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ON INFLUENCING NOISE LEGISLATION AND NOISE-ABATEMENT POLICY

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Policy makers are now convinced that it is essential to find new solutions for the noise problem. In the Netherlands, three studies have already been completed in support of the policy makers. The first study indicates that by reducing the amount of noise produced at the source, a factor of 10 can be saved on the costs of noise barriers and wall insulation over the period from 2000 to 2010, which totals about 0·85 billion Euros. The second study, a first attempt of an economic study, indicates that investments in reduction at source can have a significant Financial benefit. Finally, the third study shows that a broad overview of the technical potential of the development of quieter trains and tracks is now available. However, it also shows that many challenges will still have to be faced before these source measures can be implemented on a large scale.

1. INTRODUCTION

Noise resulting from road, rail or air transport is bound by national noise legislation in most European countries. The aim of this legislation is to protect the inhabitants from noise pollution. In general, great social pressure is aimed at more stringent noise legislation. At the same time, European legislation is being drawn up with regard to noise pollution control.

During the last decade, railway companies have often had to deal with national noise legislation. So for these companies, almost without exception, were able to find local solutions in order to comply with noise legislation. These solutions comprised, for example, the installation of noise barriers or the insulation of dwellings. Nowadays, it is becoming increasingly evident that a different approach to the noise problem is required. The predicted growth of rail traffic and the tendency to impose increasingly strict noise legislation is expected to lead to more bottlenecks. A realistic solution to these bottlenecks should not be provided by noise barriers. In addition, the question arises to what extent noise barriers would provide the most effective solution from a financial point of view. This question becomes even more interesting in the light of the promising results obtained from national and international studies with regard to quieter railway vehicles and quieter track constructions. Many of these studies give the impression that a reduction of many decibels can still be achieved by constructing low-noise trains

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and tracks. However, for the time being it does not seem likely that quieter, low-noise trains and tracks will be built on a large scale on the European rail network. Important questions for policy makers and decision makers in governments and railway companies are, therefore:

- What is the expectation for technical solutions for reduction at source?
- What is the cost–benefit of investments in reduction at source?
- What will be an effective system of rules and legislation to enforce reductions at sources?
- How will effective noise legislation protect citizens against unacceptable noise levels and yet does not affect the growth of rail traffic?

Currently, acousticians support policy makers in addressing the questions above. They influence the choices made by policy makers and proposed new noise legislation with their research work and advice influences new noise legislation.

This paper gives an overview of three studies carried out in the Netherlands which discuss the problems referred to above. These studies were designed to support policy makers and decision makers.

2. STUDY 1: CONSEQUENCES OF NOISE QUOTA AS PRESCRIBED BY LAW

2.1. NOISE QUOTA AS A SUPPLEMENT TO CURRENT NOISE LEGISLATION

The Dutch Decree for Railway Noise Pollution (Bgs, 1989) as prescribed by law contains rules with regard to railway noise. During the past 10 years implementation of this decree has led to noise measures in situations where there were physical alterations to the rail infrastructure (e.g., track extensions) and in the case of new housing development. The increase in noise pollution along existing lines as a result of heavier rail traffic only is disregarded by the current Bgs in most cases.

On behalf of the Ministry for Housing and the Environment, the working group named PUEB is currently planning the introduction of noise quota (or noise-emission ceilings). A noise quotum establishes the maximum noise emission for a particular piece of track. If, for example, as a result of an increase in rail traffic a higher emission level is desired, this can only be established by following a procedure to increase the noise quotum. Part of this procedure concerns taking measures to ensure that the noise levels at noise-sensitive structures in the vicinity of the railway do not increase (standstill), or that interior levels are guaranteed. Noise quota should lead to better control of the noise emission of the entire Dutch rail network.

With regard to the value of the initial assessment of noise quota, it appeared that the parties represented in the PUEB (Ministry for Housing Spatial Planning and the Environment, Ministry of Transport, Rail Infrastructure Managers, Rail Capacity Managers and local authorities) had differing interests. An initial assessment of noise quota based on noise emissions occurring in practice seemed reasonable when first introducing the rule, especially if these quota were increased slightly in order to prevent normal fluctuations, which occur from year to year,

from immediately exceeding the quota. Before the PUEB were ready to accept this recommendation for the value of the initial assessment, they wished to gain insight into the effects of this in the long term. In order to answer this specific question, a study was performed by the NS Technisch Onderzoek (NSTO) (Dutch Railways Technical Research), in co-operation with the National Institute for Health and the Environment (RIVM) [1]. The Ministry for Housing, Spatial Planning and the Environment, Railned (Dutch Rail Capacity Manager) and NS Railinfrabeheer (Dutch Railways Rail Infrastructure Management) commissioned this study.

