Report VA4447.221222.NIA

33 Goodge Street, London

Noise Impact Assessment

22 December 2022

Fan Rescue
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Ability House
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Attachments

1. Introduction

Retrospective planning permission is sought for a kitchen extract fan and condensing unit installed at 33 Goodge Street, London.

Venta Acoustics has been commissioned by Fan Rescue to undertake an assessment of the noise impact of these items.

An environmental noise survey has been undertaken to determine the background noise levels at the most affected noise sensitive receptors. These levels are used to undertake an assessment of the likely impact with reference to the planning requirements of Camden Council.

2. Design Criterion and Assessment Methodology

2.1 Camden Council Requirements

Camden Council's Local Plan (adopted June 2017), Appendix 3, provides the following guidance regarding noise from Industrial and Commercial Noise Sources

> *A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).*

Existing Noise sensitive receiver	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dBL_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dBL_{Amax}

**10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required.*

In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

***levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.*

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted $L_{eq,5mins}$ noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.

2.2 BS8233:2014

BS8233 *Guidance on sound insulation and noise reduction for buildings* provides guidance as to suitable internal noise levels for different areas within residential buildings.

The relevant section of the standard is shown below in Table 2.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,\ 16\ hour}$	-
Dining	Dining Room	40 dB $L_{Aeq,\ 16\ hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16\ hour}$	30 dB $L_{Aeq,\ 8\ hour}$

Table 2.1 - Excerpt from BS8233: 2014 **[dB ref. 20µPa]**

3. Site Description

33 Goodge Street is a mid-terrace, 4-storey mixed use building. There is a restaurant at ground floor, which is served by the plant items assessed in this report. There are residential dwellings at 1st – 3rd floors, which have windows overlooking the plant installations at the rear.

The neighbouring buildings also feature dwellings at first floor upward, also with windows overlooking the rear plant installation.

Most-affected sensitive windows are expected to be 2nd floor rear windows of 33 Goodge Street and 2nd floor rear windows of 8 Colville Place, opposite.

1st floor rear windows of 33 Goodge Street, immediately opposite the plant area, are to the non-sensitive galley-kitchen, assessment to which is not required.

There is other kitchen extract and condensing plant at the rear of the block serving other neighbouring restaurants.

4. Environmental Noise Survey

4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Thursday 15th and Sunday 18th December 2022 at the external first floor location shown in site plan VA4447/SP1. This location was chosen to be representative of the background noise level at the most affected noise sensitive receivers.

The microphone was well screened from noise emissions from the condensing unit and kitchen extract fan which are the subject of the retrospective planning application by a large sheet of circa-15mm timber board.

Continuous 5-minute samples of the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were undertaken at the measurement location.

The weather during the survey period was generally dry with light winds. The background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-11461-E0	TCRT22/1490	3/8/22
Larson Davis calibrator	CAL200	13069	1502936-1	22/7/22

Table 4.1 – Equipment used for the tests

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

4.2 Results

The background noise level is determined by existing plant and road traffic on the surrounding road network.

The typical background noise levels measured were:

Monitoring Period	Typical[1] $L_{A90,5min}$
07:00 – 23:00 hours	48 dB
23:00 – 07:00 hours	42 dB
Background noise just after equipment turns off	43 dB

Table 4.2 – Typical background noise levels [dB ref. 20 µPa]

[1] The typical L_{A90} value is taken as the 10th percentile of all L_{A90} values measured during the relevant period.

4.3 Plant Noise Emission Limits

On the basis of the measured noise levels and the planning requirements of the Local Authority, and considering that it is not expected that tonal noise will be generated by the proposed plant units, the following plant specific sound levels should not be exceeded at the most affected noise sensitive receivers:

Monitoring Period	Limiting Design Criterion (L_{Aeq})
23:00 – 07:00 hours	32 dB
Kitchen extract operational hours, 11:00 – 23:00	33 dB

Table 4.3 – Specific sound pressure levels not to be exceeded at most affected noise sensitive receivers

5. Predicted Noise Impact

5.1 Proposed plant

The following plant has been installed at the locations indicated on site plan VA4447/SP1.

