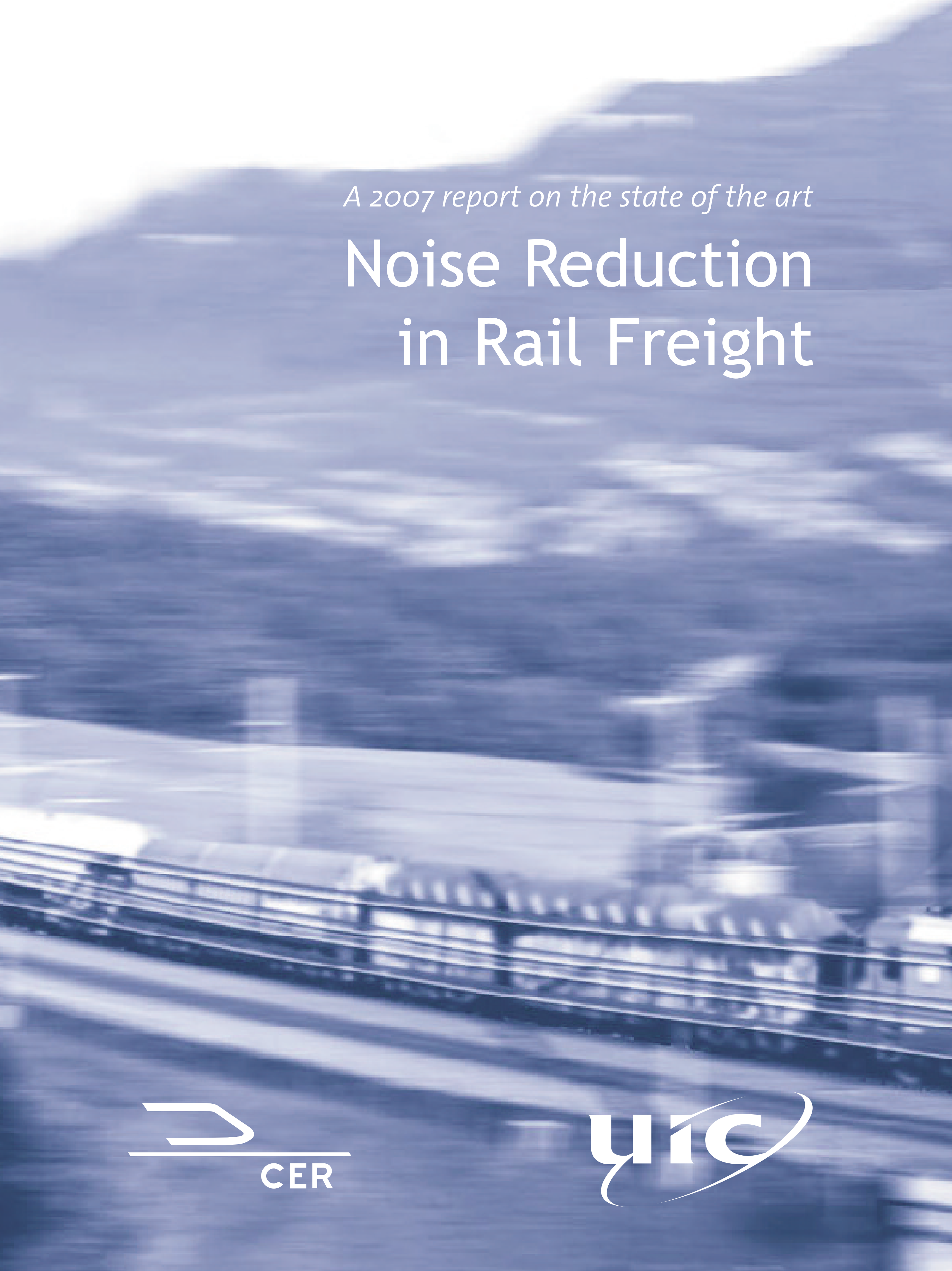
A 2007 report on the state of the art

Noise Reduction in Rail Freight



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Summary

This report summarizes the state of the art in railway noise control. The report is based on a series of European Union (EU) and International Union of Railways (UIC) workshops held in Brussels, Paris, Pisa and Utrecht from 2005 – 2007, on recent information from the UIC Network Noise as well as on direct contacts with the EU Commission, the railways and national ministries. The report intends to inform a wider public on the issues involved.

European Union (EU) transport policy calls for effective and efficient transport systems. Support of the railways meets these objectives in a sustainable manner. However, the impact of rail noise might result in restrictions to rail freight traffic along the most important European transport corridors.

Noise concern in the European Union has led to the Environmental Noise Directive (END), which requires noise maps and action plans for major railways as well as inside agglomerations. The END also applies to road and airplane traffic as well as for industrial noise. Railway noise emissions of new and upgraded vehicles are limited by EU legislation. Noise reception on the other hand is subject to national legislation.

The specific situation of the railways must be considered when discussing noise abatement strategies. Important characteristics are the separation of infrastructure and operations which complicate a whole-system approach, the tight economic environment and competition in the transport market as well as the fact that railways are a long term endeavour, limiting possibilities for short term solutions.

