Using PMS Data to Review Surface Mix Performance

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Overview

• **Scope**
  – Most common asphalt surface mixes
  – Primaries (PS) – 5 years condition state data
  – Interstates (IS) – 6 years condition state data

• **Warrants for review**
  – 10+ years “full-production” SMA use
  – 15+ years Superpave experience
  – Fully automated distress surveys
Population by Mix Class - PS

2008
Super: 15000
SMA: 1000
Other: 2000

2012
Super: 15000
SMA: 1000
Other: 3000
Key Assumptions

• **#1:** District “schedulers” adhere to Section 605 – Asphalt Concrete Mix Selection Guidelines, which includes application of “…experience and judgment …”

• **#2:** C/O PMS is a viable and functioning system

Not a random number generator!!
Pavement Condition State

- **LDR (load related distress index)**
  - Alligator cracking, patching, potholes, delaminations, rutting

- **NDR (non-load related distress index)**
  - Block cracking, patching and longitudinal cracking out of the wheelpath, transverse cracking, reflection cracking, bleeding

- **CCI (critical condition index)**
  - Lowest of the LDR and NDR
  - 100 is new/60 triggers replacement
Database Preparation (combined 5 & 6 years)

- “First cut” – only *homogeneous* sections greater than 0.5-mile in length
- Filter for “reasonableness” – CCI versus Age

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>100</td>
</tr>
<tr>
<td>5 – 10</td>
<td>95</td>
</tr>
<tr>
<td>10 – 15</td>
<td>90</td>
</tr>
<tr>
<td>15 – 20</td>
<td>85</td>
</tr>
<tr>
<td>20+</td>
<td>80</td>
</tr>
</tbody>
</table>
Filter Results (What was culled?)

• Interstate System
  – Dense Graded (SM) – 6% mileage loss
  – Gap Graded (SMA) – 9% mileage loss

• Primary System
  – Dense Graded (SM) – 3% mileage loss
  – Gap Graded (SMA) – 1% mileage loss

• Assumption #3:
  – Errors/omissions not biased to one surface material/mix
Primary System – Surface Mix Distribution

![Bar Chart]

- **No. of Sections**
- **Age Grouping**
  - LT 3
  - GT 3 & LT 5
  - GT 5 & LT 7
  - GT 7 & LT 10

- **Legend**
  - SM-9.5
  - SM-12.5
  - SMA

**Key**
- LT = Less Than
- GT = Greater Than

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Assumption #4a: Primary system pavement structures will vary.
Primary System – SM12.5
Primary System – SMA

![Box plot](image)

- Quartile 3
- Quartile 2

Age Grouping (years):
- LT 3
- GT 3 & LT 5
- GT 5 & LT 7
- GT 7 & LT 10

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Interstate System – Surface Mix Distribution

No. of Sections

Age Grouping

LT 3  GT 3 & LT 5  GT 5 & LT 7  GT 7 & LT 10  GT 10 & LT 15

SM-9.5  SM-12.5  SMA
Assumption #4b: Interstate pavements are structurally sufficient…generally.
Interstate System – D vs. E

![Graph showing the comparison between SM-D's and SM-E's over different age groupings (LT 3, GT 3 & LT 5, GT 5 & LT 7, GT 7 & LT 10, GT 10 & LT 15). The graph plots the change in CCI (a measure of performance or safety) over time, with a clear downward trend for both groups, indicating a decrease in performance or increase in safety with age.](image-url)
System/Type Summaries

• Primary System
  – Dense (SM) vs. gap (SMA) grading

• Interstate System
  – Dense (SM) vs. gap (SMA) grading
  – Gap-grading – pavement type trends
    • BIT – full-depth flexible
    • BOJ – composite over jointed concrete
    • BOC – composite over continuous concrete
Primary System – Mean Condition

![Graph showing mean condition over age groupings]

- SM 9.5
- SM 12.5
- SMA

Age Grouping (years):
- LT 3
- GT 3 & LT 5
- GT 5 & LT 7
- GT 7 & LT 10
- GT 10 & LT 15

CCI
Interstate System – Mean Condition

The image shows a line graph with the x-axis labeled "Age Grouping (years)" and the y-axis labeled "CCI." The graph includes data points for different age groupings, represented by various symbols and line styles, indicating the mean condition of the interstate system over time. The data points are plotted for different age groupings: LT 3, GT 3 & LT 5, GT 5 & LT 7, GT 7 & LT 10, and GT 10 & LT 15. The graph is marked with symbols and lines denoting different conditions, such as SM 9.5 and SMA.
Interstate System – SMA(BOC)
I-295 Hanover/Henrico County:
• “SMA Surface” – circa 1996
• Approx. 4 lanes E/W for 6 miles
• CCI (2013) - _85 to 96_ (18 years old!)
US-15N Loudon County:
• SM-9.5D – 2004 & 2010
• CCI (2008) = 37
• CCI (2012) = 67
• Life expectancy → 3 to 4 years
Generic System – Money Pits?

![Chart showing age grouping and financial data with a dollar sign symbol highlighting the cost.]

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Conclusions

- **SMA most rapidly propagating technology on Virginia Interstates**
- **SMA mixes continue to exhibit consistent performance advantage over dense-graded (SM) mixes.**
- **(Overlaid) jointed concrete (BOJ) continues to be the most challenging environment for asphalt surface mixes.**
Recommendations

• …SMA mixes (should be) the “default” technology for overlays and surface replacements on Interstate highways.

• …SMA (should be considered) a reliable high-performing alternative for primary system pavements, especially for highest-priority facilities.

• …ensure that PMS data is complete and current

• …develop strategy for addressing pavements where surface mixes historically underperform
  – Overlays of BOJ pavements
  – Average service lives of surface mix ≤ 5 to 7 years
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