SANDY BROWN

Consultants in Acoustics, Noise & Vibration

14109-R02-F

28 June 2017

UCL Laws

Environmental noise survey report and plant noise assessment

55 Charterhouse Street, London EC1M 6HA
68 Sackville Street, Manchester M1 3NJ
2 Walker Street, Edinburgh EH3 7LA
87 Caroline Street, Birmingham B3 1UP

T: +44 (0)20 7549 3500
T: +44 (0)161 771 2020
T: +44 (0)131 235 2020
T: +44 (0)121 227 5020

post@sandybrown.com
www.sandybrown.com

Sandy Brown Associates LLP
Registered in England & Wales No. OC 307504

Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	22 Apr 14		Philip Owen	Andrew Long
B	31 Jul 14		Chris Springthorpe	Andrew Long
C	10 Feb 17		Jonathan Riley	Daryl Prasad
D	9 May 17	Updated plant attenuation measures	Jonathan Riley	Daryl Prasad
E	19 Jun 17	Revised flue extract fan	Jonathan Riley	Daryl Prasad
F	28 Jun 17	Updated plant drawings	Jonathan Riley	Daryl Prasad

Summary

Sandy Brown has been commissioned by University College London to provide acoustic advice in relation to the proposed development at Bentham House.

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

The noise survey was performed between 14:30 on 7 April 2014 and 10:50 on 11 April 2014.

The minimum background sound levels measured during the survey were $L_{A90,5min}$ 53 dB during the daytime and $L_{A90,5min}$ 54 dB during the evening and $L_{A90,5min}$ 54 dB at night.

Based on the requirements of the Camden 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 $L_{Aeq,15min}$ 48 dB during the daytime, and $L_{Aeq,15min}$ 49 dB during the evening and night for normally operating plant. Noise levels resulting from emergency plant must not exceed $L_{Aeq,15min}$ 58 dB during the daytime, and $L_{Aeq,15min}$ 59 dB during the evening and night.

These limits are cumulative, and apply with all plant 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.

The proposed building services plant has been assessed in terms of the noise emissions from their operation to the top level window of the Hilton hotel, the worst affected noise sensitive receptor.

The noise assessment indicates that the proposed units will comply with the daytime, evening and night-time noise limits.

Contents

1 Introduction

Sandy Brown has been commissioned by University College London (UCL) to provide acoustic advice in relation to the proposed development at Bentham House, which contains UCL Laws faculty.

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.

2 Site description

2.1 The site and its surrounding

Bentham House and the Gideon Schreier Wing (formally Hillel House) form the UCL Laws faculty. The two building have been modified so that there is access between the two buildings from first floor level upwards.

The Gideon Schreier Wing is located facing Endsleigh Street, with Bentham House located at the junction of Endsleigh Gardens and Endsleigh Street in the London Borough of Camden, WC1H 0EG.

The site location in relation to its surroundings is shown in Figure 1 with the UCL site highlighted in blue.

Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Adjacent premises

The surrounding buildings to the development site are residential use buildings, with either private residences or hotel accommodation.

It is proposed that the building services plant will be installed at roof level to the rear of the building. As such, the worst affects noise sensitive receiver will be the Hilton Hotel. This is highlighted in green 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

A 5 day unattended continuous noise logging survey was undertaken at the site to determine the existing background noise levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 5 minute periods between 14:30 on 7 April 2014 and 10:50 on 11 April 2014.

The measurement positions used during the survey are indicated in Figure 1, denoted by 'A' and 'B' respectively. Position A was chosen to be reasonably representative of the ambient levels experienced upon the Endsleigh Street facade, with position B chosen to be reasonably representative of the background noise levels experienced by the Hilton Hotel.

Position A was located upon the roof top of Bentham House with a full view of the surrounding road. The microphone was positioned so that it was 1.5 m above the roof level and at least 3 m from other nearby reflective surfaces.

