The Future of Pavement Management...

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National Center for Pavement Preservation
Is Preservation!
So what does that mean?

- Network condition
- Preservation
- Economics
- Sustainability
- Public Expectations
Let's look at Public Expectations - from IPAC

- Best administration possible
- Highest degree of integrity
- Fair and transparent governance
- High quality services

Stewardship of government funds that maximize cost effectiveness and provide accountability.
A few key facts about Public Expectations

- The public has NO IDEA of how much activities cost.
Public Expectations

- Want the roads they drive to be smooth and safe.
- No potholes.
- Shortest possible traffic disruptions for road work.
Complaints

- Citizens want to feel they are getting their tax money’s worth.
- Along with not knowing how much things cost, they don’t usually know how our road infrastructure is funded.
- When conditions reach a certain level, complaints begin to be received.
Goal 1:

- Meet citizen expectations at a network level.
- Not be driven by complaints alone.
- Help citizens understand our decisions. That means we need to understand them ourselves!
Recalling the preservation wheel...
So let’s look at Network Conditions

- Pavement Management System
  - Inventory
  - Condition Data
  - Construction History
  - Maintenance History?
  - Analyses
PMS Analyses

- Deterioration models/curves for various pavement categories
- Project conditions based on funding levels
- Gap analysis- what will happen to network conditions if budget is cut...
- Funding distribution within agency
- Program Development-resurfacing and preservation.
Things we consider in project selection...

- **Pavement conditions.** Existing pavement structure.
- Bridges that may need work during the road project.
- Accident history.
- Geometric or Drainage improvements that are needed.
- Average daily traffic. Trucks vs cars. Projected traffic growth.
- Businesses along the route. Businesses that use the route.
- Road category. (Interstate, Trunkline, Arterial, Collector, etc.)
- Urban vs rural.
Treatment Selection must be based on Road Needs

- Decision trees or decision matrices should point to treatment(s) that fit the distresses.

- Example: Micro surfacing is well suited to low to moderate rutting with low severity cracking.
  
  If cracking is more severe, can be patched in advance of micro surfacing, or use a cape seal that consists of a chip seal with a micro surfacing on top.
Goal 2:

- Use our PMS to tell the story about network conditions, our programs (like resurfacing or preservation), and risks we face.
- Make sure our data quality is up to the task!
- Carefully evaluate when we change vendors or equipment.
- Select treatments to fit conditions.
Recalling the preservation wheel...

- Network condition
- Preservation
- Economics
- Sustainability
- Public Expectations
Economics - Not just Costs but also life extension

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost (Canadian $ per sq. meter)</th>
<th>Life Extension (yr)</th>
<th>EAC ($/sm/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack seal</td>
<td>0.72</td>
<td>2.0</td>
<td>0.36</td>
</tr>
<tr>
<td>Chip seal</td>
<td>3.07</td>
<td>6.0</td>
<td>0.51</td>
</tr>
<tr>
<td>Micro surfacing</td>
<td>4.14</td>
<td>6.0</td>
<td>0.69</td>
</tr>
<tr>
<td>Cape seal</td>
<td>7.77</td>
<td>10.0</td>
<td>0.78</td>
</tr>
<tr>
<td>Thin lift overlay</td>
<td>10.42</td>
<td>11</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Source: PPRA website; US national averages
More costs

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</tr>
</thead>
<tbody>
<tr>
<td>Mill and Fill</td>
<td>14.65</td>
<td>11</td>
<td>1.33</td>
</tr>
<tr>
<td>Hot-in-place</td>
<td>17.81</td>
<td>11</td>
<td>1.62</td>
</tr>
<tr>
<td>Full depth remove and replace</td>
<td>58.32</td>
<td>25.0</td>
<td>2.33</td>
</tr>
</tbody>
</table>

Source: PPRA website; US national averages
What is life extension?

- Time from time of application of a treatment until condition returns to the same level it was at prior to application.
- So if the PCR is 74 at the time a chip seal is applied, the life extension is the time until the PCR is again 74. (average is 6 years based on US averages).
 Lets look at a simple network of 24 roads with lengths between 2 and 12 km.

- 8 in good condition: PCR between 85 and 100
- 8 in fair+ condition: PCR between 70 and 85
- 4 in fair- condition: PCR between 59 and 63
- 4 in poor condition: PCR between 47 and 58.

Rate of decline of PCR:
- Good: 2 per year
- Fair+: 2 per year
- Fair-: 5 per year
- Poor: 3 per year
What if we do nothing for 4 years?

![Graph showing Pavement Condition Rating over years with No Treatments]
What if we reconstruct 5 km per year of the poor roads?

