The Implementation of the Maintenance Decision Support System (MDSS): The MnDOT Story

NRITS Conference August 27th, 2013
St. Cloud, MN

Your Destination...Our Priority

What is MDSS?

Maintenance Decision Support System

- Decision logic system that integrates current weather, maintenance and road condition information with forecasted weather and road surface conditions to evaluate and recommend treatment options
- Transforms huge volumes of weather and maintenance information into direct response recommendations
- Provides more effective use of maintenance resources
- Increases safety, reliability and mobility - can save time, money & resources

What is an AVL?

Automated Vehicle Location

- Technology used in a vehicle to determine geographic location and transmit information to and from the vehicle
- MnDOT's AVL-equipped vehicles are mobile weather stations and mobile data collectors for MDSS
- Provides in-cab, real-time weather information to the vehicle operator to support weather-related decision making for maintenance activities and events

MnDOT's MDSS Activities

- Involved since start of FHWA project in late 90's
  - Member of Graphical User Interface (GUI) design team
  - Location of Proof of Concept testing
- Pooled-fund research
  - Refined system & tailored to members needs
  - Limited scale deployment
  - Began with 4 members, now at 14 states
  - Recognized by FHWA and AASHTO as "Market Ready Technology"

Why add AVL to MDSS?

- AVL provided the real-time feedback MDSS needed to function in an operational setting
- AVL gives operators on-demand access to MDSS features
  - Latest recommendations
  - Radar screens and loops
  - Route Specific Weather Forecasts
  - Nearby snowplow locations
  - Forces accountability by recording actions

Present status

- Mn/DOT's participation has grown from 6 test sections to ~350 throughout the state
- AVL is currently installed in ~370 plows
  - Expect the number to be well over 400 by 2014
  - Standard equipment on all new snowplows
- Exploring new uses for data through FHWA research project "ITS Mobile Observations"
  - Includes data from vehicle CAN-Bus

Winter of 2011/2012

- 79 working AVL units installed prior to the start of the 2011/2012 Snow & Ice season
  - District 2 - 27 units
  - District 3 - 19 units
  - District 4 - 18 units
  - District 8 - 15 units

Winter of 2012/2013

By the end of the 2012/2013 Snow & Ice Season

- 370 AVL units installed on Plow Trucks
- 19 AVL units installed on Light Duty vehicles
- Total of 389 AVL units installed in MnDOT

Moving forward

- Actively promote the technology
  - Demonstrate benefits to agency and public
  - Help build grassroots support
    - Overcome natural resistance to change
- Expanded project team
  - Added staff for training and support
  - Transfering knowledge to the local level

