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Project:

UCL 31 Tavistock Square WC1

Title:

Noise Survey and Plant Noise Assessment Report

quietly moving forward

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Report Title	UCL 31 Tavistock Square WC1 Noise Survey and Plant Noise Assessment Report
Reference	RK/EC12512-002
Version	ISSUE
Issue Date	18 December 2012
Client	Fowler Martin
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CONTENTS:

1 INTRODUCTION

1.01 Environmental Equipment Corporation Limited has been commissioned by Fowler Martin to undertake a background noise survey at UCL 31 Tavistock Square WC1, with a view to ascertaining prevailing background noise levels for the immediate vicinity.

1.02 Proposals are being submitted to the London Borough of Camden to install external air conditioning and boiler plant to the rear garden of the property. Noise levels from the plant need to be assessed as part of the planning application and are therefore addressed in this report.

1.03 This report is prepared solely for Fowler Martin. Environmental Equipment Corporation Ltd accepts no responsibility for its use by any third party.

2 SITE

2.01 31 Tavistock Square is located in Bloomsbury, within walking distance of London Euston, Goodge Street and Russell Square Underground Stations. Appendix A shows a plan of the proposed roof layout and notes indicating properties in the surrounding area.

2.02 The nearest noise sensitive properties are those immediately to the rear on Gordon Square, at approximately 10m distance.

3 MEASUREMENTS

3.01 Background noise levels have been measured over an extended period at a suitable location, representative of the immediate noise environment, as shown on the site plan in Appendix A.

3.02 The equipment was set up to integrate sound levels over 5 minute intervals between 1045hrs, Wednesday 5th December and 0835hrs, Thursday 6th December 2012.

3.03 Existing plant was in operation in the rear garden of the adjacent 30 Tavistock Square, and so the measurement location was selected to minimise any influence this may have had on the measurements.

3.04 Levels were recorded as A weighted L_{eq}, L_{max}, L_{10} and L_{90}.

3.05 Weather conditions during the survey were calm and mild with no discernible wind, therefore giving a reasonable indication that noise levels would not have been adversely affected and are a reasonable representative sample.

4 EQUIPMENT

4.01 Equipment for the survey was as follows:-

- Brüel & Kjær type 2250 Light Integrating Sound Level Meter conforming to Class 1 BS EN 61672, Type 1 BS EN 60804 & BS EN 60651: 1994.
- Brüel & Kjær Condenser Microphone type 4950.
- Brüel & Kjær Outdoor Microphone, type 4952/UA1679.
- Tripod.

4.02 The equipment holds current UKAS or equivalent accreditation and serial numbers as follows:

Sound Level Meter B&K2250	Serial No.	2766725
	Calibration Date	14th June 2011
	Cal Certificate No.	C1104527
½" Condenser Mic. B&K 4950	Serial No.	2742570
	Calibration Date	14th June 2011
	Cal Certificate No.	C1104527
Calibrator B&K4231	Serial No.	1761563
	Calibration Date	31st October 2012
	Cal. Certificate No.	01079/1

N.B. Copies of calibration certificates are available upon request.

4.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

5 RESULTS

5.01 A list of the levels measured is included in Appendix B and represented graphically in Appendix C.

5.02 Inspection of the noise data suggests the background noise climate is already dominated by existing plant, although the data shows periods when this plant noise is minimised. These lowest background noise levels are used in our assessment.

5.03 A summary of the time averaged ambient level and lowest measured background levels are shown in Table 5.1, below.

Period	$L_{Aeq,T}$ – dB	L_{A90} – dB
Day time (0700-1900 hrs)	69	46
Evening (1900-2300 hrs)	52	47
Night-time (2300-0700 hrs)	51	44

Table 5.1: Measured Ambient and Lowest Background Noise Levels

6 DISCUSSION

6.01 The London Borough of Camden Planning Policy DP28, as described in their Local Development Framework (LDF) document states the following noise levels from plant and machinery at which planning permission will not be granted:

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) $<L_{A90}$
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) $<L_{A90}$
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) $<L_{A90}$
Noise at 1 metre external to sensitive façade where L_{A90}>60dB	Day, evening and night	0000-2400	55dB L_{Aeq}

6.02 "Noise sensitive development", according to the LDF, includes housing, schools and hospitals as well as offices, workshops and open spaces.

