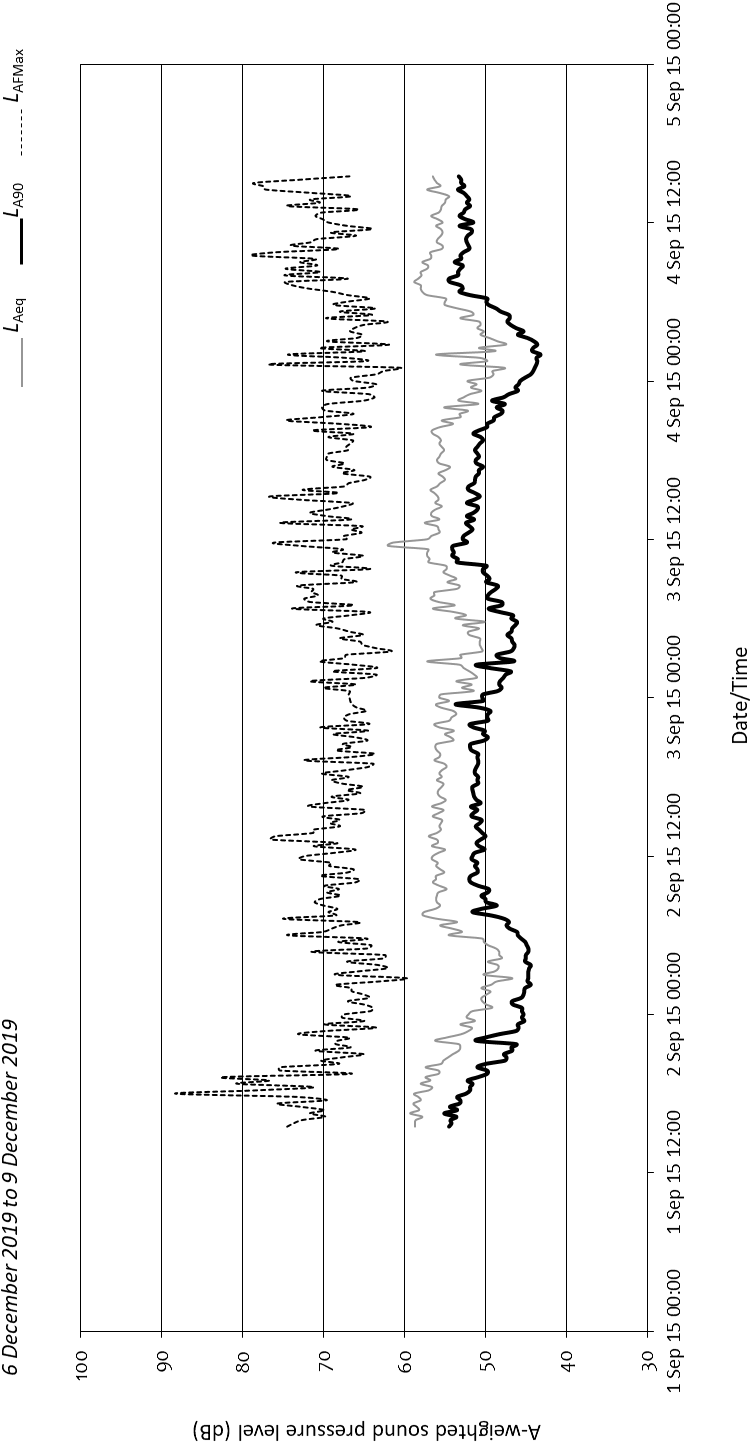
During the attended noise measurement on 29 June 2023, the weather was generally clear and dry and no rain occurred. Wind speeds at each position and varied between 0 m/s and 2.5 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location L (December 2019)

Nightingale Centre Extension, Wythenshawe Hospital
Results of noise logging survey at Location 'L'
6 December 2019 to 9 December 2019



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.