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Consultants in Acoustics, Noise & Vibration

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48-56 Bayham Place

Acoustic planning report

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Version	Date	Comments	Author	Reviewer
A	3 May 17	Initial Issue	Robert Burrell	Richard Muir
B	11 May 17	Minor update	Robert Burrell	Richard Muir

Summary

Sandy Brown (SB) has been commissioned by Ambigram Architects to provide acoustic advice in relation to the proposed development at 48-56 Bayham Place.

An environmental noise survey has been conducted at the site and this survey has been used as the basis for the assessment.

The proposed development is located adjacent to the music venue KOKO. Music breakout from KOKO is considered to have a potential noise impact on the residential development. The noise survey was carried out over a total of 12s weeks and captured data for 39 amplified music events.

The long term noise measurements demonstrate that the representative music noise levels over the course of the noisiest events are $L_{eq,5min}$ 63 dB, $L_{eq,31.5Hz,5min}$ 77 dB, $L_{eq,63Hz,5min}$ 76 dB and $L_{eq,125Hz,5min}$ 66 dB.

Target noise levels due to music ingress of NR15 in bedrooms and NR20 in living rooms are proposed. To achieve these targets the facades that overlook Bayham place must achieve minimum sound reduction performances of R_{63Hz} 31 dB and R_{125Hz} 33 dB, which equates to a single figure performance of approximately R_w+C_{tr} 41 dB. To achieve these performance requirements a wide airspace double/secondary glazing system such as 20 mm/200 cavity/20 mm will likely be required. The sound insulation performance requirements can be achieved by the solid elements of the facade with both lightweight cladding and brick facings that have internal sound insulating linings.

At the facade to the rear of the development noise levels due to breakout from KOKO are at least 8 dB lower. To meet the music noise targets the façade must achieve a minimum sound reduction performances of R_{63Hz} 23 dB and R_{125Hz} 25 dB, which equates to a single figure performance of approximately R_w+C_{tr} 33 dB. High performance double glazing is capable of achieving these performance requirements.

Based on the proposed minimum facade sound insulation performance requirements the BS 8233 internal noise criteria will also be achieved.

The environmental noise survey was also used to determine the background noise levels representative of the surrounding receptors.

Based on the requirements of the London Borough of Camden, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 47 dB during the day, and L_{Aeq} 36 dB during the night. These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent than those set out above.

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1 Introduction

Sandy Brown (SB) has been commissioned by Ambigram Architects to provide acoustic advice in relation to the proposed development at 48-56 Bayham Place.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises and the existing ambient noise levels in the vicinity of the site due to road traffic and music noise egress from the adjacent club KOKO.

This report presents the results of the environmental noise survey and a discussion of acceptable limits for noise emission from building services plant and provide recommendations for the sound insulation performance of the facades.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1. The site indicated in green is located lies on Bayham Place to the north of Crowndale road. Bayham Street is to the east of the site and Camden high street is to the west of the site

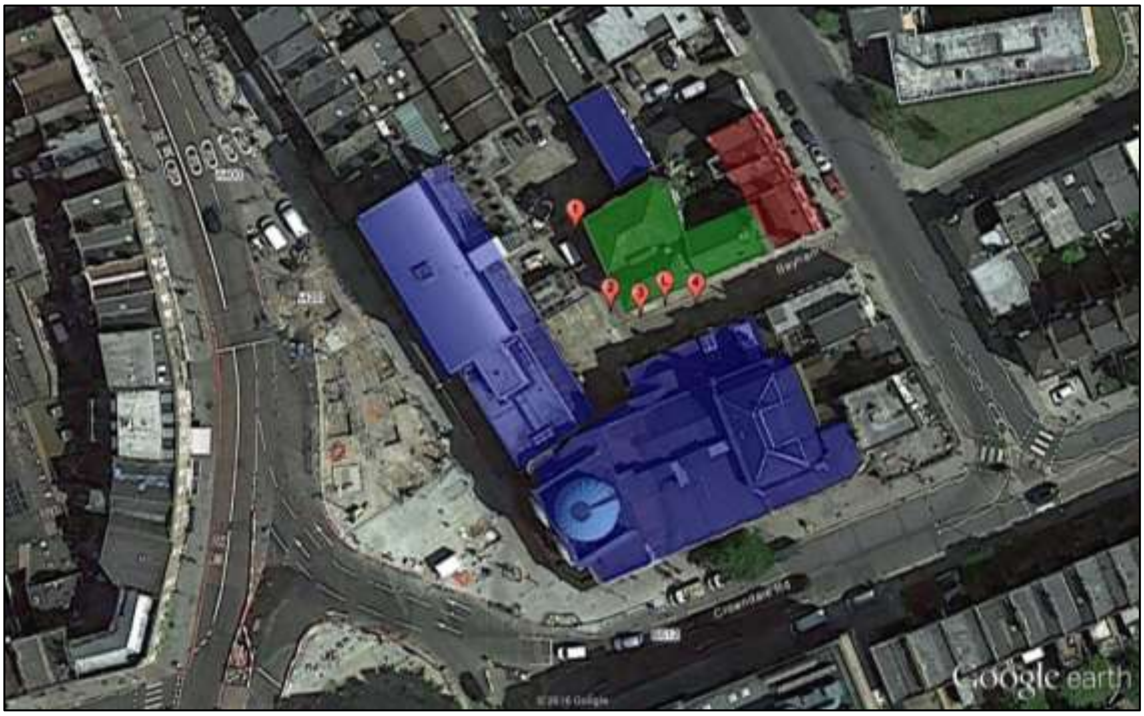


Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Proposed development

In August 2015 prior approval (planning ref: 2015/4598/P) was granted by LB Camden for the change of use of the building from office (Class B1a) to residential (Class C3). In October 2016 planning permission (ref. 2016/4116/P) was granted by LB Camden for the erection of a part single, part double roof extension to the building to provide four self-contained units (Class C3), two rear extensions at first and second floor level and associated external alterations. Since the approval of the planning application in October 2016 the applicant has constructed the rear extensions at first and second floor level to allow the occupation of these floors. This application seeks an additional floor at third floor level and to replicate a similar two storey roof extension as approved under planning permission ref. 2016/4116/P. The scheme also includes a rear extension at second floor level.

The proposed development which is considered as part of this assessment comprises the erection of a single storey extension at 3rd floor level plus double roof extension to provide 9 self-contained units, rear extension at second floor level and associated works.

2.3 Adjacent premises

The site is surrounded by both commercial and residential properties; these are indicated in blue and red respectively. These include KOKO nightclub lies to the south of the site and a series of shops to the west.

3 Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended measurements

Continuous unattended noise monitoring was undertaken at the site over 12 weeks on the external facade of the building facing KOKO nightclub. The measurements whilst continuous were recorded in 5 minute intervals. The external unattended measurements were performed between the following dates:

- 9 December 2016 to 3 February 2017
- 8 February 2017 to 10 March 2017

In each case the microphone was mounted on a bracket outside of the second floor window, such that the microphone was approximately 1 m from the building façade. The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'L'. A photograph showing the measurement location is provided Figure 2. This location was chosen to be representative of the noise levels experienced by the facade of Bayham Place that overlooks KOKO.

The equipment was installed by Zac Fox and Robert Burrell and serviced by Zac Fox on a biweekly basis.

Figure 2 Photograph of microphone outside of flat 13 window

3.2 Attended measurements

Attended sample measurements were performed by Robert Burrell at a number of locations around Bayham Place. These are indicated in Figure 1 as positions 1 to 4.

The attended measurements were carried out on 25 February 2017, over 5 minute periods, with the purpose of determining the existing noise levels from KOKO nightclub during an event. The specific event was Guilty Pleasures, which is understood to have music with significant low frequency bass component

The locations of the measurements are indicated in Figure 1. In each case the microphone was mounted on a tripod approximately 1.2 m above the ground level and approximately 1 m from the building facade; these are considered facade measurements.

4 Events

During the total of 12 weeks monitoring, 39 amplified music events occurred at KOKO. The events that were captured during the monitoring are given in Table 1. The assumed end time of each event has also been listed. The 4am end times are based on the curfews listed on the KOKO events page on their website.

Table 1 List of events

Event name	Start date	Assumed end time
Skillet / Pham	09/12/2016	04:00
7 up presents the ceremony	10/12/2016	04:00
William Single	11/12/2016	23:00
1st annual white rabbit Christmas ball	17/12/2016	04:00
Orange Goblin	18/12/2016	23:00
James Arther	21/12/2016	23:00
The club NME xmas party	23/12/2016	04:00
Buttoned down disco's FNYE party	30/12/2016	04:00
Club NME: The club NME NYE ball	31/12/2016	04:00
Zico X Misbhv	05/01/2017	23:00
Burst: Burst - Jkay	06/01/2017	04:00
Burst: Burst - Kadiata	13/01/2017	04:00
Buttoned Down Disco	14/01/2017	04:00
Jojo	17/01/2017	23:00
Burst - Ryan Blyth	20/01/2017	04:00
Gilles Peterson's	21/01/2017	04:00
Burst: Burst - Cadenza	27/01/2017	04:00
Guilty Pleasures	28/01/2017	04:00
The wonder years - PUP	01/02/2017	04:00
Burst: Burst - Jazz Carter	10/02/2017	04:00
Trevor Nelsons's Soul nation tour finale	11/02/2017	23:00
Ladyhawke	15/02/2017	23:00
Sigala	16/02/2017	23:00

Event name	Start date	Assumed end time
Four years strong - Chunk! No Captain Chunk / Burst - Jodie Abacus	17/02/2017	04:00
Boneca 4th Birthday	18/02/2017	23:00
Mic Lowry	20/02/2017	23:00
Sango	23/02/2017	23:00
Lil Yachty	24/02/2017	23:00
Guilty Pleasures	25/02/2017	04:00
Brother Strut	26/02/2017	23:00
Foxygen	27/02/2017	23:00
George Mazonakis	28/02/2017	23:00
Sophie Ellis-Bextor	01/03/2017	23:00
Lucy Spraggan	02/03/2017	23:00
Wax Tailor / Jay Prince and Friends	03/03/2017	04:00
Button down disco	04/03/2017	04:00
Kehlani	05/03/2017	23:00
Kehlani	06/03/2017	23:00
Lany	08/03/2017	23:00
Highly Suspect	09/03/2017	23:00

5 Measurement results

5.1 Unattended measurement results

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

The typical day and night time ambient noise levels measured during the unattended survey are presented in Table 2 for the week of Friday 9 December to Thursday 15 December 2016.

Table 2 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 9 December 2016	-	57
Saturday 10 December 2016	60	60
Sunday 11 December 2016	64	56
Monday 12 December 2016	64	52
Tuesday 13 December 2016	64	55
Wednesday 14 December 2016	62	52
Thursday 15 December 2016	63	60
Average	63	56

The minimum background sound levels measured for the week of Friday 9 December to Thursday 15 December 2016 are given in Table 3.

Table 3 Minimum background sound levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{A90,5min}$ (dB)	Night (23:00 – 07:00) $L_{A90,5min}$ (dB)
Friday 9 December 2016	51*	45
Saturday 10 December 2016	46	55
Sunday 11 December 2016	53	44
Monday 12 December 2016	46	44
Tuesday 13 December 2016	48	45
Wednesday 14 December 2016	47	45
Thursday 15 December 2016	47	45

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

The noise levels measured during each of the events at KOKO nightclub are presented in Table 1.

