



THE ACTION PROGRAMME OF UIC, CER* AND UIP “ABATEMENT OF RAILWAY NOISE EMISSIONS ON GOODS TRAINS”

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Although rail transport has a low environmental impact overall, noise from goods trains remains a major problem. Research has identified that wheel roughness is the critical factor and that composite materials will deliver adequate braking with less damage to the wheel surface than existing iron brake blocks. Accordingly, the UIC/CER has made a formal commitment to fit composite blocks to existing wagons as well as to all new wagons, although existing wheels cannot cope with the thermal stress from composite blocks. Fitting new wheels only when the old are worn out will be cost neutral, but will take 15–20 yr. Premature wheel replacement will involve additional cost, but will deliver the benefits in 5 years. This can be achieved with financial assistance from EU member-states, who will thereby avoid unnecessary outlay on noise barriers. At the same time proposals for a EU noise emission standard should reflect the performance achieved by the modified wagons. The railways propose a voluntary environmental agreement with the EU

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1. GENERAL BACKGROUND

Railways are the most environmental friendly means of transportation. However, one serious problem remains to be dealt with: the noise level produced by railway traffic, especially by goods trains. The railways are aware that they have to start action in this field or they will lose their advantage in competition with road transport especially at nighttime. They know that goods trains generate too much noise. In public opinion as the noise level produced by goods train is unacceptable, especially goods trains will be operated at higher speeds and/or with tighter schedules during the night.

Where new lines are built, or existing lines reconstructed, national law will require noise barriers where the imposed threshold values for noise reception cannot be met with other technical “state-of-the-art” measures, such as track grinding or the use of smooth wheel surfaces, achieved for instance with brake shoes of composite material. Even for the long-established railway lines there is

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a tendency to impose restrictive threshold values for noise reception. These will very soon create major problems for the railways, as operational changes are not feasible in the short run and will entail excessive costs. Implementation of tight limits for noise emission will have a similar effect unless there is an adequate period of time to adapt.

2. TECHNICAL BACKGROUND

Our knowledge of railway noise and the opportunities to reduce will now be reviewed. The endeavours of the research workers have created a body of knowledge that is now at the disposal of railway management and natural policy makers. Key elements in this body of knowledge are:

- the fundamental importance of rolling noise
- the critical contribution made by the roughness of the rolling surfaces of the wheel and rail
- the role of cast-iron-tread brakes in creating a rough rolling wheel surface.

Empirical observations have shown that replacement of tread brakes by disc brakes will lead to a reduction in noise emission of—8 dB. In recent years, it has been a standard practice in most countries to fit disc brakes to new passenger vehicles. As a result, noise levels at speeds as high as 200 km/h do not exceed 88 dB (speeds greater than 200 km/h are of course only reached on new railways which have noise barriers installed during construction). As older passenger vehicles are withdrawn from service, the noise created by passenger trains in Europe will continue to decline. Accordingly, a specific programme to tackle noise creation from passenger vehicles need not be considered.

Freight vehicles are, however, quite a different matter. Interoperability constraints have resulted in Europe's wagon fleet continuing to be fitted with cast-iron-tread brakes. As a result the noise performance of such vehicles—91 dB at 100 km/h—is unacceptable. It is known that alternative types of brake which do not damage the running surface of the wheel will reduce noise by about 8 dB. A further reduction can be obtained by increasing the propagation loss. This can be achieved with a combination of bogie shrouds and low trackside barriers; together these may contribute a further 5 dB.

Thus, technical solutions—i.e., smooth wheels, bogie shrouds and low trackside barriers—which will achieve a reduction of some 13–15 dB can be defined.

Identifying the means of a further 5–7 dB reduction to achieve the long-term objective of 20 dB represents the overriding goal for the noise research agenda of the future.

2.1. TACKLING THE PROBLEM OF FREIGHT TRAIN NOISE

The problem of the noisy freight train is essentially the phenomenon of cast-iron-tread brakes. Until recently, technical opinion believed that the modification of existing vehicles by installing quieter brakes would be too

expensive to be cost-effective; only new vehicles could be fitted with quiet brakes if the economics of freight train operations were not to be jeopardized. However, in the past 1 yr, technical investigations have demonstrated that there are cost-effective opportunities to retro-fit the existing fleet.

The results confirm the possibility of managing the safety problems involved with the heating of the wheels when braking with composite brake shoes. The retro-fitting consists of replacement of the cast-iron-brake shoes, small modifications on the braking system and, as far as is known today, there is also the need to replace the wheelsets by thermo-resistant wheels.

