

“Noise climate” improvement as an opportunity at road reconstructions

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Summary

In the Netherlands, the noise impact on houses as a result of road traffic continues to increase. This is mainly caused by the high population density, continuing urbanisation and the related increase in number of vehicles. It is a persistent problem affecting the health of many and there are no simple solutions. The Province of Gelderland is aware of the problem of its roads and this aspect is taken very seriously by the province in their road reconstructions. By assessment in an early stage, certain measures may be integrated in the road design. A transparent information process for local residents is essential as well, providing options for consultations and input. In this way, the reconstruction not only solves traffic management issues, but also generates a sustainable solution for the living environment, making the situation future-proof in a number of aspects.

1. Introduction

The Province of Gelderland is located in the east of the Netherlands and has a population of some 2 million inhabitants. Some of the towns are Arnhem (provincial capital), Nijmegen, Apeldoorn and Doetinchem. Next to residential areas and economic activity, there is room for agriculture and livestock farming and there are extensive nature conservation areas.

One of the tasks of the elected administration of the province is the management of roads with a regional function. These have a variety of designs; from a motorway-ish layout to fairly narrow roads between smaller villages. However, most ‘provincial’ roads have two lanes (2x1) and provide connections between villages and towns while mostly passing through built-up areas.

The Province of Gelderland manages some 1,200 kilometres of provincial roads. This is the largest provincial road network of the Netherlands.

2. Road reconstructions

The province facilitates particularly regional traffic on its roads. In itself a dynamic fact influenced by various developments. Traffic may increase e.g. when new residential areas are constructed or with the establishment of new enterprises. Problems may arise with the free flow of traffic during rush hours. This is not only inconvenient for through traffic but may also pose an extra annoyance for local residents, which may result in health risks [1]. When bottlenecks arise, action can be taken to tackle it. In that case, not only a traffic engineering solution is targeted, but the living environment of the road is one the main considerations as well.

3. Open planning process

Once a present or future bottleneck is noted, the administration may decide to tackle the problem. A first step in this process is exploring problem-solving approaches in which the free flow of traffic, safety and the living environment are the main points to consider. For example, a comparison may be made between ring road alternatives and problem-solving approaches based on the existing route. Already in this phase, local residents are included in the process. What is important to them? Noise nuisance often plays an important part. Preliminary results are presented to local residents at information evenings e.g. and they are allowed to voice their opinions about any options. The municipality concerned is also an important player in this respect. The result of this phase is the decision which alternatives will be selected for the following steps in the process. Environmental aspects, and therefore noise as well will expressly be included in this first assessment.



Fig. 1: information evening for residents (source: Province of Gelderland)

In the next phase, preparations will be taken to reach a final decision. The alternatives will be worked out and the environmental consequences will be mapped precisely (Environmental Impact Statement - EIS). The ambitions are also determined; will legal requirements suffice or is a higher level of quality of the living environment targeted. In the design phase, integrations options for noise measures may be evaluated. Next, additional measures may be considered, such as the use of noise-reducing asphalt. The application of acoustic barriers in built-up areas often comes up against urban planning objections and is often met with resistance from the side of the residents. In this phase as well they are actively involved in the process and are invited to think along. To this end, residents' evenings are organised in the immediate surrounding area of the project, talks with interest

groups are started and a call-up for input is communicated through social media and websites. This will create a process with an open character and establish a level of support as those concerned perceive that the problems they experience do not fall on deaf ears.

After the decision-making there are legal objection procedures. In first instance, this will be handled by the province itself but if the objection continues to exist, it may also be submitted to the court for a decision. Experience shows that an open planning process leads to far fewer legal procedures.

4. Quality of the environment

Through roads that pass through residential centres often put a lot of pressure on the quality of life of the local residents. Noise is one of the aspects that pose a direct nuisance. This also has health consequences, ranging from sleep disturbance to long-term health issues through stress, such a high blood pressure and myocardial infarction. In the reconstruction of roads, the Province of Gelderland, therefore, aims at improving the living environment and reducing noise levels.

With respect to road reconstruction, Dutch noise legislation looks at the increase of noise ten years from the completion of the new situation. Reference point is the situation one year prior to the start of the reconstruction work. With increases higher than 1.5 dB, measures have to be taken. Any increase will only be allowed in the event of material financial, landscape or traffic engineering objections. Finalisation of such a decision will require completing a legal procedure.

