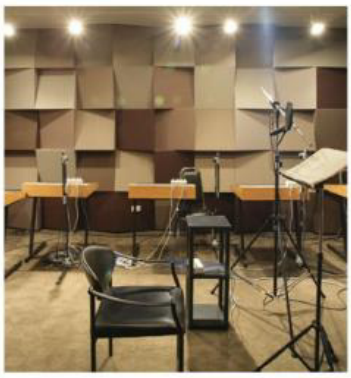
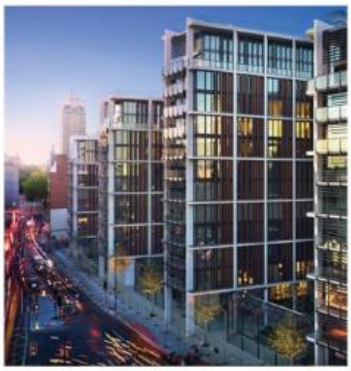
clarke saunders | acoustics
specialist consultants



REPORT AS9286.170314.NIA1.2

SEVEN DIALS WAREHOUSE, COVENT GARDEN



NOISE IMPACT ASSESSMENT

Prepared: 14 March 2017

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AS9286/SP1	Indicative Site Plan
AS9286/TH1-TH6	Environmental Noise Time Histories
Appendix A	Acoustic Terminology
Appendix B	Acoustic Calculations

1.0 INTRODUCTION

Planning approval is being sought for the installation of new plant at Seven Dials Warehouse, 42-56 Earlham Street, London WC2H 9LJ, as part of a wider refurbishment scheme.

Clarke Saunders Associates (CSA) has been commissioned by CBRE, on behalf of PEC Neale Ltd, to undertake a noise impact assessment of the proposed replacement tenant plant. CSA have undertaken 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 Camden Council.

2.0 SITE DESCRIPTION

Seven Dials Warehouse is a mixed-use building with a restaurant use at basement level, retail use at ground floor level, and office use from first floor to sixth floor.

Neighbouring and surrounding buildings also appear to be of mixed use, with retail and restaurant use at ground floor level and office use at upper levels.

Planning approval is sought for the replacement of existing tenant plant. The existing plant area is on the roof of the sixth floor and there is an imperforate screen surrounding the plant area. The replacement plant will be located in the same location as the previous plant that is to be replaced, the approximate location of which is shown on AS9286/SP1.

Observations on site suggested that the nearest, most affected, noise sensitive receptor is The London Film School which is situated the opposite side of Shelton Street. This building has a roof skylight at fifth floor level, as shown on AS9286/SP1.

3.0 SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at a secure and safely accessible position at roof level of the existing building, the approximate location of which is shown on site plan AS9286/SP1. This position was deemed representative of the noise climate experienced at the receptor.

Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were taken between 12:45 hours on Tuesday 4th October and 09:30 hours on Monday 10th October 2016. 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;
- GRAS environmental microphone type 41AL;
- 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 generally 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.

4.0 RESULTS

Figures AS9286/TH1-TH6 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the measurement position.

5.0 DISCUSSION

The background noise climate at the property is determined by some existing roof-mounted plant and road traffic noise in the surrounding streets. It is understood that the tenant plant, which is to be replaced, was not operational during the survey.

Measured minimum background and average noise levels are shown in Table 5.1 below.

Monitoring period	Minimum $L_{A90,10mins}$
07:00 - 23:00 hours	48 dB 09/10/16 @ 22:25
23:00 - 07:00 hours	47 dB 10/10/16 @ 01:05
24 hours	47 dB

Table 5.1 - Minimum measured background and average noise levels **[dB ref. 20µPa]**

6.0 DESIGN CRITERIA

6.1 Local Authority Requirements

It is understood that Camden Council requires new plant to achieve 5dB below the background level at the nearest receptor. 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 or intermittent noise will be generated by the plant and therefor the pant noise emissions criteria that should not be exceeded at the nearest noise sensitive receiver should be set to the proposed levels detailed in Table 6.1 and Table 6.2

Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)	24 hours
L_{Aeq} 43 dB	L_{Aeq} 42 dB	L_{Aeq} 42 dB

Table 6.1 - Proposed design noise criteria **[dB ref. 20µPa]**

Freq (Hz)	63	125	250	500	1k	2k	4k	8k
24 Hour Criterion	51	50	47	44	42	37	27	17

Table 6.2 - Spectral design criterion **[dB ref. 20µPa]**

7.0 PREDICTED NOISE IMPACT

7.1 Proposed plant

The selected plant has been confirmed as:

- 1no. Mitsubishi Condensing Unit Type PUHZ-ZRP 250 YKA 2
- 2no. Mitsubishi Condensing Units Type PURY-P700 YSLM-A1
- 2no. Mitsubishi Condensing Units Type PUHZ-ZRP 200 YKA 2
- 4no. Mitsubishi Condensing Units Type PURY-P400 YLM-A1
- 1no. Mitsubishi Condensing Unit Type PUMY-P112 VKM1

The approximate location of the plant to be installed is shown in site plan AS9286/SP1.

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

Unit	Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
PUHZ-ZRP 250 YKA 2	Lp @ 1m (dB)	76	63	61	60	58	53	48	43	62
PURY-P700 YSLM-A1	Lp @ 1m (dB)	77	72	68	65	59	51	46	41	66
PUHZ-ZRP 200 YKA 2	Lp @ 1m (dB)	71	61	62	59	59	53	46	41	62
PURY-P400 YLM-A1	Lp @ 1m (dB)	74	69	65	62	56	48	43	38	62
PUMY-P112 VKM1	Lp @ 1m (dB)	64	52	52	49	41	41	35	30	50

Table 7.1 - Source noise data for the proposed units **[dB ref. 20µPa]**

7.2 Predicted noise levels

Following an inspection of the site, the nearest noise sensitive receiver is situated on Shelton Street, to the south of the existing plant installation, at fifth floor level, as shown on the indicative site plan AS9286/SP1. This window is at least 17 metres away from the PUHZ-ZRP 250 YKA 2 location and at least 25 metres away from all other proposed units.

The cumulative noise level at the nearest noise sensitive receiver has been assessed following procedures 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 barrier which surrounds the plant enclosure have been included in the prediction of the

cumulative plant noise level at the nearest receiver. The calculations assume a 2.5 metre high screen, installed 1.5m from the plant. The screen is continuous and imperforate, with a minimum mass per unit area of 15kg/m^2.

Freq (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Criterion	51	50	47	44	42	37	27	17	47
Predicted level at 1m from receiver	49	41	35	30	23	15	10	7	32

Table 7.2 - Predicted noise level and criteria at nearest noise sensitive location **[dB ref. 20 µPa]**

A summary of the calculations are shown in Appendix B.

8.0 CONCLUSION

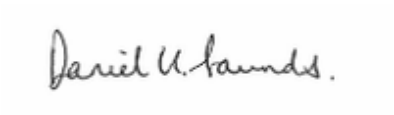
A noise impact assessment for replacement plant has been undertaken by Clarke Saunders Associates.

An environmental noise survey has been undertaken at Seven Dials Warehouse between Tuesday 4th and Monday 10th October 2016.

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 Mitsubishi 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, therefore, required for external noise emissions.



