Bridge Preservation Performance Measures

George Hearn
University of Colorado Boulder
Bridge Preservation

Actions or strategies:
• Prevent, delay or reduce deterioration of bridges or elements
• Restore the function of existing bridges
• Keep bridges in good condition
• Extend bridge life

Preservation actions may be preventive or condition-driven.

## Performance Measures

<table>
<thead>
<tr>
<th>DOTs Represented, count</th>
<th>MTKN</th>
<th>NCHRP 20-24(37)E</th>
<th>AASHTO Roundtable</th>
<th>BPETG Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>36</td>
<td>39</td>
<td>33</td>
<td>17</td>
</tr>
</tbody>
</table>

**Performance Measure**

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Performance Measure Use, % of DOTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Condition</td>
<td>56  56  55  64</td>
</tr>
<tr>
<td>Bridge Program</td>
<td>33  10  18  7</td>
</tr>
<tr>
<td>Functional Obsolescence</td>
<td>14  26  15  29</td>
</tr>
<tr>
<td>Weight Restriction</td>
<td>3   10  18  7</td>
</tr>
<tr>
<td>Maint. &amp; Operations</td>
<td>22  3   12  7</td>
</tr>
<tr>
<td>Structural Deficiency</td>
<td>39  56  52  50</td>
</tr>
<tr>
<td>Sufficiency Rating</td>
<td>-   10  9   7</td>
</tr>
</tbody>
</table>
National Performance Management Measures

\[
Pct \ Good = 100 \times \frac{\sum_{g=1}^{GOOD} [Length \times Width]_{Bridge \ g}}{\sum_{s=1}^{TOTAL} [Length \times Width]_{Bridge \ s}}
\]

\[
Pct \ Poor = 100 \times \frac{\sum_{p=1}^{POOR} [Length \times Width]_{Bridge \ p}}{\sum_{s=1}^{TOTAL} [Length \times Width]_{Bridge \ s}}
\]
## Performance, What to Measure

<table>
<thead>
<tr>
<th>Inventory: Good / Fair</th>
<th>Keep bridges in good condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deterioration: Transitions of condition</td>
<td>Extend bridge life, Reduce deterioration</td>
</tr>
<tr>
<td>Risk: Element to element</td>
<td>Prevent, delay deterioration</td>
</tr>
</tbody>
</table>
Performance Measures – Inventory

**Preservation Candidates**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridges, count</td>
<td>3200</td>
</tr>
<tr>
<td>Deck area, SY</td>
<td>3,140,000</td>
</tr>
<tr>
<td>% of State-owned structures</td>
<td>93%</td>
</tr>
</tbody>
</table>

**Preservation Impact**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average GCR</td>
<td>+ 0.6</td>
</tr>
<tr>
<td>Bridges ≥ GCR 6</td>
<td>+ 23%</td>
</tr>
<tr>
<td>Bridges ≥ GCR 5</td>
<td>+ 17%</td>
</tr>
</tbody>
</table>

**Preservation Need**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridges, count</td>
<td>50</td>
</tr>
<tr>
<td>Deck area, SY</td>
<td>49,100</td>
</tr>
<tr>
<td>RC deck, Epoxy bars, SY</td>
<td>10,200</td>
</tr>
<tr>
<td>Compression joints, Ft</td>
<td>6,040</td>
</tr>
</tbody>
</table>

General Condition – Progression

Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming
General Condition – Progression

![Bar Chart]

- **GCR**
  - 9
  - 8
  - 7
  - 6
  - 5
  - 4

- **10^6 SF**

- **w/ Preservation**

- **no Preservation**

![Line Graph]

- **GCR**
  - 9
  - 7
  - 5
  - 3

- **Years**
  - 0
  - 50
  - 100
Service Progression

[Diagram showing the progression of service, with options for Remove, Replace, and Preserve, and a graph indicating population decline without preservation.]
Flow of Inventory

10^6 SF

GCR

9  8  7  6  5  4

9.9 9.9 9.9 9.9 9.9 9.9

52 124 137 117 109 105

no Preservation
Flow of Inventory

Population

$10^6$ SF

GCR

5.9  0.3  4.7  18  16  9.6  5.9
Flow of Inventory

- **Preserve**
  - 11.6 → 1.4
  - 6.5

- **Replace**
  - 0.3 → 4.4 → 1.2
  - 16.1

- 10^6 SF

GCR:
- 9 → 8 → 7 → 6 → 5 → 4
α, Fraction preserved
Risk Among Bridge Elements

Four Outcomes

NBE Condition

BME Condition

Outcomes

Performance
Risk: MidWest States

- **Wearing surface**
  - MidWest NBE Deck :: Wearing Surface
  - Good Preservation: 93%
  - Poor: 4%
  - At Risk: 3%

- **Steel Coating**
  - MidWest NBE Steel :: BME Coatings
  - Good Preservation: 83%
  - Poor: 7%
  - At Risk: 10%
Risk: MidWest States

MidWest Superstructure :: Joint
Good Preservation: 74%
At Risk: 23%
Poor: 3%

MidWest NBE :: BME
Good Preservation: 56%
At Risk: 15%
Poor: 29%
Performance Measures

• Inventory, Condition: Good/Fair

• Transitions, Condition: Preservation fraction \( \alpha \)

• Relative condition: Risk
Bridge Preservation
Performance Measures

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