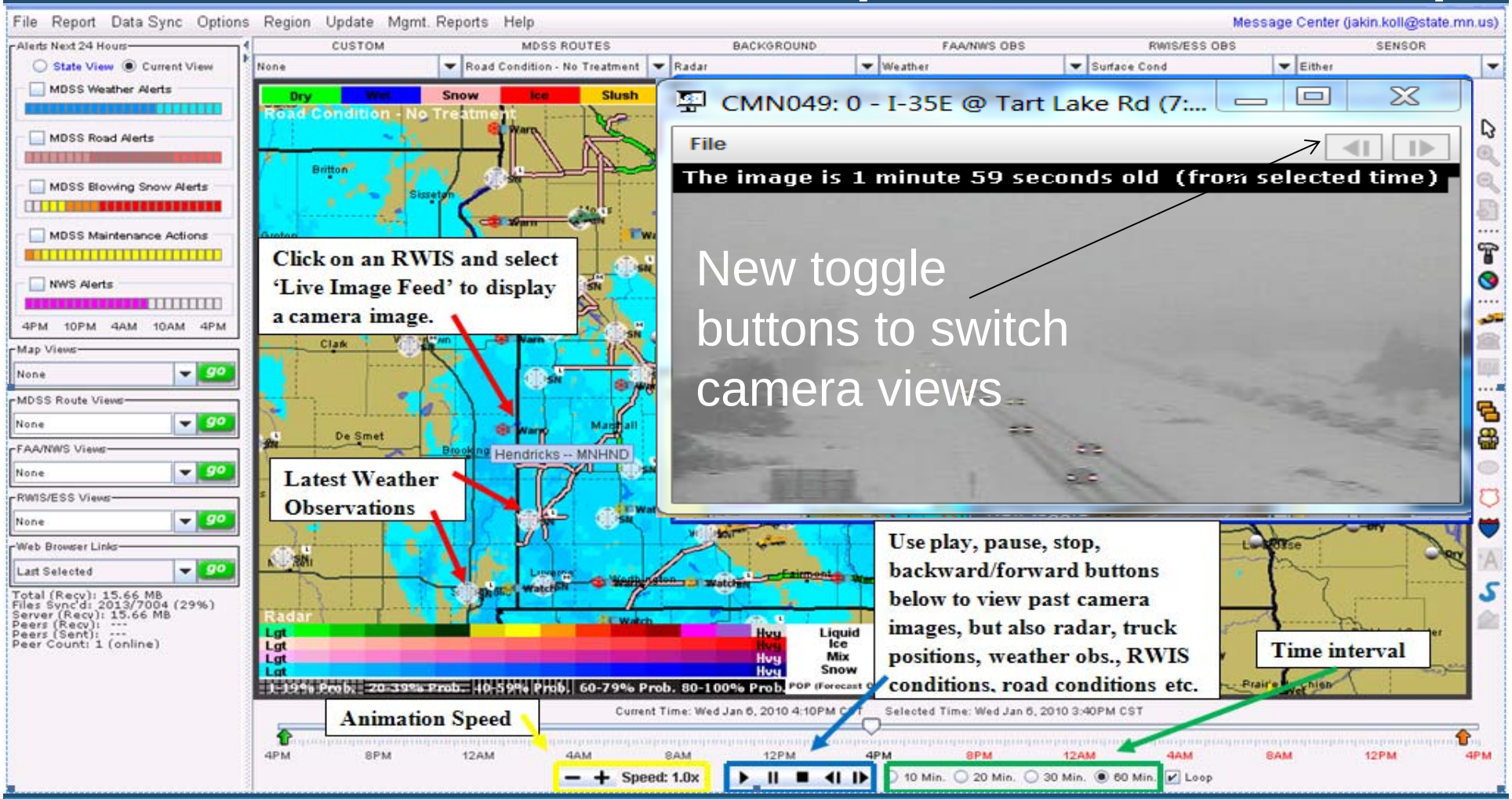
Challenges ahead

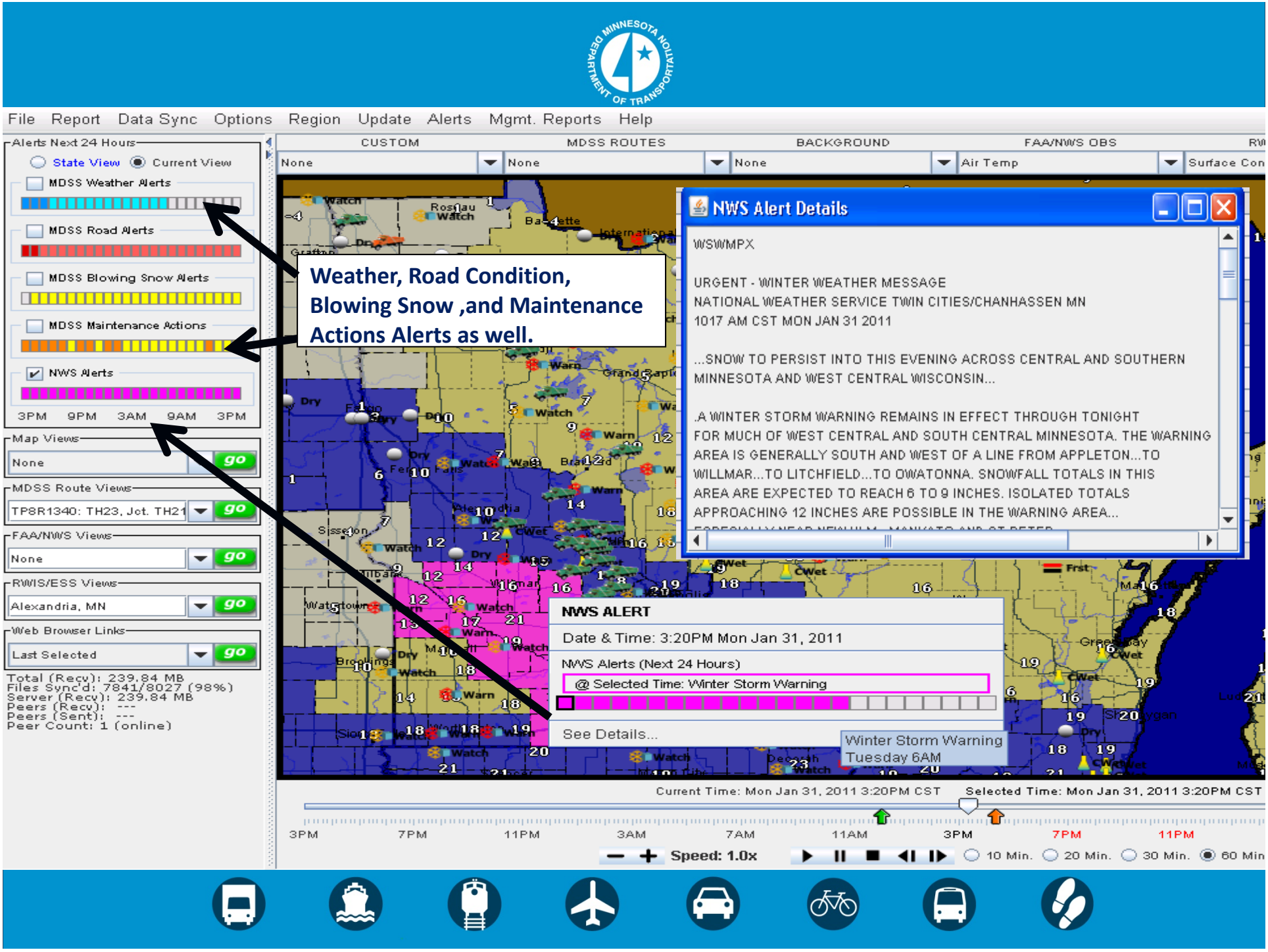
- Expectations vary across state
  - Need to develop clear plan, articulate it to all, and establish accountability measures for adoption.
- Political climate and budget shortage
  - Difficult to gain support for new initiatives
  - Push to downsize government

