

## **APPENDIX 6 NOISE IMPACT ASSESSMENT**

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**REPORT AS8611.151217.NIA**



**46-47 RUSSELL SQUARE, LONDON**

**NOISE IMPACT ASSESSMENT**



**Prepared: 17 December 2015**



**Taylor Project Services LLP  
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## 1.0 INTRODUCTION

Planning approval is being sought for the installation of new plant within the rear light-well of 46-47 Russell Square, London.

Clarke Saunders Associates has been commissioned by Taylor Project Services LLP 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 the noise impact of proposed building services plant on nearby noise-sensitive receptors in accordance with the planning requirements of Camden Council.

## 2.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at 1.5m above local ground level at the rear of the property, as the location shown in site plan AS8611/SP1. Measurements of consecutive 5-minute  $L_{Aeq}$ ,  $L_{Amax}$ ,  $L_{A10}$  and  $L_{A90}$  sound pressure levels were taken between 12:15 hours on Monday 14<sup>th</sup> December and 13:25 hours on Wednesday 16<sup>th</sup> December 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:

- Rion data logging sound level meter type NA28;
- Rion sound level calibrator type NC-74.

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 AS8611/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 by some existing extract plant terminating at rear ground level, belonging to both 46-47 Russell Square and neighbouring properties. There is also a contribution from local vehicle and pedestrian traffic.

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

Monitoring period	Minimum $L_{A90,5mins}$
07:00 - 23:00 hours	43 dB 22:55-23:00, 14/12/15
23:00 - 07:00 hours	40 dB 04:00-04:05, 15/12/15
24 hours	40 dB

Table 4.1 - Minimum measured background noise levels

[dB ref. 20 $\mu$ Pa]

### 5.0 DESIGN CRITERIA

#### 5.1 Local Authority Requirements

Camden Council currently requires new plant to be 5dB below the background level. In addition, the background level must not be exceeded by more than 1dB in any octave band between 63Hz and 8kHz

*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, 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 and Table 5.2.

Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)	24 hours
L <sub>Aeq</sub> 38dB	L <sub>Aeq</sub> 35dB	L <sub>Aeq</sub> 35dB

Table 5.1 - Proposed design noise criteria

[dB ref. 20µPa]

Freq (Hz)	63	125	250	500	1k	2k	4k	8k
Criterion	50	42	42	37	35	31	21	13

Table 5.2 - Spectral design criterion

[dB ref. 20µPa]

## 6.0 PREDICTED NOISE IMPACT

### 6.1 Proposed plant

The proposed condensing plant has been confirmed as:

- 1 no. Daikin Condensing Units Type REYQ8T
- 1 no. Daikin Condensing Units Type REYQ16T
- 1 no. Daikin Condensing Units Type REYQ20T
- 1 no. Daikin Condensing Units Type RX50GV

The approximate location of the plant to be installed is shown in site plan AS8611/SP1.

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

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
REYQ8T Lp @ 1m (dB)	60	58	58	57	51	46	49	38	58
REYQ16T Lp @ 1m (dB)	70	68	67	62	57	53	48	42	64
REYQ20T Lp @ 1m (dB)	65	65	67	65	60	57	53	45	66
RX50GV Lp @ 1m (dB)	43	54	49	44	46	43	37	34	50

Table 6.1 - Source noise data for the proposed condensing units

[dB ref. 20µPa]

## 6.2 Predicted noise levels

Following an inspection of the site, the most affected noise sensitive receptors are rear 1<sup>st</sup> floor windows of 13 Montague Street, as shown on the indicative site plan AS8611/SP1. The nearest windows are at least 14 metres away from the proposed plant location.

The cumulative noise level at the nearest noise sensitive receiver has been predicted at the receptor using the noise data above. Screening losses afforded by the enclosing walls of the light-well and intermediate buildings have been included in the prediction of the cumulative plant noise level at the nearest receiver.