6.03 It is not considered that the proposed plant is tonal or intermittent enough to attract attention, and therefore the applicable criteria for this application will be 5dB below the lowest background noise levels of 46, 47 and 44 dB(A) for the respective day, evening and night-time periods.

6.04 It is assumed that there is scope for the plant to be in operation at any time, including at night, therefore, noise emitted from the proposed plant should not exceed 39dB(A) at 1m external of the nearest sensitive window.

7 PLANT ASSESSMENT

7.01 The proposed plant consists of 1 no Daikin RZQ71D3V1 and 1 no Daikin RX50GV condensers. The manufacturer's published noise level for these units is 48 and 47 dB(A) at 1m free-field on "high" settings, respectively.

7.02 2 no Broag Quinta 65 wall mounted boilers will also be installed in a new fully enclosed boiler room with louvred door, with common vertical flue discharging externally. The only noise data available for the boiler is "<48dB(A)" at 1m. As is typical, noise data for the flue termination is unavailable. From experience, and bearing in mind the noise level at 1m from the boiler, we would assume a cumulative noise level of 55dB(A) at 1m from the common flue to be a reasonable "worst case" assumption.

7.03 Allowing for distance attenuation over 10m, and the screening of the condensers from the properties by the boundary wall, the cumulative plant noise level outside the rear windows of the properties on Gordon Square have been calculated as indicated below.

Element	Level	Comments
Daikin RZQ71D3V1	48 dB(A)	SPL at 1m
Distance Attenuation	- 17 dB	10m parallelepiped propagation
Directivity	+3	Wall reflection
Acoustic Screening	-5	Boundary wall (conservative)
Propagated Noise	**29 dB(A)**	1m outside residential windows

Table 7.1: Daikin RZQ71D3V1 Plant Noise Calculation

Element	Level	Comments
Daikin RX50GV	47 dB(A)	SPL at 1m
Distance Attenuation	- 18 dB	10m parallelepiped propagation
Directivity	+3	Wall reflection
Acoustic Screening	-5	Boundary wall (conservative)
Propagated Noise	**27 dB(A)**	1m outside residential windows

Table 7.2: Daikin RX50GV Plant Noise Calculation

Element	Level	Comments
Boiler flue	55 dB(A)	SPL at 1m (common flue)
Distance Attenuation	- 20 dB	10m point source propagation
Directivity	+3	Wall reflection
Directionality	-3	Vertical discharge
Acoustic Screening	0	Assumed above boundary wall height
Propagated Noise	**35 dB(A)**	1m outside residential windows

Table 7.3: Boiler External Flue Noise Calculation

Element	Level	Comments
Cumulative Source Noise	65dB(A)	Calculated Sound Power Level of 2 boilers
Correction for room volume (Assumed $16m^3$)	-12	-10 log V
Correction for reverberation time (assumed 1 second)	0	+10 log T
	+14	10 log (4) + 10 log (0.16)
Reverberant Sound Pressure Level	67dB(A)	Boiler Room
Minimum 103mm brick + louvre	-10*	SRI assumption for poor quality build + louvred door*
Correction for area/conversion to sound power	+8	10 log S (3m x 2.8m)
Distance attenuation	-20	10m
Correction for Sound pressure	-8	
Direct field correction	-6	
Acoustic Screening	-	None assumed
Propagated Noise	**31dB(A)**	outside residential window

Table 7.4: Boiler Room Breakout Noise Level Calculation

*the louvred door is screened by the boundary wall, which has not been accounted for in the above calculation. Therefore the reduction from the boiler room construction will be higher, and the resultant noise level lower

