



Noise Survey Report

DATE OF ISSUE: 8 MAY 2015
REVISION NUMBER: 00
HM REFERENCE: 19878-01/A/NS01/00

PROJECT:
Queens Theatre
London

CLIENT:
UCLH Capital Investments
149 Tottenham Court Road
London
W1T 7DN



ONE DISCOVERY PLACE
FARNBOROUGH
T: +44 (0)1252 550 500
www.hilsonmoran.com

COLUMBUS DRIVE
HAMPSHIRE
F: +44 (0)1252 550 501
info@hilsonmoran.com

| GU14 0NZ

HILSON
MORAN

PROJECT NAME: **Queens Theatre**
REPORT NAME: **Noise Survey Report**

ISSUE STATUS: **FINAL**
HM REFERENCE: **19878-01/A/NS01/00**

DATE OF ISSUE: **8 MAY 2015**
REVISION NUMBER: **00**

AUTHOR: **SEBASTIAN WOODHAMS**
CHECKER: **MARK BRIGHTWELL**
APPROVER: **MARK BRIGHTWELL**

DOCUMENT HISTORY:

ISSUE	DATE	DETAILS
00	8/5/2015	DOCUMENT ISSUED EXTERNALLY.

Copyright © Hilson Moran 2015. All rights reserved. This report is confidential to the party to whom it is addressed and their professional advisers for the specific purpose to which it refers. No responsibility is accepted to third parties, and neither the whole nor any part of this report nor reference thereto may be published or disclosed without the written consent of Hilson Moran.



Contents

1.	Executive Summary	1
2.	Introduction.....	2
3.	Site Description.....	3
4.	Survey Methodology	4
5.	Survey Results & Observations	7
5.1.	Results.....	7
5.2.	Observations.....	7
6.	External Plant Noise Emission Limits	8
6.1.	Local Authority Requirements	8
6.2.	Hospital Internal Noise Level Limits	8
7.	Plant Noise Assessment.....	10



1. Executive Summary

It is proposed to remodel the first and second floors of the National Hospital for Neurology and Neurosurgery (NHNN) and expand the capacity of operating theatres from 4 to 6.

New building services plant will be introduced to the central courtyard of the site on a deck at first floor level, noise from which will be subject to limits specified by the Local Authority as well as to control noise break-in to hospital rooms.

Hilson Moran has therefore an environmental noise survey at the development site, in order to determine prevailing noise levels affecting the site and its surroundings.

The results of the noise survey were considered reasonable, considering the location of the measurement positions and the dominant nearby noise sources.

Based on the results of the noise survey, external plant noise emission limits have been proposed in accordance with the requirements of Camden Council and also considering noise break-in to the hospital rooms. The new building services plant will sit alongside existing plant serving the building, and shall be selected, designed and located so as to comply with the proposed external plant noise limits.

Our assessment indicates, upon introduction of attenuators, the proposed air handling units should meet the proposed plant noise limits.

2. Introduction

It is proposed to remodel the first and second floors of the National Hospital for Neurology and Neurosurgery (NHNN) and expand the capacity of operating theatres from 4 to 6.

New building services plant will be introduced to the central courtyard of the site on a deck at first floor level, noise from which will be subject to limits specified by the Local Authority as well as to control noise break-in to hospital rooms

Hilson Moran has therefore undertaken an environmental noise survey at the existing site, in order to determine prevailing noise levels affecting the site and its surroundings.

The purposes of this report are:

- a) To determine prevailing environmental noise levels affecting the site due to nearby noise sources (e.g. road traffic)
- b) To determine external plant noise limits as required by Camden Council and also considering noise break-in to the hospital rooms
- c) To undertake a plant noise assessment of the proposed plant and determine mitigation measures necessary to meet the proposed limits

