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XIII INTERNATIONAL WINTER ROAD CONGRESS

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SUSTAINABLE WINTER SERVICE FOR ROAD USERS

An Overview of the Pooled Fund Study Maintenance Decision Support System

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Maintenance Decision Support System (MDSS) Background

- What is an MDSS?
  - Generally speaking, it is a system that integrates road weather and maintenance policy & resources information to suggest real-time maintenance treatments or strategies
- What are the capabilities of an MDSS?
  - Provide past, present, and future weather conditions
  - Simulate the expected response of the road to these weather conditions and maintenance activities
  - Suggest optimal maintenance treatments given current and forecast road and weather conditions
  - Provide a scientific framework for integration of information from a wide range of information resources

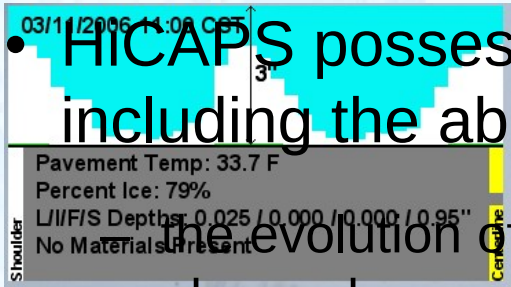
Maintenance Decision Support System (MDSS) Background

- What specifically is the ‘Pooled Fund Study MDSS’?
  - Beginning in 2001, the FHWA collaborated with a team of U.S. government research laboratories to develop a prototype MDSS
  - Goal was to develop concepts and technology that could be picked up and built upon by private road weather service providers
  - Meridian (private sector partner) teamed initially with four State Transportation Departments to move these and related technologies into maintenance operations
    - Used the FHWA Transportation Pooled Fund program to share resources
    - Membership in the MDSS Pooled Fund Study has grown with success

The PFS MDSS: Scientific Basis

- A key premise of the PFS MDSS is that the evolution of the 'dynamic layer' of moisture, chemicals and grit lying atop a road is predictable over time
- The PFS MDSS can assimilate / integrate a wide variety of information:
  - Route-specific, time-specific weather information (past, present, future)
  - Road Weather Information System road condition and weather observations
  - Human road condition reports
  - Maintenance activities reports from the transportation agencies
  - Maintenance, road, and weather information collected by agency Mobile Data Collection / Automated Vehicle Location technologies
- The information is tied together through time and space by a pavement model that serves as the backbone of the system
  - Meridian's HiCAPS model presently serves in this capacity, although other models could be substituted