Element	Level
Daikin RZQ71D3V1	29 dB(A)
Daikin RX50GV	27 dB(A)
Boiler flues	35 dB(A)
Boiler Room breakout	31 dB(A)
Cumulative Noise	**38 dB(A)**

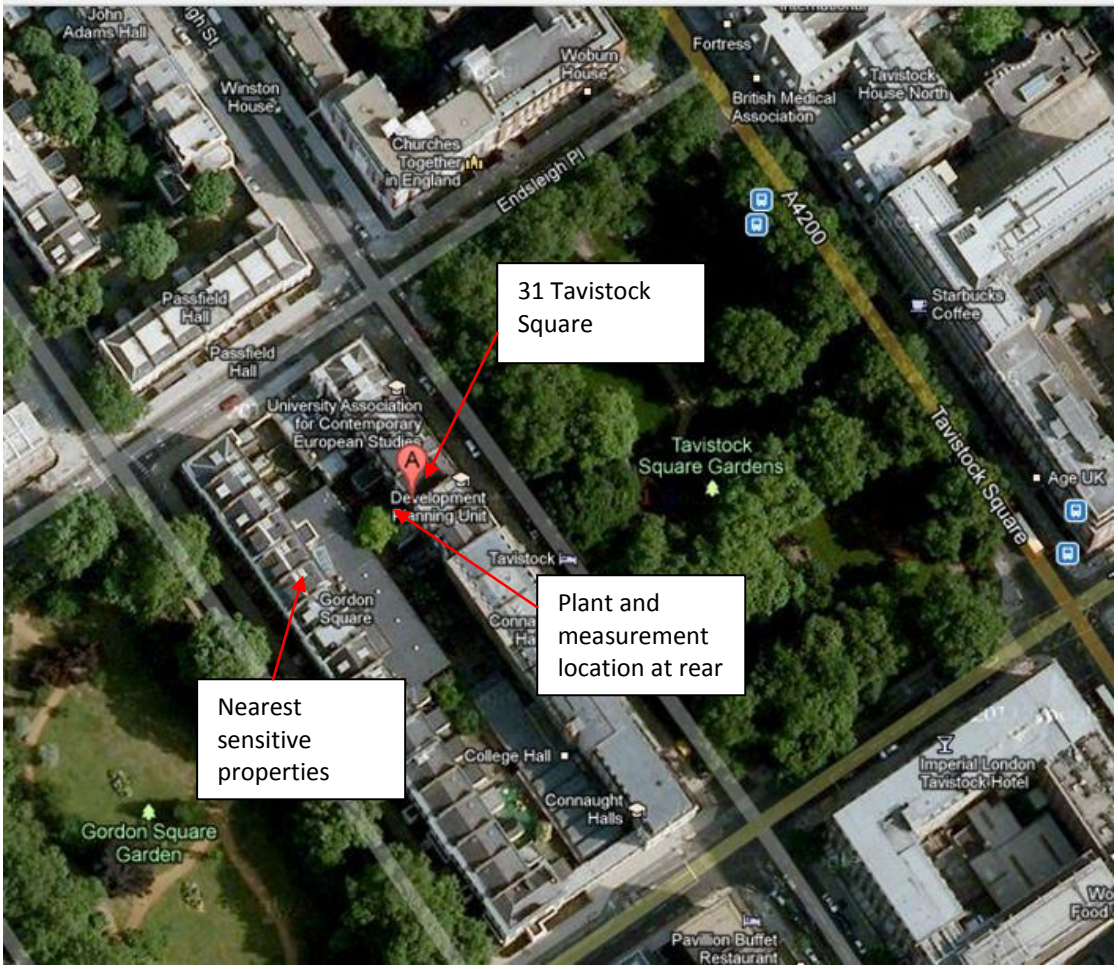
Table 7.5: Cumulative Plant Noise Calculation

