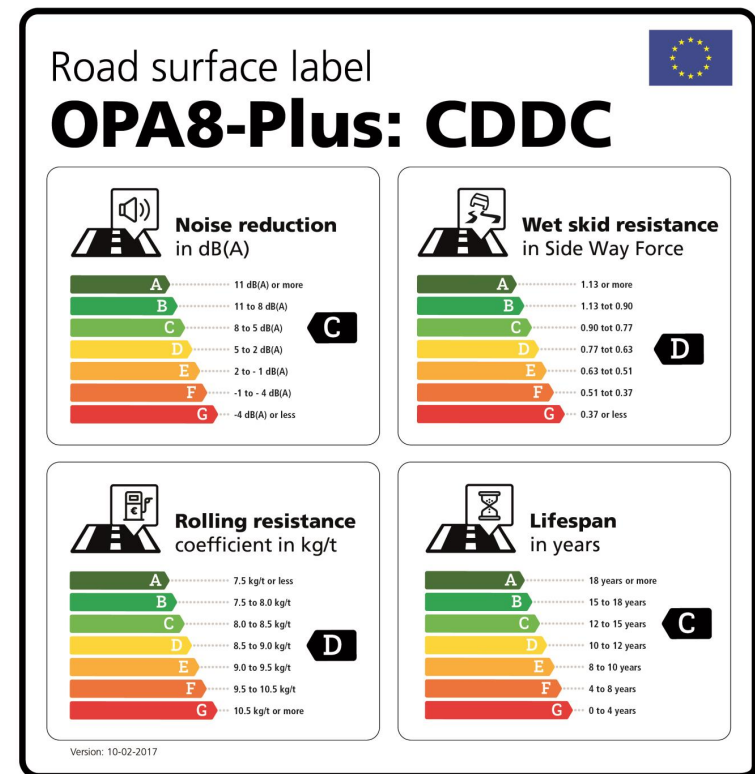


Labelling road surfaces

- An initiative from the Netherlands



Dr.ir. Arian de Bondt and dr.ir. Frank Bijleveld, Ooms Civiel / Strukton Civiel

Berry Bobbink and Remco Hermsen - Province of Gelderland

Michiel van Koeverden – Apollo Vredestein

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UNECE Working Party on Noise (GRB)

16 February 2017, Geneva



Content of the presentation

- Why road surface labels?
- How does it benefit society?
- Boundary conditions
- Methodology and measurement methods
- Implementation of road surface labels
- Conclusions and recommendations
- How to proceed?

Follow-up on EU research project: Safe and Silent Road Traffic



STIL VEILIG WEGVERKEER



Why road surface labels?

- Recognition for society and politicians
- To acknowledge that a road surface is a product that can industrially be developed, designed, built, maintained and removed
- To facilitate the collaboration between tyre manufacturers and road builders and other relevant industrial partners → shorter innovation cycles (shorter time-to-market)
- It makes the optimisation of tyre-road interaction really possible
- It facilitates the interaction and communication with road users and residents
- Focus on the road surface label, not on changing the existing tyre label



How does it benefit society?



Labelling is a method to encourage progress and stimulates optimisation.

- Safety - Skid resistance;
- Liveability, health - Noise (reduction);
- Sustainability and economics (road user) - Rolling resistance;
- Availability, durability and economics (road owner) - Lifespan.

Line of thought (for each item):

- At present, on average approximately label F/E;
- Short term potentially to label D/C via smart contracts of the client + innovations from the contractor;
- Medium term (5-7 years) label B possible;
- Long term (7-10 years) label A possible.



Benefits – the numbers

Labelling is a method to encourage progress and stimulates optimisation.

- Skid resistance – risk to accidents 3x smaller at a proper skid resistance (road accidents cost NL app. €8 billion annually).
- Noise (reduction) – 9 dB(A) noise reduction possible by optimum tyre-road combination (EU-project ‘Safe and Silent Road Traffic’)
- Rolling resistance – 10-30% reduction rolling resistance → 2-6% fuel savings → saving 488 mln. litres and 1000 kton CO₂ (NL)
- Lifespan – from 9 years to 10-12 years (i.e. for porous asphalt)



Boundary conditions and assumptions

- Relate to the existing labels for tyres (same properties)
- Suitable for current and future vehicle fleet
- Covers the essential road surface functionalities for existing and new roads
- Should provide opportunities for innovations
- Maximum of 5-10 families of road surfaces Europe-wide
- Methodology: 5 measured representative road surfaces per label (based on Dutch regulations for noise reduction)
- Independent certifying authority to provide road surface labels
- Validated measurement methods (+ field prediction models) per item both in the laboratory and in-situ
- Product development not on the road (high risks and time consuming), but preferably using (advanced) laboratory methods and modelling
- Label-requirements will be determined per project and thoroughly underpinned