Position B was located upon the roof top of the Gideon Schreier Wing ground floor lecture theatre in a position that overlooked the courtyard. The microphone was positioned so that it was 1.5 m above the roof level and at least 3 m from other nearby reflective surfaces. The position was chosen as it is approximately the same distance from the existing noise producing equipment as the nearest noise sensitive window and therefore considered to be representative of the background noise levels at the nearest noise sensitive property.

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the survey consisted of building services noise from existing plant located within the Bentham House courtyard and the rooftop of the Hilton Hotel.

Less significant noise sources included traffic along Endsleigh Street and Endsleigh Gardens, pedestrians talking and aircraft flyovers.

4.2 Unattended measurement results

The results of the unattended noise measurements performed at the site are summarised in the following tables. Graphs showing the results of the unattended measurements are provided in Appendix B of this report.

4.2.1 Position A – Endsleigh Street

The day and night time ambient noise levels measured during the unattended survey at position A 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 (23:00–07:00) $L_{Aeq,8h}$ (dB)
7 April 2014	-	60	58
8 April 2014	61	59	57
9 April 2014	61	59	57
10 April 2014	61	59	58
Average	61	59	58

* Measurement not made over full period due to monitoring start and end time; not included in the average

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) $L_{A90,5min}$ (dB)	Evening (19:00-23:00) $L_{A90,5min}$ (dB)	Night (23:00-07:00) $L_{A90,5min}$ (dB)
7 April 2014	56 *	55	55
8 April 2014	56	55	54
9 April 2014	55	55	54
10 April 2014	56	55	55
11 April 2014	56 *	-	-

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

4.2.2 Position B – Courtyard

The day and night time ambient noise levels measured during the unattended survey at position B are presented in Table 3.

Table 3 Ambient noise levels measured during the survey

Date	Daytime (07:00–19:00)	Evening (19:00-23:00)	Night (23:00–07:00)
	$L_{Aeq,12h}$ (dB)	$L_{Aeq,4h}$ (dB)	$L_{Aeq,8h}$ (dB)
7 April 2014	-	56	55
8 April 2014	57	55	55
9 April 2014	56	55	55
10 April 2014	56	55	55
Average	56	55	55

* Measurement not made over full period due to monitoring start and end time; not included in the average

The minimum background sound levels measured during the unattended survey are given in Table 4.

Table 4 Minimum background sound levels measured during the survey

Date	Daytime (07:00–19:00)	Evening (19:00-23:00)	Night (23:00-07:00)
	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)
7 April 2014	54 *	54	54
8 April 2014	54	54	54
9 April 2014	53	54	54
10 April 2014	53	54	54
11 April 2014	54 *	-	-

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

The lowest background sound levels measured during the survey were $L_{A90,5min}$ 55 dB during the daytime, $L_{A90,5min}$ 55 dB during the evening and $L_{A90,5min}$ 54 dB at night.

5 Building services noise egress limits

5.1 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 as Table 5.

Table 5 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	55 dBA L_{Aeq}

Camden Council also requires that noise due to the operation of emergency and standby plant does not increase the background noise level by more than 5 dB.

5.2 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 most affected windows of the nearest noise sensitive premises should not exceed 5 dB below the minimum external noise level. These limits are set out in Table 6.

Table 6 Plant noise limits at 1 m from the nearest noise sensitive premises for plant other than emergency plant

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises (dB)
Daytime (07:00-19:00)	48
Evening (19:00-23:00)	49
Night-time (23:00-07:00)	49

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 5 dB below those set out above.

The limiting sound pressure levels at 1 m from the nearest noise sensitive premises resulting from the operation of emergency plant are presented in Table 7.

Table 7 Plant noise limits at 1 m from the nearest noise sensitive premises for emergency plant

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises (dB)
Daytime (07:00-19:00)	58
Evening (19:00-23:00)	59
Night-time (23:00-07:00)	59

6 Noise egress assessment

6.1 Proposed plant locations

There are a total of 12 external units proposed for UCL Laws; 6 on the rooftop of Bentham House, and 6 on the rooftop of the Gideon Schreier Wing. There is also a boiler flue fan located in a lower level plantroom that discharges at roof level. Figure 2 and Figure 3 indicate the locations of the plant items on the Bentham House and Gideon Schreier Wing rooftops respectively.