Basically rolling noise in railways is created by rough running surfaces of wheels and tracks. If both can be kept smooth, noise can be reduced significantly. Smooth running surfaces of wheels can be achieved by replacing cast-iron brake-blocks with composite brake blocks. Other source reduction measures include rail and wheel absorbers as well as track grinding. Barriers reduce noise on the path of propagation, while insulated windows protect inhabitants directly in their buildings. Measures on the wagons have a network-wide effect, while all other measures reduce noise locally only.

Currently two types of composite brake blocks are being developed: K- and LL-blocks. Both show a noise reduction between 8 – 10 dB. K-blocks are chosen for new wagons because they have a better braking performance and are cost-neutral in comparison to cast-iron brake blocks. For retrofitting, K-blocks require adapting the braking system which causes additional costs. LL-blocks simulate cast iron block braking characteristics and can be retrofitted without changing the braking system.

Several economic studies show that railway noise reduction in retrofitting the freight wagon fleet with composite brake blocks has the highest cost-effectiveness. Also, if composite brake blocks are combined with other measures the overall cost-effectiveness is increased.

Life cycle costs are currently being investigated. It is expected that retrofitting with LL-blocks could be nearly cost neutral in certain circumstances. Because retrofitting with K-blocks requires adapting the braking system additional costs occur.

The railway sector's strategy focuses on equipping new freight wagons with composite brake blocks and retrofitting the existing fleet. Several incentives to promote retrofitting are under discussion. Due to the harsh competition in the transport market, the sector prefers direct subsidies in the short term and differential track access charges as a second step for achieving a silent freight fleet.

Introduction

This report summarizes the state of the art in railway noise control. The report is based on a series of European Union (EU) and International Union of Railways (UIC) workshops held in Brussels, Paris, Pisa and Utrecht from 2005 – 2007, on recent information from the UIC Network Noise as well as on direct contacts with the EU Commission, the railways and national ministries. The report intends to inform a wider public on the issues involved.

The European framework

European traffic and noise policy

European policy supports rail traffic: The European Commission is concerned about the impact of transportation on the environment. It realises that railways are the most environmentally friendly and sustainable means of transportation, both for freight and passenger traffic. In 2001 a White Paper of the European Commission therefore proposed to increase the market share of the railways to the levels of 1998 by the year 2010(1), a position reaffirmed in the 2006 Mid-term Review(2). If rail noise results in restriction in freight traffic, this would endanger the aims of the White Paper.

Noise is an important environmental problem: The European Commission considers noise one of the main local environmental problems(3) and therefore gives noise abatement a high priority. An EU working group on railway noise analysed different noise abatement scenarios and produced a position paper(4) proposing to retrofit the existing rolling stock with braking systems that reduced rolling noise and to introduce noise creation limits for new rolling stock as the first priority.

(1) White Paper of the European Commission "European transport policy for 2012, time to decide" (Com (2001) 370, 2001.
(2) http://ec.europa.eu/transport/transport_policy_review/doc/2006_3167_brochure_en.pdf
(3) Green Paper (Com(96)540), see: http://ec.europa.eu/environment/noise/greenpap.htm
(4) See: http://ec.europa.eu/environment/noise/pdf/railway_noise_de.pdf

Legal framework for railway noise

Noise creation (emission): In the Technical Specifications for Interoperability (TSI) the EU enacts noise creation limits for railway vehicles, both for new rolling stock and for renewed or upgraded rolling stock. Different values are defined for the various types of rolling stock (i.e. freight wagons, locomotives, multiple units, coaches) as well as for different operating situations (i.e. pass by, stationary, starting and interior noise). For conventional railways the limit values for pass-by noise came into force in June 2006. This TSI includes noise emission limits for wagons with retrofitted braking systems[5]. Already in 2002, a TSI for high speed trains came into force, which also includes noise regulations[6]. TSI regulations must be revised every three years.

Noise reception: All EU member states as well as Norway and Switzerland have enacted noise reception thresholds for new lines. Most countries have also enacted limits for up-graded lines, while a few, such as Switzerland and Italy, have also enacted reception thresh-olds for existing lines.

Environmental Noise Directive (END) requires noise maps and action plans: The directive 2002/49/EC relating to the assessment and management of environmental noise[7] has the intention to give the European Commission an overview of the extent of noise problems, to determine if the population is sufficiently protected and, if necessary, to reconsider the legislation. The END requires strategic noise maps and action plans for major railway lines (≥ 60,000 trains per year) and for large agglomerations (≥ 250,000 inhabitants) by 2007 (maps) and 2008 (action plans). Five years later strategic noise maps and action plans will have to be drawn up for railway lines with more than 30,000 trains per year and agglomerations with more than 100,000 inhabitants per year. The END also applies to road and airplane traffic as well as for industrial noise. The action planning is the responsibility of the individual member states, who usually delegate the actual planning to regional or local authorities. The EU intends to organize meetings with member states to prepare the review of the legislation due in 2009.

The railway framework

Relevance of railway noise

Noise abatement of increasing importance for railway operation: On existing railway networks, freight traffic is the main source of noise. In order to maintain a sustainable transport system, the railways must reduce noise because it is their main

(5) See Commission decision 2006/66/EC of 23 December 2005 (chapter 7.4).
(6) TSI HST, 2002/735/EC, 30.5.2002.
(7) See: http://ec.europa.eu/environment/noise/#2.

environmental problem. Otherwise political and public support of the railways may decline. In addition noise issues may prevent a traffic increase and therefore hinder the implementation of the European transport policy and its focus on increasing the railways' traffic share. The situation is high on the political agenda in certain areas: In Germany, for example, there is tremendous public pressure along the Rhine corridor to reduce noise and operational restrictions have been threatened on the political level. In The Netherlands operational restrictions and lawsuits have already been issued by the government.

