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CRITICAL SURVEY OF AIRCRAFT NOISE MEASUREMENTS IN THE NEIGHBOURHOOD OF BRUSSELS NATIONAL AIRPORT

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INTRODUCTION

This study about noise pollution caused by air traffic noise in the vicinity of the international airport of Zaventem (Brussels-National) is conducted by order of the Belgian "Ministerie van de Vlaamse Gemeenschap" and the "Ministerie van Volksgezondheid en het Gezin - Dienst Milieuhinder". The main object of this study is the description of the noise climate and the annoyance in a larger environment around the airport. Prolonged measurements have been done at distances of up to 12 km from the airport, and at up to four sites simultaneously.

The airport of Zaventem is a medium international airport, situated near the city of Brussels. The total traffic in 1981 amounted to about 105.000 movements. On a mean workday 330 flight-movements are executed, on the weekends about 250 a day. 65 % are large commercial jet-aircraft. The airport has three runways, two are parallel and used 80-90 % of the time, the third one is used only at night and at high cross- or down-wind speeds (see fig. 1). Normally aircraft take off from 25R and land on 25L (75 %) and 25R (25 %), fig. 1 shows the main arrival and departure routes for these runways. There is a minimal noise procedure and there are restrictions on night-flights.

MEASUREMENTS AND ANALYSIS

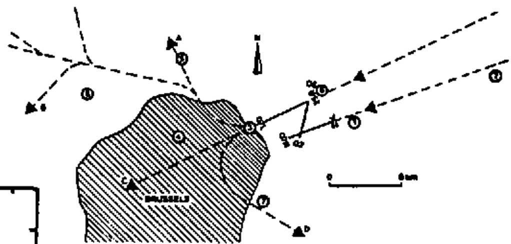
On each site the A-weighted sound level was registrated continuously on paper tape, which afterwards was analysed in the laboratory. About 30 000 flight movements were measured, 22 000 were actually observed. For each movement several characteristics were determined, such as L_{Amax}, 10 dB down time, the time above 90, 80, 70, 60 dB and the total time above the background. Each aircraft has been identified, and the type of movement (landing or take-off, runway, ...) and the procedure after take-off were determined. Every hour meteorological data and the background level were added to the data, which were entered in the computer and stored on magnetic disc.

This procedure allows many different ways of analysis on a large number of relatively detailed data. Firstly each day has been analysed separately, what resulted in sets of tables with statistical results about the traffic, L_{Amax}, L_{AX}, the noisiest overflights, the number of aircraft and the time above a certain level, meteorological conditions, etc... Several indices were calculated such as L_{eqA}, L_{DN}, NNI, Indice Isopsophique. From these data mean values were determined for the total measuring period at each site. The measured I.I. was compared with the results of a calculation method used by the Belgian Aeronautic Administration. Table 1 shows the mean values of NNI and II, and the prognosis for II based on the mean traffic during our measuring period. Underneath the landingroutes (site 1 and 2) and near the airport (sites 3 and 4) the agreement is good, further away calculations seem to underestimate the noise.At site 8 no calculation was made, because the prognosis-method only considers overflying aircraft, whereas the noise at this site is caused mainly by aircraft taking-off away from the site. Instead of the mean value of the measured indices the spread is given, because we found large variations due to the wind. In fig. 2 the influence of the wind speed on the sound level at site 8 is shown for the B737 taking-off from 25R. The points represent mean values of L_{Amax} for several aircraft. The direction of the wind has not been taken into account yet, but the graph already gives an indication of the influence of the wind.

The data were also analysed per type of aicraft over the total measuring period. 135 different aircraft types have been observed, and for each mean values were calculated for L_{Amax}, L_{AX}, ..., the frequency of observation, etc... In fig. 3 and 4 the mean measured L_{Amax} has been plotted against the mean L_{AX}, calculated from L_{Amax} and T_{10}, for all aircraft landing on 25L and taking-off from 25R, observed at site 1. The regression lines are based on aircraft with at least 10 observations only. Fig. 3 shows that L_{AX} does not give much more information than L_{Amax} for overflying aircraft. Aircraft taking-off, actually"airport-noise", show a greater difference between the two parameters at higher noise levels (fig. 4).

The histograms of fig. 5 show the distribution of the measured L_{Amax} in classes of 2 dB for a certain type of aircraft on a certain departure route, measured at three sites simultaneously. The spread is relatively large, especially for the DC9 at sites 4 and 7. The figures show also the logaritmic mean of L_{Amax} and the value used in the calculation method. This value tends to be lower than the measured values for all aircraft at all sites, especially at the sites some distance away from the airport. This explains the lower values for the calculated II in tabel I. The deviations for the DC9 are large, probably because the data in the calculation method are based on a modern, quiet DC9. The DC9 on route B shows even larger differences, perhaps because there are more older aircraft on this route. Further analysis of the data will be necessary to explain the spread on the measurements and to asses the influence of different factors, such as e.g. the meteorological conditions.

