Bickerdike Allen Partners
Architecture
Acoustics
Technology

LONDON CITY AIRPORT

AIRCRAFT NOISE SURVEY

BRIXTON

Report to

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A6209-R016-NW
09 August 2016

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Acoustic Consultants: Expertise in planning and noise, the control of noise and vibration and the sound insulation and acoustic treatment of buildings.

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This report has been redacted to remove identifiable details of the survey location to comply with GDPR.

1.0 INTRODUCTION

Bickerdike Allen Partners LLP (BAP) have been commissioned by London City Airport (LCA) to carry out a noise monitoring survey at [redacted] Brixton, in response to complaints from the residents since the introduction of RNAV tracks in early 2016. BAP have also been asked to review the flight tracks to compare the effect of the introduction of RNAV tracks in this area.

A glossary of acoustic terminology is provided in Appendix 1.

2.0 SURVEY DETAILS

2.1 Methodology

BAP visited the property on 19 July 2016 to set up a noise monitor in the garden of the property which recorded continuously between the hours of 16:35 and 19:45. This represents a period of the day when activity at LCA is normally at its busiest on a weekday.

This date was chosen as easterly winds were forecast, meaning runway 09 was in use at LCA. This is the worst case situation for this property with respect to noise from LCA, as when runway 27 is in use the aircraft from LCA do not pass as closely to the property. It is noted that when there are westerly winds, aircraft arriving at London Heathrow Airport (LHA) using runway 27 will pass close to the property. It is understood from the residents that the LHA aircraft are slightly louder than the LCA aircraft.

An operative was situated outside the rear of the property which enabled a good view of passing aircraft.

2.2 Equipment

The equipment used for this survey was a Norsonic Sound Analyser Nor140, mounted on a tripod approximately 2.5m off the ground, and 1m from a corner junction of 2 walls. The monitor was located outside the bedroom window of the property, as this was the location reported to be the worst affected by aircraft from LCA. The monitor location is shown in Figure 1 below. The monitor was calibrated at the start and end of the measurements, and no significant drift was observed.

2.3 Weather Conditions

The weather was clear and dry, with a fair wind coming from the southeast.

[redacted]

Figure 1: Noise Monitor Location

3.0 SURVEY RESULTS AND DISCUSSION

3.1 Noise Measurements

The noise monitoring data was processed to highlight all noise events which were significantly above the background level.

The large majority of the loudest events, were aircraft approaching LCA using runway 09. Some other aircraft were visible and were audible, but were relatively high and generally significantly quieter than the LCA aircraft. The exceptions were two movements by helicopters which were of a similar level to the LCA aircraft. The aircraft from LCA flew over the measurement position at varying intervals over the approximately 3-hour measurement period, with time intervals between flights ranging from around 2 to 31 minutes.

Aircraft height data has been provided by the airport, given to the nearest 100 ft. The heights of the LCA aircraft when passing over the property ranged from 1,900 to 2,000 ft.

38 of the 39 aircraft that approached LCA during the measurement period resulted in a correlated noise measurement. The exception was a Saab 2000 aircraft, which is one of the quieter types, and also did not pass close to the property, as shown in Figure 2 below as an outlier from the main zone of aircraft tracks. The detailed results of the aircraft events are presented in Appendix 2 and are summarised in Table 1 below.

Description	No. Correlated	Average L_{Amax}	Maximum L_{Amax}
LCA Runway 09 Arrivals	38	60 dB	69 dB
Helicopter	2	62 dB	64 dB

Table 1: Summary of Noise Results

The noise level of the aircraft departures averaged over the measurement period was 45.7 dB L_{Aeq}. The average noise level from all sources over the same period was 47.8 L_{Aeq}. Even assuming that this level of LCA activity, and resulting noise level, continues throughout the whole day (which would be an over-estimate of the true situation), this is significantly below the 57 dB $L_{Aeq,16h}$ average daytime aircraft noise level that is widely considered in the UK to mark the approximate onset of significant community annoyance. However, it is noted that some people will be annoyed by levels lower than this (and conversely others may find higher noise levels acceptable). As found in the results of the 2000/1 National Noise Incidence Survey, 90% of the UK are exposed to noise levels of 50 dB $L_{Aeq,16h}$ or higher (from all sources rather than only aircraft). Therefore this is considered to be a relatively modest level of daytime noise exposure for a large urban conurbation such as London.

