Plant Noise Impact Assessment

Client:	Chapman Ventilation Ltd
Project:	Benito's Hat 56 Goodge Street London W1T 4NB
Our Reference:	BS 33424/NIA_Rev B
Date of Report:	07 January 2013
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1.0 Introduction

Noise Solutions Ltd has been commissioned by Chapman Ventilation Ltd to assess the noise impact of proposed alterations to existing supply/extract ventilation plant at the Benito's Hat Restaurant, 56 Goodge Street, London.

Remedial works to reduce noise emissions from the existing systems are required following noise complaints made by local residents. Noise emissions from the revised scheme have been predicted at the nearest noise sensitive receptors to the site and assessed against Camden Council requirements.

2.0 Details of existing plant and nearest receptors

The existing Benito's Hat Restaurant is located on the ground and basement floors of a four-storey building on the north side of Goodge Street. It is understood that the upper floors of the building are occupied by residential properties.

External plant serving the restaurant is located on a first floor flat roof to the rear of the building. The existing kitchen extract and supply fans are located at roof level. The extract discharge and supply inlet terminate at roof level; both systems are currently fitted with 600mm and 1200mm atmospheric side circular attenuators respectively. There are two active air conditioning condensers located on the roof.

The plant area is overlooked by residential properties located directly above the restaurant. The nearest residential window is located approximately 3m from the existing kitchen extract discharge.

Appendix A contains an aerial photograph showing the site and surrounding area.

3.0 Understanding of noise complaint and assessment criteria

Richard Drew (Environmental Health Officer for Camden Council) wrote to the restaurant in May 2012 with regard to complaints made by local residents relating to noise emissions from the existing ventilation equipment.

Camden Council has requested that remedial measures are taken to ensure noise from the ventilation equipment is controlled not to exceed a level 5dB below the prevailing background noise level.

4.0 Existing noise climate

4.1. Overview

Noise survey and assessment works were undertaken in June 2012 to assess the noise impact of the existing ventilation plant (i.e. kitchen supply and extract systems). All survey works were undertaken prior to the implementation of any remedial works to reduce noise emissions.

4.2. Environmental noise survey

An environmental noise survey was undertaken on the flat roof area to the rear of the restaurant building to establish existing noise levels at a location representative of the nearest residential receptors to the site. Full details of the survey methodology are provided in Appendix B.

All plant was operating under normal conditions during the course of the survey, although it should be noted that the ventilation plant switched off automatically at night when the restaurant closed. As a result, measurements during the day are inclusive of noise from the ventilation plant whilst measurements during the early morning and night are representative of prevailing background levels with the ventilation plant switched off.

The lowest background noise level just before the existing extract and supply systems switched on was measured to be 44dB $L_{A90(5mins)}$. This level is considered representative of the lowest background noise level during the operational hours of the existing ventilation plant. Therefore, cumulative noise levels from the ventilation systems should not exceed 39dB L_{Aeq} at the nearest residential windows in order to comply with Camden Council's emissions criteria.

4.3. Plant noise levels

Noise Solutions Ltd attended site on Thursday 10th May 2012 to investigate the noise issues reported on site. All plant was fully operational during the site visit.

It was observed that the existing kitchen extract system was the dominant source of noise at the nearest residential windows surrounding the flat roof area. The primary source of noise from the extract system was the discharge termination, although noise breakout from the ductwork was also audible.

It should be noted that it was not possible to turn the various items of plant on and off during the course of the site visit. As noise from the kitchen extract system was dominant at the nearest receptor locations, it was not possible to ascertain whether other items of plant (e.g. the supply system) were contributing to overall plant noise levels.

Attended noise measurements were taken over short durations 1m from the nearest residential windows. The noise level was measured to be 81dB L_{Aeq} at the nearest residential window with all plant operating. This measurement was dominated by the kitchen extract fan. Although it was not possible to correct this measurement for extraneous noise (i.e. take a measurement with the plant on and off to enable corrections for general road traffic noise, etc.) the subjective impression was that this measurement was completely dominated by noise from the kitchen extract. Therefore, for the purposes of this assessment, noise from the kitchen extract system has been taken to be 81dB L_{Aeq} at the worst affected receptor location. This exceeds the local authority emissions criterion by 42dB. It was not possible to ascertain the level of noise emitted by the quieter supply system.