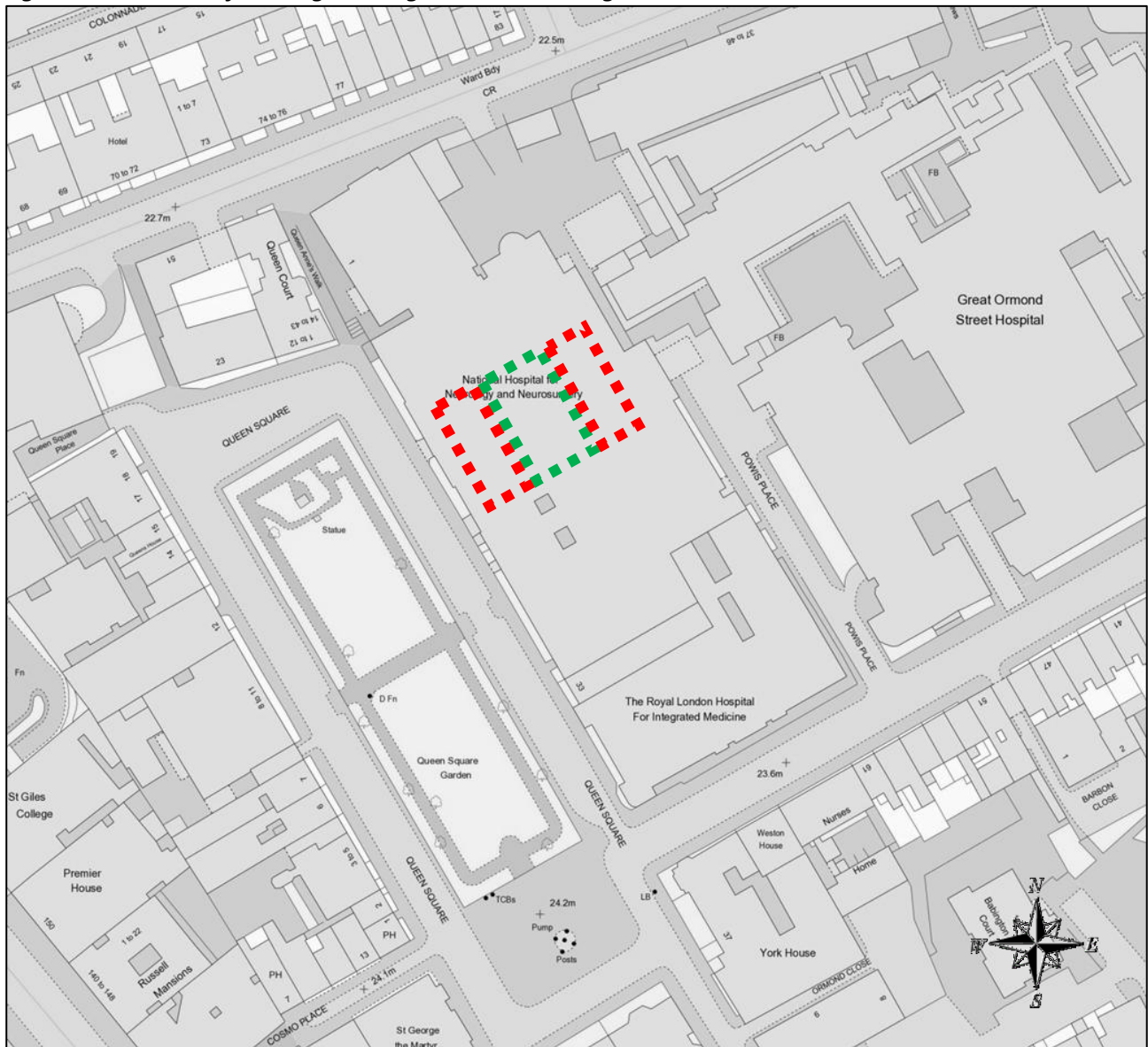
Following this introductory section, a description of the site is given in Section 3. Section 4 gives a description of the environmental noise survey methodology, with the results presented in Section 5, Appendix B and Appendix C. Section 6 presents noise limits for external plant. Finally section 7 presents a plant noise assessment. Appendix A presents an explanation of the acoustic terminology used in this report.

