clarke saunders | acoustics

specialist consultants

REPORT AS9324.181008.NIA 1.2

80 CHARLOTTE STREET, LONDON

NOISE IMPACT ASSESSMENT (ADDENDUM)

UPDATED OCTOBER 2018

Prepared: 30 October 2018

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List of Attachments

1.0 INTRODUCTION

The addendum assessment provides an update on acoustic matters given amendments proposed to the approved scheme at 80 Charlotte Street and 65 Whitfield Street (the Site). Planning permission for the full redevelopment of the Site was granted in March 2012 under application reference 2010/6873/P. The submission was accompanied by an Acoustic Statement (dated December 2010) which considered the prevailing noise climate at the Site and concluded that it would be suitable for residential development. The purpose of this addendum assessment is to update the environmental noise survey to ensure that any change to the prevailing noise climate, including the plant equipment proposed at the Site, is acceptable given design and noise criteria. The addendum assessment supports a minor material amendment application for additional demolition at the Site, which results in a number of design changes to the approved scheme.

Vibration levels were measured during the noise surveys and confirmed to have not altered since the previous survey. This assessment does not update the vibration or external building fabric elements of the approved December 2010 Acoustic Statement, as these elements are still current and acceptable.

This report has been updated in October 2018 to reflect revised plant selections and to specifically include reference to Condition 7 of the planning permission. Updated elements are highlighted red for clarity.

2.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at sixth floor roof level of the existing building at the locations shown in site plan AS6171/SP1. Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 09:55 hours on Thursday 19th and 10:40 hours on Monday 23rd November 2015.

These measurements will allow suitable noise criteria to be set for the new building services plant, dependent on hours of operation.

The following equipment was used during the course of the survey:

- 3 no. NTi data logging sound level meters type XL2;
- 1 no. Svantek data logging sound level meter type 958;
- Rion sound level calibrator type NC-74.

The calibration of the sound level meter was verified before and after use. No calibration drift was detected.

The weather during the survey had periods of dry weather with light winds, which made the conditions suitable for the measurement of environmental noise.

Measurements were made generally in accordance with ISO 1996-2:2007 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels*.

Please refer to Appendix A for details of the acoustic terminology used throughout this report.

3.0 RESULTS

Figures AS6171/TH1-TH18 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the measurement position.

4.0 DISCUSSION

The background noise climate at the site is determined by roof-mounted plant on surrounding buildings and road traffic noise in the surrounding streets with occasional aircraft noise.

Measured minimum background noise levels are shown in Table 4.1 below.

Location	Monitoring period	Minimum $L_{A90, 5 mins}$
Chitty Street	07:00 - 23:00 hours	50 dB 10:30 - 10:35, 22/11/15
Charlotte Street		52 dB 07:00 - 07:05, 20/11/15
Howland Street		50 dB 07:00 - 07:05, 22/11/15
Whitfield Street		50 dB 20:35 - 20:40, 21/11/15
Chitty Street	23:00 - 07:00 hours	49 dB 3:40 - 3:45, 23/11/15
Charlotte Street		47 dB 3:00 - 3:05, 20/11/15
Howland Street		50 dB 5:40 - 5:45, 22/11/15
Whitfield Street		48 dB 05:45 - 5:50, 22/11/15

Table 4.1 - Minimum measured background noise levels **[dB ref. 20µPa]**

5.0 DESIGN CRITERIA

5.1 Local Authority Requirements

Condition 4 attached to the planning permission requires new plant to be 5dB below the background level. It states that:

Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the L_{A90}, expressed in dB(A).

It is not expected that tonal noise will be generated by the proposed plant units and so the plant noise emissions criteria that should not be exceeded at the nearest noise sensitive receiver should be set to the proposed levels detailed in Table 5.1.

Location	Monitoring period	$L_{Aeq, T}$
Chitty Street	07:00 - 23:00 hours	45 dB
Charlotte Street		47 dB
Howland Street		45 dB
Whitfield Street		45 dB
Chitty Street	23:00 - 07:00 hours	44 dB
Charlotte Street		42 dB
Howland Street		45 dB
Whitfield Street		43 dB

Table 5.1 - Proposed design noise criteria at noise sensitive receivers **[dB ref. 20µPa]**

Condition 7 stipulates: *Before the relevant use commences, details of the extract ventilating system and air-conditioning plant shall be provided with acoustic isolation and sound attenuation in accordance with the scheme approved by the Council. The acoustic isolation shall thereafter be maintained in effective order to the reasonable satisfaction of the Local Planning Authority.*

Extract ventilation is provided by the air handling units (AHU's) and toilet extract fans (TEF's) which are considered within this report, with cooling provided by air cooled chillers. The AHU's specified have integral atmospheric silencers. Noise emissions to atmosphere are considered below and specific plant items listed. Noise data is listed in Appendix B.

5.2 External Noise Emissions (Emergency Plant)

London Borough of Camden do not currently have a specific design criterion for noise in relation to emergency plant noise emissions.

It is proposed, therefore, to set the design noise criterion for emergency operational plant at the nearest noise sensitive receiver to 10dB above the background noise level, using the noise monitoring data, as shown in Table 5.2.

It should be noted that any standby (as opposed to 'emergency') plant, however, would need to achieve the plant noise emissions criteria detailed in Table 5.1.

Location	24 hour $L_{Aeq, T}$
Chitty Street	59 dB
Charlotte Street	57 dB
Howland Street	50 dB
Whitfield Street	58 dB

Table 5.2 Emergency plant noise criteria at nearest noise sensitive receivers **[dB ref. 20µPa]**

5.3 BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*

The guidance in this document indicates suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this standard are shown in the following table:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 hour}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 hour}$	30 dB $L_{Aeq, 8 hour}$
Work requiring concentration	Executive Office	35-40 dB $L_{Aeq, T}$	-
Work requiring concentration	Open Plan Office	45-50 dB $L_{Aeq, T}$	-

Table 5.3 - Excerpt from BS8233: 2014 **[dB ref. 20µPa]**

6.0 PREDICTED NOISE IMPACT

6.1 Proposed plant

The selected rooftop plant has been confirmed as:

- 3 no. Dalair AHU HSF/26/F
- 1 no. AHU Nuaire XBC15-H-EES
- 2 no. Mitsubishi Climaventa Air cooled Chillers TECS2 SL-CA 0652
- 2 no. Mitsubishi Climaventa Heat Pump ERACS2-Q/SL-CA2622
- 1 no. Mitsubishi Climaventa Heat Pump i-FX-Q2 /SL-CA /1102
- 1 no. Mitsubishi PURY-P450YLM-A VRF Heat Pump Condensers
- 1 no. Mitsubishi PURY-P300YKB-A VRF Heat Pump Condenser
- 1 no. Mitsubishi PURY-P200YLM-A VRF Heat Pump Condenser
- 4 no. Mitsbusihi CAHV-P500YA-HPB Heat Pump Boilers
- 9 no. Enclosed Chilled Water Pumps
- 5 no. Enclosed Wilo Pumps
- 1 no. Spirovent Pressurisation Unit
- 3 no. Nuaire Toilet extract fan
- 2 no. Colt Extract Fan (emergency)
- 1 no. Perkins Silenced Generator (emergency)

Noise levels generated by the plant to be installed are summarised in Appendix B.

6.2 Predicted noise levels

Assessments have been undertaken to the most affected receivers on each road facing all façades of the building.

Due to the complexity of the building interaction in this locale and the likelihood of noise both reflecting off and being screened by the proposed plant and surrounding buildings, 3D noise mapping was implemented to ensure the most accurate prediction of plant noise levels at the nearest noise sensitive receivers.

This process uses several different calculation protocols to derive accurate noise analysis predictions. Noise propagation and barrier attenuation are calculated in accordance with ISO 9613-1:1993 *Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere* and ISO 9613-2:1996 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*.

The cumulative noise level at the nearest noise sensitive receiver has been assessed according to the guidelines set out in BS4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas* as guidance, using the noise data above.

Location	24-hour plant noise design criterion, $L_{Aeq,\,T}$	Predicted noise level, $L_{Aeq,\,T}$
Chitty Street	44 dB	33 dB
Charlotte Street	42 dB	41 dB
Howland Street	45 dB	41 dB
Whitfield Street	43 dB	37 dB

Table 6.1 – Operational plant noise levels at nearest noise sensitive receivers [dB ref. 20µPa]

The calculated noise levels at the receivers due to emergency plant are shown in Table 6.2.

Location	Emergency plant noise design criterion, $L_{Aeq,\,T}$	Predicted noise level, $L_{Aeq,\,T}$
Chitty Street	59 dB	31 dB
Charlotte Street	57 dB	45 dB
Howland Street	50 dB	34 dB
Whitfield Street	58 dB	33 dB

Table 6.2 - Emergency plant noise levels at nearest noise sensitive receivers [dB ref. 20µPa]

6.3 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 6.1 would result in an internal noise levels that would meet the level shown in Table 5.3.

7.0 CONCLUSION

An environmental noise survey has been undertaken at 80 Charlotte Street, London by Clarke Saunders Associates between Thursday 19th and Monday 23rd November 2015.

Measurements have been made to establish the current background noise climate. This has enabled a 24-hour design criterion to be set for the control of plant noise emissions to noise sensitive properties, in accordance with requirements set in Condition 4 attached to the permission granted in March 2012.

Data for the plant now proposed have been used to predict the noise impact of the new plant on neighbouring residential properties.

Compliance with the noise emission design criterion has been demonstrated. No further mitigation measures are, therefore, required for external noise emissions.

Ian MacArthur MIOA

CLARKE SAUNDERS ASSOCIATES

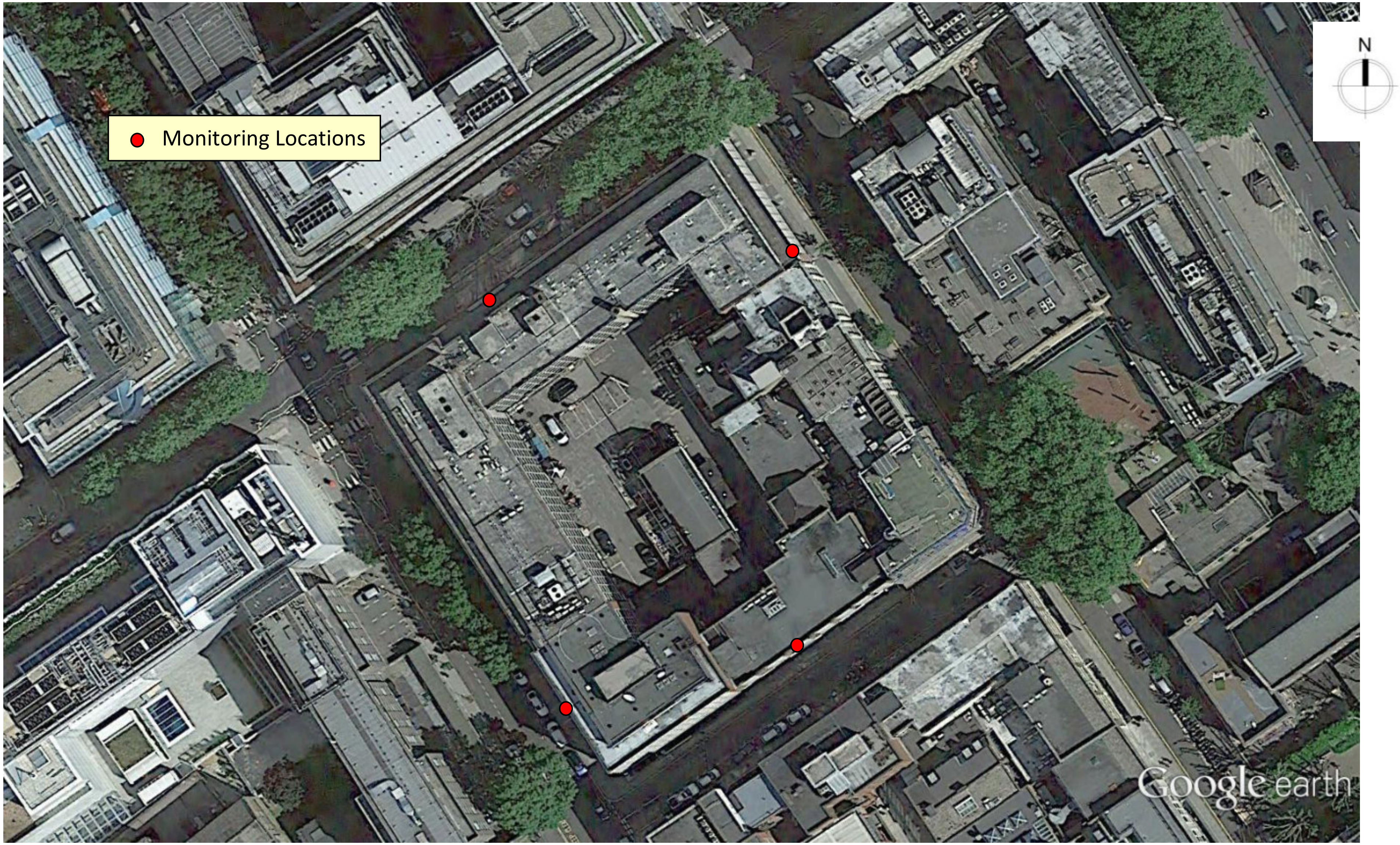
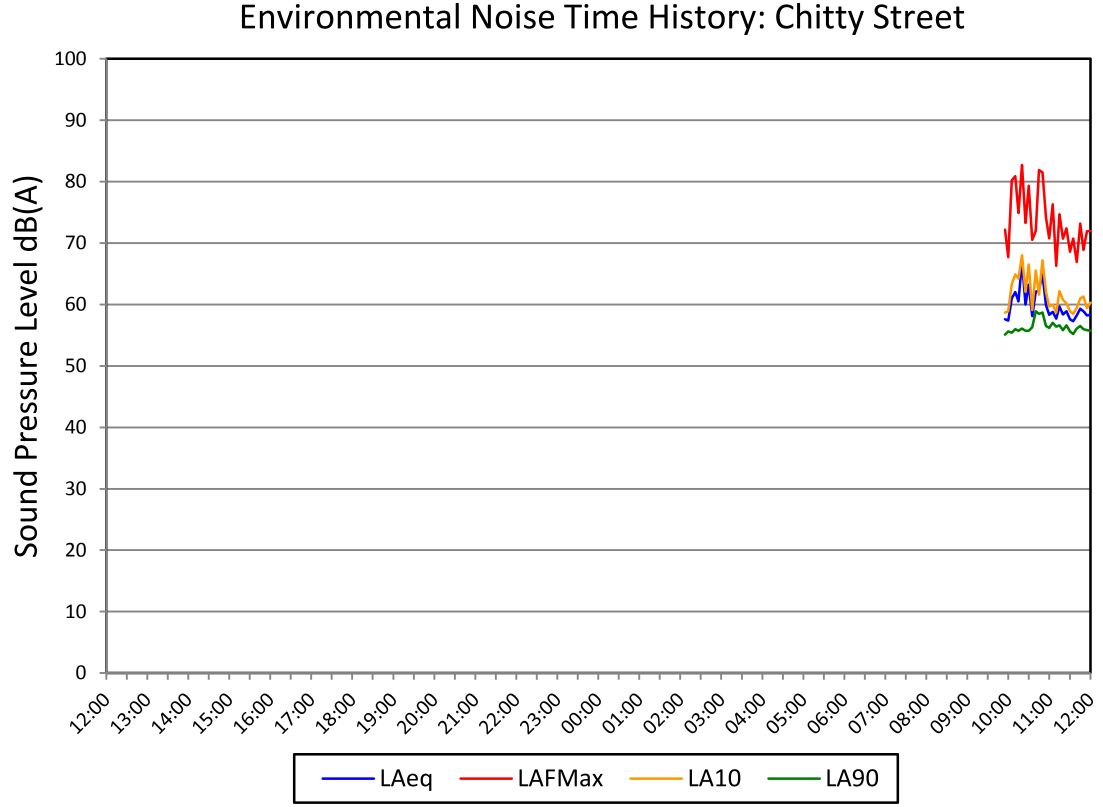


