Bickerdike
Allen
Partners
Architecture
Acoustics
Technology

LONDON CITY AIRPORT

AIRCRAFT NOISE SURVEY

[redacted] SOMERVILLE ROAD, ROMFORD

Report to

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Bickerdike Allen Partners LLP is an integrated practice of Architects, Acousticians, and Construction Technologists, celebrating over 50 years of continuous practice.

Architects: Design and project management services which cover all stages of design, from feasibility and planning through to construction on site and completion.

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

Construction Technology Consultants: Expertise in building cladding, technical appraisals and defect investigation and provision of construction expert witness services.

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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 survey to monitor aircraft noise outside [redacted] Somerville Road, Romford RM6 [redacted]. This property is located just over 9 kilometres to the north-east of the airport. This report provides a summary of the noise measurements. A glossary of acoustic terminology is provided in Appendix 1.

2.0 SURVEY DETAILS

2.1 Methodology

Environmental noise measurements were carried out in accordance with BS 7445[1].

BAP visited the property and set up a noise monitor in the rear garden of the property, which faces to the east. This recorded continuously for 11 days between approximately 12:30 pm on 17th July 2017 and 12:30 pm on 28th July 2017.

This period was chosen as a mixture of westerly and easterly winds were forecast for the period, meaning measurements could be taken for both runway 09 and runway 27 aircraft operations at LCA. Before the survey it was unclear whether flights using both runways affected the property, or only those departing runway 27.

2.2 Equipment

The equipment used for the long term survey was an 01dB DUO Smart Noise Monitor, mounted on a tripod approximately 3 m above the ground, in a free field position in the garden of the property. The monitor location is shown in Figure 1. The monitor was calibrated at the start and end of the measurements, and no significant drift was observed.

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[1] BS 7445-1:2003 *Description and measurement of environmental noise*

[redacted]

Figure 1: Noise monitor location, facing east

3.0 SURVEY RESULTS AND DISCUSSION

3.1 Flight Tracks

3.1.1 Runway 27 Departures

The airport have provided BAP with the aircraft movement data and flight track data for the monitoring period. Figure 2 shows the flight tracks for runway 27 departures during the monitoring period, with the property location marked by a blue spot. As can be seen, there are three main swathes of aircraft routes; one which turns north a long way to the west of the property, one which branches off and passes around 2 km to the north of the property, and one which flies almost directly over the property.

BAP have reviewed the actual flights on each track, and found that during the measurement period, approximately 20% of all runway 27 departures followed the route that passes over the property.

