



The danish national road noise strategy

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ABSTRACT

The Danish National Road Noise Strategy (2003) incorporates ten initiatives to reinforce the road authorities' efforts to reduce noise. The strategy address the annoyance and health impacts of traffic noise taking into account efficiency and costs of the noise mitigation measures. The socio-economic analysis of the initiatives shows that there are good opportunities to organize efforts providing economic surpluses.

As nine out of ten dwellings affected by noise are situated adjacent to municipal roads, the strategy emphasizes helping the municipalities in their efforts to reduce noise. Nevertheless most of the initiatives to control noise problems before and after 2003 have been carried out along the national roads. As a follow-up to the strategy, a 'recipe book' for financial noise partnerships between municipalities and homeowners has been developed, so that this form of co-financing can become more widespread.

In spite of the efforts of the government and the municipalities to reduce the road traffic noise, the latest evaluation of the strategy (2010) concludes that: The health effects are unchanged and the number of dwellings exposed to noise is not reduced. This emphasizes the importance of continued efforts to implement the strategy combined with the strategic EU noise mapping and action plans.

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1. INTRODUCTION

The Danish National Road Noise Strategy from 2003 (1) incorporates a number of initiatives intended to reinforce the road authorities' efforts to reduce noise from roads. The strategy address the annoyance and health impacts of road traffic noise taking into account efficiency and costs of noise mitigation measures.

The strategy was evaluated and adjusted in 2010 (2). The strategy places particular emphasis on helping the municipalities in their efforts to reduce road noise. As nine out of ten homes affected by noise are situated along municipal roads, the local authorities are having the biggest challenge in the effort to reduce road noise. The Road Noise Strategy is based on the existing division of responsibilities between the state and municipalities; the state is responsible for noise reducing efforts on national roads, while initiatives regarding municipal roads are the responsibility of the relevant municipality.

However, a number of state initiatives will also affect the noise impact from the entire road network (e.g. promoting quieter tires); just as the state is responsible for developing the legislative framework and guidelines for noise related initiatives by all road authorities.

Over the past years the most important initiatives to control noise problems in existing dwellings have been carried out along the state road network. From 1992 to 2012, the Danish Road Directorate (DRD) within the Ministry of Transport carried out noise abatement initiatives along the existing state road network, in particular the building of noise screens and laying out noise reducing asphalt, at a total cost of about DKK 600 million. Furthermore, in connection with the construction of new roads, or the extension of existing roads in urban areas, significant resources have been allocated for noise abatement.

Finally, the efforts by the authorities over the past 25 - 30 years to prevent new noise problems to occur have been mainly made within the Act on Physical Planning. The Act states that noise exposed areas cannot be planned for noise sensitive use unless binding provisions are made against the noise.

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This act has been in force since the late 70'ies, with the objective that no future dwellings are located in areas exposed to noise exceeding the indicative noise limit - which is 58 dB L_{den} for road traffic noise. In fact thousands of dwellings have been built taking into account the noise, depending on the local planning authorities and the public interest in noise. It is seen that most new dwelling areas adjacent to major roads are protected by noise screens or barriers, and many new developments in cities are designed with special glazing or other types of noise protection.

2. EU Directive on Environmental Noise

Another strategic element is the EU Directive on the Assessment and Management of Environmental Noise (2002) (3). The Directive subjects Member States to an obligation to map noise from road traffic, railways, airports, and industry for the most exposed areas (next round of strategic noise mapping in 2017). Moreover, action plans must be prepared to reduce noise and these plans must be made public (next round of action plans in 2018).

3. Pricing health and annoyance & socio-economic analysis of tools

In the strategy several means to reduce noise were analysed in a socio-economic context. Valuation of annoyance is based on studies of house prices and noise levels. In general Danish studies show a drop in house prices of about 1 % for each dB road noise increase for houses by busy roads. For apartments the drop in prices is 0.5 % per decibel (4).

