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N591 The Dutch Noise Innovation Program Road Traffic (IPG)

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ABSTRACT

In the Netherlands the Ministry of Transport, Public Works and Water Management and the Ministry of Environmental Affairs have initiated a sizeable research and development program to reduce road traffic noise. This program has to result noise reducing measurements that enable to reach strong strategic goals on the influence of road noise on inhabitants. The focus is on source oriented measures which are generally more cost-efficient than effect related measures.

The Innovation Program, with a budget of more than 50 million euros, will address the following topics:

- investigation of the possible noise reductions by road surfaces, tyres and vehicles and enhanced noise barriers;
- scientific research into the knowledge needed to realize the reduction effects;
- development of the technologies and products to a level of general application in the national main road and vehicle population.

The program must result in a significant reduction of the noise production (including shielding effects) of the main road network system. In case of combinations of measures after 4 years of IPG for every location the technology and products for 8 dB(A) noise reduction will be feasible.

KEYWORDS: innovation, pavements, noise reduction

INTRODUCTION

The Dutch national Traffic and Transportation plan for the next two decades (NVVP 2001 - 2020) defines strategic goals for circulation, traffic safety and the quality of the environment for our main road system.
The ambition for improving environmental quality, comprises an important section on controlling noise exposure of nearby residential areas in which concrete goals are formulated. The plan formulates specific levels of ambition for noise nuisance caused by road traffic:

1. decreasing the number of houses exposed to a noise level of >70 dB(A) by 100%, the number > 65 dB(A) by 90% and the number > 60 dB(A) by 50% to be realised in 2030.
2. a 'stand still' of noise exposure for areas belonging to the main ecological areas (EHS), the development of a set of permissible levels and enforcement of these levels in 2030.

In addition to the above mentioned general ambitions for achieving an acceptable noise situation along the main road network, there is the obligation to obey maximum noise levels for a large number of houses, within the frame work of the Noise Nuisance Act of 1979 (Wet geluidhinder). Noise levels which have been exceeded because of increasing traffic intensity, especially in night periods, and the disappointing developments on individual vehicle noise control.

The realisation of these ambitions and obligations with conventional measures will not only involve a tremendous financial effort, but will also lead to an extensive application of higher and longer noise barriers, that from a landscape point of view are less and less acceptable. Several studies have pointed out that source oriented measures are generally more cost-efficient than effect related measures and that the potential reductions can be significant.

The Ministry of Transport, in co-operation with the Ministry of Environmental Affairs have initiated an extensive Research and Development Program that in the first phase will address the following topics:

1. investigation of the possible noise reductions by road surfaces, tyres and vehicles;
2. scientific research into the knowledge needed to realise the reduction effects;
3. development of the technologies and products to a level of general application in the national main road and vehicle population.

This program is to be followed by a next phase in which wide application of the technologies and products will result in realisation of the formulated NVVP ambitions.

This paper describes the structures, projects and development goals of the first phase of the program. The program is referred to as the Innovatieprogramma Geluid (IPG), that can be translated as the innovative noise reduction program for road traffic [1]. A similar program is initiated for the national railway system.

Project parts

In the preparation phase of the IPG-program many experts in the relevant research fields have been consulted about possibilities, feasibility's, technologies and general opinions on solutions for silent road traffic. This has resulted in an inventory of over a hundred ideas on noise reduction. Out of that five research clusters have been defined for the IPG-Silent road traffic program (figure 1).
Three clusters are dedicated to specific parts of the noise generating and propagating process, i.e. the road surface, the tyre/vehicle system and the noise barrier. The fourth and fifth cluster comprise topics of general importance, that cannot be clearly attributed to a certain clusters and involve issues such as the scientific infrastructure of the program and the framework that enables wide implementation of the R&D products.

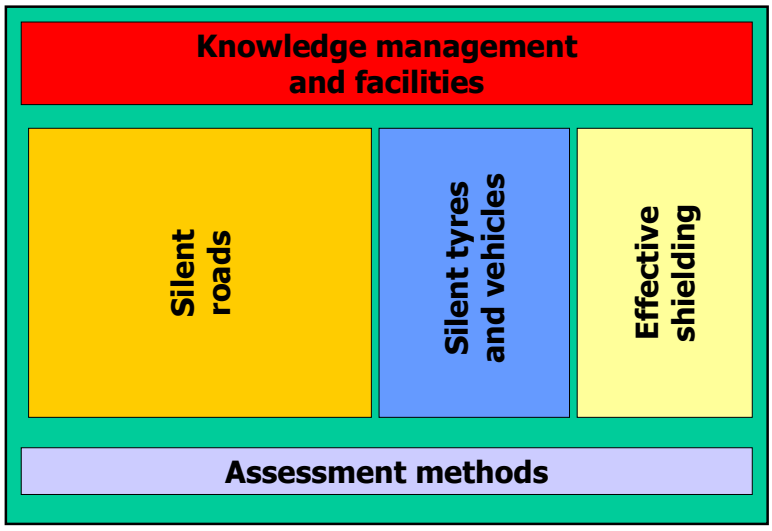

Figure 1 Research clusters

The development of noise reducing measures will not start from scratch, but is mostly based on already existing ideas and technologies. The challenge in the IPG-program is to develop these ideas and immature technologies to broadly applicable products, that will continue to work over a considerable life time. In the IPG-program there will also be given significant emphasis on the development of regulations and implementation rules that support wide application of the project results.