Railway particulars

EU railway package divides infrastructure and operations: The first railway package separates essential functions, such as rail capacity allocation, infrastructure charging and licensing from transport operations to enable new rail operators identical access conditions to the rail market. This package also foresees that railway undertakings set up different accounts for passenger transport services and freight transport services[(8)]. The package requires that environmental charging can only occur if the same charges are applied to competing transport modes. A further constraint is that infrastructure may not profit from money earned from environmental charging. Many different stakeholders with different agendas are therefore involved in all railway noise issues.

Railways operate in a tight competitive economic environment: Two types of competition are relevant: The railway sector competes with other transport modes and there is competition between railways. For achieving the goals of the EU White Paper, the competition between sectors is more relevant. Since it is the stated policy of the EU to promote railway traffic, it must be avoided that noise abatement becomes an additional cost factor and thus causing the railways to lose market shares.

Railway operations are a long term endeavour: Normally railway rolling stock is only replaced after a very long life span. A satisfactory noise reduction within reasonable time therefore cannot be achieved merely through the commercially motivated replacement of noisy existing wagons with new silent wagons. Time tables are generally adapted once every year and allow little short term flexibility. Also infrastructure improvements are usually planned many decades in advance before being implemented during several years of construction.

(8) http://ec.europa.eu/transport/rail/overview/infrastructure_en.htm.

The available technology

Basic noise control possibilities

Different possibilities exist for controlling traffic noise: Traffic noise, including railway noise, can be controlled at several different locations:

- *At the source:* Rolling noise is caused by small irregularities on both the wheel and the track in the contact area between the two. Noise reduction at the source can be achieved by either reducing this roughness or by preventing its growth. This is usually attained by either improving the running gear of the rolling stock and/or the track. Lower speeds also reduce noise at the source, but large changes in train speed are required to give noticeable changes in noise and are therefore contrary to efforts to attain a modal shift from road to rail.
- *Between source and inhabitant:* A further possibility to reduce the impact of noise is by preventing its propagation. Noise barriers (walls, berms, in extreme cases tunnels) are the most common method of noise abatement between the railway lines and inhabitants.
- *Near the inhabitant:* Finally, noise can be reduced in the immediate vicinity of the inhabitant, i.e. on the buildings itself. This is usually done with insulated windows or façade insulation.

For several decades the railways and the UIC, often supported by the European Commission, have undertook extensive research and pilot projects to determine different noise abatement possibilities. Additionally practical experience has been gained in several countries. This work has led to a large knowledge base on the subject. The main noise abatement possibilities are listed in the following table. It must be noted that not all noise reduction potentials on the list are additive.

Many European and national research projects study the implementation possibilities in more detail. A selection of these projects is:

- **Imagine:** This European Commission project includes noise modelling to develop calculation methods for railway, road, aircraft and industrial noise (2003 – 2006)[9].
- **Silence:** Project of the 6th framework of the European Commission. Aims to develop an integrated methodology and technology for improved control of surface transport noise in urban areas (2005 – 2008)[10].
- **Nicobb (Noise Impact Composite Brake Blocks):** This UIC project assesses noise impact assessment of cast-iron, K- and LL-blocks on test benches (project start 2007).
- **Leila:** This developmental disk-braked freight bogie shows significant noise reduction in first test however the costs are currently much too high for practical implementation (development since 2002)[11].
- **Dutch Innovation programme:** The Noise Innovation Programme (Innovatiepro-gramma Geluid) develops measures to tackle traffic noise at the source, to make Dutch railways and highways quieter (2003 – 2007)[12].

(9) www.imagine-project.org
(10) www.silence-ip.org
(11) Compare International Railway Journal, August, 2005

Noise abatement method	Overall noise reduction potential	Noise abatement effect	Comment
At the source			
Retrofitting with composite brake blocks	8 – 10 dB(A)	Network wide	Considered method of choice for freight vehicles by the railway sector.
Wheel absorbers	1 – 4 dB(A)	Network wide	Wheel maintenance difficulties may occur. Solutions for disk-braked wheel-sets exist, for tread tread-braked wheels development is still in progress.
Track absorbers	1 – 4 dB(A)	Local	Track maintenance difficulties may occur, homologated in several countries
Removal of corrugation by grinding	up to 20 dB(A) in comparison to poorly maintained track to achieve well maintained noise level.	Local	Is usually a measure of standard track maintenance
Track renewal	up to 10 dB(A) in comparison to old and poorly maintained track	Local	Is usually a measure of standard track maintenance
Acoustic rail grinding	1 – 3 dB(A)	Local	Requires monitoring of the railway lines and usually frequent grinding with special grinding machines. Smooth wheels are a precondition for a good effect. Reduction potential depends on average rail surface quality of standard track.
Operational changes	Variable	Local	Negative effect on operations and rail-way capacity. Method hinders railway traffic and is therefore not in line with the EU White Paper.
Between source and inhabitant			
Noise barriers	Depends on height, usually 5 – 15 dB(A)	Local	Negative effect on landscape, influence on railway maintenance procedures, unattractive for railway passengers and residents.
Near inhabitant			
Noise insulated windows	10 – 30 dB(A)	Local	Effect is only achieved when windows are closed

Silent train on realistic track: The German project LZarG (leiser Zug auf realem Gleis) was started in December 2007 with the aim of reducing source noise by 5 – 7 dB(A) in addition to retrofitting.