Fig.1. Map of the airport



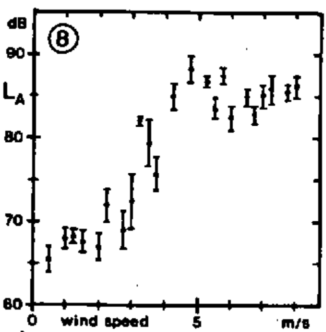


Fig.2. Mean L_{Amax} against wind speed - take-offs on 25R at site 8 (366 B737).

site	NNI	II-meas.	II-calc.
1	44	83	83
2	51	70	70
3	59	98	97
4	39	79	77
5	41	82	77
6	32	74	61
7	41	82	76
8	43-50	82-89	-

Table 1. Measured and calculated indices.

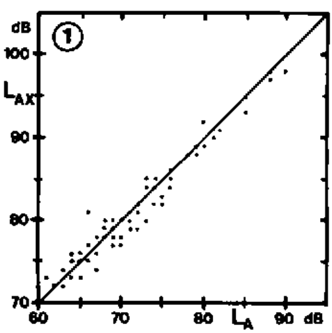


Fig.3. Mean L_{Amax} against mean L_{AX} for all aircraft types landing on 25L at site 1.

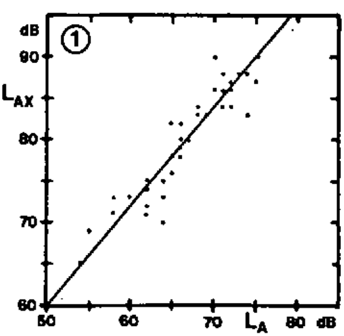


Fig.4. Mean L_{Amax} against mean L_{AX} for all aircraft types taking-off from 25R at site 1.

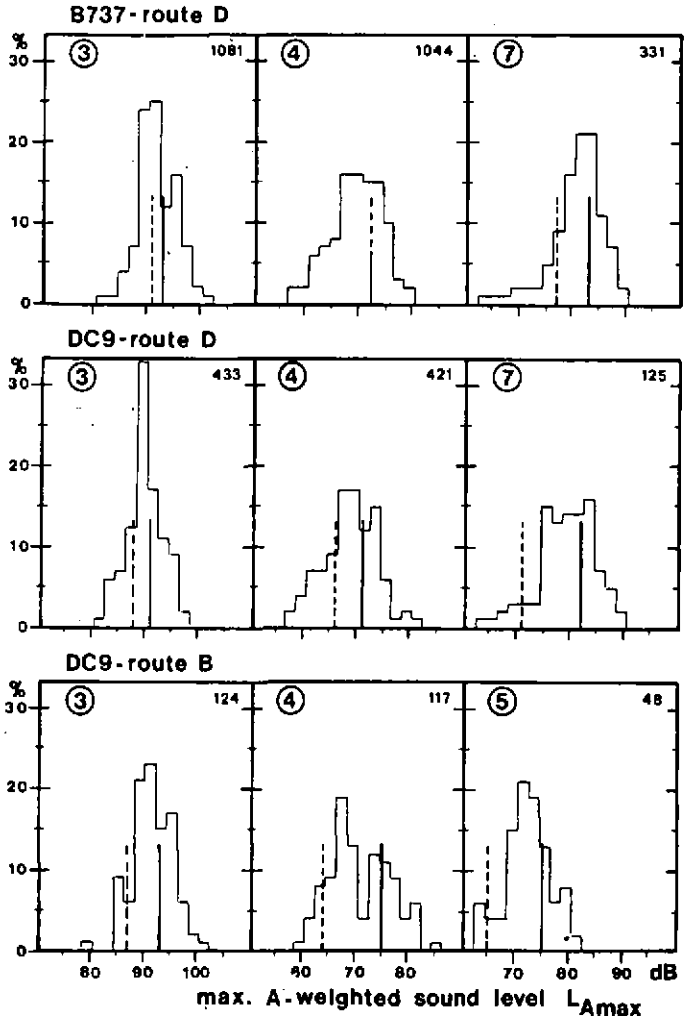


Fig.5. Histograms of overflying aircraft – left corner : n° of site, right corner : number of aircraft measured.
———: logarithmic mean level, – – – –: calculated level