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3D geospatial data requirements for simulating noise using the Nord2000 model: Case study of the impact of building façade types and roof configurations on simulated traffic noise levels

The European Union implements the Environmental Noise Directive (END), which offers a framework for evaluating and assessing environmental noise. All EU members are required to create strategic noise maps to inform the public about noise pollution and its effects. This study followed these directives and guidelines to collect the required data and employed the NORD2000 model to simulate traffic noise. SoundPLAN was used as simulation software.

For accurate simulation, the layers related to urban furniture and the ground covers were imported into SoundPLAN from 3CIM (3D city models). The case study was Lorensborg, a district of Malmö city in Sweden. The study findings indicate that the Nord2000 model requires more detailed input data compared to other models, e.g., meteorology, temperature, type of road surface, and information about heavy vehicles. The inclusion of additional information increased the computational resources and time required. However, the research underscored the significance of integrating geospatial data to achieve precise noise modelling.

In addition, the study investigates the effect of densification in urban areas. So, two scenarios were designed, with and without planned building. For each scenario, acoustic properties for three building façade types were determined, fully reflective 0 dB, hard reflective 1 dB, and soft reflective 4 dB. The study revealed that increasing reflection loss in each type influences the simulated noise levels by an average of 2 dB. Soft façades were found to be more effective in reducing noise dispersion and subsequently lowering noise levels compared to hard façades. Furthermore, the orientation of the building towards the noise source also influenced the simulated noise levels. For example, buildings oriented vertically, with their front face perpendicular to the road, experience less noise impact compared to buildings that are parallel to the road.

In the simulation considering roof configuration, the roof layer from 3CIM was imported into SoundPLAN as a Noise Protection Wall. However, in the specific conditions outlined in this study, the inclusion of roofs did not result in significant changes in the measured noise levels when compared to flat roofs.

The study highlights the importance of detailed geospatial input data for achieving precise noise modelling. Additionally, it reveals that soft façades and vertical building orientation are effective in reducing noise dispersion based on the simulation results and investigation into the effects of densification. The findings suggest that urban planning and design should consider factors such as building density, orientation, and façade reflection losses to meet the noise reduction standards.

Keywords: *Physical Geography, Ecosystem Analysis, noise simulation, traffic, Nord2000 model, building façade types, roof configurations, geospatial data, 3CIM, SoundPLAN, acoustic properties, urban areas, 3D city model.*

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Master's degree project 30 credits in Geomatics, 2023
Department of Physical Geography and Ecosystem Science, Lund University. Student thesis series INES nr 611