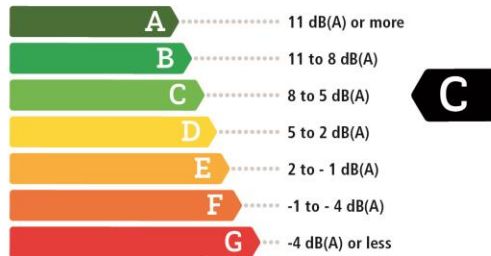
Road surface label



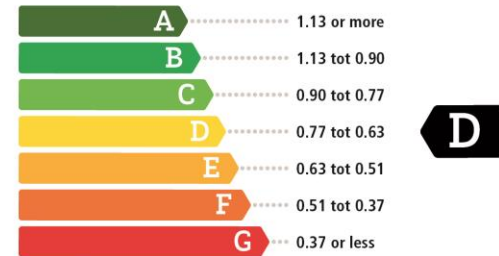
OPA8-Plus: CDDC



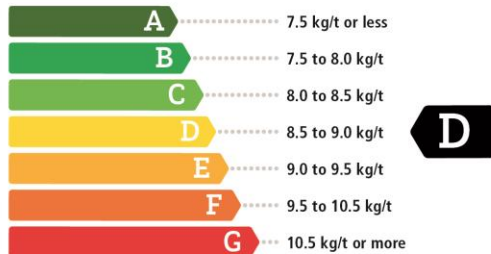
Noise reduction in dB(A)



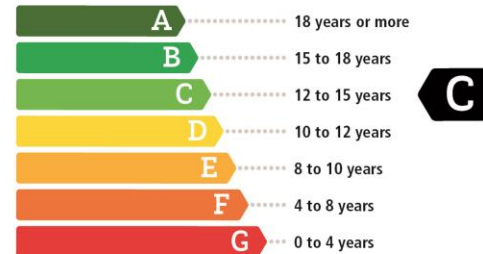
Wet skid resistance in Side Way Force



Rolling resistance coefficient in kg/t



Lifespan in years



Noise reduction

Noise reduction in dB(A)

A	11 dB(A) or more
B	11 to 8 dB(A)
C	8 to 5 dB(A)
D	5 to 2 dB(A)
E	2 to - 1 dB(A)
F	-1 to - 4 dB(A)
G	-4 dB(A) or less



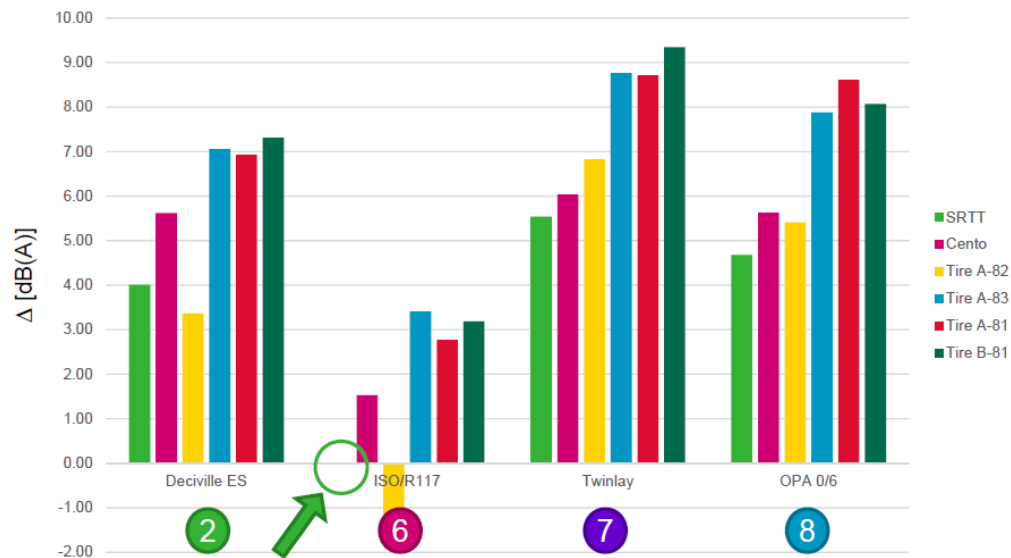
Noise level

<u>Noise level in dB(A)</u>	
A	66.2 dB(A) or less
B	66.2 to 69.2 dB(A)
C	69.2 to 72.2 dB(A)
D	72.2 to 75.2 dB(A)
E	75.2 to 78.2 dB(A)
F	78.2 to 81.2 dB(A)
G	81.2 dB(A) or more

Noise reduction

Silent and safe road traffic:
test sections at airport Twente
(PhD research M. Bezemer,
University of Twente)

