

The U.S. Federal Highway Administration Winter Road Maintenance Decision Support System (MDSS)

Recent Enhancements & Refinements

Kevin R. Petty, Ph.D.
&
William P. Mahoney III

National Center for Atmospheric Research
Boulder, Colorado, USA

SIRWEC 2008 (ID:29)
International Road Weather Conference





Federal Highway Administration (FHWA) Road Weather Management Program objective:

- Develop an understanding of how weather and road conditions impact the nation's roadways
- Determine how best to mitigate road weather impacts

FHWA initiated a project to:

- Construct a MDSS functional prototype (MDSS FP) that can **provide objective guidance** to winter road maintenance decision makers concerning the appropriate treatment strategies to use to control roadway snow and ice during adverse winter weather events
- Provide a system that will **serve as a catalyst for additional research and development** by the private sector
- **Raise overall awareness** of the impact of weather on the roadway system by involving: AMS, ITSA, TRB, AASHTO, State DOTs, private sector, universities, national labs, etc.
- **Investigate new weather technologies and methods** that may have applicability for road weather use

MDSS Strategic Capabilities



Weather Information



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

Pavement Information



- Road temperature
- Bridge temperature
- Bridge frost potential
- Blowing snow potential
- Road contamination & chemical concentration

Treatment Guidance



- Treatment type (plow, chemical, pre-treat)
- Treatment amount
- Treatment location

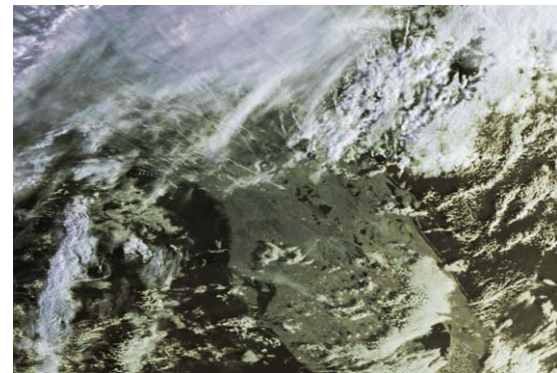


MDSS Tactical Capabilities

Observed (e.g., RWIS)



Remotely Sensed



Other



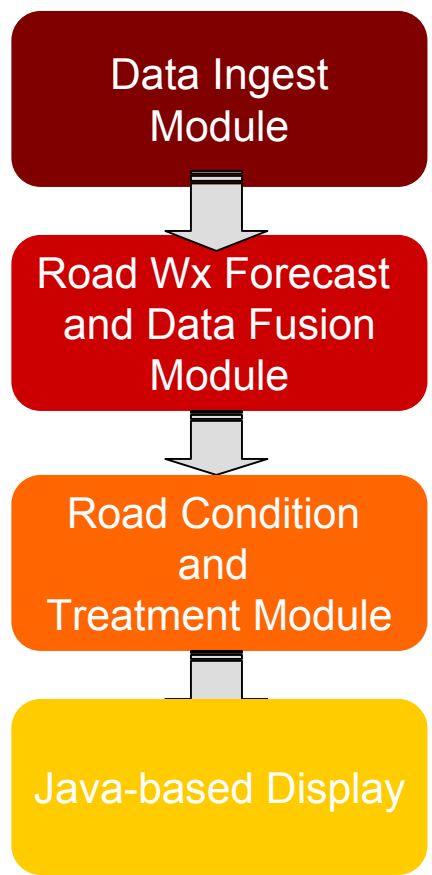
- Air temperature
- Relative humidity
- Wind speed
- Road temperature
- Bridge temperature
- Subsurface temp.

- Radar reflectivity
- Satellite imagery

- Automated Vehicle Location (AVL)
- Tactical alerts
 - Frozen precipitation
 - Pavement temp. < 0°C



