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# AIRCRAFT NOISE SURVEY

# THAMESMEAD

Report to

London City Airport
City Aviation House
London City Airport
The Royal Docks
London E16 2PB

A11327_12_RP069_1.0
21 November 2024

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**Bickerdike Allen Partners LLP** is an integrated practice of Architects, Acousticians, and Construction Technologists, celebrating over 60 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.

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## 1.0 INTRODUCTION

Bickerdike Allen Partners LLP (BAP) have been commissioned by London City Airport (LCA) to carry out a survey of the noise in Thamesmead. The survey measured aircraft noise between 2nd September and 8th October 2024. The location is shown on a map in Figure A11327_12_DR004, along with the locations of the airport's six permanent noise monitoring terminals (NMTs).

This report provides a summary of the noise measurements by aircraft type and compares these with the noise levels measured at the closest of the airport's Noise Monitoring Terminals (NMTs).

A glossary of acoustic terminology is provided in Appendix 1.

## 2.0 SURVEY DETAILS

### 2.1 Location

The measurement location in Thamesmead was at a residential property on Thamesbank Place. This location is around 4 km east north east of the threshold of Runway 27 of LCY. It is typically overflown by aircraft which depart LCY on Runway 09 during easterly operations. Aircraft which arrive at LCY on Runway 27 during westerly operations pass around 500m to the south.

### 2.2 Methodology

A long-term unattended noise monitor was set up and environmental noise measurements were carried out in general accordance with BS 7445-1:2003[1].

The monitor recorded noise data continuously while it was operational. There was a brief period during which the monitor was not operational while batteries were changed. The monitor recorded noise data for a total of around 37 days between 14:30 on the 2nd September and 20:30 on the 8th October.

[1] British Standards Institute, BS 7445-1:2003 Description and measurement of environmental noise, 2003

## 2.3 Equipment

The equipment used for the long-term survey was an 01dB DUO noise monitoring terminal, with the microphone approximately 3 m above the ground supported by a tripod, and clear of reflecting surfaces. The monitor installation is shown in Figure 1. The monitor was checked for correct calibration at the start and end of the measurements, and no significant drift was observed.

**Figure 1: Noise Monitor Location, Thamesmead**

## 2.4 Flight Tracks

LCA has provided BAP with the aircraft movement data and flight track data for the monitoring period. BAP have reviewed the flight tracks and found that, all Runway 27 arrivals and Runway 09 departures flew relatively close to the location, although the location is around 500m north of the arrival flight path. Runway 09 arrivals and Runway 27 departures do not fly near the location.

## 3.0 RESULTS

The noise monitoring data was processed by BAP to correlate the measured noise levels with the aircraft movement data, provided by the airport. Measurements of the same aircraft operations were also extracted from the noise monitoring system at the airport. All noise levels presented in the tables in this section have been rounded to 1 decimal place.

### 3.1 Aircraft Noise Levels

During the measurement period there were 1,461 arrivals which used Runway 27, of these 1,339 (92%) were correlated with a noise event at the monitor. There were 1,239 departures which used Runway 09, of these 1,135 (92%) were correlated with a noise event at the monitor.

The correlated arrival and departure noise events are summarised in Table 1 and Table 2 respectively. Aircraft types with at least ten measurements are shown individually. Aircraft types with fewer than 10 measurements are grouped in "Other", these are mostly business jets.

| Aircraft Type | No. Correlated | Average $L_{Amax}$ (dB) | Average SEL (dB(A)) |
|---|---|---|---|
| Airbus A220-100 | 48 | 62.1 | 71.1 |
| ATR72 | 133 | 60.6 | 68.5 |
| Bombardier Dash 8-Q400 | 85 | 59.8 | 68.3 |
| Embraer E190 | 1,009 | 63.0 | 72.9 |
| Embraer E190-E2 | 12 | 61.3 | 70.5 |
| Other | 52 | 58.3 | 65.3 |

**Table 1: Summary of Arrival Noise Results**

| Aircraft Type | No. Correlated | Average $L_{Amax}$ (dB) | Average SEL (dB(A)) |
|---|---|---|---|
| Airbus A220-100 | 38 | 69.3 | 78.5 |
| ATR72 | 133 | 71.4 | 81.0 |
| Bombardier Dash 8-Q400 | 68 | 68.0 | 77.6 |
| Embraer E190 | 802 | 74.8 | 84.5 |
| Other | 94 | 67.3 | 76.9 |

**Table 2: Summary of Departure Noise Results**

Aircraft noise in the UK is typically assessed using the $L_{Aeq}$ metric, which averages the noise energy over a specified period (e.g. 16 hours for daytime). The SEL metric is most directly related to such assessments, when measuring individual aircraft. However, the $L_{Amax}$ metric is easier to understand, simply being the highest noise level measured during an aircraft overflight.