2.2. FUTURE EFFECTS WITH TWO SCENARIOS

In the NSTO/RIVM study the assessment of noise quota was based on the 1997 situation and it includes a prediction of the situation in 2010. A prognosis for the volume of traffic has been drawn up for the situation in 2010, which includes the growth of rail traffic predicted (and desired) by the government. Two scenarios are then considered with regard to the composition of the rolling stock fleet in 2010 and track constructions:

1. The rolling stock fleet and track constructions are comparable to the present situation with regard to the acoustic properties.
2. The passenger stock consists entirely of quiet trains (in other words, trains with "smooth" wheels which means a reduction of 7 dB(A) as compared to the old passenger trains) and 70% of the freight wagons are 7 dB(A) quieter than the current freight wagons. In addition, wooden sleepers have been entirely replaced by concrete sleepers which are approximately 2 dB(A) quieter.

At the same time, the impact of developments in the rail network during the last 10 years has been made by comparing the 1997 situation with that of 1987. The following effects have been determined:

(1) impact on the environment:
   - the area subjected to noise ($>$ 50 dB(A) LAeq 24-h period value)
   - how many seriously affected people

(2) cost effects
   - costs of propagation control measures such as noise barriers and insulation of dwellings which have become necessary as a result of the noise emission ceilings.

With the aid of computer simulation programs, in combination with geographically oriented computer software (Gerano98), the above-mentioned effects were quantitatively determined for the entire Dutch rail network.

2.3. CONCLUSIONS

The results of the study are presented in Table 1.

TABLE 1
Results of the study

Situation	Costs of noise barriers	Effects on the environment (including noise barriers)	
	Façade insulation period 2000–2010 in Euros	Number of seriously affected (% of population)	Area within 50 dB(A) contour (% of area of the Netherlands)
1987	—	1·4%	9·2%
1997	—	0·9%	7·4%
2010 scenario 1	850 million	0·8%	9·3%
2010 scenario 2 (with quiet trains and quiet infra-structure)	0·8 million	0·6%	5·6%

Important conclusions derived from the study are:

- Between 1987 and 1997 on a national level there was a decrease in the noise emission of rail traffic (and, therefore, also in the impact on the environment). This was achieved by replacing wooden sleepers by concrete ones, the use of quieter passenger trains, the installation of noise barriers and a decrease in the volume of freight traffic and other changes.
- Based on noise quota for the national rail network laid down by law, in the period between 2000 and 2010 about 850 million Euros will be needed for noise barriers and façade insulation. This amount can be reduced to 0·8 million Euros if trains and track themselves become quieter (scenario 2).

The latter conclusion is the most important. However, it must be stated that the variation without quiet trains and infrastructure will not only lead to higher costs to cover control measures, but will also result in relatively lengthy procedures to increase noise quota and in many cases also to local problems with regard to visual disruption and barrier effectiveness. This is why it is important that all parties recognize the importance of ensuring that rail traffic itself becomes quieter. Only then will the growth in rail transport desired by the government be possible, with no need for large-scale measures to control the noise by interrupting the path of propagation. This would also be beneficial to the environment and would mean more opportunities for the building of new houses. In this manner, the wishes of almost all of the parties concerned could be satisfied.

3. STUDY 2: QUIET TRAINS A SOURCE OF SAVINGS

On behalf of the Ministry for Housing Spatial Planning and the Environment (VROM), KPMG, in co-operation with the RIVM and the NSTO, investigated the

cost effectiveness of measures to reduce noise at source measures for railway traffic. The study concerned a case study for the Utrecht–Amsterdam Muiderpoort line, in which the costs and effects of source control measures and propagation control measures were examined. Four scenarios were considered, varying in the degree of source control measures taken and the phases in which they were introduced. They were compared with a zero scenario. The zero scenario states the costs of propagation control measures which must be taken in order to remain within legal limits, based on the noise emission of the current rolling stock fleet. In all cases, it appeared that the scenarios with source control measures were considerably less expensive than the zero scenario. It is also of interest to note that the scenarios with source control measures frequently led to greater noise reduction than required by law. As a result of this, the environment also tends to benefit when compared with the zero scenario. Figure 1 gives a comparison of the additional costs per scenario. An overview of the scenarios is presented in Table 2.

