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17 DUKE'S ROAD, LONDON

PLANNING COMPLIANCE REPORT

Report 10717.PCR.02

For:

Claremore Mechanical Services Ltd

31 Grangewood Street

London

E6 1HB

Site Address	Report Date	Revision History
17 Duke's Road, London, WC1H 9PY	11/08/2016	

CONTENTS

List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd, Britannia House, 11 Glenthorne Road, London, W6 0LH, has been commissioned by Claremore Mechanical Services Ltd., 31 Grangewood Street, London, E6 1HB to undertake an environmental noise survey at 17 Duke's Road, London, WC1H 9PY. The background noise levels measured will be used to determine daytime and night-time noise emission criteria for the replacement of one air conditioning unit in agreement with the planning requirements of The London Borough of Camden.

This report presents the overall methodology and results from the environmental survey followed by calculations to demonstrate the feasibility of the plant installation to satisfy the emissions criterion at the closest noise-sensitive receiver and outline mitigation measures as appropriate.

2.0 ENVIRONMENTAL NOISE SURVEY AND EQUIPMENT

2.1 Procedure

Automated noise monitoring and manual measurements were undertaken on the proposed site as shown in Site Plan 10717.SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver relative to the proposed plant installation. The duration of the survey was between 11:00 on 25/07/2016 and 11:00 on 26/07/2015.

Initial inspection of the site revealed that the background noise profile at the monitoring location was dominated by road traffic noise from the surrounding roads and mechanical noise from existing plant units on the roof of the same and neighbouring buildings.

The weather during the course of the survey was generally dry with wind speeds within acceptable tolerances and therefore suitable for the measurement of environmental noise. The measurement procedure generally complied with ISO 1996-2:2007 Acoustics *"Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels".*

2.2 Equipment

The equipment calibration was verified before and after the survey and no calibration irregularities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 958 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator

3.0 RESULTS

The results from the continuous noise monitoring are shown as a time history of L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} averaged over 5 minute sample periods in Figure 10717.TH1.

Minimum background noise levels are shown in Table 3.1.

	Minimum background noise level $L_{A90:\,5min}$ dB(A)
Daytime (07:00-23:00)	49
Night-time (23:00-07:00)	46

Table 3.1: Minimum measured background noise levels

4.0 NOISE CRITERIA

The criterion of The London Borough of Camden states that noise emission level from machinery at 1m from the closest noise sensitive receiver should be at least 5 dB below background noise level. If the proposed plant units generate noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) or distinct impulses the noise emission level should be at least 10 dB below background noise level.

Since the proposed condenser unit could generate a low-medium frequency hum noise, the 10 dB below background noise level criterion is proposed and shown in Table 4.1.

	Noise emission level criteria for proposed new plant units (dBA)
Daytime (07:00-23:00)	39
Night-time (23:00-07:00)	36

Table 4.1: Proposed criteria following The London borough of Camden criterion

Since the plant unit would operate only at daytime, we therefore propose the level of 39 dB(A) Daytime as the noise emission level criterion at 1m from the closest noise sensitive receiver façade for new plant units.

5.0 DISCUSSION

It is understood that the plant installation is comprised of the following units:

- 1 No. Carrier 30RBY/RQY 021 Outdoors Condenser Unit

The unit would replace an existing unit on the roof of 17 Duke's Road, London. The closest noise sensitive receivers to this location will be the residential windows at the top floor level of 43-66 Flaxman Terrace located to the South-West of the proposed plant unit location. The aforementioned closest noise sensitive receiver is located at a direct distance of approximately 27 meters as shown in site plan 10717.02.SP1.

The sound power levels as provided by the manufacturer for the unit are shown in Table 5.1.

	Sound Pressure Level at 1m (dB) by octave frequency band (Hz)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Carrier 30RBY/RQY 021 Condenser Unit	-	95	80	78	73	71	69	65

Table 5.1 Manufacturer's Sound Power Level

5.1 Objective overview

As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive window fully satisfies the London Borough of Camden noise emission criterion provided that the condenser unit is installed within a louvered acoustic enclosure with, at least, the Sound Reduction Index values shown in table 5.3.