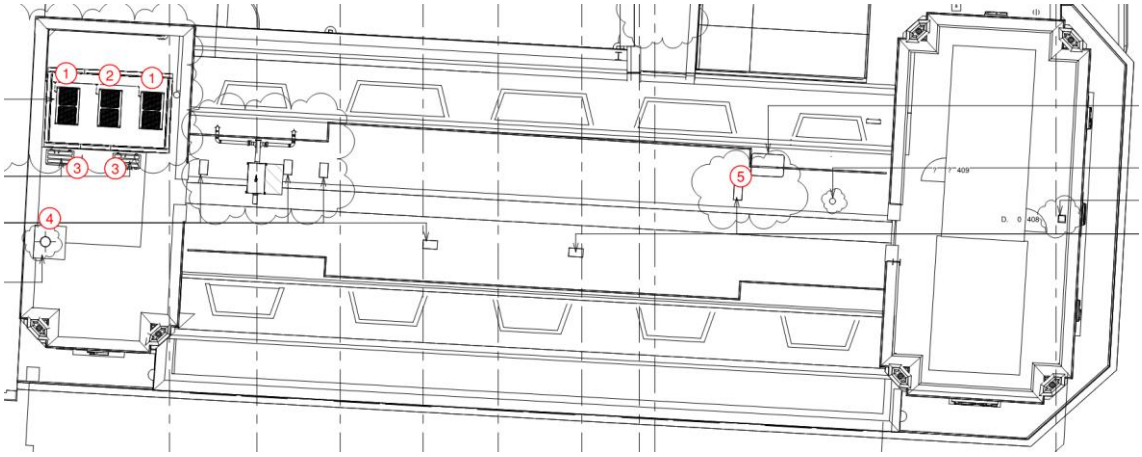


Figure 2 Bentham House rooftop plant layout

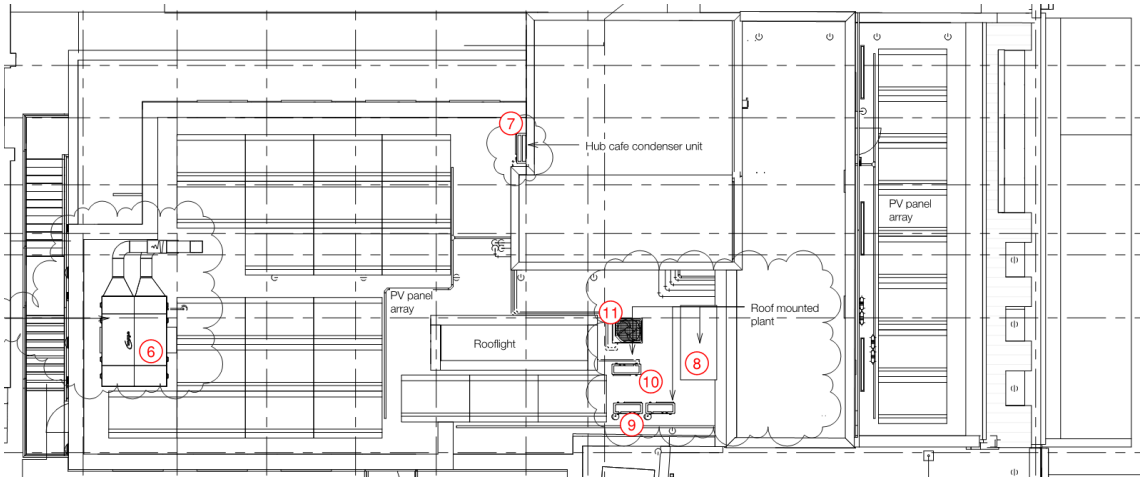


Figure 3 Gideon Schreier Wing rooftop plant layout

The window of the Hilton Hotel worst affected by the plant on the Bentham House rooftop is located on the north-west facade and is indicated by the number '1' in Figure 1. The window of the Hilton Hotel worst affected by the plant on the roof of the Gideon Schreier Wing is on the south-west facade and is indicated by the number '2' in Figure 1. Both of these windows are located at the highest level of the Hilton Hotel.

