Road traffic noise in EU-15

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Introduction

The development of an European noise policy requires reliable data on the present noise exposure of the EU population and on the effect of measures and other future developments. Several studies have been performed with limited accuracy as can be concluded from the widely varying results [1,2,3].

In this paper we present two complementary model-based approaches to evaluate the total EU traffic noise exposure of both its population and its land area.

The first model combines already available noise exposure data on about 40 cities in Europe and population data on nearly all major European cities. Both data sets are combined on base of a relation between city parameters and noise exposure distributions of its population.

The second model uses road and traffic data of all EU-15 countries to evaluate the land area exposed to traffic noise.

The advantages of these models compared to methodologies used in former studies are firstly the clear starting points with respect to model and input data and secondly the use of unambiguous relations between input parameters. Furthermore these models can be extended with other relevant input data and relations (see for instance [4]) to improve reliability, accuracy and ability to predict the consequences of noise reducing policies.

Methodology

Population exposure model

The first model calculates the number of inhabitants of the EU exposed to road traffic noise levels exceeding 55, 65 and 75 dB(A) (L_{dn}-metric). This model is based on the following methodology:

- Based on statistics of Sweden, the Netherlands (see Fig.1), Greece, Denmark, Spain and France a relation is derived between the size of the city and the distribution of noise exposure of the population. In addition to this a distribution is determined for the exposure of people living in the rural areas.
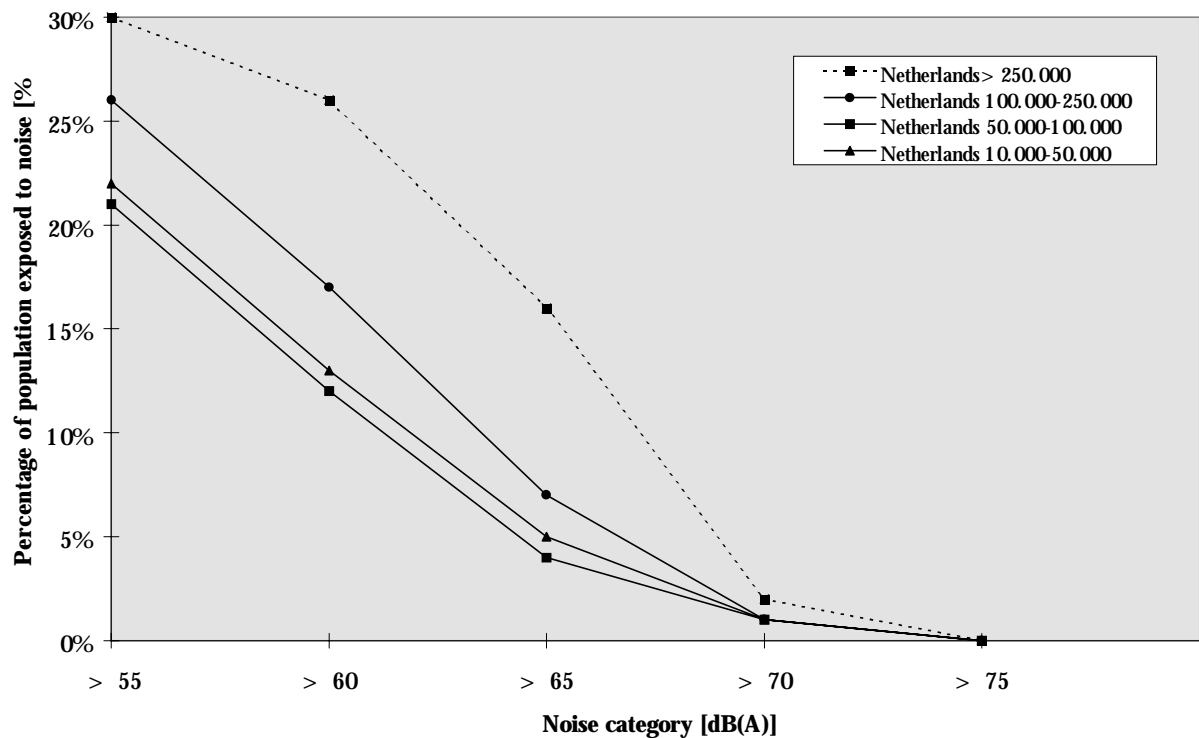

Fig. 1   Cumulative distribution of the road traffic noise exposure of inhabitants of differently sized cities in the Netherlands.

- Five city types ranging from "moderately noisy" to "extremely noisy" are defined with different distributions of the number of inhabitants exposed to levels >55, >65 and >75 dB(A) (see Fig. 2). For instance in an "extremely noisy" city 85% of the population is considered to be exposed to levels exceeding 55 dB(A); in the "moderately noisy" cities only 20% is exposed to noise of 55 dB(A). The rural areas are attributed with a distribution in which even less people are exposed to noise.

