HMA Preservation: Seal Coat and Micro Surfacing

Adriana Vargas, PhD

Background

- Seal coats and micro surfaces are some of the most popular treatments
- Relatively inexpensive
- Can be very effective
- Cost-effectiveness is maximized with proper treatment selection
Seal Coat

- Application of asphalt binder (hot or emulsion) immediately followed by application of an aggregate
- Seal is then rolled to sit the aggregate in the binder
- “Chip seal”

![Diagram of Seal Coat process](Caltrans, 2008)
Seal Coat

- Cracking
- Weathering
- Raveling
- Friction

- Loose chips
- Noise
- Weather limitations

Micro Surfacing

- Mixture of polymer modified emulsified asphalt, dense-graded crushed fine aggregate, mineral filler, break control additives and water
- High performance enhanced slurry seal
- Allows for quick return to traffic (~ 1 hour)
Micro Surfacing

• Weathering
• Raveling
• Friction
• Rutting
• Irregular profile

• Special equipment
• Cost
What to Expect


<table>
<thead>
<tr>
<th>Treatment</th>
<th>Expected Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment Life (yr)</td>
</tr>
<tr>
<td>Microsurfacing</td>
<td>3–6</td>
</tr>
<tr>
<td>Single course</td>
<td>4–7</td>
</tr>
<tr>
<td>Double course</td>
<td></td>
</tr>
<tr>
<td>Chip seal</td>
<td>3–7</td>
</tr>
<tr>
<td>Single course</td>
<td>5–10</td>
</tr>
<tr>
<td>Double course</td>
<td></td>
</tr>
</tbody>
</table>

LESSONS LEARNED FROM NCAT-MnROAD RESEARCH
TPF-5(375)

Transportation Pooled Fund Program

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Study Detail View
National Partnership to Determine the Life Extending Benefit Curves of Pavement Preservation Techniques (MnROAD/NCAT Joint Study – Phase II)

General Information
Study Number: TPF-5[375] View Commitment Details
Lead Agency: Minnesota Department of Transportation
Contract Start Date: Jan 1, 2010
Est. Completion Date: Dec 20, 2023
Contract/Other Number: 1461
Sponsors: AL, AR, CO, FL, GA, IN, IL, KS, KY, LA, MD, MA, MI, MN, MO, MS, NC, NJ, NY, OH, PA, SC, TX, TN, WI, WV
Related Study Number(s): 1459 - ACCELERATED PERFORMANCE TESTING ON THE 2018

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FHWA Technical Liaison(s):
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Sponsors

[Images of various state transportation logos]
**PG Study Sections**

- **Cold, wet, freeze**
  - CSAH 8 & US 169, treated 2016
- **Hot, wet, no-freeze**
  - Lee Road 159, treated 2012
  - US 280, treated 2015

**Time in Service**

- **LR 159**
  - 9 years
- **US 280**
  - 6 years
- **CSAH 8**
  - 5 years
- **US 169**
  - 5 years
- **70th St**
  - 2 years

- **Stations**
  - 13

- **Date**
  - 12/29/2021
PG Study Sections

CHIP SEALS
- Single layer
- Double layer
- Triple layer
- Single layers with crack sealing
- Fibermat
- Scrub seals*

MICRO SURFACES
- Single layer
- Double layer
- Single layers with crack sealing
- Fibers
- HiMA

Fibermat Chip Seal
Scrub Seal

Cape Seals
What We’ve Learned

• Target GOOD pavements
• There’s always *some* benefit even if pavement is in poor condition
  • Not cost-effective

What We’ve Learned

• Life extension may be higher than typically reported
  • Good materials
  • Good designs
  • Good treatment selection
  • Good construction
At year 9, treated pavement is barely transitioning to “fair” condition.
What We’ve Learned

- The more you do, the more you get
  - Multiple layers
  - Crack sealing
  - Treatment combinations (Cape seals)
DOUBLE LAYER CHIP SEAL

SCRUB SEAL

FIBERMAT CHIP SEAL

TRIPLE LAYER CHIP SEAL

SINGLE MICRO SURFACE WITH CRACK SEALING

SINGLE MICRO SURFACE
What We’ve Learned

• Treatments can work under different conditions
  • Don’t immediately rule out based on traffic or climate