In terms of determining appropriate music noise levels the $L_{Aeq,5min}$ is used to describe representative overall noise levels. In addition, the $L_{eq,5min}$ at the octave band frequencies 31.5 Hz, 63 Hz and 125 Hz are used to describe the low frequency (bass) energy associated with music noise breakout.

As the ambient noise levels are time varying and generally dominated by road traffic and mechanical plant noise rather than music noise, statistical analysis of the periods when an event was taking place is necessary to determine the representative music noise levels. It is anticipated that over the course of a music event the music volume will in terms of $L_{eq,5min}$ be relatively consistent with a possible gradual increase in noise level with increased occupancy over the course of the evening. In other words if music noise predominated, it would be self-evident in the measurements.

It is therefore considered that 10% percentile is the best representation of the music noise levels as this represents a regularly occurring level over the course of the evening. The highest level only occurs for 5 minutes over 6 hours in the case of a 4am finish time.

The results are given in terms of the highest measured L_{Aeq} and $L_{eq,63Hz}$ values for the worst case event noting that the majority of events were lower than this. The top 1% percentile of the measured L_{Aeq} and $L_{eq,63Hz}$ values and the top 10% percentile of the measured L_{Aeq} and $L_{eq,63Hz}$ values. The data has been analysed from 7pm till 11pm or 4am depending on the event.

Table 4 Noise levels recorded during events

Start date	$L_{Aeq,5min}$			$L_{eq,63,5min}$		
	Highest	1% percentile	10% percentile	Highest	1% percentile	10% percentile
09/12/16	68	62	60	77	71	70
10/12/16	63	63	61	76	77	75
11/12/16	62	62	61	75	75	74
17/12/16	65	65	61	74	76	74
18/12/16	64	62	60	74	75	74
21/12/16	71	64	60	76	73	72
23/12/16	65	63	60	75	76	75
30/12/16	62	61	60	76	76	74

Start date	$L_{Aeq,5min}$			$L_{eq,63,5min}$		
	Highest	1% percentile	10% percentile	Highest	1% percentile	10% percentile
31/12/16	68	68	62	76	77	75
05/01/17	66	65	60	78	76	74
06/01/17	63	62	61	74	77	76
13/01/17	66	60	58	77	75	74
14/01/17	75	75	63	79	77	74
17/01/17	62	60	56	76	70	69
20/01/17	72	63	60	79	79	76
21/01/17	68	62	60	73	73	73
27/01/17	68	66	60	80	75	74
28/01/17	66	63	60	74	74	73
01/02/17	73	66	60	76	74	73
10/02/17	63	61	59	79	76	75
11/02/17	63	62	60	73	74	73
15/02/17	66	58	57	70	74	72
16/02/17	64	60	59	74	74	73
17/02/17	74	73	58	80	75	73
18/02/17	69	66	59	72	73	69
20/02/17	61	59	56	71	69	68
23/02/17	62	61	57	80	74	72
24/02/17	64	61	59	79	75	74
25/02/17	66	63	59	74	75	73
26/02/17	65	62	60	73	74	73
27/02/17	62	60	58	71	72	71
28/02/17	68	67	57	69	71	67
01/03/17	67	63	57	73	73	69
02/03/17	61	61	57	76	69	68
03/03/17	68	67	61	76	75	74

Start date	$L_{Aeq,5min}$			$L_{eq,63,5min}$		
	Highest	1% percentile	10% percentile	Highest	1% percentile	10% percentile
04/03/17	63	62	60	77	77	76
05/03/17	66	62	60	72	74	73
06/03/17	73	67	60	75	75	73
08/03/17	63	62	60	76	76	74
09/03/17	69	65	60	73	74	73
Highest	**75**	**75**	**63**	**80**	**79**	**76**
Average	**66**	**63**	**59**	**75**	**74**	**72**

The average noise levels are based on all of the events that occurred over the measurement period and the highest measurement represents the worst case (i.e. noisiest event). It is considered that the 10% percentile measurement of the highest recorded event is a representative level to form the basis of any design advice.

The long term noise measurements demonstrate that the representative music noise levels over the course of the noisiest event are $L_{eq,5min}$ 63 dB and $L_{eq,5min,63Hz}$ 76 dB. These levels are consistent with surveys conducted by other acoustic consultants in October 2015 over typical music events.

Statistical analysis has also been carried out on the measured noise levels data captured during events (7pm till 11pm/4am) and the data captured outside of the event hours. The analysis has been carried out of the following acoustic parameters:

- $L_{Aeq,5min}$
- $L_{eq,31.5Hz,5min}$
- $L_{eq,63Hz,5min}$
- $L_{eq,125Hz,5min}$

The data presented in Figure 3, Figure 4, Figure 5 and Figure 6 shows histograms of all measured values during events and outside of the event durations in terms of $L_{Aeq,5min}$, $L_{eq,31.5Hz,5min}$, $L_{eq,63HZ,5min}$ and $L_{eq,125Hz,5min}$ respectively.

