62-63 Tottenham Court Road
1 – 7 Goodge Street
London

ENVIRONMENTAL NOISE SURVEY
& PLANT NOISE ASSESSMENT
REPORT 17152/PNA1 RevA

For:

Dukelease Properties
23 Old Bond Street
London
W1S 4PZ

21 November 2014

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Revision No.	Date	Description
0	17/11/2014	First Issue
A	21/11/2014	Minor changing to Section 9.2.2

1.0 INTRODUCTION

New items of buildings services plant are proposed for the development at 62-63 Tottenham Court Road, 1-7 Goodge Street, London.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and carry out a plant noise assessment.

This report presents the methodology and findings of our noise survey and plant noise assessment.

2.0 OBJECTIVES

To establish, by means of detailed 72 hour daytime and night-time fully automated environmental noise monitoring, the existing A-weighted (dBA) L_{90}, L_{eq} and L_{max} environmental noise levels at a selected accessible roof level position thought to be representative of the nearest affected property.

To measure L_{eq}, L_{90} and L_{max} octave band spectra noise levels for typical daytime and night-time periods at the measurement position in order to obtain a more detailed description of the noise climate.

Based on the results of the noise survey, and with reference to the requirements of the Local Authority, to recommend suitable plant noise emission criteria.

To assess the proposed plant and comment on its acceptability.

3.0 SITE DESCRIPTION

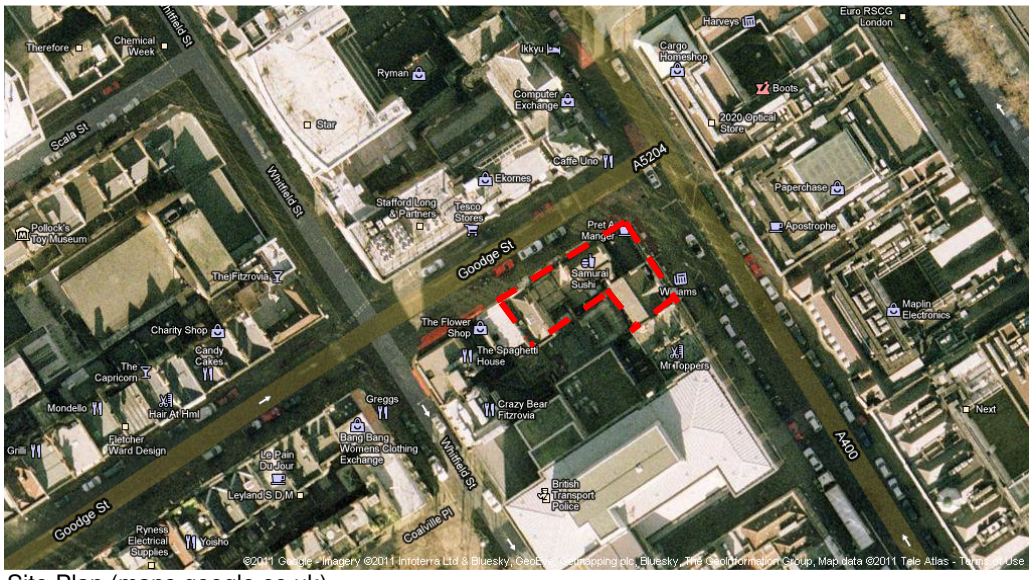
3.1 Location

The site is located at 61-63 Tottenham Court Road, London and falls within London Borough of Camden jurisdiction. See Location Map below.

Location Map (maps.google.co.uk)

3.2 Description

The site is located at the corner of Goodge Street. In general this area appears to comprise mixed retail, commercial and residential properties.



Site Plan (maps.google.co.uk)

4.0 ACOUSTIC TERMINOLOGY

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 METHODOLOGY

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 11:30 hours on Friday 18 February 2011 to 11:30 hours on Tuesday 22 February 2011.

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However at the beginning and end of the survey period the wind conditions were light and the sky was generally overcast. We understand that generally throughout the survey period the weather conditions were similar. These conditions are considered suitable for obtaining representative measurement results.

