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PERCEIVED ANNOYANCE FROM ROAD TRAFFIC NOISE

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ABSTRACT

In a questionnaire survey on road traffic noise 6151 questionnaires were sent out. 55 % were returned. The results show that traffic noise is not only a concern inside peoples homes. Noise outdoors is also a source of annoyance. A clear relationship is found between noise levels and stated degrees of annoyance, and dose-response relationships have been drawn. Annoyance is found to be most common during the morning and the afternoon. No relationship is found between degree of annoyance and how long people had lived in the present dwelling, but when asked to give 3 reasons for planning to move, noise is the second most common. Most of the annoyed persons have not done anything to mitigate the noise and only 15 percent are willing to pay for a significant noise reduction. It is a common opinion that it is a duty for the public authorities.

1 - INTRODUCTION

In 1999 the Danish Road Directorate and Aarhus Municipality carried out a questionnaire survey on road traffic noise. More than 6000 questionnaires were sent to a random selection of the 132.000 households in the municipality. 55% were returned.

Aarhus is the second largest city in Denmark, and with the municipality also comprising a number of small communities and rural areas, all levels of traffic noise are represented. A major aim of the survey is therefore to match the stated annoyance with the noise levels at the dwellings.

Besides being asked to state their annoyance, the respondents are also asked how the noise affects their everyday life, whether they have done anything on their own to mitigate the noise, what should be done, and who in their opinion should pay for the mitigation.

As a basis for analyzing the returned questionnaires, the following eight hypotheses have been formulated:

1. Increasing noise levels result in increasing annoyance.
2. People have adapted the use of their homes to the noise.
3. The degree of annoyance depends on the time of day of the noise events.
4. The degree of annoyance depends on how long a person has lived in the current dwelling.
5. Noise outdoors is important to people.
6. Age is significant to the degree of annoyance.
7. There is a non-activated basis among the residents for an increased effort against noise problems.
8. There is a willingness to pay among the residents, if noise levels can be decreased.

2 - METHOD

Based on the distribution of the Aarhus dwellings on 5 dB noise intervals and the expected distribution of answers on each degree of annoyance, it was assessed that 6151 questionnaires should be sent out. The questionnaires were sent to private addresses randomly selected by the Ministry of the Interior. It was

asked, that one adult answer the questionnaire. As an incentive for people to return the questionnaires it was decided to draw 10 winners of small wine or chocolate prizes. No reminders were sent to those who did not answer.

The questionnaire contain 29 questions, which can be divided into the following categories:

- General questions about traffic.
- General questions about noise.
- Questions about traffic noise indoors.
- Questions about traffic noise outdoors.
- Questions on local conditions.
- Questions related to methods of and financing mitigation.
- Questions about the person answering the questionnaire.

Based on ongoing international work on standardization of questionnaires regarding noise, it was decided to use the following graduation of annoyance: Extremely annoyed, very annoyed, annoyed, a little annoyed, not annoyed, do not notice noise from road traffic.

The questionnaires are all individually numbered, allowing the answers to be linked to calculated noise levels ($L_{Aeq,24}$) at the individual addresses. The calculations are done using the Nordic Prediction Method [1]. The noise levels are calculated 10 meters from the center of the road, on the face of the building at a height of 2 meters, and on the face of the building on the floor of the dwelling. This allows the answers on annoyance indoors and outdoors to be combined with a noise level related to the situation. On a number of minor roads, mainly residential, no traffic counts are available for the noise calculations. On these roads the annual daily traffic is assessed based on four trips per day per household. The other traffic parameters necessary for the calculations are assessed by the municipality's traffic engineers based on knowledge of local conditions.

3 - RETURNED QUESTIONNAIRES

Of the 6151 distributed questionnaires 3378 were returned. This gives a return rate of 54.9 percent. It could be expected that the return rate would be highest among those subjected to the highest noise levels. This is not the case. The distribution of returned questionnaires on noise levels is very much similar to the distribution of the questionnaires, which were not returned. Furthermore, the distribution on noise levels of the randomly selected dwellings has proved to be similar to the total distribution of dwellings in the municipality's noise mappings. It is therefore reasonable to assume that the results of this questionnaire survey are representative of the general situation in the municipality.

