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REPORT AS4302/NIA Rev.C

74-77 GREAT RUSSELL STREET LONDON WC1

NOISE IMPACT ASSESSMENT

Prepared: 9th October 2006

The Bedford Estate
c/o Taylor Project Services
No. 1 Cornhill
London
EC3V 3ND

CONTENTS

List of Attachments

1.0 INTRODUCTION

As part of the refurbishment of 74-77 Great Russell Street, London planning approval is being sought for the new building services plant to be installed at roof level.

Alan Saunders Associates has been commissioned to carry out an environmental noise survey in order to measure the prevailing background noise climate at the site. The background noise levels measured will be used to determine daytime and night-time noise emission limits for new building services plant in accordance with the planning requirements of London Borough of Camden.

Calculations have been undertaken to demonstrate the ability of new plant to achieve the design criteria at the nearest noise sensitive receiver.

2.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at roof level at the location shown in site plan AS4302/SP1. Measurements of consecutive 15 minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 12:00 hours on Monday 22nd March and 12:00 hours on Thursday 23rd March 2006.

These measurements will allow a suitable noise criterion level 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:

- Norsonic data-logging sound level meter type 118
- G.R.A.S. Environmental Microphone type 41AL
- Norsonic sound level calibrator type 1253
- Specialist acoustic software

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

The weather during the survey was dry and mild with only moderate wind, which made the conditions suitable for the measurement of environmental noise.

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

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

3.0 RESULTS

Figure AS4302/TH1 shows the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as a time history at the measurement position.

4.0 DISCUSSION

The background noise climate at the site is dominated by road traffic noise from Great Russell Street and the surrounding environs.

The measured minimum background levels are shown in Table 4.1 below.

Monitoring period	Minimum $L_{A90,15mins}$
07:00 - 23:00 hours	48 dB (A) 22:45 – 23:00, Wednesday 22/03/06
07:00 - 19:00 hours	50 dB (A) 07:00 – 07:15, Thursday 23/03/06
23:00 - 07:00 hours	42 dB(A) 02:00 – 02:15, Thursday 23/03/06

Table 4.1 Measured minimum background noise levels

5.0 DESIGN CRITERIA

London Borough of Camden's current planning conditions, which have been imposed on the building services plant of this development, are as follows:

1(a) *"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 are in operation. Where it is anticipated that any plant/equipment 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) special attention should be given to reducing the noise levels from that piece of plant/equipment at any sensitive façade to at least 10dB(A) below the L_{A90}, expressed in dB(A)."*

1(b) *"For each of the octave band of centre frequencies 63Hz-8KHz inclusive, noise levels from all plant/equipment (measured in L_{Aeq}) when in operation shall at all times add not more than 1 decibel to the existing background noise level L_{A90}, expressed in dB(A), in the same octave band as measured 1 metre external to sensitive facades."*

1(c) *"All related measurements shall be carried out over a period of 60 minutes (that is, hourly recorded measurements shall be presented over a 24 hour period)."*

5.1 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 5.1 Excerpt from BS8233: 1999

It is not expected that tonal noise will be generated by the new plant and so it is proposed to set the design noise criterion at the nearest noise sensitive receiver to the level detailed in Table 5.2 below.

Operating Period (24-Hour Operation)
L_{Aeq} 37 dB

Table 5.2 Noise criterion at nearest sensitive receiver

6.0 PREDICTED NOISE IMPACT

6.1 Proposed plant

The selected roof-mounted plant has been confirmed as:

- 5 no. Daikin Condensing Units Type RXQ8M7W1B

The approximate location of the plant to be installed is shown on the attached site plan AS4302/SP1.

Maximum noise levels generated by the type RXQ8M7W1B condenser to be installed are as follows:

Freq (Hz)	63	125	250	500	1000	2000	4000	dB(A)
Lp @ 1m (dB)	56	61	56	54	48	44	37	55

Table 6.1 Source Noise Data for the Type RXQ8M7W1B condenser

6.2 Predicted noise levels

Following a careful inspection of the environs, the residential receiver considered to be most affected was found to be the rear window of 18 Bloomsbury Place, the adjacent property to 74-77 Great Russell Street. Calculations of plant noise emissions have been made 1m from the façade of the nearest noise sensitive window details of which are included with this report in Appendix B. The distance between the location of the proposed plant (shown on AS4302/SP1) and the nearest residential window has been measured at 13m. The window is also afforded line of sight screening from the condensing units by the parapet wall on the roof of 74-77 Great Russell Street.

Based on the information provided by Taylor Project Services at the time of writing, the predicted plant noise level at the nearest noise sensitive receiver has been calculated using the noise data detailed in Table 6.1 above.

