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specialist consultants

REPORT AS8240.150429.NIA1.1

25 BEDFORD SQUARE, LONDON

NOISE IMPACT ASSESSMENT

Prepared: 17 July 2015

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List of Attachments

1.0 INTRODUCTION

Planning approval is being sought for the installation of new plant at 25 Bedford Square, London.

Clarke Saunders Associates has been commissioned by Taylor Project Services to undertake 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 and subsequently to assess noise emission of proposed building services plant in accordance with the planning requirements of Camden Council.

2.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing external background noise levels was undertaken at the rear 4th floor flat roof area of the property, at the location shown in site plan AS8240/SP1. Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 13:10 hours on Monday 30th March and 13:05 hours on Wednesday 1st April 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:

- Norsonic data logging sound level meter type 118;
- G.R.A.S environmental microphone type 41AL;
- Norsonic sound level calibrator type 1253.

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

The weather during the survey was dry 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 AS8240/TH1-TH3 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 property is determined road traffic noise in the surrounding streets with a contribution from an extract system installed on a building to the north west.

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

Monitoring period	Minimum $L_{A90,10mins}$
07:00 - 23:00 hours	51 dB 18:15-18:20, 30/03/2015
23:00 - 07:00 hours	48 dB 02:25-02:30, 01/04/2015
24 hours	48 dB

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

5.0 DESIGN CRITERIA

Camden Council currently requires new plant to be 5dB below the background level.

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.

Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)	24 hours
L_{Aeq} 46 dB	L_{Aeq} 43 dB	L_{Aeq} 43 dB

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

5.2 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 $L_{Aeq, 8 hour}$

Table 5.2 - Excerpt from BS8233: 2014 **[dB ref. 20µPa]**

6.0 PREDICTED NOISE IMPACT

6.1 Proposed plant

The selected plant items have been confirmed as:

- 2 no. Daikin Condensing Units Type RXYSCQ4
- 2 no. Daikin Condensing Units Type RXYSCQ5
- 1 no. Daikin Condensing Unit Type RXS60F

The approximate location of the plant to be installed is shown in site plan AS8240/SP1 at roof level with a RXS60F unit at basement level within the front vaults area.

Noise levels generated by the units have been confirmed by the manufacturer as follows:

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
RXYSCQ4 Lp @ 1m (dB)	60	53	53	51	47	42	35	29	52
RXYSCQ5 Lp @ 1m (dB)	63	55	54	52	48	43	36	30	53
RXS60F Lp @ 1m (dB)	55	60	53	46	45	43	41	36	52

Table 6.1 - Source noise data for the plant items **[dB ref. 20µPa]**

6.2 Predicted noise levels

Following an inspection of the site, the nearest noise sensitive receivers are situated at third floor level of Gower Mews Mansions located on Gower Mews, as shown on the indicative site plan AS8240/SP1. These windows are at least 43 metres away from the proposed plant location and 55mm from the basement vault location.

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. Screening losses afforded by the existing masonry roof edge have been included in the prediction of the cumulative plant noise level at the nearest receiver. An additional assessment has been undertaken for the condenser located in the vault to outside the nearest window at the adjacent property, 24 Bedford Square.

Receiver	Predicted noise level	Design criterion
Gower Mews	L_{Aeq} 21 dB	L_{Aeq} 43 dB
24 Bedford Square	L_{Aeq} 28 dB	L_{Aeq} 43 dB

Table 6.2 - Predicted noise level and criteria **[dB ref. 20μPa]**

A summary of the calculations are shown in Appendix B.

6.3 Comparison to BS8233:2014 Criteria

Previous publications of BS8233 have assumed a loss of 10dB - 15dB for a partially open window. Assuming a conservative loss of 10dB, the predicted noise level shown in Table 6.2 would result in an internal noise levels that would comply with the level recommended by BS8233:2014 for sleeping in bedrooms at night, as shown in Table 5.2.

7.0 CONCLUSION

An environmental noise survey has been undertaken at 25 Bedford Square, London by Clarke Saunders Associates between Monday 30th March and Wednesday 1st April 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 Camden Council's requirements.