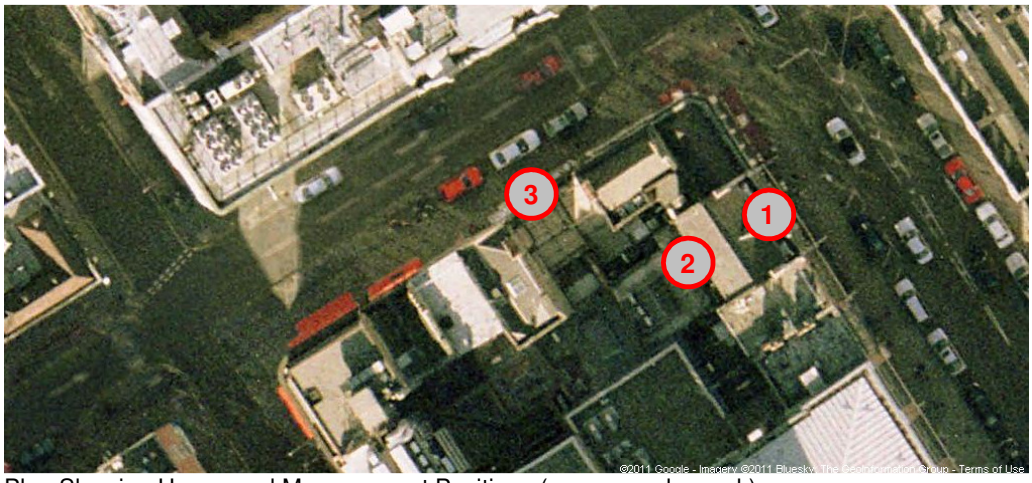
Measurements were taken continuously of the A-weighted (dBA) L_{10}, L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

5.2 Measurement Positions

The noise level measurements were undertaken at 3No. positions around the development site. The measurement positions are described in the table below.

Position No	Description
1	The sound level meter was located to the East of the site, overlooking Tottenham Court Road. The microphone was attached to a pole protruding out of a second floor window at a height of approximately 9m from ground level.
2	The sound level meter was located to the South of the site, at the rear of the building adjacent to Tottenham Court Road. The microphone was attached to a pole protruding out of a second floor window at a height of approximately 9m from ground level.
3	The sound level meter was located to the West of the site, overlooking Goodge Street at third floor level. The microphone was attached to a pole protruding out of a third floor window at a height of approximately 12m from ground level.

The approximate measurement locations are detailed on the plan below.



Plan Showing Unmanned Measurement Positions (maps.google.co.uk)

5.3 Instrumentation

The instrumentation used during the survey is presented in the Table below:

Description	Manufacturer	Type	Serial Number	Latest Verification
Position 1, Type 1, Data Logging Sound Level Meter	Larson Davis	824	3802	LD calibration on 18/08/2010
Position 1, Type 1, ½" Condenser Microphone	PCB	377B02	107040	LD calibration on 18/08/2010
Position 2, Type 1, Data Logging Sound Level Meter	Larson Davis	824	3721	LD calibration on 20/04/2010
Position 2, Type 1, ½" Condenser Microphone	PCB	PCB377 A02	105393	LD calibration on 20/04/2010
Position 3, Type 1, Data Logging Sound Level Meter	Larson Davis	824	3838	LD calibration on 27/09/2010
Position 3, Type 1, ½" Condenser Microphone	Larson Davis	377B02	108306	LD calibration on 27/09/2010
Type 1 Calibrator	Larson Davis	CAL200	3082	LD calibration on 21/01/2011

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant change was found to have occurred (no more than 0.1 dB).

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. Each microphone was fitted with a Larson Davis windshield.

6.0 RESULTS

The results have been plotted on Time History Graphs 17152/TH1 to 17152/TH3 enclosed, presenting the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

The lowest $L_{A90\ (15min)}$ measurements are detailed in the table below.