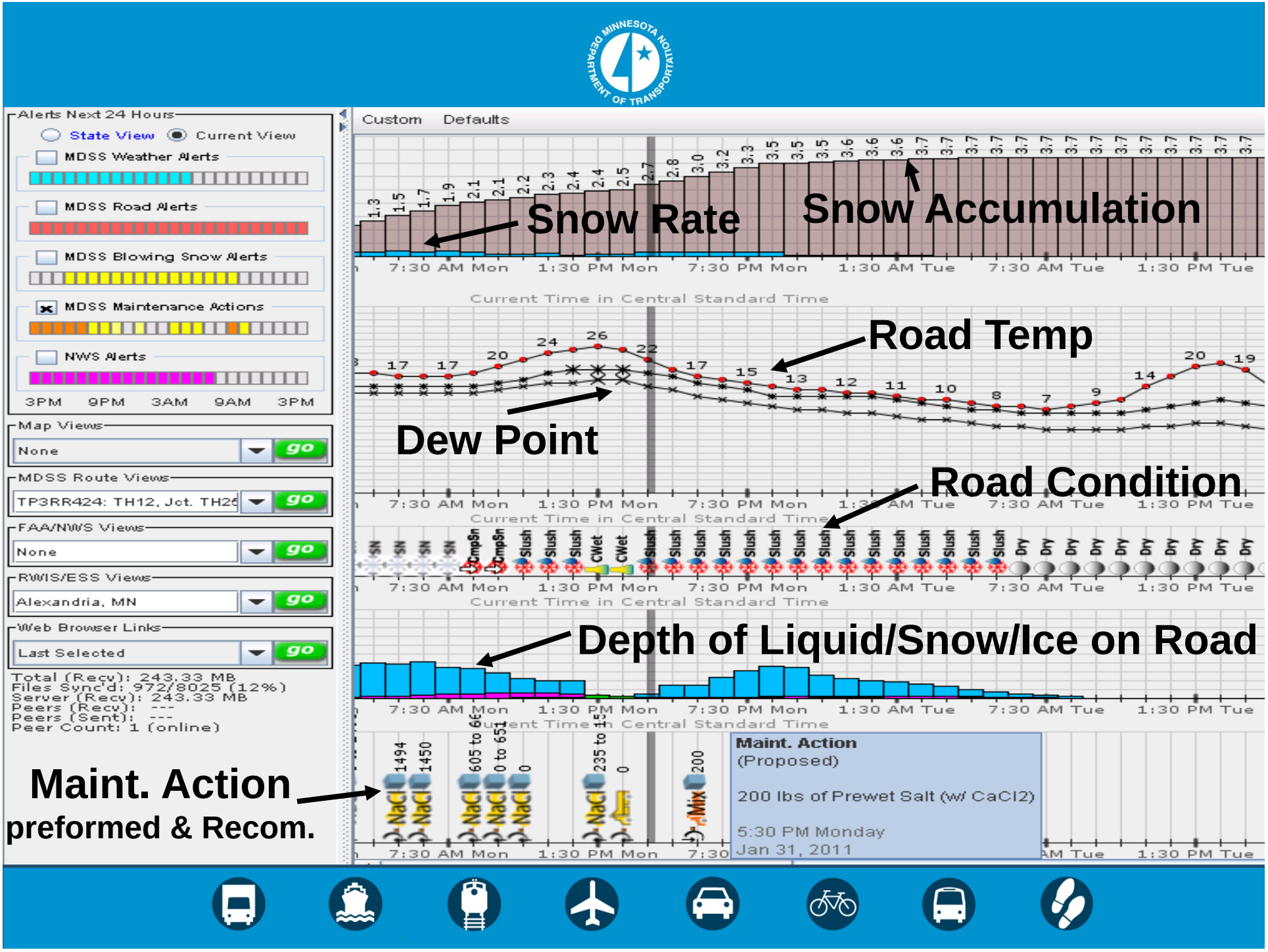
Positives

- MDSS/AVL can produce dramatic results
- Mature enough for agencies to successfully adopt
- Mn/DOT's Management recommends deployment
- Nationally State DOT's are implementing
  - Some locals also

