Acoustic Consultancy Report

74953/3/1/2
External Plant Assessment

Report Prepared For

Designbrook Ltd
112 Oxford Street
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Checked By

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Contents

i) Executive Summary

New mechanical plant is to be installed at 112 Oxford Street, in London.

LCP has been commissioned by Designbrook Ltd to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The design criterion is as follows:

Day:	46 dB $L_{Aeq, T}$ at 26m, Bloomsbury Hotel;
Night:	43 dB $L_{Aeq, T}$ at 26m, Bloomsbury Hotel.

The design as proposed and assessed will achieve the required criteria the emissions have been calculated as follows:

Day:	28 dB $L_{Aeq, T}$ at 26m, Bloomsbury Hotel;
Night:	28 dB $L_{Aeq, T}$ at 26m, Bloomsbury Hotel.

This report concludes that the design criteria will be achieved.

ii) Document History

Issue	Date	Issue Details	Issued By	Checked By
1	03/11/2015	Initial Issue	RM	MB

1 Introduction

New mechanical plant is to be installed at 112 Oxford Street, in London.

LCP has been commissioned by Designbrook Ltd to carry out a background noise survey and to use the obtained data to assess the noise impact of the plant installation on surrounding noise sensitive receptors.

The guidance contained in this report is given on the basis that the operational period of the plant may potentially be continuous between 06:00 and 22:00.

2 Survey

2.1 Site Description

The site layout together with the measurement position is shown in the drawing contained within Appendix A.

2.2 Receiver Location

The site was surveyed to determine the location of the most affected receiver.

The nearest receiver with direct line of sight to the plant area is 26m to the east of the site. This is shown in both the site plan in Appendix A.

2.3 Local Noise Climate

The predominant local noise sources were road traffic noise and pedestrians.

2.4 Measurements

The noise monitoring took place on the 03/11/2015. The measurement period was considered sufficient to establish the lowest background noise levels corresponding to the operational period of the plant.

The weather conditions during the survey were predominantly calm and dry.

2.5 Measurement Results

The measured statistical broad-band sound pressure levels are shown within Appendix C. The lowest representative background noise level(s) obtained being as follows:

Table 1: Lowest measured background noise levels, dB re $2x10^{-5}$ Pa

Measurement Position	$L_{A90,\ 15\ mins}$ Day*	$L_{A90,\ 15\ mins}$ Night*
MP	56	53

* Day and Night periods are defined as between 07:00 - 23.00 and 23:00 - 07:00 respectively.

3 Evaluation of Design Criteria

3.1 Local Authority Requirement

Camden Development Policies 2010-2025 state the following;

Table E: Noise levels from plant and machinery at which planning permission will not be granted

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	5dB(A) <LA90
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	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB$L_{Aeq'}$

3.2 Design Rating Level

On the basis of the above the design rating level shall therefore be:

Design Rating Level
Existing lowest $L_{A90,\ 15\ mins}$ - 10 dB

3.3 Commercial Design Criterion (BS8233)

Design criteria for non-residential buildings have been derived from BS8233.

For typical office environments, the rating level is $L_{Aeq,\ T}$ 55 dB at 1m from the façade of the receiver premises.

Design Rating level
$L_{Aeq,\ T}$ 55 dB

3.4 Design Rating Levels

The design levels to be adopted for this project are set out in the table below.

Table 2: Design rating levels, dB re 2x10^{-5} Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq,\ 18\ hr}$	Design Level (Night) $L_{Aeq,\ 8\ hr}$
Bloomsbury Hotel	26	46	43

4 Review of Current Design

4.1 Current Design

The proposed plant shall be located at the rear of the building on Bainbridge Street at ground level. There are currently seven existing condensers in this same location, the proposed Toshiba RAS-3M2UAV-E condenser will be installed above an existing Toshiba unit.

The Proposed condensers will have the capability to operate at full capacity between the hours of 06:00-22:00.

4.2 Calculated Results

Calculations of the predicted noise levels have been carried out with the appropriate corrections for geometric attenuation, barrier effect, reflective surfaces and multiple source addition.

The design rating levels to be adopted for this project, together with the predicted noise levels, are set out in the table below.

