

# Extended cost / benefit analysis for noise control for municipal and provincial roads

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## Summary

The introduction of Swung-1 (Dutch law on noise control) has resulted in an efficiency criterion for national roads and railways. This criterion determines, by using a Cost Benefit Analysis methodology, whether measures at the source (noise reducing pavements) or in the area between the source and the receiver (noise barriers) are effective for protecting noise-sensitive locations.

In the new system of Swung-2 a comparable system of noise limitation for provincial roads is proposed. The CBA system of Swung-1 was not applicable for municipal roads. Swung-2 offers an obligation of monitoring noise production and prevention of noise pollution. The municipal and provincial need to implement noise policy to protect the residents against noise pollution for new and existing situations. More often than in the current situation assessments need to be made or measures need to be taken.

Antea Group has developed an application that provides an objective assessment whether or not to implement measures. The application not only considers a cost benefit analysis but also takes into account a number of important other factors. Examples of that factors are landscape, urban and traffic constraints or opportunities. In addition, we want to include different factors of quality of life in the application like air pollution, safety, presence of a green area etc. Depending on the policy and the factors that are important for that specific area, it is possible to assign a higher score to that factor. With this application we give the municipal and provincial authorities the opportunity to make customized and well considered choices for noise measures. By offering this extended cost benefit analysis Antea Group anticipates on the new environmental law and provides an efficiency analysis of noise measures by using an integral approach.

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## 1. Introduction

Noise sensitive locations in Holland, like dwellings, schools and hospitals, are protected against traffic noise by national legislation [2]. This legislation provides minimal and maximum noise limits for these noise sensitive locations. If the minimal limit value is exceeded a survey must be made whether noise reducing measures are applicable. But there is no way to determine if the measures that are applied provide enough protection against noise from municipal and provincial roads and if they are cost effective.. Although a survey is required, there is no general noise policy that determines which measures eventually has to be applied.

Most of the provinces and municipalities have no noise policy document that describes how the decision whether or not to apply noise measures in relation to their cost effectiveness must be made. The result is that people in different regions have different protection levels regarding the noise level on the façades of their homes.

## 2. Legislation to prevent noise pollution

### 2.1 SWUNG-1

In 2012 the legislation for national roads and railways changed by the introduction of Swung-1 (Dutch law on noise control). Under this Law the so called Noise Production Levels were introduced along all national roads and railways. On the Noise Production Level point a maximum noise level is allowed and must not be exceeded or measures to prevent this must be taken. This law includes a cost benefit analysis method for noise measures along National roads and railways. This method determines whether measures at the source (noise reducing pavements) or measures in between source and receiver (noise barriers) are cost effective for protecting noise sensitive locations. The outcome of the cost-benefit analysis gives a positive or negative indication whether the measures should be applied in terms of cost effectiveness. When the indication is positive, other aspects like technical restrictions, aesthetics, engineering and other environmental aspects are examined.

### 2.2 SWUNG-2

In the new system of Swung-2 a comparable system of Noise production Levels is proposed for

provincial roads.. The system of Swung-1 is not suitable for municipal roads. Swung-2 provides an obligation of monitoring noise production levels and the further prevention of noise pollution by traffic noise. The municipalities and province need to implement noise policy to protect the residents against noise pollution from traffic noise for new and existing noise sensitive locations. More often than in under the current legislation there will be a need for the assessment of noise measures regarding their cost effectiveness.. This new legislation gives the opportunity to introduce simultaneously a new cost benefit analysis method to be used in these assessments.

## 3. Process of developing the application

### 3.1 Organisation of the team

Antea Group created a working group to develop an application that can be used for the assessment of noise measures in existing as well as future situation. One of the important goals we wanted to achieve in developing an application was to create support from potential users (stakeholders) of the application. These users must be able to use the application to determine if the noise measures are cost effective and if they contribute to creating an acceptable noise climate at the noise sensitive locations. We organized several meetings where we collected input from stakeholders like provinces, municipalities, DMCR environmental services (DCMR, VNG (Association of Dutch municipalities) and the Ministry of Infrastructure and Environment. These meetings were also used to get feedback on the usability of the application.

### 3.2 Conditions of the application

We developed an application that provides an objective assessment whether or not to implement noise measures against traffic noise for existing noise sensitive locations as well as locations under the new Swung-2 legislation. The application not only performs a cost benefit analysis of the measures but also takes into account a number of important other factors. Examples of these factors are landscape, urban and traffic constraints or opportunities. Because of the urban situation it is not possible to use the existing CBA method for the main roads (SWUNG-1) in this local urban environment. This local urban environment gives specific restrictions for the application of noise

barriers or noise reducing pavements. Therefore the local circumstances are taken into consideration in a first step. For example; is it physical possible to erect a noise barrier or does the road has turn-outs (driveways) that directly connect to the main road? Is it necessary to apply a specific kind of pavement from an aesthetic point of view (for instance a brick pavement?) that is characteristic for this environment. By answering the questions on the local circumstances the applications restricts the number of possible noise measures that are available for the specific local circumstances and helps the user in making a good choice.