Freq (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Criterion	50	42	42	37	35	31	21	13	35
Predicted level at 1m from receiver	37	33	31	27	22	19	15	7	29

Table 6.2 - Predicted noise level and criteria at nearest noise sensitive location

[dB ref. 20 µPa]

A summary of the calculations are shown in Appendix B.

## 7.0 CONCLUSION

An environmental noise survey has been undertaken at 46-47 Russell Square, London by Clarke Saunders Associates between Monday 14<sup>th</sup> December and Wednesday 16<sup>th</sup> December 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 requirements.

Data for the new Daikin condensing units 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 required for external noise emissions.

  
Jamie Duncan (Dec 17, 2015)

Jamie Duncan MIOA

CLARKE SAUNDERS ASSOCIATES



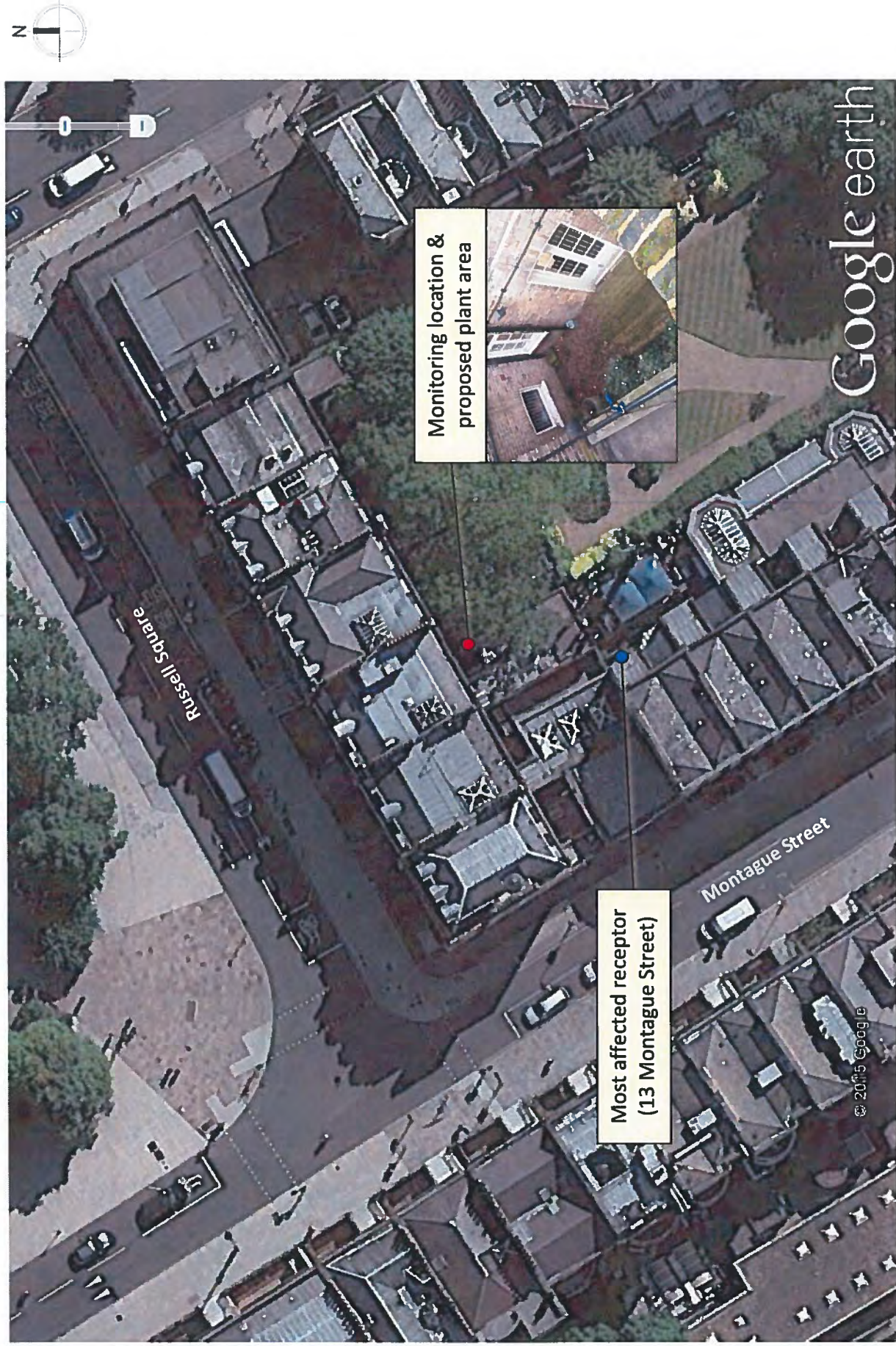
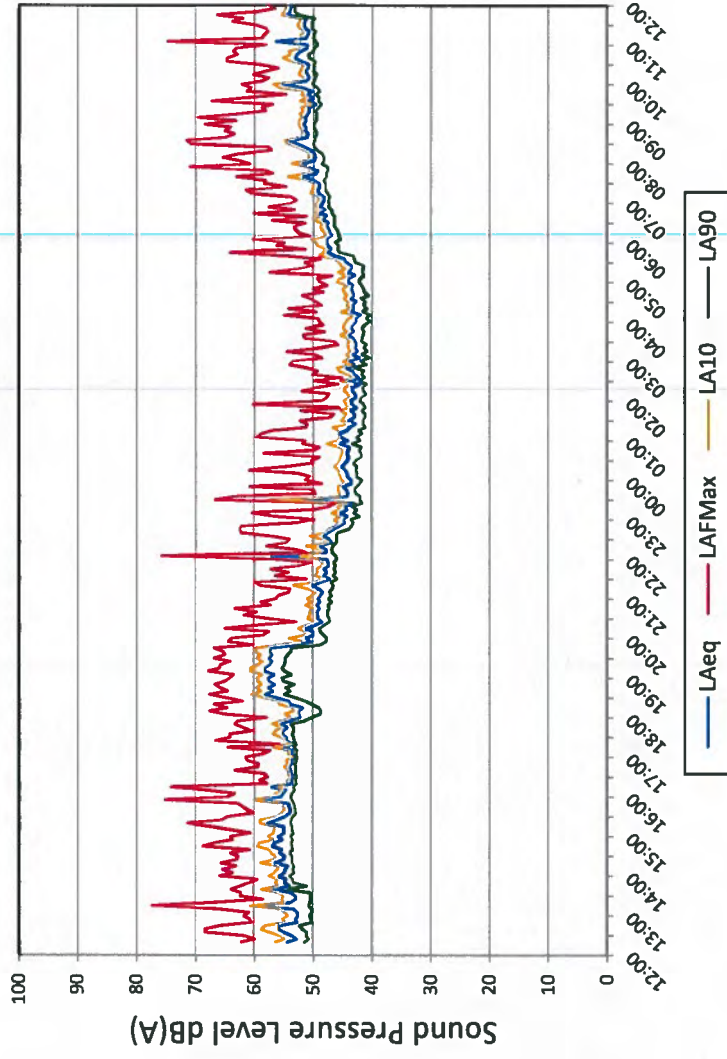