MDSS Structure



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

- Consensus forecast generation

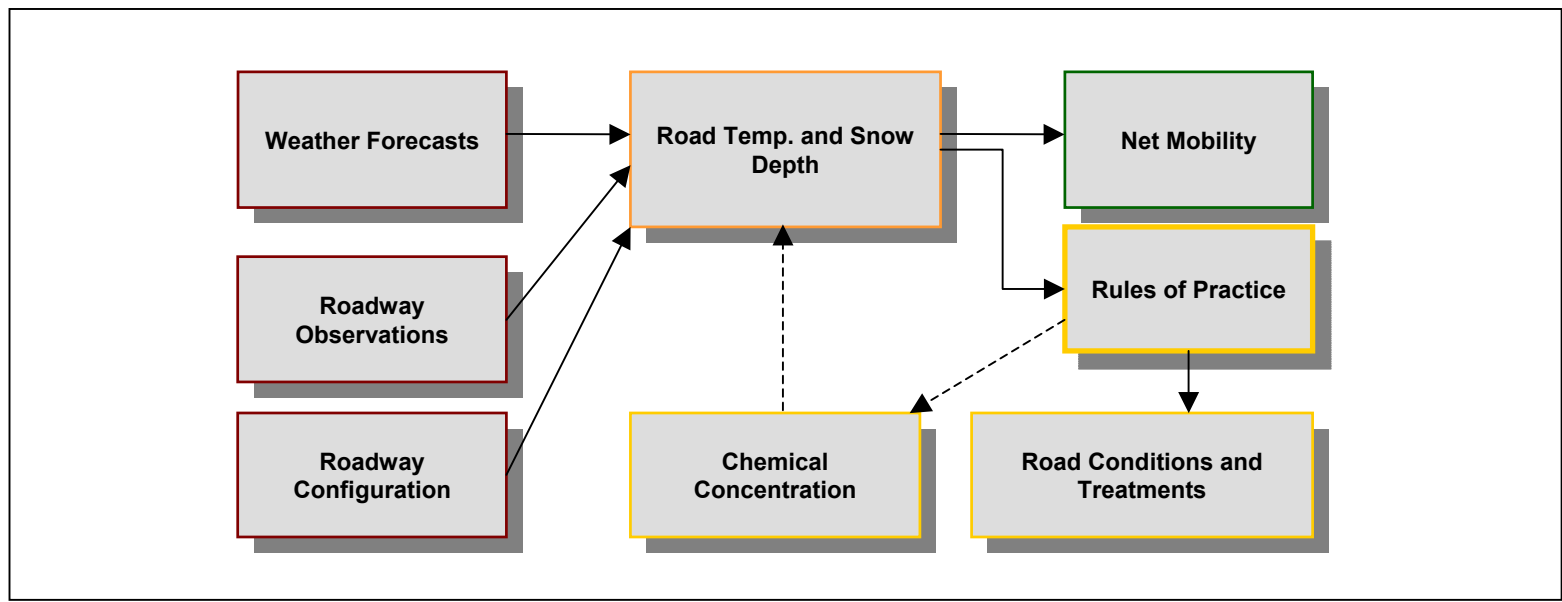
- Road temperature and condition forecasts
- Rules of practice for anti-icing and deicing operations
- Treatment recommendations

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



MDSS Refinements and Improvements

Road Condition and Treatment Module (RCTM)



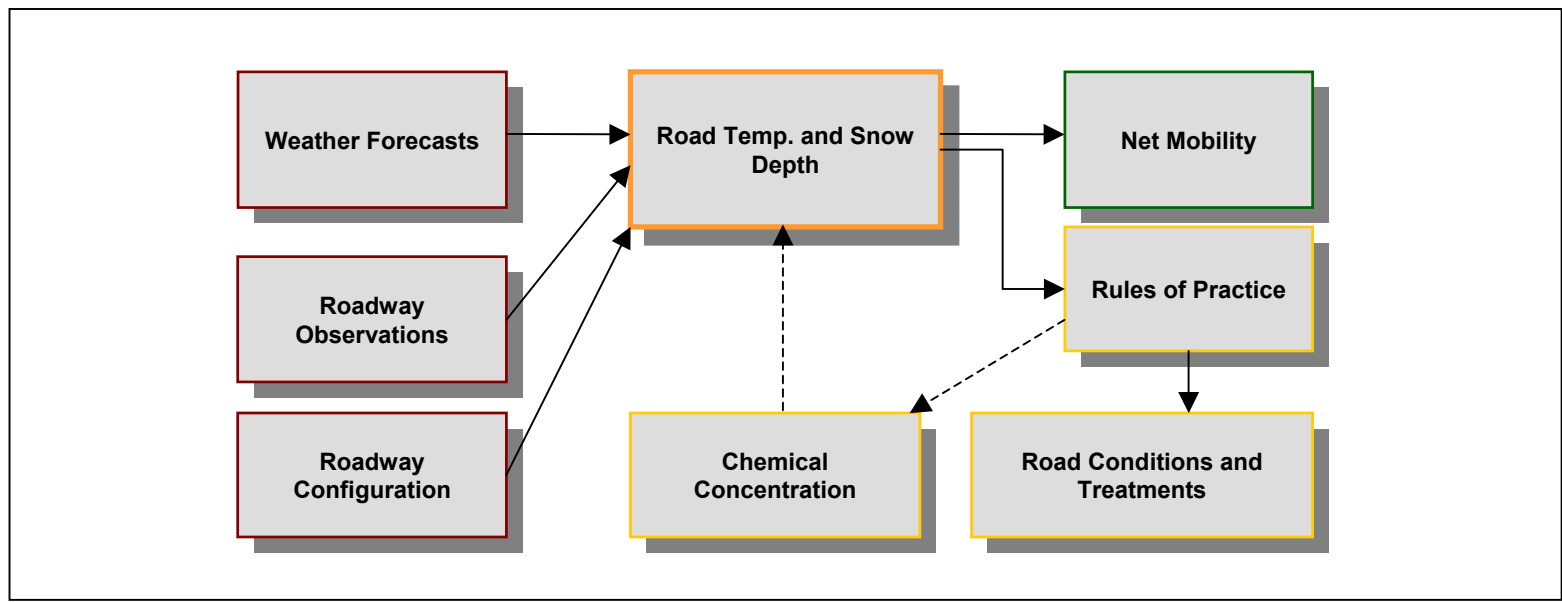
Rules of Practice (RoP)

