



**U.S. Department of Transportation Federal Highway Administration**



# *New and Emerging Strategies for Road-Weather Management*

**Maintenance Decision Support System**  
*transforming the world of winter maintenance*



# Presentation Topics

## ❖ MDSS

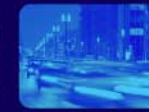
**Maintenance Decision Support System**

## ❖ X-DSS

**eXtensive Decision Support System**

## ❖ VII & Winter Maintenance

**Vehicle Infrastructure Integration**



## What is the MDSS?

### Maintenance Decision Support System (MDSS)

- **Computer-based, customizable tool that provides winter maintenance personnel with:**
    - **Route-specific weather forecast information**
    - **Road treatment recommendations**
      - **anti-icing, deicing**
      - **chemical applications**
      - **optimized treatment times**
- Generates treatment recommendations on a route by route basis



## Objectives of MDSS

- With MDSS, maintenance managers can:
  - better manage & operate our nation's roads
  - mitigate adverse aspects of weather-related congestion & delay
  - reduce weather-related crashes
  - disseminate relevant information to travelers
  - reduce DOT operating costs through better management of staff, equipment & reduced chemical applications



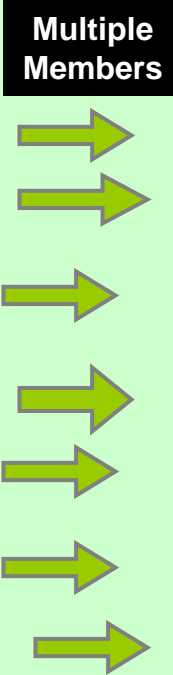
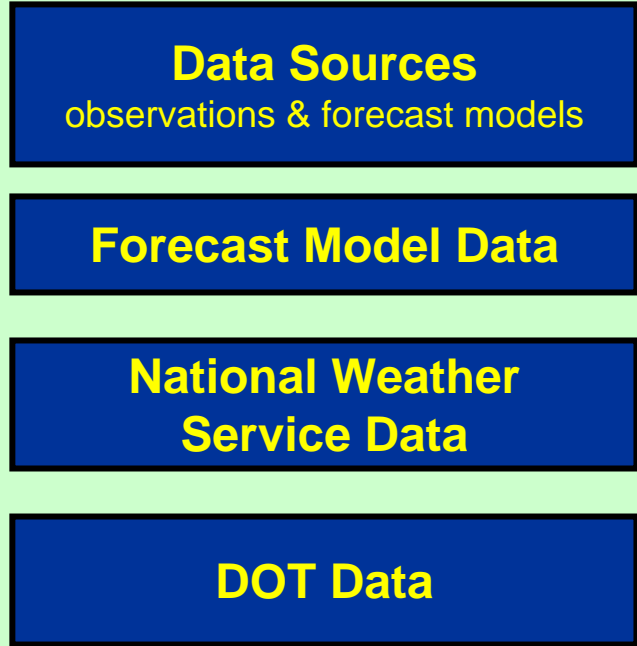
## Target Audience

- State Departments of Transportation
- Local/municipal operating agencies
- National Association Stakeholders  
(e.g. AASHTO, ITE, ITS America, the Aurora Consortium)
- Private sector providers of MDSS Services

# MDSS Configuration

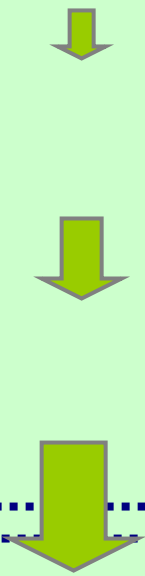
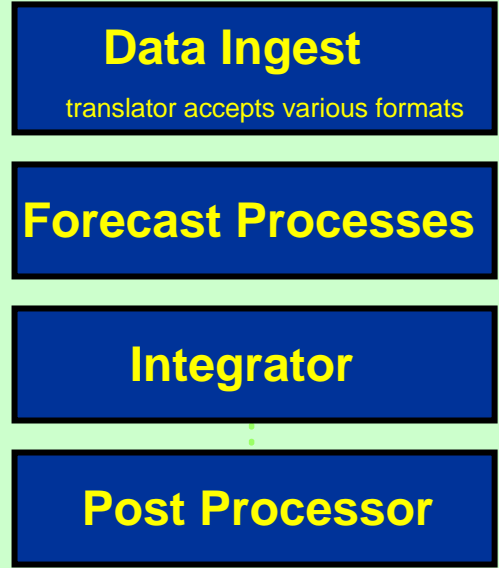
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## Weather Forecast & Observations Module



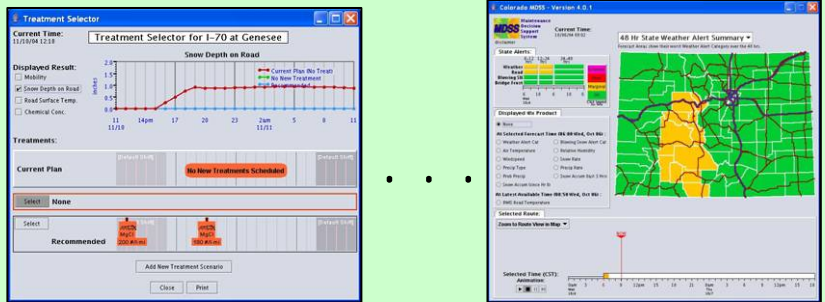
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## Road Weather Forecast System Module (RWFS) [Data Fusion Engine]