3. Site Description

The proposed site is the National Hospital for Neurology and Neurosurgery in London. The location of the plant is overlooked by a mixture of patient and staff rooms, with patient wards to the west and east.

Figure 3.1 below shows the existing site and its surroundings, with the courtyard highlighted in **green** and the nearest noise sensitive areas highlighted in **red**.

Figure 3.1 Location of Existing Buildings and Surrounding Land Use



4. Survey Methodology

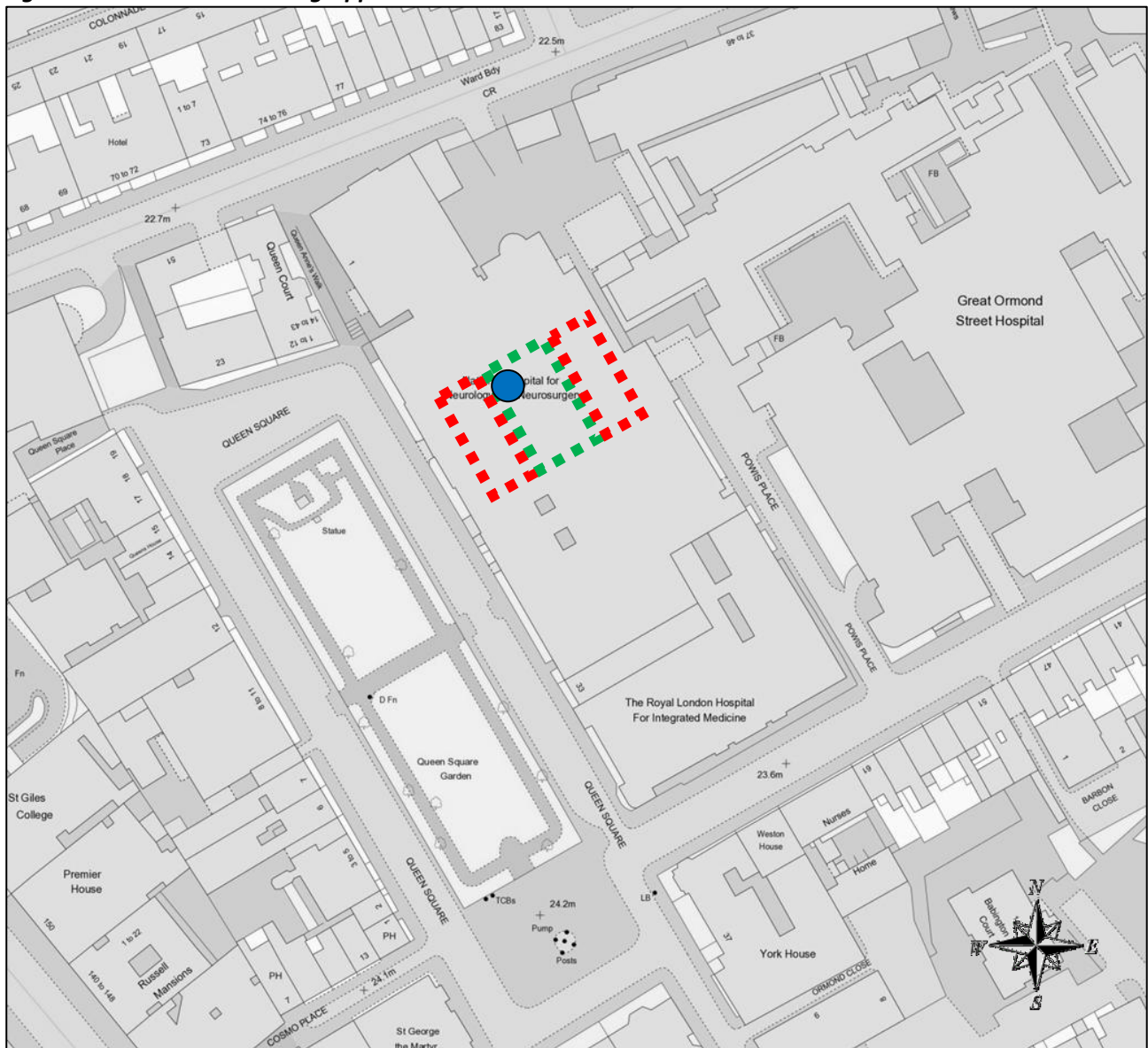
An unmanned environmental noise survey was undertaken at a single measurement location at the proposed site. The noise survey was undertaken between approximately 11:00 hours on Thursday 9 April 2015 and 09:00 hours on Monday 13 April 2015. In addition, manned noise level measurements were undertaken at the site on Thursday 9 April between approximately 10:00 and 11:00 hours.

