Overview

• Preventive Maintenance Concepts
• What are thin and ultra thin mixes
• Experience in Michigan with ultra thin
• Case Study- Washington County Thin mix overlays
Preventive Maintenance

The planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without increasing structural capacity).

- AASHTO’s Standing Committee on Highways
Preventive Maintenance

- Planned
- Performed on good pavements
- Contributes to long-term performance
- Examples: Fog Seal, Chip Seal, Thin HMA Overlay
Double Road Seal
Pavement Lifecycle

Pavement Condition vs. Time or Traffic
Critical PCI

Pavement Condition Index

Time or Traffic

100

0

Preventive Maintenance

Corrective Maint, Rehabilitation, or Reconstruction

Critical PCI
Preventive Maintenance

Pavement Condition

Time or Traffic
Preventive Maintenance Issues

• Most thin treatments only address what you see at the surface
• Most thin treatments due not improve ride and some actually reduce ride quality
• Pavement Condition Index (PCI) is a measure of surface condition only
Why Thin Hot Mix Overlays?

- Improves Serviceability (Ride)
- Seals the surface
- Restores skid resistance
- Low Initial Cost & Life Cycle Cost
- Minimal Road User Delays/Impacts
- Low Performance Risk
- Adds Structure
SHRP SPS-3 STUDY

- Thin overlays significantly improved pavement smoothness after treatment

- Chip seals and slurry seals improved pavement smoothness slightly after treatment
# Thin Treatment Benefits

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Smoothness</th>
<th>Rut Depth</th>
<th>Crack &amp; Patches</th>
<th>Structure</th>
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<tbody>
<tr>
<td>THMO's</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Slurry/Chip Seals</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Micro Surfacing</td>
<td>X</td>
<td>X</td>
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</table>
Thin Mixes

- 3/8” mixes Placed 1.0-1.25” thick
- Designed for traffic levels according to current best practice
- Binder Grade selected according to current best practices
Ultra Thin Mixes

- Slightly finer graded Mixes
- Able to be place 0.6-1.0 inches thick
- Mix design levels and binder grade selection following current best practices
<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Thin Mix</th>
<th>Ultra Thin Mix</th>
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</thead>
<tbody>
<tr>
<td>½”</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>3/8”</td>
<td>90-100</td>
<td>99-100</td>
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<tr>
<td>#4</td>
<td></td>
<td>75-95</td>
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<tr>
<td>#8</td>
<td>32-67</td>
<td>55-75</td>
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<tr>
<td>#200</td>
<td>2-10</td>
<td>3-8</td>
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</table>
Mix Design

• Require Mix Design Provided by Contractor Meeting Requirements of Current ODOT “Contractor HMA Design Guidelines”

• Require Submitted by CMDT

• Select Criteria Based on Traffic Level

• Select Binder based on Climate/Loading
Asphalt Pavement Association Of Michigan
Ultra-Thin Overlay

Description:

• A dense graded HMA mixture with an application rate between 65 - 90 lbs./sq.yd.

• .60 inch to .80 inch thickness
Purpose:

- Protect the pavement structure
- Slow rate of deterioration
- Correct surface deficiencies
- Improve skid - resistance
- Improve ride quality (restores crown)
Genesee County -- Ultra-Thin Overlay

Asphalt Pavement Association Of Michigan

Ultra-Thin Overlay

Genesee County - Ultra-Thin - 1997
Asphalt Pavement Association Of Michigan
Ultra-Thin Overlay

Close-up .75 in
Advantages:

- Improved ride quality
- Quiet
- Very smooth riding surface
- No excess stone buildups
- No broken windshields from loose aggregate
Advantages:

• Ease of construction, use standard paver
• Minimal construction time
• Don’t have to adjust structures
Ultra-Thin Overlay

MDOT Implementation

- Alternate to Micro-Surfacing & Chip Seal
- Specification developed by Industry/MDOT Mixtures Task Force
- Mixture properties/materials engineered for specific traffic levels
Asphalt Pavement Association Of Michigan
Ultra-Thin Overlay

Traffic Classifications

<table>
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<tr>
<th>Low Volume</th>
<th>Medium Volume</th>
<th>High Volume</th>
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<tbody>
<tr>
<td>Comm. ADT*</td>
<td>Comm. ADT*</td>
<td>Comm. ADT*</td>
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<td>&lt;380</td>
<td>380 - 3400</td>
<td>&gt;3400</td>
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</table>

* Two-Way Truck Traffic
## MDOT Projects to Date

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<th>UT Type</th>
<th># of Jobs</th>
<th>Length (miles)</th>
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<tr>
<td>Ultra-thin low</td>
<td>30</td>
<td>256</td>
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<tr>
<td>Ultra-thin med</td>
<td>18</td>
<td>145</td>
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<tr>
<td>Ultra-thin high</td>
<td>8</td>
<td>50</td>
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</table>
Asphalt Pavement Association Of Michigan
Ultra-Thin Overlay

Ultra-Thin (#3) Davison Hwy (3 yrs old) Micro-Surface
Asphalt Pavement Association Of Michigan
Ultra-Thin Overlay

Davison Highway
Micro-Surfacing transitioning to Ultra-Thin overlay
## Prevention Maintenance Treatments Cost Comparison

