Noise mitigation of rolling stock

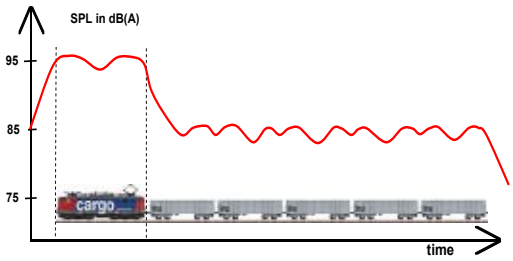
Locomotives SBB Re 620 and Re 420

Costumer Requirements

In Switzerland the entire rolling stock of wagons is refitted with regard to noise reduction within the next few years. The noise emission of passing trains now is dominated by older locomotives which will be kept in operation for still some time. To reduce railway noise these older vehicles should be noise mitigated within the context of a refit too.

Solution

It is important to note that the selection of measures to achieve noise abatement vary from measures needed e.g. to achieve weight reduction. A sufficient weight reduction of a vehicle can be obtained linearly with every kilo saved. The sound level [dB] is defined by the logarithmic ratio of sound pressures [Pa], as shown in the chart above. A physical doubling of the sound implies a 6 dB increase of the sound level. However, the smallest audible difference of sound level man can discern is 3 dB and in terms of perceiving a doubling 10 dB. Unlike weight, the overall sound level of a vehicle is derived by adding the sound pressure levels of all sound sources via energetic sum. The sound source with the highest sound level is dominating and should be reduced mandatory.
In the range of 50 to 200 km/h, the railway noise is emission dominated by the rolling noise. Thereby, the rough wheel treads of old vehicles, caused by cast-iron brake blocks, generate especially high noise emissions. With modern and innovative friction materials, the rolling noise can be reduced by 10 dB. This would allow to reduce the noise level of locomotives to the one of retrofitted wagons. From the acoustical point of view a measure close to the sound source is defined, what now has to be realised in the context of modifications on rail vehicles. Modern friction materials cause a high thermal load to the wheel which can produce wheel cracks or wheel fractures in the worst case. To avoid wheel defects - brake forces and other parameters must be dimensioned properly. To implement measures as efficient and as simply as possibly into the existing construction environment of a vehicle is decisive for successful noise mitigation refits.



Costumers Advantage

Noise abatement on existing rolling stock needs interdisciplinary technical skills. Acousticians do define the physical properties of sound generation and optimal mode of action of measures. Experts of rail vehicle engineering, especially in the field of bogie design and brake system, do develop refit concepts according to operational requirements. Engineers of PROSE cover all these expertises to realise refit solutions with favourable cost-benefit ratio.

Factsheet 7.00046

Details

Project Information

- Customer: BAFU Budesamt für Umwelt
- Period: 2008 - 2010

Projectpartner

- SBB Schweizerische Bundesbahnen
- BLS Lötschbergbahn AG
- SOB Schweizerische Südostbahn AG
- SZU Sihltal Zürich Uetliberg Bahn AG

Project Content

- Selection of vehicle types and illustration of noise reduction possibilities
- Procurement of all necessary engineering drawings of the braking systems
- Selection of suitable new friction materials
- Dimensioning of brake system; verification of stopping distance and braking energy
- Estimation of costs for upgrading of prototypes and entire fleet
- Prototype test proposal

General Procedure

- Only measures at the dominating noise sources are of benefit.
- Therefore, the dominant sources and their contribution to the total level have to be established.
- Estimation of the effects and interaction of other noise sources
- Development of technical and operationally feasible measures with the best cost-benefit ratio.
- Validation of the noise reduction by suitable measurements

Project responsibility

Dr. Christian Czolbe
Tel. +41 52 262 74 40
Fax +41 52 262 74 01
christian.czolbe@prose.ch

PROSE Ltd.
Zuercherstrasse 41
8400 Winterthur
Switzerland
Tel. +41 52 262 74 00
Fax +41 52 262 74 01
www.prose.ch
info@prose.ch