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Consultants in Acoustics, Noise & Vibration

19330-R01-A

4 December 2019

Substation, The National Hospital of Neurology and Neurosurgery

Environmental noise survey report

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Version	Date	Comments	Author	Reviewer
A	4 Dec 19		Dilan Neumann	Andrew Long

Summary

Sandy Brown has been appointed to provide acoustic design advice in relation to the proposed substation at The National Hospital of Neurology and Neurosurgery, UCLH, London, W1T.

An environmental noise survey has been carried out to determine the existing background sound levels in the area.

The results of the survey have been used to set plant noise limits at the nearest external noise sensitive receptors, in line with the London Borough of Camden's requirements

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15min}$ 40 dB during the daytime, and $L_{Aeq,15min}$ 36 dB during the night. These limits are cumulative, and apply with all plant operating under normal conditions. If the plant contains audible tonal elements the limits will be 5 dB more stringent.

An initial assessment of the proposed plant items associated with the development has been carried out and the proposed plant items are expected to comply with the relevant noise limits.

Contents

1 Introduction

Sandy Brown has been appointed to provide acoustic design advice in relation to the proposed Substation at The National Hospital of Neurology and Neurosurgery, UCLH, London, W1T.

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, results of the environmental noise survey, and a discussion of acceptable limits for noise emission from building services plant. An assessment has been carried out for the proposed plant.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1 (highlighted in red). The site is located on Queen Square. To the south of the site lies Great Ormond Street, to the north is Guilford Street and to the east is Powis Place.

Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Nearest noise sensitive premises

The nearest noise sensitive premise is Queen Court located on Queen Square to the north-west of the site. This is highlighted in blue in Figure 1.

3 Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended measurements

Unattended noise monitoring was undertaken on the site over 5 days to determine the existing background sound levels at the nearest noise sensitive premise.

The unattended measurements were performed over 15-minute periods between 11:40 on 23 February 2018 and 10:54 on 28 February 2018.

The equipment was installed and collected by Dilan Neumann.

The measurement position used during the survey is indicated in Figure 1, denoted by 'L'. Photographs showing the measurement location are provided in Figure 2. The location was chosen to be reasonably representative of the noise levels experienced by the nearest external noise sensitive premise, which is highlighted in blue in Figure 1.

Figure 2 Photograph of measurement position 'L'

4 Measurement results

4.1 Observations

The dominant noise source observed at position L during the survey was road traffic.

4.2 Unattended measurement results

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements are provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 1.

The measurements taken were considered to be facade levels.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 23 February 2018	-	50
Saturday 24 February 2018	56	49
Sunday 25 February 2018	54	50
Monday 26 February 2018	57	50
Tuesday 27 February 2018	56	49
Wednesday 28 February 2018	-	-
Average	56	50

The minimum background sound levels measured during the unattended survey are given in Table 2.

Table 2 Minimum background sound levels measured during the survey at position L

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Friday 23 February 2018	49 *	45
Saturday 24 February 2018	48	45
Sunday 25 February 2018	47	45
Monday 26 February 2018	48	45
Tuesday 27 February 2018	48	43
Wednesday 28 February 2018	46 *	-

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 43 dB at night.

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, day and night time typical levels have been quantified using statistical analysis from the continuous logging measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 3 and Figure 4.

