Tempered recycling with bituminous emulsion
Main problems found in conservation of roads

- Scarcity of financial resources
- Scarcity of natural resources
- High energetic costs
- Few human resources with proper qualification
Items to have in consideration

• **Need → Method → Solution**

  • Characterization of the existing pavement and qualification of provided solicitations
  • Diagnosis of possible problems and forecast of their evolution
  • Choice of the most adequate solution and project
Reasons for recycling pavements

• Give the original proprieties of the pavement and, if possible, improve them.

• Structural capacities or mechanical resistance
• Resistance to water action
• Resistance to fatigue
Tempered recycling with bituminous emulsion

- Up to 100% milled material + emulsion (medium temp)
- Produced in plant
- Without later curing period
Materials

- **Aggregate** = Milled material
Materials

- Binder = Special emulsion modified with polymers
  - Involving 100%, with no drip
  - Resistance to thermal shock
  - High initial cohesion
  - High active and passive adhesiveness
Manufacture and put in place

- Plant of conventional hot mixtures
  - Continuous
  - Discontinuous
- In the case of not existing, implement a feed system
- Doesn’t need technical adaptations
Manufacture and put in place

• Similar to the manufacture and put in place of hot mixtures
• Milled material is warmed at 90 - 95°C
• Mix with emulsion
• Storage possibility
• Transportation to the spreading local
Manufacture and put in place

- Conventional spreading
- Same spreading equipment as for hot mixtures
- Compression made by using a metallic and pneumatic cylinder
- Opening to traffic is immediately
Results of samples that were taken from field

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Dry resistance</td>
<td>5.7 MPa</td>
</tr>
<tr>
<td>Wet resistance</td>
<td>3.46 MPa</td>
</tr>
<tr>
<td>Retained resistance</td>
<td>81%</td>
</tr>
<tr>
<td>Mixture density</td>
<td>2.257 g/cm³</td>
</tr>
</tbody>
</table>
Advantages

- Recycles until up to 100%
- Use of bituminous emulsion
- Can be produced in continuous or discontinuous plants
- The opening to traffic is immediately, no need of curing period
Field experience

- Two experiences in Portugal during 2009
  - EN 205 and 206 (Famalicão)
  - EN 244 (Ponte de Sor)
Conclusions

- Solution compatible with environment
- Can be used until up to 100% of the milled material
- Possibility of not having new aggregates
- Manufacture at 90ºC
Conclusions

• Storage possibility
• Spreading and compression > 60ºC
• Without curing period
Thank you for your attention