Examples of Decision Support Using Pavement Management Data

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Oregon Department of Transportation
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Decision Levels*

• Strategic
• Network (Tactical)
• Project (Operational)

*Pavement Management Guide, 2nd Ed.  
AASHTO, 2012
<table>
<thead>
<tr>
<th>Level</th>
<th>Audience</th>
<th>Types of Decisions</th>
<th>Apply to</th>
<th>Detail</th>
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</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Politicians Commission Agency Heads</td>
<td>Perf. Meas./Targets Funding Impacts Pavement Strategy</td>
<td>Entire Network</td>
<td>Low</td>
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<tr>
<td>Project</td>
<td>Project and Maintenance staff</td>
<td>Scope refinement Thickness design Materials selection</td>
<td>Project or corridor</td>
<td>High</td>
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</table>
Strategic Network Project Network
STRATEGIC LEVEL

• What is the condition of our roads?
Measuring Pavement Conditions

AUTOMATED

WINDSHIELD

National Pavement Preservation Conference 2016
Pavement Rating

- 100% Survey
- Score each PMS section
- Sum miles in each category
- Calculate % Fair-or-better mileage
STRATEGIC LEVEL

• What is the condition of our roads?
• Are they getting better or worse?
Performance Measures and Targets

Pavement Condition - Percent of miles rated 'fair' or better out of total miles on ODOT highway system

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Goal</th>
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<tbody>
<tr>
<td>2006</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2007</td>
<td>85%</td>
<td>78%</td>
</tr>
<tr>
<td>2008</td>
<td>86%</td>
<td>78%</td>
</tr>
<tr>
<td>2009</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2010</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2011</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2012</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2013</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2014</td>
<td>87%</td>
<td>78%</td>
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<tr>
<td>2015</td>
<td>87%</td>
<td>78%</td>
</tr>
<tr>
<td>2016</td>
<td>85%</td>
<td>78%</td>
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</table>
STRATEGIC LEVEL

• What is the condition of our roads?
• Are they getting better or worse?
• How much money should we allocate to our pavement programs?
STRATEGIC LEVEL

• What is the condition of our roads?
• Are they getting better or worse?
• How much money should we allocate to our pavement programs?
• How should we prioritize our pavement investments?
## Investment Priorities

<table>
<thead>
<tr>
<th>Route Strategy</th>
<th>Treatment Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Importance</td>
<td>Cost / Benefit</td>
</tr>
<tr>
<td>1. Interstate</td>
<td>1. Chip Seals / 1” Lift</td>
</tr>
<tr>
<td>2. State Level (NHS) Routes</td>
<td>2. 2”-3” Paving</td>
</tr>
<tr>
<td>3. Region / District Level</td>
<td>3. Multi-lift 3R Paving</td>
</tr>
<tr>
<td>Routes</td>
<td>4. Reconstruction</td>
</tr>
</tbody>
</table>

**NPPC16 National Pavement Preservation Conference 2016**
Treatment Priorities

<table>
<thead>
<tr>
<th>Condition</th>
<th>Typical Treatment</th>
<th>Life</th>
<th>$/LM/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>Crack Seal</td>
<td>2 yrs</td>
<td>$1,500</td>
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<tr>
<td>Good</td>
<td>Chip Seal</td>
<td>5 yrs</td>
<td>$5,000</td>
</tr>
<tr>
<td>Fair</td>
<td>1” Overlay</td>
<td>9 yrs</td>
<td>$8,000</td>
</tr>
<tr>
<td>Poor</td>
<td>2”-3” Overlay</td>
<td>14 yrs</td>
<td>$12,000</td>
</tr>
<tr>
<td>Very Poor</td>
<td>Thk. Overlay</td>
<td>17 yrs</td>
<td>$16,000</td>
</tr>
<tr>
<td></td>
<td>Rebuild</td>
<td>40 yrs</td>
<td>$50,000</td>
</tr>
</tbody>
</table>

Years (varies by road section)

Typical Treatment:
- Crack Seal: 2 yrs, $1,500
- Chip Seal: 5 yrs, $5,000
- 1” Overlay: 9 yrs, $8,000
- 2”-3” Overlay: 14 yrs, $12,000
- Thk. Overlay: 17 yrs, $16,000
- Rebuild: 40 yrs, $50,000

Pavement Preservation Conference 2016
NETWORK LEVEL

• How do we divide the money up?
Money Allocations

• Fix-It STIP (Federal Funds)
  – Interstate Paving
  – Region Paving
  – Chip Seals

• Maintenance Program (State Funds)
  – MIM (Interstate quick hit)
  – Low Volume (Chip Seals and Thin Paving)
  – Patching
Interstate Allocation

• Target - minimum 95% fair or better

• Revolving 8 Year Workplan – Update every 2 yrs.
  – Current 4-Year STIP
  – Draft STIP (Years 5 and 6)
  – Future STIP (Years 7 and 8)
  – Shelf Projects
Region Paving – Initial Allocation