It is understood that the kitchen extract and supply systems operate between approximately 07.00-10.00 and 22.30-23.00 hours each day. This is reflected in the survey data given in Appendix B as background noise levels reduce significantly outside of this period. It should be noted that the noise climate appears to be dominated by an unidentified plant item at night until approximately 00.00-01.00 hours thereafter each day. The Benito's Hat plant does not operate during this period, therefore, noise from this plant item must be attributable to another premises. This unidentified plant item does not meet Camden Council noise requirements.

5.0 Noise impact assessment

5.1. Details of proposed system alterations

The existing kitchen extract system is to be rerouted to discharge above the eaves of the building. The existing supply and extract attenuators are to be replaced with suitable alternatives (note – although it was not possible to measure noise emissions from the supply system in isolation, analysis of manufacturer noise data for the unit indicates that the existing system is also likely to exceed the emissions criterion).

Appendix C contains a drawing showing the layout of the proposed plant area and the nearest noise sensitive window (R1), located approximately 3m from the kitchen extract discharge.

5.2. Noise assessment

Cumulative noise levels from the supply and extract systems have been predicted at the nearest noise sensitive receptor (R1) based on the manufacturer noise data given in Appendix D. Noise levels have been predicted taking into account system losses (i.e. resulting from ductwork, attenuators, etc.), directivity of sound propagation and the distance between the sources and receiver. Predictions have been based on there being line of sight between receptor R1 and the supply/extract terminations.

Noise level predictions have been based upon the following attenuators being installed;

Table 1 Proposed attenuator selections

System	Insertion loss of proposed attenuator							
	63Hz	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Extract	-10	-20	-36	-40	-40	-36	-31	-26
Supply	-11	-23	-41	-40	-40	-36	-31	-27

Table 2, below, summarises the assessment of predicted noise levels at receptor R1. The full set of calculations can be found in Appendix E.

Table 2 Assessment of predicted noise levels

Receptor	Cumulative predicted noise level, L_{Aeq} (dB)	Design criterion, L_{Aeq} (dB)	Difference (dB)
R1	39	39	0

The noise level predictions demonstrate that emissions from the supply/extract terminations will comply with Camden Council noise requirements at the nearest and most affected receptor locations, provided suitable atmospheric-side attenuation is installed as detailed in Table 1.

6.0 Design considerations

The following measures will be incorporated into the design to ensure compliance with the local authority emissions criterion is achieved;

- *Anti-vibration isolation:* All external plant (including ductwork and attenuation) will be fitted with suitable anti-vibration mounts in order to minimise structure-borne noise and vibration affecting the adjoined residential premises.

- *Acoustic lagging:* All unattenuated sections of ductwork (i.e. between the fans and the roof penetrations and between the fans and attenuation) will be acoustically lagged to minimise noise breakout from the ductwork.

- *Kitchen extract ductwork:* If the proposed flue is to be constructed of rectangular ductwork, the duct will need to have a minimum thickness of 16 swg in order to minimise noise breakout. If the ductwork does not meet this minimum thickness the flue may require acoustic lagging or, alternatively, circular ductwork should be installed.

- *Fan noise breakout:* The fan manufacturer does not provide noise breakout data for the units. Due to the high levels of noise emanating from the ductwork terminations during the site survey, it was not possible to determine whether noise breakout from the fan casings was contributing to overall plant noise levels. Once all above alterations have been made to the ventilation systems, additional treatment may be required to reduce casing breakout (e.g. installation of acoustic enclosures or insulating jackets); however treatment to the fans should be considered as a secondary measure.

The above, combined with the installation of suitable atmospheric-side attenuation, represents all reasonably practical measures to control noise emissions from the ventilation plant.

The proposed scheme will result in a significant reduction in plant noise emissions at the nearest noise sensitive receptors. Noise Solutions Ltd can provide advice relating to the above measures on request.

