WINTER PERFORMANCE MEASURES

Bob Koeberlein, PE
Mobility Services Engineer
Idaho Transportation Department
Topics

• Background
• Development Process
• Methodology
• Storm Severity and Winter Performance Formulas
• Partnership with Vaisala
• Winter Mobility Index
• Future plans
Background

- ITD spends $30 Million on Winter Maintenance for labor, materials and equipment
- 500 vehicles statewide
- Salt, salt brine, magnesium chloride, anti-skid
- 100 RWIS locations with 95 measuring Grip
- Differences in geography, terrain and weather patterns among the 6 districts created various basic maintenance practices
- ITD needed a uniform approach for measuring winter maintenance performance
Idaho has Diverse Geography
The Birth of Idaho’s Winter Performance Measure

• Ed Bala, D5 District Administrator, developed the storm severity and performance index in 2008
• Dennis Jensen, District 4 foreman, was using the RWIS data to evaluate various treatment success
• 2009-10 Ed and Dennis shared ideas and worked out a system to evaluate winter maintenance
• In 2011 ITD Director Brian Ness instructed the districts to develop a statewide performance measure for winter maintenance.
• Upgrades to existing RWIS sites began utilizing end of year and redirected funds
Methodology for Idaho’s Winter Performance Measure Index

• How everything works
  – RWIS network with non-invasive pavement sensors (“grip”)
  – Storm severity index (multiple available)
    • Performance Measurements for Highway Winter Maintenance operations (QUI 2008)
    • Developing of a Roadway Weather Severity Index (Strong et al. 2005)
    • Local Storm Scale (Cerruti and Decker, 2001)
    • SHRP (Boselly et al.)
    • States; Idaho, Wisconsin, Indiana, Iowa, Ontario, Utah, California

– Time element for grip recovery
Idaho’s Storm Severity Index

• Storm Severity Index rates three storm parameters

• FORMULA:
  
  – \textbf{Storm Severity Index} = \textit{Wind Speed Max} (mph) + \textit{Water Equivalent Layer Max} (mm) + \textit{300/Surface Temperature} Minimum (degrees F)

• Lower values indicate light storm events

• Range 10- 80 normal events with severe cold and high winds as high as 500
Winter Performance Measure (WPM) Index

• Winter Performance Measure Index rates the treatment effectiveness to the storm (recovery time to safe grip)

• FORMULA:
  - Winter Performance Measure Index = Ice Up Time (hours) / Storm Severity Index

• Ice up time is the duration of the event when the grip is below 0.60 for more than ½ hour
Partnership with Vaisala

- ITD Collaborated with Vaisala during the development of the project to automate the WPM calculations

<table>
<thead>
<tr>
<th>Station</th>
<th>Date</th>
<th>Time Range</th>
<th>Event</th>
<th>Duration (hours)</th>
<th>Max Wind Speed (mph)</th>
<th>Max Ice Layer (mm)</th>
<th>Max Snow Layer (mm)</th>
<th>Max Water Layer (mm)</th>
<th>Min Surface Temp (°F)</th>
<th>Severity Index</th>
<th>Performance Index</th>
<th>Mobility Index</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Di - 4th of July Pass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.02.2011</td>
<td>12:45 - 22:00</td>
<td>TREATED</td>
<td>9.25</td>
<td>6.25</td>
<td>0.12</td>
<td>0.11</td>
<td>1.12</td>
<td>29.30</td>
<td>17.52</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.02.2011</td>
<td>22:00 - 22:30</td>
<td>GRIP&lt;.5</td>
<td>0.50</td>
<td>5.82</td>
<td>0.00</td>
<td>0.00</td>
<td>1.17</td>
<td>31.10</td>
<td>16.53</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.02.2011</td>
<td>22:30 - 07:15</td>
<td>TREATED</td>
<td>8.75</td>
<td>10.95</td>
<td>0.03</td>
<td>0.01</td>
<td>1.02</td>
<td>27.50</td>
<td>22.89</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.02.2011</td>
<td>07:15 - 08:00</td>
<td>FROST trea</td>
<td>0.75</td>
<td>5.37</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>27.14</td>
<td>16.45</td>
<td>0</td>
<td></td>
<td></td>
<td>96%</td>
</tr>
<tr>
<td>23.02.2011</td>
<td>08:00 - 08:45</td>
<td>TREATED</td>
<td>0.75</td>
<td>3.13</td>
<td>0.05</td>
<td>0.14</td>
<td>0.05</td>
<td>27.32</td>
<td>14.25</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.02.2011</td>
<td>08:45 - 09:15</td>
<td>GRIP&lt;.5</td>
<td>0.50</td>
<td>4.03</td>
<td>0.05</td>
<td>0.20</td>
<td>0.00</td>
<td>26.78</td>
<td>15.43</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.02.2011</td>
<td>09:15 - 11:30</td>
<td>TREATED</td>
<td>2.25</td>
<td>6.71</td>
<td>0.03</td>
<td>0.10</td>
<td>0.32</td>
<td>26.06</td>
<td>18.54</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.02.2011</td>
<td>18:00 - 21:00</td>
<td>FROST trea</td>
<td>3.00</td>
<td>4.03</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>26.96</td>
<td>15.16</td>
<td>0</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>25.02.2011</td>
<td>07:00 - 10:15</td>
<td>TREATED</td>
<td>3.25</td>
<td>4.92</td>
<td>0.16</td>
<td>0.21</td>
<td>0.28</td>
<td>26.24</td>
<td>16.63</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.02.2011</td>
<td>10:15 - 11:30</td>
<td>GRIP&lt;.5</td>
<td>1.25</td>
<td>1.79</td>
<td>0.08</td>
<td>0.27</td>
<td>0.03</td>
<td>28.22</td>
<td>12.69</td>
<td>0.10</td>
<td></td>
<td></td>
<td>80%</td>
</tr>
<tr>
<td>25.02.2011</td>
<td>11:30 - 13:15</td>
<td>TREATED</td>
<td>1.75</td>
<td>9.84</td>
<td>0.04</td>
<td>0.06</td>
<td>0.59</td>
<td>28.22</td>
<td>21.06</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Partnership with Vaisala
Mobility Index

• Winter Mobility Index rates the percentage of time of wet pavement with below freezing conditions

• FORMULA:
  – Mobility Index = % Time Grip above 0.60 when surface layer is below freezing (32 degrees F)
Results 2010-2013

Winter Storm Mobility by District -- Total
% of Time Mobility Not Significantly Impeded During Winter Storms
How We Achieved the Results 2010-2012

• Management emphasis on performance measures
• Positive influences in performance were recognized
• Statewide training was implemented
• Critiquing of graphs allowed crews to evaluate products and timing
• Adaptation of new Basic Maintenance Procedures
• Feedback and coaching created more communication and a learning environment
Mastering Applications
What is Next?

• Add RWIS sites at strategic locations
• Monitor performance of maintenance crews
• Analyze WPM results; make adjustments if indicated
• Provide on-going training and coaching
Thanks for your Attention

• QUESTIONS?

Bob Koeberlein
Mobility Services Engineer
Robert.Koeberlein@itd.idaho.gov
208 334 8487 (office)
208 484 9443 (cell)