



Project:	Royal Court, Kings Road, Reading		
Client:	Dr Bizzari		
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1 Introduction

Paragon Acoustic Consultants Ltd has been commissioned by Dr Bizzari to conduct an environmental noise survey to obtain statistical noise data to characterise the existing local background and ambient noise climate at the site and to derive noise limits to atmosphere based on Local Authority Noise Policy and other relevant guideline documents. This information shall be used at the appropriate stage of the project to determine if the proposed new mechanical plant selections will meet with the derived noise limits.

If deemed necessary, effective mitigation measures shall be introduced as necessary to achieve the Local Authority Noise Policy requirements.

The operational period of the proposed mechanical plant is understood to be 08:00 hours to 20:00 hours inclusive.

2 Site Description

The site under consideration is situated at Royal Court, Kings Road, Reading, and is to comprise conversion of a restaurant to provide a new café and new residential accommodation. The latter aspect of the proposed scheme is not considered herein.

The site lies in area that contains a mix of residential dwellings, commercial premises and retail outlets.

Royal Court is a five storey building predominantly containing residential dwellings. It is of traditional masonry construction and features openable double glazed windows and French doors.

The site is bounded to the north by the River Kennet, beyond which is the A329 Kings Road. A number of four storey office buildings are located in this aspect including the premises occupied by Prudential Reading.

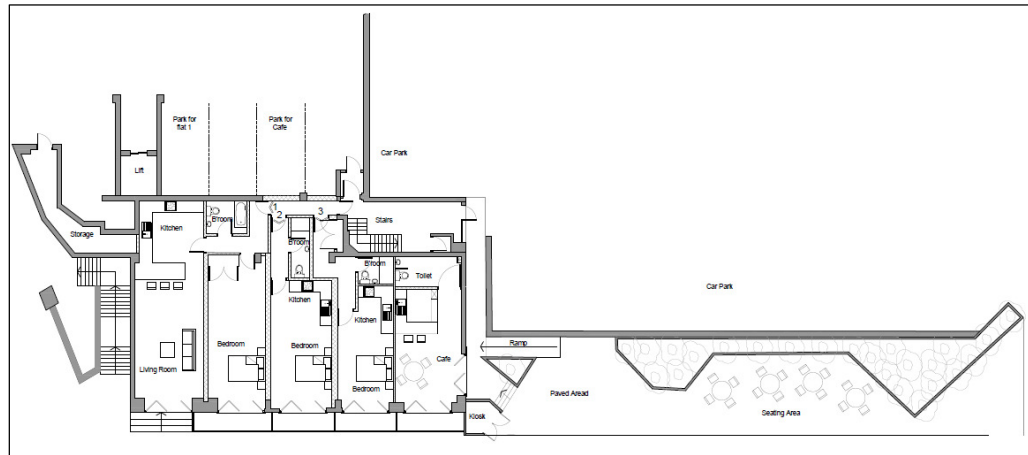
Immediately to the west of site is the HM Revenue and Customs Building, known as Sapphire Plaza, which extends to four storeys in height and is possessed of sealed double glazed fenestration.

The site location and internal layout of the proposed scheme is illustrated in Figures 1 and 2 below.

Figure 1: Site Location



Figure 2: Proposed lower ground floor layout (source: Bluebird Design Services drawing A-1010)



The dominant noise source affecting the site was due to road traffic movements along Kings Road and Watlington Street. No other significant noise sources were evident during the survey period.

3 Environmental Noise Surveys

3.1 Method

As noted at Section 1, the proposed operational period of mechanical services equipment serving the café is 08:00 hours to 20:00 hours inclusive. Attended noise monitoring was undertaken on 14 January 2019 between 18:00 and 20:00 hours at the location described below and illustrated by Figure 3.

- MP1: Ground floor Terrace area to the north of Royal Court car park (approx. 51° 27' 16"N, 0° -57' -40" W)

Figure 3: Noise monitoring position



The microphone was tripod mounted such that the microphone diaphragm was 1.5m above local ground level and positioned at least 3m from any reflecting surfaces other than the ground plane.

