Acoustic Consultancy Report

81430/3/4/13

45 Bedford Row External Plant Assessment

Report Prepared For

G.D.M. Pts.
High Holborn Estate
04 March 2019

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Checked By

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i) Executive Summary

New mechanical plant is to be installed at 45 Bedford Row, in London.

LCP has been commissioned to carry out an acoustic environment survey and to use the obtained data to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The guidance contained in this report is given on the basis that the plant may be consistently operating between 07:00 and 19:00.

The design criterion is as follows:

Day:	41 dB $L_{Aeq,\,T}$ at 12m, Mid City Place.

The design as proposed and assessed will achieve the required criteria; the calculated rating levels are as follows:

Day:	41 dB $L_{Aeq,\,T}$ at 12m, Mid City Place.

This report concludes that the design criteria can be achieved.

ii) Document History

Issue	Date	Issue Details	Issued by	Checked By
1	25th November 2016	Initial Issue	JN	-
2	6th November 2018	Additional Plant	RM	MB
3	04th March 2018	Revised Issue	RM	-

1 Introduction

New mechanical plant is to be installed at 45 Bedford Row, in London.

LCP has been commissioned to carry out an acoustic environment survey and to use the obtained data to assess the potential noise impact of the plant installation on surrounding noise sensitive receptors.

The report details recommendations for necessary noise mitigation where necessary.

The guidance contained in this report is given on the basis that the plant may be consistently operating between 07:00 and 19:00.

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 12m to the west of the site, on the upper stories of Mid City Place.

2.3 Local Noise Climate

The predominant local noise sources were road traffic noise and some light construction work on Bedford Row.

2.4 Measurements

The noise monitoring took place on 17th to 18th November 2016. The measurement period was considered sufficient to establish the representative background sound levels corresponding to the operational period of the plant.

The weather conditions monitored during the survey are shown in the following table.

Table 1: Weather Conditions at Measurement Location

Weather	Value
Average Wind Speed	3 m/s
Wind Direction	SW
Cloud Cover	75%
Max. Temperature	9°C
Min. Temperature	3°C
Precipitation	None

2.5 Measurement Results

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

Table 2: Representative background sound levels, dB re $2x10^{-5}$ Pa

Measurement Position	$L_{A90,\ 15\ mins}$ Day*	$L_{A90,\ 15\ mins}$ Evening*	$L_{A90,\ 15\ mins}$ Night*
MP1	51	48	45

* Day, Evening and Night periods are defined as between 07:00 - 19.00, 19.00 - 23.00 and 23:00 - 07:00 respectively.

3 Evaluation of Design Criteria

3.1 BS4142:2014

BS4142:2014 states that the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.

Table 3: BS4142 assessment based upon rating level

Difference between background noise and rating levels	Assessment
+ 10 dB	Indication of a significant adverse impact
+ 5 dB	Indication of an adverse impact
0 dB	Indication of low impact

Certain acoustic features can increase the significance of impact. The specific sound level should be corrected if a tone, impulse or other acoustic feature is expected to be present.

Table 4: Corrections for acoustic features, subjective method

Acoustic Feature	Correction, dB		
	Just Perceptible	Clearly Perceptible	Highly Perceptible
Tonality	2	4	6
Impulsivity	3	6	9
Other Characteristics	3		
Intermittency	3		

Typically, the acoustic feature correction would not be expected to exceed 10dB.

Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty.

3.2 World Health Organisation Night Noise Guidelines for Europe (2009)

The WHO's document 'Night Noise Guidelines for Europe (NNG) states the following:

"*…it is recommended that the population should not be exposed to night noise levels greater than 40 dB of* $L_{night,\ outside}$ *during the part of the night when most people are in bed*."

It then goes on to say:

"*An interim target (IT) if 55 dB* $L_{night,\ outside}$ *is recommended in the situations where the achievement of NNG is not feasible in the short run for various reasons*."

As the above guideline values consider the combined level of noise external to a façade (i.e. vehicular traffic, air traffic, building services noise etc, it is recommended that a criterion of 10 dB below these given levels is applied, depending on the particulars of the site in question.

3.3 World Health Organisation (WHO) Guidelines for Community Noise (1999)

The WHO's 'Guidelines for Community Noise' gives the following relevant noise criteria:

Table 5: Guideline values for community noise, from Guidelines for Community Noise (WHO, 1999)

Specific Environment	$L_{Aeq,\ T}$ dB	Time Base (hours)	L_{Amax}, fast dB
Outdoor living area (serious annoyance, daytime and evening)	55	16	-
Outdoor living area (moderate annoyance, daytime and evening)	50	16	-
Dwelling, indoors	35	16	-
Inside bedrooms	30	8	45
Outside bedrooms	45	8	60
Outdoors in parkland and conservation areas*	-	-	-

* Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low

The WHO's 'Guidelines for Community Noise' also gives the following general guidance on the expected sound insulation performance of a façade with a partly open window, it states that:

"*At night, sound pressure levels at the outside facades of the living spaces should not exceed 45 dB* L_{Aeq} *and 60 dB* L_{Amax}*, so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB.*"

3.4 BS8233:2014

The criteria offered in BS8233 for residential buildings are largely based on the recommendations made in the Guidelines for Community Noise.