Figure AS6171/SP1

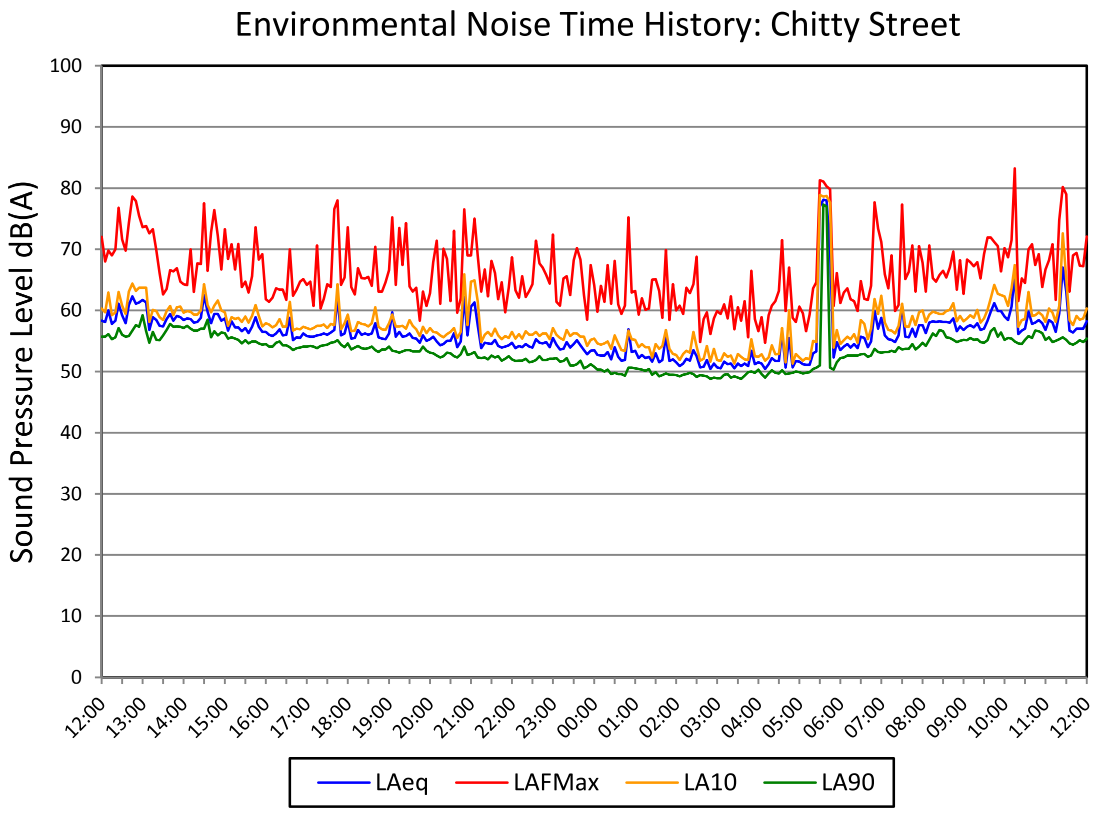
80 Charlotte Street, London



Wednesday 18 November to Thursday 19 November 2015

Figure AS6171/TH1

80 Charlotte Street, London



Thursday 19 November to Friday 20 November 2015

Figure AS6171/TH2

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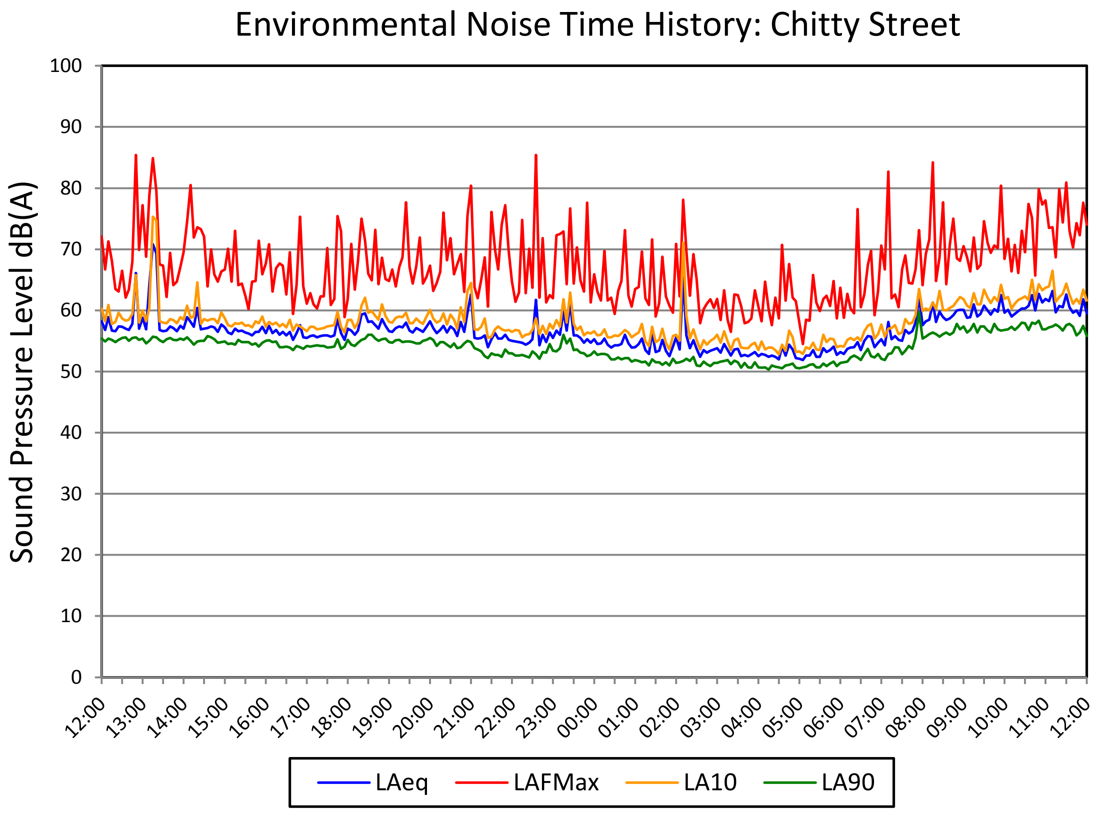

Friday 20 November to Saturday 21 November 2015

Figure AS6171/TH3

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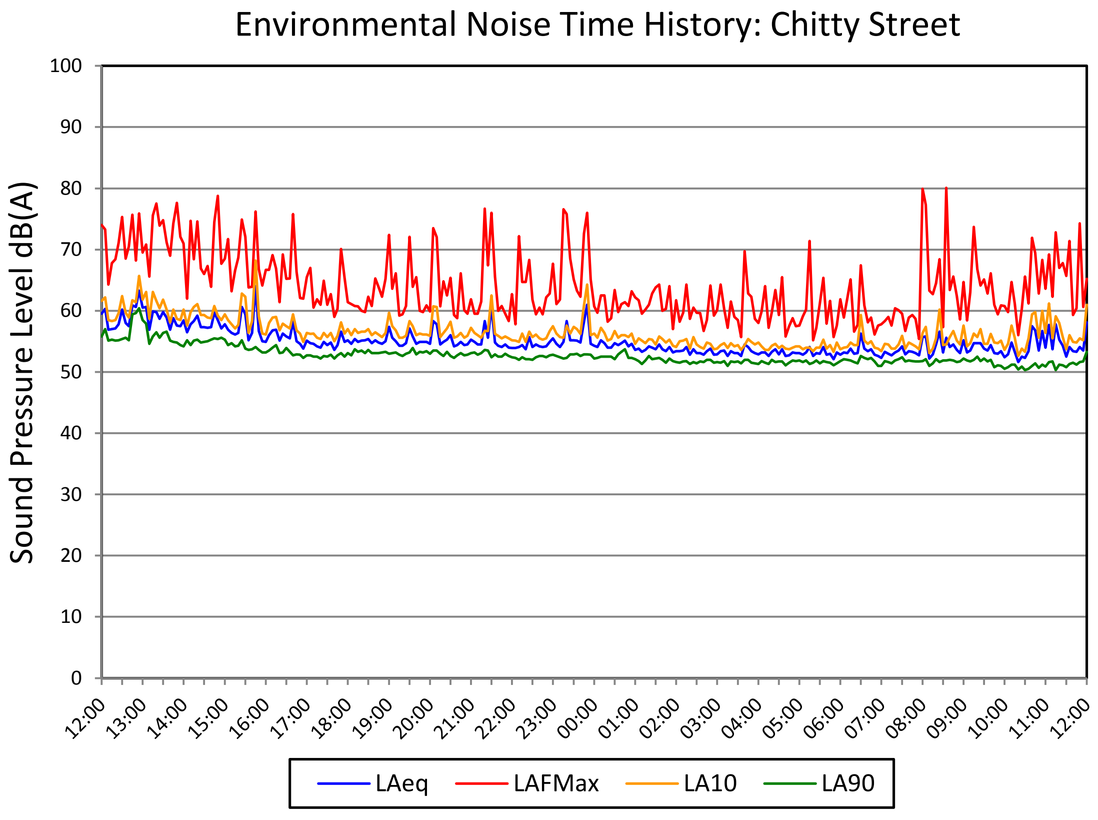

Saturday 21 November to Sunday 22 November 2015

Figure AS6171/TH4

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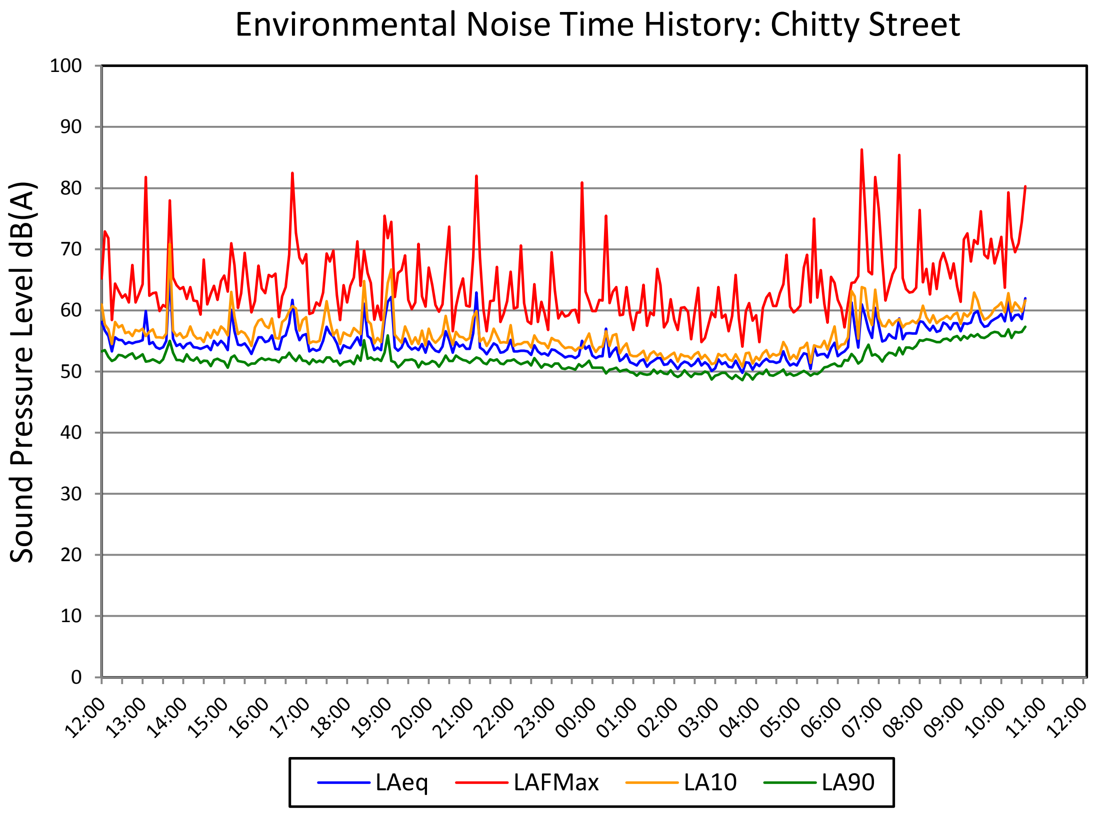