Noise reductions to be expected

The program must result in a significant reduction of the noise production (including shielding effects) of the main road network system. This challenging goal can only be achieved if all contributions and influencing factors to the total noise production are taken care of. This, of course, explains this extensive R&D program.

The expectation of the outcome of the program is defined with respect to the time period and is defined for each research cluster since some parts will result in significant noise reductions in short term; other parts will need some more time.

Figure 2 gives the expected reduction effects of the developed technologies and products. These figures are based on an average fleet composition of 80% light vehicles and 20% heavy vehicles and a speed of 85 and 110 km/h respectively. Reductions are defined relative to the present situation with the existing tyre/vehicle population and a road surface of dense asphalt concrete of average age. Noise barrier efficiency is related to the efficiency of the conventional barrier types.

Short term is defined as the status after 4 years after start of the IPG and Long term indicates implementation of the results after about 10 years.

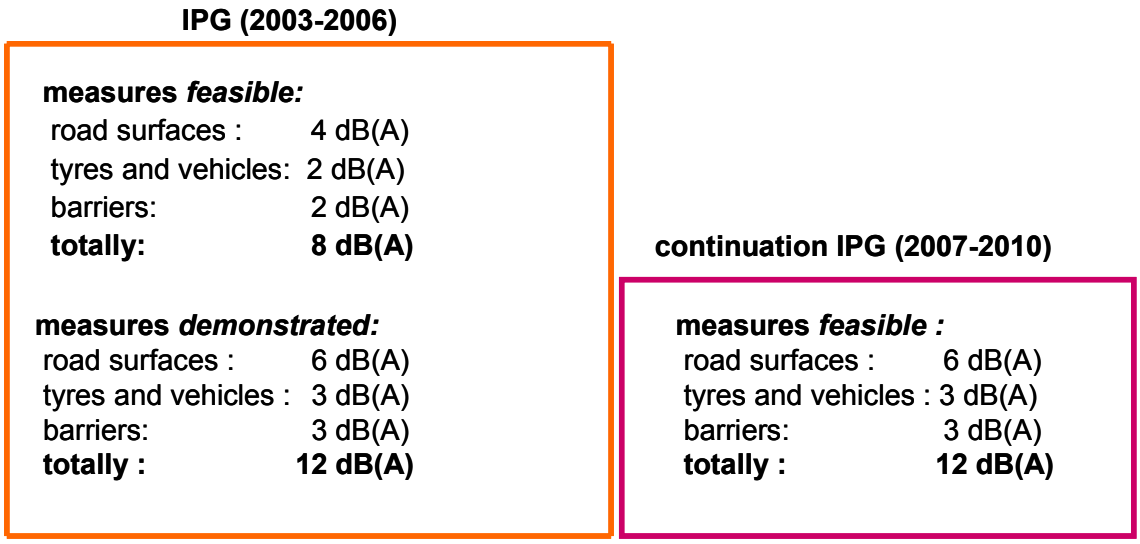

Figure 2 Expected noise reductions for the short and long term

In case of combinations of measures it does not mean that the total effect is equal to the sum of the single effects, but after 4 years of IPG for every location 8 dB(A) noise reduction will be feasible.

In the long run the IPG-program will make realisation of a noise reduction effect of the combined measures on road, vehicle and barrier of about 12 dB(A) achievable.

The realisation of the potential reduction effects depends of course highly on the actual application of the developed measures and technologies, facilitated by the regulatory framework to be developed.

Research clusters

The contents of the research cluster are summarised below.

Knowledge management and facilities

- setting up of a system that gathers and communicates technical/scientific results of research inside and outside the IPG;
- broadening and deepening of the basic knowledge on rolling noise generation, short distance propagation (including shielding) and active noise cancellation;
- building and maintenance of research facilities for vehicle/tyre testing in semi-trafficked conditions and real trafficked conditions.

