

# New Dutch legislation for motorways, national cost-benefit analysis explained.

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## Introduction

The Netherlands Environmental Assessment Agency (PBL) has performed an ex-ante evaluation of a proposed new policy strategy for motorway noise. Aim of the study was to estimate costs and benefits, and to investigate the robustness of proposed legislation. The method of evaluation of legislation is described in this article. The results of the study will be published when the proposal is made public, probably before mid-2009.

## Pillars of noise policy

The Ministry of Housing, Spatial Planning and the Environment, and the Ministry of Transport, Public Works and Water Management, together formulated noise policy strategies for national roads and railways. Their overall policy is based on four elements. These elements are described below.

### Remediation for highly exposed dwellings

The houses that are most exposed, will receive extra attention with special programmes, to even out the noise exposure.

### Noise control

Noise control is necessary to protect good acoustic environments from an increased exposure to noise.

### Measures at the source

It is recognised that measures are most efficient when applied at the source. These measures concern either vehicles or road surfaces. Noise-source measures do not have the visual disadvantages of noise barriers. Adjustments to facades of buildings are less suitable, because they only protect the people inside those buildings.

### Efficiency of noise measures

Costs and benefits of noise measures, such as noise barriers and quiet road surfaces, are taken into account on a local scale.

## Targets for new policy

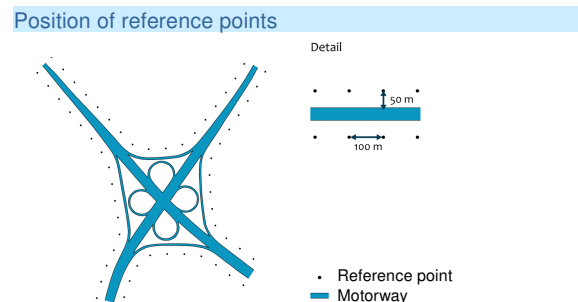
The new legislation will be less complicated. It will focus more on noise emission, with simplified noise standards for houses. Road administrators will control the noise levels, therefore, municipalities can rely on this for spatial planning.

A recently formulated target of Dutch noise policy for motorways aims to avoid high exposure for noise sensitive buildings (e.g. domestic housing). The government will improve situations of houses with noise levels higher than 65 dB(A)  $L_{den}$ .

## Changes in legislation

A new strategy for noise policy, for the main infrastructure, will focus on overall noise control. The new legislation prescribes that measures have to be considered, when noise levels are increasing, instead of having noise control procedures coupled to events, such as the building and rebuilding of roads or railways. This will be effectuated when the so-called 'noise emission ceilings' are introduced, which are represented by maximum noise levels, at fixed points, on both sides of the motorway, at 50 metre distances.

These ceiling levels will be set at 1.5 dB(A) above the existing noise levels ( $L_{den}$ ), to limit noise increases until this level. Under today's conditions for noise emission, this will allow for a traffic increase of 40 percent. Noise measures must be considered when noise emissions are about to rise above the emission ceiling. In some cases, target levels for the future noise levels after taking measures are less strict than under the current law.



**Figure 1:** Example of the position of the points that assess the noise emission ceiling.

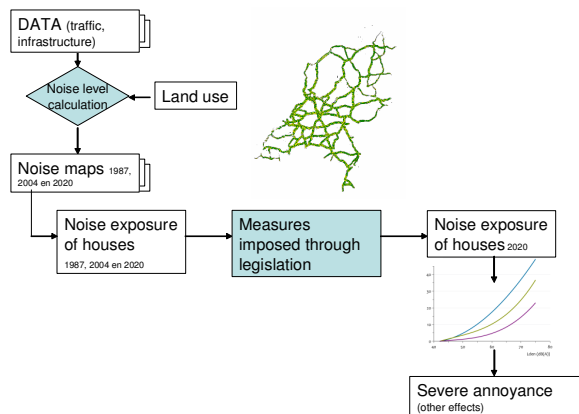
The proposed legislation will be accompanied by an extended remediation programme for highly exposed dwellings. More houses will benefit from this programme, although the aspiration for future noise levels will be less strict than under the current remediation programme.

The existing legislation already contained some criteria for the local effectiveness of measures, but for a more univocal purpose, these will be replaced by a one new criterion. This new criterion was integrated into the study. Application of this criterion will mean that the available budget for taking measures will depend on the amount of affected houses and their noise levels.

## Method of retrieving costs and benefits

The PBL evaluation focused on the differences in the approach to control noise levels. This means that, for the sake of comparison, the extended remediation programme was assumed to be definite, both under proposed and current legislation.