<table>
<thead>
<tr>
<th>Treatment</th>
<th>$/syd</th>
<th>Cost/mile (24’ wide)</th>
<th>Life extension range (years)</th>
<th>APAM Life extension range average (years)</th>
<th>Cost/mile* per year</th>
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<tr>
<td>Double chip seal</td>
<td>$2.40</td>
<td>$33,791</td>
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<td>Micro-surface</td>
<td>$2.44</td>
<td>$34,354</td>
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<td>Ultra-thin low</td>
<td>$2.20</td>
<td>$30,975</td>
<td>5-9</td>
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<tr>
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<td>$35,903</td>
<td>5-9</td>
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<td>$5,129</td>
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<tr>
<td>Ultra-thin high</td>
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<td>$39,845</td>
<td>5-9</td>
<td>7</td>
<td>$5,692</td>
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<tr>
<td>Single course overlay (1.5”)</td>
<td>$4.12</td>
<td>$58,078</td>
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<td>7.5</td>
<td>$7,743</td>
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<tr>
<td>Mill &amp; fill (1.5”)</td>
<td>$5.15</td>
<td>$72,509</td>
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<td>$9,668</td>
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Unit Prices based on MDOT Information as of Oct. 2008
HMA Ultra-Thin
High Value Pavement Enhancement

- Extends Pavement Life
- Protects the Pavement Structure
- Restores Pavement Smoothness

HMA Ultra-Thin 3/4” - 1”
Over existing asphalt pavement

- VS -

Typical Surface Treatment 3/16” - 3/8”
Over existing asphalt pavement
Thin Mix Experience in Oregon

• Washington County Case Study
A Case Study

Rehabilitation Using Thin-Lift Overlays

Washington County
Summer, 2001
Why Slurry Seals? (or micro-surfacing)

- Weathered Surface
- Very Minor Cracking
- Restoration of Skid Resistance
- Pavement Life Extension
Jamieson Road Micro-Surface
Evergreen Micro-Surface
Why Thin-Lift Overlays? (1” Hot-Mix Asphalt Concrete)

- Minimize Lane Closures
- Appearance and Ride Quality
- Added Structural Life
- Limited Contractor Availability for Slurry Seals/Micro-Seals
- Reduced Risk
- Lower Life-Cycle Cost???
Mix Design

• 1” thick Hot-Mix Asphalt Overlay
• 12.5 mm --- 100%
• 9.5 mm --- 99%
• 6.3 mm --- 88%
• 4.75 mm --- 75%
• 2.36 mm --- 51%
• 600 um --- 25%
• 75 um --- 6.7%
• PBA-5 --- 6.0%

APA Rut Test Result - 4.6 mm
Fischer Road

- ADT = 3,200 vehicles per day
Leahy Road

- ADT = 4,800 vehicles per day
Murray Blvd.

- ADT = 30,000 vehicles per day
9.5 mm mix
# Skid Test Results

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<th>MP</th>
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Cost

• Thin Lift Overlay = $2.53 per square yard

• Micro-Surfacing = $1.92 per square yard

• 32% cost increase
Life Cycle Costs

- 20 Years, I=4%
- Thin Lift = $5.82
- Micro Surface = $8.20

Thin Lift Saves $2.38/\text{yd}^2 \text{ in 20 Years and Adds 3” of Structure}$
Summary

- Thin Overlays Provide Excellent Serviceability
- Effectively Seal Surface
- Provide Smooth High Skid Surface
- Low Life-cycle Costs
- Minimal User Impacts
- Will consider for future treatments
## Summary of Washington County
### Thin Lift

<table>
<thead>
<tr>
<th>Road Name</th>
<th>Paved</th>
<th>Age</th>
<th>Current PCI</th>
<th>Projected Life</th>
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<tbody>
<tr>
<td>90th Ave</td>
<td>2001</td>
<td>7.5</td>
<td>92</td>
<td>12-15</td>
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<tr>
<td>Fischer Road</td>
<td>2001</td>
<td>7.5</td>
<td>95</td>
<td>12-15</td>
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<tr>
<td>Leahy Rd (1)</td>
<td>2001</td>
<td>7.5</td>
<td>92</td>
<td>12-15</td>
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<tr>
<td>Leahy Rd (2)</td>
<td>2001</td>
<td>7.5</td>
<td>92</td>
<td>12-15</td>
</tr>
<tr>
<td>Murray Blvd (1)</td>
<td>2001</td>
<td>7.5</td>
<td>95</td>
<td>12-15</td>
</tr>
<tr>
<td>Murray Blvd (2)</td>
<td>2002</td>
<td>6.5</td>
<td>95</td>
<td>12-15</td>
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<tr>
<td>Walker Road</td>
<td>2002</td>
<td>6.5</td>
<td>95</td>
<td>12-15</td>
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<tr>
<td>Murray Blvd (3)</td>
<td>2007</td>
<td>1.5</td>
<td>100</td>
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<tr>
<td>Murray Blvd (4)</td>
<td>2007</td>
<td>1.5</td>
<td>88</td>
<td>?</td>
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Pavement performance curve

Preventive Maintenance

Maintenance and Rehabilitation

Minimum recommended condition

Reconstruction

Change due to a preventive maintenance treatment

Extended pavement life due to preventive maintenance

Benefit
Fischer Road Paved 2001
Current PCI 95
Murray Blvd. ADT 30,000 Paved
2001 Current PCI 95
Walker Road Paved 2002
Current PCI 95
Murray Blvd. Paved 2002
Current PCI 95
Summary

- Thin and Ultra thin asphalt overlays are proven performers
- Thin and Ultra thin asphalt overlays have performance advantages compared to other preventive maintenance treatments
- Initial Costs may be higher however life cycle costs will clearly save agencies money and extend limited budgets