Survey of State PMS Practices for Concrete Pavements

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IGGA
Survey of State DOT PMS Trigger Values for Concrete Pavement Preservation

Preliminary Draft Not for Distribution

The FHWA Pavement Preservation ETG Rigid Subcommittee conducted a survey of the state DOT PMS practices to determine the state-of-the-practice of concrete pavement preservation. Thirty-eight states responded to the survey and 23 states (61%) used trigger values for managing concrete pavements within the PMS system. Recommendations for follow up activities are included.

FHWA ETG Pavement Preservation
Rigid Subcommittee
L. Scofield, C. Hennings, S. Varneedd, S. Heallow, D. Harrington
4/30/2011
Lanes Miles of Concrete on State Systems  2009 - 2010
Circle of Life – PMS Style

Construction → Environment
Traffic and Maintenance

Pavement

Materials & Specification → Preservation → Performance Monitoring and Evaluation → Design
Survival Curves for Diamond Ground Pavements

- Time since first grind to regrind or rehabilitation
- Pavement age since initial construction to overlaying or reconstruction of a PCCP that has been diamond ground at least once
PMS Survey Questionnaire

- Organizational Setting of PMS Unit
- Pavement Funding Sources Used to Fund PMS Designated Projects
- PMS Distress Data Collection
- PMS Operation
- Miscellaneous
Do You Know the Name of Thomas Edison's Brother?

Organizational Setting
Asset Management Group

Yes (75%)

No
Location of PMS Unit

- Planning
- Materials & Construction
- Maintenance
- Design
- Other
Questions on PMS Operations

- What PMS Software does your agency use?
- Is an annual report prepared and if so, what period of time is covered (i.e. 3 yrs, 5 yrs)
- What models are used to predict the concrete pavement performance and associated trigger values for intervention for the various strategies.
- Is there a different model for each strategy type (i.e. overlay, diamond grinding, etc.)
- How often are the models re-evaluated to verify adequate prediction capability?
- What are the approximate percentages of pavement interventions triggered by each of the different models (i.e. for example 25% of the projects for faulting, 15% due to cracking, etc.)
- How is the service life defined?
  - Remaining Service Life
  - Present Condition Index
  - Remaining Service Interval
  - Time Based
  - Other?
- Are maintenance costs tracked and included in the PMS decision process
- How does the PMS system develop the prioritized listing of projects and funding levels for the annual program?
- How does the PMS system account for the projects that were not executed as planned?
- Are there any planned near-term changes to the PMS operation planned?
- How long has the state been operating a PMS system and how long has the current process been in use.
Software Use and Maturity 2016
<table>
<thead>
<tr>
<th>State</th>
<th>Performance Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa</td>
<td>Each strategy modeled for each distress</td>
</tr>
<tr>
<td>Illinois</td>
<td>Single Model Defined by Condition Ride Score?</td>
</tr>
<tr>
<td>Florida</td>
<td>Piece wise linear regression for all strategies</td>
</tr>
<tr>
<td>South Carolina</td>
<td>Single Sigmoidal Model</td>
</tr>
<tr>
<td>Ohio</td>
<td>Model for each strategy &amp; distress</td>
</tr>
<tr>
<td>Kentucky</td>
<td>None</td>
</tr>
<tr>
<td>Utah</td>
<td>Four models</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Decision Trees</td>
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<tr>
<td>North Carolina</td>
<td>Single Sigmoidal Model for all</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>PQI based on deduct values and condition index</td>
</tr>
<tr>
<td>Colorado</td>
<td>Three models</td>
</tr>
<tr>
<td>Texas</td>
<td>Decision Tree &amp; Composite Scores</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Different models for each strategy</td>
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<tr>
<td>Kansas</td>
<td>Markov Optimization</td>
</tr>
<tr>
<td>California</td>
<td>3rd Stage Crck, Faulting, IRI, Decision tree used to associate condition&amp; Treatment</td>
</tr>
</tbody>
</table>
Reporting Frequency and Forecasts Period

A = Annually  B = Bi-
Annually Number = Forecast Period
Performance Model Update

Periods

- Periodically
- Not Often
- As Needed
- 5 Yrs ago
- 2 yrs Old
- Not Often
- Periodically
- 5 yrs
- 6 yrs
- 2 yrs

Note: Cost Models Oftentimes Updated Annually
Approximate % of Interventions Triggered by Each Model

- CRK 75%
- Rut 50%
- Ride 10%

100% Joint Distress

States with specific model percentages:

- CRK: 75%
- Rut: 50%
- Ride: 10%

States with 100% Joint Distress:

- Texas
- Oklahoma
- Arkansas
- Louisiana
- Mississippi
- Alabama

States with 75% Joint Distress:

- California
- Colorado
- Utah
- Arizona
- Nevada
- New Mexico

Additional states with varying percentages:
Maintenance Costs Tracked and Included in PMS

[Map showing states with Yes or No for tracking and inclusion of maintenance costs]
Implementation of PMS Program
Which of the following scenarios best describes the implementation of the actual PMS program?

