The Selection and Timing of Pavement Preservation Strategies

Louisiana Asphalt Technology Conference

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National Center for Pavement Preservation
Americans demand easy mobility on safe, smooth, and well-maintained roads.
Driving on Poor Roads Cost

- $49 billion per year in extra vehicle repairs and operation costs
- $255 per motorist

Source: The Road Information Program
EVOLVING DEMANDS

- Highway Usage Increased 29% in the 1990’s
- Truck Traffic Increased 40% in the 1990’s
- Truck Traffic Will Increase 3% per year in the next 20 years
CONSEQUENCES

- Operating Revenues *Can’t* Keep Pace with Needs
- Highway Agencies Face *Increasing* Demands with *Decreasing Resources*
The Solution:

Pavement Preservation

Improves the Performance of the Network while Spending Less Program Dollars
What is Pavement Preservation?
Time
0
45
Performance
Funding
Pavement Preservation is *NOT* about Maintenance as Usual
Pavement Preservation
“Definition”

Pavement preservation is a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations.
• Routine Maintenance
• Preventive Maintenance
• Rehabilitation

• Sustainable Financing
• Long-Term Network Planning
• Cost-Effective Decision Making
• Pavement Management System
• Optimization
Rehabilitation

Minor Rehab
Extends Life

Adding More Time
Rehabilitation

Major Rehab

Originates Life

Initiating Time
The Pavement Preservation Concept

Rehabilitation Trigger

Original Pavement

Time (Years)
Current Condition

Pavement Remaining Life Categories

Percent of Network Pavement

- I: 19% (0-2 years)
- II: 10% (3-7 years)
- III: 40% (8-12 years)
- IV: 8% (13-17 years)
- V: 6% (18-22 years)
- VI: 17% (23-27 years)

Pavement Remaining Life Categories

MICHIGAN STATE UNIVERSITY
Optimal Condition

Percent of Network Pavement

Pavement Remaining Life Categories

I (0-2) 11%
II (3-7) 18%
III (8-12) 18%
IV (13-17) 16%
V (18-22) 17%
VI (23-27) 20%

Years
Reconstruction Strategy
(20, 25, & 30 Year Fixes)

Years
0 5 10 15 20 25 30 35 40

Percent of Total Network
0 10 20 30 40 50 60 70 80 90 100

Poor Fair Good

MICHIGAN STATE UNIVERSITY
Combined Reconstruct, Rehab & Preventive Maintenance Strategy
(5 to 30 Year Fixes)

- 0% to 10% Poor
- 10% to 70% Fair
- 70% to 100% Good

Years

Percent of Total Network
MEASUREMENTS
Of
PAVEMENT LIFE
Life Extension

Very
Good
Good
Fair
Poor
Very Poor

Measured Life Extension

PMS Data Point

Time (Years)
Typical Treatments
Flexible & Composite Pavements

- Asphalt Crack Sealing
- Asphalt Crack Filling
- Chip Seals
- Slurry Seals
- Micro-Surfacing
- Thin Bonded Wearing Course
- HMA Thin Overlay
- Surface Milling w/ Non-Structural HMA Overlay
Typical Treatments
Rigid Pavements

- Diamond Grinding
- Concrete Crack Sealing
- Concrete Joint Resealing
- Partial Depth Concrete Pavement Repair
- Dowel Bar Retrofit
- Full Depth Concrete Pavement Repair
PREVENTIVE MAINTENANCE PROGRAM

GUIDELINES
1 - ASPHALT CRACK SEALING

Description: Crack sealing is the placement of specialized materials into working cracks to increase the desired reservoir and provide cleaning of the cut or milled surface. This treatment is performed in conjunction with other treatments.

Expected Life Extension (3)

<table>
<thead>
<tr>
<th>Commercial Traffic/Pavement Type</th>
<th>(Trucks)/(Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT-T</td>
<td>&lt; 400</td>
</tr>
<tr>
<td>Flexible</td>
<td>400 - 6000</td>
</tr>
<tr>
<td>Flexible</td>
<td>&gt; 6000</td>
</tr>
<tr>
<td>Flexible</td>
<td>Up to 4 (4)</td>
</tr>
<tr>
<td>Flexible</td>
<td>Up to 3</td>
</tr>
<tr>
<td>Flexible</td>
<td>Up to 2</td>
</tr>
</tbody>
</table>

(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000’ elevation should be reduced up to 50% from the values shown in the table.

