SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Redevelopment of 135-149 Shaftesbury Avenue

Planning noise report

London, Manchester, Edinburgh, Birmingham, Belfast, Stevenage

post@sandybrown.com
www.sandybrown.com

Sandy Brown Associates LLP
Registered in England & Wales No. OC 307504

Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	06 Nov 17		Adam Page	Mark Howarth
B	13 Nov 17	Additional measurements	Adam Page	Mark Howarth
C	19 Dec 17	Additional section on rooftop noise egress	Adam Page	Mark Howarth
D	18 Mar 20	Plant assessment included	Amal Emthyas	Jason Swan

Summary

Sandy Brown has been commissioned by Capitalstart Limited to provide acoustic advice in support of the planning application for the proposed redevelopment of 135-149 Shaftesbury Avenue, WC2H 8AH.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The data collected is used to determine appropriate plant noise limits in line with the requirements of Camden Council.

A noise survey was performed between 27 and 29 October 2017 and between 9 and 13 November 2017.

The minimum background sound levels measured during the survey were $L_{A90,15}$ 49 dB during the daytime and $L_{A90,15}$ 47 dB at night.

Based on the requirements of Camden Council and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed $L_{Aeq,15min}$ 39 dB during the daytime, and $L_{Aeq,15min}$ 37 dB during the night.

These limits are cumulative, and apply with all plant operation under normal conditions. If plant items contain tonal or attention catching features, a penalty based on the type and impact of those features will be applied, and the limits will be more stringent than those set.

An assessment of the proposed plant has been undertaken to determine its noise in relation to the nearby noise sensitive premises. It is predicted that with the recommended mitigation measures incorporated within the design, the noise egress from plant associated with the development will meet Camden Council's requirements.

Noise egress from the rooftop bar has also been assessed and noise limits following Camden Council's requirement have been set.

Contents

1 Introduction

Sandy Brown has been commissioned by Capitalstart Limited to provide acoustic advice in support of a planning application for the proposed development at the 135-149 Shaftesbury Avenue, WC2H 8AH.

As part of this, an environmental noise survey is required, the purpose of which is to establish existing sound levels in the vicinity of the site.

The collected data is used to set appropriate limits for noise egress from building services plant. It will also inform the design of building envelope elements to control noise transfer into the building.

This report presents the survey method, results of the environmental noise survey, and sets limits for noise emission from building services plant as well as noise limits for entertainment noise associated with the rooftop bar. The results of an assessment of noise from the proposed plant is also included with any resulting necessary mitigation measures outlined.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1. The measurement positions and nearest residential location (highlighted in pink) are also shown in Figure 1.

The cinema is situated on Shaftesbury Avenue, which has constant and generally slow-moving traffic during the daytime. The other roads surrounding the site are Stacey Street, St Giles Passage and New Compton Street. Road traffic is less frequent on these roads and they are mainly used by delivery drivers and by drivers turning or parking their vehicles. Motorbike parking is available on New Compton Street; hence scooters and motorbikes regularly pass by the site.

Aircraft pass over the site fairly regularly, and it is assumed these are flying to / from London City Airport.