- Annual program is developed by central office for statewide application and is sent to Districts for implementation. Districts must implement the plan unless exception reports are made justifying other actions or strategies.
- Annual program is developed by central office for statewide application and is sent to Districts for review and comment. Final prioritized list of projects and strategies is jointly developed by PMS Unit and District offices.
- Annual program is developed by central office for statewide application and is sent to Districts for consideration. Districts develop final prioritized list of projects and strategies.
- Each District uses the PMS system to prepare their own list of prioritized projects and strategies for their District.
- Other Please Explain.
Implementation of PMS Program

- **33** Districts Use PMS to Develop Program
- **25** Statewide Program Developed by Central for Implementation by Districts
- **13** Statewide Program Developed by Central for Review & Comment by Districts—Final Program Jointly Developed
- **21** Statewide Program Developed by Central for Consideration—Districts Develop Final Program
- **8** Other

Districts Use PMS to Develop Program
PMS Distresses
PMS Distress Data Collection

- What Distresses/Attributes are monitored for the PMS and which ones apply to concrete (i.e. faulting, longitudinal cracking, roughness, transverse cracking, friction, etc.)
- What frequency is each distress/attribute monitored (i.e. annually, bi-annually, etc.)
- Is deflection testing conducted as part of the PMS or is it only conducted for project design
- How is your PMS data collected, by contract, in-house, combination of both?
Measured Distresses

Pavement ME Distresses for Design: F,R,C
How States Conduct Network Level Testing

- In-House
- Contracted
- In-House & Contracted
Deflection Testing as Part of Network Level PMS Surveys

Conducts Network Level Deflection Testing

Does Not Conduct Network Level Deflection Testing
Miscellaneous

- What are the perceived risks of using concrete based pavement strategies such as new construction, preservation?
- Did you or will you use your PMS data to conduct local calibration of Pavement ME?
Barriers to Using Concrete
Barriers to Using Concrete

• Failures are Very Expensive
• D-Cracking, ASR, and Air Voids Issues
• In-experienced personnel for new construction
• Districts that Lack Concrete Experience
• Will it Last as Long as We Think
• Knowing when preservation is not an option
• High Cost of Maintenance and Construction Issues Like Phasing
States Who Have or Will Use PMS Data for Pavement ME Local Calibration

- **States Who Have or Will Use PMS Data for Pavement ME Calibration:**
  - California
  - LTPP

- **States Who Have Not Used PMS Data for Pavement ME Calibration:**
  - TBD

Legend:
- Green: States Who Have or Will Use PMS Data for Pavement ME Calibration
- Orange: States Who Have Not Used PMS Data for Pavement ME Calibration
What We Didn’t Ask

Survey Author

Respondent
What We Didn’t Ask

• Visualization Capability versus Data Only Approach
• 2D versus 3D Data Collection
• Perhaps Mulligans on:
  – Performance thresholds (what’s triggering projects)
  – Reporting periods for distress versus funding
• Analysis Segment Lengths Or Dynamic Segmentation Capability
• What is the Time (lag) Between PMS Identified Need and Project Completion
Opportunities
What We Don’t Know About Our Product

- We Need to Better Understand How Each of the Concrete Strategies is Modeled and How Each Strategy, New and Preservation, Performs
- We Need to Know What Distresses Are Triggering the Intervention Cycles to Better Improve Our Product
- How to Create Performance Curves for Strategies which may currently not be used by a given state
- Better Understanding of the Value of Probabilistic and Deterministic Approaches—Difficult to grasp the impact of data variability on long term prediction
- What is the Best Time frame to forecast Out—That is the longer the forecast period used the more the results mimic the model and perhaps not real data
- We don’t know typical maintenance costs for each of the concrete strategies
- Deflection is typically not collected for PMS. Should highway speed deflection data collection be promoted from a structural capacity and fuel efficiency consideration—Consider development of a State-of-the-practice report on highway speed deflection data collection
- We should promote common terminology on strategies to assist comparisons of data
- What are the Important Distresses for Strategy Performance
On Going Research to Consider
(Controlled Data Sources)

- SPS-2 Pooled Fund
- NRRA Pooled Fund
- LTPP SPS-12
- LTPP InfoPAV
“...and the inference may be drawn that the question of expense of construction and repairs is not the only important economical question involved.”

Harper’s Weekly September 18, 1869
Questions?