Development of Maintenance Decision Support System for New Jersey

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Project Background

NJ-MDSS Goals
- Improve safety of traveling public
- Enhance operational efficiency (e.g., plan for maintenance vehicle routing and schedule, salt spreading rate, etc.)

NJ-MDSS Objectives
- Combine maintenance related data to create an integrated and understandable presentation of current environmental, atmospheric and roadway conditions
- Recommend treatment plans for maintenance operations
- Predict roadway surface conditions after treatment (if any) to aid in resource management
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NJ-MDSS

- FHWA MDSS prototype Release 5.0
- FHWA MDSS Release 6.0-component for displaying real-time observations from Clarus system
- NJIT developed programs for data retrieval and format conversion

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NJ-MDSS Study Area

Warren County, New Jersey

Route From Mile Post To Mile Post

<table>
<thead>
<tr>
<th>Route</th>
<th>From Mile Post</th>
<th>To Mile Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstate 80</td>
<td>0.5</td>
<td>19.9</td>
</tr>
<tr>
<td>State Route 46</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>
Close-up View of NJ-MDSS Study Area

- Routes using Knowlton RWIS data
- Route using Allamuchy RWIS data

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**Project Timeline**

- **January 2008**: Started NJ-MDSS development with FHWA MDSS R5
- **November 2008**: NJ-MDSS v0 ready with NJWxCNet data
- **January 2009**: NJ-MDSS v0.1 ready
- **April 2009**: NJ-MDSS v1 ready with DTN/Meteorlogix data
- **September 2008**: Received weather data from NJWxCNet
- **March 2009**: Received weather data from DTN/Meteorlogix
- **July 2009**: NJDOT RWIS data available on Clarus System

<table>
<thead>
<tr>
<th>Version</th>
<th>Major function(s) implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>v0</td>
<td>Weather forecast and alerts</td>
</tr>
<tr>
<td>V0.1</td>
<td>Road surface condition predictions without treatment</td>
</tr>
<tr>
<td>v1</td>
<td>Treatment recommendations</td>
</tr>
<tr>
<td></td>
<td>Road surface condition predictions after treatments</td>
</tr>
</tbody>
</table>
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NJ-MDSS Data Flow

MAV MOS weather forecast and RWIS observations

NJWxNet

Weather forecast and observations (in MDSS ready format)

DTN/Meteorlogix

Real-time RWIS observations

Clarus System

NJ-MDSS Server

NJ-MDSS users at NJDOT HQ

NJ-MDSS users at Regional HQs

NJ-MDSS users at Maintenance Yards

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NJ-MDSS v1

- Workable since April 2009
- Major functions
  - Weather forecast and alerts
  - Road status and surface condition forecast
  - Treatment recommendations
  - Road surface condition prediction after treatments
- Functions not implemented yet
  - Point (real-time RWIS) observations (in progress)
  - Area observations (radar and satellite images)
  - Blowing snow warning
Weather Data

- High quality weather forecast and observation data is the key to successful MDSS operation
- Evaluate weather data sources
  - Availability
  - Reliability
  - Precision
  - Format
Weather Forecast Data

Two weather forecasts were tested in NJ-MDSS during development

- MAV MOS forecast (National Weather Service)
- DTN/Meteorlogix

<table>
<thead>
<tr>
<th>Weather Forecast for Road Segments</th>
<th>Data Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAV MOS forecast</td>
<td>Interpolated for road segments, might not reflect local weather events</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Update interval: 3 hours</td>
</tr>
<tr>
<td></td>
<td>DTN/Meteorlogix</td>
<td>More precise for local weather events</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Update interval: 1 hour</td>
</tr>
</tbody>
</table>
## Weather Observation Data

### Available RWIS observation data sources

- NJWxNet
- DTN/Meteorlogix
- Clarus System

<table>
<thead>
<tr>
<th>RWIS Observations</th>
<th>Data Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NJWxNet</td>
<td>No subsurface and bridge temperatures</td>
</tr>
<tr>
<td></td>
<td>DTN/Meteorlogix</td>
<td>Processed for NJ-MDSS, not real-time</td>
</tr>
<tr>
<td></td>
<td>Clarus System</td>
<td>Real-time observations (with data check)</td>
</tr>
</tbody>
</table>
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NJ-MDSS Main Display

- Observations & Forecast Parameters
- Road and Weather Alerts
- Map of Routes and Alerts Zones
- Forecast time & Animation Control

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Weather Forecast Time Series (4/21/09)

- Weather Alert
- Air Temp & Dew Point
- Wind Speed
- Wind Direction
- Precip Type
- Precip Rate
- Snow Rate
- Total Snow Accumulation
- Precip Probability
Treatment Recommendations (4/21/09)
Event Summary (4/21/09)

- Probabilistic forecasts of each precipitation type
- Snow accumulation on the road with no treatment & total snowfall.
- Road Temps with recommended treatment
- Forecast wind speeds
- Treatment recommendations
NJ-MDSS Short Term Development Goals

- Collect weather and maintenance related data in the coming winter
- Work with maintenance crew to identify critical road segments under adverse weather condition
- Determine optimal coverage of road segments based on location of RWIS, terrain and local weather pattern
- Evaluate NJ-MDSS prediction accuracy in road surface condition after implementing recommended treatment and fine tune NJ-MDSS
NJ-MDSS Long Term Development Goals

- Display area observations in NJ-MDSS
- Expand NJ-MDSS coverage area
  - Study area → region → state wide deployment
- Use NJ-MDSS as a training tool for maintenance operations
- Integrate other maintenance related information into NJ-MDSS
  - Maintenance trucks (AVL, spreading rate, camera, etc.)
  - Maintenance yards (snow removal resources, etc.)
  - Traffic (traffic camera, traffic volume, location of accident, etc.)
Lessons and Recommendations

- Undocumented extraneous configuration files from previous MDSS release
- Remote access to the NJ-MDSS server by developers at UCAR helped in identifying and solving many issues
- Up-to-date FHWA MDSS prototype development, solutions for issues might have been developed already
- More information about how to calibrate parameters in MDSS should be researched and documented
For More Information, Contact

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