Sunday 22 November to Monday 23 November 2015

Figure AS6171/TH5

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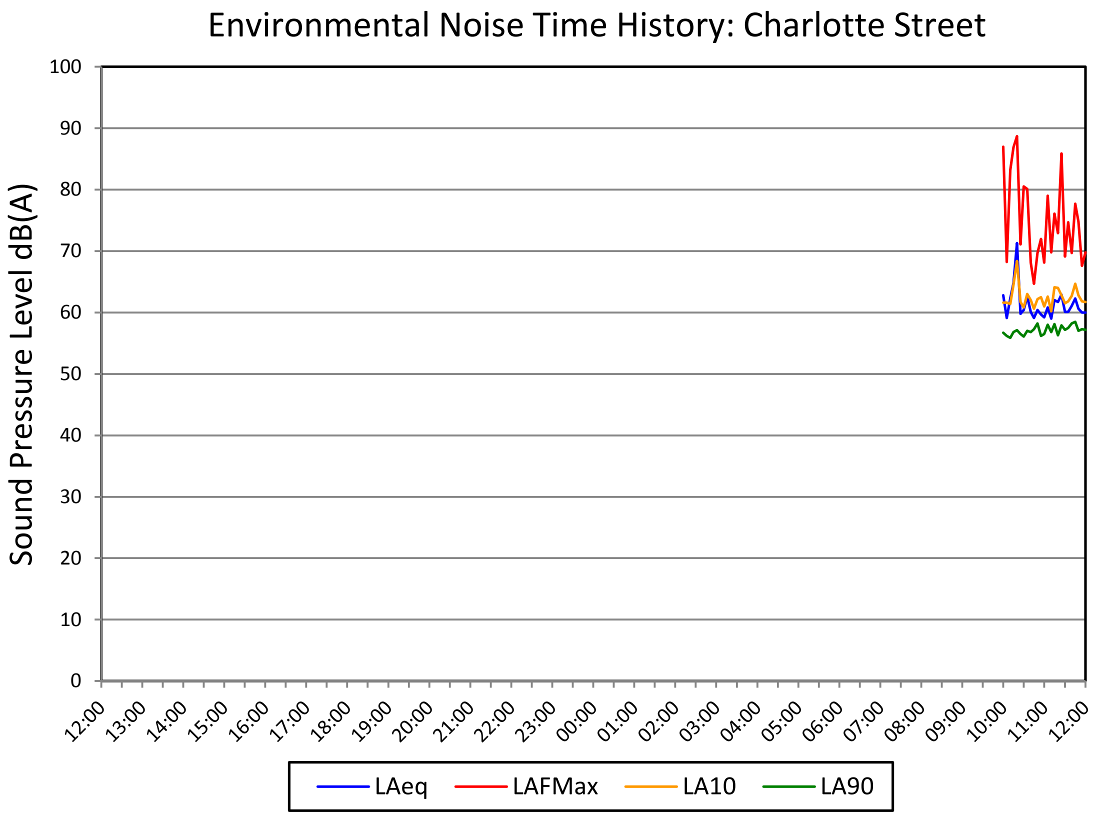
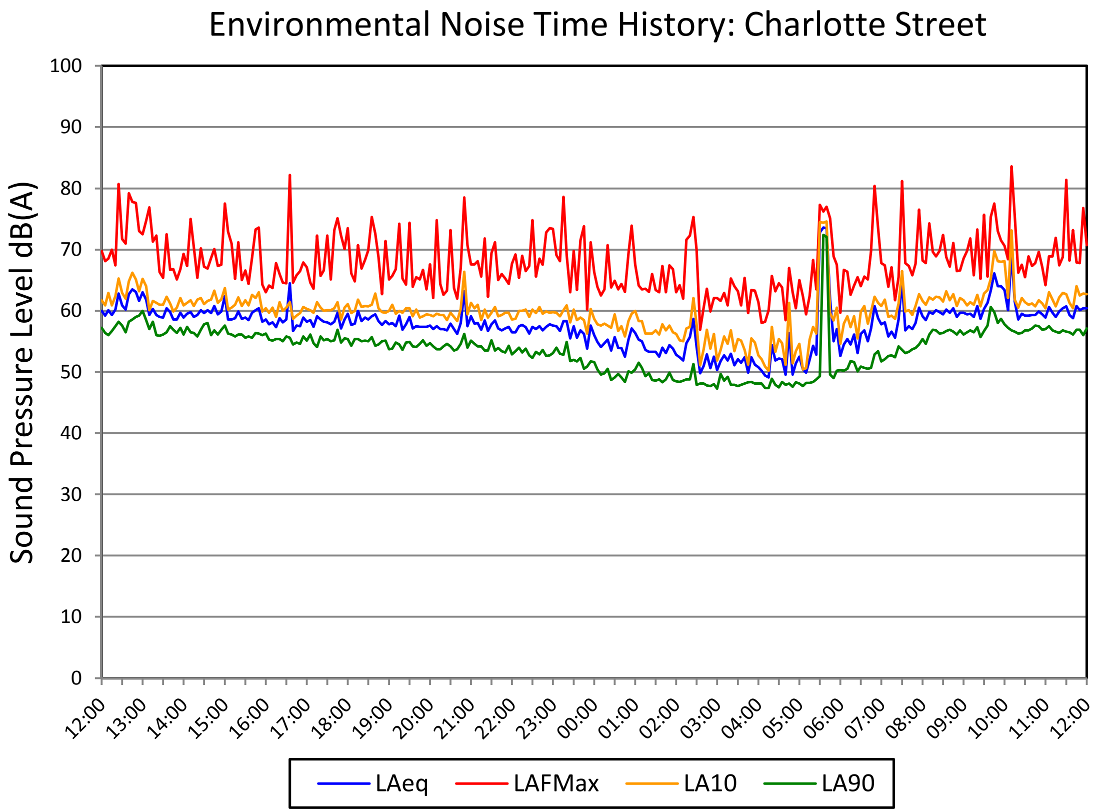


Wednesday 18 November to Thursday 19 November 2015

Figure AS6171/TH6

80 Charlotte Street, London

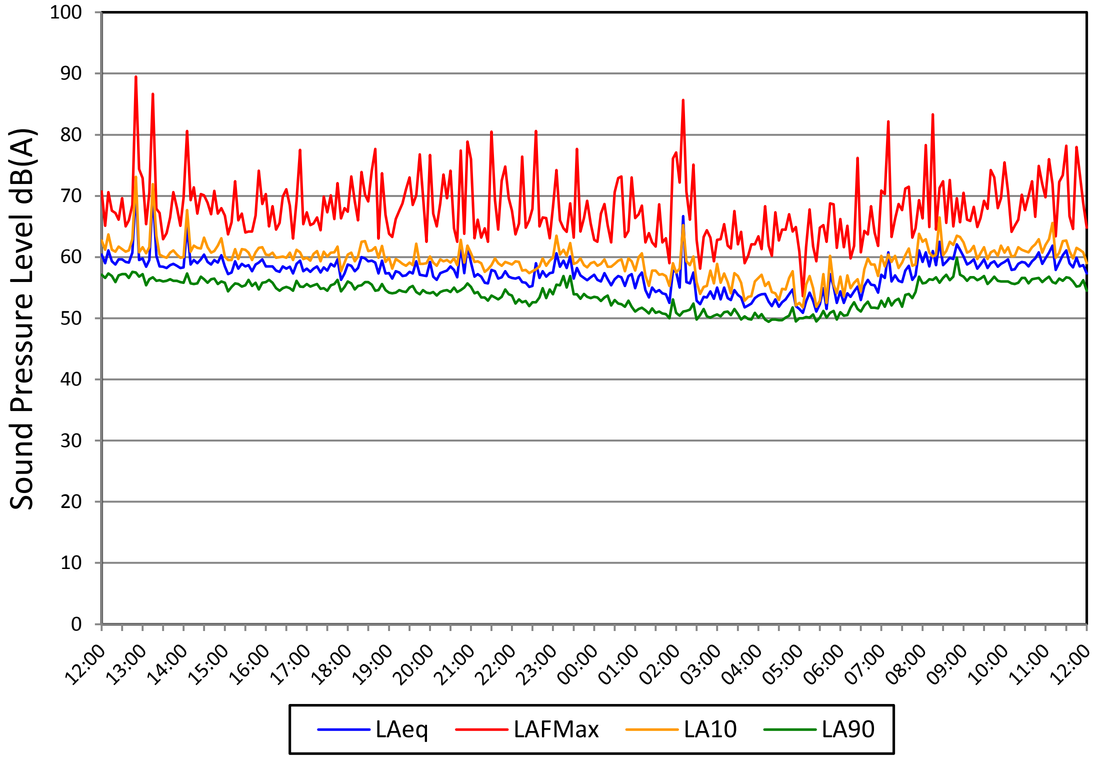


Thursday 19 November to Friday 20 November 2015

Figure AS6171/TH7

80 Charlotte Street, London

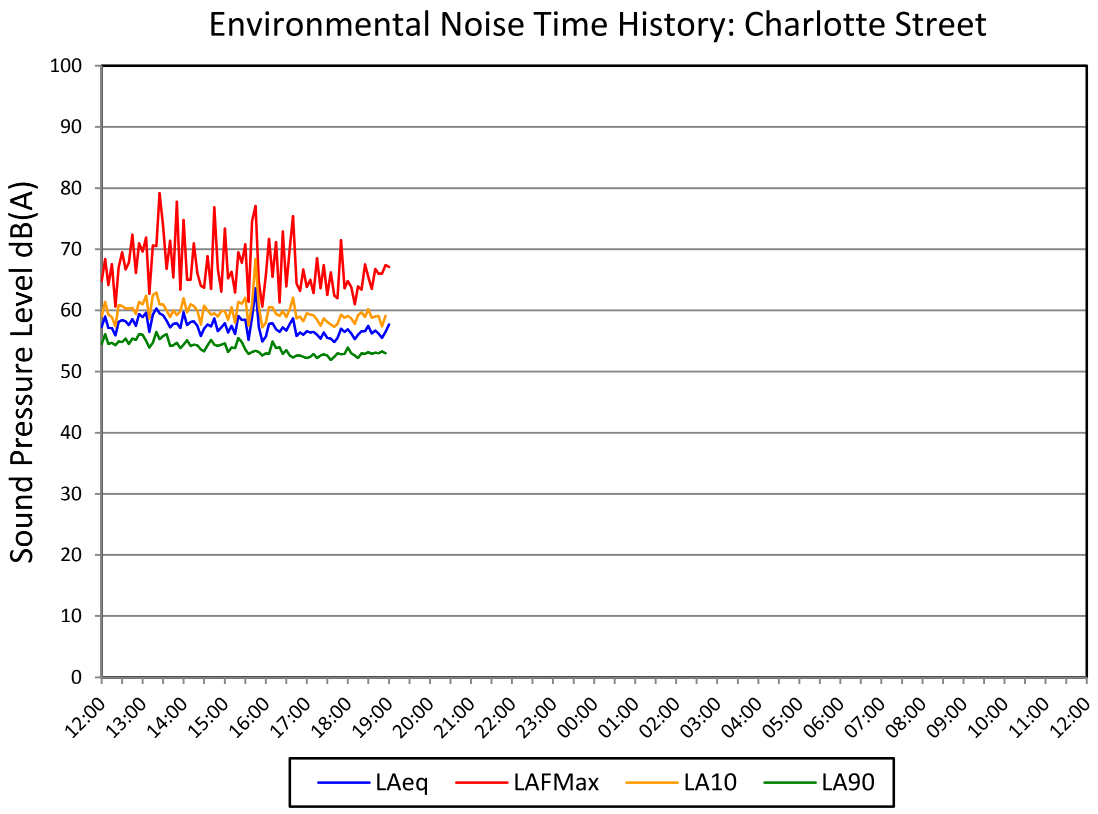
Environmental Noise Time History: Charlotte Street



