Quantifying the Effects of Preservation Treatments on Pavement Performance

AASHTO SCOM Meeting – Providence, RI
August 1, 2017

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1. **Project background**
   - Objective and scope

2. **Project Findings**
   - Effects of preservation
   - Analysis of performance measures
   - Analysis of State & LTPP data
     - Effect of thin overlay on performance

3. **Summary**
Project Background
Background

• Research conducted under NCHRP Project 14-33 to:
  ► Identify and/or develop pavement performance measures that consider contributions of preservation to performance, service life, and life-cycle costs
  ► Prepare guide document to facilitate implementation of measures by highway agencies

• Many performance measures evaluated
• Recommended measures and approach to evaluate effect of preservation
Phase I Outcomes

Identify information on performance measures and preservation treatment use

- Literature review identified numerous potential performance measures:
  - Individual distress/condition
  - Composite pavement measures
  - Cost-based measures
  - Other measures (e.g., noise, RSI, VOC, etc.)

- Performance measures reflect strategic objectives of agency
Phase I Outcomes

• **Defining performance measures**
  ► Metrics that quantify degree of achieving specific goals pertaining to performance.
  ► Evaluate current condition
  ► Forecast effect of certain actions

• **Selected performance measures**
  ► Many candidate measures evaluated
  ► Recommended individual distress measurements
  ► Drive maintenance decisions and collected by ~every agency
Modelling the Effect of Preservation
Data Gathering

- Data gathered from 8 agencies + LTPP
  - 6 AC preservation treatments
  - 2 PCC preservation treatments

- Examples: effects of thin overlay on IRI & Rutting
Calculating initial change in condition

- **Difference in two measurements**

- **Errors in initial condition and change in condition**
Initial Change

- Data from
  - LTPP SPS-3
  - Virginia DOT (2007-2014)
  - Ohio DOT (2011-2014)

- Significant variables
  - Initial condition
  - Pavement type
  - Treatment type
Calculating change in performance

- **Growth rates modeled using robust linear regression**

Each Figure on Left = Single Pavement Segment
- Individual Distress Measurement
- Regression Line
- Distress Growth Rate for Single Pavement Segment
- Growth Rate as a Function of Initial Condition

Calculate the slope of the regression line for each segment, shown as □ in the figure on the right.
Change in performance

- **Relative Rutting comparison using LTPP data**
  - Relative comparison – does control section grow more rapidly than overlay section?
  - Overlay rutting growth $\sim 0.031$ in./mile/year
  - Control rutting growth $\sim 0.038$ in./mile/year
Change in performance

- **Relative Rutting comparison using VA data**
  - Relative comparison – does rut growth rate following overlay relate to initial rutting?
  - Simulation performed to identify ratio of variances

![Scatter plot with regression line](image)

- **Slope of Regression Line = 0.020**
- **Confidence Interval on Slope = [0.01 0.032]**

Rut Growth Rate (in/year) vs. Pre Overlay Rutting (inches)
Change in performance

**Modelling rutting performance**

- Many control sites had better rutting performance
  - Can independent variables be used to predict rut growth?
  - Do the same variables show similar significance to the model?
- Following variable showed as significant
  - Rainfall
  - Freeze-thaw cycles
  - Temperature
  - Structural number
  - Traffic (AADT)
Implementation

- Change in condition and performance input into effectiveness evaluation
  - Life extension and changes in performance can be estimated
  - Effect on LCC can be calculated
  - Can be implemented in project selection or optimization
Summary
Project Report and Guide

- **NCHRP Report 858 currently in publication**
  - Report documents work performed on project

- **Includes guide as attachment**
  - Selecting performance measures
  - Evaluating effect of preservation using measures
    - Gathering and assessing required data
    - Developing models supporting performance measures
  - Implementing measures in PMS
Select Project Conclusions

- Data do exist for moving away from anecdotal evidence for demonstrating preservation effects
  - Many agencies collect and store data required to assess effectiveness of preservation
  - Other sources of data (e.g., LTPP) can be used to supplement agency data
- Analysis of condition data requires techniques not traditionally found in pavement literature
  - e.g., robust or censored regression techniques, econometric techniques, etc.
Thank You!