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Status report 2007

Noise Reduction in European Railway Infrastructure



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Summary



The railways recognise the need to reduce noise, especially the noise caused by freight trains.

In 1998 therefore, the International Union of Railways (UIC), the Community of European Railways and Infrastructure Companies (CER) and the International Union of Private Wagon Owners (UIP) initiated the "Action Programme for Noise Abatement in Freight Traffic". The objective of this programme is to implement sustainable railway noise abatement measures by introducing low-noise technology in freight traffic, since it is this traffic which is the main source of railway noise.

The reduction in noise is achievable by removing cast iron brake shoes, since this technology leads to rough wheel surfaces which in turn cause railway noise. Cast iron shoes are replaced by synthetic brake shoes.

Fitting new wagons with synthetic brake shoes is cost-neutral. The railways therefore already decided to use this technology for new rolling stock from 2002. Currently some 8,500 wagons equipped with synthetic brake shoes are in operation or on order.

The main problem hindering implementation of this technology on the existing railway fleet is the lack of funding. Part of the funding could be contributed by infrastructure, since fewer noise barriers are required. Until now no overview has been available of the noise abatement programmes implemented, ongoing or planned on European railway infrastructure. This report intends to fill this need.

An enquiry was conducted among all the major railways in the European Union, plus Norway and Switzerland. Information was received from Austria, Belgium, the Czech Republic, Denmark, France, Germany, Hungary, Italy, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the UK, enabling a fairly clear picture to be drawn of the noise abatement measures currently applied on Europe's railway infrastructure. It can be summarised as follows:



- All the countries surveyed apply the required noise protection measures when building new lines or upgrading existing lines.
- With a few exceptions (Italy, Switzerland) their laws prescribe no direct obligation for noise abatement on existing lines. Nevertheless, more or less extensive noise abatement programmes are underway in nearly all the countries surveyed.
- In northern Europe (Scandinavia) noise protection is achieved mainly by noise-protecting buildings, whereas in southern Europe (Italy) noise barriers tend to be used. Both means of noise abatement are used in central Europe.
- The data received for the present study indicates that there were around 1,000 km of noise barriers in place and c. 60,000 noise-insulated houses or residences (mostly fitted with noise-insulated windows) in the vicinity of existing railway lines in Europe by late 2005. These figures do not include noise protection measures situated adjacent to new railway lines, e.g. to protect against noise from high-speed traffic.
- An estimated one million people in Europe are protected from railway noise by noise barriers and another c. 250,000 protected by noise-insulated buildings, making a total of some 1,250,000 people who benefit from railway noise protection.
- Altogether c. € 150-200 million is spent annually in Europe on infrastructure-related noise protection measures. The information received for this report indicates that cumulative expenditure as of late 2005 was something in excess of € 600 million.
- Estimated future expenditure on infrastructure-related noise protection is not available for all countries. The future investments announced thus far amount to c. € 4 billion. However, data is missing for large countries. Also missing are the financial requirements resulting from the action plans to be provided which will implement the European Union Noise Directive. If all these investments are included in the projected future expenditure on railway noise protection, the figure could reach up to € 10 billion.
- These outstanding investments of € 10 billion are enormous, and the countries involved must seek to keep these investments as low as possible, whilst trying to optimise their efficacy.
- This is possible if the retrofitting of freight wagon fleets in Europe is included in noise abatement action plans.

Project background



SNCF



A railway initiative to promote rail freight noise abatement:

The railways recognise the need to reduce noise, especially the noise caused by freight trains. In 1998 therefore, the International Union of Railways (UIC), the Community of European Railways and Infrastructure Companies (CER) and the International Union of Private Wagon Owners (UIP) initiated the "Action Programme for Noise Abatement in Freight Traffic".

The objective of this programme is to implement sustainable railway noise abatement measures by introducing low-noise technology in freight traffic, since it is this traffic which is the main source of railway noise.

The reduction in noise is achievable by removing cast iron brake shoes, since this technology leads to rough wheel surfaces which in turn cause railway noise. Cast iron shoes are replaced by synthetic brake shoes.

For new vehicles, the brake blocks to be used are the K-blocks: wagons fitted with this technology will be no more expensive than those using cast iron blocks. K-blocks can also be used on the existing fleet, but the vehicles' braking systems must be adapted to do so, incurring retrofitting costs of between € 4,000 per vehicle (2-axled wagons) and € 8,000 per vehicle (4-axled wagons).

There are several types of K-blocks available on the market.

One alternative is the LL blocks. These blocks require only minor adaptations to the braking system and therefore cost only about one third of the amount mentioned above.

The total European fleet to be retrofitted is about 600,000 vehicles. The total projected costs are around € 3 billion for K-blocks and around € 1 billion if LL-blocks are used.

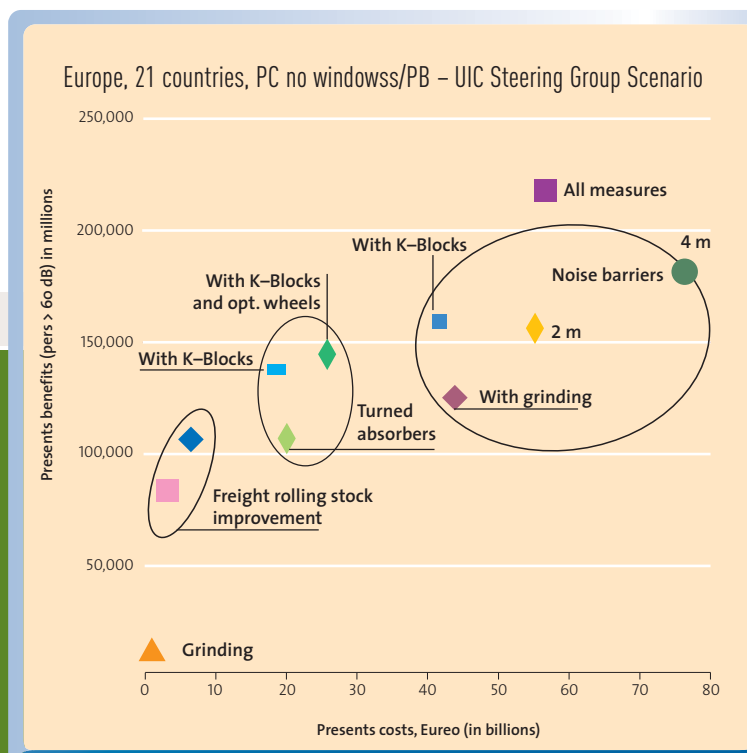
Fitting new wagons with synthetic brake shoes is cost-neutral; therefore the railways already decided to fit new rolling stock with this technology from 2002.

Currently some 8,500 wagons equipped with synthetic brake blocks are in revenue service or on order. The main problem hindering implementation of this technology on the existing railway fleet is the lack of funding. Part of the funding could be contributed by infrastructure, since fewer noise barriers are required.



JR

Introduction: purpose of this paper, methodology adopted



STAIRRS results: Costs and benefits of various noise abatement strategies.

Overview of ongoing and planned noise abatement needed on infrastructure.

The UIC Action Programme for Noise Abatement in Freight Traffic focuses on rolling stock.

The EU-funded STAIRRS project has demonstrated that retrofitting rolling stock will save money compared with equivalent investments in infrastructure (as shown in graph 1).

One way of financing retrofitting could therefore consist of redirecting investment from infrastructure to rolling stock.

Until now no overview has been available of the noise abatement programmes implemented, ongoing or planned on European railway infrastructure. This report intends to fill this need.

The method used was a questionnaire sent to all the major railways of the European Union, plus Norway and Switzerland. Information was received from Austria, Belgium, the Czech Republic, Denmark, Germany, Hungary, Italy, Norway, Poland, Spain, Sweden, Switzerland and the UK. The responses received were investigated in more depth and supplemented where needed by contacting the railways in question.



Brief overview of railway noise legislation in Europe



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Currently the principle guiding noise legislation in Europe aims to regulate:

- Noise creation (emission) at European level and
- Noise reception (immission) at national level.

The text implementing legislation on noise creation limits is the Technical Specification for Interoperability (TSI) for rolling stock.

There are TSIs in force for high speed trains as well as for conventional rail. The TSI regulates noise by defining the permitted pass-by noise levels, accelerating noise levels and noise emissions when vehicles are at a standstill. These specifications are generally only applicable to new rolling stock. Because the replacement of railway vehicles is very slow due to their long service life, it takes a long time for this legislation to have any discernible impact.

In order to obtain an overview of the existing noise situation in Europe, the European Union enacted the Environmental Noise Directive (END) in 2004.

In accordance with the END, all EU Member States must create noise maps for all major traffic noise sources (main roads, railways and airports) and in large conurbations by July 2007, and must put forward noise abatement action plans by July 2008. For smaller conurbations, the same maps and plans must be completed by 2012/13.

The EU will consider further legislative steps once the Member States' noise action plans are established. Further steps might include more stringent noise limits in the TSIs, or further TSIs governing existing rolling stock as well as a proposal for harmonised noise reception limit values across Europe.

At national level, all European countries have noise reception limit values for new railway lines, and in almost all countries limit values are in force for upgraded railway lines as well. It is therefore state-of-the-art procedure to include noise protection measures (mostly noise barriers) in projects for new or upgraded lines.

In general, good noise protection planning will help the project acceptance process succeed with the local population. In Italy and Switzerland, noise reception limits are in force for existing lines.

Noise mapping in accordance with the END is currently in progress in all EU countries, though the mapping process is often delegated to the regions. In this context, it will be difficult to achieve an overarching noise abatement strategy for the railways and to include retrofitting as a possibility in the national noise abatement action programmes.

Spring 2006 survey



Response on Spring 2006 survey.

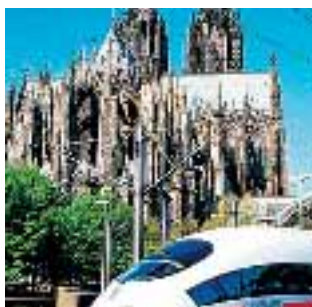
In order to obtain the information needed to produce this report, a survey was issued in spring 2006, contacting almost all the EU, Norwegian and Swiss railways and infrastructure companies by email. After some prompting and a number of reminder emails, some very good feedback was forthcoming, with 16 out of the 17 companies contacted answering. No response was received from Luxembourg.

The survey included the following seven questions:

- Are there noise abatement projects implemented, ongoing or planned on your infrastructure, such as noise barriers, noise insulation windows, or rail grinding programmes?
- If yes, please name them (location) and/or estimate their total length (km of noise barriers, number of windows, etc).
- Are they part of an ongoing or planned noise abatement programme on your network? if so, when did it start and when will it be completed?
- What financing is invested in the programme (in total/per year)?
- Could you send some references (web-links, hard copy or electronically) on your noise abatement programme or tell us where to find more information if needed?
- Do you intend to implement a noise abatement programme on the infrastructure as part of your country's action programmes for the implementation of the EU Noise Directive?
- Do you think it will be possible to include retrofitting existing rolling stock in these programmes?

As expected, the answers received varied widely in quality: in some cases only an email was received in response, in other cases complete reports were sent or even written specially.

Nevertheless, the information received enables a coherent Europe-wide overview to be established as intended.



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National railway noise abatement programmes for railway infrastructure

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The following paragraphs summarise the information obtained for each country.

First, the legal background is described (where available), followed by a description of the programmes underway, the use of different noise protection measures such as noise barriers, window insulation or grinding techniques. Where data is available, information on budgets is included. The final paragraph summarises the status as of late 2005. The various European countries are listed from north to south and from west to east.



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Norway



Legal background:

In Norway, regulations governing noise mainly fall into two categories: pollution regulations and requirements based on technical regulations. Generally speaking, national targets exist to reduce noise pollution in Norway by 25% between 1999 and 2010.

Norway's regulation on noise (part of the Pollution Control Act) was adopted in 1999 and is applicable to existing railways. It clarifies the preceding regulations on noise limitations and proposes a maximum limit value for noise from outdoor sources permissible in residential buildings. The limit value was set at $Leq, 24h = 42$ dB(A) for indoor rooms.

The owners of sources of noise, including the National Rail Administration, are responsible for surveying all residential buildings exposed to noise from their activities, and for implementing measures if buildings exceed the specified indoor noise levels. Exemptions are granted only for houses in a very poor state of repair or if the house owners are opposed to noise reduction measures.

As part of the technical regulations, noise issues have to be taken into account when building new residential buildings. Buildings are classified according to four different sound categories: A, B, C and D. For example, new buildings in category C are supposed to meet a specified 24h noise level of $Leq, 24h = 35$ dB(A). Construction of new lines is rather limited in Norway; the most important major construction to date was the new line to Oslo's new main airport, completed in 1998. Large portions of this line are routed through tunnels.

Noise abatement programme:

Various measures are used to implement the noise abatement programme in Norway, with priority given to source-related measures, such as rail grinding, replacing noisy rolling stock with silent vehicles, replacing old steel bridges or placing insulating material between the track and steel constructions, removing level crossings and the associated noise sources (signals and horns).

Railway noise pollution in Norway



was reduced by some 20% between 1999 and 2004. The major factors in achieving this were: new rolling stock, construction of new tracks, construction of the Romeriksporten tunnel for part of the Oslo airport rail link and the resulting changes in traffic, and rail grinding.

Status in late 2005:

As a consequence of the Noise Pollution Act, the National Rail Administration carried out a survey showing that approximately 150 houses had unacceptable indoor noise levels.



Several types of measures were initiated. Additional rail grinding was carried out in Oslo and Akershus and in the Fredrikstad-Sarpsborg district. This resulted in average noise reductions of 3 dB(A) in areas where the rail quality was of a reasonably good standard, and even higher noise reductions in areas where the rail quality was not so good.

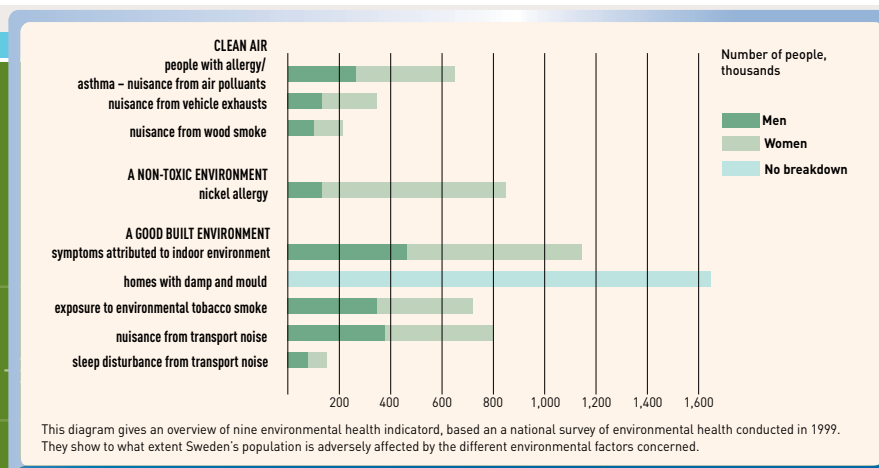
In Drammen and Trondheim two large-scale noise-protection systems were installed, reducing noise in a total of 45 houses. In the remaining cases, work was required on the buildings themselves, mainly replacing windows or air vents. In some cases the entire facade was replaced and the roofs were replaced on a few houses situated below the level of the railway line. The last of these measures was completed in 2005.

In the last five years an estimated NOK 35 million (€ 4 million) has been spent on noise reduction measures on the existing Norwegian rail network.



Overview of nine environmental health indicators

Sweden



Overview of Swedish environmental health indicators – Source: "Sweden de Facto 2006"; Progress report from the Swedish Environmental Objectives Council.

Legal background:

National guidelines for noise reception are in force in Sweden. The goal is to limit outdoor levels (on patios or in gardens) to Leq 24h = 55 dB(A) and Lmax = 70 dB(A) and to limit maximum indoor levels in homes to Leq 24h = 30 dB(A) and Lmax = 45 dB(A). Measures must be taken if Lmax exceeds indoor levels of 55 dB(A) or when a level of Lmax (outdoor, on façade) of 85 dB(A) is reached on more than five occasions/nights.

Under the Swedish national environmental objectives, noise reduction is monitored as part of the Environmental Quality Objective "A Good Built Environment".

The target for 2010 is a 5% reduction (compared with 1998) in the number of people exposed to traffic noise in excess of the guide values approved by Parliament for noise in dwellings.

Annual reports are produced, called 'Sweden de facto'. In its

2006 issue, traffic noise pollution is ranked third out of the nine most important environmental health indicators affecting some 800,000 people in Sweden.

Noise abatement programme:

Banverket's environmental strategy has long consisted of preventing noise emissions and vibrations and protecting those people and dwellings most exposed to them.

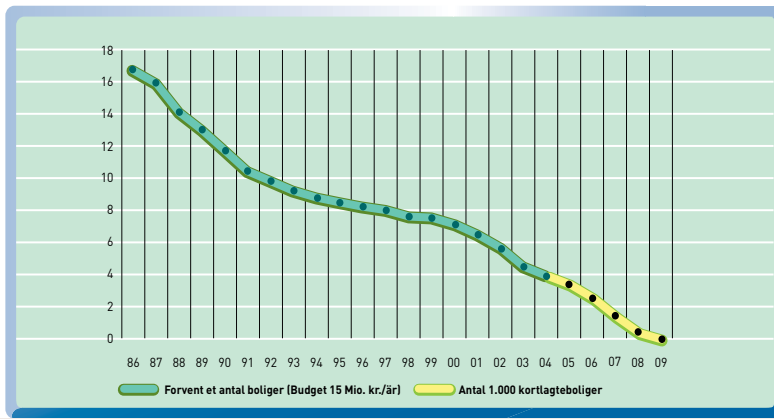
Anticipated noise or vibration issues are therefore dealt with during the construction and/or upgrading of railway lines. Banverket has implemented a noise abatement programme for homes adjacent to its network. Between 2000 and 2005, measures were taken for over 20,000 homes in accordance with a programme agreed upon by the Swedish government. The measures taken included the upgrading or replacement of windows and the construction of noise barriers.

The total cost of all the measures was SKr 492 million or c. € 52 million. Banverket has not yet included grinding in its noise abatement programme, but it is under consideration. As a first step, methods have been developed to examine the need for grinding from an acoustic point of view.

Status in late 2005:

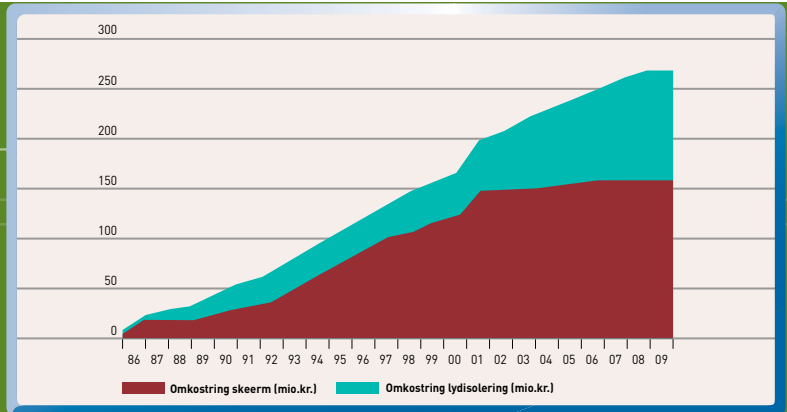
In addition to the aforementioned completed programme, it is intended to apply measures to buildings when Leq 24h exceeds 70 dB(A) or schools, nurseries, hospitals etc. where Lmax indoor reaches → 55 dB(A).

These plans will probably form part of the action programme implementing the EU Environmental Noise Directive: the budget for the period 2007-2014 is some € 53 million. In addition, Banverket intends to introduce source-related measures into the action programmes such as a retrofitting programme in accordance with END



Number of dwellings affected by noise – Source: Arsprapport 2004, Banedanmark 2005.

Denmark



Investments for noise screens (green) and noise insulations (red).

Legal background:

New and heavily-upgraded lines (e.g. from single to double track) are covered by an Environmental Impact Assessment (EIA) process. The EIA process is based on recommended limit values. These levels are also used for new buildings along existing lines.

Unlike noise prevention for new or upgraded lines, there is no legal obligation to implement noise abatement measures on existing lines. The legal background here is a voluntary agreement allowing the infrastructure manager to spend a given annual sum on noise abatement.

Noise abatement programme for existing lines:

A noise abatement programme was launched in Denmark in 1986, and is expected to be finalised in 2010. It consists of building noise barriers and lays particular emphasis on providing noise-insulated windows.

In addition, there is an ongoing grinding programme for c. 300 km

of track/year. As well as constructing noise barriers, home owners are offered insulation for their houses, especially their windows, covering between 50 – 90% (proportion varies according to noise levels) of the costs for noise levels above 65 dB.

The total budget per residence is between € 10,000 – 13,000. Action is required for around 1,000 homes per year.

Status in late 2005:

Since the programme was launched some 41 km of noise barriers have been built, financed by the noise abatement programme, with another 17 km constructed in conjunction with other railway projects.

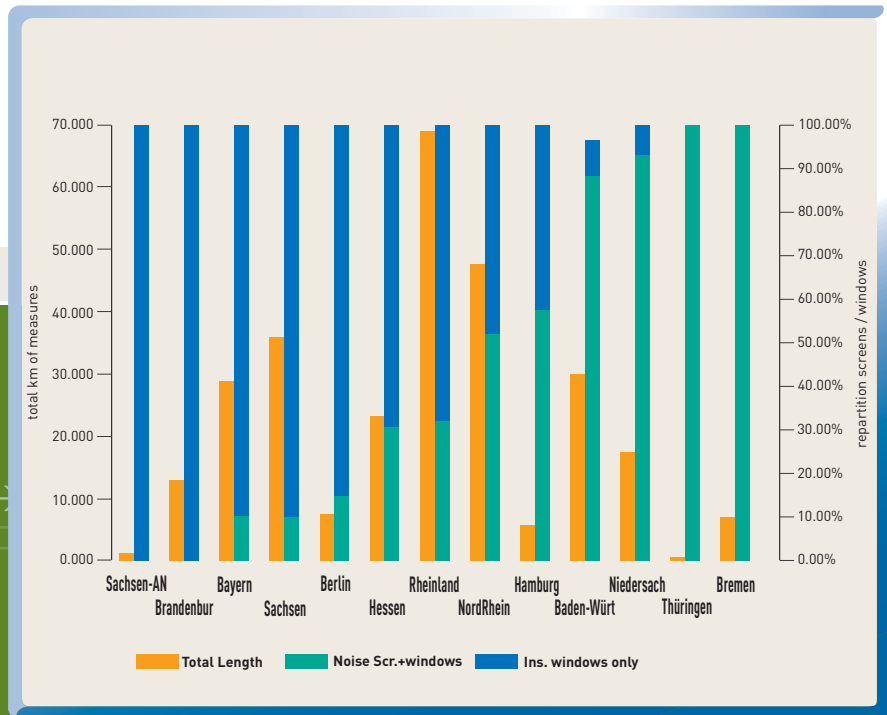
The noise abatement programme has progressed well, as shown by the graphs (right): the number of residences exposed to noise without noise protection installed or offered fell from 17,500 in 1986 to 3,400 by the end of 2005. Noise barriers provide noise protection for 4,300 homes. Another 10,500 homeowners have been offered

support for noise insulation (i.e. insulated windows): 6,700 of these were interested, of whom 4,200 submitted a cost estimate. In the end, 3,600 dwellings were fitted with insulation.

The discrepancies in the figures above are attributable to the difference between overall and detailed noise mapping

Total expenditure by the end of 2005 amounted to c. DKr 150 million (c. € 20 million) on noise barriers and DKr 80 million (€ 11 million) on noise insulation. Another c. DKr 40 million (c. € 5.5 million) was budgeted to finalise the programme, and will be spent mostly on noise-insulating homes.

Germany



Noise abatement in Germany – Noise screens/windows.

Legal background:

In Germany, DB has implemented the noise legislation in force since 1974 when constructing new lines or upgrading existing ones. This process is called "noise prevention". Consequently, noise abatement measures must be taken during construction as soon as defined limit values are exceeded.

Unlike noise prevention for new or upgraded lines, there is no legal obligation to implement noise abatement on existing lines ("noise mitigation"). The legal background here is a voluntary governmental coalition agreement reached in 1998, providing an annual fund of € 50 million for a noise abatement programme starting in 1999.

Noise protection consists of what are known as "active" noise-protection measures (e.g. noise barriers or noise berms) and/or "passive" noise protection measures (e.g. noise-insulated windows).

The current status of the noise abatement programme is that of the network fitted with noise protection measures, around 60% has noise-insulated windows, while

some 40% is equipped with noise barriers and noise-insulated windows.

The graph illustrates the use of the different measures in the various German Federal States in more detail.

A further noise protection measure used in Germany is acoustically-optimised track grinding. This measure reduces the roughness of the tracks using special grinding techniques. The results have to be monitored periodically, but allow a 3 dB reduction to be assumed when calculating noise creation. Consequently, the height of noise barriers and/or the number of noise-insulated windows can be reduced.

Noise abatement programme:

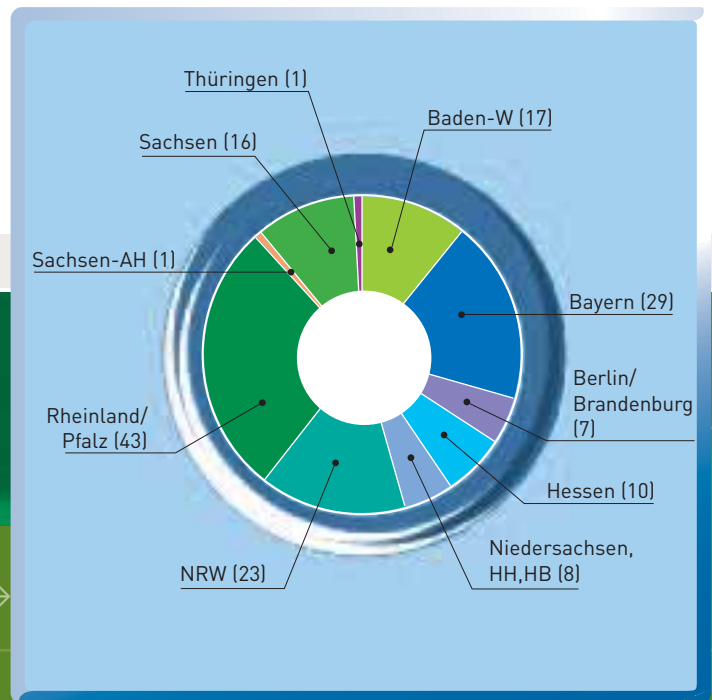
To implement the noise abatement programme, DB first pinpointed those cities most heavily affected by railway noise. The Ministry of Transport then used this list in determining priorities.

From 2005 onward this priority list was expanded to become an overall concept document for the



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Noise abatement in Germany – Cities with noise abatement/State.



whole network, covering 3,500 km of lines and 1,350 cities and communities to be dealt with.

Thresholds of 70 dB(A) (day) and 60 dB(A) (night) are used to decide whether a home in a residential area may be fitted with noise protection measures. In addition to this noise abatement programme, provision is made for noise protection in all projects concerning new or upgraded lines.

Special care is taken to reduce the noise at source, i.e. by vehicles. It is well known that the roughness of wheel surfaces can be reduced by using synthetic brake blocks instead of cast iron materials.

For new vehicles, this has been state-of-the-art technology at DB since 2001.

In order to retrofit existing rolling stock with this technology the German federal noise abatement programme and the associated financial resources must be expanded to include rolling stock upgrades.

In late 2006, the German Federal Council (Bundesrat) decided to support such a programme to the

tune of € 60 million/year, but this decision must be approved by the German parliament in order to enter into force.

DB is also heading the UIC Action Programme on Noise Abatement in Freight Traffic.

Status in late 2005:

Since its launch in 1999, the German noise abatement programme had made good progress by the end of 2005:

- 193 towns and cities covering 285 km of DB's lines had been dealt with
- 68 of these towns and cities had received noise barriers and noise-insulated windows.
- 125 towns had been protected using noise-insulated windows.

Priority was given to towns and cities located on major railway corridors such as the Rhine Valley (see graph).

The measures implemented by the noise abatement programme from 1999 - 2005 were:

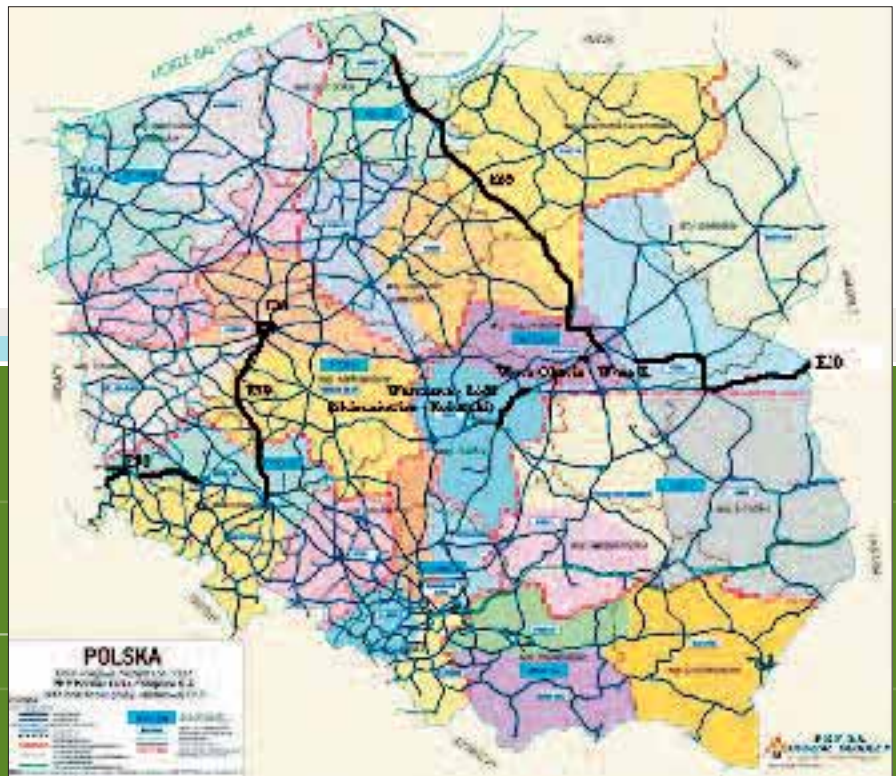
- 110 km of noise barriers built during this period,
- 24,000 dwellings fitted with noise-insulated windows,
- an additional 17,000 windows equipped with special fans allowing rooms to be aired with the windows closed.

Noise prevention programme (2004 - 2005):

- an additional 57 km of noise barriers were built and noise-insulated windows for another 3,600 dwellings fitted.

The noise abatement programme saw c. € 110 million invested in the noise barriers installed thus far. Another € 25 million was invested in ongoing projects implementing active measures and c. € 160 million is earmarked for projects on the drawing board or in the approval process.

Poland



Legal background:

There is no specific legislation on noise in Poland. The legal framework for environmental noise issues is laid down by the Environment Protection Law (Prawo Ochrony Środowiska or POŚ) of 27 April 2001.

The main obligation for the railways resulting from POŚ is to ensure an optimum acoustic environment, especially by:

- keeping noise below the noise limit values or at least not above these limit values,
- reducing the noise level to the limit values (or below) if the limit values are exceeded.

Noise emissions from railway lines during operations may not exceed the environmental quality standards applicable to non-railway property. The railway infrastructure manager must perform periodic measurements of the environmental noise generated by railway operations. Noise measurements are also mandatory in the event of modernisation of railway lines.

There are specific laws (Ordinances) in Poland regulating issues regarding the measurement of environmental noise. The Infrastructure Manager is obliged to compile a noise map every 5 years for the railway lines listed in the Environment Ministry Ordinance. However, there is no legal provision governing the compilation of noise maps. As a Member of the EU, Poland is obliged to comply with the EU Environmental Noise Directive.

Several legal provisions executing the Environment Protection Law are in force and are of particular importance for the transport sector. An Environment Ministry Ordinance of 23 January 2003 governs environmental noise measurement (methodology, etc) and an Environment Ministry Ordinance of 17 January 2003 specifies the standard formats for documenting and presenting the results of noise measurements.

A third Environment Ministry Ordinance dates from 29 July 2004 and sets the following noise limit values:

Polish noise limit values.

Type of area	Daytime Leq dB (A) (16 hours)	Night-time Leq dB (A) (8 hours)
Health centres, hospitals located outside cities	50	45
One-family houses, hospitals located in cities	55	50
Multi-family houses, one-family houses serving as artisans' workshops, recreation areas outside cities, farm buildings	60	50
City centres in cities with more than 100 000 inhabitants, with buildings close together and a high density of administrative and commercial buildings	65	55

PKP Polish Railways S.A intends to draw up a strategic noise abatement programme in order to comply with the requirements of the European Environmental Noise Directive.

Noise abatement measures are currently carried out alongside the modernisation of existing railway lines co-funded by the cohesion fund.

The former single rail operator PKP Polish Railways is now split into passenger traffic, freight traffic (PKP CARGO S.A.) and the infrastructure company (PKP Polish Railway Lines S.A). The infrastructure manager can therefore have no part in financing measures to be applied to the freight fleet and has no influence on the policy of PKP CARGO S.A.

In this light, PKP Polish Railways S.A sees no way of including retrofitting of the existing fleet in the infrastructure noise abatement programmes.

Noise abatement programme:

Noise abatement measures on the Polish railway network are implemented by PKP Polish Railway Lines S.A in accordance with the following priorities:

- Noise abatement at source by rail grinding. Rail grinding is carried out as part of day-to-day maintenance. The annual grinding programme covers around 1,000 km with an annual budget of c. € 3.9 million.

- Limiting the impact of noise by using noise barriers and anti-vibration equipment such as anti-vibration pads, since these measures can also reduce noise.

- Monitoring noise emissions by carrying out noise measurements on the railway lines or drawing potential noise maps

There are currently noise abatement programmes underway on 6 railway line modernisation projects, shown on the map below:

1. E-20 Railway Line Modernisation (II Helsinki Corridor): section from Mińsk Mazowiecki – Siedlce;



section from Siedlce – Terespol;
Poznański Railway Junction

2. E-30 Railway Line Modernisation
(III Helsinki Corridor): section from
Legnica – Zbrzydowa; section
from Węglińiec – Zgorzelec;
section from Węglińiec – Bielawa
Dolna

3. E-59 Railway Line
Modernisation: section from
Wrocław – Poznań

4. E-65 Railway Line Modernisation
(VI Helsinki Corridor): section from
Warszawa Wschodnia – Gdynia

5. Warszawa – Łódź Railway Line
Modernisation: section from
Skierniewice – Koruszki

6. Warszawa Okęcie – Kielce
Railway Line Modernisation:
a) section from Warszawa Okęcie –
Warszawa Zachodnia.

Status in late 2005:

Railway line modernisation has included the installation of over 50 km of noise barriers at a cost of c. € 47.3 million. In addition, some 10,000 noise-insulated windows have been installed along one section. The total programme to be implemented is estimated at c. 74 km of noise barriers with a total budget of c. € 90 million. These projects are scheduled to be completed in 2013, though this will depend on the availability of financing.



United Kingdom



Legal background:

In the UK, considerable noise reduction work is included in major projects at the planning and design stage. This is done in response to the need for the railways to be good neighbours.

There are no measures taken on existing infrastructure.

After noise mapping has been completed, any noise abatement measures necessary can be taken in view of the overall situation, which is deemed more appropriate than isolated projects.

At present, the major issue that railways face is greatly increased demand in the face of an imperative to significantly reduce costs. There is a concern that implementation of END could increase the cost and complexity of railway infrastructure.

Noise abatement programme:

No major projects underway



Belgium



Legal Background:

No country-wide noise legislation is in force in Belgium. Noise legislation is the responsibility of the Regions (the Flemish, Brussels-Capital and Walloon regions).

In the case of new or upgraded lines an EIA is required, and the projected situation has to comply with reception noise levels.

In theory these noise levels may differ from project to project and from region to region but the SNCB Group (SNCB Holding, SNCB and Infrabel (the Belgian IM)) aim to harmonise all such projects. In the Brussels-Capital region these attempts at harmonisation have been formalised by an environmental agreement.

Noise abatement measures through specific infrastructural measures on the existing network are not on the agenda in any region.

Noise mapping in accordance with the END is also the responsibility of the regions. SNCB group provides data such as the number and type of trains for each line section, infrastructure data and general support.

Work on noise consultancy is organised by the environmental agencies in each region. Action programmes will be based on noise reception limits, which are not yet available in Belgium. Defining noise reception limits will require discussion between all the parties involved.

Noise abatement programme:

No dedicated noise abatement programme is in force in Belgium, and noise protection measures are taken only in the context of new infrastructure projects.

Noise barriers or noise protection berms are installed during the construction of new railway lines or when upgrading or extending existing lines. The most frequently-used noise abatement measures are noise barriers, whereas noise-insulated windows are very rare. The Belgian infrastructure manager Infrabel has a conventional grinding programme, but no acoustic grinding.

Status in late 2005:

About 36 km of noise barriers and some 50 km of noise protection berms had been installed in Belgium. The average height of the noise barriers is c. 2.4 m. The average height of the protection berms is 3.5 m. These noise protection measures have been installed on the following lines:

Line 1: HST line Brussels – French border

New line 2: HST line Brussels – Liege

New line 4: HST line Antwerp – Netherlands

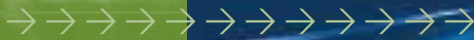
New line 36: Brussels – Leuven: extension of existing line from 2 to 4 tracks

Line 96: Brussels – Halle: extension of existing line from 2 to 4 tracks.

As all these measures are implemented in the context of projects already underway, there is no dedicated budget for noise abatement measures.

The total investment cost of these noise abatement measures to date is estimated at around € 80 million.

Netherlands



Legal background:

In the Netherlands railway noise reception is regulated by the "Noise Pollution by Railways Decree", published by the Ministry of Housing, Spatial Planning and the Built Environment in 1987. The decree contains definitions of noise-sensitive areas and the procedures to be followed when reducing the noise impact.

In addition, a noise calculation model was introduced by the Dutch Noise Pollution Act in 1987 (updated in 1996). This calculation model constitutes the default model for implementation of the European Environmental Noise Directive and its noise mapping and action plans. In 2003, the long-term goals were localised in the Dutch railway sector's "Utilise & Expand project", identifying the most cost-effective way of tackling railway noise on specific lines.

With actions at source or contained in other processes, the construction of noise barriers is to be limited as far as possible. Practical measures are being tested and implemented in the "Noise Innovation Programme", running

from 2002 – 2007. Currently in preparation is a regulation on upper noise limits, to be incorporated into the railways' capacity management using noise-related differential track access charges.

Dutch policy goals regarding noise are to reduce the noise created by most trains by 7 dB(A) compared to the noise levels of trains using cast iron braking equipment. Only quiet trains will be allowed to operate at night on all sections of track since 2015. The long-term ambition is to reduce noise by between 10 and 12 dB(A) compared to conventional rolling stock fitted with cast iron brake blocks.

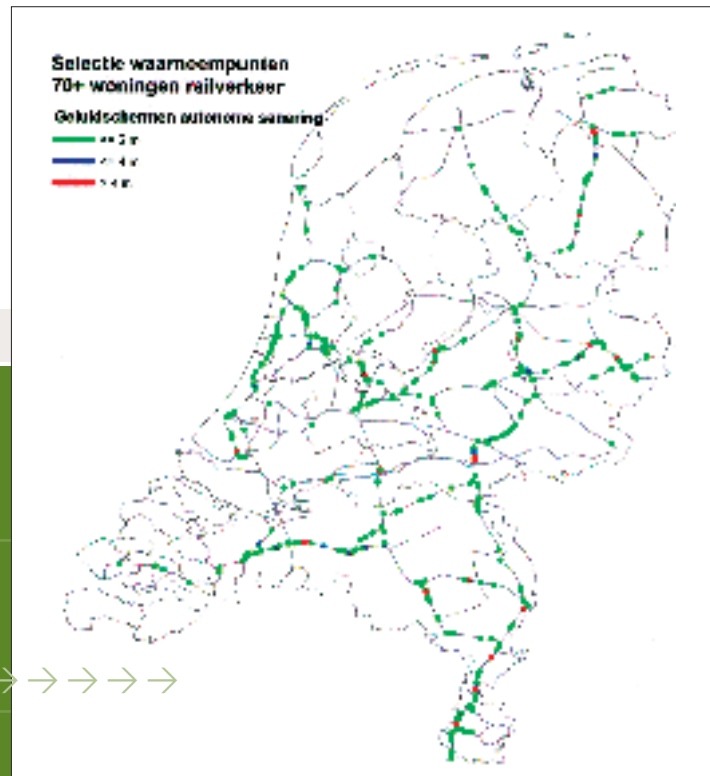
The costs of noise measures are classified using the following three categories:

Category 1:

costs are assumed by the Ministry of Transport, Public Works and Water Management (V&W) in accordance with the Noise Pollution Act. Where the track is physically modified, measures are taken to achieve "stand-still". In this way, the maintenance deficit is addressed (compliance with higher



VR



values), and the associated improvement is achieved.

Category 2:

costs are assumed by the Ministry of Housing, Spatial Planning and the Built Environment (VROM) in the event of a “stand-alone” improvement. This means an improvement of noise pollution situations which existed before the entry into force of the Noise Pollution Act and which were not resolved by V&W in accordance with its obligation under the Noise Pollution Act.

Projects can be financed by the government if noise levels exceed 65 dB(A). Other aspects coming into play are the choice of measure, noise impact and cost-effectiveness. The preparation of projects can also be financed in cases where indicative noise calculations show reception values higher than 65 dB(A).

In the near future a new approach is expected integrating categories 1 and 2. This will be incorporated into the noise action plans as prescribed by the EU.

Category 3:

costs resulting from resolving railway noise hot spots of above 70 dB. As this partly coincides with the obligations listed in categories 1 2, the costs are covered jointly by V&W and VROM.

Noise abatement programme (category 2):

A noise abatement programme has been underway in the Netherlands since around 1987.

Budgets are provided by the Ministry of the Environment (€ 5-10 million/year) and the Ministry of Transport, though the latter is not specifically earmarked for noise measures. The share of this budget earmarked for noise reduction is € 5 million/year.

The impact of noise on the Dutch railway network is high: it is estimated that one third of the network will exceed the planned upper noise limits in 2015.

This significant impact results in very high estimated costs. The Multi-annual Programme for

Infrastructure and Transport” (MIT) provides for € 525 million to be spent on noise protection measures, with an additional € 350 million earmarked for noise protection in the context of expansion projects.

Alongside these projects, “stand-alone” mitigation (e.g. of hot spots) is being carried out at an additional investment cost of c. € 280 million. The extent of these projects is illustrated by the diagram (above).

In view of the high costs, investigations of alternative noise abatement methods have been launched, and have found that significant savings are possible using at-source measures.

Calculations have showed that at-source measures such as retrofitting of rolling stock could save c. € 750 million by 2020. Projects have thus been launched to study the possibilities for retrofitting.

The most important project is the ‘Noise Innovation Programme’ with a budget of € 40 million. The project contains 6 pilot studies using LL-blocks and 1 pilot using K-blocks and testing of track noise dampers and smooth rails.



Status in late 2005:

The following noise impact was determined for Dutch homes:

- 55 – 60 Lden: 210,000 homes
- 61 – 65 Lden: 112,000 homes
- 66 – 70 Lden: 43,000 homes
- > 71 Lden: 13,000 homes

In the picture, the main railway lines (as defined by the noise-mapping Directive) carrying more than 60,000 trains per year are marked in blue. The areas with houses with a higher noise reception than 70 Lden are marked as red dots. Red dots outside the blue lines are on tracks that will be mapped during the second round of mapping in 2012 and 2013, and will thus come under consideration in future.

Since 1987 almost 200 km of noise barriers have been installed.

Test trains using both K-blocks and LL-blocks are in operation in the “Fluistertrein” (whispering train) project. These trains aim to make possible an at-source noise reduction of 7 – 10 dB(A). The life-cycle costs (LCC) are also being investigated.

One of these test trains is the Dolomite Shuttle, an existing shuttle service carrying dolomite between Hermalle in Belgium and the Dutch town of Veendam. The long route and fixed composition made the train ideal for collecting statistically reliable data.

One important result already obtained is the noise reduction of around 9 dB(A) obtained by using K-blocks and wheel dampers. The LCC are still under investigation. Other test trains with LL-brake blocks have just started. In total, around 150 freight wagons of different types, different owners and different operators are undergoing testing to determine their LCC, noise and other aspects in 6 projects (www.innovatieprogramma-mageluid.nl).



Luxembourg



RENFE



Luxembourg did not participate in this study. From other studies it is known that in Luxembourg some 10,000 people are affected by railway noise. There is no known noise abatement programme.



France



Legal background:

In France some 40% of people say they are affected by noise in their homes. In 55% of these cases the source of noise is traffic. In 2% of the traffic noise cases, railways are the original source.

In France, legislation was enacted through the Law on Noise Abatement 92-1444 (published in late 1992). The legislation applies to both road and rail traffic. However, mode-specific regulations do exist. The law provides for 3 main types of action:

- Address the sources of noise when constructing new lines or upgrading existing lines
- Classify infrastructure by noise level, and define sections where all new buildings must be protected against existing traffic noise
- Implement a noise control programme at hot spots within 10 years.

The first two types of action are focussed on noise prevention, either by limiting noise during construction of infrastructure or by limiting noise inside the homes

adjacent to a piece of infrastructure classified as noisy. The third type of action aims to address the noisiest hot spots by setting up programmes to reduce noise on a case-by-case basis.

The French law also lays down the obligation to achieve results: studies or noise protection measures must be checked and validated after implementation by taking new noise measurements.

The classification of noise from railway lines is carried out by the Prefect of each Département, who is responsible for counting and classifying the parts of railway infrastructure with traffic in excess of 50 trains per day in interurban areas or 100 trains per day in urban areas.

After consulting the Municipalities in the Département, the Prefect identifies those sectors in the vicinity of these infrastructure which are affected by noise (between 10 m and 300 m from tracks depending on the level of daytime and night-time noise) and the technical specifications (minimum sound-insulation levels) to be applied when a new building is



built. In accordance with the Urban Planning Code these classifications must be incorporated into local urban planning charts and the information must be included in documentation relating to urban planning.

For noise from new or modified infrastructure, in the event of work causing an increase in noise levels of more than 2 dB(A) on a worksite with no protective measures in place, the infrastructure owner must take all appropriate measures to observe the noise limits laid down in the decree. The noise limits must be observed throughout the service life of the infrastructure.

For new infrastructure, the maximum noise levels to be observed for general residential areas (sectors with moderate noise levels excluding works (<65 dB(A) during the day and 60 dB(A) at night)), are as follows:

- 60 dB(A) during the day and 55 dB(A) at night for TGV lines operated at >250 km/h
- 63 dB(A) during the day and 58 dB(A) at night for other lines.

If a sector is located in an area with more than moderate noise levels excluding works, the preceding limits are raised by 5 dB(A).

In the event of significant modifications to existing infrastructure, if the noise levels excluding works are lower than the values defined above, they must also be observed in the event of works. In other cases, the values in the event of works should not exceed the existing values excluding works, or at least should observe the limit values of 68 dB(A) during the day and 63 dB(A) at night.

Noise abatement programme

France has a national programme for the reduction of noise from land transport (road and rail) based on legislation passed in June 2001.

For the railways this concerns all railway lines with traffic in excess of 50 trains per day in interurban areas or 100 trains per day in urban areas. This applies to approximately 12,000 km of

the 32,000 km of the national network.

The legislation considers noise levels in excess of 73 dB(A) (day) and/or 68 dB(A) (night) in sensitive built-up areas as a noise hot spot requiring action. The legislation also defines the noise levels to be reached by installing noise protection as 68 dB(A) (day) and 63 dB(A) (night).

The process is as follows:

- mapping of critical noise areas,
- assessment of the buildings and the populations exposed to noise in the noise hot spots
- outline and cost-estimate of noise protection measures to be implemented
- draw up action plan (overall programme covering a 10-year period)
- dissemination of information to the public.

A Geographical Information System (GIS) enables data to be entered and monitored by dedicated land transport noise observation units set up in each Département. The Prefects of each Region and



Département are responsible for organising the installation of these noise observation units, scheduling the work and the financing.

The infrastructure manager must supply the data and technical information such as the location of noise hot spots, proposed corrective measures and the implementation of measures.

Many possible noise abatement measures exist, though priority is given to at-source protection such as noise screens or berms, retrofitting rolling stock and noise protection on façades.

25% of the financing of railway noise abatement comes from the infrastructure manager, 25% from central government (Ministry of Public Works) and 50% from local authorities. Central government and the infrastructure manager also earmark an annual budget for € 15.4 million to tackling railway noise hot spots.

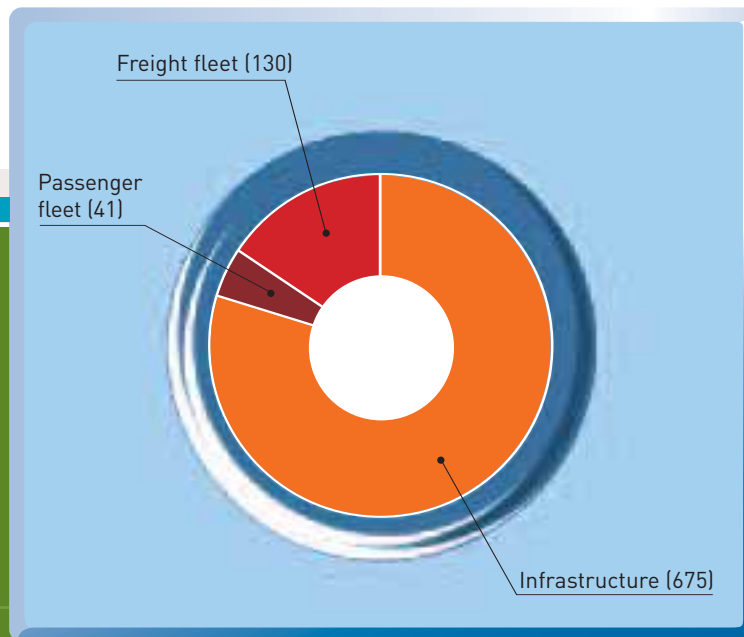
Status in late 2005

Mapping of the critical noise areas for all the affected parts of the network was completed in 2003.

Surveying of noise hot spots in buildings and outlining of the protection measures are underway in two areas. The remaining areas are scheduled to be tackled during 2007-08.

However, in anticipation of this programme, operations to rectify noise hot spots have already been launched. Thus, in-depth studies are being carried out on 70 Municipalities, concentrated primarily in the Île-de-France and Rhone-Alps areas. The work has been completed on one site and is in progress on another, with a total of some 2000 m of noise barriers having been erected. Five other sites are ready to start. The most significant difficulty is obtaining financing from local authorities. In addition to this assessment, noise protection installation is being undertaken alongside construction/upgrading of new or existing lines.

Switzerland



Costs Swiss noise abatement program – SBB part (MioCHF).

Legal background and the Swiss noise abatement programme:

In Switzerland, noise legislation and a Swiss noise abatement programme were developed side by side and are therefore dealt with in the same chapter of this report.

The installation of noise abatement measures when building new lines or upgrading existing lines has been mandatory since around 1980.

The main piece of Swiss legislation on noise was enacted in 1987 with the aim of all the necessary traffic noise abatement measures being implemented on existing networks within 15 years. However, neither road nor rail was able to comply with this goal due to insufficient funding.

A concept for an optimised rail noise abatement programme was developed over a five-year period, covering the entire existing railway network and implemented by a special law on noise abatement by Swiss railways enacted in 2000, with detailed regulations passed in 2001.

This legislation defines the top priority for railway noise abatement in Switzerland as retrofitting the existing passenger and freight fleet.

Secondary priority is given to noise barriers with a standard height of 2 m. The use of noise barriers is limited by a cost-benefit-index (KNI). If the required noise reduction cannot be achieved using these two measures, noise-insulated windows are to be used in addition.

All costs are covered by a special funding mechanism called 'Funding for public transport'. The same fund also covers all the costs of the new lines under the Alps, connections to European high speed lines and the Rail 2000 project.

The noise abatement programme is managed by a dedicated project group within SBB.

The SBB project represents around 80% of the Swiss noise abatement programme and is very wide-ranging: noise investigations had to be undertaken for over 1,200 communities.

Noise project planning must even be performed if it is found that no noise protection is required. A total



of 1,030 passenger cars and 11,500 freight wagons must be retrofitted initially.

Implementation of the noise abatement programme started in 2000.

Retrofitting of passenger rolling stock was almost completed by late 2005, freight rolling stock will have been retrofitted by the end of 2009 and infrastructure-level noise abatement measures will be completed by 2015.

The total costs of the Swiss noise abatement programme were estimated at c. € 1 400 million in 1999. The current final cost estimate is significantly lower, at around € 550 million for SBB's part of the programme (see graph), and the overall cost of Swiss noise abatement is estimated at around € 810 million. The reduction compared to the 1999 estimate was mainly due to the reduction of the freight fleet by almost 50%.

Status in late 2005:

The noise abatement programme had been implemented for 38 Municipalities, with a total of around 33 km of noise barriers

having been installed. In 25 Municipalities work on noise barriers was underway. For 61 Municipalities authorisation for construction had been given by the Federal Ministry of Transport.

The top priority for construction was given to the two main north-south transit corridors.

Retrofitting of passenger rolling stock was largely completed: 991 coaches had undergone the retrofitting process at a cost of CHF 40 million or c. € 25 million.

In addition 1,165 freight wagons had been retrofitted by the end of 2005. In accordance with the agreed payment plan, SBB was able to bill the Swiss Ministry of Transport for a total of CHF 206 million (€ 130 million).

As a result of the noise abatement programme, some 35 000 inhabitants benefited from significantly reduced railway noise levels. Around 37 km of noise barriers were also erected during construction of new lines or upgrading of existing lines.

Austria



FS

Legal background:

In Austria the permitted levels of noise created by road traffic and on new railway lines are regulated at national level. No national law on noise protection has yet been enacted. Regulation is performed partly by the Federal Government

and partly by the Federal States (Bundesländer), resulting in multiple regulations of which it is difficult to obtain a clear overview.

The regulation on new or upgraded railway lines was enacted in 1993 in the "Schienenverkehrs-Lärmimmissionschutzverordnung", a regulation on noise protection. If the noise levels defined by this regulation are exceeded on new or upgraded lines, noise protection measures must be implemented. No regulation is in place for existing lines.

However, noise on existing lines was recorded between 1993 and 1995 in a noise register ("Schienenlärmimmissionskataster") and this register forms a framework for setting priorities and implementing noise protection measures on existing lines.

Noise abatement programme:

The noise register of 1993-95 showed that 497 municipalities and some 300 000 inhabitants were exposed to excessive levels of railway noise.

The legal basis for the Austrian noise abatement programmes is formed by political contracts concluded between the Ministry of Transport and the Federal States (Bundesländer) stipulating that the ÖBB infrastructure unit shall take the lead in executing the programme. 50% of the cost of the noise abatement programme is covered by ÖBB Infrastructure and 50% by the municipalities and the Federal States.

Status in late 2005:

Contracts for the planning process had been concluded in 209 municipalities and implementation had been completed in 152 municipalities.

By late 2005 some 295 km of noise barriers had been built with an average height of around 3 m. In addition, 1,550 out of 2 310 requests for buildings needing protection had been processed. Between 2002 and 2005, € 128 million was invested in this area. Annual investment for the years to come is budgeted at € 30 – 35 million.



8

Czech Republic



Legal background:

In the Czech Republic there are two basic legal regulations on noise and vibrations in force, which are to be applied to noise pollution from all sources, not only railways.

The first is Law 258/2000 "On the Protection of Public Health" and the second is Decree of Government 502/2000 "On the Protection of Health against Adverse Impacts from Noise and Vibrations".

Decree 502/2000 defines permitted noise limits for outside noise. These are 60 dB(A) during the day and 50 dB(A) at night and are not to be exceeded by any noise sources, whether combined or separately.

For railway noise at night, an extra 5 dB(A) is allowed (the railway 'bonus'). These limits apply to new and substantially upgraded lines. For existing lines the limits may be exceeded by up to 12 dB(A) because of what is known as the "old load".

Both regulations are currently under revision.

The END Directive was adopted in 2005 by the Czech Parliament as Czech law, but the President of the Czech Republic Vaclav Klaus did not sign the law, meaning it was returned to the Parliament.

Thus far the basic part of this Directive has been incorporated

into a new draft of Law 258 "On the Protection of Public Health". This law is now awaiting a vote in parliament. The remainder of the END Directive (noise mapping, action plans) is due to be incorporated into a new government Decree.

Noise abatement programme:

No overarching noise abatement programme has been implemented on the Czech railway infrastructure to date. One may be implemented in future in the context of an action programme implementing the END Directive in the Czech Republic.

Status in late 2005:

All the necessary noise protection measures provided for under national legislation were taken when constructing the two new high speed corridors, mostly noise barriers.

Noise-insulated windows are only used in the event of complaints received from residents. Noise mapping in accordance with the END started in 2005.

Hungary



Legal background:

Hungarian national law requires that the Hungarian Railways (MAV) must take noise protection measures when constructing new lines or when upgrading existing lines.

In other cases, especially concerning non-upgraded existing lines, only operational measures are possible.

This situation is expected to change when implementing EC Directive 2002/49 on Environmental Noise (END). This Directive has been transposed into Hungarian law. A request has been made to define an action plan including implementation timescales once noise maps or conflict plans have been drawn up. A new law or government decision concerning the implementation of the action plan may be forthcoming.

The situation was similar when MAV was transformed from a state-owned company to a joint-stock company and had to measure the environmental damage caused by past operations. A government decision on rectifying old environmental damage now exists. MAV must rectify old environmen-

tal damage by 2010 and must submit a yearly progress report.

Noise abatement programme:

Hungarian Railways aims to fulfil the requirements stemming from both national law as well as from the EU accession process.

Its first priority in noise reduction is prevention, followed by measures taken at the source of railway noise (active solutions) such as retrofitting the freight fleet. The third priority includes passive solutions to reduce the harmful effects of noise with noise barriers or noise-insulated windows.

MAV intends to meet the requirements and deadlines of the END as well as the requirements of interoperability, especially the noise limits as defined in the TSI. Currently MAV must install all the necessary noise protection measures (noise barriers, noise-insulated windows) when reconstructing or upgrading railway lines. MAV is also revising its noise protection technology such as wagon warm-up systems, passenger information systems (loudspeakers), shunting

operations and loading/unloading activities at freight terminals near residential areas.

Status in late 2005:

Noise protection measures had been installed during upgrading of the three corridors Budapest-Hegyeshalom-Vienna, Budapest-Szolnok-Romania, Budapest-Boba-Slovenia.

The costs spent on installing noise protection measures formed part of the overall construction costs. The investments for noise protection measures were estimated at € 1.2 – 2.4 million/year.

Portugal



Legal Framework:

Portuguese legislation treats railway operations similarly to all other transport infrastructure. Railways are considered a permanent noise-emitting activity and are provided for in Decree 292/2000, which (it is assumed) will be updated in the near future.

This Decree defines two types of land occupation for current or future land use:

- Sensitive areas (e.g. existing/planned residential use, schools, hospitals, leisure areas) used by the general population and requiring low noise levels.
- Mixed areas - complementary areas to those described above, in which uses such as commercial activities or activities related to services and trade are also present or permitted.

The local or municipal authorities are responsible for identifying the two area types and must include these identifications, based on noise maps, in the land planning process.

The noise limits which must not be exceeded for the two types (outdoor levels) are:

- (LAeq, 55 dB(A) (daytime) and 45 dB(A) (night-time) for sensitive areas.
- (LAeq) 65 dB(A) (daytime) and 55 dB(A), (night-time) for mixed areas.

Portuguese noise legislation accords existing railway infrastructure no exception, special treatment or privilege. The rail companies have had to comply with the regulations from their entry into force on 14 May 2001.

The EU Noise Directive had not been transposed into national legislation by the end of 2005.

Noise Reduction Plans

Up until 2003, REFER applied both the noise mitigation measures included in the substantial investments in modernising the existing infrastructure and those resulting from the Environmental Impact Assessments (EIA). With very rare exceptions those measures were confined to the installation of sound-absorbent or reflecting barriers.

From 2003 onward and with the European Directive as its principal guideline, REFER began developing and implementing its own

master plan intended to manage all of its noise-emitting activities.

The objectives of this master plan included the identification and progressively refined assessment of all the noise abatement measures available, a cost/benefit appraisal of each one, in addition to drawing up noise maps and noise abatement action plans.

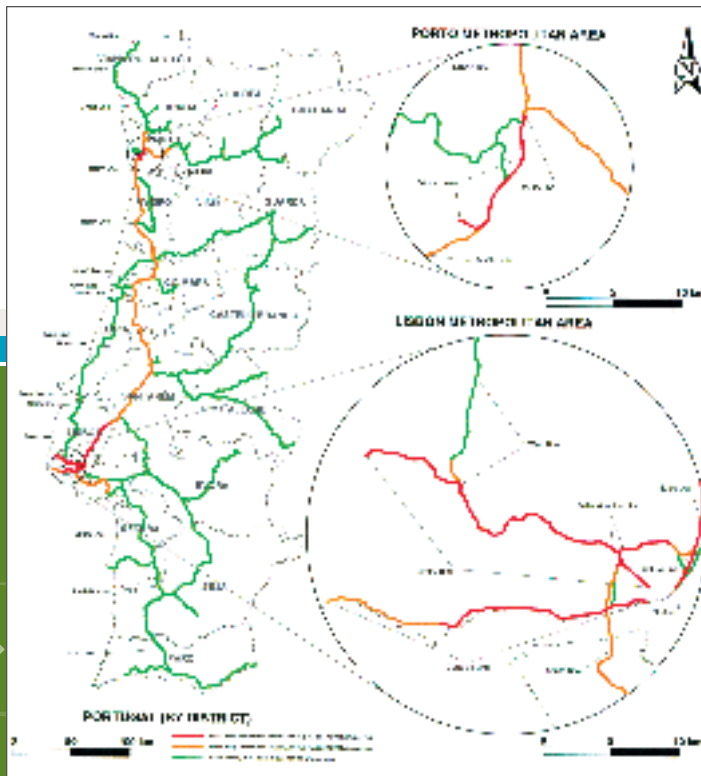
To do so, the master plan brought together all the relevant areas of expertise within REFER, namely maintenance, operations, research and development, strategic planning, investment and the environment.

The classification of the Portuguese railway infrastructure (a network of just over 2 800 km in revenue service) in accordance with the definitions of the European Directive delivered the following results (map, right):

Main lines with over 60,000 trains per year (GEF60 k+, red): 106.5 km

Main lines with over 30,000 trains per year (GEF30 k+, orange): 401.1 km

Secondary lines with fewer than 30,000 trains per year (green): 2,321 km



Using Geographical Information Systems (GIS) and geographical databases provided by the Portuguese National Statistics Institute (INE), REFER estimated that roughly 64,000 inhabitants lived within 50 metres of around 508 km of main lines.

The noise abatement action plans are set to be finalised for the five GEF60k + lines by late 2007 and for the ten GEF30k + lines by late 2011.

After the first version of each plan is produced, it will initially be evaluated by REFER's shareholder (the Portuguese government) and major stakeholders. The plan will subsequently be subject to public consultation.

REFER aims to establish a well-defined decision-making hierarchy in which the first priority is investment in modernising railway infrastructure, since it is not considered good sense to invest in mitigation measures when the infrastructure cannot meet the minimum essential operational standards.

REFER will then establish priorities for the application of noise mitigation measures, starting with those that reduce emissions at

source, and subsequently applying those solutions intended to reduce noise propagation. REFER is currently considering all available measures (ballast mats, sleeper pads, resilient sleepers, fastening systems, rail dampers, rail lubricators, friction modifying agents, acoustic grinding, sound barriers near tracks, sound barriers bordering the railway line, tilted or curved sound barriers, sound-absorbent materials, speed restrictions, train type restrictions and timetable restrictions). However, the railway operator must also fulfil its important role in this process.

Status in late 2005:

54 km of sound barriers had been constructed at a total investment cost of c. € 13 million.

56 km of sound barriers were planned at an investment cost of c. € 39 million. These were to be evaluated and integrated into the aforementioned master plan as far as possible.

Spain

RENFE



Legal background:

A Spanish noise law was enacted in late 2003, but the required regulations to implement it are not yet available. These regulations are to tackle issues such as financing for the action programmes. Discussions are ongoing with local authorities and regional governments in a committee chaired by the Ministry of the Environment. The regulations are envisaged to be in force by late 2006.

Noise maps are currently being drawn up in accordance with the EU Directive on Environmental Noise (END) and the associated noise action programmes.

ADIF (the Spanish infrastructure manager) has been delegated responsibility for this work by the Ministry of Infrastructure. Both noise maps and action programmes must be approved by the Ministry.

Noise abatement programme:

No noise abatement programme is in progress.

Status in late 2005:

Noise mapping will cover some 700 km of the network, mainly used for commuter traffic.



Italy



Legal background:

The Italian noise reduction programme stems from a decree issued by the Italian Ministry of the Environment called "Criteria for drawing up action plans to limit and reduce noise created by companies and public transport" enacted on 29 November 2000.

This legislation takes a three-step approach. The infrastructure owner had to locate areas where noise levels were estimated to be exceeding legal limits and communicate this information to the Ministry of the Environment and the regional and local authorities concerned within 18 months (by 5 August 2002).

The second step was to be implemented within another 18 months (by 5 February 2004), and consisted of action plans aiming at limiting and reducing noise, which had to be presented to the same authorities. These action plans had to describe the intended action including the schedule of work, a cost estimate and a priority ranking for each measure.

The third step will be the implementation of these measures, which must take place within 15 years.

Noise abatement programme:

The Italian noise abatement programme is very wide-ranging.

Noise mapping demonstrated that some 8 000 km (out of a total of 17 000 km) of railway lines required action if they were to comply with the legal noise limits. In a first 4-years period some 700 km of noise screen will have to be built with a budget of € 1 800 Mio.

The costs of noise barriers 3 - 4 m in height are estimated at € 1.5 - 1.8 million/km and noise barriers 7 - 8 in height are required in numerous cases. The total cost estimate for the noise abatement programme is 6.8 billion.

A retrofitting programme could limit both the costs and the visual impact of high noise barriers, but there is currently no way of shifting funding from infrastructure (RFI) to operators (Trenitalia).

The noise abatement programme is currently in its infancy. RFI is currently spending some € 15 million/year, of which 80% is spent during the planning process and 20% on construction. This ratio is expected to change as the project gathers speed.

Status in late 2005:

Noise barriers with a total length of around 5 km had been installed in the Venice and Florence regions. Noise barriers with a length of 6.5 km at Pescara and 6 km at Trento were under construction. Projects were starting on the Mestre - Udine line, on the Milan - Venice corridor at Padova and between Messina and Palermo. The locations demonstrate that projects were being launched across the whole of Italy.

Summary of the state of play across Europe



A table in the appendix summarises the information received.

However, the same type and quality of information was not received from all the countries questioned. The current status of noise mitigation measures on European railway infrastructure can be characterised as follows:

- All the countries surveyed apply the required noise protection measures when building new lines or upgrading existing lines.
- With a few exceptions (Italy, Switzerland) national legislation does not set out any direct obligation for noise abatement on existing lines. Nevertheless, more or less extensive noise abatement programmes are underway in nearly all the countries surveyed. The exceptions are the UK, Belgium, Hungary and the Czech Republic. The situation in Luxembourg is unknown.
- In northern Europe (Scandinavia) noise protection is mainly achieved by noise-protecting buildings. In southern Europe (Italy) noise barriers are mainly used. Both forms of noise abatement are used in central Europe.

■ The results of earlier studies showing Switzerland to have the most comprehensive noise protection programme (programme based on a cost-benefit methodology).

■ The data received for the present study shows that as of late 2005 there were around 1,000 km of noise barriers installed on existing railway lines in Europe, with around 60,000 houses or residences noise-insulated, mostly by means of noise protection windows. These figures do not include noise protection on new railway lines, e.g. for high-speed services.

■ Estimating the number of people protected against railway noise is difficult, but it is nonetheless worth speculating on the order of magnitude. Noise barriers protect all the developed land situated behind the barrier. If we accept as a basis that a noise barrier protecting three-storey buildings (assuming each residence is occupied by an average of three people) protects an average of 1000 people/km, we can estimate that as of 2005, one million people in Europe have been protected by noise barriers and another c. 250,000 people are

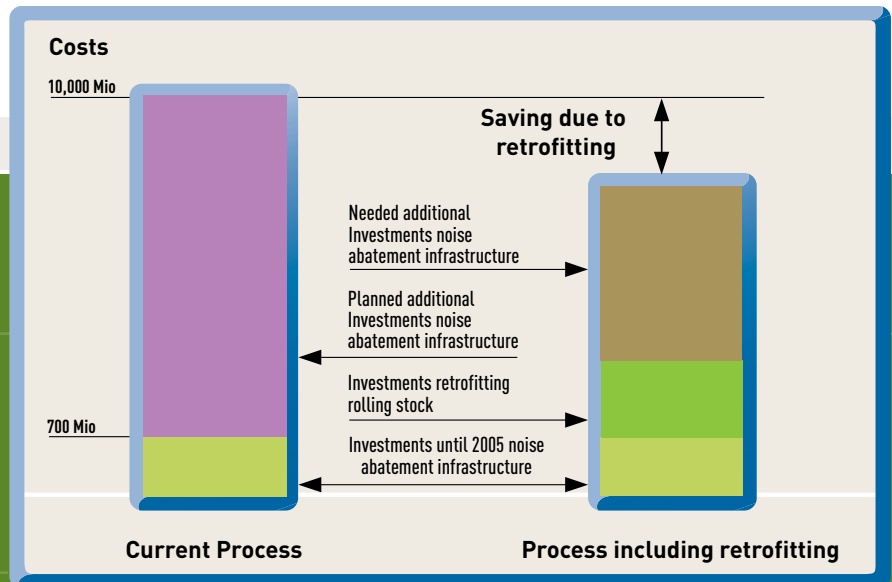
protected by means of noise-protected buildings, a total of 1,250 000 people benefiting from protection against railway noise.

■ A total of € 150-200 million is spent annually in Europe on infrastructure-related noise protection measures. According to the information gathered for this report, the cumulative expenditure as of late 2005 was over € 600 million.

■ Estimates are not available for all European countries regarding future expenditure on infrastructure-related noise protection measures. The future investments announced to date total € 5 billion for the countries concerned. However, data is missing for large countries such as France, and for Austria, where relatively substantial investment is underway. The financial requirements resulting from the action plans to be provided for the implementation of the EU Noise Directive are also missing. Were all these investments to be included, the future expenditure on railway noise protection could total € 10 billion.

Funding and financing of retrofitting

Cost savings using retrofitting: investing in retrofitting rolling stock will reduce the need for noise barriers by more than the investment cost, resulting in an overall saving.



The UIC Action Programme on Noise Reduction in Freight Traffic is based on the idea of using only low-noise vehicles in freight traffic.

The existing fleets are to be retrofitted with synthetic brake blocks.

Railway operators cannot finance retrofitting themselves, since this would immediately lead to price increases in rail freight transport, ensuring modal shift to road haulage. This would indirectly create an increase in road traffic and noise.

As seen in the STAIRRS project described above, however, noise reduction at source is qualitatively more efficient than infrastructure-related noise protection.

If in future it is possible to redirect around 10% of planned infrastructure-related noise abatement investments to retrofitting freight wagons, and if the noise reduction thus obtained is taken into account when planning infrastructure-related noise abatement measures, the costs of the latter will decrease more than the aforementioned 10%. This efficient form of noise abatement must be incorporated into the action plans implementing the EU Noise Directive as a matter of priority.

Conclusions



■ European countries and their railways have already achieved considerable success in reducing the impact of railway noise pollution on their populations. In nearly all countries, noise protection is on the political and business agenda and is being actively pursued.

■ Substantial investments have already been undertaken, resulting in some 1.25 million inhabitants benefiting from railway noise protection across Europe.

■ The outstanding investments of € 10 billion are enormous, and it is in the interest for the community of European countries to keep these

investments as low as possible on the one hand whilst optimising their benefits on the other.

■ This is possible if retrofitting of freight wagon fleets in Europe is made part of the noise reduction action plans.

■ It will then be possible to markedly reduce railway noise everywhere in Europe, not only where noise-insulated windows or noise barriers are installed.

■ This opportunity should be capitalised upon both politically and economically.

Annexe 1: Overview of the information received.

Country	Network length	Cities affected by railway noise	Cities with railway noise protection	Cities with planned railway noise protection	Noise barriers built thus far (km, end 2005)	Planned noise barriers (km, end 2005)	Homes with noise protection installed	Homes with planned noise protection	Investments/year (million €)	Investments as of end 2005 (million €)	Planned total investments (million €)
Austria	5,690	497	152	209	295		1,550	760	30	128	
Belgium	3,536				86		0	0	17(1)	80	
Czech Rep.	9,513										
Denmark	2,323				58		7,486	3,000	2(1)	31	38
Germany	34,218	1,350	193		167		27,600		23(2)	135	1,400(3)
France	32,000				2				15 (6)		
Hungary	7,729								2		
Italy	16,225				5	700	0	0	15		1,800
Netherlands	2,806				200				12		875
Norway	4,087						150		1	4	4
Poland	19,507				50	47			9	47	90
Portugal	2,800				54	56				13	52
Spain	12,814					700					
Sweden	10,000						20,000		10	52	105
Switzerland	3,404	933	38	895	33	149	3,000	3,300	36 (4)	140	545 (5)
United Kingdom	16,116										
Total			383		950	1,652	59,786	7,060	172	630	4,909

1) Annual investments calculated from total investment.

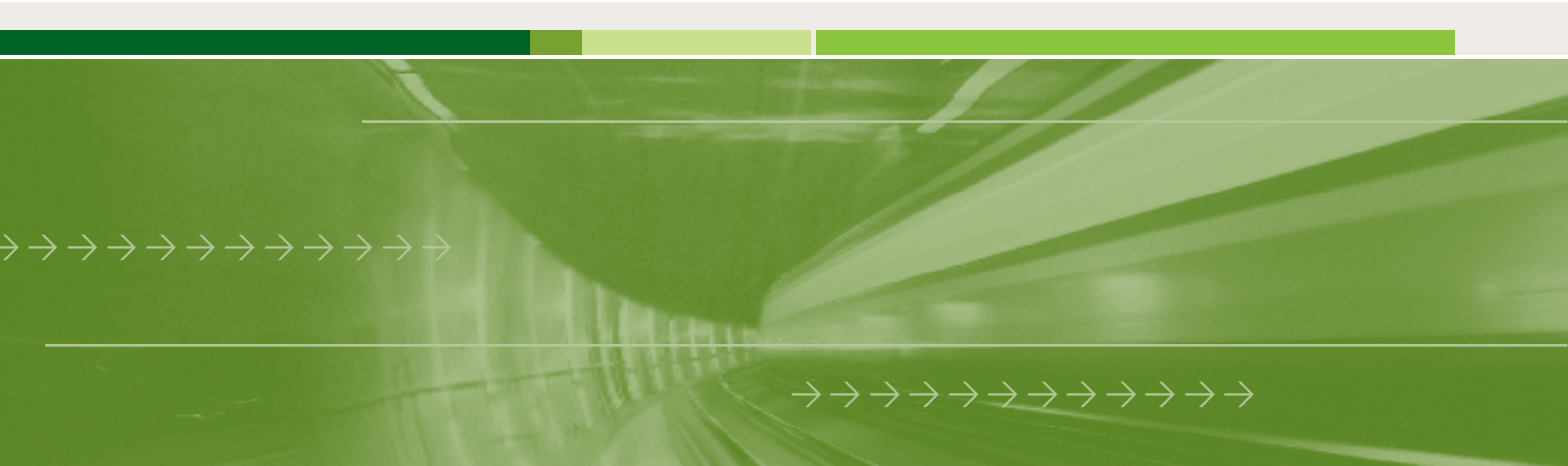
2) Annual investments calculated from investments as of late 2005.

3) Total investment includes the benefits (reduced infrastructure costs) of retrofitting, not the costs of retrofitting.

4) Average annual investment over 15 years.

5) Infrastructure-related measures only.

6) Investment by French government and infrastructure owner only. Some investment expeted by Municipalities, though this encountered problems.



Annexe 2: Contact partners for this report.

Country	Company	Contact	E-Mail	Data received
Austria	ÖBB Infrastruktur AG	Helmut Gutschelhofer	helmut.gutschelhofer@bau.oebb.at	Yes
Belgium	SNCB Holding	Willy Bontinck	willy.bontinck@b-rail.be	Yes
Czech Rep.	CD	Jean Hlavacek	hlavacekjl@cdvuz.cz	Yes
Denmark	Trafikstyrelsen	Lars Deigaard	ide@trafikstyrelsen.dk	Yes
France	RFF	Anne Guerrero	anne.guerrero@rff.fr	Yes
Germany	DB Netz	Bernhard Koch	bernhard.koch@bahn.de	Yes
Hungary	MAV	Püski Imre	puski@mav.hu	Yes
Italy	RFI	Pasquale Scarano Luca Ricciardi	p.scarano@rfi.it l.ricciardi@rfi.it	Yes Yes
Luxemburg	CFL	Doris Horvath	doric.horvath@cfl.lu	No
Netherlands	Prorail	Jan-Willem Lammers	janwillem.lammers@prorail.nl	Yes
Norway	Jernbaneverket	Veronica Valderhaug	veronica.valderhaug@jbnv.no	Yes
Poland	PKP Polish Railway Lines AG	Urszula Michajlow	u.michajlow@pkk.com.pl	Yes
Portugal	REFER	Mr Sarmiento	jmsarmiento@refer.pt	Yes
Spain	ADIF	Pedro Perez del Campo	pperezc@adif.es	Yes
Sweden	Banverket	Karin Blidberg	Karin.blidberg@banverket.se	Yes
Switzerland	SBB AG	Philipp Frabetti	philipp.frabetti@sbb.ch	Yes
UK	Network Rail	John Armoore	John.Armoore@networkrail.co.uk	Yes

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