Data for the new plant items has been used to predict the noise impact of the new plant on nearby residential properties.

Compliance with the noise emission design criterion set by Camden, shown in Table 5.1, has been demonstrated. No further mitigation measures are, therefore, required for external noise emissions.

Jamie Duncan
Jamie Duncan (Jul 17, 2015)

Jamie Duncan MIOA
CLARKE SAUNDERS ASSOCIATES

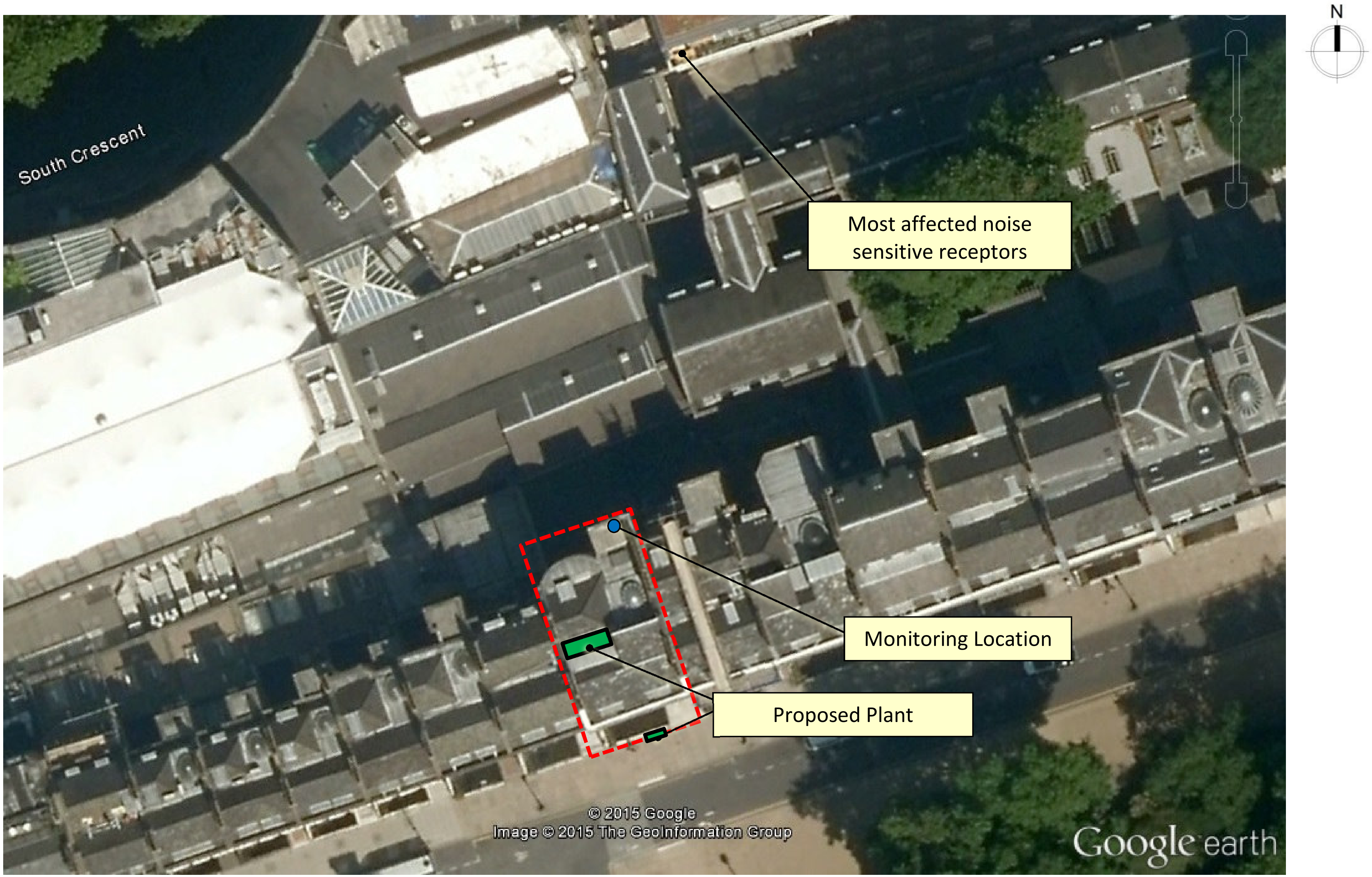
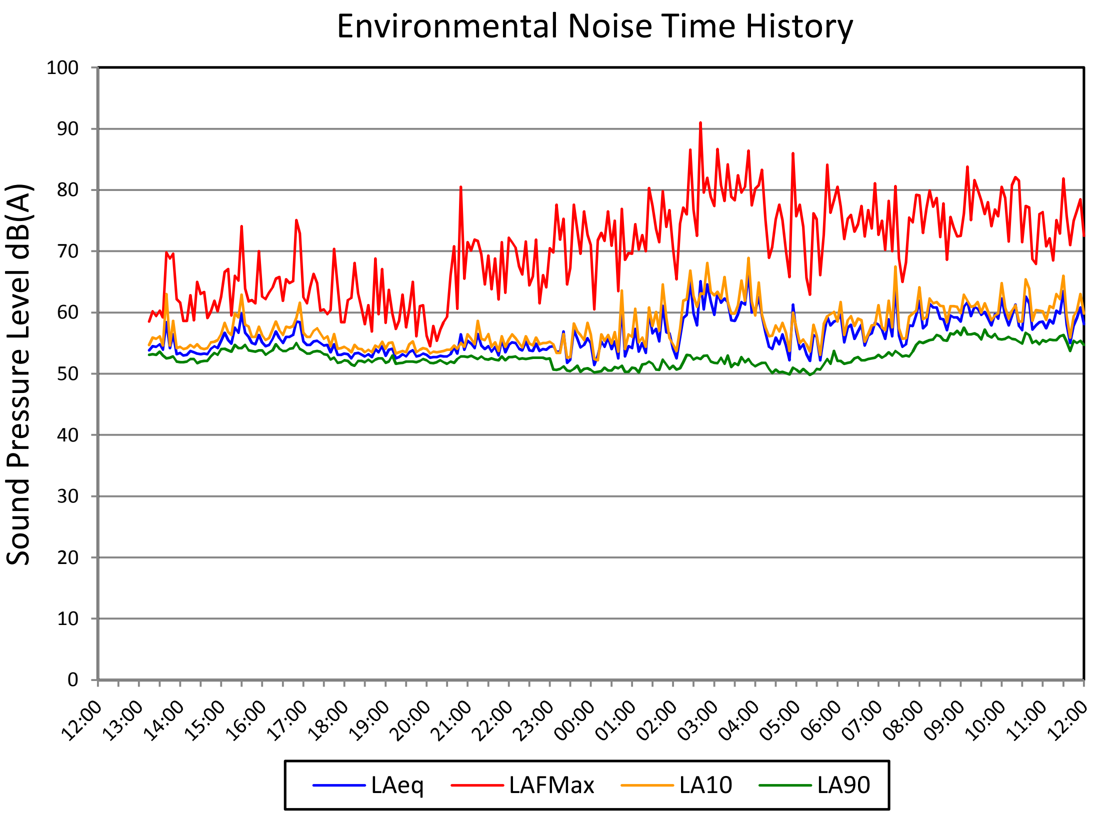