Receiver - Nearest Noise Sensitive Window	**Criterion**	**Noise Level at Receiver (Residential Window)**
Daytime	39 dB(A)	39 dB(A)

Table 5.2: Predicted noise level and criterion at nearest noise sensitive location

	Sound Reduction Index (dB) by octave frequency band (Hz)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Louvered acoustic enclosure	-4	-5	-8	-9	-12	-10	-8	-6

Table 5.3: Minimum Sound Reduction Index of the proposed acoustic enclosure

Furthermore, the predicted value of 39 dB(A) is to be considered outside of the receiver's facade. Windows may be closed or partially closed leading to further attenuation.

Further calculations have been undertaken to assess whether the noise emissions from the air conditioning unit would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard BS8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' gives recommendations for acceptable internal noise levels in different types of buildings. Assuming worst case conditions of the closest window being for sleeping/resting space, BS8233 recommends 30-35 dB(A) as being acceptable internal rest conditions.

According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level.

Receiver	Conditions Design Range – *For resting/sleeping conditions in a bedroom, in BS8233:2014*	Noise Level at Receiver (due to plant installation)
Inside Nearest Residential Space	30-35 dB(A)	29 dB(A)

Table 5.4: Noise levels and criterion inside nearest residential space

Predicted levels are shown in Table 5.4, with detailed calculations shown in Appendix B. It can therefore be stated that, as well as complying with the set criterion, the emissions from the air conditioning units would be expected to comfortably meet the most stringent recommendations of the relevant British Standard.

6.0 CONCLUSION

An environmental noise survey has been undertaken at 17 Duke's Road, London, WC1H 9PY, by KP Acoustics Ltd between 25/07/2015 and 26/07/2015. The results of the survey have enabled criteria to be set for noise emissions. Using manufacturer noise data, noise levels are predicted at the nearby noise sensitive receivers for compliance with current requirements.

Calculations show that noise emissions from the proposed plant unit installation would meet the set requirements provided that the aforementioned acoustic enclosure is installed.

Further calculations have been undertaken with regards to the relevant British Standard and it has been ensured that the amenity of nearby residential receiver will be protected.