The most common aircraft was the Embraer E190, this was also the nosiest aircraft measured. The Embraer E190 is gradually being replaced by a new generation of quieter modernised passenger jets, specifically the Embraer E190-E2 and Airbus A220-100. On average the arrival maximum noise levels for these aircraft are around 1 to 2 dB quieter compared to the current generation E190. On departure the Airbus A220-100 measured around 5 dB quieter than the E190. There were too few correlated E190-E2 departures to include individually in the table.

The other aircraft that operated regularly were the ATR72 and Bombardier Dash 8-Q400 turboprops. These were both quieter than the current generation E190. Compared to the new generation passenger jets they were slightly quieter on arrival, but similar on departure despite their smaller size.

## 3.2 Long term average noise levels

Aircraft noise in the UK, and at LCY, is commonly assessed in terms of the average “summer” day. This is the average noise level produced by aircraft for the 92-day “summer”, defined as 16th June to 15th September inclusive. This typically represents the peak period of activity at UK airports.

This is consistent with LCY’s sound insulation scheme eligibility criteria, and is the metric used to rate community response to airborne aircraft noise in the UK, as recommended by the Government[2]. Noise levels at LCY are presented in terms of the $L_{Aeq,16h}$ metric for the summer day (06:30 to 22:30), based on the airport’s operational hours.

During the 37 day survey period based on the correlated events, the noise level due to aircraft was 52.2 dB $L_{Aeq,16h}$. There were more Runway 09 operations during the survey period (46%) compared to the long-term average (27%). If the measured levels were adjusted to allow for the long-term average runway use, then the average noise level due to aircraft become 50.3 dB $L_{Aeq,16h}$. This is because the Runway 09 departures are louder than the Runway 27 arrivals at the survey location and they occurred more often than normal during the survey.

[2] Department for Transport, Aviation Policy Framework, 2013

These levels are below the lowest threshold of eligibility for LCY's sound insulation scheme, which is 57 dB $L_{Aeq,16h}$. As activity at the airport has yet to fully recover following the pandemic, 2019 is the loudest year at the airport to date, as measured by the size of the average summer day $L_{Aeq,16h}$ noise contours. The survey location in Thamesmead was outside of the airport's published noise contours in 2019.

51 dB is defined as the Lowest Adverse Effect Level (LOAEL) for aircraft noise in government guidance[3]. The noise level based on the long terms average runway use is below the LOAEL. This does not mean that the aircraft are not audible, but that adverse effects on health and quality of life cannot be readily detected.

## 3.3 NMT Noise Levels

The results of the comparable analysis undertaken for the same flights based on measured results from NMT6, which is the nearest fixed Noise Monitoring Terminal (NMT), are summarised in Table 3 and Table 4 for arrivals and departures respectively.

| Aircraft Type | NMT6 | | |
|---|---|---|---|
| | No. Correlated | Avg. $L_{Amax}$ (dB) | Avg. SEL (dB(A)) |
| Airbus A220-100 | 53 | 74.3 | 83.7 |
| ATR72 | 147 | 71.3 | 80.4 |
| Bombardier Dash 8-Q400 | 78 | 71.5 | 81.2 |
| Embraer E190 | 955 | 74.8 | 83.8 |
| Embraer E190-E2 | 15 | 72.7 | 81.6 |
| Other | 101 | 69.2 | 77.0 |

**Table 3: Summary of Arrival Noise Results – NMT6**

[3] UK air navigation guidance 2017, https://www.gov.uk/government/publications/uk-air-navigation-guidance-2017

| Aircraft Type | NMT6 | | |
|---|---|---|---|
| | No. Correlated | Avg. $L_{Amax}$ (dB) | Avg. SEL (dB(A)) |
| Airbus A220-100 | 35 | 71.0 | 79.6 |
| ATR72 | 94 | 72.7 | 82.1 |
| Bombardier Dash 8-Q400 | 45 | 68.8 | 77.8 |
| Embraer E190 | 575 | 76.1 | 85.9 |
| Other | 52 | 70.5 | 78.6 |

**Table 4: Summary of Departure Noise Results – NMT6**

Comparing the various aircraft types, the NMT results broadly mirror those for the survey in Thamesmead, with the Embraer E190 being the loudest, particularly on departure.