7.0 Summary

Noise Solutions Ltd has been commissioned by Chapman Ventilation Ltd to assess the noise impact of proposed alterations to existing supply/extract ventilation plant at the Benito's Hat Restaurant, 56 Goodge Street, London.

Noise level predictions demonstrate that the proposed systems will comply with Camden Council's noise requirements, inclusive of a suitable scheme of mitigation measures as outlined in Sections 5.0 and 6.0. The proposed scheme will result in a significant reduction in plant noise emissions at the nearest noise sensitive receptors.

It is recommended that noise should not be grounds for refusal of planning permission.

APPENDIX A
Aerial photograph of site and surrounding area

APPENDIX B
Details of environmental noise survey

B.1. Measurement period

Measurements of the existing background noise level were taken between Thursday 10th May and Monday 14th May 2012. The sound level meter was programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices for consecutive five-minute sample periods for the duration of the noise survey.

Weather conditions were changeable throughout the course of the survey; however, measurements were taken over a sufficient period to ensure adverse weather did not affect the lowest measured background noise level.

B.2. Measurement position

The measurement position was located in the centre of the flat roof plant area to the rear of the restaurant building. In accordance with BS 7445-2:2003 *'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use'*, the measurements were taken with the microphone positioned at a height of 1.5m above roof level.

B.3. Noise measurement equipment

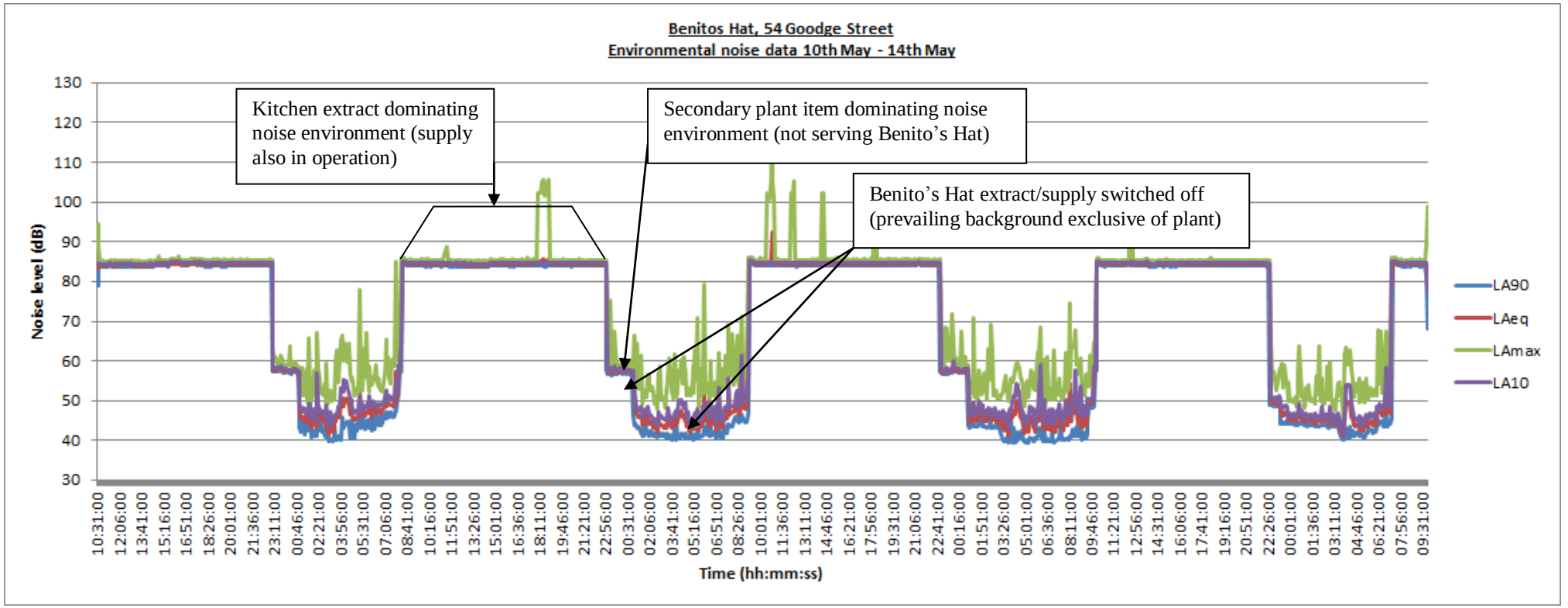
Details of the equipment used during the course of the noise survey have been provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.1 dB) in the calibration level was noted.

