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ECONOMIC STUDY ON RAILWAY NOISE: ENVIRONMENTAL IMPACT OF DIFFERENT LEGISLATION SCENARIOS

F. Elbers, P. Van Der Stap

NS Technisch Onderzoek, Concordiastraat 67, 3551 EM, Utrecht, Netherlands

Tel.: +31 30 2358128 / Fax: +31 30 2359150 / Email: f.b.j.elbers@geluid.nsto.ns.nl

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ABSTRACT
This paper presents the results of the EU/ERRI sponsored project Economic study [1] for Silent Track, Silent Freight and Eurosabot. These Brite Euram projects have resulted in several noise reducing measures. The focus of this article is on the environmental impact of three different legislation scenarios. Each scenario gives results of up to seven different combinations of source reducing variants. Additional to a reference situation the variants. Within the Economic study the effectiveness of these measures is tested by applying them for a single European freight transit line from Rotterdam to Milano. The calculations are undertaken with the special purpose GIS Eurano99. The impact is expressed in length of noise barriers, number of insulation's of houses, number of wagons to improve and length of track to improve. The cost of the measures are calculated in Euro and are based on average prices.

1 - INTRODUCTION
Transport policy tend towards an increase of rail transport. There is a need for (a more stringent) noise legislation because of a growing awareness of local communities to railway noise. When noise legislation is being enacted the cost for noise measures becomes a major economic factor for the railways. Optimization of noise control will lead to an increase of large scale environmental benefit and a decrease of cost for noise measures.
Noise control measures were studied in three research projects within the EU Brite Euram program: (1) Silent Freight and (2) Silent Track for development of new technologies for low noise freight wagons and railway infrastructure and (3) EuroSabot for Sound Attenuation By Optimized Tread brake.
Within these projects railway companies, research organizations, supplying industry and governmental bodies worked together to find a number of new noise reducing measures. Measures that came out of these studies are tested in the Economic study.
The focus of this article is on the environmental impact of three different legislation scenarios. In [2] results of this study are presented with the focus the effectiveness of different source reduction configurations. [2] gives a more detailed description of the seven different combinations of source reduction variants. This article will only summarize these different combinations:

- 0 dB(A) reduction for the reference situation without any additional.
- 5 dB(A) reduction for the brake block solution.
- 6 dB(A) reduction for the low cost retrofit solution.
- 7 dB(A) reduction for the advanced retrofit solution.
- 10 dB(A) reduction for the maximized retrofit solution.
- 8 dB(A) reduction for the new track solution.
- 18 dB(A) reduction for the maximized new track solution.

Noise calculations are undertaken with Eurano99: A noise policy tool for monitoring and prediction of large scale impact of railway noise [3].

2 - NOISE LEGISLATION SCENARIOS

This study will test the effect of three noise legislation scenario for (almost) each of the source reduction variants:

- No additional barriers.
- Additional barriers above a 65 dB(A) threshold limit for houses in urban areas and (optional) window insulation for houses in rural areas.
- Additional barriers above a 55 dB(A) threshold limit for houses in urban areas and (optional) window insulation for houses in rural areas.

Noise reception values (L_{den}) are tested for the traffic flow in the year 2005.
There is made a distinction between additional measures for houses in urban and rural areas because of efficiency reasons. Noise barriers need to be placed along a relative large part of the line to reduce the noise for one building. In rural areas only a small amount of buildings will profit from the noise barrier. However in urban areas their is a large group of buildings who will profit from this barrier. A description of the method is given in [4].

3 - CALCULATION OF COST AND NOISE IMPACT

Additional to the results presented in the report [1] calculation of cost is undertaken in three different ways:

- Investment cost: The initial amount of money that is needed to change rolling stock and place barriers and window insulation. These cost do not account interest, depreciation and maintenance.
- Capitalized costs: All costs arising during a defined number of years are added together
- Net present value: The initial amount of money necessary to pay for all costs arising during a defined number of years. Money that is not used right away earns interest, therefore less capital is required for investments which occur later on (replacement).

The main results (cost and noise impact) of the economic study presented in three different cost units are given in figure 1. Every noise reduction variant has a different dot and dots valid for one legislation scenario are bounded in one box. The noise impact is expressed in total number of people annoyed. A dose-responds function is used to calculate a weighted total of people annoyed.

4 - CONCLUSIONS

The economic study for railway noise results in the following major conclusions with respect to the environmental impact of three different legislation scenarios:

- Limit threshold values is effective to limit to number of people annoyed by railway lines.
  - Without threshold values the number of people annoyed (per km) will vary between 150-320 along freight lines.
  - A threshold value of 65 dB(A) will limit the number of people annoyed (per km) to 90-120 along freight lines.
  - A threshold value of 55 dB(A) will limit the number of people annoyed (per km) to 25-45 along freight lines.
- Without a noise legislation and without noise measures 95 % of the people annoyed live in urban areas.
- Limit threshold values is will mainly reduce annoyance in urban areas. Below given range indicate the difference between with and without source measures.
  - A threshold value of 65 dB(A) will limit the number of people annoyed in urban areas with about 70 % and in rural areas with about 10-30%.