Up to 9 dB(A) possible with
optimal tyre-road combination
compared to ref. tyre and ref. road
(SRTT, ISOR117, CPX 80 km/h)





Rolling resistance

Rolling resistance coefficient in kg/t

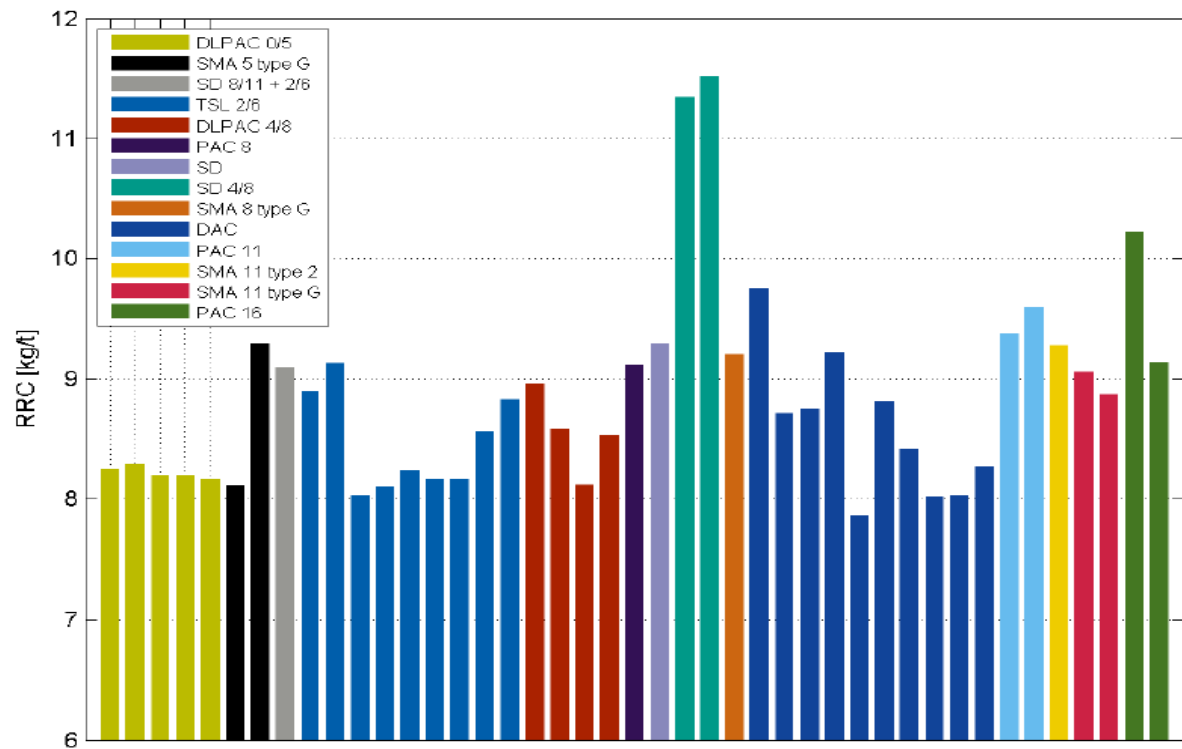
A	7.5 kg/t or less
B	7.5 to 8.0 kg/t
C	8.0 to 8.5 kg/t
D	8.5 to 9.0 kg/t
E	9.0 to 9.5 kg/t
F	9.5 to 10.5 kg/t
G	10.5 kg/t or more

Rolling resistance

10-30 % reduction of the rolling resistance possible.

This leads to app. 2-6 % fuel savings.

NL: 488 mln. litres and 1000 kton CO₂ annually.



Skid resistance (wet)

Wet skid resistance in friction coefficient

A

0.75 or more

B

0.75 to 0.60

C

0.60 to 0.54

D

0.54 to 0.45

E

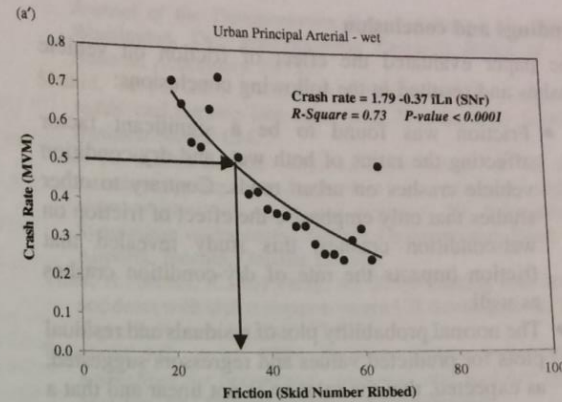
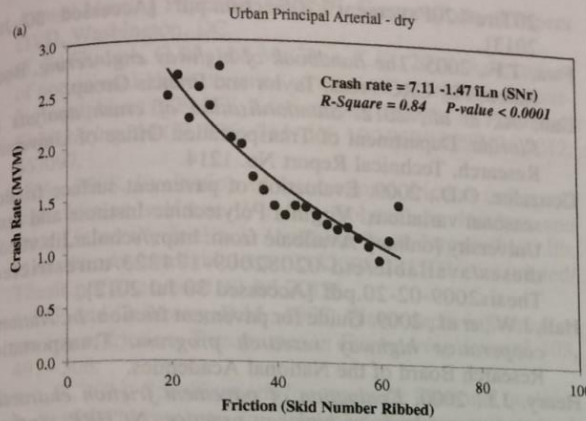
0.45 to 0.38