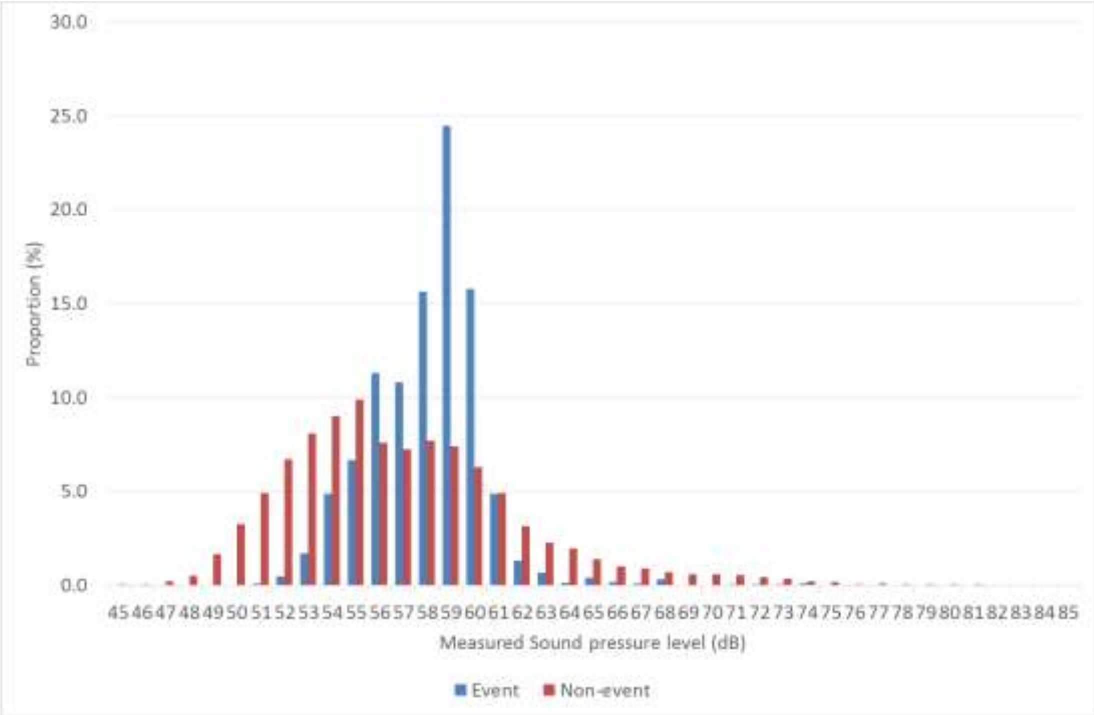


Figure 3 Histogram distribution of $L_{Aeq,5min}$ values

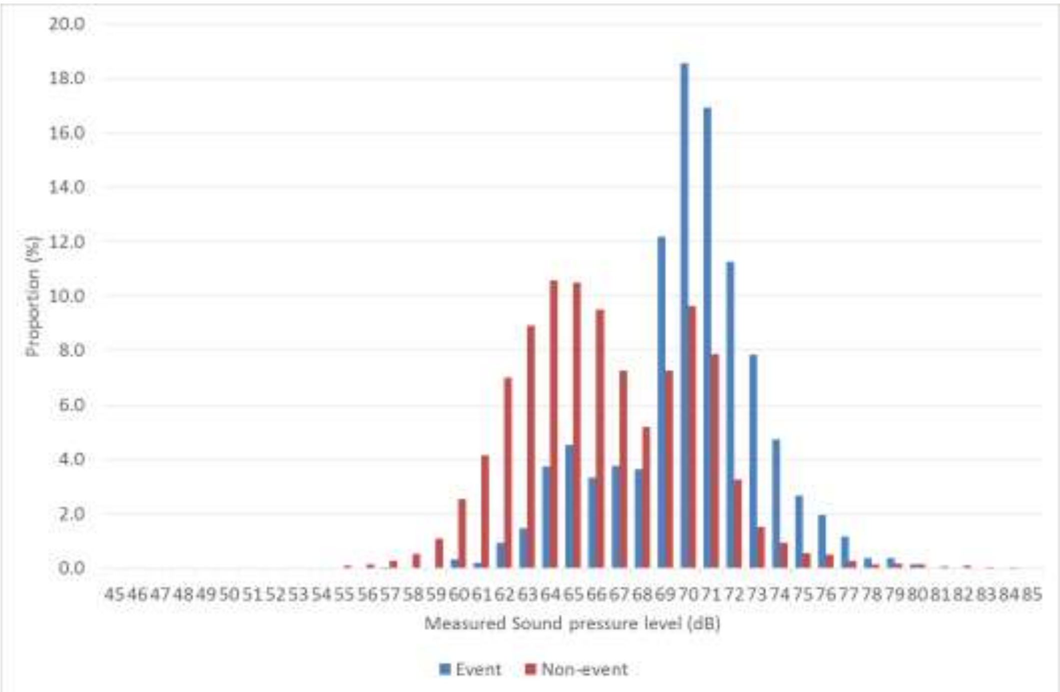


Figure 4 Histogram distribution of $L_{eq,31.5Hz,5min}$ values

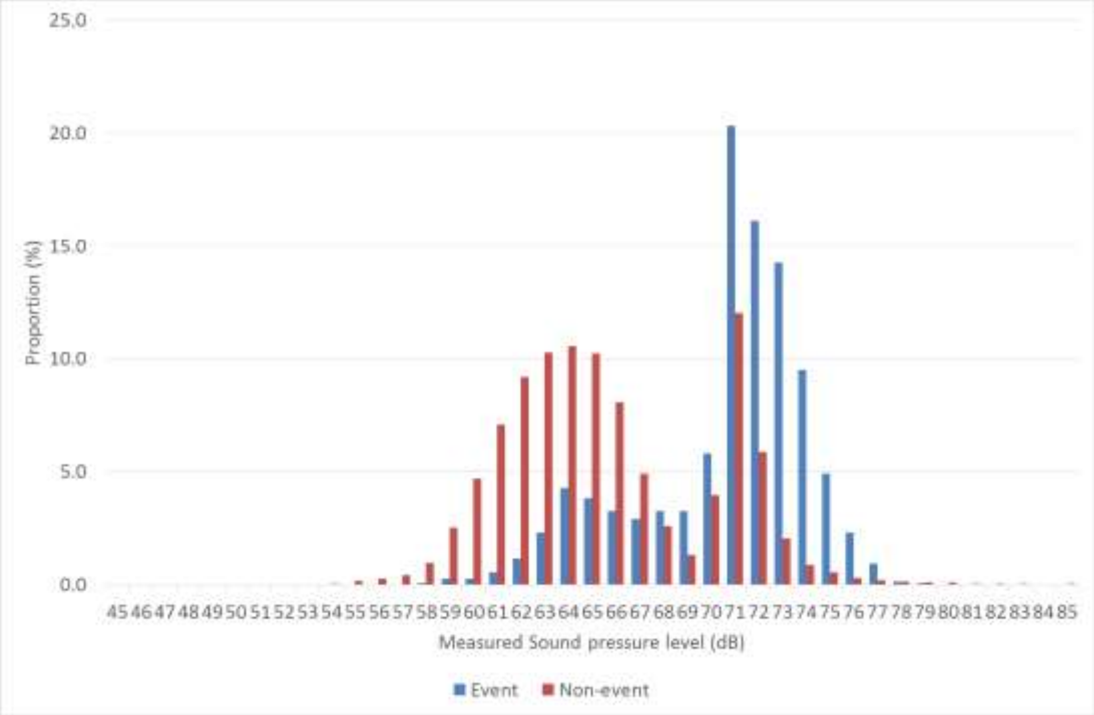


Figure 5 Histogram distribution of $L_{eq,63Hz,5min}$ values

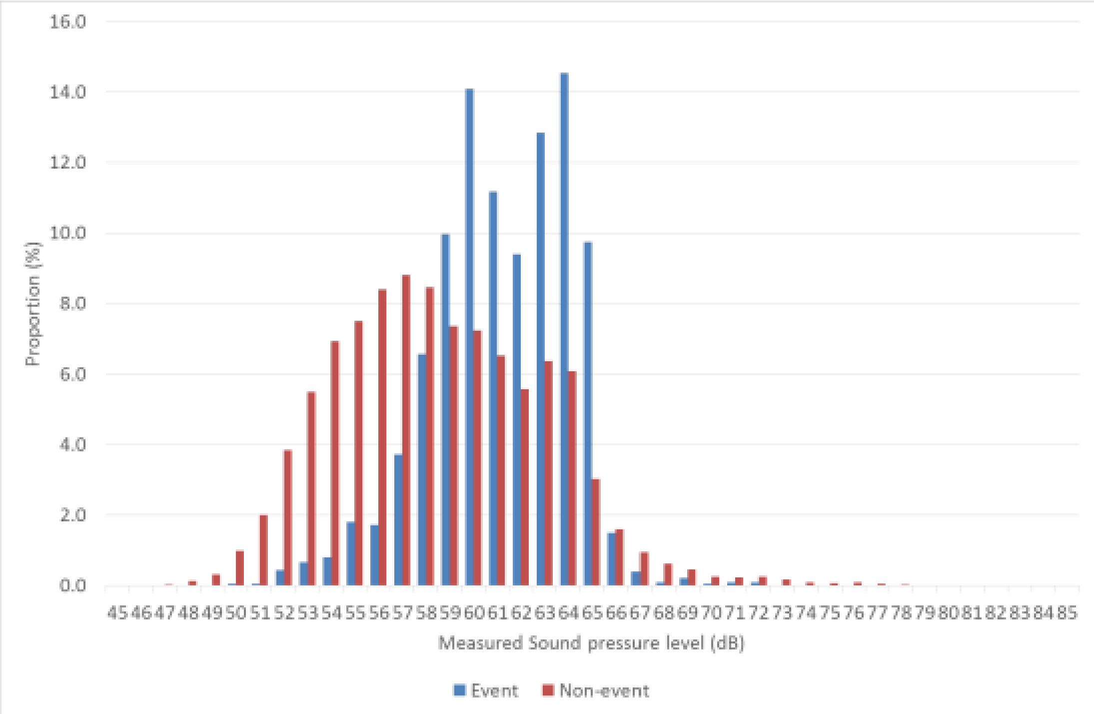
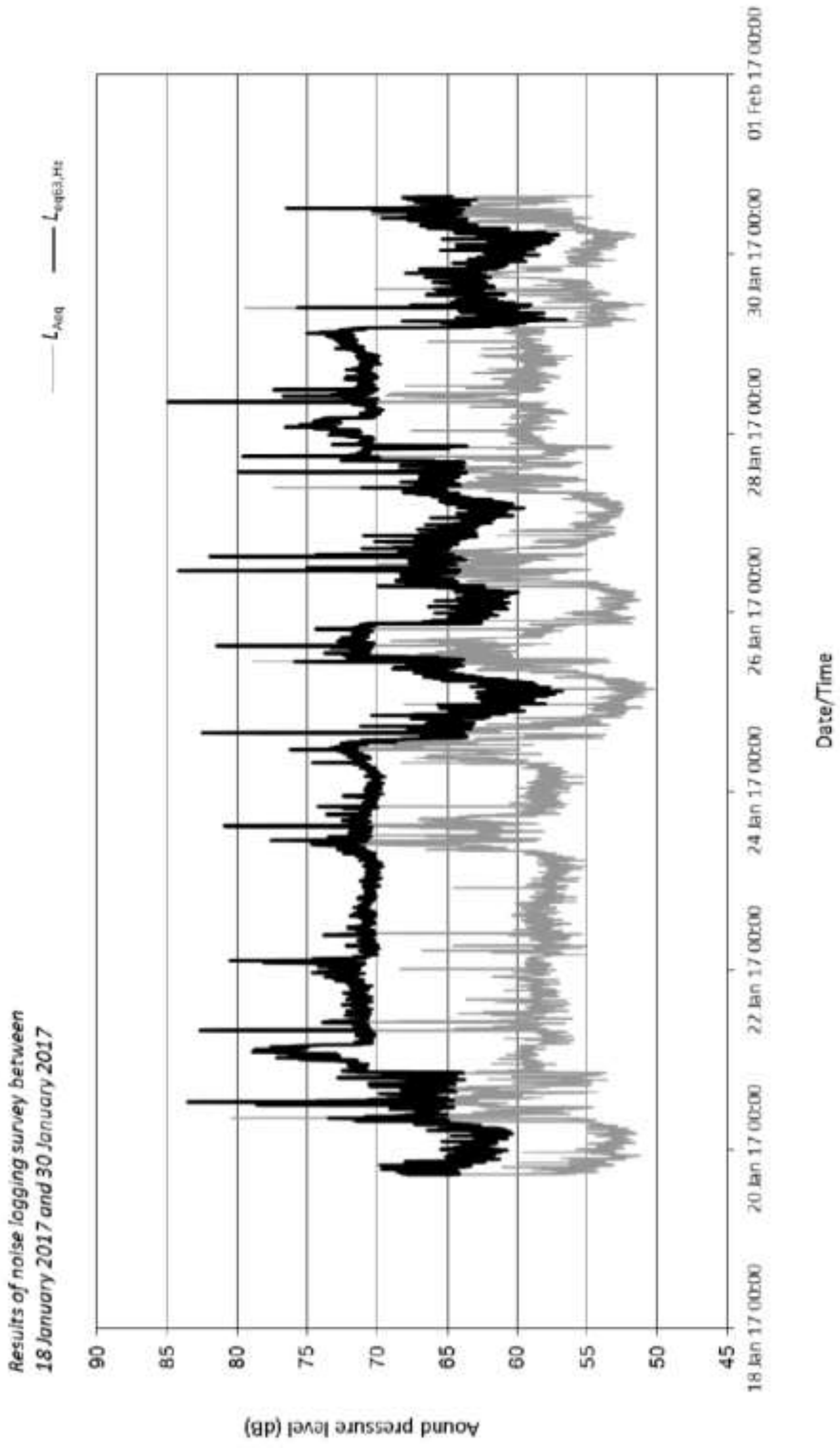


Figure 6 Histogram distribution of $L_{eq,125Hz,5min}$ values

It can be seen in Figure 5 that the $L_{eq,63Hz}$ levels measured when events did not occur reach higher maximum values (up to a maximum of $L_{eq,63Hz,5min}$ 89 dB) than periods when events did occur (up to a maximum of $L_{eq,63Hz,5min}$ 80 dB). Therefore, it is possible that that some of the data that is measured during events may occur due to noise sources other than music.

From subjective observations while on site noise levels at 63 Hz were generally dominated by mechanical services noise from KOKO. This can be seen from Figure 6 which shows services noise levels over a 12 day period. The 63 Hz noise levels are consistent (around 70-72 dB) over approximately 3½ days. These levels are consistent with the peak of $L_{eq,63Hz,5min}$ 71 dB as shown in Figure 5 for non-event times.

Data analysis has been carried out for the 31.5 Hz and 125 Hz octave bands. Based on the data analysis the representative levels in these octave bands, for durations when events take place at KOKO, are considered to be $L_{eq,31.5Hz,5min}$ 77 dB and $L_{eq,125Hz,5min}$ 66 dB.


Results of noise logging survey between 18 January 2017 and 30 January 2017
L_{Aeq}
$L_{eq63,Hz}$
90
85
80
75
70
65
60
55
50
45
18 Jan 17 00:00
20 Jan 17 00:00
22 Jan 17 00:00
24 Jan 17 00:00
26 Jan 17 00:00
28 Jan 17 00:00
30 Jan 17 00:00
01 Feb 17 00:00
Date/Time

5.2 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 5. The dominant noise sources noted during the measurements are also described in Table 5. All the attended measurements were performed over 5 minute periods. These are facade measurements.

Table 5 Sound pressure levels from attended measurements

Position	Start time	Sound pressure levels (dB)				
		L_{Aeq}	L_{AFmax}	L_{A90}	$L_{eq,63Hz}$	$L_{eq,125Hz}$
1	23:35	56	76	50	65	54
1	23:40	51	63	49	67	55
1	23:50	52	59	50	66	54
1	01:15	52	56	51	69	57
1	01:20	54	76	52	68	59
2	00:00	53	60	51	66	56
2	00:10	56	74	52	67	57
2	00:15	53	59	52	67	57
2	01:25	55	66	53	72	60
3	00:25	57	66	54	74	59
3	00:30	57	66	54	72	58
3	00:40	57	71	54	71	58
3	01:30	55	64	54	75	59
4	00:45	58	70	53	69	60
4	01:00	58	67	53	70	59
4	01:05	59	71	53	72	60
4	01:35	60	81	54	72	63

The measured $L_{Aeq,5min}$, $L_{eq,63Hz,5min}$ & $L_{eq,125Hz,5min}$ levels are higher at positions 3 and 4 because these locations have line of sight to and proximity to road traffic on Bayham Street and noisy mechanical services plant associated with KOKO.

6 Assessment criteria

6.1 NPPF and NPSE

The National Planning Policy Framework (NPPF) sets out the government planning requirements, and supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

'Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

The NPSE states that its aims are as follows:

'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.'*

As such, although neither of these documents sets out specific acoustic criteria for new residential development, the requirement to control both the effect of existing noise on the new development and the effect of noise from the development on the surroundings needs to be considered.

6.2 External noise levels - noise egress

6.2.1 *Standard guidance*

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains ‘attention catching features’ such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

6.2.2 *London Borough of Camden*

The development is located in the London Borough of Camden (LBC). The requirements specified by LBC are set out in Table 6.

