PMS: PUTTING THE DATA TO WORK

Judith Corley-Lay
May 16, 2016
Outline of Presentation

• Use of Open graded friction course in NC
• Data available in PMS
• Individual performance curves
• Overall performance of OGFC and FC-2
• How we will use the results
• Broader application
Use of friction course in NC
Uses

• Reduction of splash and spray on roadways with high truck traffic and significant passenger car traffic.

• Reduction of wet weather accidents, especially where land is naturally flat (eastern coastal plain).

• Two gradations have been used: OGFC and FC-2.
Data in PMS
PMS data

- Inventory data
- Construction history indicates when OGFC or FC-2 is the wearing surface, date of construction.
- Pavement Condition over 25 years. Only 15 years maximum for OGFC, 13 years maximum for FC-2.
Individual performance curves
Each project length evaluated.

- Plotted pavement condition rating versus survey year.
Not all data is “easy”

OGFC Perform. I-40 WB Pender
Overall performance
OGFC- All sections combined

OGFC Performance - All

Years since Placement

Pavement Condition Rating
OGFC Performance

Average OGFC PCR

This graph takes all the PCRs with the same time since construction and averages them together.
FC-2 Performance

FC-2 Average PCR

Years since placement

Pavement Condition Rating

0 2 4 6 8 10 12 14

60 70 80 90 100 110

Pavement Condition Rating
FC-2 Performance

![FC-2 Average Performance Graph]

- **Pavement condition rating**
  - Ranges from 60 to 110

- **Time since placement**
  - Ranges from 0 to 14
Using the results
Uses

• Life cycle cost analysis for pavement design
• Life cycle cost analysis for system (would need similar work for multiple treatments)
• Informing choices made by field divisions.
Transportation Asset Management

• Must be data based. Must use PMS or other data source to identify life of treatments.

• NCDOT has used our data to look at performance, or time to treatment for flexible pavements based on climate region, use of UTBWC on jointed pavements and other treatments. This will be included in our TAMP calculations.
MY CONTACT INFORMATION:
JLAY@NCDOT.GOV

Thank you for your attention.
QUESTIONS?
USING PMS DATA FOR PERFORMANCE MANAGEMENT IN AN MPO

Sui Tan, PE
Metropolitan Transportation Commission

SAN FRANCISCO METROPOLITAN REGION

POPULATION = 7.4 MILLION

9 COUNTIES
100 CITIES

43,000 LANE-MILES OF LOCAL STREETS & ROADS
6,850 LANE-MILES OF STATE HIGHWAY (CALTRANS)
23 TRANSIT AGENCIES
7 TOLL BRIDGES

One MPO - Metropolitan Transportation Commission
LOCAL STREETS & ROADS NEEDS ASSESSMENT:

- Answer how much we need to invest as a region for:
  - Pavement
  - Non-Pavement
  - Local Bridges
- Facilitate Regional Transportation Plan (RTP) discussion and funding policies
- Are easy due to exclusive use of a common PMS by Bay Area jurisdictions
## 28-Year Needs Assessment

($ in millions)

<table>
<thead>
<tr>
<th>County</th>
<th>Avail. Revenues</th>
<th>Pavement Needs</th>
<th>Non-Pavement Needs</th>
<th>Total Capital Needs</th>
<th>Total Remaining Capital Needs</th>
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<tbody>
<tr>
<td>Alameda</td>
<td>$2,148</td>
<td>$3,715</td>
<td>$4,082</td>
<td>$7,798</td>
<td>$5,650</td>
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<td>Contra Costa</td>
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<td>$865</td>
<td>$641</td>
<td>$1,506</td>
<td>$852</td>
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<td>Napa</td>
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<td>$1,087</td>
<td>$429</td>
<td>$1,516</td>
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<td>San Francisco</td>
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<td>$2,416</td>
<td>$2,363</td>
<td>$4,778</td>
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<tr>
<td>San Mateo</td>
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<td>$1,929</td>
<td>$1,984</td>
<td>$3,913</td>
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<td>Santa Clara</td>
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<td>$3,699</td>
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<tr>
<td>REGION</td>
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<td>$24,500</td>
<td>$20,000</td>
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<td>$30,000</td>
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Performance-based planning approach

