Labelling road surfaces
- An initiative from the Netherlands

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Content of the presentation

• Why road surface labels?
• How does it benefit society?
• Boundary conditions
• Methodology and measurement methods
• Implementation of road surface labels
• How to use the road surface label in tenders for roads construction & maintenance?
• 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 (NL)

Labelling is a method to encourage progress and stimulates optimisation.

- Skid resistance – risk of accidents 3x smaller at a proper skid resistance (road accidents cost NL approximately €8 billion annually).
- Noise (reduction) – 9 dB(A) noise reduction seems 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)

* Benefits determined for the Netherlands; still to be determined for Europe
Boundary conditions and assumptions

- Relate to the existing labels for tyres (same properties or performance indicators)
- Suitable for current and future vehicle fleet
- Covers the essential road surface functionalities for existing and new roads
- Should provide opportunities for innovations
- Label is based on in-situ properties, based on advanced laboratory research tests, predictive models and previous in-situ experience
- Product development not on the road (high risks and time consuming), but preferably using (advanced) laboratory methods and modelling
- Self-regulating and an independent authority that validates the self-regulation
- Label-requirements will be determined per project and thoroughly underpinned
- Used by professional road authorities and contractors
- Label directly after construction, but possibly also requirements over time (end of life)
## Noise reduction in dB(A)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Noise Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>11 dB(A) or more</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>11 to 8 dB(A)</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>8 to 5 dB(A)</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>5 to 2 dB(A)</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>2 to -1 dB(A)</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>-1 to -4 dB(A)</td>
</tr>
<tr>
<td><strong>G</strong></td>
<td>-4 dB(A) or less</td>
</tr>
</tbody>
</table>
Noise reduction

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

Up to 9 dB(A) seems 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

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.5 kg/t or less</td>
</tr>
<tr>
<td>B</td>
<td>7.5 to 8.0 kg/t</td>
</tr>
<tr>
<td>C</td>
<td>8.0 to 8.5 kg/t</td>
</tr>
<tr>
<td>D</td>
<td>8.5 to 9.0 kg/t</td>
</tr>
<tr>
<td>E</td>
<td>9.0 to 9.5 kg/t</td>
</tr>
<tr>
<td>F</td>
<td>9.5 to 10.5 kg/t</td>
</tr>
<tr>
<td>G</td>
<td>10.5 kg/t or more</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>Wet skid resistance in Side Way Force</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.13 or more</td>
</tr>
<tr>
<td>B</td>
<td>1.13 to 0.90</td>
</tr>
<tr>
<td>C</td>
<td>0.90 to 0.77</td>
</tr>
<tr>
<td>D</td>
<td>0.77 to 0.63</td>
</tr>
<tr>
<td>E</td>
<td>0.63 to 0.51</td>
</tr>
<tr>
<td>F</td>
<td>0.51 to 0.37</td>
</tr>
<tr>
<td>G</td>
<td>0.37 or less</td>
</tr>
</tbody>
</table>
Skid resistance (wet)

Risk of 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.
<table>
<thead>
<tr>
<th>Lifespan in years</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>18 years or more</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>15 to 18 years</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>12 to 15 years</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>10 to 12 years</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>8 to 10 years</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>4 to 8 years</td>
</tr>
<tr>
<td><strong>G</strong></td>
<td>0 to 4 years</td>
</tr>
</tbody>
</table>
Lifespan

- Ravelling
- Rutting
- Cracking
Measurement methods in-situ: Noise reduction

- Noise reduction based on Noise Directive 2015/996/EC for m=1 (light motor vehicles) and A-weighted over all octave bands
- Label scale: Noise reduction at 80 km/hr, light motor vehicles

- CEN-TC227/WG 5 (Road materials, pavement surface characteristics): Harmonising noise measurement methods, still under development. Possible to use this in the future
Measurement methods in-situ: Wet Skid Resistance

- Wet sideway force skid resistance coefficient at 80 km/hr using German SKM (CEN/TS 15901-8), according to TP Griff-StB 07 (SKM)
- German SKM and British SCRIM (CEN/TS 15901-8 and -6) are similar, but procedures still differ
- Possible to work with conversion tables in the future
- Measurement method for tyre label not possible because deceleration (from 80 to 20 km/hr) not applicable in in-traffic conditions
- Label scale: Wet skid resistance after 3-6 months of traffic (can fluctuate significantly directly after construction)
- Prediction: Friction After Polishing (NEN-EN 12697-49:2014) and SR-ITD machine developed in EU-project SKIDSAFE

