



# Organising urban noise abatement

- New ideas



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# **Organising urban noise abatement**

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# Contents

- Abstract ..... 5
- Preface ..... 6
- 1. Introduction ..... 7
- 2. The city without annoyance ..... 8
- 3. Methods for noise abatement..... 9
- 4. Organisation of noise abatement..... 10
- 5. Acknowledgements ..... 12
- References ..... 13



# Abstract

In Denmark road traffic noise is an integrated parameter in the planning and design of new housing areas and roads. But very little is done to reduce noise on the 28 % of all Danish dwellings exposed to more than 55 dB from road traffic. The aim of this paper is to present ideas and methods that can be used by municipal authorities to reduce road traffic noise. The background is studies of European and Danish experiences as well as discussions with planners from Danish municipalities and a questionnaire survey of the ideas of residents in three urban areas. The effects of noise are presented as annoyance, impact on health and the effects on housing prices. Various guidelines and goals are discussed, and a zoning of urban areas in four groups in relation to noise with different limit values is suggested. A broad selection of technical and practical methods to reduce noise is presented. This includes noise abatement by the source divided in road/tyre interaction noise and traffic noise, abatement under propagation as well as noise reductions by the receivers both outdoors and inside the homes. In order to get a local noise abatement process started a broad selection of municipal initiatives are suggested. A key proposal is to establish a secretariat within the municipal administration, which across the administrative borders can take initiatives. It is suggested to give advises to the public on how house owners by themselves can reduce noise. Alternative ideas on how to finance noise abatement are suggested.

# Preface

This report contains an article written by Hans Bendtsen, Danish Road Institute, Lene Nøhr Michelsen, Planning Department and Brian Kristensen, Industry & Transport, Danish Environmental Protection Agency, for Forum Acusticum 2005 in Budapest.



# 1. Introduction

Nowadays, when constructing new buildings or roads in Denmark special consideration is taken to traffic noise. A new national noise map indicates that 28% of Danish homes are exposed to noise levels that exceed the threshold value of 55dB ( $L_{Aeq,24h}$ ) and that noise problems are concentrated in cities.

Road traffic noise affects people in different manners such as sleeping disorders, stress and troubles learning. Furthermore, new studies show that noise can contribute to an increased risk of cardio-vascular diseases. The effects of noise are also of an economic nature in that they influence housing prices in noise polluted areas. Furthermore, health related issues caused by noise also incur costs. The socioeconomic costs related to road traffic noise have been calculated to amount to between 0.8 and 1.2 billion Euro annually in Denmark. [1]

It is a difficult task to reduce road noise in cities. It is therefore necessary to find new ways and means to reduce the effects of road noise. With the passing of EU directive 2002/49 [2] it can be expected that in the future there will be an increased focus on noise and its effects.

This paper is based on a catalogue of ideas that was presented by the Road Directorate and the Danish Environmental Protection Agency in the autumn of 2004. It is the aim to present visionary ideas and proposals to help the local authorities and private participants to reduce the negative effects of road traffic noise in urban areas and noise polluted residential areas. The catalogue is a collection of new alternative ideas and well known, proven methods that can be combined in a new manner. Special emphasis has been placed on methods that are not costly for the public authorities. The starting point of the report is a presentation of noise problems experienced in daily life situations in residential areas, illustrated by both Danish and foreign examples. The work with the idea catalogue is a follow-up to the “Strategy for Limiting Road Noise Traffic” from the Danish government in 2003 [1].

Changes in the noise levels due to the expected general increase in traffic in the period 2001 – 2020 and the implementation of EU legislation for noise emissions from new cars and new tyres are limited. In Denmark a general decrease of 0.6 dB is expected in city streets, where the main part of the exposed homes is located. Along country roads and motorways a slight increase of 0.2 to 0.7 dB is expected in the period until 2020. Nothing indicates therefore, that improved car technology within the foreseeable future will solve noise problems. It is however, necessary to have a targeted local effort if something is to be done to reduce the noise problems. Economic aspects tend to limit the authorities in their efforts and in some cases might even deter them from even addressing the noise issue.