Report by

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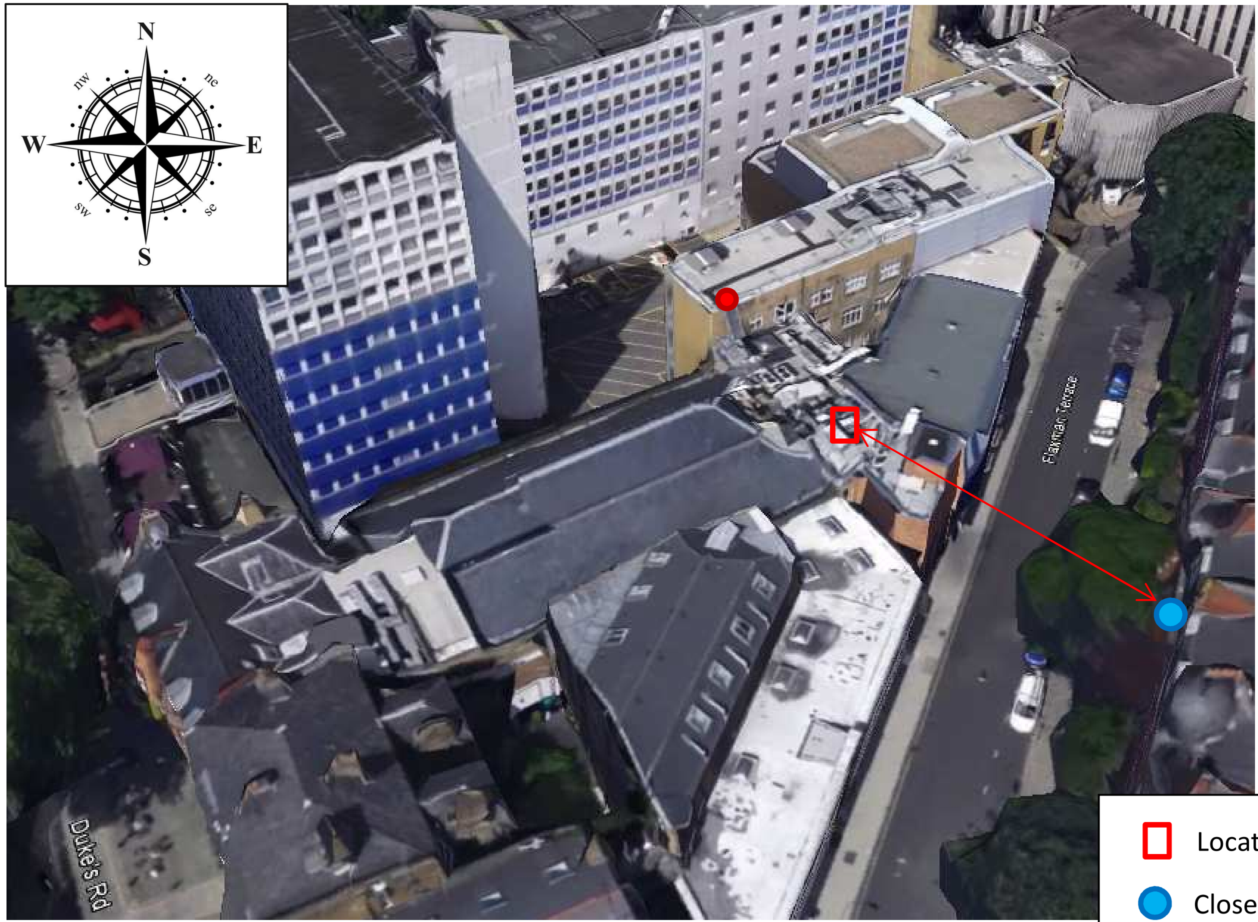

Location of the existing plant unit to be replaced

Closest Noise Sensitive Receiver

24h Noise monitoring location

Title: Indicative site plan showing manual and 24h noise monitoring position and closest noise sensitive receiver to the location of the plant unit.