	Lowest Measured $L_{A90(15min)}$ dB	
Position	**Daytime (07:00 – 23:00 hours)**	**Night Time (23:00 – 07:00 hours)**
1	51	47
2	48	46
3	52	49

7.0 DISCUSSION OF NOISE CLIMATE

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately describe the dominant noise sources, or specific noise events throughout the entire survey period. However at the beginning and end of the survey period the dominant noise source was noted to be road traffic noise from the boundary roads.

8.0 PLANT NOISE EMISSION CRITERIA

We understand that the London Borough of Camden requires the following:

Noise description and location of measurement	**Period**	**Time**	**Noise Level**
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dBA < L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	10dBA < L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	10dBA < L_{A90}
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB LAeq

Based on the above criteria and the results of the environmental noise survey we therefore propose the following future plant noise emission criteria, should be achieved (with all relevant plant operating simultaneously) at 1m from the nearest noise sensitive facades based on the minimum measured L_{90} noise level.

	Proposed Plant Noise Limit $L_{A90(15min)}$ dBA at Nearest Noise Sensitive Façade	
Position	**Daytime (07:00 – 23:00 hours)**	**Night Time (23:00 – 07:00 hours)**
1	41	37
2	38	36
3	42	39

9.0 PLANT NOISE ASSESSMENT

We understand that the following items of plant are to be installed at 62-63 Tottenham Court Road, 1-7 Goodge Street, London.

Plant Description	Location	Qty	Plant Make	Model Number
CON-01	Rooftop Plant Area	1	Mitsubishi	P125
CON-02	Rooftop Plant Area	1	Mitsubishi	P100
CON-03	Rooftop Plant Area	1	Mitsubishi	P100
CON-04	Rooftop Plant Area	1	Mitsubishi	P125
CON-05	Rooftop Plant Area	1	Mitsubishi	P100
CON-06	Rooftop Plant Area	1	Mitsubishi	P100
CON-07	Rooftop Plant Area	1	Mitsubishi	P140
CON-08	Rooftop Plant Area	1	Mitsubishi	P140
CON-09	Rooftop Plant Area	1	Mitsubishi	P125
CON-L-01	Rooftop Plant Area	1	Mitsubishi	RP35
EAT-01	Rooftop Plant Area	1	Toshiba	MCY-MAP0401HT
EAT-02	Rooftop Plant Area	1	Toshiba	MCY-MAP0501HT

In addition to the above we understand three existing extract ducts serving the EAT retail unit are to be rearranged. As a result the noise from each of these ducts is to be assessed. The three ducts have the following dimensions, 450mm, 200mm and 350mm diameter. There are 3 fans proposed, one serving each duct.

We understand the following items of existing plant belong to the EAT retail unit on Tottenham Court Road.

Plant Description	Location	Qty	Plant Make	Model Number
Front of house/display extract	Inside EAT	1	Systemair	MUB 042 450E4-A2
Toilet extract	Inside EAT	1	Systemair	K200L
Kitchen extract	Inside EAT	1	Systemair	K315L

9.1 Plant Noise Emissions

9.1.1 New Plant Items

We understand the manufacturer's noise data for the equipment to be as follows:

Plant Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 1 metre at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
CON-01	52	47	44	44	39	35	30	32	45
CON-02	52	47	44	44	39	35	30	32	45
CON-03	47	42	39	39	35	31	25	27	40
CON-04	52	47	44	44	39	35	30	32	45
CON-05	52	47	44	44	39	35	30	32	45
CON-06	47	42	39	39	35	31	25	27	40
CON-07	56	51	48	48	44	40	34	36	49
CON-08	55	50	47	47	43	39	33	35	48
CON-09	53	48	45	45	41	37	31	33	46
CON-L-01	37	32	29	29	25	21	15	17	30
EAT-01	57	52	49	49	45	41	35	37	50
EAT-02	59	54	51	51	47	43	37	39	52

9.1.2 Existing EAT Plant

We understand the manufacturer's noise data for the existing EAT extract equipment to be as follows:

Plant Description	Sound Power Level at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
MUB450 Outlet	64	66	70	72	71	68	63	56	77
K200L Outlet	32	63	65	70	70	67	64	54	75
K315L Outlet	83	81	76	73	71	69	63	59	86

9.2 Location of Plant

9.2.1 Roof Level

The new items of condenser plant are proposed to be located at roof level. The plant area is proposed to be surrounded by an acoustic louvered perimeter screen. The acoustic performance of the louvered screen must comply with the enclosed acoustic specification, and the north east end of this louvered screen must be solid/blanked off from roof level to the top of the screen.