4 - RESULTS

In order to see noise in relation to other nuisances from road traffic, the respondents were asked to indicate which of a number of possible nuisances they experience. One third of all the respondents mark noise as a nuisance. This makes it the most common, far more common than air pollution and children's safety, which answers are given by 20 percent each.

Noise abatement may be aimed at a number of places indoors and outside, where people stay or go. To give indications as to the relevance of various means of noise abatement in different situations, the questionnaire contains questions about annoyance in the following situations:

1. Indoors with closed windows.
2. Indoors with open windows.
3. Outdoors in gardens, on terraces, balconies, etc.
4. On the road where the respondent lives.
5. On public recreational areas near the respondents home.

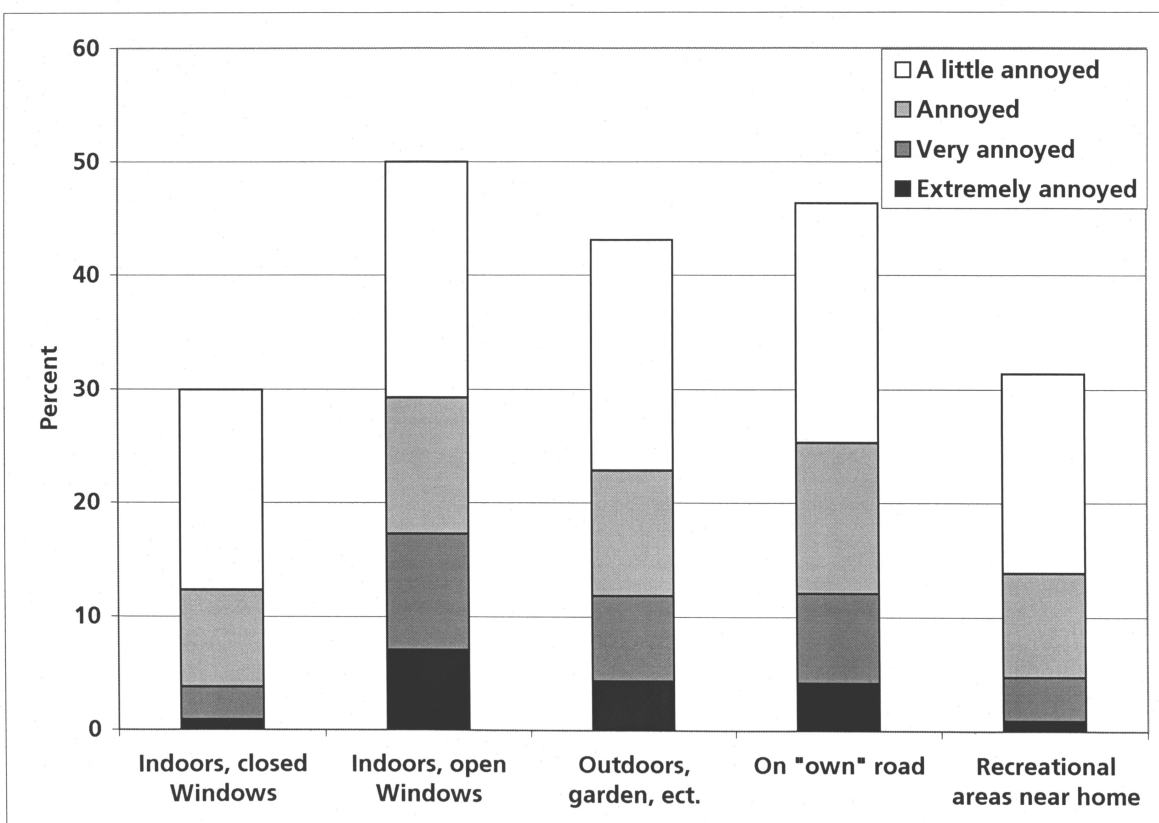


Figure 1: Annoyance in various situations.

The stated degrees of annoyance in the different situations are shown in figure 1. This indicates that noise insulation of homes should not be the primary method of abatement. Instead, means of abatement which also lower noise levels outdoors should be used where possible.

