The Trevor Osborne Property Group

Buxton Crescent Hotel & Spa

Building Services Plant Noise, Planning Condition 24

R02

Issue | May 2011

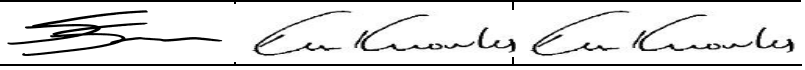
Ove Arup & Partners Ltd
8th Floor
St James's Buildings
Oxford Street
Manchester
M1 6EL
United Kingdom
arup.com

Job number 216069-00

ARUP

Document Verification

ARUP

Job title		Buxton Crescent Hotel & Spa			**Job number** 216069-00
Document title		Building Services Plant Noise, Planning Condition 24			**File reference**
Document ref		R02			
Revision	**Date**	**Filename**	R002_SJS (issue).docx		
Issue	27/05/11	**Description**	First issue		
			Prepared by	Checked by	Approved by
		Name	Steven Swan BEng CEng MIOA MIET	Ian Knowles BSc, AUS, CPhys, MInstP, FIOA	Ian Knowles BSc, AUS, CPhys, MInstP, FIOA
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document Verification with Document	✓

Contents

Appendices

1 Introduction

Arup Acoustics has been appointed to advise on Planning Condition 24, which relates to the control of noise emission of any new building services plant associated with the new hotel and spa development.

In order to advise on this and consider the noise impact resulting from the operation of new services plant on the nearby dwellings it has been necessary to carry out a noise survey around the site. The following report details the results of this survey, the assessment and sets noise criteria to which the new services plant can be designed to achieve the Local Authority requirements.

A description of the acoustic terminology used in this report can be found in Appendix A.

2 Planning Condition 24

We understand that the development is subject to the following condition:

"All inlet and extract ventilation systems shall be fitted with effective silencers in accordance with an acoustic specification to be agreed in writing by the Local Planning Authority. The approved silencers shall be installed prior to the commencement of the use of the development and maintained thereafter."

Following discussions with the Environmental Health Department (Peter Hollingsworth) we understand they require that the noise of any new services plant associated with the building is assessed in line with the requirements of BS4142: 1997 "Method for rating industrial noise affecting mixed residential and industrial areas". This standard provides a method for rating external noise levels from fixed installations such as building services plant, to determine the likelihood of complaints from occupants of nearby residential properties.

This report carries out the BS4142 assessment and provides noise criteria at the nearby dwellings to which the building services plant can be designed. The design of the noise control (silencers, acoustic enclosures etc) to achieve these noise limits is a matter for detailed design, when plant selections, locations, barriers etc have been finalised.

3 Environmental Noise Survey

3.1 Introduction

A noise survey has been carried out around the site to determine typical background noise levels at the nearest noise sensitive receivers (dwellings), which form the basis of the BS4142 assessment and plant noise criteria.

We understand that the majority of the plant will be located at the rear of the building, with some small items located to the front of the building. The measurement locations have been chosen to cover these key plant areas.

3.2 Procedure

Craig Reid of Arup Acoustics carried out the noise survey between 18 and 25 May 2011. The survey was carried out at 4 locations around the site, which are shown on Figure 1.

Sample noise measurements were taken at Positions 1 to 3, and the microphone of the noise meter was located at around 1.2m above local ground level for these measurements. The measurements at Positions 1 to 3 had a minimum duration of 10mins.

A fixed noise monitor was installed in the Crescent Building at Position 4 which continuously measured and logged noise levels every 5 minutes between 18 and 25 May 2011. The microphone of this noise meter was located outside the building, at 2nd floor level and around 1m from the building facade.