Table 6 Requirements of LBC

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	5 dBA < L_{A90}
Noise that has a distinguishable note (whine, hiss, screech, hum) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10 dBA < L_{A90}
Noise that has a distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10 dBA < L_{A90}
Noise at 1 metre external to a sensitive facade where L_{A90} > 60 dB	Day, evening and night	0000-2400	L_{Aeq} 55 dB

6.2.3 *Emergency plant noise limits*

Typically limits for noise emissions from items emergency plant are set to be 10 dB above the background noise level, outside the window of the nearest noise sensitive or residential premises.

This is on the basis that such plant is only tested between 09:00-17:00 Monday to Friday for a short duration and used only during emergencies.

6.3 Internal noise levels – noise ingress

6.3.1 *Standard guidance*

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings*, and is also provided by the World Health Organisation. The guidance given by BS 8233:2014and WHO is shown in Table 7.

Table 7 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level L_{Aeq} (dB)		
	BS 8233 (07:00 to 23:00)	BS 8233 (23:00 to 07:00)	WHO
Living rooms	35	-	30/35[1]
Dining room	40	-	-
Bedrooms	35	30[2]	30[2]

[1] WHO does not differentiate between different types of living spaces, but recommends L_{Aeq} 30 dB in relation to sleep disturbance and L_{Aeq} 35 dB in relation to speech intelligibility. WHO provides a 16 hour time base when referring to speech intelligibility and an 8 hour time base when referring to sleep disturbance.

[2] BS 8233 notes that individual noise events can cause sleep disturbance, and that a guideline value may be set depending on the character and number of events per night, although no specific limit is provided. Section 3.4 of the WHO guidelines for community noise suggests that good sleep will not generally be affected if internal levels of L_{Amax} 45 dB are not exceeded more than 10-15 times per night.

6.4 Music noise

The research project Noise from pubs and clubs: DEFRA research Contract NANR163 (2006) Phase II report considered methods of predicting the subjective response to music noise and on page 32 the conclusions are summarised as follows:

> *5.61 The noise metric that appears to provide the best prediction of subjective response across the board for different entertainment noise types is the Absolute L_{Aeq}. This noise metric provided consistently high correlation coefficients when compared with the subjects' ratings of acceptability.*
>
> *5.62 According to the regression between subjective acceptability rating and noise level in absolute L_{Aeq}, the table below shows that L_{Aeq} levels associated with each value of acceptability. For example, therefore, if the objective is that the new criterion reflect the level at which householders feel the noise is "just unacceptable", the target absolute $L_{Aeq,5min}$ should be 34.0 dB.*

Table 4 Semantic descriptor and associated value of acceptability Semantic descriptor Score Absolute $L_{Aeq,5min}$

Clearly acceptable	*1*	*17.0*
	2	*20.4*
	3	*23.8*
	4	*27.2*
Just acceptable	*5*	*30.6*
Just unacceptable	*6*	*34.0*
	7	*37.4*
	8	*40.8*
	9	*44.2*
Clearly unacceptable	*10*	*47.5*

A level of around L_{Aeq} 20 dB would therefore be considered to be at an acceptable music noise ingress level for bedrooms, based on absolute level assessment. L_{Aeq} 20 dB is approximately equivalent to NR15.

For living rooms it is considered that a limit of L_{Aeq} 25 dB would be appropriate. L_{Aeq} 25 dB is approximately equivalent to NR20.

It is therefore recommended that music from KOKO be attenuated such that it does not exceed NR20 in living rooms and NR15 in bedrooms to ensure minimal disturbance to the residential receptors. For reference the NR 15 and NR 20 curves are provided in Table 8.

Table 8 NR15 and NR20 reference curves

	Octave band centre frequency (Hz)							
	31.5	63	125	250	500	1k	2k	4k
NR15 curve (dB)	66	47	35	26	19	15	12	9
NR20 curve (dB)	69	51	39	31	24	20	17	14

7 Facade sound insulation – noise ingress

This section discusses internal noise level criteria and assesses the required facade sound insulation performance. In principle, the required facade specification depends on two factors – the external noise levels at the site, and the internal noise criteria.

The glazing sound insulation performance requirements for the residential units facing Bayham Street are typically dictated by achieving day time internal noise criteria based on traffic noise whereas the residential units facing Bayham Place are typically dictated by achieving the night time internal noise criteria based on music noise.

The following assessment is based on achieving the internal noise levels recommended in BS 8233:2014, which are set out in Section 6.2.2 and in the case of music noise the limits given in 5.3.2.

7.1 Facade noise levels

The noise incident on the facade is primarily from local road traffic along Bayham Street during the daytime. The lower floors of the facade adjacent to Bayham Place experience the highest noise levels. The daytime road traffic noise levels are in the region of L_{Aeq16hr} 63 dB. The night time noise in the absence of events occurring at KOKO are around L_{Aeq8hr} 52 dB. Noise levels due to traffic incident on the rear facade of the development will be lower than those measured at the front facade as there is no direct line of sight.

The logging survey recorded noise levels over a 12 week long period and captured 39 events at KOKO. The long term noise measurements demonstrate that the representative music noise levels over the course of the noisiest events are $L_{\mathrm{eq,5min}}$ 63 dB, $L_{\mathrm{eq,31.5Hz,5min}}$ 77 dB, $L_{\mathrm{eq,63Hz,5min}}$ 76 dB and $L_{\mathrm{eq,125Hz,5min}}$ 66 dB.

7.2 Sound insulation performance requirements

On the basis that these are representative of the external noise levels from KOKO and considering a music noise target of NR15 in bedrooms and NR20 in living areas the facades that overlook Bayham place must achieve minimum sound reduction performances of $R_{\mathrm{31.5Hz}}$ 12 dB, R_{63Hz} 31 dB, R_{125Hz} 33 dB, which equates to a single figure performance of approximately $R_{\mathrm{w}}+C_{\mathrm{tr}}$ 41 dB.

Noise levels due to music at the rear facade of the development are at least 8 dB lower than those measured at the Bayham Place facade due to screening provided by the building. To meet the music noise targets the facade must achieve minimum sound reduction performances of $R_{\mathrm{31.5Hz}}$ 4 dB, R_{63Hz} 23 dB, R_{125Hz} 25 dB, which equates to a single figure performance of approximately $R_{\mathrm{w}}+C_{\mathrm{tr}}$ 33 dB.

The minimum facade sound insulation performance requirements for levels 3, 4 and 5 are summarised in Figure 7, Figure 8 and Figure 9 respectively.

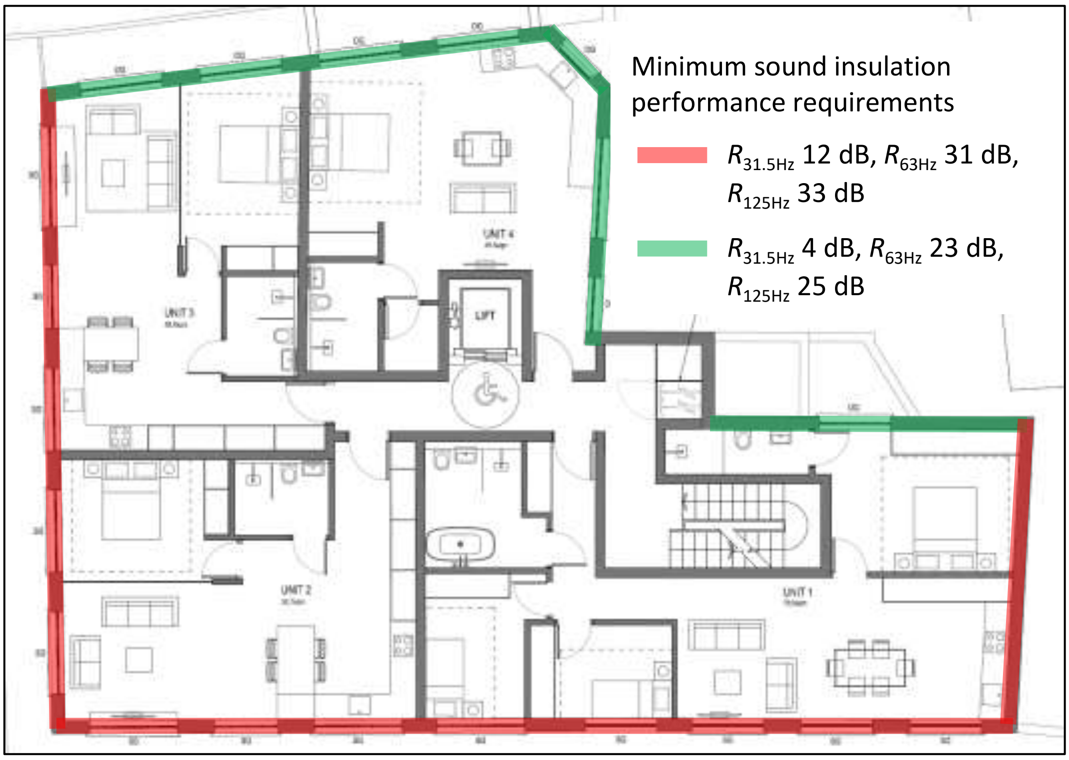


Figure 7 Summary of the facade sound insulation performance requirements for Level 3

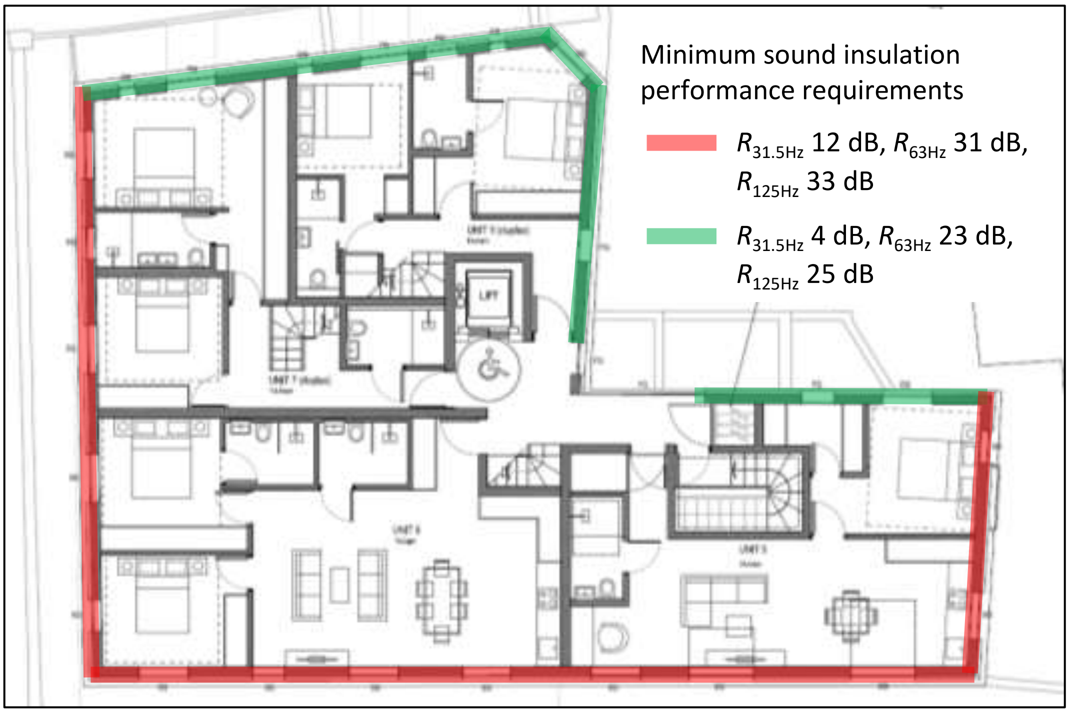


Figure 8 Summary of the facade sound insulation performance requirements for Level 4