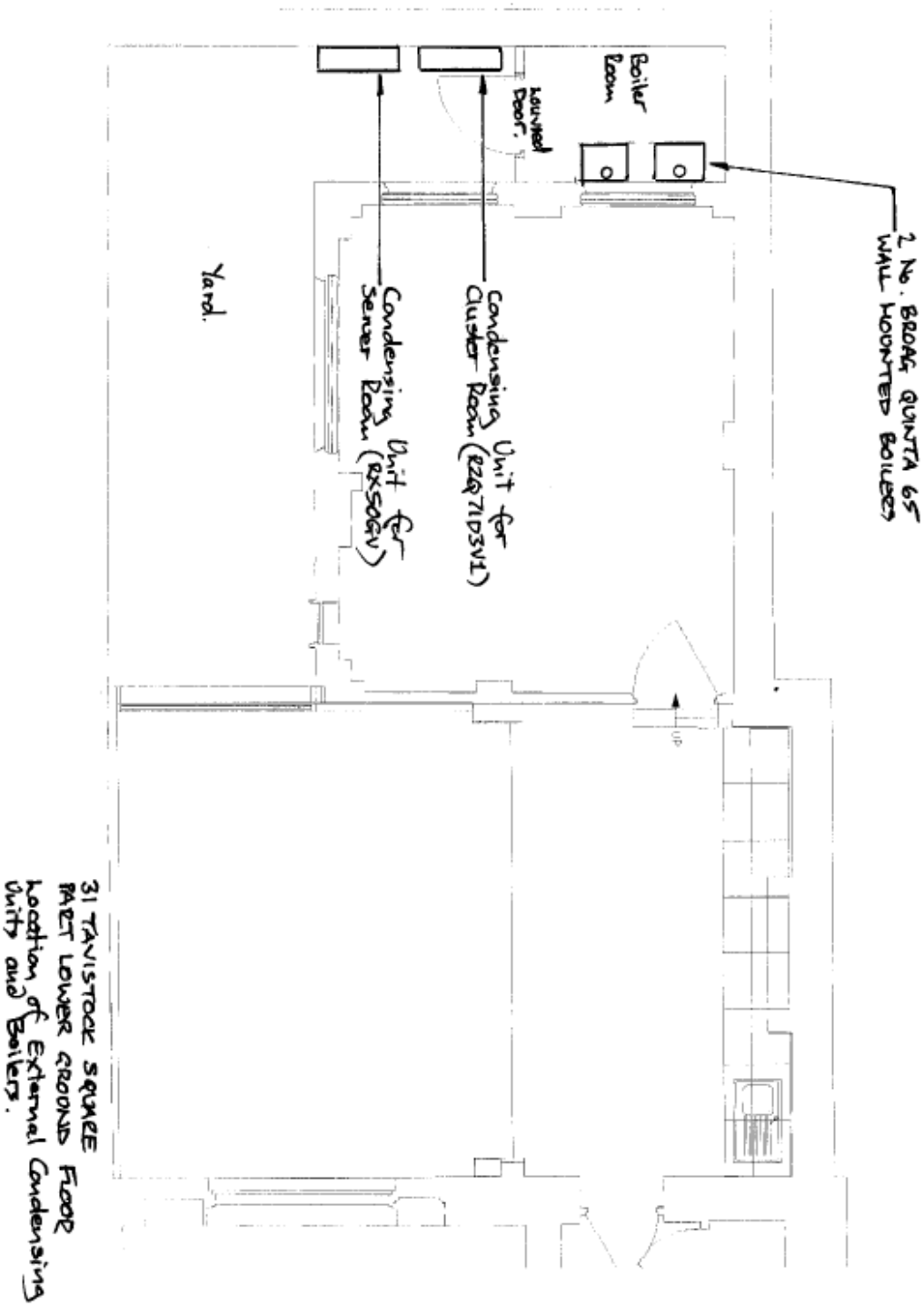
7.04 As discussed in section 6 of this report, the applicable noise level design criterion for the proposed new plant has been set at 39 dB(A) outside the nearest noise sensitive windows.