Compared to the survey location arrival noise levels at NMT6 are much louder, by more than 10 dB. This is due to the survey location being around 500m north of the Runway 27 arrival flight path whereas it does overfly NMT6.

The Runway 09 departure flight path directly overflies NMT6 and the survey location. The measured departure noise levels are therefore more similar, however all aircraft types measured louder at NMT6 than at the survey location.

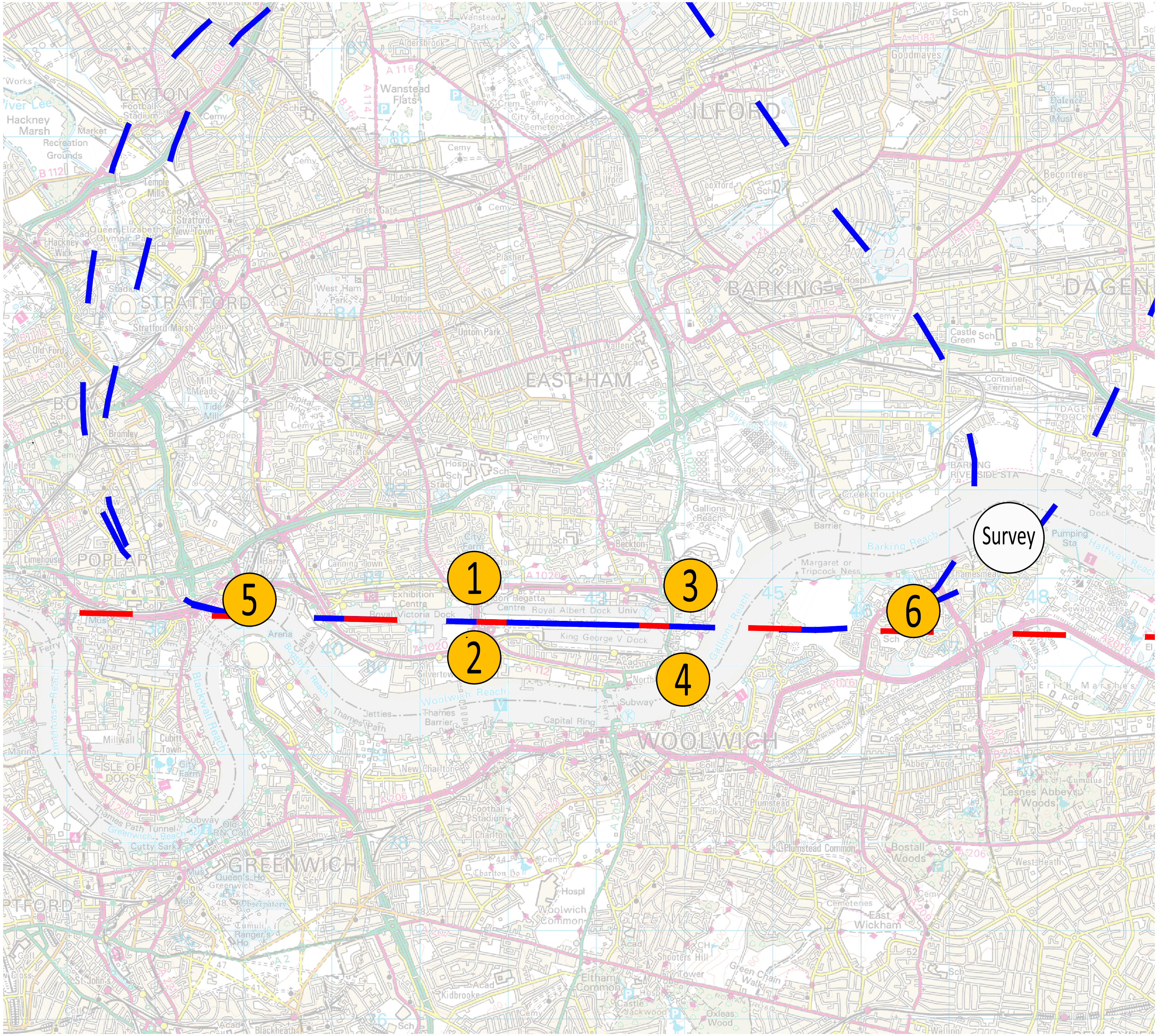
## 4.0 SUMMARY

BAP have carried out a long-term noise survey in Thamesmead to measure the aircraft noise levels and have reported the results. The absolute noise levels for the aircraft types are lower at the survey location compared to the levels measured at NMT6. The results confirm that the new generation passenger jet aircraft are quieter at the survey location than the current generation Embraer E190, particularly on departure.

The average noise levels at the survey location are below the lowest eligibility threshold for the sound insulation scheme, which is 57 dB $L_{Aeq,16h}$. When adjusted for the long term average runway use, the aircraft noise level at the survey location would be 50.3 dB $L_{Aeq,16h}$, which is below the 51 dB $L_{Aeq,16h}$ level defined by the government[3] as the Lowest Observed Adverse Effect Level (LOAEL).

