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THE CHANGE OF ACOUSTICAL PROPERTIES OF TRAFFIC NOISE AT DIFFERENT DISTANCES FROM THE ROAD

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DESCRIPTION

The noise originated by a motorway is leading along a hill with irregular spread one- family houses is measured. The motorway is very buisy. 3940 vehicles per hour with 27% trucks during the daytime pass by. In such a situation the noise has very little fluctuations and is quite constant so that only very loud trucks can be heard separately at the closest row of houses, ca. 90m from the road away.

MEASUREMENTS

The measurements were made including residential traffic in the area, and led to a noise map with noise contours in 5 dB steps. The criterion for the selection of the measuring points was to measure each source, i.e. street separately. Close to the motorway we made 3 long- term measurements over 24 hours which show the daily variance of the noise. Between 8.00 a.m. and 4.00 p.m. the Leq did not change of more than 2 dB, so that short time measurements in this period are representative enough to characterize the noise situation in the daytime. 24 short time measurements of 20 min. supplied the long time measurements and allow to draw the noise contours.

The closest houses of about 100m distance are situated in the 65-70 dB(A) zone, whereas houses 500m away are exposed to levels between 45 and 50 dB(A).

Three simultaneous tape recordings at distances of 90m, 215m, and 406m over a 20 min. period were analyzed more detailed in order to get information about the statistical distribution and the frequency spectrum of the noise.

All used equipment for measurement and analysis fits IEC 651 class 1, except the tape recorders (Uher report monitor 4200) at frequencies higher than 15 KHz, which were not used, as it is shown later.

ANALYSIS

All analyses were made with a B&K 4426 statistical analyzer and a B&K 3347 real- time one third octave analyzer connected to a Rockwell AIM 65 microcomputer. The time constant "fast" and the frequency weighting "A" was used except in the spectrum analysis. At lower frequencies the time constant of the filters is longer than 125 ms. The sampling rate was 10x per second. At the two higher distances birds were disturbing the frequency analysis at frequencies higher than 3150 Hz, so that we cut them off. Because the power maximum of traffic noise is at lower frequencies (see fig. 1 and fig. 2), these frequencies are of few importance.

FIG. 1 DISTANCE 90m

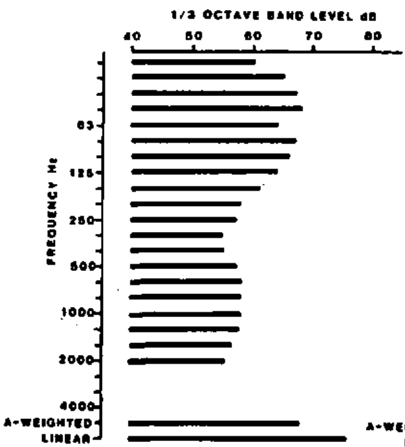
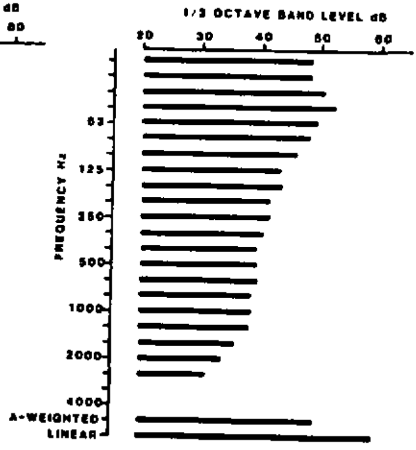


FIG.2 DISTANCE 406m



RESULTS

The fig. 1 and 2 show the spectra energetically averaged over 20 min. of the 90m and the 406m point. The A- weighted difference of both points is 19 dB(A), the linear difference is 17 dB. So we can see a slight trend to lower frequencies at the 406m point because of atmospheric attenuation and some screening effect.

Fig. 3 shows the change of some calculated statistical levels, some percentiles and Leq, with the distance on a logarithmic scale. Except one point, L99% at 406m, all slopes are parallel. This leads to 3 conclusions:

1. The noise is of a steady- state kind, even at the closest distance, with L1% - L99% = 10 dB, because of the high traffic density. This finding is in accordance with the results of GLOECKNER /1/, which he presented at the 9th ICA 1977. He found that the difference L1%-L95% goes to a constant value of 9 to 10 dB for high traffic densities, even at distances of 25m.

2. The attenuation with doubling the distance is between 9 and 10 dB constant for all calculated values.

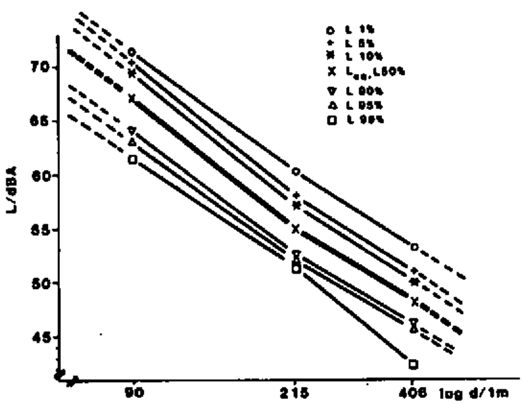


FIG. 3 CHANGE OF LEVEL WITH DISTANCE

This high attenuation with doubling the distance is caused by geometrical, surface, atmospheric attenuation, and screening by the irregular spread houses. Because of this irregularity the attenuation by screening only can be calculated statistically, as LESCHNIK /2/ proposed. The measured attenuation is in accordance with the calculated results of his scattering model.

3. Leq and L50% is equal (see bold line in fig. 3) which shows that the levels are distributed nearly normally.

These findings show that a typical situation: busy road, low residential traffic, statistically distributed houses, some screening effect, normal weather conditions lead to an attenuation of 10 dB per doubling of the distance. Further we see that a busy road is a constant sound source, even close to the road in daytime from 8.00 a.m. to 4.00 p.m.

REFERENCES

/1/ Gloeckner, W.: "Die die Haeufigkeitsverteilung von Verkehrsgeraeuschen bestimmenden Faktoren", 9th Int. Congres on Acoustics, Madrid, 1977

/2/ Leschnik, W.: "Zur Schallausbreitung in bebauten und bepflanzten Gebieten", ACUSTICA Vol.44 (1980), p.14-22