



Effective abatement of railway noise in Germany

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Summary

Many people are exposed to high levels of noise that adversely affect their health and quality of life. Noise is now experienced virtually every-where and around the clock. Therefore, noise is an important environmental issue in Germany and within the EU. Under the Directives on rail traffic across Europe, the EU Commission has established pan-European noise thresholds for new types of rolling stock in the Technical Specifications for Interoperability (TSI). The most important consequence of the noise thresholds is that particularly noisy rolling stock fitted with cast iron block brakes is no longer permitted. The challenge is now to replace these brakes in especially noisy freight wagons in the current rolling stock with quieter braking systems. As a financial incentive for rail operators to refit such rolling stock with quieter brakes, track access charges are implemented in Germany. Additionally, there are a number of technical and legal measures available. The presentation will give an overview on these measures to efficiently abate railway noise in Germany.

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1. Introduction

Environmental noise emerged as an important environmental nuisance causing one of the most common public complaints in the EU. Noise causes health threats, like cardiovascular effects and cognitive impairment and has an enormous negative economic impact. The most important source for rail noise is freight trains that operate around the clock.

Railway traffic has an important function for a sustainable mobility in Germany and Europe. Therefore, it is planned to transfer more traffic from the roads or waterways or aircrafts towards the railway. This is supported both by the politicians and the majority of the people. However, in contrast to that is the enormous ecological "Achilles' heel", the noise emissions. Especially during the nights, the noise impairment is up to 25 dB(A) above the threshold, which is to be aspired in terms of a precautionous health protection of the people. Noise is a frequent reason for complains and of high relevance with respect to any expansion, upgrade or construction measures of railway infrastructure. Along of one of the most used railway corridor Rotterdam-Genoa, the resistance is very high, many people in Germany tried to prevent any more railway traffic in this region and proposed to remove the traffic away from the populated areas.

2. Technical measures to reduce railway noise

Railway freight traffic is mainly because of their braking technology the predominant railway noise issue in Europe, followed by high speed and inner-urban railway lines. The Federal Environment Agency priority recommends measures to reduce noise at the source, i.e. vehicles and tracks, which are more cost-effective and generally more effective. Freight trains still use cast iron brake shoes and are therefore much noisier. Wheel roughness together with rail roughness is the main source of noise in conventional rail, the main cause of wheel roughness being the use of cast iron brakes. This problem is still more urgent considering that these trains often operate at night. It is therefore necessary to replace the iron brakes

by new composite or similar brake shoes ("K-Blocks", for an example see Fig. 1).



Figure 1. Freight wagon wheel with synthetic material brake Jurid 816M.

Further details on the general measures are given by in a position paper on the European strategies and priorities for railway noise abatement [1]. In order to achieve and to maintain smooth wheels and smooth tracks, it is important to monitor the track quality and to regularly improve it e.g. via rail grinding systems. Appropriate maintenance of the tracks and the wheels include vibration isolation and high damping which leads to a reduction of the track decay rate and therefore a minimum of structure-borne noise transmission in the track and the wheels. Technically, this will be achieved for example by smaller wheels supplied with wheel dampers and with optimized wheel geometry. In addition, wheel-mounted disc brakes and rail damping devices reduces noise at the source. Shielding measures like wheel-mounted, bogie-mounted or vehicle-mounted absorber or low noise barriers close to the rail further abates rail noise. Coated wheels will reduce noise by up to 2 dB. The bogie itself is a noise source; there are less noisy bogies available which should therefore be applied. Noise barriers up to 4 meters are efficient; however, due to its vision

impairment they are only in suitable locations a matter of choice. For traction noise, effective engine enclosure and vibration isolation is to be taken into account. Aerodynamic noise can be reduced by streamlined covers for the bogies and a streamlined front of the vehicle. It is to be stated, that the majority of these techniques are already available. However, its implementation cause higher costs for the railway sector, which in fact can lead to unappreciated intermodal effects, i.e. a shift of freight transport toward road traffic. Therefore, the Federal Environment Agency favours economic measures such as noise differentiated track access charges.