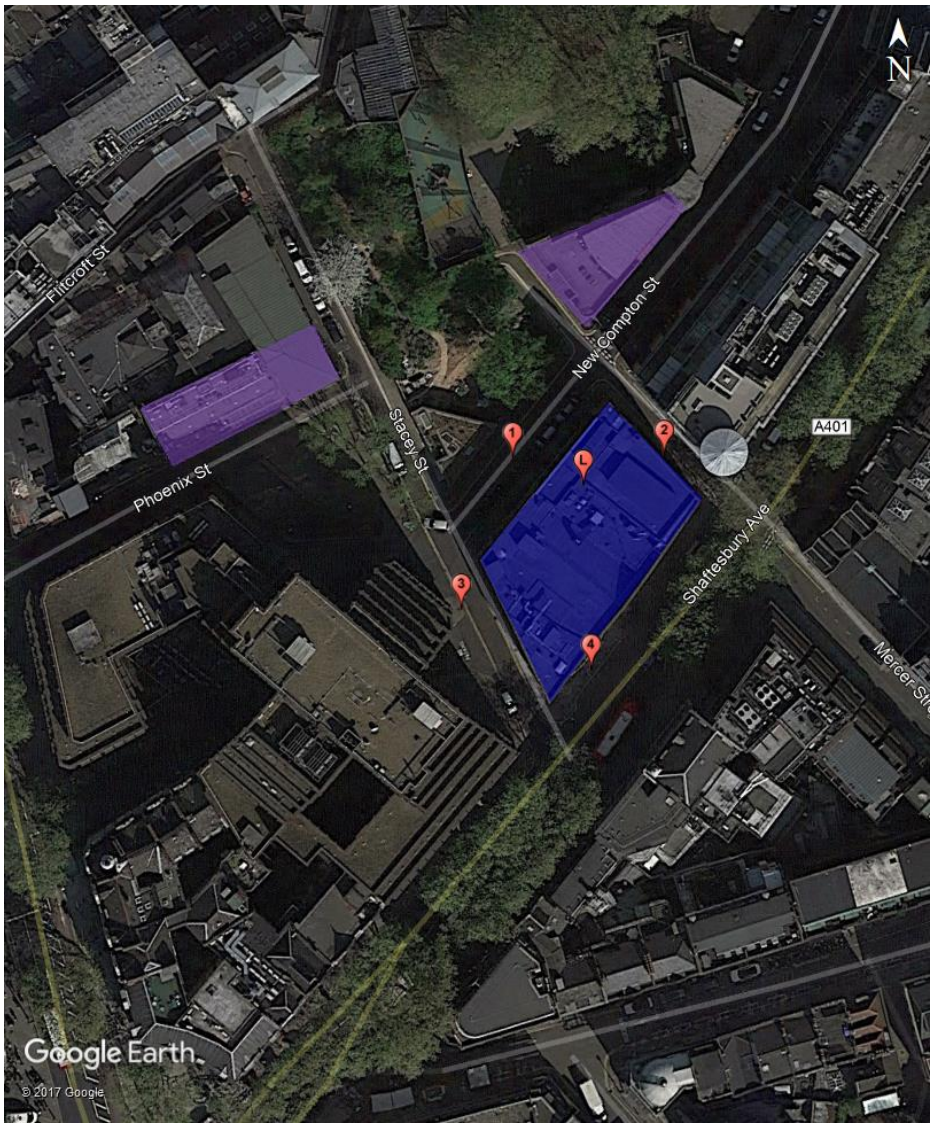


Figure 1 Aerial view of site (courtesy of Google Earth Pro)

2.2 Adjacent premises

The nearest residential location is Pendrell House, an apartment building on New Compton Street. Pendrell House is situated approximately 15m north of the site and is shown in purple in Figure 1. Other nearby dwellings are the apartments within 1 and 1A Phoenix Street, which are approximately 40 north west of the site and also shown in purple in Figure 1.There are commercial buildings directly opposite the site on Stacey Street, St Giles Passage and Shaftesbury Avenue.

3 Building services noise egress criteria

3.1 Local Authority criteria

The relevant Camden Council requirement is outlined in *Appendix 3* of the *Camden Local Plan, June 2017.* In relation to commercial noise the following is stated:

> *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).*

4 Noise survey method

The survey included unattended and attended noise measurements.

4.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over five days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 15-minute periods between 11:15 on 27 October 2017 and 10:15 on 31 October 2017. Due to high wind speeds interfering with measurement equipment the noise levels measured between 08:30 on 29 October and 10:15 on 31 October 2017 have been discounted.

Further measurements were performed between 11:15 on 9 November 2017 and 10:00 on 13 November 2017.

The equipment was installed and collected by Adam Page.

The unattended measurement position used during the survey is indicated in Figure 1 as 'L'. A photograph showing the logging measurement location is provided Figure 2. This location was chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises.

The microphone was mounted on a tripod approximately 1.5 m above the roof level and 1 m from one other hard reflective surface.

Figure 2 Unattended measurement position L

4.2 Attended measurements

Attended sample measurements were performed by Adam Page at a number of locations around the site. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out on 27 and 31 October 2017, over 15-minute periods, with the purpose of determining existing noise levels from road traffic and other noise sources in the area.

In each case the microphone was mounted on a tripod approximately 1.5 m above the ground level and 1 m from one other reflective surface.

4.3 Weather conditions

Weather conditions during the survey are described in Appendix A.

5 Noise survey results

5.1 Observations

The dominant noise sources observed at the site during the survey consisted of road traffic noise from Shaftesbury Avenue, and from vehicles accessing Stacey Street, St Giles Passage and New Compton Street.

Less significant noise sources included aircraft passing over the site and plant noise from surrounding buildings.

5.2 Noise measurement results

5.2.1 Unattended measurement results

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix B.

The day and night-time ambient noise levels measured during the unattended survey are presented in Table 1. The results presented are facade noise levels.

Table 1 Ambient noise levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 27 October 2017	*60	54
Saturday 28 October 2017	57	55
Thursday 9 November 2017	-	55
Friday 10 November 2017	59	56
Saturday 11 November 2017	58	54
Sunday 12 November 2017	58	53
Average	58	55

*Measurement not made over full period due to monitoring start and end; not included in the average.

The minimum background sound levels measured during the unattended survey are given in Table 2.

Table 2 Minimum background sound levels measured during the unattended survey

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Friday 27 October 2017	*55	48
Saturday 28 October 2017	49	47
Thursday 9 November 2017	*55	48
Friday 10 November 2017	53	50
Saturday 11 November 2017	52	47
Sunday 12 November 2017	50	48

[1] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,\ 15min}$ 49 dB during the daytime and $L_{A90,\ 15min}$ 47 dB at night.

5.2.2 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 3.

The dominant noise sources noted during the measurements are also described in Table 3.

All the attended measurements were performed over 15-minute periods. All results include facade reflections.

Table 3 Attended measurement results

Position	Start time / date	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
S1	13:20 /27-10-17	62	82	55	Road traffic on Shaftesbury Avenue, vehicles on New Compton Street, reverse alarms, plant noise from louvres at the back of cinema, aircraft
S1	14:26 / 27-10-17	65	90	55	
S1	08:45 / 31-10-17	65	79	57	
S2	13:37 / 27-10-17	65	85	60	Road traffic on Shaftesbury Avenue, vehicles on St Giles Passage, aircraft
S2	15:12 / 27-10-17	67	89	58	
S2	09:00 / 31-10-17	70	83	60	
S3	12:45 / 27-10-17	68	92	59	Road traffic on Shaftesbury Avenue, vehicles on Stacey Street, plant noise hum just audible, aircraft, car park gates opening, delivery van doors
S3	13:53 / 27-10-17	67	87	59	
S3	15:27 / 27-10-17	66	87	58	
S4	13:02 / 27-10-17	73	93	65	Road traffic constant and dominant, aircraft, HGV reversing, sirens, pedestrians talking
S4	14:09 / 27-10-17	77	106	64	
S4	14:55 / 27-10-17	72	95	64	

5.3 Basic limits

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 4.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels.