3.2 Flight Tracks

3.2.1 Radar Tracks of Measurement Period

Figure 2 shows the radar tracks supplied by LCA, with the property in the area marked by a black circle. As can be seen, the 34 of the 39 aircraft followed the track very closely, with the others diverging significantly from the track centreline. The majority of aircraft ground tracks pass around 1000m from the property at their closest point.

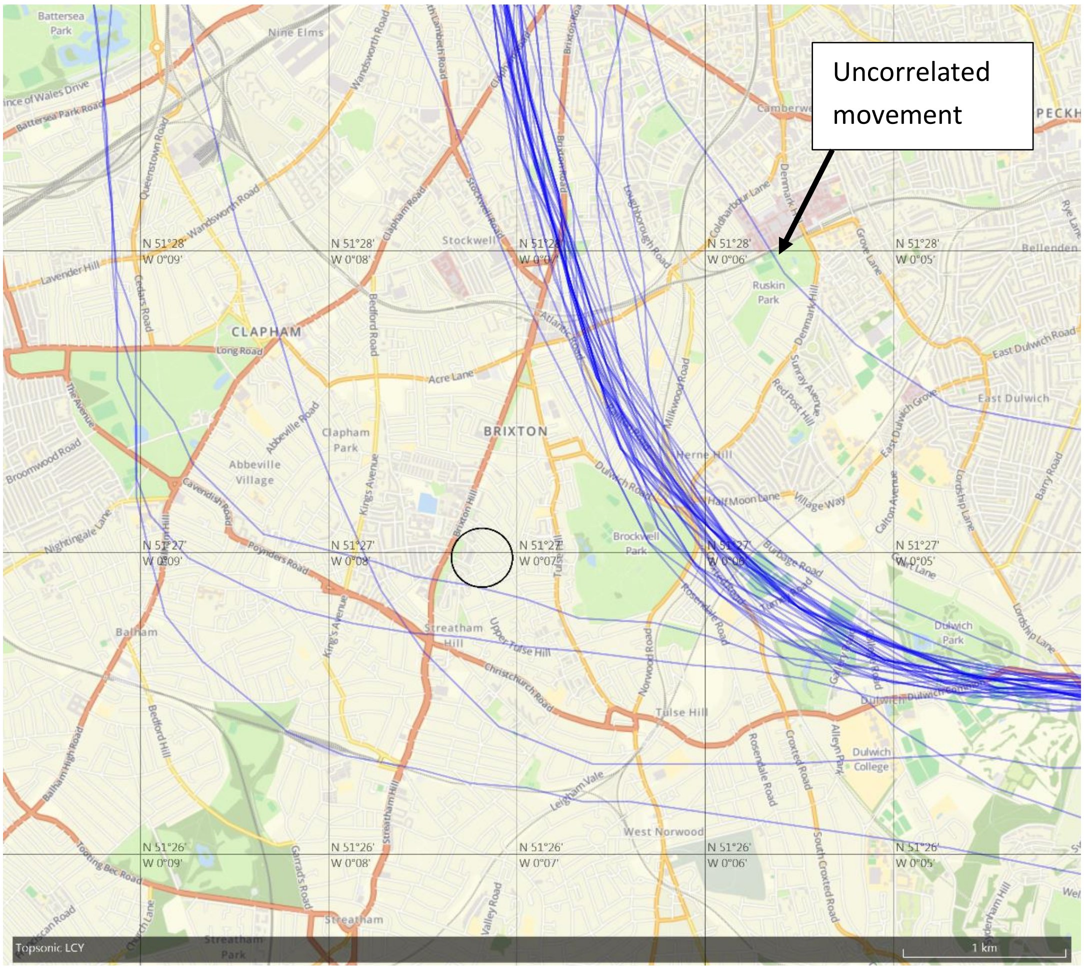

Figure 2: Radar Tracks During Survey (16:42 - 19:46 Arrivals, 19th July 2016)

3.2.2 Effect of Introduction of RNAV Tracks

In early 2016, following a consultation period, departure routes at LCA were upgraded to take advantage of the improved navigational capabilities of RNAV (aRea NAVigation). The intention of this change was to replicate the existing routes as closely as possible with RNAV routes. The expected effect was that aircraft would on average follow very similar tracks, but that they would be more concentrated around the centre track as the RNAV technology allows more accurate navigation.

To show a comparison of the effect, track density plots of runway 09 arrivals have been produced for two periods; one before the change (1 March 2015 to 11 June 2015) and one after the change (1 March 2016 to 31 May 2016). These periods have been chosen so that they contain the same number of runway 09 arrivals (4445), and are approximately the same time of year. These are displayed in Figure 3 and Figure 4 below. The property in question is again marked by a black circle.