Table 3: Predicted and design noise levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 18 hr}$	Design Level (Night) $L_{Aeq, 8 hr}$	Predicted Level $L_{Aeq,T}$
Bloomsbury Hotel	26	46	43	28

Plant noise level data used in this assessment are contained within Appendix C.

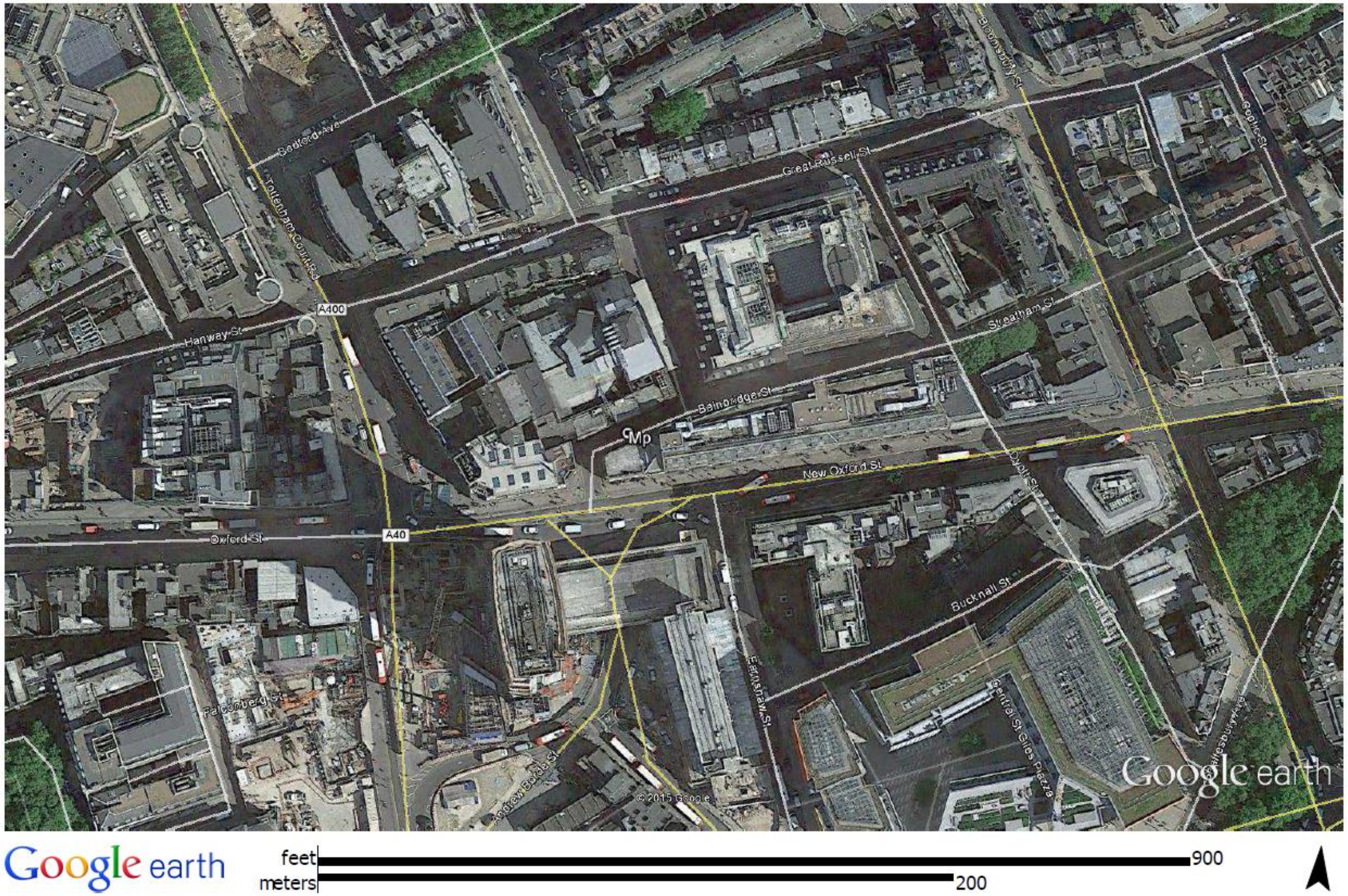
Calculations are shown within Appendix D.

