

Assessment of Mechanical Plant Noise

Oriental Dragon, 100 Cleveland Street, W1T 6NS

for Ms Nicole Zhou

12 February 2016

ARM 177-01

Title:Assessment of Mechanical Plant NoiseProject:Oriental Dragon, 100 Cleveland Street, W1T 6NSRef:ARM 177-01Revision:-

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12 February 2016

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1. INTRODUCTION

It is understood that the existing kitchen extract and ventilation equipment serving the restaurant premises of the Oriental Dragon at 100 Cleveland Street, London W1T 6NS is to be replaced. The new plant will utilise existing ductwork and comprise an odour filtration unit, carbon filter, disposable G4 pre-filter with the filter box connected to a new extract fan with intake and exhaust attenuators. Mechanical plant will be utilised during restaurant hours only, which are as follows:

Monday -to Sunday 11am - 11pm.

In order to ensure that the amenity of adjacent premises is not unduly affected as a result of noise emission from the mechanical plant, it is necessary to demonstrate to the local planning authority, the London Borough of Camden, that noise will be controlled in line with the requirements of their Local Development Framework, specifically *DP28 Noise and vibration*.

To satisfy the requirements of the local authority, an ambient noise survey was undertaken over a period considered representative of the lowest prevailing background noise level corresponding to the operation of the plant. This information and noise emission data obtained from the equipment supplier was subsequently used to assess the impact of the scheme upon local amenity. The survey and assessment methods were based upon the guidance, principles and recommendations contained in the following documents:

- BS 4142:2014 Methods for rating and assessing industrial and commercial sound;
- BS 7445: Part 2: 1991: Description and measurement of environmental noise. Part 2. Guide to the acquisition of data pertinent to land use; and
- BS 8233: 2014: Guidance on sound insulation and noise reduction for buildings.

2. SITE DESCRIPTION

The premises of the Oriental Dragon are located at ground floor level of 100 Cleveland Street, London W1T 6NS. The building comprises four storeys, with the ground floor extending beyond the upper storeys to the rear of the premises. The existing extract fan and associated ductwork are situated on the flat roof to the ground floor, with the extract ductwork rising up the side of the building to discharge above roof level. The new plant will utilise the existing ductwork runs, connecting to 2no. kitchen canopy/extract hoods and will incorporate an odour filtration unit, carbon filter, disposable G4 pre-filter with the filter box connected to a new extract fan with intake and exhaust attenuators. The fan unit is to be connected with flexible connectors and provided with anti-vibration mounts, as provided by the fan manufacturer. Details of the mechanical plant specification is provided in section 5.2.

Adjoining the property to the south is the 5 storey Glebe House, with the ground floor given over to commercial usage, including restaurants and retail, and the upper floors being residential. To the north of the site are further 4 storey properties, with commercial usage at ground floor level and upper storeys a mixture of residential and office uses. The rear facade of each of the adjoining premises is in line with the rear facade of the ground floor of 100 Cleveland Street, with the facades facing the site being blind ie containing no windows.

To the rear (east) of the site is Fitzroy Mews. The premises on Fitzroy Mews are largely residential in nature, with the exception of a small number of office premises, and comprise a mixture of 3 and 4 storeys. Those situated immediately opposite the site are nos. 4-7 Fitzroy Mews which lie some 7m from the site boundary and approximately 9m from the location of the new mechanical plant.

The soundscape within Fitzroy Mews comprises continuous low level road traffic noise and higher transient noise from individual road traffic events passing along Cleveland Street. During the course of the ambient noise survey a small number of vehicle movements also occurred within Fitzroy Mews itself. Continuous noise arising from mechanical plant serving a number of the ground floor commercial premises was also in evidence. This included the existing mechanical plant serving 100 Cleveland Street, plant serving a commercial unit within Glebe House and another property further to the south on Cleveland Street.

During the course of the survey the plant serving 100 Cleveland Street was switched off at approximately 10:30pm and the plant serving Glebe House switched off at approximately 10:45pm, such that road traffic noise was considered to be the dominant source thereafter.

