

Use of Mobile Sensors and Maintenance Decision Support for Automated Road Condition Reporting

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2012 National Rural ITS / Gulf Region ITS, Biloxi MS

Monday, September 17th, 2012

Session A3: RWIS: Continued Evolution to Meet Needs

Overview

- ❄ Introduction and Background
- ❄ Project Objectives Statement
- ❄ Tasks to be Completed
- ❄ Best Practices
- ❄ Conclusions

Introduction and Background

- ❄ Project is a collaboration between Iteris/Meridian and the North/West Passage Pooled Fund Study states



- ❄ Encompasses the states of Minnesota, North Dakota, South Dakota, Montana, Wyoming, Wisconsin, Idaho and Washington along Interstate 90 and Interstate 94 (I-90/I-94).

N/W Passage Background

- ❄ Predominately rural states that face similar transportation issues related to traffic management, traveler information and commercial vehicle operations.
- ❄ Within the corridor states, numerous systems collect, process and integrate traveler and road work information.
- ❄ At present, this information is not readily shared across state borders.

Project Background

- ❄ The concept of mobile sensors reporting weather and driving conditions from moving snowplows in real time has been developed and tested by multiple state Departments of Transportation (DOTs) in recent years.
- ❄ Several approaches for mobile sensors have been deployed and tested in operational environments.
- ❄ States have deployed mature MDSS systems that are capable of predicting road conditions
- ❄ Most states presently manual report road conditions

Project Goal

- ❄ Perform a synthesis of the best practices of deploying and using mobile sensors. The synthesis will document the successful deployments that remain in operation today and document what can be learned by approaches that did not succeed.
- ❄ Explore the current state of the MDSS initiatives and research if MDSS (perhaps combined with mobile sensors) is a viable option for automating road condition reporting systems.

Tasks to Perform

- ❄ Task 1: Project Management
- ❄ Task 2: Interview Public Agencies that have deployed Mobile Sensors and MDSS
- ❄ Task 3: Interview Mobile Sensor and MDSS Private Contractors/Vendors
- ❄ Task 4: Interview National Weather Programs
- ❄ Task 5: Research Automated Road Condition Reporting
- ❄ Task 6: Final Best Practice Report

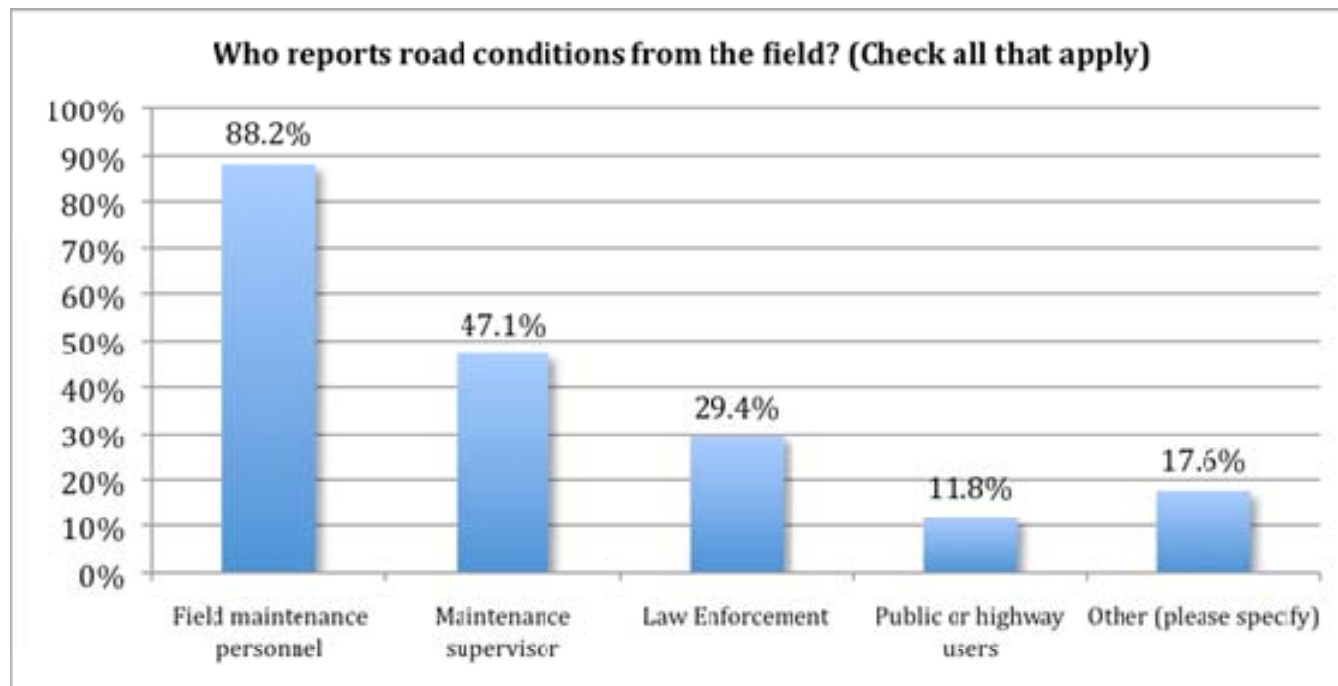
Task 2: Interview Public Agencies That Have Deployed Mobile Sensors and MDSS



