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PRESENTATION OF ENVIRONMENTAL NOISE

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ABSTRACT
New roads cause changed noise loads for the population. A shift of traffic may induce an increase as well a decrease of noise burden. In order to present this dynamic process and to provide assistance for the assessment of this problem to officials, a new graphic-statistical presentation of noise data was chosen. Sound levels were subdivided into categories 5 dB(A) each and frequencies of these categories were presented in a histogram. The project was structured on 4 levels. The first level included the total project from point A to point D (altogether 16,2 km). Noise levels for both scenarios, with and without the construction of a new road, were forecasted for the year 2015 and the load was assessed by a comparison of histograms. On the second level, noise at the individual four townships (A-D) and on the third level, noise at individual important emission areas (each township consisting of several emission areas) were represented in the form of a box plot. Finally, the fourth level contains the medical assessment of each single result.

1 - INTRODUCTION

According to a representative survey, some 20% of the population are permanently and strongly disturbed by traffic noise. In urban and metropolitan areas, approximately 30% of the population consider their daily activities and leisure activities impaired by traffic noise [1]. In 1946, a consensus was established that such noise is "unwanted" [2]. The definition for undesirable noise starts from the origin of a noise, which can be described in physical terms, in the outside world. The decision, however, whether sound can be defined as noise is made by the individual person affected based on physical, situational and personal criteria [3].
The construction of new roads causes changed noise loads for the population. This does not always increase the noise load but traffic shifts may result in changes in noise loads. In order to present this dynamic process and to provide assistance for the assessment of this problem to officials, a new graphic-statistical presentation of noise data was chosen providing a contextual survey of individual parameters. So far, noise emissions have been presented in the form of isophons on noise exposure maps.

2 - METHODS AND RESULTS

The project consists of 4 levels. The first level includes the overall project from point A to point D (total length= 16.2 km, see Fig.1). Noise data are subdivided into individual categories of 5 dB(A) each and the frequencies are presented in a histogram. This statistical calculation focuses especially on the shifts of the individual categories caused by the new road (B-301). Another advantage of this method of presentation is the ability to take into account the related measures on the feeder-streets and peripheral roads where traffic shifts occur as a result of the new road. The changes in the traffic on side roads, noise loads in individual towns and villages may increase or decrease which can be shown in the chosen statistical-graphic presentation. Noise levels with and without construction of road B-301 are contrasted and the loads are evaluated. On the second level, noise levels of the four townships (A-D) are discussed

using the method described above. On the third level, noise levels of several important emission areas are presented in the form of box plots. This form of presentation allows a graphic evaluation of various statistical quantities such as median, quartile, skewness and the range of distribution. As far outside values are listed separately, the data for both scenarios can be more easily compared. On the fourth level, each single result is assessed medically.
This statistical calculation focuses especially on the changes of the individual noise categories within the histogram caused by the B-301 road (see figs. 2 and 3). Another advantage of this type of noise presentation is the ability to take into account the related measures on the feeder-streets and peripheral roads where traffic shifts occur as a result of the new road.
In the present case, the construction of a bypass road is supposed to lighten the traffic load of a highly trafficked road (A23 see fig.1); also, the new road is to focus local traffic (Vienna-South) in order to abate traffic ion of certain areas. The concentration of traffic usually leads to a discharge of townships and villages resulting in a decrease of accidents pollutants in heavily populated areas. The advantages must be weighed against disadvantages if the latter are medically acceptable.

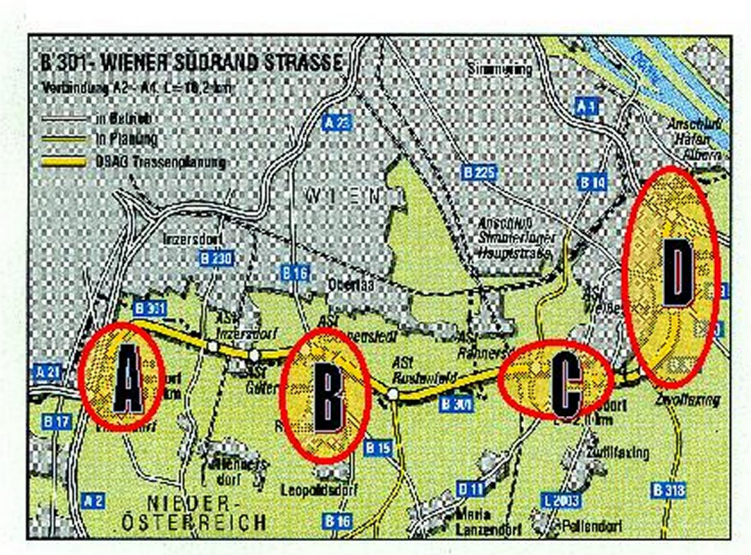

Figure 1: Road project B-301; A-D are four townships directly affected by the construction of the road.