There are five noise sensitive window areas to consider in relation to the roof level new plant noise.

a) An IQ Sliding openable rooflight approximately 2m away from the solid blanked of end of the acoustic louvered screen.

b) A pair of openable Velux windows side by side to the east of the plant area, at a distance of approximately 5m away from the edge of the acoustic louvered plant screen.

c) Another pair of openable Velux windows side by side to the south east of the plant area, at a distance of approximately 8m away from the edge of the acoustic louvered screen.

d) A Flushglaze 1100mm square fixed shut roof light to the south of the plant area, at a distance of approximately 5m away from the edge of the acoustic louvered screen.

e) A Flushglaze 1400mm circular fixed shut roof light to the west of the plant area, at a distance of approximately 5m away from the edge of the acoustic louvered screen.

9.2.2 Existing EAT Extract Plant

All three extract fans are located inside the EAT retail unit. The three fans are ducted through to the outside of the building. The ducts are proposed to be attached to the full height of the building and terminated at around 800mm above roof level. The tip of the duct terminations are proposed to be located at a horizontal distance of approximately 6m away from the nearest potentially effected noise sensitive windows.

The atmospheric side of the fans will require acoustic attenuators to be installed. We would recommend this be done as close to the fan connection as possible. The acoustic insertion loss performance required for each attenuator is detailed on the enclosed attenuator schedule.

Note the ducts are proposed to be enclosed the whole length up the rear of the building and the open ends to point away from the nearest openable windows which would appear to be at top floor level.

The ducts will need to be fixed to the staircore area of the building using suitable anti-vibration mounts to prevent complaint from structureborne noise. We would be happy to review the proposed fixings if/when required.

9.3 Plant Noise Impact Assessment

9.3.1 New Condenser Plant

Using our in-house noise prediction software we have calculated the following resultant noise levels at 1m from the five window locations described above.

Window	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 1m from Noise Sensitive Window
a) IQ Sliding Rooflight	31dBA
b) Pair of Velux at 5m	31dBA
c) Pair of Velux at 8m	28dBA
d) Flushglaze 1100mm	32dBA
e) Flushglaze 1400mm	36dBA

The above values consider the distance loss attenuation, acoustic louvered screening and barrier loss reductions, and directivity effects where necessary. We understand that the proposed units can be operational 24 hours per day.

Our calculations indicate that the proposed plant should be capable of achieving the requirements of the Local Authority outlined in Section 8.0.

9.3.2 Existing EAT Extract Fans

Using our in-house noise prediction software we have calculated the following resultant noise levels at the nearest noise sensitive window at the top floor residential level.

Fan	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 1m from Noise Sensitive Window
MUB 450mm Duct	31dBA
K200L 200mm Duct	31dBA
K315L 350mm Duct	31dBA
Total	36dBA

The above values consider the induct attenuators, distance loss attenuation and directivity effects where necessary. We understand that the proposed units can be operational 24 hours per day.

We understand that the proposed units can be operational 24 hours per day. Our calculations indicate that the proposed plant should be capable of achieving the requirements of the Local Authority outlined in Section 8.0, provided atmospheric side attenuators with the performance as per the enclosed schedule are used.

It should be noted that an internal noise assessment has not been undertaken in EAT. It is normally the responsibility of the retail tenant to control their internal noise to a suitable level.

10.0 CONCLUSIONS

A detailed 24 hour daytime and night-time fully automated environmental noise survey has been undertaken in order to establish the currently prevailing roof level environmental noise climate around the site.

Plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the requirements of the Local Authority.

An assessment has been carried out to determine the plant noise emissions at the nearest noise sensitive window.

Acoustic specification for acoustic louvered screening and attenuators has been provided.

The assessment indicates that provided suitable mitigation measures are properly implemented, the proposed plant should be capable of achieving the requirements of the Local Authority at the associated noise sensitive residential windows.

Prepared by
Adam Kershaw
Principal Consultant
HANN TUCKER ASSOCIATES

Checked by
John Ridpath
Director
HANN TUCKER ASSOCIATES

Appendix A

The acoustic terms used in this report are as follows:

dB : Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.

dBA : 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 dBA level.

Because of being a logarithmic scale noise levels in dBA do not have a linear relationship to each other. For similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

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 Ln 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. 1 hour).

The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.

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.

HT: 17152 **21 November 2014**

62-63 TOTTENHAM COURT ROAD

ACOUSTIC SPECIFICATION FOR ACOUSTIC LOUVRE SCREENING

Acoustic louvre screening shall extend:

- continuously along/around the perimeter of the plant area.
- from the roof up to a minimum height of at least equal to the highest part of the tallest plant item.

The louvre blades shall face in the direction opposite to that which would be conventional for weather louvers, such that the plant is not visible between the louvre blades when viewed from below.

Performance

The acoustic louvres shall be at least 300mm deep and provide, in their as-installed condition, the following minimum combined sound reduction indices (SRI's)/Transmission Losses when tested in accordance with BS EN ISO 10140-2:2010:

Minimum Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
6	7	10	12	17	17	14	13

Construction

The louvre frame shall be constructed from a suitable gauge of galvanised mild steel, or aluminium, supporting louvre blades of like material. The acoustic material in the blades shall be packed to a density of not less than 45kg/m^3 and be inert, rot and vermin proof, non-hygroscopic incombustible mineral fibre. This shall be faced with glass fibre cloth, or other approved infill protection membrane, and retained on the lower blade face by perforated galvanised mild steel or aluminium (not "expamet" or similar derivative) having a minimum thickness of 0.5mm fixed at 200mm (max) centres.

All junctions between the acoustic screen and adjacent structures shall be made good and sealed with a heavy grout and/or non-hardening dense mastic.

The supplier shall ensure that the assembled enclosure is designed and constructed to withstand site operating conditions such as wind and snow loads, etc., as appropriate, and is suitably weatherproofed.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

Any deviations from the above specification must be agreed by, and confirmed in writing to, Hann Tucker Associates.