The measurements were obtained using the instrumentation scheduled below, which complies with the Type 1 specification of IEC 60651 and IEC 60804, Class 1 specification of IEC 61260 and IEC 61672 and Class 1 of IEC 60942 as applicable.

Field calibration checks were made at the beginning and end of each measurement session. No significant drift was encountered, calibration level with matched calibrator 113.8 dB(A) (± 0.2 dB @ 1000 Hz $\pm 0.2\%$), observed drift 0.1 dB.

Table 1: Equipment Details

Equipment Description and Serial Number	Manufacturer	Model Number	Calibration certificate number	Calibration expiry date
Sound level analyser, s/n 31663	Norsonic	NOR 118	U28129	16/03/2020
Microphone, s/n 65276	Norsonic	NOR 1225	U28129	16/03/2020
Acoustic Calibrator, s/n 31313	Norsonic	NOR 1251	U28128	16/03/2020
Preamplifier, s/n 30342	Norsonic	NOR 1206	U28128	16/03/2020

Various statistical broad-band and spectral sound pressure level measurements were obtained during the survey. A measurement time interval $T_m = 30$ minutes was used for sampling. Measurements of the percentile level $L_{A90,T}$ were made using time weighting F as per sub clause 3.4 of BS 4142:2014.

The quantities recorded included:

- $L_{Aeq,T}$: the equivalent continuous A-weighted sound pressure level over the measurement period, T;
- L_{AFmax} : the maximum A-weighted sound pressure level for the measurement period;
- $L_{AF90%,T}$: the A-weighted sound pressure level exceeded for 90% of the measurement period, T.

Weather conditions¹ during the survey were typically as per Table 2 below.

Table 2: Typical weather data during survey period

Day and Date	Temperature		Average Humidity	Average Pressure	Average wind speed	Precip.
	Min	Max				
Monday 14/01/2019	4° C	10° C	74%	1022 hPa	<2 ms ⁻¹	0 mm

3.2 Results

The measured survey data is reproduced in Appendix A and summarised as broadband quantities applicable to the plant operational period, as below.

Table 3: Summary of Environmental Noise Levels

Measurement position	Free field sound pressure level, dB re 20μPa		
	$L_{Aeq,30min}$	L_{AFmax}	$L_{AF90,30min}$
MP1	59 dB	63-67 dB	51-53 dB

¹ Weather station Redaing114

4 Evaluation of External Noise Criteria

4.1 Noise Sensitive Properties

Planning application advice has been given by Reading Borough Council which states:

Applications which include noise generating plant when there are nearby noise sensitive receptors should be accompanied by an acoustic assessment carried out in accordance with BS4142:2014 methodology

BS 4142:2014: “Methods for rating and assessing industrial and commercial sound” describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations which comprise mechanical and electrical plant and equipment.

The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The standard provides a method for correcting the specific sound levels so as to account for acoustic features that are present at the assessment location (scaled corrections up to +6 dB for tones and up to +9 dB for impulses, depending upon the prominence of the tones or impulses, as well as +3 dB corrections for other sound characteristics).

Where characteristics likely to affect perception and response are present in the specific sound within the same reference period; then the applicable corrections ought normally to be added arithmetically. However, if any single feature is dominant, to the exclusion of the others, then it may be appropriate to apply a reduced, or even zero, correction to the minor characteristics.

Whereas the 1997 edition of BS4142 assess likelihood of complaints, the 2014 edition was revised to use assessment of adverse impacts. This change was introduced because the likelihood of complaints is not a particularly appropriate benchmark, especially when it is used in a planning context, and it also aligns the standard more closely with the type of language and benchmarks that are suitable for the assessment of sound at the planning stage, e.g., for new proposed development. The 2014 edition of the standard continues to use the difference between the rating level and the background sound level:

- a) Typically, the greater this difference, the greater the magnitude of the impact.
- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.”

It can also be seen that the range of assessment outcomes has been reduced and it is now suggested that rating levels equal to the background would indicate a low impact. This is in contrast to the earlier edition which gave indications of the likelihood of complaints based upon differences ranging between +10 and -10 dB.

It is important to note that the numerical outcome only represents the **initial** estimate of impact, as noted in the first paragraph of Clause 11 of the standard, and that contextual matters should be considered **before** determining what the potential impact is.

