Future European noise emission ceilings: Threat or Solution? A review based on Swiss and Dutch ceilings

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Summary

Since 2008, the European Commission recommends Member States to establish noise emission ceilings along their railway corridors. These ceilings should prevent that railway noise will increase due to growing freight transport. This policy instrument is just a rough idea now and it is not clear if (and when) it will be enforced through a directive. However, as the impact of noise emission ceilings on future railway operations could be large, it would be wise for stakeholders to prepare themselves. This paper discusses the pros and cons of ceilings from various points of view, based on experience with Swiss and Dutch ceiling legislation that is in force already.

1 Introduction

Inspite of its environmentally friendly image, rail transport encounters substantial public opposition to noise in some European regions. The European Commission (EC) believes that "if no remedial action is taken, this could lead to restrictions in rail freight traffic along the most important European rail corridors" [1]. A threefold European policy strategy has been unfolded in 2008:

1. Noise-differentiated track access charges (NDTAC);
2. Noise emission ceilings;
3. Voluntary commitments of Member States.

While first instrument (NDTAC) received top priority, the noise emissions ceilings are proposed as a second step. Ceilings are required "in order to maintain the noise reduction achieved by retrofitting", because ortherwise the desired growth of rail freight transport would again lead to more noise. So far, these

ceilings are not more than a conceptual policy proposal described in only half a page. However, if this non-committal recommendation is widely ignored, the EC may decide to develop compulsory legislation (a Directive).
The Commission's interpretation of 'emission ceilings' is based on particular Swiss and Dutch regulations. If Swiss and Dutch ceilings will appear to be successful tools to control noise growth, this would certainly motivate the EC to develop an Emission Ceilings Directive. It will therefore be interesting to describe and compare the ceilings in these countries.

The purpose of this paper is to inform railway stakeholders of the ins and outs of emission ceilings, to explain the difference between ceilings and limits and to show the differences of the concept of ceilings in Swiss and Dutch legislation. It will be demonstrated that the effects of ceilings largely depend on how the instrument is tuned and how flexible a ceiling is, on procedural burdens and on responsibilities of the parties involved. It is left to the reader to decide whether emission ceilings are a blessing or curse for the railways and for the residents.

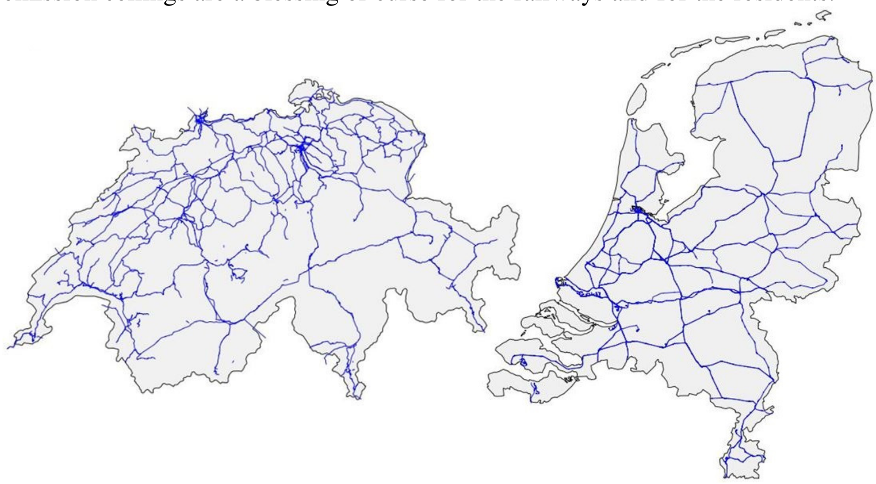

Fig. 1. Swiss and Dutch railway networks. Countries drawn to scale.

2 Emission ceilings and reception limits

It is important to understand the difference between noise emission ceilings and reception limits. Noise reception limits are a national or local matter and they serve as protection against excessive noise levels near dwellings [2]. The World Health Organization has published certain target noise reception levels [3,4], but it is considered disproportional and impracticable to establish mandatory reception limits in the EU [5].

Emission ceilings set limits to the emitting sources (track and train), not to the level at the façade of dwellings, see Fig. 2. Relative changes to the source lead to corresponding changes at the façade of dwellings. By monitoring the emission of the source and comparing this level to a certain pre-set maximum, i.e. the ceiling, it is possible to detect locations where noise has been growing and action may be required. According to the EC, it would be a task for the rail sector "to find optimal solutions" to avoid exceeding of the ceiling. Thus, a system of noise emission ceilings is a trigger for action and an incentive for (possible) source measures. It is not meant as an alternative for the existing national noise legislation.