6.2 Rooftop plant noise levels

Manufacturer's data has been provided in either sound power levels or sound pressure levels at 1 metre. These are shown in Table 8 and Table 9 respectively.

Table 8 Rooftop plant sound power data

Unit ref.	Unit	No. units		Sound power level (dB, re 1 pW) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
3	Daikin RXYSCQ4TV1	2		-	70	67	68	64	55	49	43
4	BIFCL040K2-A5/13	1	Outlet	81	82	88	86	88	85	80	75
5	Nuaire	1	Inlet	63	76	69	64	56	57	56	61
	TRCS 350-41		Outlet	63	76	72	67	59	61	60	65
6	Nuaire XBC75-H-LESWP	1	Breakout	62	54	51	49	40	32	33	25
			Intake	68	67	66	69	62	56	50	46
			Supply	69	65	59	66	63	53	37	37
			Discharge	72	71	66	74	73	65	58	54
			Extract	66	60	58	60	55	50	46	45
9	Daikin RXYSCQ4TV1	2		-	70	67	68	64	55	49	43
10	Daikin RXYSCQ4TV1	1		-	70	67	68	64	55	49	43
11	Daikin RYYQ8T	1		-	77	78	76	73	67	63	59

Table 9 Rooftop plant sound pressure level at 1 metre

Unit ref.	Unit	No. units		Sound pressure level at 1m (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
1	Daikin RYM016T	2	Low noise mode 1	63	62	61	56	51	48	42	36
2	Daikin RYM014T	1	Low noise mode 1	62	65	61	56	51	47	44	35
7	Daikin 2MXS50H (Cooling)	1		57	54	50	46	42	37	33	26
8†	FG Wilson P55-3	1		72	63	58	53	51	49	49	47

† Denotes emergency plant item

6.3 Mitigation

6.3.1 Plant enclosure

In order to control noise breakout from the units on the east rooftop of Bentham House the three condenser units have been placed within an open acoustic enclosure. The location of the enclosure is indicated in Figure 2 and is shown in detail in Figure 4.

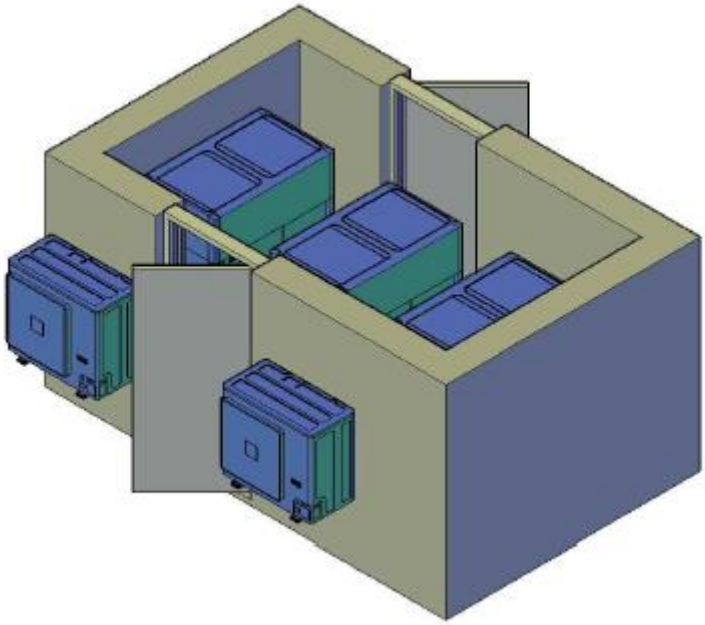


Figure 4 Layout of acoustic enclosure on east rooftop of Bentham House

The static insertion loss of the louvres making up the acoustic enclosure is given in Table 10.