Daniel Saunders MIOA

CLARKE SAUNDERS ASSOCIATES

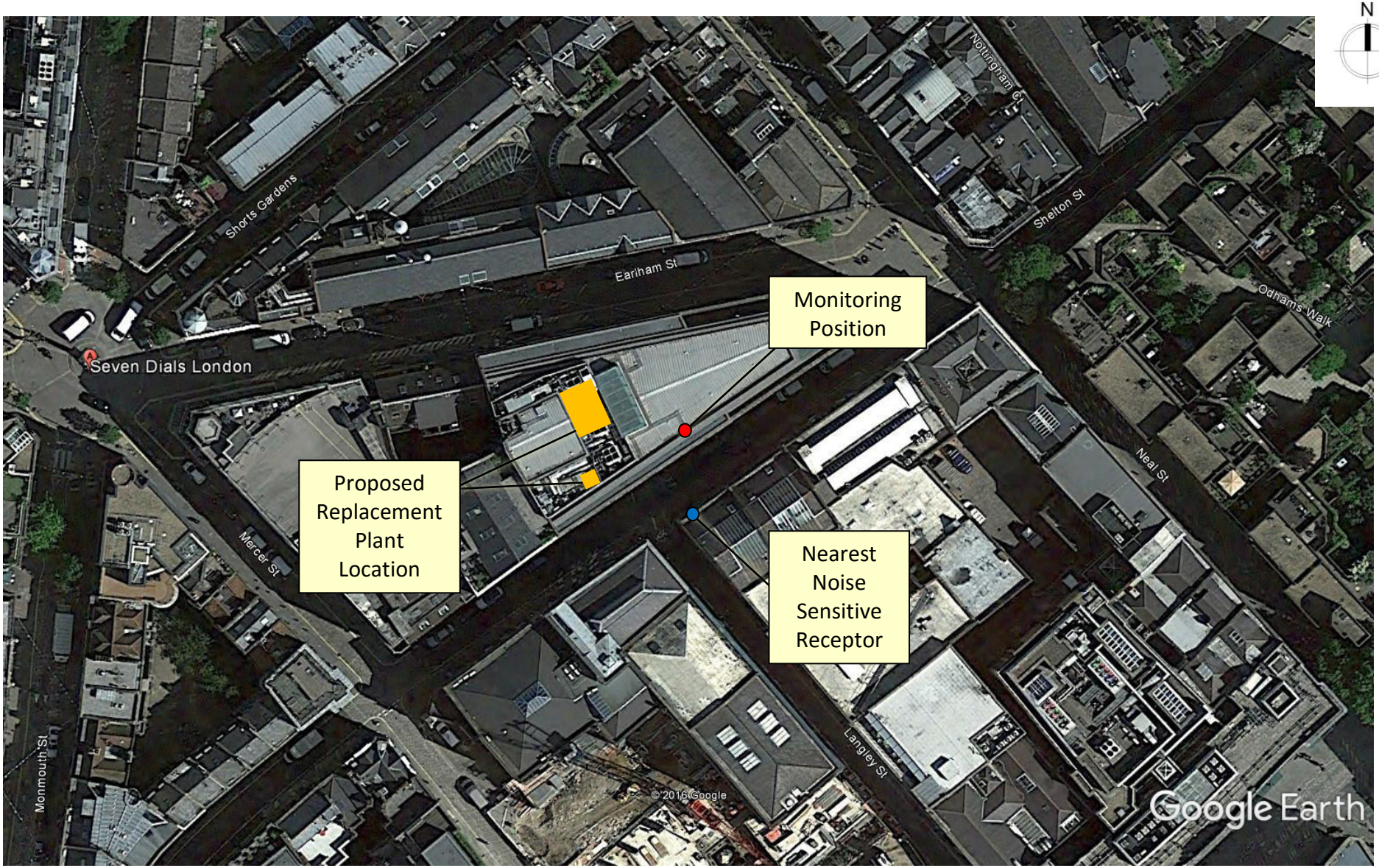
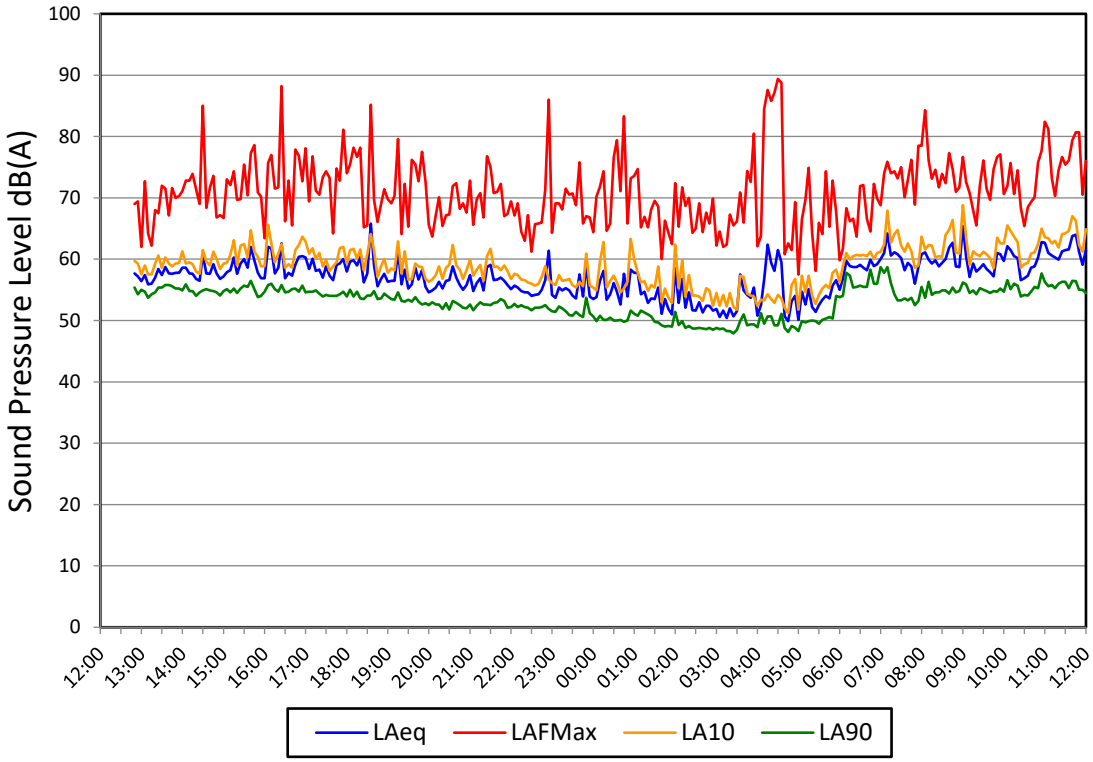


