Weather-Responsive Traffic Management

2012 Stakeholder Meeting Update

Deepak Gopalakrishna
Battelle

Roemer Alfelor
Federal Highway Administration

Weather-Responsive Traffic Management (WRTM)

Implementation of

traffic advisory, control and treatment strategies

in direct response to, or in anticipation of

developing roadway and visibility issues

that result from

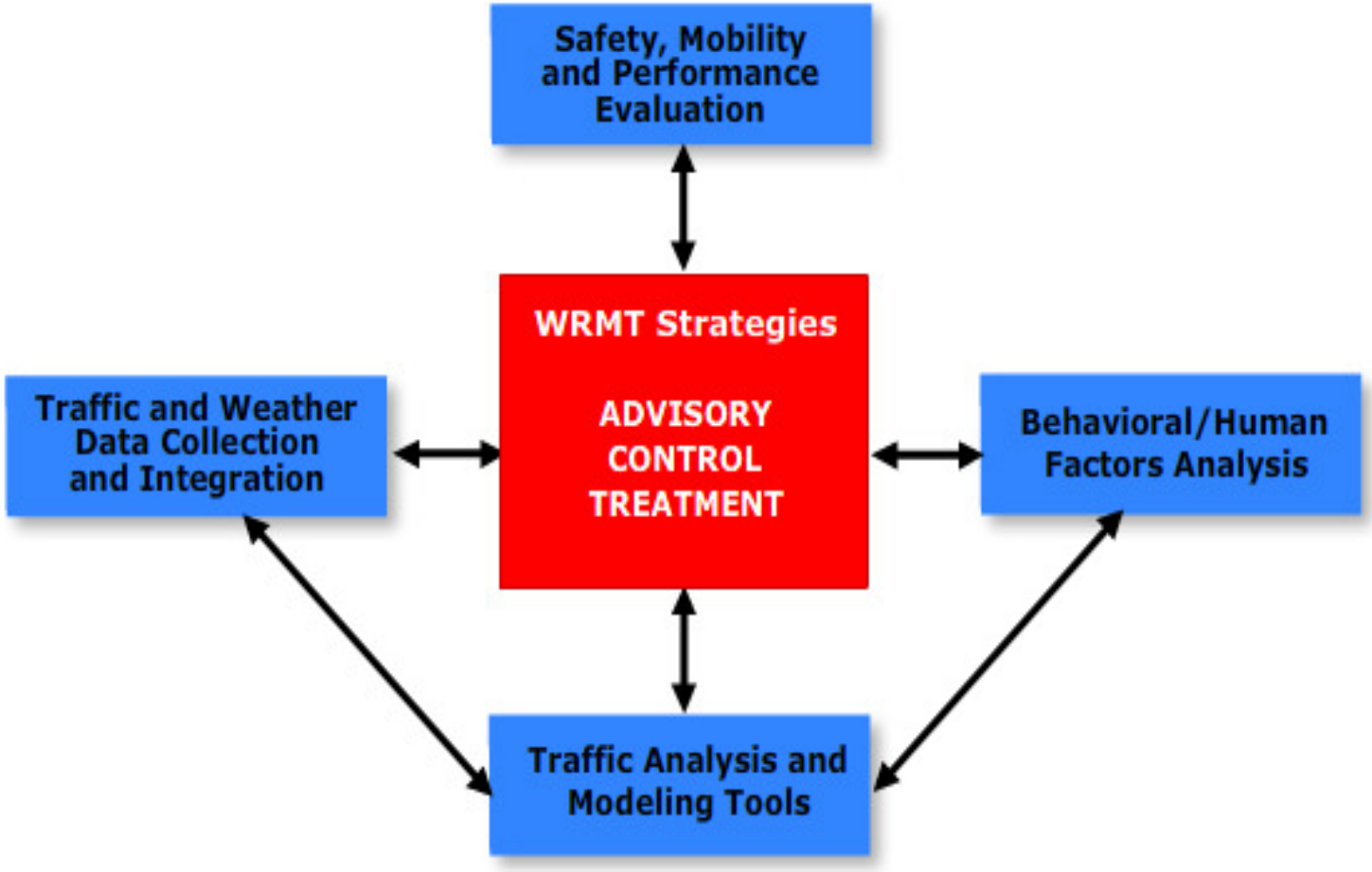
deteriorating or forecasted weather conditions