The PFS MDSS: Scientific Basis

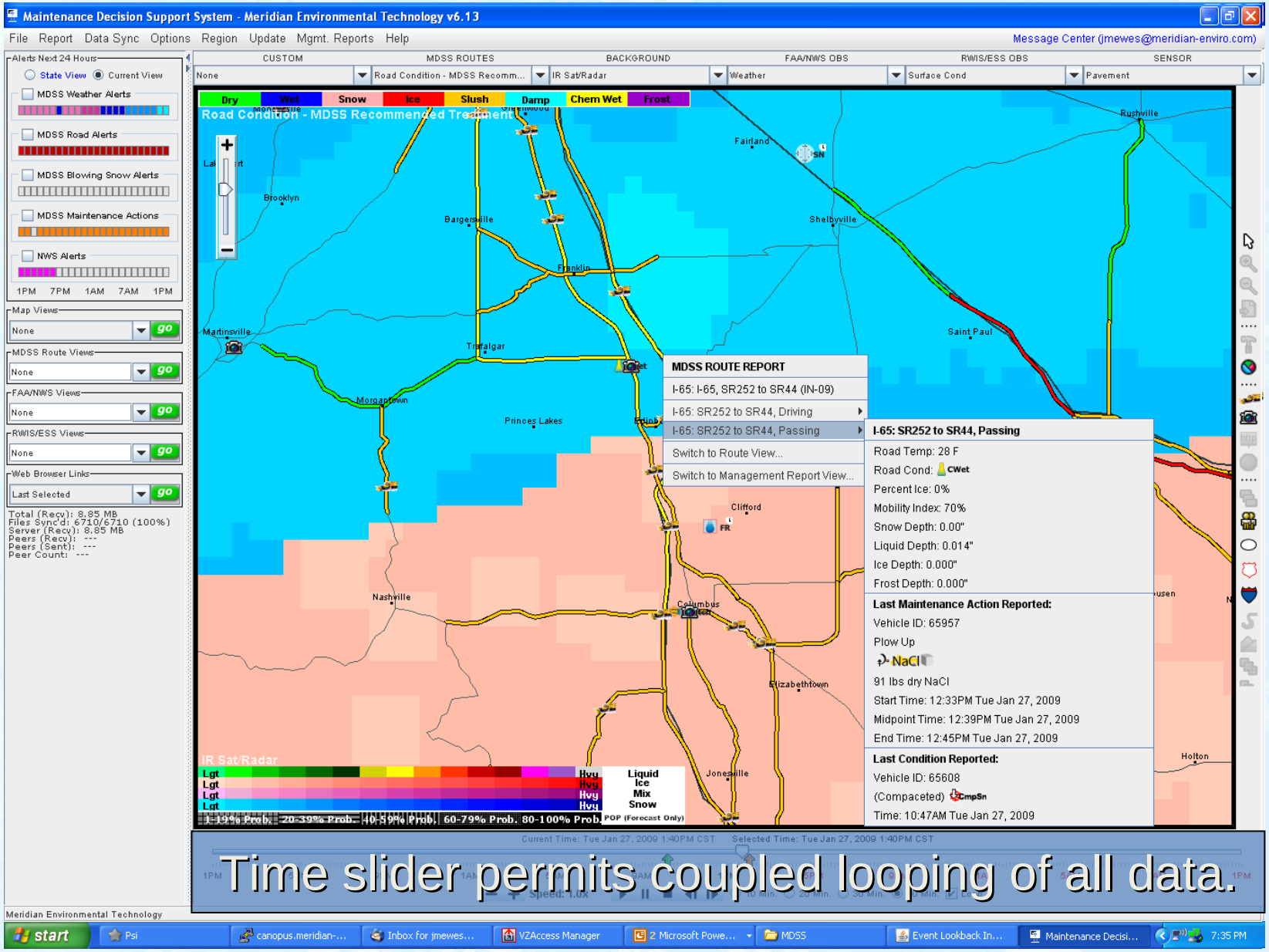


- HICAPS possess capabilities vital to MDSS, including the abilities to simulate:
  - the evolution of 6 different forms of moisture, and the phase changes between them,
  - the impact of maintenance activities, to include the effects of deicing chemicals,
  - chemically-induced variable freeze points,
  - phase changes in a manner that is consistent with mass and energy balance and the properties of the deicing chemicals present in the dynamic layer,
  - and the ability to function reliably in the absence of in-situ observations of weather or road conditions.