Because retrofitting has the best cost-effectiveness, the involved technology will be discussed in more detail in the next chapters.

Composite brake blocks

Smooth wheels on smooth tracks result in less noise: Railway rolling noise is the result of roughness on both the wheel and the track in the contact area between the two. Both the wheel and the track vibrate, when the train is in motion, thus creating noise. A significant portion of the noise can be eliminated, if the both wheels and the track are smooth. The use of cast-iron brakes causes rough wheels. On the other hand, wheels remain smooth using composite brake blocks. Therefore, the choice of brake blocks has a large effect on rolling noise levels.

(12) http://www.innovatieprogrammageluid.nl

Figure 3.2.1: Picture of wagon retrofitted with k-blocks. Old wagons such as these are now as silent as modern passenger vehicles.

Smooth wheels can be achieved using composite brake blocks: Currently two types of composite brake blocks are being developed and implemented: The K- and the LL-blocks. K-blocks have a higher coefficient of friction than cast iron blocks; because of this they require an adaptation of the braking system. LL-blocks simulate the braking performance of cast-iron brake blocks and therefore only minor adaptations of the braking system are necessary. The reason for the difference in braking performance lies in the variation in the coefficient of friction at different speeds for different brake blocks. Figure 3.2.2 shows the higher coefficient of friction for K-blocks and the similar level of LL- and cast iron brake blocks over a range of speeds.

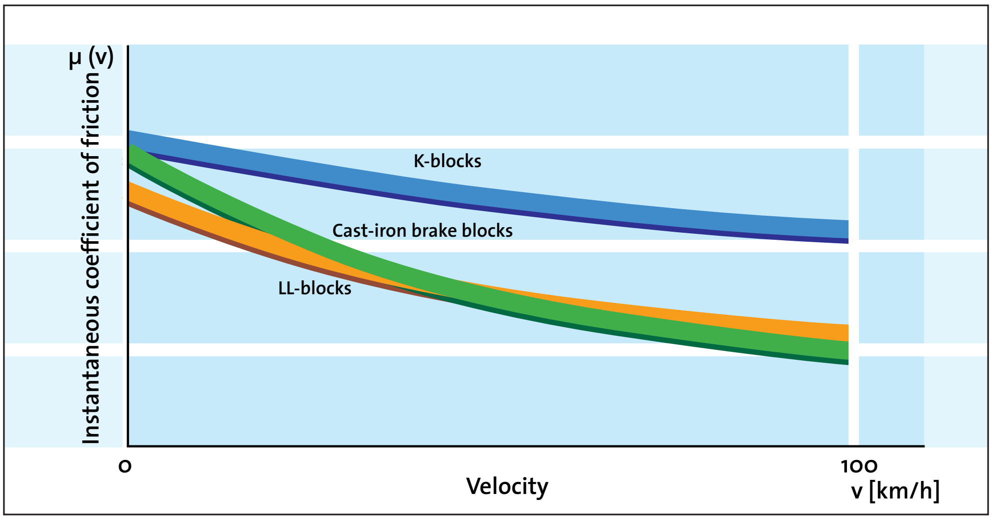


Figure 3.2.2: Coefficient of friction for different brake blocks at different speeds. The graph shows the higher coefficient of friction of K-blocks and the similar performance of LL and cast iron brake blocks.

Brake block homologation: Braking is crucial for the safety of operations. Therefore there is a need for a well defined approval process. In addition to braking performance, homologation procedures require considering safety and operating issues, such as performance under severe winter conditions and studying possible effects on track circuits. The brake blocks are developed by industry and the UIC defines the homologation process including the required tests. The UIC Leaflet 541-4 describes the requirements for composite brake blocks and is available on the UIC website[13]. Currently two K-blocks have been homologated and two LL-blocks have passed all safety tests, the latter however show very high wheel and block wear.

Figure 3.2.3: Testing braking performance under winter conditions and locked brake testing. Both are part of the homologation testing. Work is going on to enable the testing of these properties on test benches.

Summary of K- and LL-blocks: The main characteristics of the two composite brake blocks under consideration are summarized in Table 3.2.

	K blocks	LL blocks
Rolling noise reduction[14]	8 - 10 dB	Similar range as for K-blocks
Retrofitting requirements	Requires adapting braking system	Minor adaptation required
Braking characteristics	Independent of train speed, higher braking coefficient than cast iron brake blocks	Train speed dependent (similar to cast iron brake blocks), braking coefficient similar to that of cast iron brake blocks
Homologation	System approval since 2003, Cofren C810 (2003) and Jurid 816 M (2008) have been approved unconditionally. Further blocks being tested	Provisional certification since 2005, definitive homologation expected for 2009. Three LL-blocks have received preliminary approval for in service tests; however some block problems have not been solved (e.g. concerning high block and wheel wear, brake failure test or sufficiently stable coefficient of friction). At present it is unclear if these problems can be solved and when a usable LL-block will become available.
Further notes	Construction guideline and damage catalogue for K-blocks available on UIC website.	Application guideline for LL-blocks available on UIC website

Table 3.2: Comparison of K-and LL-brake blocks.