Predicted noise level at nearest sensitive location due to the new plant	24-hour design criterion
35 dB(A)	37 dB(A)

Table 6.2 Predicted noise level and criterion at nearest noise sensitive location

The full calculations are shown in Appendix B.

Appendix B also shows that noise emissions due to the proposed plant would be at least 5dB below the background traffic noise at each octave frequency band except at 8kHz where it would exceed it by 1dB. Therefore, compliance would be achieved with the London Borough of Camden's requirements in all octave bands except 8kHz where a marginal but imperceptible exceedance may occur.

6.3 Comparison to BS8233:1999 Criteria

Table 6.2 clearly shows that predicted noise levels from the plant are within the BS8233 internal noise criteria.

7.0 CONCLUSIONS

An environmental noise survey has been carried out at 74-77 Great Russell Street, London by Alan Saunders Associates between Wednesday 22nd March and Thursday 23rd March 2006.

Establishing the background noise climate has enabled a 24-hour design criterion to be set for the control of plant noise emissions to noise sensitive properties, in accordance with the requirements set by the London Borough of Camden.

Data for the proposed Daikin condensing units have been used to predict the noise impact of the new plant on the nearest residential receiver.

Compliance with the noise emission design criterion has been shown. Further mitigation measures are not required for external plant noise emissions.

Daniel Saunders AMIOA

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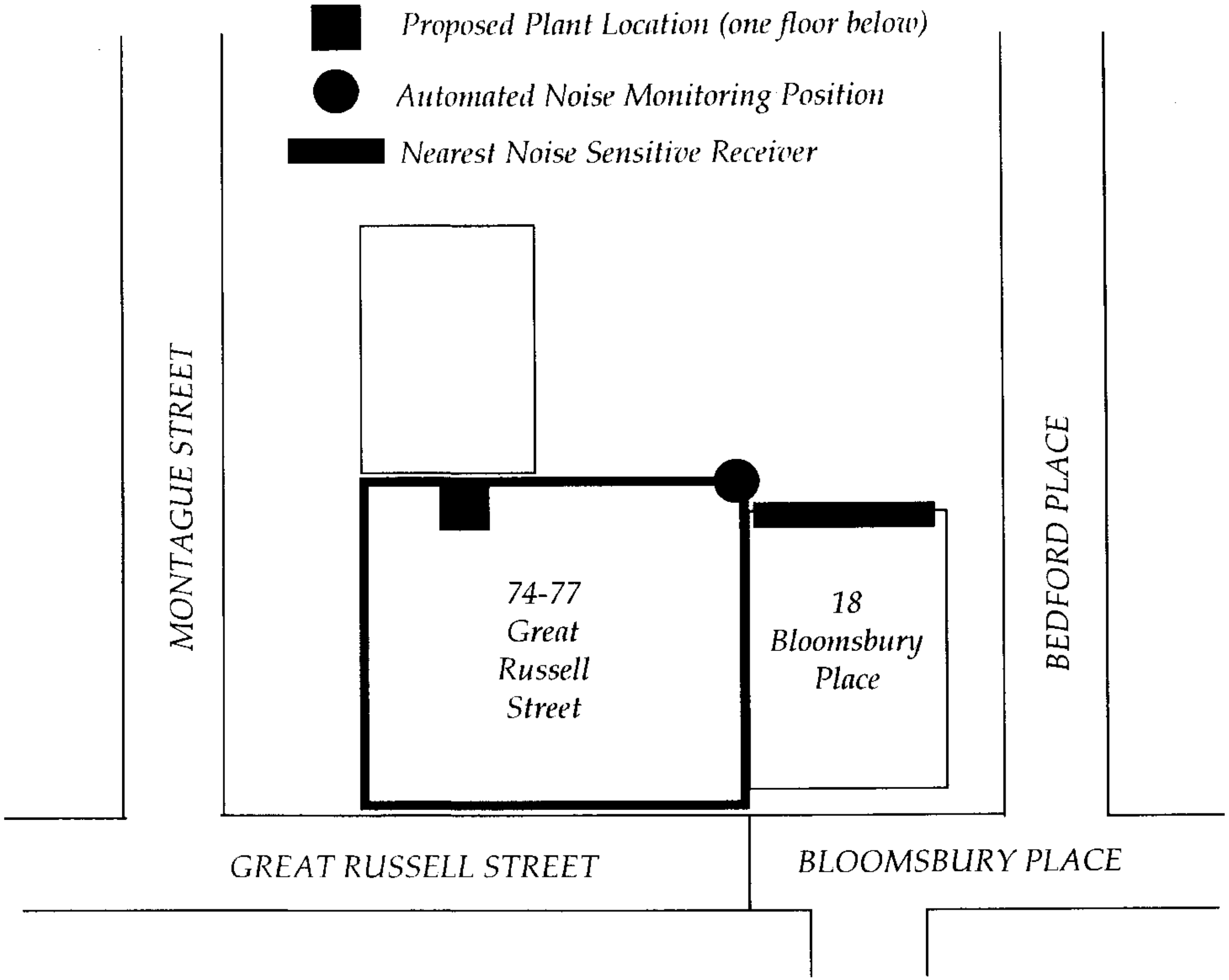