Figure AS9286/SP1

Seven Dials Warehouse, Covent Garden

Environmental Noise Time History

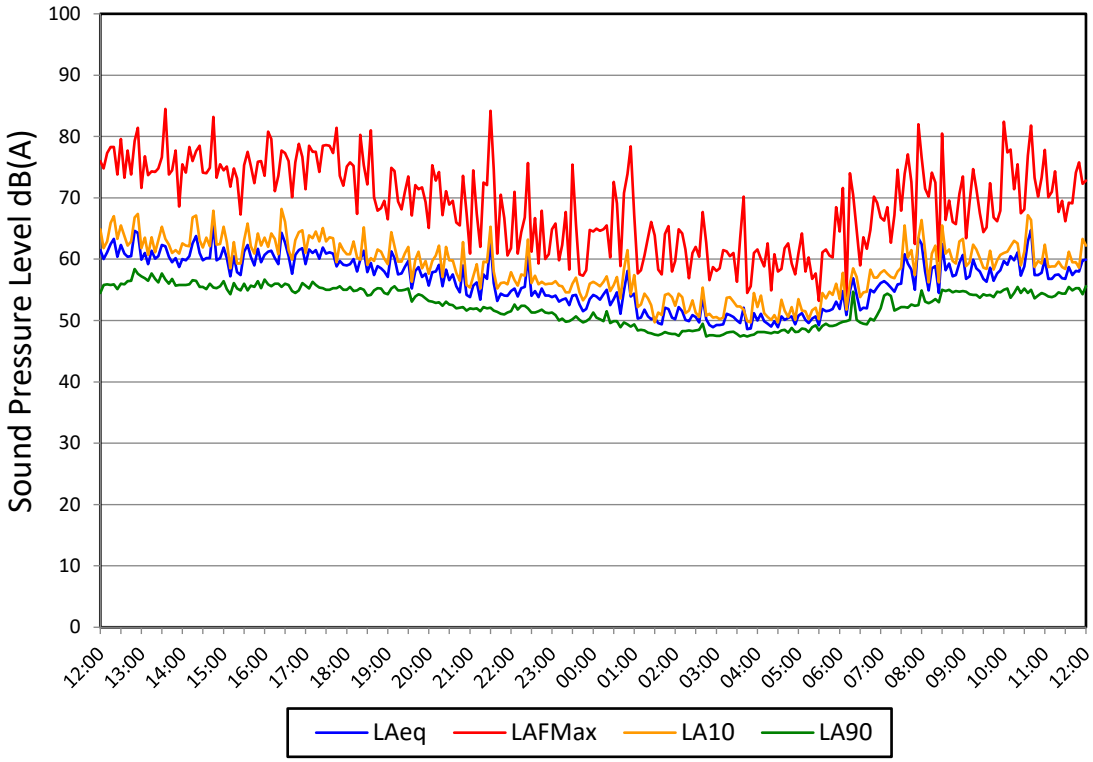


Tuesday 04 October to Wednesday 05 October 2016

Figure AS9286/TH1

Seven Dials Warehouse, Covent Garden

Environmental Noise Time History

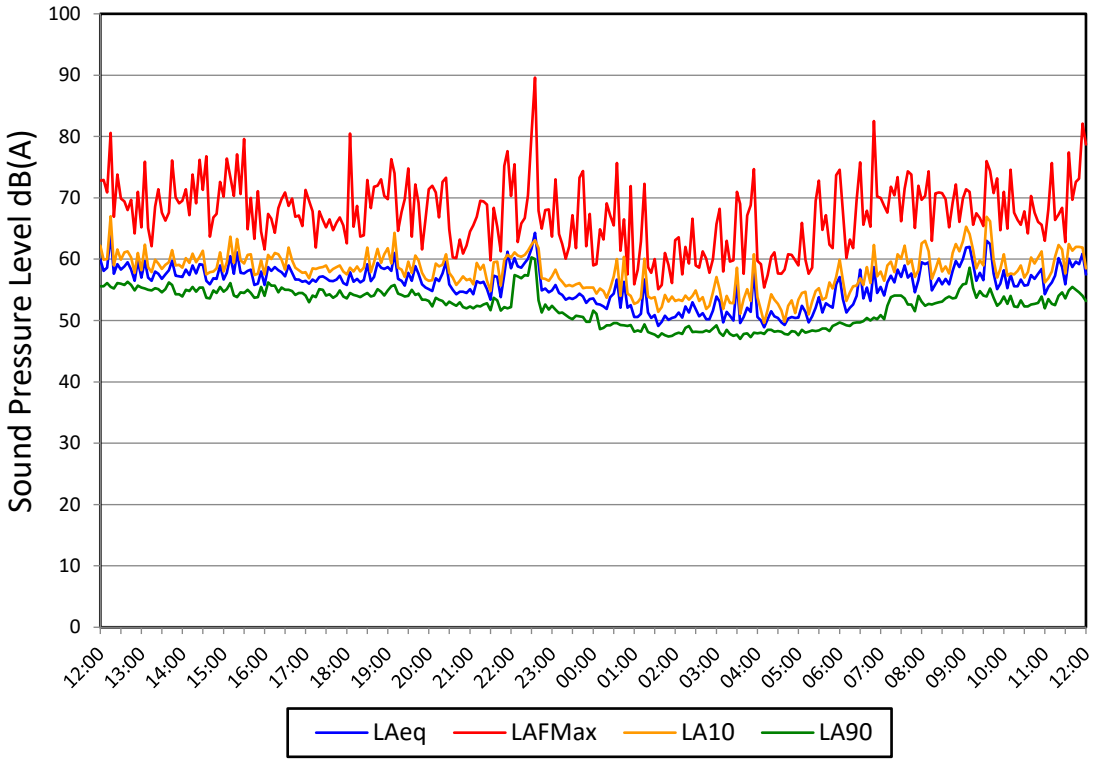


Wednesday 05 October to Thursday 06 October 2016

Figure AS9286/TH2

Seven Dials Warehouse, Covent Garden

Environmental Noise Time History

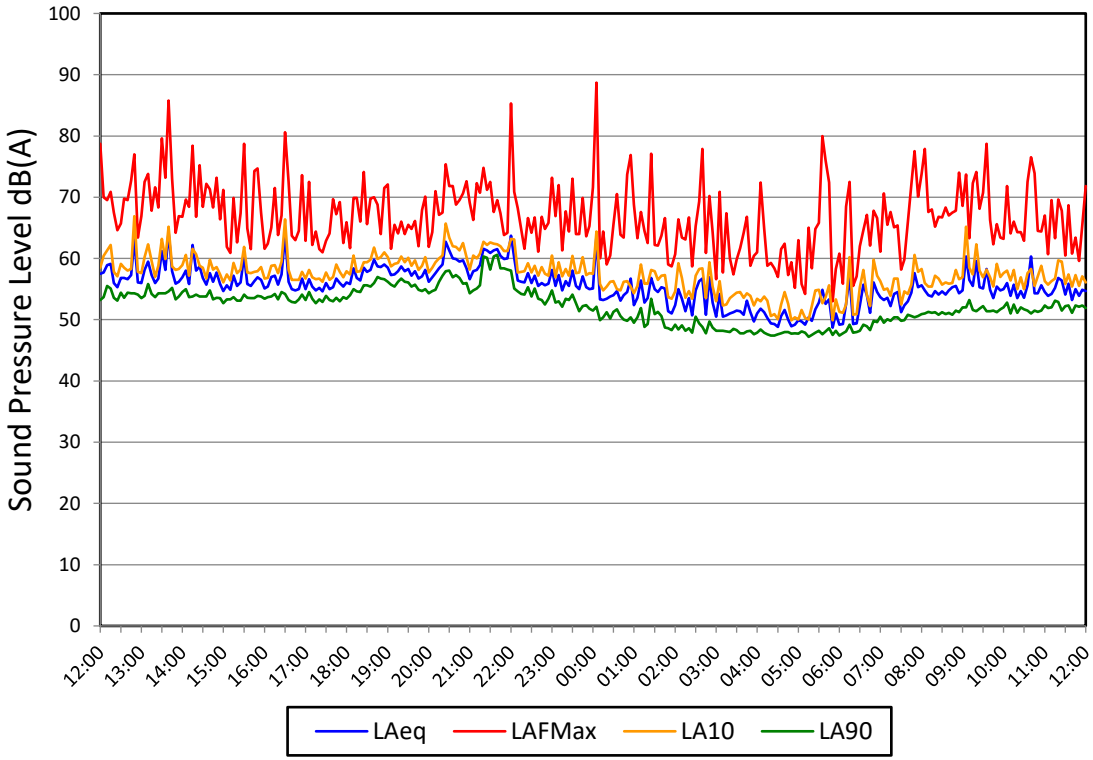


Thursday 06 October to Friday 07 October 2016

Figure AS9286/TH3

Seven Dials Warehouse, Covent Garden

Environmental Noise Time History

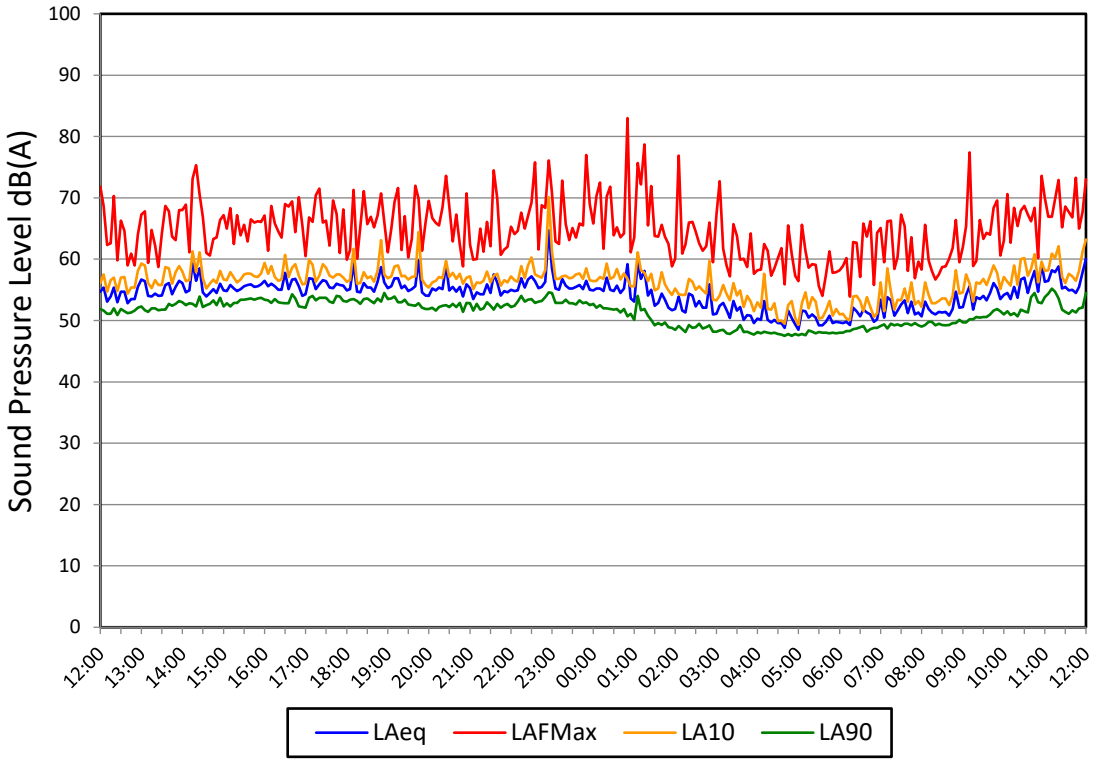


Friday 07 October to Saturday 08 October 2016

Figure AS9286/TH4

Seven Dials Warehouse, Covent Garden

Environmental Noise Time History

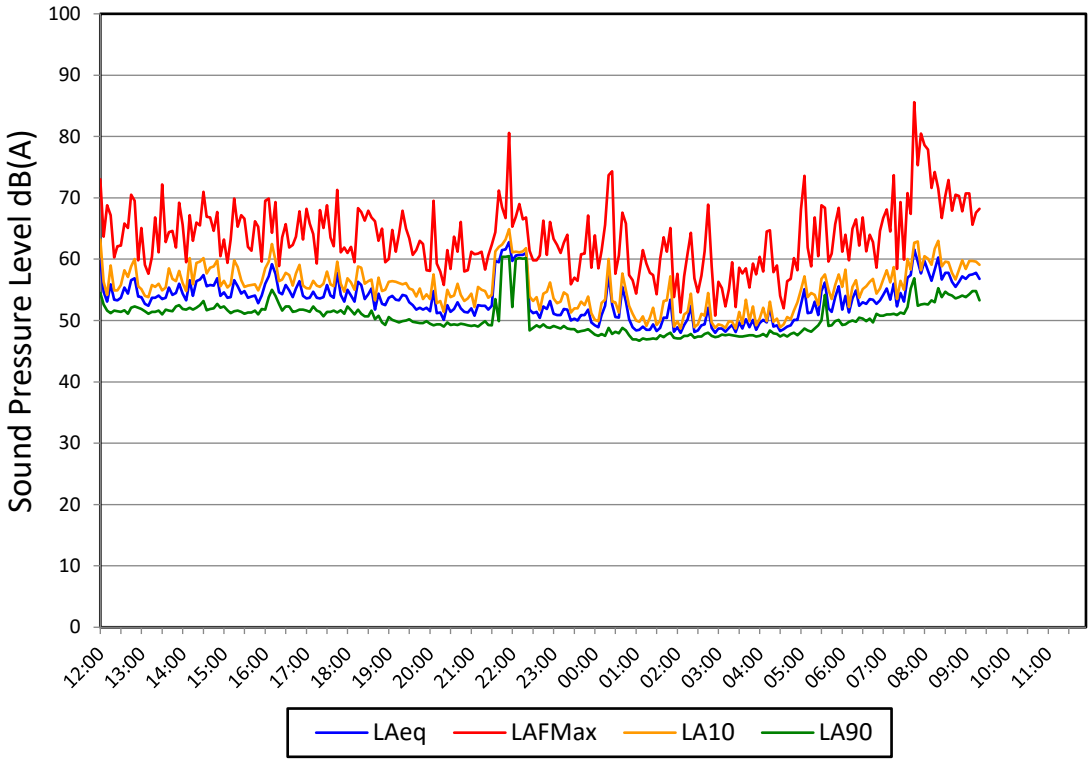


Saturday 08 October to Sunday 09 October 2016

Figure AS9286/TH5

