



# LEGAL AND ECONOMIC INSTRUMENTS FOR ACTIVATING THE NOISE REDUCTION POTENTIAL OF RAILWAY VEHICLES

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The impact of noise on the population is one of the major environmental problems faced by the European railways. Technical solutions are now available which allow the noise problem largely to be solved at an acceptable cost. However, the European railway companies rarely use these solutions. For the rapid introduction of low-noise railbound vehicles, legal and economic instruments must therefore be used. The most effective instrument among them is the enforcement of ambitious European noise emission limits for railway vehicles. These noise regulations have to be complemented by economic instruments such as emission-related track charges.

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## 1. INTRODUCTION

The impact of noise on the population is one of the major environmental problems of the European railways. In Germany, opposition from the community to new railway lines is mainly due to the fear of increased noise pollution. Therefore, costly traditional noise protection devices such as barriers or sound attenuating windows must be installed (thus for the new 200 km line, from Cologne to Frankfurt, 125 million DM will be spent on such measures despite the fact that large portions of the line run parallel to the existing autobahn). The noise problem posed by rail traffic could, to a large extent, be solved far more effectively and at an acceptable cost if the new low-noise railbound vehicles were used, such as

- the “Lok 2000”, the quietest locomotive of the world, manufactured by SLM with a reduction potential of 7–14 dB(A) compared to conventional locomotives;
- the new S-train in Copenhagen (reduction of about 7 dB(A)),
- low-noise freight wagons,
  - replacing the cast iron brake blocks by composite blocks (reduction of about 9 dB(A)),
  - or with noise reduction measurements incorporated in the low-noise (freight) train of DB, ÖBB and FS (reduction of about 20 dB(A), partly due to the use of disc brakes).

At two international workshops of the Umweltbundesamt, solutions for quiet railway vehicles have been discussed [1, 2]. The railway companies hardly use these

low-noise versions, introducing them only on lines that are subject to noise exposure limits (e.g., in Germany on new ICE lines) or when the counterproductive consequences of high noise exposure are apparent. Due to the long lifetime of railbound vehicles this failure to use low-noise vehicles is particularly problematic and makes it necessary to issue requirements for the retro-fitting of vehicles already in operation.

The limited use of low-noise vehicles results from the absence of noise regulations (in contrast to those which apply to road vehicles for which the European Union introduced the first noise emission regulations nearly 30 years ago), and the normally higher purchase price of these versions.

The rapid introduction of low-noise railbound vehicles, therefore, has to be supported by additional strategies, including legal regulations and economic incentives.

The most important instruments among them are:

- the enforcement of noise exposure limits,
- the introduction of noise emission regulations for both new and old railbound vehicles,
- financial or operational incentives for quieter vehicles such as emission-related track charges.

## 2. NOISE EXPOSURE LIMITS

Noise exposure limits exist within the European Union at national level and vary in form and content. In Germany, for example, they exist only for new and *structurally* substantially altered lines. For existing lines and in the event of noise increases due to higher speeds or traffic volumes the residents affected are normally not entitled to any protective measures.

Furthermore, noise reception limits provide freedom to choose between vehicle- and track-related measures and sound propagation control measures such as barriers or sound attenuating windows, which have mainly been used up to now.

With the increasing division of railway companies into infrastructure and transportation companies there is a growing risk that the measures chosen are not the optimal solution from an economic perspective (e.g., barriers instead of vehicle-related measures). Emission-related track charges and other incentives can then encourage infrastructure and transportation companies to work together to find the optimal solution (see below). Because of the international character of railway transport an introduction of low-noise railway vehicles is only possible on a European level. As European harmonization of noise exposure regulations appears to be difficult and lengthy, the approach of noise reduction by exposure limits may be ineffective.

## 3. NOISE EMISSION LIMITS

Noise emission limits compel the application of measures to the source; that is, to the noise generating vehicle components and to the track. Generally, they lead to

reductions with the best cost-benefit ratio which are effective over the entire railway network (in the case of vehicle-related measures) and across the entire sound propagation area. They send a clear signal for vehicle manufacturers and railway companies to produce and use low-noise railway vehicles. At the European level they correspond to the product regulations of the European Union which initially served the Common Market but later gained increasing importance for environment protection. Such noise emission limits were introduced for road vehicles in the early 1970s and they have repeatedly been reduced since then (for heavy goods vehicles (the most important competitor of rail freight transport) by 11 dB(A)). Marked reductions have thereby been achieved in road vehicle engine noise emissions, particularly in urban areas.

The first proposal of the European Union for railway vehicle noise emission limits was effectively withdrawn in 1983. One of the arguments against such a regulation was its supposed lack of effectiveness as it would not have been valid for railway companies outside the Union. With the increasing number of member states of the European Union and the far-reaching commitment of states outside the Union to adopt its regulations, this argument has lost its validity. Furthermore, this problem can be solved with the imposition of emission-related track charges (see below).

For the reasons stated above it seems clear that the enforcement of noise emission limits for railway vehicles is the best way (corresponding with European Union legislation) to promote significant reductions in railway noise at the least possible expenditure.