- Improved flexibility in setting treatment parameters (e.g., agency-specific, route-specific)
- Direct use of eutectic curves and dilution information
- Added chemical types
- Improved treatment strategies (*continuous and triggered*)



MDSS Refinements and Improvements

Road Condition and Treatment Module (RCTM)



Road Temperature and Snow Depth Module

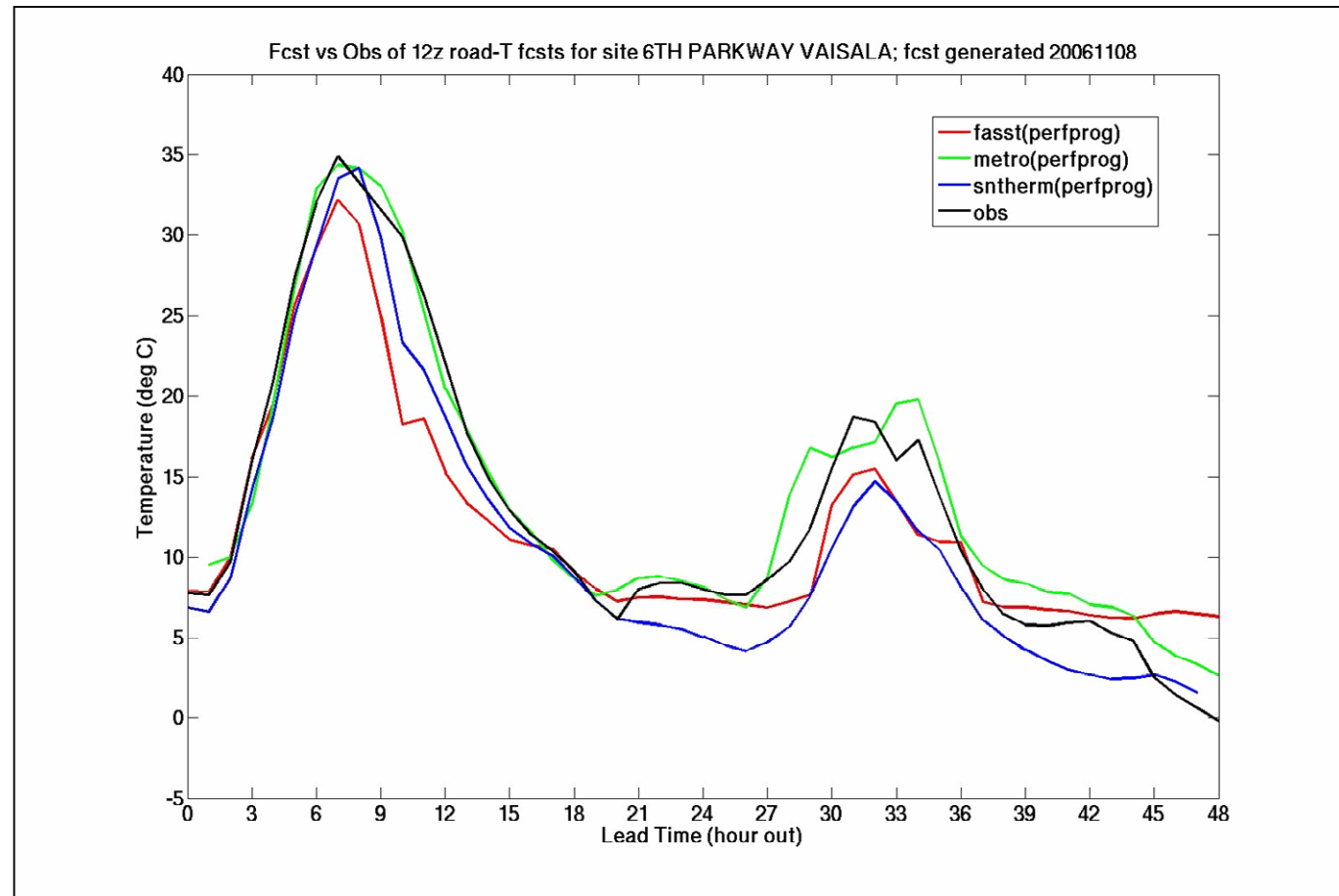
• Transitioned to using METRo (Model of the Environment and Temperature of Roads)*

