

Subject : Labelling road surfaces - numerical substantiation

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To : Stakeholders labelling road surfaces

Date : 29-07-2016

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Starting points:

- Labelling is a method to encourage progress.
- Stimulation:
 - At present, approximately label F/E;
 - In the short term potentially to label D/C by smart contracts of the client;
 - In the medium term (5-7 years) label B possible;
 - In the long term (7-10 years) label A possible.

How does it benefit the society?

Road surface labels stimulate the road construction industry to optimise road surfaces when it comes to (1) rolling resistance and CO₂ emissions, (2) wet skid resistance, (3) noise and (4) lifespan. Successively, a numerical basis is given for these parameters, which could potentially result in road surface labelling.

Rolling resistance and CO₂ emissions

Road surface labels can stimulate the decrease of rolling resistance of road surfaces. Earlier research conducted by Rijkswaterstaat and the Province of Gelderland shows that a rolling resistance improvement of approximately 10% to 30% is possible - see figure 1. This means that fuel savings of 2% to 6% can be achieved by optimising the road surface for rolling resistance.

In 2015, approximately 12 billion litres of fuel was used for road transport in the Netherlands (CBS). An average fuel savings of 4% would thus mean an annual saving of 488 million litres of fuel. In addition, approximately 2.23 kg of CO₂ is released per liter of fuel. Annual savings of 488 million litres could therefore yield an annual saving of 1.08 billion kg of CO₂.

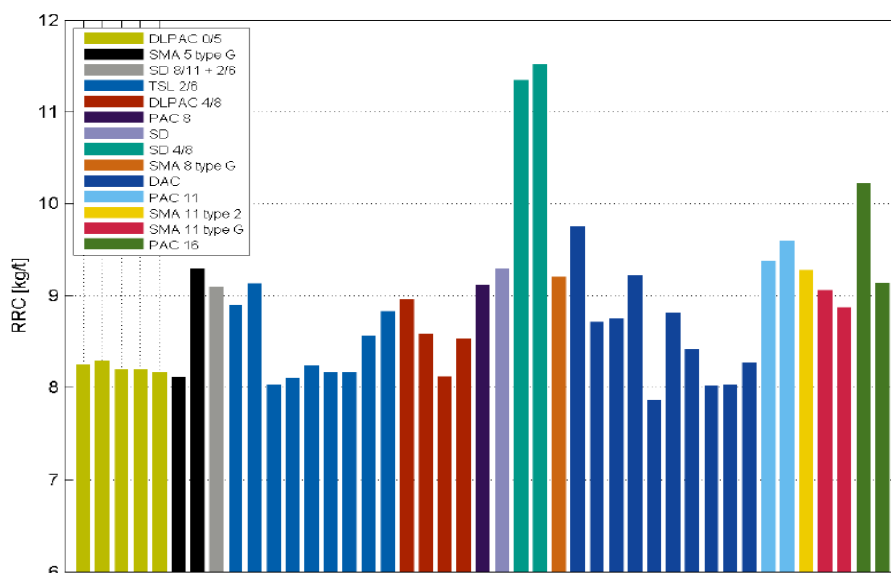


Figure 1: Rolling resistance coefficients for the roads in the province of Gelderland

Skid resistance

Research conducted by SWOV (Foundation for Road Safety Research) and KOAC-NPC shows that the risk of accidents at low skid resistance is about 2 to 5 times greater than for proper skid resistance (although a large variation was found) - see figure 2. For example, the number of accidents per million kilometres on motorways on the main road with porous asphalt (AW HR ZOAB) at a skid resistance of 0.30, is three times as high as it is at a skid resistance of 0.60 (0.3 accidents per million vehicle kilometres versus 0.1 accidents per million vehicle kilometres).

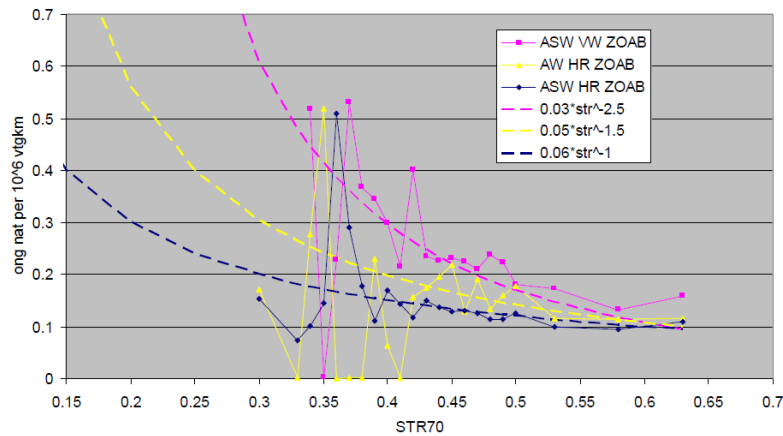


Figure 2: Number of accidents per million kilometres (ong nat per 10⁶ vtgkm) at various levels of skid resistance (STR70)

Each year, people in the Netherlands drive approximately 146 billion kilometres, resulting in approximately 720 fatalities, 18,600 serious road injuries and 108,000 minor injuries (treated in the hospital), see table 1. Annually, this is a cost to the Netherlands of about 8 billion euros (2012).