The stated degrees of annoyance have been paired with the corresponding noise levels to form dose-response curves. The curves for noise indoors with open and closed windows are shown in figures 2 and 3. As it is to be expected, the percentage stating to be annoyed rises with increasing noise levels. However, there is also a tendency towards an increase in the percentage annoyed persons at the low levels under 50 dB(A). The noise level at a dwelling is generally calculated based on the traffic on the road, on which the dwelling is situated. At some dwellings a nearby major road has been the basis for calculations. This may have been missed at some locations, which could explain the higher percentage annoyed at low noise levels. Another explanation may be, that at very low local noise levels noise from far away major roads may be a cause of annoyance as background noise.

The respondents are asked to state their age. No relationship is found between the age of the respondent and the stated degree of annoyance. Equally, no relationship is found between how long they had lived in their current home and the stated degree of annoyance. When asked: "If you plan to move, what are the three main reasons for moving?", the second most common answer (25 %) is road traffic noise. The most common (61 %) is "living conditions".

Those respondents who stated to be annoyed by traffic noise are also asked to state when during the day they are annoyed. It is found that the degree of annoyance is highest in the morning (7 to 9 o'clock) and the afternoon (12 noon to 7 p.m.). As traffic levels can be expected to be highest during these periods, this is not surprising. The lowest degree of annoyance is found during the night (23 to 7). Even among those subjected to noise levels exceeding 70 dB(A) only 17 percent stated to be annoyed during the night. Those who stated to be annoyed are also asked whether they have done something to mitigate the annoyance. 75 percent have done nothing, 11 percent have put in noise reducing windows, and 9 percent have moved their sleeping room away from the side of the house facing the road.

When asked whether they would be willing to pay for a significant noise reduction only 15 percent of the respondents answer positively. 26 percent are uncertain. Only those stating to be annoyed by traffic noise are asked this question. The majority of the annoyed respondents see noise amendment as a job

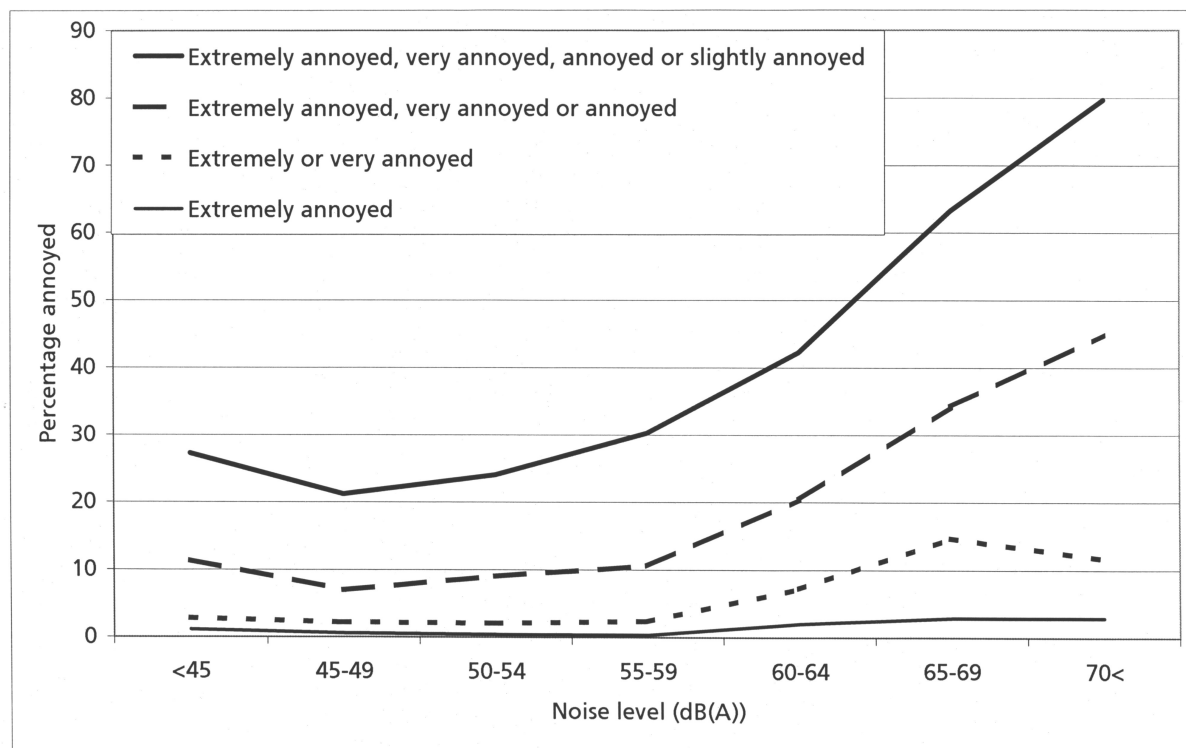


Figure 2: Dose-response relations indoors with closed windows.

