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Consultants in Acoustics, Noise & Vibration

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UCLH, NHS Trust

*Environmental noise survey and plant noise assessment
report*

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A	28 Jul 15		Tom Bonnert	Helen Sheldon
B	18 Nov 15	Updated plant assessment	Ben Phillips	Stephen Stringer

Summary

Sandy Brown Associates LLP (SBA) has been commissioned by University College London Hospitals (UCLH) to undertake an environmental noise survey at the National Hospital for Neurology and Neurosurgery (NHNN), Queen Square, London, WC1N in relation to the proposed additional building services plant to be installed on the Level 8 roof.

An environmental noise survey has been carried out to determine the existing background sound levels in the area and set appropriate plant noise limits in line with the requirements of the Local Authority, London Borough of Camden (LBC).

The noise survey was performed between 11:35 on 17 July 2015 and 12:05 on 21 July 2015.

The representative background sound levels measured during the survey were $L_{A90,15min}$ 49 dB during the daytime, $L_{A90,15min}$ 50 dB during the evening and $L_{A90,15min}$ 45 dB at night time.

Based on the requirements of the LBC 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} 44 dB during the daytime, L_{Aeq} 45 dB during the evening and L_{Aeq} 40 dB during the night time. These limits are cumulative, and apply with all plant in operation 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.

Noise from the proposed rooftop chiller has been assessed to nearby noise sensitive receptors. The chiller has been selected to be a low noise model and an attenuation package is to be included. Based on these selections, the predicted noise from the chiller at nearby noise sensitive receptors is in-line with the London Borough of Camden's noise criteria.

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1 Introduction

Sandy Brown Associates LLP (SBA) has been commissioned by University College London Hospitals (UCLH) to undertake an environmental noise survey at the National Hospital for Neurology and Neurosurgery, Queen Square, London, WC1N in relation to the proposed additional building services plant to be installed on the Level 8 roof.

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, a discussion of acceptable limits for noise emission from building services plant and an assessment of the noise egress from the proposed plant to be installed.

2 Site description

2.1 The site and its surrounding

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

The National Hospital for Neurology and Neurosurgery is highlighted in red in Figure 1. The nearest noise sensitive receptors are highlighted in blue and green. Other hospital premises situated to the east and south of the site are highlighted in yellow in Figure 1.

The site is bound by Queens Square to the west of the site and Great Ormond Street to the south of the site. Guildford Street and Russel Square underground station are located to the north of the site.



Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Adjacent premises

The adjacent properties to the National Hospital for Neurology and Neurosurgery include other departments of the hospital. This includes Great Ormond Street Hospital to the east and the Royal London Hospital for Integrated Medicine to the south of the site.

The nearest residential properties surrounding the site are located to the west (Queen House) and north (Queen Court) and are both highlighted in Figure 1 in green. Other noise sensitive receptors are 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 at the site over 5 days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed between 11:35 on 17 July 2015 and 12:05 on 21 July 2015. The equipment was installed and collected by Tom Bonnert.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided in Figure 2. This location was chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises.

The equipment was located in an office on Level 6 of the NHNN building. The microphone was extended out of an open window for which it remained for the entirety of the survey. The microphone was positioned approximately 0.5 m from the facade of the building and approximately 1.5 m from any other significant reflecting surface. The unattended measurement results are considered to be facade noise levels.



Figure 2 Photograph showing the unattended measurement location

3.2 Attended measurements

Attended sample measurements were performed by Tom Bonnert at a number of locations around the National Hospital for Neurology and Neurosurgery. These are indicated in Figure 1 as positions 1 to 3. The attended measurements were carried out on 21 July 2015, over 15 minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

The locations of the measurements are indicated in Figure 1 in each case the microphone was mounted on a tripod approximately 1.5 m above the ground level and at least 3 m from any other reflective surface. These measurement results are considered to be free field noise levels.

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of road traffic noise from Queens Square primarily and Southampton Row in the distance. Aircraft noise was observed whilst on site along with people/pedestrians at Queens Square Park and Garden.

Less significant noise sources included plant noise from the existing chillers located at rooftop level. These chillers were inspected during the initial site visit and were noted to be quiet. They were not observed to be a dominant noise source at the measurement location.

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 is provided in Appendix B.