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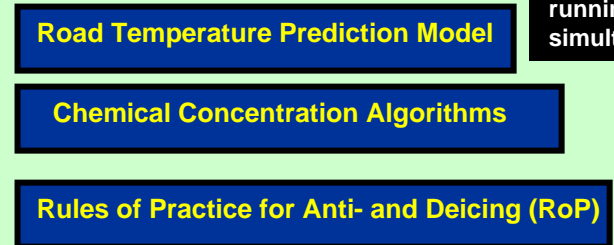
## GUI Module



Plow route specific treatment recommendations

3

## Road Condition & Treatment Module (RCTM)

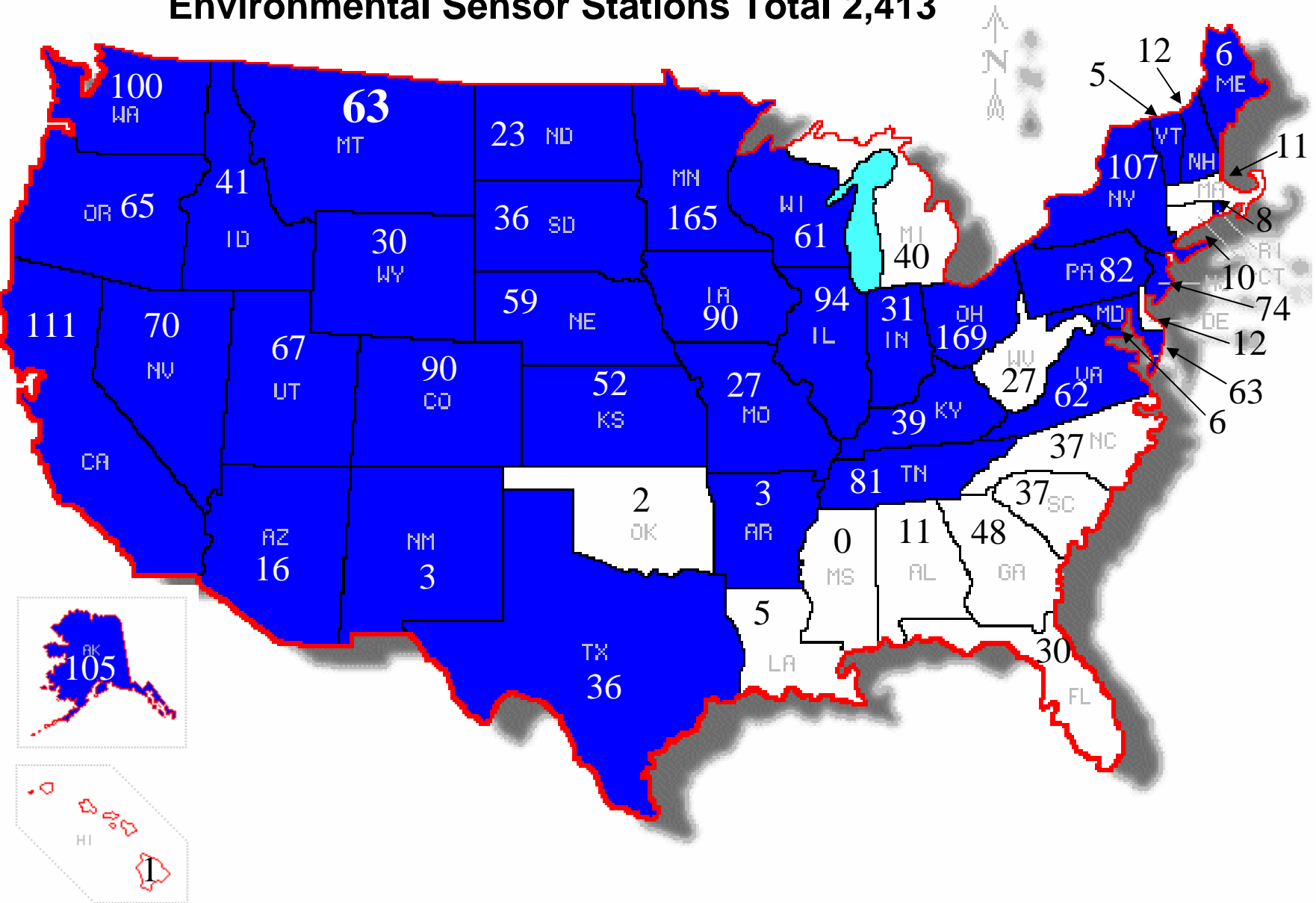


Several algorithms running simultaneously

Transmitted to the GUI at the shop

# ESS owned by State Transportation Agencies

Environmental Sensor Stations Total 2,413



# Road Weather Information System Environmental Sensor Station Siting Guidelines

An Environmental Sensor Station (ESS) is any site with sensors measuring atmospheric conditions, pavement conditions, and/or water level conditions.