In railway traffic, they are raised for the usage of the infrastructure and shall cover the costs of its utilization. They include a mileage component e.g. in terms of track kilometres. Moreover, it is allowed to incorporate the ecological costs. Following that, for less noisy wagons a smaller amount of money is to be paid compared to the common railway traffic. The wagon operator obtains a bonus for less noisier wagons. The required money is raised by the government. In addition to that, a malus is charged by those railway sector members still employing noisy rolling stock. This difference can increase with the taken measures of noise reduction. Noise differentiated track access charges therefore have the potential to stimulate the employment of less noisy wagons, a less noisy way to operate e.g. with speed limits, an acoustically optimized traffic management e.g. via a shift of transports from the more sensible night towards the day. Its implementation follows two different objectives: first the stimulation of less noisy rolling stock, second the internalization of external costs. Due to the polluter pay principle, the polluter is responsible for the covering of the emerging costs by the environmental impairments. Internalization of external costs means that the costs for the communality e.g. due to the loss of value for real estate's or health costs has to be paid by the polluter. Such strategies are of high relevance in the European environment and infrastructure politics in order to change the impairing behaviour. The polluter pays principle should therefore apply to all modes of transport so as to remove current inequalities. At present, prices for more polluting modes unfortunately do not reflect the real costs to society. The external costs of transport, such as air pollution, noise, congestion, accidents and CO₂ emissions, are largely ignored.

These costs urgently need to be internalized in order to achieve a sustainable mobility.

3. Legal requirements to reduce railway noise

In order to address the rail noise problem, noise thresholds were enacted in Europe in 2006 via the TSI Noise [2]. Technical specifications for interoperability (TSIs) mean the specifications by which each subsystem or part of subsystem is covered in order to meet the essential requirements and to ensure the interoperability of the trans-European rail systems. The European Railway Agency (ERA) carried out the full revision of TSI related to Noise. The main subjects were discussed in a working group consisting of the European Member States and guided by the European Railway Agency. Besides the merging of high speed and conventional rail traffic, the assessment of more ambitious and accentuated noise thresholds especially for the passing-by noise level of freight wagons combined with the evaluation of the economic consequences via a cost-benefit-analysis is of major relevance. However, generally still not clarified is the scope of the revised TSI Noise in terms of addressing the existing fleet as these regulations are only obligatory for new wagons, a retrofitting of existing railway rolling stock is not mandatory. As railway wagons are used for up to 40 years, any positive effects are not perceptible in the near future. The Federal Environment Agency of Germany recommends an inclusion of the already employed rolling stock, representing the vast majority of the freight wagons, as this is one of the measurements to be taken in order to tackle the severe noise problems of railway traffic.

4. Conclusions

Rail noise is in particular a problem in Germany. Therefore, it is contrived to restrict the access for noisy wagons or trains on certain sensitive lines and at certain times, especially during the night. A hot spot in this respect is the German Rhine Valley. The prerequisite of such restrictions is a classification and identification of single vehicles according to their noise emission. Moreover, the conditions under which such national restrictions can be enacted have to be clarified with respect to the German and EU Transport Policy goals with

the target of shifting the balance of the modes in favour of rail transport. Furthermore, as such restrictions hinder the free circulation of railway vehicles and are therefore contradictory to free trade; its legitimacy with EU regulations is to be checked in advance. In Switzerland, they proposed a ban of noise freight wagons from 2020 on. However, access restrictions can yield a high level of protection and are efficient to protect the people from rail noise. A further measure is a speed limit, as slower trains are less noisy.

5. Acknowledgements

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References

- [1] WG Railway Noise of the European Commission: Position Paper on the European strategies and priorities for railway noise abatement (2003).
- [2] Commission Decision of 23 December 2005 concerning the technical specification for interoperability relating to the subsystem 'rolling stock— noise' of the trans-European conventional rail system (2006/66/EC) (2006)