The socio-economic analysis of the tools in the strategy show that there are good opportunities to take initiatives which are providing economic surpluses, as most of the tools do give a positive socio-economic result. The surplus arises because the benefits of higher house prices and less health effects exceed the costs of the initiatives to reduce noise (noise screens, noise-reducing asphalt, noise reducing windows, etc.).

The house-price study provides an interesting perspective of the Road Noise Strategy by showing that significant reductions in noise annoyance for dwellings will lead to rise in prices of these properties. On the basis of this assumption home owners can reap an economic advantage from investments leading to less noise impacts on their dwellings.

As a follow-up to the Road Noise Strategy, the Danish Ministry of the Environment, decided to spend DKK 5 million (EUR 0.7 million) on preparing a 'recipe book' (5) for financial noise partnerships between municipalities and homeowners, so that this kind of co-financing can become more widespread.

4. Evaluation of the National Road Noise Strategy

The Road Noise Strategy and the ten initiatives were revised in 2010. The ensuing report summarised the ongoing efforts to mitigate noise since 2003 and national initiatives were updated accordingly.

The number of dwellings exposed to noise above the noise limit for new dwellings was in 2001 estimated to be 705,000 and in 2006 estimated to be 786,000. This development is, however, influenced by the different methods used for noise mapping in 2001 and 2006 respectively.

It is the recommendation that conclusions on the development in the number of exposed dwellings are made with great caution. Nevertheless it has to be recognized that there is no indication of a reduction in the number of traffic noise exposed dwellings and it seems reasonable to suspect that the number is growing.

Approximately 90 % of the noise exposed dwelling is located along municipality roads. It is estimated that the total investment of the municipalities on reducing noise from existing roads during the period 2003 –2008 has been less than 50 million DKK. During this period the state used approx. 100 million DKK on national roads. This ratio must to some extent be seen as an unbalance in the effort against on one hand the national roads and on the other hand the municipality roads.

On the municipal roads the evaluation tells us that noise-reducing asphalt and reduced speed limits are tools widely used by the municipalities. New research on the importance of access to a silent side of the dwelling provides inspiration for new developments, especially in existing urban areas.

Several municipalities have prepared action plans for noise reduction. The evaluation shows that municipalities with experience in preparing the plans have a positive attitude to use the plans as a tool to initiate an effort to reduce road noise. The action plans on noise unite the knowledge of the municipality and creates cooperation across the organisation.

