Economical and sustainable pavement infrastructure for surface transport

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http://ecolanes.shef.ac.uk
Outline

• Surface transport pavements
• EcoLanes project
• Steel fibres roller-compacted concrete
• Benefits / Conclusions
Surface transport pavements

Extension/ maintenance of European infrastructure network
   - respond needs of enlarged EU
   - benefit single market

Road pavements main element of infrastructure
   - Flexible: Asphalt concrete
   - Rigid: Portland cement concrete
Surface transport pavements: concrete

- Use of steel fibre reinforcement
  - improves mechanical properties
  - reduces pavement depth
Surface transport pavements: concrete

- Steel fibres reduce costs associated with rebar placement
  - but restrained by initial material costs
  - use recycled fibres, e.g. steel tyre-cord
Surface transport pavements: concrete

Concrete mixes

- wet / slip forming (laborious - require side formwork)
- dry / roller compaction (fast – cost effective)

Difficult to add fibres in RCC
Surface transport pavements: concrete

• Concrete pavements could be made more cost-effective than asphalt
  – energy consumption
  – construction time and costs
• FP6 EcoLanes STREP project
  – 6th FP thematic area Sustainable Surface Transport
  – 2006-09, 6 European countries, 11 partners
  – Total cost €2.1m, EC funding €1.7m
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<thead>
<tr>
<th>No.</th>
<th>Participant organisation name</th>
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<tbody>
<tr>
<td>1</td>
<td>The University of Sheffield (concrete)</td>
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<td>2</td>
<td>Akdeniz University (environmental)</td>
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<td>3</td>
<td>Technical University “Gheorghe Asachi” Iasi (transportation)</td>
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<td>4</td>
<td>European Tyre Recycling Association (environmental policy)</td>
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<td>5</td>
<td>Aggregates Industries UK Ltd (concrete materials &amp; pilot demonstration)</td>
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<td>Antalya Municipality (demonstration)</td>
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<td>8</td>
<td>Adriatica Riciclaggio e Ambiente s.r.l. (tyre recycler)</td>
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<td>Public Works Department (demonstration)</td>
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<td>10</td>
<td>Cyprus University of Technology (LCA)</td>
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<td>11</td>
<td>Scott Wilson Ltd (LCA)</td>
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EcoLanes aims & objectives

Develop pavement infrastructure using:

- RCC techniques based on existing asphalt laying equipment
- Steel fibre reinforced concrete
- Concept of long-lasting-rigid-pavements
EcoLanes aims and objectives

Reduce:

– Construction costs by 10-20%
– Construction time by 15%
– Energy consumption in road construction by 40%,
– Maintenance

and to

– Use post-consumer materials
– Make tyre recycling more economically attractive
EcoLanes scientific / technological barriers
EcoLanes work plan

**Tasks**
Steel fibre-reinforced RCC

- Mix optimisation

**Optimum moisture content**

![Graph showing compaction curve with maximum dry density at 2.81 Mg/m³.](image)

- Compressive
- Tensile
Steel fibre-reinforced RCC

- Flexural characterisation

Fibre Content: 
- Unreinforced
- 1% Steel tyre-cord fibres
- 2% Industrial steel fibres
Steel fibre-reinforced RCC

• Flexural characterisation

• Durability testing (corrosion, freeze-thaw)

• Design models
Conclusions

Steel fibre reinforced RCC pavements

• Improved mechanical properties
• Extend life of pavements
• Utilise post-consumer materials
• Minimise energy consumption
• Reduce construction costs & time
This research has been financially supported by the 6th FP of the European Community within the framework of specific research and technological development programme “Integrating and strengthening the European Research Area”, under contract number 031530.

Thank You
Placing of RCC in truck

Placing of RCC in paver

From mixing to rolling ~ ½ hour

Rolling of RCC pavement

Placing of RCC pavement