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ScienceDirect

Transportation Research Procedia 14 (2016) 830 – 839

Transportation Research Procedia

www.elsevier.com/locate/procedia

6th Transport Research Arena April 18-21, 2016

Defining road and rail vehicles with a low environmental footprint

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Abstract

Determining the environmental footprint of heavy vehicles and limiting this footprint is a complex task that requires the involvement of all stakeholders. The ongoing Ecovehicle project that is summarized in this paper demonstrates that the footprint of heavy vehicles can be quantified. It was shown that in each vehicle category there are those with a high total footprint indicating a large difference between vehicles in every category and a high potential for improvement. A recent study in Switzerland has calculated the external costs of the four modes of transport, to be over CHF 9'400 million for 2010. It was shown that most of these costs are not recovered. Considering the external cost of freight transport, the report shows that the freight traffic cost 7.1 Rp/tkm of which 4.4 Rp/tkm was internalized through the heavy vehicle fee (LSVA), implying in turn that 2.7 Rp/tkm was not recovered by the fee. The external cost of rail on the other hand was 2.8 Rp/tkm, air freight 7.6 Rp/tkm whereas the cost of ship transport on the Rhein was 0.5 Rp/tkm. Promoting ecofriendly vehicles however requires the introduction of incentives, and bonus-malus systems Europe wide. Data quality is of particular importance when comparing the environmental effects in different European countries. The data reported here, the external costs as well as the incentives discussed are from Switzerland however, the general conclusions can be extended to all modes of transport and other countries as the results are universal.

Peer-review under responsibility of Road and Bridge Research Institute (IBDiM)
Keywords: Transport Footprint; noise; WIM; pollutants; bonus/malus

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Peer-review under responsibility of Road and Bridge Research Institute (IBDiM)
doi:10.1016/j.trpro.2016.05.031

1. Introduction

Road and rail infrastructure comprise an important asset of any country and a vital contributor to its economy and society. The ongoing Eureka European cooperative project Ecovehicle E!7219 (www.eureka.be) addresses various options to reduce the impact of road and rail vehicles on the infrastructure and the environment.

The interaction between a vehicle and its infrastructure be it road or rail is very non-linear and can increase up to the 4th power of the axle load for road vehicles. For rail vehicles operating on poorly aligned track, unloading on one wheel can lead to overloading up to 60%. With improved technical standards it is a timely topic to discuss options to reduce this disproportionate damage to the infrastructure considering also policy options. Many countries have policy in place to limit such damage through track access or road usage charging. In the light of ever increasing volumes of transit traffic, it is therefore important to reduce damage to the infrastructure and that of the infrastructure to the vehicle by minimizing the static and dynamic interaction between these two components. Noise generation is one of the most important factors limiting the capacity of the EU's transport. This has been the subject of the EU's noise directive (2002/49/EC) and also the EU's greening transport package (MEMO/08/492 08/07/2008) in which the idea of a bonus/malus incentive was described. As noise arises from the interaction of a wheel/tyre with its infrastructure, this paper will review cost effective solutions for both road and rail modes and the role of regulation and incentives. To initiate the transformation to low noise rail vehicles, a bonus system has been introduced in some countries for vehicles equipped with low noise (composite) brake blocks. In addition a further bonus has been introduced for braking on discs rather than on the wheel tread. Options for a bonus/malus system for quiet road vehicles will be discussed subsequently.

There is a need for stabilizing the world's carbon emissions by 2020 and then to decrease these by a minimum of 3% each year up to at least 2100 (5th IPCC assessment report). In addition in many cities and along traffic corridors, WHO guidelines are exceeded for pollutants like PM10, SO_x and NO_x. Pollutant emissions of heavy duty road vehicles were drastically reduced in the last years which will lead to reduced pollutant emissions as these vehicles are penetrating the fleet due to the introduction of low emission engines. The political focus will therefore change from local pollutants to the globally relevant greenhouse gas emissions. The reduction in gaseous emissions will be reviewed against a background of rising energy prices, increased societal concern about pollution, EU regulation and legislation and industrial initiatives and what options exist for further reductions in emissions.

A case study from Switzerland will be presented where in situ measurements have shown that no vehicle class is particularly damaging to the road or the environment. It was shown that in every vehicle category there are those with a low and those with a high overall footprint. Therefore the need for incentives to encourage the vehicle with a low overall footprint and discourage those with a high footprint is paramount. The data reported here, the external costs as well as the incentives discussed are primarily from Switzerland however, the general conclusions can be extended to all modes of transport and other countries as the results are universal.

Nomenclature

WIM	weight-in-motion
LSVA	Swiss heavy vehicle fee (HVF)
WHO	World Health Organization
HDV	Heavy duty vehicles

2. Cooperative project Ecovehicle

The European cooperative project Ecovehicle (E!7219) is a follow up of Eureka Logchain Footprint (E!2486) that has been successful in developing methods to identify environmentally friendly vehicles for road and rail transport modes (www.eureka.be, Poulikakos et al. 2009, 2010, 2013, Mayer et al, 2012). The footprint of vehicles was defined as dynamic load, noise, pollutant emissions and vibrations. Footprint monitoring sites were installed in Switzerland and other partner countries in order to measure the footprint of passing vehicles using innovative techniques. It was