Cost and Performance of Preventive Maintenance

Ohio Asphalt Paving Conference
February 4, 2015
We will cover PM from several angles

- A common understanding
- How long does it last?
- A Few Questions on Pavement Maintenance
- What is the cost/benefit?
  - NewMexirado Case Study
  - Champaign County Case Study
Preventive maintenance based on plans

- **Planned strategy**
- **Cost effective treatments**
- **Maintains or improves functional condition**
- **Does not increase structural capacity**

*Maintaining good roads in good condition.*
Preventive Maintenance is a strategy

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 substantially increasing structural capacity).

*American Association of State Highway and Transportation Officials*
Pavement Condition vs Time

- Excellent
- V. Good
- Good
- Fair
- Poor
- V. Poor
- Failed

PM cost is a fraction of a $

75% of Life

40% quality drop

$1

40% quality drop

$6-14

12% of Life

Terminal Serviceability
Preventive Maintenance Timing

- Good Pavement Condition
- Preventive Maintenance
- Pavement Preservation
- Poor Pavement Condition
- Rehabilitation
- Routine/Corrective Maintenance

Time
There Are Many Common Flexible Pavement Treatments

- Crack Sealing
- Patching
- Fog Seal
- Sand Seal
- Slurry Seal
- Chip Seal
- Micro-surfacing
- Texturization
- Thin Overlay
- Hot In-Place Recycling
Crack Treatments

- Prevent water and debris from entering individual cracks in the HMA pavement surface
Patching

- Address localized areas of distress
- Correct surface discontinuities
- Seal the pavement from moisture infiltration

1. Select
2. Clean and trim
3. Apply a tack coat
4. Add patching material
5. Compact
Fog Seal

- Seal pavement surface
- Rejuvenate oxidized HMA
- Provide delineation
Slurry Seal

- Seal pavement surface
- Retard surface raveling
- Improved surface friction
Asphalt Chip Seal

- Provide wearing course
- Improve surface friction
- Seal pavement surface from water penetration
- Lower maintenance, eliminate dust

Power broom or sweeper  Rubber-tired rollers  Cover aggregate  Self-propelled aggregate spreader  Asphalt distributor

May be one unit
Asphalt Chip Seal
Localized Chip Seal
Microsurfacing

- Similar to slurry seal
- BUT.....
- Large and higher quality aggregate
- Modified emulsion & Portland Cement

Diagram:
- Portland cement
- Aggregate
- Emulsion
- Pug mill
- Spreader box
- Application unit
- Feeder & propulsion unit
- Tack coat application
Microsurfacing
Thin Hot Mix Overlay

- Wearing course
- Level pavement
- Improve friction
- Seal pavement
- Fills ruts
Hot In-Place Recycling

- Reduce rutting
- Reduce roughness
- Improve friction
- Reduce distress
How long does it last?
## PM has large range of life extension

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Reported Extended Service Life Range (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin Overlay</td>
<td>3-23</td>
</tr>
<tr>
<td>Chip Seal</td>
<td>3-8</td>
</tr>
<tr>
<td>Microsurfacing</td>
<td>3-8</td>
</tr>
<tr>
<td>Crack Sealing</td>
<td>0-4</td>
</tr>
<tr>
<td>Mill and Resurfacing</td>
<td>4-20</td>
</tr>
<tr>
<td>Hot In-place Recycling</td>
<td>3-8</td>
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<tr>
<td>Slurry Seal</td>
<td>4-7</td>
</tr>
<tr>
<td>Fog Seal</td>
<td>4-5</td>
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<tr>
<td>Cold In-place Recycling</td>
<td>4-17</td>
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<tr>
<td>Full Depth Reclamation</td>
<td>10-20</td>
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<tr>
<td>Structural Overlay (Mill and Fill)</td>
<td>6-17</td>
</tr>
<tr>
<td>Whitetopping</td>
<td>3-17</td>
</tr>
</tbody>
</table>

FHWA-HIF-10-020, January 2010
Service Life Range Related To Environmental Differences
Service Life Range Related To Construction Quality Standards
Service Life Range Related To Variations on Material Quality
Service Life Range Related To Using PM Treatments as a Temporary Fix
A Few Questions on Pavement Maintenance
What would you rather do?
Mill and Overlay
Or Full Reconstruction?
Right Treatment on the Right Road at the Right Time
Stop the Water Infiltration?
Until you have to Reconstruct it?
Right Treatment on the Right Road at the Right Time
What would you rather do?

Rout and Seal this Crack at $0.50/ft?
What would you rather do?

Dig this out and Patch it at $25/ft?
Right Treatment on the Right Road at the Right Time
THERE! THAT OUGHTA DO IT.