Table 4 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,15min}$ (dB)
Daytime (07:00-23:00)	39
Night-time (23:00-07:00)	37

[1] The limits set out in Table 4 do not include any attention catching features. Penalty corrections for attention catching features may be significant and will need to be considered as the building services design progresses. This is discussed in Appendix C.

6 Plant noise assessment

6.1 Building services plant proposals

The building services design proposal includes installation of plant on the following levels:

- Basement 2
- Level 8
- Roof.

Plant locations on the three levels are shown in Figure 3, Figure 4 and Figure 5, and noise data for all plant items are included in Appendix D.

6.1.1 Basement 2

There are 8 AHUs installed in Basement 2 which serve various spaces throughout the building. In addition to the AHUs, a supply, extract and smoke extract fan are also installed on this level. The inlet and discharge terminations of all plant on this level are on the ground floor level on the western facade.

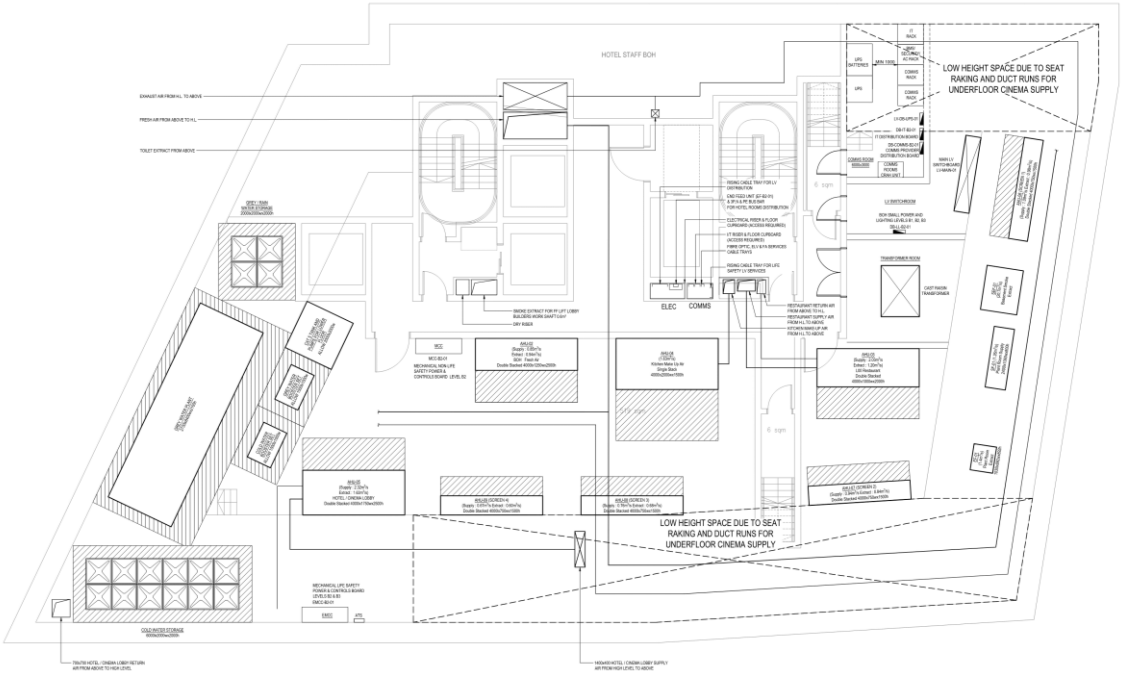


Figure 3 Plant locations on Basement 2

6.1.2 Level 8

There are internal and external plant areas on Level 8. Two heat pumps and an AHU are present in the external plant area, which is screened by a louvre, and has a roof.

