

Planning Condition 33 Boiler Design Note

Project Kenavon Drive
 Subject Acoustics
 Project no 043261
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1	Design Note for Issue	DH	17/02/2021	MH

1 Introduction

Buro Happold has been appointed by Berkeley Homes (Western) to provide acoustic consultancy on the Kenavon Drive residential led, mixed-use development. The development is located at the site of the former Huntley Warf commercial development, which is bound by Kenavon Dr. to the north, Frobury Rd to the west, Blake's Wharf and the river Kennet to the south and Gas Works Rd to the east.

The purpose of this Design Note is to summarise the findings of a Buro Happold noise survey, conducted to identify the noise associated with the operation of the fixed boiler plant serving the development.

It is important that noise associated with the operation of any fixed mechanical plant, which serves the development, does not unduly disturb the nearby noise-sensitive receivers. Whilst considering existing residential NSRs (Berkshire Rooms, Meridian House), the assessment in this report applies plant design levels to the facades of sensitive residential receivers within the proposed development itself (in accordance with Planning Condition 33). The development site and existing NSRs are shown in Figure 1—1.



Figure 1—1 Site map & nearest NSRs (Source: Google Maps)

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2 Acoustic Design Guidance for Noise Generating Plant

2.1 Reference Codes and Standards

This acoustic design report references the following list of codes and standards:

- British Standard 4142:2014+A1:2019; *Methods for rating and assessing industrial and commercial sound*.
- Reading Borough Council, 2019, *Local Planning Policy*.

2.2 Reading Borough Council, Local Planning Policy Review

The Reading Borough Council's local planning policy provides guidance that informs the design of the Kenavon Drive development.

Figure 2—1 details the limiting noise levels for noise generating equipment at the development from Reading Borough Council's local planning policy, EN17. The criteria is in line with BS 4142:2014+A1:2019, setting a rating noise limit ($L_{Ar,Tr}$ dB(A)) that is 10 dB below the existing background noise level ($L_{90,T}$ dB(A)). As noted in the planning policy, this level difference avoids the potential of 'background creep' – where new plant installations cause incremental increases to background noise climate of an area.

The Kenavon Drive development is also subject to specific planning conditions relating to noise break-out. Planning Condition 33 (shown in Figure 2—2) stipulates a further requirement to set rating noise limits on all 'sensitive façades', inclusive of the residential receivers within the proposed development itself.

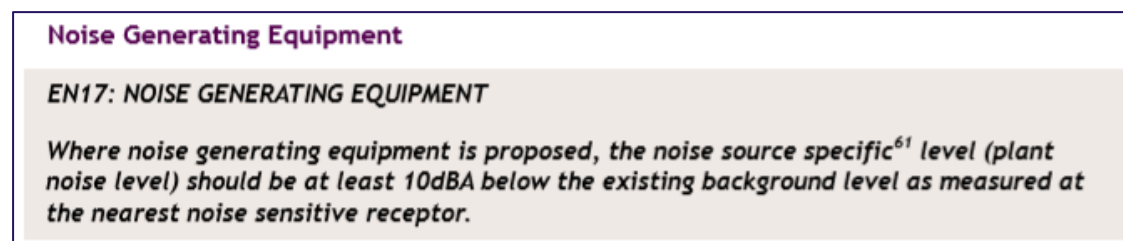


Figure 2—1 Reading Borough Council's local planning policy. EN17: Noise Generating Equipment background level limits

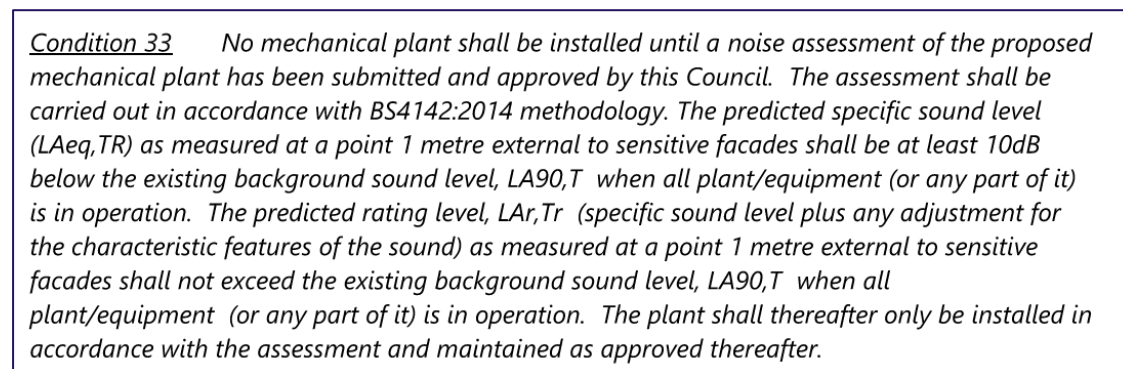


Figure 2—2 Kenavon Drive planning condition 33

3 Acoustic Assessment of Boiler Operation

3.1 Introduction

Buro Happold visited the Kenavon Drive site on the 4th February 2021, conducting measurements under two conditions, when the developments boiler units are operational and non-operational.

