

# Selecting Road-Noise Abatement Measures: Economic Analysis of Different Policy Objectives

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**Abstract:** To satisfy new legislation, the Norwegian Public Roads Administration implemented a national façade insulation program encompassing 2,500 dwellings exposed to high levels of road traffic noise. Thereby, the road owner brought the equivalent noise levels from road traffic in compliance with a new indoor limit of 42dB. Cost-effectiveness analyses show that façade insulation was the least expensive noise-control alternative per dwelling. However, cost-benefit analyses show that the benefits were less than 20 per cent of costs. One reason for the poor benefit-cost ratio is that only the residents of the targeted dwellings benefit from at-receiver measures. Measures at the source and/or targeting the propagation paths also provide noise benefits for residents living along the same streets as the most noise exposed and inadequately insulated dwellings.

A mixed noise abatement policy employing low-noise asphalts in addition to façade insulation is therefore considered. For 750 dwellings where two or more of the dwellings were located along the same road stretch, low noise asphalts replaced façade insulation as noise abatement method. Façade insulation was kept as noise abatement method for the remaining 1,750 dwellings. The mixed noise abatement policy costs more, but now provides total benefits that match the total costs.

Even higher benefit-cost ratios are obtained when reframing the economic analyses within the context of a national policy to reduce noise annoyance, and when focussing solely on more densely populated areas where low-noise asphalts is a viable alternative to façade insulation. Since environmental authorities are in the process of further lowering the indoor noise limit, the road authorities should consider preparing an organisational and financial framework for implementing low-noise surfaces based on cost-benefit calculations. Such a policy would have the added benefit of improving urban soundscapes for a significant number of residents, workers, cyclists, pedestrians and children.

**Keywords:** Environmental limits, façade insulation, low-noise asphalt, noise measures, noise policy, dual objectives, soundscape.

## 1. INTRODUCTION

Traffic noise became the subject of Norwegian pollution regulation in 1997, regulation specifying that indoor equivalent noise levels should not exceed 42 decibels (dB). Where indoor noise levels exceeded the new environmental limit, infrastructure owners, among them, the Norwegian Public Road Authorities, were obliged to comply with the new regulations before the year 2005. One measure reducing indoor noise exposure, indoor noise annoyance and sleep disturbance is façade insulation [1-3]. To meet the new noise limits, the Norwegian Public Road Authorities introduced a façade insulation programme affecting 2,500 dwellings nationally and, to capitalize on the research opportunity presented, the Norwegian Façade Insulation Study [4] was realised.

The first round of results from the Norwegian Façade Insulation Study shows that respondents receiving façade insulation benefited significantly and substantially from the measure [5]. However, since noise abatement using façade insulation is costly, economic analyses were undertaken as part of the Insulation Study. Here, we examine this clean-up

effort along the roads, focussing on how an alternative mix of noise-abatement measures would have been in terms of costs and benefits compared to façade insulation alone.

When the objective of fulfilling a new pollution regulation is being considered, a cost-effectiveness analysis (CEA), which is about finding the least costly way of meeting the regulatory limit, is often carried out. Measures more costly than the least costly are disregarded, even though the additional benefits may outweigh the added cost. Cost-benefit analysis (CBA), on the other hand, compares the various benefits of a measure to the costs [6]. In CBA, the measure with the highest ratio between benefits and costs will often be considered the most advantageous, regardless of whether it is relatively costly or not. When considering CEA vs CBA, it is relevant to point out that Norway has been moving towards a national target of noise annoyance reduction by 25 per cent before the year 2010. This reduction was to be accomplished mainly by addressing noise emissions at source. The target has since been reduced to 10 per cent reduction in noise annoyance, and the time limit for attaining the target pushed forward to 2020. Since road traffic noise is responsible for 80 per cent of noise-annoyance in Norway [7], and the main cause is road surface/tyre interaction, the authorities may need to find low-noise road surfaces that will survive winter conditions in the country [8].