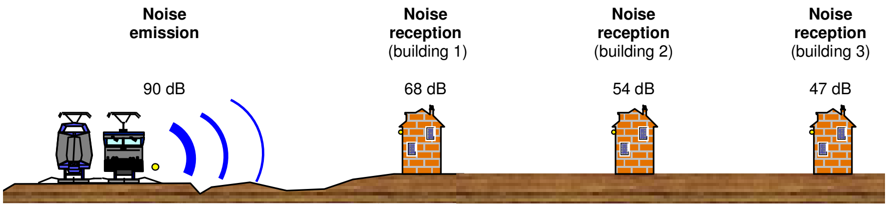

Fig. 2. Emission level and reception levels.

As railway noise emission depends on many parameters, such as type of rolling stock, local speed, type of track superstructure, the emission will vary along the network. If emission ceilings are introduced as a way to control noise growth, there is no need to establish one fixed ceiling level along the network.

The height of a noise ceiling (in terms of decibels) can basically be chosen relative to the present source emission level or based on the future traffic situation.

3 Experience with emission ceilings

3.1 Switzerland

The Swiss abatement programme, started in 2000 is based on emission ceilings for the railway network, called Emission Plan 2015. Distinct ceilings are defined at about 6 600 track sections of variable length (between 1 meter and 20 km) along the entire railway network (3700 km). The Swiss ceilings are monitored by a combination of measurements and calculations [6]. The measurements, carried out continuously with six fixed systems and a few mobile systems, see Fig. 2, mainly aim at monitoring the progress of the vehicle retrofitting programme. Additional calculations are required to check if the actual noise emission on the whole network is still compliant with Emission Plan 2015. This task has not yet been completed. A huge noise abatement programme, with façade insulation and noise barriers, was based on the predicted noise situation of 2015. This programme is nearly finalized.

If the ceilings are exceeded in the long term, the infrastructure manager is responsible for further noise abatement. The track section under consideration is then treated as a track being upgraded and (possible) noise measures are taken near dwellings in accordance with the legal cost-benefit scheme. The legal framework for this intervention is laid down in article 37a of the Swiss Ordinance on Noise Protection [7]. At present, the ceilings of Emission Plan 2015 are not restrictive for railway operations. On most locations the measured levels are a few decibels below the ceiling levels, providing headroom for traffic growth.

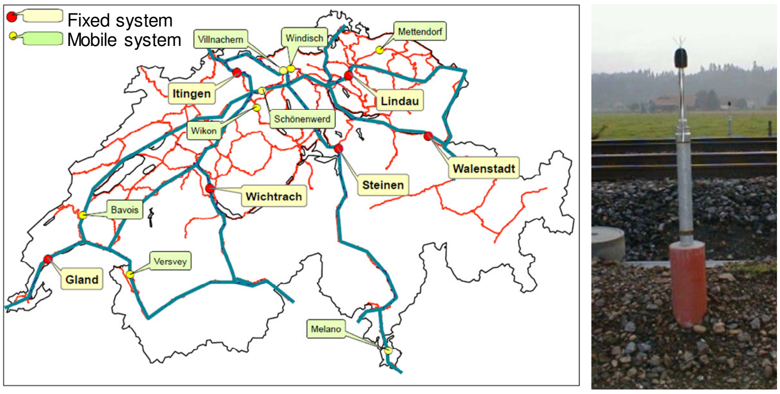

Fig. 3. Fixed and mobile measurement sites on the Swiss railway network.

3.2 Netherlands

The ceilings in the Netherlands are established at reference points at 50 m distance from the tracks, 4 m above the ground, see Fig. 4. These virtual points are spaced by 100 m. This way, the 3 000 km long Dutch network features 60 000 reference points, see Fig. 5.

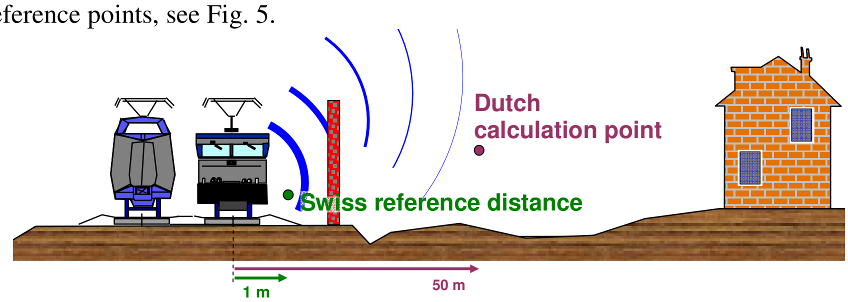

Fig. 4. Position where the ceilings are defined.