The context includes consideration of pertinent factors, such as:

- The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound;
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

For the purposes of this assessment, it is considered that a target noise level should be set having regard to both background and residual sound levels. It is therefore proposed that a rating level of the sound from the proposed new plant be set to a value 5 dB below the typical background sound level at the assessment location.

4.2 Commercial Properties

It is considered appropriate to assess noise emissions to commercial properties in line with the guidelines provided in BS 8233:2014.

Table 4: Typical noise levels in non-domestic buildings (source: BS8233:2014, Table 6)

Activity	Location	Design range dB $L_{Aeq, T}$
Speech or telephone communications	Department store	50 – 55
	Cafeteria, canteen, kitchen	
	Concourse	45 – 55
Study and work requiring concentration	Corridor, circulation space	
	Library, gallery, museum	40 – 50
	Staff/meeting room, training room	35 – 45
Listening	Executive office	35 – 40
	Place of worship, counselling, meditation, relaxation	30 – 35

Table 5: Indoor ambient noise levels in unoccupied spaces (source: BS8233:2014, Table 2)

Objective	Typical situations	Design range $L_{Aeq,T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Restaurant	40 – 55
	Open plan office	45 – 50
	Night club, public house	40 – 45
	Ballroom, banqueting hall	35 – 40
	Living room	35 – 40

NOTE See Noise control in building services [28] and BS EN ISO 3382.

In view of the details presented above it is considered reasonable to adopt an indoor noise criterion of 45 dB $L_{Aeq,T}$ for commercial office space in the proximity of the site.

It is also reasonable to consider a noise criterion external to commercial property windows that takes account of the internal design range, plus the loss expected through an openable window. In a research study conducted for DEFRA NANR116: “Open/Closed Window Research”, numerous references are provided which quantify losses through open and partially open windows:

Table 6: DEFRA NANR16 Summary of findings

Information Source	Summary of Findings
PPG 24 (1994) ^[2]	A reduction of 13 dB(A) from the facade level is assumed for an open window
WHO (1999) ^[4]	A reduction of 15 dB from the facade level is assumed for a partially open window. (no reference)
BS 8233 (1999) ^[5]	Windows providing rapid ventilation and summer cooling are assumed to provide 10 - 15 dB attenuation (no specific reference)
BRE Digest 338 (1988) ^[6]	A partly open window has an averaged level difference, $D_{1m;av100-3150}$ of 15 dB
DoE Design Bulletin 26 (1972) ^[7]	A reduction of 5 dB(A) with a window wide open
Nelson - Transportation Noise (1987) ^[8]	Sound insulation of an open single window is 5 – 15 dB. (theoretical)
Mackenzie & Williamson DoE Report (1972–73) ^{[9],[10]}	A vertical sliding sash window open 0.027 m ² (summer night-time ventilation) and 0.36 m ² (daytime summer ventilation) provided a sound level reduction of 16 and 11 dB(A) respectively. (Lab Study)
Kerry and Ford (1973 – 74) ^{[11],[12]}	A horizontal sliding sash window open 25 mm and 200 mm provided averaged sound reduction indices, R_{av} of 14 and 9 dB respectively. (Field Study)
Lawrence and Burgess (1982 – 83) ^{[13],[14]}	A vertical sliding sash open 9% of the total façade provided a sound reduction index R_w 10 dB. (Field study)
Hopkins (2004) ^[15]	Road traffic noise reductions through window openings resulted in reductions of between $D_{2m,n,T}$ 8 and 14 dB. (Field Study)

Table 1.1 Summary of open-window acoustic transmission literature

The findings of the study are referenced in this report to substantiate the use of a 13 dB(A) loss through a partially open window. This leads to a limiting noise criteria of 58 dB $L_{Aeq,T}$ at a position 1 metre outside the window of the nearest exposed 3rd party commercial property.

