Warm Mix Asphalt +

NCAT Pavement Test Track

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  – Coarse versus fine (versus gap graded) blends
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• Evolution of pavement structural design
  – Interim recalibration of layer coefficients
  – M-E validation/calibration and perpetual design
  – Implementation of new technologies
Accelerated Performance Testing (APT)

Track Research Program

- Optimize pavement thickness design
- Identify ideal mixes, materials, methods, etc.

Performance Measures

- Rutting
- Roughness
- Texture
- Density
- Cracking
- Permeability
- Noise
- Friction
- Reflectivity
- High-speed response
2009 Thinner Structural Test Sections

High-Speed Pavement Response

Effect of Thickness on Strain Response

Perpetual Pavement on Soft Clay

- 14” pavement looks great after 15.5 million ESALs
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- 14” pavement looks great after 15.5 million ESALs
- 10” pavement recently rehabilitated for 2nd time
  - In need of 1st rehabilitation after 10 million ESALs
  - 5” mill/inlay failed again after 3.5 million ESALs
  - 1 million ESALs on 5-3/4” high polymer inlay (stay tuned)

2009 Group Experiment (+)

High Recycled Content Mixes

Effective Asphalt Contents
Gradations of Base/Binder Mixes

Sieve Size

0.075 0.15 0.30 0.60 1.15 2.36 4.75 9.5 16 31.5 63 90

Gradations: S9-3, S9-2, N10-3, N10-2

Web Performance Reports

WMA in the United States

- Technology imported from European practice
- Reduced production energy and emissions
- Better compactability (at lower temperatures)
- Reduced short term binder aging
- May be key to higher RAP percentages in future
Track History with WMA

2003 mill/inlay additive WMA with early traffic
- 0.5 million ESALs with immediate traffic

2006 wax as compaction agent in high RAP mix
- 10.5 millions ESALs on previous additive mill/inlay

2009 Group Experiment (+) and WMA Certification
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  - Additive & water injection foam (virgin & high RAP)

2009 Group Experiment (+)

<table>
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<th>Conventional</th>
<th>Permeable</th>
<th>High RAP %</th>
<th>Foamed</th>
<th>Thiope WMA</th>
<th>Kraton Modified</th>
<th>TLA Modified</th>
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S9 S10 S11
**HMA vs WMA<sub>foam</sub> vs WMA<sub>additive</sub>**

- Time of Production on 7/3/09
- Burner Setting (%)
  - HMA @ 325°
  - Foamed WMA @ 275°
  - Additive WMA @ 250°
- Graph showing burner settings (a% vs b%)

**Less Short Term Aging of WMA**

- Graph showing average rut depth (mm)
  - Control Section: 5.5
  - PFC Surface: 5.1
  - RAP HMA: 1.3
  - RAP WMA: 3.6
  - Foamed WMA: 7.3
  - Add WMA: 1.8
  - Thio Thick: 7.7
  - Thio Std: 6.7
  - Kretan Trim: 4.5

**Similar Strain Response for WMA**

- Graph showing longitudinal microstrain
  - 50% RAP

**Current WMA New Process Approval**

- Many states eager to approve new technologies
- Important to keep inferior processes off QPL
- Need confidence in quality of lab & field efforts
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- Important to keep inferior processes off QPL
- Need confidence in quality of lab & field efforts
- Vendors must work to secure field projects
- Circumstances may be less than ideal
- Process is often repeated in every state

National WMA Certification Program

- 9.5 mm coarse granite PG67-22 mix (TSR \approx 0.3!)

- Laboratory performance of plant produced mix
  - Flow number, dynamic modulus, APA
  - IDT, overlay tester, bond strength, PG grading
  - TSR, stripping via boiling, Hamburg (aged & unaged)
- Field performance on Pavement Test Track
  - Hot-mix control, immediate traffic (1 year thereafter)
  - Weekly rutting, roughness, macrotexture
  - Final report within 18 months of commitment

WMA Certification Endorsements

- Alabama
- Arizona
- Colorado
- Delaware
- Florida
- Indiana
- New Hampshire
- South Carolina
- Texas
- Washington