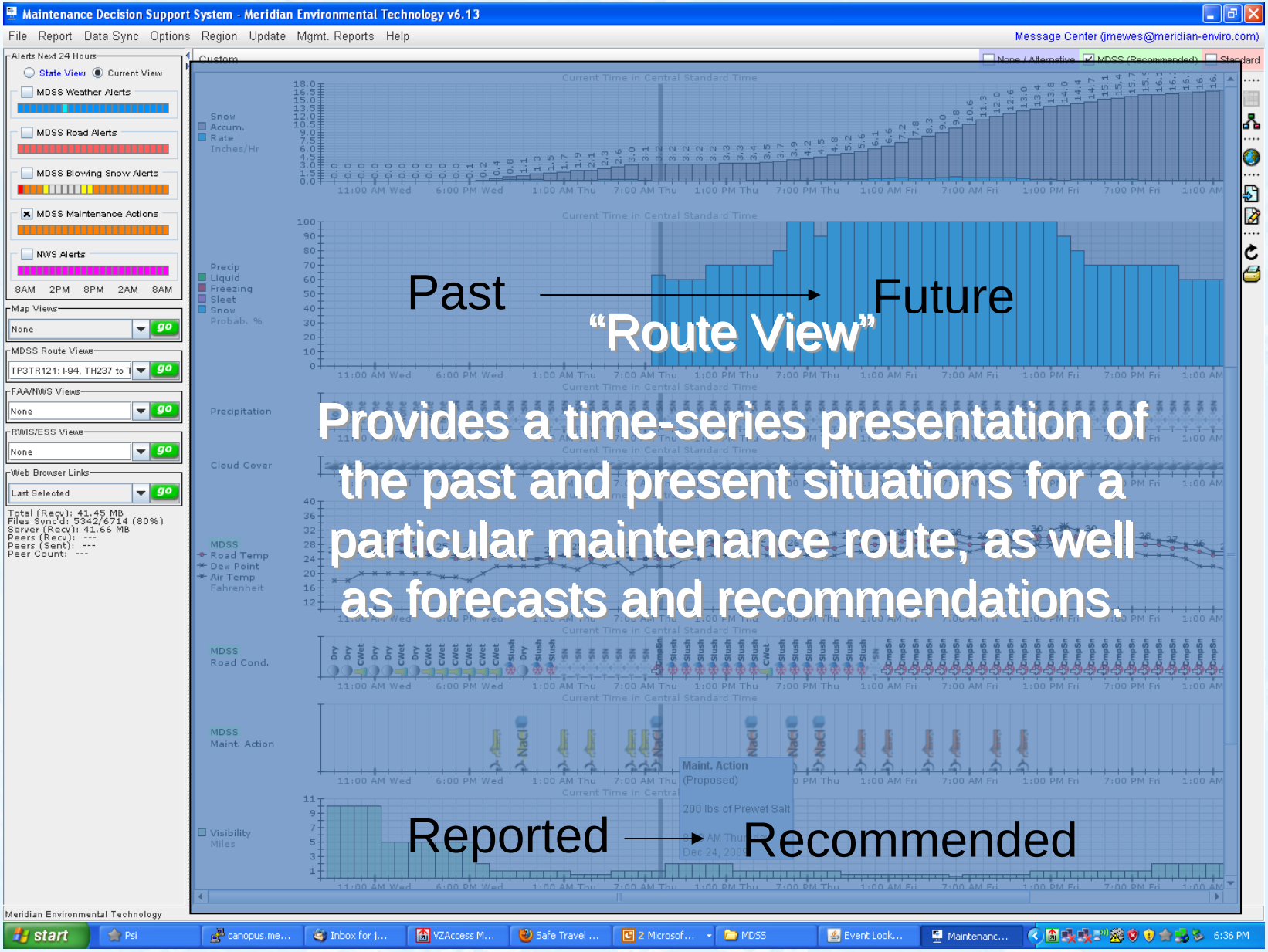
The PFS MDSS: Graphical User Interface

- The PFS MDSS Graphical User Interface (GUI) is presently distributed as a compiled Java executable
  - The client-side application provides capability not available with browser-based approaches
  - Highly customizable so as to be adaptable to the needs of users at levels of management
  - Self-synchronizing with the server so that data is available on the local machine for immediate access when requested by the user
  - Storm playback capability allows for post-storm playback of situations at a user-definable pace – permitting use in post-storm evaluation as well as off-season training

The PFS MDSS: Graphical User Interface



The PFS MDSS: Graphical User Interface



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The PFS MDSS: In-Vehicle Information Provision

- The PFS MDSS both receives information from and dist
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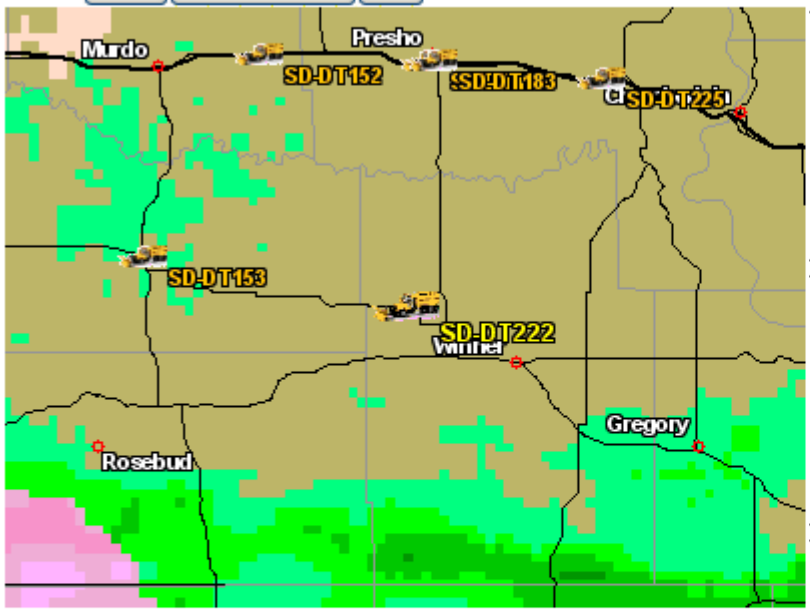