- Available exposure statistics for several countries and cities, as well as the calculated values for the exposed inhabitants of Munich, Madrid and Amsterdam [5] are used as calibration and verification values for these estimated values.
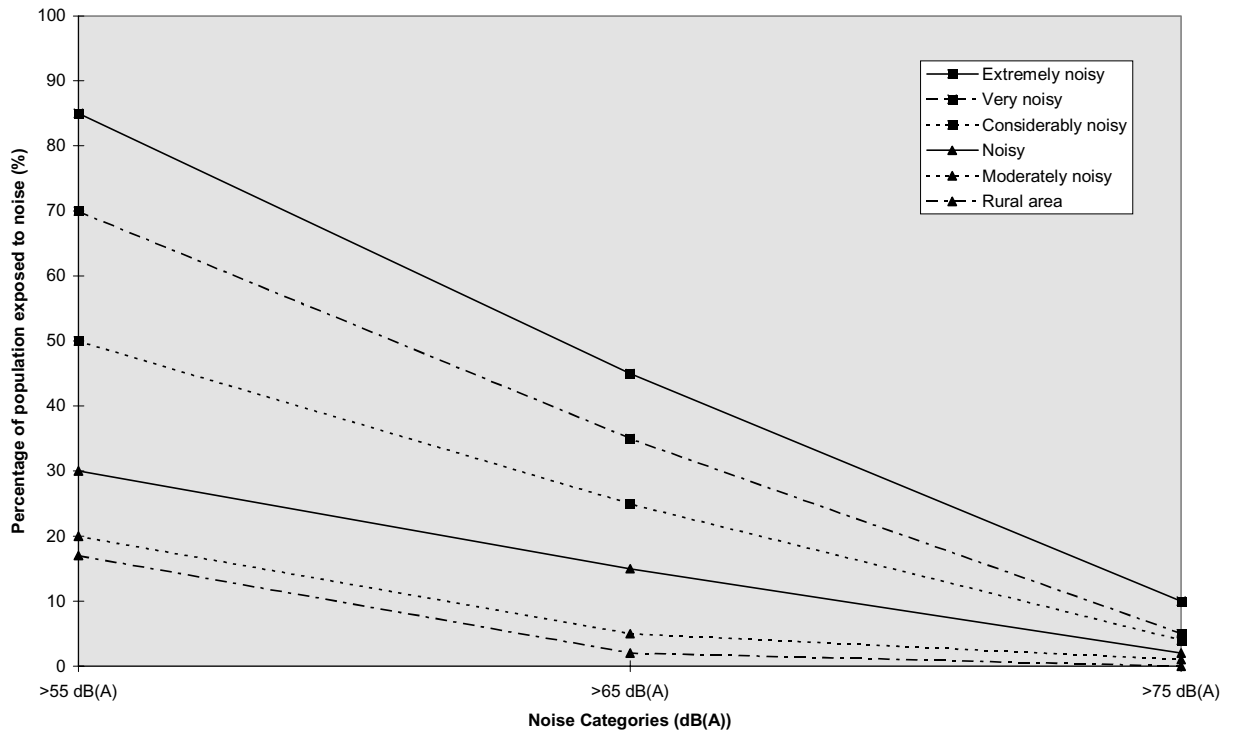

Fig. 2   Relation between city size and exposure of inhabitants applied in the model.

- The population of EU-15 countries are attributed to urban and rural areas based on UN statistics [6].

- All cities of the EU-15 countries are distributed over the five "noisiness"-classes. For instance, in this way a large city like Madrid is "extremely noisy", whereas a (just as) large city like Stockholm is just "considerably noisy", which results in much less exposed inhabitants in Stockholm. Next, the smaller cities are distributed over the remaining classes, which for instance results in small cities in Spain being as noisy as a large city like Stockholm.

- In this way all inhabitants of the EU, including those living in the rural areas, are distributed over 3 noise-exposure classes.

Land area exposure model

A background level of road traffic noise exceeding 40 dB(A) L_{dn} affects nature quality. Noise levels exceeding 47 dB(A) L_{dn} can disturb nature life, especially the breeding of birds. L_{dn}-levels exceeding 55 dB(A) result in the restraining of housing activities.

The total land area exposed to L_{dn}-levels exceeding 40, 47 and 55 dB(A) is computed by calculating all distances between the roads in the EU-15 countries and the L_{dn}-contours according to these indicators. The calculation scheme of the distance of the contours is based on the calculation scheme which is used in the Dutch legislative.

For every country a separate calculation scheme is designed. Five classes of traffic intensities on the motorways, national and regional roads are made, resulting in very busy to very quiet roads. The total road length of each country is distributed over these five classes based on Dutch, German, Spanish, Swedish, Belgium and Austrian data.

Results

After running both models the following outcome was obtained (see Table I and II).

Table I Estimated exposure of the total EU-15 population to road traffic noise

L_{dn} dB(A)	< 55	55-65	65-75	> 75
% exposed	68	19	11	2
population [millions]	251	71	41	8

Table II Exposure data of land area of EU-15 within successive noise categories

L_{dn} dB(A)	> 40	> 47	> 55
% exposed land area	15	7	3
exposed land area [km^2]	500.000	240.000	110.000

Discussion

The model approaches presented here can be considered as a first step to reliable European wide assessment of noise exposure data, based on statistical relations. It needs further refinement, especially for the situation in southern EU countries, because the noise exposure data used in this model possibly underestimates the actual situation. It may be expected that the work of EU WG IV on noise mapping and WG III on calculation methods will improve the quality of basic data and therefore the reliability of the overall assessment.

The claimed advantage of prediction possibilities was already proven with the application of these models for the assessment of the "SoER98-OUTLOOK" scenario and the "BAT 2010" scenario [5].

References

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