Road Weather Management Program

2012 Performance Measures

Roemer Alfelor (FHWA)
Deepak Gopalakrishna (Battelle)
Chris Cluett (Battelle)
Rachel Klein (Battelle)

RWMP Stakeholder Meeting
Little Rock, AR
July 16-18, 2013
Performance Metrics

• Goals of the 2012 update:
  – Assess RWMP performance in achieving stated objectives from 2009-2012
  – Gather and document available road weather management benefits
  – Incorporate emerging areas of importance to program performance
  – Create a framework for continuous performance measurement
<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Began study to determine RWMP performance measures needed for evaluating goal completion</td>
</tr>
<tr>
<td>2009</td>
<td>Formulated RWMP performance measures</td>
</tr>
<tr>
<td>2010</td>
<td>Quantified defined RWMP performance measures</td>
</tr>
<tr>
<td>2012</td>
<td>Updated and quantified revised RWMP performance measures</td>
</tr>
</tbody>
</table>
Context for 2012 Update

• Transition from SAFETEA-LU to MAP-21
• New program focus areas (Connected Vehicles, SHRP2 Reliability, Climate Change)
• Completion of certain major initiatives (Clarus)
• Evolving stakeholder needs
# Updated RWMP Objectives

<table>
<thead>
<tr>
<th>Objectives in 2009</th>
<th>Objectives in 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a national, open observing system that promotes data sharing to support weather observing and forecasting and transportation operations.</td>
<td>Advance the Collection, Processing, and Distribution of Fixed and Mobile Observations.</td>
</tr>
<tr>
<td>Develop resources and training methods to assist State and local partners in deployment of weather management tools.</td>
<td>Raise Road Weather Management Capabilities and Knowledge across the Transportation Industry.</td>
</tr>
<tr>
<td>Advance the State-of-the-practice by developing proactive solutions and disseminating information on adverse weather.</td>
<td>Develop and Support Operational Deployment of Advanced Road Weather Management Strategies.</td>
</tr>
<tr>
<td>Foster a collaborative, comprehensive, and dedicated surface transportation weather research program.</td>
<td>Increase the Use of Weather-Based Decision Support Tools and Dynamic Mobility Applications.</td>
</tr>
<tr>
<td>Build Partnerships with Transportation and Weather Communities.</td>
<td>Engage the Climate Change Community in Transportation Maintenance and Operations.</td>
</tr>
</tbody>
</table>
Results from 2012 Update

• Detailed measure-by-measure findings available in final report (Upcoming)

• Data sources used:
  – RWMP Data
  – State Surveys
  – Literature Search
  – ITS-JPO databases (Benefit-Cost, Deployment Statistics)
Updated Performance Measures

• Updated based on
  – Internal review of RWMP activities
  – Examining external needs and performance-related initiatives that affect the program

• Organized by the seven program objectives
  – Twenty two (22) measures
  – Measures that remain unchanged from 2009
  – Measures modified from those used in 2009
  – Several new measures reflecting current RWMP priorities
Obj. 1 - Build Partnerships with Transportation and Weather Communities

- Stakeholder engagement continues to grow
- States involved in multiple RWMP R&D efforts
- RWMP actively fostering partnership role through various forums
Obj. 2 - Raise Rd Wx Management Knowledge and Capabilities

<table>
<thead>
<tr>
<th>Training Activities and Sponsorship</th>
<th>Number of Participants (self-study and blended)</th>
<th>Details of Session</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principles and Tools for Road Weather Management</td>
<td>59</td>
<td>Blended</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>Fall 2012</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Self-study</td>
<td>28</td>
</tr>
<tr>
<td>Weather Responsive Traffic Management</td>
<td>62</td>
<td>Blended</td>
<td>28</td>
</tr>
<tr>
<td>Road Weather Information Systems (RWIS) Equipment and Operations (CITE Maryland)</td>
<td>28</td>
<td>Self-study</td>
<td>28</td>
</tr>
</tbody>
</table>

Measure: Training Activities and Courses

- Training courses offered by RWMP have increased. New certificate course in Road Weather
- NTOC webinars have shown strong sustained and diverse attendance
- RWMP Website usage continues to grow
- Mostly output measures. Need to figure out how to assess capability of the industry
Obj. 3 - Advance the Collection, Processing and Distribution of Fixed and Mobile Rd Wx Obs

- Increase in connectivity to *Clarus* but need to ensure transition
- RWMP Products and Services use has leveled off with high-degree of awareness and use of NWS, Agency sensors, Field personnel and Private Providers
Obj. 3 - Advance the Collection, Processing and Distribution of Fixed and Mobile Rd Wx Obs

- About a quarter of the DOTs said that half or more of their vehicle fleets collect maintenance, weather and road weather data.
- 3 out of 4 State DOTs are using these road weather data collection strategies in at least some of their vehicles.
- Unclear on State DOT’s perspective of what constitutes mobile road weather data.