BUT…

• Be cautious

SINGLE CHIP SEALS

Observations:
• Good to fair cracking performance
• Roughness in Northern sections is higher, related to thermal cracking
• Chip loss in Northern sections as a result of snow plowing
FIBERMAT CHIP SEALS

Observations:
- Better cracking performance compared to single chip seals
- Better chip retention

CHIP SEAL

FIBERMAT CHIP SEAL
TRIPLE CHIP SEALS

Observations:
- Good cracking performance
- Bleeding, especially in high traffic sections – may require action if friction is affected
What We’ve Learned

• Cracking reduction is most notable benefit
  • Easy to see
  • It is not the only parameter
• What are you targeting?

Time to 20% Cracking – Lee Road 159

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single chip seal</td>
<td>4.4</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Single chip seal + crack</td>
<td>7.3</td>
<td>7.3</td>
<td>8.6</td>
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<tr>
<td>seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double chip seal</td>
<td>6.7</td>
<td>9+</td>
<td>9+</td>
</tr>
<tr>
<td>Triple chip seal</td>
<td>9+</td>
<td>9+</td>
<td>9+</td>
</tr>
<tr>
<td>Fibermat chip seal</td>
<td>7.0</td>
<td>8.7</td>
<td>9+</td>
</tr>
<tr>
<td>Scrub seal</td>
<td>9+</td>
<td>9+</td>
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### % Crack Reduction at Year 9 – Lee Road 159

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<th>Treatment</th>
<th>Poor</th>
<th>Fair</th>
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<tbody>
<tr>
<td>Single chip seal</td>
<td>14</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>Single chip seal + crack seal</td>
<td>20</td>
<td>31</td>
<td>17</td>
</tr>
<tr>
<td>Double chip seal</td>
<td>38</td>
<td>46</td>
<td>35</td>
</tr>
<tr>
<td>Triple chip seal</td>
<td>56</td>
<td>54</td>
<td>39</td>
</tr>
<tr>
<td>Fibermat chip seal</td>
<td>41</td>
<td>39</td>
<td>30</td>
</tr>
<tr>
<td>Scrub seal</td>
<td>55</td>
<td>46</td>
<td>32</td>
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<tbody>
<tr>
<td>Single micro surface</td>
<td>1.7</td>
<td>4.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Single micro + crack seal</td>
<td>4.6</td>
<td>6.1</td>
<td>5.1</td>
</tr>
<tr>
<td>Double micro surface</td>
<td>9+</td>
<td>9+</td>
<td>9+</td>
</tr>
<tr>
<td>Cape seal</td>
<td>9+</td>
<td>9+</td>
<td>9+</td>
</tr>
<tr>
<td>Fibermat cape seal</td>
<td>9+</td>
<td>9+</td>
<td>9+</td>
</tr>
<tr>
<td>Scrub cape seal</td>
<td>9+</td>
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## % Crack Reduction at Year 9 – Lee Road 159

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<tr>
<td>Single micro surface</td>
<td>6</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>Single micro + crack seal</td>
<td>31</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>Double micro surface</td>
<td>59</td>
<td>55</td>
<td>40</td>
</tr>
<tr>
<td>Cape seal</td>
<td>61</td>
<td>56</td>
<td>40</td>
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<tr>
<td>Fibermat cape seal</td>
<td>72</td>
<td>64</td>
<td>43</td>
</tr>
<tr>
<td>Scrub cape seal</td>
<td>68</td>
<td>56</td>
<td>40</td>
</tr>
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**RIDE QUALITY - CSAH 8**

- Expon. (Control)
- Expon. (Chip Seals)
- Expon. (Micros & Cape Seals)
Summary

• Chip seals and micro surfacing extend pavement life
  • Combinations = added benefits

• Some treatments within same category have similar performance
  • Unit costs for each agency will determine cost-effectiveness

• No major issues in any location
  • Adjust to your particular conditions

More information: www.ncat.us
Thank you!

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