To perform the cost benefit analysis the application uses standardized costs for the noise measures that are part of the application. The standardized cost factors for noise barriers include initial building and engineering costs and maintenance costs for 30 years.. For the source related measures like noise reducing pavements the application uses the costs of resurfacing a road and also maintenance of the surface for 30 years. The big difference between the system of SWUNG-1 and the choice of the application for SWUNG-2, is that it considers the difference in cost between the initial existing road surface and the noise reducing surface that will be applied. The different roads that can be chosen within the application are shown in table 1. These are officially registrated noise reducing pavements that are registrated on the website 'www.infomil.nl'. The initial road surface is also given in the table and this initial road surface determines the possibilities for the new noise reducing surface. Only future surfaces (given in the rows) that are marked with an X are applicable for the existing initial road surface (given in the columns).

For the future surface is required that it has to be a more silent surface than the existing initial one. So depending on the initial road surface you there is a limited choice of future road surfaces. In the application we already provide the information for the user. The possibilities are marked with a 'x' in table 1. The application itself works with drop down menus that only show the silent roads surface that are better than the initial road surface.

To keep the system solid for the future we made a conversion from costs in Euro's to a point system. The points for the noise-sensitive buildings are in the basis the same as in the SWUNG-1 system. The difference is that there is a possibility for the user to take the noise policy (if available) of his or her organization into account on forehand in the

Table 1. Road Surfaces

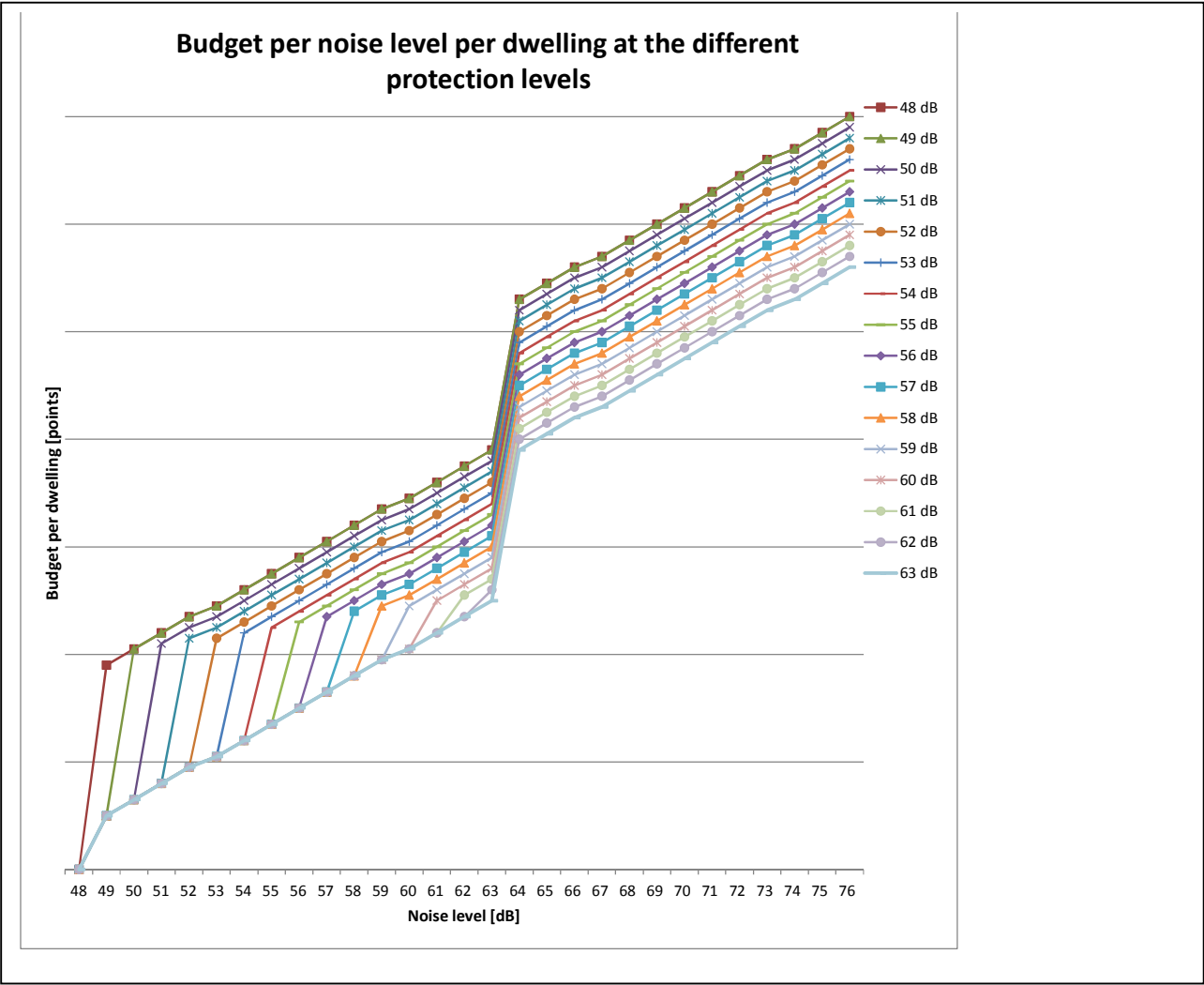
Future surface	Current surface									
	referentiewegdek (dab)	SMA 0/5	SMA 0/8	uitgeborsteld beton	geoptim. uitgeborsteld beton	fijngebezd beton	oppervlaktbewerking	elementenverharding keperverband	elementenverharding niet in keperverband	stille elementenverharding
referentiewegdek (dab)				x	x	x	x	x	x	
SMA 0/5	x		x	x	x	x	x	x	x	
SMA 0/8	x			x	x	x	x	x	x	
uitgeborsteld beton					x				x	
geoptim. uitgeborsteld beton				x		x	x			
fijngebezd beton							x			
oppervlaktbewerking										
elementenverharding keperverband									x	
elementenverharding niet in keperverband										
stille elementenverharding								x	x	
dunne deklagen A	x	x	x	x	x	x	x	x	x	x
dunne deklagen B	x	x	x	x	x	x	x	x	x	x