- ❄ A survey was established with 41 questions
- ❄ State Project Managers responsible for or familiar with the road reporting activities, MDC/AVL systems, and MDSS programs within their states were targeted.
- ❄ Survey was designed to collect information about current practices in:
 - Road Condition Reporting
 - AVL/MDC usage within the agency
 - MDSS Deployment

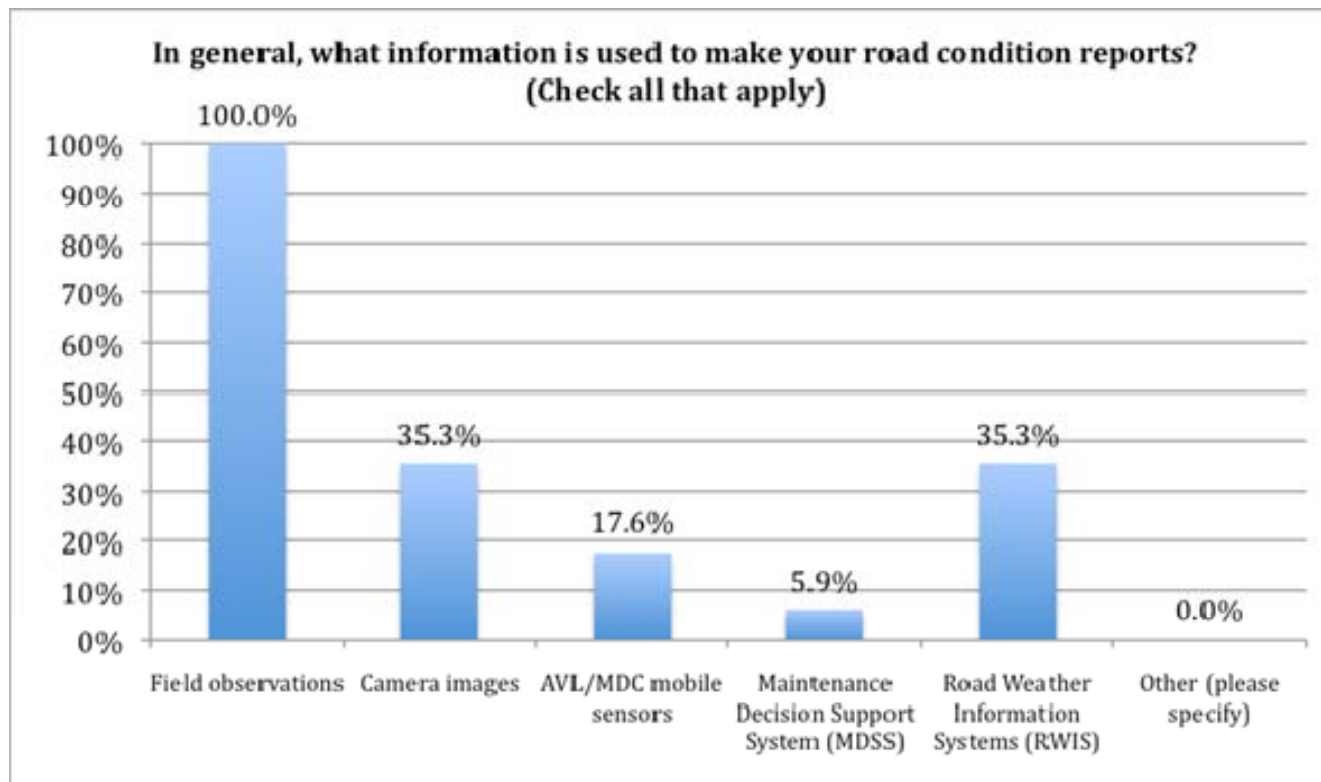
Road Condition Reporting

- ❄ Road conditions are generally reported during the winter months (Oct – April)
- ❄ Who reports road conditions?



Road Condition Reporting

❄️ What information is used to make road conditions reports?