7.05 The calculated plant noise levels are less than the design criterion and therefore satisfy the planning requirements of the London Borough of Camden.

APPENDIX A

SITE PLAN
&
MEASUREMENT LOCATION





APPENDIX B

SURVEY RESULTS
(TABULAR)

EC 12512 - UCL 31 Tavistock Square

Fowler Martin

24 Hour Noise data

Time	L_{Aeq}	L_{Amax}	L_{A90}
10:45	90	110	51
10:45	60	82	51
10:50	52	65	51
10:55	53	61	51
11:00	57	78	52
11:05	52	56	51
11:10	52	55	50
11:15	53	64	51
11:20	55	71	51
11:25	53	60	51
11:30	52	59	51
11:35	52	61	51
11:40	52	58	51
11:45	52	54	51
11:50	54	72	51
11:55	53	62	51
12:00	54	64	51
12:05	53	58	51
12:10	52	60	50
12:15	53	67	51
12:20	52	65	50
12:25	50	59	48
12:30	54	62	52
12:35	52	58	51
12:40	52	56	51
12:45	53	71	51
12:50	54	68	51
12:55	53	60	51
13:00	53	58	51
13:05	60	79	51
13:10	63	72	53
13:15	53	56	52
13:20	57	69	53
13:25	53	59	52
13:30	54	61	52
13:35	54	66	53
13:40	55	65	53
13:45	55	64	53
13:50	53	58	51
13:55	52	60	51
14:00	52	61	51
14:05	52	59	50
14:10	52	56	51
14:15	52	63	51
14:20	53	64	51
14:25	52	60	51
14:30	52	56	50
14:35	52	56	50

Time	L_{Aeq}	L_{Amax}	L_{A90}
14:40	52	63	49
14:45	51	57	49
14:50	53	57	52
14:55	54	67	51
15:00	52	61	51
15:05	52	63	51
15:10	52	58	50
15:15	53	64	51
15:20	52	56	51
15:25	52	55	50
15:30	52	55	50
15:35	53	64	51
15:40	52	59	51
15:45	52	55	51
15:50	53	64	51
15:55	54	65	51
16:00	53	58	51
16:05	52	59	51
16:10	52	59	51
16:15	53	66	51
16:20	53	58	52
16:25	52	58	51
16:30	52	60	51
16:35	53	62	51
16:40	53	64	51
16:45	51	55	50
16:50	52	58	51
16:55	51	60	50
17:00	52	59	51
17:05	53	63	51
17:10	52	58	50
17:15	52	57	51
17:20	52	57	50
17:25	53	61	51
17:30	51	56	48
17:35	53	69	48
17:40	53	59	51
17:45	52	62	51
17:50	51	54	50
17:55	51	56	50
18:00	52	58	50
18:05	52	61	51
18:10	52	54	50
18:15	52	62	50
18:20	52	56	50
18:25	52	59	50
18:30	51	57	50
18:35	52	61	51

EC 12512 - UCL 31 Tavistock Square

Fowler Martin

24 Hour Noise data

Time	L_{Aeq}	L_{Amax}	L_{A90}
18:40	52	58	51
18:45	54	65	50
18:50	53	61	50
18:55	52	59	50
19:00	52	62	50
19:05	52	58	50
19:10	54	73	50
19:15	53	60	51
19:20	51	57	50
19:25	52	59	50
19:30	53	63	50
19:35	54	69	51
19:40	55	67	50
19:45	50	57	47
19:50	51	65	48
19:55	55	67	51
20:00	54	69	50
20:05	53	66	50
20:10	51	56	50
20:15	51	54	50
20:20	54	66	50
20:25	54	65	51
20:30	54	71	50
20:35	52	59	50
20:40	52	58	50
20:45	53	68	50
20:50	54	67	50
20:55	52	61	50
21:00	51	64	50
21:05	51	61	50
21:10	52	57	50
21:15	51	61	50
21:20	51	57	50
21:25	51	58	49
21:30	51	60	50
21:35	52	58	51
21:40	51	55	50
21:45	50	55	47
21:50	49	54	47
21:55	53	68	50
22:00	53	63	50
22:05	51	62	50
22:10	53	63	51
22:15	51	55	50
22:20	51	58	50
22:25	52	67	50
22:30	51	57	50
22:35	51	57	50

