WSDOT Perspective on MAP-21 and Pavement Management

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§150. National goals and performance management measures

(a) DECLARATION OF POLICY. — Performance management will transform the Federal-aid highway program and provide a means to the most efficient investment of Federal transportation funds by refocusing on national transportation goals, increasing the accountability and transparency of the Federal-aid highway program, and improving project decisionmaking through performance-based planning and programming.
Performance Measures

For Decision Making
- Project & Network Level Pavement Management

For Accountability
- State Legislature
- Governor’s Office
- State Auditor’s Office
- GASB
- MAP-21
Typical Pavement Performance Measures

- Present Serviceability Index (PSI) - 1958
- Roughness (IRI) - 1986
- Distress (cracking, rutting, raveling, faulting, etc.)
- Friction (Skid Number, macrotexture, IFI)
- Structure (deflection, seismic response)
- Remaining Service Life (RSL)

- What about cost??
- Performance at what price??
Cost-Effectiveness

“…the most efficient investment…”

– Annual Cost ($ / lane-mile / year of life)

• Historical Cost of Acceptable Pavement Performance
  – Actual historical cost ($/LMY)

• Expected Cost of Future Pavement Rehab
  – Projected LCCA ($ /LMY)
Comparing LCCA

• Long Term
  – Evaluating Pavement Design Strategies over many performance periods
  – Assumed performance
  – FHWA RealCost

• Operational (Year-to-Year)
  – Historical performance is known
  – Evaluation of single performance period
  – Decisions involve maintenance/preservation and rehabilitation/reconstruction
Decisions and Outcomes

Maint. (what, when, where, how, why)

Rehab. (what, when, where, how, why)

Reconst. (what, when, where, how, why)

Cost (minimize annual life-cycle cost)

Performance (achieve minimum requirement)
The Pavement Management Perspective

18,500 lane-miles

$16 billion pavement replacement cost

Statewide Lane Miles

- Concrete 2,250 (13%)
- Asphalt 10,250 (55%)
- Chip Seal 6,000 (32%)

Statewide VMT

- Concrete 28%
- Asphalt 66%
- Chip Seal 6%
Long-life History by Pavement Type
**Pavement Models: Flexible and Rigid**

**Flexible pavements**
- Asphalt or chip seal
- Managed in cycles
- Emphasis is to limit scope of work to only resurfacing

**Rigid pavements**
- Concrete pavements managed as long-term structures
- Eventually must be reconstructed.
LLCC: Asphalt and Chip Seal

Do Nothing ??

Maintenance ($$) ??

Preventive  Strategic  Reactive

Rehab ($$$)??

Optimum time for Rehab

Condition Indexes

Index value 45 ~ 50

Excessive Vehicle Operating Costs

Excessive Agency Construction Costs

Reconstruction ?? ($$$$$$)

Years

Maintenance ($$) ??

Do Nothing ??

Preventive  Strategic  Reactive

Rehab ($$$)??

Excessive Vehicle Operating Costs

Excessive Agency Construction Costs

Reconstruction ?? ($$$$$$)

Condition Indexes

Index value 45 ~ 50

Do Nothing ??

Preventive  Strategic  Reactive

Rehab ($$$)??

Excessive Vehicle Operating Costs

Excessive Agency Construction Costs

Reconstruction ?? ($$$$$$)

Years
**Risk of Catastrophic Failure:**

- **Very Low:** Grind
- **Low:** Grind and/or DBR and Selective Reconst.
- **Med.:** Wait for Total Reconst. (Replace high risk panels)
- **High:**

**Strategy:**

- Cannot do grind or DBR after this point
- MUST do reconstruction after this point

**Condition Indexes**

**Years**

**Total Reconst. (index < 25)**
Replacement (Strategy) Analysis

• Decision Analysis to consider:
  – Do Nothing (no replacement)
  – Maintenance
  – Rehabilitation
  – Reconstruction

• If proposed alternative results in lower annual cost, then make decision for (strategy) replacement
Calculation of Equivalent Uniform Annual Cost (EUAC) for an asphalt pavement resurfacing ($250k for 12 year period).

Spending additional $5k on maintenance in year 10 and $15k in year 15 results in EUAC that is $3.1k less (12% reduction in annual cost). (Assumed Discount Rate 4%)
## Flexible Cost Effectiveness Evaluation

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Typical Cost ($/LM)</th>
<th>(Avg.) LMY gained</th>
<th>Annual Cost $/LMY * (no user $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack Seal</td>
<td>$5,000</td>
<td>3</td>
<td>$1,800</td>
</tr>
<tr>
<td>Chip Seal</td>
<td>$45,000</td>
<td>7</td>
<td>$7,500</td>
</tr>
<tr>
<td>Rehab (ACP)</td>
<td>$250,000</td>
<td>14</td>
<td>$23,000</td>
</tr>
<tr>
<td>Reconst (ACP)</td>
<td>$900,000</td>
<td>20</td>
<td>$66,000</td>
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</tbody>
</table>

* * includes 4% Discount Rate
# Rigid Cost Effectiveness Evaluation

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Typical Const. Cost ($/LM)</th>
<th>(Avg.) LMY gained</th>
<th>Annual Cost $/LMY * (no user $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinding</td>
<td>$150,000</td>
<td>15</td>
<td>$13,500</td>
</tr>
<tr>
<td>Rehab.</td>
<td>$250,000</td>
<td>15</td>
<td>$22,500</td>
</tr>
<tr>
<td>Reconst. (CSOL)</td>
<td>$900,000</td>
<td>50</td>
<td>$49,000</td>
</tr>
<tr>
<td>Reconst. (unbonded)</td>
<td>$1,600,000</td>
<td>50</td>
<td>$74,000</td>
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<tr>
<td>Reconst. (PCC)</td>
<td>$2,500,000</td>
<td>50</td>
<td>$116,000</td>
</tr>
</tbody>
</table>

* includes 4% Discount Rate
WSDOT 10-Year Concrete Plan

- Maximize opportunities for rehabilitation
- Project staging on congested corridors
- 515 lane-miles of reconstruction
- 366 lane-miles of rehabilitation
- $103 million per year
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