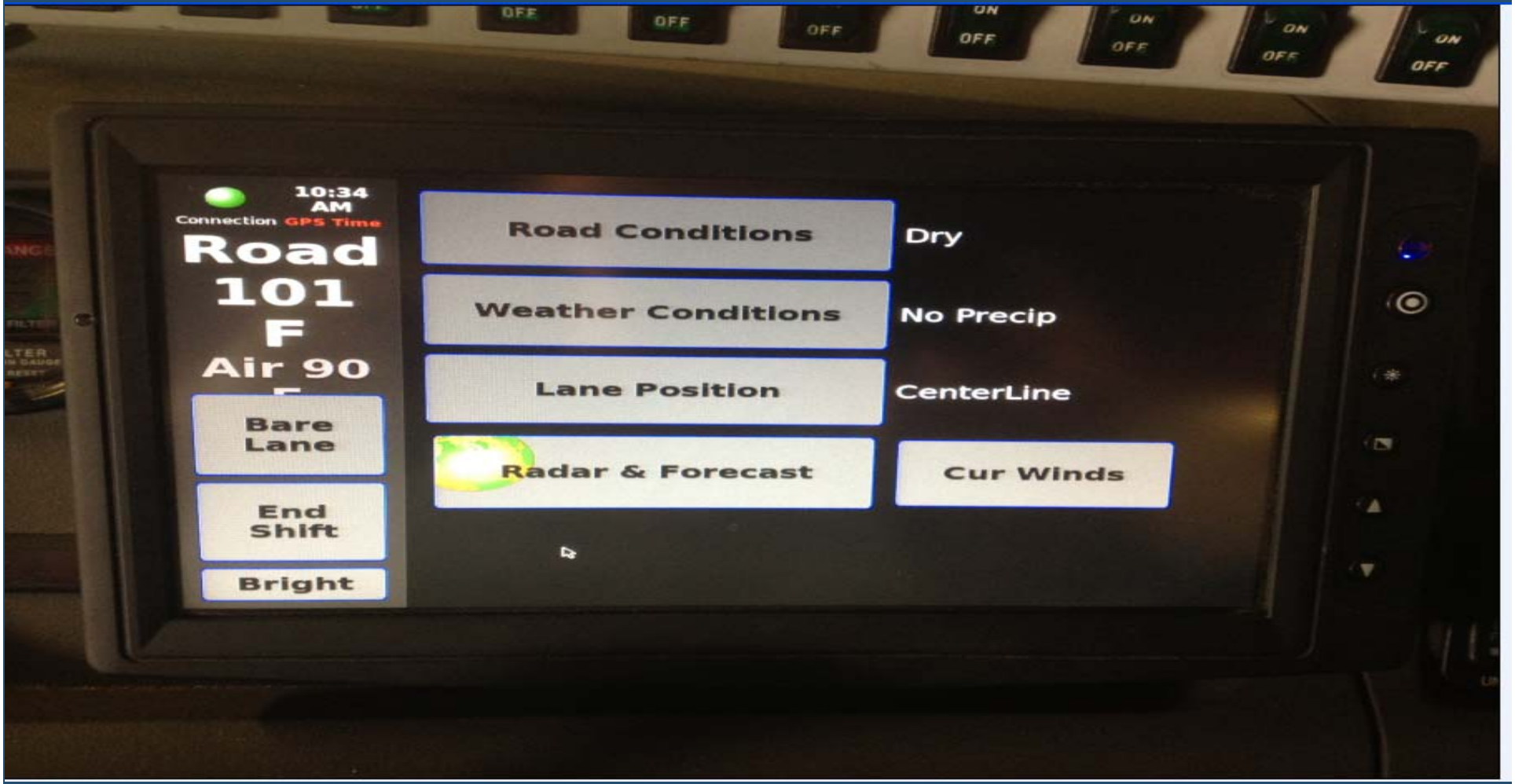
MDSS on the Desktop in Office/Shop



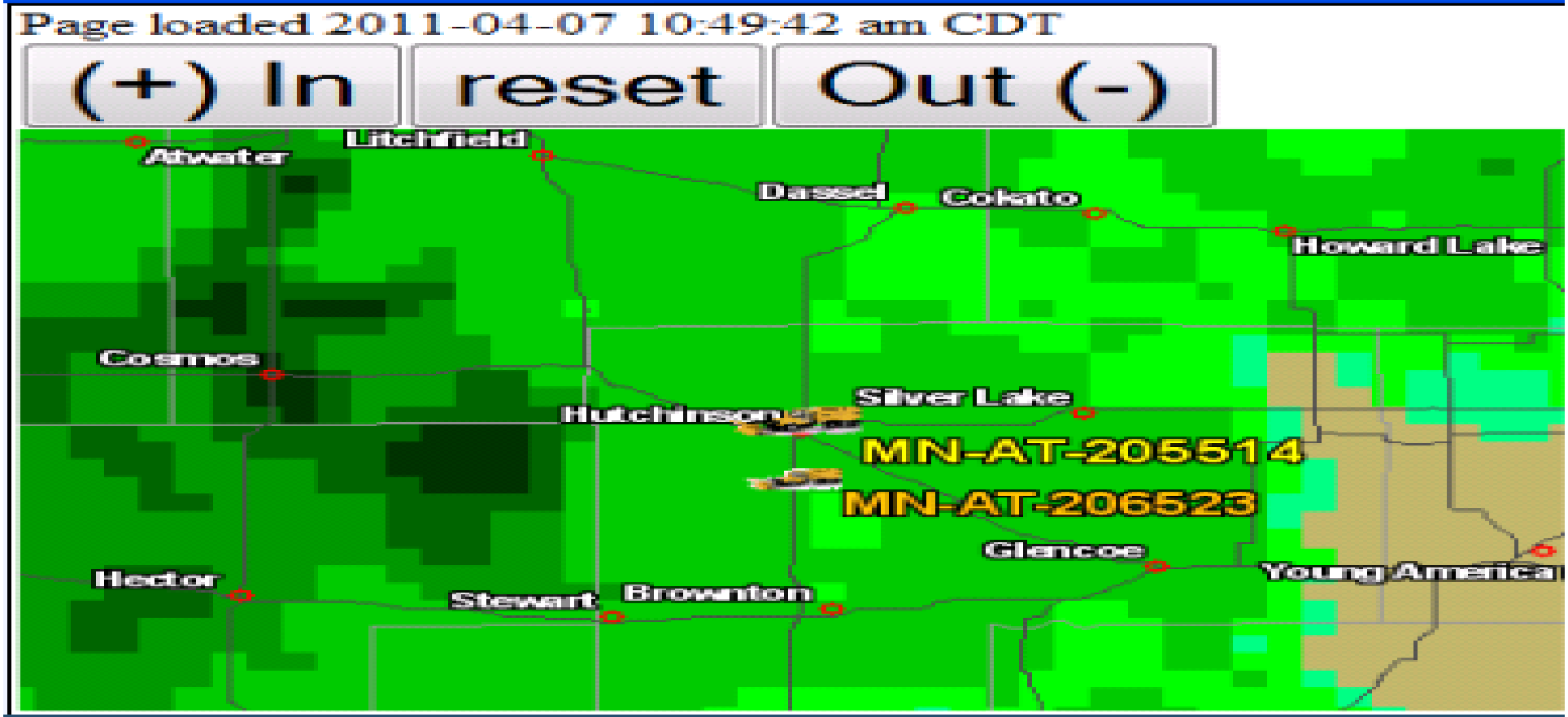

File Report Data Sync Options Region Update Alerts Mgmt. Reports Help
Alerts Next 24 Hours
State View Current View
MDSS Weather Alerts
MDSS Road Alerts
MDSS Blowing Snow Alerts
MDSS Maintenance Actions
NWS Alerts
3PM 9PM 3AM 9AM 3PM
Map Views
None go
MDSS Route Views
TP8R1340: TH23, Jct. TH21 go
FAA/NWS Views
None go
RWIS/ESS Views
Alexandria, MN go
Web Browser Links
Last Selected go
Total (Recv): 239.84 MB
Files Sync'd: 7841/8027 (98%)
Server (Recv): 239.84 MB
Peers (Recv): ---
Peers (Sent): ---
Peer Count: 1 (online)
CUSTOM
MDSS ROUTES
BACKGROUND
FAA/NWS OBS
None
None
None
Air Temp
Surface Con
Weather, Road Condition, Blowing Snow ,and Maintenance Actions Alerts as well.
NWS Alert Details
WSWMPX
URGENT - WINTER WEATHER MESSAGE
NATIONAL WEATHER SERVICE TWIN CITIES/CHANHASSEN MN
1017 AM CST MON JAN 31 2011
...SNOW TO PERSIST INTO THIS EVENING ACROSS CENTRAL AND SOUTHERN MINNESOTA AND WEST CENTRAL WISCONSIN...
.A WINTER STORM WARNING REMAINS IN EFFECT THROUGH TONIGHT FOR MUCH OF WEST CENTRAL AND SOUTH CENTRAL MINNESOTA. THE WARNING AREA IS GENERALLY SOUTH AND WEST OF A LINE FROM APPLETON...TO WILLMAR...TO LITCHFIELD...TO OWATONNA. SNOWFALL TOTALS IN THIS AREA ARE EXPECTED TO REACH 6 TO 9 INCHES. ISOLATED TOTALS APPROACHING 12 INCHES ARE POSSIBLE IN THE WARNING AREA...
NWS ALERT
Date & Time: 3:20PM Mon Jan 31, 2011
NWS Alerts (Next 24 Hours)
@ Selected Time: Winter Storm Warning
See Details...
Winter Storm Warning
Tuesday 6AM
Current Time: Mon Jan 31, 2011 3:20PM CST
Selected Time: Mon Jan 31, 2011 3:20PM CST
3PM 7PM 11PM 3AM 7AM 11AM 3PM 7PM 11PM
Speed: 1.0x
10 Min. 20 Min. 30 Min. 60 Min


Alerts Next 24 Hours
State View
Current View
MDSS Weather Alerts
MDSS Road Alerts
MDSS Blowing Snow Alerts
MDSS Maintenance Actions
NWS Alerts
3PM 9PM 3AM 9AM 3PM
Map Views
None
go
MDSS Route Views
TP3RR424: TH12, Jct. TH25
FAA/NWS Views
None
RWIS/ESS Views
Alexandria, MN
Web Browser Links
Last Selected
Total (Recv): 243.33 MB
Files Sync'd: 972/8025 (12%)
Server (Recv): 243.33 MB
Peers (Recv): ---
Peers (Sent): ---
Peer Count: 1 (online)
Custom
Defaults
Snow Rate
Snow Accumulation
Current Time in Central Standard Time
Road Temp
Dew Point
Road Condition
Depth of Liquid/Snow/Ice on Road
Maint. Action
(Proposed)
200 lbs of Prewet Salt (w/ CaCl2)
5:30 PM Monday
Jan 31, 2011
Maint. Action
preformed & Recom.

