Maintaining your roads with Asphalt

HMA – America’s Most Versatile Product
Maintaining your roads with Asphalt

- Asphalt Overlays
- Asphalt for Preventive Maintenance
Asphalt Overlays

- Functional overlays
  - Typically used to address surface distresses or improve ride quality
  - Generally not designed and rely on past experience
- Structural overlays
  - Correct structural deficiencies and are designed
Asphalt Overlays

Thin Overlay
- Surface Defects

Thick Overlay
- Structural Defects
Functional Overlays

- Remedy functional deficiencies
- Minimum constructible thickness
- May involve surface milling and repair with overlay
Functional Deficiencies

- Adversely affect highway user
  - Poor surface friction
  - Hydro-planing
  - Surface distortion
    - Minor Rutting
    - Raveling
  - Surface Cracking
  - Surface Irregularities
Surface Roughness

Irregularities in the pavement surface that adversely affect ride quality, safety, and vehicle maintenance costs

- HMA Pavements
  - Heaves, settlements
  - Deteriorated cracks
  - Deterioration
  - Raveling

- PCC Pavements
  - Heaves, settlements
  - Spalling
  - Faulting
  - Curling/warping
  - Texture application
Options for Correcting Functional Deficiencies

• Thin overlay
• Milling plus thin overlay
• Full-depth or partial-depth repairs with thin overlay
Structural Overlays

- Remedy structural deficiencies
- Minimum design thickness
- May involve surface milling and repair with overlay
Structural Deficiencies

- Adversely affect the load-carrying capability of the pavement
- Indicators
  - Cracking
  - Distortion (rutting)
  - Disintegration
Options for Correcting Structural Deficiencies

- Structural overlay
- Pre-overlay repair and structural overlay
- Rehabilitation and structural overlay
- Reconstruction
Pre - overlay Repairs

- Amount and type depends on
  - Type of overlay
  - Structural adequacy
  - Distress types and severity
  - Future traffic loadings
  - Physical constraints
  - Overall project funding
Pre - overlay Repairs

• Consider trade-offs between
  • Overlay type
  • Overlay thickness
  • Pre - overlay repair extent
Reflection Cracking

- Appear above joints or cracks in underlying pavement layer
  - AASHTO design equations do not consider directly
  - Additional steps must be taken to reduce the rate and severity
Reflection Cracking

- Causes
  - Low temperature cycles
  - Traffic loads
  - Excessive tensile stresses developed in overlay due to movement of existing pavement
  - Initiates at bottom of overlay
Stresses from Low Temperatures

- Lower temperatures
  - Overlay
  - Thermal stress
  - Old pavement
  - Higher temperatures
  - Joint or crack
  - Subgrade
Stresses from Traffic Loads

Tip of the joint or working crack
AC overlay
Void
Old AC pavement

AC bending stress

Stress at the tip of the crack

Shearing stress

A
B
C
Reflection Cracking Control Measures

- Increased overlay thickness
- Fabrics
- Crack-arresting interlayers
- Pre-overlay treatments
Increased Overlay Thickness

- Does not prevent the occurrence of reflection cracking
- Reduces the rate and severity of reflection cracking
- Cost-effectiveness must be considered relative to other techniques
Fabrics

• Provide physical restraint (reinforcing layer) to resist formation of cracks
• Not as effective with substantial horizontal and vertical movements
• Most effective at longitudinal joints and in warm climates
Crack-Arresting Interlayers

Aggregate lift or ASCRL (HMA)

Overlay

Crack arresting layer High voids

Old pavement

Subgrade
Pre-overlay Repair Treatments

• Any method that reduces movement at joints and cracks can potentially reduce reflection cracking

• Possible treatments
  • Surface milling
  • Crack Repair
  • Crush and Shape (rehab strategy)
Summary

• Examine the feasibility of an overlay as most effective alternative vs. major rehab
• There is more to overlay design than just thickness design
  • Pre-overlay repairs
  • Sub-drainage
  • Reflection crack control
• Need to have reasonable performance expectations!
Maintaining your roads with Asphalt

