Adapting Pavement Preservation Strategies to Significant Changes in Economic Conditions

Don Reid, Paving Manager
Metro Nashville, Public Works

David Hein, P. Eng., Principal Engineer
Vice-President, Transportation
2010 Metro Nashville Road Network

- High density urban, suburban and rural roadways
- 2,400 CL miles (3,850 kms)
- 397 million ft\(^2\) (37 million m\(^2\)) of pavement
What Happened?

• 1,000 year flood of the Cumberland River
• Over 13 inches of rain in one storm
What Happened?
What Happened?
The Aftermath
The Aftermath
Stages of Response

- Emergency Response
- Restore Service
- Long-Term Response
Evaluating the Impact of the Flood

• Evaluate the system to determine the type of pavement damage caused by the flood
• Comparison of overall condition index (OCI) from 2010 and 2011 pavement management surveys
Evaluating Condition

• Each road segment has 3 measurements:

  - PCI
  - IRI
  - Weathering

ASTM D6433, detailed distress data is stored

ASTM E1926, based on Mean Texture Depth, but only for pavements > 5 years old
Evaluating Condition

• Digital survey vehicle
• Evaluate ½ of network each year
• Collect imagery, location and laser based data
Evaluating Condition

• Overall condition index (OCI) based on weighted average

<table>
<thead>
<tr>
<th>OCI Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI</td>
<td>75</td>
</tr>
<tr>
<td>IRI</td>
<td>10</td>
</tr>
<tr>
<td>Ravelling</td>
<td>15</td>
</tr>
</tbody>
</table>
Network Health

• A road segment is deficient if OCI < 70
• Metro’s goal is no more than 30% of the network is deficient
• “70 above 70”
Comparison of Aggregate OCI Results

<table>
<thead>
<tr>
<th>OCI Range</th>
<th>% Within Range (2010)</th>
<th>% Within Range (2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;49</td>
<td>6.5</td>
<td>12.5</td>
</tr>
<tr>
<td>50-59</td>
<td>8.4</td>
<td>13.3</td>
</tr>
<tr>
<td>60-69</td>
<td>15.3</td>
<td>21.5</td>
</tr>
<tr>
<td>70-79</td>
<td>21.8</td>
<td>21.2</td>
</tr>
<tr>
<td>80-84</td>
<td>12.5</td>
<td>9.5</td>
</tr>
<tr>
<td>90-100</td>
<td>35.5</td>
<td>22.1</td>
</tr>
</tbody>
</table>

69.8  52.8
Primary Reason for Reduced OCI

- Significant increase in number of moderate and low severity potholes
- Almost 100 percent increase in only 1 year

<table>
<thead>
<tr>
<th>Year</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>2008</td>
<td>715</td>
<td>769</td>
<td>872</td>
<td>2,271</td>
</tr>
<tr>
<td>2011</td>
<td>823</td>
<td>1790</td>
<td>1,907</td>
<td>4,520</td>
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</tbody>
</table>
Damage Locations
Pavement Condition Comparison

Condition in 2008

Condition in 2011
Pavement Condition Comparison

Condition in 2008

Condition in 2011
Pavement Condition Comparison

Condition in 2008

Condition in 2011
Impact of Distress Deducts on OCI

- Impact of potholes much large than that for patching
So what do we do now?

• Metro has an agreement with bondholders under GASB-34 to maintain a minimum overall network OCI of 70
So what do we do now?

- Examined segments with OCI > 70 in 2008 and < 70 in 2011
- Increase in deduct value due to potholes
- Significant decrease in OCI
What happens if we treat potholes by patching?

<table>
<thead>
<tr>
<th>Section</th>
<th>2008</th>
<th>2011</th>
<th>After Patching</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>95</td>
<td>47</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>50</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
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<td>49</td>
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<td>86</td>
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<td>5</td>
<td>81</td>
<td>49</td>
<td>73</td>
</tr>
<tr>
<td>6</td>
<td>90</td>
<td>50</td>
<td>75</td>
</tr>
</tbody>
</table>
Predicted Network Impact

Improvement of almost 5% for network condition
Field Assessment of Pothole Conditions

• Observations indicated that majority of potholes were a result of surface delamination due to flood conditions
• Failure of bond between asphalt layers
Treatment Approach

• Full-depth reconstruction for base failures
• Successful use of infrared patching technology
• Soften asphalt adjacent to pothole
• Steel rake to scarify the pavement
• Add new asphalt and compact
Infra Red Patching – Heating
Infra Red Patching – Scarifying and New Mix
Infra Red Patching – Finishing
Infrared Patching Program

- Increased to almost $1M/yr @ ($5/ft²)
- 1,660 patches in 2013
- Purchased equipment to do patching in house starting in 2016
Network Performance

• Tracking to date indicates excellent performance
Conclusions

• Flooding caused significant damage to the pavement
• Major impact on the number of potholes
• Needed an appropriate response to improve overall network condition and show that it was effective
Conclusions

• Pavement management is a key element in disaster response – especially the long-term damage mitigation

• Without a PMS system, you cannot provide an overall analysis of past, current or future conditions
Conclusions

• Flooding caused significant damage to the pavement

• Properly implemented system will provide:
  ▪ Data to support evaluating the specific problem(s)
  ▪ A mechanism to immediately address problems with existing methods
  ▪ A way to integrate new methods that effectively mitigate new issues and/or use new technology