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systems that are both efficient and sustainable In this book leading international researchers explore the issues and concepts and define the state of knowledge concerning transportation s full costs and benefits Transportation Noise Reference Book P. M. Nelson,1987 **Techniques to Measure Damages to Natural Resources** William H. Desvousges,1987 **Management** ,1968 **Management, a Continuing Literature Survey with Indexes** ,1969 **Environmental Quality Research and Development: a Review and Analysis of Federal Programs** Federal Council for Science and Technology (U.S.). Ad Hoc Committee on Environmental Quality Research and Development,1972 *Environmental Protection Research Catalog: Indexes* Smithsonian Science Information Exchange,1972 **NASA SP-7500** United States. National Aeronautics and Space Administration,1972 Hedonic Methods in Housing Markets Andrea Baranzini,José Ramirez,Caroline Schaerer,Philippe Thalmann,2008-09-20 Cities are growing worldwide and their sprawl is increasingly challenged for its pressure on open spaces and environmental quality Economic arguments can help to decide about the trade off between preserving environmental quality and developing housing and business surfaces provided the benefits of environmental quality are adequately quantified To this end this book focuses on the use and advancement of the hedonic approach an economic valuation technique that analyses and quantifies the sources of rent and property price differentials Starting from theoretical foundations the hedonic approach is applied to the valuation of natural land use preservation and noise abatement measures as well as to residential segregation and discrimination extending the analysis to the role of the buyers and sellers identity on housing market prices and to the issue of environmental justice *The Economics of Neighborhood* David S. Segal,2014-05-10 The Economics of Neighborhood integrates neighborhood into contemporary notions of the urban economy Neighborhood is viewed as a good with demand supply and equilibrium aspects Topics covered range from demand for neighborhood and interneighborhood mobility to neighborhood choice and transportation services The role of governments as suppliers of neighborhoods is also considered Comprised of 12 chapters this book begins with an introduction to some of the efforts to measure neighborhood effects and the approaches used in analyzing the role of neighborhood in the urban economy The next section deals with the determinants of neighborhood demand in different eastern and midwestern cities in the United States in the mid to late 1960s The location choice of a sample of Pittsburgh households is examined along with the role that neighborhood transition at the origin played in governing the decision to move or stay put Subsequent chapters focus on the neighborhood choice of households already living in Washington D C in 1968 as a joint prior choice of residential location housing type automobile ownership and mode of travel to work how the supply of certain kinds of neighborhoods can be determined by the interaction of residential demand and housing supply in the private sector and optimum neighborhood supply by local governments The concluding section analyzes neighborhood in an equilibrium setting with emphasis on price outcomes and the quantity aspects of neighborhood This monograph will be of value to economists as well as to researchers and students interested in urban economics United States Marine Corps

F-35B West Coast Basing ,2010      *Environmental Methods for Transport Noise Reduction* Mats Nilsson,Jörgen Bengtsson,Ronny Klæboe,2014-11-20 Presents Evidence Based Guidance on Noise Abatement Methods Solutions for reducing the noise impact of road and rail traffic can be found in the use of natural elements in combination with artificial elements in urban and rural environments Ground and road surface treatments trees forests and tall vegetation and the greening of buildings and other surfaces can contribute to powerful and cost effective noise reduction *Environmental Methods for Transport Noise Reduction* presents the main findings of the Holistic and Sustainable Abatement of Noise by optimized combinations of Natural and Artificial means HOSANNA research project This project involved experts from seven countries and assessed noise reduction in terms of sound level reductions perceptual effects and cost benefit analysis It considered a number of green abatement strategies and aimed to develop a toolbox for reducing road and rail traffic noise in outdoor environments Combines Theory with Practice Broad in both theory and application and based on leading edge research the book brings together the findings and their practical use It details assessment methods for perceived noise and outlines noise prediction methods that can be integrated with noise mapping software It also explores the economic benefits and positive effects on urban air quality and CO2 levels The material is this book Includes up to date results on noise mitigation using vegetation and ground treatments Contains relevant results on innovative noise barrier designs Presents data on acoustic performance of vegetation and soil substratum Provides perceptual and cost benefit analyses of noise mitigation methods *Environmental Methods for Transport Noise Reduction* is a helpful guide for noise consultants city planners architects landscape architects and researchers      **Scientific and Technical Aerospace Reports** ,1973

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