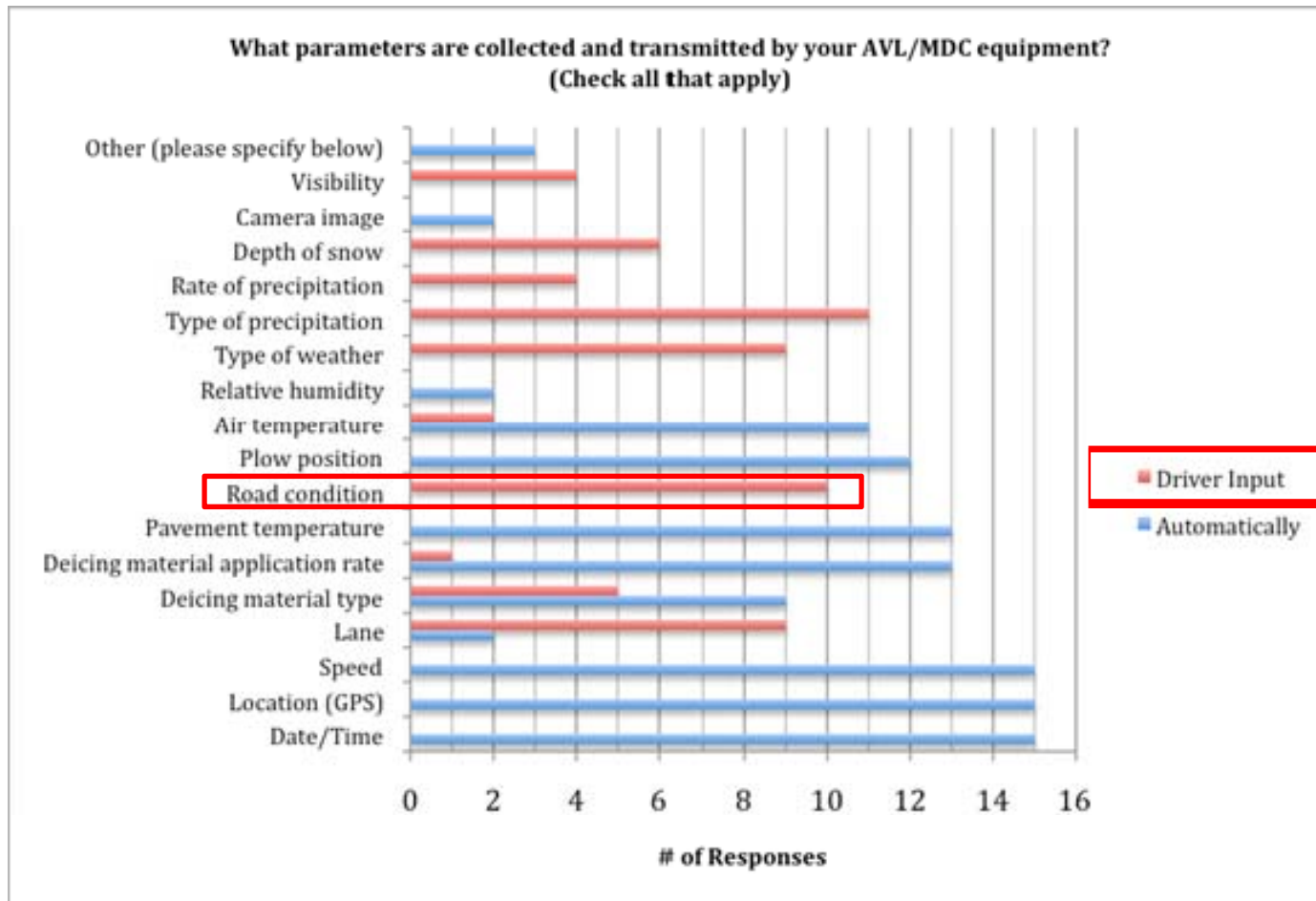


Road Condition Reporting

- ❄️ “What do you see as the primary limitations of your Agency’s existing road condition reporting service?”
- Timeliness/frequency of the updates
 - Adequately report road condition severity
 - Can not update road conditions frequently enough to meet user demands
 - Inability to update around the clock
 - Inaccuracies due to reporting conditions over the majority of the road segment instead of for specific locations.

AVL/MDC Usage

❄ Driver vs Automated Data collection



AVL/MDC Usage

❄ “What have been some of the positive outcomes from your deployment of mobile sensors in maintenance vehicles?”

- Ability to better track maintenance vehicle location and material usage
- Improvement of maintenance operator self-regulation of material usage
- Use of real-time data in decision making
- Provide weather radar and forecast information directly to maintenance operators