5 Conclusion

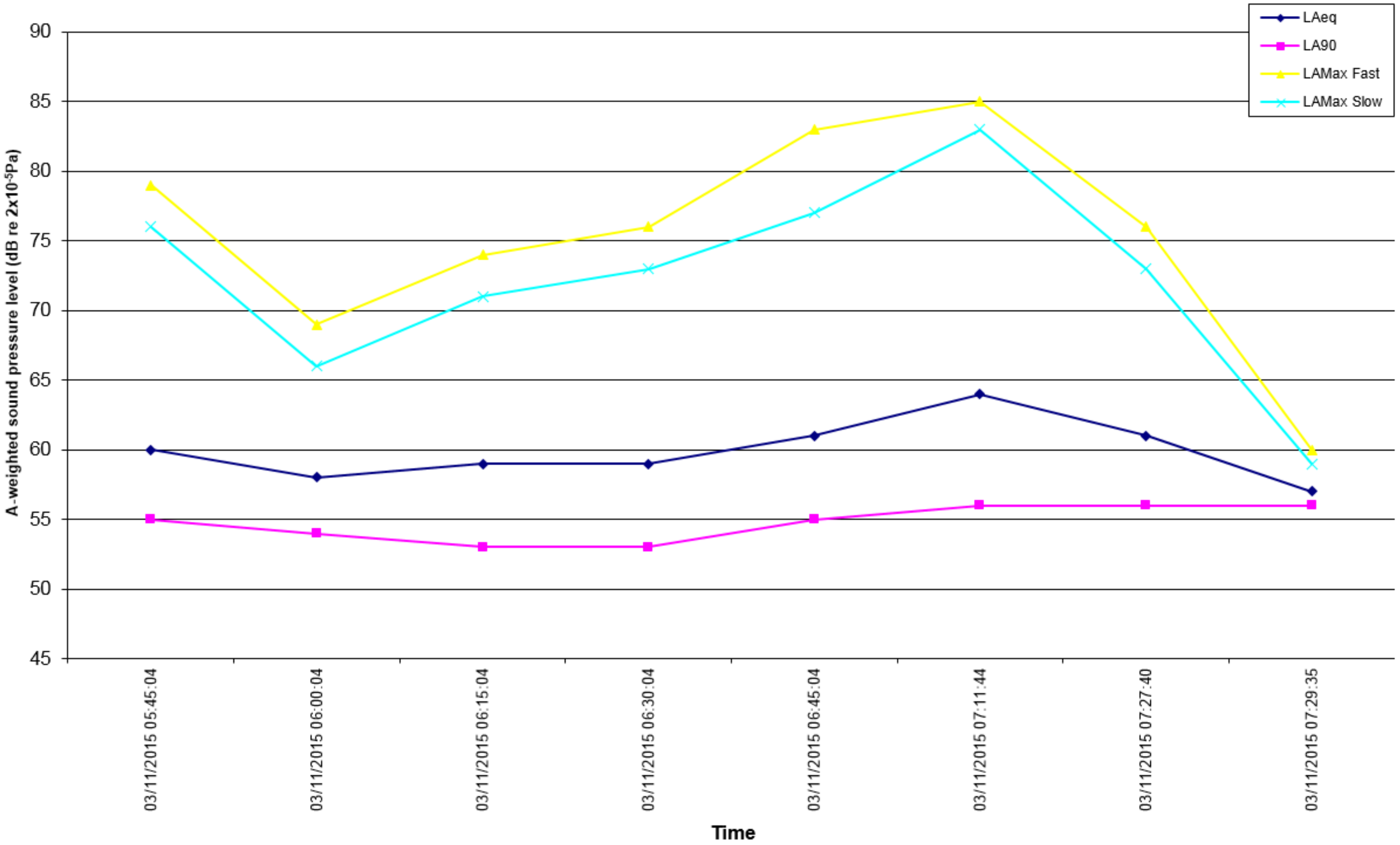
An environmental noise survey has been undertaken in order to establish the existing background noise levels local to the site generally in accordance with the method contained within BS4142.

Calculations have been carried out to determine the noise levels at the nearest receiver premises. The calculations show that the design criteria will be met.