Table 10 Minimum static insertion loss for proposed acoustic louvres to enclosure

	Octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic louvres static insertion loss	9	11	13	11	10	13	11	11

6.3.2 Flue extract fan

A flue extract fan is to be located in the Lower Ground Floor Boiler Room. A 1500 mm attenuator is to be installed vertically within the internal riser at Level 5.

The minimum insertion loss values for the attenuator are shown in Table 11. The 1500 mm long attenuator should readily achieve these requirements.

Table 11 Minimum dynamic attenuator insertion loss, dB

	Octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Flue attenuator dynamic insertion loss	0	1	15	18	23	21	16	9

6.4 Assessment

6.4.1 Noise level

An assessment of the noise levels due to the mechanical services plant has been carried out to ascertain the predicted noise level at 1 m external to the worst affected windows of the nearest noise sensitive premises, taking into account the proposed attenuation measures. The resultant noise levels are given in Table 12.

Table 12 Predicted noise level at Hilton Hotel without noise mitigation measures

Assessment location	Predicted noise level
North-west facade	L_{Aeq} 46 dB
South-west facade (no emergency plant)	L_{Aeq} 44 dB
South-west facade (with emergency plant)	L_{Aeq} 50 dB

It can be seen from Table 12 that the noise levels at the facade of the Hilton Hotel due to all sources comply with the Camden Council criteria. No further mitigation measures are required.

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 lowest background noise levels were $L_{A90,5min}$ 53 dB during the daytime and $L_{A90,5min}$ 54 dB during the evening and $L_{A90,5min}$ 54 dB at night.

Based on the requirements of the Camden 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 $L_{Aeq,15min}$ 48 dB during the daytime, and $L_{Aeq,15min}$ 49 dB during the evening and night for normally operating plant. Noise levels resulting from emergency plant must not exceed $L_{Aeq,15min}$ 58 dB during the daytime, and $L_{Aeq,15min}$ 59 dB during the evening and 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 5 dB more stringent than those set out above.

An assessment of the proposed plant items associated with the development has been carried out. As long as the recommended mitigation measures are incorporated within the design, the proposed plant items are expected to comply with the relevant noise limits.

Appendix A

Survey details

Equipment

Two Svantek SVAN 957 sound level meters 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
957A				
Sound level meter	SVAN957/12327	Svantek	23 Oct 15	1310490
Microphone	ACO7052H/43273	Svantek	23 Oct 15	1310490
Calibrator	SV30A/7451	Svantek	23 Oct 15	1310484
957B				
Sound level meter	SVAN957/12326	Svantek	15 Dec 15	1312599
Microphone	ACO7052H/36733	Svantek	15 Dec 15	1312599
Calibrator	SV30A/10931	Svantek	15 Dec 15	1312592