Title:

Indicative site plan showing automated noise monitoring position, location of proposed new plant and nearest noise sensitive window

Project:

74-77 Great Russell Street, London WC1

Figure No:

AS4302/SP1

Date:

9th October 2006

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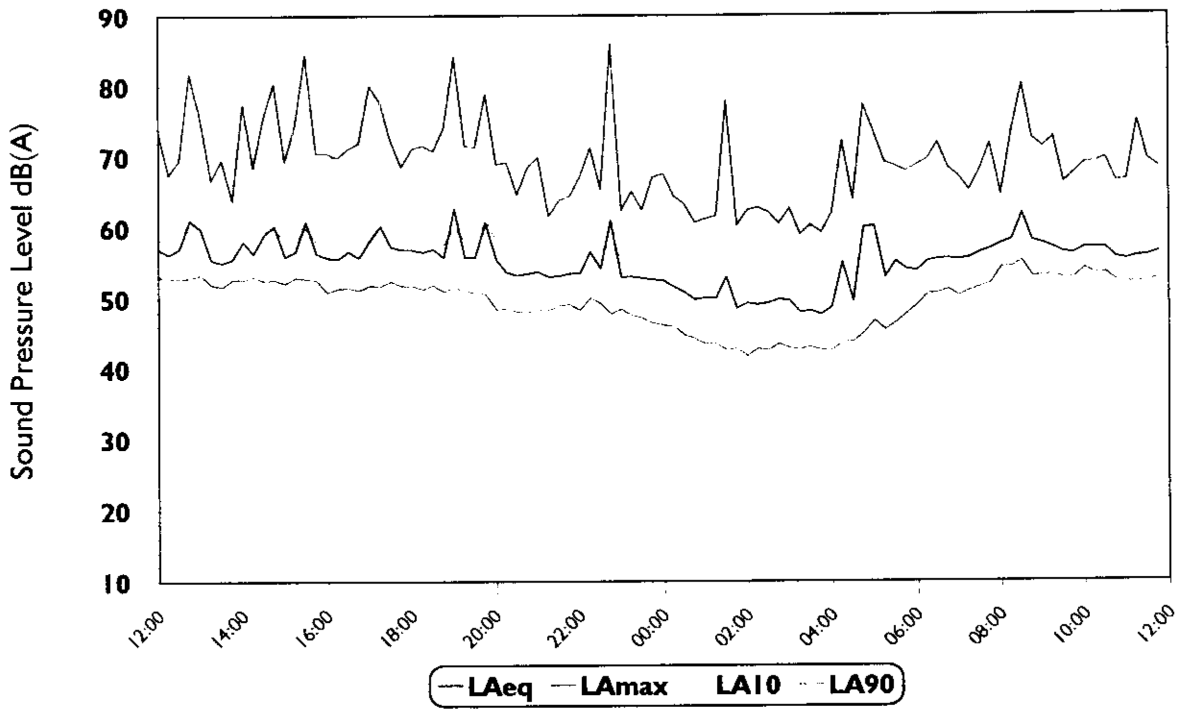
Environmental Noise Time History



Wednesday 22nd March to Thursday 23rd March 2006

Figure AS4302/TH1

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.

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

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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.

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APPENDIX B

EXTERNAL PLANT NOISE EMISSIONS CALCULATION REV.B

Calculation 1: Direct path to nearest residential window

		63	125	250	500	1000	2000	4000	8000	dB(A)
Condenser	5 no. Daikin RXQ8M7W1B condensing units									
Sound pressure level	1 m	56	61	56	54	48	44	37	37	55
[illegible]	5	7	7	7	7	7	7	7	7	
Distance loss to receiver (nearest window)	13 m	-22	-22	-22	-22	-22	-22	-22	-22	
Screening loss		-5	-5	-5	-5	-5	-5	-5	-5	
Sound pressure level at nearest residential receiver		36	41	36	34	28	24	17	17	35
									24 Hour Design Criterion	**37** dB(A)

Calculation 2: Comparing minimum L90 spectrum with plant noise at nearest residential window

		63	125	250	500	1000	2000	4000	8000	dB(A)
Condenser	5 no. Daikin RXQ8M7W1B condensing units									
Plant noise level at receiver	1 m	36	41	36	34	28	24	17	17	35
Min L90 spectrum		50	48	44	40	37	32	20	16	42
SPL difference		14	7	8	6	9	8	3	-1	