- Performance
- Stability
- Efficiency
- Ease of Use
- Support



MDSS Refinements and Improvements

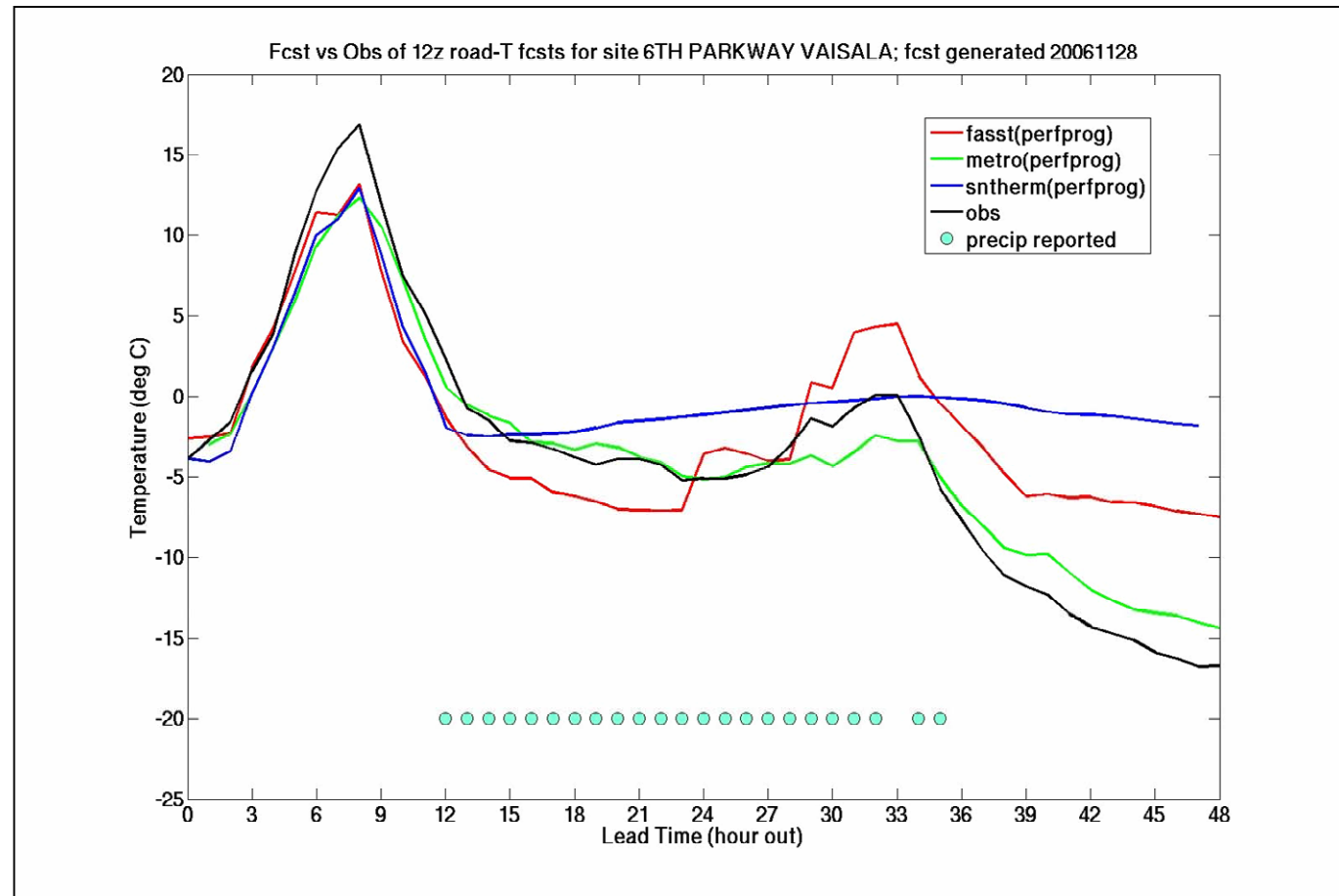
METRo (Model of the Environment and Temperature of Roads)*