Time	L_{Aeq}	L_{Amax}	L_{A90}
22:40	51	59	50
22:45	51	55	50
22:50	52	62	50
22:55	51	56	50
23:00	50	53	49
23:05	50	54	49
23:10	51	56	50
23:15	51	55	50
23:20	51	54	49
23:25	53	66	48
23:30	49	54	46
23:35	51	56	50
23:40	51	55	50
23:45	50	54	49
23:50	50	54	49
23:55	51	56	49
00:00	52	63	49
00:05	50	55	49
00:10	50	53	49
00:15	53	67	49
00:20	50	53	49
00:25	50	54	49
00:30	50	57	49
00:35	50	57	49
00:40	49	55	46
00:45	48	53	45
00:50	51	54	50
00:55	50	54	49
01:00	50	53	49
01:05	50	56	49
01:10	51	62	49
01:15	50	53	49
01:20	50	53	49
01:25	50	53	49
01:30	50	53	48
01:35	50	52	48
01:40	49	52	48
01:45	50	54	49
01:50	50	53	49
01:55	48	53	44
02:00	50	62	45
02:05	50	54	49
02:10	50	52	48
02:15	50	54	49
02:20	50	53	49
02:25	50	61	49
02:30	50	53	48
02:35	50	53	48

EC 12512 - UCL 31 Tavistock Square

Fowler Martin

24 Hour Noise data

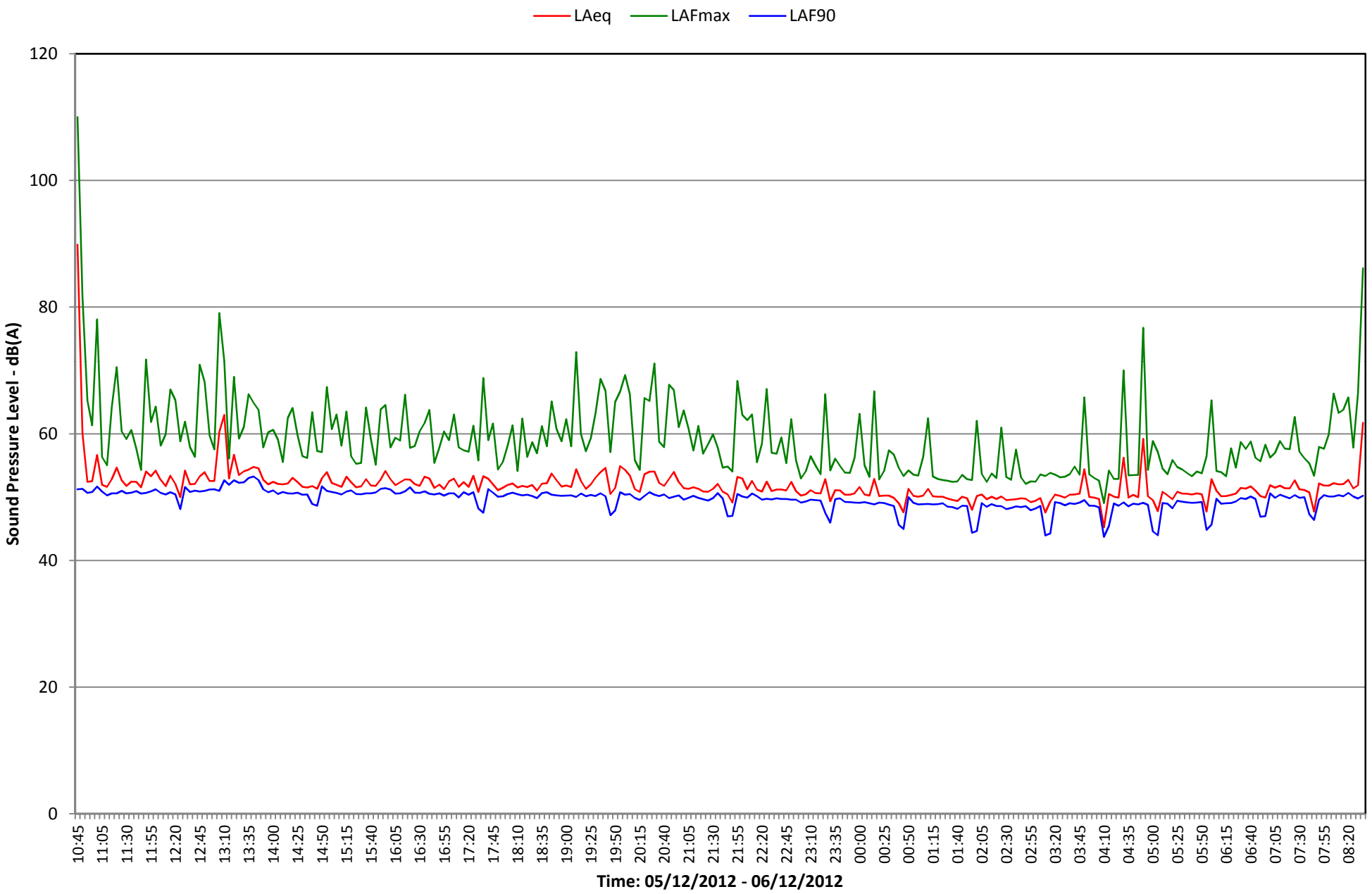
Time	L_{Aeq}	L_{Amax}	L_{A90}
02:40	50	58	49
02:45	50	53	48
02:50	50	52	49
02:55	49	52	48
03:00	49	52	48
03:05	50	54	49
03:10	48	53	44
03:15	49	54	44
03:20	50	54	49
03:25	50	53	49
03:30	50	53	49
03:35	50	54	49
03:40	50	55	49
03:45	51	54	49
03:50	54	66	50
03:55	50	54	49
04:00	50	53	49
04:05	50	53	48
04:10	45	49	44
04:15	50	54	45
04:20	50	53	49
04:25	50	53	49
04:30	56	70	49
04:35	50	53	49
04:40	50	53	49
04:45	50	54	49