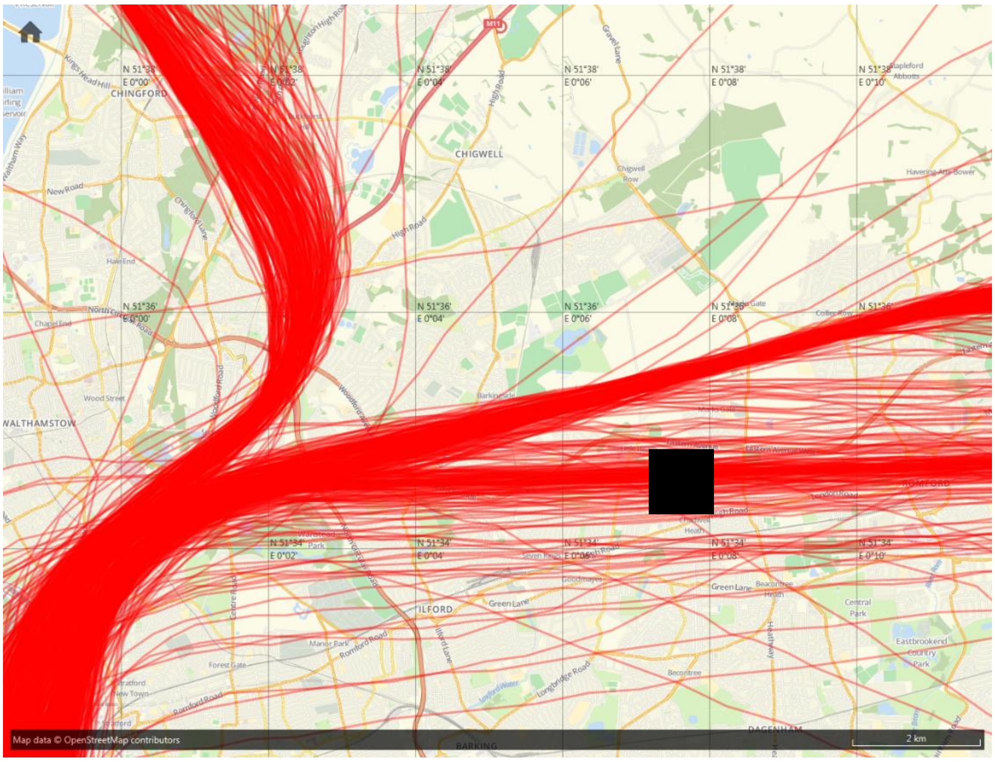

Figure 2: Runway 27 Departure Tracks During Measurement Period

3.1.2 Runway 09 Departures

Figure 3 shows the flight tracks for runway 09 departures during the monitoring period, with the property location marked by a blue spot. As can be seen, runway 09 flights do not routinely pass close to the property.

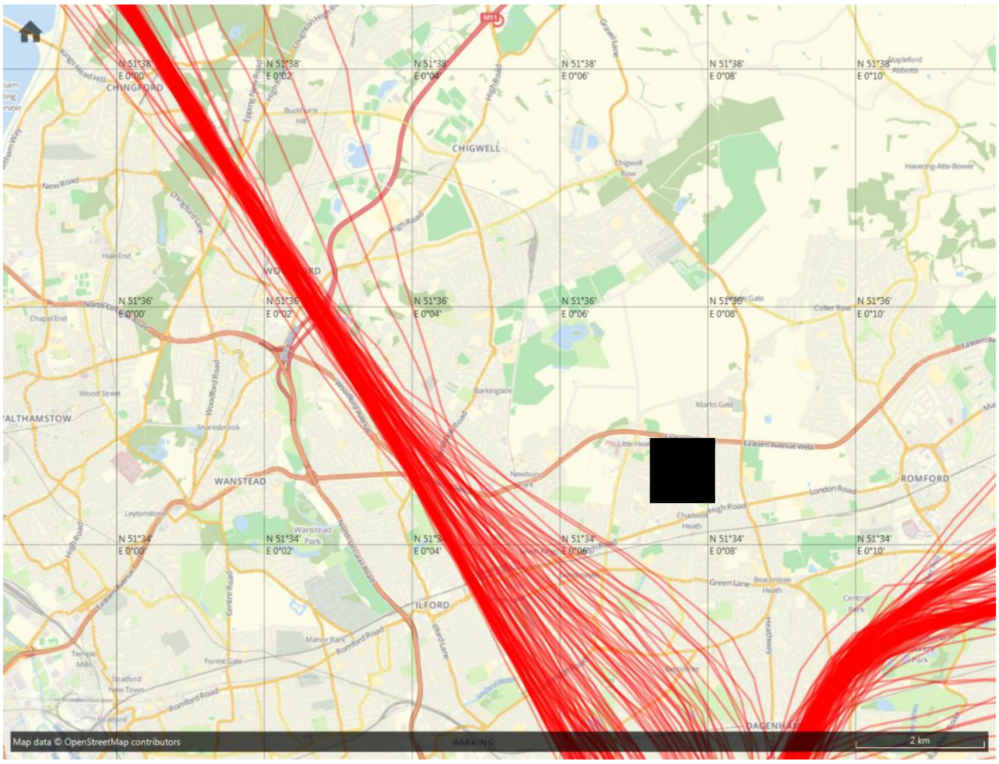

Figure 3: Runway 09 Departure Tracks During Measurement Period

3.1.3 Arrivals

Aircraft arriving at LCA are routinely a large distance from the property.

3.2 Noise Measurements

The noise monitoring data was processed by BAP to correlate the measured noise levels with the aircraft movement data, provided by the airport.

The loudest aircraft events were caused by a subset of aircraft departing LCA using runway 27, i.e. those flying closest to the property. Some of the more distant aircraft were also audible, although at a significantly lower noise level such that they were not clearly distinct from non-aircraft noise sources and therefore it was not possible to correlate these quieter aircraft events.

During the 11 day measurement period, there were 879 departures using runway 27, of which 140 flew close to the property. Of these, 135 (96%) were correlated with a noise event. The aircraft noise events are summarised in Table 1.