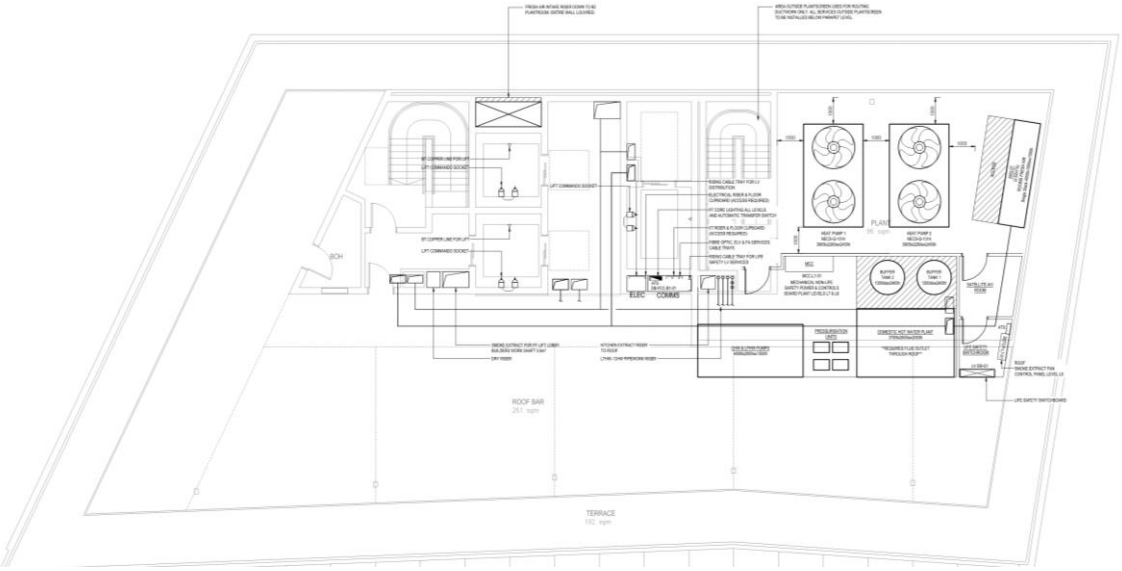


Figure 4 Plant locations on Level 8

6.1.3 Roof

There are two toilet extract fans, one kitchen extract fan and an AHU on the roof. The roof is screened by a 1.5 m high screen around the plant area. There is also a generator room on the roof, which also has a smoke extract installed within. The generator room is louvered to the atmosphere as shown in Figure 5.

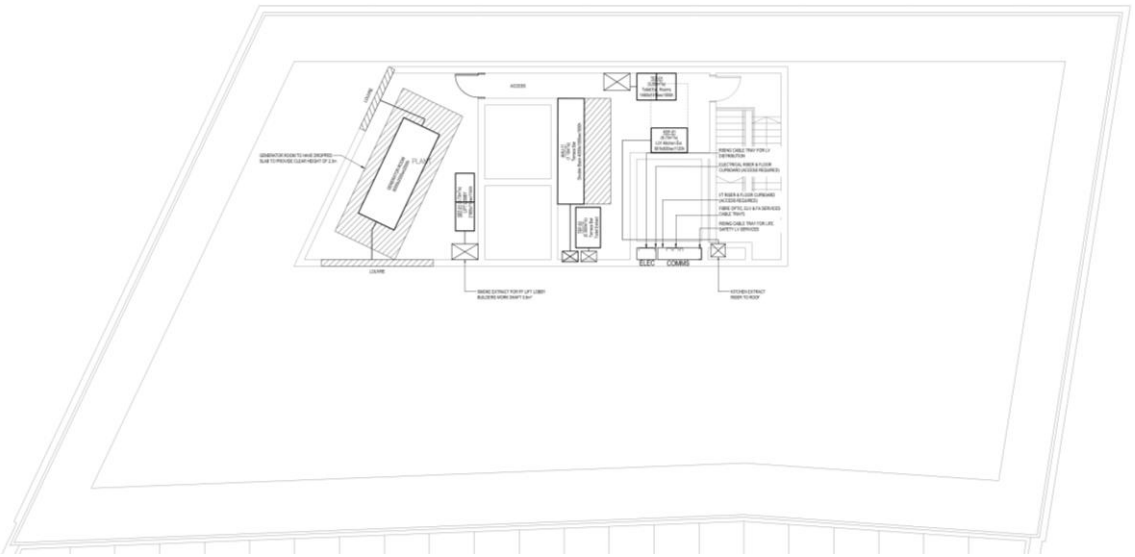


Figure 5 Plant locations on the roof

6.2 Assessment of noise

Calculations have been undertaken to predict the noise levels resulting from the operation of the plant associated with the development at the nearest residential window. Attention catching features such as tones do not appear to be an issue at the receivers, so no penalty corrections have been applied. Minimum acoustic attenuation required for the plant items on all three levels are discussed in the next section.

6.3 Noise mitigation measures

To comply with Camden Council's noise criteria, the following acoustic mitigation measures are to be adopted.

6.3.1 Basement 2

Install attenuators to the duct terminations of the following plant items located on Basement 2. The minimum attenuation required for each plant item is presented in Table 5.

Table 5 Minimum attenuation required for plant on Basement 2

	Minimum insertion loss (dB) at octave band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
AHU-04 Intake	0	6	8	7	0	6	5	1
SEF-01 Outlet	0	0	10	8	0	8	10	4
SF-01 Inlet	0	0	8	11	9	5	2	0

6.3.2 Level 8

Provide acoustic enclosures for the heat pumps on level 8 with the minimum attenuation as presented in Table 6.

Table 6 Minimum attenuation required for the heat pumps enclosures on Level 8

	Minimum attenuation required (dB) at octave band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
NECS-Q-CA-1314	9	19	24	28	31	29	26	21

6.3.3 Roof

Install attenuators on duct terminations of plant items on the roof having minimum attenuation as presented in Table 7.

Table 7 minimum attenuation required for plant items on roof

	Minimum insertion loss (dB) at octave band centre frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
AHU-11 Inlet	0	0	6	7	8	10	15	13
AHU-11 Discharge	0	0	7	12	15	18	18	15
TEF-01 Outlet	3	7	13	15	17	16	13	9
KEF-01 Outlet	0	3	10	16	13	17	20	7

As long as the stated mitigation measures for the specified plant items are incorporated within the design, the cumulative noise egress at the nearest residential window will comply with the requirements of Camden Council.

7 Rooftop bar noise egress

A rooftop bar is proposed for the development, and a plan showing this is presented in Figure 6. It is considered that the nearest receptors to the rooftop bar will be the offices directly opposite the development on Shaftesbury Avenue, and directly west of the development on Stacey Street.

The nearest residential dwellings are the apartments within Pendrell House, New Compton Street and 1 /1A Phoenix Street, as shown in purple in Figure 1.