## 2. The city without annoyance

In planning tasks it is common to base work in a set of goals and to analyse which means and methods can be applied to meet the goals. Technical, economic and political possibilities and limitations are important factors in the preparation of plans that should realistically be able to be executed. In the idea catalogue several differentiated noise criteria are presented with a view to “bring to life” the term “The City without Noise Annoyance” in such a manner that takes the city’s existing physical and functional structures into consideration. This is done on the basis of noise criteria that have been compiled by the World Health Organisation and on the basis of the noise criteria applied in Denmark when building new homes in existing residential areas. It is proposed that cities be divided into 4 noise zones, each to be assigned specific noise level requirements (expressed as  $L_{Aeq,24h}$  levels):

- Zone A: quiet areas, where noise levels may not exceed 45 dB.
- Zone B: residential areas with reasonable noise conditions, where noise levels may not exceed 55 dB.
- Zone C: noise polluted central areas, where noise levels may not exceed 65 dB.
- Zone D: heavily noise polluted areas that are typically located near main roads and intersections.

The same noise level requirements should also be applicable to public institutions etc. that are located in these areas. To compensate for the high noise levels that are expected to be experienced outdoors in zones C and D, there should also be public open space areas such as parks, playgrounds or other similar areas that have relatively low noise levels.

The four noise zones are intended to be used as a tool for taking noise problems into consideration when planning in cities. They can also be applied in connection with municipal planning or when drawing up noise action/reduction plans. The tool will be able to place all residential areas in a city in one of the four noise zones based on the actual noise conditions in the respective areas. This will result in noise level guidelines for all residential areas. If there is a local wish for a special effort to reduce noise, individual guidelines and a prioritized plan can be drawn up using different means.

The division of the noise zones will shed light on the noise conditions in a city. It can form the framework for noise level identification in all areas of a city, in such a manner that the noise levels can be objective parameters when choosing an area in which to live. It can be used by citizens to examine noise conditions before choosing i.e. day-care for children, schools or work place. Furthermore, defining noise zones will ensure that conditions in zones A and B will not be negatively affected by permitting activities like more or faster traffic that will increase the noise levels in these areas.

## 3. Methods for noise abatement

There is no single method that can remove all noise problems in a city. It will be necessary to work on several fronts and to employ several different methods in order to change the trend towards a city without noise annoyance. This task is formidable and the technical methods alone will not be able to achieve the goals. It will be necessary to address the noise abatement on several different levels [3]:

1. **At the source:** this covers vehicles, pavements, traffic and speed. When noise is reduced at the source it has an effect on all buildings and open space areas that are affected by the noise on a given road section. A noise reduction on pavements and bicycle paths along the road will also be experienced, an improvement for pedestrians and cyclists
2. **At the area of propagation:** in the form of noise barriers and such. By using noise barriers a noise reduction will be experienced in buildings and open space areas that are behind the barriers, but not for the areas in front of the barriers.
3. **At the receiver:** in the form of façade insulation and local barriers. Façade insulation is limited to reducing the noise level inside when the windows are closed, whereas the noise level outside remains unaffected.

A series of methods can be applied to reduce noise such as noise reducing pavements, traffic diversion, speed reductions, limiting heavy traffic access at night, vegetation and façade insulation to name a few. Environmental zones with speed limits can also be used to reduce noise levels.

## 4. Organisation of noise abatement

Often nothing is done to reduce noise problems, perhaps due to the fact that there often is no clear “owner” of the problem or there not being an organisation that can take initiatives for improvements. Also, problems might seem overwhelming; there could be a lack of useful ideas or alternatives to finance the proposed activities all resulting in nothing being done. However, it is very important to support and stimulate positive development, even though the barriers seem insurmountable and the results in the beginning are very limited.

To aid in initiating and carrying out the noise related work in the municipal authorities, a special noise secretariat could be established whose employees would mainly deal with planning, initiating and managing the local efforts. A concerted effort of the different municipal departments and other affected parties such as private citizens, owner and tenants’ associations and the business community is advisable.

A municipal authority is a large organisation that continuously plans and implements activities in the construction, running and maintenance fields. It could be considered a municipal goal that traffic noise issues become an integral part in all relevant activities such as road maintenance, building maintenance and renovation of open space areas and parks.

City planning and possible adjustments within existing urban areas are tasks that are handled by the municipal authorities. Noise is an important parameter that is taken into consideration when building new housing areas. However, it would be also be useful to include noise as a parameter when addressing issues such as rebuilding and expanding housing areas as well as in projects on rebuilding and enlarging roads or traffic calming. A starting point could be drawing up a set of municipal goals for noise related issues in existing urban areas.