“...long-standing “fix it first” maintenance policy...”
Long Range Regional Transportation Plan 2035

For Local Streets & Roads:

Performance Target: PCI = 75
BAY AREA LOCAL STREET AND ROAD CONDITIONS

San Francisco Bay Area Pavement Conditions

PCI
OUTCOME-DRIVEN PERFORMANCE MEASURE

- Easy to compute formula
- No advantage or disadvantage due to age of network, current PCI or annual budget size
- Data extracted from StreetSaver databases
- Promotes pavement preservation principles
- Replaces “Maintenance of Effort”

Shifts from “worst first” to preventive maintenance
## KPI: Pavement Preservation Index

What is the effort toward pavement preservation?

<table>
<thead>
<tr>
<th>County</th>
<th>Jurisdiction</th>
<th>Network PCI</th>
<th>$PM/ Actual Lane Mile</th>
<th>% PM Actual</th>
<th>% PM Needs</th>
<th>Pavement Preservation Index</th>
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<tr>
<td></td>
<td>Regional Benchmarks</td>
<td>66</td>
<td>$1,336</td>
<td>17%</td>
<td>16%</td>
<td>1.06</td>
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<tr>
<td>Alameda</td>
<td>ALAMEDA</td>
<td>66</td>
<td>$1,271</td>
<td>13%</td>
<td>15%</td>
<td>0.88</td>
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<tr>
<td></td>
<td>ALAMEDA CO.</td>
<td>71</td>
<td>$671</td>
<td>18%</td>
<td>28%</td>
<td>0.67</td>
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<tr>
<td></td>
<td>ALBANY</td>
<td>58</td>
<td>$1,247</td>
<td>10%</td>
<td>13%</td>
<td>0.78</td>
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<tr>
<td></td>
<td>BERKELEY</td>
<td>58</td>
<td>$263</td>
<td>2%</td>
<td>11%</td>
<td>0.20</td>
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<tr>
<td></td>
<td>DUBLIN</td>
<td>87</td>
<td>$3,124</td>
<td>50%</td>
<td>79%</td>
<td>0.62</td>
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<tr>
<td></td>
<td>EMERYVILLE</td>
<td>75</td>
<td>$48</td>
<td>100%</td>
<td>35%</td>
<td>2.87</td>
</tr>
<tr>
<td></td>
<td>FREMONT</td>
<td>63</td>
<td>$5,140</td>
<td>43%</td>
<td>16%</td>
<td>2.76</td>
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DATA QUALITY MANAGEMENT PLAN

- Consultant prequalification
- Quality control plan - before, during, and, after production
- Quality acceptance
- Rater Certification Program
QUALITY ACCEPTANCE

3rd Neutral Party – California Pavement Preservation Center:

- Verifies quality control plans (QCP) adopted by contractors
- Audits QCP results to ensure contractors are meeting the requirements
- Conducts on-project site audits
  - Survey sample sections previously rated by contractor
PRE-QUALIFICATION TEST SITES

#10 – Merritt Ave
#1 – Haddon Rd
#2 – Haddon Rd
#3 – McKinley Ave
#5 – Montclair Ave
#17 – Athol Ave
GARBAGE IN — GARBAGE OUT
JUST REMEMBER...

If it wasn’t documented, it didn’t happen!
CALIFORNIA STATEWIDE LOCAL STREETS & ROADS NEEDS ASSESSMENT

Pavement Condition Index (PCI)
- 71 - 100 (Good)
- 50 - 70 (At Risk)
- 0 - 49 (Poor)

54 counties have average PCI that is “at risk” or “poor”
WHAT ARE FUNDING SHORTFALLS?