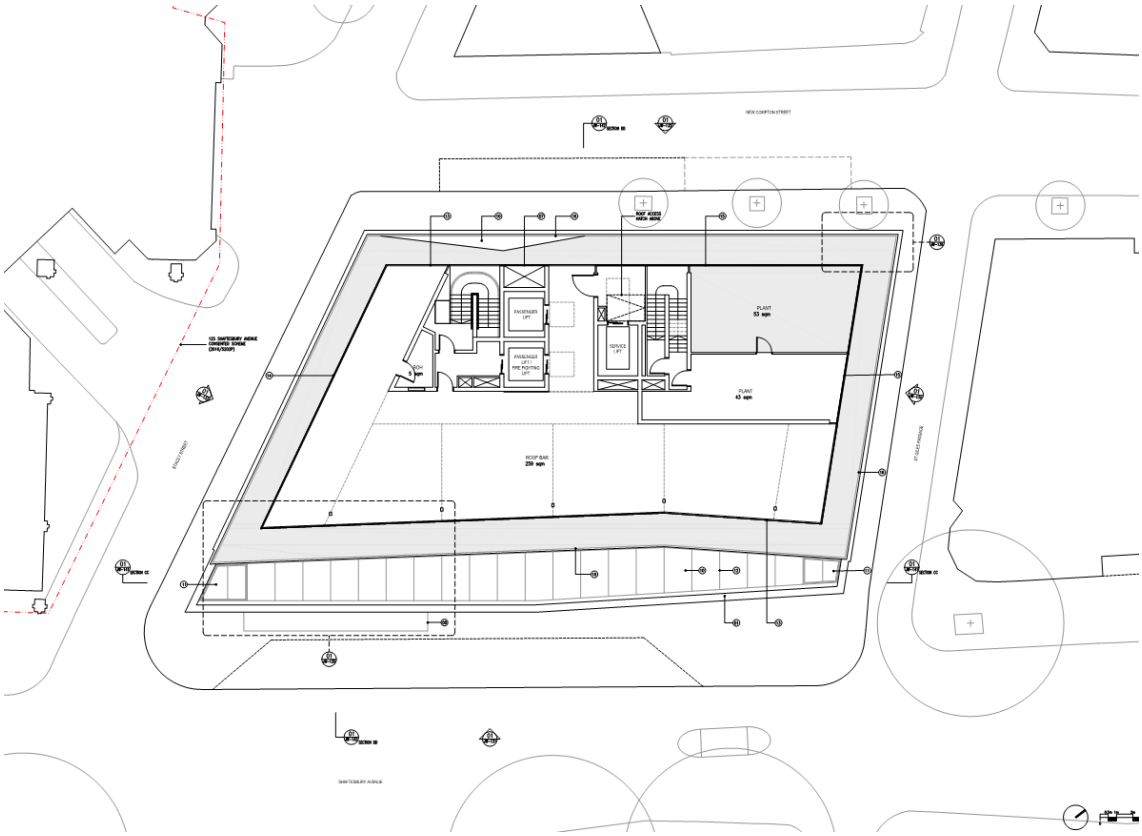


Figure 6 Rooftop bar location plan

7.1 Criteria

The *Camden Local Plan June 2017* outlines guidance on assessing the impact of noise and vibration from food, drink, entertainment and leisure noise.

Generally, the sources of noise and vibration which need to be included in an assessment are amplified or unamplified music, human voices, footfall and general activity.

Appendix 3: Noise Thresholds, outlines noise level limits within amenity areas and defines the level of impact entertainment noise will have. These are presented in Table 8.

Table 8 DP28 noise limits for places of entertainment on adjoining residential sites

Existing noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55 dB L_{Aeq},5min or 10 dB below existing L_{Aeq},5min without entertainment noise	56dB to 60dB L_{Aeq},5min Or 9dB to 3dB below existing L_{Aeq},5min without entertainment noise	The higher of 61 dB L_{Aeq},5min Or 2db below existing L_{Aeq},5min without entertainment noise
Dwellings	Garden used for amenity (free field)	Evening	The higher of 50dB L_{Aeq},5min Or 10db below existing L_{Aeq},5min Without entertainment	51dB to 55dB L_{Aeq},5min Or 9dB to 3db below existing Laeq,5min Without entertainment noise	The higher of 56dB L_{Aeq},5min Or 2dB below existing L_{Aeq},5min Without entertainment noise
Dwellings	Garden used for amenity (free field)	Night	The higher of 45dB L_{Aeq},5min Or 10db below existing L_{Aeq},5min Without entertainment noise	46dB to 50dB L_{Aeq},5min Or 9db to 3db below existing L_{Aeq},5min	The higher of 51db L_{Aeq},5min

Based on the noise survey results and the above criteria, the cumulative noise level as a result of noise egress due to noise from external entertainment should not exceed the noise levels in Table 9.

To meet the day time, evening and night time requirements set out in Table 8, a noise level limit of 10 dB below the lowest L_{Aeq} level, measured during the corresponding period, has been targeted.

Table 9 Noise limits for entertainment noise at the nearest receptor

Period	Free field sound pressure level L_{Aeq} (dB), within nearest garden / amenity area
Daytime (07:00 – 23:00)	40
Evening (19:00-23:00)	43
Night (23:00 – 07:00)	37

Table 10 and Table 11 present approximate noise level limits on the roof for both unscreened and screened noise sources. The exact limits on the roof will be set depending on speaker locations to ensure the limits outside dwellings are met.