Using the general guidance from above, on the expected sound insulation performance of a façade with a partly open window, the criteria shown in the table below have been adapted from the criteria offered in table 4 of BS8233 in order to obtain acceptable external noise levels.

The noise levels shown should be treated as overall noise levels, i.e., the combination of all existing noise levels at the site, and noise levels from any proposed plant or activity.

Table 6: External ambient noise levels for dwellings, based on BS8233, dB re $2x10^{-5}$ Pa

Activity	Location	Time period	
		07:00 to 23:00	23:00 to 07:00
Resting	Living Room	50 $L_{Aeq,16\ hour}$	-
Dining	Dining Room/area	55 $L_{Aeq,\ 16\ hour}$	-
Sleeping (daytime resting)	Bedroom	50 $L_{Aeq,\ 16\ hour}$	45 $L_{Aeq,\ 8\ hour}$

In addition to the above criteria, BS8233 goes on to say:

"*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50* $L_{Aeq,\ T}$*, with an upper guideline value of 55 dB* $L_{Aeq,\ T}$ *which would be acceptable in nosier environments*."

The above criteria are in line with the recommendations made in WHO's 'Guidelines for Community Noise'.

3.5 Local Authority Requirements

Section 4 of London Borough of Camden planning permission application Ref: 2016/7038/P states that;

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).

Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policy CS5 of the London Borough of Camden Local Development Framework Core Strategy and policies DP26 and DP28 of the London Borough of Camden Local Development Framework Development Policies.

3.6 Design Rating Level

On the basis of the above the recommended residential design rating level should therefore be:

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

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

Table 7: Design rating levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 12\ hr}$	Design Level (Evening) $L_{Aeq, 4\ hr}$	Design Level (Night) $L_{Aeq, 8\ hr}$
Mid City Place	12	41	38	35

4 Review of Current Design

4.1 Current Design

The proposed plant shall be located on the upper flat roof; plant includes five PUMY-P140VKM condensers and one PUMY-P112VKM1 condenser.

The guidance contained in this report is given on the basis that the plant may be consistently operating between 07:00 and 19:00.

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 8: Design and predicted rating levels, dB re $2x10^{-5}$ Pa

Receiver Premises	Approximate Distance (m)	Design Level (Day) $L_{Aeq, 12\ hr}$	Predicted Level $L_{Aeq, T}$
Mid City Place	12	41	41