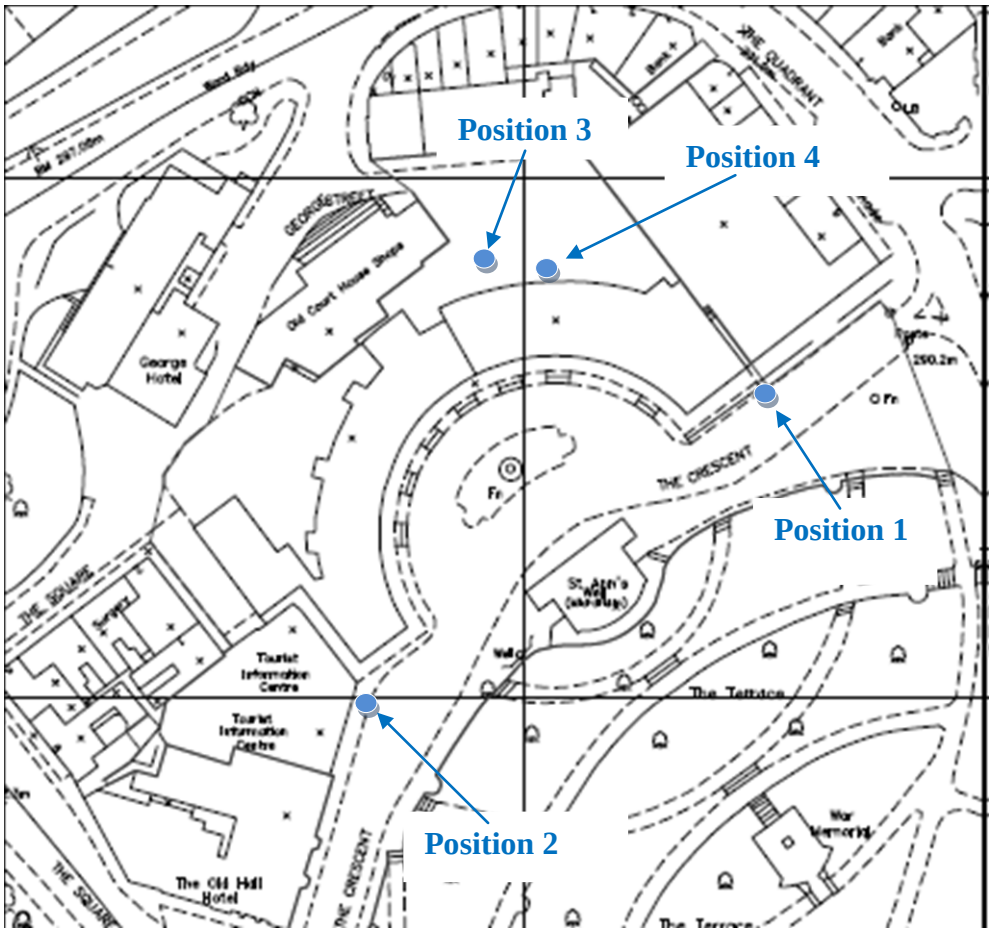


Figure 1 – Site plan showing noise measurement locations

3.3 Measurement equipment

The noise measurements were carried out using the following equipment:

- Manned noise measurements – a Bruel and Kjaer 2260 sound level meter, and Bruel and Kjaer 4231 calibrator.

- Unmanned noise measurements – a Norsonic140 sound level meter, and a Rion NC74 sound pressure level calibrator.

Both sound level meters are Type 1 conforming to BS EN 60804, and their calibration was checked using a calibrator before and after the survey, to confirm there was no significant drift in meter response at the calibrator frequency and level. The meters are annually calibrated and this calibration is traceable to international standards.

3.4 Weather

The weather throughout the manned noise measurements was fine and dry, with light winds.

3.5 Results

3.5.1 Broadband noise data

The results of the sample noise measurements are as follows:

Measurement number	Date	Start time	Statistical Indices			
			L_{A90}	L_{Aeq}	L_{A1}	L_{Amax}
Position 1						
0001.S1A	25-5-11	16:27	53	61	69	81
0003.S1A	25-5-11	17:00	52	60	68	71
0005.S1A	25-5-11	17:32	52	60	68	73
0007.S1A	25-5-11	18:01	51	60	68	73
0009.S1A	25-5-11	19:44	50	57	65	69
0012.S1A	25-5-11	20:39	44	57	65	71
Position 2						
0002.S1A	25-5-11	16:41	43	51	64	67
0004.S1A	25-5-11	17:14	45	53	62	68
0006.S1A	25-5-11	17:46	43	50	60	64
0008.S1A	25-5-11	18:14	43	50	60	68
0010.S1A	25-5-11	19:57	41	48	58	68
0013.S1A	25-5-11	20:51	42	49	58	63
Position 3						
0011.S1A	25-5-11	20:25	48	50	55	70

Table 1: Broad band noise survey results

The results of the continuous unmanned noise measurements at Position 4 are provided in Appendix B. The microphone of the noise meter was located at around 1m from the building facade and so these measurements are classed as being facade noise levels. The minimum day and night-time free-field noise levels have been calculated as follows:

- 43dBL_{A90} daytime (07:00 - 23:00hrs)
- 42dBL_{A90} night time (23:00 - 07:00hrs)

3.5.2 Octave band noise data

Relevant spectra for the above noise measurements are provided as follows:

	Octave Band Centre Frequency, Hz							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Position 1								
0001.S1A, L_{eq}	70	62	59	57	56	53	47	39
0003.S1A, L_{eq}	70	63	59	56	55	51	44	36
0005.S1A, L_{eq}	70	61	58	55	56	52	45	37
0007.S1A, L_{eq}	70	63	59	55	56	52	45	36
0009.S1A, L_{eq}	68	58	55	53	54	49	40	30
00012.S1A, L_{eq}	65	58	56	52	54	51	40	32
Position 2								
0002.S1A, L_{eq}	66	55	52	49	49	48	43	34
0004.S1A, L_{eq}	67	57	55	52	51	49	43	36
0006.S1A, L_{eq}	66	52	52	48	48	46	40	34
0008.S1A, L_{eq}	64	55	51	50	47	47	38	31
0010.S1A, L_{eq}	63	56	52	46	46	45	37	29
0013.S1A, L_{eq}	63	53	49	47	46	46	38	30
Position 3								
0011.S1A, L_{90}	52	49	47	45	42	38	30	20

Table 2: Selected octave band noise data

3.5.3 Noise climate

The noise climate at all locations was observed to be predominantly due to local road traffic noise, which was relatively constant throughout the day and evening. At the rear of the building (Positions 3 & 4), we noted a significant contribution to

the noise climate by building services plant mounted on the roofs of nearby buildings, and vehicles manoeuvring in the carparks.