L_{Amax} , L_{Aeq} and L_{A90} noise levels were measured throughout the unmanned environmental noise survey over contiguous 125 millisecond intervals.

Noise monitoring was undertaken in general accordance with guidance within British Standard (BS) 7445 'Description and measurement of environmental noise'.

The unmanned measurement position is shown on Figure 4.1.

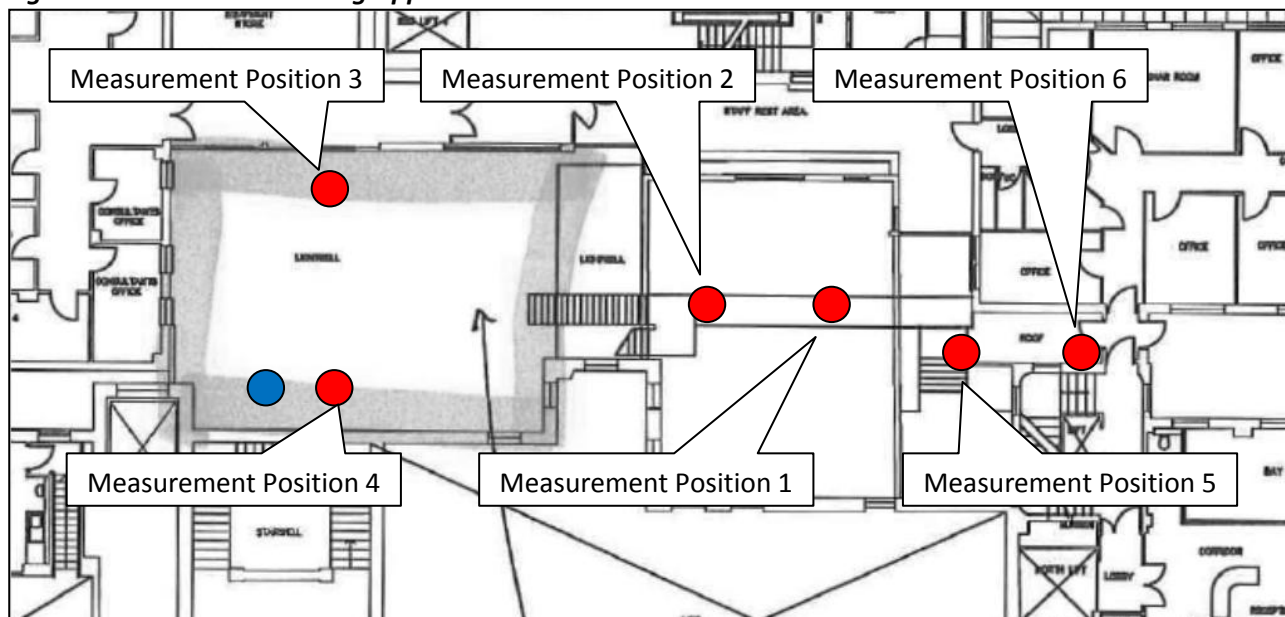
Figure 4.1 Site Plan Indicating Approximate Measurement Positions



The measurement microphone was fixed to a railing on a first floor roof within the courtyard, approximately 3m above ground level. This measurement position is considered representative of the noise levels affecting the nearest noise sensitive receptors.

The manned measurement positions are shown in **red** and the unmanned measurement position is shown in **blue** on Figure 4.2 below.