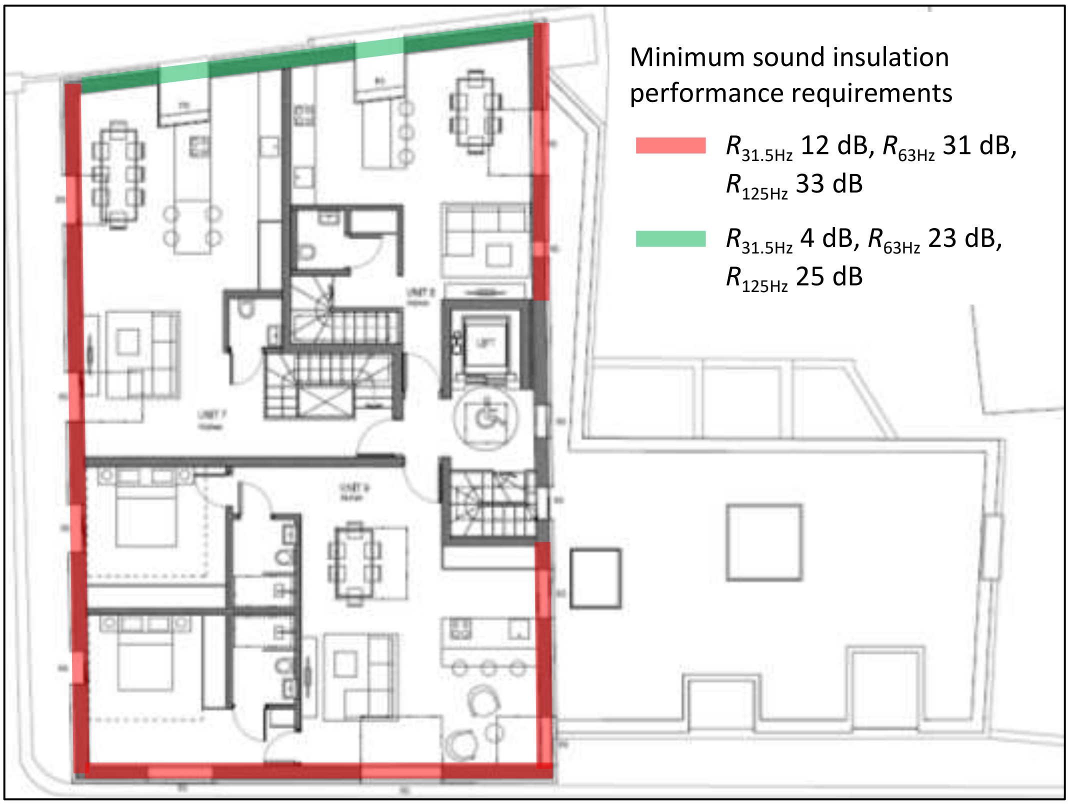


Figure 9 Summary of the facade sound insulation performance requirements for Level 5

Based on the proposed minimum facade sound insulation performance requirements the BS 8233 internal noise criteria will also be achieved.

7.3 Guidance on facade constructions

7.3.1 *General*

The sound insulation performance is rarely measured in the 31.5 Hz octave band, however, the requirement of $R_{31.5Hz}$ 12 dB which is determined by the stiffness of materials will be achieve by most glazing system and facade systems.

7.3.2 *Glazing*

To achieve the R_{63Hz} 31 dB and R_{125Hz} 33 dB performance requirements a wide airspace double/secondary glazing system such as 20 mm/200 cavity/20 mm will likely be required.

The R_{63Hz} 23 dB and R_{125Hz} 25 dB performance requirements can be achieved by a high performance double glazing system.

7.3.3 *Level 3 masonry facade*

The Level 3 facade comprises an external brick facing within an internal lining. Internal linings of either dense blockwork or two layers of plasterboard with acoustic insulation in the cavity are capable of achieving the façade sound insulation performance requirements for all areas.

Example constructions and performances are given below:

- Brickwork with internal plasterboard lining:
  - 102 mm brick
  - 50 mm cavity with 50 mm acoustic insulation
  - 2 layers of 15mm plasterboard
  - Sound insulation performance of:
    - R_{63Hz} 34 dB
    - R_{125Hz} 41 dB
    - $R_w + C_{tr}$ 53 dB

- Brickwork with internal blockwork lining:
  - 102 mm brick
  - 50 mm air cavity
  - 100 mm medium dense blockwork wall connected with wall ties
  - Sound insulation performance of:
    - R_{63Hz} 34 dB
    - R_{125Hz} 44 dB
    - $R_w + C_{tr}$ 50 dB

The actual wall construction will need to achieve other requirements in addition to the sound insulation performance requirements. The wall constructions above are provided only to demonstrate that the sound insulation performance requirements can be achieved.

7.3.4 *Levels 4 &5 lightweight cladding*

The level 4 and level 4 facades comprises an external lightweight cladding within an internal lining. Internal linings of either dense blockwork or three layers of plasterboard with acoustic insulation in the cavity and additional cement boards attached to the lightweight cladding are capable of achieving the façade sound insulation performance requirements for all areas.

Example constructions and performances are given below:

- Lightweight cladding with internal plasterboard lining:
  - 100 mm lightweight cladding
  - 2 layers of cement board attached to the lightweight cladding (30 kg/m^2)
  - 120 mm air cavity with 50 mm acoustic insulation
  - 3 layers of 15mm acoustic plasterboard
  - Sound insulation performance of:
    - R_{63Hz} 31 dB
    - R_{125Hz} 49 dB
    - R_w+C_{tr} 55 dB

- Lightweight cladding with internal blockwork lining:
  - 100 mm lightweight cladding
  - 50 mm cavity with 50 mm acoustic insulation
  - 100 mm medium dense blockwork wall connected with wall ties
  - Sound insulation performance of:
    - R_{63Hz} 32 dB
    - R_{125Hz} 38 dB
    - R_w+C_{tr} 46 dB

The actual wall construction will need to achieve other requirements in addition to the sound insulation performance requirements. The wall constructions above are provided only to demonstrate that the sound insulation performance requirements can be achieved with a facade that has an external light weight cladding system.

8 Building services noise egress limits

Based on the above criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 9.

Table 9 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)	47
Night-time (23:00-07:00)	36

The limits set out in Table 9 do not include any attention catching features.

8.1 Assessment

At this stage, there is limited information available in relation to the proposed installation of building services plant. Plant items are to be located in an enclosure on the roof of the top level. The location of the plant enclosure is shown in Figure 10.

Figure 10 Location of the rooftop plant enclosure

To achieve the plant noise limits and the cumulative sound power level from all plant items should not exceed a sound power level of L_{WA} 85 dB.

Noise from plant will need to be assessed in detail as the design progresses. However, all plant items will be designed to achieve the plant noise limits set out above, including any corrections for attention catching features.

9 Conclusion

The proposed development is located adjacent to the music venue KOKO. Music breakout from KOKO is considered as having a potential noise impact on the residential development. A 12 week noise survey, which included 39 events, has been undertaken to determine representative music noise levels.

The long term noise measurements demonstrate that the representative music noise levels over the course of the noisiest events are $L_{eq,5min}$ 63 dB, $L_{eq,31.5Hz,5min}$ 77 dB, $L_{eq,63Hz,5min}$ 76 dB and $L_{eq,125Hz,5min}$ 66 dB.

Target noise levels due to music ingress of NR15 in bedrooms and NR20 in living rooms are proposed. To achieve these targets the facades that overlook Bayham place must achieve minimum sound reduction performances of R_{63Hz} 31 dB and R_{125Hz} 33 dB, which equates to a single figure performance of approximately R_w+C_{tr} 41 dB. To achieve these performance requirements a wide airspace double/secondary glazing system such as 20 mm/200 cavity/20 mm will likely be required. The sound insulation performance requirements can be achieved by the solid elements of the facade with both lightweight cladding and brick facings that have internal sound insulating linings.

At the facade to the rear of the development noise levels due to breakout from KOKO are at least 8 dB lower. To meet the music noise targets the façade must achieve a minimum sound reduction performances of R_{63Hz} 23 dB and R_{125Hz} 25 dB, which equates to a single figure performance of approximately R_w+C_{tr} 33 dB. High performance double glazing is capable of achieving these performance requirements.

Based on the proposed minimum facade sound insulation performance requirements the BS 8233 internal noise criteria will also be achieved.

Based on the requirements of the London Borough of Camden, the relevant plant noise limits at the worst affected existing noise sensitive premises would be L_{Aeq} 47 dB during the day, and L_{Aeq} 36 dB during the night.

These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent than those set out above.

Appendix A

Survey details

Equipment

Rion NL 52 sound level meters were used to undertake the unattended measurements internally and externally. The attended measurements were carried out using a Rion NL 52 sound level meter. The calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/00242702	Rion	4 Jun 17	1506331
Microphone	UC-59/06185	Rion	4 Jun 17	1506331
Pre-amp	NH-25/32730	Rion	4 Jun 17	1506331
Calibrator	CAL200/4499	Larson Davis	4 Jun 17	1506327
Sound level meter	NL-52/00320634	Rion	22 Mar 18	TCRT16/1069
Microphone	UC-59/03383	Rion	22 Mar 18	TCRT16/1069
Pre Amp	NH-25/10642	Rion	22 Mar 18	TCRT16/1069
Calibrator	NC-74/34125431	Rion	21 Mar 18	TCRT16/1065
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

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meters used in this survey are available upon request.

The sound level meters and microphones were calibrated at regular intervals throughout the survey using their respective sound level calibrators. No significant deviation in calibration occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. 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 with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

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 25 February 2017, there was light rain and low wind with occasional gusts.

During the unattended noise measurements between 9 December 2016 and 10 March 2017, weather reports for the area indicated that temperatures varied between -4°C at night and 18°C during the day, and the wind speed was less than 10.8 m/s.

