Preservation Triggers for PMS

Necessary Functionality That is Critical To Successfully Integrate Preservation

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Agenda

• How to Integrate Pavement Preservation into PMS
  – Why Integrate PP into PMS Software
  – Software Functionality
  – Pavement Condition
  – Treatments
  – Decision-Making Framework
  – Optimized Multi-Constraint Scenario Analysis
  – Integration of PP/PMS into Broader AMS
Why Integrate PP into PMS Software

• Highly Complex Environment
  – Size and Complexity of the Network
  – Many Decision Variables
  – Many Performance Variables
  – Many Constraints

• PMS Software provides:
  – Decision-making Framework
  – Multi-Constraint Optimized Scenario Analysis
  – Reporting Tools
It Does Matter!

Cost of Delaying Maintenance

<table>
<thead>
<tr>
<th>Pavement Age</th>
<th>Pavement Condition</th>
<th>Surface Treatment</th>
<th>Functional Overlay</th>
<th>Major Rehabilitation</th>
<th>Reconstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>Very Good</td>
<td>$60,000</td>
<td>$200,000</td>
<td>$400,000</td>
<td>$750,000</td>
</tr>
<tr>
<td>New</td>
<td>Very Poor</td>
<td></td>
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<td>Old</td>
<td>Very Good</td>
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</tbody>
</table>
Software Functionality
Well-Informed Decision Makers Require Data/Information

- Inventory Data
- Condition Data/Indices
- Analysis Framework (Trees, Models, etc.)
- Optimized Scenario Analyses (What-if’s): Budgets and Performance Measures
- Integrated Asset Management (CATOA)
- Maintenance Management (Day-to-Day)
Condition Data

“The Critical Link”

The Triggers
Condition Data

• How Much is “Just Right”?

• Recommend Severity and Extent
  – Used for More Accurate Current Repair Needs (indices) and Costs
  – Use Distress Types that are “Preservation” Appropriate

• Bottom Line:
  – Sufficient to select the **Most Appropriate** Repair Strategy
    – **Quality, Repeatable** Data Collection Process
Pavement Conditions

Good Candidate?

Too Late
Appropriate Distresses for Preservation

• Consider what is the purpose of Preservation?

• Ride (IRI) ????

• What Distresses should be evaluated?
  – Primary Distresses
    • Transverse Cracking
    • Oxidation/Raveling
    • Block Cracking (???)
  – Secondary Distresses (?)
    • Bleeding, Skid, Longitudinal Cracking
How to Handle Crack Sealing

• How to Rate Cracks
  – Sealed or Not Sealed???
  – Type of Cracking (Environmental vs. Structural)

• Need to Account for “Benefit”
  – Do You Have Knowledge
    • Improvement in Condition
    • Length of Time
Condition Indexes

The Link between Conditions and Treatments
Indices

• Individual
  – Specific type of distress
    • Fatigue Cracking, Transverse Cracking, Rutting, Potholes, Surface Defects, etc.

• Combined
  – Focused boarder type of failure
    • Structural, Environmental, Functional, etc.

• Composite
  – Reflects the General Health
    • A poor “treatment trigger”
## Typical Indices
### Individual, Combined & Composite

<table>
<thead>
<tr>
<th>Individual Index</th>
<th>Combined Index</th>
<th>Composite Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alligator Cracking</td>
<td>Structural Index</td>
<td>Composite Index (PCI, PSI, OCI, etc.)</td>
</tr>
<tr>
<td>Edge Cracking</td>
<td>Environmental Index</td>
<td></td>
</tr>
<tr>
<td>Patches/Potholes</td>
<td>Functional Index</td>
<td></td>
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<tr>
<td>Transverse Cracking</td>
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<td>Block Cracking</td>
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<td>Oxidation/Raveling</td>
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<tr>
<td>Bleeding</td>
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<tr>
<td>Skid</td>
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<tr>
<td>Rutting</td>
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<tr>
<td>Ride</td>
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</tbody>
</table>

### Condition/Treatment
- Treatments
- "Health"/Benefit

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*2012 National Pavement Preservation Conference*
Treatments

“The Toolbox”
Utilize the Entire Tool Box

There is a most Cost-effective Treatment for every combination of Distresses
Preservation Treatments

- Fog Seals
- Sand Seals
- Chip Seals
- Slurry Seals
- Micro-Surfacing
- Cape Seals
- Ultra-Thin Bonded Overlays
- Thin HMA Overlays/Inlays
- CIR/HIR
Question

• Should Individual Treatments be selected in a Network-Level Scenario Analysis???

• Typically not enough data/indices to select “specific” treatments
  – Utilize Repair Categories
    • “General” Groups of Treatments
Decision Variables

For Building Decision Trees
Decision Variables

Questions:
Do You Have the Data?
What are the Decision Rules?
Does it Matter?