(13) www.uic.asso.fr.
(14) under normal operating conditions.

Railway sector supports development of K- and LL-blocks: UIC has supported development of K- and LL-blocks for many years. Its current strategy is the following:

1) Until end of 2008 UIC continues support of developing more types of K-blocks and the observations of those wagons already retrofitted.

2) The ongoing programmes to finalise homologation of LL-blocks will be continued until end of 2008. The aim is to have either homologated types of LL-blocks or a defined state of the art.

3) Simultaneously UIC will prepare technical specification for test procedures so that LL-development could continue even without a specific UIC test programme. For this purpose the UIC will provide the technical expertise and test facilities on a commercial basis.

The economics

Cost effectiveness of different measures

Retrofitting has the best cost-benefit ratio: Anticipating the need to optimize noise control strategies on a European level, both the railways and the EU have undertaken cost-effectiveness analyses. The most comprehensive study was the STAIRRS[15] project, co-financed by the EU fifth framework programme and by the UIC. In this project the acoustically relevant geographic, traffic and track data were collected for 11,000 km of lines in seven European countries. Standard cost-benefit

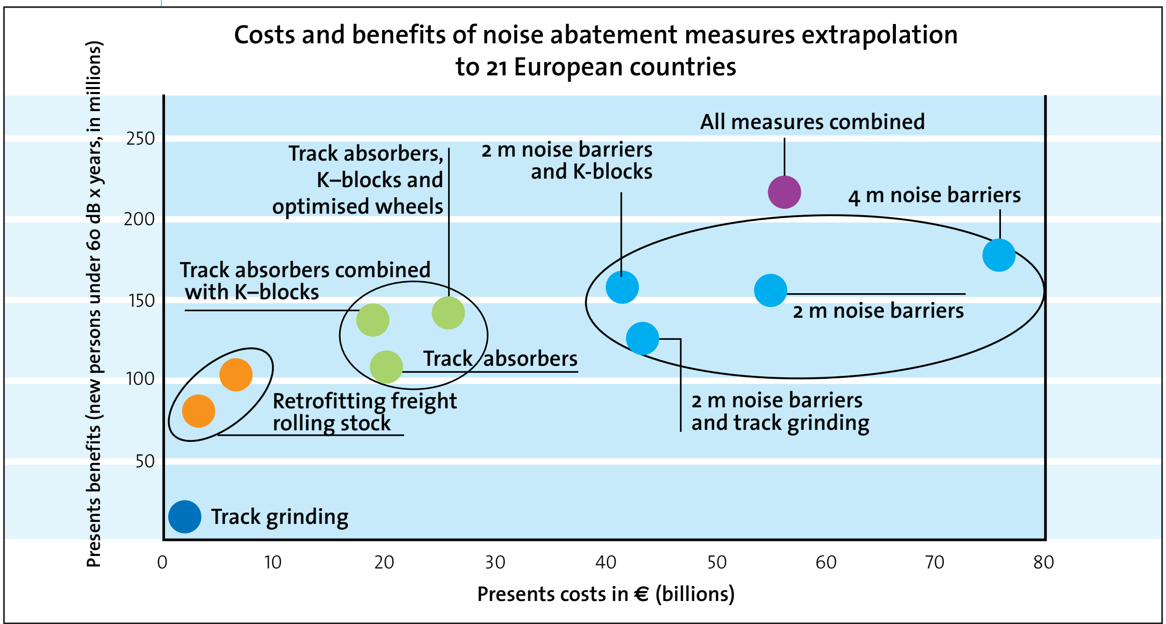


Figure 4.1: Main results of the STAIRRS project. The graph shows that solutions using composite brake blocks save considerable amounts of money in comparison to noise abatement with only noise barriers.

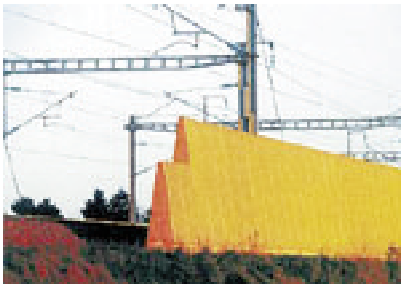
(15) Strategies and Tools to Assess and Implement noise Reducing measures for Railway Systems

methodologies were adapted to fit the requirements of the project. An extrapolation mechanism allows studies on Europe as a whole and, in an approximate manner, also on each individual country or region of interest.

Major conclusions were:

- Retrofitting freight rolling stock has the highest cost-effectiveness both on its own and in combination with other measures.
- Noise barriers, in particular high ones, have a low cost-effectiveness.
- Combining noise barriers with retrofitting improves overall cost-effectiveness
- The conclusions for Europe as a whole are also true for individual countries.

In summary, STAIRRS shows that solutions using composite brake blocks save considerable amounts of money (billions of Euros in Europe) in comparison to noise abatement with only noise barriers. These conclusions were supported by studies undertaken in Switzerland, The Netherlands, France, and Germany. In Switzerland, for example, using the combination of retrofitting with noise barriers costs only 30% of a solution consisting of noise barriers only, reducing original costs of €2.2 billion to €0.7 billion. Also in The Netherlands €750 Million could be saved by 2020, if retrofitting is implemented.



