Design of LTPP Pavement Preservation Experiments

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Bozeman MT
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Principal Investigator
Agenda

1. Background
2. Overview of Experiment Approach
3. Key Considerations
4. Experimental Designs & Project Layouts
5. Getting Word Out
1. Background
LTPP Mission

Increase pavement life by investigation of various designs of pavement structures and rehabilitated pavement structures, using different materials and under different loads, environments, subgrade soil, and maintenance practices

“Understand how pavements behave and why they behave as they do”
Project Objective

Design pavement preservation experiments for the LTPP program

- Enable LTPP to provide short- and long-term performance data on pavements relative to preservation technology
- Verify preservation as a viable technology in extending pavement life
- Document impacts of preservation to enable development and implementation of important products and tools
Project Phases & Tasks

PHASE I:
6. Expert Task Group (ETG)
1. Experiment Design
2. Materials Testing Plan

PHASE II:
3. Performance Monitoring Requirements
4. Construction Requirements for RSCs
5. Other Data Collection Needs
7. Marketing and Technical Support
Expert Task Group (ETG)

Provide review/feedback throughout development of experiment

- Anita Bush (Nevada DOT)
- Colin Franco (Rhode Island DOT)
- Morgan Kessler (FHWA)
- David Luhr (Washington State DOT)
- Magdy Mikhail (Texas DOT)
- Jim Moulthrop (FP²)
- Larry Scofield (IGGA)
- Roger Smith (Texas A&M University)
- Ben Worel (MnROAD)
ETG Phase I Activities

- January 22, 2015 kick-off webinar
- April 23, 2015 face-to-face meeting in Reno, NV
- July 28, 2015 webinar
- September 11 and 14, 2015 webinars
2. Overview of Experiment Approach
LTPP Pavement Preservation Experiments

- SPS-11 AC Pavement Preservation Study
- SPS-12 PCC Pavement Preservation Study

Two experiments; consistent with other LTPP experiments
Experimental Approach

- Segregate treatment types and pavement project locations into discrete groups
- Apply same preservation treatment, at different times, on same pavement structure
- LTPP focus is on timing/distress propagation rates, while NCAT/MnROAD studies and others focus on treatment comparisons…

LTPP and NCAT/MnROAD studies complement / supplement each other
Example SPS-11 Project

6 test sections – 1 control (no overlay) and 5 treatment sections:

<table>
<thead>
<tr>
<th>Traffic</th>
<th>Treatment Test Section 5 (8 years)</th>
<th>Treatment Test Section 3 (4 years)</th>
<th>Treatment Test Section 1 (0 years)</th>
<th>Control Test Section</th>
<th>Treatment Test Section 2 (2 years)</th>
<th>Treatment Test Section 4 (6 years)</th>
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</tbody>
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Approach Motivations

- Each pavement has unique distress propagation rate
- Only one treatment required per project:
  - Reduce number of test sections required
  - Tailoring timing of treatments
  - Enhance implementation (agencies with experience with specific treatment more willing to participate)
- Meaningful results not reliant on other project sites, etc.
Approach Shortcomings

- Materials (aggregate source, binder type, etc.), equipment and/or contractor responsible for placement of treatment may vary from one year to another.

As along as changes are captured by LTPP, benefits outweigh negatives.

- Uncertainty as to State DOTs’ level of comfort with approach.

Reaction to date has been very good.
3. Key Considerations
Key Experiment Factors

- Pavement preservation treatments
- Pavement type and age
- Climate
- Traffic
- Replicate and repeat test sections
- Supplemental test sections
Preservation Treatments

AC Pavements (SPS-11)

- Thin HMA overlays (< 1 inch thick)
- Chip seals
- Micro Surfacing
- Crack seals
- Fog seals
- Slurry seals
- Other seals
- Mill & fill
- Patching
- Nova Chip
Preservation Treatments

PCC Pavements (SPS-12)

- Diamond grinding & dowel bar retrofit
- Joint sealants
- Joint penetrating sealers
- Concrete surface hardeners
- Partial depth patching
- Full depth patching
- Crack sealing
- Slab repair/replacement
Pavement Types

- **SPS-11:**
  - Original AC pavement
  - AC overlay of existing AC pavement (AC/AC)
  - AC overlay of existing PCC pavement (AC/PCC)

- **SPS-12:**
  - Original jointed plain concrete pavement (JPCP)
  - Original reinforced concrete pavement (JRCP)
  - Original CRCP pavement
  - PCC overlay of existing PCC pavement (PCC/PCC)
Pavement Age

- **SPS-11:**
  - AC overlays of AC pavements ≤ 4 years
- **SPS-12:**
  - Original jointed plain PCC pavements ≤ 4 to 10 years

Pavement in “good” condition
Climate

Thresholds:
- Precipitation of 20 inches/year
- Freezing Index of 150°F-days/year

MERRA data
Traffic: Volumes

- SPS-11 experiment considers both volumes and ESALs, while SPS-12 only considers ESALs
  - Low $\leq 5,000$ vpd
  - High $> 5,000$ vpd
Traffic: ESALs

- Same approach and threshold value as in SPS-10 WMA experiment for both SPS-11 and -12 experiments
  - Low – less than 500,000 ESALs per year
  - High – greater than 500,000 ESALs per year
SPS-11 Traffic Levels

Annual ESALs

Vehicles per Day

LOW

HIGH

100,000 200,000 300,000 400,000 500,000 600,000 700,000 800,000 > 900,000
Replicates, Repeats & Supplemental

Replicates:
- Two per experimental cell; will depend on funding

Repeat:
- Control test section plus test sections that have not received treatment

Supplemental:
- Highly encouraged; will be supported and monitored by LTPP
4. Experimental Designs &
Project Layouts
# SPS-11 Matrix