<table>
<thead>
<tr>
<th>Transportation Asset</th>
<th>10 Year Needs (2014 $B)</th>
<th>Funding</th>
<th>Shortfall</th>
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<tbody>
<tr>
<td>Pavements</td>
<td>$72.7</td>
<td>$16.6</td>
<td>$(56.1)</td>
</tr>
<tr>
<td>Essential Components</td>
<td>$31.0</td>
<td>$10.1</td>
<td>$(20.9)</td>
</tr>
<tr>
<td>Bridges</td>
<td>$4.3</td>
<td>$3.0</td>
<td>$(1.3)</td>
</tr>
<tr>
<td>Totals</td>
<td>$108.0</td>
<td>$29.7</td>
<td>$(78.3)</td>
</tr>
</tbody>
</table>
Measure T—Fix Our Local Roads

How did we get here?
Federal and State revenues over the last 10 years have been declining in both real and nominal terms. The 18.4¢ per gallon tax deposited in the National Highway Trust Fund for surface transportation projects has not been increased since 1993. Reductions in federal funds has been compounded by the diversion of millions in State Highway and local streets and roads funds for highway needs or to backfill shortfalls in the State’s general fund.

What’s the Problem?
The Cities, Town, and County of Napa have almost $300 million in deferred road maintenance. Without a near term infusion of new revenues, this figure is projected to grow to almost $2 billion over the next 25 years. Measure T will not solve all of the county’s problems but will help get a handle on exponential growth of Streets & Roads Deferred Maintenance needs.

NAPA’S ROADS ARE THE WORST IN THE REGION - ON A SCORE FROM 25 (LOW) TO 89 (HIGH) - 90% OF NAPA’S ROADS ARE CONSIDERED VERY POOR OR AT RISK ON THE REGION’S PAVEMENT CONDITION INDEX (PCI).

Napa County & Jurisdictions Pavement Condition & Deferred Maintenance

Source: MTC—Pavement Management System
DELAY RESULTS IN EXPONENTIAL GROWTH OF DEFERRED MAINTENANCE

Napa County & Jurisdictions Pavement Condition & Deferred Maintenance

- County-Wide Deferred Maint w/Measure
- County-Wide Baseline Deferred Maint
- County-Wide PCI w/Measure

Year
- Pavement Condition Index

Pavement Condition Index

Years 2012 to 2041

($ in Millions)

$0
$200
$400
$600
$800
$1,000
$1,200
$1,400
$1,600
$1,800

$0
$200
$400
$600
$800
$1,000
$1,200
$1,400
$1,600
$1,800

20
NAPA COUNTYWIDE ROAD MAINTENANCE ACT

~$300 million over 25 years

- Dedicated funding:
  - ✓ 99% Local Streets Maintenance
  - ✓ 1% Administration
- 75% YES votes
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StreetSaver Program Manager
MTC
stan@mtc.ca.gov
510-400-8428
Performance Measures for Pavement Management

David Luhr
Pavement Management Engineer

Washington State DOT
§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.
1958: The concept of pavement performance was developed

How does the public perceive the quality of a road?

Figure 1-F. Individual present serviceability rating form.

Highway Research Board 1962
Figure 5.1 Cyclic improvements of pavement design and management system.

Haas, et al, 1994
Performance Measures within what Context?

- Historical?
- Future Projection?
- Project Level?
- Network Level?
- Agency Perspective?
- User Perspective?
Performance Measures as Tools in Pavement Management

• Decision Support
  - What, When, and How for pavement decisions

• Accountability & Communication
  - achieving standards, reports to legislature & public
  - stewardship, protecting infrastructure investment

• Forecasting Needs & Risks
  - funding needs, evaluation of risk

• Learning
  - continual improvement of methods & procedures
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)
### Cost Effectiveness Examples

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Typical Cost ($/LM)</th>
<th>(Avg.) LMY gained</th>
<th>Annual Cost $/LMY * (no user $)</th>
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<tbody>
<tr>
<td>Reconst (ACP)</td>
<td>$900,000</td>
<td>20</td>
<td>$66,000</td>
</tr>
<tr>
<td>Rehab (ACP)</td>
<td>$250,000</td>
<td>14</td>
<td>$23,000</td>
</tr>
<tr>
<td>Chip Seal</td>
<td>$45,000</td>
<td>7</td>
<td>$7,500</td>
</tr>
<tr>
<td>Crack Seal</td>
<td>$5,000</td>
<td>3</td>
<td>$1,800</td>
</tr>
<tr>
<td>Reconst. (PCCP)</td>
<td>$2,500,000</td>
<td>50</td>
<td>$116,000</td>
</tr>
<tr>
<td>Grinding (PCCP)</td>
<td>$150,000</td>
<td>15</td>
<td>$13,500</td>
</tr>
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</table>

* includes 4% Discount Rate
Performance Measures as tools in Pavement Management

- **Decision Support**
  - What, When, and How for pavement decisions

- **Accountability & Communication**
  - achieving standards, reports to legislature & public
  - stewardship, protecting infrastructure investment

- **Forecasting Needs & Risks**
  - funding needs, evaluation of risk

- **Learning**
  - continual improvement of methods & procedures
How well is infrastructure being managed (past and future)?