assessment. If there is a noise policy which requires a higher protection level from traffic noise the application generates more points. The system is explained in figure 1.

You see a leap in points at a noise level of 63 dB. That is in the current law (Wet geluidhinder) the maximum limit value for traffic noise in urban situations. When there a noise policy is available the user you can add the preferred value in the application. The application creates another leap which generate more points at noise polluted dwellings with a noise level above the preferred value.

Depending on the type of the noise-sensitive buildings the application also generate points for measures at the façades of the building. The application makes a distinction between the costs for new or existing buildings. The efforts to apply noise insulation measures in existing building are much more than for new buildings. For new buildings it is fairly simple to integrate measures in the building process.

Figure 1. Budget per noise level



In figure 2 a screen shot of the application is shown.

Figure 2. Screen shot of the application



The user can see the different tabs that have to fill out. First the general information (A), the next one is about the road surface (B), than the barriers (C). At the next tab (D) the user has to fill out the information about the noise levels of the noise polluted dwellings. At the end the user get a

summary of the input and the cost-benefit analysis of the different measures. In figure 3 is shown a screen shot of part of a conclusion.

Figure 3. Conclusion of the cost/benefit analysis

Conclusies		
• Berekende reductiepunten op basis van het aantal woningen per geluidbelasting: <b>2600</b>		
• Berekende maatregelpunten bronmaatregel (SMA 0/8, 100m lang met 2 rijbanen): <b>280</b>		
• Berekende maatregelpunten schermmaatregel (absorberend scherm, 50m lang en 2m hoog): <b>5140</b>		
Benodigde punten Conclusie		
Bron	280	+
Overdracht	5140	-
Bron+Overdracht	5420	-
Gevelisolatie (voor)	38	+
Gevelisolatie (na)	NVT	NVT

### 3.3 Possibilities in use

The application can be used in situations where the noise levels are known on a detailed level at the façades of the dwellings, with or without the effect of noise measures. Also in an EIA study with results in noise contours, the application can be used. The advantage of using the application in an early stage of the process is that you can determine the feasibility of different alternatives. In this way the user is able to compare the different alternatives not only on their effect on noise reduction (like common methodologies) but also the difference in 'costs' and benefits of the noise measures. A next step could be to integrate a preferred soundscape and the way people experience noise into the application.

#### 4. Additional possibilities

In addition, the application can be extended with other factors than noise like quality of life, or air pollution, safety, presence of a green (quiet) areas, etc. Depending on the policy and the factors that are important for that specific area, the user is able to assign a higher score to that factor. With this application we give the municipal and provincial authorities the opportunity to make customized and well considered choices for the application of noise measures. By offering this extended cost benefit analysis Antea Group anticipates on the new environmental legislation and provides an efficient analysis using an integral approach.

## 5. Conclusions

With the cost benefit analysis method for noise control we provide the province and municipal organizations a way to make well considered choices.

The application provides  
an objective assessment to implement traffic noise measures.  
a standardized procedure for different noise affected situations.  
Possibilities to introduce noise policy into the assessment of measures  
an integrated approach under the new environmental law (still in development).

The goal of the application is to support organizations in making assessments for the use and cost effectiveness of noise measures in urban areas, and not as a mandatory legal decision without flexibility! It is always important to take

into account all aspects that determine the best available option for noise measures and not only the noise level itself and the costs.

## References

- [1] Ministry of Infrastructure and Environment, Wet Milieubeheer, Chapter 11 Noise, The Hague, 2012.
- [2] Ministry of Infrastructure and Environment, Wet geluidhinder, The Hague, 1979.
- [3] Ministry of Infrastructure and Environment, Rijkswaterstaat, Kader Doelmatigheidscriterium Geluidsmaatregelen, The Hague, 2014
- [4] Website [www.infomil.nl](http://www.infomil.nl)