The results from this survey are used to evaluate the noise breakout from the boiler flues against Planning Condition 33 requirements, identifying the suitability of existing sound pressure levels from the efflux points or need for further attenuation methods.

3.2 Boiler Assessment Conditions

Five Hoval Ultragas 1150 boiler units (individual unit shown in Figure 3—1) are situated in the development's energy centre for the purpose of supplying residents with heating. Exhaust gases escape from the plant compound by flues that terminate at roof level of the central block (Core M2).

For the investigation of operational noise from the plant flues, the following conditions were employed during the noise survey. These are considered to represent a worst-case scenario for residential heating use.

- Four out of the five boiler units are operational
- Each of the four boilers operating at 70% of their peak load.



Figure 3—1 Hoval
(Source: UltraGas® (125-1550) | Hoval)

3.3 Measurement Locations

Noise levels were recorded at the façade of two residential locations. These were selected to provide a description of the boiler noise impact at various development elevations, in particular those adjacent to due to the flue path (L1) and with a direct line of sight to the efflux termination from the upper level measurement (L2). The monitoring locations are shown in Figure 3—2. A markup of an on-site image has also been provided for reference in Appendix A.

The locations represent the following middle block residential spaces:

- **L1:** Level 6 residential apartment window located close to boiler flues.
- **L2:** Level 11 residential apartment window. This is the closest residential element to the boiler flue efflux termination points.