MDSS Refinements and Improvements

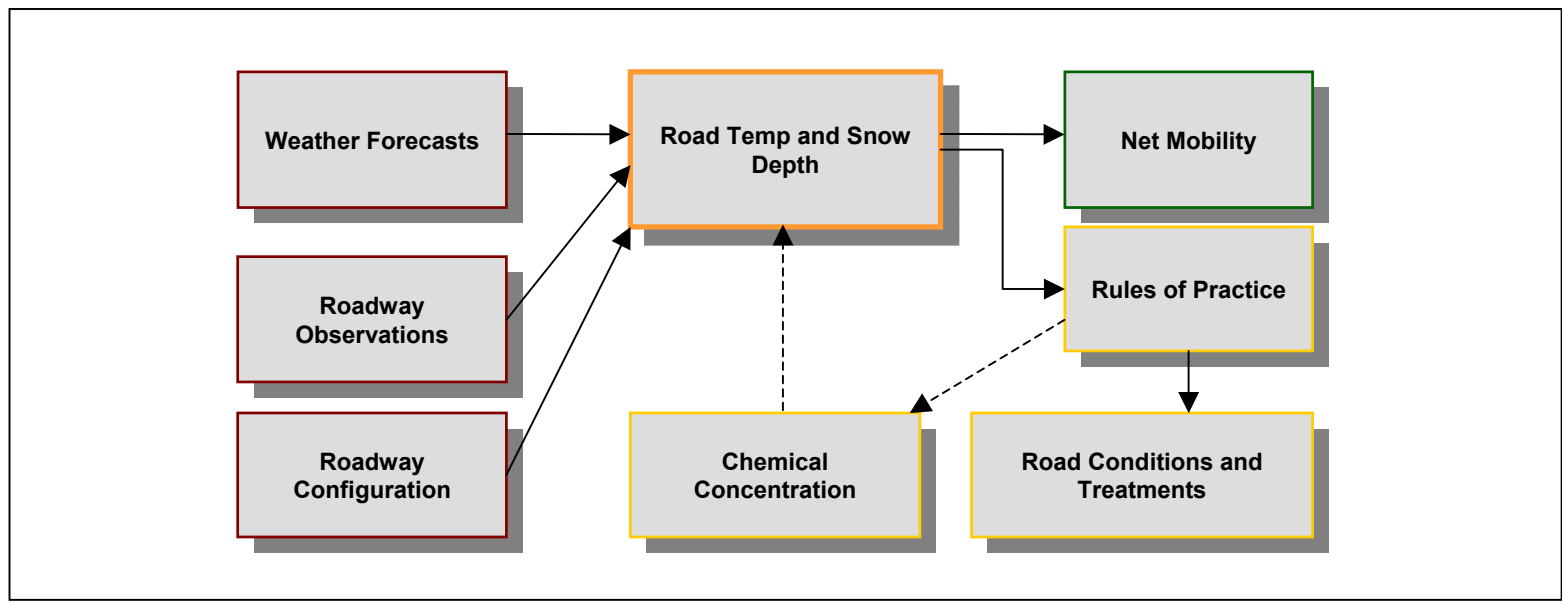
METRo (Model of the Environment and Temperature of Roads)*





MDSS Refinements and Improvements

Road Condition and Treatment Module (RCTM)



Road Temperature and Snow Depth Module

- Transitioned to using METRo (Model of the Environment and Temperature of Roads)*
- Performance
- **Ease of Use**
- **Stability**
- **Support**
- **Efficiency**

MDSS Display Features



Java-based Display

- Determine whether adverse weather or road conditions are predicted to occur in the future (current forecast period is 48 hours, updated every 3 hours)

Colorado MDSS - v5.0.1
File Configuration Help
Wednesday 11/28/07 13:02:40 MST

Selected Maintenance Area:
Colorado

Colorado Alerts:

	0-12 Hrs	12-24 Hrs	24-48 Hrs
Weather	OK	OK	OK
Road	OK	OK	OK
Blowing SN	OK	OK	OK
Bridge Frost	OK	OK	OK

23 Tue 11/27 11 Wed 11/28 23 Thu 11/29 23

No Frozen Precipitation Observed Road(s) <= 32°F

Map Products:

State Zone Alerts: County Weather
Weather Forecasts: Weather Alerts
Road Forecasts: Mobility Alerts
Point Observations: None
Area Observations: None

Selected Plow Route:
Select a route...

Selected Time and Animation:

Observations Only
 Forecast Only
 Observations and Forecast

GO

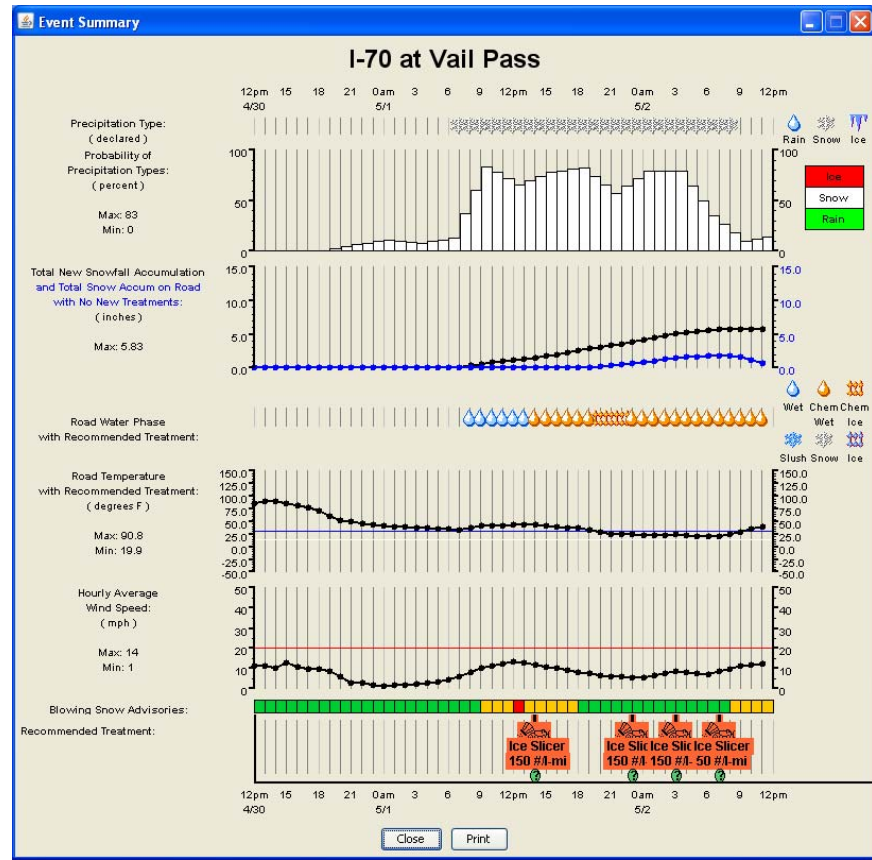
23:00 2:00 5:00 8:00 11:00 14:00 17:00 20:00 23:00 2:00 5:00 8:00 11:00
11/27 11/28 11/29

MDSS Display Features



Java-based Display

- Examine forecasted and observed road weather information at user-defined forecast sites/routes/zones



MDSS Display Features



Java-based Display

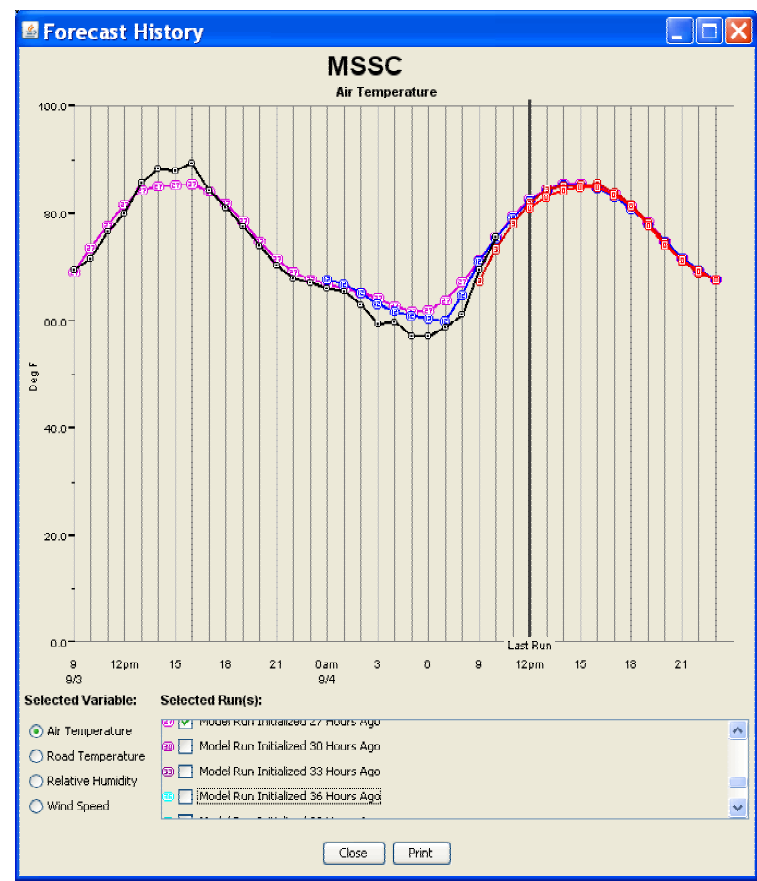
- Be alerted to potential real-time and near-term road weather hazards



MDSS Display Features

Java-based Display

- Verify forecast performance (air and pavement temperature, relative humidity, and wind speed)





MDSS Display Elements

Java-based Display

- Examine archived events, including weather and road condition forecasts, observations, treatment recommendations, and selected treatment actions

Colorado MDSS - v5.0.5
File Configuration Help
Wednesday 5/7/08 20:45:54 MDT

Selected Maintenance Area:
E-470

Road Surface Temperature (Degrees F)
-50 0 10 15 20 28 30 32 35 40 50 60 70 150

Data Archive
Select the date and time of the model run's initial timestep:
May 2008
1 2 3
7 8 9 10
14 15 16 17
21 22 23 24
25 26 27 28 29 30 31
Thu May 01 06:00:00 MDT 2008
OK Apply Cancel
Reset to Realtime