Forecast

Time	Wind speed (miles/hour)	Wind Direction	Wind Gust (miles/hour)	Precip Type	Precip Prob (%)	Snow Rate (in/hour)	Cloud Cover (%)	Air Temp (°F)
Thu 01:00 PM	13	SSE		MX	70	0.02	100	34
Thu 02:00 PM	13	UNK		SN	70	0.13	100	34
Thu 03:00 PM	16	SSE	23	SN	70	0.07	100	35
Thu 04:00 PM	14	SSE	22	SN	70	0.07	100	36

Recommended Actions

Road Cond.	Start Time	Practice: Rate
For US183 MP 19.6 to 27.5 & SD44 MP 240 to 220, MP 19.6 to 27.5:		
-	Thu 12:13 PM	Prewet Salt with Mag: 0lbs
-	Thu 03:13 PM	Patrol & Plow: - more...
-	Thu 06:13 PM	Prewet Salt with Mag: 100lbs
-	Fri 05:00 AM	Prewet Salt with Mag: 100lbs
-	Fri 08:00 AM	Patrol & Plow: - more...
-	Fri 03:43 PM	Patrol & Plow: - more...
For US183 MP 19.6 to 27.5 & SD44 MP 240 to 220, MP 240 to 220:		
-	Thu 12:13 PM	Prewet Salt with Mag: 50lbs
-	Thu 03:13 PM	Patrol & Plow: - more...
-	Thu 06:13 PM	Prewet Salt with Mag: 50lbs
-	Fri 05:00 AM	Prewet Salt with Mag: 100lbs
-	Fri 08:00 AM	Patrol & Plow: - more...
-	Fri 03:43 PM	Patrol & Plow: - more...
For US18 MP 252 to 263 & US183 MP 39 to 61, MP 39 to 61:		
-	Thu 11:40 AM	Prewet Salt with Mag: 50lbs
-	Thu 02:40 PM	Prewet Salt with Mag: 200lbs
-	Fri 05:00 AM	Prewet Salt with Mag: 200lbs
-	Fri 08:00 AM	Patrol & Plow: - more...

The PFS MDSS: Current Deployment Status

- The PFS MDSS is presently in various stages of deployment across the PFS MDSS member agencies
  - 16 U.S. State Transportation Departments
    (CA, CO, ID, IN, KS, KY, MN, NE, NH, NY, ND, PA, SD, VA, WI, WY)
  - approximately 4000 registered users
  - approximately 1100 ‘maintenance routes’
  - approximately 850 plow trucks equipped with MDC/AVL technologies
  - approximately 1600 RWIS/ESS
  - approximately 1500 fixed and mobile camera locations (2500 views)

The PFS MDSS: Outcomes of Early Deployments

- Deployment growth has been based on successes within each agency, but few have collected the data needed to quantify this success
    - Agencies that have been in the PFS longer tend to be further along
- The Indiana DOT made an abrupt transition from localized to statewide deployment during the winter of 2008/2009, providing a unique opportunity for measuring MDSS' impact
    - Collected the resource utilization and winter normalization data needed to compare INDOT operations before and after statewide implementation
    - Calculated savings, normalized for winter severity: **$10,000,000+**
    - Savings come in the form of reduced material, overtime, and fuel, and are the result of the improved management capability MDSS provides INDOT
    - The Indiana DOT will provide more information on their deployment with a presentation at SIRWEC

The PFS MDSS: Current Focus

- Integration with other agency information systems
  - Traveler Information
  - Asset Management

- High-Level Management Capabilities
  - More reports and capabilities aimed toward high-level management within PFS agencies (as opposed to front-line management)
  - Seasonal simulation capabilities / winter severity normalization

- Continued Research
  - Many road weather processes are still poorly understood (traffic impacts on road conditions and deicer performance, for example)
  - Winter precipitation is poorly observed / measured
  - Quantifying the ‘secondary’ properties of deicing agents that often make substantial differences in their performance

The PFS MDSS: Contact Information

- MDSS Pooled Fund Study (lead state: South Dakota)
  - Dave Huft
  - Research Director, South Dakota Department of Transportation
  - Dave.Huft@state.sd.us
- Meridian Environmental Technology (private sector partner)
  - John Mewes
  - Chief Scientist
  - jmewes@meridian-enviro.com
- Thank You!

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