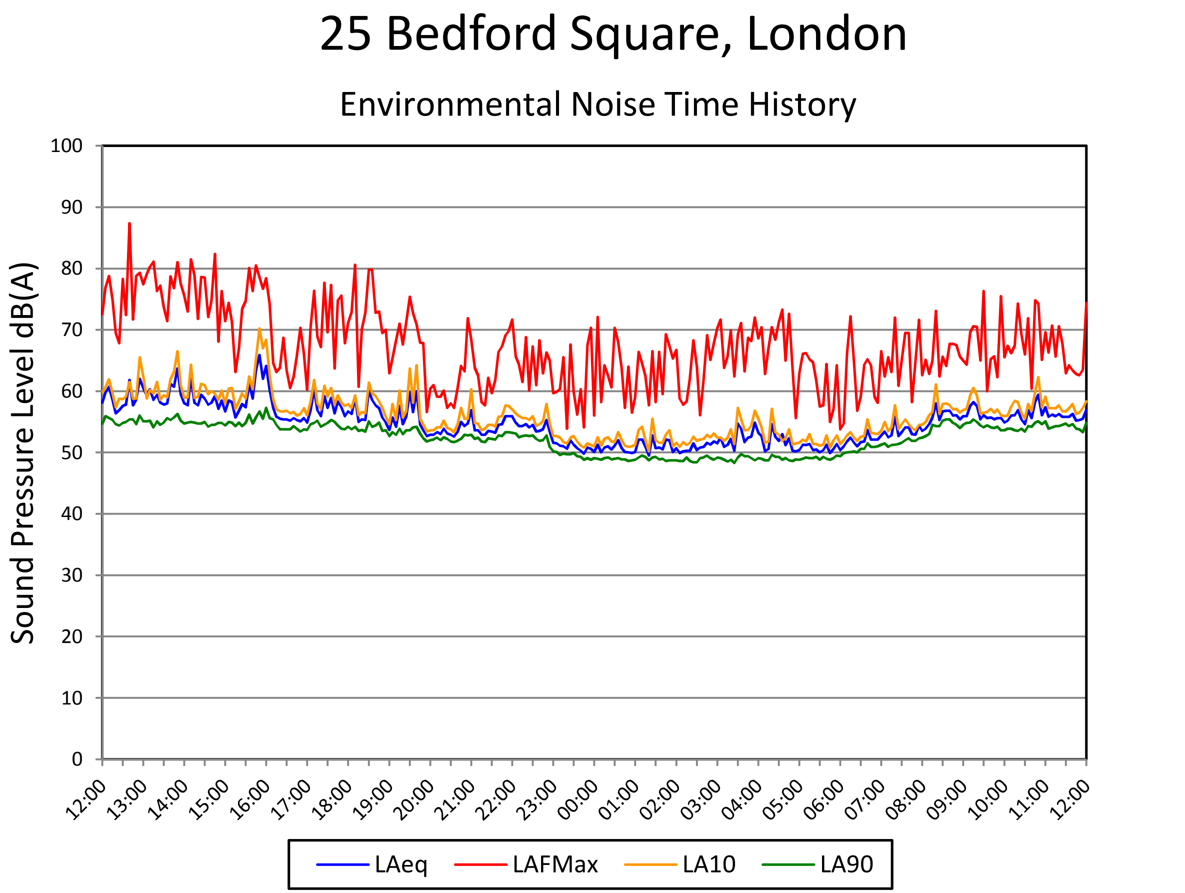
Figure AS8240/SP1

25 Bedford Square, London



Monday 30 March to Tuesday 31 March 2015

Figure AS8240/TH1

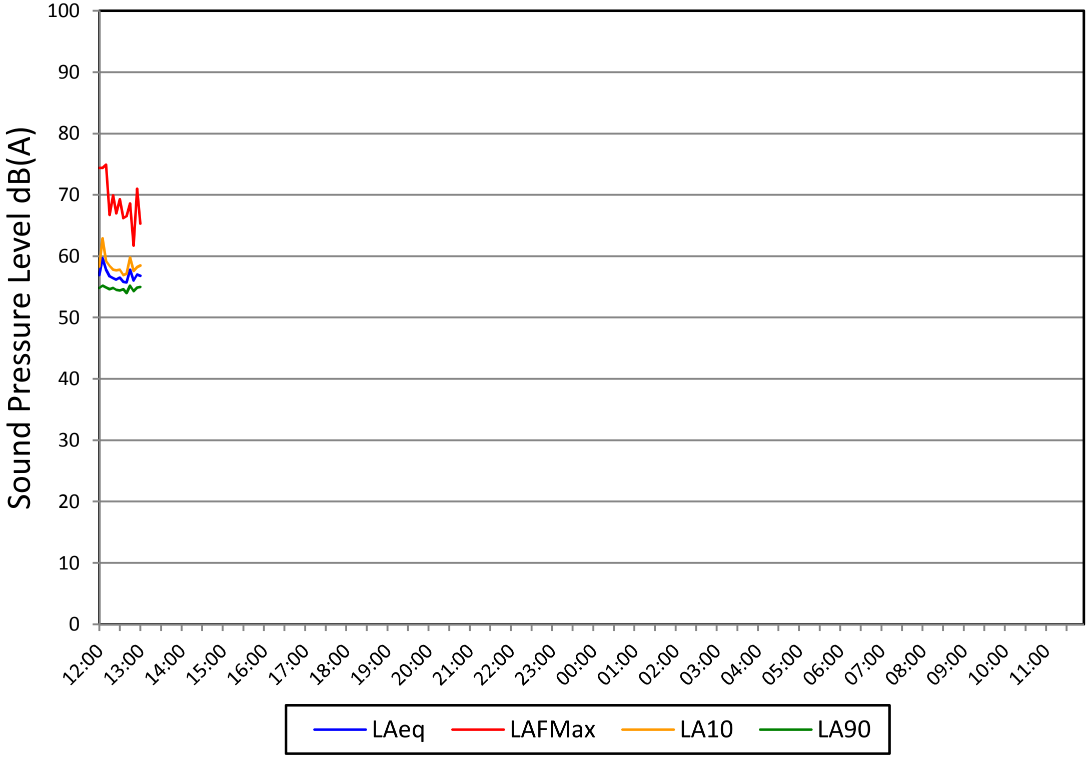


Tuesday 31 March to Wednesday 01 April 2015

Figure AS8240/TH2

25 Bedford Square, London

Environmental Noise Time History



Wednesday 01 April to Thursday 02 April 2015

Figure AS8240/TH3

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.

APPENDIX B

EXTERNAL PLANT NOISE EMISSIONS CALCULATIONS

Calculation 1: Rooftop

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXYSCQ4	Lp	1 m	60	53	53	51	47	42	35	29	52
Number of units		2	3	3	3	3	3	3	3	3	
Distance Loss		43 m	-33	-33	-33	-33	-33	-33	-33	-33	
Screening*			-18	-18	-18	-18	-18	-18	-18	-18	
Level At Receiver			*12*	*5*	*5*	*3*	*-1*	*-6*	*-13*	*-19*	4

* Screening limited to -18dB

Calculation 2: Rooftop

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXYSCQ5	Lp	1 m	63	55	54	52	48	43	36	30	53