Table 1: Number of road accidents and costs per category

Slachtoffercategorie	Aantal slachtoffers	Kosten	Kosten per slachtoffer
Verkeersdoden	720	1.880	2,612
Ernstig verkeersgewonden	18.600	5.213	0,281
Lichtgewonden (behandeld in het ziekenhuis)	108.000	932	0,009

At the same time, this is considerably better than the neighbouring countries, due to the fact that the Dutch requirements are higher than the requirements in some neighbouring countries.

To date, there is no direct relationship in absolute terms found between the skid resistance of a road surface and road accidents. However, from the aforementioned studies it appears that there is indeed some kind of relationship and that the social cost of road accidents is a significant cost to the Netherlands and that much can still be achieved on this item.

Noise

Traffic noise is still a major source of nuisance and health problems. Research (including by M+P) shows that society has about €25/dB(A)/household left to live in areas with less noise. To reduce this traffic noise, European directives exist relating to the assessment and management of noise. Road surface labels can stimulate the development of road surfaces with a low noise level. Although this is a topic in which considerable research has already been conducted, it still seems possible to take steps forward.

At present there are approximately 400 km of noise barriers to protect against tyre-road noise. If noise screens must be increased by one meter (to achieve the noise targets), this will cost society 400 million euros (1m higher per meter costs about €1,000). If due to technical reasons it would not be possible to increase the sound barriers, and all screens are to be replaced, the costs will rise to about 1.2 billion euros (replacing noise barriers per meter completely costs about €3.000). Source: Dutch foundation noise nuisance.

In addition, road surface labels optimise the tyre-road interaction so that less visually unattractive noise barriers have to be placed. The previous research, Stil Veilig Wegverkeer (Silent and Safe Road Traffic), showed that through an optimal tyre-road combination, approximately 9 dB(A) noise reduction can be achieved compared to a standard tyre and a standard roadway (research M. Bezemer, University of Twente).

From the medical environmental science, the GES method (health effect screening) was developed to identify health effects of noise pollution. With this method, health scores can be awarded to the living environment in homes based on the local noise and air quality. The GES score thus describes the 'environmental health quality' near a house. Sound reduction of the tyre-road surface may therefore also have a significant impact on the environmental health quality.

Geluidbelasting op de gevels van woningen	GES-score	
< 55 dB	0 - 3	(zeer) goed, redelijk of vrij matig
55 - 59 dB	4	matig
60 - 64 dB	5	zeer matig
65 - 67 dB	6	onvoldoende
68 - 72 dB	7	ruim onvoldoende
> 72 dB	8	zeer onvoldoende

Lifespan

The (technical) lifespan of the road depends on a mix of mechanical and functional properties. The road surface label will also encourage the development of roads with a longer lifespan. On average, roads in the Netherlands currently last about 9 years (for porous asphalt). The ambition is to gradually shift this average toward an average of 10 years or even 12 years. Roads with longer lifespan also result in less maintenance and management costs in the long term. The annual budget for roads in the Netherlands is approximately €2.5 billion (Bouwend Nederland), and if it's possible to boost the average lifespan of a road to 12 years at say 10% more cost, then big savings appear to be possible in maintenance costs, but also in traffic jam costs (lost vehicle hours).

In conclusion

Road surface labelling stimulates the road builders to develop products with enhanced rolling resistance, optimum skid resistance, less noise, and a longer lifespan. In addition, road surface labelling also leads to a number of indirect results. For example, the road surface label can easily be used in the management stage in order to more accurately determine the replacement time in advance and to be able to communicate with politics and society.

In addition, it facilitates the cooperation between the road industry and tyre industry and other relevant partners, resulting in faster innovation cycles (shorter turnaround of new products) and makes the optimisation of tyre-road interaction really possible. Indeed, a tyre can be optimised for a particular type of road surface, but might be less optimised for another type. Alternatively, a road surface can be optimised for a particular type of tyre, but might be less favourable for another type. If these two sectors - the tyre industry and road construction industry - understand each other better, tyre-road interaction can be optimised as a whole. This will make the optimisation of the cohesion of tyre-road really possible. Road surface labels are a step forward towards professionalisation and industrialisation of the road and tyre industry. Road surface labelling should lead to the recognition of a road as a product that is industrially designed, built and maintained.