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NOISE LEVELS AROUND LISBON AIRPORT

J L Bento Coelho

CAPS - Instituto Superior Técnico, 1096 Lisboa, Codex, Portugal

INTRODUCTION

Lisbon Airport is practically located within the urban limits, thereby making air traffic noise an environmental issue for some time. Although noise emission from aircraft have been diminishing over the years, the air traffic density has steadily increased. The airport has four runways two of which are equipped with instrument landing systems, and of the other two, one is practically inactive and the other is rarely used. A greater environmental awareness and stricter noise legislation, has pressed the Airport Authorities for an assessment of the extent of the air traffic noise impact on the city environment, as well as for installation of a noise monitoring network. An extensive study was then conducted, with some of the results being reported here.

NOISE SURVEY

A noise survey was conducted in a broad area around Lisbon airport. Strips of about 2000 m for each side of each runway and lengths of about 6000 to 8000 m were defined for surveying. The criteria for selection of these points included: (i) vicinity of the landing/take off path, (ii) survey of noise sensitive locations (hospitals, schools, residential areas), (iii) uniformity of coverage, (iv) quietness and limited influence of other noise sources (mainly road traffic noise), (v) ease of access and (vi) possibility of future placement of a noise monitoring terminal.

A set of 169 positions were chosen for measurements during the day period (7h00- 22h00). Of these, 16 positions were surveyed during the night (22h00-7h00). Most of the air traffic is concentrated in daytime. The measuring time intervals ranged between one and two hours. In the experimental work B & K 4184-4435-7618 equipment and software were used. All events whose noise level reached above a limit which was specified at 65 dB(A) for the day and 55 dB(A) for the night (so as to be

close to Portuguese noise legislation) were registered. As such, the contribution of air traffic noise could be calculated.

NOISE LEVELS

Air traffic noise was evaluated by using the one-hour L_{eq} index. L_{eq} was chosen as the measuring unit since it seemed to be an adequate and proven noise index, well correlated with nuisance due to noise (aircraft noise included), can be easily used for comparisons of noise from other sources and is used, generally, in noise regulations. That makes L_{eq} an important tool used for planning purposes in urban areas.

Noise maps for both the overall environmental noise and the aircraft noise in the city were drawn. Figure 1 depicts the curves for the overall daytime outdoor noise, with contributions from all different sources, air traffic included. Figure 2 shows the air traffic noise map, also for daytime. This considers the noise resulting only from the aircraft passing events, thereby representing the contribution of air traffic to the environmental noise. Landing and take-off L_{eq} maps for the most frequent types of aircraft using Lisbon airport were also produced in order to estimate the influence of their operations in the nearby area. Considerable differences were registered between modern aircraft, such as the Airbus A300, and older ones, like the Boeing B737/200 or B727/200. The noisier ones have, since, been banned from using the airport.

The one-hour L_{eq} index was calculated from:

$$L_{eq} = 10 \log_{10}\left(\frac{1}{T}\sum_{i=1}^{M}\sum_{j=1}^{N}\sum_{k=1}^{P} 10^{SEL_{ijk}/10}\right) \quad \text{dBA}$$

where SEL_{ijk} is the single event noise exposure level produced by operation k (landing, take-off, ground) of aircraft of type j of order i, provided that is equal or above 65 dB(A) (or 55 dB(A) for night operations) at the measuring point. A correction was made for the operations that did not trigger an event (due to particular screening effects or high background levels), since the number of flight passages were recorded, for which values of SEL = 75 dB(A) for the day and SEL = 65 dB(A) for the night were attributed. These corrections proved to be marginal and practically irrelevant.

CONCLUSIONS

The study showed that influence of the air traffic noise in the city of Lisbon is predominant only over a limited area around the airport. This is mainly due to the fact that modern aircraft are less noisy than the older generations, thus resulting in a less important contribution to the overall environmental noise, even with increased traffic density.

L_{eq} seemed to be an adequate noise index for this purpose, especially since only daytime analysis has been carried out.