Figure AS8611/SP1



### 46-47 Russell Square

#### Environmental Noise Time History

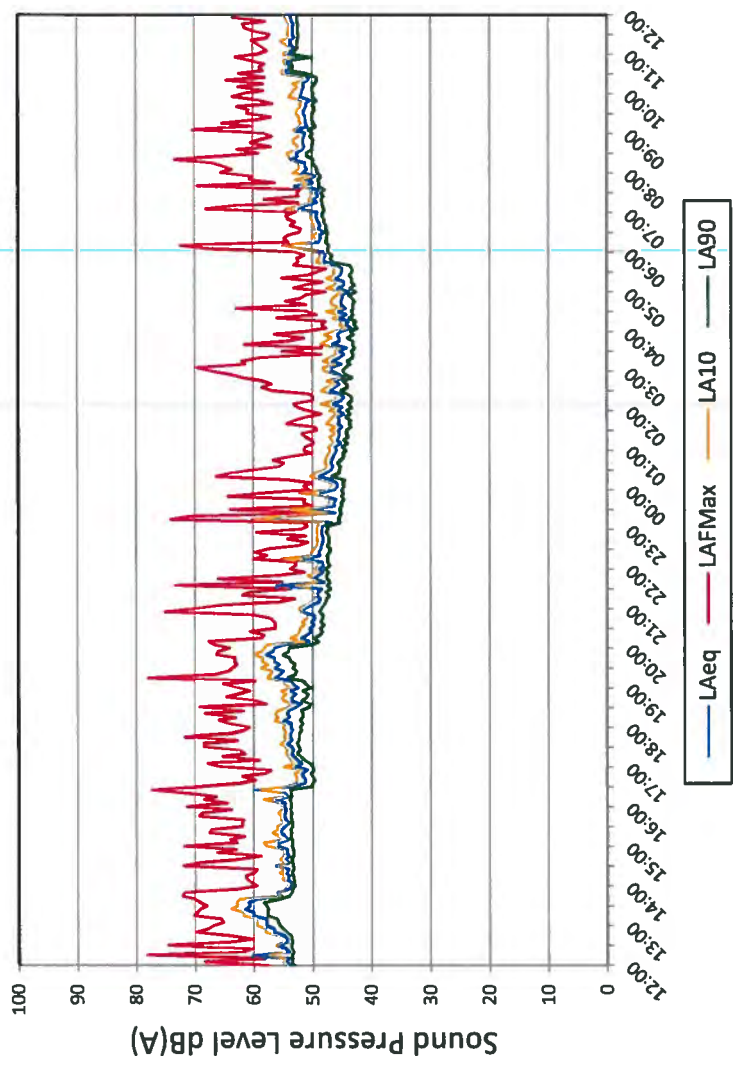


Monday 14 December to Tuesday 15 December 2015

Figure AS8611/TH1

### 46-47 Russell Square

#### Environmental Noise Time History

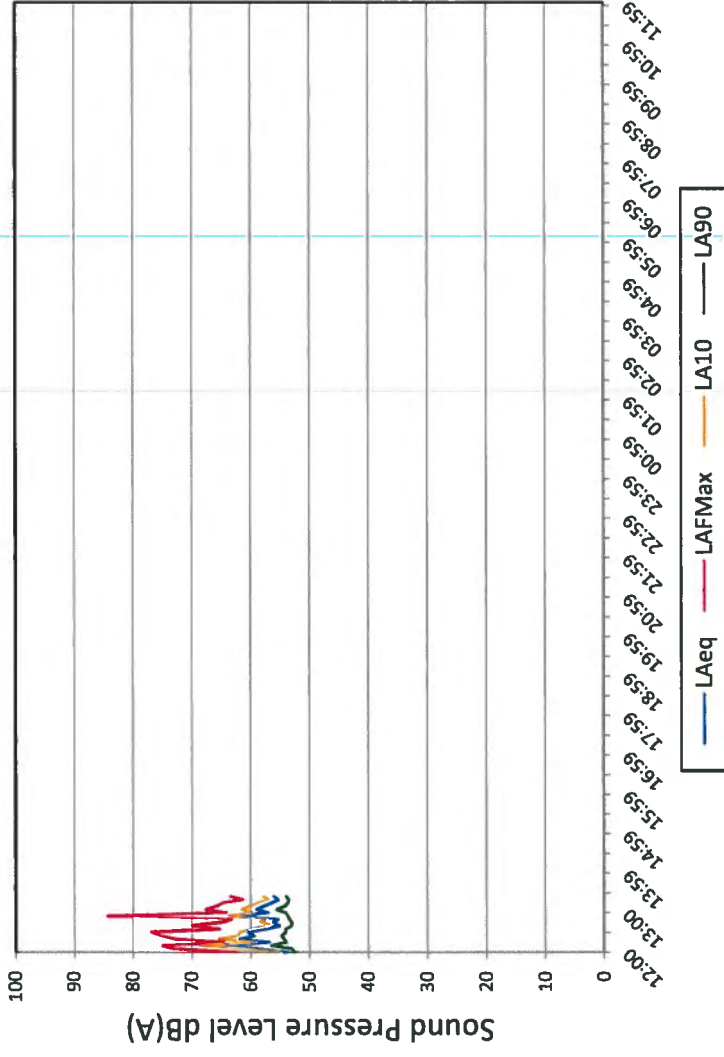


Tuesday 15 December to Wednesday 16 December 2015

Figure AS8611/TH2

# 46-47 Russell Square

## Environmental Noise Time History



Wednesday 16 December to Thursday 17 December 2015

Figure AS8611/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<sub>10</sub> & L<sub>90</sub> :** If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L<sub>n</sub> indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L<sub>10</sub> is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L<sub>90</sub> is the average minimum level and is often used to describe the background noise.

It is common practice to use the L<sub>10</sub> 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<sub>eq</sub> :** The concept of L<sub>eq</sub> (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<sub>eq</sub> 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<sub>eq</sub> very straightforward.

Because L<sub>eq</sub> 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<sub>max</sub> :** L<sub>max</sub> is the maximum sound pressure level recorded over the period stated. L<sub>max</sub> is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L<sub>eq</sub> 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<sub>w</sub>** D<sub>w</sub> 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<sub>nT,w</sub>** D<sub>nT,w</sub> 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<sub>tr</sub>** C<sub>tr</sub> is a spectrum adaptation term to be added to a single number quantity such as D<sub>nT,w</sub> to take account of characteristics of a particular sound.