Publication No.: FHWA-HOP-05-026

<http://ops.fhwa.dot.gov/publications/ess05/>





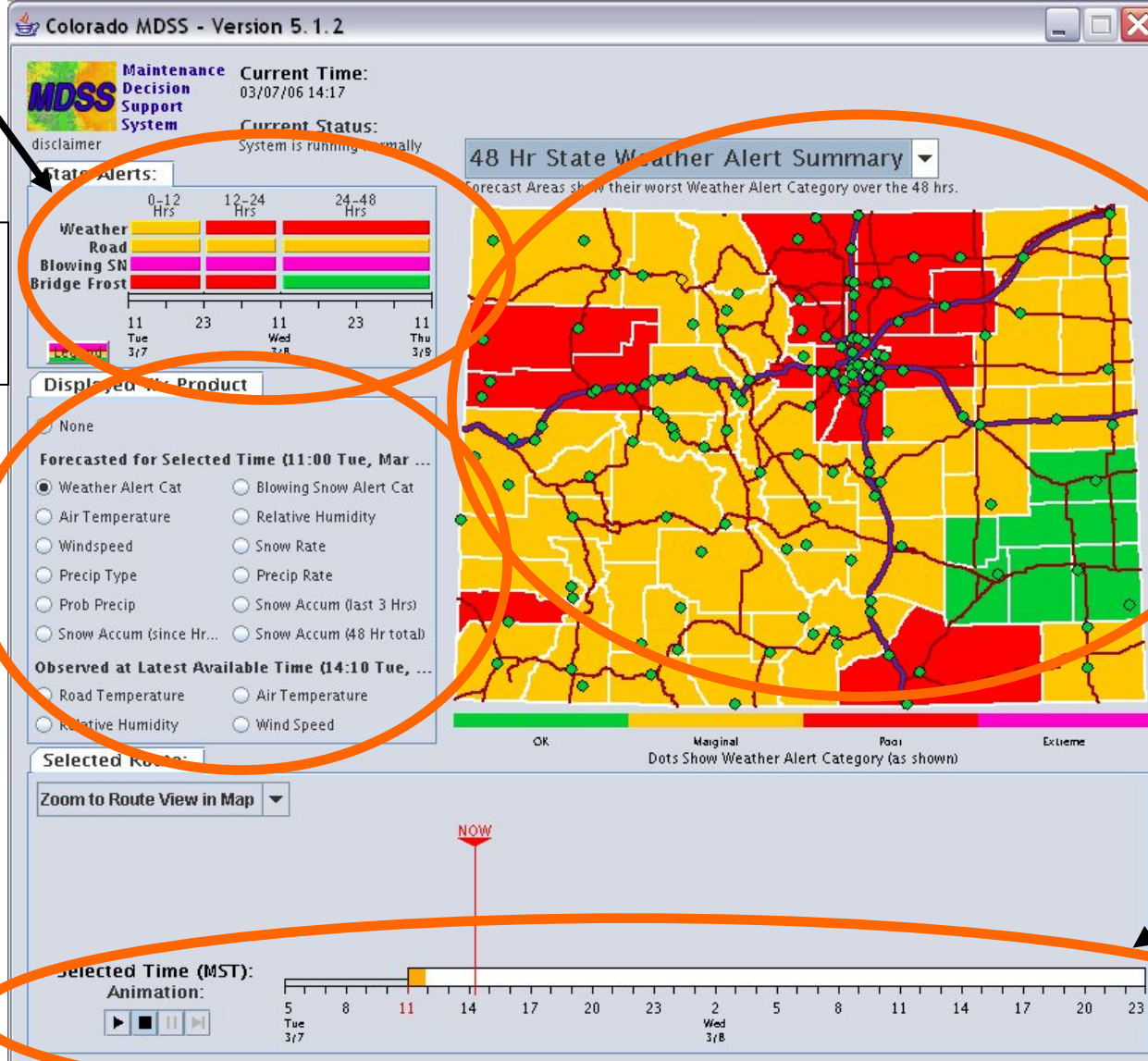
# MDSS Main Screen Display

Road & Weather Alerts

State Alerts and Local Routes

Weather & Road Parameters

Time Selection and Animation





## ***Outreach Efforts***

# MDSS 2006 Annual Stakeholder Meeting

Falls Church, VA August 10 -11

### Focus:

- The latest activities and advancements regarding MDSS deployments and
- The growing market for MDSS services.