Plant Item	Quantity	Proposed Model	Notes
Kitchen extract fan	1	Helios GBW EC 500	11:00 – 23:00 hours operation only
Condensing unit	1	Mitsubishi FDC100VNP-W	Can operate 24 hours

Table 5.1 – Indicative plant selections assumed for this assessment.

Consulting the manufacturer's datasheets, the following noise emissions levels are attributed to the proposed plant items:

Plant Item	Sound Pressure/Power Level, (dB) at Octave Band Centre Frequency (Hz)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Mitsubishi FDC100VNP-W, L_p @ 1m	56	51	50	46	45	36	34	31	49
Helios GBW EC 500, Exhaust, L_w	-	88	84	79	78	74	70	68	83
Helios GBW EC 500, Case Radiated, L_w	-	80	72	56	52	49	45	41	67

Table 5.2 – Advised plant noise data used for the assessment.

5.2 Recommended Mitigation Measures

It is not clear whether the atmospheric side ductwork to the kitchen extract fan is already fitted with attenuation.

Where no attenuator has been fitted, the ductwork will need to be fitted with attenuation providing the minimum insertion losses shown in Table 5.3. Alternatively, where an attenuator has been fitted, the supplier should be contacted to confirm the specification and check against the following.

Attenuation Component	Octave Band Centre Frequency (Hz) Minimum Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
Exhaust attenuator	8	16	28	43	47	47	39	22

Table 5.3 – Minimum required attenuator insertion loss

Alternative attenuation performance shape curves may be suitable and should be confirmed prior to installation. It is recommended that a Melinex lined silencer is used to prevent grease impregnation into the acoustic media which may otherwise degrade the performance over time.

Should the above insertion loss be achieved using multiple silencers, these should be separated from each other by a distance of minimum 3-4 x D, where D is the largest internal dimension of the duct work (e.g. D is 0.5m, so a minimum of 1.5-2m apart) or a bend of at least 90°. Attenuators should be fitted as close to the fan as possible, and attached to the ductwork using flexible connections.

In addition to in-duct attenuation, the fan housing and condensing unit will need to be placed within fully-enclosed plant housings providing the following insertion loss performances.

Alternative attenuation performance shape curves may be suitable and should be confirmed prior to installation:

Attenuation Component	Required Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Kitchen extract fan enclosure	9	14	21	27	32	37	43	44
Condensing unit enclosure	5	4	5	6	9	13	14	13

Table 5.4 – Required insertion loss for enclosures

Please note that the above recommendations relate to acoustic issues only. It is recommended that professional advice confirming the suitability of these measures be sought from others with regards to issues such as airflow, structural stability and visual impact.

5.3 Predicted noise levels

The cumulative noise level at the most affected 2nd floor overlooking receptors, has been calculated on the basis of the above information and assuming the recommended mitigation measures, with reference to the guidelines set out in ISO 9613-2:1996 *Attenuation of sound during propagation outdoors - Part 2: General method of calculation.*

Separate calculations have been undertaken of overnight condensing unit operation and cumulative condensing unit and kitchen extract fan operation during the 11:00 – 23:00 hours period.

A summary of the calculations are shown in Appendix B.

Assessment	Level at 1m from Receptor	Limiting Criterion
23:00 – 07:00, condensing unit only	L_{Aeq} 31 dB	32 dB
11:00 – 23:00, cumulative plant operation	L_{Aeq} 33 dB	33 dB

Table 5.5 – Predicted noise and level and design criteria at noise sensitive location

5.4 Comparison to NR35 Curve

As can been seen from the following comparison in Table 5.6, the predicted noise levels at 1m from the most affected receiver are below the NR35 curve.

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
NR35	63	52	45	39	35	35	30	28
23:00 – 07:00, condensing unit only	40	36	34	29	25	12	9	7
11:00 – 23:00, cumulative plant operation	51	47	34	26	22	9	6	7

Table 5.6 – Comparison of predicted noise levels against the NR35 criterion

5.4.2 Structureborne Noise

All plant and ductwork should be fitted with anti-vibration mounts in accordance with the manufacturer guidelines.