(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.

Existing Pavement Surface Preparation:

Timing: The use of magnesium chloride as a roadway snow and ice melt may leave residue in pavement cracks. Early season crack treatment applications could likely result in poor adhesion and a high loss of the sealant material. To assure a successful crack sealing operation, work should be scheduled in the early fall once daytime temperatures begin to cool. Application should be scheduled only when daily and ambient temperatures are 50°F or greater.

Performance: Crack sealing introduces materials that adhere to the crack walls. These are flexible and elastomeric in nature. This allows significant strain to be absorbed by the material without fracture. Much of the strain will be recoverable.

Working Crack: A crack is a pavement that undergoes significant deflection and thermal opening and closing movements greater than 2 mm (0.06 inches), typically oriented transversely to the pavement centerline.
Working Crack

Criteria:

Crack movement is at least 1/8” (3-mm)
Crack Sealing

Working Cracks

Typical Crack

Standard Reservoir
Crack Router
Random Crack Saw
Attention to Detail

Corrects Future Problems

Reservoir

Sliver

Sliver
2 – ASPHALT CRACK FILLING

Existing Pavement Conditions

<table>
<thead>
<tr>
<th>Pavement</th>
<th>Min RSL (1)</th>
<th>Long_Index</th>
<th>Tran_Index</th>
<th>Ride_Index</th>
<th>Rut_Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>9</td>
<td>80</td>
<td>80</td>
<td>85</td>
<td>80</td>
</tr>
</tbody>
</table>

(1) For low commercial traffic roadways (AADT-T < 400), the minimum RSL = 7.
(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.

Note: Contact the Region Pavement Manager for the Index Values of specific highways.

Performance

Expected Life Extension (3)

<table>
<thead>
<tr>
<th>Commercial Traffic/Pavement Type</th>
<th>(Trucks)/(Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT-T</td>
<td>&lt; 400</td>
</tr>
<tr>
<td>Flexible</td>
<td>Up to 4 (4)</td>
</tr>
<tr>
<td></td>
<td>Up to 2</td>
</tr>
</tbody>
</table>

(3) Range is the expected life extending benefit given to the pavement, not the anticipated longevity of the treatment. The life extending value for pavements above 8,000' elevation should be reduced up to 30% from the values shown in the table.

(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.
Crack Filling

Non-Working Cracks

Typical Crack

Simple Overband
Melter / Applicator
Overband Crack Fill Operation

What’s wrong with this operation?
Safety Issues...

Economic Issues...

Too Much Material
4 – CHIP SEALS

Description: A chip seal is a surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and then covered with crushed stone and rolled. Chip seals may be applied in a flexible or rigid pavement type.

Existing Pavement Conditions:

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>AADT-T</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>&lt; 400</td>
<td>(Trucks)/(Years)</td>
</tr>
<tr>
<td></td>
<td>400 - 6000</td>
<td>6 to 9 (4)</td>
</tr>
<tr>
<td></td>
<td>&gt; 6000</td>
<td>3 to 6</td>
</tr>
</tbody>
</table>

(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000’ elevation should be reduced up to 50% from the values shown in the table.

(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.

Note: Contact the Region Pavement Manager for the Index Values of specific highways.

Existing Pavement Surface Preparation: For single and double chip seals, all visible cracks and construction joints should be sealed by the overand crack fill method.

Timing:

<table>
<thead>
<tr>
<th>Location</th>
<th>Start</th>
<th>Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 10,000’</td>
<td>July 4</td>
<td>August 1</td>
</tr>
<tr>
<td>8,000’ to 10,000’</td>
<td>June 15</td>
<td>August 15</td>
</tr>
<tr>
<td>6,000’ to 8,000’</td>
<td>June 1</td>
<td>September 1</td>
</tr>
<tr>
<td>4,000’ to 6,000’</td>
<td>May 15</td>
<td>September 1</td>
</tr>
<tr>
<td>Below 4,000’</td>
<td>May 1</td>
<td>September 1</td>
</tr>
</tbody>
</table>

Performance: Chip seals perform best on flexible pavement structures in rural
Watercutter Retexturizing

Before

After
5 - MICRO-SURFACING

Description: Micro-surfacing is a mixture of polymer modified asphalt emulsion, fine aggregate, mineral filler, water, and other materials that are mixed, and sprayed on a paved surface.