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

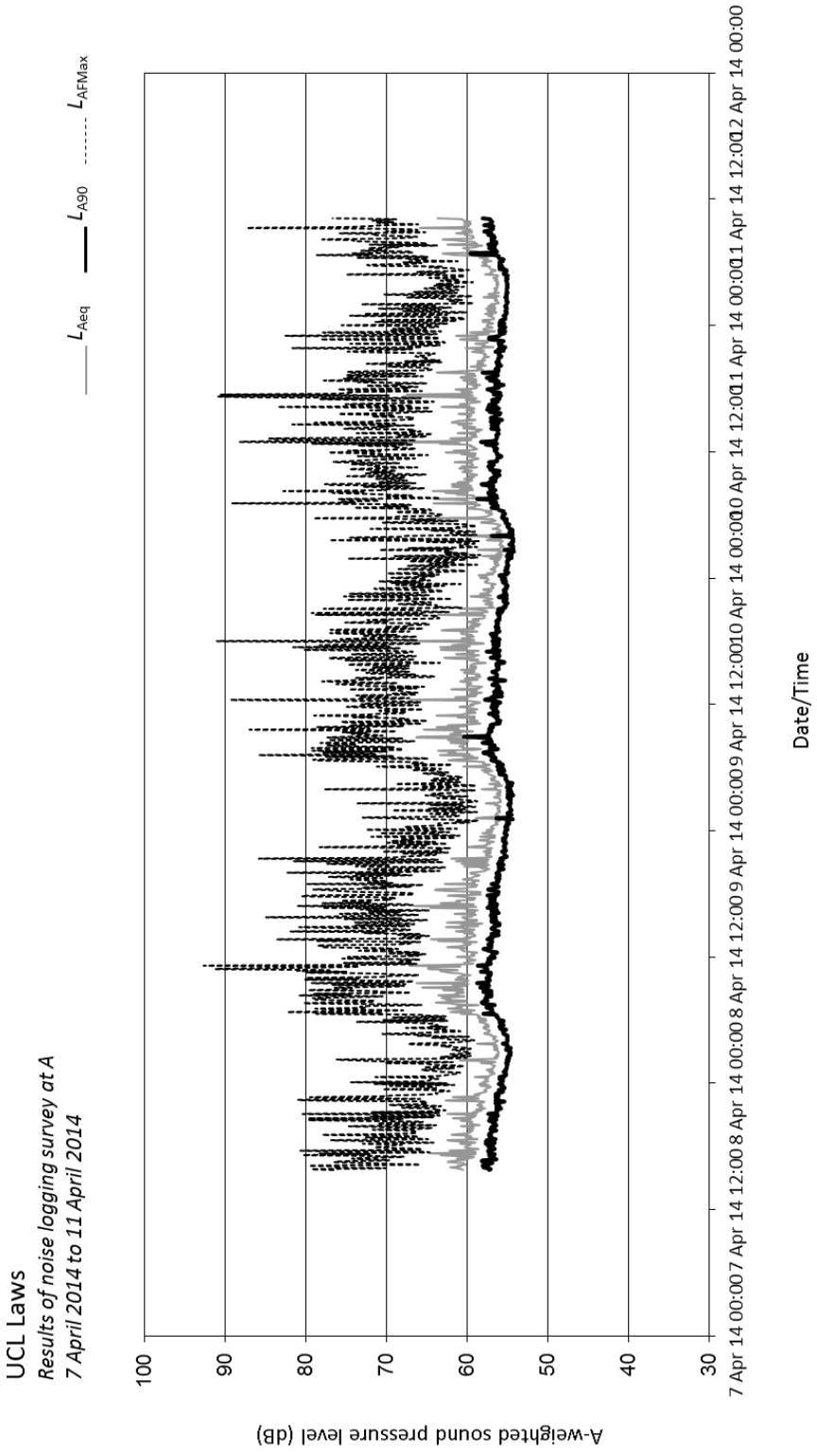
During the unattended noise measurements between 7 April 2014 and 11 April 2014, weather reports for the area indicated that temperatures varied between 4°C at night and 17°C during the day, and the wind speed was generally less than 5 m/s.

