

A COMPARISON OF TWO ENGINEERING MODELS FOR SOUND PROPAGATION: HARMONOISE AND NORD2000

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1. INTRODUCTION

Two established models for predicting environmental noise levels, the European 'Harmonoise' and the Scandinavian 'Nord2000', have been compared for a number of test cases involving a variety of source and receiver configurations, terrain profiles, noise barriers, properties of the ground, and meteorological conditions. The predictions are compared with reference data from the literature, and with new experimental results. In most cases the models agree very well; but in some cases the predictions deviate significantly from each other. There are many similarities between the approximations used in the two models, but some parts of the modeling methods are clearly different. The most significant differences between the two modeling methods are pointed out, and it is attempted to explain the observed differences between their predictions.

2. THE MODELS

Harmonoise and Nord2000 are two very similar engineering models for predicting environmental noise levels. Both models account for the effects of various factors that influence the sound propagation. These factors are: spherical divergence, air absorption, reflections from the ground and diffraction from barriers, energy losses during side reflections, effects of scattering zones and meteorological conditions.

The effects of spherical divergence, air absorption and energy losses during reflections are handled in the same way by the two models. On the other hand the methods used to estimate the effects of ground reflections, diffraction from barriers, and scattering zones are not the same in the two models. The effects of meteorological conditions are handled in fundamentally different ways.

3. RESULTS

More than one hundred test cases involving a variety of source and receiver configurations, terrain profiles, noise barriers, properties of the ground, and meteorological conditions have been tested. Results are presented graphically, showing the prediction from each model along with reference data, an illustration of the terrain profile and meteorological information.

Most of the test cases are validation cases from Nord2000. The data used for comparison are results from calculations made with the Crank-Nicholson parabolic equation method and from measurements. Furthermore, some scale model experiments have been conducted to supplement the reference data for some cases of special interest.

In addition to the graphical results, A-weighted sound pressure levels have been calculated for all predictions and compared with the reference data.

4. CONCLUSIONS

Both Harmonoise and Nord2000 have been found to predict sound propagation reasonably well for a variety of different cases. The accuracy of the predictions varies between different cases, and the predictions are in general very accurate for the simplest cases, but often rather inaccurate for more complex cases. A-weighted levels calculated with the two models are fairly accurate in general, but can vary significantly for complex cases. Neither model gives better predictions in all cases, and although the two models are able to predict sound propagation reasonably well in most cases, there is still room for improvement.