Thin Overlays for Pavement Preservation with a Texas Swing

Minnesota Asphalt Pavement Association
February 2015
Thin Asphalt Overlays for Pavement Preservation
Why Thin Overlays?

- Shift from new construction to renewal and preservation
- Functional improvements for safety and smoothness needed more than structural improvements – Perpetual Pavements
- Material improvements
  - Binders – Superpave and Polymers
  - SMA, OGFC and Dense-Graded
  - Superpave mix design
  - Warm Mix
  - Reclaimed Asphalt Pavement (RAP)
  - Roofing Shingles
Treatment Use–HMA Rural (ADT > 5,000)
Treatment Use—HMA Urban (ADT>10,000)

% of Agencies

C79%
Benefits of Thin Overlays

- Long service, low life-cycle cost
- Maintain grade and slope
- Handles heavy traffic
- Smooth surface
- Seal the surface
- Minimize traffic delays

- Low noise generation
- Can be recycled
- Can use in stage construction
- Easy to maintain
- Restore skid resistance
NCAT Noise Trailer

Smaller Aggregate = Less Noise
Texas Ultrathin

• Alternate to 1 or 2 Course Surface Treatment
  – For pavement needing a highly flexible surface, but could also benefit from good ride quality associated with HMA
  – For pavement with a number of seal coats, shallow rutting, patching, and other distresses
Topics

- Project Selection
- Materials Selection and Mix Design
- Construction and Quality Control
- Performance
- Conclusions
PROJECT SELECTION

Avoid Projects Needing Structural Rehabilitation!!
Types of Distress

- Raveling
- Longitudinal Cracking (not in wheelpath)
- Longitudinal Cracking (in wheelpath)
- Transverse Cracking
- Alligator Cracking
- Rutting
Raveling
Longitudinal Cracking (not wheelpath)
Longitudinal Cracking (wheelpath)

Temporary Fix for Minor Distress
Transverse Cracking
Alligator Cracking (minor)

Temporary Fix for Minor Distress
Rutting or Shoving

Severe Structural Failure

Surface Failure – Milling Required
If Thin Overlay is the Answer:

- Select
  - Surface Preparation
    - Distresses
    - Roughness
    - Considerations for Curb Reveal and Drainage
  - Materials
    - Traffic
    - Availability
    - Climate
  - Thickness
    - NMAS
    - Geometrics
## Surface Preparation

<table>
<thead>
<tr>
<th></th>
<th>Mill</th>
<th>Fill Cracks with Mix</th>
<th>Clean and Tack</th>
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<tbody>
<tr>
<td>Raveling</td>
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Lives, Time and Resources
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MATERIALS AND MIX DESIGN

- Materials Selection
- Mix Design for Dense-Graded Mixes
- Other Mix Types
Materials Selection - Binder

- Most specifications use PG system for climate and traffic
  - Ohio – Polymer modified PG 64-22 or PG 76-22
  - New York – same as Ohio
  - New Jersey – PG 76-22 for high performance mix
  - North Carolina – depends upon traffic level
Small NMAS mixes should contain fine RAP

RAP or shingles will help
- Stabilize cost by reducing added asphalt and added aggregate
- Prevent rutting
- Prevent scuffing

Use maximum allowable while maintaining gradation
Mix Design

• Laboratory Compaction
  – Low Volume – 50 gyrations in MD and GA
  – Medium Volume – 60 to 75 in MD, NY, AL
  – High Volume – 60 (AL) to 125 (UT)
  – Needs to be enough for interlock without fracturing aggregate

• Volumetrics
  – Void Requirements – Mixes are relatively impermeable
  – VMA – Should increase as NMAS decreases
  – Asphalt Content – Should depend on Voids and VMA
TxDOT – Ultrathin Overlays

- 1/2” HMA
- Aggregate < 1/4”
- Binder: 7.0 to 7.3% PG76-22
CONSTRUCTION & QUALITY CONTROL

- Construction
- Production
- Paving
- Quality Control
Construction - Production

• RAP – Process for size and consistency
  – Max size ≤ NMAS

• Storage and Loading
  – Follow normal best practices

• Warm Mix
  – Increase haul distance
  – Pave at cooler temperatures
  – Achieve density at lower temperatures
  – Extend paving season
  – Pave over crack sealer
Construction – Paving Surface Preparation

• Milling
  – Remove defects
  – Roughen surface
  – Improve smoothness
  – Provide RAP
  – May eliminate need for tack
  – Size machinery properly

• Tack
  – Emulsion or hot asphalt
  – Polymer emulsion or unmodified
  – Rate: 0.10 to 0.15 gal/sy (undiluted emulsion)
Construction – Paving and Compaction

• Paving
  – Best to move continuously
  – MTV or windrow can help
  – Cooling can be an issue
    • 1” cools 2X faster than 1.5”
  – Warm mix

• Compaction
  – Seal voids & increase stability
  – Low permeability
  – No vibratory on < 1”
Texas Ultrathin

• Static vs. Vibratory
  – Better texture with static
  – Vibratory compaction migrated tack to the surface – fat spots
Quality Control - Field

• Field Density
  – Thin-lift NDT gauges OK for > 1” mat
  – Cores may not be representative
  – Permeability not as big an issue

• Ride Quality
  – Depends on
    • Condition of existing pavement
    • Surface preparation
    • Overlay thickness
  – Specification should be based on existing condition
PERFORMANCE

- Immediate Benefits
- Pavement Life
- Economics
Immediate Benefits

• Labi et al. (2005)
  – 18 to 36% decrease in roughness
  – 5 to 55% decrease in rut depth
  – 1 to 10% improvement in condition rating

• Noise
  – FHWA (2005): 5 dB reduction on overlaid PCC in Phoenix

• 3dB reduction = ½ traffic volume
Perpetual Pavement Strategy

- Max Tensile Strain
- 100 mm to 150 mm Zone Of High Compression
- High Modulus Rut Resistant Material (Varies As Needed)
- Flexible Fatigue Resistant Material 75 - 100 mm

Pavement Foundation
# Thin Overlay Life

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• Chou et al. (2008):
  – Thin overlays on asphalt – almost always most cost effective
  – Thin overlays on PCC – not as cost effective, but greater deterioration prior to overlay
Texas Pilot Program

0.5” Tiny TOM

1” TOM
Texas Ultrathin - Future

• Issue with obtaining target AC with fine mixes
  – Target AC = 7.2%; Actual AC = 7.8-8.0%

• Develop Special Specification
  – Vary AC to match required performance
  – Strict temperature requirements for placement
  – Static Compaction
  – Water Flow Rate ≥ 2 minutes

• Now have OGFC thin lift.
Conclusions

• Thin Overlays for Pavement Preservation
  – Improve Ride Quality
  – Reduce Distresses
  – Maintain Road Geometrics
  – Reduce Noise
  – Reduce Life Cycle Costs
  – Provide Long Lasting Service

• Place before extensive rehab required

• Expected performance
  – 10 years or more on asphalt
  – 6 to 10 years on PCC