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# GERANO: GEOGRAPHIC RAILWAY NOISE SYSTEM

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## 1. INTRODUCTION

Nowadays the noise emission of road, rail and air transport systems receives more attention. The public demands a serious treatment of the noise nuisance they are suffering from. They will simply resist new transport line with all possible means if there is not an acceptable solution to the possible noise problems. The central governments of most European countries have devised noise nuisance laws to protect the public from high noise levels.

Dutch noise legislation enacted in 1987 calls for noise control measures on existing railway lines and new lines as they are built. In order to comply with the noise nuisance laws and to satisfy the public the railway company often install noise barriers and isolate houses near the tracks. Another method to comply with the law is vehicle noise control or control at the sources. Most railway companies don't have a well defined and funded strategy for noise control [1]. As a result noise problems are solved often with measures like noise barriers which are only locally effective.

In order to develop and test noise control strategies there is a need for an interactive information system which contains the national and, when dealing with freight cars, European railway networks. In this way different integrated noise control scenarios can be compared, allowing for example the determination of the most cost effective strategy.

The Swiss railway company [2] and the Dutch railway company [3] have developed automated noise calculation and information systems covering the entire national railway networks. This article describes the Dutch system Geographic Railway Noise: GERANO.

GERANO is developed at NS Technical Research by order of NS Railinfrastructure Management.

## 2. THE COMPONENTS OF GERANO

The components are extensively described in [3]. GERANO is capable of quantifying the important acoustic parameters for large lengths of railway lines. The system makes use of huge amounts of data and contains the simple Dutch legal calculation method and a simulation module of the Dutch noise abatement act. The system combines calculated acoustic data and geographical information. The present state-of-the-art programming techniques, software tool-kits and fast computers enable the realization of this complex system.

Fig. 1 shows a diagram of the complete system. The input databases (1) and the manipulated source strength calculation define the input or primary parameters. The impact on the surroundings is calculated by the geographical module. This module uses the input databases (2) as a source of information on the type of surroundings near the railway line. As a result the system generates output parameters. A special module is available to calculate output parameters which are related to a particular noise nuisance act.

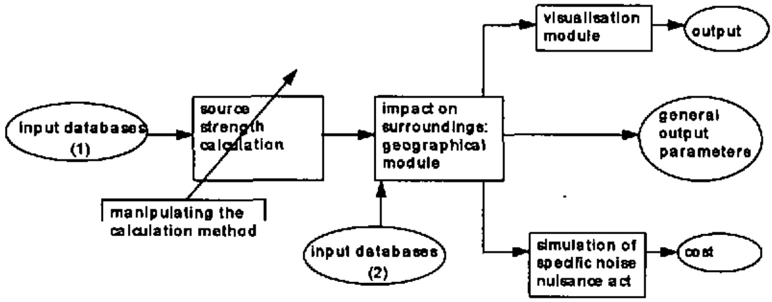


*Fig. 1: Diagram of the system. The input data and the adjusted formulas of the calculation method define a particular scenario. The system uses geographical data (the input databases 2) and software modules to calculate the output parameters*

A user of the system can compose different scenarios by defining input parameters. The system will predict the output parameters for each scenario. For example the GERANO can predict the measures in the path of propagation, like noise barriers, to comply with the law. It is also possible to change the standards or methods of simulation of the noise nuisance act. So its possible to study the effects of different kinds of noise legislation.

## 3. STUDYING THE FINANCIAL ASPECTS OF NOISE REDUCTION AT THE SOURCES

According to the Dutch noise nuisance act the railway company has to take acoustic measures when certain limits are exceeded. The company is free to choose between measures taken at the sources, measures in the path of propagation or a combination of these two. At this point the cost effectiveness of investments in quieter trains and tracks becomes important. We expect that the amount of money to be spent on sound barriers and the sound insulation of dwellings will decrease when trains and tracks are quieter. This is illustrated in fig. 2.