  - A threshold value of 55 dB(A) will limit the number of people annoyed in urban areas with about 90 % and in rural areas with about 30-40%.

- Limit threshold values will increase cost for railways significant.
  - Without threshold values the cost for noise measures (net present value) will vary between 0-1.600 million Euro per km.
  - A threshold value of 65 dB(A) will force cost for noise measures between 750-1.600 million Euro per km.
  - A threshold value of 55 dB(A) will force cost for noise measures between 1.500-2.800 million Euro per km.

- Noise barriers and track improvement take 80-100 % of the cost for noise measures when noise reception threshold values between 65 and 5 dB(A) are within the legislation.

- For a legislation with noise reception threshold values source measures will reduce cost and annoyance.
  - A threshold value of 65 dB(A) will reduce cost with 19 % and annoyance with 15 %.
  - A threshold value of 55 dB(A) will reduce cost with 11 % and annoyance with 31 %.

- Main results are not influenced by different cost calculation methods: net present value, investment cost and capitalized cost.

- A scenario with a more efficient freight transport by rail will need less wagons (to be improved) and will further increase total cost reduction for measures on freight wagons.

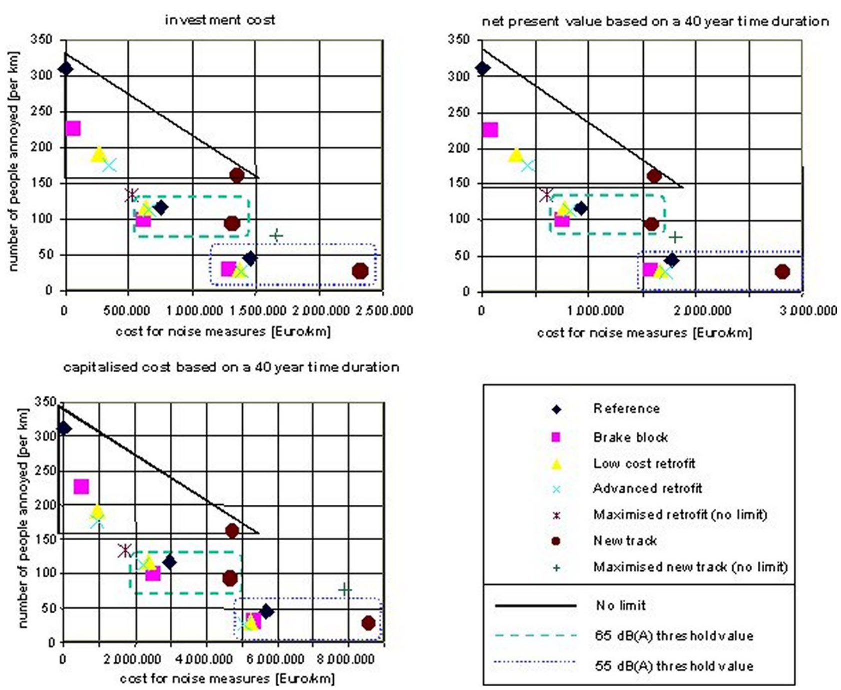

Figure 1: Main results (cost and noise impact) of the economic study presented in three different cost units.

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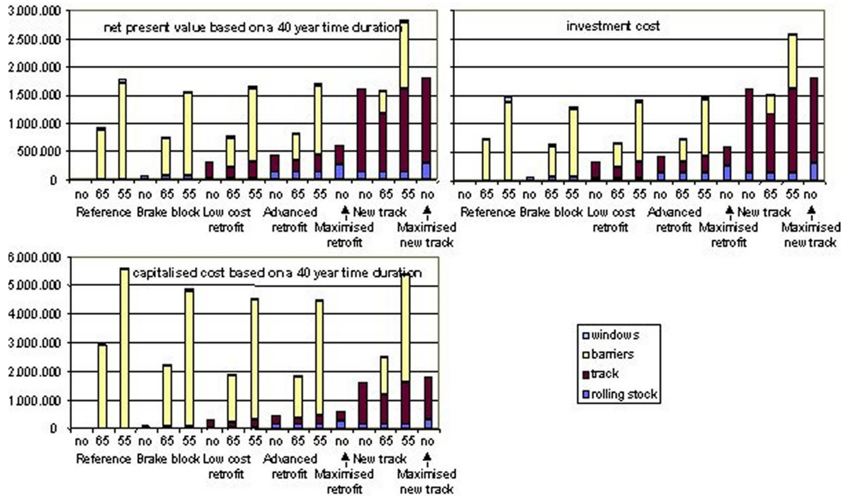

Figure 2: Cost break down for noise measures of the economic study presented in three different cost units.

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