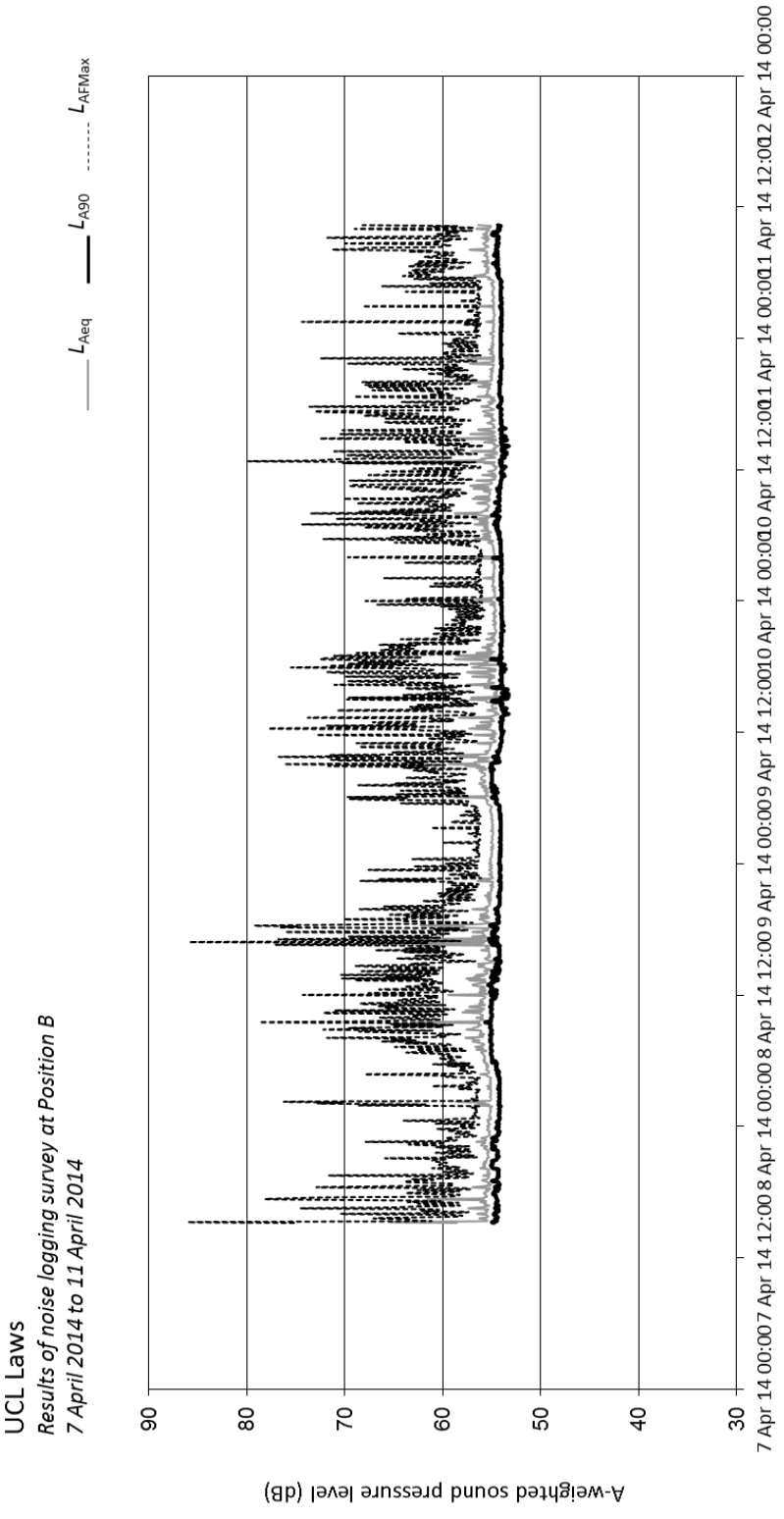
Rain showers occurred on the 7 April 2014 however, the survey duration was sufficiently long to include periods unaffected by adverse weather. These measurements are consequently considered to have obtained a representative sample of noise data.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Locations A and B


UCL Laws
Results of noise logging survey at A
7 April 2014 to 11 April 2014
LAeq
LA90
LAFMax
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
7 Apr 14 00:00
7 Apr 14 12:00
8 Apr 14 00:00
8 Apr 14 12:00
9 Apr 14 00:00
9 Apr 14 12:00
10 Apr 14 00:00
10 Apr 14 12:00
11 Apr 14 00:00
11 Apr 14 12:00
12 Apr 14 00:00
Date/Time


UCL Laws
Results of noise logging survey at Position B
7 April 2014 to 11 April 2014
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
90
80
70
60
50
40
30
7 Apr 14 00:00
7 Apr 14 12:00
8 Apr 14 00:00
8 Apr 14 12:00
9 Apr 14 00:00
9 Apr 14 12:00
10 Apr 14 00:00
10 Apr 14 12:00
11 Apr 14 00:00
11 Apr 14 12:00
12 Apr 14 00:00
Date/Time