A site plan is presented in Appendix 1.

Assessment of Mechanical Plant Noise Emissions

Oriental Dragon, 100 Cleveland Street, W1T 6NS

3. BASIS OF ASSESSMENT

In assessing the impact of the proposed development upon local amenity, it is necessary to consider the effects upon sensitive premises. Evaluation of the effects upon residential accommodation will be based upon the level of the specific plant noise emissions relative to the underlying ambient noise climate and undertaken in accordance the method set out within BS 4142: 2014 - *Methods for rating and assessing industrial and commercial sound*. It will also be necessary to consider any requirements the local authority may impose in the application of their noise policy.

3.1. Planning Policy

In order to ensure that the amenity of adjacent premises is not unduly affected as a result of noise emission from the mechanical plant, it is necessary to demonstrate to the local planning authority, the London Borough of Camder, that noise will be controlled in line with Development Policy DP28 as set out within their Local Development Framework. This policy advises that:

"The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:

a) development likely to generate noise pollution; or

b) development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds."

The noise thresholds applicable to noise from mechanical plant and machinery are set out in Table E, as reproduced below:

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< td=""></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< td=""></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< td=""></la90<>
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL _{Aeq} '

4. **MEASUREMENTS**

4.1. Background noise measurements

An attended noise survey was undertaken between 19:30 hrs and 23:00 hrs on Wednesday 3rd February 2016. The measurement period was considered sufficient to establish the typical lowest background noise levels corresponding to the operational period of the plant. The measurement location was chosen so as to minimise the influence of mechanical plant noise arising from the premises of 100 Cleveland Street, whilst remaining representative of the residual noise level otherwise existing. As noted previously, the mechanical plant serving 100 Cleveland Street was inoperative after approximately 10:30pm and the period thereafter is therefore considered representative of the residual noise level i.e. that existing in the absence of the specific noise source.

The site plan contained in **Appendix 1** identifies the measurement position.

Position 1: Free-field measurement adjacent to 10 Fitzroy Mews at 1.5m above the ground plane.

The weather conditions during the survey were clear and cool with no precipitation and a very light westerly breeze.

4.2. Measuring Equipment

Sound pressure level measurements were obtained using the instrumentation detailed in Table 1 below. The equipment complies with the class 1 specification of IEC 61672 and is certified to that standard:

 Table 1:
 Instrumentation Details

Instrument	Serial Number
ACOEM 01dB Cube noise monitor	10532
ACOEM 01dB - PRE22 preamplifier	10535
GRAS 40CD microphone	207181

Calibration checks were made prior to and after completion of measurements using the calibrator complying with class 1 of IEC 60942, calibration level 94.0 dB, \pm 0.1 dB, @ 1.0 kHz. No drift in calibration was noted. All acoustic instrumentation carried current manufacturer's certificates of conformance.

Various statistical broad-band and spectral (1/1 octave band) level measurements were obtained during the surveys.

The data are defined as follows:

L _{Aeq,T}	The A-weighted equivalent continuous noise level for the duration of
	the measurement time interval, T

- L_{A90,T} The A-weighted sound pressure level exceeded for 90% of the measurement time interval, T.
- $L_{eq,T}/L_{90,T}$ The linear 1/3 octave band sound pressure levels.

5. **RESULTS**

5.1. Background noise levels

During the survey period, continuous measurement of the ambient sound was obtained. In order to characterise the background sound level a measurement time interval of 15 minutes has been adopted, in accordance with the minimum period suggested in BS4142 (8.1.3). The lowest $L_{A90,15min}$ measured during the survey period is considered to represent the background noise level in the absence of specific noise. Data across the survey period and a graph of such are presented in Appendix 2, whilst a summary of the data to be used in the assessment are presented in Table 2, below.