Further details of weather conditions are provided in Table 10

Table 10 Weather Conditions

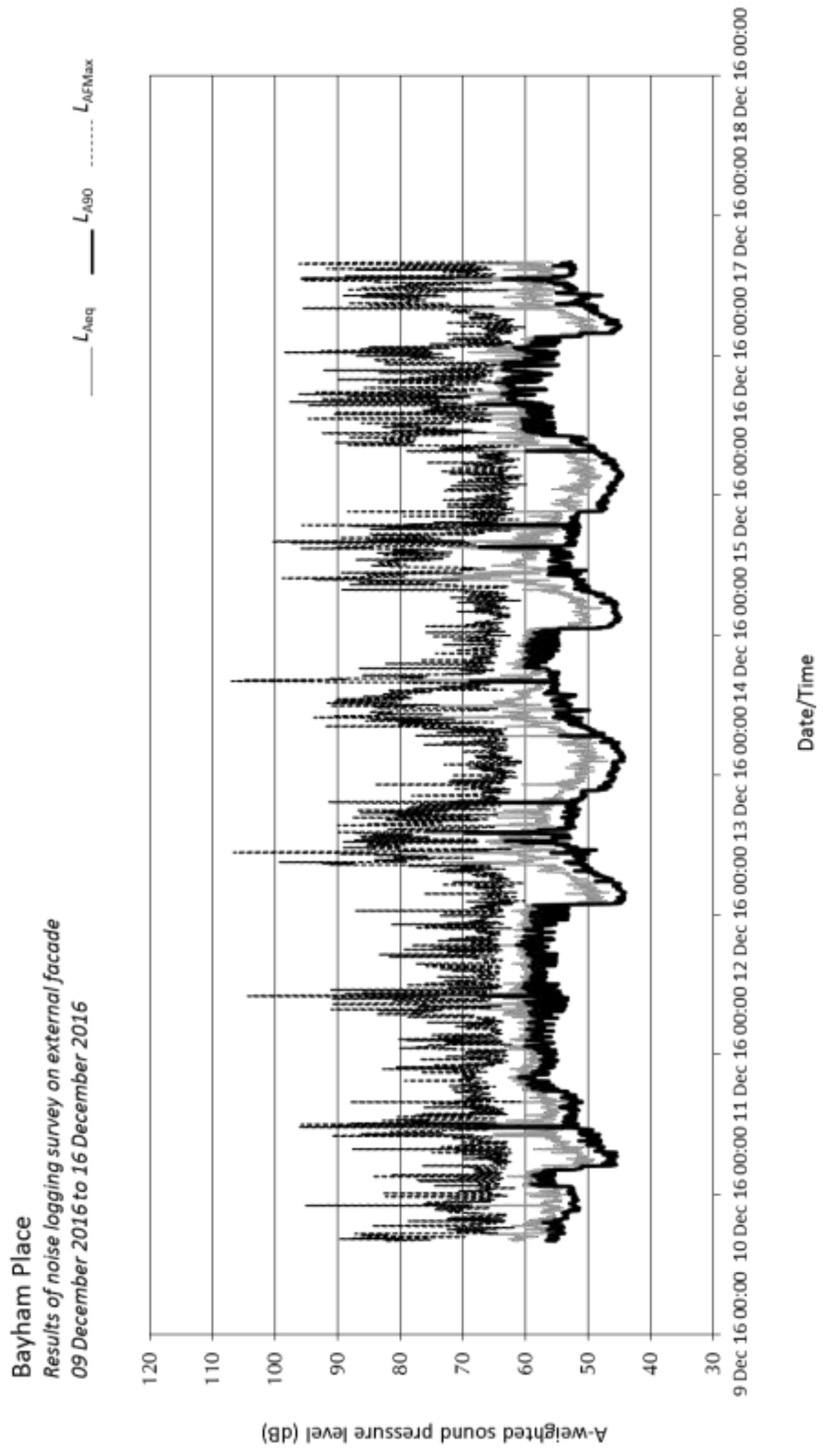
Date	Temp. (°C)	Wind (m/s)		Precipitation (mm)	Events
		highest	average		
09/12/2016	12	5.8	3.6	0	Rain
10/12/2016	10	7.5	3.9	0.76	Rain
11/12/2016	7	6.4	3.1	0	Fog
12/12/2016	7	5.3	2.2	1.02	Fog , Rain
13/12/2016	10	5.3	3.1	0.25	Rain
14/12/2016	10	5.8	2.8	0	Fog
15/12/2016	8	4.4	2.8	0	
16/12/2016	9	3.6	2.2	0	
17/12/2016	6	3.6	1.4	0	Fog
18/12/2016	7	3.6	1.4	0	Fog
19/12/2016	6	3.1	1.7	0.76	Rain
20/12/2016	6	4.4	2.8	0	
21/12/2016	8	7.2	4.4	0.25	Rain
22/12/2016	6	5.3	2.2	0.25	Fog
23/12/2016	7	10.8	4.4	1.02	Rain
24/12/2016	8	9.4	5.8	0	Rain
25/12/2016	11	9.7	7.5	0	Rain
26/12/2016	5	7.5	5.3	0	Rain
27/12/2016	3	4.4	1.7	0	
28/12/2016	3	3.6	1.4	0.25	Fog
29/12/2016	3	3.6	1.4	0.25	Fog
30/12/2016	1	3.1	1.4	0	Fog
31/12/2016	6	5.8	2.8	0	Fog , Rain
01/01/2017	7	6.4	3.6	5.08	Rain
02/01/2017	2	3.9	2.8	0	
03/01/2017	1	6.7	3.1	0.25	
04/01/2017	4	6.4	3.9	0	Rain
05/01/2017	2	2.8	1.4	0	
06/01/2017	2	4.4	1.7	2.03	Fog , Rain
07/01/2017	8	5.3	2.8	0.25	Rain
08/01/2017	8	3.1	1.4	1.02	Fog , Rain
09/01/2017	7	8.1	3.9	3.05	Fog , Rain
10/01/2017	6	5.8	4.4	0	Rain
11/01/2017	8	8.1	5.0	0	
12/01/2017	3	7.2	5.0	13.97	Rain , Snow
13/01/2017	3	9.7	5.8	0.25	Rain , Snow
14/01/2017	2	5.8	3.6	0.76	Rain

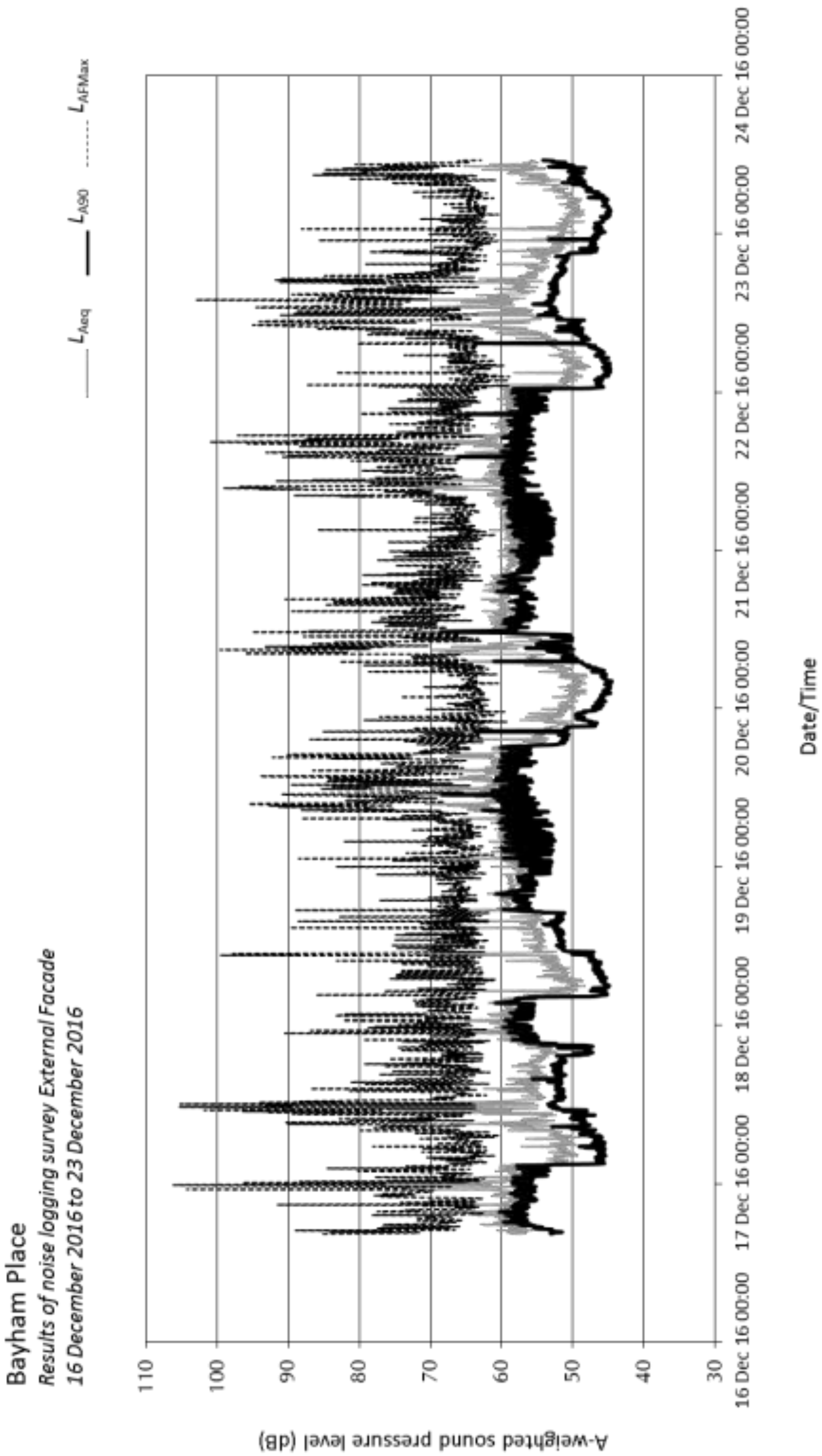
Date	Temp. (°C)	Wind (m/s)		Precipitation (mm)	Events
		highest	average		
15/01/2017	4	4.4	2.2	4.06	Rain
16/01/2017	4	3.1	1.7	4.06	Rain
17/01/2017	2	2.8	1.4	0	
18/01/2017	1	2.2	0.8	0	
19/01/2017	2	3.1	1.4	0	
20/01/2017	2	4.4	2.2	0	Fog
21/01/2017	1	5.3	2.8	0	
22/01/2017	1	2.2	0.8	0	
23/01/2017	0	2.2	0.8	0.25	Fog
24/01/2017	3	3.6	1.4	0	Fog
25/01/2017	1	4.4	1.4	0.25	Fog
26/01/2017	-1	6.4	3.9	0	
27/01/2017	2	5.8	3.1	0	
28/01/2017	7	6.7	4.4	0.51	Rain
29/01/2017	6	6.4	3.6	4.06	Rain
30/01/2017	7	5.3	3.1	0.25	Rain
31/01/2017	8	5.8	3.6	0.51	Rain
01/02/2017	10	6.7	3.9	1.02	Rain
02/02/2017	10	8.9	6.4	1.02	Rain
03/02/2017	8	11.7	5.8	2.03	Rain
04/02/2017	6	5.3	2.2	0.51	Rain
05/02/2017	4	3.9	2.8	0	Rain
06/02/2017	3	5.8	2.2	6.1	Fog , Rain
07/02/2017	7	3.9	2.8	0.25	Rain
08/02/2017	4	3.6	2.2	0	Rain
09/02/2017	1	4.4	3.1	0	Rain , Snow
10/02/2017	1	3.9	3.1	0.25	Rain , Snow
11/02/2017	2	4.4	3.1	0.51	Rain , Snow
12/02/2017	4	6.7	3.9	0	Rain , Snow
13/02/2017	7	8.1	6.4	0	
14/02/2017	7	5.3	3.6	0	
15/02/2017	9	6.7	3.1	1.02	Fog , Rain
16/02/2017	9	6.4	3.6	0.25	Rain
17/02/2017	9	4.4	3.1	0	Rain
18/02/2017	9	4.4	3.1	0	
19/02/2017	8	5.8	3.1	0	Rain
20/02/2017	13	8.9	5.0	0	
21/02/2017	11	9.7	5.8	0.25	Rain

