Evaluation of cost and benefit of railway traffic noise reduction measures

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Abstract

The *Evaluation of Costs and Benefits of Railway Traffic Noise Reduction Measures* aims at the evaluation and possibly optimisation of noise abatement strategies for railway traffic on a European scale. The investigations support an overall sustainability assessment of noise abatement measures (carried out at the Chair of Environmental Sciences, Natural and Social Science Interface) and are ongoing within the framework of the EU-project STAIRRS, in which many European countries – including Switzerland – participate.
The presentation explains the ideas, assumptions, prerequisites and approaches used in these cost efficiency calculations, which enable decision makers to evaluate different scenarios of noise abatement strategies during a long time period (e.g. 10 years) including the resulting costs and benefits during a much longer period (at least the lifetime of the implemented measures). This causes severe interpolation and extrapolation problems.
There are three categories of measures. The first category is related to the railway line. The noise barriers and the track improvements belong to this category. The second category is related to the rolling stock. This includes the implementation of composite brakes and the wheel optimisation. The third category is related to the noise recipients. This category consists only of the insulation of windows.
The benefit calculations are based on a goal function, which measures the total noise immissions weighted with the number of persons and their initial noise exposition and discounted in time. Because the noise immissions vary with distance from the railway line a ‘mean’ noise immission is calculated as an integral over the distance of 1 km on each side of the railway line. This calculation is similar to assuming a representative calculation distance, but it depends on the local characteristics of noise propagation. The benefit calculations are conducted separately for the different measure categories.
The benefits of line measures are averaged according to the length of the installed measures as percentage of the total line length. They are calculated from the reduction of noise immissions. The improvement of rolling stock is assumed to reduce noise additionally and independently of the line measures. We use the expression for the general noise emissions to calculate the benefits from rolling stock improvements. As opposed to line measures, they are thus calculated from noise emissions.
The cost calculations take into account possible removal costs of the measures and use the econometric formula for so-called perpetual annuities. The consequence is that measures with a smaller lifetime have higher replacement costs. There are two reasons why we think this cost model is appropriate. The first reason is, that in general noise measures cannot simply end after their lifetime, and therefore the measures are really perpetual annuities (the evaluation model might also be known as *dividend discount model*). The second

reason is, that this evaluation comes closer to an evaluation of sustainability. The results of the example calculations exhibited 25% higher perpetual costs than without taking replacement into account. But not only the higher value of perpetual costs will influence the evaluation of the investment programs. An important feature is, that the different lifetimes of the measures are reflected by this approach, which influences the optimisation of the investment programs.
The presentation discusses the different approaches as applied to investment programs, which are constructed, assessed and optimised within the STAIRRS project during the next months.