Friday 20 November to Saturday 21 November 2015

Figure AS6171/TH8

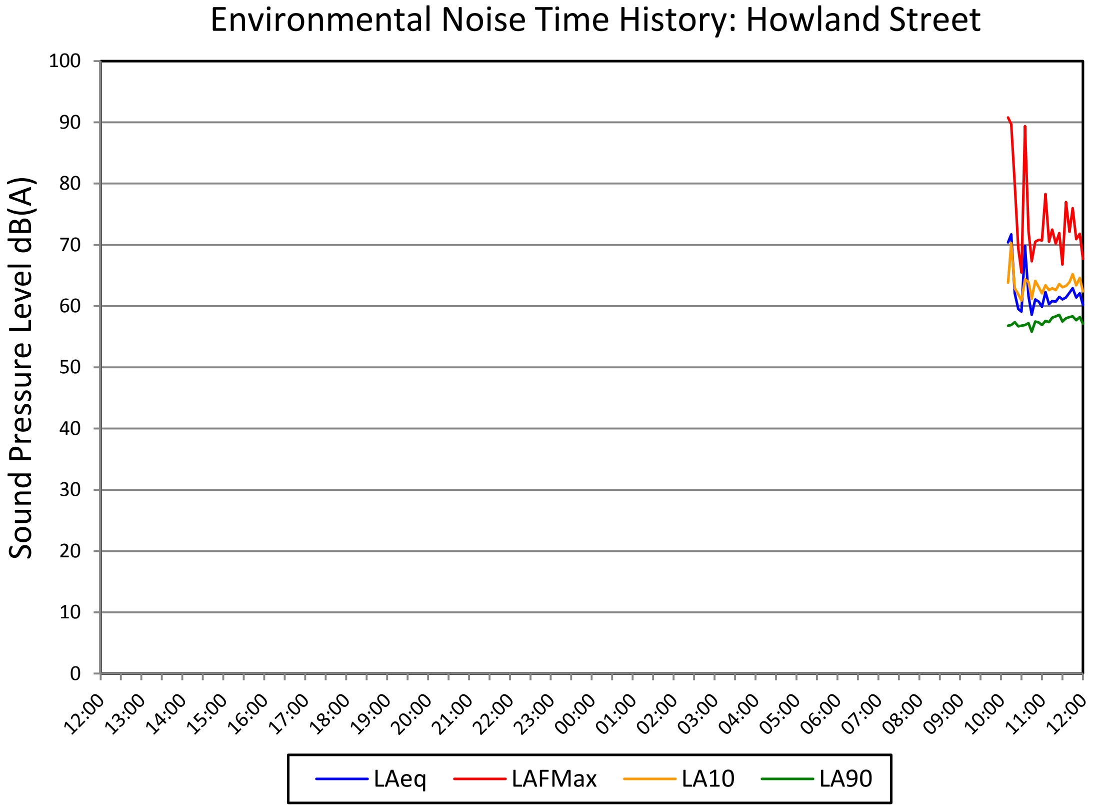
80 Charlotte Street, London



Saturday 21 November to Sunday 22 November 2015

Figure AS6171/TH9

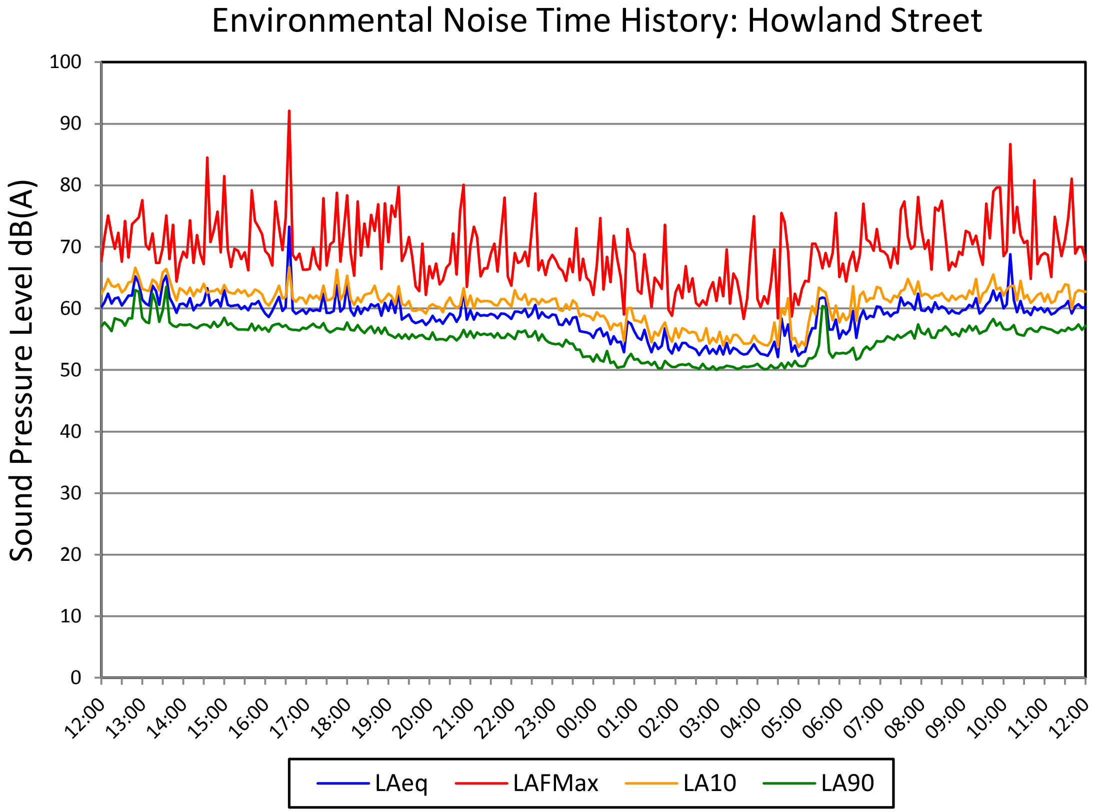
80 Charlotte Street, London



Wednesday 18 November to Thursday 19 November 2015

Figure AS6171/TH9

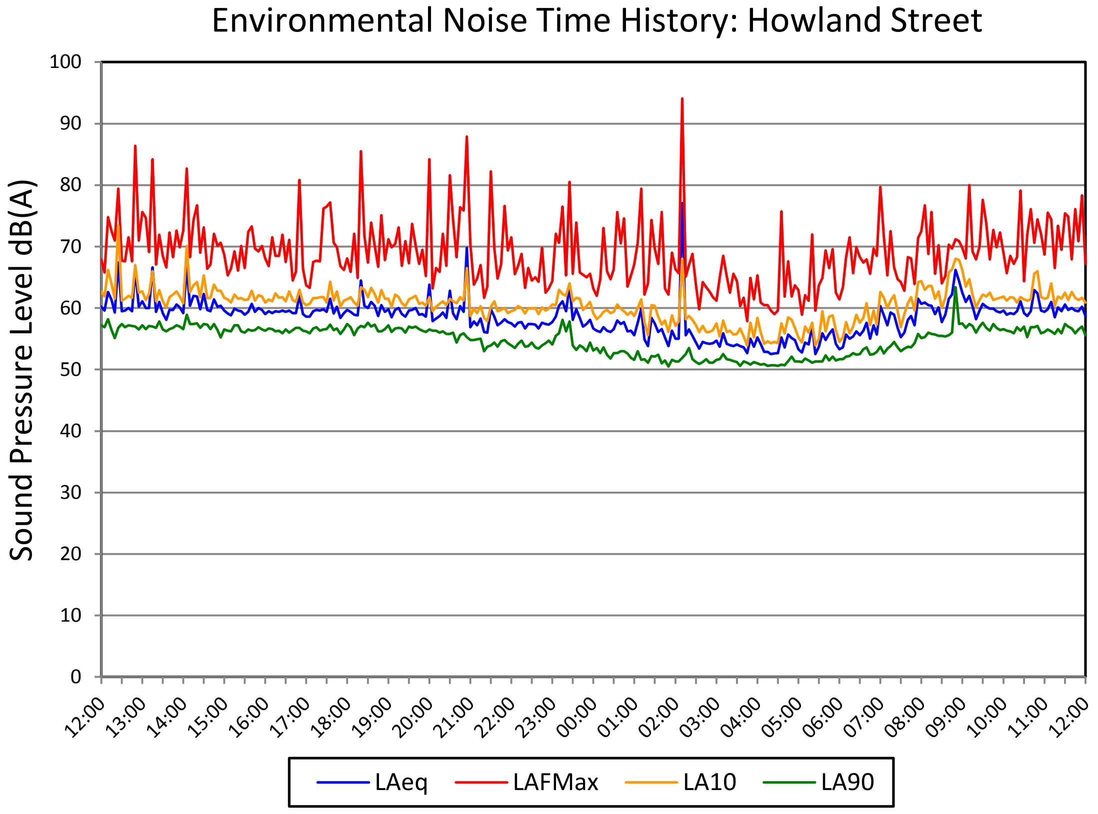
80 Charlotte Street, London



Thursday 19 November to Friday 20 November 2015

Figure AS6171/TH10

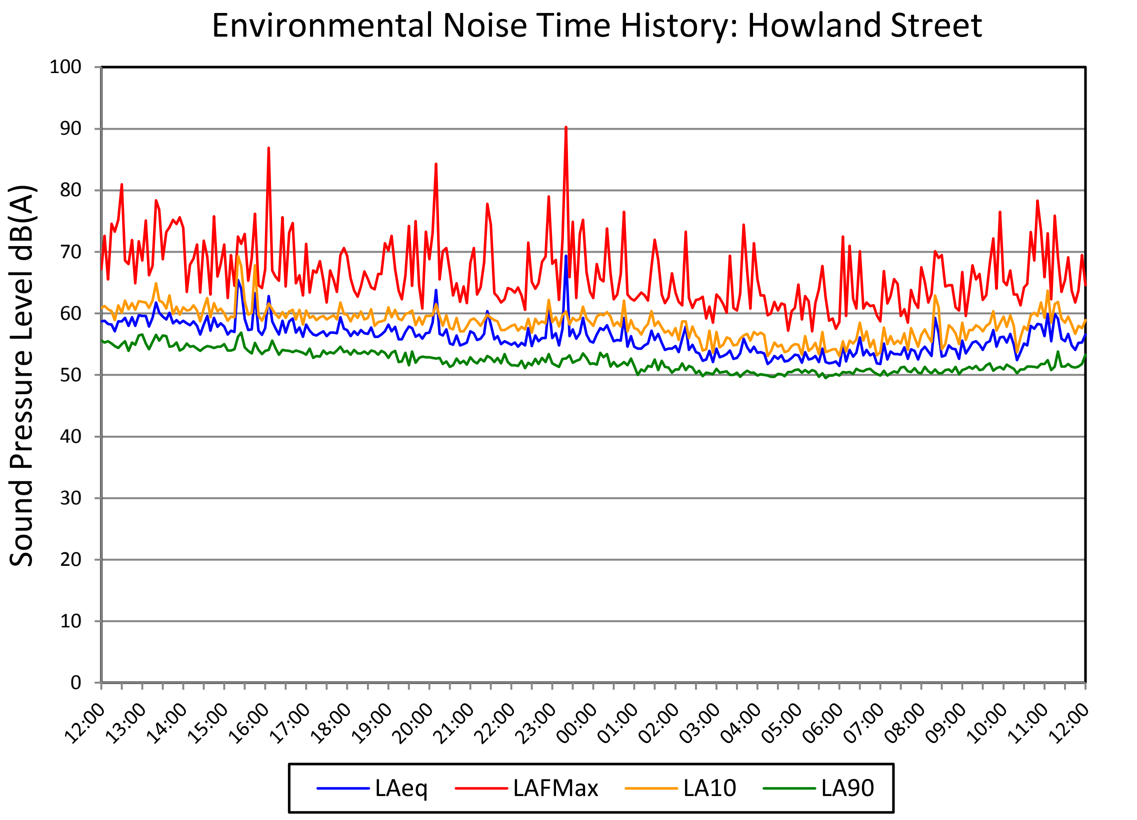
80 Charlotte Street, London



Friday 20 November to Saturday 21 November 2015

Figure AS6171/TH11

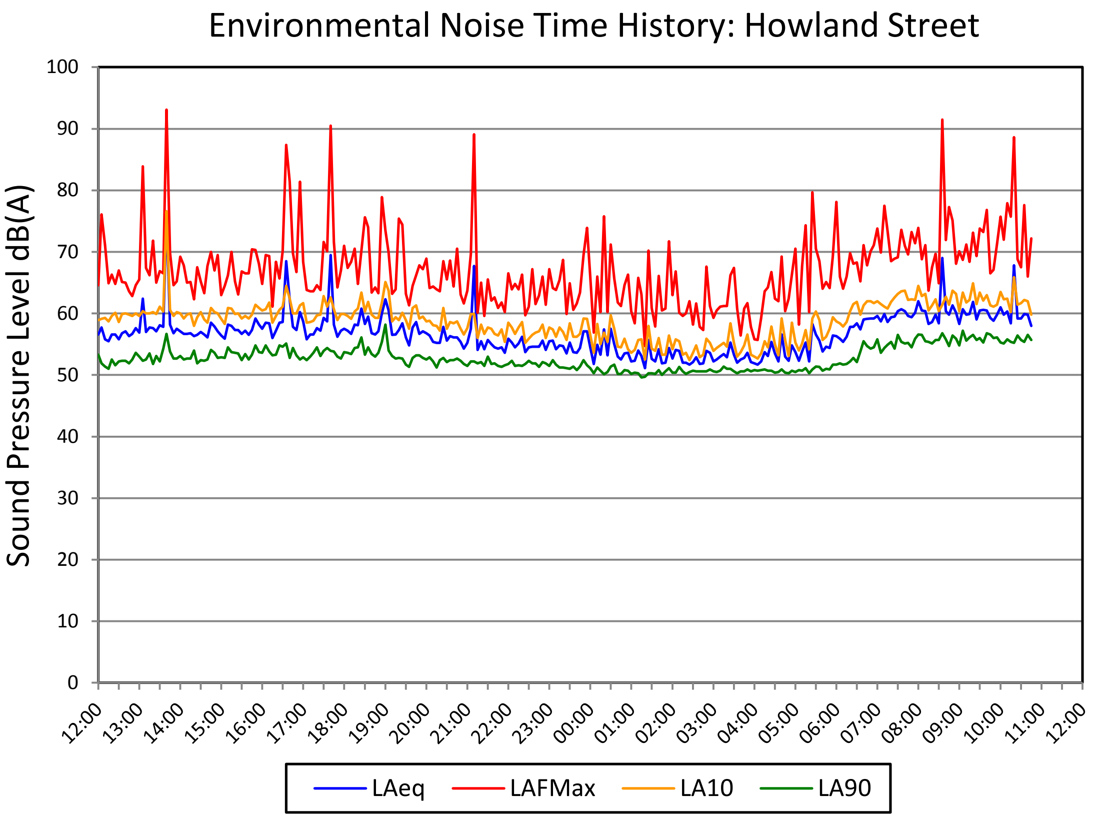