Date	Temp. (°C)	Wind (m/s)		Precipitation (mm)	Events
		highest	average		
22/02/2017	12	11.1	8.6	0.25	Rain
23/02/2017	8	16.9	9.7	2.03	Rain
24/02/2017	6	6.7	3.9	0	Rain
25/02/2017	8	9.4	5.3	0.76	Rain
26/02/2017	10	10.8	7.2	0.25	Rain
27/02/2017	6	9.7	5.3	6.1	Rain
28/02/2017	4	9.7	5.0	1.02	Rain
01/03/2017	7	11.7	5.3	0.51	Rain
02/03/2017	8	13.1	8.9	0	
03/03/2017	8	6.4	3.9	2.03	Rain , Thunderstorm
04/03/2017	9	8.1	3.9	0.25	Rain
05/03/2017	8	10.8	6.7	4.06	Rain
06/03/2017	7	6.7	4.4	0	Rain
07/03/2017	8	5.8	3.9	0.25	Rain
08/03/2017	11	7.2	5.3	0.76	Rain
09/03/2017	12	7.5	3.9	0	
10/03/2017	9	4.4	3.1	0	Rain

Appendix B

Results of unattended facade measurements


Bayham Place
Results of noise logging survey on external facade
09 December 2016 to 16 December 2016
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
120
110
100
90
80
70
60
50
40
30
9 Dec 16 00:00
10 Dec 16 00:00
11 Dec 16 00:00
12 Dec 16 00:00
13 Dec 16 00:00
14 Dec 16 00:00
15 Dec 16 00:00
16 Dec 16 00:00
17 Dec 16 00:00
18 Dec 16 00:00
Date/Time


Bayham Place
Results of noise logging survey External Facade
16 December 2016 to 23 December 2016
LAeq
LA90
LAFMax
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
16 Dec 16 00:00
17 Dec 16 00:00
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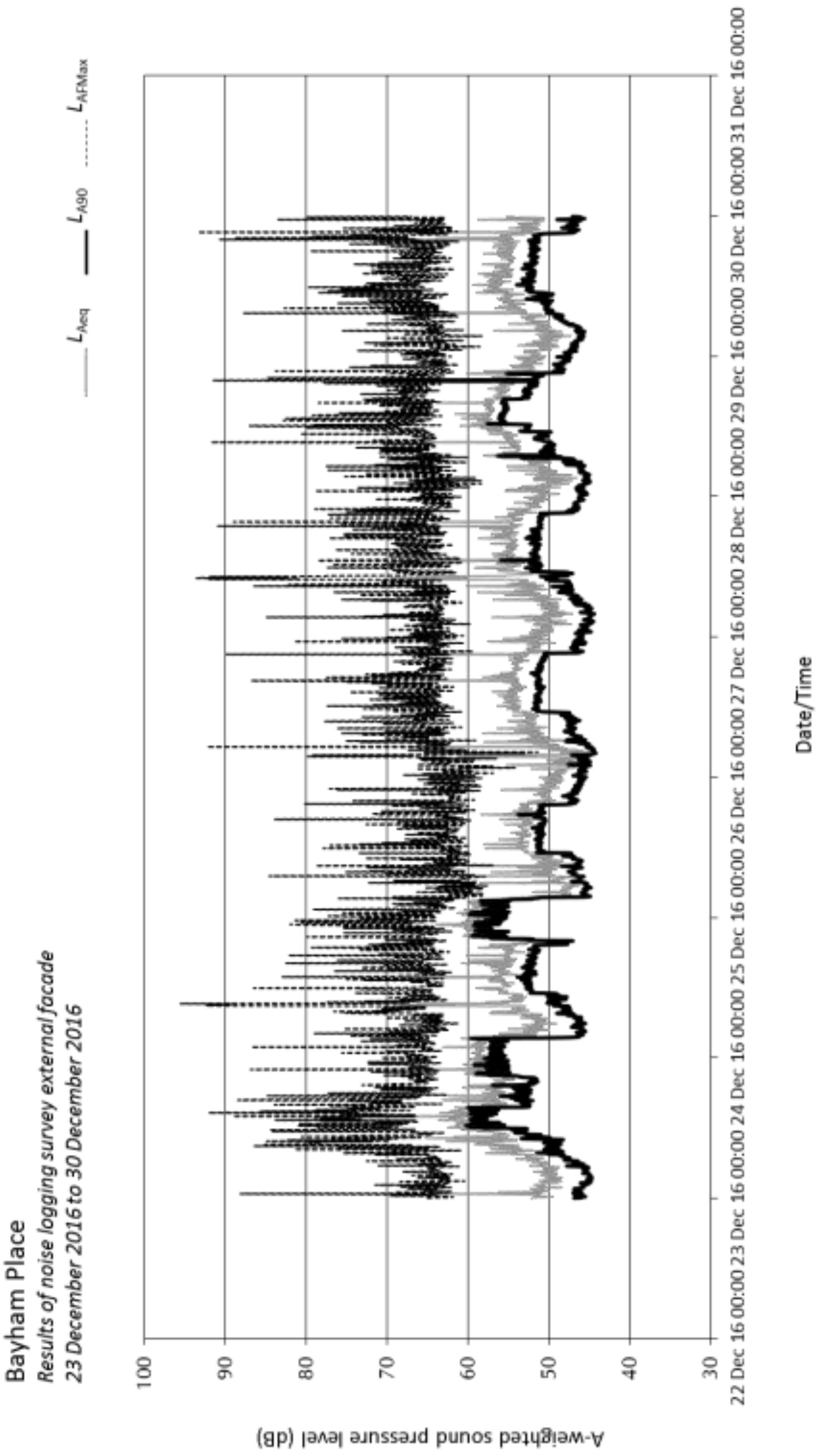
24 Dec 16 00:00
Date/Time


Bayham Place
Results of noise logging survey external facade
23 December 2016 to 30 December 2016
LAeq
LA90
LAFMax
A-weighted sound pressure level (dB)
100
90
80
70
60
50
40
30
22 Dec 16 00:00
23 Dec 16 00:00
24 Dec 16 00:00
25 Dec 16 00:00
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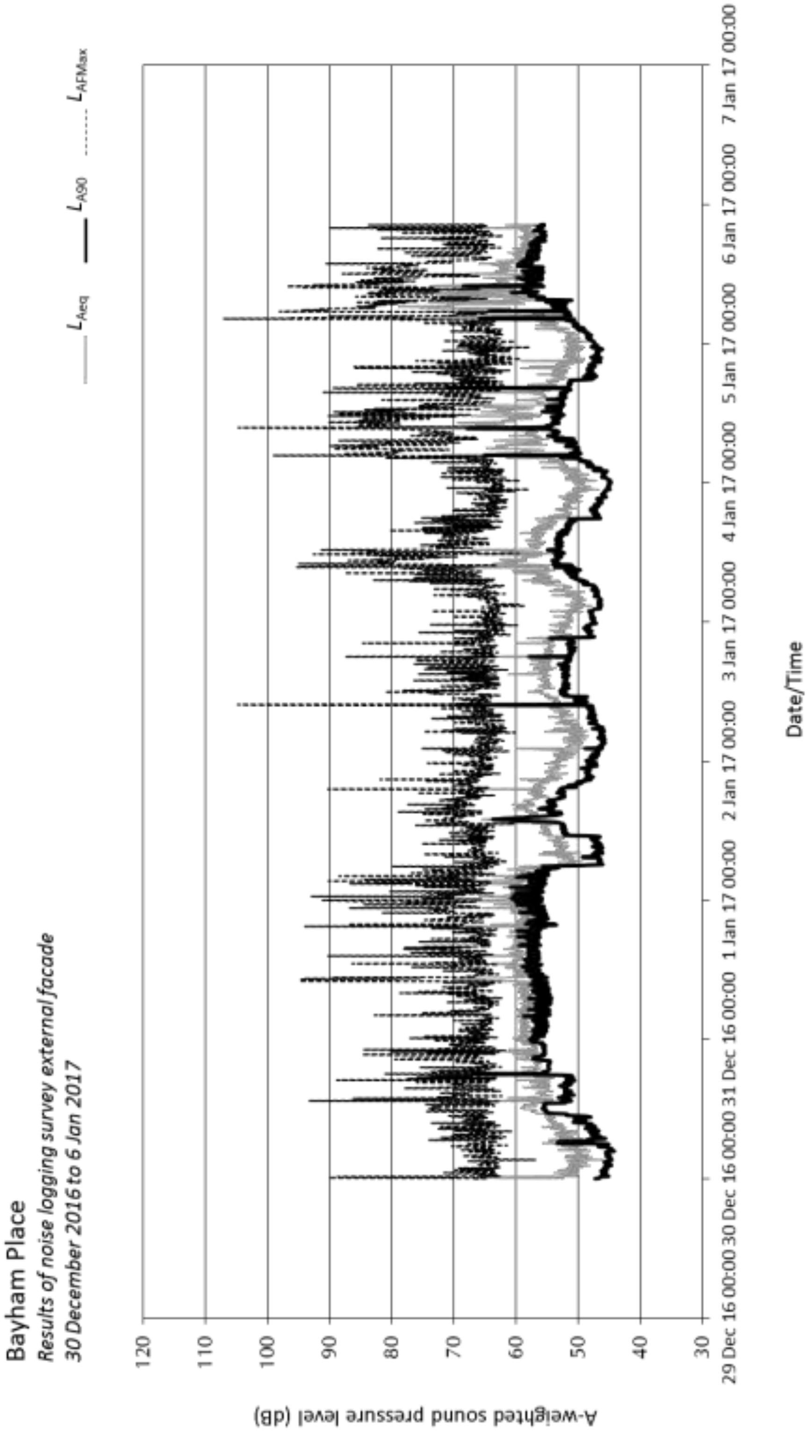
31 Dec 16 00:00
Date/Time