Attenuator Schedule
17152/AS/FANS

Hann Tucker Associates
Woking (Head Office)
Tel: 01483 770595

Manchester (Northern Office)
Tel: 0161 832 7041

62-63 Tottenham Court Road

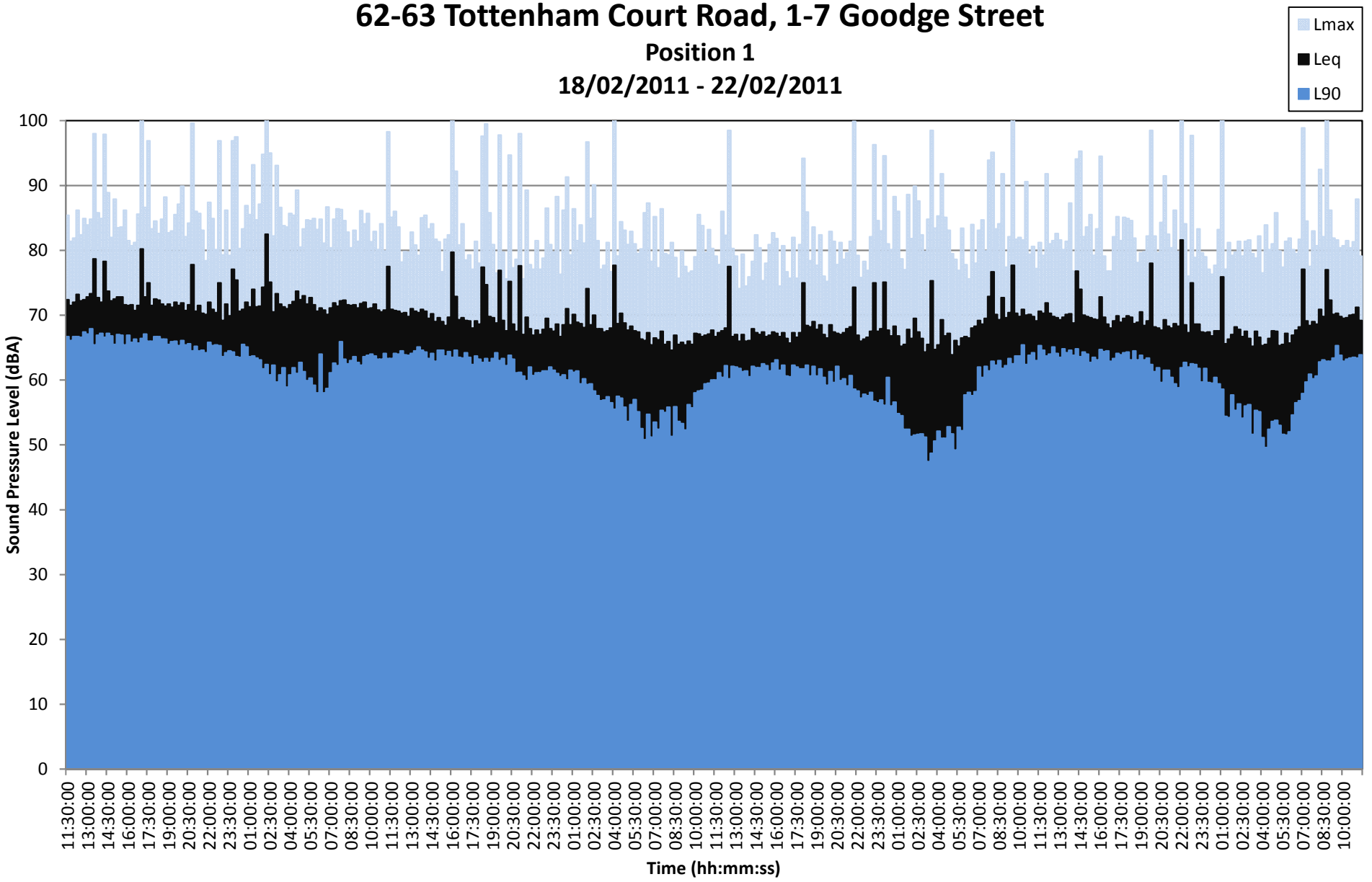
Revision:0	**Date: 10/11/2014**	**Prepared by:ASK**				**Comments: None**									
Attenuator Ref.	**Description**	**Qty**	**Dimensions (mm)**			**Vol** m^3/s	**Max PD** Pa	**Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)**							
			W	**H**	**L**			**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
ATT1	Main Shop Display MUB 450mm Extract Fan Atmospheric side Attenuator	1	To suit pressure drop		900	0.76	50	2	5	11	17	20	19	12	10
ATT2	K200L 200mm Toilet Extract Fan Atmospheric side Attenuator	1	To suit pressure drop		1200	0.95	50	3	7	14	21	27	26	17	12
ATT3	K315L 350mm Kitchen Extract Fan Atmospheric Side Attenuator	1	To suit pressure drop		1200	0.535	50	5	11	19	29	36	37	29	18

All attenuators must comply with Hann Tucker Associates General Specification for Acoustic and Vibration Isolation Materials and Products (copy available upon request if not supplied)