• Asphalt Overlays

• Asphalt for Preventive Maintenance
Asphalt for Preventive Maintenance

Thin Asphalt Overlays

• Shift from new construction to renewal and preservation
• Functional improvements for safety and smoothness needed more than structural improvements
Benefits of Thin Asphalt Overlays

- Long service, low life-cycle cost
- Maintain grade and slope
- Handles heavy traffic
- Smooth surface
- Seal the surface
- No loose stones
- Minimize dust
- Minimize traffic delays

- No curing time
- Low noise generation
- No binder runoff
- Can be recycled
- Can use in stage construction
- Easy to maintain
- Restore skid resistance
Preventive Maintenance

WHAT EXACTLY IS YOUR PREVENTIVE MAINTENANCE PROGRAM PREVENTING?
Asphalt for Preventive Maintenance

HMA Ultra-Thin:

• Extends Pavement Service Life
• Protects the Pavement Structure
• Restores Pavement Smoothness

HMA – America’s Most Versatile Product

SMOOTH | DURABLE | SAFE | QUIET
What does HMA Ultra-Thin do:

• Protects the pavement structure
• Adds structural value
• Corrects surface deficiencies
• Improves skid - resistance
• Improves ride quality (restores crown)
HMA Ultra Thin

Guide Specification for HMA Ultra-Thin 2005:
APAM

12/23/2005

GUIDE SPECIFICATION
FOR
HMA Ultra-Thin

1 of 4

a. Description. This special provision provides acceptance testing requirements for use on HMA Ultra-Thin Overlay mixture.

b. Materials. The HMA and materials shall meet the following requirements:

1. Bond Coat. The bond coat material will be emulsified asphalt conforming to the requirements of Section 904 of the Michigan Department of Transportation (MDOT) 2009 Standard Specifications for Construction, Type 551b.

2. HMA Ultra-Thin Overlay. The Ultra Thin HMA Overlay shall be composed of a mixture of aggregate, asphalt binder, and if required, mineral filler, as listed in Table 1.

### Table 1 - HMA Ultra-Thin Overlay Mixture Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Low Volume</th>
<th>Medium Volume</th>
<th>High Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Volum</td>
<td>Medium Volum</td>
<td>High Volum</td>
</tr>
<tr>
<td></td>
<td>Comm. ADT</td>
<td>Comm. ADT</td>
<td>Comm. ADT</td>
</tr>
<tr>
<td>Marshall Air Voids %</td>
<td>4.5</td>
<td>4.5</td>
<td>5.0</td>
</tr>
<tr>
<td>VMA % (min.)</td>
<td>15.5</td>
<td>15.5</td>
<td>15.5</td>
</tr>
<tr>
<td>Max. Binder %</td>
<td>12</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Flow (0.01 in.)</td>
<td>2-16</td>
<td>2-16</td>
<td>2-16</td>
</tr>
<tr>
<td>Stability Min. (GPa)</td>
<td>1200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Aggregate Gradation and Physical Properties. The combined gradation of the aggregate portion of the mixture, including the mineral filler, shall be within the limits of Table 2. The physical properties of the combined aggregate shall meet the criteria of Table 3.

### Table 2 - HMA Ultra-Thin Overlay Aggregate Gradation

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Total Passing Percent by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in.</td>
<td>100</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>80-100</td>
</tr>
<tr>
<td>3/16 in.</td>
<td>75-95</td>
</tr>
<tr>
<td>No. 4</td>
<td>75-95</td>
</tr>
<tr>
<td>No. 8</td>
<td>55-75</td>
</tr>
<tr>
<td>No. 10</td>
<td>75-95</td>
</tr>
<tr>
<td>No. 200</td>
<td>2-8</td>
</tr>
</tbody>
</table>

