International Workshop
ISAP Technical Committee APE
Asphalt Pavement & Environment

Wrap-up, Conclusions

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General Outcome…1

- Excellent overview on RAP technology including Asian experience
- RAP lot of interest **worldwide** (sustainable development)
  → research and use is intensified
- **Political** reservations; quality and performance issues
- Use of RAP in **hot mix** leads to mixes with best performance; quite mature technology; quite extensively used in many countries
- Mostly **in-plant** recycling
- On the long term use of RAP in **low temperature mixes** will become standard, but there are challenges regarding production, placing, performance, durability (aging, moisture), economics
- „Dumping" RAP in lower layers is a waste of valuable material and should become „bad practice", i.e.
  learn to **up-grade RAP** to the highest technical and economically feasible level before using it (pre-processing)
- Reduce diversity of RAP, improve consistency and **homogenize** as much as possible in order to improve quality and fascilitate logistics
- **Repeated re-use** of RAP (e.g. in PA)

General Outcome…2

- Recycling method for **polymer modified** asphalt raises questions
- Don't mix RAP with **PC concrete**
- **Crumb rubber** modified pavements can be recycled, but experience is limited (emissions are discussed controversial, but they may be more hazardous than conventional asphalt)
- Mostly wet process; long-term experience lacking, field performance varies widely
- **Poroelastic** pavements still in the experimental stage (durability, skid resistance)
- Lab tests show that **mixing time** of RAP plays a role for obtaining homogeneous mixtures. The RAP size at the beginning plays a role. The smaller, the higher the stiffness
- Batch plant and continuous drum plant; both are used; no clear preference
- **Cold in-place** recycling is most popular in China

Results …1

- **R&D:** What should be the major future **R&D directions** (what is promising, what is not?) what should be the priorities?
  - Accelerated curing*)
  - Special tools for predicting material durability (under traffic)
  - Improve performance and identify reliable performance tests (possibly simulating curing process)..hardening I
  - Use warm/cold asphalt to reduce emission issues (fume and other pollutants)
  - Clarify, how the RAP should be treated before be used (pre-processing, homogeneity, consistency)
  - How to get the best RAP without damaging the aggregates (double drum technology)
  - Comparison between lab and in field (hardening in lab more severe than in field)
  - Understand, how RAP works (mechanical, chemical physical, e. g. healing) and improve mix design
  - How to classify RAP; performance specs
  - Improve mix design (when use which binder?)

*) Mentioned at during ISAP Workshop 07

Results …2

- **Quality & Management:** How to deal with **quality, durability, functionality** (where special and where not)?
  - Increase the quality of the RAP according to how the RAP itself can be "pre" treated
  - Develop a reasonable "separation method" to obtain fractions and RAP and perform separate analyses
  - Supply of RAP: If more RAP should be used then management strategies must be developed that allow to produce more RAP
  - Maintain volumetric properties is one of main problems in using RAP
  - Storage of RAP is very important (avoid water contact, provide enough space in asphalt plants)
  - **Future aging** of RAP must be considered in mix design

*) Mentioned at during ISAP Workshop 07

Results …3

- **Politics:** How promote re-use & recycling in terms of **social & political acceptance?**
  - Need for guidelines for guaranteeing a certain quality
  - Research Institutes and Universities must help society and the authorities to think in "longer terms" proving the advantages of recycling *)
  - Owners and the researchers should invest in monitoring long-term pavement performances
  - Prove that RAP does not negatively influence the quality of a pavement
  - Change the criteria of contracting in terms of life cycle analysis
  - RAP dumping is a problem in densely populated countries (NL); 1t RAP dumping costs as much as 1 new t of mix
  - Who gets to own the RAP?
  - How to build up a global database for assessment(LCA)?

*) Mentioned at during ISAP Workshop 07


Thank You
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