AVL Units in Truck: End-of-Shift Report button. (details later)



MDSS in Truck: Color-coded truck centered Radar shows your trucks location (yellow) and other AVL equipped trucks (orange) near you. The Radar view follows your truck around. (Auto Refresh)



MDSS in Truck: End-of-Shift Report

Shows amount of material applied and number of miles/hours spent sanding on each route maintained during shift

Accessed from: Truck, Smartphone or Office/Shop computer

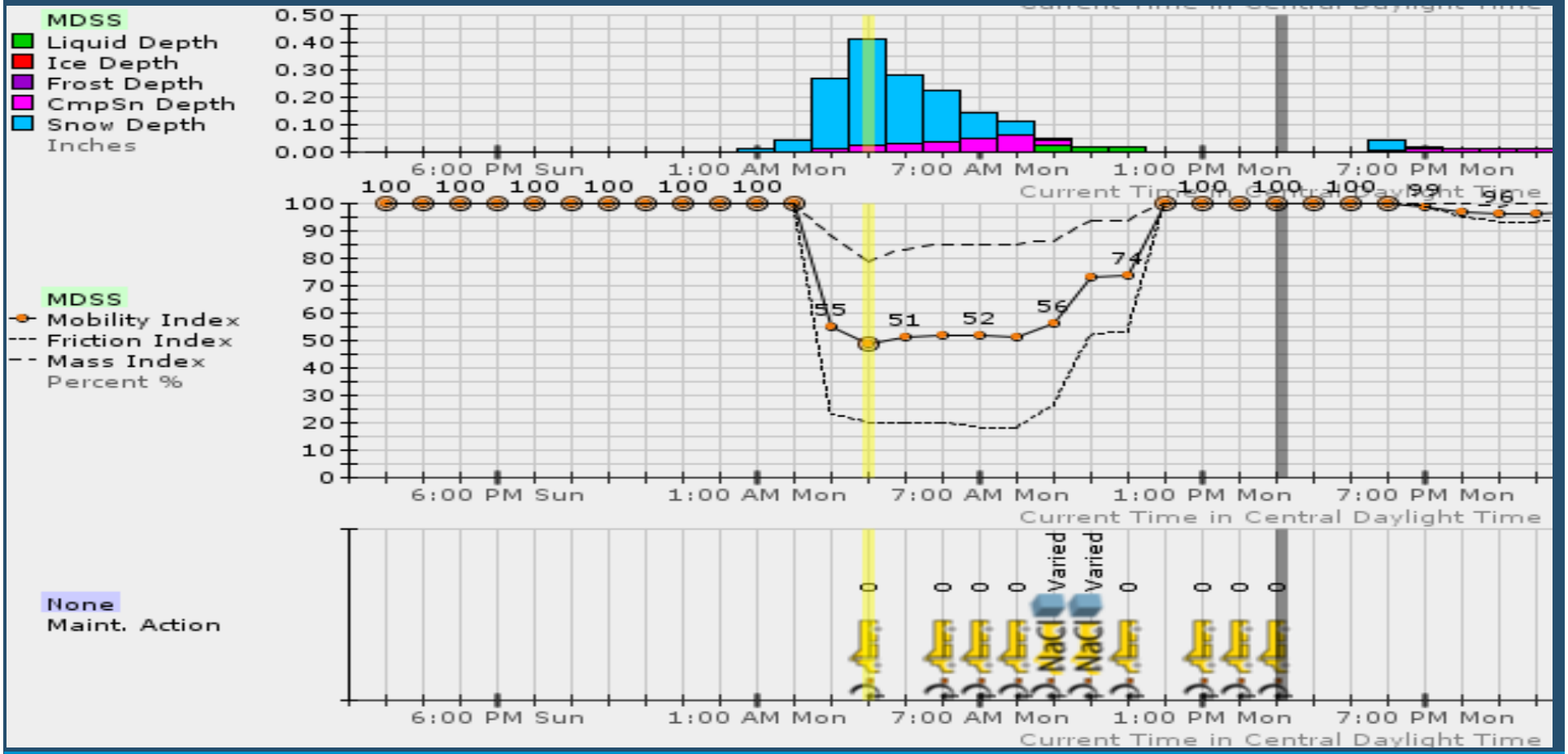
MN-208572 | MN-208572 | MN-208572

Report Index:

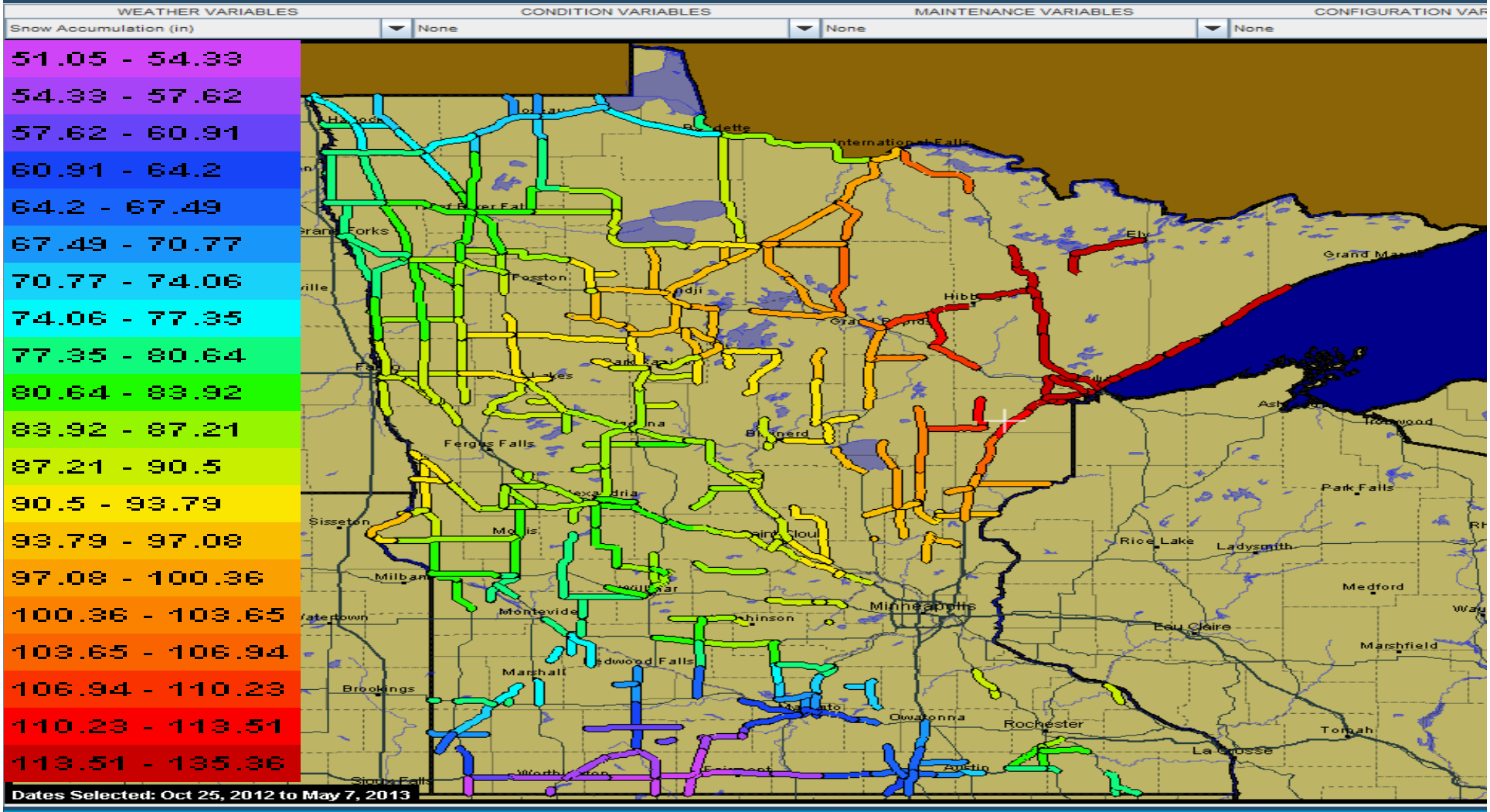
Route(s)	Truck(s)	Miles	Hours	Materials	
All	208572	43.5	1.7	12118 lbs Salt (6.06 tons)	More Details...
TP7R060F	208572	38.9	1.3	11442 lbs Salt (5.72 tons)	More Details...
TP7T060G	208572	2.1	0.1	630 lbs Salt (0.32 tons)	More Details...
TP7R060D	208572	0.8	0.0	None	More Details...