Table 2: Measured background noise levels

Location	Period	Residual $L_{Aeq,T}$	Background L _{A90}
Position 1	11:00 - 23:00	48 dB	45 dB

5.2. Source noise levels

The specific noise level attributable to the mechanical plant at the receptor location shall be determined through calculation, as endorsed by Section 7.3.6 of BS 4142. The external plant comprises the following:

• 1 x Helios GBD 630/4 extract fan with Acoustic RO2 6-1200 intake and

exhaust attenuators

Noise data pertaining to the fan and attenuators are presented within **Table 3** are from manufacturer data and are stated as sound power levels.

Table 3: Mechanical plan t acoustic data, dB

Plant Item	125	250	500	1k	2k	4k	8k	Α
Helios GBD 630/4 extract								
In-duct exhaust SWL	82	86	82	79	77	73	66	85
Casing radiated SWL	84	77	55	54	49	46	42	71
Acoustica R02 6- 1200								
Attenuator insertion loss	-7	-15	-26	-26	-29	-32	-20	-14

5.3. Resultant noise levels

The acoustic data set out in **Table 3**,foregoing, have been used as the basis of calculations carried out in accordance with BS4142: 2014 *Methods for rating and assessing industrial and commercial sound* to determine the resultant noise level experienced at a distance of 1m external to windows of the nearest noise sensitive premises – the results of which are set out in **Table 4**, below.

Table 4: Predicted resultant noise levels external to receiver

Receptor	Noise source	Specific noise level	Background noise level
		L _{Aeq,T}	L _{A90,T}
4-7 Fitzroy Mews	Ducted	28 dB	45 dB
	Casing radiated	47 dB	45 dB

As set out within LB Camden Development Policy 28, planning permission will only be granted for plant and machinery where the specific noise level at sensitive facades does not exceed the threshold of L_{90,T} - 5dB, or L_{90,T} -10dB in cases where noise has a distinguishable discrete continuous note (whine, hiss, screech, hum).

Given the relatively low residual noise levels and the spectral content it is anticipated that the plant may exhibit a distinguishable discrete continuous note (hum) at the receptor location. The plant should therefore be design to achieve a specific noise level of L_{90T}-10dB i.e 35 dBA. It will therefore be necessary to incorporate additional mitigation in order to reduce the level of casing radiated noise from the fan unit. Ductborne noise levels are considered to be adequately controlled by the specified attenuator.

5.4. Mitigation

In order to control casing radiated noise from the Helios GBD630/4 fan unit it is necessary to upgrade the casing with acoustic panels. Calculations have been carried out in order to determine a form of construction adequate to control casing radiated noise to an appropriate level. The application of the mitigation measures set out below are anticipated to achieve a specific noise level due to the noise radiated from the casing of the fan unit of LAeg.T 34 dB.

The specification is based upon an enhanced version of the GB acoustic panels provided by Helios which are understood to bolt to the fan casing using existing fixing holes. The manufacturer should be contacted to finalise specification of the acoustic panels.

Acoustic panels to Helios GBD 630/4

Additional cladding panels should be affixed to each side of the fan unit and should comprise an inner skin of solid 1.0mm thick galvanised sheet steel, an infill of 50mm thick controlled density mineral wool or fibre glass (nominally 60kg/m³), 2no. layers of 12.5mm plasterboard with an outer skin of solid 1.0mm galvanised sheet steel. The infill shall be inert, non-hygroscopic, rot proof, vermin proof and have a Class 1 rating for spread of flame in accordance in BS 476: Part 7, with appropriate protection provided to the plasterboard to prevent water ingress.

 Table 5: Predicted increase in casing SRI re standard Helios GBD 630

Plant Item	63	125	250	500	1k	2k	4k
Fan acoustic panels							
Increase in casing SRI	4	10	24	27	18	11	3

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Hammersmith

Acoustic duct flexible connections

In order to prevent breakout from fan flexible connections, acoustic duct flexibles shall be constructed from barrier mat with a superficial density of 10kg/m². Where a fire rating application is required then the barrier mat shall be uprated to have a Class 1 rating for spread of flame in accordance with BS476 Part 7.