As can be seen from the figures below, the track centreline is in a similar location in 2016 to 2015, but in 2016 the tracks are a lot more concentrated around the centreline. This means that although a smaller number of aircraft fly directly over the property in question now compared to before the RNAV tracks were introduced, there are more that pass within 1500m of the property.

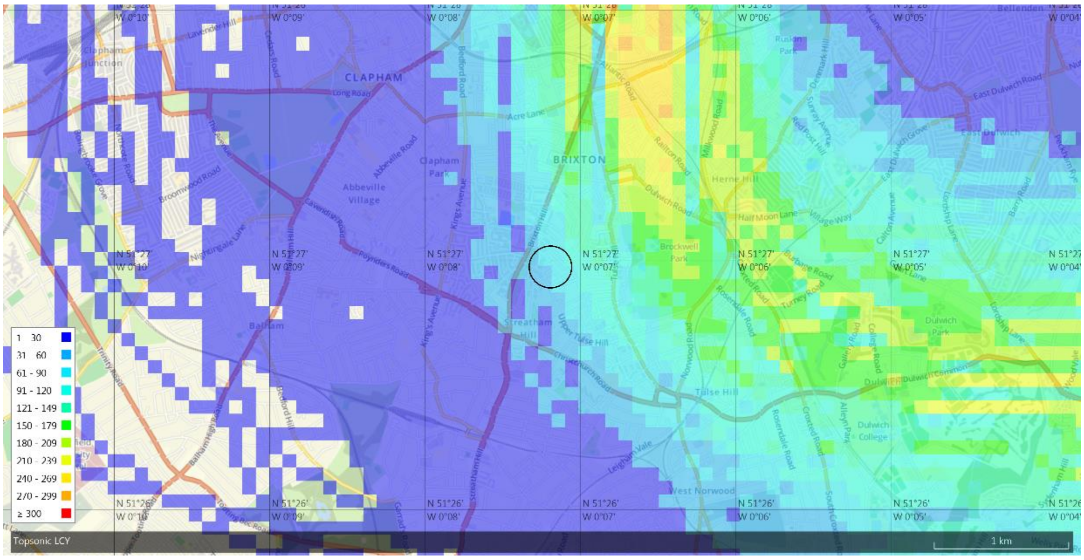

Figure 3: Track Density Plot - Pre RNAV (1 Mar 2015 to 11 Jun 2015)

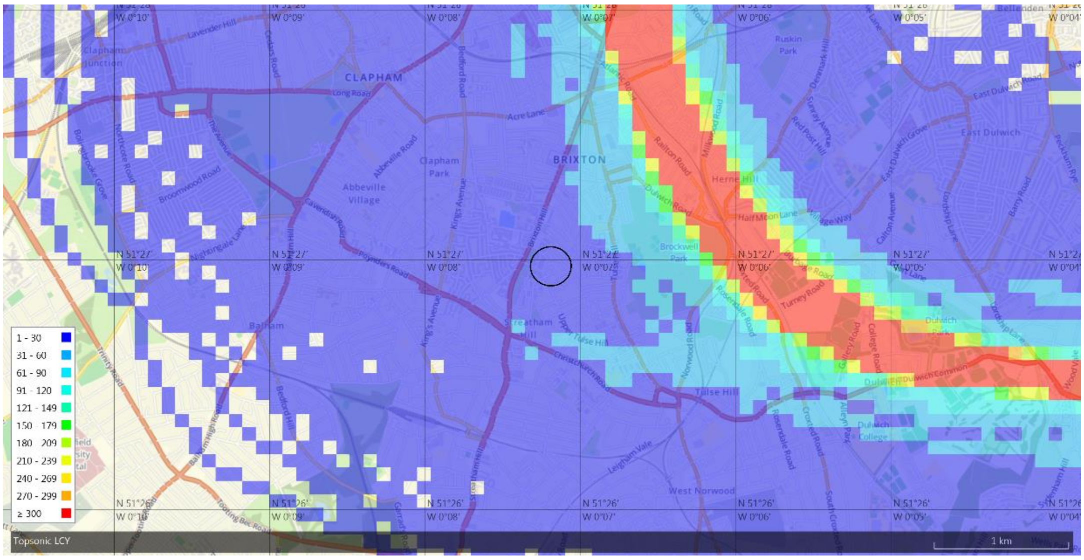

Figure 4: Track Density Plot - Post-RNAV (1 Mar 2016 to 31 May 2016)

4.0 SUMMARY

BAP have measured the noise levels of aircraft approaching London City Airport at [redacted] Brixton, in response to complaints from the residents.