**Duncan Rogers** | **David Charles**

**for Bickerdike Allen Partners LLP** | **Partner**






LEGEND:

- X — Survey Location
- X — Permanent Noise Monitors
- Typical Departure Tracks
- Typical Arrival Tracks

REVISIONS

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London City Airport

Survey Location
Thamesmead

DRAWN: DR

CHECKED: DC

DATE: November 2024

SCALE: 1:60,000@A4

FIGURE No:

A11327_12_DR004_1.0

# 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).

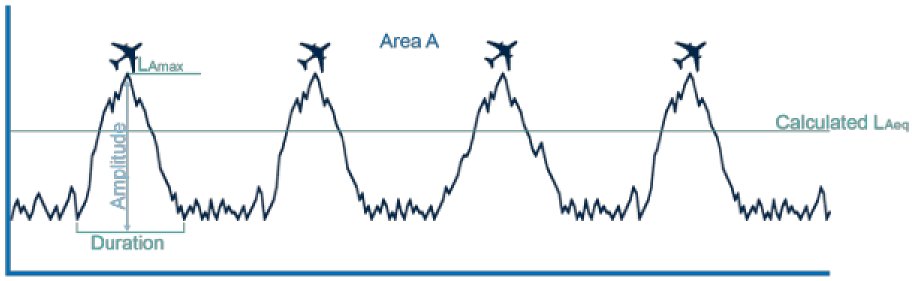
**A-weighting**

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.

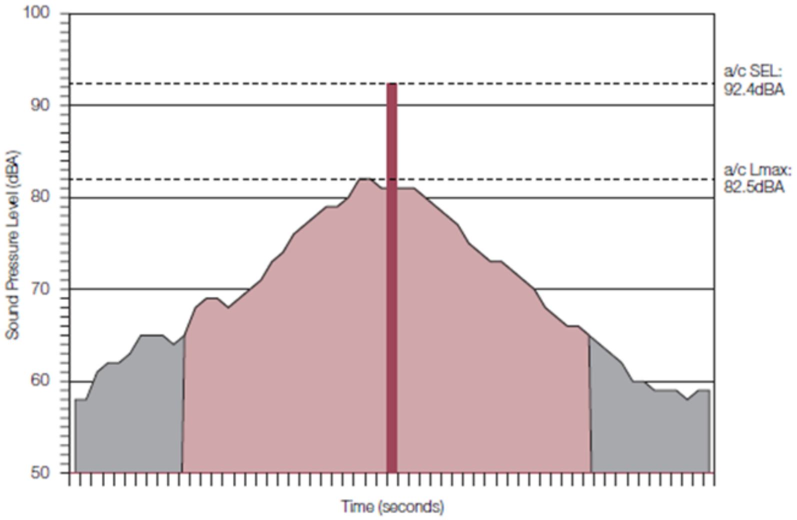
| Statistical Term | Description |
|---|---|
| $L_{Aeq, T}$ | The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq, T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same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




| | |
|---|---|
| $L_{Amax,T}$ | 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.<br>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.<br>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*

## 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.