INDUSTRY PERSPECTIVE AND ACTIVITIES TO HELP IMPLEMENT MAP-21
ASSET MANAGEMENT REQUIREMENTS

September 2017
MAP-21 TRANSPORTATION LEGISLATION

Goal is to have a Long-term, Strategically-driven Performance Based Management Program that uses Targets, Measures and Investment Strategies to improve project decision-making

Performance Based Management Program

Asset Management Plan

National Goals (MAP 21 – §150(b))
Maintain Highway assets in a state of good repair.

Performance Measures (§150(c))
Pavement Condition
IRI, Cracking, Faulting, etc.

Performance Targets (§150(d))
What are acceptable condition measures

Statewide Planning (§135(d))
Performance-based Approach

State Performance Management (§119(e))
Risk-based Asset Management Performance Driven

Pavement Condition (§150(c))
Asset condition and how is it changing

Asset Management Plan should link the Goals, Condition, Measures, Targets, and Planning
OVERALL, INDUSTRY HAS HIGH PRAISE OF THE MAP 21’S PERFORMANCE MEASURES AND ASSET MANAGEMENT RULE MAKING

We commend FHWA on how they balanced the goals and intent of MAP 21 legislation and the State DOTs ability to implement AMPs for our National Highway System

We believe that many of the recommendations follow or build on best practices and will help improve how state DOTs manage their highways and bridges

We support FHWA’s efforts to promote transparency

We continue to support State DOTs by providing quality resources to assist in constructing, rehabilitating, reconstructing, and repairing our nation’s roads and bridges

While Asset Management and the rulemaking provide great potential for DOTs, we believe that there are some shortcomings and missed opportunities
CURRENT CONDITION PERFORMANCE INDICATORS ARE “DELAYED” INDICATORS

- By the time a pavement reaches an unacceptable threshold, rehabilitation should have already been performed
- It does not tell how long a section will remain in a given condition.
  - Cannot distinguish between pavements that are stable and pavements that are deteriorating

**Issue 1: Condition does not help program activities (promotes “band aid approaches”)**
ASSET / PAVEMENT MANAGEMENT PLAN IS INTENDED TO DEFINE THE PATH FOR AN AGENCY TO MEET ITS LONG TERM GOALS

10-Year Asset Management Plan
- Specific asset condition targets
- System resiliency strategies
- Lifecycle investment strategies
- Recommended asset program allocations

20-Year Long Range Transportation Plan
Provides Goals, Vision, Long-Term Context

1. What is the current state of my assets?
2. What is my required level of service/performance?
3. Which assets are critical to sustained performance?
4. What are my best “Operations and Maintenance” and “Capital Improvement” investment strategies?
5. What is my best long-term funding strategy?

Questions to be answered

Issue 2: A 10-year AMP requirement is not long enough evaluate the economic impacts of different Investment strategies and treatment options (promotes “band aid approaches”)

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ASSET / PAVEMENT MANAGEMENT FOCUS IS ON DEVELOPING A "LIFE CYCLE PLAN (LCP)" FOR NETWORK ANALYSIS


Issue 3: Analysis stops at the network level and does not evaluate alternate actions at the project level
CEMENT / CONCRETE INDUSTRY IDEAS FOR A WELL-WORKING ASSET MANAGEMENT FRAMEWORK

Asset Management needs to:

1. Use a forward looking performance indicator that helps agencies properly plan for the long term.

2. Link the Network Level Analysis (Life Cycle Planning) and the Project Level Analysis (Life Cycle Cost Analysis) to take into account how different activity’s impact network performance:
   - Network analysis – allocates funds among classes of activities (construction, maintenance, preservation, repair, rehabilitation, and replacement actions).
   - Project level analysis – tells what investment option for a given project provides the greatest return (lowest life cycle costs).

3. Include all the cement / concrete based options:
   - Asset management is not “code” for preservation activities only – there will sections at different condition levels
     - Need “mix of fixes”
   - Most agencies have a limited number concrete options in their planning program (if any at all)

All three are linked and intertwined with each other.
Definition

- RSI tells HOW WELL and HOW LONG the pavement will serve the public
  - A RSI=10 means that it is 10 years to next construction treatment for that segment
  - A RSI=0 means that its condition is worse than the agency’s defined trigger value
  - “Treatment” can be anything from preservation activities (i.e. crack sealing) to full reconstruction for the segment

What it does

- Two pavement sections at the same condition are not necessarily equal
  - They will require different management strategies
  - RSI takes into account “rate of deterioration”
  - Higher RSI pavements / networks deliver higher value than lower RSI networks

RSI provides insight into future conditions and impact of different investment strategies
RSI IS DETERMINED USING A MULTI-CONDITION APPROACH
Uses Current Condition & Predicted Performance Data

RSI builds on each DOT’s “condition” measures already being required

- For each roadway segment, DOT determines “Time to Next Treatment” for each distress
  - Time to next treat. (IRI) = 16 years
  - Time to next treat. (cracking) = 12 years
  - Time to next treat. (faulting) = 10 years

- RSI determination can be based on any distress or performance indicator

Distress targets are set by each DOT

- Performance predictions are based on modeling (Pavement-ME models, LTPP Models, FHWA PHT, state AM models, straight line predictions, etc.)

