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REPORT AS7738.140313.NIA

18 BEDFORD SQUARE
LONDON

NOISE IMPACT ASSESSMENT

Prepared: 13 March 2014

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CONTENTS

List of Attachments

1. INTRODUCTION

Planning approval is being sought for the installation of new basement and roof level plant at 18 Bedford Square, London.

Clarke Saunders Associates has been commissioned by Taylor Project Services to undertake an assessment of noise emissions from the proposed plant in accordance with the planning requirements of Camden Council.

An environmental noise survey has been undertaken in order to measure the prevailing background noise climate at the site from which daytime and night-time noise emission limits for new building services plant have been derived.

2. SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at rear 2nd floor level of the building at the location shown in site plan AS7738/SP1, in an environment representative of the nearest receiver. Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10}, L_{A90} and spectral sound pressure levels were taken between 12:55 hours on Friday 24th and 11:35 hours on Monday 27th January 2014.

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:

- 1 no. Norsonic data logging sound level meter type 118;
- 1 no. Norsonic sound level calibrator type 1253.

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

Figures AS7738/TH1 – TH3 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the measurement position.

4. DISCUSSION

The background noise climate at the monitoring location is determined by adjacent plant serving a neighbouring property.

Minimum background levels are shown in Table 4.1 below.

Monitoring period	Minimum $L_{A90,5mins}$
07:00 - 23:00 hours	45 dB 07:35 – 07:40, 26/01/14
23:00 - 07:00 hours	45 dB 05:20 – 05:25, 26/01/14

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

5. DESIGN CRITERION

Camden Council currently requires the following in regard to external plant noise emissions:

> *"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)."*

In addition, the background level must not be exceeded by more than 1dB in any octave band between 63Hz and 8kHz.

On this basis, the resultant plant noise emissions criteria that should not be exceeded at the most affected noise sensitive receiver are detailed in Table 5.1.

Daytime (07:00 – 19:00 hours)	Night-time (23:00 – 07:00 hours)	24-Hour
L_{Aeq} 35 dB	L_{Aeq} 35 dB	L_{Aeq} 35 dB

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

6. PREDICTED NOISE IMPACT

6.1 Proposed Plant

The selected basement level plant has been confirmed as:

- 1 no. Daikin RXYSQ6P8Y1 condensing unit;
- 1 no. Daikin RZQSG71 condensing unit;
- 1 no. Daikin RYYQ8T condensing unit.

The selected roof level plant has been confirmed as:

- 1 no. Daikin RXYSQ5P8Y1 condensing unit;
- 2 no. Daikin RXYSQ6P8Y1 condensing unis.

The proposed location of the plant is shown in site plan AS7738/SP1.

Maximum noise levels generated by the condensing units to be installed have been confirmed by the manufacturer as follows:

L_p @ 1m (dB)	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
RXYSQ6P8Y1	65	57	56	53	50	45	38	33	55
RXYSQ5P8Y1	63	55	54	52	48	43	37	31	53
RYYQ8T	61	58	58	57	52	46	48	37	58
RZQSG71	52	50	52	48	47	41	38	31	51

Table 6.1 – Source noise data for proposed condensing units **[dB ref. 20µPa]**

The spectral data for these plant items does not suggest the presence of any tonal characteristics.

6.2 Predicted noise levels at nearest receiver

Following an inspection of the site, it is not clear where the most affected noise sensitive receiver is located. To ensure a robust assessment, an assessment has been undertaken to outside the nearest window, a third floor window to the rear of 17 Bedford Square.

The noise level at the receiver has been calculated and assessed in general accordance with the guidelines set out in BS4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas*, (upon which the Camden Council criterion is based), using the noise data above.

A screening loss has been included in the calculations for the existing building for the basmement level plant and the roof for the roof level plant.

Freq (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Criterion	50	45	45	44	39	33	22	16	35
Predicted level @ 1m from receiver	44	35	33	28	23	17	13	5	30

Table 6.2 – Predicted noise level and criteria at nearest noise sensitive location dB ref. 20µPa]

The full calculations are shown in Appendix B.