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-31 / 00593605	03/01/2012	13870
Condenser microphone	Rion UC-53A / 316133		
Preamplifier	Rion NH-21 / 30367		
Calibrator	Rion NC-74 / 35094453	03/01/2012	13869

B.4. Results

The results of the noise survey are considered to be representative of prevailing noise levels at the nearest receptor location both inclusive and exclusive of the existing plant. All existing ventilation plant operates between approximately 07.00-10.00 and 22.30-23.00 hours each day (as demonstrated on graph) and, thus, background noise levels exclusive of the Benito's Hat plant were established during the early morning and night when the plant was not operating.

The results of the noise survey have been provided overleaf.


Benitos Hat, 54 Goodge Street
Environmental noise data 10th May - 14th May
Kitchen extract dominating noise environment (supply also in operation)
Secondary plant item dominating noise environment (not serving Benito's Hat)
Benito's Hat extract/supply switched off (prevailing background exclusive of plant)
Noise level (dB)
130
120
110
100
90
80
70
60
50
40
30
Time (hh:mm:ss)
10:31:00
12:06:00
13:41:00
15:16:00
16:51:00
18:26:00
20:01:00
21:36:00
23:11:00
00:46:00
02:21:00
03:56:00
05:31:00
07:06:00
08:41:00
10:16:00
11:51:00
13:26:00
15:01:00
16:36:00
18:11:00
19:46:00
21:21:00
22:56:00
00:31:00
02:06:00
03:41:00
05:16:00
06:51:00
08:26:00
10:01:00
11:36:00
13:11:00
14:46:00
16:21:00
17:56:00
19:31:00
21:06:00
22:41:00
00:16:00
01:51:00
03:26:00
05:01:00
06:36:00
08:11:00
09:46:00
11:21:00
12:56:00
14:31:00
16:06:00
17:41:00
19:16:00
20:51:00
22:26:00
00:01:00
01:36:00
03:11:00
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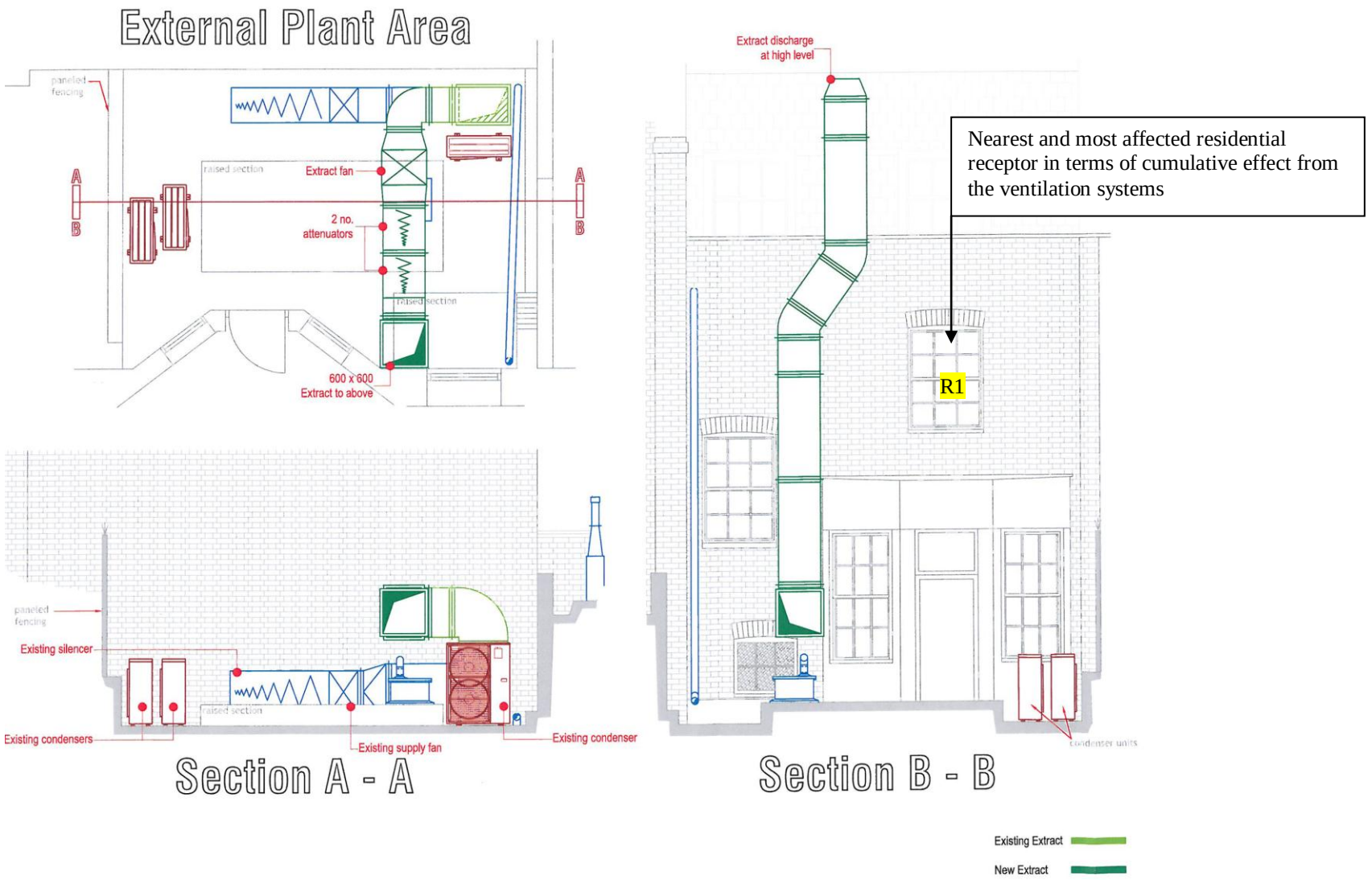
06:21:00
07:56:00
09:31:00
LA90
LAeq
LAmax
LA10