For each Roadway Segment, RSI converts “Performance Data” to “Operational Information”
ONCE RSI’s ARE DETERMINED FOR EACH SEGMENT
Data is combined to give the Network RSI Graph

Segment 1
RSI = 10 years
10 Miles (0.02% of system)

Segment 2
RSI = 27 years
5 Miles (0.01% of system)

Segment Xi
RSI = Ti years
10 Miles (0.02% of system)

Network Length = 3849 Lane Miles
Network RSI = 51,269 lane-mi-yrs
Avg RSI = 13.3 years

Remaining Service Interval (before repairs are needed)
RSI Plot shows:
• How long portions of the pavement will last
• What future obligations will be
It also shows what performance is needed in upcoming treatment activities
• Cannot do rehabilitation activities that last 10 years
  - Increases amount to repair in 10 years from 22% to 46%
  - Creates a funding crises in 10 years

Goal is to Increase Network RSI

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Agencies need to find the best combination of activities that increase RSI without piling work onto a time that already has a large amount of the repair.

Network Length = 3849 Lane Miles
Network RSI = 43,263 lane-mi-yrs
Avg RSI = 11.2 years

Projected RSI (Lane-mile-years)

Remaining Service Interval (before treatment is needed)
AN EFFECTIVE MANAGEMENT PROGRAM REQUIRES A “MIX OF FIXES”

Agencies need to design their state’s program of projects and pavement treatments to meet minimum performance requirements.

A Network’s RSI plot defines the minimum performance requirements for the state’s program of projects.

Treatment strategies are based on falling into “times frames” that do not have a high percentage of pavements needing repair:
- Yrs 4-8, 16-20, 20-24, 24-28 & 32+

“Mix of Fixes” reduces the amount to be repaired at any given time, increases the Network RSI, lessens likelihood of funding crisis, and lowers annual cost requirements.

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OPPORTUNITY 3: EXPAND THE AVAILABLE TREATMENTS THAT CAN BE USED
Need to design & use treatments that meet the RSI requirements

### Mix of Fix treatments applicable to existing Concrete Pavements

<table>
<thead>
<tr>
<th>Category</th>
<th>Treatment Techniques</th>
<th>Materl. Used</th>
<th>Perform Period*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventive maintenance</td>
<td>Crack/joint sealing</td>
<td>AC</td>
<td>5-10</td>
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<tr>
<td>Corrective maintenance</td>
<td>Partial / full-depth repair and Slab replacement</td>
<td>PCC</td>
<td>5-15</td>
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<td></td>
<td>Concrete patch using asphalt</td>
<td>AC</td>
<td>1-3</td>
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<tr>
<td></td>
<td>Joint LTE restoration</td>
<td></td>
<td>5-15</td>
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<tr>
<td></td>
<td>Diamond grinding &amp; grooving</td>
<td></td>
<td>10-15</td>
</tr>
<tr>
<td>Preservation</td>
<td>Open gradation friction course</td>
<td>AC</td>
<td>5-10</td>
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<tr>
<td></td>
<td>Thin asphalt overlay (2-4&quot;)</td>
<td>AC</td>
<td>5-15</td>
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<tr>
<td>Minor Rehabilitation</td>
<td>Bonded concrete overlay (2-4&quot;)</td>
<td>PCC</td>
<td>10-20</td>
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<tr>
<td></td>
<td>Thin concrete overlay (4-8&quot;)</td>
<td>PCC</td>
<td>10-20+</td>
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<tr>
<td></td>
<td>RCC overlay (4-8&quot;)</td>
<td>RCC</td>
<td>10-20+</td>
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<tr>
<td>Major Rehabilitation</td>
<td>Asphalt overlay (4-8&quot;)</td>
<td>AC</td>
<td>5-20</td>
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<td></td>
<td>Asphalt overlay (&gt;8&quot;)</td>
<td>AC</td>
<td>10-20</td>
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<tr>
<td></td>
<td>Concrete overlay (8-12&quot;)</td>
<td>PCC</td>
<td>20-35+</td>
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<tr>
<td></td>
<td>RCC overlay (&gt;8&quot;)</td>
<td>RCC</td>
<td>15-25+</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>New asphalt</td>
<td>AC</td>
<td>10-20</td>
</tr>
<tr>
<td></td>
<td>New concrete</td>
<td>PCC</td>
<td>25-35+</td>
</tr>
<tr>
<td></td>
<td>New Roller Compacted Concrete</td>
<td>RCC</td>
<td>15-30+</td>
</tr>
</tbody>
</table>