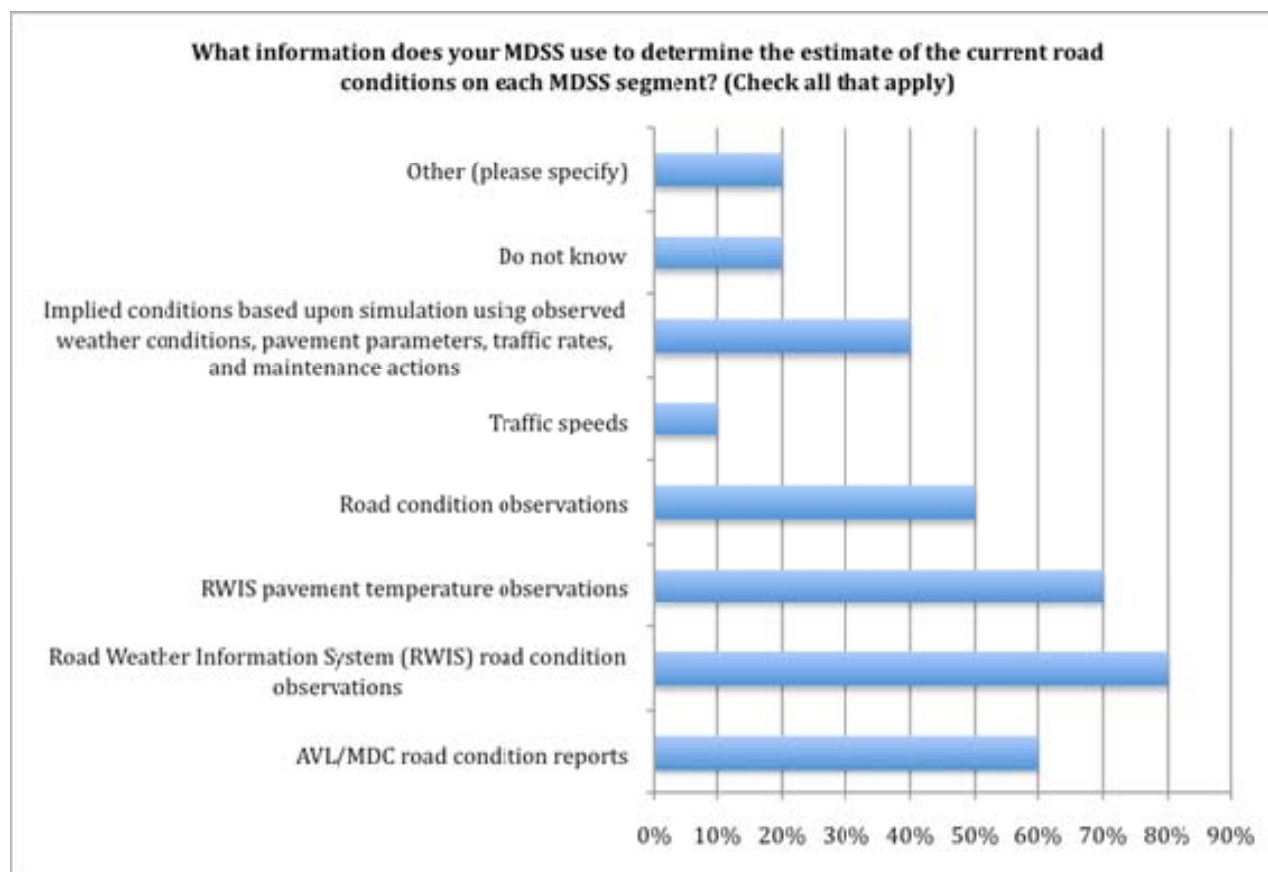
AVL/MDC Usage

❄️ “What have been some of the negative outcomes from your deployment of mobile sensors in maintenance vehicles?”

- Cost of the deployment
- Increased workload for maintenance of the equipment
- Resistance to the deployment from maintenance operators