Table 10 Approximate noise limits for entertainment noise on the roof of the development assuming no screening

Period	Free field sound pressure level L_{Aeq},(dB), on roof
Daytime (07:00 – 23:00)	63
Evening (19:00-23:00)	66
Night (23:00 – 07:00)	61

Table 11 Approximate noise limits for entertainment noise on the roof of the development with screening

Period	Free field sound pressure level L_{Aeq},(dB), on roof
Daytime (07:00 – 23:00)	73
Evening (19:00-23:00)	76
Night (23:00 – 07:00)	71

These noise levels limits would be suitable for low to medium level background music. If live music, DJs etc. are proposed then these would be subject to the requirements of Code of Practice for Environmental Noise Control at Concerts published by the Chartered Institute of Environmental Health.

8 Conclusion

A noise survey has been carried out to determine the existing background sound levels in the vicinity of the site and surrounding noise sensitive premises. The representative background sound levels were $L_{A90,15min}$ 49 dB during the day, and $L_{A90,15min}$ 47 dB during the night.

On the basis of the requirements of the Local Authority, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 39 dB during the day, and L_{Aeq} 37 dB during the night.

Noise egress from proposed plant has been assessed, and it is predicted that with the recommended mitigation measures incorporated within the design, the noise egress from plant will meet Camden Council's requirements.

Noise egress from the rooftop bar has also been assessed and noise limits following Camden Council's requirement have been set.

Appendix A

Survey details

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{ASmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a slow time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

During the attended measurements carried out on 27 and 31 October 2017, the weather was generally clear and dry, and no rain occurred. Wind speeds varied between approximately 1 m/s and 3 m/s.

During the unattended noise measurements between 27 October 2017 and 31 October 2017, weather reports for the area indicated that temperatures varied between 5°C at night and 15°C during the day, and no rain occurred. The wind speed on 29 October 2017 was generally quite high, and for periods was up to 9 m/s. This interfered with measurement equipment and therefore measurements undertaken after 08:30 on 29 October 2017 to 31 October 2017 were discounted from the results.

Equipment

A RION NL-52 sound level meter was used to undertake the initial unattended measurements. A RION NL-32 sound level meter was used to undertake the additional unattended measurements.

The attended measurements were carried out using an NTi Xl2 and a B&K 2250 sound level meter. The calibration details for the equipment used during the survey are provided in Table A1.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