<table>
<thead>
<tr>
<th>Sub-Experiment / Treatment</th>
<th>Wet</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Freeze</td>
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<td>Freeze</td>
<td>No Freeze</td>
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<td>No Freeze</td>
<td>Freeze</td>
<td>No Freeze</td>
<td>Freeze</td>
<td>No Freeze</td>
<td>Freeze</td>
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<tr>
<td>Thin AC Overlay</td>
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<td>High</td>
<td>Low</td>
<td>High</td>
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<tr>
<td>Chip Seal</td>
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<td>Micro-Surfacing</td>
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</table>
Typical SPS-11 Layout

Traffic

| Treatment Test Section 5 (8 years) | Treatment Test Section 3 (4 years) | Treatment Test Section 1 (0 years) | Control Test Section | Treatment Test Section 2 (2 years) | Treatment Test Section 4 (6 years) | Traffic |
Timing of Treatments

- Treatment Section 1 – 0 years from inclusion
- Treatment Section 2 – 2 years from inclusion
- Treatment Section 3 – 4 years from inclusion
- Treatment Section 4 – 6 years from inclusion
- Treatment Section 5 – 8 years from inclusion

Schedule can be changed:
- Accelerated (e.g., 0, 2, 3, 4 and 5 years) if deterioration rate is higher than anticipated
- Decelerated (e.g., 0, 2, 5, 9 and 12) if condition of pavement remains stable
# SPS-12 Matrix

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Moisture</th>
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<th>Temperature</th>
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<th>Traffic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Wet</td>
<td>Dry</td>
<td>Freeze</td>
<td>No Freeze</td>
<td>Freeze</td>
<td>No Freeze</td>
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<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>Diamond Grinding &amp; Dowel Bar Retrofit</td>
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<tr>
<td>Joint Sealant</td>
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<tr>
<td>Joint Penetrating Sealers</td>
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</tbody>
</table>
# Diamond Grinding & DBR

<table>
<thead>
<tr>
<th>Traffic</th>
<th>Diamond Grinding (5 years)</th>
<th>Diamond Grinding &amp; DBR (5 years)</th>
<th>Control Test Section</th>
<th>Diamond Grinding (0 years)</th>
<th>Diamond Grinding &amp; DBR (0 years)</th>
<th>Diamond Grinding (10 years)</th>
<th>Diamond Grinding &amp; DBR (10 years)</th>
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Joint Sealant
(Cap/Replace Sealant)

Capped Sealant at Year 10; Replaced @ 10 year Intervals
Replace Sealant @ Year 10; Replace @ 10 year Intervals
Control: No Sealant
Control: Sealant Maintained
Control: Sealant kept As-Is
Capped Sealant at Year 5; Replaced @ 5 year Intervals
Replace Sealant @ Year 5; Replace @ 5 year Intervals

Traffic
# Penetrating Sealer (Silanes or Siloxanes)

<table>
<thead>
<tr>
<th>Traffic</th>
<th>Sealer at Year 0; Re-Apply @ 2 year Intervals</th>
<th>Sealer at Year 0; Do Not Re-Apply</th>
<th>Control: Joint Sealant Maintained; No sealer</th>
<th>Control: Joint Sealant @ Year 0, but Not Maintained; No sealer</th>
<th>Control: No Joint Sealant (remove if present); No Sealer</th>
<th>Sealer at Year 5; Do Not Re-Apply</th>
<th>Sealer at Year 5; Re-Apply @ 5 year Intervals</th>
</tr>
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<tbody>
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</table>

- **Sealer at Year 5; Re-Apply @ 5 year Intervals**: Apply sealer every 5 years.
- **Sealer at Year 5; Do Not Re-Apply**: Do not apply sealer at Year 5.
- **Control: No Joint Sealant (remove if present); No Sealer**: Remove joint sealant if present and do not apply sealer.
- **Control: Joint Sealant Maintained; No sealer**: Maintain joint sealant and do not apply sealer.
- **Control: Joint Sealant @ Year 0, but Not Maintained; No sealer**: Apply joint sealant at Year 0 and do not maintain it, do not apply sealer.
- **Sealer at Year 0; Re-Apply**: Apply sealer at Year 0 and repeat every 2 years.
- **Sealer at Year 0; Do Not Re-Apply**: Do not apply sealer at Year 0.
Typical Test Section

- Sampling Area
- Buffer Area
- Test Section
- Buffer Area
- Sampling Area
5. Getting Word Out
Meetings & Conferences

- FHWA LTPP Pavement Preservation ETG Webinar, January 2015 ✓
- FHWA LTPP Team Meeting, Reno, NV, April 2015 ✓
- FHWA LTPP Pavement Preservation ETG Meeting, Reno, NV, April 2015 ✓
- TRB LTPP Committee Meeting, Washington, D.C., May 2015 ✓
- FHWA Emulsion Task Force, Denver, CO, June 2015 ✓
Meetings & Conferences

- FHWA LTPP Pavement Preservation ETG Webinar, July 2015
- AASHTO Subcommittee on Materials Meeting, Pittsburg, PA, August 2015
- FHWA LTPP Pavement Preservation ETG Webinar, January 2015
- Midwestern Pavement Preservation Partnership, Kansas City, KS, September 2015
- TRB LSPEC Committee Meeting, Washington, D.C., October 2015
Meetings & Conferences

- Rocky Mountain West Pavement Preservation Partnership, Bozeman, MT, October 2015
- TRB LTPP State Coordinators Meeting, Washington, D.C., January 2016
- TRB AHD20 Committee on Pavement Maintenance Meeting, Washington, D.C., January 2016
- TRB AHD18 Committee on Pavement Preservation Meeting, Washington, D.C., January 2016
Meetings & Conferences

- Others?