Impact of Pavement Performance Models on Strategic Funding Analyses in the NCDOT Pavement Management System

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NCDOT
Background - NCDOT Network

Interstates – 6,000 lane miles
Primaries – 35,000 lane miles
Secondaries – 121,000 lane miles
Rural – 105,000 lane miles
Subdivision – 16,000 lane miles
Background – Current Funding

• STIP - $1.9 Billion (State and Federal)

• Contract Resurfacing – $408 Million

• Preservation - $65 Million

• Maintenance - $404 Million
Why Update Models?

- PMS Analysis results (rapid deterioration over time) did not agree with the real world results (stable or small variance over time)

- Existing power form models were often too aggressive when compared to data, especially on the secondary system.

- Needed a repeatable and defendable method to consistently update models
Initiated New Research Project

- Research project with UNC-Charlotte (Don Chen, Ph.D.) began in 2012
- Goals
  - Update and improve the pavement distress performance curves in the PMS
  - Original curves developed in-house in 2007
  - Increase number of model families to better understand and predict performance of a highly variable highway network.
Outliers

Pavement Models - Index vs Age

- Data
- Cur. Power

MCDOT Rating Number vs Pavement Age
Dramatic Result: Subdivision Curves

Secondary Route Performance Curves

- New, Flatter HMA Curve
- New, Flatter BST Curve
- Old, More Aggressive Curve
Dramatic Result: Subdivision Curves
Decision Tree Changes Needed

- Creation of a new composite Pavement Condition Rating (PCR) tree

- Adjusting the alligator cracking tree due to the new index calculation

- New decision points based on curb and gutter vs shoulder
Decision Tree Changes

Curb – Yes:
Mill 1.25” & Replace / Full Depth Patching

Curb – No:
1.25” Overlay / Full Depth Patching

BST – Yes:
Triple Seal

BST – No:

Curb – Yes:
Mill 1.25” & Replace

Curb – No:
Seal Cracks / 1.25” Overlay
### Change in Need by System

<table>
<thead>
<tr>
<th>System</th>
<th>FY 2014</th>
<th>FY 2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>$135,000,000</td>
<td>$80,000,000</td>
<td>$55,000,000</td>
</tr>
<tr>
<td>Primary</td>
<td>$270,000,000</td>
<td>$225,000,000</td>
<td>$45,000,000</td>
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<tr>
<td>Secondary</td>
<td>$485,000,000</td>
<td>$290,000,000</td>
<td>$195,000,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$890,000,000</strong></td>
<td><strong>$595,000,000</strong></td>
<td><strong>$295,000,000</strong></td>
</tr>
</tbody>
</table>

Note that the reduced total need calculations still represented a greater level of funding than what is being annually allocated.
### Change in Need by Treatment Type

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>FY 2014</th>
<th>FY 2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction</td>
<td>$80,000,000</td>
<td>$7,000,000</td>
<td>$73,000,000</td>
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<tr>
<td>Rehabilitation</td>
<td>$200,000,000</td>
<td>$183,000,000</td>
<td>$17,000,000</td>
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<tr>
<td>Resurfacing</td>
<td>$418,000,000</td>
<td>$250,000,000</td>
<td>$168,000,000</td>
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<tr>
<td>Other Preservation</td>
<td>$14,000,000</td>
<td>$12,000,000</td>
<td>$2,000,000</td>
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<tr>
<td>Chip Seal</td>
<td>$100,000,000</td>
<td>$88,500,000</td>
<td>$11,500,000</td>
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<tr>
<td>Interstate Maintenance</td>
<td>$70,000,000</td>
<td>$54,000,000</td>
<td>$16,000,000</td>
</tr>
<tr>
<td>Interstate Preservation</td>
<td>$8,000,000</td>
<td>$500,000</td>
<td>$7,500,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$890,000,000</strong></td>
<td><strong>$595,000,000</strong></td>
<td><strong>$295,000,000</strong></td>
</tr>
</tbody>
</table>
Conclusion

- The project was successful
  - PMS Analyses more closely matched observed performance
  - Decision tree updates combined with new models yield analysis results and project selection that better aligned with the needs of field engineers to create work plans
More Work to Be Done

- Regionalized/Localized Cost information
- Regionalized/Localized models for certain classes of roadway
- Tighter integration of STIP projects with maintenance and resurfacing
- Improve feedback loop of work accomplished vs work recommended.