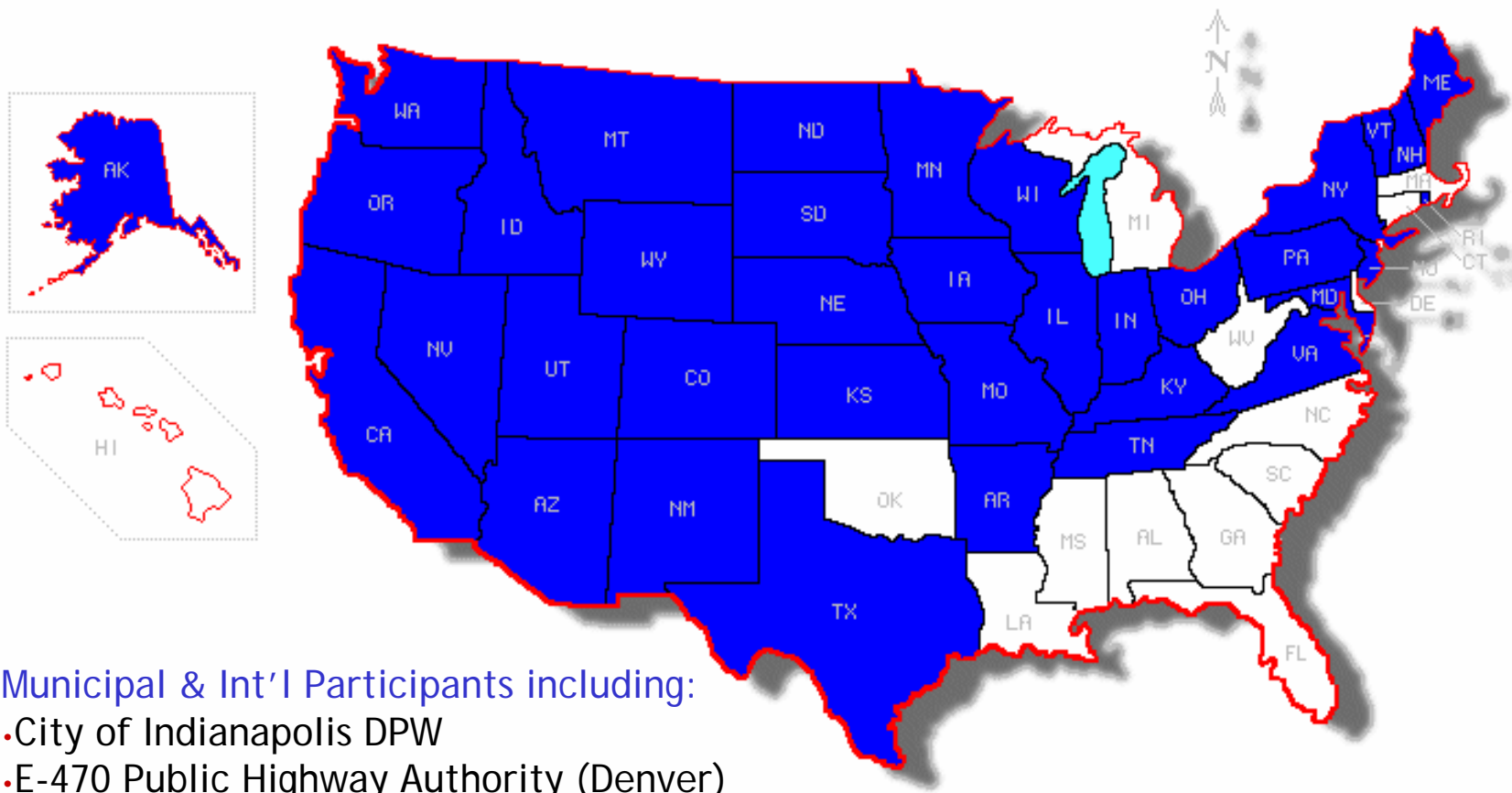
# 8<sup>th</sup> MDSS Stakeholder Meeting since 2000!

## ➤ 87 participants

- 32 representatives from 28 state DOTs
- 4 from local DOTs
- 7 from academic institutions
- 30 from the private sector representing 20 companies
- 11 from the U.S. Government
- 3 from the Canadian Government



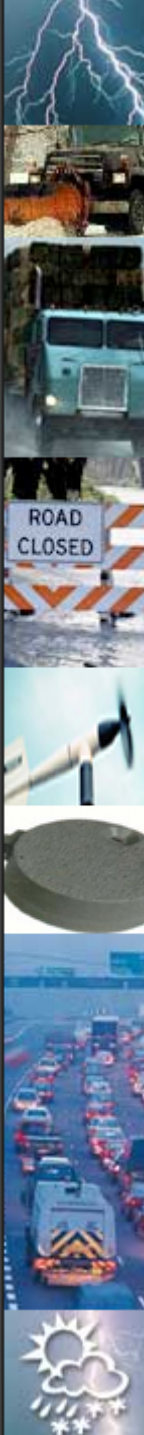
# MDSS Stakeholder Participation



## Municipal & Int'l Participants including:

- City of Indianapolis DPW
- E-470 Public Highway Authority (Denver)
- District of Columbia DOT
- New York State Thruway Authority
- Ontario Ministry of Transportation
- Environment Canada
- City/County of Denver, CO
- City of Grand Prairie, TX
- Dallas Area Rapid Transit