Comparing Do Nothing to 5 km Reconstruct

- **Do Nothing**: Pavement Condition Rating decreases linearly over the years.
- **Reconstruct 5 km/yr**: Pavement Condition Rating decreases at a slower rate compared to Do Nothing.

The graph shows the comparison between 'Do Nothing' and 'Reconstruct 5 km/yr' in terms of pavement condition rating over the years.
What if we do preservation on 30 km per year?
What about the costs?

- Reconstruct 5 km per year: $2,624,400 per year
- Preservation (used cost for micro surfacing): $1,117,800 per year

That means we could do the full program of preservation + $1.5 million in reconstruction for the same budget as the reconstruct 5 km per year case.
If you do nothing, you lose 1 year of service life from every km of pavement in your network.
Are we doing enough to maintain status quo of our network?

- To maintain current condition, **must add 136 km yrs** each year.
- Preservation with chip seal adds 6 years of service life. So applying chips seals to 30 km per year, **adds 180 km yrs**.
- Reconstruction of 5 km, with a life of 25 years, **adds 125 km yrs**... not enough to maintain network condition over time.
Want a “Mix of Fixes”...

Total needed to maintain condition:

<table>
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<tr>
<th>Treatment</th>
<th>Length to be treated</th>
<th>Service life extension</th>
<th>Total lane km years added</th>
</tr>
</thead>
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<tr>
<td>Crack seal</td>
<td></td>
<td>2</td>
<td></td>
</tr>
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You can add two columns for unit cost and total cost!
Goal 3:

- Select the treatment for each road based on distresses and conditions.
- Provide enough km-years of treatments each year to maintain or improve network conditions.
- Update the service life extensions to improve accuracy.
Recalling the preservation wheel...
Road building materials require significant energy to produce.

- Production of Portland Cement
- Drilling for and refining oil for asphalt and asphalt emulsions.

Must consider the energy to obtain and process the raw materials, transport, mix and apply the final product.
Preservation Techniques use less materials...

- A chip seal typical stone size is 9.5 mm, and most use less than 12.7 mm.
- The aggregate application goal is a single stone thickness.
- Emulsion application rate is typically selected to fill voids to 0.5 to 0.7 of the aggregate height.
Thin asphalt overlays

- NCAT reported on performance of 4.75mm asphalt mix.
- Placed in Kansas in lifts of 15 to 19 mm. Performance related to aggregate type and anti-stripping agent used. Fatigue performance affected by river sand content and binder grade.
- Florida looked at thicknesses of 0.5 inch to 1.0 inch for two asphalt binder grades: PG 67-22 and PG 76-22 (polymer modified). Recommended thickness of 0.75 inches or more for higher traffic volumes.
There is more to Sustainability than material costs...

- NAPA and ACPA both extol the sustainability benefits of smooth roads...
  - Improved fuel economy, reduced wear on vehicle and tires.
- Warm mix asphalt lowers energy and greenhouse gases for HMA production.
- RAP, RAS reduce new material costs.
Sustainable Pavements Technical Working Group

- Has been meeting since 2011
- FHWA has a Pavement Life Cycle Assessment framework document, which provides a framework for performing LCA for pavement systems.
- Webinar Series “LCCA and LCA”, multiple sessions (Feb 13, March 19, April 16, May 21) + other topics
Goal 4

- A well-understood and consistent approach to evaluating sustainability becomes normal practice in pavement design, construction, maintenance and management.
- The sustainability benefits of preservation should be part of the conversation when we discuss the future of pavement management.
Recalling the preservation wheel...
Lets close with a Success Story...

- Town of Moraga, California has a population of 16,000 and 55.95 centerline miles (about 90 km) of paved streets. 24.7% arterial, 28.2% collector and 47% residential streets.
- 8 years ago, the network PCI was 49!
What they did...

- Education effort to enable passage of one-cent sales tax called Measure K. This measure extends 20 years!
- Once passed, Town leveraged the revenue to issue Certificate of Participation so it could launch a 3-year intensive pavement program. The 3-year program raised the PCI from 49 to 70!
The work continued...

- Focus on one type of treatment per year
- Budget an appropriate % funding for each treatment type
- Budget non-Measure K funds at or greater than pre-Measure K levels
- Partner with other agencies to reduce costs.
Other actions

- Used cost-effective pavement treatments to address more streets than conventional methods.
- Passed a street-cut ordinance and moratorium.
- Used grants to increase funds.
- Next three years saw PCI increase from 70 to 74.
2019 James Sorenson Award for Pavement Preservation

Edric Kwan, Public Works Director, Town of Moraga
In conclusion

- Pavement preservation can be used to address citizen objectives, network conditions, budget limitations and sustainability concerns.
- Like the Town of Moraga, we can succeed.
- Pavement Preservation is the Future of Pavement Management!
Thank you for your attention.

Are there any questions?

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