Thin Asphalt Concrete Overlays

Southeastern Pavement Preservation Partnership
March 18, 2015
Outline

- NCHRP Synthesis Topic 44-07
- Purpose/Scope
- Use
- Design and Construction
- Performance, Maintenance, Rehab
- Case Studies
- Conclusions
Purpose/Scope

- Document current experience/research
- Agency/industry survey
  - 43 States
  - 8 Private Industry companies
Advantages of Thin Overlays

- Provides long service life (when placed over structurally sound pavements)
- Provides good riding surface
- Reduces noise (fine-graded mixes)
- Maintains grade and slope geometry
- Is easily maintained
- Is recyclable
Thin Overlay Definition

Responses

Definition of Thin Overlay (Thickness, in)

- >2.0: 2
- 1.5-2.0: 5
- 1.0-1.5: 16
- 0.75-1.5: 16
- ≤1.0: 17
- ≤0.75: 6
Previous Research

- NAPA – (Newcomb, 2009) IS 135
- Zubek – Cold Regions, 2012
- Montana – (Cuelho, 2006)
- NCHRP Synthesis 222 – (Zimmerman, 1995)

Project/Treatment selection
## Montana Survey

<table>
<thead>
<tr>
<th>Preventive Maintenance Treatment</th>
<th>Average Service Life (Years)</th>
<th>Cost per Lane Mile (12 feet wide)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin Overlay</td>
<td>8.4</td>
<td>$14,600</td>
</tr>
<tr>
<td>Double Chip Seal</td>
<td>7.3</td>
<td>$12,600</td>
</tr>
<tr>
<td>Microsurfacing</td>
<td>7.4</td>
<td>$12,600</td>
</tr>
<tr>
<td>Slurry Seal</td>
<td>4.8</td>
<td>$6,600</td>
</tr>
</tbody>
</table>
Project/Treatment Selection Strategies (NCHRP Synthesis 222)

- Current condition rating
- Prediction models ("What if" scenario)
- Network Optimization models
- Find treatment that addresses deficiencies (may be affected by local policies/mandates)
Types of Thin Overlays

- 9.5 and 12.5mm Superpave
- 9.5 and 12.5mm SMA
- UTBWC
  - Arkansas
  - Illinois, Kansas, Louisiana, Minnesota, Vermont
- 4.75mm Superpave and SMA
- OGFC/PFC
UTBWC
Use of Thin Overlays

Pavements that are failing, or have already failed, cannot be successfully treated with a thin overlay alone.
PennDOT Use of Thin Overlays
Where Not To Use Thin Overlays
NCAT Pavement Preservation Study

<table>
<thead>
<tr>
<th>Section</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>4.75/PG 67-22</td>
<td>4.75/PG 67-22</td>
<td>4.75/PG 76-22</td>
<td>4.75/PG 76-22</td>
<td>UTBWC</td>
<td>4.75 50% RAP</td>
<td>4.75 5% Shingles</td>
<td>4.75 PG 88-22</td>
</tr>
<tr>
<td>Subsurface</td>
<td>Fibermat</td>
<td>Existing</td>
<td>Full-Depth Reclamation</td>
<td>Existing</td>
<td>Existing</td>
<td>Existing</td>
<td>Existing</td>
<td>Existing</td>
</tr>
</tbody>
</table>
Design and Construction

- Aggregate – Superpave quality standards
- Binder – Often modified
- Compaction level – 50 gyrations, locking point, other
- Testing constraints (due to thin layer)
RAP May Need to be Crushed/Fractionated
Design and Construction

1% increase in moisture = 10-12% increase in drying cost while reducing production about 11%.
Design and Construction

Thin Layers must have good tack bond.
Design and Construction

As a general rule, only 40-60% improvement in ride quality can be expected with a single layer of asphalt mix.
Performance, Maintenance, Rehab

How Service Life is Monitored

% of Responses

Threshold Values
Performance Curves
Video Log
Manual Survey

How Service Life is Monitored
## Performance Measures (Purdue Study)

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Roughness (IRI)</th>
<th>Condition (PCR)</th>
<th>Rut Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Used</td>
<td>110 in/mi (1.74 m/km)</td>
<td>85</td>
<td>0.25 in (6 mm)</td>
</tr>
<tr>
<td>Expected Life (Yrs.)</td>
<td>7 - 10</td>
<td>7 - 11</td>
<td>8 - 11</td>
</tr>
</tbody>
</table>
Maintenance
(Fog Seal/Rejuvenator Application)

Application Rate
Service Life

- LTPP Data (Liu, 2013)
  - 341 Thin Overlay Sections
  - 40 States, 8 Canadian Provinces
- Typical life expectancy – 7 to 9.5 years
Service Life

Responses

<table>
<thead>
<tr>
<th>Years</th>
<th>&lt; 5</th>
<th>5-8</th>
<th>8-10</th>
<th>10-12</th>
<th>&gt; 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>10</td>
<td>35</td>
<td>25</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>
Explanations for Range in Service Life

Environmental Differences
Explanations for Range in Service Life

Construction Quality Standards - Interstate versus Secondary
Explanations for Range in Service Life

Variation in material quality
Explanations for Range in Service Life

Temporary Fix
(They knew it wouldn’t last under project conditions, but needed something to just get by temporarily)
Cost/Benefit of Preservation Treatments

- Wang, 2012 – 29 state agencies
  - Thin Overlays cost more initially
  - Extended pavement life the longest
- Oregon (Parker, 1993) – 87 sites within state
  - Thin overlays most cost-effective
  - Particularly more effective for heavy traffic
Case Studies - Tennessee

Bid Prices for Preservation Treatments

<table>
<thead>
<tr>
<th>Year</th>
<th>Microsurfacing ($/sy)</th>
<th>4.75 mm NMAS ($/sy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>2.02</td>
<td>2.24</td>
</tr>
<tr>
<td>2011</td>
<td>2.41</td>
<td>1.88</td>
</tr>
<tr>
<td>2009</td>
<td>2.15</td>
<td>2.09</td>
</tr>
</tbody>
</table>
Case Studies - Ohio

Mileage vs Service Life of Thin Overlays

Total Miles = 4075.2
No. of Projects = 764
Mean = 9.1 years
Conclusions

- Thin overlays routinely used as maintenance/preservation tool
- Thin overlays are economical
- Thin overlays extend life of concrete pavements
  - Act as insulation to reduce curling of slabs
  - Provides smoother surface
- Success depends on existing distresses
- Service life generally in 7 – 11 year range
- Some test procedures not reliable for thin layers