Pavement Preservation in the Wild West

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Peter E. Sebaaly, PhD, PE
Director
Western Regional Superpave Center
University of Nevada Reno (UNR)
WHAT IS OLD?

- Evaluate *effectiveness* & *optimum time* for *single* application of slurry seal

- Evaluate *effectiveness* & *optimum time* for *sequential* application of slurry seal
WHAT IS NEW?

- Evaluate the **long-term performance** of Cape Seals:
  - Slurry Seal
  - Micro-surfacing
Phase I: Slurry Seal Performance Life & Extension in Pavement Service Life

- Performance Life ≈ 2 yrs
- Performance Life ≈ 3 yrs
- Extension in Pavement Service Life ≈ 2 yrs

Graph showing the PCI vs. Age in Years for:
- New Construction
- Slurry Seal at year 3
- Slurry Seal at year 7

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In general, performance life ranged between 2 & 4 years.

- Except when slurry seal was applied at year 0 and 1, performance life ranged from 0 to 1 year.

- Except few cases, the pavement service life **was not extended by application of the single slurry seal**.
Phase I: Slurry Seal Effectiveness

Relative Benefit = 100 \frac{B}{B_0}  

Benefit Cost Ratio = \frac{B}{C}

Overlay (Do Nothing)  

Slurry Seal

PCI

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Age (years)
Phase I: Effectiveness Analysis – New Construction

Year of Slurry Seal Application

Benefit (PCI yrs)

Relative Benefit

Benefit-Cost Ratio (x1000)

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Phase I: Conclusion

- Application of SS *immediately* or *one year after* construction of asphalt layer is not effective in terms of:
  - the benefit to the users and
  - the benefit-cost ratio for the agency.

**Optimum time** for application of a **Single Slurry Seal**:

- Newly constructed pavements: *3 years after construction*.
- Pavements subjected to overlays: *3-5 years after construction*. 
Phase II: *Newly Constructed* Pavements: 
1\textsuperscript{st} SS at year 3, 2\textsuperscript{nd} SS at year 7

![Graph showing predicted condition index (PCI) vs. age in years for newly constructed pavements with first slurry seal at year 3, second slurry seal at year 7, and a do-nothing performance curve using models developed in Phase I.](image)

- **Predicted 1\textsuperscript{st} slurry seal**
- *4.0 yrs*

- **Predicted 2\textsuperscript{nd} slurry seal**
- *3.5 yrs*

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Phase II: Slurry Seal Effectiveness

Relative Benefit = \(100 \times \frac{B}{B_0}\)

Benefit-Cost Ratio = \(\frac{B}{C}\)

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Phase II:

Effectiveness

- OL-0-7: 15% (Benefit-Cost Ratio: 2.3)
- OL-0-9: 8% (Benefit-Cost Ratio: 1.2)
- OL-1-7: 12% (Benefit-Cost Ratio: 2.1)
- OL-1-9: 11% (Benefit-Cost Ratio: 1.9)
- OL-3-7: 56% (Benefit-Cost Ratio: 7.7)
- OL-3-9: 46% (Benefit-Cost Ratio: 7.3)
- OL-5-9: 26% (Benefit-Cost Ratio: 4.6)
- NC-0-7: 25% (Benefit-Cost Ratio: 3.8)
- NC-0-9: 21% (Benefit-Cost Ratio: 3.3)
- NC-1-7: 17% (Benefit-Cost Ratio: 2.9)
- NC-1-9: 23% (Benefit-Cost Ratio: 3.8)
- NC-3-7: 88% (Benefit-Cost Ratio: 13.0)
- NC-3-9: 77% (Benefit-Cost Ratio: 11.7)
- NC-5-9: 32% (Benefit-Cost Ratio: 5.4)
PHASE II: Conclusions

- Application of first SS **immediately or one year after** construction is **not effective** in terms of both the benefit to users and benefit cost ratio for the agency.

- Regardless of construction activity, **optimum time for a sequential slurry seal** is when
  
  first SS is applied in year 3  
  &  
  second SS is applied in year 7 (i.e. 4 years after the application of the first SS)
OVERALL RECOMMENDATION

For both new and overlay constructions, it is recommended that the agency applies:

First slurry seal 3 years after the construction of the asphalt layer and the second slurry seal 7 years after the construction.
CAPE SEALS: Slurry or Micro

Chip Seal

Asphalt Concrete
Base
Subgrade

Slurry or Micro

Asphalt Concrete
Base
Subgrade
WHY CAPE SEALS

- Snow-Plow Damage
- Chip Loss
- Quieter
- Longer Life
Chip Seal
Chip Seal
Cape Seal: Slurry Seal
Cape Seal: Microsurfacing
# Evaluated Sections

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<th>7</th>
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Emulsions Grades

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<td>PASS</td>
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LMCRS: Latex-Modified Cationic Rapid Set
LMCQS: Latex-Modified Cationic Quick Set
PASS - "Proprietary" Polymer-Modified Emulsion
MSE – Micro-surfacing Surfacing Emulsion
RTE - Rapid Traffic Emulsion - Polymer-Modified
## Quality Control

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<th>Year</th>
<th>Slurry Seal</th>
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<td>2008</td>
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Impact of Construction Practice: Micro
Impact of Traffic Level: Micro

The graph illustrates the PCI (Pavement Condition Index) over age for different traffic levels. The lines represent different traffic categories and their impact on PCI over time. The x-axis represents age in years, while the y-axis represents the PCI value.
Impact of Traffic Level: Slurry

![Graph showing the impact of traffic level on slurry, with various markers representing different conditions or years.](image-url)
Impact of Structure: Slurry

![Graph showing the impact of structure on slurry performance over different sections and years.]
Impact of Pre-PCI: Micro
Impact of Pre-PCI: Slurry
# Benefit Cost Ratio

<table>
<thead>
<tr>
<th>Location</th>
<th>Cape Seal</th>
<th>Effective Performance Life (yrs)</th>
<th>Unit Cost ($/yd^2)</th>
<th>Benefit Cost Ratio (yr/$)</th>
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<tbody>
<tr>
<td><strong>Truckee Meadows</strong></td>
<td>Micro-surfacing</td>
<td>7.0</td>
<td>4.46</td>
<td>1.57</td>
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<td>Slurry Seal</td>
<td>3.5</td>
<td>3.50</td>
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<td><strong>Incline Village</strong></td>
<td>Micro-surfacing</td>
<td>5.0</td>
<td>4.46</td>
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<td>Slurry Seal</td>
<td>3.0</td>
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</table>
Mico-Cape Seal: 9yrs/Pre-PCI:34
Micro-Cape Seal: 6yrs/Pre-PCI: 56
Micro-Cape Seal: 1yr
FINDINGS

- The effective performance life of micro-surfacing cape seals is 7 years in the Truckee Meadows and 5 years in Incline Village.

- The effective performance life of slurry seal cape seals is 3.5 years in the Truckee Meadows and 3 years in Incline Village.

- The LCCA indicates that the micro-surfacing cape seal is more cost effective than the slurry seal cape seal at both locations of Truckee Meadows and Incline Village.
RECOMMENDATIONS

- Continue to use the micro-surfacing cape seal as a preventive maintenance treatment

- Conduct full mix designs and implement an effective QA testing program for the cape seal projects

- Implement an effective crack sealing program prior to the application of the cape seal treatment

- Investigate the various individual distresses on the existing pavement
THANK YOU FOR YOUR ATTENDANCE

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Contact Information:
Peter E. Sebaaly, psebaaly@unr.edu, 775-784-6565
Elie Y. Hajj, elieh@unr.edu, 775-784-1180