1. Forecast conditions one STIP cycle ahead (8 yrs. from data year)
2. Compute % fair or better by Region
3. Compare to target (by Hwy. class)
4. Determine $ needs in each Region to reach target
5. Apply resulting percentages to funds available
Chip Seal Allocations

• STIP – Primary Routes
  – Target Cycle Time – 6-10 years

• Maintenance – Low Volume Secondary
  – District Discretion – up to 80% of their budget
  – Target Cycle Time – 8-14 years
NETWORK LEVEL

• How do we divide the money up?
• What projects should we do, and what year?
Fix-It STIP Paving Program

• Timeline – Data to Construction – 6 years!
• Use PMS to develop initial priority list
  – Project conditions 6 years ahead
  – Look to paving where chip seals, crack sealing, or patching is not viable option or will no longer work
  – Priority to higher classes / traffic highways
  – Priority to projects with higher cost effectiveness
Fix-It STIP Paving Program

• Regional preservation team (led by DM’s)
  – Do road tour
  – Factor in regional and local issues, other work, etc.
  – Prioritize list for scoping
150% List

1. Start with Road Tour Priority List
2. Field Scope ≈200% of Initial Allocation
3. Refine Cost Estimates
   – Investigate differences - planning $ vs. scope $
4. Cut to 150% list
New Trial Process 150% → 100%

Applies to Pavement and Bridge Program

<table>
<thead>
<tr>
<th>Score 1-5 for Each of these Factors</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Classification, ADT, Truck ADT</td>
<td>25%</td>
</tr>
<tr>
<td>Cost Effectiveness, Delay Risk</td>
<td>25%</td>
</tr>
<tr>
<td>Program Priority</td>
<td>25%</td>
</tr>
<tr>
<td>Region Priority</td>
<td>25%</td>
</tr>
</tbody>
</table>
## Classification Points

<table>
<thead>
<tr>
<th>Classification</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate</td>
<td>5</td>
</tr>
<tr>
<td>OTIA or Seismic Lifeline</td>
<td>4</td>
</tr>
<tr>
<td>State Class Route or NHS</td>
<td>3</td>
</tr>
<tr>
<td>Regional Class Route</td>
<td>2</td>
</tr>
<tr>
<td>District Class or Other</td>
<td>1</td>
</tr>
<tr>
<td>Traffic Level (ADT)</td>
<td>Score</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
</tr>
<tr>
<td>&gt; 10,000</td>
<td>5</td>
</tr>
<tr>
<td>&gt; 4,000 to &lt;=10,000</td>
<td>4</td>
</tr>
<tr>
<td>&gt; 1,500 to &lt;= 4,000</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 500 to &lt;=1,500</td>
<td>2</td>
</tr>
<tr>
<td>&lt;=500</td>
<td>1</td>
</tr>
</tbody>
</table>
## Truck ADT Points

<table>
<thead>
<tr>
<th>Truck ADT</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1,200</td>
<td>5</td>
</tr>
<tr>
<td>&gt;600 to &lt;= 1,200</td>
<td>4</td>
</tr>
<tr>
<td>&gt;300 to &lt;= 600</td>
<td>3</td>
</tr>
<tr>
<td>&gt;100 to &lt;= 300</td>
<td>2</td>
</tr>
<tr>
<td>&lt;=100</td>
<td>1</td>
</tr>
</tbody>
</table>
## Cost Effectiveness

<table>
<thead>
<tr>
<th>$ / Lane Mile / Year</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= $10,000</td>
<td>5</td>
</tr>
<tr>
<td>&gt;$10,000 to &lt;= $15,000</td>
<td>4</td>
</tr>
<tr>
<td>&gt;$15,000 to &lt;= $20,000</td>
<td>3</td>
</tr>
<tr>
<td>&gt;$20,000 to &lt;= $40,000</td>
<td>2</td>
</tr>
<tr>
<td>&gt;$40,000</td>
<td>1</td>
</tr>
</tbody>
</table>
Delay Risk

• Score 1 to 5
• Looks at Consequence of Delay beyond STIP
  – Maintenance Cost / Risk
  – Pavement Repair Cost Risk (missing the window)
Program Priority (1 to 5)

• Pavement Program Manager (yours truly) allotted 3 points per project

• Favor Projects which....
• Help performance measure achieve target
• Maximize benefit to the pavement and/or reduce maintenance requirements and costs
• Maximize long term pavement service life
• Provide safety benefits (i.e. rutting or pothole / failed pavement hazards / friction issues)
• Improve poor smoothness on routes with higher traffic speeds and freight movements
• Address severe raveling / degradation of driving surface too widespread for patching
• Minimize repetitive, reactive “throw away” maintenance costs
• Treat the disease rather than doing “short term fixes” that temporarily treat symptoms
• Have negative impacts if treatment is deferred beyond the STIP period
Region Priority (1 to 5)