Seven Dials Warehouse, Covent Garden

Environmental Noise Time History



Sunday 09 October to Monday 10 October 2016

Figure AS9286/TH6

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

1.1 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

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 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

1.3 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

1.4 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
AS9286 - Seven Dials Warehouse, Covent Garden
Plant Noise Assessment

To Nearest Noise Sensitive Receiver

24 hour Operation		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PUHZ-ZRP 250 YKA 2	Lp @ 1m	76	63	61	60	58	53	48	43	**62**
Number of units	1	0	0	0	0	0	0	0	0	
Distance Loss	17m	-25	-25	-25	-25	-25	-25	-25	-25	
Screening Loss*		-8	-9	-12	-14	-17	-18	-18	-18	
Noise Level at Receiver	$L_{eq,T}$	**43**	**29**	**24**	**21**	**17**	**10**	**5**	**0**	**24**

**Screening loss limited to 18dB*

24 hour Operation		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PURY-P700 YSLM-A1	Lp @ 1m	77	72	68	65	59	51	46	41	**66**
Number of units	2	3	3	3	3	3	3	3	3	
Distance Loss	24m	-28	-28	-28	-28	-28	-28	-28	-28	
Screening Loss*		-8	-9	-12	-14	-17	-18	-18	-18	
Noise Level at Receiver	$L_{eq,T}$	**44**	**38**	**31**	**26**	**17**	**8**	**3**	**0**	**28**

24 hour Operation		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PUHZ-ZRP 200 YKA 2	Lp @ 1m	71	61	62	59	59	53	46	41	**62**
Number of units	2	3	3	3	3	3	3	3	3	
Distance Loss	24m	-28	-28	-28	-28	-28	-28	-28	-28	
Screening Loss*		-8	-9	-12	-14	-17	-18	-18	-18	
Noise Level at Receiver	$L_{eq,T}$	**39**	**27**	**25**	**20**	**17**	**10**	**3**	**0**	**23**

24 hour Operation		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PURY-P400 YLM-A1	Lp @ 1m	74	69	65	62	56	48	43	38	**62**
Number of units	4	6	6	6	6	6	6	6	6	