F

0.38 to 0.30

G

0.30 or less

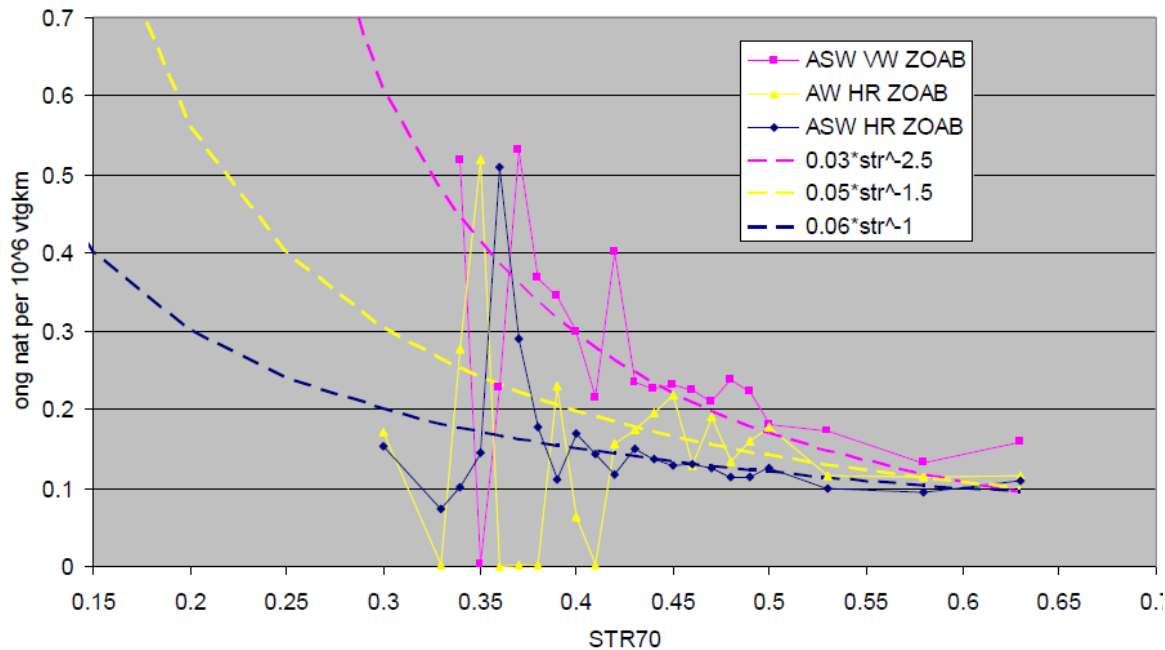


Skid resistance (wet)

Risk to accidents app. 3x smaller at a proper skid resistance.

Accidents costs NL app. € 8 bn. annually.

Estimated saving due to labelling: 1.25% = 100 mln



Example differences in EU-regulations

Skid resistance levels (SWF) 0,39 vs. 0,51

Zustandswerte		Zustandsgrößen						
		Messverfahren SKM			LFC-Messverfahren (GripTester)		Messverfahren SRT/AM	
		μ_{SKM} bei $v =$			μ_{LFC} bei $v =$		SRT [Einheiten]	AM [s]
Zustandswert	Bedeutung	40 km/h	60 km/h	80 km/h	40 km/h	60 km/h		
1,5	1,5-Wert	0,63	0,58	0,53	0,64	0,62	65	≤ 30
3,5	Warnwert	0,49	0,44	0,39	0,46	0,44	55	≤ 60
4,5	Schwellenwert	0,42	0,37	0,32	0,38	0,36	50	≤ 120

Anmerkung:
 Da je nach Oberflächenstruktur die mit den unterschiedlichen Verfahrenen gemessenen Werte unterschiedlich beeinflusst werden, sind sie untereinander **nicht** vergleichbar.
 Daher ist eine Korrelation zwischen den Messverfahren nicht zulässig. Des Weiteren sind auch Umrechnungen zwischen den verschiedenen Messgeschwindigkeiten der jeweiligen Verfahren nicht zulässig.

