

Advanced Tools for Traffic Noise Modelling and Prediction

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Abstract: - Environmental impact studies are strongly related to road traffic noise, especially in urban areas. A long term exposure to road traffic noise, in fact, can lead to relevant effects, both auditory (e.g. sleep disturbance, hearing loss, etc.) or not auditory (e.g. stress, anxiety, cardiovascular problems, etc.). A proper modelling of noise production and propagation is a challenging issue, especially in areas where the complexity of sources, receivers and other objects makes difficult to use standard predictive formulas, such as the usual Traffic Noise predictive Models (TNMs). The collection of experimental data is always advisable, in order to control the predictive tools and eventually tune their parameters. In this paper, the author presents a set of advanced tools for noise modelling, particularly aimed at the prediction of non-conventional situations, such as road intersections, traffic jams, extreme traffic flow, etc., where the standard TNMs usually fail. The main idea is to implement a dynamical approach in the traffic noise prediction, i.e. to include the dependence of noise emission by kinematical parameters, such as speed, position and eventually acceleration. This can be achieved by means of different approaches, some of them resumed in the paper, for instance cellular automata, traffic theory (Fundamental Diagram), source power dependence from the speed, etc.. The implementation of these models in easy to use tools represents the new horizon in traffic noise prediction.

Key-Words: - Noise Control, Road Traffic Noise, Traffic Theory, Dynamical Models.

1 Introduction

The environmental impact control is nowadays one of the most important problem in urban areas. The European Community (EC) settled, funded and developed the Harmonoise and IMAGINE projects (*Improved Methods for the Assessment of the Generic Impact of Noise in the Environment*) [1, 2] with the aim of furnishing an uniform approach to community noise and common standard criteria for monitoring and control of noise impact on human activities, in particular for developing predictive models.

The relevant sources that are to be considered are transportation infrastructures, industrial settlements and anthropic activities. In particular, scientific literature reports many studies, both theoretical and experimental, concerning monitoring and reduction of noise produced by transportation means, especially road networks, railways and airports (see for instance [3-12]). It's reasonable to affirm that in urban areas, road traffic noise is the most relevant source, since airports are usually placed outside the downtowns and railways are usually designed to move out from the centre of the cities and rarely

cross the residential districts. Medium-big size cities may be equipped with subways that do not hardly affect the environment from the acoustical point of view.

The annoyance produced by noise pollution has been studied and documented in scientific literature (see for instance [13, 14]). The exposure to noise, in general, may affect mental and physical health in terms of sleep and/or conversation disturbance, hearing loss, cardiovascular problems, anxiety and stress, etc.. Thus, the need for monitoring and eventually predicting road traffic noise is evident.

Traffic Noise predictive Models (TNMs) are usually adopted to control the noise level in a certain areas where road network is highly present. These TNMs are also used to define risk classes for each area, according to the purpose of the activities therein, and to adopt the zoning required by European regulation. Experimental measurements are performed together with TNM simulation, especially when the number and typology of sources make difficult to use a single predictive model. Sometimes predictive commercial software are also adopted in the environmental study, since they take into account several sources at the same time.