Micro-surfacing formulation makes it a poor crack filler. It is very aggregate-specific because of the characteristics of the mixture. Late season performance is also affected by temperature and relative humidity of the environment.

Performance: Micro-surfacing corrects several surface deficiencies related to wet weather traffic accidents. A micro-surface application performs under all traffic volumes to correct the pavement surface conditions described above.

Existing Pavement Conditions

<table>
<thead>
<tr>
<th>Pavement</th>
<th>Min RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>8 (multi)</td>
</tr>
<tr>
<td></td>
<td>12 (single)</td>
</tr>
</tbody>
</table>

(1) For low commercial traffic loads.
(2) These are initial starting points. The actual performance may vary depending on the specific treating job.

Note: Contact the Regional Transportation Office for more information about the maintenance of existing pavement conditions.

Timing:

Recommended Placement Times

<table>
<thead>
<tr>
<th>Location</th>
<th>Start</th>
<th>Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 16,000</td>
<td>July 1</td>
<td>August 1</td>
</tr>
<tr>
<td>6,000 to 10,000</td>
<td>June 15</td>
<td>August 15</td>
</tr>
<tr>
<td>6,000 to 8,000</td>
<td>June</td>
<td>September 1</td>
</tr>
<tr>
<td>4,000 to 6,000</td>
<td>May 15</td>
<td>September 1</td>
</tr>
<tr>
<td>Below 4,000</td>
<td>May 1</td>
<td>September 1</td>
</tr>
</tbody>
</table>

(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000’ elevation should be reduced up to 50% from the values shown in the table.

(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.

Expected Life Extension

<table>
<thead>
<tr>
<th>Commercial Traffic/Pavement Type</th>
<th>(Trucks)/(Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT-T</td>
<td></td>
</tr>
<tr>
<td>Flexible: Single Course</td>
<td>6 to 9</td>
</tr>
<tr>
<td>Flexible: Multiple Course</td>
<td>8 to 9</td>
</tr>
<tr>
<td></td>
<td>3 to 5</td>
</tr>
<tr>
<td></td>
<td>4 to 6</td>
</tr>
<tr>
<td></td>
<td>2 to 3</td>
</tr>
</tbody>
</table>

(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.
6 – Thin Bonded Wearing Course

**Existing Pavement Condition**

**Minimum PMS Values**

<table>
<thead>
<tr>
<th>Pavement</th>
<th>Min RSL (1)</th>
<th>Long Index</th>
<th>Tran Index</th>
<th>Ride Index (2)</th>
<th>Rut Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>8</td>
<td>70</td>
<td>70</td>
<td>80</td>
<td>65</td>
</tr>
</tbody>
</table>

(1) For low counts, use the number of occurrences.
(2) These are the range of counts.

**Existing Pavement Surface Preparation:** The following items should be performed before paving operations.

1. Cover all utility structures such as manhole covers, etc.
2. Remove thermoplastic traffic markings.
3. Clean and fill pavement cracks greater than 0.25 inch wide.
4. Fill surface irregularities greater than 1 inch deep.
5. Mill or fill ruts greater than 0.5 inch.

**ACM Values**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Flexible of Composite</th>
<th>Up to 3</th>
<th>Up to 7</th>
<th>Up to 9</th>
</tr>
</thead>
</table>
| (3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000’ elevation should be reduced up to 50% from the values shown in the table.
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7 – HMA THIN OVERLAY (Less than 1½”)

**Description:** A dense-graded hot-mix asphalt (HMA) applied at a maximum rate of 170 lb/square yard over an existing bituminous surface.

**Purpose:** A non-structural HMA overlay will provide protection to the pavement structure, slow the rate of pavement deterioration, correct many pavement performance problems, and extend the life of the pavement.

### Existing Pavement Conditions

**Minimum PMS Values**

<table>
<thead>
<tr>
<th>Pavement</th>
<th>Min RSL</th>
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<th>Tran_Index</th>
<th>Ride_Index</th>
<th>Rut_Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>6</td>
<td>70</td>
<td>70</td>
<td>60</td>
<td>65</td>
</tr>
</tbody>
</table>

(1) For low commercial traffic roadways (AADT-T < 400), the minimum RSL = 4.

(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.