This assessment is widely shared. At their conference in Vienna in November 1997, the European Ministers of environment and transport backed calls for international standards for noise (and air pollution) from railway vehicles. The Green Paper of the European Commission on the Future Noise Policy, published in November 1996, also takes emission limits into consideration. The resolution of the Conference on the Green Paper in The Hague in May 1997 stated that without noise emission limits hardly any operator or infrastructure organization would be willing to invest in quiet technology.

A noise emission regulation of the European Union should be enforced in two stages:

- The first step is based on available abatement measures. For freight wagons with block brakes a reduction of 11 dB(A) versus present emission levels should be realized. For disc-braked passenger vehicles the noise emission of the ICE cars should be the target. This corresponds to a reduction of 5 dB(A) for disc-braked and up to 18 dB(A) for block-braked cars. Powered vehicles (locomotives and railcoaches) should in future only be equipped with disc brakes and should achieve noise emissions lower than those of the Copenhagen S-Train (reduction of between 5 and 10 dB(A) depending on the brake system). For the details of the proposed regulation see reference [3]. The first step should be enforced as soon as possible, and the Commission should therefore prepare a draft before the year 2000. For existing vehicles with block brakes, emission limits resulting in a reduction of 10 dB(A) should be proposed. They should be enforced at a time

which allows for retro-fitting of the whole fleet as part of major maintenance checks.

- The second step should be enforced about 5 years after the first step, with an additional reduction of the limits for freight wagons of about 10 dB(A). This can be realized using present state of technology by shielding on vehicles and tracks, and wheel absorbers (see the above-mentioned low-noise train). For disc-braked vehicles reductions of between 5 and 8 dB(A) should be achieved by shielding.

In September 1998 a further conference on the Future Noise Policy of the Commission was held. Contrary to the original programme the noise abatement of railway vehicles was not a topic of the conference. This was regrettable and the Commission is requested to establish a Working Group on noise emission regulations for railbound vehicles as soon as possible.

Nonetheless, the re-opening of the discussion on noise regulations no doubt contributed to the launch of the ambitious noise abatement programme of the UIC and the Community of European Railways, which is particularly welcomed.

The full realization of the vehicle-related noise reduction potential requires optimal track maintenance, e.g., by smoothing the rail surface. Results obtained in Germany show that rail grinding leads to a reduction of noise emissions which is about 3 dB(A) higher for disc-braked wagons than for cast iron block-braked freight wagons.

#### 4. INCENTIVES FOR THE USE OF QUIETER RAILWAY VEHICLES

The enforcement of noise regulations for railway vehicles should be accompanied by incentives for the use of quieter vehicles. Such incentives will support the use of low-noise railway vehicles already before regulations are enacted.

They may stimulate the railway companies outside the European Union to implement noise abatement measures for those vehicles which are introduced into the European Union.

They will also provide an important economic link between infrastructure and transportation companies, for example, if the former wants to promote the use of low-noise vehicles in order to save expenditures for barriers and sound-proof windows.

By far, the most important incentive for the promotion of quieter or environmentally less harmful railway vehicles is an emission-related track charge. Under this scheme quieter vehicles would get a reduction in track charges. The new track charge regulation of the Deutsche Bahn AG of 1998 allows for this instrument but it has not yet been put into practice. The Umweltbundesamt proposed a cost-neutral introduction of the emission-related track charges for freight wagons to the infrastructure company of the DB AG. Low-noise freight wagons should get a reduction of about 10% of their track charge relating to the retro-fitting costs for composite block brakes and wheel absorbers. This reduction will be compensated for by an increase in the charge for conventional wagons. Assuming that 5% of the freight wagon fleet is retrofitted in the first year the additional charges for noisy vehicles would only be 3%.

An important pre-requisite for the introduction of emission-related track charges in the European Union is to harmonize the present charging systems. Today the spectrum ranges from zero (Netherlands) to charge schemes that cover the full costs of the tracks (Germany).

Another important financial incentive for the use of low-noise railbound vehicles are appropriate government programmes. The German government has funded noise abatement measures for existing Federal roads since 1978. A corresponding programme for existing railway lines does not yet exist. The Umweltbundesamt has therefore demanded that the two modes of transportation be dealt with equally. With the money already spent for Federal roads the entire freight wagon fleet of the DB AG and private rail vehicle owners could have been equipped with composite brake blocks and wheel absorbers. There are several possible forms of such government programmes ranging from direct financial support up to higher penalties or charges.

In addition to these financial incentives others are possible, especially concerning the operation of vehicles on tracks with high noise exposure. Thus, for example, night bans could be introduced for freight wagons with exemption of low-noise wagons, as is practised in Austria for road freight transport. As noise emissions increase with higher speeds, speed limits for conventional freight wagons could be introduced, again with the exemption of low-noise versions.

## 5. CONCLUSION

An appropriate combination of regulations and economic or operational incentives can activate the considerable noise reduction potential for railway vehicles. The severe impact of the population by railway noise and the broad consensus that more transport must be shifted from road to rail make it necessary to apply these instruments immediately. Because of the European dimension of the problem the European Commission in particular is urged to initiate the necessary steps as soon as possible.

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