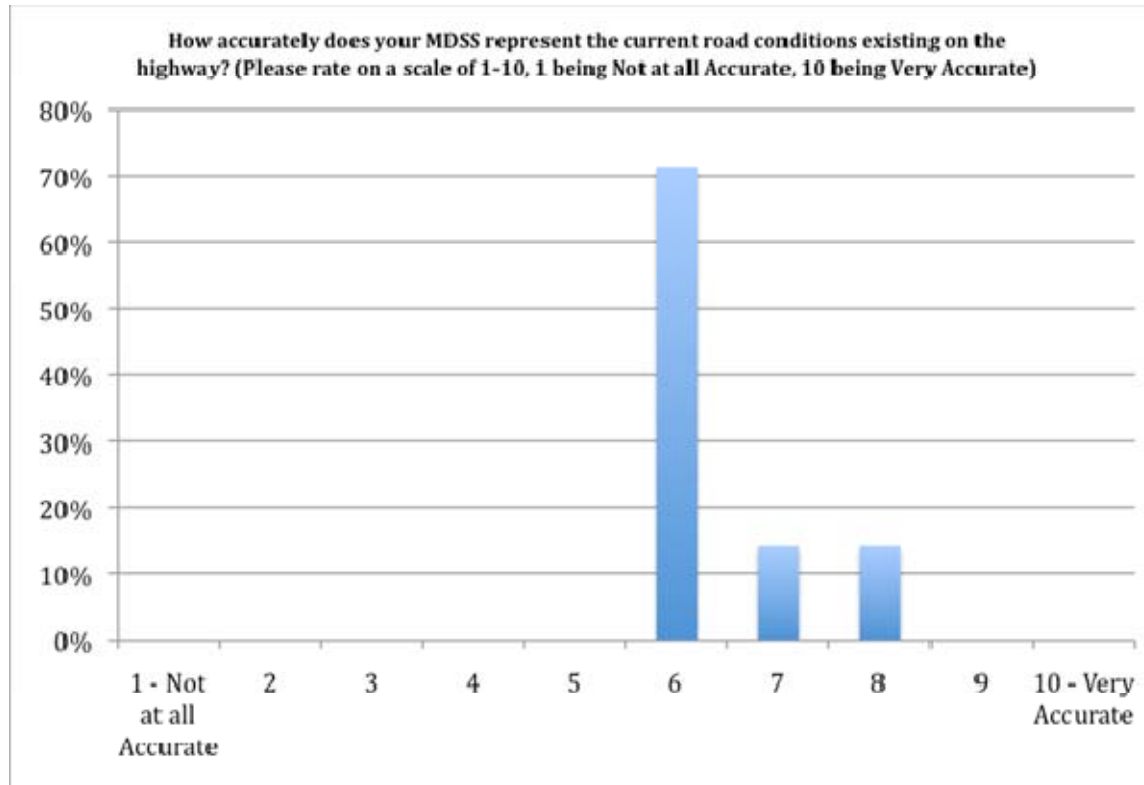
MDSS Usage

❄️ “What information does your MDSS use to determine the estimate of the current road conditions on each MDSS segment?”