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

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night time (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
17 Jul 2015	-	57	51
18 Jul 2015	56	53	50
19 Jul 2015	58	53	50
20 Jul 2015	57	54	51
Average	57	54	51

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

Date	Daytime (07:00 – 19:00)	Evening (19:00 – 23:00)	Night time (23:00 – 07:00)
	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)
17 Jul 2015	55*	52	47
18 Jul 2015	49	50	46
19 Jul 2015	49	50	45
20 Jul 2015	50	52	47
21 Jul 2015	52*	-	-

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

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 49 dB during the daytime, $L_{A90,15min}$ 50 dB during the evening and $L_{A90,15min}$ 45 dB at night time.

4.3 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 3. The dominant noise sources noted during the measurements are also described in Table 3. All the attended measurements were performed over 15 minute periods.

Table 3 Sound pressure levels from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
1	11:04	59	85	51	Steady traffic noise from nearby quiet roads and distant busy roads, intermittent pedestrians. Building works carried out internally within an adjacent building and trees rustling in the winds.
2	11:22	61	67	52	Steady traffic noise from nearby quiet roads and distant busy roads. More pedestrian footfall due to entrance to building near measurement position. Noise from people in Queens Square Park and Gardens.
3	11:39	60	65	55	Less screening to busy road, more pedestrian footfall due to thoroughway to Southampton Row.

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 development is located within the London Borough of Camden and therefore will need to comply with Table E of policy DP28. Table E has been reproduced in full in Table 4.

Table 4 Local authority noise emission criteria

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive facade	Day, evening and night	00:00 – 24:00	5 dBA < L_{A90}
Noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive facade	Day, evening and night	00:00 – 24:00	10 dBA < L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive facade	Day, evening and night	00:00 – 24:00	10 dBA < L_{A90}
Noise at 1 metre external to sensitive facade where $L_{A90} > 60$ dB	Day, evening and night	00:00 – 24:00	5 dBA < L_{A90}

5.3 Limits

Based on the above criteria 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 noise sensitive premises should not exceed the limits are set out in Table 5.

Table 5 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} dB)
Daytime (07:00-19:00)	44
Evening (19:00 – 23:00)	45
Night-time (23:00-07:00)	40

The limits set out in Table 5 do not include any allowance for the plant noise to contain attention catching features. If specific plant does contain these features (eg tonality or impulsivity) then a further 5 dB penalty will be imposed and this will be the basis of any performance specification.

Predicted noise levels at residential and commercial premises have been assessed against the night time plant noise limits given in Table 5 as it is understood the proposed plant items are to run 24/7. Daytime limits have been used when assessing against the Queens Square Park and Garden noise sensitive receiver, as this is would typically only be occupied during the daytime.

6 Plant noise assessment

The following section presents the manufacturer's data for the proposed plant, the assessment to the worst affected noise sensitive receivers, and recommendations for any noise mitigation measures where necessary.

6.1 Proposed plant

It is proposed that a new chiller is to be installed on the Level 8 rooftop of the NHNN with an integrated pump. The location of the chiller is given in Figure 3. Manufacturer's noise data for the chiller and associated pump is given in Table 6.

The chiller has been selected to be a low noise model and an attenuation package is to be provided. The proposed attenuation package is an Allaway Acoustic AA2013L.

The existing chillers are highlighted in yellow in Figure 3. The proposed chiller is highlighted in green and the associated pump within enclosure is highlighted in blue in Figure 3. The units highlighted in yellow are existing chillers which are already in operation.

