2016
INTERNATIONAL CONFERENCE & WORKSHOP ON
WINTER MAINTENANCE AND SURFACE TRANSPORTATION WEATHER

Fort Collins Marriott, Fort Collins, CO
April 25 -27, 2016

Workshop Breakout Background Materials
Decision Support Part 1: Tools to aid travel planning

Decision support systems are so much more than simply saying when to plow and how much chemical to apply. Speed and travel time are also of critical concern to road users. This session contains presentations that explore novel uses of decision support systems and investigate how these uses can benefit winter operations.

Main Issues for Discussion:

- **Determining and monitoring travel conditions during inclement weather**
  - Using instrumented vehicles and sensors to determine road weather conditions, and using this info for road weather forecasting and travel time estimation
  - Identifying locations that are prone to experiencing low visibility due to blowing snow.

- **Speed modeling and speed management**
  - Effectiveness of VSL in improving safety during bad weather
  - Determining and forecasting impacts of winter road conditions on traffic speeds

- **Driver decision support tools (for routing, travel planning, etc)**.
  - Determining the optimal routes for snow plows taking into account travel time/distance, quantity of materials, number of vehicles, road priorities and storm intensities.
  - Real-time information for truck drivers on road conditions and decisions made by other drivers
  - System to alerts drivers of low visibility conditions for travel planning and decision-making

- **Driver Behavior in Winter Operations**
  - Factors affecting driver fatigue during winter maintenance operations

Relevant On-Demand Presentations:

- ROSTMOS - Remote Sensing Techniques to Monitor Driving Conditions in Winter
- Influence of Roadside Environment and Road Structures on Blowing-Snow-Induced Visibility Hindrance
- A Feasibility Study for Weather-Controlled Variable Speed Limits (VSL) in Norway
- Modeling Highway Speed Decreases during Winter Weather Events in Iowa
- Drivers’ Decision-Making Supported by the Snow Visibility Information System
- Automated Vehicle Decision Support System (AVDSS) for Inclement Weather,
- Adaptive Snow Plow Routing Using Genetic Algorithm Artificial Intelligence
- Plowing the Streets of Pittsburgh: A Dynamic Route Planning Approach
- Weather and Travel Time Decision Support
- A Pilot Naturalistic Driving Study on Fatigue in Winter Maintenance Operations
Best Management Practices

Administrative and management policies for winter maintenance vary across agencies as well as the types and providers of services. Research and analysis are needed to evaluate the effectiveness of these policies and identify potential improvements. Having well trained, well equipment personnel is also a keys for successful winter maintenance operations. This breakout session will focus on management practices that support sustainability in use of materials, and other resources. It will also explore training and other programs that are used in support of preparing operations and administrators for winter maintenance operations.

Main Issues for Discussion:

- Development of snowplow routes and snow plans
- Salt management including management, storage, and handling in a sustainable way
- The human element in winter maintenance

Relevant On-Demand Presentations:

- Results Based Benefits of Integrating Technology Into a Winter Operations Program-Hodne
- A Pilot Naturalistic Driving Study on Fatigue in Winter Maintenance Operations-Jeff Hickman
- Plowing the Streets of Pittsburgh: A Dynamic Route Planning Approach-Kokubu
- Adaptive Snow Plow Routing Using Genetic Algorithm Artificial Intelligence-Zollweg
- Modeling Highway Speed Decreases during Winter Weather Events in Iowa-Nixon
- Methodology for Locational Priority of Fixed Automated Spray Technology (FAST)-Kim
- Sites using Analytic Hierarchy Process
- Identification of Salt Vulnerable Areas: A Critical Step in Road Salt Management-Belts
- Innovative Uses of Maintenance Decision Support Systems as a Research Tool for Analyzing Winter Road Salt Usage-Reeler
- Laboratory and Field Evaluation of a Chloride-free Material for Snow and Ice Control-Sato

Other Relevant Information

NCHRP 688 Determining Highway Maintenance Costs
http://www.trb.org/Highways1/Blurbs/165504.aspx

http://www.trb.org/Publications/Blurbs/173819.aspx

NCHRP Project 20-83(03) Long Range Strategic Issues Affecting Preservation, Maintenance, and Renewal of Highway Infrastructure
Equipment & Materials

Effective snow and ice control is a critical aspect of highway winter maintenance. Snow removal equipment, especially, is a key element that is affected by harsh conditions. This session is relevant for fleet management and maintenance and operations personnel who have winter maintenance responsibility.

Main Issues For Discussion:
- Accuracy of data collected from equipment/vehicles (scales and plow sensors)
- New equipment (plow lighting, plug and play communication protocol) and cost benefits (plow blades, tow plow)
- Mitigating corrosion
- Effective use of winter maintenance materials
- Optimizing computer-based plow routes to minimize completion time, balance work load, reduce wasteful deadheading
- Snow Plow Operators
- Visibility

Relevant On-Demand Presentations:
- Results Based Benefits of Integrating Technology Into a Winter Operations Program
- Innovative Uses of Maintenance Decision Support Systems as a Research Tool for Analysing Winter Road Salt Usage
- Laboratory and Field Evaluation of a Chloride-free Material for Snow and Ice Control
- Automated Vehicle Decision Support System (AVDSS) for Inclement
- Adaptive Snow Plow Routing Using Genetic Algorithm Artificial
- Plowing the Streets of Pittsburgh: A Dynamic Route Planning Approach
- System for On-Board Weighing on Maintenance Trucks
- Determining the In-Field Life Span of Various Types of Plow Blades and the Potential Cost Benefits Associated with Implementing a Specialty Blade Instead of a Standard Flame Harden Steel Blade
- Determining that Potential Cost Benefits of Utilizing a Truck with a Tow behind Plow when compared to a Truck with a Standard Front Plow and a Mid-mounted Wing Plow
- A Pilot Naturalistic Driving Study on Fatigue in Winter Maintenance Operations
- Methodology for Locational Priority of Fixed Automated Spray Technology (FAST) Sites using Analytic Hierarchy Process
- Evaluating the Use of Web-Based Systems to Manage Policy Documentation in Winter Maintenance
Big Data & Winter Maintenance

The fields of automated and connected vehicle technologies will have a strong impact on winter maintenance operations in coming years. The emergence of remote sensing and mobile data collection technologies will also impact the amount of data that is collected to support winter maintenance operations.