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

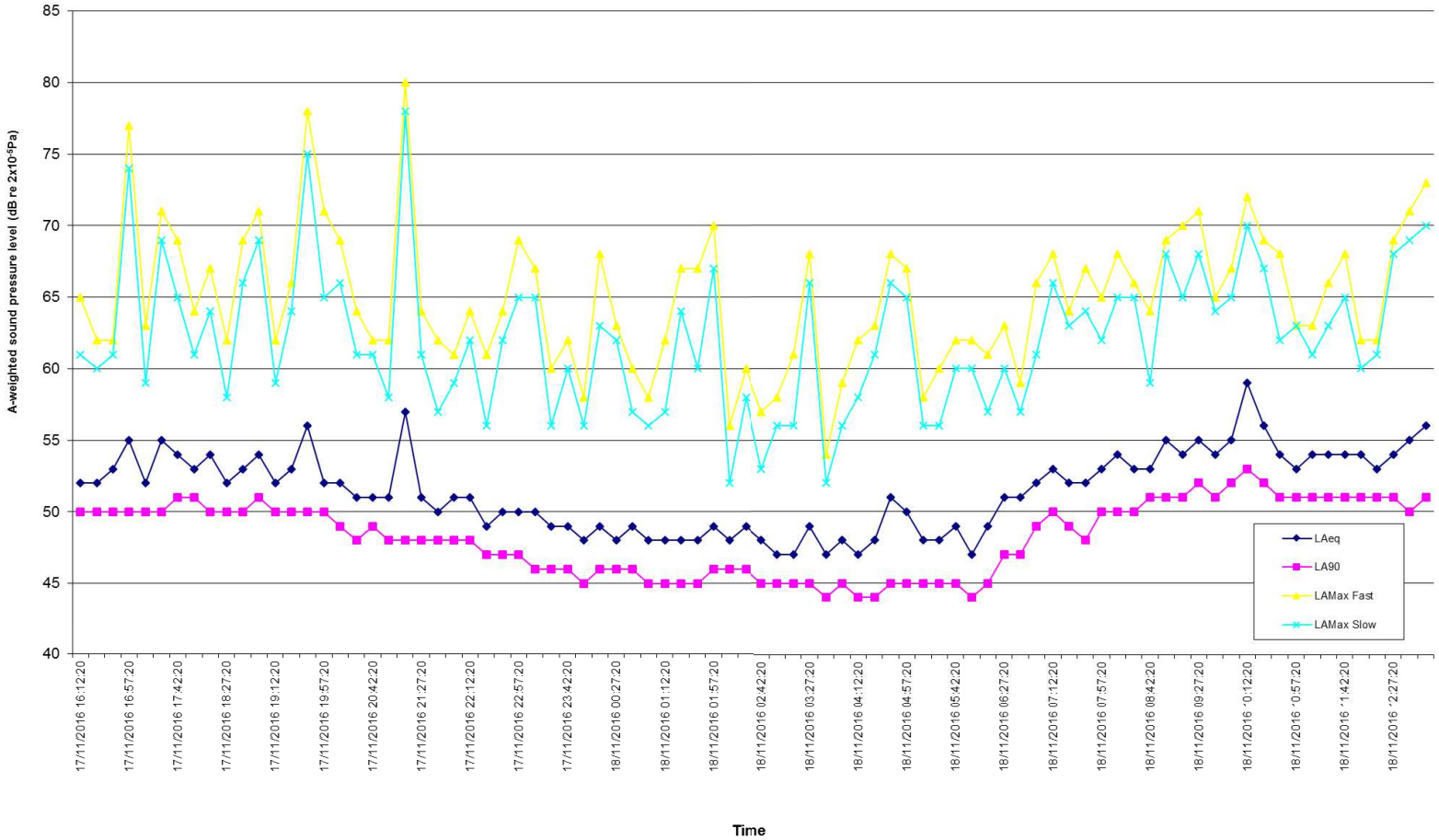
5 Conclusion

An environmental noise survey has been undertaken in order to establish the representative background sound levels local to the site generally in accordance with the method contained within BS4142: 2014.

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: 11205
- Svantek pre-amplifier SV12L S/N: 13245 with GRAS microphone capsule 40AE S/N: 75181

Calibration checks were made prior to and after completion of measurements using a Svantek SV30A calibrator, S/N: 43066 complying with Class 1 specification of BS EN 60942:2003, calibration level 114.0 dB @ 1.0 kHz. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Appendix C: Plant Data

Table 9: 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	
PUMY-P140VKM	1	59	60	50	52	46	42	37	31	53
PUMY-P112YKM1	1	57	52	49	46	45	39	33	32	49

Appendix D: Calculations

Ref.	plant	Ref.dist.	Sound Level (Lp/Lw)									Lw
			63	125	250	500	1k	2k	4k	8k	dB(A)	dB(A)
1	PUMY-P140VKM	1.00	59	60	50	52	46	42	37	31	53	61
2	PUMY-P112YKM1	1.00	57	52	49	46	45	39	33	32	49	57

Reciever Distance (m)	dB(A)	Lp	No. off	dB	Angular Directionality	63	125	250	500	1k	2k	4k	8k	Façade correction	dB
12.0	-30	31	5	7	None	0	0	0	0	0	0	0	0	Yes	3
12.0	-30	27	1	0	None	0	0	0	0	0	0	0	0	Yes	3

Ref.	plant	Receiver Lp								
		63	125	250	500	1k	2k	4k	8k	dB(A)
1	PUMY-P140VKM	47	48	38	40	34	30	25	19	41
2	PUMY-P112YKM1	41	36	33	30	29	23	17	16	33
Total		**48**	**48**	**39**	**40**	**35**	**31**	**26**	**21**	**41**

Barrier Path Difference Loss:														
Source height	Receiver height	Barrier height	Source to barrier distance	Barrier to receiver distance	Calculated path difference	63	125	250	500	1000	2000	4000	8000
1.0				12.0	-0.96	0	0	0	0	0	0	0	0
1.0				12.0	-0.96	0	0	0	0	0	0	0	0

Criteria										
NR	63	125	250	500	1k	2k	4k	8k	dB(A)
32	61	50	42	36	32	29	27	25	41

Barrier SRI			63	125	250	500	1k	2k	4k	8k
		Manual								
		Unknown	100	100	100	100	100	100	100	100

Ref.	Plant	Excess								
		63	125	250	500	1k	2k	4k	8k	dB(A)
1	PUMY-P140VKM	-14	-2	-4	4	2	1	-2	-6	0
2	PUMY-P112YKM1	-20	-14	-9	-6	-3	-6	-10	-9	-8
Total		-13	-2	-3	4	3	2	-1	-4	0

Barrier Deration			63	125	250	500	1k	2k	4k	8k
		PUMY-P140VKM	0	0	0	0	0	0	0	0
		PUMY-P112YKM1	0	0	0	0	0	0	0	0

Ref.	Plant	Mitigated Receiver Lp								
		63	125	250	500	1k	2k	4k	8k	dB(A)
1	PUMY-P140VKM	47	48	38	40	34	30	25	19	41
2	PUMY-P112YKM1	41	36	33	30	29	23	17	16	33
Total		**48**	**48**	**39**	**40**	**35**	**31**	**26**	**21**	**41**

Net barrier loss			63	125	250	500	1k	2k	4k	8k
		PUMY-P140VKM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		PUMY-P112YKM1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

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.