MDSS Ongoing Research

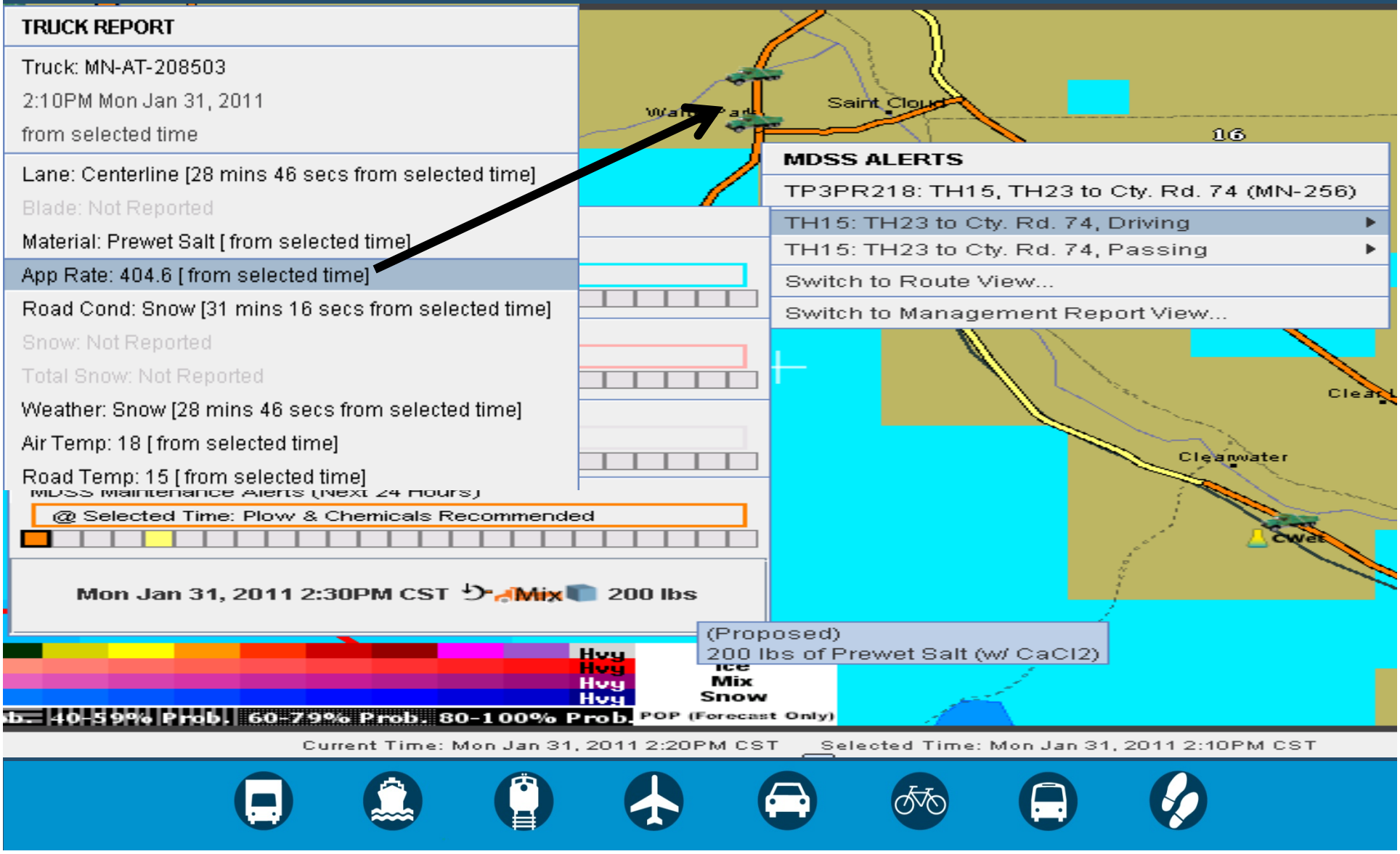
Investigation in road condition based mobility index