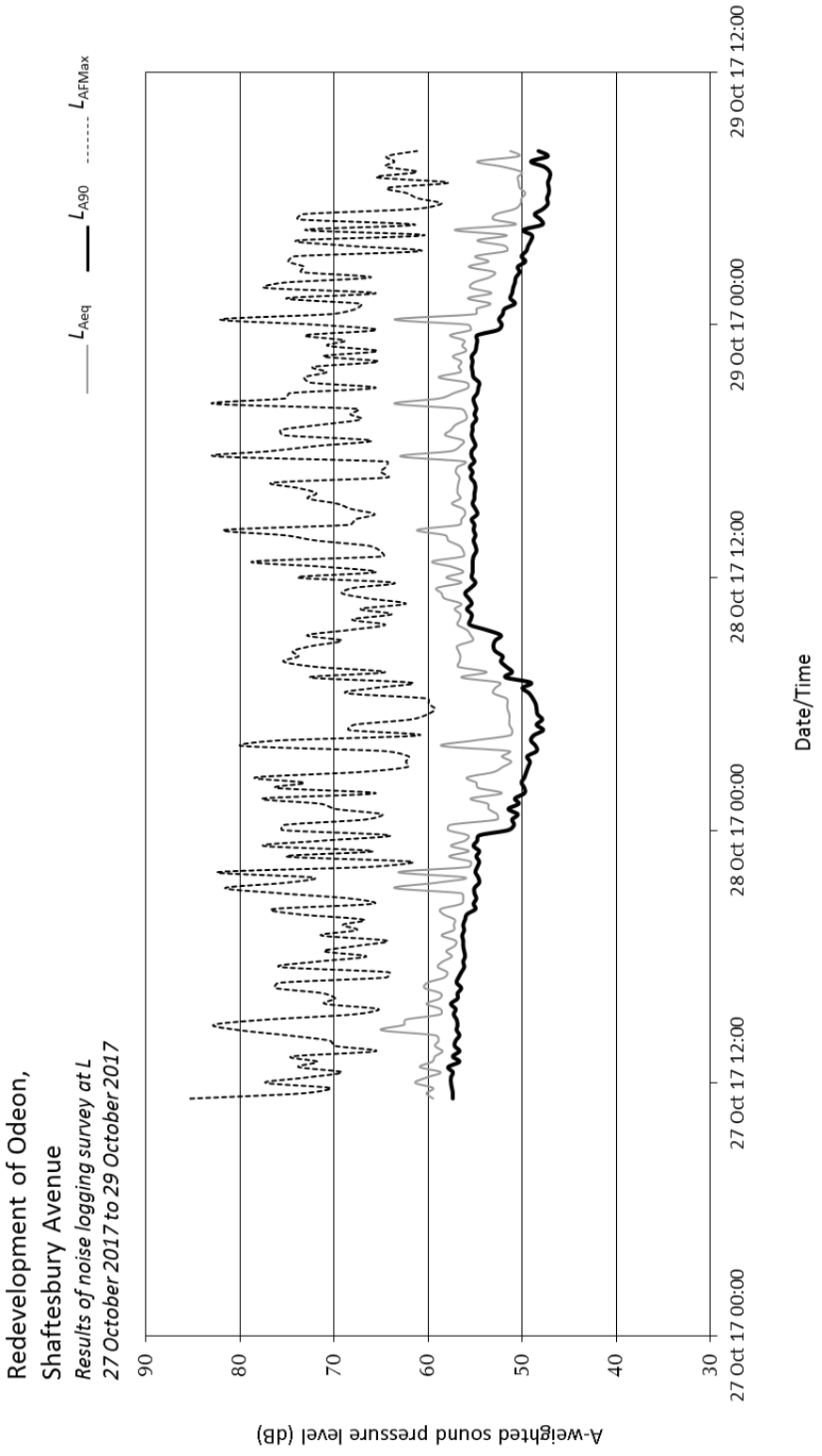
Table A1 Equipment calibration data

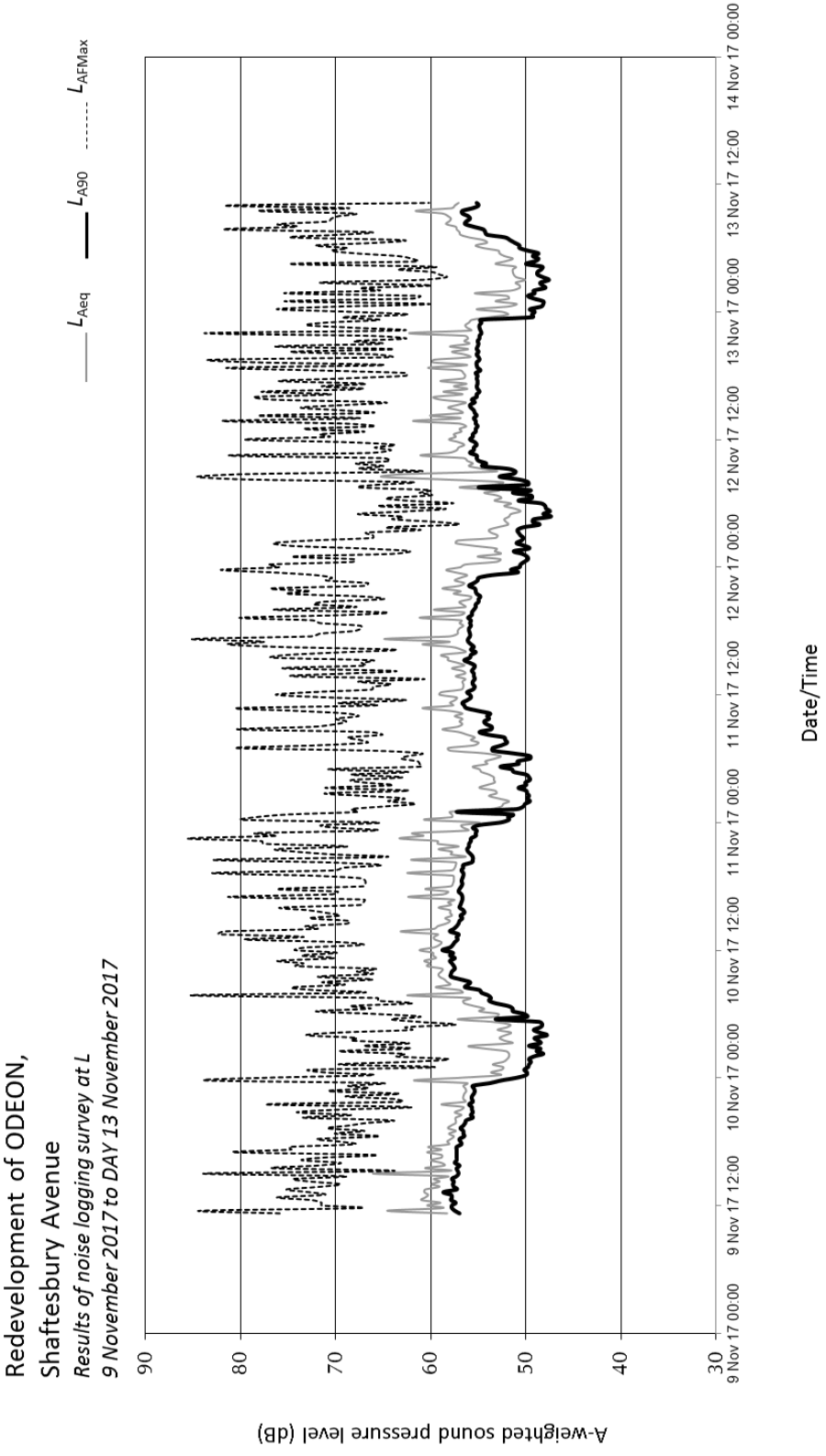
Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/00320633	Rion	11 May 18	1605234
Microphone	UC-59/03382	Rion	11 May 18	1605234
Pre-amp	NH-25/10641	Rion	11 May 18	1605234
Calibrator	N7-74/34125430	Rion	3 May 18	1605223
Sound level meter	XL2-TA/A2A-09251-E0	NTi Audio	10 Feb 19	1702079
Microphone	MC230/8391	NTi Audio	10 Feb 19	1702079
Pre-amp	MA220/5159	NTi Audio	10 Feb 19	1702079
Calibrator	SVA30A/10565	Svantek	6 Feb 19	1702068
Sound level meter	2250/3011096	Brüel & Kjær	16 Mar 19	UCRT17/1150, UTRC17/1152
Microphone	4189/3060575	Brüel & Kjær	16 Mar 19	UCRT17/1150, UTRC17/1152
Pre-amp	ZC0032/25430	Brüel & Kjær	16 Mar 19	UCRT17/1150, UTRC17/1152
Calibrator	4231/3017675	Brüel & Kjær	10 Mar 19	UCRT17/1122
Sound level meter	NL-32/00623769	Rion	06 Oct 19	TCRT17/1656
Microphone	UC-53A/319244	Rion	06 Oct 19	TCRT17/1656
Pre-amp	NH-21/36677	Rion	06 Oct 19	TCRT17/1656
Calibrator	NC-74/34336009	Rion	05 Oct 19	TCRT17/1649