Rectangular and circular flexibles shall be provided with flanges, or where specified galvanised sheet steel spigots, which shall be fixed and sealed to the barrier mat material.

Acoustic lagging

Any ductwork between the fan and attenuator should be uprated to 1.2mm thick galvanised steel. In addition, acoustic lagging should be provided to such ductwork between the fan unit upto and including the attenuator. The acoustic lagging material shall be 10kg/m² superficial density with a thickness of approximately 30mm. The material shall be laminated with two outer layers of 100kg/m3 density cellular foam with an intermediate lead barrier, externally faced with impermeable aluminium foil. The composite material shall be Class 0 Building Regulation E15 fire rated.

Acoustic lagging shall be applied to ductwork using a fire retardant contact adhesive applied to both surfaces. Joints shall be overlapped by a minimum of 100mm and sealed using aluminium duct tape.

Approvals

To ensure the criteria are achieved the Contractor shall provide and install equipment in full compliance with this specification, and should seek confirmation of the assumed plant data set out in Table 3 and elsewhere, as below :-

Acoustic Products:

a) Acoustic and aerodynamic performance data with details of appropriate test standards.

b) Construction details of the products offered.

Mechanical Plant and Equipment:

a) Certified noise level data with details of appropriate test standards.

b) Performance and construction details of any acoustic products offered within their scope of supply.

c) Review plant and ductwork layouts to ensure system velocities, attenuator positioning and internal attenuator element orientation do not generate excess flow noise.

6. CONCLUSION

New mechanical plant serving the Oriental Dragon at 100 Cleveland Street will utilise existing ductwork and comprise an odour filtration unit, carbon filter, disposable G4 pre-filter with the filter box connected to a new extract fan with intake and exhaust attenuators. The mechanical plant will be utilised during restaurant hours only, Monday to Sunday 11am - 11pm.

In order to ensure that the amenity of adjacent premises is not unduly affected as a result of noise emission from the mechanical plant, it is necessary to demonstrate to the local planning authority, the London Borough of Camden, that noise will be controlled in line with the requirements of their Local Development Framework, specifically *DP28 Noise and vibration*.

An ambient noise survey was undertaken over a period considered representative of the lowest prevailing background noise level corresponding to the operation of the plant. This information and noise emission data obtained from the equipment supplier was subsequently used to assess the impact of the scheme upon local amenity.

The specific noise level due to the proposed plant was found to exceed the background noise level. Consequently, mitigation measures have been proposed (see section 5.4) to control casing radiated noise from the fan unit which, in conjunction with the specified atmosphere side attenuator, will control mechanical plant noise emissions to a level of $L_{Aeq,T}$ 34 dB. This is some 11dBA below the lowest measured background noise level during the proposed operational period of the plant and therefore accords with the design requirements of Camden Development Policy 28.

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APPENDIX 1 Site Plan





- * Measurement Location
 - Indicative plant location

APPENDIX 2 Ambient noise survey data

File	20160203_193629_230105_1.CMG						
Periods	15m						
Start	03/02/2016 19:30						
End	03/02/201	L6 23:00					
Location	CUBE_105	532					
Weighting	А						
Unit	dB						
Period start	L _{Aeq}	L _{AMax, F}	L_{A90}	L_{A10}			
19:30	54.2	75.1	52.1	54.6			
19:45	53.1	73.9	51.9	53.8			
20:00	54.7	75.5	52.2	56.4			
20:15	53	66	51.8	53.8			
20:30	52.7	73.4	49	54.8			
20:45	51.7	66.6	49	52.8			
21:00	58.7	86.3	48.6	53.2			
21:15	50.6	70.6	48.3	52.1			
21:30	52.3	72.7	48.4	52.8			
21:45	50.7	67.2	48.5	51.6			
22:00	51	72.4	48.5	51.1			
22:15	50.8	70.6	48.6	52.1			
22:30	49.5	65.3	46.2	50.8			
22:45	47.8 63.2 45.1 48.9						
Overall	53	86.3	47.7	53.6			



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