World Road Association (PIARC)

- Established in 1909
- Non-political, non-profit organization
- Development of global road community
Mission

- Lead international forum
- Disseminate best practice
- Promote efficient tools for decision making
- Special emphasis for Developing Countries and Countries in Transition
111 Member Governments

21.02.2007, Geneva
Presentation to UN ECE/TRANS/ WP.29/GRB
A Large Range of Publications
23rd World Road Congress

- 17 - 21 September 2007, Paris, France
- The Centenary Congress
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Become a member of PIARC...

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Strategic Themes

ST1: Governance and Management of the Road System
ST2: Sustainable Mobility
ST3: Safety and Road Operations
ST4: Quality of Road Infrastructure
Technical Committees

- 18 Technical Committees + Terminology
- 800 experts and decision-makers
- Various topics of road and road transport
- Outputs assist decision-makers
ST4: Quality of Road Infrastructures

4.1 Management of Road Infrastructure Assets

4.2 Road/Vehicle Interaction

4.3 Road Pavements

4.4 Bridges and Related Structures

4.5 Earthworks, Drainage and Subgrade
TC 4.2: Road/Vehicle Interaction

WG A: Trends in vehicle-road interaction monitoring

WG B: Road Traffic Noise

WG C: Texture, Skid resistance and Evenness

WG D: Cracks and road distresses

WG E: Advanced road works acceptance methods and criteria
**WG B: Work Programme**

| Description of the selected strategies | 1) **Review the recent developments and future prospects in vehicles, tyres and pavements influencing road traffic noise emission. Establishing a state of the art of traffic noise reduction technologies at the source, identifying research needs, as well as identifying and recommending new promising global noise reduction strategies.**  
2) **Review the current noise measurement methods, recommend on strategies for their harmonisation (if necessary) and support the integration of methods to achieve a standardised set of tools to characterize road traffic noise.** |
| Working group leader | Manfred HAIDER, Austria |
## WG B: Links

<table>
<thead>
<tr>
<th>Type</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal to PIARC</td>
<td>TC 4.1 Road Management</td>
</tr>
<tr>
<td>Internal to PIARC</td>
<td>TC 4.2 WG A Future Developments</td>
</tr>
<tr>
<td>Internal to PIARC</td>
<td>TC 4.2 WG C Road Surface Characteristics</td>
</tr>
<tr>
<td>Internal to PIARC</td>
<td>TC 4.3 Road Pavements</td>
</tr>
<tr>
<td>ISO WG</td>
<td>ISO/TC 43/SC 1/WG 33 SPB, CPX</td>
</tr>
<tr>
<td>ISO WG</td>
<td>ISO/TC 43/SC 1/WG 42 reference surfaces</td>
</tr>
<tr>
<td>CEN WG</td>
<td>CEN/TC 227/WG 5 – road surface characteristics</td>
</tr>
<tr>
<td>EU WG</td>
<td>EU WG 8 - Tyre noise policy</td>
</tr>
<tr>
<td>UN</td>
<td>UN/ECE/GRB Geneva</td>
</tr>
<tr>
<td>EU Project</td>
<td>SILVIA</td>
</tr>
<tr>
<td>EU Project</td>
<td>HARMONOISE</td>
</tr>
<tr>
<td>EU Project</td>
<td>SILENCE</td>
</tr>
<tr>
<td>National Project</td>
<td>IPG (NL)</td>
</tr>
<tr>
<td>National Project</td>
<td>Leiser Verkehr (Germany)</td>
</tr>
<tr>
<td>National Project</td>
<td>BUWAL/ASTRA project (CH)</td>
</tr>
<tr>
<td>National Project</td>
<td>Low noise tyre project (SE, FI, PL, GB)</td>
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<tr>
<td>National Project</td>
<td>Quiet Pavement programme (US)</td>
</tr>
</tbody>
</table>
Noise emission of road vehicles

- Engine/powertrain noise
- Tyre/road noise (rolling noise)
- Aerodynamic noise
Dominance of tyre/road noise

Tyre/road noise typically dominates the noise emission starting from 30 km/h (passenger cars) respectively 50 km/h (heavy vehicles)

Source: Sandberg/Ejsmont, Tyre/Road Noise Reference Book (www.informex.info)
Generation of tyre/road noise

Source: Sandberg/Ejsmont, Tyre/Road Noise Reference Book (www.informex.info)

- tyre vibrations
- air pumping

DI Manfred Haider
arsenal research
WG leader of PIARC TC 4.2 WG B Road Traffic Noise
21.02.2007, Geneva Presentation to UN ECE/TRANS/ WP.29/GRB
Measurement methods

- Spot method
  - 180 vehicle pass-bys
  - Strict conditions, time-consuming
  - Representative of total road traffic noise emission
  - All vehicle types
  - Includes engine noise and propagation effects

- Long-distance measurements
  - 4 reference tyres
  - Fast, inexpensive, flexible
  - Low representativity for truck tyre noise
  - only accounts for tyre/road noise
Tyre/road noise reduction strategies

Tyre/road noise is an highly interactive phenomenon. Strictly speaking there are only **low-noise tyre/pavement combinations**.

