MDSS Development & Deployment

Accomplishments of the Pooled Fund Study Maintenance Decision Support System

David L. Huft
South Dakota Department of Transportation

Leon F. Osborne, Jr.
Meridian Environmental Technology, Inc.

Presented at the MDSS Stakeholders Meeting #10
Reno, NV August 6, 2008
Pooled Fund Study (PFS)

Maintenance Decision Support System

Meridian Environmental Technology
Pooled Fund Study TPF-5(054)
Beginnings

- Roots in FHWA-led Surface Transportation Weather Decision Support Requirements (STWDSR)
- 2001: MN, ND, SD, & Meridian discuss Multi-State MDSS alternative to Functional Prototype
- June 2002: SDDOT Research Project Statement for Pooled Fund Study MDSS (IN, MN, ND, SD)
- September 2002: Kickoff meeting identified issues to guide MDSS Development
- November 2002: Contract award to Meridian
Pooled Fund MDSS Timeline

- **2002**: Assess DOT Needs, Readiness
- **2003**: Evaluate Functional Prototype
- **2004**: Develop MDSS Software
  - 6-State Limited Deployment
- **2005**: Refine MDSS Software
  - Validation Studies
  - 8-State Field Trials
- **2006**: 10-State Field Trials
- **2007**: 12-State Field Trials
  - Extensive Deployment
  - B/C Analysis
- **2008**: 14-State Field Trials
  - Full Deployment
**MDSS Operating Premise**

<table>
<thead>
<tr>
<th>If you know…</th>
<th>Then you can recommend…</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Road characteristics</td>
<td>• Treatment type</td>
</tr>
<tr>
<td>• Current conditions</td>
<td>• Application rate</td>
</tr>
<tr>
<td>• Weather forecast</td>
<td>• Optimal timing</td>
</tr>
<tr>
<td>• Physics &amp; chemistry of snow, ice, chemicals</td>
<td>…and predict</td>
</tr>
<tr>
<td>• Available resources (material, equipment,</td>
<td>• Future road conditions with or without treatments</td>
</tr>
<tr>
<td>schedule)</td>
<td></td>
</tr>
</tbody>
</table>
PFS MDSS Objectives

- **Integrate**
  - Maintenance practices & policies
  - Available maintenance resources
  - Previously reported maintenance treatments
  - Road conditions and predictions
  - Weather conditions and forecasts

- **To Yield**
  - Continuously updated maintenance recommendations
  - Mechanisms that enable “What If” decision support
Concept of Operations

- Weather creates a dynamic layer on the road surface
- The intent of maintenance is to modify or remove this layer in the most effective and efficient manner
- The goal is to improve safety and mobility
MDSS Mass & Energy Model

MDSS modeling requires knowledge of plowing and chemical applications.
MDSS Map Display
1. Geographic background
2. MDSS Routes – road condition shown
3. Weather backgrounds – radar shown
4. RWIS data – road temperature shown
5. NWS/FAA observations – present weather shown
MDSS Alert System

- Weather alerts
- Road condition alerts
- Blowing snow alerts
- National Weather Service watches and warnings
MDSS incorporates camera images as a support resource
PFS MDSS map is a link to more detailed pavement and weather info.
PFS MDSS integrates maintenance actions reported from manual and automated sources:

- Maintenance actions
- Road conditions
- Weather conditions
- Pavement temperatures
PFS MDSS generates maintenance recommendations showing:

- Road temperature
- Road condition
- Percent ice
- Maintenance actions
- Depth of ice
- Depth of liquid
- Depth of snow
Maintenance Recommendations and Forecasted Road Conditions

Freeze Point Temp
Dew Point
Pavement Temp
Snow Depth
Ice Depth
Pavement Condition
% Ice
Maintenance Actions

US 385 (Pringle to Wind Cave) SD-06-2

Maintenance Decision Support System - Meridian Environmental Technology v1.00.6
MDSS Routes Supported: 2007-2008

Winter 2007-2008: 568 Total Routes

<table>
<thead>
<tr>
<th>State</th>
<th>Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>6</td>
</tr>
<tr>
<td>CO</td>
<td>89</td>
</tr>
<tr>
<td>IN</td>
<td>50</td>
</tr>
<tr>
<td>IA</td>
<td>67</td>
</tr>
<tr>
<td>KS</td>
<td>18</td>
</tr>
<tr>
<td>KY</td>
<td>NEW</td>
</tr>
<tr>
<td>MN</td>
<td>142</td>
</tr>
<tr>
<td>NE</td>
<td>28</td>
</tr>
<tr>
<td>NH</td>
<td>4</td>
</tr>
<tr>
<td>NY</td>
<td>19</td>
</tr>
<tr>
<td>ND</td>
<td>77</td>
</tr>
<tr>
<td>SD</td>
<td>24</td>
</tr>
<tr>
<td>VA</td>
<td>19</td>
</tr>
<tr>
<td>WY</td>
<td>25</td>
</tr>
</tbody>
</table>
In-Vehicle MDC/AVL MDSS

Advanced method for determining real-time maintenance actions. Two way data flow maximizes value of MDC/AVL systems.
MDC/AVL MDSS Use

- PFS states at varying levels of MDC/AVL implementation
- 366 total MDC/AVL units used 2007/2008
- Significant expansion expected 2008/2009

<table>
<thead>
<tr>
<th>State</th>
<th>MDC/AVL Use</th>
<th>State</th>
<th>MDC/AVL Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>N/A</td>
<td>NE</td>
<td>IWAPI(8)</td>
</tr>
<tr>
<td>CO</td>
<td>IWAPI (152)</td>
<td>NH</td>
<td>N/A</td>
</tr>
<tr>
<td>IN</td>
<td>IWAPI(12) Purdue U(8)</td>
<td>NY</td>
<td>AmeriTrak(37)</td>
</tr>
<tr>
<td>IA</td>
<td>N/A</td>
<td>ND</td>
<td>Location Tech (27)</td>
</tr>
<tr>
<td>KS</td>
<td>IWAPI(25)</td>
<td>SD</td>
<td>Intelligent Devices (4) ➔ (104)</td>
</tr>
<tr>
<td>KY</td>
<td>N/A</td>
<td>VA</td>
<td>N/A</td>
</tr>
<tr>
<td>MN</td>
<td>IWAPI(70)/SEI</td>
<td>WY</td>
<td>IWAPI(23)</td>
</tr>
</tbody>
</table>
Summary of Achievements

- GIS display of weather, pavement, route conditions
- Display of vehicle location and treatment history
- Display of video imagery
- Enhancement of alert system
- Site specific pavement condition modeling
- Integration of actual maintenance into pavement condition model
- Incorporation of standard maintenance practices where MDC/AVL data is not available
- Integration of traffic into pavement condition model
Summary of Achievements

- Introduction of innovative treatment recommendations based on performance and cost considerations
- Creation of in-vehicle display of weather conditions and route recommendations
- Modular, open architecture design
- Development of interface specifications
- Storm playback for training & analysis
- Support for Benefit/Cost analysis
For More Information

David L. Huft  
Research Program Manager  
South Dakota Department of Transportation  
Pierre, SD 57501  
605.773.3358  
dave.huft@state.sd.us

Leon F. Osborne, Jr.  
President / CEO  
Meridian Environmental Technology, Inc.  
Grand Forks, ND  
701.792.1802  
leono@meridian-enviro.com