Appendix A: Site Plan



Appendix B: Measurement Data



Sound pressure level measurements were obtained using the following instrumentation complying with the Class 1 specification of BS EN 61672:2003

- Svantek 959 Sound Level Meter S/N: 11207
- Svantek pre-amplifier SV12L S/N: 13260 with GRAS microphone capsule 40AE S/N: 215511

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 10893 complying with Class 1 specification of BS EN 60942:2003, calibration level 94.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix C: Plant Data

Plant noise data used in the preceding assessment follow.

Table 4: Manufacturer's plant sound pressure data, dB re $2x10^{-5}$ Pa

Plant	Distance (m)	Octave Band Centre Frequency (Hz)								L_{PA}
		63	125	250	500	1k	2k	4k	8k	
Toshiba RAS-3M26UAV-E	1	46	53	50	48	44	36	38	30	49

Appendix D: Calculations

Project Information:

Project Number	**74953**

Calculation Information:

Source Description	**Toshiba RAS-3M26UAV-E**
Receiver Description	**Bloomsbury Hotel**

Source Dimensions:

Description	Value	Units
Source height (dimension a) (1)	0.8	m
Source length (dimension b) (1)	0.9	m
Source depth	0.3	m

Barrier Loss:

Description	Value	Units
Source height (2)		m
Receiver height		m
Barrier height		m
Source to barrier distance		m
Barrier to receiver distance		m
Calculated path difference		**m**

Distance to Receiver:

Description	Value	Units
Barrier Present	N	
Distance to Receiver (no barrier) (3)	26	m

Calculated Noise Level at Receiver:

Description				Octave Band Centre Frequency (Hz)								A	Units	Ref
				63	125	250	500	1000	2000	4000	8000			
Source Noise Data (Lp) (5)	Reference distance	1.0	m	46	53	50	48	44	36	38	30	49	dB	
Calculated Source Lw (6)				54	61	58	56	52	44	46	38	58	dB	1
Distance Attenuation (from Lw)	Distance to receiver	26.0	m	-36	-36	-36	-36	-36	-36	-36	-36		dB	1
Net Barrier Loss				0	0	0	0	0	0	0	0		dB	2,3
Reflections (7)		1		3	3	3	3	3	3	3	3		dB	3
Number of sources		1		0	0	0	0	0	0	0	0		dB	3
Façade Correction (3dB) (8)				3	3	3	3	3	3	3	3		dB	
Noise Level at Receiver (Lp)				**24**	**31**	**28**	**26**	**22**	**14**	**16**	**8**	**28**	**dB**	

Required Criteria:

Description	Criteria Type	Value		Octave Band Centre Frequency (Hz)								A	Units	Ref
				63	125	250	500	1000	2000	4000	8000			
Limiting Noise Criteria	dBA	43		**61**	**51**	**44**	**39**	**35**	**32**	**30**	**28**	**43**	dB	
Excess													**dB**	

Suggested Noise Mitigation (9)

Additional Noise Reduction (e.g. enclosure)		Octave Band Centre Frequency (Hz)								A	Units	Ref
		63	125	250	500	1000	2000	4000	8000			
Noise Reduction Loss (10)	None	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		dB	
Resultant Noise Level		**24**	**31**	**28**	**26**	**22**	**14**	**16**	**8**	**28**	dB	
Remaining Excess											**dB**	

Reference 1	"Note on two common problems of sound propogation"	E.J. Rathe	Journal of Sound and Vibration	1969
Reference 2	"Calculation of Road Traffic Noise"		Department of Transport	1988
Reference 3	IOA Diploma Formula Sheet Edition 5			2003

Note 1	Rathe method only uses height and length - depth is not used. This assumes that the recevier is perpendicular to the source surface defined by a and b
Note 2	Heights should be specified relative to the reference level shown in the sheet
Note 3	Distance from receiver should be entered when a barrier is not present. This cell will clear if a barrier is present
Note 4	Barrier attenuation deration is based on the logairthimic addition of noise over and through the barrier
Note 5	Enter a reference distance of 0 to input a sound power level
Note 6	Source is assumed to be on a solid ground plane
Note 7	Allow 3 dB for each reflective surface that influences the site conditions (excluding ground plane)
Note 8	3dB is added for increase at façade
Note 9	The supplier shall confirm that the installed solution will comply with the required additional noise reduction
Note 10	Reduction should be entered as negative values

Appendix E: Glossary

The list below details the major acoustical terms and descriptors, with brief definitions:

'A' Weighting

Weighting applied to the level in each stated octave band by a specified amount, in order to better represent the response of the human ear. The letter 'A' will follow a descriptor, indicating the value has been 'A' weighted. An 'A' weighted noise level may also be written as dB(A).