By the end of 1997 the CER therefore concluded that enough knowledge was available to initiate action. The action is based on the knowledge of the options:

- the possibility of replacing the cast-iron shoes on existing wagons by synthetic/composite shoes
- the possibility of equipping new vehicles with authorized synthetic brake shoes.

Considering the time scale, there are political choices open: If enough time were available (i.e., ~ 20 yr), it will be possible to achieve retro-fitting at a modest additional cost (in ideal circumstances it may even be cost-neutral), by co-ordinating the modification described above with the normal maintenance cycle for replacing wheel-sets. This scenario enables, in principle, compliance by the railways with noise emission standards whilst not jeopardizing the competitiveness of their freight business. When legislation considers faster action to be necessary, then retro-fitting is technically possible within a 5 yr period starting in the year 2000. This scenario will require financial funding from EU or from individual states, which can be justified by the fact that the states will save money on the fixed installation in reducing the need for noise abatement measures such as noise barriers.

It is important that any action by regulatory authorities concerning noise emission from existing goods wagons must; if unnecessary cost is to be avoided, reflect both these time-scales and the noise performance of the modified vehicles.

Reducing noise at the source is most efficient procedure. Use of cost-benefit methodology enables the identification of the optimum balance between all the means of noise reduction, such as retro-fitting of wagons, noise barriers and noise insulation windows with the best use of money. Calculations established in Switzerland show that in this way only one quarter of the noise barriers needed are still necessary. This enables the infrastructure owner to save money. With this information it may make sense to spend public money to support retro-fitting programmes.

2.2. PRINCIPLES OF THE ACTION PROGRAMME

On 16th June 1998, the UIC board of management approved the action-programme for noise reduction on goods trains consisting the following elements:

New vehicles are to be equipped with well-tried, authorized synthetic brake shoes inserts. To be able to do this, the relevant, still unresolved, technical questions must be settled in a short time. The framework to guarantee free circulation of these wagons on all UIC railways must be established quickly.

The existing wagon fleet is to be retro-fitted with synthetic or compound brake shoe inserts of compatible formats, especially with sufficient low friction coefficients. In this field, development work is to be accelerated. The acceptance test must be carried out in a short time, so that an international authorization is achieved by the end of 1999.

- It is foreseen that the retro-fitting programme will start in the year 2000 and will be largely completed within five years, when financing problems can be solved. The preparation work in progress will clarify whether this demanding time scale is achievable as regards industrial capacity and the cycles for vehicle overhaul (particularly wheel-set replacement).

In parallel with these activities, joint research with industry will be initiated in order to ensure, for new construction, that more demanding specifications can be achieved by means of constructive low cost measures. These must reflect life cycle cost. A considerable noise reduction must be guaranteed without imposing any additional cost burden on the railways' freight business.

2.3. NOISE REDUCTION EXPECTED BY THIS PROGRAMME

At present only limited estimates of the extent of noise reduction on a railway line by a retro-fitting programme are possible. Calculations using the "Swiss Lärmbelastungskataster" (a management tool to calculate different scenarios) show that on the Swiss main lines it is possible to reduce the noise reception level by up to 7 dB while in the same time increasing the number of passenger trains by 10% and the number and length of goods trains by almost 100% (see Figure 1).

