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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

In today's rapidly evolving world, the increase in population and urbanization has led to an alarming rise in noise pollution, which has become a serious problem in many urban areas. There are several factors that contribute to noise pollution in cities, including traffic, aircraft, railways, and industries. Exposure to this noise pollution can cause headaches, anxiety, and sleep disturbances and even lead to more serious problems such as hearing loss, high blood pressure, and heart disease. Urban planning plays a crucial role in controlling noise pollution. A range of noise reduction elements, including sound barriers, vegetation, and effective building design, can be incorporated into urban planning to mitigate noise pollution. From that, evaluating and monitoring noise levels have become a critical concern for decision-makers. Following this, World Health Organisation (WHO), has issued guidelines for protecting human health, against public noise. At the European Union scale, the Environmental Noise Directive provides an approach related to assessing and managing environmental noise. According to this directive, all EU members must prepare a strategic noise map to inform the public about noise pollution and its effects. In this regard, the use of GIS is highly important in mapping noise, as they allow for the integration of various data sources, such as noise observations, land use patterns, etc.

A case study of noise simulations was performed with a focus on the need for 3D geospatial input data. The study area was Lorensborg, a district of Malmö city in Sweden. The geospatial data input which was needed for the Nord2000 model simulation was gathered. The study findings indicate that the Nord2000 model requires more detailed geospatial input data compared to other models, which may limit its applicability to smaller geographical areas due to the required computer resources and computation time. Nevertheless, the research highlighted the importance of incorporating geospatial data for accurate noise modelling.

In addition, acoustic properties of different building façade types and roofs were determined. The study revealed that the acoustic properties of the façade, such as reflection loss and reflection coefficient, influence the simulated noise levels. 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. Regarding roof designs, the study determined that in the specific context of this research, the inclusion of roofs did not significantly alter the noise level values compared to flat roofs.

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

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