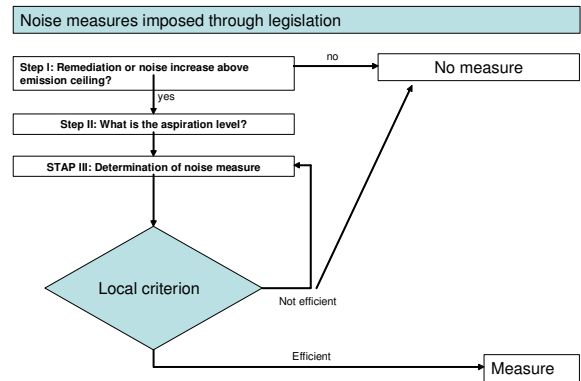
It is the intention of the ministries that the new criterion for the local effectiveness of measures is comparable with the existing ones, leading to a similar number of measures, on the national scale. For reasons of simplification, the study considered only the new criterion for both proposed and current legislation. In this way any differences that might be caused by the change in criteria are excluded from the results.



**Figure 2:** Calculated noise levels formed the input for the study.

Noise levels were obtained by calculation. The calculation steps are described in Figures 2 and 3. Per road section, the current noise exposure of houses was calculated and combined with future and past levels. The future noise exposure of a section was adjusted to comply with future noise measures resulting from legislation. Below, a schematic view describes the method to determine future measures in more detail.

Subsequently, severe annoyance was calculated from the adjusted future noise exposure, using dose-effect relations of Miedema and Oudshoorn [4]. Noise levels of 45 dB(A)  $L_{den}$  and higher, at the facades of houses, were taken into account for this calculation.



**Figure 3:** A schematic view of the legislation model shows the determination of noise measures on a local scale.

Figure 3 shows a legislation model was developed for the ex-ante evaluation. For road sections of 300 metres, noise levels were considered for each side of the road, separately. Possible future measures were predicted, according to a schematic view of the regulation. This schematic view has three steps. The first step is to determine whether any regulation would apply to a particular road section. This is the case when dwellings are included in the remediation programme, or when there is an increase in noise above the emission ceiling. For the existing legislation, future rebuilding programmes are taken into account. If the answer in the first step is yes, the second step determines the aspiration for the future noise level. In the last step, measures are considered according to the criterion for the local effectiveness of measures.

Only measures that are efficient according to the local criterion, are taken into account. The target level determines the measure, even if budget for more measures would be available. However, aspiration levels might not be reached if the budget is restricted. In that case, the maximum measure within the available budget is considered. Therefore, the criterion plays an important role in the legislation.

In the study, single-layer asphalt was taken as the future standard road surface, and the noise measures considered were: double-layered open asphalt and noise barriers. A limited noise reduction at larger distances from noise barriers was taken into account, considering a finite length of 500 metres from the barrier.

First, we looked at remediation. If measures for remediation followed from the legislation model, the new noise level was assumed for determining a new (lower) emission ceiling. Second, further measures necessary to control noise levels were also examined.

Costs and benefits of legislation were calculated and will be presented for the national scale. The costs represented investments, up to the year 2020. The benefits were considered in two ways. Both the number of highly exposed houses in 2020, and the amount of severely annoyed persons

were determined, and compared to a situation without supplementary noise measures.

## Discussion

Like any model, the method contains many uncertainties that should be taken into account. All the uncertainties of the noise model were introduced when it was used for calculating the noise exposures that were input for the legislation model. The most important uncertainties are discussed briefly below.

PBL uses a noise model that is especially validated for large distances. In comparison to noise models that are prescribed by Dutch legislation, it is expected that noise contours are calculated further away from motorways. Existing legislation neglects distances of more than 600 metres, therefore, the official calculation models are not especially validated for larger distances. Along very busy motorways, noise levels relevant to new legislation exceed those distances. When modelling the local criterion, it is expected that the PBL calculation method will result in higher budgets for measures.

The effect of noise measures had to be simplified. Especially for noise barriers, the effect is strongly dependent on the distance from the source. Also, the length of road along which measures are taken is a very important factor. The limited noise reduction of finite noise barriers was taken into account, considering five categories of noise reduction, depending on distance from the road for each noise barrier height. Double-layered open asphalt was assumed to achieve the maximum effect, since this measure was expected to be taken on a larger scale.

The noise effects for dwellings on the opposite side of a road were not taken into account – either in a positive way (reduction on both sides when using a quiet road surface), or in a negative way (reflection from noise barriers).

However, the importance of many of the uncertainties was less significant when comparing policies, because all results contained mainly the same uncertainties. Only for policies that deviated strongly from the model assumptions, were the results expected to be distorted. This issue was not investigated in detail.

PBL compared the model results with figures from other studies, and, for both remediation and noise control, the calculated costs were comparable.

## Conclusions

Although the method of modelling contains uncertainties, it is helpful to compare differences in noise policies. The model translates proposed legislation to expected noise measures, from which costs and benefits can be derived. This will deliver information that is helpful to decision makers.

## References

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