**L'<sub>nT,w</sub>** L'<sub>nT,w</sub> 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
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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.

## APPENDIX B

### EXTERNAL PLANT NOISE EMISSIONS CALCULATIONS

Calculation 1: Noise emissions to rear 1st floor windows of 13 Montague Street

<b>Daikin REYQ8T</b>												
												dB(A)
	Lp @ 1 m	63	60	58	58	57	51	46	49	38	58	
Distance Loss	13 m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Screening*		-12	-15	-15	-18	-18	-18	-18	-18	-18	-18	
<b>Level At Receiver</b>		<b>26</b>	<b>21</b>	<b>18</b>	<b>17</b>	<b>11</b>	<b>6</b>	<b>9</b>	<b>2</b>	<b>18</b>	<b>18</b>	
<b>Daikin REYQ16T</b>												
	Lp @ 1 m	63	70	68	67	62	57	53	48	42	64	
Distance Loss	13 m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Screening*		-12	-15	-15	-18	-18	-18	-18	-18	-18	-18	
<b>Level At Receiver</b>		<b>36</b>	<b>31</b>	<b>27</b>	<b>22</b>	<b>17</b>	<b>13</b>	<b>8</b>	<b>2</b>	<b>24</b>	<b>24</b>	
<b>Daikin REYQ20T</b>												
	Lp @ 1 m	63	65	65	67	65	60	57	53	45	66	
Distance Loss	13 m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Screening*		-12	-15	-15	-18	-18	-18	-18	-18	-18	-18	
<b>Level At Receiver</b>		<b>31</b>	<b>28</b>	<b>27</b>	<b>25</b>	<b>20</b>	<b>17</b>	<b>13</b>	<b>5</b>	<b>26</b>	<b>26</b>	
<b>Daikin RX5UGV</b>												
	Lp @ 1 m	63	43	54	49	44	46	43	37	34	50	
Distance Loss	13 m	-22	-22	-22	-22	-22	-22	-22	-22	-22	-22	
Screening*		-12	-15	-15	-18	-18	-18	-18	-18	-18	-18	
<b>Level At Receiver</b>		<b>9</b>	<b>17</b>	<b>9</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>-3</b>	<b>-6</b>	<b>10</b>	<b>10</b>	

Predicted cumulative plant noise level @ 1m from receptor

Camden Council criteria for 24 hour plant operation

\* Screening Limited to 18dB