Main Issues For Discussion:
- Mobile data collection – imagery, sensors, and vehicle state data
- Crowd-sourced road condition information – using driver speeds or citizen reports to gauge road conditions or operations performance
- Operations analysis using GPS/AVL
- In-cab considerations: informed and connected vs. distracted and data-overloaded
- Sharing maintenance data with the public and researchers

Relevant On-Demand Presentations:
- Zhengyuan Zhu: Modeling Highway Speed Decreases during Winter Weather Events in Iowa
- Steve Cook: Connected Vehicle Winter Weather Maintenance Advanced Technologies for Motorist Advisories and Warnings
- Nikola Ivanov: RWIS Data Integration for Improved Decision Making
- Nikola Ivanov: Collaborative Decision Making
- Bret Hodne: Results Based Benefits of Integrating Technology Into a Winter Operations Program
- Yang-Choong Heon: Feasible Experiment to Predict Road Surface Temperature using vehicle ambient temperature sensor
- Gerry Wiener: Weather and Travel Time Decision Support
- Gabe Guevara: Road Weather Management Program Decision Support Tools

Other Relevant Information

Citizen Reporting of Current Road Conditions
http://ops.fhwa.dot.gov/weather/best_practices/citizenreportingcre/
Decision Support Part 2: Maintenance Operations

Roadway condition determinations remain a critical component of winter maintenance, and many decisions are based upon data received from static and mobile sensors. This session explores the techniques to assess sensor accuracy, placement, and equipment and will discuss issues and opportunities revolving around data confidence in decision making.

Main Issues for Discussion:
- Using road surface-state and infrastructure monitoring technology
- Integrating roadside data with mobile observations
- Implementing Enhanced Maintenance Decision Support Systems
- Active plow routing

Relevant On-Demand Presentations:
- Innovative Uses of Maintenance Decision Support Systems as a Research Tool for Analysing Winter Road Salt Usage
- Adaptive Snow Plow Routing Using Genetic Algorithm Artificial Intelligence
- Plowing the Streets of Pittsburgh, A Dynamic Route Planning Approach
- Road Weather Management Program Decision Support Tools
- Difference in Remote Road Surface Sensor Performance by Pavement Type
- Study on Winter Road Surface Friction Characteristics and their Reproducibility
- ROSTMOS – Remote Sensing Techniques to Monitor Driving Conditions in Wintertime
- Feasible Experiment to Predict Road Surface Temperatures using Vehicle Ambient Temperature Sensor
- Development of an Automated Ice Sensing System to Assist the Operators of a Cable Stayed Bridge in Making Decisions

Other Relevant Information:

Resilience & Climate Change

People are fond of saying "if you don't like the weather, wait a day, it will change". Climate does change and how it changes can affect the way transportation agencies maintain the roads especially in winter. What are some of issues your agency is dealing with in regards to climate change, extreme weather events and resiliency to future events? This session will focus on how agencies are facing changes and building in resilience to winter weather.

Main Issues for Discussion:

- These trends have been noticed when averaged globally, as well as within individual countries, states and cities.
- Storm patterns are changing, which can contribute to changes in local wind speeds and directions. A greater number of, and/or more intense, blowing snow events can occur as a result. Equations have been developed to help quantify visibility and blowing snow issues.
- Changes in storm patterns also alter precipitation patterns. This can lead to increases or decreases of average or expected precipitation amounts per storm or per year.
- Precipitation is able to occur at greater intensities in a warmer atmosphere, and this has been noted in many locations around the world. Heavy snow has resulted in winter maintenance issues.

Relevant On-Demand Presentations:

- Influence of Roadside Environment and Road Structures on Blowing-Snow-Induced Visibility Hindrance on Winter Roads: Analysis using the results of weather observations by a visibility observation vehicle during blowing snow. Hritotaka Takechi
- Outline of the Automated Continuous Snowdrift Transport Rate Observation System and Analysis of the Conditions Necessary for Drifting Snow to Occur in Light of Meteorological Factors Satoshi Omiya
- Recent Changes in Pressure Patterns and Their Regional Occurrence at Times of Heavy Snowfall and Blizzard Events in Hokkaido, Japan Masaru Matsuzawa

Other Relevant Information:

Surface Transportation System Resilience to Climate Change and Extreme Weather Events
http://www.trb.org/Main/Blurbs/174026.aspx

For USDOT/FHWA’s summary of climate change adaptation, see:

TRB’s First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events, Sept. 16-18, 2015 (see flyer graphic below)—link to program and presentations: http://onlinepubs.trb.org/onlinepubs/conferences/2015/ClimateChange/Program.pdf

For an overview of observed and predicted climate changes in the United States and resulting impacts:
- http://nca2014.globalchange.gov/highlights/report-findings/infrastructure (impacts specific to infrastructure)
For a global and high-level summary of impacts from the Intergovernmental Panel on Climate Change: