

Railway Freight Noise Reduction – 7th annual workshop: enlarging the scope

Jakob Oertli, SBB

The seventh annual UIC workshop on railway freight noise reduction, held on 8 & 9 November 2011 at UIC headquarters in Paris, was attended by more than 80 participants. The main aim of the workshop was to report on the progress in terms of incentives for silent freight vehicles on a European level and with respect to LL brake block homologation. For this year's workshop the scope was additionally enlarged to include reports on UIC projects and descriptions of railway noise mitigation progress in various railways throughout Europe. The conference was rounded off with talks on the TSI revision and the ERRAC noise roadmap. The presentations and the programme can be found on the UIC website (<http://www.uic.org/spip.php?article280>). A short summary of some of the main points of the workshop follows:

In this edition:

- Railway Freight Noise Reduction
- Bearable noise limits and emission ceilings
- ERRAC Noise roadmap
- Noise-differentiated track access charging for rail freight to take effect in Germany from 9 December 2012
- Noise differentiated track access charges: Current issues
- Management of railway noise in the Leiser Rhein
- EuropeTrain – update

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INCENTIVES ON A EUROPEAN LEVEL:

The EU has undertaken several studies over the past few years concerning incentives. The method of choice for the EU is noise differentiated track access charging (NDTAC). As part of the recast of the first railway package the EU has proposed an amendment to directive 2001/14/EC requiring the implementation of NDTAC. An agreement on the recast is expected for 2012 with a transposition to the Member States 1 – 3 years later. An expert group will propose practical solutions for their implementation. The Connecting Europe Programme may form a first formal possibility for financial support from the EU.

In Germany NDTAC will be introduced towards the end of 2012. The German railway sector studied different methods of implementing track access charges and the associated transaction costs. It is important that a pragmatic solution is found, because in the worst case the transaction costs can be as high as the retrofitting itself. Further reaching proposals prohibiting the use of cast iron brake blocks are also being discussed.

PROGRESS IN LL BLOCK HOMOLOGATION:

The EuropeTrain project evaluates the running behaviour, wheel wear and life cycle costs of LL brake blocks under operational conditions. The test train consists of 32 representative wagons running on loops through all European climatic conditions. An intermediate report is planned for spring of 2012, evaluating approximately 100,000 km.



Matthias Mather and Jakob Oertli (SBB)

RAILWAY NOISE ISSUES IN VARIOUS COUNTRIES:

The current railway noise situation was presented in Belgium, Denmark, Norway, Sweden, Finland, Spain: railways have similar issues (e.g. work on rail dampers), and therefore it was suggested that closer cooperation on technical measures should be achieved.

UIC NOISE PROJECTS:

UIC has two groups dedicated to noise: The network noise and a core group. These groups share information on railway noise abatement and manage additional noise projects. During the workshop completed projects on bearable noise limits and the noise correction factor and ongoing projects on a collection of results and testing conditions of rail dampers, low height barriers and rail grinding in Europe, follow up costs of noise abatement as well as a collection of noise reduction results of retrofitting the freight fleet were presented.

TSI NOISE AND ERRAC ROADMAP:

The workshop included information on the current state of the TSI revision, the subjects to be considered therein as well as the process involved. The ERRAC roadmap suggests topics for research in European programmes both for noise and vibrations.

CONCLUSIONS

The conclusion of the workshop was that progress was indeed being made and that many projects and players are involved. Retrofitting the freight fleet and all work that supports this (i.e. the homologation of LL brake blocks) should continue to receive priority attention.

However, at the same time, it is necessary to widen the scope and to consider other measures as well. Concerning these, closer cooperation between the railways would benefit all.

Bearable noise limits and emission ceilings

By Frank Elbers (dB Vision) & Nicholas Craven (UIC)

The question 'What are bearable limits for environmental railway noise?' is discussed regularly in different forums at both National and European levels. To inform this debate, UIC has commissioned dB Vision to perform a systematic evaluation of all aspects affecting what is 'bearable'. This allows UIC to propose, for the first time, a well balanced noise limit considering the interests of lineside residents and also what is feasible for the railways.

The findings are presented in a two-part report titled 'Bearable noise limits and emission ceilings for the railways' (http://www.uic.org/spip.php?rubrique1638#outil_sommaire_2)

This study clearly demonstrates that:

- » Railway noise reception limits should not be set lower than 55 dB L_{night}
- » Below 55 dB L_{night} it is more cost-effective to mitigate road traffic noise
- » Reductions below 50 dB L_{night} incur large costs with diminishing returns
- » Achieving the WHO night noise guideline of 40 dB L_{night} would result in high costs and a massive impact on transport and the spatial environment.

WORLD HEALTH ORGANISATION PROPOSAL FOR A NIGHT NOISE GUIDELINE

The World Health Organization (WHO) has proposed a night noise guideline (NNG) of 40 dB L_{night} . However, it also recognises that this may not be feasible in the short run. In these cases WHO encourages a gradual reduction to the interim target of 55 dB L_{night} , to be achieved in the context of wider sustainable development objectives.

The NNG of 40 dB is apparently a rounded figure of 42 dB, i.e. the threshold level identified for five non-biological effects. Whilst WHO lists 40 dB as a threshold for one additional non-biological effect (use of sleep inducing drugs and sedatives) there is insufficient evidence to identify exactly 40 dB. The difference of 2 dB represents an enormous additional cost.

It should also be noted that the research supporting the unrounded NNG 42 dB is almost exclusively based on studies of road and aircraft noise. The same base of scientific material indicates much higher thresholds (typically by 6 to 12 dB) for railway noise and so could justify a separate higher railway NNG. Further research is necessary to determine an appropriate figure.

IMPLEMENTATION

The report also considers how the noise limit should be implemented. It concludes that reception limits should be combined with a noise emission ceiling and monitoring system. The noise emission ceiling should be flexible, adjustable and complement existing national legislation.

To reduce costs, each Member State should be free to develop their own monitoring system based on calculated levels. When emission ceilings are exceeded, further assessment of the noise reception should be made and, if appropriate, noise reduction measures implemented.

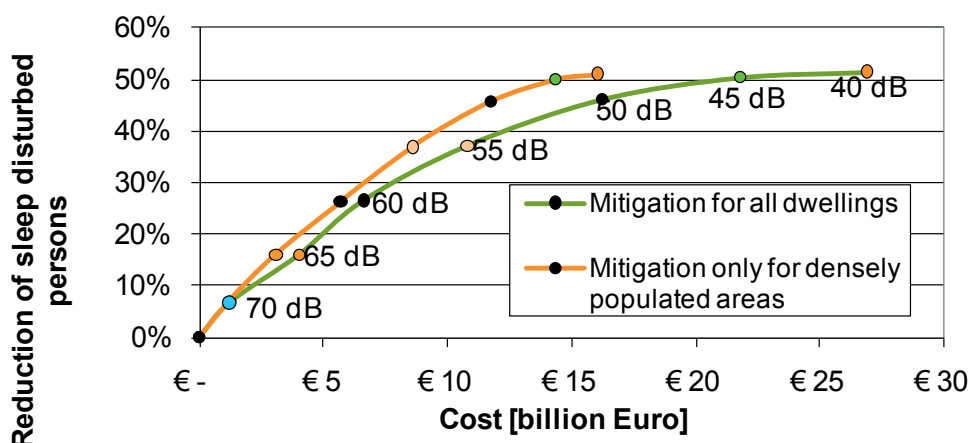
Operational measures to reduce noise (e.g. restricting traffic speed and volume) are counterproductive. While these measures have little impact on railway noise reduction they will cause a modal shift towards road, thereby increasing the total transport noise annoyance.

PROJECTED COSTS

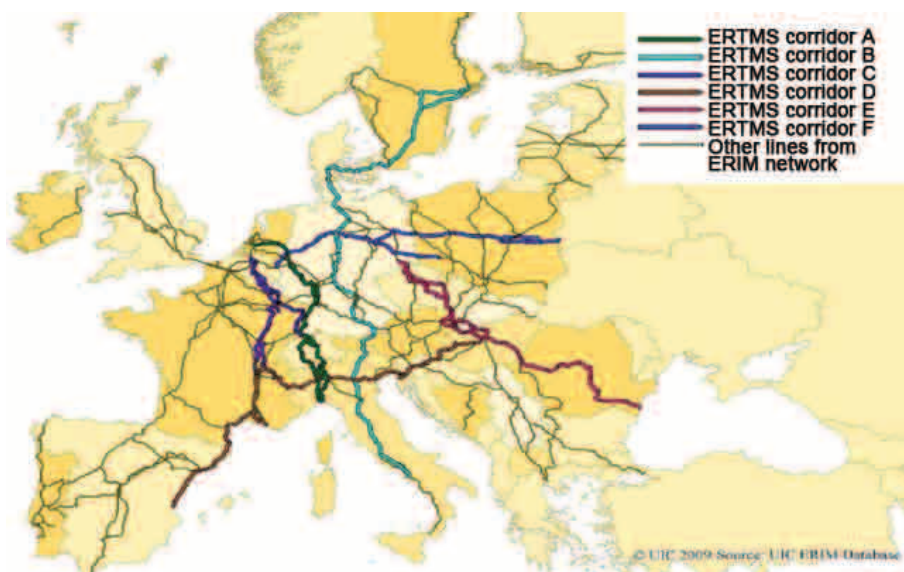
Significant cost savings can be made by implementing a cost-benefit criterion, allowing for the railway noise annoyance correction factor and 100% retrofitting with K or LL blocks. These savings have been illustrated for a 55 dB L_{night} limit applied to six ERTMS freight corridors:

Cost	System
€ 10.8 billion	without optimization
€ 8.6 billion	with cost-benefit criterion (CBC)
€ 5.3 billion	CBC + annoyance correction
€ 3.1 billion	CBC, annoyance correction & retrofitting

NOISE MITIGATION AND COST FOR ERTMS CORRIDORS



THE UIC ERIM NETWORK OF INTERNATIONAL RAIL CORRIDORS



This network is mainly for freight on which a European Rail Infrastructure Masterplan could be built on (UIC Atlas 2008 of infrastructure in the ERIM Network).

ERRAC Noise roadmap

By Christophe Chéron (SNCF)

The European Rail Research Advisory Council (ERRAC) is a European Technology Platform and an advisory body to the European Commission, advising on the research needs of European rail stakeholders. From 2009 to 2012, ERRAC is focusing on concrete and detailed R&D roadmaps to implement the Strategic Rail Research Agenda.

Noise and vibration are the subject of ERRAC Roadmap project WP1 – The Greening of rail transport which was led by Christophe Chéron, SNCF and Stefan Haas, Knorr Bremse AG, railway operators, industry and academic research and universities, with the support of UIC and UNIFE.

“Towards 2030 – Noise and Vibrations Roadmap” is developed along three main domains.

The first domain aims at keeping the acoustic performance of the system (train and infrastructure) throughout its whole life. Promising subjects are the cost effectiveness of solutions for commercial and operational solutions and the monitoring and maintenance of the system vehicle and infrastructure.

The second domain aims at leading to a new breakthrough in noise reduction (minus 5-10 dB or more), by revisiting rolling noise, developing more research on aerodynamic noise, generation and propagation, and through improved prediction methods and design solutions for aero acoustics of high speed trains. It could be possible to target tonal noise, traction noise, equipment noise, screech and squeal, by developing indicators beyond the dB (A) level, by adopting a system approach for noise reduction. All these efforts should be implemented in a demonstrator: Green Silent European Train & Track (Real

train and track where green solutions are implemented and tested in operation).

The third domain considers the improvement of interior acoustic comfort for passengers. By defining estimators enabling to relate the sound intensity to the discomfort/annoyance perceived by passengers, by characterising the background interior noise (comfortable, annoying or uncomfortable), by working on the emerging sounds, by defining physical criteria allowing the specification of various types of sound experiences, research should lead to express the relationship between the perception of vibration and sound in the overall subjective perception of comfort or discomfort and to the development of tools to evaluate the perceived acoustic comfort of users during design and pre-design phases.

Moreover, and it has been underlined by UIC members, an improved communication strategy towards the society will be fully necessary. “Towards 2030 – Noise and Vibrations Roadmap” is available at www.errac.org.

Noise-differentiated track access charging for rail freight to take effect in Germany from 9 December 2012

By Wolfgang Bohrer (DB Netz)

DB Netz AG has decided that a system of noise-differentiated track access charges will be introduced from 9 December 2012, in implementation of its 5 July 2011 framework agreement with the Federal Ministry of Transport, Building and Urban Affairs (BMVBS).

A track access bonus for low-noise wagons will be introduced, providing a financial incentive for wagons to be retrofitted with low-noise brakes (also known as “whispering brakes”). The aim is to achieve a significant and sustained reduction in railway noise between now and 2020.

The noise-differentiated track access charges are made up of two components, and will be funded by a 50/50 combination of a federal subsidy and revenue from the higher fees charged for noisier wagons.

Wagon keepers will receive a bonus calculated on the basis of the mileage run on the DB Netz network by those of their wagons which are fitted with low-noise braking equipment. This applies irrespective of what type of blocks the wagons are fitted with, as long as they meet the requirements of the Noise TSI.

Railway undertakings will have to pay a surcharge for freight services in addition to the track access charges.

Retrofitting can reduce wagon noise emissions by up to 10 dB(A). The cost of fitting LL blocks to the wagons operating on the German network which are suitable for such retrofitting (approximately 180,000 wagons) is over 300 million euros.

DB Netz AG will introduce the new charging regime from 9 December 2012, and is currently working all-out to develop the processes which need to be in place by the time the new system goes live. The design of business processes and the development of the requisite databases are the subject of particular attention.

Keepers will be informed of the financial conditions and other details once the federal government has provided DB Netz AG with the financing guidelines.

Noise differentiated track access charges: Current issues

By Peter Hübner (UIC)

The retrofitting of low noise braking technology to existing freight vehicles forms a key component of the European Commission's preferred strategy for tackling railway noise. Noise differentiated track access charging (NDTAC) (i.e. lower charges for silent vehicles) are proposed to incentivise the investment in quiet technology.

TRANSACTION COSTS TO IMPLEMENT AND OPERATE NDTAC

In the context of retrofitting and NDTAC, three cost elements have to be considered:

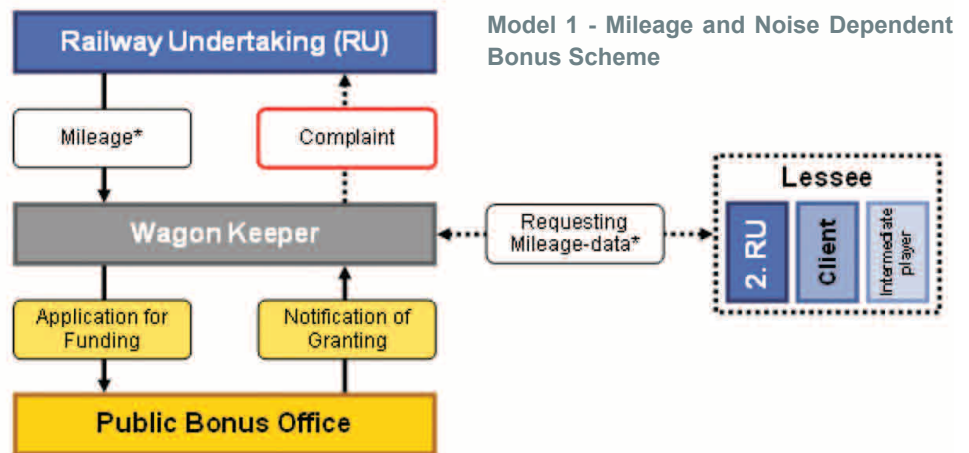
1. The Retrofitting cost itself: Costs to install K/LL blocks. These costs are known and there is a large consensus on their level.
2. The (additional) lifecycle costs of using K/LL blocks: These are known and agreed for the use of K blocks. For LL blocks additional knowledge is needed and should be provided by the EuropeTrain project.
3. Transaction costs to implement NDTAC & forward the bonus/malus on to wagon keepers: These costs are not yet known and there is large disagreement on estimates. To clarify this, the German Rail Sector (VDV, VPI, DB AG, DBSR, AAE), ERFA and UIC commissioned a study, carried out by KCW GmbH (Berlin) and finalised in April 2011. The study is available at UIC's homepage: http://www.uic.org/IMG/pdf/transaction_cost_study_kcw_english.pdf