Picture Source: Oregon Department of Transportation

WRTM Success Measures

- Transportation agencies use **current and forecast** weather and traffic conditions to manage traffic flow and highway operations
- Motorists **receive and respond** to road weather and traffic information in the **short-term and in the long-term**
- Weather impacts incorporated in **traffic analysis and engineering models** to calibrate and optimize advisory, control and treatment strategies

WRTM Framework



Recently Completed/Ongoing Activities

- **Research and Guidance**
  - Human Factors Guidelines for Messaging
  - TrEPs
  - WRTM Strategies Development
- **Stakeholder Outreach**
  - 1ST National Workshop on WRTM, Portland, OR
- **Training/Technical Assistance**
  - Webinar Series on WRTM (Use of Social Media, Active Traffic Management and Weather, Traffic Signal Timing)
  - CITE Online Training

Human Factors Analysis of Road Weather Advisory and Control Information

- Project Purpose: Identify ways to disseminate road weather advisory and control information to travelers in a manner that is understandable, useful, and effective

Project Overview: General Approach

Phase I
(2008 - 2010)
Develop Preliminary Road Weather Messaging Guidelines

Literature Review of Traveler Information Needs & Relevant Human Factors Research

Survey of Travelers in Washington State

Review of DOT Messaging Practices

30 Preliminary Guidelines, Organized by Message Type

Phase II
(2010 – 2012)
Evaluate and Revise the Guidelines

On-line Questionnaire Sent to over 200 Potential End-users

Site Visits and In-depth Evaluations with State-level DOT & TMC Staff (6 States + 2 Private Organizations)

Simpler, More Streamlined Guidelines Organized by Dissemination Method (DMS, 511/HAR, Web-based)

Evaluate and Revise the Guidelines: Key Recommendations for Revisions

- Organize the guidelines by major dissemination methods (Dynamic Message Signs (DMS, Auditory Messages (511/HAR), and Web-based Messages).
- Increase focus on weather and road weather in the guidelines.
- Identify how to communicate road weather information such as roadway surface conditions more clearly in the guidelines.
- Consolidate guidelines and reduce verbosity as much as possible.

Updated Guidelines

Chapter Title

Guideline Title

Introduction

Design Guidelines

Examples

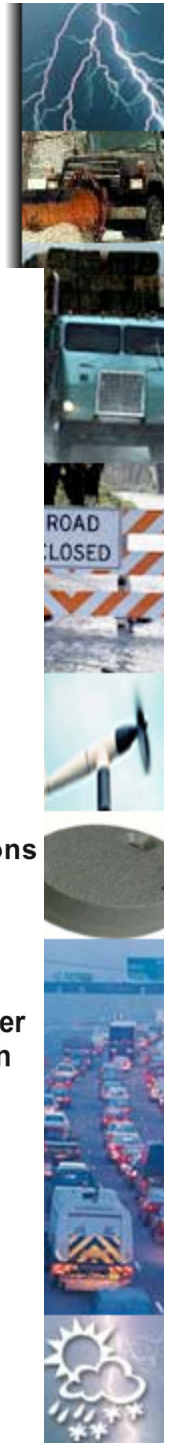
Discussion

Design Considerations

Notes for Other Dissemination Methods

References

Note



Chapter 2 Dynamic Message Signs

GUIDELINE 2-2. DETERMINING DMS MESSAGE LENGTH LIMITS

Introduction

This guideline provides a method for determining the appropriate length of a DMS message by considering information units, which are a measurement of the amount of information in a message. Information units are often defined as the answers to basic questions (e.g., what, where, who).

Design Guidelines

- Keep messages as short and concise as possible.
- Use no more than:
  - 2 information units per line
  - 3 information units per phase
  - 4 information units per message read at speeds of 35 mi/h or more (Figure A)
  - 5 information units per message read at speeds less than 35 mi/h (Figure B)
- Messages may reference other sources containing additional information (e.g., 511, HAR).