The assessment indicates that predicted noise levels at the identified most affected noise sensitive receiver are compliant with the identified Camden Council criterion and therefore, no further mitigation measures are necessary.

Any other air handling or extract plant will be fitted with acoustically specified splitter attenuators in order that the cumulative noise level does not exceed the 24-hour design noise criterion.

7. CONCLUSIONS

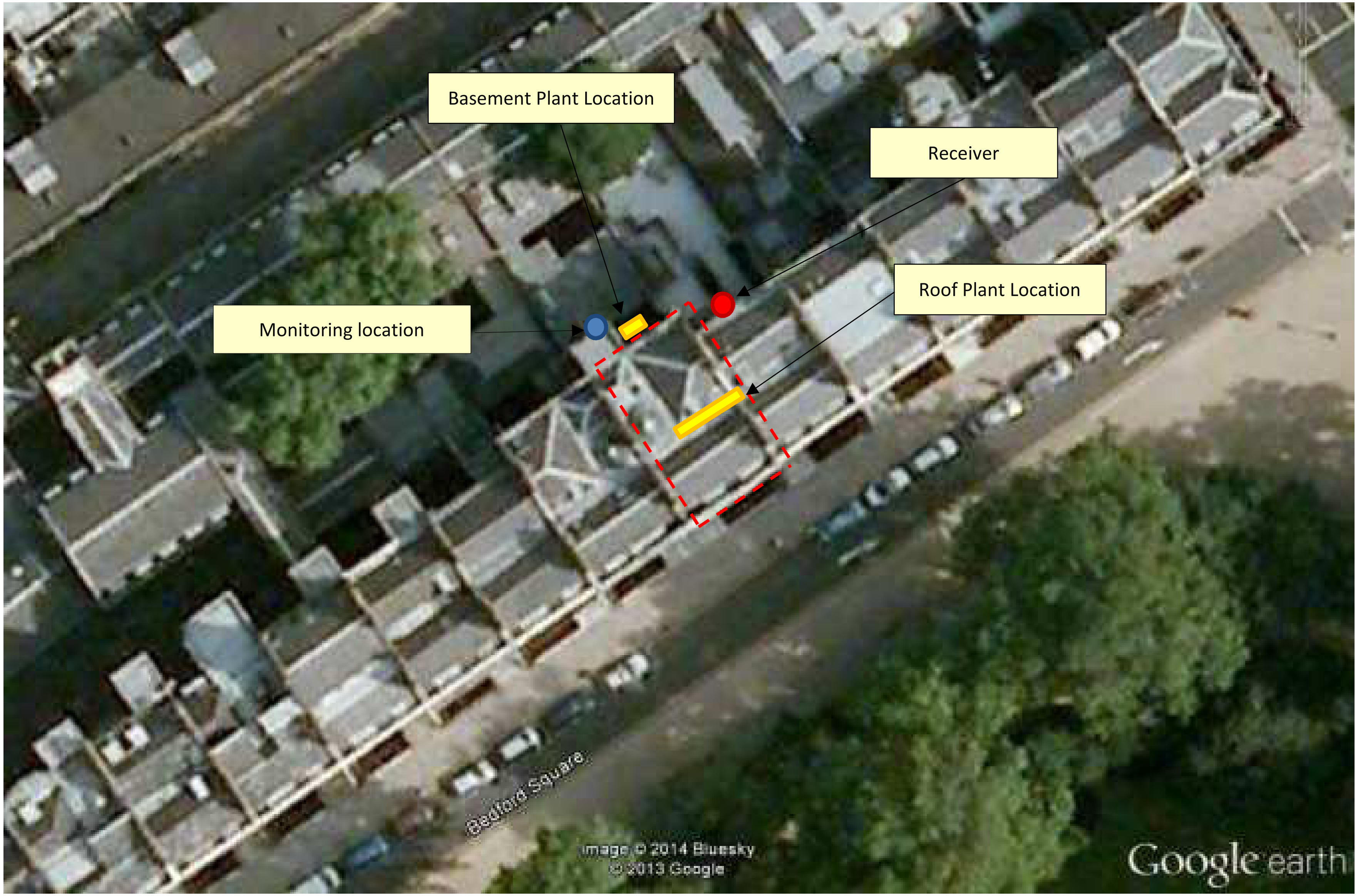
An environmental noise survey has been undertaken at 18 Bedford Square, London by Clarke Saunders Associates between Friday 24th and Monday 27th January 2014.