The general conclusion of the study is clear: reduction at source to prevent railway noise is less expensive and more effective than propagation control measures. A limitation of the study is that it only concerns the Amsterdam

TABLE 2

Overview scenarios. The combi scenario is a combination of the easy and the strong scenario which succeed each other

Scenario	Type of train	Source measure: Replace?	Source measure: (alter) brake system	Source measure: Add shrouds	Source measure: Reduce speed?	Total effect (dB(A))
Null	—	—	—	—	—	0
Easy	Old slow train	Yes	Disc	No	No	−7
	Old ICs	No	Replace shoe brake by magnet	No	No	−7
	Cargo	No	No	No	Yes	−1 to −4
Strong 1	Old slow train	Yes	Disc	Yes	No	−14
	Old ICs	No	Non-roughening shoes	Yes	No	−14
	Cargo	No	Non-roughening shoes	Yes	No	−14
	New ICs	No	—	Yes	No	−7
Strong 2	Old slow train	Yes	Disc	Yes	No	−14
	Old ICs	No	Replace shoe brake by magnet	Yes	No	−14
	Cargo	No	Replace shoe brake by magnet	Yes	No	−14
	New ICs	No	—	Yes	No	−7

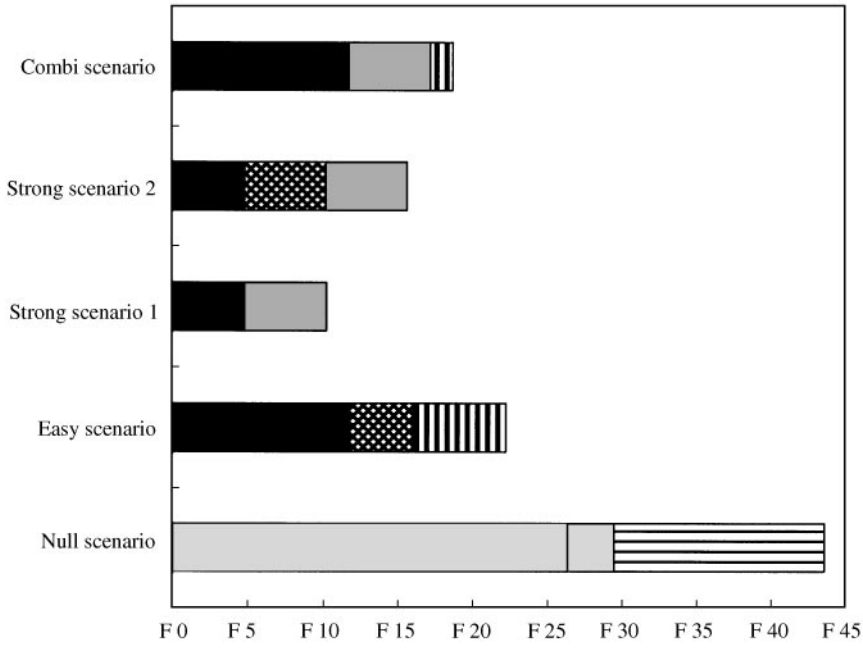

Figure 1. Schematic overview of additional costs per scenario (NCW) Note: the shrouds which have been installed on the trains are also included under the item Screening. ▭ maintenance barriers; ◧ , delay Cargo (speed reduction); ■ , small barriers and shrouds; ▩ , replace brakes; ■ , windows isolation; ■ , barriers; ■ , purchase new rolling stock.
Source: KPMG Bureau for Economic Argumentation [2].

Muiderpoort–Utrecht line (50 km of track) and, as a result, a number of less realistic hypotheses were required. It is not clear to what extent the results of the study can be extrapolated to a national or even a European scale. However, the indication that there is another approach to the problem of railway noise which is probably less expensive than the current approach, does, of course, remain valid.

4. STUDY 3: PERSPECTIVES FOR QUIETER FREIGHT TRAFFIC

4.1. SUFFICIENT INFORMATION?

The NSTO was commissioned by the Project Team for the North-East Connection (NOV, a "branch" of the Betuwe route running towards the north of the Netherlands) to make an analysis of the anticipated reduction in noise of freight traffic travelling by rail. In the first instance, an inventory was made to determine whether sufficient information was available in order to achieve a reduction in the noise generated the rolling stock. A positive reply was expected to this question taking into account the large investments in research capacity and money over the last 10 years. The study describes three large research programmes in the Netherlands, including Quieter Railway Traffic which has the largest budget and the highest ambitions. Outside the Netherlands, five large and many smaller programmes have been initiated in which researchers from different European

countries are working together; finally, there are also initiatives in many countries at a national level. All of this has led to a much better understanding of the mechanisms of generation of rolling noise on a straight track in particular, and to the possibility of indicating the effectiveness of real solutions in advance with the aid of parameter studies.