Four models to incentive retrofitting freight wagons were investigated:

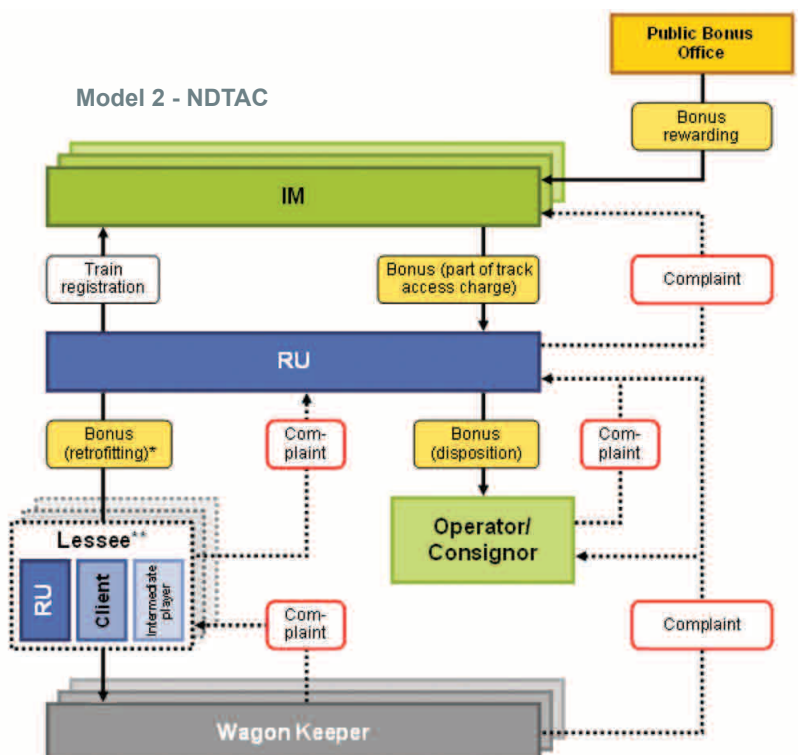
1. Mileage and noise-dependent bonus model (so-called sector model), based on self-declaration using General Contract of Use and National Vehicles Registers data
2. Noise dependent track access charging system using IT-based train path and wagon movement data in three variations: Pure bonus model, bonus/malus-model and bonus model, compensating costs by general increase of TAC

3. Noise dependent track access charging system using RFID in the same three variations.
4. Direct funding

Implementation of NDTAC via these four models, and six additional sub-models, have been analysed. This demonstrates large differences in the complexity of the various models, illustrated in the following two examples:



* Not applicable if wagon keeper = RU
 — Necessary process
 Possible process (dependent on frequency)

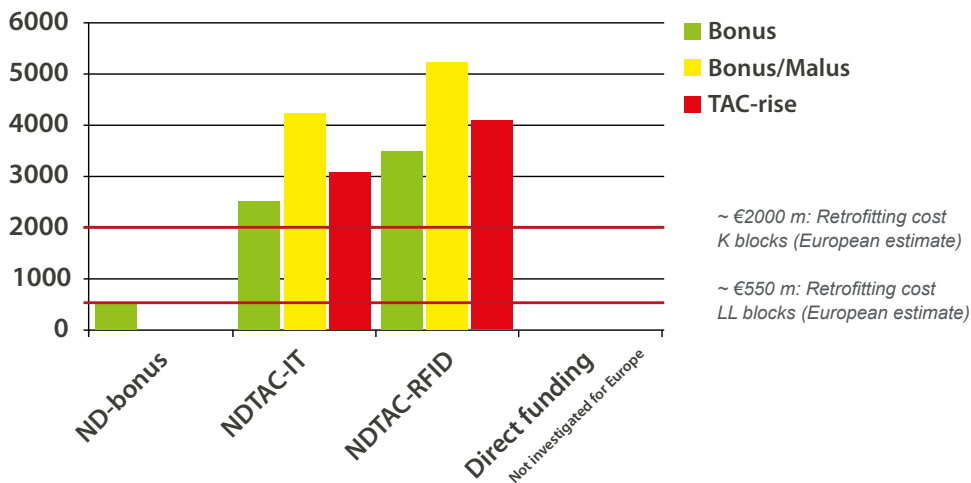


The study analysed the business processes of the involved stakeholders, the identification of the additional processes to implement the NDTAC schemes, the identification of sub processes and the development of a cost model, based on the volume and cost drivers to determine the transaction costs.