It was only possible to carry out one noise measurement at Position 3 due to noisy works taking place nearby (cutting flagstones etc). However, the unmanned noise measurements (Position 4) adequately represent the noise climate at the rear of the building.

4 Plant Noise Assessment/Criteria

The BS4142 method is based on the difference between the Background Noise Level (ie without the plant noise) and the Rating Noise Level of the plant at the receiver location. The noise level of the plant (called the Specific Noise Level) is weighted by 5dB where it has an identifiable character (such as tonality, impulsiveness or intermittency) and by 0dB if there are no such features. This level then becomes the Rating Level. The Rating Level is subtracted from the Background Noise Level and the difference used to assess the likelihood of complaints as shown below.

Difference between Rating and Background Noise Level	**Assessment**
10dB or higher	Complaints likely
5dB	Of marginal significance
-10dB	Positive indication that complaints are unlikely

Table 3: Summary of BS4142 rating method

As discussed in Section 2, we understand the Environmental Health Department require that the Rating Noise Level of any new plant at the nearest noise sensitive building (dwellings etc) does not exceed the existing background noise levels, ie a difference between the Rating and Background Noise Level of 0dB. BS 4142 does not have a specific assessment for this difference, although it can be seen that such a margin is between a “Positive indication that complaints are unlikely” and the plant noise being “Of marginal significance”. This represents a good standard.

As can be seen from Section 3, the minimum background noise levels measured during the noise survey at the rear of the building (Position 4 - unmanned position) were 43dBL_{A90} between 07:00 & 23:00hrs and 42dBL_{A90} between 23:00 & 07:00hrs. The minimum noise level measured at the front of the building was 41dBL_{A90} between 07:00 & 23:00hrs. Since there is little difference between the minimum noise levels with time and location we propose that the plant noise criterion is based on 41dB$L_{A90.}$

Therefore in order to achieve the requirements of the Environmental Health Department, the total plant noise level must not exceed 41dBL_{Aeq} when measured at 1m from the facade of the nearest residential property. If the plant noise exhibits any noticeable characteristics (eg tones, impulses etc) then the above noise limit must be reduced by 5dB.

We understand that plant operating times are not known in detail at this stage; however, since the development is a hotel, the majority of plant could operate at any time during the day or night. The above noise limit is applicable to day or night-time operation and so gives maximum flexibility. However, if certain items of plant will only run over specified times (ie just during the daytime when background noise levels are higher) it would be possible to relax the above noise limit (for the relevant plant items) and still achieve the standards required by the Environmental Health Department. We would be happy to advise further on this as necessary.

5 Conclusions

This report considers the impact of the noise of any new services plant on the nearby dwellings, which is the subject of Planning Condition 24.

Following discussions with the Environmental Health Department we understand they require that the noise of any new plant be assessed in line with BS4142, and noise criteria set to which the plant can be designed. BS4142 assesses noise in relation to the existing background noise levels at the site, and so a noise survey has been carried out to establish these.

Based on the results of the noise survey, the plant noise emission limits to achieve the requirements of the Environmental Health Department and Planning Condition 24 are as follows:

> *The total plant noise level must not exceed 41dBL_{Aeq} when measured at 1m from the facade of the nearest residential property. If the plant noise exhibits any noticeable characteristics (eg tones, impulses etc) then this noise limit must be reduced by 5dB.*

The design of the noise control (silencers, acoustic enclosures etc) to achieve the above noise limit will be carried out during detailed design when plant selections, locations etc are finalised.

Appendix A

Acoustic Terminology

A1 Acoustic Terminology

Decibel (dB)

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

Frequency

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, eg 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

Sound Pressure Level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (L_p) is 10 times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10^{-5}Pa (the threshold of hearing).

Thus L_p (dB) = 10 log $(P1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (ie $2x10^{-5}$ Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dBL_A and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Statistical Noise Levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for ten per cent of the time period under consideration, has been adopted in this country for the assessment of road traffic noise. The L_{90}, the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for one per cent of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, eg dB$L_{A10,\ 5min}$ or dB $L_{A90,\ 8hr}$.

Appendix B

Graph of continuous noise measurements

B1 Continuous noise measurements at Position 4, 18/5/11 to 25/5/11