When the ceilings were adopted in legislation on July 1st, 2012, the ceilings were fixed at 1.5 dB above the current[1] noise level at each reference point. In some cases the ceilings were fixed at the situation expected in the near future. The actual noise impact at these points is monitored every year by calculation. If ceilings are exceeded or if a permanent capacity increase is expected, the track section under consideration is treated as a track being upgraded and (possible) noise measures are taken near dwellings in accordance with the (already existing) national cost-benefit scheme. Source measures like rail dampers and acoustical

[1] The 'current noise level' has been defined as the average level over 2006, 2007 and 2008.

grinding are stimulated by the fact that the procedural workload is less heavy compared to noise barriers.

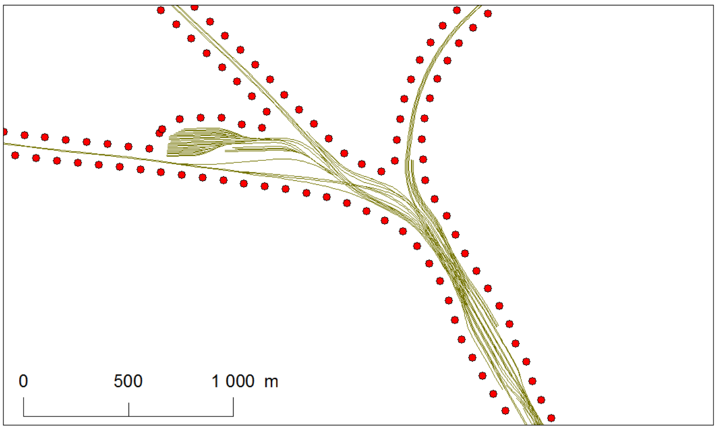

Fig. 5. Reference points at 50 m from the outer tracks near Utrecht station (NL).

The initial height of the ceilings, featuring a headroom of 1.5 dB, has been chosen after a number of assessment studies between 2005 and 2008. The assessments concentrated on long-term and short-term bearability of different headroom settings. The long-term effects refer to financial aspects for measures and incentives for retrofitting. The costs of the ceiling system in the long run are compared to the base system (no change of legislation). The short-term effects relate to operational consequences (network capacity, annual time-table).

The noise ceiling level as well as the actual annual level are calculated in a computation model where buildings and other reflective structures than noise barriers are left out deliberately. This is done for technical and administrative reasons. For the purpose of triggering noise growth this simplification is allowed.

The ceilings are not inflexible. If traffic grows, the local ceiling level can be increased, in case noise reduction measures are less cost-effective than façade insulation, or decreased, after noise barriers have been installed. Naturally, the exceedance of ceilings in areas without any dwellings does not require noise measures.

The development of the ceiling system in the Netherlands took about 15 years from initial idea to legislation. After the decision was made to implement the system (around 2006), the remaining time was used to acquire more accurate traffic and superstructure data, to develop software tools, to set up a ceiling adminstration, to implement independent inspection and to reform the infrastructure manager's process of traffic capacity allocation.

3.3 Comparison

The Swiss ceilings are defined in a fairly simple way. Ceilings are guarded using measurement stations, but the main purpose of these stations is to obtain an overview of the progress on retrofitting noisy wagons. The Dutch ceilings are very detailed and serve as a warning system: they ensure that local reception limits will not be exceeded without noticing.

Neither in Switzerland nor in the Netherlands the introduction of emission ceilings required a change of noise reception limits. The limits in these countries were established many years before the ceilings were effectuated.

At present, the ceilings of Emission Plan 2015 are not restrictive for Swiss railway operations. In the Netherlands the ceiling headroom of 1.5 dB seemingly allows for traffic growth by 41%, but as operators run silent as well as noisy trains, a slight change of train operations could already cause problems (for example exchanging rolling stock types between two service connections). The Ministry may grant temporary exemptions in such cases.

While in Switzerland the monitoring of ceilings was initially based on measurements alone, to be followed by network wide calculations later on, the Dutch decided to start off with calculations and to develop a measuring strategy later. The task of conducting noise measurements is given to executive agencies, independently of the railway infrastructure manager: BAV in Switzerland, RIVM in the Netherlands.