Figure 4.1 Site Plan Indicating Approximate Measurement Positions



For each manned measurement, the microphone was fixed to a tripod 1.2m above the existing first floor roof.

The equipment used for the noise survey is summarised in Table 4.1 below.

Table 4.1 Description of Equipment used for Noise Survey

Equipment	Description	Quantity	Serial Number
01 dB Solo	Type 1 automated logging sound level meter	1	60447
01 dB PRE 21	Type 1 ½" microphone and pre-amplifier	1	13259
01 dB BAP 21	Outdoor microphone casing	1	10935
01 dB CAL 21	Calibrator	1	50441990

Due to the nature of the unmanned noise survey, i.e. unmanned, we are unable to comment on the weather conditions throughout the entire noise survey period. However, at the beginning and end of the unmanned noise survey period, there was noted to be no rainfall, a cloudy sky and a light wind.

During the manned noise survey there was no rainfall, a cloudy sky and a light wind.



The noise monitoring equipment used was calibrated before and after the noise survey periods. No significant change was found.

Equipment calibration certificates can be provided upon request.

5. Survey Results & Observations

5.1. Results

Appendix B presents time history graphs showing the L_{Amax} , L_{Aeq} and L_{A90} noise levels at the unmanned measurement position, throughout the noise survey period.

We would consider the noise levels measured to be reasonable, considering the location of the measurement positions and the dominant nearby noise sources.

The lowest background $L_{A90,T}$ noise levels measured during daytime and night-time periods at the unmanned position are summarised in Table 5.1 below.

Table 5.1 Lowest Measured Background LA90 Noise Levels (Unmanned Noise Survey)

Lowest Measured $L_{A90,T}$ Background Noise Level (dB)	
Daytime, T = 1 hour (07:00 – 23:00 hours)	Night-time, T = 15 min (23:00 – 07:00 hours)
57	56

The background $L_{A90,T}$ noise levels measured at each manned position are summarised in Table 5.2 below.

Table 5.2 Measured Background LA90 Noise Levels (Manned Noise Survey)

Measurement Position	Measured $L_{A90,T}$ Background Noise Level (dB)
	Daytime, T = 1 minute
1	72
2	65
3	64
4	61
5	68
6	64

5.2. Observations

Due to the nature of the unmanned survey we are unable to comment on the exact noise climate throughout the entire noise survey period. However, at the beginning and end of the survey period the daytime noise climate at was noted to be dominated by existing plant within the rear courtyard. This was also the case for the manned survey.

6. External Plant Noise Emission Limits

The proposed redevelopment will involve replacing the existing external building services plant with new items of plant, noise from which will be subject to limits specified by Camden Council, in addition we advise consideration be given to noise break-in to hospital rooms.

6.1. Local Authority Requirements

The site lies within the jurisdiction of Camden Council, whose typical requirements are for plant noise to be 5 dBA below the background noise level at the nearest noise sensitive property.

Based on the above, we would propose the plant noise limits shown in Table 6.1, to be achieved during the relevant plant operating period, when measured 1m external to the nearest noise sensitive windows to the site.

Table 6.1 Proposed External Plant Noise Limits – Based on Local Authority Requirements

External Plant Noise Limit during Plant Operating Period $L_{Aeq,T}$ (dB)	
Daytime, T = 1 hour (07:00 – 23:00 hours)	Night-time, T = 15 min (23:00 – 07:00 hours)
52	51

The external plant noise limits proposed in Table 6.1 are subject to approval by Camden Council.

6.2. Hospital Internal Noise Level Limits

The nearest noise sensitive facades to the proposed plant location are two consultants' offices to the north, at a distance of approximately 2m from the proposed plant location, and an operating theatre to the north-east, at a distance of approximately 5m from the proposed plant location.

Health Technical Memorandum 08-01: Acoustics (HTM 08), published by the Department of Health, gives criteria for noise intrusion to be met inside the spaces from external noise sources. Table 6.2 below presents the criteria.