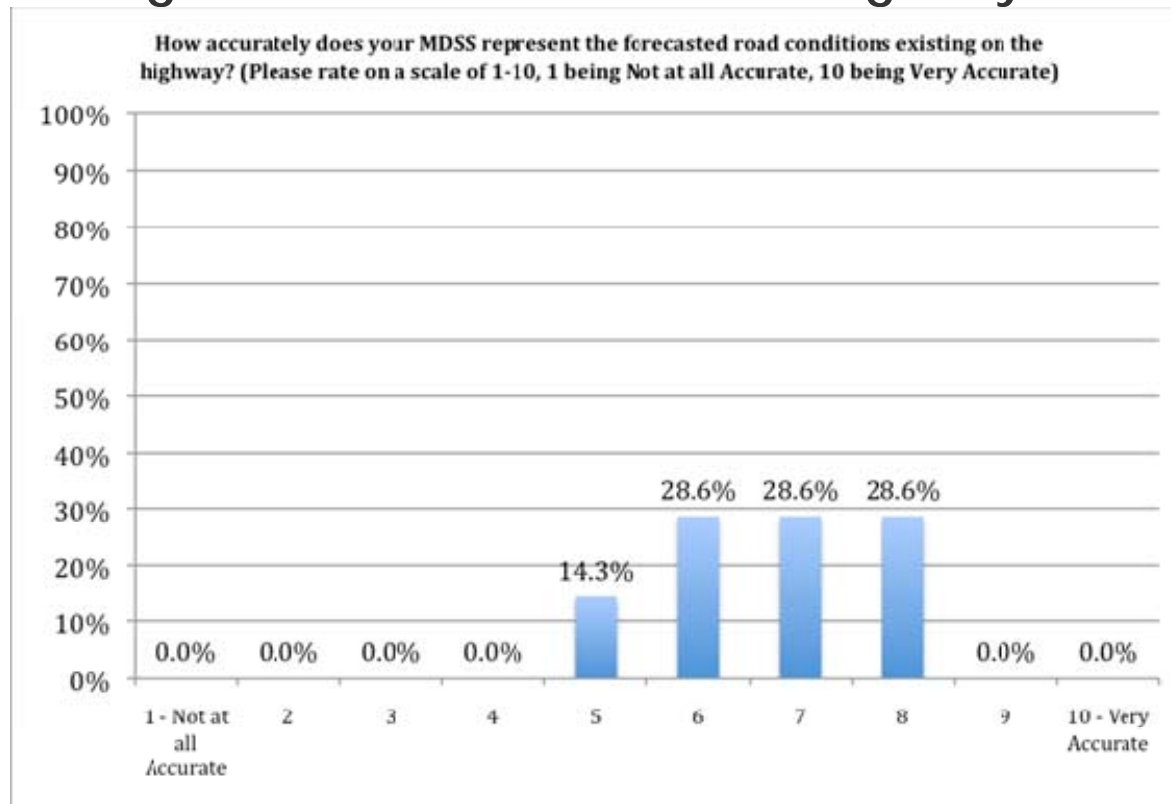
MDSS Usage

❄ “How accurately does your MDSS represent the current road conditions existing on the highway? (Please rate on a scale of 1-10, 1 being Not at all Accurate, 10 being Very Accurate)”



