RILEM & ISAP Activities on Recycling

• RILEM TC 206 ATB Advanced Testing and Character. of Bit. Materials: TG05 Recycling of Bituminous Materials

• ISAP TC on Constitutive Modeling of Asphaltic Materials: WG05 Re-Use of Construction Materials for Asphalt Pav.

by

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Vairirei ISAP-SIIV, L’Aquila, 28 June 2007
TC 206-ATB
Advanced Testing and Characterization of Bit. Materials

Task Groups:

- TG 1 Binders *(Dariusz Sybilski)*
- TG 2 Compaction *(Hussain Bahia)*
- TG 3 Mechanical testing of mixtures *(Herve Di Benedetto)*
- TG 4 Pavement perf. prediction eval. *(Herald Piber)*
- TG 5 Recycling *(Chantal De La Roche)*
TG5 Recycling of Bituminous Materials
(Chantal De La Roche)

Task: Evaluate tests & mix design for use of RAP for hot mix recycling; Propose Recommendation

Working Plan:

Aim:
- Evaluate test and mix design methods for the use of materials with bituminous materials from the road (RAP), cold & hot in view of sustainable development
- Propose a recommendation on this subject
- But not duplicate the existing work (PIARC, European projects as SAMARIS, SCORE, NR2C, PARAMIX, ALTMAT (ended in 2002), NCHRP D9-12 use of RAP, NCHRP - detection of RAP in asphalt mixtures)
  - Recommendation on Aging Methodology
  - Mix Design Methodology from Mixes Containing RAP
    - Search for old sites to be recycled or for RAP stockpile
      - Proposal for RAP Site: LCPC

Members: De La Roche, Planche, Khalid, Hugener, Koenders-Porot, Ishai, Luminari, Paez, Buttlar.
Correspond.: Bankowski, Bernaldo, Airey, Chaidron, Di Benedetto, Isaacsson, Partl, Soenen, Svechinsky, Sybilski, Vanelstraete, Van de Ven, Mouillet, Loizos, Freire, Jenkins, Van den Bergh, Gaudefroy, Farcas

TG5 European Survey on Recycling
(J.-P. Planche) Countries: BE (Flanders and Wallonia), CZ, FR, DE, IT, NL, Nordic Countries, ES, CH, UK

Findings:
- **Growing use** of RAP to overcome bitumen cost increase & aggregate shortage
  - Use differs in each country, but similar usages and trends
- **Regulations:**
  - Use of RAP generally not mandatory but pressure from highway agencies
  - Not always nat. specs (Recom, Guidelines, Local Specs, Requir. in UK, BE, CZ,...)
- **Techniques / usages:**
  - Main techniques use hot recycling (see EAPA for available processes)
  - RAP content limits
    - Hot recycling, always below 50%, usually below 30% (depends on layer)
    - For cold recycling, up to 100% RAP
  - Main use in base and binder course
  - New usages in wearing courses for SMA (DE, CZ) and dense mixes (BE)
  - Use of PmB: not common but does not seem to be a problem
## TG5 Overview on Aging Protocols

*(L. Porot)*

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Sample type</th>
<th>Short-term ag.</th>
<th>Long-term ageing</th>
<th>Characterization</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO R30-02</td>
<td>Compacted samples</td>
<td>Loose state 4h @ 135°C</td>
<td>5d @ 85°C</td>
<td>For further mix testing</td>
<td>With LTPP field sections</td>
</tr>
<tr>
<td>Liverpool University</td>
<td>Marshall comp. of Porous Asphalt</td>
<td>None</td>
<td>Air flow @ 60°C up to 21d</td>
<td>Binder recovered &amp; rheol. eval.</td>
<td>With exposed sample (18 mths)</td>
</tr>
<tr>
<td>Nottingham University SATS</td>
<td>Compacted samples</td>
<td>None</td>
<td>Saturated @ 85°C, 2.1MPa for 65h</td>
<td>ITSM on mix samples</td>
<td></td>
</tr>
<tr>
<td>TRL</td>
<td>Cores from pav.</td>
<td>None</td>
<td>48h @ 60°C</td>
<td>ITSM</td>
<td>With field (397d)</td>
</tr>
<tr>
<td>EMPA</td>
<td>Compacted sample</td>
<td>3h @ 135°C</td>
<td>16h @ 120°C or 110°C</td>
<td></td>
<td>Correlate w. 20 y field aging</td>
</tr>
<tr>
<td>VTI</td>
<td>Gyratorty comp. samples</td>
<td>4.5 wks @ ambient temp.</td>
<td>7d @ 60°C with oxygen flow</td>
<td>Mech. properties of asphalt mix</td>
<td>Ranking test</td>
</tr>
<tr>
<td>BRRC</td>
<td>Loose material of Porous Asphalt</td>
<td>none</td>
<td>1y @60°C no air flow or w. oxygen flow</td>
<td>R&amp;B, pen, rheol. eval. asphaltene,</td>
<td></td>
</tr>
<tr>
<td>LCPC (4 methods)</td>
<td>Loose mix</td>
<td>4h @ 135°C</td>
<td>24h @ 100°C (then compaction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell Qualagon</td>
<td>Loose material</td>
<td>2h @ mix temp 16h @ 160°C</td>
<td>7d @ 80°C</td>
<td>Pen and R&amp;B R&amp;B and Pen</td>
<td>With PAV Long-term storage @ mix plant</td>
</tr>
</tbody>
</table>

