Minimizing Paving Costs with Sustainable Materials for IRC 2014

Presented by

Sustainability

- Definition: “practices that conserve resources in a manner that allow growth and development to be sustained for the long-term without degrading the environment”.
- Controversy over what practices, products, materials actually meet the definition
- The simple approach:
  - 3Rs, Reduce-Reuse-Recycle

Alternative Titles

- Saving money and saving the environment – No, (unintended consequences)
- Doing more with less
- Increasing performance and value - cost effectively, not just cutting cost
- The rest of this presentation will focus on the use of several asphalt paving technologies that improve the 3Rs of asphalt pavement and reduce the cost when implemented.
**Asphalt is the Sustainable Pavement**

- Reclaimed asphalt pavement (RAP) is 100% reusable
- Reclaimed asphalt shingles (RAS) – recycled waste
- Asphalt Rubber using ground tire rubber (GTR) - recycle
- Bio-based and other additives – reduce use of petroleum
- Other waste products, recycled aggregates
- Warm Mix technology reduces energy and emissions at the plant and paving site
- Perpetual (long-lived) pavement – reduce reconstruction
- Porous pavements reduce stormwater runoff and pollution
- Visit: http://www.flexiblepavements.org/sustainable_pav.cfm

**RAP**

- Reclaimed Asphalt Pavement (RAP) is the big story in re-use and reduction.
- RAP is the most re-used/recycled of all materials

**OHIO is a high RAP usage State**

According to an FHWA/NAPA survey in 2013, new asphalt concrete in Ohio used an average of 28% RAP and nearly 100% of all RAP was reused in new asphalt concrete.
**RAP**

- Nearly 100% of the RAP is re-used to produce new asphalt concrete.

**RAP**

- Approximately 28% (average) of every ton of new asphalt concrete is reused RAP.
- Use of virgin materials are reduced.
- The numbers are getting better every year as equipment and technology improves.

**Reclaimed Asphalt Shingles (RAS)**

- Research and demonstration projects in the 1980’s and ‘90 showed RAS could be beneficially used in HMA.

- Some producers have routinely used manufacturer’s waste RAS in HMA.

- A 1997 FHWA/ODOT study showed use of shingle manufacturing waste could improve the performance characteristics of asphalt concrete

**RAS from Tear-offs**

- 10 million tons of asphalt Shingles enter waste stream each year
  - 1 million tons manufacturer waste
  - 9 million tons tear-offs or used Shingles
  - Third largest construction material waste

- The Asphalt Roofing Manufacturers Association (ARMA) analyzed a number of recycling options and identified HMA as the best use
  - Volume of waste used
  - Ease of recycling since Shingles composed of materials routinely used in HMA
Why recycle shingles into asphalt concrete?

- Economic benefits
  - Considerable cost savings per ton of HMA – replaces some of the most costly ingredient, asphalt binder
  - Reduces the use of virgin binder
- Important where RAP is in insufficient supply
- It's the right thing to do
  - Process can be engineered to provide asphalt mixtures with equivalent or improved performance
  - Keeps waste out of the landfill

RAS Challenge

- Shingles typically contain:
  - Asphalt
  - Tear-offs contain 30 – 40% asphalt content
  - Manufacturer waste 18 – 22% asphalt
  - 40 to 60% hard rock granules and fillers
  - 1 to 12% fiber and other materials
But, RAS from tear-offs is harder to re-use and blend the reclaimed asphalt

ODOT RAS Specifications

- In 2010 and 2011 ODOT specifications were modified to permit the use of post-consumer, tear-off shingles in asphalt concrete
- Requires careful testing and processing to ensure no asbestos or other hazardous or deleterious material.
- Development continues on how best to incorporate tear-off RAS

Ground tire rubber recycling

- Recycled GTR has been used in asphalt pavement mixtures in various ways
- As a aggregate replacement (dry process)
- And in a more beneficial method known as the ‘wet process’ or Asphalt Rubber
- Recycle 1000 tires per inch per mile
Ground tire rubber recycling

- In the wet process, GTR is reacted with the asphalt at the rate of 15 to 20% to cause swelling and partial digestion of the rubber particles into the asphalt.
- This type of blending can be done at the asphalt terminal or asphalt mixing plant.
- Properly done, this modification produces a beneficial improvement of the asphalt elastic properties similar to what we are used to seeing in polymer modification of asphalt.

GTR

- This blending of a large volume of rubber into the binder is a two-edged sword.
- It uses more recycled material, but
- It can be more problematic than polymer modification to produce consistent results.

ODNR GTR Demo projects

- Several done in Ohio
- Lucas County, King Rd., 2004
- Franklin County, Frank Rd., 2006

More GTR information

- http://www.rubberpavements.org/faq.html
Bio-Derived Asphalt Binders

- Many companies and research institutions (Iowa State U) are busy developing alternative binders and supplements from crops, biomass or bio wastes.
- See the discussion at http://www.fhwa.dot.gov/pavement/materials/pubs/hif10002/ahpm04.cfm
- Also, Ecopave Australia and Road Oyl

Bio based additives

- An Ohio Company is developing a bio-oil from swine manure waste that can be used to extend and improve asphalt binder, based on laboratory results.
- The process is ready for full-scale production and testing.

Other recycled aggregates

- Steel slag
- Foundry sand
- Glass
- Wet bottom boiler slag

FHWA, Every Day Counts, WMA

www.fhwa.dot.gov/pavement/wma.htm
Reduce pavement reconstruction by using long-life pavement

No asphalt base pavement on Ohio’s Interstate system has ever required replacement or major rehabilitation – see the study: Economic Evaluation of Ohio’s Flexible and Rigid Interstate Pavements at: http://www.flexiblepavements.org/images/ecoeval.pdf

The Perpetual Pavement Concept – base that lasts indefinitely with just surface maintenance

Economics and Sustainability

• If the process is not economical, it’s not sustainable
• Economics drives 3R activities – not all currently being used, but may become important
• The economics are changing constantly:
  Cost of asphalt, polymers and aggregates
  New equipment and technology for using reclaimed materials

For more Information on Sustainable Pavement visit: http://www.flexiblepavements.org/sustainable_pav.cfm

Questions?

• About Sustainability in Asphalt Pavements?