Measure: Percent of State DOTs Indicating the Percent of their Vehicle Fleets that are Used to Collect Weather and Road Weather Data in Real Time: 2013
Almost three-quarters (74 percent) of the State DOTs responding to the 2013 survey said they either have in place (fully or partially deployed), are considering, or need an MDSS.

State DOTs are using a wider array of decision support tools now to support their road weather management practices, and the use of some of these tools is becoming increasingly widespread.

Measure: MDSS Use Reported by States

Status of MDSS Usage

- Yes, statewide: 26%
- Yes, considering or partial: 33%
- No, but needed: 15%
- No, don’t need: 26%

Percent of State DOTs Responding

Measure: Use of Other Decision Support Tools

Use of Decision Support Tools

- Provide traveler information: 96%
- Coordinate with other agencies: 77%
- Support non-winter maintenance: 62%
- Traffic control & management: 62%
- Seasonal load restrictions: 38%
- Other: 8%
- None: 0%
Obj. 5 - Develop and Support Operational Deployment of Advanced Road Weather Management Strategies

Measure: Weather Capabilities Assessment in Top 40 Metro Areas

• Further progress since 2007 in the deployment of road weather information to the traveling public, though direct comparisons are difficult given differences in the surveys conducted in 2007 and 2013 and the response rates for these surveys
• Several strategies are still in partial deployment and not deployed Statewide (where needed)
Obj. 5 - Develop and Support Operational Deployment of Advanced Road Weather Management Strategies

Measure: Percent of State DOTs Indicating Extent of Deployment of Selected Control and Treatment Strategies: 2013

- Most widely deployed, either partially or Statewide (88 percent of State DOTs), are traffic incident management practices in response to inclement weather.
- Adjusting signal timing at intersections in response to weather remains relatively rare, with twenty-one (21) percent of State DOTs deploying this strategy either partially or Statewide.
- The use of the other control and treatment strategies falls in between these two strategies.
Obj. 6 - Improve Overall System Performance during Weather Events (Agency Cost, Fatalities)

- Nationally, agency costs for snow and ice removal have been trending upward.
- Fatal crash rates due to weather have mirrored national-level decreases in overall fatalities.
- Several new evaluations point to significant agency cost reductions due to MDSS, winter maintenance practices.
Obj. 6 - Improve Overall System Performance during Weather Events (Capacity, Reliability)

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Traffic Flow Impacts</th>
<th>Reporting State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Visibility Warning Systems</td>
<td>More uniform traffic flow reduced speed variability by 22 percent speeds increased 11 percent (^1)</td>
<td>Salt Lake City, Utah</td>
</tr>
<tr>
<td>Highway Advisory Radio</td>
<td>1/3 of Commercial Vehicle Operators (CVOs) reported (when interviewed) that they would change routes based on road weather information provided (^2)</td>
<td>Washington</td>
</tr>
<tr>
<td>High Wind Warning System</td>
<td>90 percent of motorists surveyed indicated they would slow down in response to messages displayed (^3)</td>
<td>Oregon</td>
</tr>
<tr>
<td>Road Weather Information Systems and Highway Advisory Radio</td>
<td>56 percent agreed the information helped them avoid travel delays (^4)</td>
<td>Washington</td>
</tr>
<tr>
<td>Weather Related Signal Timing</td>
<td>Reduced vehicle delay by 8 percent and vehicle stops by over 5 percent (^5)</td>
<td>Minneapolis/St. Paul</td>
</tr>
<tr>
<td>En-Route Weather Alerts and Pavement Condition Information</td>
<td>Average vehicle speeds decreased by 23 percent when traffic managers displayed condition data during high winds (i.e., wind speeds over 20 mph) (^6)</td>
<td>Idaho</td>
</tr>
<tr>
<td></td>
<td>Average speeds were 12 percent lower when the system was activated during high wind events occurring simultaneously with moderate to heavy precipitation (^7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average speeds declined by 35 percent when warnings were displayed on the signs when the pavement was snow-covered and wind speeds were high (^8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In light rain condition, the 85th percentile speed decreased by 8 percent and speed variance was reduced from 6.7 mph to 5.7 mph (^9)</td>
<td>Florida</td>
</tr>
<tr>
<td></td>
<td>During heavy rain, the 85th percentile decreased by 20 percent and speed variance was reduced from 6.1 to 5.6 mph (^10)</td>
<td></td>
</tr>
</tbody>
</table>

