Use of [other] secondary and recycled materials in pavements

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Scope

- Why is a pavement of interest for such materials ? (Rationale)
- State-of-art
- Recycled materials
- Secondary materials
- Gaps in knowledge
- Research needs

Rationale

- Aggregate
  - Consumption second only to water!
  - 6-8t / capita in USA & Europe
  - 2bn tonnes/yr in USA at $8bn/yr
  - c20bn tonnes/yr in World
  - But ... least controlled / scientifically handled
- Binders are expensive
  - financially
  - emissions (cement produces 5-10% of world's CO_2)
  - sustainability (bitumen derives from oil, or is in competition with food production)

State-of-art / practice

- Most research is material-, source-, oriented
  - performance
  - modification
- Less pavement-, destination-, oriented work
  - How can we design pavements to use XXXX ?
  - How can we integrate sustainability benefits with "performance/efficiency" reduction ?
- Research mostly describes
  - short-term response
    not long-term utility
  - material characteristics,
    not in-system characteristics

- Take-up increasing due to incentives ($ and "green")
  - hindered by environmental concerns
  - still 'narrow'

Recycled Materials

- Any number!
- Local concentrations can usually only be used locally
  - bulk materials don't travel sustainably
  - low energy / low fossil binders might be exceptions
- Does recycling help?
  - better to concentrate on reuse research?

Secondary Materials

- Any number!
- Bulk materials locally available in most locations
  - Very variable properties even in one location
  - No two locations the same
- We've forgotten how to use them (?)
- Treatment-palette needed
  - Adaptable, adjustable, assessable on-site

Gaps

- What's available (really)
- Generic ways of using / treating candidates
- In-service performance (not just adequacy)
- Adaptable pavement design to incorporate "funny" materials
- Assessing now, the adequacy until recycled
- QA/QC goals for layers comprised of these materials
  - e.g. how does one assess a marginal aggregate stabilized with foamed asphalt & fly ash?
- Environmental impact (not only leaching)
- Relative sustainability evaluation of alternatives

Key Research Needs

- Understand and describe aggregates better (long-term goal)
- Design tools that allow range of solutions and materials to be evaluated, incorporating sustainability measures
- Develop pavement performance (and QA/QC) assessment techniques that can
  - work locally
  - work in-situ
  - work reliably on a very wide range of materials
  - measure relevant & long-term properties in use
  - determine in-use applicability from raw(ish) form
- Develop predictive environmental impact procedures
- Develop expert system of treatment methods
  - with generic approaches