80 Charlotte Street, London



Saturday 21 November to Sunday 22 November 2015

Figure AS6171/TH12

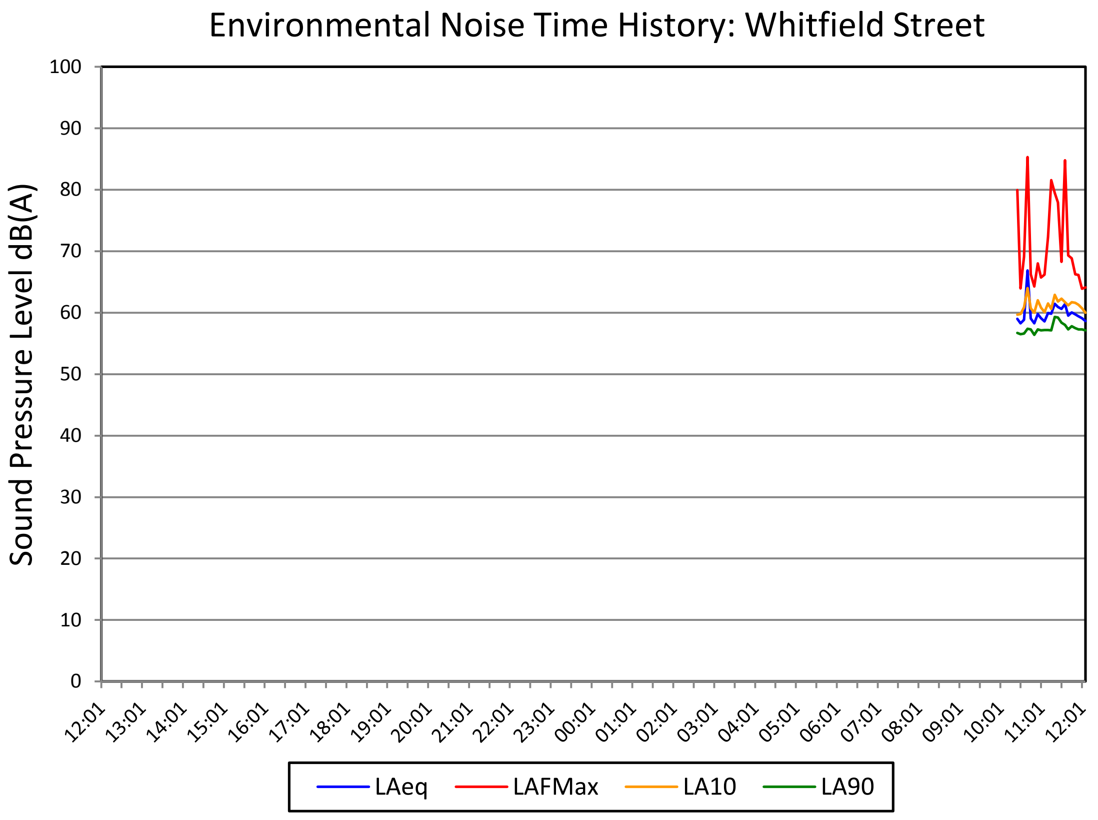
80 Charlotte Street, London



Sunday 22 November to Monday 23 November 2015

Figure AS6171/TH13

80 Charlotte Street, London

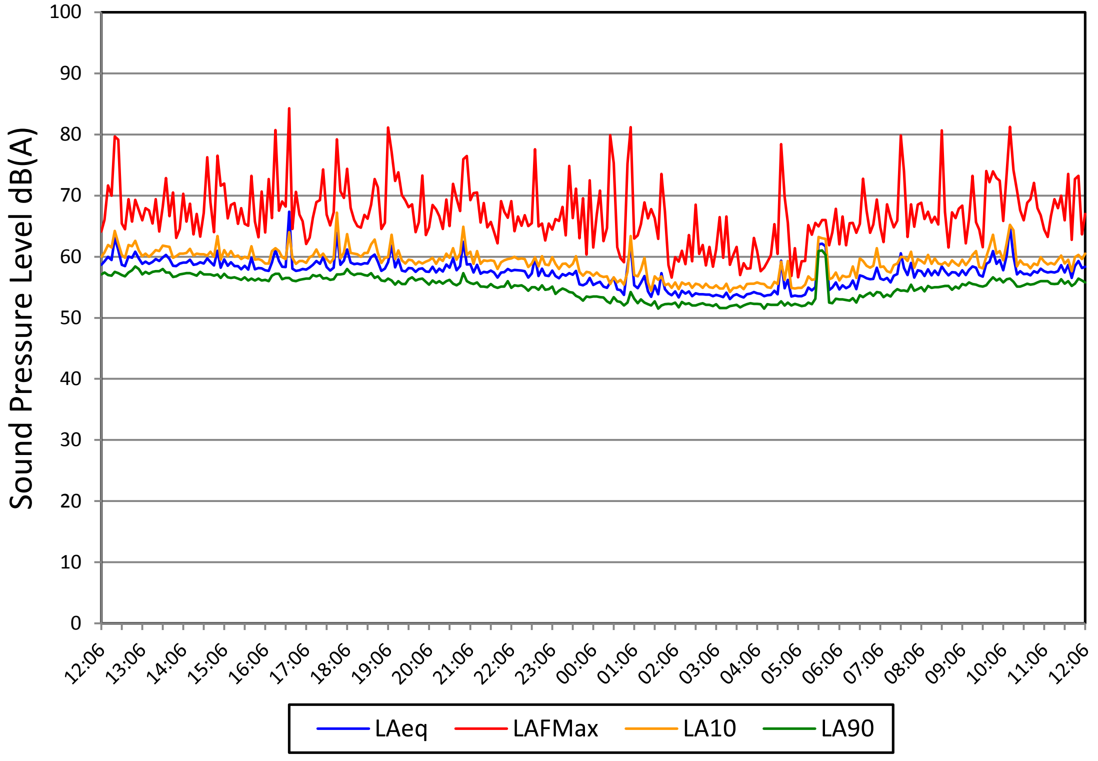


Wednesday 18 November to Thursday 19 November 2015

Figure AS6171/TH14

80 Charlotte Street, London

Environmental Noise Time History: Whitfield Street

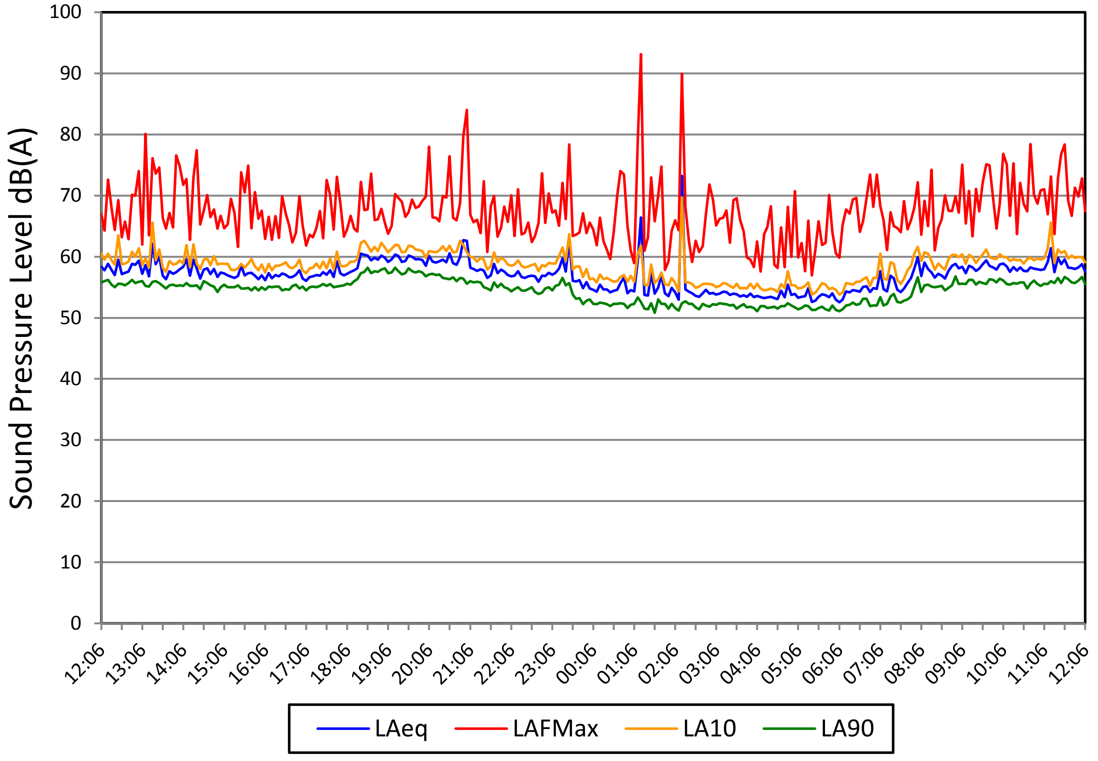


Thursday 19 November to Friday 20 November 2015

Figure AS6171/TH15

80 Charlotte Street, London

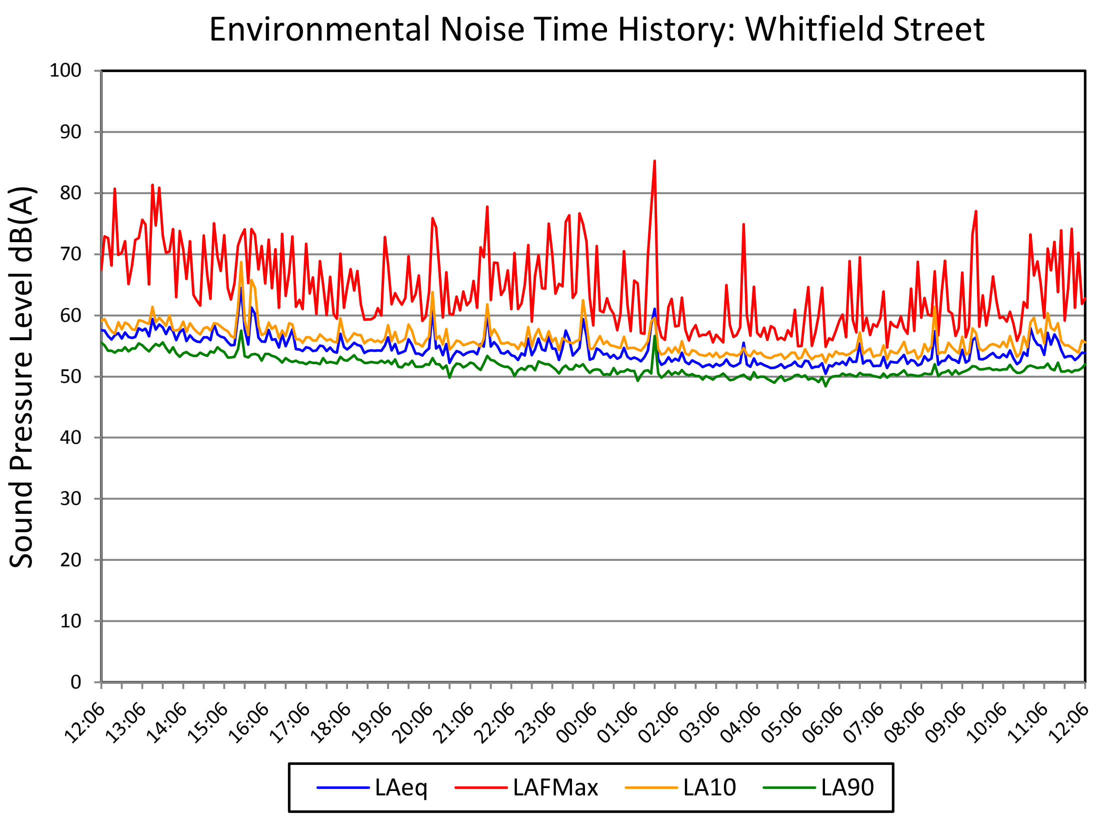
Environmental Noise Time History: Whitfield Street