The current situation

Noise barriers are most commonly used noise abatement strategy: Despite the fact that retrofitting has very good cost effectiveness, the most commonly used noise abatement strategy are noise barriers. A study undertaken by the UIC[16] (compare Annex as well) shows that at the end of 2005 some 1,000 km of noise barriers had been built and insulated windows installed in 60,000 buildings. This results in a noise protection of about 1,250,000 persons.

Significant savings possible with retrofitting instead of noise barriers: Just based on the planned expenditures for noise barriers, it is estimated that several billion € can be saved throughout Europe, if the freight fleet is retrofitted instead of only constructing noise barriers.

Reasons why noise barriers are being favoured: Analyzing the reasons why noise barriers are being built may help to promote retrofitting.

- Organisational obstacles: The separation of infrastructure and operations gives no incentives to look at the whole system.
- Legal obstacles: It is currently unclear, if state aid rules apply to retrofitting. Additionally, certain countries, i.e. Italy have a national legislation preventing the funding of retrofitting.
- Political obstacles: Locally elected politicians favour local solutions.
- Philosophical obstacles: Fighting symptoms with noise barriers is usually preferred over fighting causes with retrofitting. There is also concern that others profit from money spent on retrofitting.

(16) UIC Status report 2007, Noise Reduction in European Railway Infrastructure – available on the UIC website.

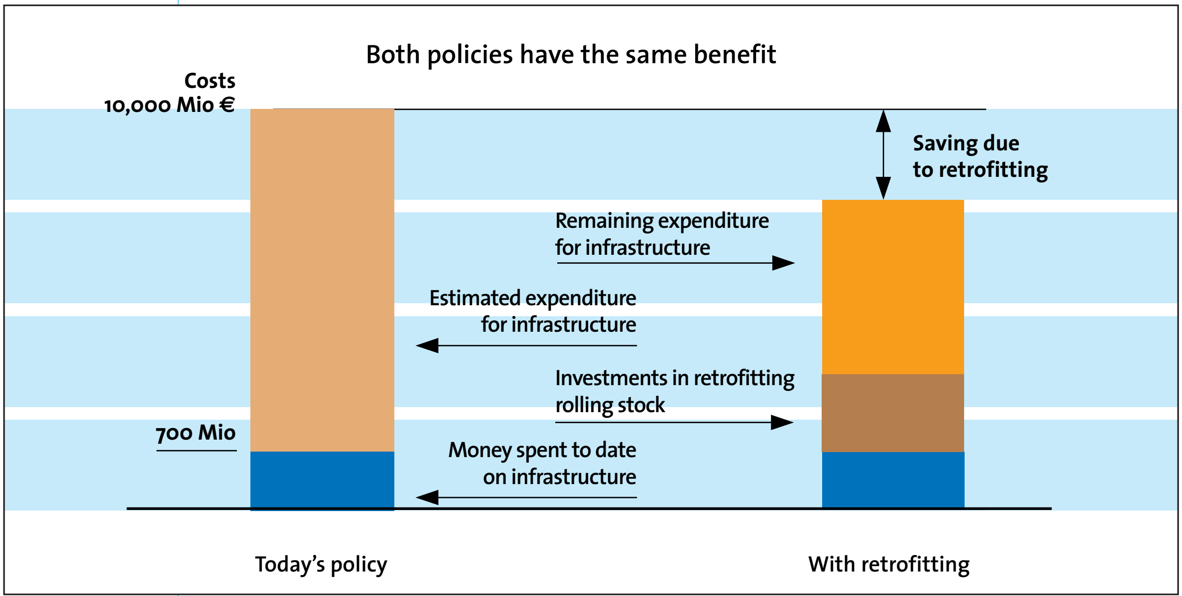


Figure 4.2: Potential savings in Europe by retrofitting the freight fleet with composite brake blocks.

- Incentives mainly for noise barriers: The price for noise barriers is usually included in new projects.
- Lobbying support for noise barriers: The construction lobby promotes noise barriers and the road lobby is against direct subsidies of railway operators.

Cost estimates for retrofitting

New wagons cost neutral; retrofitting requires investment: Purchasing new wagons with K- or LL-blocks instead of cast iron blocks does not increase the overall costs of a vehicle. As shown in table 4.3 the cost for retrofitting wagons are significantly lower using LL-blocks than using K-blocks. Even when a block is homologated, each wagon type must undergo testing to prove the braking performance before retrofitting is possible. This results in considerable costs (several hundred thousand Euros) for each wagon type. Wagon classes consisting of only few vehicles are therefore not the primary focus for retrofitting. Because the life span of K- and LL-blocks is expected to be longer once a wagon has been retrofitted, the life-cycle costs for K-blocks and LL-blocks may be in the same range as for cast-iron brake blocks.

	K-blocks	LL-blocks
Retrofitting costs	€ 4,000 – 10,000	€ 500 – 2,000
Costs for brake blocks	€ 23 – 28	€ 23 – 28 (organic) € 40 – 60 (sintered)
Life cycle costs in comparison to cast iron brake blocks, once a wagon has been retrofitted	Probably similar due to expected longer life span	Not quantified yet

Table 4.3: Costs for K- and LL-blocks

Maintenance costs: First studies indicate that maintenance costs are probably not affected when cast-iron blocks are replaced with composite brake blocks. Some studies indicate a small increase while others show a small decrease. The main cost drivers are wheel and brake block wear. These effects are in the process of being evaluated, in particular the cost effects of the wheel-sets. There is potential for optimization in maintenance cycles, so that an overall decrease in costs is expected.

Extent of retrofitting: Retrofitting is most cost-effective if carried out during compulsory freight wagon inspection, which must be undertaken at least every 6 years. In total about 400,000 – 500,000 wagons must be retrofitted throughout Europe. This number has been reduced from previous estimates because the freight fleet has been optimised and an increasing number of new wagons with K-blocks have been purchased.

Current activities

European Commission

European Commission addresses retrofitting issue: In 2007 the European Commission held a public consultation as well as a workshop on noise abatement measures addressing the existing European freight fleet[(17)]. The commission's discussion focuses on planning and decision issues as well as incentives. An impact report has been published which analyses two scenarios in detail: A combination of subsidies, operating restrictions and voluntary agreements as well as differential track access charges, emission ceilings and voluntary agreements. A communication on the subject is planned for 2008.

Railway sector

UIC supports retrofitting: For more than a decade, the UIC has actively supported retrofitting by providing the framework for brake block homologation, by considering funding and financing issues as well as communicating the issues involved.

National retrofitting projects: Switzerland is in the process of retrofitting its entire national rolling stock. All of the passenger wagons and half of the freight wagons have been retrofitted. The programme will be completed by 2010 and is financed by direct subsidies. Germany has started a retrofitting pilot project. Several countries, such as The Netherlands, have extensive pilot projects and testing programmes.

National incentives: The Netherlands and Switzerland have adopted noise related differential track access charges. The subject is being studied in other countries as well, although not all countries are convinced that this is an appropriate incentive. Switzerland also provides direct subsidies for retrofitting as mentioned above.

(17) http://ec.europa.eu/transport/rail/consultation/2007_rail_noise_en.htm.

Railway support of testing: Several railways and wagons owners are active in the testing of K- and LL-shoes. Examples include DB, Green Cargo, SBB, Hupac, and AAE.

A country by country summary of national activities is included in the annex.

Incentives

Many retrofitting incentives under discussion: The incentives currently being discussed are given in the following table. They are the same as discussed in the EU communication[18].

Incentive	Description	Result of EU consultation	Railway point of view
Differential track access charges	Operators with quieter wagons pay less for track access charges (bonus) or operators with loud wagons pay more (malus); the bonus and the malus must either be equal or the state must pay or receive the difference	Agreement 70 – 80 %	Complicated because wagon owners are often not identical to operators. Therefore it is unclear, if money actually reaches wagon owners. Expensive monitoring systems must be avoided. Railways see this option as a long term measure for continued retrofitting[19].
Subsidies for use of silent wagons	Direct payments are made to operators to use silent wagons	Agreement 60 – 70 %	Situation similar to differential track access charges. The railways do not favour this method.
Subsidies for retrofitting	Direct payments are made to wagon owner to retrofit their freight fleet with composite brake blocks	Agreement 70 – 80 %	Since the money is directed where it is needed, this could probably be the most efficient means of achieving a silent freight fleet. The railways favour this option.
Loans at preferential terms	Wagon owners receive loans to retrofit their fleet. .	Agreement 70 – 80 %	This option is similar to direct subsidies, except that the money must be returned. Due to the harsh competitive market, this is a weak incentive. The railways require a higher level of funding than loans on preferred terms.
Limit values	Emission limits prevent loud wagons from operating.	Agreement 80 - 90 %	The costs for retrofitting are carried by the railways thus reducing their market share in a competitive market (the traffic is transferred from rail to road)
Operating restrictions	Night time operating bans or lower speeds in residential areas	Agreement ca. 80 %	This option runs counter to the policy of promoting railways.
Emission ceiling	The emissions on a given linemay not exceed defined values	Agreement 70 – 80 %	This option allows a planning security; however if not accompanied by other measures it may reduce network capacity or increase noise abatement costs.
Tradable permits	Specific permits must be obtained to produce emissions	Agreement 30 - 40 %	The costs for retrofitting are carried by the railways thus reducing their market share in a competitive market. Additionally high administrative costs are expected

Table 5.3: Summary of incentives for retrofitting currently under discussion.

(18) Public consultation on « Rail noise abatement measures addressing the existing fleet ». Summary of the contributions received. 17.10.07.
(19) Status report and background information on noise-related track access charges, P. Hübner, UIC, 2007, available on UIC website.

Funding and financing

Railways require outside funding for retrofitting: Due to the harsh competition in the transport market, railway freight companies currently do not have the financial possibilities for investments in composite brake blocks. Therefore, whichever incentive system is chosen, the financial resources must come from outside the system if railway traffic should be promoted – which is the stated aim of the European Union.

EU funding possibilities: Currently two EU funding possibilities exist. The LIFE+ programme offers a co-financing for demonstrator and pilot projects. The Cohesion Fund offers investment help in economic developing areas. In addition, within the 7th framework project, the EU can also co-sponsor research in the field of new brake blocks.