62-63 Tottenham Court Road, 1-7 Goodge Street

Position 1

18/02/2011 - 22/02/2011

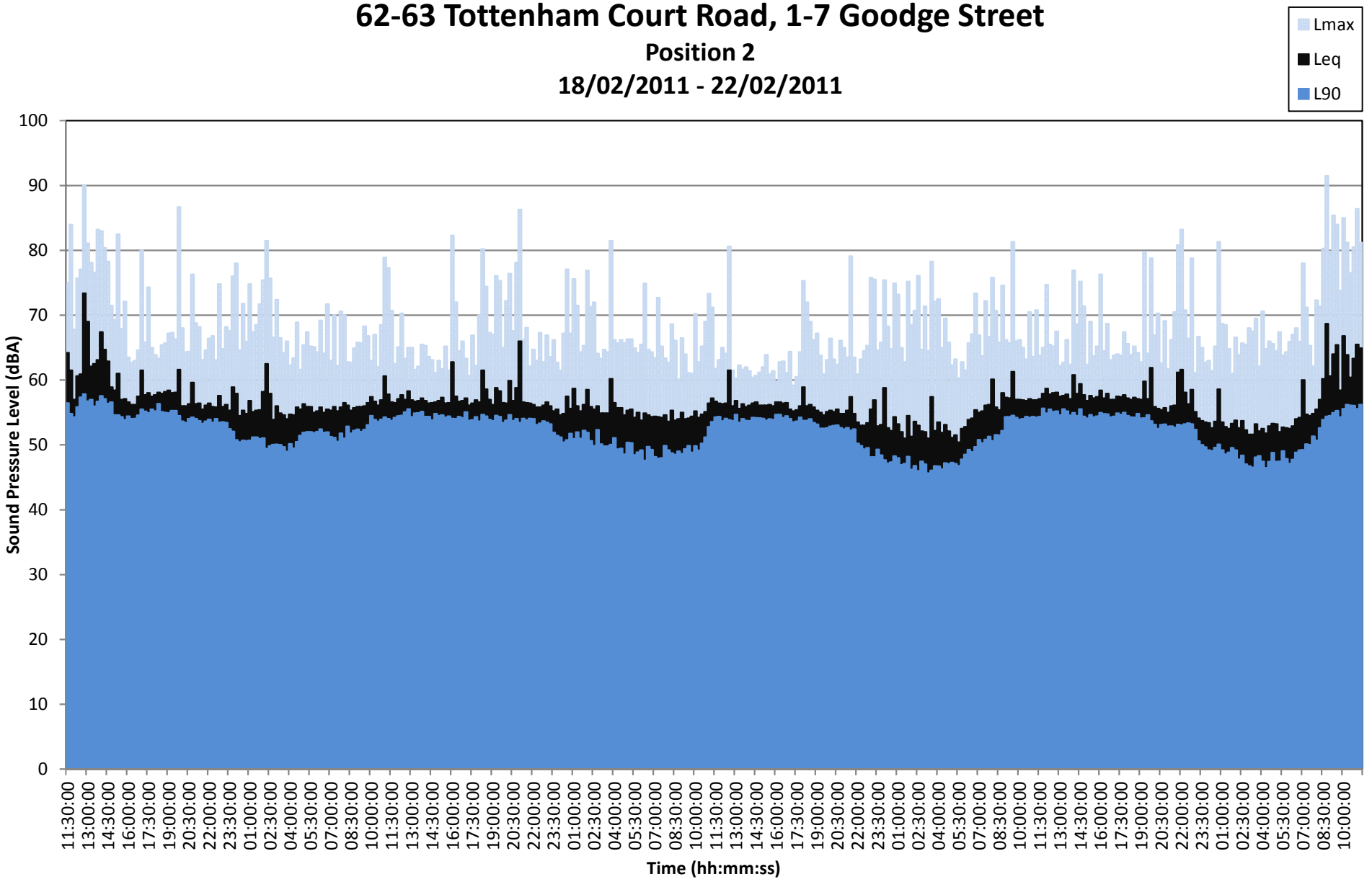


17152/TH1

62-63 Tottenham Court Road, 1-7 Goodge Street

Position 2