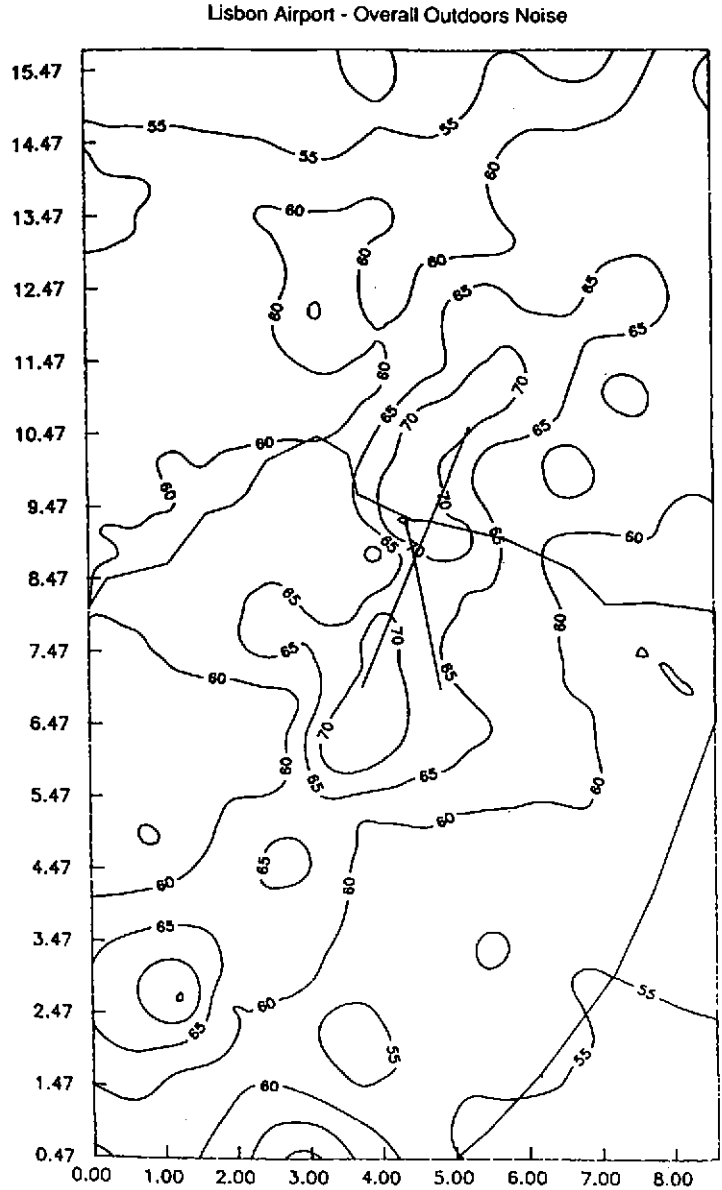
Lisbon Airport - Overall Outdoors Noise
15.47
14.47
13.47
12.47
11.47
10.47
9.47
8.47
7.47
6.47
5.47
4.47
3.47
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Figure 1

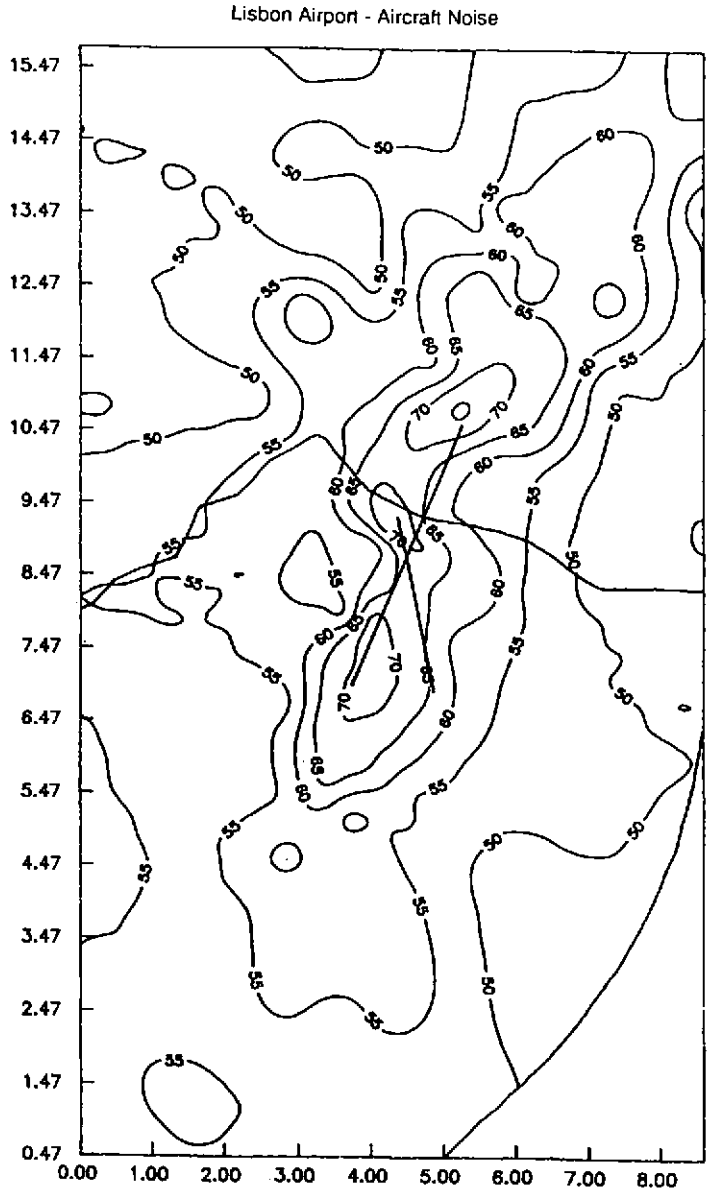
Lisbon Airport - Aircraft Noise
15.47
14.47
13.47
12.47
11.47
10.47
9.47
8.47
7.47
6.47
5.47
4.47
3.47
2.47
1.47
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Figure 2