Blowing Snow Alerts: [Green bar]
Bridge Frost Alerts: [Green bar]
Current Treatment: [No New Treatments Scheduled]

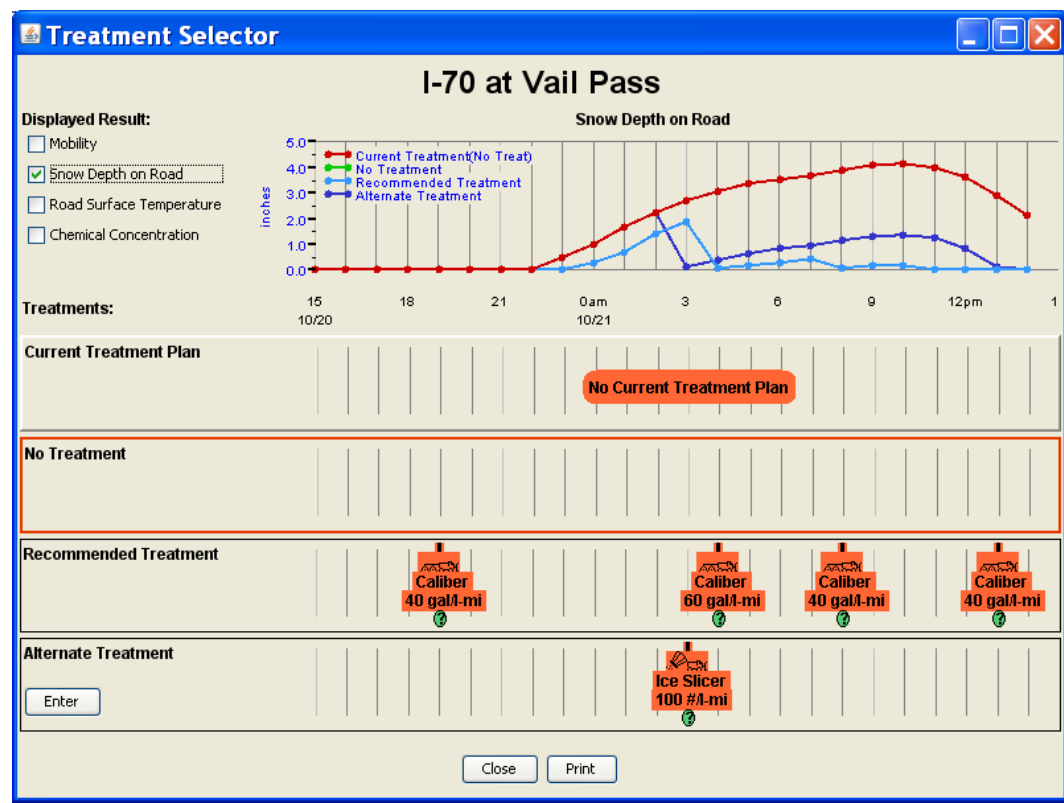
18:00 21:00 0:00 3:00 6:00 9:00 12:00 15:00 18:00 21:00 0:00 3:00 6:00
5/7 5/8 5/9



MDSS Display Elements

Java-based Display

- View system-generated winter maintenance treatment plans for each route or zone
- Assess the predicted impact of system-recommended treatment plans
- Perform *what if* scenarios to assess the impact of user-defined treatment plans