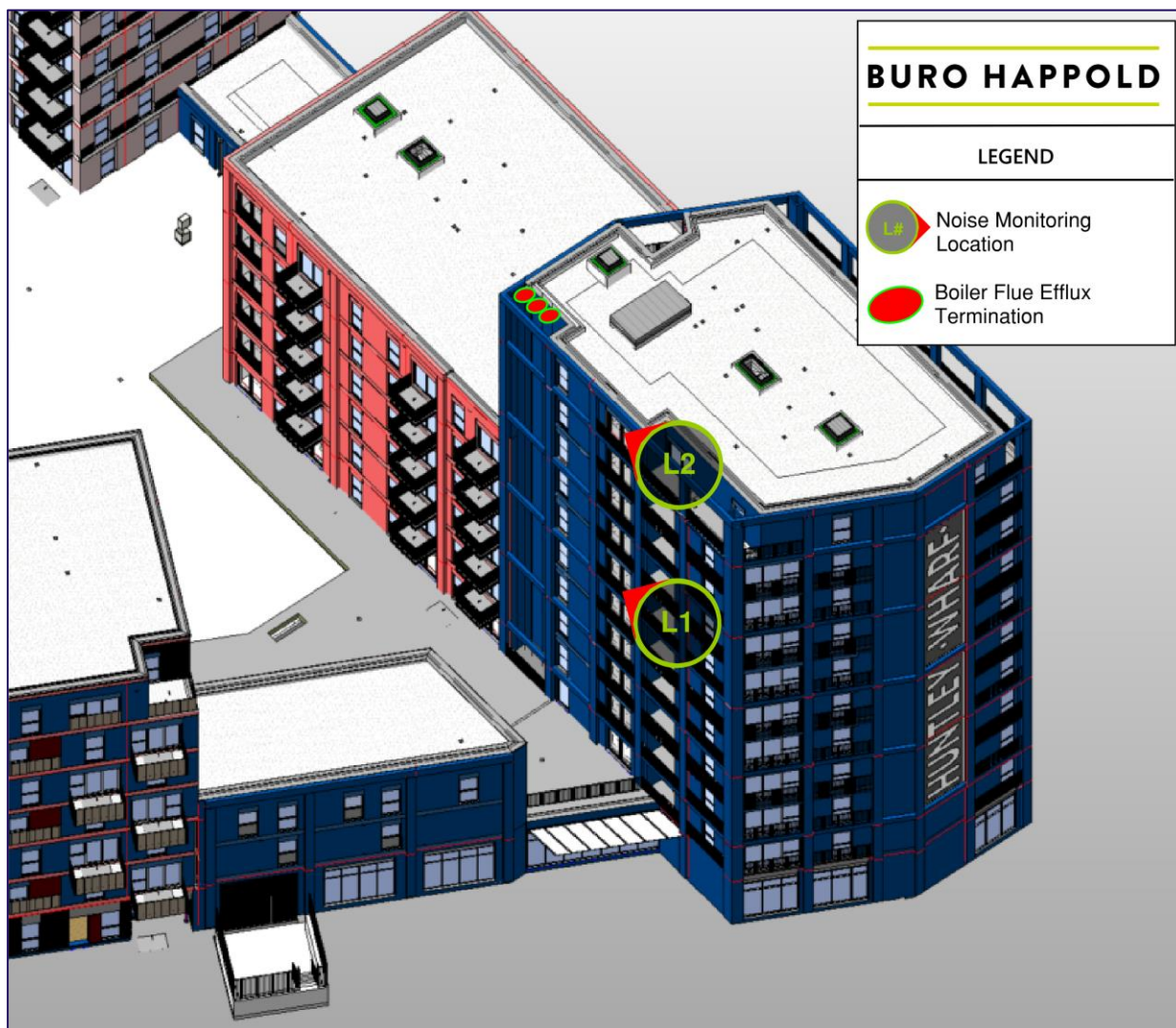


Figure 3—2 Schematic showing the noise monitoring locations around the Kenavon Drive Middle Block

3.4 Limitations

The Kenavon Drive development is currently under construction. This brought about the following limitations to the measurements recorded on site:

- Façades are not yet installed, likely causing higher background noise levels. Increased traffic noise from Forbury Road will have been present in the results due to less building shielding.
- Boiler noise was limited to short 2-minute measurement periods due to the operational time of the plant units under a zero-usage scenario.

3.5 Noise Survey Results

3.5.1 Introduction

A summary of the results of the survey are shown in Table 3—1 to Table 3—2. The explanation of the measurement indices are as follows:

- **$L_{eq,T}$** – the average sound pressure level within a measurement period (1 min intervals were considered due to the feasible operational time of the boiler flues). Typically thought of as the average ambient noise level at a particular time, and likely to be due to a combination of various noise sources, near and far. $L_{eq,T}$ results in Table 3—1 to Table 3—2 show the logarithmic average of on-site measurements.
- **$L_{90,T}$** – the sound pressure level exceeded for 90% of the measurement period i.e. a level which would be perceived as a constant, background noise level. Typically, largely unaffected by local traffic pass-byes or by transient events. More usually attributable to background noise such as distant road traffic or building services such as the operation of boilers (e.g. what you would hear when there is no local traffic or other readily identifiable noise source present). $L_{eq,90}$ results in Table 3—1 to Table 3—2 show the logarithmic average of on-site measurements. $L_{90,T}$ results in Table 3—1 to Table 3—2 show the lowest measured background noise levels from on-site measurements without operational boilers, and the highest $L_{90,T}$ results with operational boilers (worst-case assessment condition).

3.5.2 Recorded Data

Table 3—1 Summary of Results at Location 2

Boiler Condition	Acoustic Descriptor	Broadband Measurement (dB)	Sound Pressure Level (dB) at octave band centre frequencies (Hz)										
			16	31.5	63	125	250	500	1000	2000	4000	8000	16000
On	$L_{eq,T}$	59.8	59	62	63	54	54	54	57	53	45	35	23
	$L_{90,T}$	54.1	52	58	57	50	50	48	51	47	40	31	19
Off	$L_{eq,T}$	58.7	59	62	62	53	53	53	56	51	42	37	27
	$L_{90,T}$	53.8	52	57	56	49	50	47	51	46	38	31	19

Table 3—2 Summary of Results at Location 3

Boiler Condition	Acoustic Descriptor	Broadband Measurement (dB)	Sound Pressure Level (dB) at octave band centre frequencies (Hz)										
			16	31.5	63	125	250	500	1000	2000	4000	8000	16000
On	$L_{eq,T}$	58.9	60	66	64	58	58	54	55	51	44	34	20
	$L_{90,T}$	55.0	53	62	59	53	52	49	51	47	38	27	16
Off	$L_{eq,T}$	57.7	57	66	65	56	56	54	54	50	42	31	19
	$L_{90,T}$	55.2	52	63	59	53	53	51	52	48	39	27	16

3.5.3 Noise level changes due to boiler operation

The following table details the difference in the measured $L_{90,T}$ noise levels due to the operation of the Kenavon Drive boilers (in a worst-case scenario).