Measurements have been made to establish the current background noise climate. This has enabled a design criterion to be set for the control of plant noise emissions to atmosphere, in accordance with Camden Council's requirements.

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

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

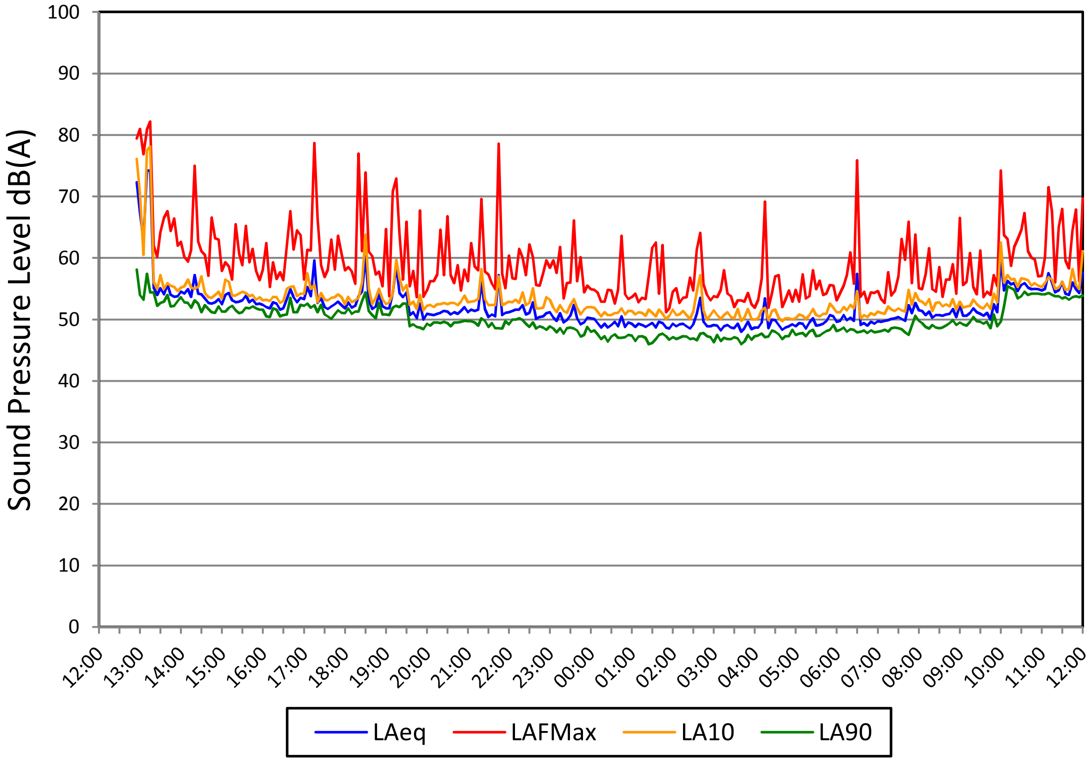
Jamie Duncan AMIOA
CLARKE SAUNDERS ASSOCIATES



clarke saunders associates | acoustics Head Office: Westgate House 39-41 Romsey Road Winchester Hampshire SO22 5BE Tel: 01962 872130 mail@clarkesaunders.com	**Project:** 18 Bedford Square, London	**Title:** Indicative Site Plan	**Figure:** AS7738/SP1	**Date:** 13th March 2014