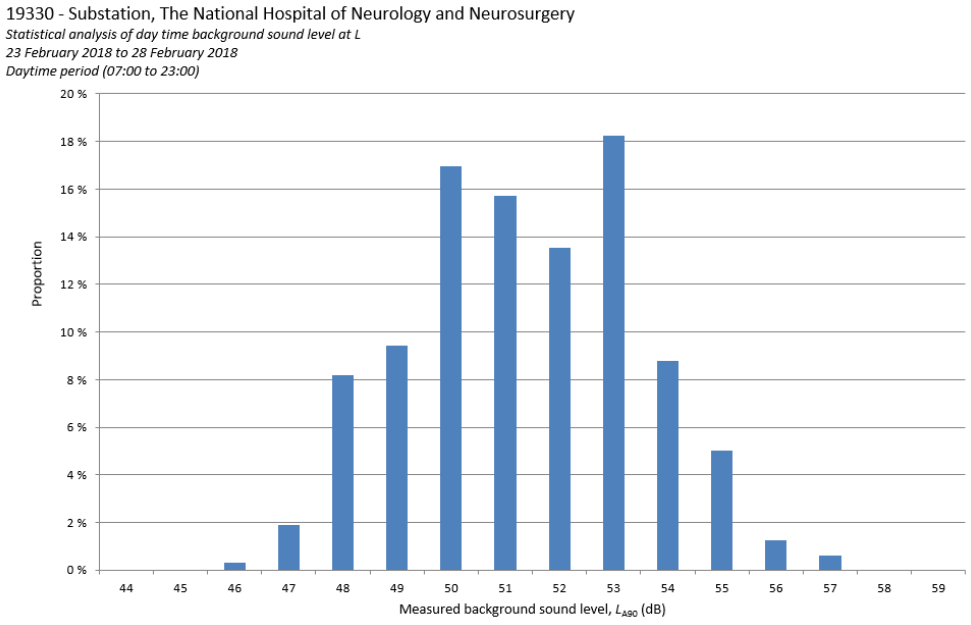


Figure 3 Representative daytime background sound levels at position L

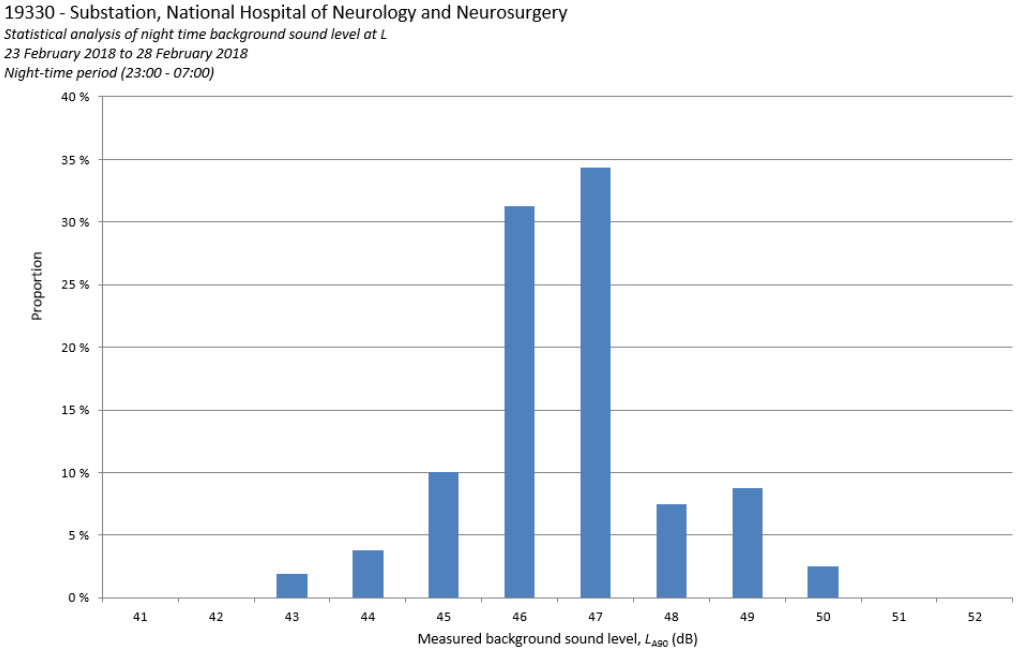


Figure 4 Representative night time background sound levels at position L

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 46 dB at night.

5 Building services noise egress limits

5.1 Standard guidance

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*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 the nearest noise sensitive.

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.

5.2 Local Authority criteria

The Camden Local Plan 2017 employs the idea of "effect levels" as described in the National Planning Policy Framework and Planning Practice Guidance. The effect levels are: No Observed Effect Level (NOEL), Lowest Observed Adverse Effect Level (LOAEL), and Significant Observed Adverse Effect Level (SOAEL). There are numerical values assigned to each effect level.

The Camden Local Plan 2017 suggest that noise from industrial and commercial sources should be designed to be 10 dB below the background noise level (15 dB below if tonal components are present).

5.3 Limits

5.3.1 External noise sensitive premises

Based on achieving a noise level that is at or below the LOAEL, the requirements of the London Borough of Camden (Section 5.2) and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest external noise sensitive premises should not exceed the limits set out in Table 3.

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)	40
Night-time (23:00-07:00)	36

If the plant contains audible tonal elements the limits will be 5 dB more stringent.