HMA – America’s Most Versatile Product

SMOOTH | DURABLE | SAFE | QUIET
## HMA Ultra Thin

### APAM Guide Specification

**Table 4 - Asphalt Binder Selection for HMA Ultra-Thin Overlay**

<table>
<thead>
<tr>
<th>Low Volume</th>
<th>Medium Volume</th>
<th>High Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comm. ADT</td>
<td>Comm. ADT</td>
<td>Comm. ADT</td>
</tr>
<tr>
<td>&lt;380</td>
<td>380 - 3400</td>
<td>&gt;3400</td>
</tr>
<tr>
<td>PG 64-22*</td>
<td>PG 64-28P**</td>
<td>PG 70-22P*</td>
</tr>
</tbody>
</table>

* In areas North of M-46, May use PG 58-28 (Low) or PG 70-28P (High)
** May use another “readily available” polymer modified (P) grade.
HMA Ultra Thin

Existing Pavement Conditions:

- Good cross section
- Good base, structurally sound
- Visible surface distress may include:
  - Moderate cracking, \( \leq 1/2'' \) wide
  - Raveling and surface wear
  - Slight to moderate flushing or polishing
  - Occasional patch in good condition
HMA Ultra Thin

4 – 6 Paser rating
# HMA Ultra Thin

<table>
<thead>
<tr>
<th>Feature</th>
<th>HMA UT</th>
<th>Chip Seal</th>
<th>Microsurfacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase skid resistance</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Minimizes curb loss</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Corrects surface distress</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Can be applied in one pass</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Increases structural strength</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improves ride quality</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improves pavement draining</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrects minor rutting</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Eliminates dust, loose aggregate</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Minimizes delamination</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
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</tbody>
</table>
# HMA Ultra-Thin Performance

## MDOT Projects - Statewide

<table>
<thead>
<tr>
<th>UT Type</th>
<th># of Jobs</th>
<th>Length (miles)</th>
<th>Avg. Age (end service)</th>
<th>Avg. Age (in service)</th>
<th>Avg. Age (overall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra-thin low</td>
<td>52</td>
<td>483</td>
<td>6.6 (13)</td>
<td>9.8</td>
<td>8.6</td>
</tr>
<tr>
<td>Ultra-thin med</td>
<td>41</td>
<td>339</td>
<td>5.5 (4)</td>
<td>8.6</td>
<td>6.6</td>
</tr>
<tr>
<td>Ultra-thin high</td>
<td>16</td>
<td>89</td>
<td>5.3 (3)</td>
<td>7.3</td>
<td>6.4</td>
</tr>
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</table>
## Prevention Maintenance Treatments Cost Comparison

<table>
<thead>
<tr>
<th>Treatment</th>
<th>$/syd</th>
<th>Cost/mile (24’ wide)</th>
<th>MDOT Life extension range (years)</th>
<th>Life extension range average (years)</th>
<th>Cost/mile per year</th>
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<tbody>
<tr>
<td>Double chip seal</td>
<td>$3.18</td>
<td>$44,773</td>
<td>3-5</td>
<td>4</td>
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</tr>
<tr>
<td>Micro-surface</td>
<td>$2.61</td>
<td>$36,747</td>
<td>3-5</td>
<td>4</td>
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<tr>
<td>Ultra-thin low</td>
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<td>5-9*</td>
<td>9*</td>
<td>$3,927</td>
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<tr>
<td>Ultra-thin med</td>
<td>$2.87</td>
<td>$40,408</td>
<td>5-9*</td>
<td>8*</td>
<td>$5,051</td>
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<tr>
<td>Ultra-thin high</td>
<td>$3.29</td>
<td>$46,321</td>
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*Average Life Extension estimated by APAM
Unit Prices based on MDOT Information as of Jan. 2016
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Asphalt for Preventive Maintenance

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- Restores Pavement Smoothness
Maintaining your roads with Asphalt

Asphalt is the popular solution to pavement maintenance. Asphalt overlays are economical, long-lasting, and effective in treating a wide variety of surface distresses to restore ride quality, skid resistance, and overall performance.
Maintaining your roads with Asphalt

Thank You!

Questions??

www.apa-mi.org