Aircraft	No. Correlated	Avg L_{Amax} (dB)
Avions de Transport ATR42	12	65
De Havilland Dash 8-Q400	17	61
Embraer E170	23	65
Embraer E190	66	66
Other Aircraft	17	61
Total	135	64

Table 1: Summary of Noise Results

Aircraft noise in the UK, and at LCA, is commonly assessed in terms of the $L_{Aeq,16h}$ metric for the average "summer" day, which is the average noise level produced by aircraft over the 16-hour daytime period (07:00 to 23:00) for the 92-day "summer", defined as 16th June to 15th September inclusive. This is consistent with the government policy as stated in its Aviation Policy Framework (March 2013).

As LCA operates from 06:30 to 22:30, the full extent of operations is deemed as daytime for this purpose.

The 11 day measurement period is considered broadly representative of an average summer day, as 70% of the operations used runway 27 during this period, which is marginally higher than the typical average (the average over the last 5 summer periods is 66%).

The noise level of the aircraft movements averaged over the measurement period was 39 dB $L_{Aeq,16h}$. To put this into context, the average measured noise level from non-aircraft sources was 51 dB $L_{Aeq,16h}$.

This means that the aircraft noise level is significantly below both the noise level from other sources and 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. It is however recognised 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.

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4.0 SUMMARY

BAP have measured the noise levels at [redacted] Somerville Road, Romford RM6 [redacted] over an 11 day period. The average aircraft noise level measured over the 11 days was 39 dB $L_{Aeq,16h}$. This level is well below the average daytime aircraft noise level used by the government as marking the approximate onset of significant community annoyance.

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

APPENDIX 1

GLOSSARY OF ACOUSTIC TERMINOLOGY

Sound

This is a physical vibration in the air, propagating away from a source, whether heard or not.

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).

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB.

Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening and Diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation, however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

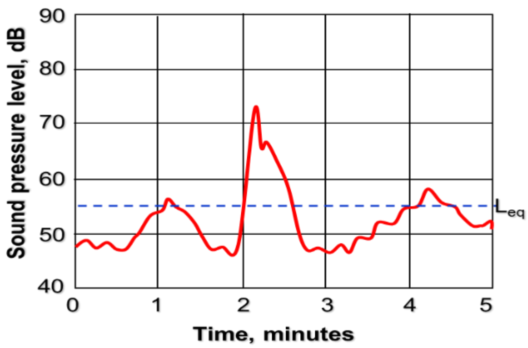
Meteorological Effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.

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.

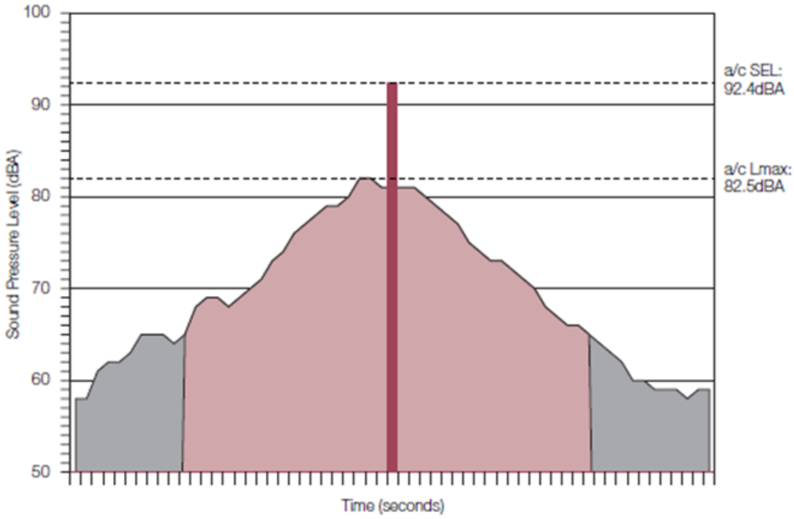
Statistical Term	**Description**
$L_{Aeq,T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound. This is shown in the graph below:



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 Exposure Level (SEL)	An SEL is a measure the total noise from an aircraft movement. The SEL noise level for an aircraft movement is the sum of all the noise energy for the event expressed as an average noise level for 1 second. This is shown in the graph below:

Figure 3.1: Aircraft time history, showing maximum level L_{Amax} and associated Sound Exposure Level (SEL)[41]



Source: CAA data