APPENDIX C
Proposed plant layout



APPENDIX D
Manufacturer plant noise data

Unit	Notes	L_{eq} (dB)								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
AHU (Flakt Woods 50MaxFan/16/4/5/42/36)	In-duct L_w	92	95	99	94	89	84	75	68	96
Kitchen extract (Flakt Woods 63MaxFan/16/4/5/19/18)	In-duct L_w	88	86	94	100	92	86	81	74	99

APPENDIX E
Noise level predictions

Description	Notes	L_{eq} (dB)								L_{Aeq} (dB)
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Supply (AHU)										
Source level	In-duct L_w	92	95	99	94	89	84	75	68	96
System losses		-9	-5	-1	0	0	0	0	0	
Atmospheric-side attenuator	I.L.	-11	-23	-41	-40	-40	-36	-31	-27	
Façade correction		3	3	3	3	3	3	3	3	
Directivity correction	0^o, 90^o	0	0	0	0	-5	-7	-7	-7	
Distance correction	4m	-23	-23	-23	-23	-23	-23	-23	-23	
Resultant at receptor R1	L_p @ R1	52	47	37	34	24	21	17	14	36
Kitchen extract										
Source level	In-duct L_w	88	86	94	100	92	86	81	74	99
System losses		-13	-8	-4	-1	-1	-1	-1	-1	
Atmospheric-side attenuator	I.L	-10	-20	-36	-40	-40	-36	-31	-26	
Directivity correction	0^o, 90^o	0	0	0	0	-5	-7	-7	-7	
Distance correction	3m	-21	-21	-21	-21	-21	-21	-21	-21	
Resultant at receptor R1	L_p @ R1	44	37	34	38	26	21	21	19	37