The idea to introduce ceilings in the Netherlands is developed by environmentalist and by the railway sector together. The advantage for the railway sector is that under the new law a small change in the track lay-out does not require lengthy noise procedures as long as the local ceilings are respected (for example by installing rail dampers). The advantage for the environment is that the ceilings prevent gradual year-by-year noise growth. Given the short period during which the law is in force, it is too early to evaluate whether these expectations have been fulfilled. For the Swiss ceiling instrument and the corresponding remediation programme, which is operational for over ten years, it can be concluded that large noise reductions have been achieved at national rolling stock and infrastructure. On many lines, the remediation programme offered perspectives for future increase of railway traffic.

4 Pros and cons of ceilings

4.1 Why ceilings anyway?

Recent inventories show that all EU Member States as well as candidate countries have established noise reception limits to protect residents against excessive noise. However, the effectiveness of these reception limits is largely determined by the legal necessity to verify the noise levels against the reception limits. Countries where procedures for urban planning (new dwellings, new railway lines) include stringent noise assessment procedures will be able to provide better protection than countries where action plans under the END and complaints by annoyed citizens are the main incentives to improve the noise situation. But urban planning procedures and action plans are not suitable to handle steady noise growth due to slowly increasing rail traffic as a result of economic growth. This is the main reason to implement the instrument of emission ceilings.

4.2 How can ceilings be successful?

The potential success of ceilings will depend on many things, for example:

- the ‘headroom’ between the current level and the ceiling;
- the reception limit system by which the ceiling system is backed;
- the separated responsibilities of the authorities and bodies involved;
- the legal flexibility to deal with temporary trespassing;
- the procedural and administrative burden related to ceilings;
- the ability to stimulate retrofitting freight with LL blocks;
- the reliability of the system in the eyes of the resident;
- the effect on costs for abatement measures.

It is also important that the authoritities as well as the railways are really committed to make this move. Because a (partial) revision of the national noise regulations is required to introduce ceilings, this would also be the right moment to repair failures in the existing legislation and procedures. The ceiling instrument potentially provides sufficient opportunities for future development of the rail sector.

4.2 What costs are involved?

Also the cost of a ceiling system need consideration. In the Swiss case, the abatement programme that was launched together with the ceiling plan, costs approximately 1,5 billion CHF [8]. The cost related to development of the ceiling administration and the annual noise monitoring are additional. In the Netherlands, where the ceiling levels were based on the present levels, several studies showed a short term cost reduction instead of a cost increase. This was a result of the fact that planned infrastructure reconstruction projects would benefit from the headroom of 1,5 dB. In the long run costs for extra noise measures would probably increase, unless traffic emissions will decrease because of retrofitting with LL blocks.

If the infrastructure manager is given sufficient influence to cope with the ceilings, this instrument could stimulate retrofitting and thereby reduce costs for track-related measures.

5 Conclusions

Two countries have developed a concept of noise emission ceilings. These countries do so in a very different way, but there are also similarities. The EC idea of noise emission ceilings has been based on these examples. The Swiss ceilings are defined in a fairly simple way. Ceilings are guarded using measurement stations, but the main purpose of these stations is to obtain an overview of the progress on retrofitting noisy wagons. The Dutch ceilings are very detailed and serve as a warning system: they ensure that local reception limits will not be exceeded without noticing.

The European policy instrument of noise emission ceilings for the railways does not necessarily interfere with existing national noise legislation. Because the concept is not yet very specific, it is currently not possible to take a position. However, if ceilings are introduced as an incentive for retrofitting freight wagons, there is a short term need for implementation.

A system of noise emission ceilings can be supportive to keep railway traffic viable and competitive in the future, but the Dutch case shows that the workload to set up a very detailed system can be considerably. The Swiss case shows that if ceilings are combined with noise abatement, the cost can be huge. The advantage for the line side residents is that ceilings prevent railway noise to grow continuously. The advantage for the railways is that they should be able to (partly) use the extra noise capacity, that is released by retrofitting with LL blocks, for future growth. The advantage for the government could be a reduction of cost for track-side noise measures. For this to come true, the ingredients that make up the ceiling system must be balanced properly.

This article is based on the findings of an assessment study on ‘Bearable Noise Limits’ commission by the International Union of Railways (UIC), conducted in 2010 and 2011 [9].

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