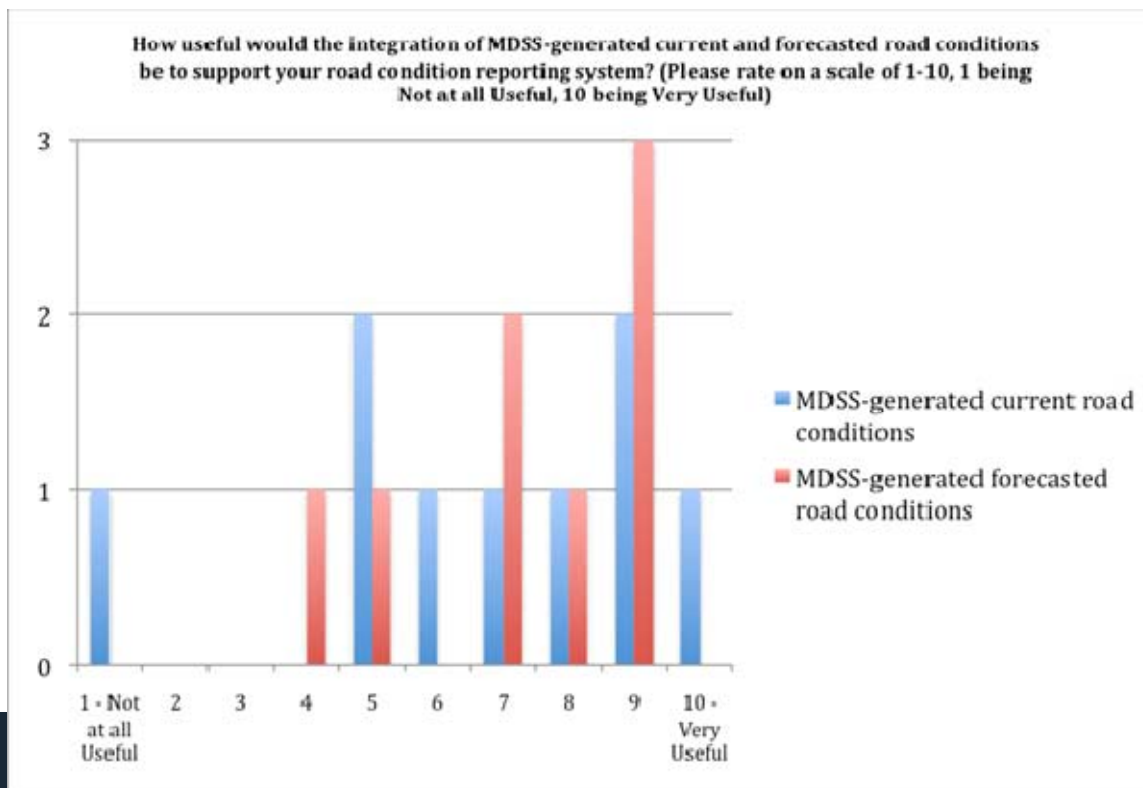
MDSS Usage

❄️ “How accurately does your MDSS represent the forecasted road conditions existing on the highway? (Please rate on a scale of 1-10, 1 being Not at all Accurate, 10 being Very Accurate)”