The extract fan will have a dominant case frequency of 50-60Hz. To mitigate this and remove the tonal element, the fan motor should be mounted on rubber or neoprene mounts with a minimum deflection of 5mm, which would provide 95% isolation efficiency, considerably more than the recommended minimum of 90% isolation.

The fan should be attached to the ductwork on either side using flexible coupling to minimise vibration transfer to the ductwork. Ductwork should be attached to the building using isolated fixings, with either a rubber or neoprene isolator with a minimum deflection of 1mm, which would provide 90% isolation, considerably more than would be required considering the reduced energy transmitted to the ductwork.

The above measures are to control structureborne noise and re-radiated noise to other areas of the building to considerably below current internal noise levels and hence would be considered acceptable.

6. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 33 Goodge Street, London in support of a retrospective planning application for building services plant already in-situ.

This has enabled noise emission limits to be set at the most affected noise sensitive receiver such that the proposed installation meets the requirements of Camden Council .

The cumulative noise emission levels from the proposed plant have been assessed to be compliant with the plant noise emission limits, with necessary mitigation measures specified.

The proposed scheme is not expected to have a significant adverse noise impact and the relevant planning requirements have been shown to be met.

Ben Alexander MIOA


Goodge Street
Kitchen extract & ducting
Condensing unit
Noise monitoring location
Colville Place
Google

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	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. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. 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 a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.1 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.2 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

APPENDIX B

VA4447 - 33 Goodge Street, London

Noise Impact Assessment

Night-Time Condensing Unit Assessment, 23:00 - 07:00 hours, to Nearest Overlooking 2nd Floor Receptor

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Mitsubishi FDC100VNP-W	Lp @ 1m	56	51	50	46	45	36	34	31	**49**
Enclosure Loss		-5	-4	-5	-6	-9	-13	-14	-13	
Distance Loss	To 3.5m	-11	-11	-11	-11	-11	-11	-11	-11	
Level at receiver	**LAeq**	**40**	**36**	**34**	**29**	**25**	**12**	**9**	**7**	**31**

Daytime Cumulative Assessment, 11:00 - 23:00 hours, to Most-Affected Overlooking 2nd Floor Receptor

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
GBW EC 500 Exhaust	Lw	88	88	84	79	78	74	70	68	**83**
Indicative Attenuator (1800mm)		-8	-16	-28	-43	-47	-47	-39	-22	
Bend		-1	-1	-2	-3	-3	-3	-3	-3	
End reflection		-10	-5	-2	-1	0	0	0	0	
Spherical radiation		-11	-11	-11	-11	-11	-11	-11	-11	
Distance Loss	To 7m	-17	-17	-17	-17	-17	-17	-17	-17	
Directivity (Hor:140,Vert:140)		-3	-5	-9	-11	-11	-11	-11	-11	
Level at receiver	**LAeq**	**39**	**33**	**15**	**-6**	**-11**	**-15**	**-11**	**4**	**19**

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
GBW EC 500 Case Radiated	Lw	80	80	72	56	52	49	45	41	**67**
Enclosure Loss		-9	-14	-21	-27	-32	-37	-43	-44	
Hemispherical radiation		-8	-8	-8	-8	-8	-8	-8	-8	
Distance Loss	To 4m	-12	-12	-12	-12	-12	-12	-12	-12	
Level at receiver	**LAeq**	**51**	**46**	**31**	**9**	**0**	**-8**	**-18**	**-23**	**32**

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Mitsubishi FDC100VNP-W	Lp @ 1m	56	51	50	46	45	36	34	31	**49**
Louvred enclosure Loss		-5	-4	-5	-6	-9	-13	-14	-13	
Distance Loss	To 5m	-14	-14	-14	-14	-14	-14	-14	-14	
Level at receiver	**LAeq**	**37**	**33**	**31**	**26**	**22**	**9**	**6**	**4**	**28**

		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Cumulative level at receiver	**LAeq**	51	47	34	26	22	9	6	7	**33**