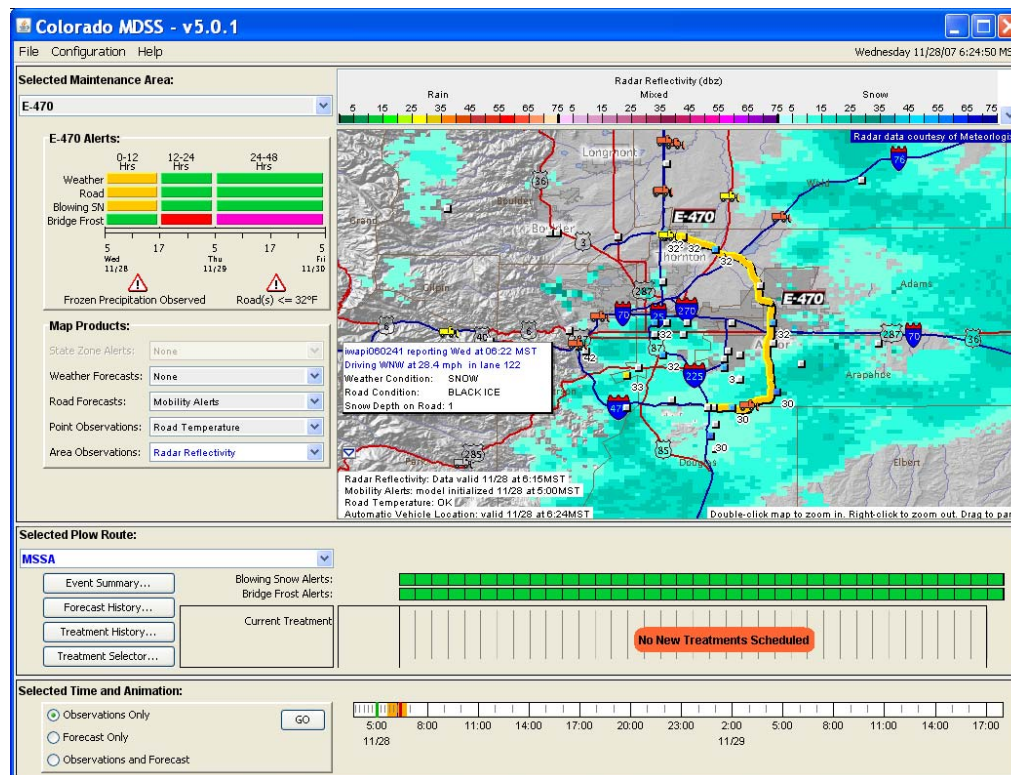


Recent MDSS Display Extensions



Java-based Display

- Display and animate gridded products, such as radar and satellite data
- Dynamic basemaps (support arbitrary zoom and pan)
- Archive forecast display
- Display Automated Vehicle Location (AVL) data



MDSS Information and Requests



- Latest public release of the MDSS FP occurred fall 2007
- Updated April 2008

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

Kevin Petty (MDSS Project Manager)

NCAR/RAL
3450 Mitchell Lane
Boulder CO 80301
Ph: 303-497-2705
Fax: 303-497-8386
kpetty@ucar.edu

The screenshot shows a web browser window displaying the NCAR Maintenance Decision Support System (MDSS) website. The browser title is "Maintenance Decision Support System (MDSS) - Mozilla Firefox". The address bar shows the URL "http://www.ral.ucar.edu/projects/rdwx_mdss/". The website header includes "NCAR" and "Maintenance Decision Support System | RAL". A navigation menu lists "RAL home", "research", "technology", "people/org", "publications", "events", "pressroom", and "for staff". A search bar is present with the text "Search RAL advanced".

The main content area features a central banner for the "Maintenance Decision Support System" with the acronym "MDSS" and the text "FEDERAL HIGHWAY ADMINISTRATION". Below the banner is a photograph of a snowplow. To the right of the banner is a text block describing the system's purpose: "Controlling snow and ice buildup on roadways during winter weather events presents several challenges for winter maintenance personnel. Among these challenges is the need to make effective winter maintenance decisions (treatment types, timing, rates, and locations), as these decisions have a considerable impact on roadway safety and efficiency. Additionally, poor decisions can have adverse economic and environmental consequences. In an effort to mitigate the challenges associated with winter maintenance decisions, the Federal Highway Administration (FHWA) Office of Transportation Operations (HOTO) initiated a program in 2001 aimed at developing a winter road Maintenance Decision support system (MDSS)."

Below the text is a list of project goals: "The MDSS project goal is to develop a prototype capability that:"

- Capitalizes on existing road and weather data sources,
- Augments data sources where they are weak or where improved accuracy could significantly improve the decision-making task,
- Fuses data to make an open, integrated and understandable presentation of current environmental and road conditions,
- Processes data to generate diagnostic and prognostic maps of road conditions along road corridors, with emphasis on the 1- to 48-hour horizon (historical information from the previous 48 hours will also be available)
- Provides a display capability on the state of the atmosphere and roadway
- Provides a decision support tool, which provides recommendations on road maintenance courses of action
- Provides all of the above on a single platform, with simple and intuitive operating requirements, and does so in a readily comprehensible display of results and recommended courses of action, together with anticipated consequences of action or inaction

On the right side of the page, there is a "Latest News & Events" section with three entries:

- 4th National Conference on Surface Transportation Weather**
June 16-17, 2008
Indianapolis, Indiana
[see details](#)
- 7th International Symposium on Snow Removal and Ice Control Technology**
June 17-19, 2008
Indianapolis, Indiana
[see details](#)
- Sixth stakeholder meeting for the Clarus Initiative Coordinating Committee (ICC)**
August 4-5, 2008
Silver Legacy Resort, Reno, Nevada
contact: Andy Stern | astern@noblis.org | 703-610-1754 or Paul Pisano | paul.pisano@dot.gov | 202-366-1301

Below these is another entry for a "Maintenance Decision Support System (MDSS) Stakeholder Meeting" on August 6-7, 2008, with the same contact information.

At the bottom of the page, there is a "Latest Release" section with the text: "Release 5.0 now available" and "Release 5.0 patch (2.4.2008) MDSS RS pre-treatment bug-fix .tar file with readme instructions".