Friday 20 November to Saturday 21 November 2015

Figure AS6171/TH16

80 Charlotte Street, London

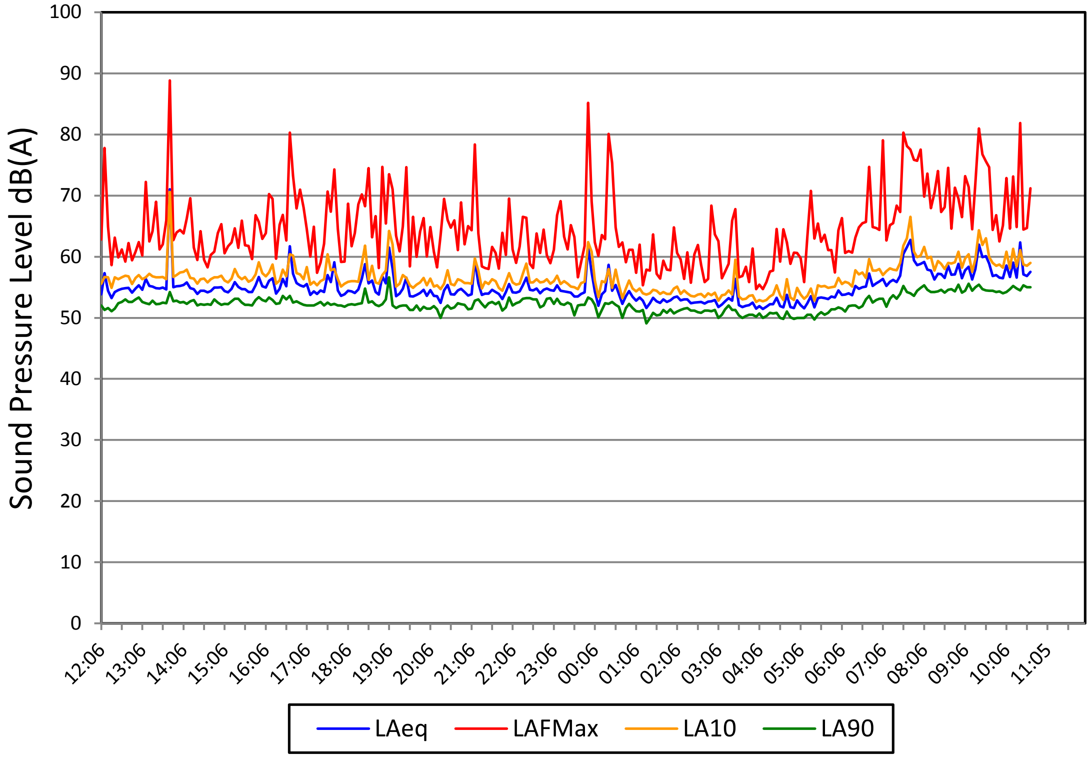


Saturday 21 November to Sunday 22 November 2015

Figure AS6171/TH17

80 Charlotte Street, London

Environmental Noise Time History: Whitfield Street



Sunday 22 November to Monday 23 November 2015

Figure AS6171/TH18

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND SOUND

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.3 Human Perception of Broadband Noise

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND SOUND

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

Appendix B

3 no. Dalair AHUs (AHU 01-03) & 1 no. Nuaire AHU (AHU 04)

L_w	63	125	250	500	1000	2000	4000	8000	dB(A)
AHU 01 Intake	75	81	66	55	58	63	71	56	74
AHU 01 Discharge	78	78	65	58	54	50	53	45	65
AHU 01 Breakout	71	76	69	71	61	59	53	54	70
AHU 02 Intake	77	81	64	51	57	62	64	53	70
AHU 02 Discharge	77	75	62	54	52	54	49	50	63
AHU 02 Breakout	69	72	64	70	61	59	51	55	69
AHU 03 Intake	78	79	63	54	57	62	66	53	70
AHU 03 Discharge	80	82	71	60	58	60	66	50	71
AHU 03 Breakout	72	75	68	59	62	55	47	51	69
AHU 04 Intake	70	60	55	56	62	55	47	43	64
AHU 04 Discharge	75	63	65	67	68	65	60	58	72
AHU 04 Breakout	61	57	42	43	41	37	34	23	47

Table 1.1 - Source noise data for the Air Handling Units **[Sound Power dB ref. 10^{-12}W]**

3 no. Air to water Heat Pumps

L_w	63	125	250	500	1000	2000	4000	8000	dB(A)
HP 01 & HP 02	94	92	94	90	86	80	72	64	91
HP 03	89	89	89	88	88	86	74	70	92

Table 1.2 - Source noise data for the type Air to water Heat Pumps **[Sound Power dB ref. 10^{-12}W]**

3 no. Toilet extract fans

L_w	63	125	250	500	1000	2000	4000	8000	dB(A)
TEF 01	87	82	75	82	67	65	57	59	80
TEF 02	87	81	75	81	66	64	57	59	79
TEF 03	78	79	75	73	73	70	65	58	77
Silencer Insertion Loss	*2*	*6*	*11*	*20*	*19*	*19*	*12*	*9*	*-*

Table 1.3 - Source noise data for the Nuaire WC extract fan **[Sound Power dB ref. 10^{-12}W]**

1 no. Emergency Generator (silenced) Perkins 2806 A-E18 TAG1

L_w	63	125	250	500	1000	2000	4000	8000	dB(A)
Air Inlet	78	81	80	71	66	67	62	57	85
Air Outlet	78	81	80	71	66	67	62	57	85
Panel Construction	67	78	75	75	74	69	60	50	82

Table 1.4 - Source noise data for the Emergency Generator **[Sound Power dB ref. 10^{-12}W]**

2 no. Air Cooled Chillers

L_w	63	125	250	500	1000	2000	4000	8000	dB(A)
CH-RF 01 & 02	90	91	91	88	88	84	79	73	92

Table 1.5 - Source noise data for the Air Cooled Chillers **[Sound Power dB ref. 10^{-12}W]**

Unit Name	No. of units Run/Standby	L_p @ distance
Heat Pump Boilers HPB-01 to 04	4	59 @ 1m
Primary CHW Pumps CHWP-RF-01 to 04	3/1	76 @ 1m
Secondary Office CHW Pumps CHWS-RF-01 to 03	2/1	76 @ 1m
Secondary Office AHU Pumps CHWS-RF-04 to 05	1/1	74 @ 1m
Primary LTHW Pumps LTHP-RF-01 to 03	2/1	71 @ 1m
Secondary LTHS Pumps LTHS-RF-01 to 02	1/1	71@ 1m
Pressurisation unit PU/RF/01	1	49 @ 3m
Mitsubishi PURY-P450YLM-A VRF	1	63 @1m
Mitsubishi PURY-P300YKB-A VRF	1	61 @1m
Mitsubishi PURY-P200YLM-A VRF	1	59 @1m

Table 1.6 - Source noise data for the assorted plant items **[dB ref. 20µPa]**

Appendix C

80 Charlotte Street & 65 Whitfield Street

Noise, Vibration and External Building Fabric Assessment

December 2010

DERWENT LONDON

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REPORT AS6171.101206.NVIA

80 CHARLOTTE STREET AND 65 WHITFIELD STREET CAMDEN

NOISE, VIBRATION AND EXTERNAL BUILDING FABRIC ASSESSMENT

Prepared: 6th December 2010

West London & Suburban Property Investments Ltd
25 Savile Row
London
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CONTENTS

List of Attachments

1. INTRODUCTION

This Acoustic Statement is submitted in support of the application by West London & Suburban Property Investments Ltd for planning permission at 80 Charlotte Street and 65 Whitfield Street (The Site). The application proposes the partial redevelopment and refurbishment of the site to create a mixed use office and residential scheme with some flexible units at ground and lower ground floor in either office, retail or restaurant use (the Proposed Development).

Alan Saunders Associates has been commissioned by West London & Suburban Property Investments Ltd. to undertake an assessment of the current environmental noise impact on the site in accordance with the requirements of PPG24: *Planning and Noise: September 1994*: Department of Environment and London Borough of The London Borough of Camden requirements. An assessment of vibration from underground trains has been undertaken in accordance with BS6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings*.

This assessment would also consider the requirement for any outline mitigation measures as appropriate for the proposed residential development.

2. DESCRIPTION OF SITE

The site is currently occupied by a number of existing buildings all of which are in office use. There are a number of existing residential properties along Chitty Street. The location and size of the site are shown in Figure one.

The background noise climate is dominated by road traffic noise in the surrounding area and aircraft noise.

The site lies to the west of the Northern underground line, between Goodge Street and Warren Street stations.

3. SURVEY PROCEDURE & EQUIPMENT

3.1 Environmental Noise Survey

An environmental noise survey was undertaken in accordance with the requirements of PPG24: *Planning and Noise: September 1994*: Department of Environment. Noise levels were monitored at third floor level on the site over consecutive 5 and 15-minute periods between 11:30 hours on Wednesday 1st and 12:45 hours on Thursday 2nd September 2010.

The following equipment was used for the survey:

- 2 no. Norsonic sound level meter type 118
- 1 no. Rion sound level meter type NA28
- 1 no. Rion sound level meter type NL32
- 1 no. Rion calibrator type NC73
- Norsonic Sound Level Calibrator type 1253

The calibration of the equipment was verified before and after use. No calibration drift was observed.

The monitoring positions used for continuous measurements are indicated in the attached site plan one.

The weather during the survey was dry with light winds. This made the conditions suitable for the measurement of environmental noise.

Measurements were made generally in accordance with the requirements of BS 7445:1991 *Description and measurement of environmental noise, Part 2 - Acquisition of data pertinent to land use.*

Descriptions and explanations of the acoustic parameters used in this report are shown in Appendix A.

3.2 Vibration Survey

An assessment of vibration was undertaken on site, as required by current guidance documents for sites close to underground or overground railway lines. The following equipment was used for the survey:

- Vibrock Seismograph type 901

The calibration of the equipment was verified before and after use.

All measurements were made at basement level generally in accordance with BS6472 and ANC guidelines for vibration measurement. This location represents the worst case scenario and is indicated on the site plan one.

Vibration levels were monitored at site over consecutive 30 second periods in three axes between 12:04 hours on Wednesday 1st and 12:54 hours on Thursday 2nd September 2010

4. RESULTS

4.1 Environmental Noise Survey

The results of the continuous monitoring are shown as time histories of the $L_{Aeq,\ 15mins}$; $L_{Amax,\ 15mins}$;$L_{A10,\ 15mins}$ and $L_{A90,15mins}$ in Figures AS6171/TH1-TH4.

4.2 Vibration Survey

The maximum results of the vibration measurements during the survey period are shown in Table 5.4 in terms of vibration dose values (VDV) for day and night periods.

Daytime VDV_{day} ($m/s^{-1.75}$)	Night-time VDV_{night} ($m/s^{-1.75}$)
0.040	0.031

Table 4.1 – Daytime and night-time VDVs

5. SUITABILITY OF THE SITE FOR RESIDENTIAL DEVELOPMENT

It is proposed to develop the first floor and above of 65 Whitfield Street and 14 Charlotte Mews and a section of the building on the corner of Whitfield and Chitty Street for residential use. The site is affected by road traffic in the surrounding area and aircraft flying overhead.

5.1 PPG 24: September 1994

In order to assess the suitability of the site for residential development, reference to current guidance documents is appropriate. The PPG 24: *Planning and Noise: September 1994*, gives guidance to local authorities in England on the use of their planning powers to minimise the adverse impact of noise.

The PPG introduces in paragraph 8 the concept of Noise Exposure Categories (NEC) from A to D, to help planning authorities in their consideration of applications for residential development near transport sources. Category A represents the circumstances in which noise is unlikely to be a determining factor, whilst Category D relates to the situation in which development should normally be refused.

The PPG also introduces a definition of night and day and are as follows:

- Daytime 07:00 - 23:00 hours

- Night-time 23:00 - 07:00 hours

The PPG uses the L_{Aeq} value for the above periods to assess the potential impact of noise on any developments from a specific source – in this case mixed sources. PPG24 also recommends that a vibration assessment be undertaken where sites are close to railway lines and that they be assessed in accordance with BS6472:1992, which has been superseded by BS6472: 2008.

5.2 Noise Assessment

The average noise levels for the '*Daytime*' and '*Night-time*' periods are shown in Table 5.1.

Position	Daytime $L_{Aeq,16hour}$ (dB)	Night-time $L_{Aeq,8hour}$ (dB)
Whitfield Street	58	54
65 Whitfield Street	60	55

Table 5.1 – Daytime and night-time average noise levels [dB ref. 20 μPa]

Table 5.2 below shows the results, indicating that the site should be rated in the following categories for '*Daytime*' and '*Night-time*' with respect to mixed noise sources.

Position	Daytime Category	Night-time Category
Whitfield Street	B	B
65 Whitfield Street	B	B

Table 5.2 – PPG 24 day and night-time categories for site

Table AS6171/NEC defines the categories of PPG24 and their significance in regards to noise exposure.

Appendix B shows noise exposure categories of PPG24 and their significance with regard to noise exposure. The most exposed area designated for residential development categorises the site as NEC B.

For sites within NEC B, PPG24 states:

> *'Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.'*

It should be noted that, in urban areas, development sites generally fall into NEC B, C or even D and mitigation measures are frequently incorporated within building design to provide appropriate internal acoustic conditions.

5.3 BS8233:1999 Sound insulation and noise reduction for buildings

The guidance in this document indicates ‘good’ and ‘reasonable’ noise levels for various activities within residential and commercial buildings.

The relevant sections of this standard are shown in the following table:

Criterion	Typical Situations	Design range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living Rooms Bedrooms	30 30	40 35

Table 5.3 – Excerpt from BS8233: 1999

This standard also states that individual noise events should not normally exceed 45 dB $L_{Amax,fast}$ within bedrooms at night.

It is understood that The London Borough of Camden requires ‘good’ internal noise levels for residential dwellings.

Residential buildings would, therefore, be designed and all elements of the building envelopes specified to ensure that internal noise levels as shown in Table 5.3 are achieved, whilst taking into account all current and future permanent noise sources.

5.4 Vibration Survey

The maximum results of the vibration measurements during the survey period are repeated below in Table 5.4 in terms of vibration dose values (VDV) for day and night periods.

Daytime VDV_{day} ($m/s^{-1.75}$)	Night-time VDV_{night} ($m/s^{-1.75}$)
0.040	0.031

Table 5.4 – Daytime and night-time VDVs

5.5 BS6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings*

BS6472 specifies building vibration with respect to human response to be measured and assessed in the form of a vibration dose value (VDV). The VDV defines a relationship that yields a consistent assessment of continuous, intermittent, occasional and impulsive vibration and correlates well with subjective response. The vibration is to be evaluated for the axis in which the magnitude of weighted acceleration is greatest, against the values in Table 5.5 below.