The headlines of the 10 initiatives and status are included in the summary below

Table 1 - The 10 initiatives and status

The 10 initiatives	Status
1. The Danish effort within the European Union on more strict requirements on noise from vehicles and tyres will be strengthened.	Completed. An EU-directive on noise from tyres (2001) has been without effect. New EU-legislation, which includes noise from tyres and labelling of tyres, is implemented. Denmark did argue for more strict requirements.
2. Consumers are informed about the possibility to use low noise tyres	Completed. Implementing EU-legislation made labelling of tyres mandatory from 1 November 2012.
3. The present level of protection against noise from adopted and planned investments at the national roads will be maintained. This will contribute to a significant reduction of noise along national roads.	Completed. The Government has maintained the level of protection and a several new road construction projects have reduced the number of noise exposed dwellings along national roads.
4. If possible the option of replacing existing conventional windows of a dwelling by new windows having both noise reducing and energy saving properties will be included in the planned campaigns to promote high energy efficient windows	Partly completed. It was not possible to include noise reduction options in the campaigns for high energy efficient windows. The DEPA has made an effort to inform about noise reducing windows and information is provided on its home page. But clearly there is a need for a coordinated effort on this issue.
5. As documentation on noise reducing pavement becomes available the effort on providing information on the effect of different types of pavement will be increased. The purpose is to provide a better basis for the road authorities to make decisions by using the strategy.	Completed. Noise reducing pavement has won widespread deployment and is today used on a routine basis by most municipalities and by the DRD. The preferred types are thin layer noise reducing pavements. Noise reducing porous pavement has almost only been used on an experimental basis. The DRD carries out significant research and development on noise reducing pavements and participates in international projects. Furthermore the Directorate performs a considerable effort on providing information to the municipalities.
6. During maintenance of the national roads the use of noise reducing road pavement shall be assessed on the basis of the available data and the given technical and economic scope.	Completed. The DRD is now using thin layer noise reducing pavements in all new road projects and for maintenance of existing roads having a noise impact on residential areas.
7. The guideline on road traffic noise in residential areas will be updated with respect to both the EU-Directive on Environmental Noise and the strategy on road traffic noise.	Completed. The DEPA published in 2007 a new guideline on road traffic noise. The guideline is not only an update but also introduces new methods, new guidelines for protection of new developments against noise and it points out the possibility for a coherent approach on noise and planning, silent areas etc.
8. The municipalities are encouraged to pay attention to the possibility of entering into negotiating with the police authorities to reduce the local speed limits on roads with many homes exposed to noise.	Completed. This possibility has been communicated to the municipalities. Reduced speed limits are a tool widely used by the municipalities. The motivation is often traffic safety, but the noise impact is of growing importance. Some municipalities have experienced that the police does not approve reduced speed limits.
9. The information in the catalog from the road noise strategy referring to measures to reduce road noise, the effect of these and the economy must be provided to the municipalities.	Completed. The DRD and the DEPA have provided an on-going flow of knowledge on road traffic noise and abatement measures, mainly aimed at the municipalities. The effect is that the abatement measures are well-known within the municipalities.
10. There will be carried out an evaluation of the on-going effort to reduce road traffic every five years in relation to the implementation of the EU Directive on Environmental Noise. Based on the evaluation the need for an adjustment of the strategy will be decided.	Completed. The initiative is completed with this report and a succeeding process on the need for adjustments.

5. CONCLUSIONS

In 2003 the National Strategy on Road Traffic Noise highlighted the health effects of road traffic noise and for the first time there was a specific estimate on the economic consequences of the effects. At the same time there was a renewed focus on the annoyance caused by the noise. The annoyance was quantified through a new investigation of the relationship between road traffic noise levels and house prices. In this way it was possible to calculate the impact of road traffic noise on the society:

- 800 - 2.200 people hospitalized and 200 - 500 incidents of premature deaths each year.
- More than one out of four dwellings in Denmark are exposed to road traffic noise above the noise limit for new dwellings (approximately 705.000 dwellings)
- 6.1 % of the population is regularly annoyed by traffic noise inside their dwelling.
- A total cost for the society of 8.7 billion DKK each year.

Six years later it can be concluded that several research projects confirms the negative impact of road traffic noise on health and well-being and the problem is not reduced:

- Health effects are unchanged.
- The number of exposed dwellings is not reduced.
- 7.8 % of the population is regularly annoyed by traffic noise inside their dwelling.
- The costs for the society have not reduced.

The number of dwellings exposed to noise above the noise limit for new dwellings was in 2001 estimated to be 705.000 and in 2006 estimated to be 786.000. The recent estimation (6), which is based on data from 2012 shows that 723.000 dwellings are exposed to noise that exceed the recommended limit of 58 dB L_{den} . Approximately 141.000 dwellings are heavily burdened by noise of 68 dB L_{den} or more.

This development is, however, influenced by the different methods and indicators used for noise mapping and conclusions on the development in the number of exposed dwellings should be made with great caution.

Nevertheless it has to be recognized that there is no indication of a reduction in the number of dwellings exposed to traffic noise and it seems reasonable to anticipate that the number is growing. On the other hand it has been established that the Government and the local authorities have made efforts to reduce road traffic noise. The 10 initiatives of the strategy have in almost all aspects been completed although the effort to promote more strict noise requirements on tires and vehicles has had no or very little effect so far.

The governmental initiative, "Sustainable transport – better infrastructure" (7), of December 2008 has led to political agreements on a sustainable transport policy. The policy includes a continuation and expansion of the governmental effort on reducing road traffic noise from national roads and the effort to provide knowledge and tools for the work being done by the municipalities.

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