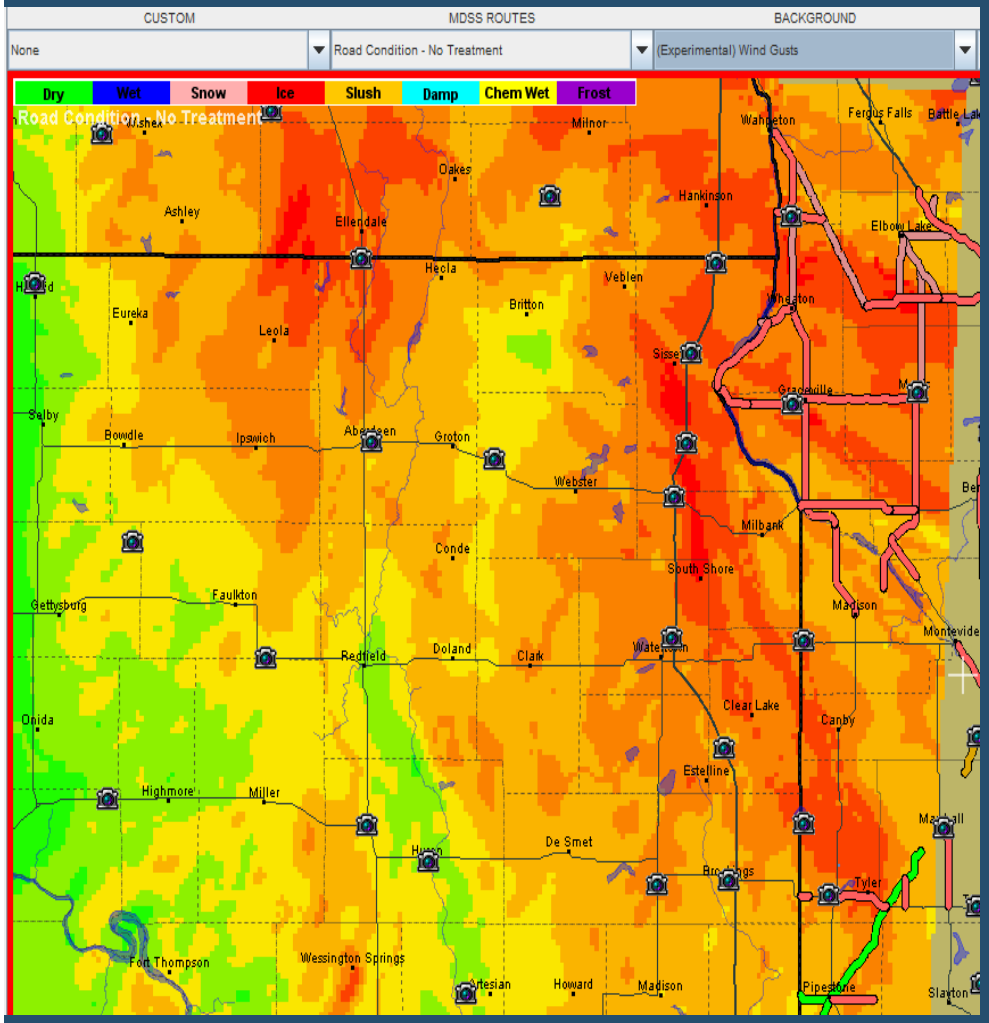
Continued Evolution of Management Tools

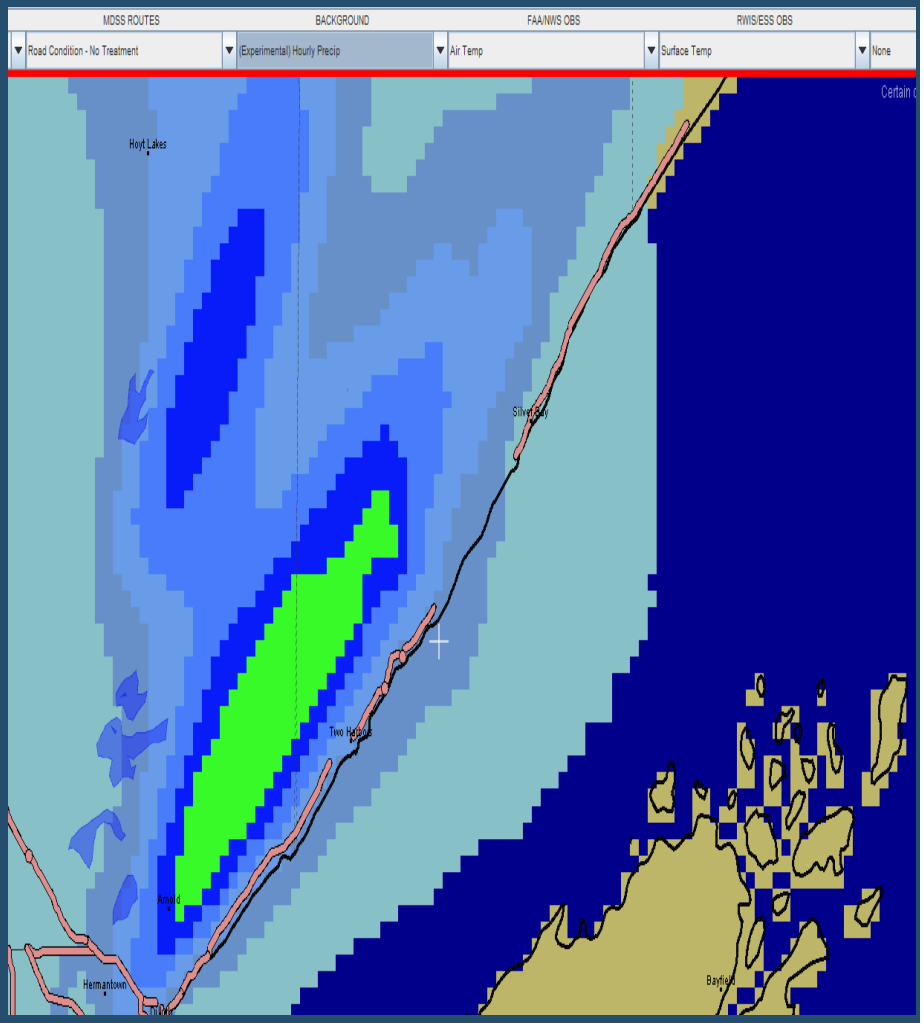


Continued Assessment of MDSS Recommendations

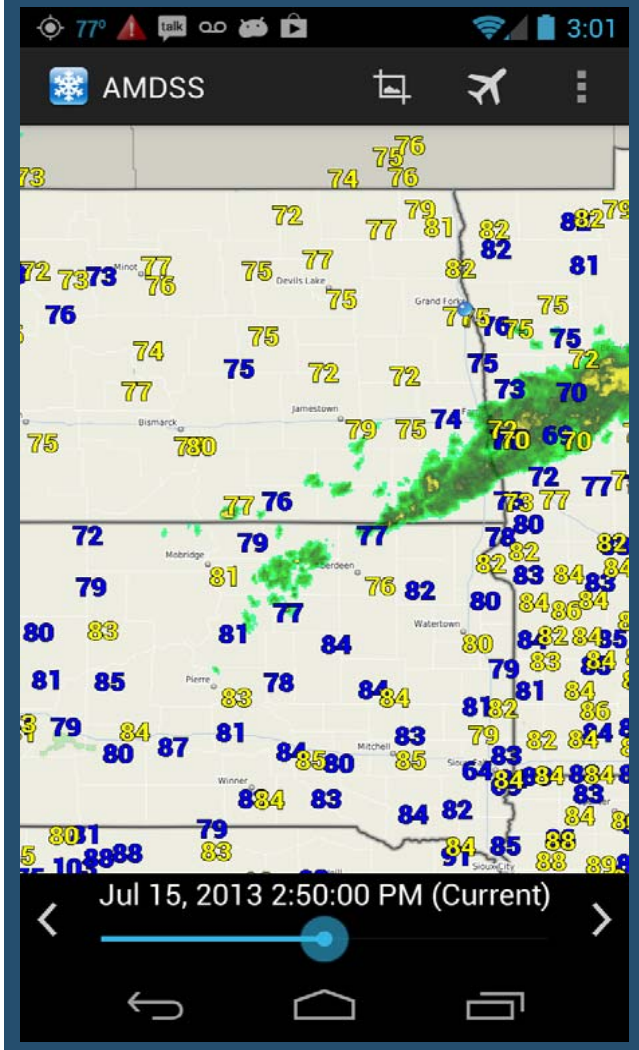


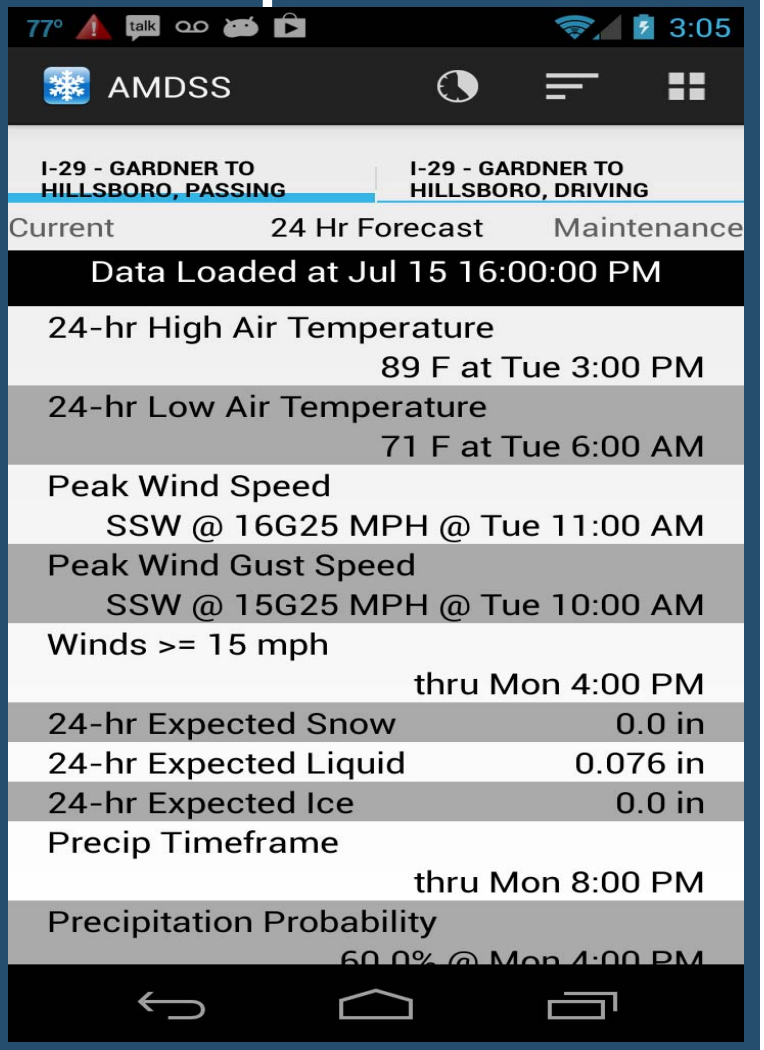
Fine-scale Weather Modeling for Roadway Impacts





Enhance Mobile MDSS options





Other Uses for AVL

- Proof of Response/Actions in Complaints/Lawsuits
- Marking potholes, weed patches, accidents, etc.
- Paint Stripe Crew
  - Site Specific Radar, Current Winds and Forecast
    - Installed in Plow Truck that follows crew in D2 and D3
- Herbicide Sprayer
  - Site Specific Radar, Current Winds and Forecast
  - Installed on one truck in Metro
    - Records chemical usage info through onboard spray system

MnDOT Safe Corridor Enhancements Project

AVL equipped trucks send message to VMS network

Challenges

- Management's early position took a "wait and see" approach
  - Difficult to get multi-year funding –feast or famine
  - Difficult to gain widespread acceptance – viewed as ongoing research
- Busy Bee syndrome
  - Didn't have time to use MDSS
  - Didn't see it as high priority due to lack of commitment from management
  - Supervisors took a "wait for it to disappear" approach
  - Project seen as belonging to "just a few pushers" instead of MNDOT

Implementation Essentials

- Planning
  - Each deployment needs to develop, articulate and follow a plan
  - Concept must be supported and promoted by management as a department goal and/or objective
- Training and Support
  - A deployment plan needs to address increased training needs over a multi-year period
  - Developing a robust support network by identifying and grooming area champions and super users will speed tech transfer and produce a sustainable long-term deployment
- Funding