TG5 Comparison Aging Protocols

- **Objectives of mix aging protocol**
  - Mostly to simulate **long term aging** of asphalt mix
  - **Field correlation** still subject of discussion

- **Type of specimen**
  - Mostly **compacted** samples (6 protocols)
  - Only few on **loose** materials (3 protocols)

- **Short-term aging (curing)**
  - Not systematic, if so mostly at **135°C** between **2…4 h**

- **Long-term aging**
  - Mostly in **oven** some times with air or oxygen flow
  - **5…7 days** @ temperature in range of **60…85°C**
  - **16…24 hours** @ high temperature (100°C to 120°C)

- **Additional conditions**
  - Pressure, flow of air or oxygen, no UV

- **Characterization**
  - For **samples**: mechanical properties
  - On recovered **binders** rheol. charact. & convent. prop. (pen, R&B)

7th In RILEM Symposium ATCBM09, Athens

Deadline Abstract Submission: 30Sep 07

WEB:
http://www.centra.ntua.gr/-pavnet/ATB2009
(under preparation)

or
http://www.rilem.net
ISAP TC WG5 „Re-Use of Construction Materials for Asphalt Pavements“

**Task:** Explore different aspects of the re-use of construction materials for asphalt pavements, such as:

- Environmentally **sustainable** material (when, where does re-used material make sense?)
- **Repeated recycling** and material **resources**
- **Durability and aging** of pavements with re-used pavement material
- **Compaction** and **quality** issues (life cycle analysis)
- **Pavement design** aspects for re-used materials
- **Mix design** link with **RILEM**: RAP content, binder, additives, moisture, mixing process
- **Low energy asphalt** mix production and placing/compaction
- **Emissions** and **working safety**
- **In situ performance**
General Recycling Research Topics

- **Temperature**: hot, warm, cold (emulsions, foam bitumen, etc)
- **Mix design**: mix components, mix properties, combination w. concrete
- **Placing**: Installation: compaction, homogeneity, mixing techniques, energy reduction, health aspects, noise
- **Layers**: wearing, binder, base coarse, overlays
- **Sustainability**: repeated recycling, material components (stones additives, stimulation to use RAP
- **Durability**: moisture/water, mechanical resistance, aging, performance under combined effects
- **Test and assessment methods**: binder, mix, aggregates, environment
ISAP TC WG5 „Re-Use of Constr. Materials for Asphalt Pav."

Topics for WG work

1) RAP recycling, in particular the repeated recycling.
   - Traditional mix design test methods applicable?
   - Specific tests or methodology necessary? (e.g. artificial aging)
   - Mix performance (fatigue, creep,...) and characteristics of single components vs performance (emulsions, old bitumen, ...)

2) byproducts suitable for asphalt mixes: mech. charact., performance and mix design (test methods & charact. protocols)

3) environmental aspects of recycling: leaching and other type of air and water pollution

Proposal Workshop/Session

During Varirei Conference
27..29 June 2007 in L'Aquila (Italy)
ISAP2008 Symposium

Topics

- Emissions and working safety
- Noise reducing pavements
- Drainage and water susceptibility
- Low energy asphalt mix production & placing
- Environmentally sustainable new materials
- Repeated recycling and material resources
- Durability and aging
- Innovative design
- Roads for energy production
- Roads for envir. friendly winter maintenance

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Aug. 18th...20th, 2008
Thank You