Number of units		1	0	0	0	0	0	0	0	0	
Distance Loss		43 m	-33	-33	-33	-33	-33	-33	-33	-33	
Screening*			-18	-18	-18	-18	-18	-18	-18	-18	
Level At Receiver			*12*	*4*	*3*	*1*	*-3*	*-8*	*-15*	*-21*	2

* Screening limited to -18dB

Calculation 3: Rooftop

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXYSCQ5	Lp	1 m	63	55	54	52	48	43	36	30	53
Number of units		1	0	0	0	0	0	0	0	0	
Distance Loss		43 m	-33	-33	-33	-33	-33	-33	-33	-33	
Level At Receiver			*30*	*22*	*21*	*19*	*15*	*10*	*3*	*-3*	20

Calculation 4: Rooftop

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXS60F	Lp	1 m	55	60	53	46	45	43	41	36	52
Number of units		1	0	0	0	0	0	0	0	0	
Distance Loss		55 m	-35	-35	-35	-35	-35	-35	-35	-35	
Screening*			-18	-18	-18	-18	-18	-18	-18	-18	
Level At Receiver			*2*	*7*	*0*	*-7*	*-8*	*-10*	*-12*	*-17*	-1

* Screening limited to -18dB

Cumulative plant noise level at nearest receiver 21 dB(A)

24-hour plant noise design criterion 43 dB(A)