3. FURTHER PROCEDURES

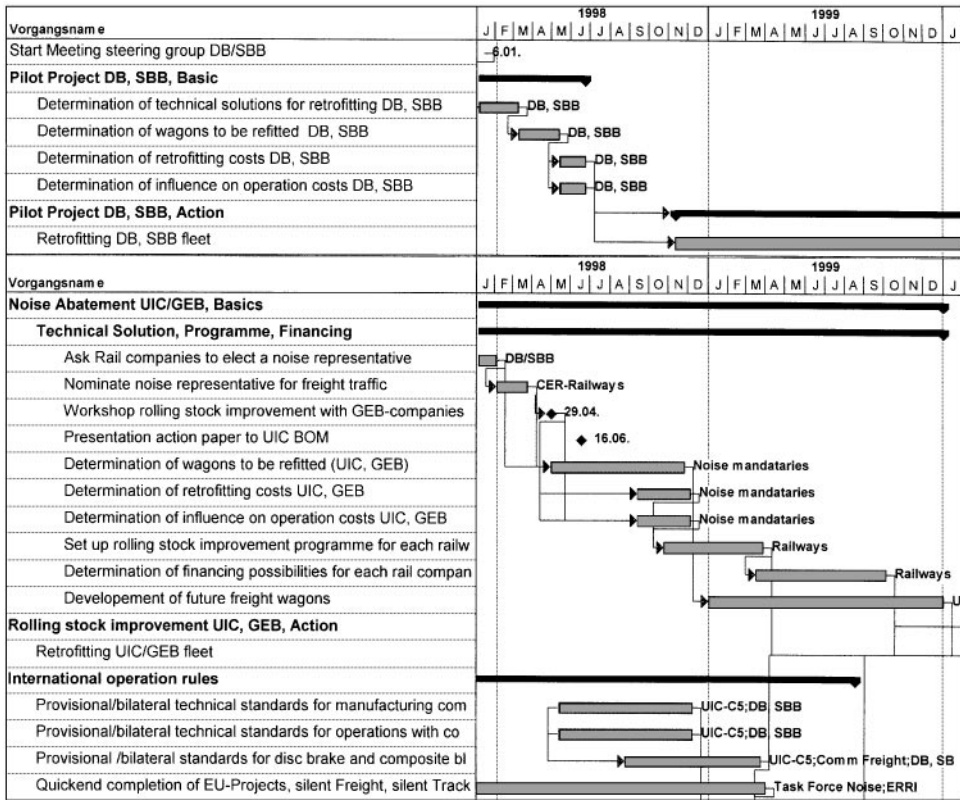
A steering group, led by DB, has prepared a project plan for this programme of work (Table 1). Represented in the steering group are: DB, SBB, SNCF, FS, UIC, CER, together with representatives from the UIC Rolling Stock Committee C5 (the wheel/brake specialists) and the UIC Task Force Noise. In addition UIP, representing the private wagon owners, joined the group in autumn 1998. To implement the UIC/CER-action-programme, the following steps of work are necessary:

- Identification of the fleet of wagons to be retro-fitted.
- Definition of the appropriate technical solutions for the retro-fitting of existing vehicles.
- Setting up an implementation programme concerning elements such as extent, costs and time scales.
- Creation of the pre-requisites for unconstrained use of upgraded wagons throughout Europe.

The work to be done is divided in two major stages: The first stage has involved the CER-railways; all CER-railways have appointed a "noise contact officer" who has the task of acting as a project manager for "noise reduction" for his/her railway.

TABLE 1

Action programme CER noise reduction on goods trains (draft February 1998)



In a second stage, all UIC-Railways have been asked to make a similar appointment. The steering group provides support, especially on technical questions and solutions for the retro-fitting to enable the project managers to undertake their task. In international workshops in Paris in April and September, the necessary input and technical knowledge was given to these project managers.

As a first result a report was presented to the Board of Management of UIC on June 16th 1998. The report included concrete figures and possible time scales for the retro-fitting of the German and Swiss fleets and first estimates on the costs for retrofitting the European freight wagon fleet. It is envisaged that a firm programme for all UIC/CER railways will be established by the end of 1999.

At the present time, the technical specialists are pursuing an urgent programme to determine the acceptance criteria for composite brake blocks; this will then provide the basis for an international standard. This programme will, for example, involve test running of a loaded freight train in severe winter conditions.

In parallel, standards for the operation and maintenance of wagons equipped with composite brake shoes must be worked out within UIC. As the programme of work proceeds, it will be possible to establish whether the retro-fitting modification can be achieved at minimal cost. If unforeseen developments should threaten this

assumption, or if regulatory authorities require implementation more quickly so that modification is no longer in harmony with the normal cycle for the renewal of wheel-sets, the railways will seek appropriate financial assistance, either from national governments, or from the European Union.