toplayer: open						
SWF		RAW		SWF		RAW
40 km/h	60 km/h	50 km/h		60 km/h	80 km/h	70 km/h
0,34	0,31	0,30		0,36	0,33	0,30
0,36	0,33	0,31		0,37	0,34	0,31
0,37	0,34	0,32		0,39	0,36	0,32
0,39	0,36	0,33		0,40	0,37	0,33
0,40	0,37	0,34		0,42	0,39	0,34
0,42	0,39	0,35		0,43	0,40	0,35
0,43	0,40	0,36		0,45	0,42	0,36
0,45	0,42	0,37		0,46	0,43	0,37
0,46	0,43	0,38		0,48	0,45	0,38
0,48	0,45	0,39		0,49	0,46	0,39
0,49	0,46	0,40		0,51	0,48	0,40
0,51	0,48	0,41		0,52	0,49	0,41
0,52	0,49	0,42		0,54	0,51	0,42
0,54	0,51	0,43		0,55	0,52	0,43
0,55	0,52	0,44		0,57	0,54	0,44
0,57	0,54	0,45		0,58	0,55	0,45
0,58	0,55	0,46		0,60	0,57	0,46
0,60	0,57	0,47		0,61	0,58	0,47
0,61	0,58	0,48		0,63	0,60	0,48
0,63	0,60	0,49		0,64	0,61	0,49
0,64	0,61	0,50		0,66	0,63	0,50
0,66	0,63	0,51		0,67	0,64	0,51
0,67	0,64	0,52		0,69	0,66	0,52



Lifespan

Lifespan in years

A

18 years or more

B

15 to 18 years

C

12 to 15 years

D

10 to 12 years

E

8 to 10 years

F

4 to 8 years

G

0 to 4 years

Lifespan

- Ravelling
- Rutting
- Cracking



Examples different road surface labels

Currently best available:

- DCDC (focus on lifespan and noise)
- CCDD (focus on rolling resistance and noise)

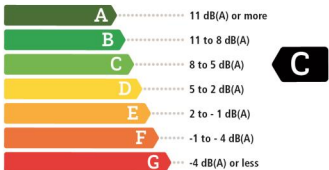
Road surface	Rolling resistance	Noise	Skid resistance	Lifespan	Label
AC 11 surf	C	E	D	C	CEDC
Surface dressing	G	F	E	F	GFEF
PA 16	E	D	E	D	EDED
2L-PA 8	D	C	E	E	DCEE
OPA8-Plus	D	C	D	C	DCDC
Novachip 5	C	C	D	D	CCDD

Road surface label

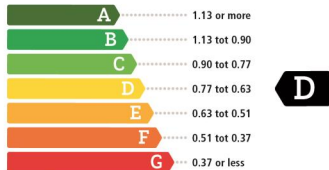
OPA8-Plus: CDDC



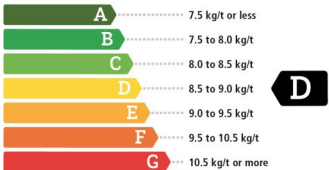
Noise reduction
in dB(A)



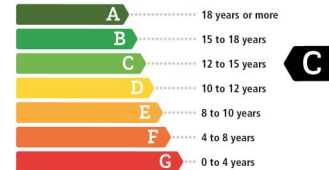
Wet skid resistance
in Side Way Force



Rolling resistance
coefficient in kg/t



Lifespan
in years



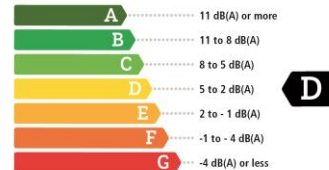
Version: 10-02-2017

Road surface label

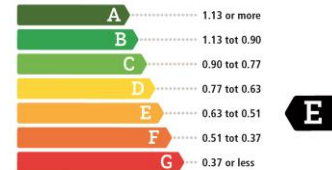
ZOAB (PA16): DEEE



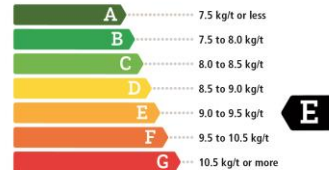
Noise reduction
in dB(A)