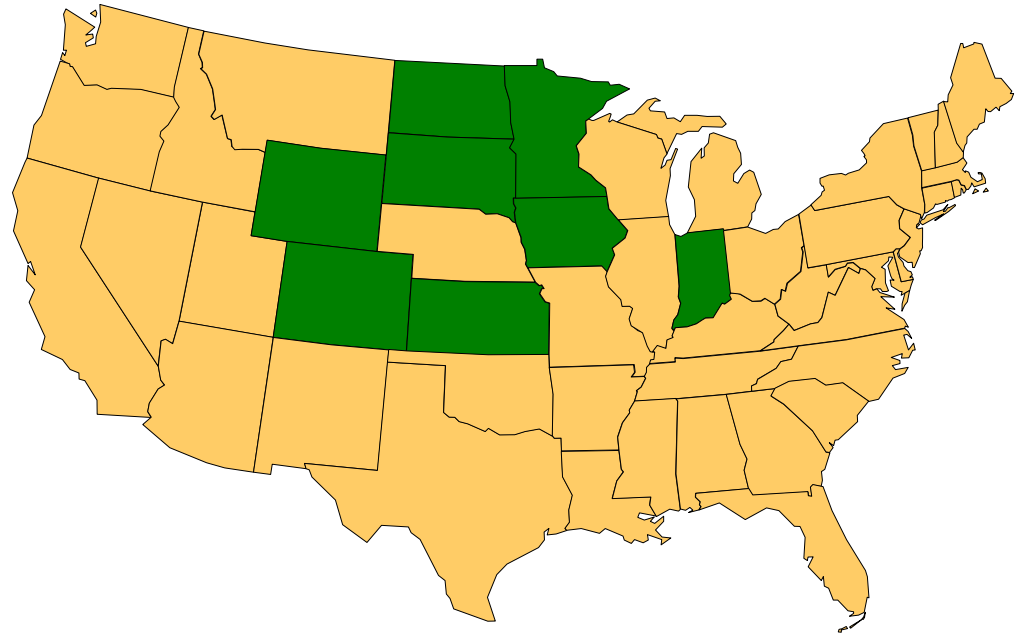
Participation  
2000-Present





## MDSS Pooled Fund Study Program

- Colorado DOT
- Indiana DOT
- Iowa DOT
- Kansas DOT
- Minnesota DOT
- North Dakota DOT
- South Dakota DOT  
(lead state)
- Wyoming DOT
- Aurora Pooled Fund Study
- Federal Highway Administration
- Meridian Environmental Technology





## Software & Documentation

Release-4.0 can be found at

[http://www.rap.ucar.edu/projects/rdwx\\_mdss/release3/index.html](http://www.rap.ucar.edu/projects/rdwx_mdss/release3/index.html)

Modules are provided on a non-exclusive basis.

All but the Road Weather Forecast System (RWFS) Component are being provided openly and without restriction, while the RWFS requires a license. A free trial license is available for the RWFS.

View MDSS Live:

[http://www.rap.ucar.edu/projects/rdwx\\_mdss/javaws/](http://www.rap.ucar.edu/projects/rdwx_mdss/javaws/)

Release-5.0 will be available next Summer.

# FHWA MDSS RoadShow

The Federal Highway Administration is offering free seminars to those that influence and manage winter road operations. The Roadshow describes the MDSS and its capabilities, providing a level of detail that helps public agencies make more informed decisions about their maintenance investments. There are two versions of the Roadshow, an [Executive Briefing](#) and a [Shop Session](#). Come see how MDSS technology is transforming the world of winter maintenance.

The [Shop Session](#) will highlight key elements of MDSS, including the use of real-time winter weather information, numerous winter maintenance treatment options, and how MDSS can be used as a training tool. This session is ~3 hours and geared towards transportation managers, maintenance engineers and operators.

The [Executive Briefing](#) will focus on deploying MDSS technology and why it can be a smart investment for your winter maintenance program. It covers prospective cost savings that can be achieved, and describes how managers can effectively deploy resources. This session is ~30 minutes and geared towards transportation agency executives.

To schedule and for more information, contact: Ray Murphy, FHWA Resource Center E-mail: [ray.murphy@fhwa.dot.gov](mailto:ray.murphy@fhwa.dot.gov) Phone: 708-283-3517 or visit [http://www.ops.fhwa.dot.gov/weather/seminars/mdss\\_roadshow/index.htm](http://www.ops.fhwa.dot.gov/weather/seminars/mdss_roadshow/index.htm)

# MDSS RoadShow



Shop Session



**MAINEDOT**  
Maine Department of Transportation



## Agenda

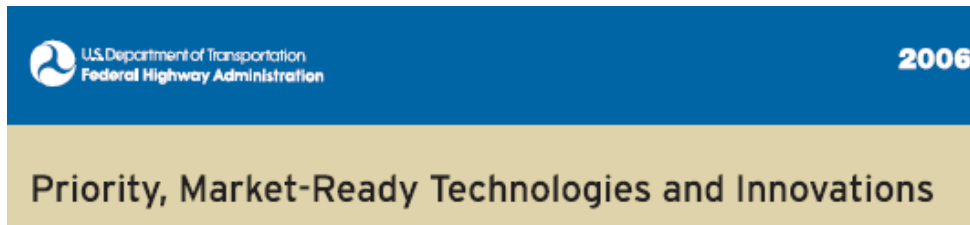
Time	Presentation	Duration
8:30 AM	Session 1 <b>Federal MDSS Development</b>	45 min
9:15 AM	Session 2 <b>MDSS Functionality</b>	45 min
10:00 AM	<b>Break</b>	15 min
10:15 AM	Session 3 <b>DOT Perspectives &amp; Vendor Capabilities</b>	45 min
11:00 AM	Session 4 <b>A Smart Investment in Winter Maintenance</b>	30 min



