Sustainability Benefits of Pavement Preservation

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Pavement Preservation and Sustainability

Preservation:

- Extends service life without rehab or reconstruction
- Reduces demand for new materials and energy
- May improve smoothness, fuel efficiency and safety
- May decrease noise

Sustainable Materials

- Reclaimed Asphalt Pavement
- Recycled Asphalt Shingles
- Slag Aggregates
- Reclaimed Rubber
- Bio-Binders and Binder Replacements/Extenders
- Ash Materials

RAP and RAS

- Widely reused but excess exists
- Binder plus aggregate
- ±5 to 30% binder
  - Oxidized, highly in RAS
- Angular sand in RAS
- RAP agg depends on source

Recycled Aggregates and Fillers

- Slag
- Rubber
- Glass
- Coal Ashes – Fly and Bottom Ash

Long History with Slag Aggregates

- Carbonate local aggregates in Indiana
  - Gravels can be 60% carbonates
  - Prone to polishing
- Air-Cooled Blast Furnace Slag use pre-dates 1946
- Steel Furnace Slag use pre-dates 1988
- Preferred aggregate for high volume surfaces

Alternative Binders

- Bio-Binders – plant, animal, algae based
- Waste cooking oils
- REOB/VTAE
- ???

Sustainable Preservation Treatments

Distresses Addressed

Asphalt Surfaces

- Cracking
- Raveling
- Bleeding/Flushing
- Oxidation
- Minor Roughness
- Friction Issues

Concrete Surfaces

- Some cracking
- Minor Roughness
- Friction Issues

Chip Seals

- Restore friction, seal surfaces, minor surface distresses
- Regular chip sealing extends life by 6 years (MnDOT)
- Single, double or triple
- Asphalt emulsion or hot-applied binder
- RAP and other reclaimed aggregates, alternative binders, ground tire rubber

Chip Seals

dot.ca.gov

- Rubberized asphalt is used
  - Reportedly better chip retention
- LA County uses RAP in all chip seals
  - Also slurry seals and microsurfacing
- Indiana DOT has studied slags in chip seals.

Chip Seal Case Study

- Tippecanoe County, Indiana
- Interstate mill and fill project generated excess RAP
- High quality surface material including slag
- RAP chips pre-coated with binder
- Higher friction than typical chip seal aggregates and lower emulsion rates needed for chip retention
- Economical
- County very pleased and will use RAP whenever they can on both asphalt surfaces and gravel roads

Other Varieties of Chip Seals

- Scrub seals
  - Binder scrubbed into surface with mechanical broom
  - Caltrans has used RAP in these applications
- Sand seals
  - Chip seals with smaller aggregate
  - Excess RAP fines from fractionating

Fog Seals

- Thin applications of asphalts/emulsions
- Seal surface, prevent intrusion of water or oxygen, lock surface aggregates in place
- Could use alternative binders
- PennDOT and MnDOT, among others, have studied bio-based sealants

Slurry Seals

cityilights.org

- Mix aggregates with emulsion and spread with squeegee or spreader box
- Waterproof surface and seal low severity cracks; may improve friction in some cases
- Recycled aggregates and/or alternative binders (including rubber)

Microsurfacing

- Similar to slurry seals but spread with specialized equipment; sets faster
- Fill ruts and surface irregularities
- Polymer-modified emulsion, aggregate, filler, other additives
- Recycled aggregates (LA County) and fillers like fly and bottom ash
- *Cape seal = chip seal + microsurfacing*

Thin and Ultra-Thin Overlays

- Small NMAS asphalt mix placed with paver
- Correct friction and minor irregularities; seal surface
- Recycled aggregates; alternative binders for thin overlays
- May be warm mix = reduced energy consumption, fumes

100% Recycle Plant

In-Place Recycling

- Hot or cold
- Up to 100% recycled aggregate
  - May include alternative binders
- Benefits – reduced hauling
- Potential drawback – energy with HIR

Concerns with RAP in Surfaces

- Unknown aggregate qualities, especially friction?
- Increased cracking potential in asphalt mix?
- NCSC has shown 25% low friction RAP can be used when blended with higher friction aggs (e.g., slag)
- Cracking limited with proper virgin binder selection and perhaps use of WMA additives

WMA + RAP and/or RAS

- Reduced aging with lower production temps
- May counteract oxidized RAP binder
- RAP contents of 50% with WMA
  - Improved rut resistance
  - Better resistance to moisture damage
  - Little to no effect on cracking

Compatibility

Pavement Preservation and Sustainability can go hand in hand.

- Extend service life
- Conserve resources
- Protect the environment

Thank You!

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