Wet skid resistance
in Side Way Force



Rolling resistance
coefficient in kg/t



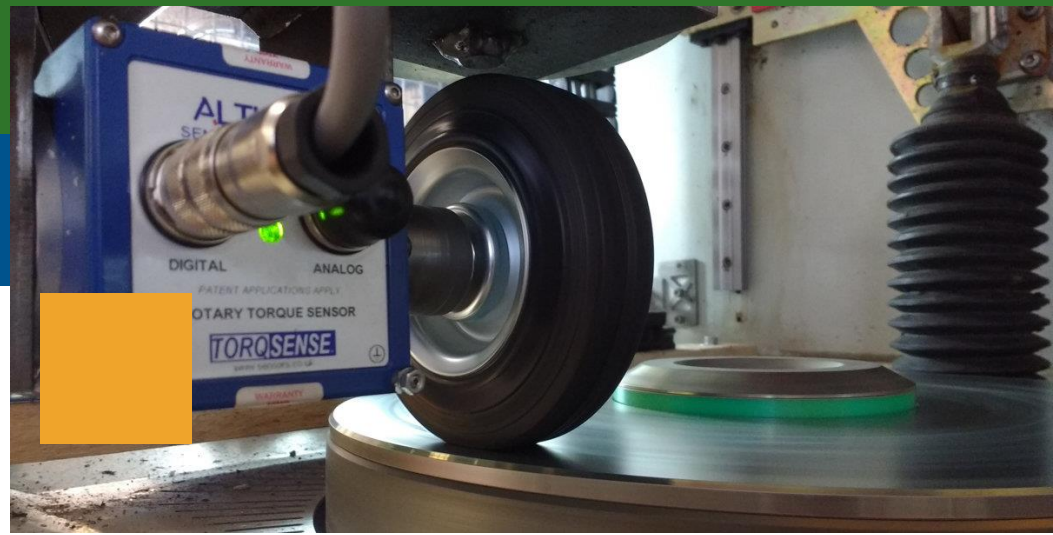
Lifespan
in years



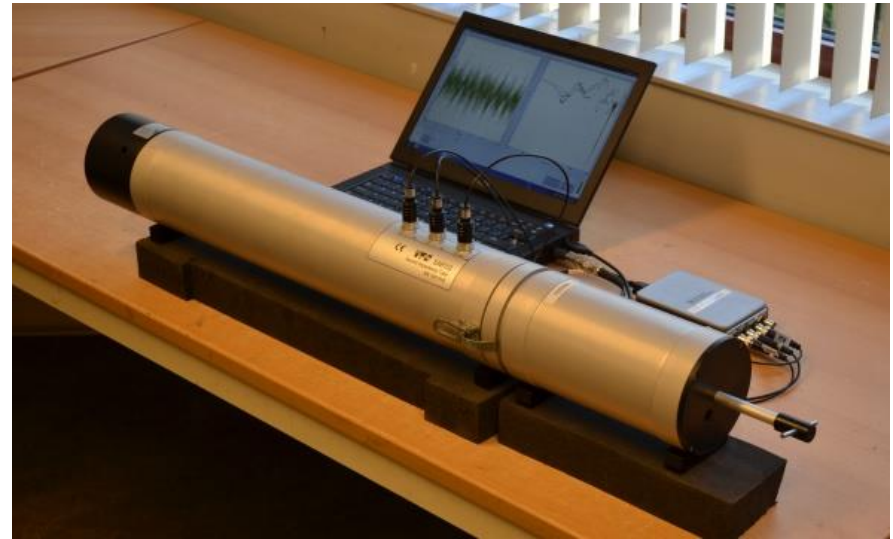
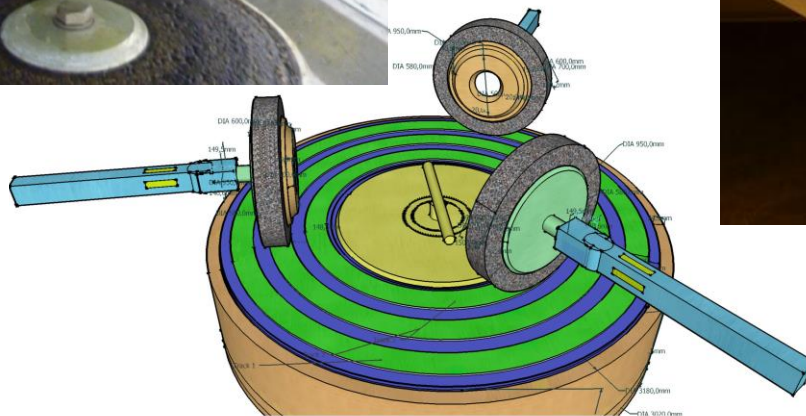
Version: 10-02-2017