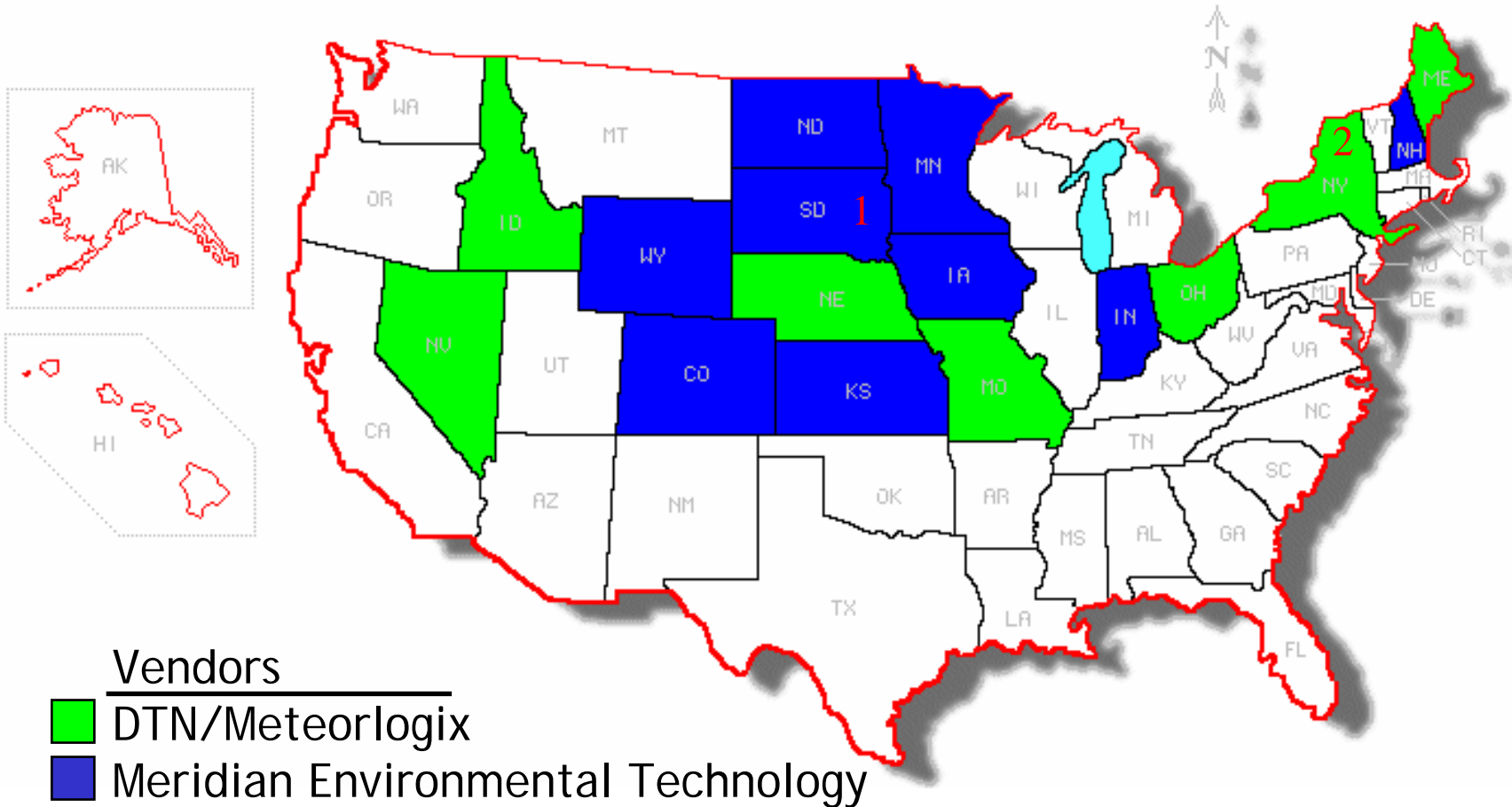


## MDSS: Market Ready!

- FHWA endorsed MDSS as a “market-ready technology and innovation” for 2006.
- AASHTO Technology Implementation Group (TIG) announced MDSS as a “2006 ready-to-implement technology” (AASHTO Journal 4/7/2006)

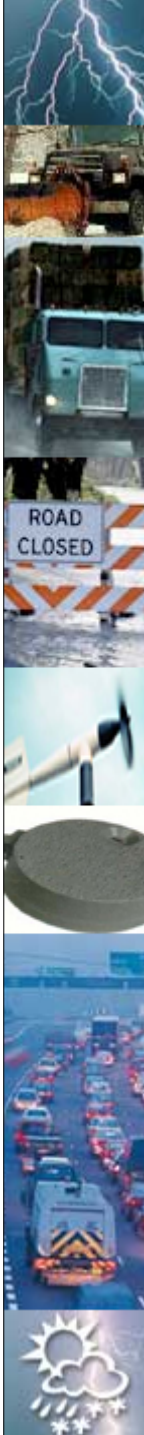


# Winter '05/'06 Participants



<sup>1</sup>South Dakota DOT is the lead Pooled-Fund State

<sup>2</sup>NY State Thruway Authority also participated in the DTN Pilot





## **MDSS... A Smart Investment in Winter Maintenance**

The Problem:

- Over 1,300 fatalities
- State and local agencies spend \$ Billions

**SOLUTION - by adding an MDSS to your tool-box, you will make a smart investment in the future of your own Winter Maintenance Program:**

- Potential cost savings can be achieved
- Managers & supervisors will more effectively employ their resources
- Improve your snow fighting techniques & material application rates.



## Iowa DOT Experience with MDSS



- **FHWA Prototype Development (3 Garages)**
- **Pooled Fund Study program (+ 6 Garages)**
- **All garages within every County in Iowa (+110 Garages)**