### Mix of Fix treatments applicable to existing Asphalt and Composite Pavements

<table>
<thead>
<tr>
<th>Category</th>
<th>Treatment Techniques</th>
<th>Materl. Used</th>
<th>Perform Period*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventive maintenance</td>
<td>Seals (chip/fog/slurry/micro-)</td>
<td>AC</td>
<td>1-5</td>
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<tr>
<td></td>
<td>Asphalt Rejuvenation</td>
<td>AC</td>
<td>1-5</td>
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<tr>
<td>Corrective maintenance</td>
<td>Asphalt Patching/Pothole filling</td>
<td>AC</td>
<td>1-5</td>
</tr>
<tr>
<td>Preservation</td>
<td>Open gradation friction course</td>
<td>AC</td>
<td>5-10</td>
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<tr>
<td></td>
<td>Full Depth Reclamation w/ cement</td>
<td>AC</td>
<td>10-20</td>
</tr>
<tr>
<td>Minor Rehabilitation</td>
<td>Mill / Thin Asphalt overlay (2-4&quot;)</td>
<td>AC</td>
<td>5-15</td>
</tr>
<tr>
<td></td>
<td>Thin asphalt overlay (2-4&quot;)</td>
<td>AC</td>
<td>8-15</td>
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<tr>
<td></td>
<td>Ultrathin concrete overlay (2-4&quot;)</td>
<td>PCC</td>
<td>8-15</td>
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<tr>
<td></td>
<td>Thin concrete overlay (4-8&quot;)</td>
<td>PCC</td>
<td>10-20+</td>
</tr>
<tr>
<td></td>
<td>RCC overlay (4-8&quot;)</td>
<td>RCC</td>
<td>10-20+</td>
</tr>
<tr>
<td>Major Rehabilitation</td>
<td>Asphalt overlay (4-8&quot;)</td>
<td>AC</td>
<td>5-20</td>
</tr>
<tr>
<td></td>
<td>Asphalt overlay (&gt;8&quot;)</td>
<td>AC</td>
<td>10-20</td>
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<tr>
<td></td>
<td>Concrete overlay (8-12&quot;)</td>
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<td></td>
<td>RCC overlay (&gt;8&quot;)</td>
<td>RCC</td>
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</tr>
<tr>
<td>Reconstruction</td>
<td>New asphalt</td>
<td>AC</td>
<td>10-20</td>
</tr>
<tr>
<td></td>
<td>New concrete</td>
<td>PCC</td>
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<tr>
<td></td>
<td>New Roller Compacted Concrete</td>
<td>RCC</td>
<td>15-30+</td>
</tr>
</tbody>
</table>

* Performance Period gives typical range for the activity until next treatment. Actual performance will vary based on the specific parameters used for each activity and project. For example, a 8-inch overlay will provide longer service than a 5-inch overlay. The numbers given here are used to indicate what length of "Service Life" can be designed.
PAVEMENT / ASSET MANAGEMENT SHOULD BE A 2-STEP PROCESS
Similar to a financial portfolio management process

Step 1 – Allocation of Funds at the network level based on “Time to Next Treatment”

- Construction – 5% (30+ years)
- Maintenance – 20% (4-8 years)
- Preservation – 5% (8-15 years)
- Minor Rehab – 30% (12-20 years)
- Major Rehab – 25% (15-30+ years)
- Replacement – 15% (30+ years)

RSI defines the allocation of funds across a variety of investment categories

Step 2 – Selection of Activities that meet “Time to Next treatment ” based on lowest LCC

LCCA determines which treatment – that meets or exceeds the performance requirements – is the lowest cost alternate
EXAMPLE OF TWO ALTERNATE INVESTMENT STRATEGIES
Preservation (8 to 15-Year Fixes) vs Mix of Fixes (8 to 30-Year Fixes)
Same Budget & Expenditures

Current Network RSI

Network RSI in 20 years

RSI (Lane-mile-years)

Network Length = 3849 Lane Miles
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Remaining Service Interval (before repairs are needed)

Mix of Fixes Strategy is providing Greater Service
(but not enough dollars going into either case)
ACTIVITIES THE CEMENT / CONCRETE PAVEMENT INDUSTRY IS DOING TO HELP AGENCIES IMPLEMENT ASSET MANAGEMENT

1. Improve understanding how “allocation practices” and “strategy selection approaches” impact a DOT’s performance targets and cost expenditures

   Improvements to the “Allocation process”
   - Looks across long time frames to account for long duration of pavement assets
   - Looks at multiple pavement solutions and treatment options
   - Account variability / uncertainty in both Performance AND Costs
   - Computationally efficient process

2. Industry needs to step up and “own” Concrete Pavement Performance

   - Asset Management is a “data driven” process.
   - We want to work with DOTs to develop / provide performance data and prediction curves for each cement / concrete based options
     - At a minimum covers MAP-21 Performance Measurement distresses (cracking, faulting, IRI)
     - Must fit into an agency’s AM / PM systems