Airborne Noise

Noise transmitted through air.

Ambient Noise

The total noise level including all 'normally experienced' noise sources.

dB or Decibel

Literally meaning 'a tenth of a bel', the bel being a unit devised by the Bell Laboratory and named after Alexander Graham Bell. A logarithmically based descriptor to compare a level to a reference level. Decibel arithmetic is not linear, due to the logarithmic base. For example:

30 dB + 30 dB ≠ 60 dB	30 dB + 30 dB = 33 dB

D_{nTw}+C_{tr}

The weighted, normalised difference in airborne noise levels measured in a source room (L1) and a receive room (L2) due to a separating partition.

D	Is simply L1 – L2.
D_{nT}	Is the normalisation of the measured level difference to the expected (in comparison to the measured) reverberation time in the receiving room.
D_{nTw}	Is the weighted and normalised level difference. This value is the result of applying a known octave band weighting curve to the measured result.
C_{tr}	Is a correction factor applied to the D_{nTw} to account for the known effects of particular types of noise, such as loud stereo music or traffic noise.

Frequency (Hz)

Measured in Hertz (after Heinrich Hertz), and represents the number of cycles per second of a sound or tone.

Insertion Loss, dB

The amount of sound reduction offered by an attenuator or louvre once placed in the path of a noise level.

$L_{A90, T}$

The ‘A’ weighted noise level exceeded for 90% of the time period T, described or measured. The ‘90’ can be substituted for any value between 1 and 99 to indicate the noise level exceeded for the corresponding percentage of time described or measured.

$L_{Aeq, T}$

The ‘A’ weighted ‘equivalent’ noise level, or the average noise level over the time period T, described or measured.

L_{Amax}

The ‘A’ weighted maximum measured noise level. Can be measured with a ‘slow’ (1 sec) or ‘fast’ (0.125 sec) time weighting.

L_{Amin}

The ‘A’ weighted minimum measured noise level.

NR

Noise Rating (NR) level. A frequency dependent system of noise level curves developed by the International Organisation for Standardisation (ISO). NR is used to categorise and determine the acceptable indoor environment in terms of hearing preservation, speech communication and annoyance in any given application as a single figure level. The US predominantly uses the Noise Criterion (NC) system.

Octave

The interval between a frequency in Hz (f) and either half or double that frequency (0.5f or 2f).

Pa

Pascals, the SI unit to describe pressure, after physicist Blaise Pascal.

Reverberation Time, T_{mf}, RT60, RT30 or RT20

The time taken in seconds for a sound to diminish within a room by 1,000 times its original level, corresponding to a drop in sound pressure of 60 dB. When taking field measurements and where background noise levels are high, the units RT20 or RT30 are used (measuring drops of 20 or 30 dB respectively). Sometimes given as a mid-frequency reverberation time, T_{mf} which is the average of reverberation time values at 500Hz, 1kHz and 2kHz.

R_w

The sound reduction value(s) of a constructional element such as a door, as measured in a laboratory, with a known octave band weighting curve applied to the result.

Sound Power Level

A noise level obtained by calculation from measurement data, given at the face of an item of plant or machinery. Referenced to 10^{-12} W or 1pW.

Sound Pressure Level

A noise level measured or given at a distance from a source or a number of sources. Referenced to $2x10^{-5}$ Pa.

Subjective Effect of Changes in Sound Pressure Level

The table below details the subjective effects of variations in sound pressures (adapted from Bies and Hansen).

Difference between background noise and rating levels	Increase in ambient noise level in 'real terms'	Change in apparent loudness
+ 10 dB	+ 10 dB	Twice as loud
+ 5 dB	+ 6 dB	Clearly noticeable
0 dB	+ 3 dB	Just perceptible
-10 dB	0 dB	No change

W

Watts, the SI unit to describe power, after engineer James Watt.