Table 6.2 HTM 08 Noise Intrusion Limits

Room Type	Example	Criteria for noise intrusion to be met inside the spaces from external noise sources (dB)
Small office-type spaces	Private offices, small treatment rooms, interview rooms, consulting rooms	40 $L_{Aeq, 1hr}$
Operating theatres	Operating theatres	40 $L_{Aeq, 1hr}$ 50 $L_{Amax, f}$

From our observations on site, it is understood that windows around the proposed plant area are both single and double glazed.

We advise a well sealed single or double glazed window should provide an outside to inside sound insulation performance of at least 15dB. Therefore provided the noise level of the proposed plant incident



upon the windows does not exceed 55dBA, and windows are well sealed and shut, the proposed plant should satisfy the limits presented in Table 6.2 above. Furthermore we note this also indicates the limits presented in Section 6.1 above should also be commensurate with the limits of HTM-08.

7. Plant Noise Assessment

It is proposed to introduce 2 No air handling units on a new plant deck to be constructed within the central courtyard.

Table 7.2 below presents the atmospheric side in-duct sound power levels of the proposed air handling units.

Table 7.2 In-Duct Sound Power Levels of Air Moving Plant

Plant Ref	System Description	Location of Grille/Louvre	In-Duct Sound Power Level (dB re 10^{-12} Watts) @ Octave Band Centre Frequency (Hz)							
			63	125	250	500	1k	2k	4k	8k
AHU01	Supply	Roof Plant Deck	75	74	75	79	75	74	68	63
AHU01	Extract	Roof Plant Deck	73	74	80	75	73	71	64	55
AHU02	Supply	Roof Plant Deck	75	74	75	79	75	74	68	63
AHU02	Extract	Roof Plant Deck	73	74	80	75	73	71	64	55

We advise that in order to meet the plant noise limits presented in Section 6.1 attenuators would need to be introduced to both the supply and extract paths of each air handling units.

Table 6.3 below presents the minimum insertion losses required of the attenuators

Table 6.3 Atmospheric Plant Noise Attenuator Insertion Losses

System Description	Minimum Attenuator Insertion Loss (dB) @ Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
AHU01 Supply	7	12	20	33	39	40	35	28
AHU01 Extract	7	12	20	33	39	40	35	28
AHU02 Supply	7	12	20	33	39	40	35	28
AHU02 Extract	7	12	20	33	39	40	35	28

We advise that typically would we anticipate the above attenuation could be provided by 1200mm long attenuators with 30% free area.

Table 6.4 below presents a summary of the predicted noise levels due to the proposed air handling units, with attenuators as described in Table 6.3, at the nearest noise sensitive facades to the proposed plant location.

Table 6.4 Plant Noise Calculations – Predicted Levels at Consultants Offices



Plant Item	Approx Distance to Receptor (m)	Predicted Noise Level at Noise Sensitive Property (dBA)
AHU01 Supply	2	37
AHU01 Extract	2	42
AHU02 Supply	2	37
AHU02 Extract	2	42
Total		46 dBA
Plant Noise Emission Limit		51 dBA

APPENDIX A – ACOUSTIC TERMINOLOGY

Parameter	Description
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing (20×10^{-6} Pascals).
Sound Pressure Level (L_p)	The sound pressure level is the sound pressure fluctuation caused by vibrating objects relative to the threshold of hearing.
A-weighting (L_A or dBA)	The sound level in dB with a filter applied to increase certain frequencies and decrease others to correspond with the average human response to sound.
$L_{Aeq,T}$	The A-weighted equivalent continuous noise level over the time period T (typically T= 16 hours for daytime periods, T = 8 hours for night-time periods). This is the sound level that is equivalent to the average energy of noise recorded over a given period.
$L_{n,T}$	The noise level exceeded for n% of the time over a given period T. e.g. L_{90} , the noise level exceeded for 90% of the time (background noise level).
L_{max}	The maximum noise level measured.
R_w (dB)	The weighted (w) Sound reduction index (R), a single figure rating of the laboratory airborne sound insulation performance of a construction, usually measured across the frequency range 100 – 3150 Hz. The higher the value, the greater the sound insulation provided by the construction.

APPENDIX B – Measured Noise Levels