- European harmonisation is being worked on by CEN, but not yet achieved.
Measurement methods in-situ: Rolling resistance

- Rolling resistance coefficient: Ratio horizontal force over vertical force (N/N or kg/ton)
- Direct measurement: TU Gdansk trailer measuring rolling resistance
- Indirect: Macrotexture of the road, MPD (mean profile depth) according to ISO 13473-1:1997 and ISO 13473-2:2002 + MPD-RR model [M+P.PGEL.17.06.1]
Measurement methods in-situ: Lifespan

The lifespan encompasses all types of distress:
- Unevenness
- Cracking
- Ravelling

Type of distress that first reaches the serviceability limit values (defined in contract or in national or international regulations) defines the ultimate lifespan.

Laboratory (indicative) tests: NEN-EN 12697 (test methods for hot mix asphalt)
Measurements methods in the laboratory
Modelling: Acoustic Optimization Tool

Calibrated noise prediction model based on:

- Tortuosity
- Porosity
- Flow resistivity
- Layer thickness
Different measurement methods
road and tyre industry
Examples different (Dutch) road surface labels

Currently best available:
- DCDC (focus on lifespan and noise)
- CCDD (focus on rolling resistance and noise)

<table>
<thead>
<tr>
<th>Road surface</th>
<th>Rolling resistance</th>
<th>Noise</th>
<th>Skid resistance</th>
<th>Lifespan</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 11 surf</td>
<td>C</td>
<td>E</td>
<td>D</td>
<td>C</td>
<td>CEDC</td>
</tr>
<tr>
<td>Surface dressing</td>
<td>G (red)</td>
<td>F</td>
<td>E</td>
<td>F</td>
<td>GFEF</td>
</tr>
<tr>
<td>PA 16</td>
<td>E</td>
<td>D</td>
<td>E</td>
<td>D</td>
<td>EDED</td>
</tr>
<tr>
<td>2L-PA 8</td>
<td>D</td>
<td>C</td>
<td>E</td>
<td>E</td>
<td>DCEE</td>
</tr>
<tr>
<td>OPA8-Plus</td>
<td>D</td>
<td>C</td>
<td>D</td>
<td>C</td>
<td>DCDC</td>
</tr>
<tr>
<td>Novachip 5</td>
<td>C</td>
<td>C</td>
<td>D</td>
<td>D</td>
<td>CCDD</td>
</tr>
</tbody>
</table>
### Example of using the Road Surface Label in tenders

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Value</th>
<th>Price (road construction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Surface Label</td>
<td>60 %</td>
<td></td>
</tr>
<tr>
<td>Wet skid resistance</td>
<td>E (0.38-0.45)</td>
<td>D: 10%</td>
</tr>
<tr>
<td>Noise reduction</td>
<td>D (2-5 dB(A))</td>
<td>C: 20%</td>
</tr>
<tr>
<td>Rolling resistance</td>
<td>E (8.5-9.0 kg/ton)</td>
<td>D: 10%</td>
</tr>
<tr>
<td>Lifespan</td>
<td>E (8-10 years)</td>
<td>D: 20%</td>
</tr>
<tr>
<td>Degree of reliability / evidence</td>
<td>For each indicator 1x evidence</td>
<td>For each indicator 2x evidence: 5 %</td>
</tr>
</tbody>
</table>
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 – possibly upgrade in i.e. 5 years

• Enormous steps forward seem to be possible regarding improved skid resistance, noise reduction, rolling resistance and lifespan

• Possible to practically use it in tenders for roads and underpin it with existing (national) measurement methods
How to proceed?

• First pilot Province of Gelderland, the Netherlands (demonstration) in 2017

• Input on our proposal (Informal document) → working document → WP 29

• Format and methodology available for everyone

• No normative legislation desired, but voluntarily use and apply the road surface label

• Include European working groups, i.e. CEN-TC227/WG5 and Rosanne EU-project

• Optimisation pavement-tyre interaction: Discuss with the automotive and tyre industry
For more information

Informal document:  

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