Environmental
Geographic
Available Resources

Traffic
Functional Class
Speed Limit

Decision Variables

No. of Treatments

Traffic

Functional Class

Speed Limit

HMA
OGFC
Composite
Condition vs. Repairs

Routine - Crack Seal
Routine - Patching
Rebuild
Rehabilitate
Preservation Candidate
Some Prep Work Of Course
Decision Trees

Purpose:
Select the Most Cost-Effective Treatment
Small City
Decision Tree - Composite Index Using “PCI”

Composite Index:
• Selects a Treatment to address the “General” Condition

Flexible

PCI ≥ 80
Monitor

80 > PCI ≥ 60
Surf Coat (PM)

60 > PCI ≥ 40
Rehabilitate

PCI < 40
Recon.

Question:
Is a “60 to an 80” a good PM Candidate?
A County
Decision Tree – Environmental Index

- Transverse Cracking
- Block Cracking
- Oxidation/Raveling
Performance Class (Models) Variables
Performance Class Variables

Questions:
Do You Have the Data?
How do the Variables affect Performance?
Does it Matter?

Subgrade
Drainage
Pavement Structure
Material Issues

Environmental
Geographic
Decision and Performance Variables
A Summary

• Data sufficient to support level of analysis

• Must be available

• Should be:
  – Current
  – Maintained/Updated
  – QA/QC (garbage in, ……)

• Must be justified (simpler the better – “KISS”)
User-defined “Other Improvements”

• Condition Reset Rules
• Update Models and Pavement Types
• Exclusion Years
• Priority Codes
• Reset Counters (Age, Treatments)

“Other Improvements” can greatly affect the selection of Repairs
Benefit
“Benefit” Calculation

With Traffic as an *Additional Factor*

\[
\text{Treatment Benefit} = (\text{A.B.C.}) \times \text{Traffic Factor} \times \text{??????}
\]

Other Possible Benefit Factors:
- Risk (reduction)
- Environmental
- Safety
- Emergency
- Functional Class
“Benefit” Calculation

Should Delay Create Less Benefit ???

- Less “Real” Improvement
- Lower Performance
- Less Benefit!!!

A way to capture the affects of “Band-aiding”

- Current Performance Model
- Threshold Line
“Band-Aiding”

• Capture “Lack of Improvement” and Benefit”

• Create a way of tracking “Band-Aids”
  – Better Models
  – Better Decisions
  – MEPDG

• If part of decision-making framework
  – Analysis can show the damage of Band-Aids
Optimized Multi-Constraint Scenario Analysis
Multi-Constraint Analysis

Objective: Maximize Roadway Condition

Constraint: Budget

Overall Budget

Maximize Condition

Arterials Budget

Collectors Budget

Maximize Condition

Local Budget

Maximize Condition

Reconstruction

Maximize Condition

Preservation

Rehabilitation
A Small City

100 Miles of Streets

2009 Budget $1 Million Per Year

Many Subdivision Streets are 8-15 year age range and needing attention soon
PCI Comparison
Optimized vs. Ranked Priority – Same Budget
10 Year Analysis
Backlog Analysis – Dollars by Repair Type
10 Year Analysis

Priority Ranking Analysis - $40 Million Backlog

Optimized Analysis - $31 Million Backlog
PCI Comparison – Optimized
Current vs. Proposed Budgets
10 Year Analysis

$2 Million/Yr.

$1 Million/Yr.
A Moderate-Sized County

1,700 Miles of Roads

Again:
Many Subdivision Streets are 8-15 year age range and needing attention soon
PCI Comparison - Optimized vs. Worst-First

Pavement Condition Index

- Optimized PCI
- Worst-First PCI
Worst-First Analysis
Backlog by Repair Cost & Category
Optimized Analysis
Backlog by Repair Cost & Category

Backlog (Dollars)

- Reconstruction
- Rehab-Thick
- Rehab-Thin
- Preservation
Backlog Analysis – Dollars by Repair Type
10-Year Analysis

Priority Ranking Analysis - $124 Million Backlog
Optimized Analysis - $53 Million Backlog
“Integrated PP” into Pavement Management

• PMS Software is only part of the answer
  – It is a tool to manage the agencies policies and practices

• Doing Things the Right Way:
  – Proper Selection (3 R’s)
  – Mix Designs/Pavement Designs
  – Quality Contract Documents
  – Thorough Inspection

• Prep Work, Calibration, Yields, Materials
Integration of PP/PMS into Broader AMS
Integrating PMS and AMS
A Few Quick Examples

• If Culvert\_Condition is “Bad” – Defer Treatments except Maintenance (Patching or Crack Sealing)

• Significant Crack Sealing (MMS) – Improve Index(es) (PMS)

• If “Surface Treatment – 2013” – Do Not Redo Pavement Markings unless it is a Safety Priority
Parting Wordings

Just do It!!!
Get Started Today

Or you may still be talking about Integrating Preservation 10 Years From Now
Something Is Better Than Nothing

No Excuses – The Taxpayers Deserve It
Questions???

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