Where normally speaking, legislation and regulations in force are taken as starting principles, the Province of Gelderland prioritizes the interests of local residents, where possible. For example, there may be no or hardly any increases, but still high noise levels close to houses. This creates the opportunity to not only address the traffic engineering issues but also shape an improvement of the living environment. In determining the ambition, the function of the area is also taken into consideration. The ambition for a lively city centre may differ from that for a quiet residential area. This constitutes a careful consideration in which the available budget also plays a part. Other aspects that have to do with quality of life, such as air quality, are weighed as well and measures are preferably integrated in the road design.

The execution offers various options to realise the stated ambition through measures. These measures may be broken down into three types, as indicated below with some examples:

- Source measures: apply noise-reducing asphalt, speed reduction, routeing adjustments, especially for freight traffic;
- Transfer measures: sound bunds or noise barriers, increased distance from the road to houses, lower (lane) positioning for through traffic;
- Measures for the houses themselves to ensure that the interior spaces are sufficiently quiet (noise-resistant).

Improvement of the living environment decreases noise nuisance and sleep disturbance and as such the health risks involved. Moreover, the reconstruction project not only offers a traffic engineering solution for a number of years, but the 'noise climate' of the environment is also at an acceptable level and as such future-proof. This way, the result is sustainable and ready for the future from various perspectives.

5. Sample projects

For three sample projects, it is described how the interaction with the environment was realised, which ambitions for environmental quality were applied and how these were moulded into measures.

Sample 1: Graafseweg Alverna

Preparation: 2004-2011

Execution: 2011

Situation:

The town of Nijmegen and its surroundings have experienced a significant growth in the past decades. Various new residential areas have been developed with a substantial increase in traffic on both local and regional roads. This is also the case on the Graafseweg (N324), as a result of which residents increasingly experience noise disturbance from road traffic. The nuisance is particularly felt in the village of Alverna, where the Graafseweg passes right through the centre.



Fig. 2: "old" situation in Alverna (source: Province of Gelderland)

Noise ambition:

Reducing the noise level to an acceptable level.

Process, design and execution:

In first instance (2004) the proposal was launched to place 4-metres high barriers in Alverna in order to reduce the noise sufficiently. This was met with strong resistance from the side of the population. Consequently, other problem-solving approaches were looked into together with the municipality and the residents that not only achieved traffic engineering and environmental goals but that also preserved the green village atmosphere of Alverna. The design consisted of lowering the main carriageway position by 0.5m, increasing the distance to the homes. This opened up room for a slope covered with a stone relief referring to the historical Roman route that used to pass here.



Fig. 3: situation after reconstruction in Alverna (Photo: P. Driessen)

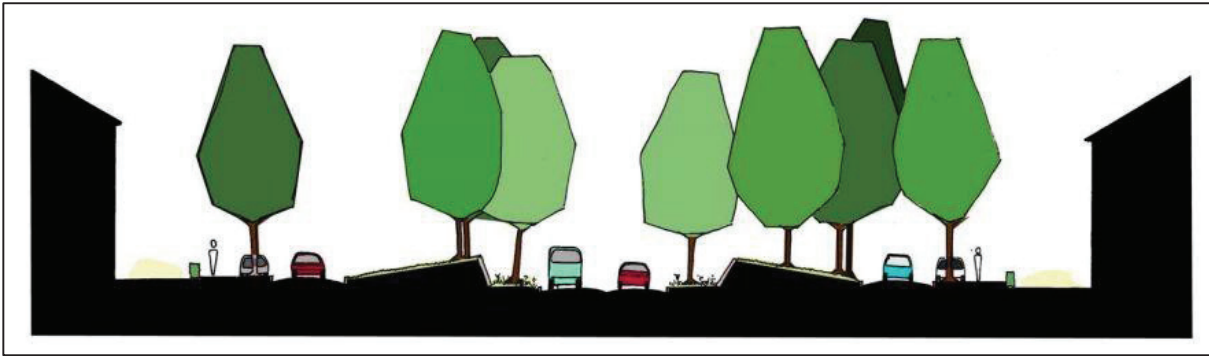


Fig. 4: final design of the Graafseweg in Alverna (source: Province of Gelderland)

In addition, the speed limit was lowered and noise-reducing asphalt was used. In combination with these measures, the image was further enhanced through suitable planting and attention for cyclists and pedestrians in the area.