The transaction costs have then been calculated for Germany and in addition been extrapolated to Europe. In the following graph the results are shown for a period of 8 years (the study's framework):

It is clear that this thorough and careful assessment of transaction costs has an important bearing on the political decision making process. Especially since, once NDTAC is implemented, the burden of transaction costs may continue even if the whole fleet has been retrofitted.

Extrapolation of results to Europe
All models, transaction costs (€m) over 8 years)



ONGOING PROCEDURES TO IMPLEMENT NDTAC IN THE EUROPEAN UNION

The regulation of NDTAC is envisaged in the framework of the revision of Directive 2001/14, which started with a first reading early in 2011. Within this revision the question of railway noise forms only one (and by far not the most dominant) field of work. At the end of the first reading, the status was as follows: Art 31 asks that infrastructure charges shall be modified to take in account costs of noise by train operation.

The TAC modification shall allow compensation of costs of retrofitting and should not lead to distortion within rail or in competition with road traffic. After a second reading the adoption of the revised Directive by European Parliament and Commission is envisaged in 2012; it might be transferred to national laws in 2014/15. The rail sector has to take note that the European Commission and also some national governments are considering a regulation to forbid the use of wagons not conforming to the TSI Noise limits after 2020 (i.e. ban the use of cast iron brake blocks).

CONNECTING EUROPE FACILITY CEF: A NEW INSTRUMENT MAY SUPPORT RETROFITTING

The European commission proposed in fall 2011 a new integrated instrument for investing in EU infrastructure priorities in transport, energy and in telecommunications, the Connecting Europe Facility with a total budget €50 billion for the period 2014 - 2020. The proposed new instrument clarifies, that (among others) actions, retrofitting of existing rolling stock to reduce rail freight noise is eligible to receive EU financial aid in the form of grants, the funding rate is some 20% of the eligible costs. Proposals may be submitted by one or several Member States, by international organisations, joint undertakings, or public or private undertakings or bodies established in the Member States.

SUMMARY

At the beginning of 2012 the situation can be summarised as follows: NDTAC has already been implemented in the Netherlands and Switzerland, will be introduced in Germany by the end of the year and is likely to be mandated throughout the European Union by 2014/15.

Depending on the form of implementation, NDTAC carries the risk of high transactions costs, which may remain as a burden on the rail sector even after retrofitting is completed. Although it remains to be seen if NDTAC will stimulate retrofitting, the threat to ban cast iron blocks could form a greater incentive. The CEF is the first formal financial support for retrofitting provided by the European Union.

Management of railway noise in the Leiser Rhein

By Dr. Jens Klocksinn (Federal Ministry of Transport) and Thomas Quernheim (Interfleet)

Over the last few years, noise abatement in rail transport has gained significant importance in Central Europe, and has typically emerged as the main obstacle for public acceptance of rail transport. The German government has demanded reductions in rail noise by 50 percent by 2020 from the 2008 levels, even though predictions anticipate the growth of freight traffic in this period.



Source: Dr. Jens Klocksinn

In response to this situation, the Federal Ministry of Transport, Building and Urban Affairs (BMVBS – Bundesministerium für Verkehr, Bau und Stadtentwicklung) launched a pilot and innovative action program in 2008 with the aim of reducing the noise emitted by freight traffic. In cooperation with the relevant ministries and railway industry representatives, this program aims to lay the foundations for the retrofitting of existing freight trains, replacing their current cast iron brake blocks with low-noise composite blocks.