Distance Loss	24m	-28	-28	-28	-28	-28	-28	-28	-28	
Screening Loss*		-8	-9	-12	-14	-17	-18	-18	-18	
Noise Level at Receiver	$L_{eq,T}$	**44**	**38**	**31**	**26**	**17**	**8**	**3**	**0**	**28**

24 hour Operation		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
PUMY-P112VKMI	Lp @ 1m	64	52	52	49	41	41	35	30	**50**
Number of units	1	0	0	0	0	0	0	0	0	
Distance Loss	24m	-28	-28	-28	-28	-28	-28	-28	-28	
Screening Loss*		-8	-9	-12	-14	-17	-18	-18	-18	
Noise Level at Receiver	$L_{eq,T}$	**29**	**15**	**13**	**7**	**0**	**0**	**0**	**0**	**11**

Night-time Background Noise Level	**47 dB(A)**
24 hour Noise Emissions Design Criteria	**42 dB(A)**
Predicted Noise Level at Receptor	**32 dB(A)**

Comparison to Spectral Data

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Noise Level at Receiver	$L_{eq\ 16hr}$	49	41	35	30	23	15	10	7	**32**
Existing Level at Receiver	$L_{eq\ 16hr}$	51	50	47	44	42	37	27	17	**47**
Exceedance		-2	-9	-12	-14	-19	-22	-17	-10	