Measurement methods in-situ





Measurements methods in the laboratory

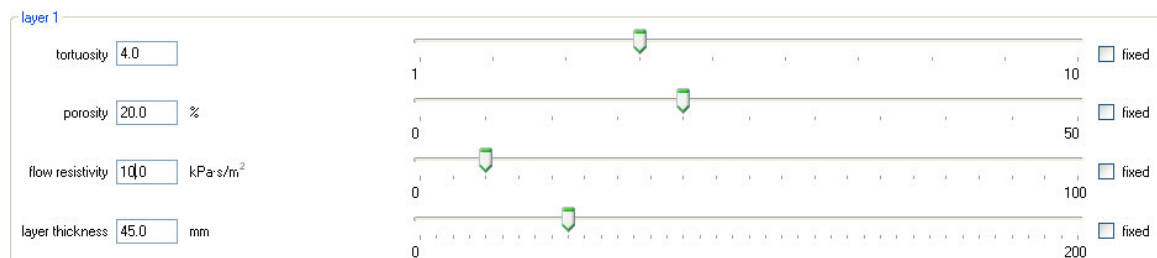
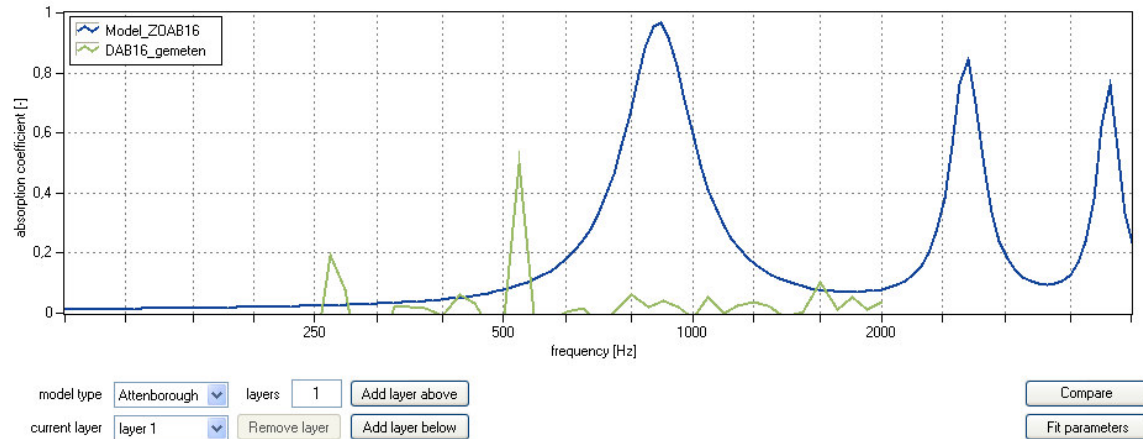




Modelling: Acoustic Optimization Tool

Noise prediction model based on:

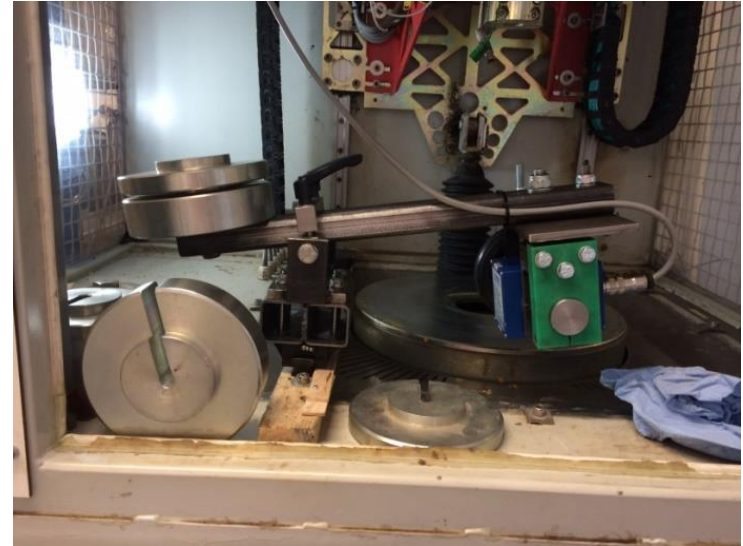
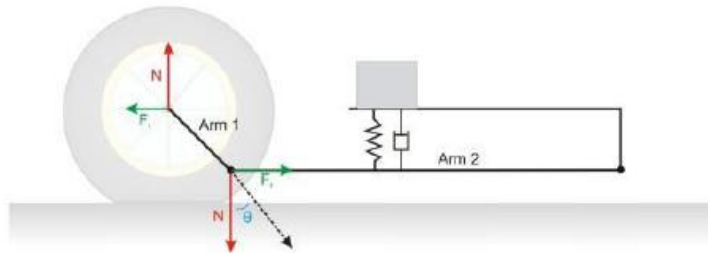
- Tortuosity
- Porosity
- Flow resistivity
- Layer thickness