5.3.2 Attention catching features

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit below those set out above, 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 taken into account 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 is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

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

5.4 Assessment

An assessment has been carried out to determine the noise from the proposed plant at the nearest noise sensitive receptor.

5.4.1 Proposed plant

The proposed plant under assessment is going to be mounted on an existing plant deck located on Level 2 and is shown in Figure 5. This is located between the Chandler Wing and Albany Wing of UCLH.

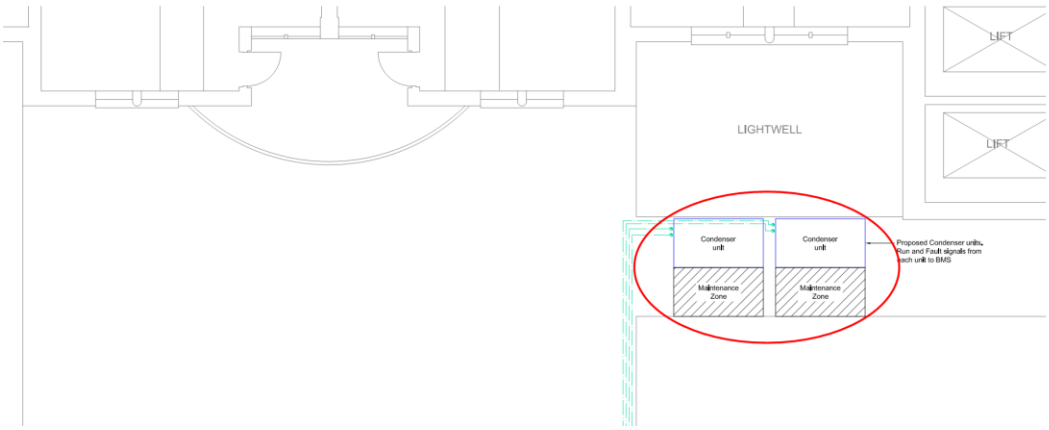


Figure 5 Location of proposed plant

The plant items consist of two outdoor condensing units, which are both to be Airdale CR65.

The sound power levels (SWL) are given in the manufacturer data sheets, provided by Arup, and have been summarised in Table 4.

Table 4 Noise data for Airdale CR65

Plant item	Sound power level (Hz) in Octave Band center frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Airdale CR65	85	90	77	77	76	73	66	65	81

5.4.2 Assessment

Noise from the proposed plant has been assessed to the nearest external noise sensitive receptor (Queen Court). The assessment has considered acoustic screening from the building geometry and distance attenuation. The result is presented in Table 5.

Table 5 Noise emissions to the nearest external noise sensitive receptor

Receptor	Noise emissions at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Queen Court	33

The calculated noise emissions from the external plant at the nearest external receptor are lower than limits set out in Table 3, thereby demonstrating compliance with the London Borough of Camden's requirements.

5.4.3 Mitigation

Noise from the proposed plant is in line with the proposed criteria such that mitigation is not considered necessary.

6 Conclusion

An environmental noise survey has been carried out at two locations, to determine the existing background sound levels in the area.

The results of the survey have been used to set plant noise limits at the nearest external noise sensitive receptor, in line with the London Borough of Camden's requirements.

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15min}$ 40 dB during the daytime, and $L_{Aeq,15min}$ 36 dB during the night.

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain tonal features, the limits will be 5 dB more stringent than those set out above.

An assessment of the proposed plant items associated with the development has been carried out and the proposed plant items are expected to comply with the relevant noise limits, such that no mitigation is deemed necessary.

Appendix A

Survey details

Equipment

A Rion NL-32 sound level meter was used to undertake the unattended measurements. The 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
NL-32				
Sound level meter	NL-32/00623769	Rion	06 Oct 19	TCRT17/1656
Microphone	UC-53A/319244	Rion	06 Oct 19	TCRT17/1656
Pre-amp	NH-21/36677	Rion	06 Oct 19	TCRT17/1656
Calibrator	NC-74/34336009	Rion	05 Oct 19	TCRT17/1649

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meters used in this survey are available upon request.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. 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 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.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