Table 3—3 Difference in $L_{90,T}$ sound pressure levels between the operational and non-operational boiler flue measurement conditions

Measurement Location	Broadband Difference (dB)	Sound Pressure Level difference (dB) at octave band centre frequencies (Hz)										
		16	31.5	63	125	250	500	1000	2000	4000	8000	16000
L1	0.3	0.0	0.0	1.2	0.7	0.2	0.6	-0.3	0.6	1.3	-0.1	-0.4
L2	-1.3	0.9	-1.5	-0.6	-0.6	-1.0	-1.6	-1.2	-1.2	-1.4	-0.1	0.1

3.6 BS 4142:2014+A1:2019 Rating Level Corrections

Planning Condition 33 stipulates the requirement for a BS 4142:2014+A1:2019 assessment methodology.

In addition to the noise level difference caused by boiler operation, in-situ measurements require penalty corrections for acoustically distinguishable features. Planning Condition 33 acceptability is therefore also subject to alterations if the plant equipment selections include tonal, impulsive or intermittent noise features.

Buro Happold have considerable experience of mechanical plant. All Buro Happold staff are (minimum) degree-qualified engineering consultants in acoustics or a related discipline. Acoustics staff members involved in this scheme are corporate members of the Institute of Acoustics and therefore considered suitably qualified to make the following assessments.

3.6.1 Impulsivity

The boilers are not considered to have particularly steep 'ramp up' levels, nor do either have any features which rapidly interrupt the sound generation. On this basis, no corrections for impulsivity are considered to be required.

3.6.2 Intermittency

There was no acoustically distinguishing feature identified during the ramp up and then down of the four boilers operating during the noise survey. On this basis, no corrections for intermittency are considered to be required.

3.6.3 Tonality

Whilst noise associated air movement can create tonal features, the combination of the sound associated with the motors, air displacement and turbulence was shown in Appendix B to not produce tonal features. No corrections for tonality are therefore considered to be required.

4 Conclusion

In-situ noise measurements of the boiler flues under high load operation demonstrated negligible noise impacts at the Kenavon Drive residential facades. Shown in Table 3—3 the $L_{90,T}$ noise climate was unaffected at the Level 6 residential façade (+0.3dB change), whilst a lower $L_{90,T}$ noise level was measured at the nearest residential glazing element to the flue efflux terminations (level 11 apartment façade).

Note: The suitably qualified engineer taking measurements on-site also noted that any noise from the boiler flues could not be subjectively distinguished from the ambient noise climate at the measurement locations during the survey.

Against these survey results, it is considered that the boiler flues will operate with a noise level that is ≥ 10 dB below the $L_{90,T}$ background noise climate at the nearest sensitive receivers. The boilers flues are therefore considered to be acceptable, in accordance with Planning Condition 33 criteria.

Appendix A

View of the Kenavon Drive Development at the time of Measurements and the Survey Monitoring Locations