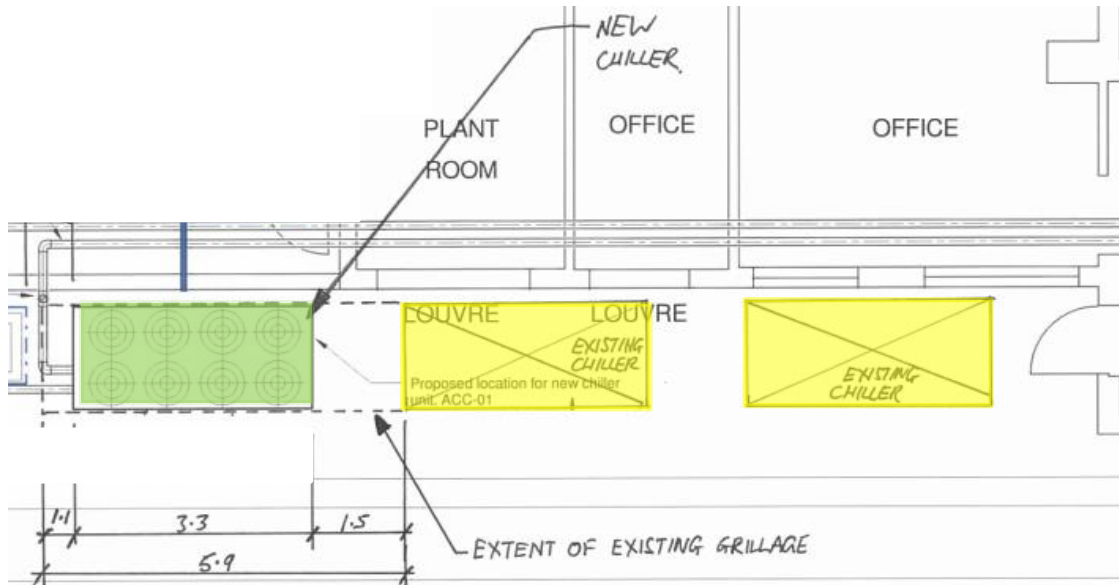


Figure 3 Rooftop plant layout for existing and proposed units

Table 6 Manufacturer's sound power levels for proposed rooftop chiller (dB)

Unit model	Octave-band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Zeta-Echos, Model LN 10.2	78	76	75	75	75	79	71	62

6.2 Predicted noise levels

Based on the London Borough of Camden requirements, the proposed plant has been assessed to both residential and commercial premises. LBC also states that open spaces are considered to be a noise sensitive receptor.

The calculated noise levels at the worst affected receptors are given in Table 7. The predicted sound pressure levels include losses from the distance between the proposed plant and the respective receivers and any screening from the site surroundings geometry.

Table 7 Predicted sound pressure levels at receptors

	Predicted sound pressure level at the worst affected noise sensitive location (dB)
Queens Park and Garden	44
Queen House	40
Queen Court	38

The noise levels given in Table 7 are compliant with the plant noise limits given in Table 5.

7 Conclusion

A noise survey has been carried out to determine the existing background sound levels in the vicinity of the site and surrounding noise sensitive premises. The representative background sound levels were $L_{A90,15min}$ 49 dB during the daytime, $L_{A90,15min}$ 50 dB during the evening and $L_{A90,15min}$ 45 dB during the night time.

On the basis of the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 44 dB during the daytime, L_{Aeq} 45 dB during the evening and L_{Aeq} 40 dB during the night time

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 indicated in Section 5.3 will be applied, and the limits will be more stringent than those set out above.

An assessment of the proposed plant items associated with the development has been carried out. The rooftop chiller has been selected to be a low noise model and an attenuation package is to be included. Based on these selections the noise from the proposed chiller is in line with the London Borough of Camden's plant noise criteria at nearby noise sensitive receptors.

Appendix A

Survey details

Equipment

A Rion NL-32 sound level meter was used to undertake the unattended measurements. The attended measurements were carried out using a Bruel & Kjaer sound level meter. 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
Sound level meter	NL-32/00423757	Rion	15 Aug 16	1408392
Microphone	UC-53A/319229	Rion	15 Aug 16	1408392
Pre-amp	NH-21/36632	Rion	15 Aug 16	1408392
Calibrator	SVA30A/10558	Rion	11 Aug 16	1408387
Sound level meter	2250/2693829	Bruel & Kjaer	30 Jan 16	07524/07525
Microphone	4189/2689268	Bruel & Kjaer	30 Jan 16	07524/07525
Pre-amp	ZC0032/12061	Bruel & Kjaer	30 Jan 16	07524/07525
Calibrator	4231/3001923	Bruel & Kjaer	30 Jan 16	07518

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meter 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 attended measurements carried out on 21 July 2015, the weather was clear and dry and no rain occurred. Wind speeds varied between approximately 3 m/s and 5 m/s.

During the unattended noise measurements between 17 July 2015 and 21 July 2015, weather reports for the area indicated that temperatures varied between 11°C at night and 25°C during the day, and the wind speed was less than 7 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Location L

UCLH, NHS Trust
Results of noise logging survey at National
Hospital of Neurology and Neuroscience
Friday 17 July 2015 to Tuesday 21 July 2015