Bayham Place
Results of noise logging survey external facade
30 December 2016 to 6 Jan 2017
LAeq
LA90
LAFMax
A-weighted sound pressure level (dB)
120
110
100
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80
70
60
50
40
30
29 Dec 16 00:00
30 Dec 16 00:00
31 Dec 16 00:00
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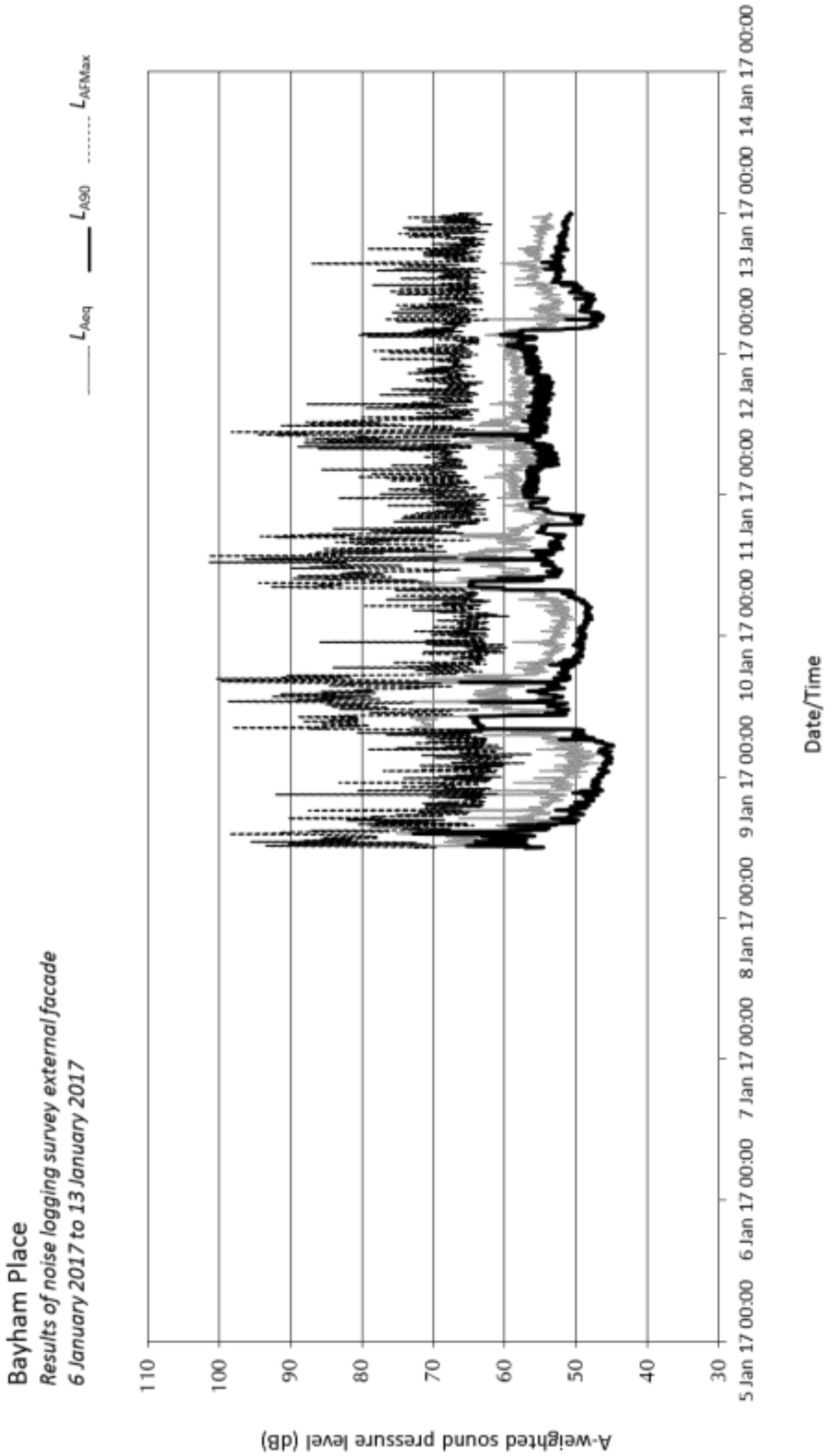
3 Jan 17 00:00
4 Jan 17 00:00
5 Jan 17 00:00
6 Jan 17 00:00
7 Jan 17 00:00
Date/Time


Bayham Place
Results of noise logging survey external facade
6 January 2017 to 13 January 2017
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
5 Jan 17 00:00
6 Jan 17 00:00
7 Jan 17 00:00
8 Jan 17 00:00
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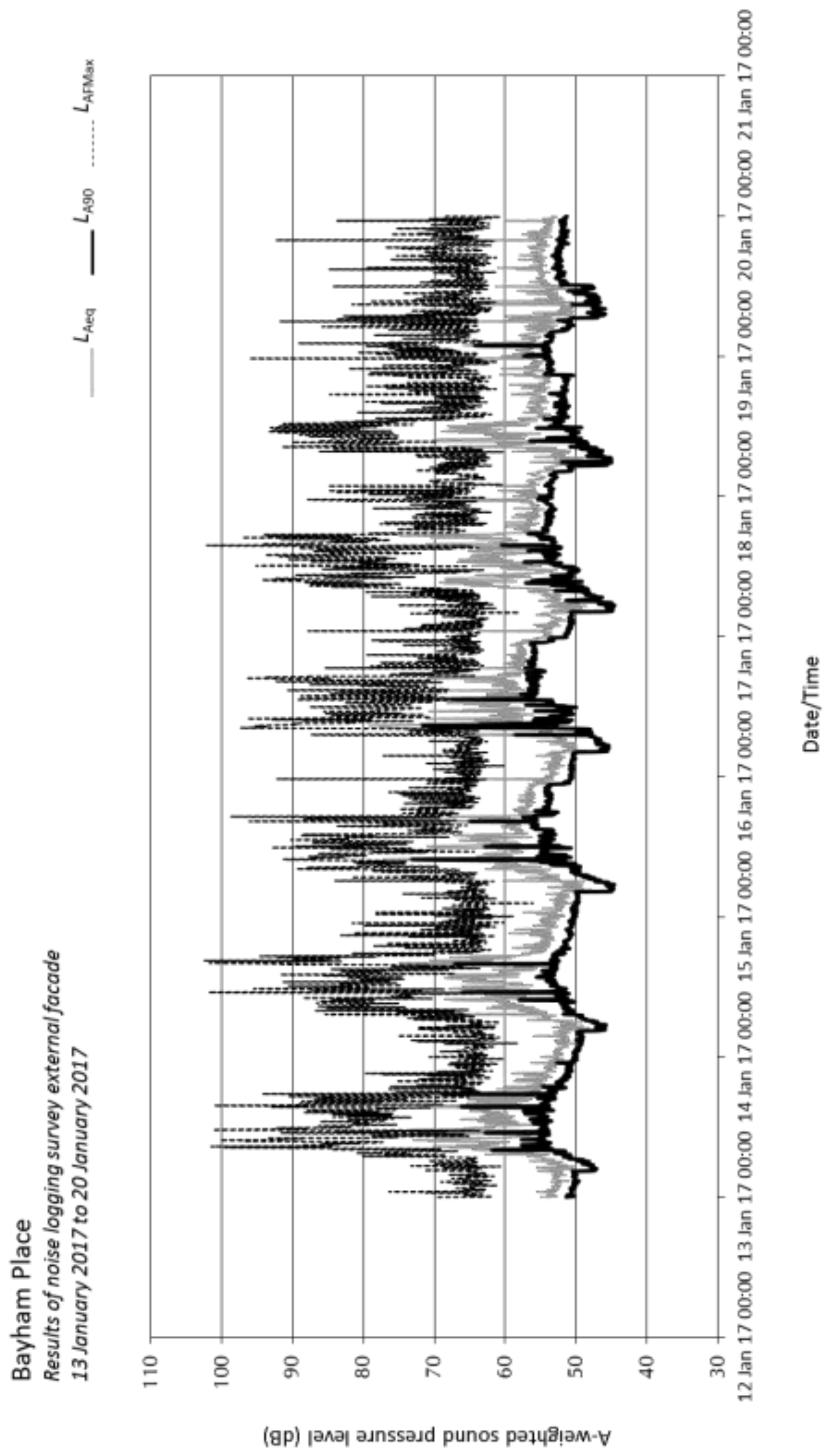
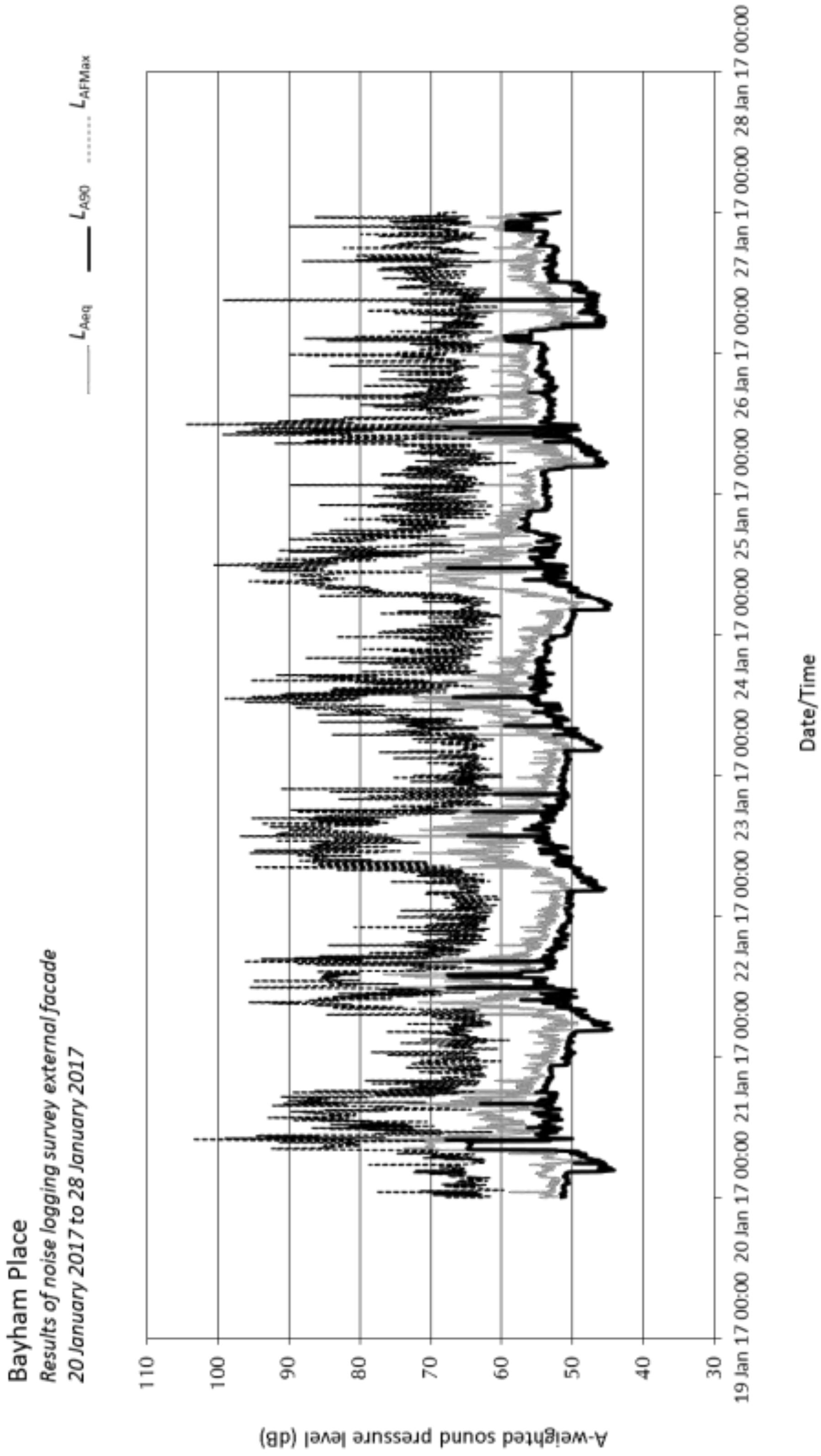
14 Jan 17 00:00
Date/Time


Bayham Place
Results of noise logging survey external facade
13 January 2017 to 20 January 2017
LAeq
LA90
LAFMax
110
100
90
80
70
60
50
40
30
A-weighted sound pressure level (dB)
12 Jan 17 00:00
13 Jan 17 00:00
14 Jan 17 00:00
15 Jan 17 00:00
16 Jan 17 00:00
17 Jan 17 00:00
18 Jan 17 00:00
19 Jan 17 00:00
20 Jan 17 00:00
21 Jan 17 00:00
Date/Time


Bayham Place
Results of noise logging survey external facade
20 January 2017 to 28 January 2017
LAeq
LA90
LAFMax
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
19 Jan 17 00:00
20 Jan 17 00:00
21 Jan 17 00:00
22 Jan 17 00:00
23 Jan 17 00:00
24 Jan 17 00:00
25 Jan 17 00:00
26 Jan 17 00:00
27 Jan 17 00:00
28 Jan 17 00:00
Date/Time

SANDY BROWN

Consultants in Acoustics, Noise & Vibration