Result:

The design realised in Alverna the same noise abatement as the unattractive 4m-high barriers, while still preserving the village atmosphere. The project received the European Soundscape award in 2011.

N302 Harderwijk

Preparation: 2005-2009

Execution: 2009-2010

Situation:

In the Harderwijk region, the N302 provincial road passes through the built-up area and has an important regional and local function. The route has a number of crossroads with traffic lights. The increase of regional traffic would make the road more and more a bottleneck, which would also have a negative effect on the quality of life in the area. In 2004, the decision was taken to tackle this problem.

Noise ambition:

The ambition for noise was formulated in concrete targets: 55dB in the main residential area, 'stand still' for houses in other areas

Process, design and execution:

For reconstructing the N302 market parties were given room to create problem-solving approaches within the predetermined framework. The final design consisted of an elevated main carriageway for regional traffic, while local traffic is handled at a lower level.



Fig. 5: New design for the N302: separation of regional and local traffic (source: Province of Gelderland)

The noise target was achieved by including sound barriers in the design and the application of noise-reducing asphalt. In addition, innovations were implemented such as leaving out the expansion ridges at flyovers.



Fig. 6: Noise barriers and "super quiet" asphalt In Harderwijk (photo: P. Driessen)

Result:

The measures taken in Harderwijk have resulted in the realisation of the targeted noise levels. This was also demonstrated through sound measurements close to the actual homes. In addition, an extensive survey was held among the residents in 2012, which pointed out that 40% thinks the noise level remained the same, 50% experiences a decrease in noise levels from the N302 provincial road [2]. This is in line with the noise target aimed at.

Traverse Dieren

Preparation: 2009-2015

Execution: 2015-2018

Situation:

The N348 is a main route from Arnhem to Zutphen. The road passes through the village of Dieren, with a lot of homes located close to the road. This puts pressure on the living environment. In addition, there is a build-up of traffic in the morning and evening rush hours. There are no options for a ring road.



Fig. 7: Present situation in Dieren (photo: P. Driessen)

Noise ambition:

Where possible, source and transfer measures, complemented by measures on the actual houses to guarantee a noise level of max 33dB in the living areas.

Process, design and execution:

After a careful weighing process in which local residents and the municipality played an important part, a design was decided on with a partial sunken location. This will make for a better flow of through traffic, while local traffic will be processed at ground level. On the south side of Dieren, the road will be 'bundled' with the railroad, resulting in less fragmentation of the country estate at that location. At the north side, the road will be optimised for future traffic volumes.



Fig. 8: New road design Traverse Dieren (source: Province of Gelderland)

The integrated design realises noise abatements through the sunken location and the application of noise-reducing asphalt. In consultation with the municipality, it was carefully considered where placing 2m-high sound barriers with a green image might be possible and acceptable.



Fig. 9: Example of noise barriers in a residential area (photo: P. Driessen, location Bommel)

On the basis of the future situation, it will also be assessed which houses still have too high noise levels. To remedy this, measures in the actual houses will be taken in consultation with the homeowners, such as replacing window panes by glazing that is extra sound-insulating and making roofs soundproof.



Fig. 10: Taking measurements for replacement window, applying extra noise reducing glass (photo: P. Driessen)

Result:

The same noise quality applies to all residents in the direct influence sphere of the provincial roads in Dieren: 33dB in the living areas of the house. The measures on the homes are applied before the ground works of the Traverse Dieren will start so that extra protection is also offered for the inevitable construction noise.

6. Recommendations

Based on the experiences of the policy of the Province of Gelderland on the aspect of the quality of the environment, the following recommendations may be made:

- Involve environment parameters in the project at an early stage in order to enable integration of the measures in the design;
- Involve local residents right from the start to generate input and create a level of support;
- Formulate an ambition that is in line with the function of the area;
- Look for measures that may be beneficial for multiple aspects;

Investing in the quality of the environment pays off; it creates a situation that not only meets the traffic engineering requirements for a longer period of time but also results in a situation that is acceptable to the residents.

References

- [1] RIVM Rapport 2014-0130: Health implication of road, railway and aircraft noise in the European Union : Provisional results based on the 2nd round of noise mapping, 2014
- [2] Companen Arnhem: Hinderbelevingsonderzoek N302 Harderwijk, 21 april 2011.