MDSS Usage

❄️ “How useful would the integration of MDSS-generated current and forecasted road conditions be to support your road condition reporting system? (Please rate on a scale of 1-10, 1 being Not at all Useful, 10 being Very Useful)”



- mean usefulness rating for current information is 6.67
- mean for forecasted information was 7.25.

Task 3: Interview Mobile Sensor and MDSS Private Contractors/Vendors



❄️ “What types of information are currently collected by your AVL/MDC system?”

Automatically Collected Information	Number of Respondents
Engine Codes	4
Latitude/Longitude	4
Date/Time	4
Vehicle Speed	4
Vehicle Heading	4
Plow Position	4
Pavement Friction	1
Deicing Material Application Rate	4
Lane	1
Road Condition	0
Air Temperature	4
Relative Humidity	3
Camera Image	3
Visibility	0
Precipitation Type	1
Precipitation Rate	1
Other (please explain)	2

Operator Entered Data	Number of Respondents
Road Condition	4
Plow Position	0
Deicing Material Application Rate	0
Deicing Material Type	2
Plow Position	0
Lane	3
Air Temperature	1
Current Weather Conditions	4
Snow Depth	3
Camera Image	0
Precipitation Type	4
Precipitation Rate	3
Visibility	2
Other (please explain)	3

MDSS Vendors

- ❄ Vendors provide current and forecast weather & road conditions.
- ❄ “What are some of the barriers to automating road condition reporting from your point of view?”
 - Relying on driver input is the biggest hurdle.
 - Getting the operator on board with the concept at an early stage to make them a willing partner in the technology change.
 - No standardization of equipment controller manufactures is becoming more proprietary as they develop their own AVL systems.

Task 4: Interview National Weather Programs

❄ The following National Weather Programs were identified:

- Federal Highway Administration – Road Weather Management Program
- *Clarus* Project
- USDOT
- ITS JPO
- Office of Federal Coordinator for Meteorological Services
- National Oceanic Atmospheric Administration/National Weather Service
- Aurora
- Clear Roads
- America Public Works Association/North American Snow Committee
- AASHTO SICOP
- National Center of Atmospheric Research
- Western Transportation Institute

National Weather Programs

❄ The five areas of the survey were:

- Current Technology
- Needs
- Information Sources
- Standards
- Role

❄ SAFETEA-LU Section 1201 Real-Time System Management Information Program was mentioned as a national effort for defining traveler road information.

Task 5: Research Automated Road Condition Reporting

- ❄ Current state of the practice, road conditions from AVL/MDC units are not automated
 - Conditions need to be manual entered
- ❄ AVL/MDC Road Conditions are only available when vehicles are on the road
 - If agency does not perform 24/7 maintenance conditions are not available to traveler 24/7
- ❄ MDSS can fill gaps in field obs to provide updates 24/7
- ❄ Accuracy concerns with information being shared with travelers

Task 5: Research Automated Road Condition Reporting



- ❄ Vendors have begun to develop sensors that can detect road conditions without operator input.
- ❄ Agencies within the project have not deployed these sensors operationally at this time.

Conclusions

- ❄ Each agency within the N/W Passage report road conditions differently to their traveling public.
- ❄ Information from automated process will have to be pre-processed before being transmitted to the general public.
- ❄ AVL/MDC units in current deployments require operator data entry for road conditions
- ❄ MDSS solutions can provide both current and forecasted road conditions
 - Not all solutions account for on-going maintenance actions during storm events

Thanks!

Questions?

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