## Iowa DOT Experience with MDSS

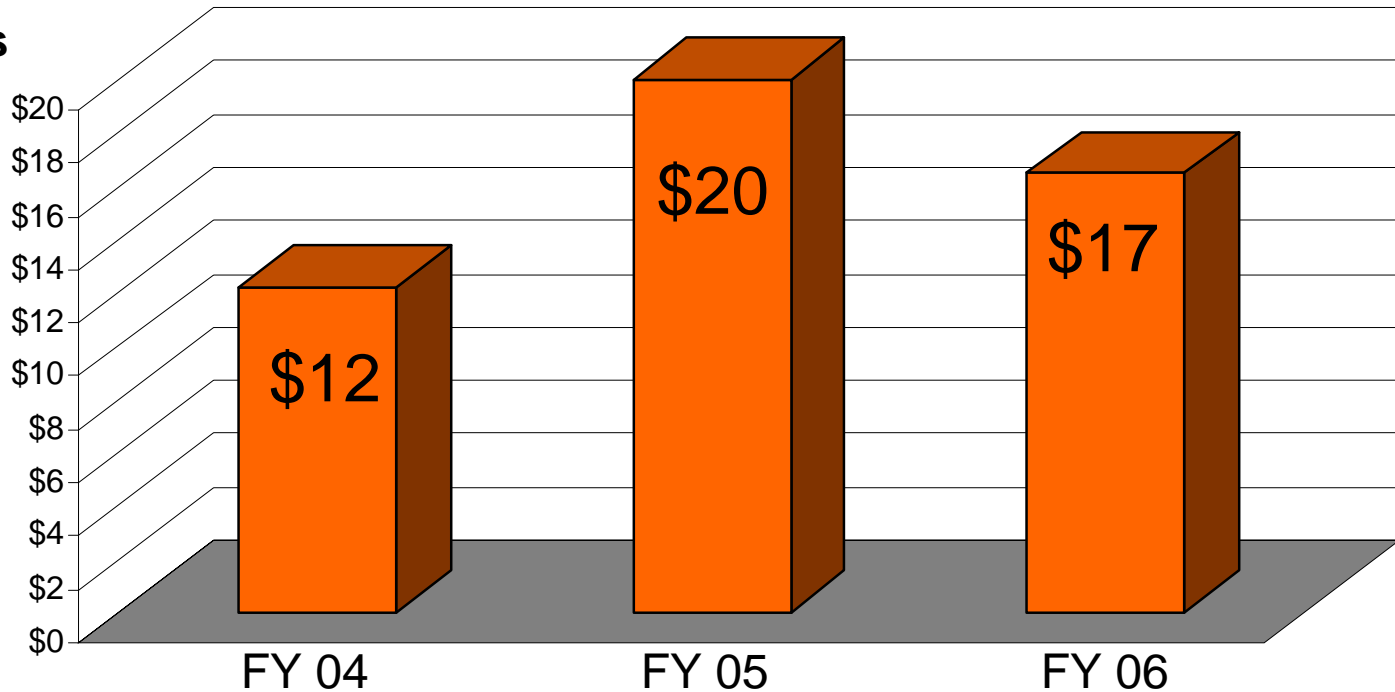


- Estimate **10% savings** in operational costs  
~\$3 to \$4 million annual savings in  
labor, materials & equipment
- Operate more efficiently
- Stewards of the environment



## Maine DOT Snow and Ice Control

Millions

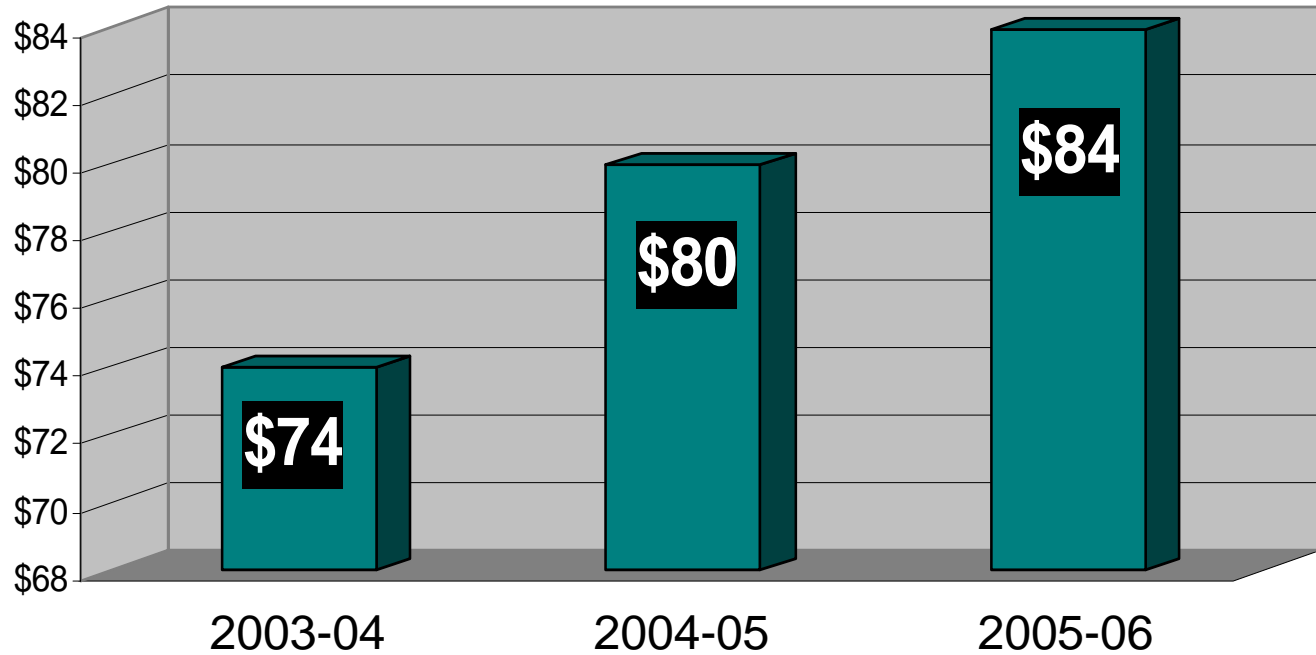


Activity includes all necessary labor, equipment, and materials used for applying salt, other chemicals, or sand to the roadway during or after weather events; for plowing snow, ice, and slush from roadways and bridges; and for plowing areas adjacent to the roadway



## New York State DOT Snow and Ice Control

Millions



Activity includes labor, equipment, and materials.