[1] Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Appendix B

Results of unattended measurements at Location L


Redevelopment of Odeon,
Shaftesbury Avenue
Results of noise logging survey at L
27 October 2017 to 29 October 2017
LAeq
LA90
LAFMax
A-weighted sound pressure level (dB)
90
80
70
60
50
40
30
27 Oct 17 00:00
27 Oct 17 12:00
28 Oct 17 00:00
28 Oct 17 12:00
29 Oct 17 00:00
29 Oct 17 12:00
Date/Time


Redevelopment of ODEON,
Shaftesbury Avenue
Results of noise logging survey at L
9 November 2017 to DAY 13 November 2017
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
90
80
70
60
50
40
30
9 Nov 17 00:00
9 Nov 17 12:00
10 Nov 17 00:00
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11 Nov 17 00:00
11 Nov 17 12:00
12 Nov 17 00:00
12 Nov 17 12:00
13 Nov 17 00:00
13 Nov 17 12:00
14 Nov 17 00:00
Date/Time

Appendix C

BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

Appendix D

Plant data

Table 12 Sound power data for plant units

	Sound power level (dB) at octave band centre frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
AHU-01 Nuaire BHS7NC-LC									
Induct Inlet	90	84	89	82	77	75	70	65	
Breakout	79	69	76	54	43	41	43	34	47
AHU-02 Nuaire B07T/LC/CO-L									
Open Intake	64	63	71	70	67	69	67	65	54
Open Discharge	67	65	71	73	77	76	73	70	61
Breakout	67	56	61	54	50	42	36	25	35
AHU-03 Nuaire B12T/LC/CO-L									
Open Intake	67	66	78	72	67	68	63	60	54
Open Discharge	71	68	77	76	76	74	68	64	59
Breakout	71	58	68	57	48	40	30	19	40
AHU-04 Nuaire BHS5NC-LC									
Induct Inlet	93	88	84	85	78	75	69	64	
Breakout	82	73	71	57	44	41	42	33	44
AHU-05 Nuaire B17T/LC/CO-L									
Open Intake	74	78	79	74	71	70	72	69	58
Open Discharge	77	78	80	79	78	78	75	71	63
Breakout	77	69	69	60	51	44	38	27	42
AHU-06 Nuaire B07T/LC/CO-L									
Open Intake	64	63	72	71	68	70	68	66	55
Open Discharge	67	65	72	74	78	77	74	71	62
Breakout	67	56	62	55	51	43	37	26	36
AHU-07 Nuaire B07T/LC/CO-L									
Open Intake	64	63	72	71	68	70	68	66	55

	Sound power level (dB) at octave band centre frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
Open Discharge	67	65	72	74	78	77	74	71	62
Breakout	67	56	62	55	51	43	37	26	36
AHU-08 Nuaire B07T/LC/CO-L									
Open Intake	64	63	72	71	68	70	68	66	55
Open Discharge	67	65	72	74	78	77	74	71	62
Breakout	67	56	62	55	51	43	37	26	36
AHU-09 Nuaire B07T/LC/CO-L									
Open Intake	64	63	72	71	68	70	68	66	55
Open Discharge	67	65	72	74	78	77	74	71	62
Breakout	67	56	62	55	51	43	37	26	36
AHU-11 Nuaire B17T/LC/CO-L									
Open Intake	74	79	70	61	52	45	39	28	43
Open Discharge	77	79	81	80	79	79	76	72	64
Breakout	77	70	70	61	52	45	39	28	43
TEF-01 Nuaire EST20HC-X									
Induct Outlet	96	89	87	83	81	77	71	66	
Breakout	86	73	82	75	71	65	56	50	59
TEF-03 Nuaire EST20HC-X									
Induct Outlet	96	89	87	83	81	77	71	66	
Breakout	86	73	82	75	71	65	56	50	59
KEF-01 Nuaire SQF44									
Induct Outlet	83	85	84	84	77	78	78	64	
Breakout	78	82	79	75	64	65	61	43	55
EF-01 Nuaire AX35B-21A3+04									
Open outlet	88	83	91	85	77	71	62	56	
Breakout	65	61	74	59	48	52	43	30	45

	Sound power level (dB) at octave band centre frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
SEF-01 AXT71P*45A7+1A									
Open outlet	90	95	95	92	86	83	80	73	
Breakout	74	76	82	68	59	65	62	48	54
Heat pump NECS-Q-CA 1314	100	99	96	94	93	88	82	76	97

Table 13 Sound pressure data for generator on roof level

	Soundproofed canopy dBA rating
Perkins AP300S generator	74