  - Need to fund agency specific developments and equipment purchases until deployment is mature enough to produce savings

MNDOT's Success Stories

- Field personnel are asking for this technology – not trying to hide from it...
- Increased use of both AVL and MDSS is helping to quickly identify and solve issues
- "End of Shift Reports" are being used by operators to improve material use reporting
- Confidence in MDSS recommendations is growing - encouraging operators to take "Intelligent Risks"

Lessons Learned

- The difference between a research and deployment project is huge
  - Research needs only “pockets of acceptance”
  - Deployment needs to identify each “pocket of resistance”
- Research projects sometimes run into a wall
- Implementation projects are driven into a box canyon
  - You can’t back up or you will lose the entire group you have convinced to follow you
  - Communications, marketing and damage control become critical paths
  - If you stop moving forward your followers go in different directions

Bottom Line = added value

- MDSS Helps achieve MDOT's Strategic goals
  - Safety – provide consistent levels of service
  - Mobility – enhance movement of freight and people
  - Innovation - give our operators the tools they need to take "intelligent risks"
  - Leadership – be a global leader in Transportation
  - Transparency – Document Operations information and make it readily available to the public

THE WORLD RESISTS CHANGE. YET WITHOUT IT THERE WOULD BE NO PROGRESS.

MnDOT MDSS Contacts

- Jakin Koll: MDSS/AVL Implementation Coordinator (D3, D4 & D8)
  - Office: 320-223-6604 Cell: 320-241-3631 Jakin.koll@state.mn.us
- Jon Bjorkquist: MDSS/AVL Implementation Coordinator (D1 & D2)
  - Office: 218-828-5722 Cell: 218-821-1505 Jon.bjorkquist@state.mn.us
- Joe Huneke: MDSS/AVL Implementation Coordinator (D6, D7 & Metro)
  - Office: 651-366-3586 Cell: 651-592-4440 Joseph.huneke@state.mn.us