Place and Time	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
16h day (07:00 – 23:00)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
8h night (23:00 – 07:00)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 5.5 – VDV ranges resulting in risk of probable comment [values ref. $m/s^{-1.75}$]

The vibration levels measured on site are substantially lower than levels associated with a *low probability of adverse comment*. BS6472-1:2008 states that 'below these ranges adverse comment is not expected'.

6. DESIGN REVIEW

The following design review is based on the architectural drawings available at the time of writing for the proposed construction of the residential areas of the development.

6.1 Architectural Arrangements

It has been assumed that all non-glazed elements, i.e. masonry walls/facings and the roof systems, will provide the following minimum sound insulation performances, when tested in accordance with BS EN ISO, 140-3:1995.

Frequency (Hz)	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Masonry	38	39	49	53	55	55

Table 6.1 – Assumed minimum sound reduction indices of solid constructions

7. REQUIRED GLAZING PERFORMANCE

The minimum sound insulation specifications for the glazed elements of the building façades are given in the table below, with an aim to meet the 'good' standard specified in BS8233 as required by The London Borough of Camden. These have been calculated using the monitoring data noise levels using $L_{Aeq,16hr,\ 8hr}$ and L_{Amax}.

Frequency (Hz)	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Type A	16	21	31	34	37	26

Table 7.1 – Minimum required sound reduction indices for glazing

The façades overlooking Charlotte Mews would be shielded from road traffic noise. No other noise sources were found, therefore it is expected that standard, thermally sealed double glazing should provide sound reduction to achieve suitable internal levels.

It is important that all principal building elements are tested in accordance with BS EN ISO 140-3:1995 and that the quoted minimum sound reduction specifications are met by the windows, including frames, seals, etc. Glass performance alone is not an acceptable means of demonstrating compliance with the specification for window performance.

The minimum sound reduction indices specified in the Table 7.1 are required to ensure that levels of traffic and plant noise intrusion are controlled with regard to the criteria stated. It must be the responsibility of the glazing system supplier/manufacturer to ensure that these performances are achieved as installed on site, and that the systems proposed for this project are therefore selected in order to achieve this.

It should be noted that the performance of the selected system must be confirmed for the actual configuration and construction used. Independent testing at a UKAS accredited laboratory or at an equal and approved laboratory will be required.

The sound reduction of the windows should be met with any proposed trickle vents installed and open. If this cannot be met then alternative means of ventilation may be required, although there is no reason why windows cannot be openable as a matter of personal preference.

8. PLANT NOISE DESIGN CRITERIA

The minimum measured background L_{A90} noise levels are shown in Table 8.1.

Location	Assessment period	Minimum $L_{A90,T}$
Howland Street	07:00 – 23:00	53 dB
Charlotte Street		54 dB
Whitfield Street		52 dB
65 Whitfield Street (Chitty/Whitfield Street)		52 dB
Howland Street	23:00 – 07:00	50 dB
Charlotte Street		51 dB
Whitfield Street		50 dB
65 Whitfield Street (Chitty/Whitfield Street)		48 dB

Table 8.1 - Minimum measured background noise levels [dB ref. 20μPa]

It is understood that The London Borough of Camden require noise levels 1m from the façade of the nearest noise sensitive receiver to be 5dB less than the existing background measurement (L_{A90}) when assessed in accordance with BS4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas*. However, in recent discussions with the Environmental Health Department at Camden, there has been a preference for 10dB below the existing background noise climate in more residential areas.

If the proposed plant has tonal qualities or operates intermittently then the plant noise emissions criterion should be an additional 5dB lower than the proposed values detailed in Table 8.2. All plant will be designed to meet these external plant noise emissions criteria.

Location	Period	Minimum $L_{A90,T}$
Howland Street	07:00 – 23:00	43 dB
Charlotte Street		44 dB
Whitfield Street		42 dB
65 Whitfield Street (Chitty/Whitfield Street)		42 dB
Howland Street	23:00 – 07:00	40 dB
Charlotte Street		41 dB
Whitfield Street		40 dB
65 Whitfield Street (Chitty/Whitfield Street)		38 dB

Table 8.2 – Proposed plant noise emissions criteria [dB ref. 20μPa]

9. CONCLUSIONS

Measurements have been made of the prevailing noise climate at the proposed site for a retail and residential development at 80 Charlotte Street and 65 Whitfield Street, Camden. Measurements of vibration affecting the site have also been made.

The measured noise levels have been assessed against currently available Standards and the guidance document, PPG24: *Planning and Noise: September 1994,* to consider whether the site is suitable for its proposed residential use.

This report shows that areas within the development site fall into Noise Exposure Category B.

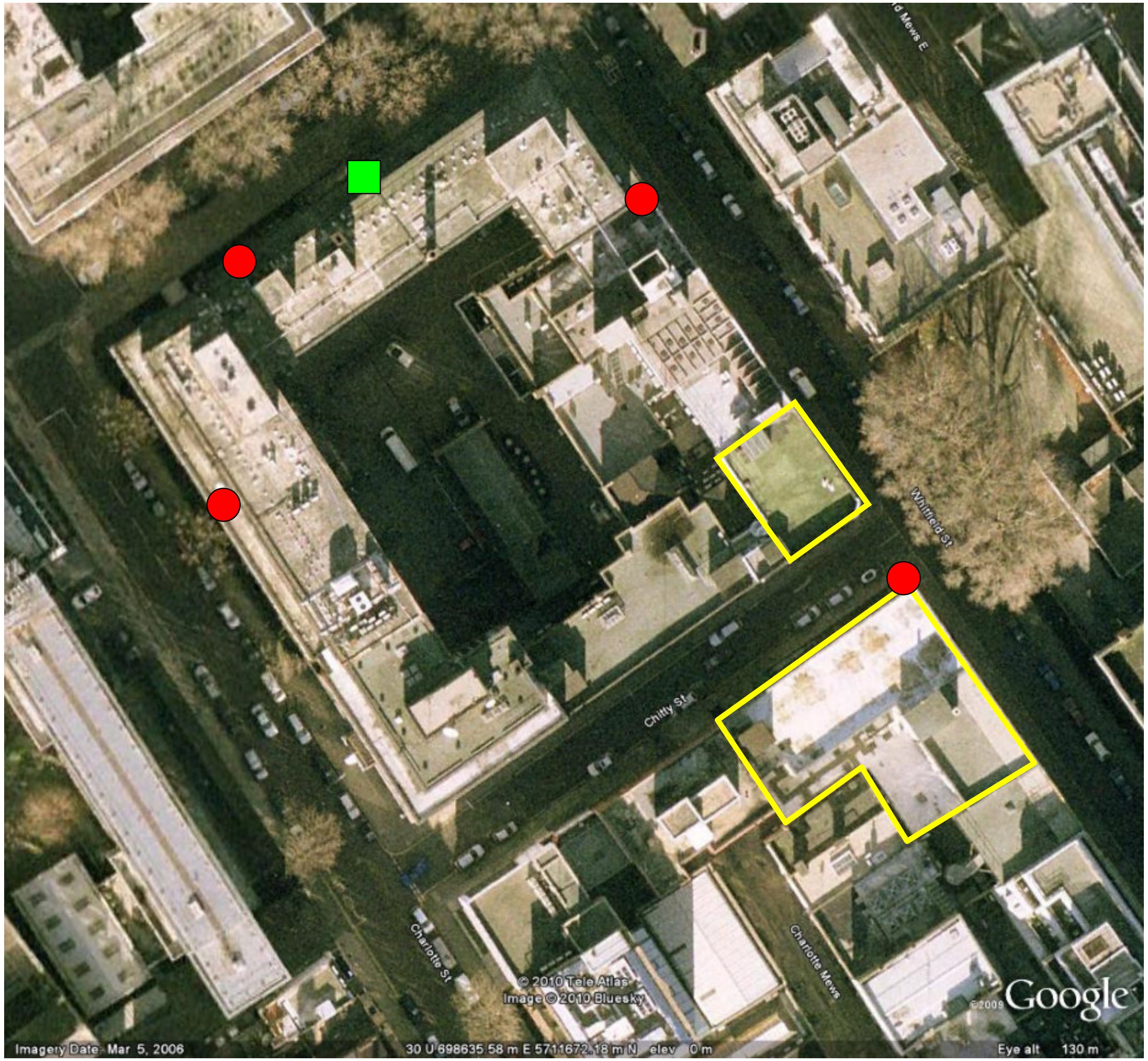
The survey has allowed the minimum sound reduction requirements of the external building fabric to be established as a performance specification, which should be incorporated into the scheme at the detailed design stage.

It is important that the successful contractor demonstrates in a UKAS accredited or an equal and approved laboratory that the minimum sound reduction requirements can be achieved by their proposed window systems.

Measured levels of vibration have been found to be within acceptable limits, with reference to BS6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings*.

Measurements have been made to establish the current background noise climate. This has enabled design criteria to be set for the control of plant noise emissions to noise sensitive properties, in accordance with The London Borough of Camden requirements.

Jamie Duncan MIOA
ALAN SAUNDERS ASSOCIATES



Automated noise monitoring position

Automated vibration monitoring position

Approximate boundary of residential areas

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Project: 80 Charlotte Street & 55-65 Whitfield Street, Camden