NICE JOB.
Benefit Study - Structural Data in Preservation

Goals of Project Analysis

• Single set of combined data
• single set of analysis results
• Generic, yet meaningful” analysis

WELCOME TO
New Mexirado
Comparative 50-year Life Cycle Cost

Consider present worth value of a new road built in 2012

<table>
<thead>
<tr>
<th>“Worst-First” Scenario</th>
<th>Year</th>
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<tbody>
<tr>
<td>Mill &amp; AC Overlay</td>
<td>14</td>
</tr>
<tr>
<td>Mill &amp; AC Overlay</td>
<td>27</td>
</tr>
<tr>
<td>Mill &amp; AC Overlay</td>
<td>39</td>
</tr>
<tr>
<td>Total M&amp;R Cost (2012 USD)</td>
<td>$ 283,964</td>
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</table>

<table>
<thead>
<tr>
<th>Preventive Maintenance Scenario</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distress Repair</td>
<td>3</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>8</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>15</td>
</tr>
<tr>
<td>Mill &amp; AC Overlay</td>
<td>26</td>
</tr>
<tr>
<td>Distress Repair</td>
<td>29</td>
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<tr>
<td>Surface Treatment</td>
<td>34</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>41</td>
</tr>
<tr>
<td>Total M&amp;R Cost (2012 USD)</td>
<td>$ 215,720</td>
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</table>

RWD-based preventive maintenance provides 24% reduction in life-cycle cost
## Decision matrix guides treatment selection

### SURFACE AND STRUCTURAL CONDITION

<table>
<thead>
<tr>
<th>PCI Value</th>
<th>PCI Rating</th>
<th>Representative RWD Deflection, mils</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt; 35</td>
<td>35 - 50</td>
<td>&gt; 50</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Very Good</td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Good</td>
<td></td>
<td><strong>PM - Crack sealing (max. 1 time)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Fair</td>
<td></td>
<td><strong>Microsurfacing (max. 1 time)</strong></td>
<td>Distress Repair (max. 1 time)</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Poor</td>
<td><strong>FEASIBILITY</strong></td>
<td>Mill &amp; Thin ACOL w/ FD Repairs</td>
<td>Mill &amp; Thick ACOL w/ PD Repairs</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Failed</td>
<td></td>
<td><strong>FEASIBILITY</strong></td>
<td>RECONSTRUCTION</td>
<td></td>
</tr>
</tbody>
</table>

### TRADITIONAL

- Surface Condition Only
  - Defer Maintenance
  - Distress Repair
  - Surface Treatment (Preventive Maint.)
  - Minor Resurfacing
  - Major Resurfacing
  - RECONSTRUCTION
Preventive Maintenance Pays Off

“Worst-First”

Prevent. Maint.

Distress Repair $10,000 / mile
Surface Treatment $50,000 / mile
Surface Treatment $50,000 / mile
Minor Rehabilitation $250,000 / mile

Major Rehabilitation $375,000 / mile
Extends life 22 years
Extends life 45 years
Total M&R Cost* = $360,000 / mile

* Does not account for inflation or discounting

Pavement Management-Preservation Case Study

- Champaign County
  - One major population center

- Highway Department
  - 400 lane mile network
  - 2-lane low-volume paved roads
  - Highly variable pavements

- The challenge
  - $3M annual road funding
  - $1M diverted to non-county roads

Can the county maintain its network with these diversions?
Typical Performance Curve

Typical AC overlay life until needing major rehabilitation is approximately 14 years
Adding in Treatments

Age, years

0 2 4 6 8 10 12 14 16 18 20

PCI

0 10 20 30 40 50 60 70 80 90 100

Excellent

Very Good

Good

Fair

Poor

Maintenance

Crack Sealing

Preventive Maintenance

Chip Seals, Microsurfacing

Rehabilitation

Chip Seals and Microsurfacing

Mill and Thin AC Overlays

Major Rehabilitation

Mill and Thick AC Overlays

Reconstruction

$ $$ $$$$
No Preventive Maintenance

PCI

- Unlimited
- Do-Nothing
- $2M
- $2M (No PM)
- $2.5M
- $2.5M (No PM)
- $3M
- $3M (No PM)

Year:
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011

Budget:
- $2M
- $2.5M
- $3M

Do Nothing
Cost and Performance of PM

Cost
- Low cost treatments – Construction Cost
- Keeps good roads in good condition – Agency Cost
- Extends pavement life – Industry Cost

Performance - It depends
- Right Treatment, Right Road, Right Time
Thank You!

William R. Vavrik, Ph.D., P.E.
Vice President & Principal Engineer
100 Trade Centre Dr., Suite 200
Champaign, IL 61820
(217) 356-4500
wvavrik@ara.com