for the state, the regional government or the municipality. Only a little more than half the annoyed respondents answer this question, but of these 72 percent state that public authorities should pay. More than one answer is allowed, but still the second most common answer – "the motorists" – is only given by 28 percent.

5 - CONCLUSIONS

Hypotheses 1, 3 and 5 can reasonably be said to be true, and hypotheses 4, 6 and 8 can be rejected based on the results of this survey. As for hypothesis no. 2 the majority have done nothing, but 25 % have taken action on their own. Hypothesis no. 7 it is difficult to conclude on from the results of the survey. Generally noise abatement is seen to be the responsibility of public authorities, but it cannot be rejected, that people can be brought to act on their own.

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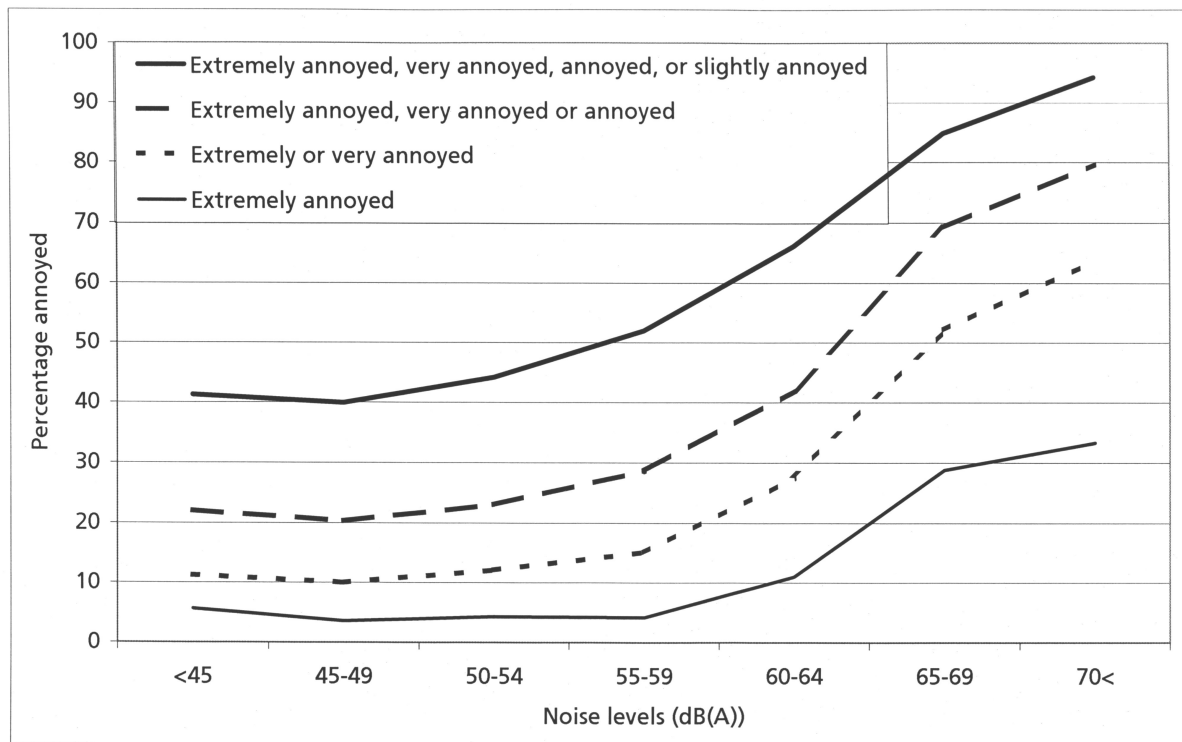


Figure 3: Dose-response relations indoors with open windows.