- Limited examples of capacity and reliability improvements observed in the literature
- Reliability improvements have mostly been attributed to pre-trip and en-route traveler information
- Very few agencies track reliability measures, and even the ones that do, do not distinguish between the various causes of reliability
Obj. 6 - Improve Overall System Performance during Weather Events (Salt Use)

- Important to track for both cost and environmental reasons
- Significant annual variability in salt usage. Several State DOTs are trying to create a winter severity index to normalize. No common approach yet
- Several case studies reporting reductions in salt use in the literature. Benefits come from MDSS use and other treatment strategies (anti-icing, pre-wetting etc)

### National Salt Consumption for Road Deicing

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of Total Salt Use</th>
<th>Total Tons Used (millions)</th>
<th>Change in Consumption from Previous Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>29%</td>
<td>12.4</td>
<td>-</td>
</tr>
<tr>
<td>2007</td>
<td>39%</td>
<td>20.8</td>
<td>68%</td>
</tr>
<tr>
<td>2008</td>
<td>43%</td>
<td>22.6</td>
<td>09%</td>
</tr>
<tr>
<td>2009</td>
<td>38%</td>
<td>16.9</td>
<td>(25%)</td>
</tr>
<tr>
<td>2010</td>
<td>38%</td>
<td>18.7</td>
<td>11%</td>
</tr>
<tr>
<td>2011</td>
<td>41%</td>
<td>19.6</td>
<td>05%</td>
</tr>
</tbody>
</table>

### Examples of Salt Usage by State

<table>
<thead>
<tr>
<th>State</th>
<th>Year</th>
<th>Snowfall Range* (inches)</th>
<th>Salt Used (tons)</th>
<th>Average Statewide Winter Severity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota</td>
<td>2009-2010</td>
<td>30 - 53</td>
<td>180,252</td>
<td>44.8</td>
</tr>
<tr>
<td></td>
<td>2010-2011</td>
<td>67 - 89</td>
<td>267,860</td>
<td>57.1</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>2009-2010</td>
<td>23 - 204</td>
<td>408,523</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td>2010-2011</td>
<td>63 - 273</td>
<td>573,253</td>
<td>38.5</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>FY10</td>
<td>No data reported</td>
<td>367,436</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>FY11</td>
<td>No data reported</td>
<td>556,839</td>
<td>27.2</td>
</tr>
</tbody>
</table>

*Minnesota and Wisconsin snowfall range sourced from DOTs. Massachusetts snowfall range sourced from the National Climatic Data Center, sensor station data.

Source: State DOTs, National Climatic Data Center.
An emerging area for the RWMP. Performance Measures are still being refined. Currently, track how agencies are doing on road-weather capabilities with respect to FHWA’s developed INVEST Criteria.

State DOTs, especially the northern-tier States, meet many if not all of the programmatic criteria identified in INVEST such as having a road weather program, having RWIS and the use of MDSS.

The major weaknesses pertain to performance measurement, use of SOPs and material management, which are more sporadic in its use across the nation.
Conclusions

• With the sunset of SAFETEA-LU and implementation of MAP-21, the past two years have seen several major changes in RWMP direction and objectives.
• Resulted in modifications to the performance measures that were established for the initial assessment five years earlier.
Conclusions (cont.)

• Shows continuing adoption of advanced technologies and decision support tools, and greater implementation of advanced road weather management strategies.

• Includes various strategies for addressing non-winter weather problems including rain, flooding, wind and fog, and their impacts on road operation and maintenance activities all year round.
Recommendations for Future Updates

• Maintain core set of measures
• Work with States to establish methods to account for seasonal variability in reporting performance
• Continue to monitor and evaluate best practices
• Influence SHRP2 Implementation to obtain road weather impacts on capacity and reliability
Contacts

Roemer Alfelor (FHWA)
Road Weather Management Program
202-366-9242, Roemer.alfelor@dot.gov

Deepak Gopalakrishna (Battelle)
202-479-9645, gopalakrishnad@battelle.org