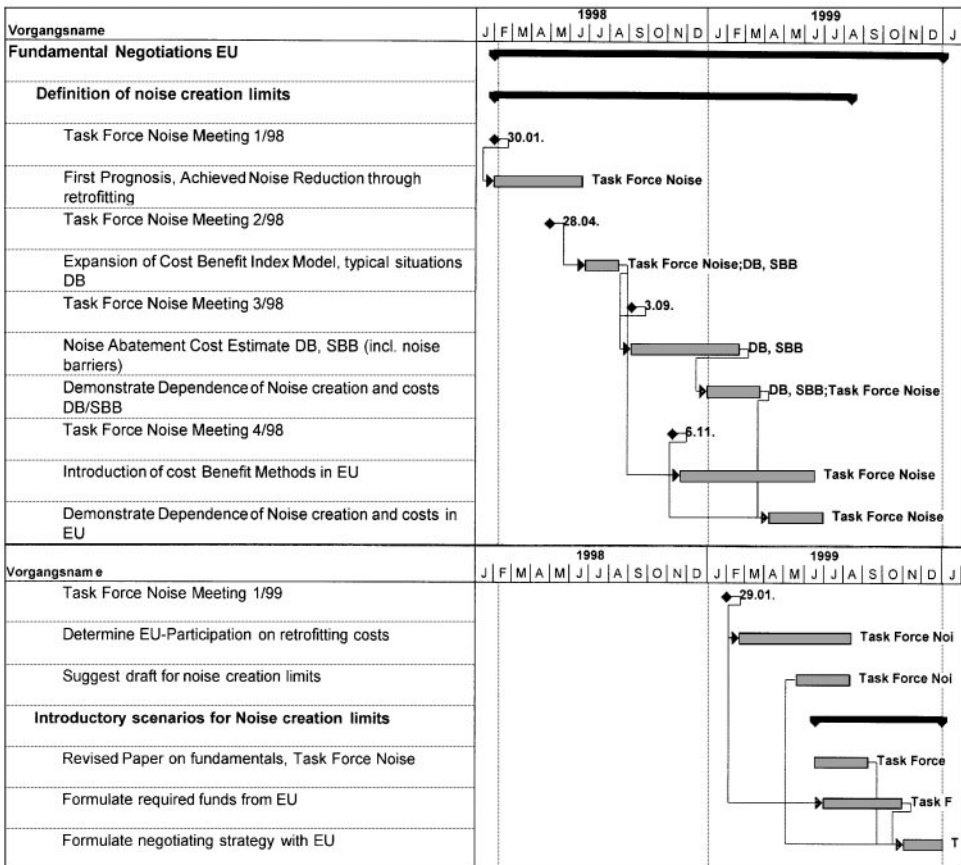
4. LINK TO LEGISLATION WORK OF THE EUROPEAN COMMISSION

The steering group DB/SBB in collaboration with the UIC Task Force Noise has developed a programme on this subject with a time scale (Table 2).

Information from the work within the UIC/CER action programme will provide important input data for discussions with the European Commission concerning railway noise legislation. Using the retro-fitting cost data and possible reduction in noise emission, it will be possible to suggest values for a noise emission standard, with knowledge of the cost consequences. Knowledge concerning the link with the time scales of a cost-minimizing retrofit programme is of central importance in the choice of dates for the implementation of a noise emission standard.

TABLE 2

Programme for negotiation work with EU Commission (draft February 1998)



The fundamental trade-off between measures involving noise emission and noise reception has been mentioned in the context of the Swiss “Lärmbelastungskataster” model. The railways believe that knowledge of the form of this trade-off within different member-states should be of particular interest to DG VII and DG XI as they develop their policies concerning noise; the railways look forward to working with DG XI in adapting the existing cost-benefit trade-off models to a European perspective.

The railways have also been working on the application of a noise emission standard and the associated process of homologation. They believe that their extensive knowledge is valuable in bringing an important practical dimension to the creation of an effective homologation process and are participating actively in the relevant CEN sub-committee.

Overall the railways believe that there are strong arguments for the process of standard-setting and for the programme of vehicle modification to be brought together in the form of a “Voluntary Environmental Agreement” between the UIP/CER and the European Commission. In this, it is envisaged that the EC would press member-states to provide finance to achieve an accelerated programme of implementation and to propose noise emission standards which take account of the resulting time scale and of the performance of the retro-fitted vehicles. In return, the railways would be committed to implement the agreed programme by the target dates and to phase out noisier vehicles by such a date.

Finally, the means have to be provided to start discussions with the member states concerning financial assistance in the retrofit programme. In this discussion, the states will have to choose between quick action on noise abatement on the rolling stock (and saving in the meantime money in terms of noise abatement walls) or allowing the railways up to 20 years for retro-fitting the rolling stock in a cost neutral way during normal maintenance.

5. FINAL REMARKS

With the UIC/CER and UIP-action-programme “Noise Reduction on Goods Trains” the European Railways will, within a few years, solve their environmental “Achilles heel”. which is the railway noise problem. It is believed that the proactive initiative to tackle the problem of noise emission from existing vehicles—in spite of previous insistence on the “no-retrospection” principle—should be properly acknowledged by the regulatory authorities. In practise this implies the adoption of noise emission limits that can be achieved with the modified equipment, and time scales for implementation which accord with a retro-fit programme in harmony with the normal process of vehicle repair and wheel-set replacement.

Of greatest importance to the railways is the fact that in a few years the inhabitants along the railway lines will realize and acknowledge that the level of railway noise has been reduced to a very significant extent. It is hoped that these inhabitants will also in future be railway customers whether on passenger trains or by sending goods on freight trains.