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Architecture
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LONDON CITY AIRPORT

AIRCRAFT NOISE SURVEY

[redacted] WARDS WHARF APPROACH/TRADE WINDS

Report to

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A6209-R018-NW
24 July 2017

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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 noise monitoring survey at [redacted] Wards Wharf Approach, London E16. 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 long term noise monitor on the balcony of the property, which faces to the west, overlooking the Thames Barrier. This recorded continuously for 11 days between approximately 09:30 on 9th March and 09:30 on 20th March.

This period was chosen as westerly winds were forecast for the majority of the period, meaning runway 27 would be in use at LCA. This is the worst case situation for this property with respect to noise from LCA, which is affected by departure noise when runway 27 is in use, and to a lesser extent by arrival noise when runway 09 is in use. In both situations there was a clear line of sight from the noise monitor to aircraft departing from or approaching LCA.

2.2 Equipment

The equipment used for the long term survey was an 01dB DUO Smart Noise Monitor, mounted on a tripod approximately 1.5 m above the balcony, and at the outer edge of the balcony. The resident had stated that the worst affected rooms were those facing west and therefore this was the most suitable measurement location. 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*

Figure 1: Noise monitor location, facing north west (toward flight path)

3.0 SURVEY RESULTS AND DISCUSSION

3.1 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 large majority of the loudest events were aircraft departing LCA using runway 27. It was noted while setting up the noise monitor that other aircraft, assumed to be approaching Heathrow, were visible and sometimes audible.

During the 11 day measurement period, there were 1154 departures using runway 27 and 104 arrivals using runway 09. Of these, 89% (1043 departures and 78 arrivals) were correlated with a noise event. The aircraft noise events are summarised in Table 1.

Aircraft	Operation	No. Correlated	Avg L_{Amax} (dB)
Avro RJ85	Arrival	6	64
	Departure	169	70
De Havilland Dash 8-Q400	Arrival	15	64
	Departure	165	64
Embraer E170	Arrival	7	64
	Departure	123	73
Embraer E190	Arrival	39	64
	Departure	404	75
Other Aircraft	Arrival	11	65
	Departure	182	66
Total	Arrival	78	64
	Departure	1043	70

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. The noise level of the aircraft movements averaged over the measurement period was 55 dB $L_{Aeq,16h}$. The contours produced by LCA use noise modelling software, which assumes "free field" positions (i.e. not near buildings which can interfere with the measurements due to screening and/or reflections), and therefore real-world measurements are not a true like for like comparison. These measured results agree well with the airport's latest published noise contours, which show this property as just outside the 57 dB $L_{Aeq,16h}$ contour based on an average summer day in 2016[2].

4.0 SUMMARY

BAP have measured the noise levels at [redacted] Wards Wharf Approach, London E16 over an 11 day period. The flat lies outside the current 57 dB $L_{Aeq,16h}$ contour used to identify properties eligible for sound insulation works. The owner of the flat requested a noise survey to investigate actual aircraft noise levels outside her flat. London City Airport instructed BAP to carry out a noise survey to investigate the noise levels at this flat.

The average aircraft noise level measured over the 11 days was 55 dB $L_{Aeq,16h}$. These measured results agree well with the airport's latest published contours, which show this property as just outside the 57 dB $L_{Aeq,16h}$ contour based on an average summer day in 2016.

Nick Williams
for Bickerdike Allen Partners LLP

Peter Henson
Partner

[2] A1125.57-APR16-01 "*Actual Noise Contours Summer 2016 (57, 66 and 69 dB $L_{Aeq,16h}$ Average Mode*"

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 2×10^{-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.

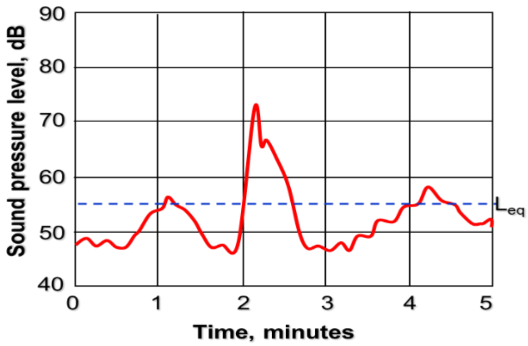
Meteorological Effects

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.

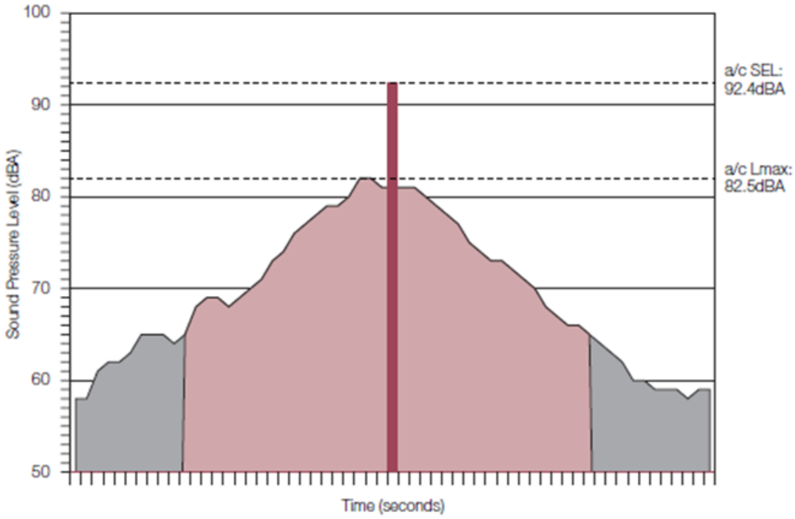
Statistical Term	Description
$L_{Aeq,T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound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



Statistical Term	Description
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