National funding possibilities: National countries can subsidize the retrofitting. Switzerland is in the process of doing so and in Germany money as been allocated for first pilot projects. Most likely, EU State Aid Rules will allow up to 50% financing by national governments for retrofitting.

Conclusions

Railway noise abatement crucial for a sustainable transport system: Railways are a sustainable means of transport, however noise issues must be addressed, if restrictions on rail freight traffic are to be avoided.

Retrofitting saves money: Noise abatement solutions using freight wagons with composite brake blocks are cost-effective and save considerable amounts of money (billions of Euros in Europe) in comparison to solutions including only noise barriers.

Outside financial support necessary for railway operators: Due to the harsh competitive transportation market, the railways are currently not in a position to finance retrofitting.

The railway sector suggests direct subsidies: The railway sector proposes that the retrofitting be subsidised directly in a first step and that differential track access charges be used in a second step to achieve a self propelling retrofitting process of the freight fleet.

Implementation of the Environmental Noise Directive (END): The possibility of retrofitting freight vehicles with composite brake blocks should be considered in the action plans of the END including funding modalities.

Continue technical development: The UIC continues its support of the development of more K-blocks until end of 2008. At the same time the efforts to finalise homologation of LL-blocks will be continued until end of 2008 as well. If no feasible LL-block is available by that time, the UIC will stop its direct support; however it will continue to offer technical expertise and to provide testing guidelines.

Annex

National developments

Initiatives in several countries are running in parallel. This annex describes a selection of national developments in alphabetical order. It must be noted that noise impact varies greatly from country to country depending on population density and traffic volume. If both are very high, as in Germany, the problem is much larger than if both are low, as in Norway.

Country	Recent developments
Austria	A complex national and state legislation exists. Noise maps have been completed since 1995. Noise barriers and insulated windows protect almost 70% of the population.
Belgium	Belgium has regional legislation and no national legislation: Flanders and Bruxelles have noise limits while Wallonie does not. There is no noise programme by the SNCB, however new and upgraded lines are protected.
Czech Republic	Noise abatement is undertaken as a part of new lines and upgraded existing lines. Action plans of the END will form the basis of a noise abatement programme. A pilot project with LL-brake blocks will start in 2008.
Denmark	Legal requirement for noise protection only for new and upgraded lines. Noise abatement is completed and was mostly done in buildings. Some noise barriers have been constructed.
Finland	A noise abatement package is being considered by parliament. Currently retrofitting is not considered, mainly because of noisy Russian freight wagon (Finland and Russia have the same wide gauge).
France	Noise protection is undertaken for new or upgraded lines. On existing lines, noise control is intended to be implemented mostly at hot spots usually with noise barriers and windows. Track absorbers have been homologated recently.
Germany	Strong political pressure may result in operational restrictions; government has earmarked €40 Million for a four year pilot programme on retrofitting. At the same time almost €100 Million are spent annually on noise barriers. Additional noise mitigation includes acoustic rail grinding. Several research projects are under way. One of them concerns silent trains on realistic track.
Hungary	Legislation requires noise protection for new and upgraded lines. To date noise barriers have been constructed as part of several new lines.
Italy	Strict noise legislation includes existing and new lines. Action plans must be implemented until 2020. Noise barriers are considered on 8,000 km of track length. Current legislation does not allow retrofitting.
Netherlands	Dutch legislation is in force since 1987 prohibiting noisy trains by 2015. The aim is a reduction of 10 – 12 dB. A comprehensive innovation programme has looked at many different measures such as retrofitting, track measures, measures on shunting yards. Differential track access charges are being implemented.
Norway	Critical areas have been protected with measures on buildings.
Poland	The environmental law includes noise. Track grinding is undertaken as a noise mitigation measure. Noise barriers (more than 50 km) and windows have been installed on new and upgraded lines.
Portugal	Noise protection required for new and existing lines. Most freight wagons have been retrofitted with LL-blocks. Since Portugal has a wide gauge these wagons don't travel to other countries and therefore do not have to be homologated. More than 50 km of noise barriers have been built and the same amount is planned for the future.
Romania	Romania has implemented national legislation in connection with the END. There are legal requirements for noise protection on existing and new lines. Noise maps have been completed and development of action plans will start in 2008.
Spain	Noise maps and action plans in connection with the END will form the basis for a noise mitigation programme. This has not been put into place yet.
Sweden	Noise abatement is introduced in the planning of new lines and upgrading old lines. Noise barriers and noise insulated windows are common along new lines. Measures as insulated windows have been taken along existing lines where the risks for sleep disturbances are high. In addition rail grinding, rail dampers and low height barriers are being studied. Promoting source-related measures such as retrofitting will be considered as part of the long-term strategy in the action program of the Environmental Noise Directive.
Switzerland	Noise legislation enacted in 1987. Comprehensive project started in 2000 to be completed by 2015. Project has three elements: retrofitting of all Swiss rolling stock, noise barriers with a cost-benefit restriction, insulated windows. The project is expected to be completed on time. It is financed largely through taxes on road traffic.
United Kingdom	Noise abatement is introduced in the planning of new lines. In existing lines current problem is not noise but how to cover higher customer demand at lower costs. There is concern that implementation of action plans will increase costs and complexity. Therefore no noise abatement program is in place.

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