There is a need to activate as many assets as possible for the work to reduce noise. A municipal authority can play an important role in relation to private citizens and the business community. Research shows that in certain cases private citizens are willing to participate in funding noise reducing measures [4]. It is important to inform citizens of the technical and economical possibilities as these are not always common knowledge.

A municipal noise secretariat can play an important role as an “idea bank”, initiative taker and coordinator. In this forum one could gather citizens affected by noise and present them with technical solutions as well helping them to organise noise reducing efforts that could be achieved and paid for, either in part or fully, by the citizens themselves. The municipal efforts could consist of organisation and coordination with a view to activating the assets and resources available amongst the citizens, and also to partake in the carrying out of certain tasks. Furthermore, one could examine the possibility to share the costs of certain activities.

There are several examples from both Denmark and abroad that show how road traffic noise reducing projects have been financed [5]. House owners can implement noise reducing measures at their own homes at their own cost. A rise in property value as a result of the noise reducing measures can be the reason that some owners finance these measures themselves. Depending on the current tax situation, increased property values mean that the both the state and the municipality receive increased taxes, that can again be reinvested in other noise reducing projects. In apartment buildings noise reduction can be achieved by changing to specially noise insulating windows that can be financed over the annual maintenance budget that could equally well finance other noise reducing projects.

In connection with noise reducing projects that are planned in cities, it is recommended to involve those citizens that will be affected by these projects. This will contribute to giving the citizens influence on which solutions will be chosen and to give them a realistic picture of which level of noise reduction to expect. Citizens can become actively involved and in some cases even be joint partners in the planned projects. A possible spin-off of becoming actively involved could be that citizens become motivated to implement further measures that can improve the effect and the quality of the planned measures [6].

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Rapport / Report	
Nr. Titel/Title/Shortcut No.	Forfatter/Author
127	Viden om anlæg af veje Flemming Berg, Finn Thøgersen Susanne Baltzer, Bo Wamsler H.J. Ertman Larsen Poul Panduro Gregers Hildebrand Per Ahrentzen Ole Milvang-Jensen Knud A. Pihl, Erik Nielsen
128	Viden om drift af veje Gregers Hildebrand Charles Lykke Hansen SvendKold Johansen Birger Roland Jensen BjarneSchmidt, Jørn Raaberg
129	Crushed concrete from building demolition is a high quality material for road construction Knud A. Pihl Ole Milvang-Jensen Flemming Berg
130	Ubundne bærelag af knust beton - efter europæiske standarder Knud A. Pihl Flemming Berg Ole Milvang-Jensen
131	Ubundne bærelag af knust tegl - efter europæiske standarder Knud A. Pihl Flemming Berg Ole Milvang-Jensen
132	Ubundne bærelag af knust asfalt - efter europæiske standarder Knud A. Pihl Flemming Berg Ole Milvang-Jensen
133	Bundsikring af forbrændingsslagge - efter europæiske standarder Knud A. Pihl Flemming Berg Ole Milvang-Jensen
134	Noise emission from 4000 vehicle pass-bys - an Inter-Noise 2004 presentation Bent Andersen Hans Bendtsen
135	Thin open layers as noise reducing pavements - an Inter-Noise 2004 presentation Hans Bendtsen Bent Andersen
136	European co-operation in COST 347 - Bringing ALT activities closer together Gregers Hildebrand Michael E. Nunn
137	Traffic management and noise reducing pavements - Recommendations on additional noise reducing measures Hans Bendtsen Jürgen Haberl Johan Litzka Ernst Pucher Ulf Sandberg Greg Watts
138	Mechanistic Design of Semi-Rigid Pavements - An Incremental Approach Finn Thøgersen Christian Busch Anders Henrichsen
139	Holdbarhed af Drænasfalt Carsten Bredahl Nielsen Jørn Raaberg Erik Nielsen
140	Indbygning af skrivekridt - Et fuldskalaforsøg Sten Thorsen Poul Panduro Knud A. Pihl
141	Noise reducing pavements - State of the art in Denmark Hans Bendtsen Bent Andersen
142	Economic assessment of traffic noise in planning - Danish experiences Lars Ellebjerg Larsen Hans Bendtsen
143	Organising urban noise abatement - New ideas Hans Bendtsen Lene Nøhr Michelsen Brian Kristensen Lars Ellebjerg Larsen



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