## **X-DSS Concept... Extending MDSS Core Capabilities**

- The MDSS prototype was envisioned & designed to be modular
- Many of the MDSS core components could be utilized in DSS for different transportation operations
- This vision of “eXtending” the MDSS core capabilities has been coined as X-DSS or the eXtensible Decision Support System
- The extensibility allows the “X” to imply association with different operations





## Introducing X-DSS

- Builds upon the core capabilities of the base MDSS (reduces development costs)
- Expands this investment to other operations within surface transportation:
  - Summer Maintenance
  - Traffic Management
  - Construction
- Will require creation and participation of new stakeholder groups



## VII – Vehicle Infrastructure Integration Day-1 Applications - MDSS

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- VII (Vehicle Infrastructure Integration) is a USDOT/FHWA sponsored initiative aimed at developing and deploying a nationwide integrated communications infrastructure that supports both vehicle-to-vehicle and vehicle-to-infrastructure communications
- Development of Day-1 applications will be used to help define and refine what this network will look like on the first day it becomes operational



## Day-1 applications

#	Name	Lead
1	Emergency Brake Warning	CAMP
2	Traffic Signal Violation Warning	CAMP
3	Stop Sign Violation Warning	CAMP
4	Curve Speed Warning	VIIC
5	Display Local Signage	VIIC
6	Present OEM Off-Board Navigation	VIIC
7	Present OEM Reroute Information	VIIC
8	Present Spontaneous Traffic Information	VIIC
9	Electronic Payments: Parking / General	VIIC
10	Electronic Payments: Gasoline	VIIC

#	Name	Lead
11	Electronic Payment: Toll Roads	USDOT
12	Traveler Information	USDOT
13	Ramp Metering	USDOT
14	Signal Timing Optimization	USDOT
15	Pothole Detection	USDOT
16	Winter Maintenance	USDOT
17	Corridor Management Planning Assistance	USDOT
18	Corridor Management Load Balancing	USDOT
19	Weather Information Traveler Notification	USDOT
20	Weather Information Improved Weather Observing	USDOT



## Day-1 application #16: Winter Maintenance

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### **PURPOSE:**

Provide additional environmental and surface condition information to the management functions responsible for winter maintenance on our nation's roadways

### **GOALS:**

- Collect environmental data from multiple vehicle sensors
- Process this data into MDSS, thereby:
  - Improving real-time surface condition information provided to transportation operators and managers
  - Improving the accuracy of predictive forecasts for route specific surface conditions and associated treatment recommendations



## Examples of VII probe sensor data and derived meaning(s)

Onboard Vehicle Sensor	Derived Information
Date time stamp	<i>Timeframe</i>
GPS vehicle location	<i>Vehicle location, altitude and direction</i>
Vehicle speed	<i>Traffic data/implied surface conditions</i>
Wiper system state	<i>Precipitation detection</i>
Exterior air temperature	<i>Estimated ambient temperature</i>
Infrared temperature sensor (√)	<i>Pavement surface temp (non-snow covered)</i>
Plow blade position (√)	<i>Surface treatment information</i>
Chemical type selection (√)	<i>Type of chemical applied</i>
Chemical application (√)	<i>Whether a chemical is being applied</i>
Chemical application rate (√)	<i>Amount of chemical applied</i>
Antilock brake status	<i>Pavement surface state</i>
Traction control status	<i>Pavement surface state</i>
Vehicle stability control	<i>Pavement surface state</i>
Steering inputs	<i>Pavement surface state</i>
Steering inputs & accelerometer outputs	<i>Deduced vehicle skid</i>
Steering inputs w/wo accelerometer outputs	<i>Snow accumulation on the road</i>
Heater/defroster state	<i>Nature of precipitation, visibility index, etc.</i>
Window washer state	<i>Visibility index, road conditions</i>



## Examples of VII/MDSS generated messages to on-board maintenance vehicle displays

### Mobility phrases (and associated color) displays

**GOOD MOBILITY**

**REDUCED MOBILITY**

**CAUTION! SLIPPERY ROAD SURFACE**

**DANGER! VERY SLIPPERY ROAD SURFACE**

### Treatment phrases

**REDUCE NACL TO 100 LBS/LANE MILE**

**INCREASE NACL TO 250 LBS/LANE MILE**

**RECOMMEND ANTI-ICING OPERATIONS**

**RECOMMEND PLOW ONLY OPERATIONS**



## Winter Maintenance Concept of Operations

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- Winter Maintenance has been chosen as one of the first four Day-1 applications for which a Concept of Operations is going to be developed
- Tasks will include:
  - Developing an initial draft for stakeholder review
  - Conducting an initial web-meeting with stakeholders
  - Hosting an industry workshop
  - Completing a final Con Ops for Winter Maintenance
- Estimated completion timeframe – Jan/Feb 2007



On behalf of the Federal Highway Administration's  
Road Weather Management Program,

**Thank you for your time and attention!**

- For information on **Road Weather Management**
  - Paul Pisano, FHWA HQ
  - Paul.Pisano@dot.gov, 202-366-1301
- For information on MDSS RoadShows:
  - Ray Murphy, FHWA Resource Center
  - Ray.Murphy@dot.gov 708-283-3517
- FHWA **RWM** Web Page
  - [www.fhwa.dot.gov/weather/](http://www.fhwa.dot.gov/weather/)