18/02/2011 - 22/02/2011

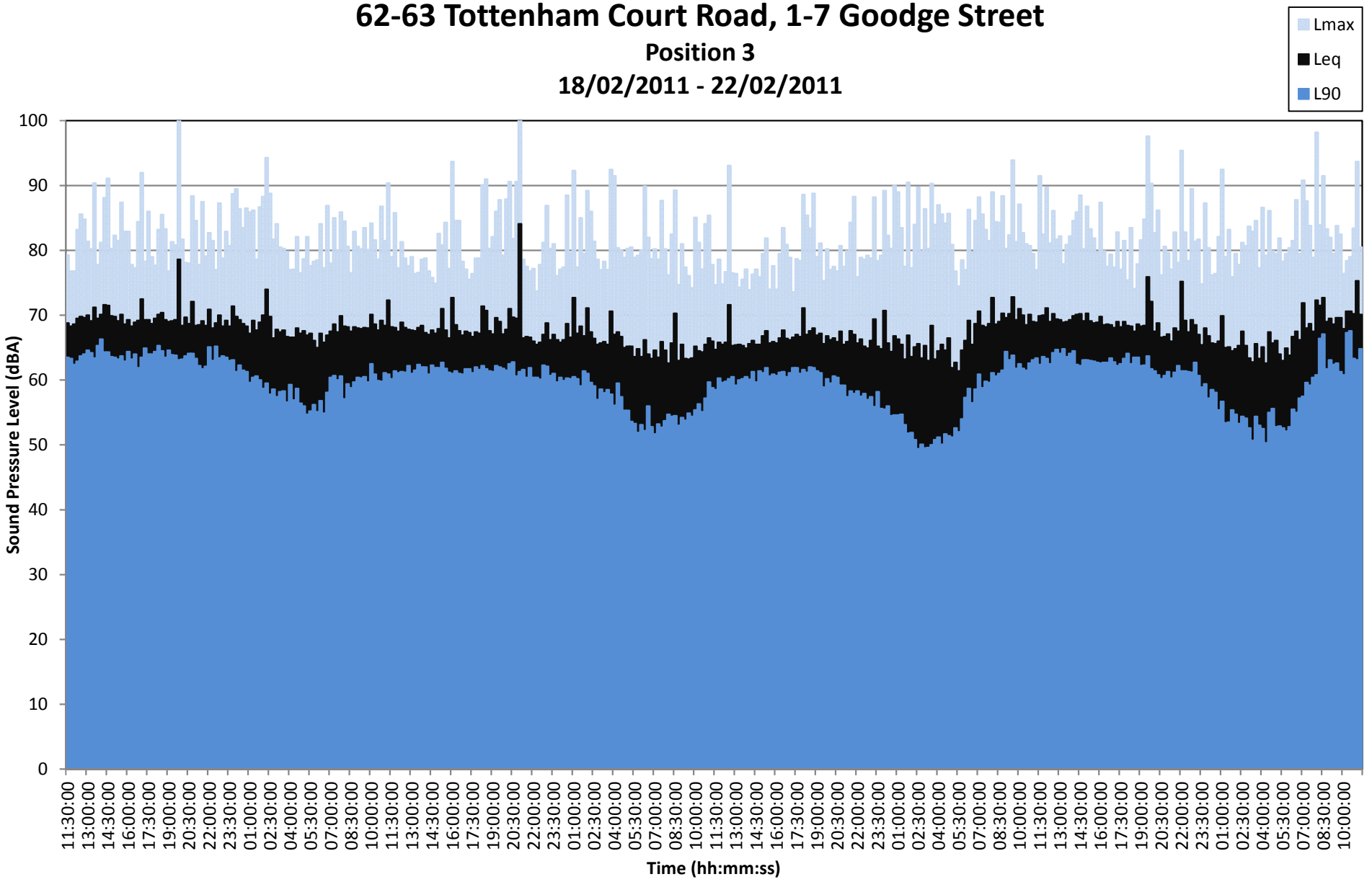


17152/TH2

62-63 Tottenham Court Road, 1-7 Goodge Street

Position 3

18/02/2011 - 22/02/2011



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