Recovering from the 2010 Nashville Flood

Pavement Management as a Tool in Long Term Disaster Recovery

Donald Reid, Metro Nashville Public Works
Jacob Walter, Applied Research Associates
What Happened?

- 1,000 Year Flood of the Cumberland River
- Over 13 inches of rain in one storm

From Bing Maps
What Happened?
What Happened?
What Happened?
What Happened?
What Happened?
The Aftermath
The Aftermath
The Aftermath
Road Closures

115 Metro Roads were closed to traffic on May 3
Metro’s Water Resources

Numbers Indicate Paving Groups

Before Flooding
Metro’s Water Resources

Flooded Areas
Damage Locations
Stages of Response

Emergency Response

Restore Service

Long-Term Response
Evaluating Condition

- Each segment has three measurements:

  - PCI
    - ASTM D6433, detailed distress data is stored
  - IRI
    - ASTM E1926
  - Weathering
    - Based on Mean Texture Depth, but only for pavements > 5 years old
Evaluating Condition

- Used a digital survey vehicle from ARA
- Evaluate ½ of network every year
- Collect imagery, location, and laser-based data
Evaluating Condition

• An Overall Condition Index (OCI) is calculated for each segment based on a weighted average:

<table>
<thead>
<tr>
<th>Measurement</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>Weathering</td>
<td>15</td>
</tr>
</tbody>
</table>
Network Health

• A segment is deficient if its OCI < 70
• Metro’s goal is no more than 30% of the network deficient
• “70 above 70”
CURRENT CONDITION OF NETWORK
2011 PAVING
(BY % AREA)

- Below Standard (0-69): 9.45%
- Fair (70-79): 21.16%
- Good (80-84): 47.27%
- Excellent (85-100): 22.12%
Network Health Before & After

![Graph showing network health before and after with a significant drop immediately after a flood event.](image)

- **Percent Above 70**
- **Year of Evaluation**
- **Actual**
- **Baseline**

Immediately After Flood
Evaluating the Problem

• We looked at data directly from the pavement management database
• Here is what we found about the number of potholes in Metro:

<table>
<thead>
<tr>
<th>Year</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>715</td>
<td>769</td>
<td>872</td>
<td>2271</td>
</tr>
<tr>
<td>2011</td>
<td>823</td>
<td>1790</td>
<td>1907</td>
<td>4520</td>
</tr>
</tbody>
</table>

Data from Paving Groups 1, 3, and 4 (1/2 of network)
Evaluating the Problem

• We also examined imagery

2008

2011
Repair Approach

- Base Failures – Full Depth Reconstruction
- Potholes – Infrared Patching
Construction Approach

• Most potholes were the result of delamination between base and surface asphalt
• New specifications required a new trackless tack product to increase shear strength between asphalt layers
Monitoring Effectiveness

- Monitor
- Evaluate
- Implement
- Test
- Track
Network Rollout

- Acquire capability (a single contractor or visiting vendor is not enough)
- Train personnel
- Track work and results
- Add to management process
Funding

- Provide simple reports and graphs to show current progress
- Show the effect of decisions (present & future)
- Let the decision makers choose

Metro Council Chamber
Conclusions

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

2. Without a pavement management system you cannot provide an overall analysis of past, current, or future conditions
Conclusions

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