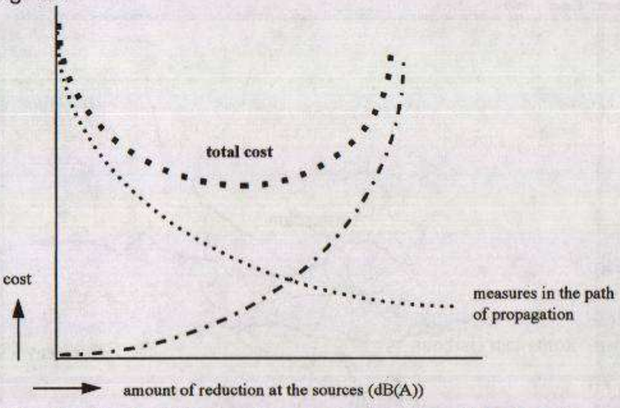


*Fig. 2: Cost minimization at concern level in theory*

The figure represents one specific future railway transport scenario. The dashed line represents the cost for measures taken in the path of propagation in order to comply with the noise nuisance law. The dashed-dotted line shows the money the company invests in quieter trains and tracks. The bold dotted line shows the total cost for the railway company to comply with the noise nuisance law. The lowest total costs occur for specific combinations of measures taken at the sources and measures taken in the path of propagation. In this situation we achieve a minimization of cost at concern level. The lines in fig. 2 are theoretical. In reality the line representing the cost for measures taken at the sources will not be continuous. It will consist of discrete points corresponding to different technical possibilities of reduction at the sources. GERANO will be used to obtain information about these points.

## 4. NOISE EMISSION CEILINGS AFTER THE REVISION OF THE DUTCH NOISE ABATEMENT ACT

The central Dutch government is preparing the revision of the Dutch noise abatement act for railway noise. After the revision maximum noise emission levels which are called noise emission ceilings will be established for each railway line in the Netherlands. Then the railway company has to show each year the realized noise emission values of their network to make sure that legal noise emission ceilings are not exceeded. The company also has to make a prediction of the noise emissions values for the next year. GERANO is used as a tool to analyze noise emission values for the entire Dutch railway network. In figure 3 predicted noise emission values for the Dutch railway network in the year 2005 are shown.

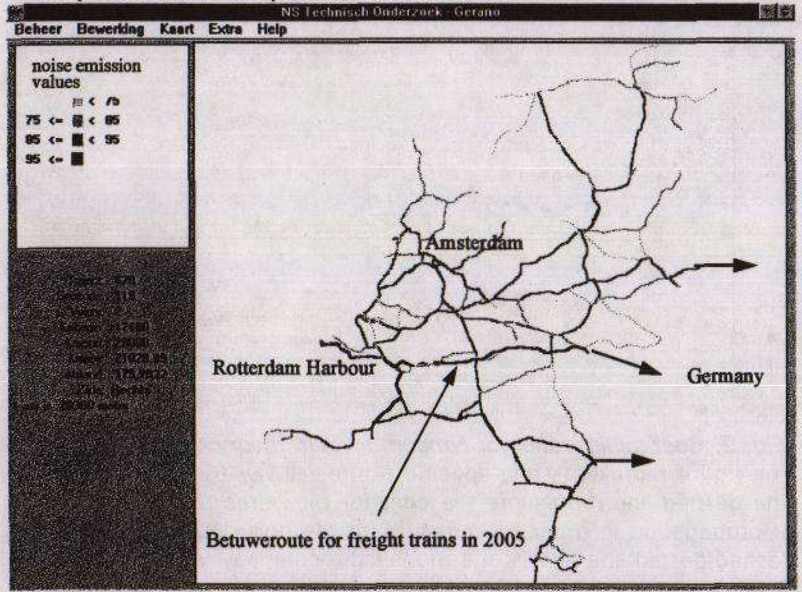


*Fig. 3: Predicted noise emission values in the Netherlands for 2005*

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