Date: 11 August 2016

FIGURE 10717.02.SP1

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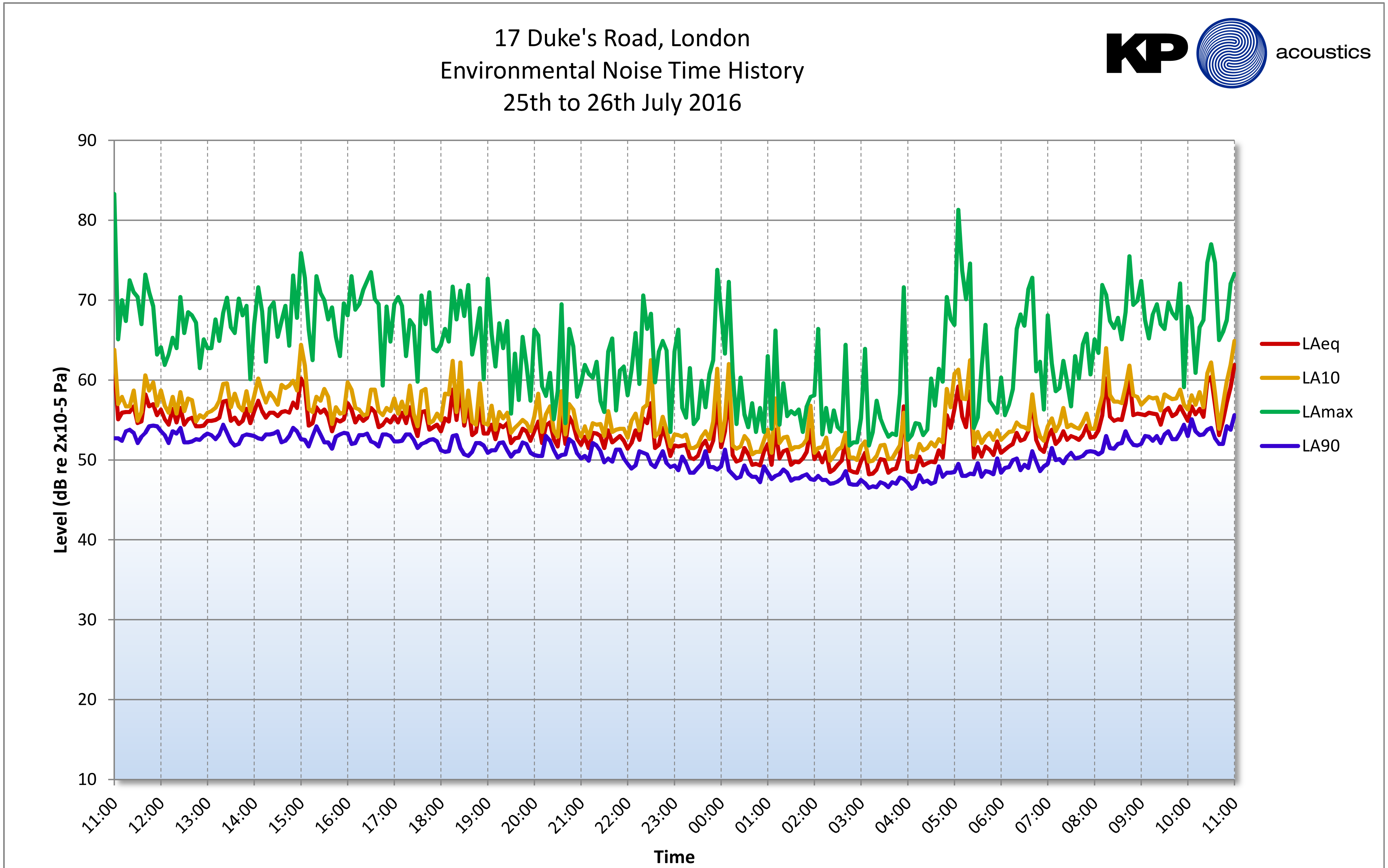

Figure 10717.02.TH1

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B

17 DUKE'S ROAD, LONDON

PLANT UNIT EMISSIONS CALCULATIONS

Source: Outdoor unit Carrier 30RBY021 on roof top at 17 duke Road	*Frequency, Hz*								
Receiver: 43-66 Flaxman Terrace top floor flats	***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Plant unit Carrier 30RBY021 Sound Power level (dB)	-	95	80	78	73	71	69	65	
Conversion to Sound Pressure Level at 1 meter	-	-11	-11	-11	-11	-11	-11	-11	
Correction due to surface reflections	-	3	3	3	3	3	3	3	
Attenuation due to distance (27 m)	-	-29	-29	-29	-29	-29	-29	-29	
Attenuation due to louvered acoustic enclosure	-	-5	-8	-9	-10	-10	-8	-6	
Total Sound pressure level at receiver due to source	**-**	**53**	**35**	**32**	**26**	**24**	**24**	**22**	**39**
					Design Criterion				**39**

Source: Outdoor unit Carrier 30RBY021 on roof top at 17 duke Road	*Frequency, Hz*								
Receiver: Inside 43-66 Flaxman Terrace top floor flats	***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Sound Pressure level at 1m from the receiver's facade	-	53	35	32	26	24	24	22	
Minimum attenuation due to slightly opened window	-	-10	-10	-10	-10	-10	-10	-10	
Total Sound pressure level at receiver due to source	**-**	**43**	**25**	**22**	**16**	**14**	**14**	**12**	**29**
					BS8233:2014 Design Criterion				**30-35**