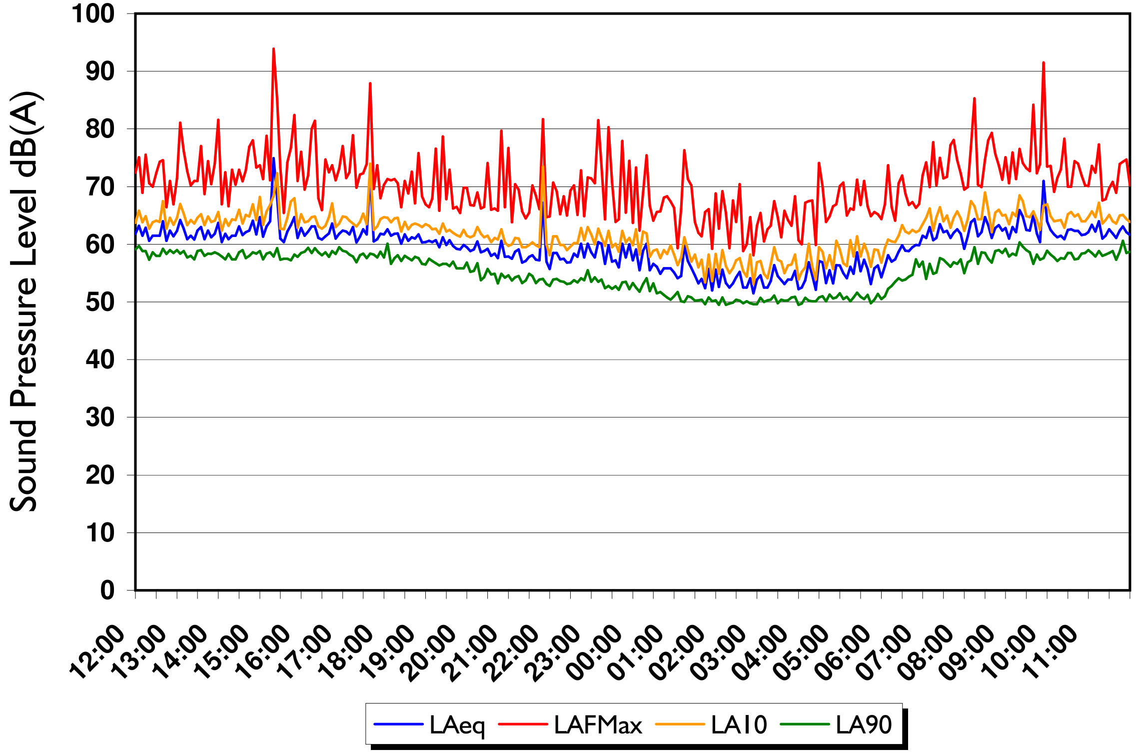
Title: Indicative Site Plan

Figure: AS6171/SP1

Date: 6th December 2010

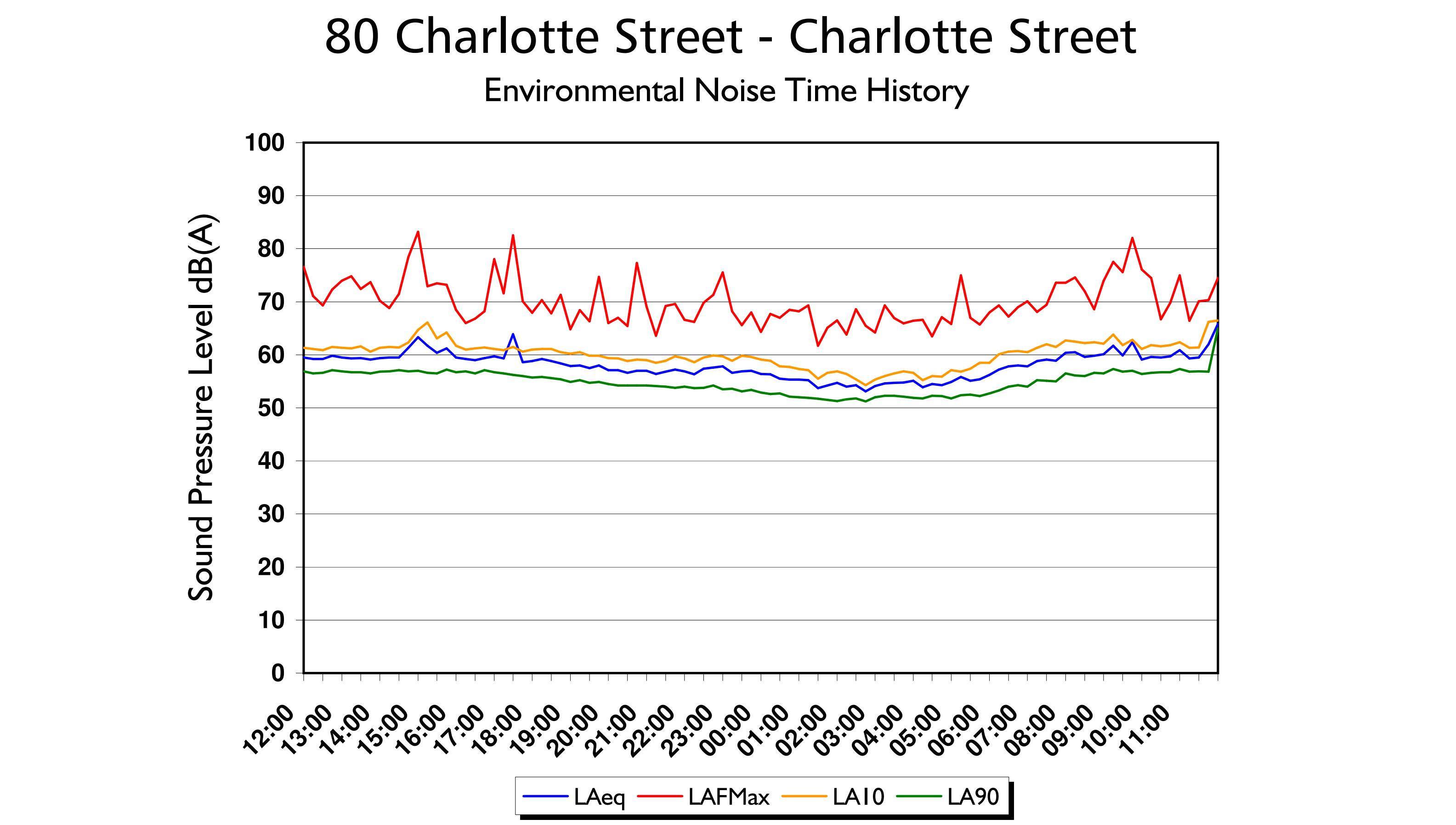
80 Charlotte Street - Howland Street

Environmental Noise Time History



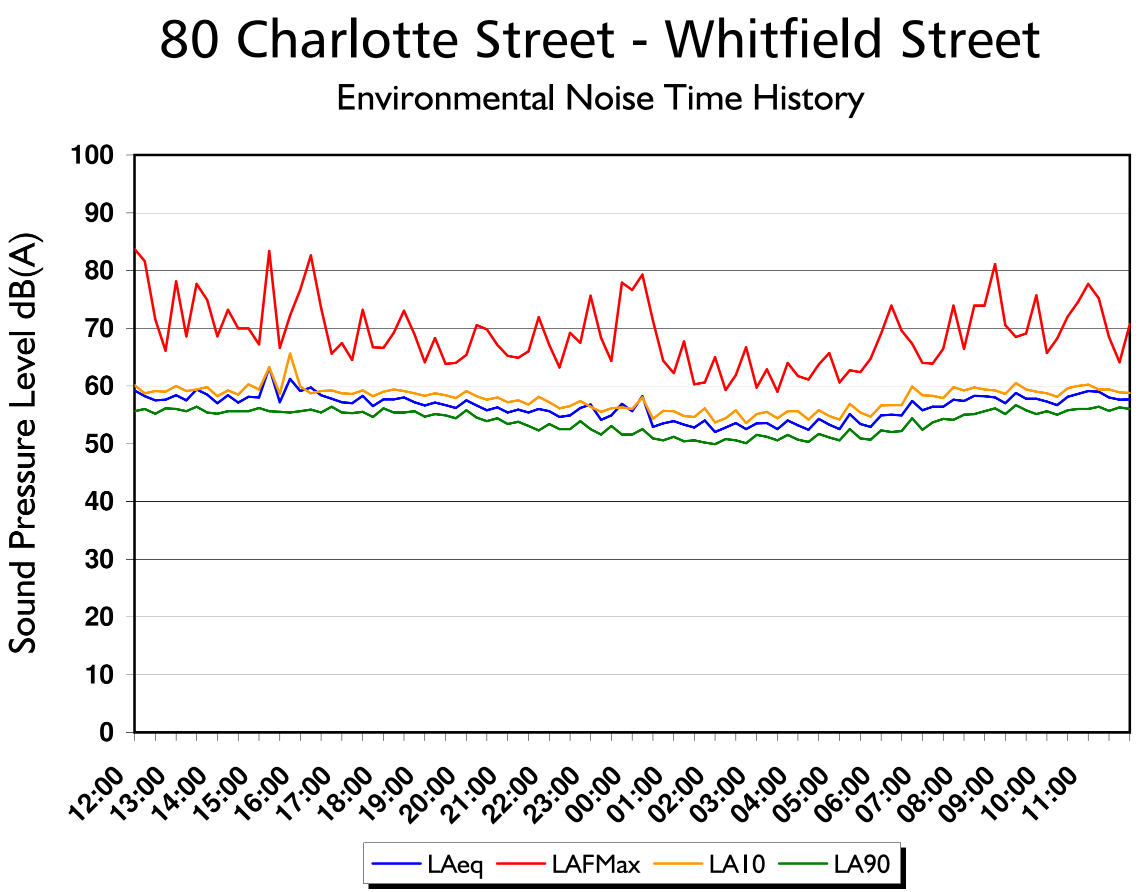
Wednesday 01 September to Thursday 02 September

Figure AS6171/TH1



Wednesday 01 September to Wednesday 01

Figure AS6171/TH2

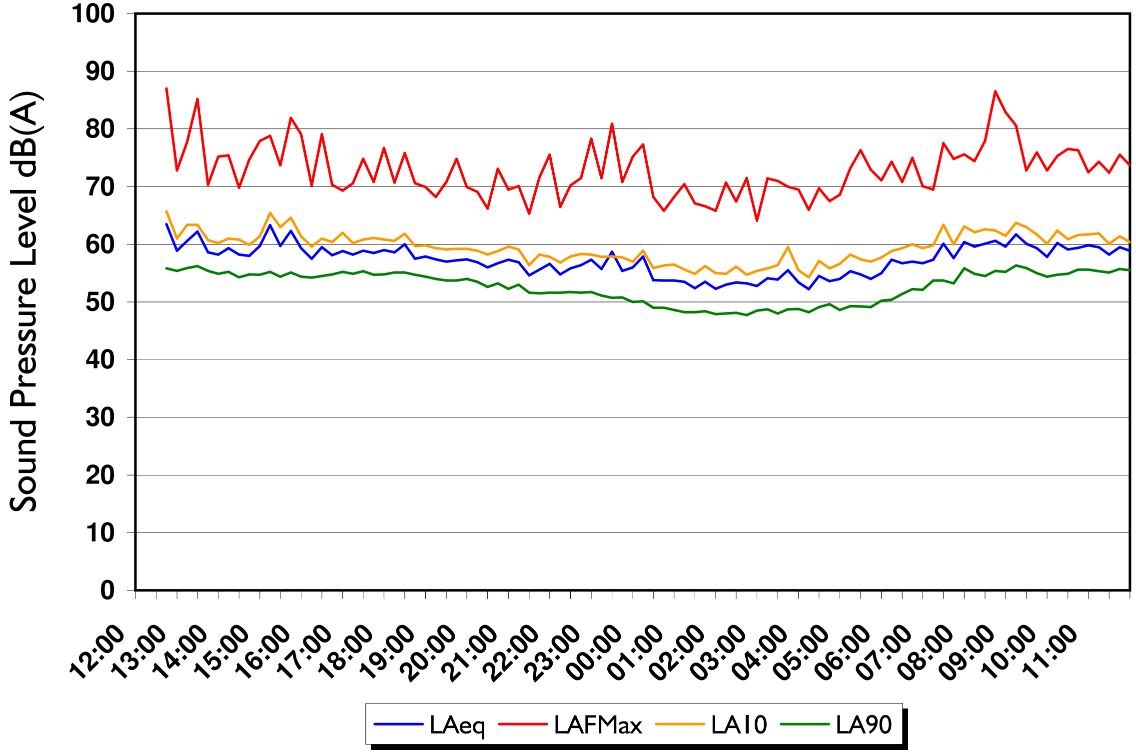


Wednesday 01 September to Wednesday 01

Figure AS6171/TH3

65 Whitfield Street

Environmental Noise Time History



Wednesday 01 September to Thursday 02 September

Figure AS6171/TH4

RECOMMENDED NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS NEAR EXISTING NOISE SOURCES: PPG24

NOISE LEVELS[0] CORRESPONDING TO THE NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS $L_{Aeq,T}$ dB

		NOISE EXPOSURE CATEGORY			
NOISE SOURCE	**PERIOD**	**A**	**B**	**C**	**D**
road traffic	07.00 - 23.00 23.00 - 07.00[1]	<55 <45	55 - 63 45 - 57	63 - 72 57 - 66	>72 >66
rail traffic	07.00 - 23.00 23.00 - 07.00[1]	<55 <45	55 - 66 45 - 59	66 - 74 59 - 66	>74 >66
air traffic[2]	07.00 - 23.00 23.00 - 07.00[1]	<57 <48	57 - 66 48 - 57	66 - 72 57 - 66	>72 >66
mixed sources[3]	07.00 - 23.00 23.00 - 07.00[1]	<55 <45	55 - 63 45 - 57	63 - 72 57 - 66	>72 >66

NEC	GUIDANCE
A	Noise need not be considered as a determined factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

NOTES

[0] **Noise Levels:** the noise level(s) (L_{AeqT}) used when deciding the NEC of a site should be representative of typical conditions.

[1] **Night time noise levels (23:00 -07:00):** sites where individual noise events regularly exceed 82dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq, 8hr}$(except where the $L_{Aeq, 8hr}$ already puts the site in NEC D).

[2] **Aircraft noise:** daytime values accord with the contour values adopted by the Department of Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2dB(A) higher than those of other sources because of ground reflection effects.

[3] **Mixed sources:** this refers to any combination of road, rail, air and industrial noise sources. The 'mixed source' values are based on the lower numerical values of the single source limits in the table. The 'mixed source' NECs should only be used where no individual noise source is dominant.

To check if any individual noise source is dominant (for the purposes of this assessment) the noise level from the individual sources should be determined and then combined by decibel addition (remembering first to subtract 2 dB(A) from any aircraft noise contour values). If the level of any one source then lies within 2 dB(A) of the calculated combined value, that source should be taken as the dominant one and the site assessed against the appropriate NEC for that source, rather than using the A'mixed source' NECs. If the dominant source is industrial noise see paragraph 19 of Annex 3.

If the contribution of the individual noise sources to the overall noise level cannot be determined by measurement and/or calculation, then the overall measured level should be used and the site assessed against the NECs for 'mixed sources'.

TABLE AS6171/NEC

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

1.0 ACOUSTIC TERMINOLOGY

The annoyance produced by noise is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and any variations in its level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

dB (A): The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level.

L_{10} & L_{90}: If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the `average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.

It is common practice to use the L_{10} index to describe traffic noise, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.

L_{eq}: The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise.

L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc).

The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.

Because L_{eq} is effectively a summation of a number of noise events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute noise limit.

L_{max}: L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

D The sound insulation performance of a construction is a function of the difference in noise level either side of the construction in the presence of a loud noise source in one of the pair of rooms under test. *D*, is therefore simply the *level difference* in decibels between the two rooms in different frequency bands.

D_w D_w is the *Weighted Level Difference* The level difference is determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1.

$D_{nT,w}$ $D_{nT,w}$ is the *Weighted Standardised Level Difference* as defined in BS EN ISO 717-1 and represents the *weighted level difference*, as described above, corrected for room reverberant characteristics.

C_{tr} C_{tr} is a spectrum adaptation term to be added to a single number quantity such as $D_{nT,w}$, to take account of characteristics of a particular sound.

$L'_{nT,w}$ $L'_{nT,w}$ is the *Weighted Standardised Impact Sound Pressure Level* as defined in BS EN ISO 717-2 and represents the level of sound pressure when measured within room where the floor above is under excitation from a calibrated tapping machine, corrected for the receive room reverberant characteristics.

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

2.0 OCTAVE BAND FREQUENCIES

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation have agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, eg. 250 Hz octave band runs from 176 Hz to 353 Hz. The most commonly used bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

3.0 HUMAN PERCEPTION OF BROADBAND NOISE

Because of the logarithmic nature of the decibel scale, it should be borne in mind that noise levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) is not twice as loud as 50 dB(A) sound level. It has been found experimentally that changes in the average level of fluctuating sound, such as traffic noise, need to be of the order of 3 dB(A) before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10 dB(A) is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in traffic noise level can be given.

INTERPRETATION

Change in Sound Level dB(A)	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

4.0 EARTH BUNDS AND BARRIERS - EFFECTIVE SCREEN HEIGHT

When considering the reduction in noise level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a 3 metre high barrier exists between a noise source and a listener, with the barrier close to the listener, the listener will perceive the noise source is louder, if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the noise source would seem quieter than it was if he were standing. This may be explained by the fact that the "effective screen height" is changing with the three cases above, the greater the effective screen height, in general, the greater the reduction in noise level.

Where the noise sources are various roads, the attenuation provided by a fixed barrier at a specific property will be greater for roads close to the barrier than for roads further away.