THE PILOT PROJECT “SILENT RHINE”: INVESTMENT SUBSIDIES FOR RETROFITTING

With funding from the German federal government, the pilot project aims to subsidise the retrofitting of up to 5,000 freight train wagons, replacing their cast iron blocks with composite brake blocks (LL and K blocks). Starting in November 2009 still not one single wagon has been retrofitted. The main reason for this is the lack of the final homologation of LL blocks as well as the precondition according the subsidy guidelines with the main focus on transport routes through the Rhine Valley. Wagon owners who are taking the decision to retrofit and who are recipients of direct state subsidy in the pilot project are not in charge of dispatching and transport planning as long as they are not a railway operator as well. Nevertheless DB Schenker Rail had applied for the retrofitting of 1,250 freight cars and the first retrofitted wagon is expected to start operation in late spring/early summer 2012.

NOISE-DIFFERENTIATED TRACK ACCESS CHARGING SYSTEM

The “Silent Rhine” project was intended to be a pilot phase for the latter nationwide and European wide retrofitting of the existing fleet. The chosen instrument for the subsequent retrofitting without direct funding in Germany is a noise-differentiated track access charge scheme (NDTAC).

Part of the Pilot and Innovation Program was to consider the possibilities of the implementation of a NDTAC in Germany. As an important outcome of this in July 2011 the German Minister Dr. Peter Ramsauer and the executive chairman of the Deutsche Bahn AG Dr. Rüdiger Grube signed a memorandum of understanding for the implementation of a NDTAC in Germany in conjunction with the change of time tables on 9 December 2012.

During a period of eight years the German federal government will subsidise the retrofitting with €152 million. It is important to note that additional measures such as operational restrictions or even the banning of noisy wagons at the end, or before the end, of NDTAC is planned in Germany.

LL BLOCKS YET TO BE HOMOLOGATED FOR STANDARD OPERATIONS

In another project called LãGiV (Silent freight traffic with innovative composite brake blocks), which is also publicly funded, five manufacturers of brake blocks and Deutsche Bahn AG are trying to invent new composite brake blocks (K and LL blocks) with a less severe impact on the wheel wear and therefore on lifecycle costs and safety related issues with regard to running stability.

In addition, it is most important that the LL block homologation achieves a positive final result. The safety related issues with the equivalent conicity are well known and well respected and are currently under special supervision in the UIC EuropeTrain project.

It is expected that the timely limited homologation of existing brake blocks will be extended for hopefully two more years and that based on the so far promising results of the EuropeTrain, full homologation by UIC will take place in the first half of 2013.

EuropeTrain – update

By Nick Craven (UIC)

The EuropeTrain Project continues to make good progress towards homologation of low-noise (LL) brake blocks by providing real operational data on equivalent conicity and life cycle costs.

The train completed 13 of the planned 16 runs by May 2012 with a total mileage of some 163,000 km. The runs started from the base at DB Systemtechnik in Minden, visiting Sweden, Germany, France (3 times), Poland (2 times) Slovakia, Switzerland, Italy and Austria to include all climatic, topographic and operational conditions. A second intermediate report examining data from the first ~100,000 km has now been published, these analyses indicate:

- » No safety problems associated with operation of LL blocks
- » Brake block wear varies very strongly between runs loops (e.g. greater wear was observed in Sweden due to the topography in combination with special climatic and operational conditions)
- » More detailed measurements are required to understand the effects on wheel and block profiles for various block shapes and block positions
- » Wagons with equivalent conicity higher than the current limit value of 0,23 can remain compliant with the stability safety limits specified in UIC 518 (although further study is required as some undesirable behaviour was observed)

The final report, analysing data from 200,000 km of runs, will be completed by the end of 2012. Further information is available from <http://EuropeTrain.uic.org>.



5 MAY 2012: THE THIRTEENTH RUN OF EUROPE TRAIN IS SUCCESSFULLY COMPLETED.

On 5 May the EuropeTrain returned to Minden after three weeks and ca. 15,000 km of successful operation in Germany.

After the train left the DB Systemtechnik test centre in Minden on 14 April, it travelled seven times between Minden and Rostock and 11 times between Minden and Ludwigslust (due to construction works). A final cycle led the train through the Rhine valley for a very successful press event with local press in Mainz on 4 May.

Following its return to Minden, the measurements of the wheels and brake blocks will be taken as usual along with subsequent activities.

Train operation will start again at the end of May for the fourteenth run, which will be the fourth and last French Loop, this time with a short side trip for a press event in Luxembourg.