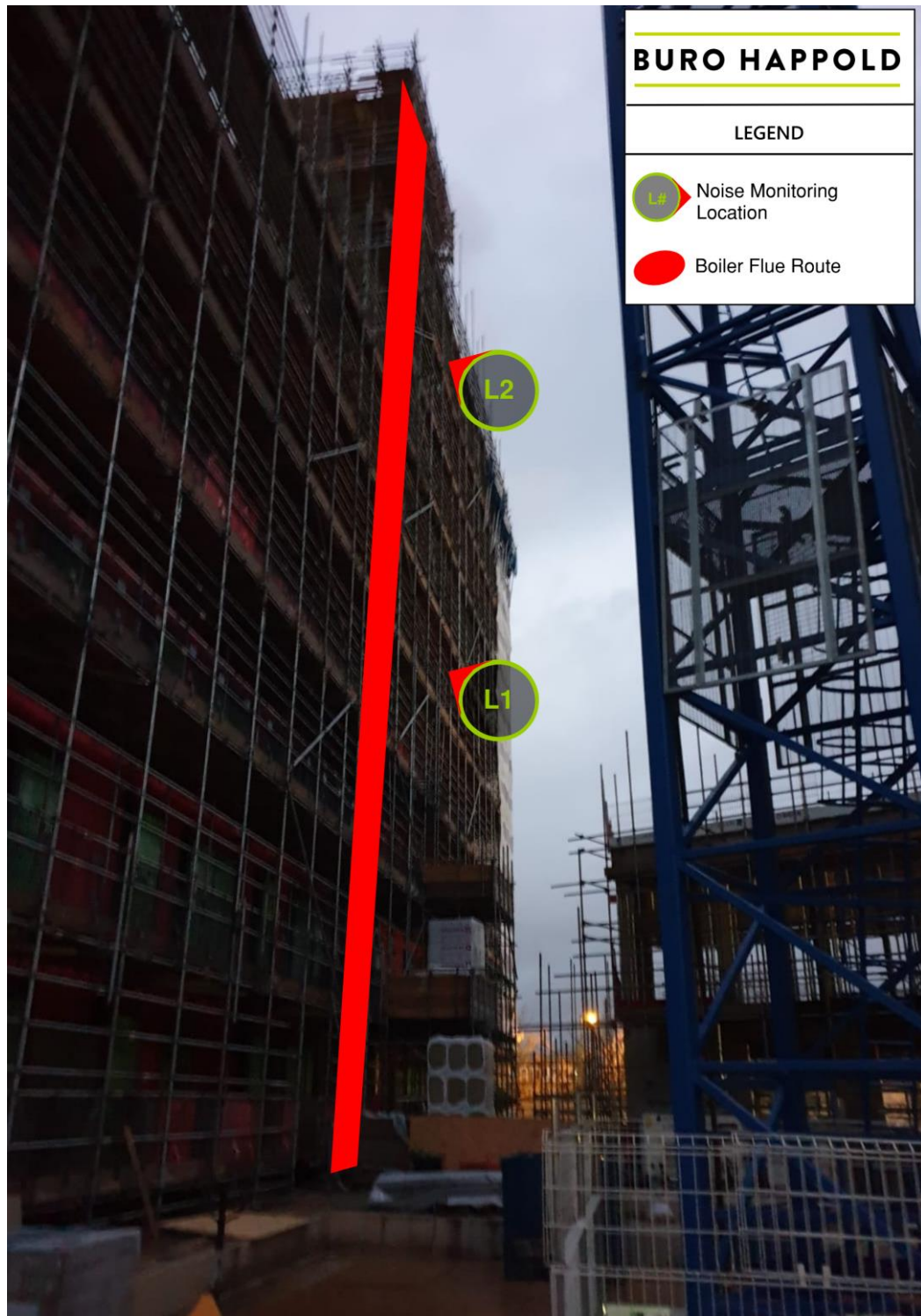


Figure 0—1 Image shown the Kenavon Drive development at the time of the noise survey. Monitoring and flue locations are marked on the image for reference

Appendix B

Boiler Flue Tonality Assessment

The test for the presence of a prominent, discrete-frequency spectral component (tone) is conducted below, by comparing the $L_{Z99,T}$ sound pressure level in a one-third-octave band during boiler flue operations to the $L_{Z99,T}$ sound pressure level in the adjacent one-third-octave band

For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third-octave bands by some constant level difference.

The level differences between adjacent one-third-octave bands that identify a tone are:

- 15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);
- 8 dB in middle-frequency one-third-octave bands (160 Hz to 400 Hz);
- 5 dB in high-frequency one-third-octave bands (500 Hz to 10 000 Hz).

Table 0—1 Tonality assessment against the $L_{99,T}$

Frequency Band	$L_{99,T}$ Measurement at Monitoring Location 3 (dB)	Difference between adjacent octave band (dB)
12.5 Hz	41.00	-
16 Hz	42.50	2
20 Hz	45.60	3
25 Hz	49.30	4
31.5 Hz	52.90	4
40 Hz	60.00	7
50 Hz	53.10	-7
63 Hz	52.00	-1
80 Hz	48.80	-3
100 Hz	47.20	-2
125 Hz	46.80	0
160 Hz	46.40	0
200 Hz	48.30	2
250 Hz	46.30	-2
315 Hz	45.30	-1
400 Hz	43.80	-2
500 Hz	45.70	2
630 Hz	44.40	-1
800 Hz	45.70	1
1 kHz	47.20	2
1.25 kHz	45.50	-2
1.6 kHz	43.80	-2
2 kHz	41.70	-2
2.5 kHz	39.00	-3
3.15 kHz	36.30	-3
4 kHz	33.00	-3

Frequency Band	L _{99,T} Measurement at Monitoring Location 3 (dB)	Difference between adjacent octave band (dB)
5 kHz	29.30	-4
6.3 kHz	23.90	-5
8 kHz	20.30	-4
10 kHz	16.10	-4
12.5 kHz	12.50	-4
16 kHz	10.00	-3
20 kHz	7.50	-3

Against the BS4142:2014+A1:2019 criteria, Table 0—1 shows the Kenavon Drive boilers to not produce tonal features.