- Regions Allotted 3 points per project
- Suggested criteria include, but not limited to:
  - Maintenance Impact
  - Community Impacts (economics, travel time, freight & modal impacts, etc.)
  - Safety Impact
  - Detour or alternative route availability
  - Project Delivery Staffing implications
100% List

1. Combine Bridge and Pavement project in one list
2. Rank by total weighted scores
3. Send to Highway Management Team
   – use results to set final Bridge/Pavement funding levels
   – use results for regional paving splits
   – use results for initial 100% project list
NETWORK LEVEL

• How do we divide the money up?
• What projects should we do, and what year?
• Are there bundling opportunities?
• Are there leveraging opportunities?
100% List → Final

• Start with 100% list
• Option to swap projects (leverage enhance)
  – Swap must be from the 150% list
  – Program Manager and District Manager must approve
• Shelf Program – develop from unselected projects
PROJECT LEVEL

• What is this road section made of?
  – Last resurfacing  When?  What?  How thick?
Pavement History

SECTION: US 30 : LEG TO BEAVER FALLS RD - SWEDETOWN RD
SEAL: 
AGE: 
PVMT TYPE: DGAC THIN OVLY A
WC: B-MIX
AGE: 19

CONSTRUCTION HISTORY

DATE THKN MTRL THKN MTRL THKN MTRL CPPR THKN BASE THKN SUB
1995 2 B  
COMMENTS: Pres list, 58.0-60.7 (1992) 2" inly in climbing lane
1972 1.5 B 1.5 B  
COMMENTS:  
1954 1.5 B 2 B 2 AG 16 AG 5V-026 C04172  
COMMENTS: 

HWY NO: 092
BEGIN MP: 54.50
ENDING MP: 60.94
LENGTH: 6.44
REGION: 2

V-FILE 00V-226 C11477
CON # 10V-289 C07716

National Pavement Preservation Conference 2016
1995 00V-226

1972 10V-289

1954 5V-026

Total via Plans:
8.5” DGAC
4” Agg. Base
15”-19” Subbase
# Mix Design Database

<table>
<thead>
<tr>
<th>Year</th>
<th>US Route</th>
<th>Location</th>
<th>Milepost</th>
<th>Type</th>
<th>Mix Properties</th>
<th>Volumetric Properties as Built</th>
<th>Asphalt Mix Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>US 30</td>
<td>Columbia County Line</td>
<td>61.70</td>
<td>Wearing Base</td>
<td>100 Number of Gyrations, 1/2&quot; Dense Mix</td>
<td>Effective binder content (%)</td>
<td>% Retained 3/4&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.0013</td>
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<td></td>
<td></td>
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<td></td>
<td>Air voids (%)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total unit weight (pcf)</td>
<td>147.98</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>% Retained 3/8&quot;</td>
<td>20</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% Retained #4</td>
<td>49</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>% Passing #200</td>
<td>7.2</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tensile Strength Ratio</td>
<td>93</td>
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</tbody>
</table>
PROJECT LEVEL

• What is this road section made of?
  – Last resurfacing When? What? How thick?

• Performance?
  – How well has this section performed?
21 yrs since last ovly (2” DGAC) 
Overall Condition = 29 
39% fatigue cracking (by length) 
27% patching 
Avg. IRI = 117 in/mi 
Avg. Rut = 0.3”

ADT = 8,000 
20 Yr ESAL’s = 5 million
### Performance Over Time

#### Condition History

<table>
<thead>
<tr>
<th>Year</th>
<th>Rating</th>
<th>RUT</th>
<th>IRk</th>
<th>SKID</th>
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<tbody>
<tr>
<td>1994</td>
<td>51</td>
<td>0.43</td>
<td>127</td>
<td>55</td>
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<td>1995</td>
<td>100</td>
<td>0.23</td>
<td>101</td>
<td>49</td>
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<td>1996</td>
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<td>2000</td>
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<td>2002</td>
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<td>2007</td>
<td>39</td>
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</tbody>
</table>

#### Condition Graph

![Graph showing performance over time](image-url)
PROJECT LEVEL

• What is this road section made of?
  – Last resurfacing When? What? How thick?

• Performance?
  – How well has this section performed?
  – How have other projects like the one we are planning to do been performing?
Nearby Project - Context

9 yrs since last ovly (3”)
Overall Condition = 96
0% cracking
Avg. IRI = 58 in/mi
Avg. Rut = 0.2”
ADT = 6,000
20 Yr ESAL’s = 5 million

Total via Plans:
8.5” DGAC
10” Agg. Base
18” Subbase
PMS Data has Lessons

• PMS data is the **feedback tool** for evaluating previous decisions that have been made

• PMS data can be an important **knowledge transfer** tool for future road managers

“Those who fail to learn from history are doomed to repeat it”

George Santayana
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