Silent roads

- wide application of 2-layer porous asphalt at highways
- improvement of acoustical and structural properties of porous and non-porous surfaces
- design and development of a new generation of silent roads

Silent tyres and vehicles

- stimulation of the use of silent tyres and vehicles by national legislation and influencing consumers behaviour by financial stimulation/taxation
- improving the quality of international regulations/legislation by sharpening of limit values and more representative measuring methods;
- development of low noise vehicle and tyre concepts

Enhanced noise barrier efficiency

- improvement of barrier top efficiency and barrier position
- improved barrier efficiency by implementation of active noise control

Assessment methods

- development and standardisation of acoustic and non acoustic measurement methods
- development of a decision making framework (Life Cycle Analysis, risk analysis, traffic safety, etc.) for the implementation of measures

Projects and subprojects

The program layout of the IPG consists of nested projects, at three levels. The result of a certain level is related to the project approach of the level above. This guarantees both the control of specific projects and the application and tuning of project results within the total framework. The projects of two levels are shown in figure 3.

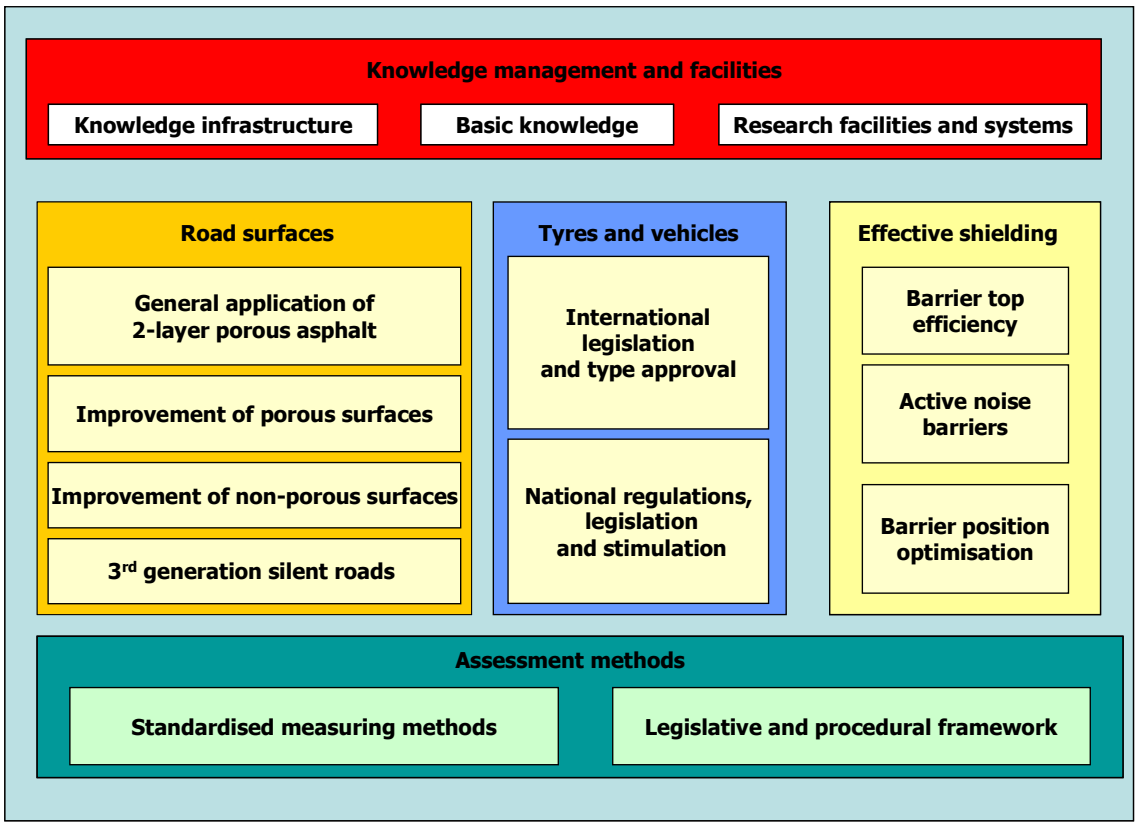

Figure 3 Clusters and main projects

FIRST RESULTS

Although the Noise Innovation Project is recently started, several results are available, especially in the clusters road surfaces and effective shielding.

For silent roads research, test sections of two layer porous asphalt both by the conventional technique were laid at the A28 near Staphorst (figure 4) and the warm-in-warm technology as used on the A27 near Hilversum. All two layer porous asphalt sections are involved in a extensively monitoring program. A special paper on the silent road projects is in the proceedings, [2].

Figure 4 Test section two layer porous asphalt

Figure 5 Barrier top

Research have indicated that acoustical tops can reduce the noise levels with about 2-3 dB. Experiments in the field are in preparation (figure 5). A simulation study for active noise control on top of a noise barrier has shown promising results. In the next phase of the study the influence of a moving primary source and wind on the reduction effect will be studied. For the topics on effective shielding see paper [3].

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