18 Bedford Square, London

Environmental Noise Time History

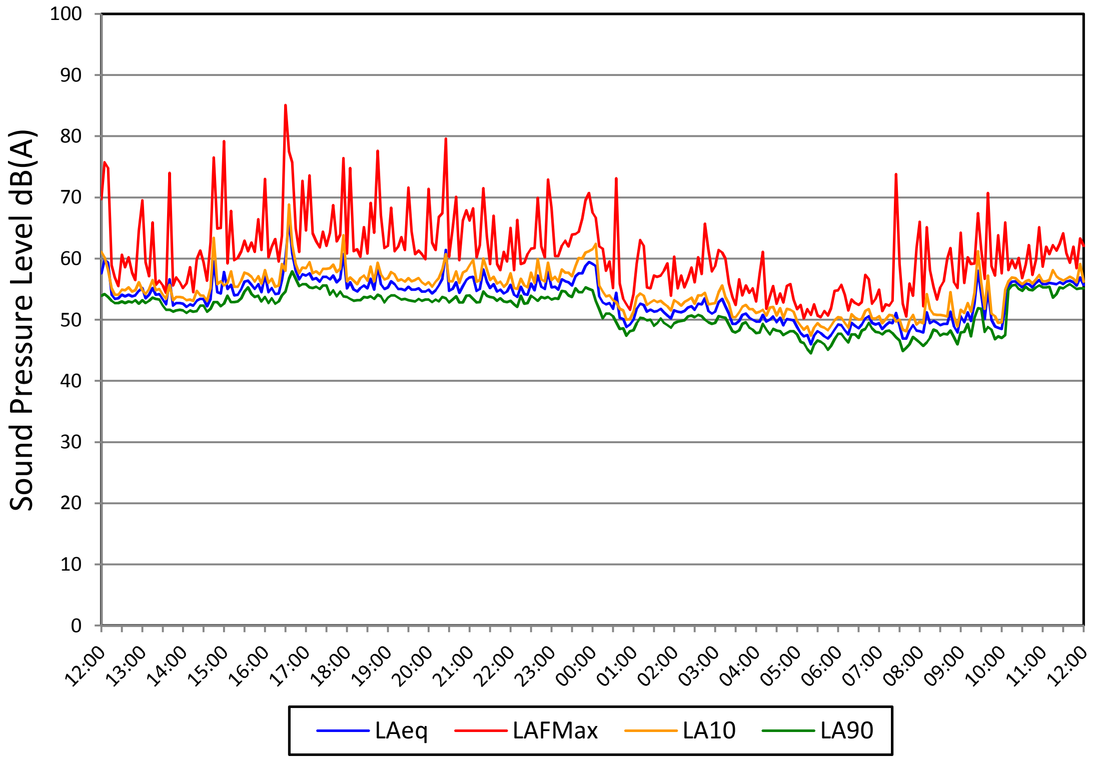


Friday 24 January to Saturday 25 January 2014

Figure AS7738/TH1

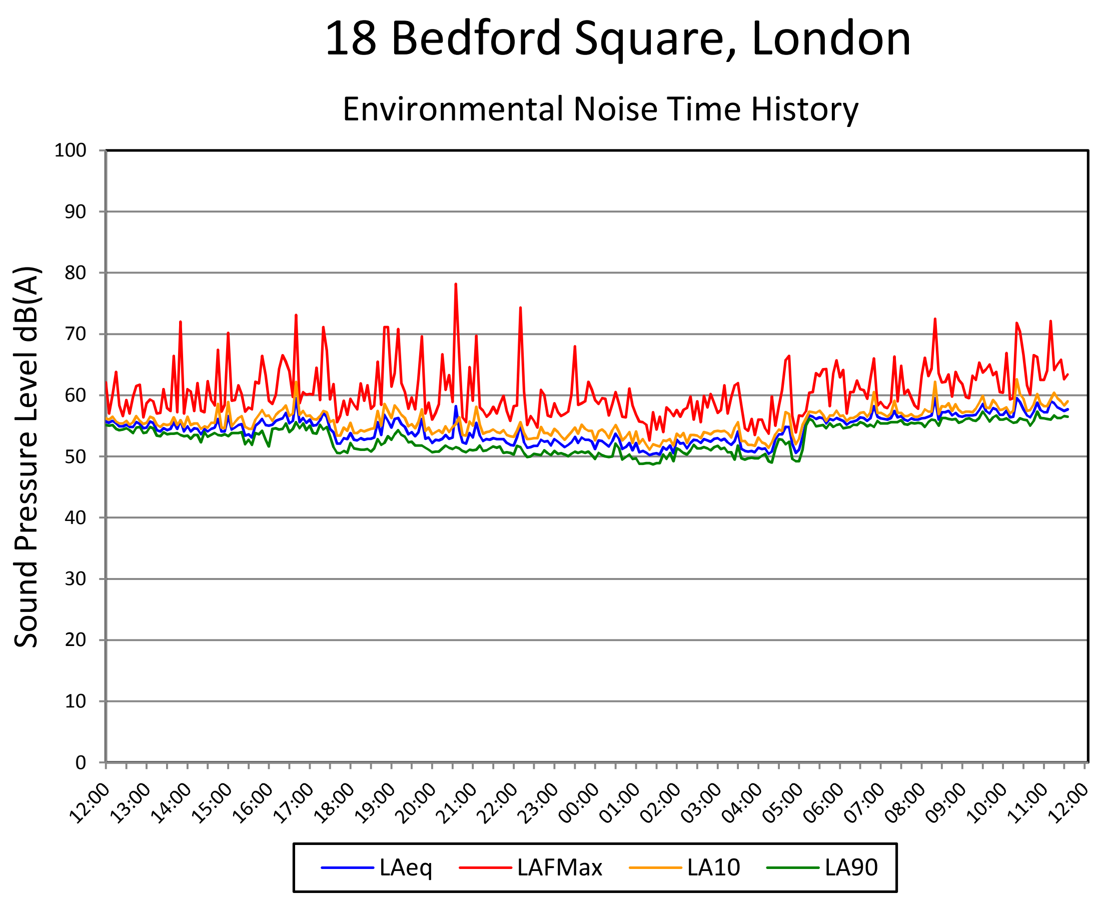
18 Bedford Square, London

Environmental Noise Time History



Saturday 25 January to Sunday 26 January 2014

Figure AS7738/TH2



Sunday 26 January to Monday 27 January 2014

Figure AS7738/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: Basement Level

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXYSQ6P8	Lp	1 m	65	57	57	53	50	45	38	33	55
Distance Loss		14 m	-23	-23	-23	-23	-23	-23	-23	-23	
Reverberant Build Up			3	3	3	3	3	2	3	2	
Screening			-10	-13	-15	-15	-15	-15	-15	-15	
Level At Receiver			*35*	*24*	*22*	*18*	*15*	*9*	*3*	*-3*	20

Calculation 2: Basement Level

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RZQSG71	Lp	1 m	52	50	52	48	47	41	38	31	51
Distance Loss		13 m	-22	-22	-22	-22	-22	-22	-22	-22	
Screening			-10	-13	-15	-15	-15	-15	-15	-15	
Level At Receiver			*20*	*15*	*15*	*11*	*10*	*4*	*1*	*-6*	14

