A Decision-support System for Winter Weather Maintenance of Bridges, Roads, and Runways

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NCAR - Research Applications Laboratory
History

• Began after a study discovered a disconnect between road weather forecasts and the road maintenance community

• A system was developed that translates current and predicted road & weather information into recommended maintenance actions

• **Goal** - improve the productivity and cost efficiency of transportation agencies

• A prototype was built [Maintenance Decision Support System; MDSS] based on open system principles, which fostered an MDSS market by making that prototype freely available
What is MDSS?

Strategic Decision-making tool (12-48 hours)

Weather Information:
- Air temperature
- Relative humidity
- Wind speed/direction
- Precipitation type, rate, accumulation
What is MDSS?

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- Relative humidity
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Road Surface Information:
- Road temperature
- Bridge temperature
- Bridge frost potential
- Blowing snow potential
What is MDSS?

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- Air temperature
- Relative humidity
- Wind speed/direction
- Precipitation type, rate, accumulation

Road Surface Information:
- Road temperature
- Bridge temperature
- Bridge frost potential
- Blowing snow potential

Treatment recommendations:
- Treatment type (plow, chemical, pre-treat)
- Treatment amount
- Treatment location
What is MDSS?
Tactical Decision-making tool (0-12 hours) - Currently

Observations:
- Air Temp
- Pavement/Bridge temp
- Wind speed/direction
- Relative Humidity
- Precipitation
What is MDSS?

Tactical Decision-making tool (0-12 hours) - Currently

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Remotely Sensed Observations:
- Radar
- Satellite
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Observations:
- Air Temp
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Remotely Sensed Observations:
- Radar
- Satellite

Other Enhancements: Traffic Cams, AVL…
What is MDSS?

- Numerical model data
- Road Weather Information System (RWIS) data
- Miscellaneous observations (e.g., airport)

- Consensus forecast generation

- Road temperature and condition forecasts
- Rules of practice for anti-icing and deicing operations
- Treatment recommendations

- Delivery of information and data from upstream modules to end users via an interactive Graphical User Interface
What is MDSS?

Currently deployed over City/County of Denver, E470, and DIA
Strategic Enhancements

METRo (Model of the Environment and Temperature of Roads)*

* Environment Canada
Strategic Enhancements

1-h updated forecast out to 72-h
Tactical Enhancements

Traffic Cameras:
Tactical Enhancements

Traffic Cameras:

<table>
<thead>
<tr>
<th>Selected Maintenance Area:</th>
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<tbody>
<tr>
<td><strong>Colorado</strong></td>
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<table>
<thead>
<tr>
<th><strong>Colorado Alerts:</strong></th>
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<tbody>
<tr>
<td>0-12 hrs</td>
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<tr>
<td>12-24 hrs</td>
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<tr>
<td>24-48 hrs</td>
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<table>
<thead>
<tr>
<th><strong>Map Products:</strong></th>
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<tbody>
<tr>
<td><strong>Weather Forecasts:</strong></td>
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<tr>
<td><strong>Road Forecasts:</strong></td>
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<tr>
<td><strong>Point Observations:</strong></td>
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<td><strong>Area Observations:</strong></td>
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<tr>
<td><strong>Overlays:</strong></td>
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<table>
<thead>
<tr>
<th><strong>Selected Plow Route:</strong></th>
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</thead>
<tbody>
<tr>
<td><em>Select a route...</em></td>
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<table>
<thead>
<tr>
<th><strong>Selected Time and Animation:</strong></th>
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<tbody>
<tr>
<td>Observations Only</td>
</tr>
<tr>
<td>Forecast Only</td>
</tr>
<tr>
<td>Observations and Forecast</td>
</tr>
</tbody>
</table>
Tactical Enhancements

AVL:

Plow diagnostics (speed, blade status, treatment rate) and dashboard cameras
New Deployments
Denver International Airport (DIA)

*Need has arisen to increase skill of 0 – 4 hour precipitation forecasts*
New Deployments

New Jersey

Development of Maintenance Decision Support System for New Jersey

NJ-MDSS Main Display

Road and Weather Alerts

Map of Routes and Alerts Zones

Observations & Forecast Parameters

Forecast time & Animation Control

NJIT
New Jersey's Science & Technology University

9/23/08
New Deployments

Vaisala – Denver and E470
Future Applications

Maintenance and Operations Decision Support System (MODSS)

- *Clarus* regional demonstration
- Non-winter weather system
- Provide support for maintenance activities such as:
  - weed spraying
  - lane striping
  - pothole repair
  - mowing
  - other weather impacted activities
Future Applications
MDSS Information

http://www.rap.ucar.edu/projects/rdwx_mdss

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