Different measurement methods road and tyre industry



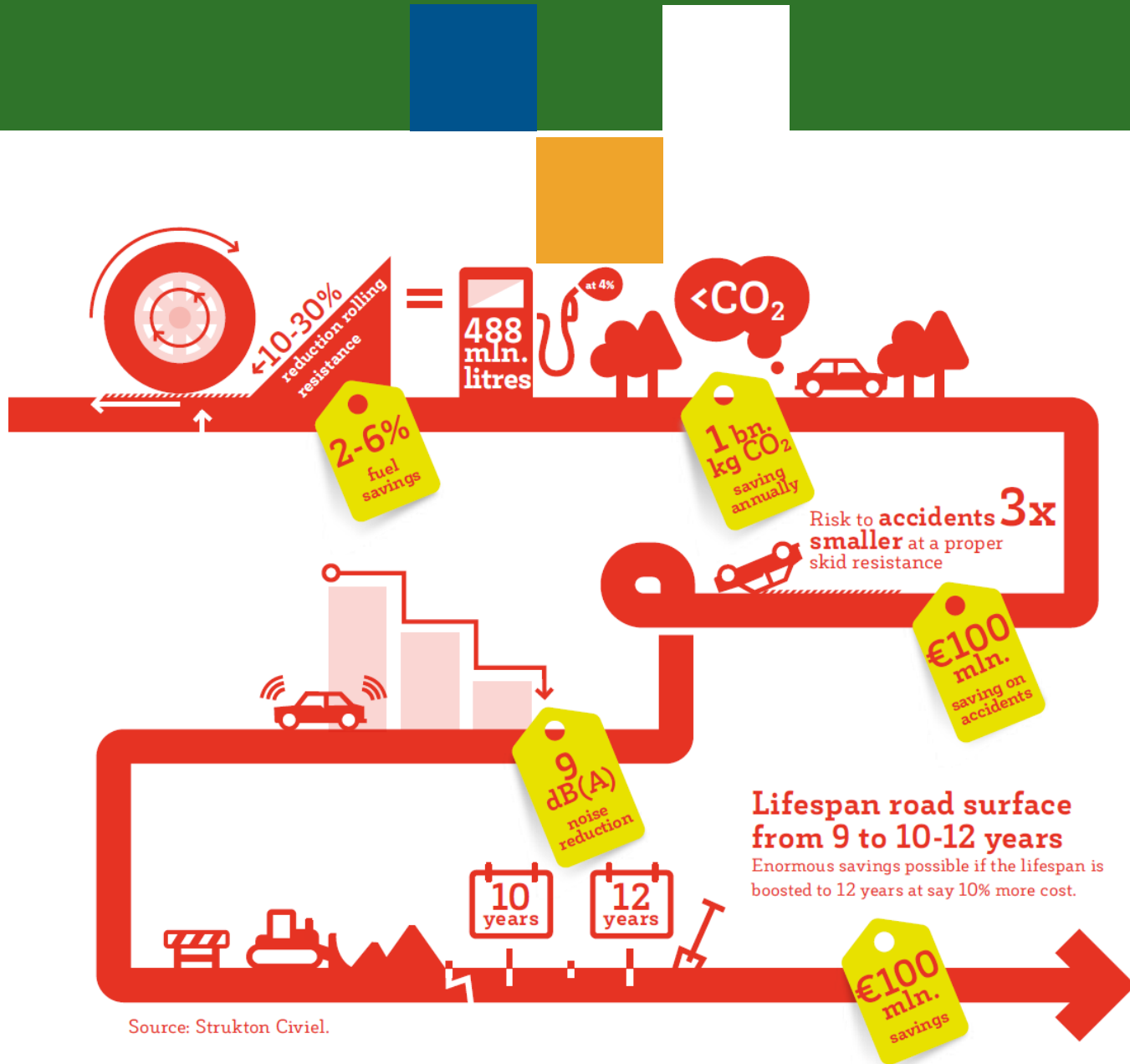
figuur 1 De TU Gdansk trailer voor het uitvoeren van rolweerstandmetingen. De gedetailleerde foto laat de bevestiging van de meetband zien





Knowledge gaps

- Measuring rolling resistance in the laboratory (ongoing research)
- Determining rolling resistance for heavy vehicles
- Field prediction model for (road) noise is available, but not for rolling resistance and skid resistance



Source: Strukton Civiel.



Conclusions and recommendations

- A road surface label would be a step forward towards professionalising and industrialising the road construction industry
- The described methodology and labels are a first step based on existing practical experience and the latest scientific knowledge
- Enormous steps forward seem to be possible regarding improved skid resistance, noise reduction, rolling resistance and lifespan
- Request: What were the lessons learned with the introduction of the tyre label?



How to proceed?

- Pilot Province of Gelderland, the Netherlands (demonstration)
- We took the initiative, but how to pass onto legislation bodies and authorities?
- Further develop methodology and procurement strategies
- Include European working groups
- Discuss with the automotive and tyre industry (focus on the road surface label, not on changing the existing tyre label)