The average noise level measured during the peak afternoon period from aircraft approaching London City Airport on runway 09 was found to be well below the average daytime aircraft noise level used by the government as marking the approximate onset of significant community annoyance.

A comparison has been carried out of flight tracks before and after the RNAV routes were introduced. This shows that fewer aircraft are flying directly over the property now, compared to before the RNAV routes were in operation. However the aircraft are now more concentrated and so there are more that pass within 1500m of the property.

Nick Williams	**Peter Henson**
for Bickerdike Allen Partners LLP	**Partner**

APPENDIX 1

GLOSSARY OF ACOUSTIC TERMINOLOGY

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10^{-5} Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

Statistical Term	Description
$L_{Aeq,\ T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq, T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.
L_{A90}	The level exceeded for 90% of the time is normally used to describe background noise.
$L_{Amax,T}$	The maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast), or S (slow)

Sound Transmission in Rooms

Sound energy is reflected from the room surfaces and this gives rise to reverberation. At short distances from a sound source, the sound level will fall off at a rate of 6 dB per doubling of distance, as it would in the open air – this is known as the direct field. Beyond a certain distance, the effect of reverberation takes over and the level ceases to fall off significantly with distance from the source. This is known as the reverberant field. For receiver positions in this part of the room, sound levels can be reduced by applying sound absorbing finishes to the surfaces of the room. A 3 dB reduction can normally be obtained by doubling the absorption present, which corresponds to halving the reverberation time (see below).

APPENDIX 2

DETAILED SURVEY RESULTS

L_{ASmax} Time	Aircraft Source	Aircraft Type	Dur, s	L_{ASmax}, dB(A)	SEL, dB(A)
16:38:27	LCY	DH8D	36	59.4	67.4
16:41:45	LCY	E190	51	63.3	72.9
16:45:02	LCY	DH8D	42	57.7	67.0
16:59:29	Unknown	Helicopter	52	59.2	70.4
17:05:47	Unknown	Helicopter	63	64.3	75.1
17:16:53	LCY	E190	44	62.5	71.7
17:30:53	LCY	RJ85	36	57.5	66.5
17:33:54	LCY	E190	42	61.3	71.4
17:39:36	LCY	RJ85	34	65.4	71.9
17:43:31	LCY	D328	34	53.0	63.0
17:46:56	LCY	RJ85	36	62.6	70.9
17:50:18	LCY	E170	209	59.2	74.7
17:53:44	LCY	E170	50	60.2	70.9
17:56:44	LCY	E190	55	62.2	72.1
17:59:51	LCY	AT45	43	58.9	69.6
18:02:53	LCY	RJ1H	38	59.7	69.2
18:05:31	LCY	DH8D	36	59.7	67.4
18:08:17	LCY	E170	45	62.3	73.1
18:13:42	LCY	SB20	19	49.7	58.3
18:16:43	LCY	E170	38	62.0	70.5
18:21:10	LCY	AT72	41	64.0	72.7
18:23:07	LCY	DH8D	16	54.3	58.0
18:25:13	LCY	C56X	32	54.8	64.3
18:29:18	LCY	RJ85	43	63.3	70.8
18:33:23	LCY	RJ85	35	60.3	69.5
18:37:04	LCY	E170	45	64.1	74.1
18:42:27	LCY	E190	48	62.8	72.4
18:46:21	LCY	DH8D	38	53.7	64.2

L_{ASmax} Time	Aircraft Source	Aircraft Type	Dur, s	L_{ASmax}, dB(A)	SEL, dB(A)
18:50:28	LCY	E190	50	62.7	71.9
18:53:42	LCY	SB20	33	51.4	62.9
18:57:13	LCY	RJ1H	39	60.8	69.8
19:00:46	LCY	E190	42	64.6	73.7
19:03:34	LCY	DH8D	36	55.9	66.9
19:07:07	LCY	E190	46	62.3	71.0
19:17:18	LCY	E190	41	68.5	74.3
19:26:26	LCY	E190	57	63.9	73.9
19:30:42	LCY	DH8D	34	57.2	66.0
19:35:10	LCY	AT43	38	54.8	66.0
19:38:30	LCY	RJ85	43	59.9	69.8
19:42:18	LCY	E190	41	61.5	71.9