The solutions themselves, however, do not appear to be very different from those in the past; it is widely known that the use of cast-iron brake shoes on the tyres (as is still the case with freight wagons today) results in damage to the tread. This damage causes vibrations when the wheel is in motion and this in turn leads to noise emission. If no measures are taken with regard to wheel roughness, reductions could still be established if the shape of the wheels were optimized, or if wheel mufflers or spring-mounted wheels and "shrouds" were used. However, as far as the total noise is concerned, these reductions would be insignificant as the track itself contributes significantly to the emission of noise. Therefore, in order to achieve larger reductions, measures will also always have to be taken with regard to the track.

If the braking system of freight wagons were to be altered, which would seem to be the obvious solution, this would result in a reduction of 6–8 dB(A). However, there is little point in limiting such a decision to one or several countries in Europe. There are around 800 000 freight wagons en route in Europe, and it is possible that they will all, on some occasion, travel on the Dutch network. For this reason, the Board of Directors of the International Railway Union, (UIC), recently decided to initiate a programme to ensure that, by the year 2015—and sooner if possible—all trains travelling on the European network will be modified during normal maintenance; they shall be fitted with synthetic brake shoes, which should result in a reduction of 10 dB(A) according to the expectations of the UIC.

4.2. QUIET FREIGHT TRAINS, WHO WILL FOOT THE BILL?

The issue regarding the responsibility for paying for these measures now that national railway companies in Europe do not exist, needs to be resolved. In most countries, the old railway structures have been split up into companies which apply themselves to the transport of people and goods, companies which apply themselves to the management and development of infrastructure, maintenance companies, station managers, capacity managers and traffic controllers. Haulage companies will have to modify their wagons. The railway manager will have to modify the track, because the full effect of the measures applied to the wagons shall otherwise not be felt. At present, none of the parties is legally authorized to do this. The responsibility for ensuring that this actually happens rest on both National and the European governments.

4.3. EMISSION DIRECTIVES

The Green Paper on Noise published by the European Committee states that emission directives will be drawn up for railway equipment. However, there are still

some problems to be solved before these can be established:

— will the directives only be concerned with new rolling stock or with existing trains also?
— how will the influence of different types of tracks be interpreted?
— should the directives only relate to international traffic or to national networks also?
— how shall this be measured?

It will be some time before all these questions can be answered satisfactorily.

4.4. CONCLUSION

It can be concluded from this paper that sufficient knowledge and ideas are available to realize substantial noise reduction. However, this process shall not be accomplished autonomously. The paper sums up a number of specific pre-conditions which must be met before the necessary source control measures can be taken, both with regard to the vehicles and the track.

5. THE THREE STUDIES TOGETHER

The three studies, each of a different nature, complement each other well. The investigation into the consequences of noise emission limits gives an indication of the costs of propagation control measures for the entire rail network for a scenarios with and without noise reduction at source. The KPMG study focuses specifically on the costs of noise reduction at source and compares these, for the Utrecht—Amsterdam Muiderpoort line only, with the costs of necessary propagation control measures.

With regard to the introduction of emission limits, it has become apparent from the first study, that reduction at the source would be extremely advantageous to all parties concerned. The KPMG study adds to this by stating that reduction at source is also considerably less expensive than comparable propagation control measures. The third study clearly indicates that there are still some questions of a technical nature and a number of procedural problems which are standing in the way of real progress. The willingness to tackle these problems is definitely present, but quieter rail traffic on a large scale will only be realized if the governments concerned and the railway parties in particular, succeed in creating an effective noise policy which is supported by legislation.

The studies described here provide an initial attempt to find answers to the questions of policy makers and decision makers. Many follow-up studies are being planned, some on a European level. The studies which have already been carried out, however, have already had an effect on policy makers. They are becoming increasingly convinced that effective noise legislation and noise policy which looks ahead to the future is based on four factors:

1. legislation with noise-emission limits which can be maintained satisfactorily
2. technical potential available for quiet trains and infrastructure

3. noise emission demands for railway vehicles
4. stimulating measures (subsidies) for transporters intended for the purchase of quiet stock or the rebuilding of existing stock and discouraging the use of noisy stock by taking account of the noise properties of the stock when levying taxes and charges.

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