4.3 External Noise Criteria

The derived external noise criteria which the new building services plant shall be required to achieve are shown below:

Table 7: Limiting noise criteria applicable at affected premises

Plant Location	Receptor	Daytime 08:00-20:00 $L_{Aeq,(60\text{ min})}$
Any Location on the site	Residential dwellings	47 dB [1] [2] [3]
Any Location on the site	Commercial premises	58 dB [3]
Notes:		
[1] Penalty for tone(s) +2 dB shall be applied for a tone that is just perceptible at the noise receptor; or +4 dB shall be applied for a tone that is clearly perceptible at the noise receptor; or +6 dB shall be applied for a tone that is highly perceptible at the noise receptor		
[2] Penalty for impulses +3 dB shall be applied for an impulse that is just perceptible at the noise receptor; or +6 dB shall be applied for an impulse that is clearly perceptible at the noise receptor; or +9 dB shall be applied for an impulse that is highly perceptible at the noise receptor		
[3] The limiting noise levels are deemed to be considered at a position 1 metre outside the nearest affected premises		

5 Conclusions

A detailed environmental noise survey has been undertaken to determine the underlying ambient and background noise climate.

Appropriate external noise criteria have been identified on the basis of Local Authority noise policy, and other industry standards and references. The external noise criteria detailed herein will be used in the future selection of mechanical plant and any noise mitigation scheme necessary.

With due consideration to achieving compliance with these external noise criteria, future objections would not be expected in respect of noise emissions from any new fixed mechanical plant which may form part of the planning application.

Appendix A: Measurement Results

Date	Duration	LAeq	LAmaz	LAF90
(2019/01/14 18:06:35.00)	(0:30:0.0)	58.9	63.2	52.5
(2019/01/14 18:36:35.00)	(0:30:0.0)	58.7	65.6	50.8
(2019/01/14 19:06:35.00)	(0:30:0.0)	58.8	67.3	51.9
(2019/01/14 19:36:35.00)	(0:30:0.0)	58.8	64.7	51.4

Sound pressure level, Leq dB at 1/1 octave band centre frequency Hz

Date	Duration	63 Hz	125 Hz	250 Hz	500 Hz	1.0 kHz	2.0 kHz	4.0 kHz	8.0 kHz
(2019/01/14 18:06:35.00)	(0:30:0.0)	68.8	60.6	53.3	52.4	56.3	51.6	39.3	28.8
(2019/01/14 18:36:35.00)	(0:30:0.0)	69.5	60.9	54.1	52.9	55.8	51.2	39.8	28.0
(2019/01/14 19:06:35.00)	(0:30:0.0)	70.9	60.0	53.6	52.4	56.1	51.6	39.4	25.4
(2019/01/14 19:36:35.00)	(0:30:0.0)	69.9	61.6	53.8	52.6	56.0	51.4	39.7	26.3

Sound pressure level, Lmax dB at 1/1 octave band centre frequency Hz

Date	Duration	63 Hz	125 Hz	250 Hz	500 Hz	1.0 kHz	2.0 kHz	4.0 kHz	8.0 kHz
(2019/01/14 18:06:35.00)	(0:30:0.0)	81.2	75.1	62.0	58.6	61.1	56.1	51.6	49.7
(2019/01/14 18:36:35.00)	(0:30:0.0)	82.2	75.5	63.3	63.5	62.6	59.1	54.0	48.3
(2019/01/14 19:06:35.00)	(0:30:0.0)	82.9	71.9	65.9	58.8	66.1	59.4	48.9	42.0
(2019/01/14 19:36:35.00)	(0:30:0.0)	85.2	77.8	67.7	63.8	62.3	57.2	49.3	47.4

Sound pressure level, LF90 dB at 1/1 octave band centre frequency Hz

Date	Duration	63 Hz	125 Hz	250 Hz	500 Hz	1.0 kHz	2.0 kHz	4.0 kHz	8.0 kHz
(2019/01/14 18:06:35.00)	(0:30:0.0)	59.9	52.3	47.0	46.5	49.8	45.2	32.6	18.0
(2019/01/14 18:36:35.00)	(0:30:0.0)	62.2	52.2	46.9	45.4	47.6	43.0	32.3	17.4
(2019/01/14 19:06:35.00)	(0:30:0.0)	62.4	53.2	46.9	46.5	48.8	44.2	32.9	16.4
(2019/01/14 19:36:35.00)	(0:30:0.0)	60.0	52.0	47.2	45.2	48.3	43.7	30.7	16.5