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.*

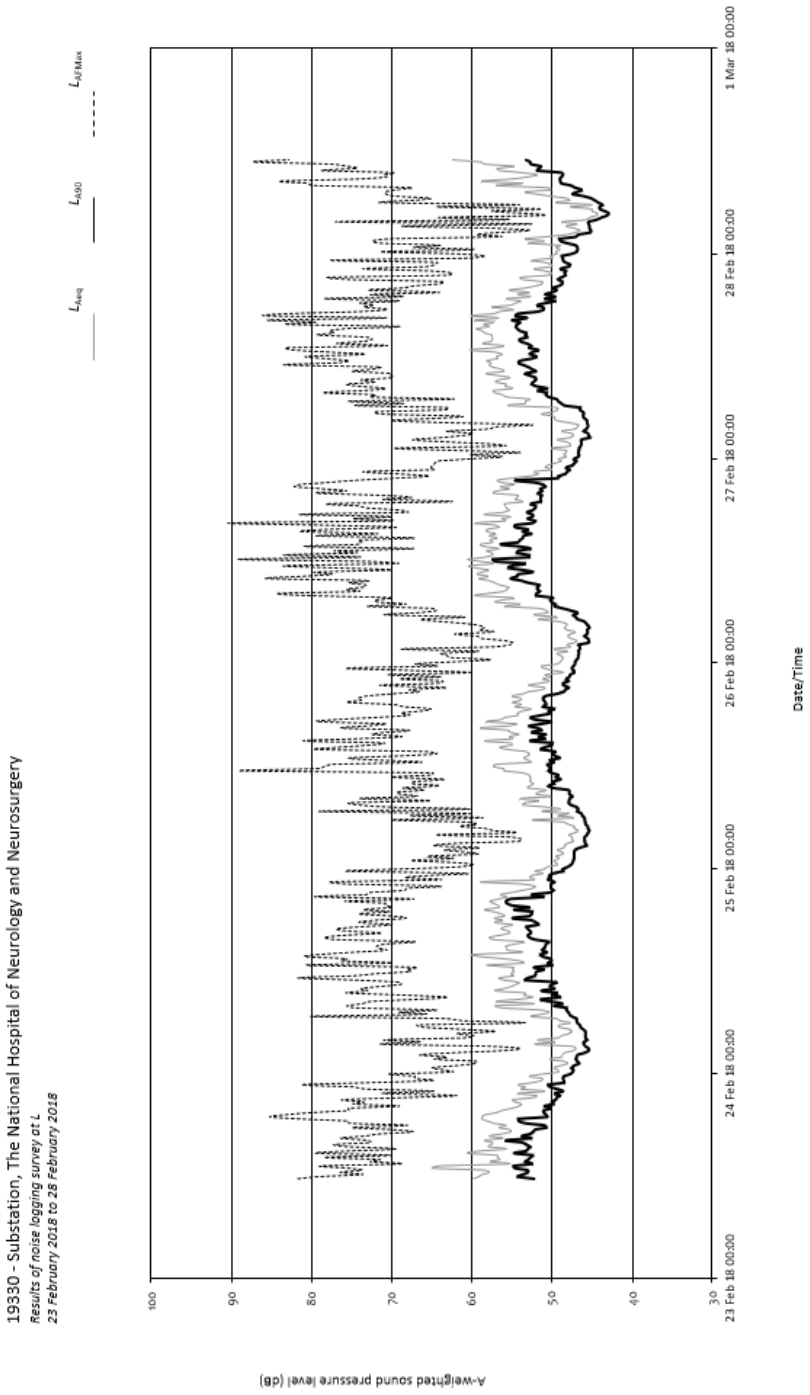
Weather conditions

During the unattended noise measurements between 23 February 2018 and 28 February 2018, weather reports for the area indicated that temperatures varied between -6°C at night and 7°C during the day, and the wind speed was less than 8 m/s.

During the unattended noise measurements between 1 March 2018 and on 5 March 2018, weather reports for the area indicated that temperatures varied between -5°C at night and 10°C during the day, and the wind speed was less than 10 m/s.

Appendix B

Results of unattended measurements at position L


19330 - Substation, The National Hospital of Neurology and Neurosurgery
Results of noise logging survey at L
23 February 2018 to 28 February 2018
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
23 Feb 18 00:00
24 Feb 18 00:00
25 Feb 18 00:00
26 Feb 18 00:00
27 Feb 18 00:00
28 Feb 18 00:00
1 Mar 18 00:00
Date/Time