**Reduction of tyre vibrations:**
- Smooth road surface (minimized megatexture, optimized macrotexture)
- Elastic road surfaces
- Optimized (randomized) tyre tread pattern, rubber compounds (especially hardness), sidewall stiffness, tyre width
Tyre/road noise reduction strategies

Tyre/road noise is an highly interactive phenomenon. Strictly speaking there are only low-noise tyre/pavement combinations.

Reduction of air pumping:
- Open-graded or porous road surface (void content >20%)
- Connected road surface pores introduce sound absorption
- Tread pattern without sealed-off cavities in the contact patch
- Porous treads?
Example: Porous Asphalt

Latest trend: Double-layer porous asphalt
- Top layer with small chipping size, bottom layer with larger chippings
- High void content (20-30%) reduces air pumping
- Sound absorption with 2 absorption peak frequencies (tunable)
- Top layer with small openings reduces clogging
- Noise reduction potential approx. 3 – 9 dB (ref. AC), durability unclear
Example: EACC

Exposed aggregate cement concrete

- High quality gap-graded aggregates (e.g. 0/8 or 0/11)
- Tips are exposed by applying a retarding agent to the surface and removing the remaining mortar after some time
- Texture depth can be controlled by choosing the time delay
- Reduces air pumping - tyre is riding on the tips
- Noise reduction potential approx. up to 3 dB (ref. standard concrete)
Example: Thin layers

Thin layers
- Developed from surface dressings
- Thin gap-graded (0/10) bituminous layer with pre-coated chippings
- Surface texture similar to porous asphalt
- Smooth due to roller compaction, reduces tyre vibrations
- Noise reduction potential somewhat less than porous asphalt

Source:
G. Descornet, BRRC
Future trends in low-noise pavements

- Improved double-layer porous asphalt (frequency tuning, durability)
- Poro-elastic road surfaces
- Improved open-graded surfaces for urban applications
- Texture optimisation for different tasks (e.g. truck versus passenger car tyres)
- New reference surfaces and tyres
- Durable low-noise pavements
Road pavement classification

- Noise reduction by choice of pavement type require a reliable acoustic classification
- Pavement type designation varies widely in different countries
- The EU Project SILVIA laid the foundation for a common labelling procedure, follow-up research is carried out in the SILENCE project
- The procedures rely on SPB values complemented with CPX or other surfaces parameters
Road pavement classification

- The LABELLING procedure yields a first-time acoustic classification of a precisely defined pavement type as installed in new optimal condition
- Labelling can be carried out on dedicated sites
- The CONFORMITY OF PRODUCTION (CoP) testing checks the performance of an actual installation against the labelling values
- Requirements of flexibility, applicability at arbitrary locations and easy handling make CPX the preferred method
### The SILVIA procedure

#### Labelling

<table>
<thead>
<tr>
<th>Grading:</th>
<th>Dense</th>
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<td>Stiffness:</td>
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<td>Elastic</td>
</tr>
</tbody>
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- **SPB**
- **CPX**
- **Texture**
- **Sound Absorption**
- **Mech. Impedance**

#### COP Testing

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- **CPX**
- **Texture**
- **Sound Absorption**
- **Mech. Impedance**

Source: G. Descornet et. al. EU Projects SILVIA and SILENCE
Noise reduction potentials

Investigation of combined tyre and pavement noise reduction potentials
Following EU Directive 2001/43/EC, using new market tyres & test tracks

Abrollgeräusch nach der EU-Reifenrichtlinie
Werte mit Abzügen laut 2001/43/EG

Source: Haider et al., Low-Noise Tyres
Research Project for the Austrian BMVIT 2003
Noise reduction potentials

Choice of pavement:

- 7-9 dB for passenger car tyres, 3-6 dB excluding porous surfaces
- 2-3 dB for truck tyres

Choice of tyre:

- 2-5 dB for passenger car tyres
- 2-3 dB for truck tyres

- ISO 10844 surface not always representative
- Most market tyres below limit values
- Comparable potential of tyre and pavement especially for truck tyres
- Values for used tyres and worn pavements: research on acoustic durability needed

Source: Haider et al., Low-Noise Tyres
Research Project for the Austrian BMVIT 2003
Research & Development needs

- Realistic modelling of tyre/pavement interaction and noise emission using real tyre and road surface data
- Long-term development of the noise emission properties of both tyres and road surfaces
- Representative reference tyres and reference surfaces for both tyre and pavement testing
Research & Development needs

- Improvement of the standardized labelling, approval testing and performance monitoring methods for pavements and tyres
- Noise classification catalogues of currently used pavements and tyres
- Optimization tools treating driver behaviour, vehicles, tyres and pavement as a system
Thank you for your attention!