The WHO guideline values are 55 dB(A) during the day and 45 dB(A) during night hours.
Levels of the study:

- The first level includes the overall project from A through D. Noise levels of scenario 1, without construction of B-301, are projected for 2015 and compared with the levels of scenario 2, with construction of the road, equally projected for 2015. The respective loads are assessed.
- On the second level, noise levels of the individual townships are discussed using the method described above. The loads are compared with several limits and recommended values as well as the health-related recommendations of the WHO.
- On the third level, the noise loads of important emission areas are presented using box plots. This form of presentation allows a graphic evaluation of various statistical quantities such as median, quartile, skewness and distribution.

From the presentation of data of noise measurements and noise forecasts in a histogram it emerges that a significant proportion of the data from scenario 1 exceeds or strongly exceeds WHO guideline values. In a few cases, the values present a definite health hazard. Scenario 1 assumes an increase of traffic without attending measures and without the construction of the new road. The Median is above 56 dB(A).
For the evaluation of a health hazard, the overall load (i.e. sum total of all noise levels) are critical. Thus, this is the parameter which is used for an assessment and not merely the noise level of road B-301.

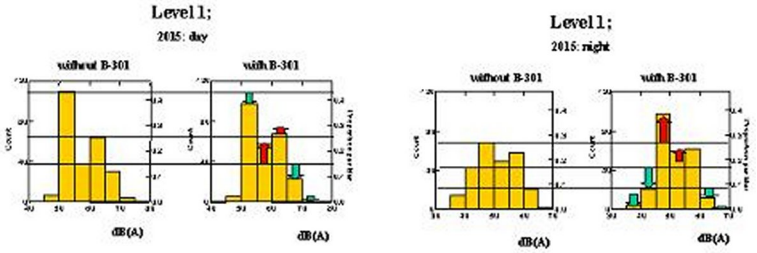

Figure 2: Forecasted changes in noise load categories for 2015 with and without construction of road B-301.

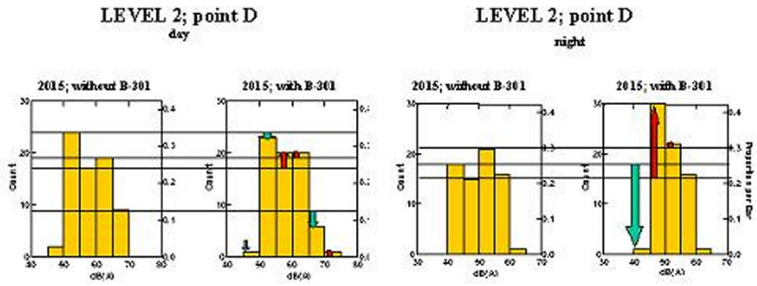

Figure 3: Forecasted changes of noise load categories in Township D (level 2) for 2015 with and without construction of road B-301.

3 - DISCUSSION

The construction of road B-301 through the townships A through D result in significant and critical changes. The graphic presentation of noise in the four levels of the study not only demonstrates noise loads but also the effects of noise management measures. As the presentation extends from the overall project to individual streets down specific points of emission, the changes of noise loads which are caused by traffic shifts to side streets can be followed in detail. As Fig.2 shows, the categories with high noise levels decrease as a result of noise management measures, but the categories with low levels also decrease. The presentation on a Gaussian curve makes this process visible.

The medical evaluation of noise is not only a question of threshold limits but must also be seen relatively to the base load.

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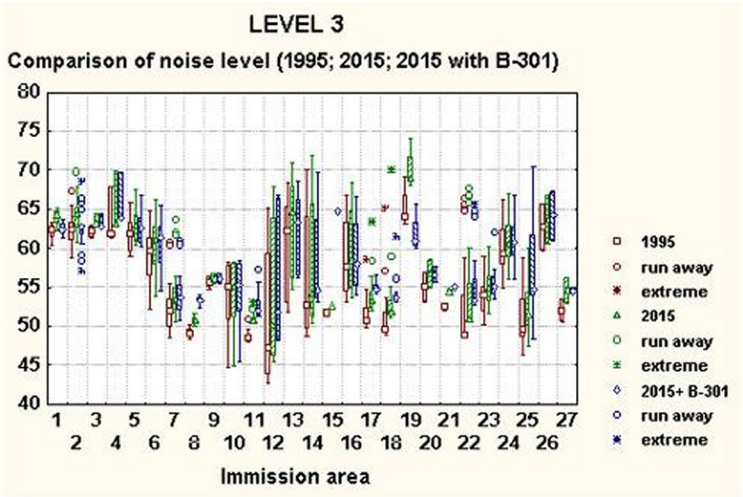

Figure 4: Box plot (=level 3) of emission areas; noise levels of 1995 are compared with forecasted levels for 2015 with and without construction of road B-301.