**Note:** Contact the Region Pavement Manager for the index Values of specific highways.

**Performance**

**Expected Life Extension**

<table>
<thead>
<tr>
<th>Commercial Traffic/Pavement Type</th>
<th>(Trucks)/(Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT-T</td>
<td></td>
</tr>
<tr>
<td>&lt; 400</td>
<td>400 - 6000</td>
</tr>
<tr>
<td>Flexible</td>
<td>10 - 11</td>
</tr>
</tbody>
</table>

(3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000’ elevation should be reduced up to 50% from the values shown in the table.

(4) After application of the treatment, the pavement service life should be limited to a maximum RSL of 15 years due to anticipated environmental effects.
### 8 – SURFACE MILLING WITH NON-STRUCTURAL HMA OVERLAY

**Less than 1½”**

**Expected Life Extension**

<table>
<thead>
<tr>
<th>Commercial Traffic/Pavement Type</th>
<th>(Trucks)/(Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 400</td>
<td>10 - 11</td>
</tr>
<tr>
<td>400 - 6000</td>
<td>5 - 10</td>
</tr>
<tr>
<td>&gt; 6000</td>
<td>3 - 5</td>
</tr>
</tbody>
</table>

#### (3) The time range is the expected life-extending benefit given to the pavement, not the anticipated longevity of the treatment. The life-extending value for pavements above 8,000’ elevation should be reduced up to 50% from the values shown in the table.

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**Existing Pavement Conditions**

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>Minimum RSL (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>6</td>
</tr>
</tbody>
</table>

---

**Minimum PMS Values**

<table>
<thead>
<tr>
<th>Pavement</th>
<th>Min RSL</th>
<th>Long Index</th>
<th>Tran Index</th>
<th>Ride Index</th>
<th>Rut Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible</td>
<td>6</td>
<td>70</td>
<td>70</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

---

(1) For low commercial traffic roadways (AADT < 400), the minimum RSL = 4.

(2) These are initial starting points that should be fine-tuned over time based upon experience in using this treatment option.

**Note:** Contact the Region Pavement Manager for the Index Values of specific highways.

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**Existing Pavement Surface Preparation:** None
Match Curb & Gutter

Re-establish Crown
Tech Sharing & Tech Support is needed for Pavement Preservation
Partnerships involve pavement preservation professionals from state & local public agencies, contractors, suppliers, academia, and federal government officials.
The Partnerships Mission

Provide ongoing regional forums for Pavement Preservation principles, by sharing and exchanging improvements in research, design, specifications, materials and construction practices, and by promoting the benefits of Pavement Preservation through education and application.
The Partnerships Objectives

- Promote uniformity of regional guidelines for pavement preservation treatments.
- Promote the use of improved materials, equipment, and processes among the member agencies.
The Partnerships Objectives

- Implement a comprehensive information sharing process.
- Establish a coordinated regional research effort.
Advocate policies that integrate system preservation activities.

Publicize pavement preservation findings at the national level.
The Partnerships Objectives

★ Advocate common terminology and their definitions.
The Partnerships Issue Teams

- Materials
- Research
- Training
- Specification
- Policy
A formal agreement between –
Foundation for Pavement Preservation & Michigan State University
Pavement preservation is a cost-effective set of practices that extend pavement life and improve safety and motorist satisfaction while saving public tax dollars.

The National Center for Pavement Preservation (NCPP) seeks to advance and promote sound preservation practices through education, research management, outreach, and technical hands-on assistance.

www.pavementpreservation.org
• Outreach
• Training
• Research
Outreach

- Assist Public Agencies to Develop Preservation Programs
- Administer & Manage Regional Pavement Preservation Partnerships
- Provide a Technical Resource Library
Current Course Offerings

• Pavement Preservation – Applied Asset Management
  (2-Day Training)
• Chip Seals – The Best Practice
  (1-Day Training)
• Ultra-Thin HMA Overlay – Design & Construction
  (1-Day Training)

Continuing Education Credits (CEU’s) granted from Michigan State University
Future Course Offerings

• Crack Sealing & Filling  
  (1-Day Training)

• Micro-Surfacing  
  (1-Day Training)

• Inspection of Preventive Maintenance Treatments  
  (1-Day Training)

Continuing Education Credits (CEU’s) granted from Michigan State University
• Facilitate Applied Research
• Oversee Pooled-Fund Studies
State of the Practice Reference