04:50	59	77	49
04:55	50	54	49
05:00	50	59	45
05:05	48	57	44
05:10	51	54	49
05:15	50	54	49
05:20	50	56	48
05:25	51	55	49
05:30	51	54	49
05:35	51	54	49
05:40	50	53	49
05:45	51	54	49
05:50	50	54	49
05:55	48	56	45
06:00	53	65	46
06:05	51	54	50
06:10	50	54	49
06:15	50	53	49
06:20	50	58	49
06:25	51	55	49
06:30	51	59	50
06:35	51	58	50

Time	L_{Aeq}	L_{Amax}	L_{A90}
06:40	52	59	50
06:45	51	56	50
06:50	50	56	47
06:55	50	58	47
07:00	52	56	51
07:05	51	57	50
07:10	52	59	50
07:15	51	58	50
07:20	51	58	50
07:25	53	63	50
07:30	51	57	50
07:35	51	56	50
07:40	51	55	47
07:45	48	53	46
07:50	52	58	50
07:55	52	58	50
08:00	52	60	50
08:05	52	66	50
08:10	52	63	50
08:15	52	64	50
08:20	53	66	51
08:25	51	58	50
08:30	52	66	50
08:35	62	86	50

APPENDIX C

SURVEY RESULTS
(GRAPHICAL)

Noise Level Time History @ UCL 31 Tavistock Square



APPENDIX D

GLOSSARY OF TECHNICAL TERMS

TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (SWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level a 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

L_{90} This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.

L_{10} This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

L_{eq} The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L_{eq} level tends to be dominated by the higher noise levels measured.