Calculation 3: Basement Level

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RYYQ8T	Lp	1 m	61	58	58	57	52	46	48	37	58
Distance Loss		15 m	-24	-24	-24	-24	-24	-24	-24	-24	
Screening			-10	-13	-15	-15	-15	-15	-15	-15	
Level At Receiver			*27*	*21*	*19*	*18*	*13*	*7*	*9*	*-2*	19

Calculation 4: Roof Level

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXYSQ5P8	Lp	1 m	63	55	54	52	48	43	37	31	53
Distance Loss		10 m	-20	-20	-20	-20	-20	-20	-20	-20	
Screening			-7	-9	-11	-13	-15	-15	-15	-15	
Level At Receiver			*36*	*26*	*23*	*19*	*13*	*8*	*2*	*-4*	21

Calculation 5: Roof Level

			63	125	250	500	1000	2000	4000	8000	dB(A)
Daikin RXYSQ6P8	Lp	1 m	65	57	57	53	50	45	38	33	55
Number of Units		2	3	3	3	3	3	3	3	3	
Distance Loss		11 m	-21	-21	-21	-21	-21	-21	-21	-21	
Reverberant Build Up			3	3	3	3	3	2	3	2	
Screening			-7	-8	-10	-12	-15	-15	-15	-15	
Level At Receiver			*43*	*34*	*32*	*26*	*20*	*14*	*8*	*2*	28

Cumulative level at nearest receiver 30 dB(A)

24-hour plant noise design criterion 35 dB(A)