- Remaining Service Life (RSL)
- Asset Sustainability Ratio
- Accrued cost of deferred maintenance/rehabilitation (Deferred Preservation Liability)
30-year Pavement Preservation (P1) Annual Funding (Constant 2012 Dollars)

- Average funding over 8 years was $234 million per year.
- Estimated future funding over 8 years is $101 million per year.
- 09-11 "Stimulus" (ARRA) $72.6 million/yr.

* As of Feb. 2014
Remaining Service Life (RSL)

• Measures the pavement life (years until due for rehabilitation) of each section over the entire network (expressed as % of typical pavement life)

• Healthy system has remaining service life of 40 – 60 percent
  – In an ideal system, the entire system would have an average remaining service life equal to 50% of the total average pavement life
If Planned Funding continues, Remaining Service Life plunges.

Statewide Average Remaining Service Life
Asphalt Pavement
In Washington, Asphalt typically needs resurfacing in 12-16 years.

- Historical Funding
- Planned Funding

Remaining Service Life has declined 18% since 2003.
If Planned Funding continues, Remaining Service Life plunges.
Statewide Remaining Service Life (Truck Miles)

- Existing LMT
- Max LMT
- % LMT Remaining

Lane Mile Trucks

- BST: 48%
- ACP: 47%
- PCCP: 26%
Asset Sustainability Ratio

• Measures how well WSDOT’s pavement replenishment is keeping up with pavement wear.

• Illustrates how much life was put back into the pavement system verses how much was consumed in a given year (units of lane-mile years).

• Consumption (for WSDOT flexible pavements) is 16,000 lane-mile years (per year)

• Target is Ratio of 1.0
Asset Sustainability Ratio (Flexible Pavements)
1980 through 2022

- BST LMY Replenishment
- ACP LMY Replenishment
- Asset Sustainability Ratio

Projected
Deferred Preservation Liability

- Is an estimate of the funding necessary to address the backlog of deferred pavement rehabilitation

- Takes into consideration higher costs as pavement condition gets worse (and needs more extensive repair)
Deferred Preservation Liability
(millions of dollars)

<table>
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<th>Year</th>
<th>Amount</th>
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<tr>
<td>2010</td>
<td>$154</td>
</tr>
<tr>
<td>2011</td>
<td>$176</td>
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<td>2012</td>
<td>$220</td>
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<tr>
<td>2013</td>
<td>$352</td>
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<td>2014</td>
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<td>2016</td>
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<td>2017</td>
<td>$826</td>
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<td>2019</td>
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<td>2020</td>
<td>$2,355</td>
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<tr>
<td>2021</td>
<td>$3,048</td>
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<tr>
<td>2022</td>
<td>$3,969</td>
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Performance Measures as Tools in Pavement Management

• Decision Support
  - What, When, and How for pavement decisions

• Accountability & Communication
  - achieving standards, reports to legislature & public
  - stewardship, protecting infrastructure investment

• Forecasting Needs & Risks
  - funding needs, evaluation of risk

• Learning
  - continual improvement of methods & procedures
### Decision Support
- Pavement Condition
- Cost-Effectiveness
- Remaining Service Life

### Forecast Needs & Risks
- Pavement Condition
- Remaining Service Life
- Deferred Preservation Liability

### Accountability & Communication
- Pavement Condition
- Asset Sustainability Ratio
- Cost-Effectiveness

### Learning
- Cost-Effectiveness
- Remaining Service Life
- Pavement Condition

<table>
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<tr>
<th></th>
<th>Future</th>
<th>Historic</th>
<th>Project Level</th>
<th>Network Level</th>
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<td>Needs &amp; Risks</td>
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<td>Accountability &amp; Communication</td>
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<td>✔</td>
<td>✔</td>
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<td>Learning</td>
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