An information unit can be defined as the answer to a basic question about the subject of the message. For example, in the table below, each answer to the question "what is the problem," is a single information unit.

Sample information units in DMS messages.

Question	Answer (One information unit each)
What is the problem?	FLOODING, SLICK IN SPOTS, BLOWING SNOW
Where is the problem?	AT US-23, PAST I-5, METRO AREA
Who is affected?	NEW YORK, ALL TRAFFIC, WEST BOUND TRAFFIC
What should they do?	USE I-280 EAST, REDUCE SPEED, TRAVEL NOT ADVISED

Phase 1: MAJOR WINTER STORM LIMIT TRAVEL

Phase 2: KC METRO AREA EXPECT DELAYS

Figure A. Example message with 4 information units.

Phase 1: HIGH WINDS ON BRIDGE ROLLOVER RISK

Phase 2: TRUCKS AND RVS DRIVE WITH CAUTION

Figure B. Example message with 5 information units.

Left-hand page

Discussion

The recommendations for the number of information units that are appropriate for display are based on research and operational experience with DMS (1). The maximum number of information units per message includes the information units in all phases of the message, if multiple phases are used. If the message is too long to be read at normal speeds, it is likely that some drivers will slow down to read the message, affecting the traffic flow and creating a potential safety hazard. In general, the message length should be reduced as much as possible without losing the message intent. This can be accomplished by using some of the following methods (1):

1. Omit evident or redundant information.
2. Delete "dead" words. Examples of "dead" words are "street," "avenue," or "boulevard" following a familiar arterial name. The word "ahead" may also be unnecessary when the road weather condition is occurring on the same freeway as the DMS.
3. Use appropriate abbreviations.

Note that the method presented in this guideline is not the only method used to count information units. The Advanced Traveler Information System (ATIS) Guidelines (2) provide a word-by-word method to count information units (generally the "relevant words" in the message, often counting each word that is not a preposition as one unit). The method proposed by Dudek is included here since weather messages on DMSs are more structured in nature (1). Additionally, message length restrictions may be expressed as a count of individual words.

Design Considerations

The MUTCD (3) states that for PCMSs, messages should be limited to two phases, with no more than three lines of text per phase. If more than two phases are needed, multiple PCMSs may be used.

Sometimes, it may be appropriate to link to other forms of media that can broadcast a larger amount of information. For HAR, the phrase "TUNE RADIO TO XX AM" may be used, where XX is the radio station (1). Additionally, one site reported using the phrase "TUNE TO LOCAL MEDIA"; however, this requires the driver to know how to do so. Another site uses "CALL 511" to direct travelers to the 511 phone system for information.

Notes for Other Dissemination Methods

The DMS message length limits are partially influenced by the amount of time available before the driver passes the sign, whereas messages on other devices, such as PEDs, do not have this limitation. However, they are still limited by the physical parameters of the device (e.g., display size, font size) and the traveler capabilities (e.g., visual acuity, memory limitations). Note that with PEDs, the intended use should be to provide information to a traveler when he or she is not driving. An important difference from DMSs is that PEDs and Twitter have space to display full sentences with supporting words. However, note that Twitter has a 140 character limit per message and many cell phone text messages have a 160 character limit. It is also important that messages using these methods include appropriate punctuation to facilitate understanding since the message may not be divided into multiple lines as it is on DMS.

References

1. Dudek, C. L. (2004). *Changeable message sign operation and messaging handbook* (Report No. FHWA-OP-03-070). College Station, TX: Texas Transportation Institute.
2. Campbell, J. L., Carney, C. and Kantowitz, B. H. (1998). *Human factors design guidelines for Advanced Traveler Information Systems (ATIS) and Commercial Vehicle Operations (CVO)* (Report No. FHWA-RD-98-057). Washington, DC: Federal Highway Administration.
3. Federal Highway Administration. (2009). *Manual on Uniform Traffic Control Devices for Streets and Highways*. Washington, DC.

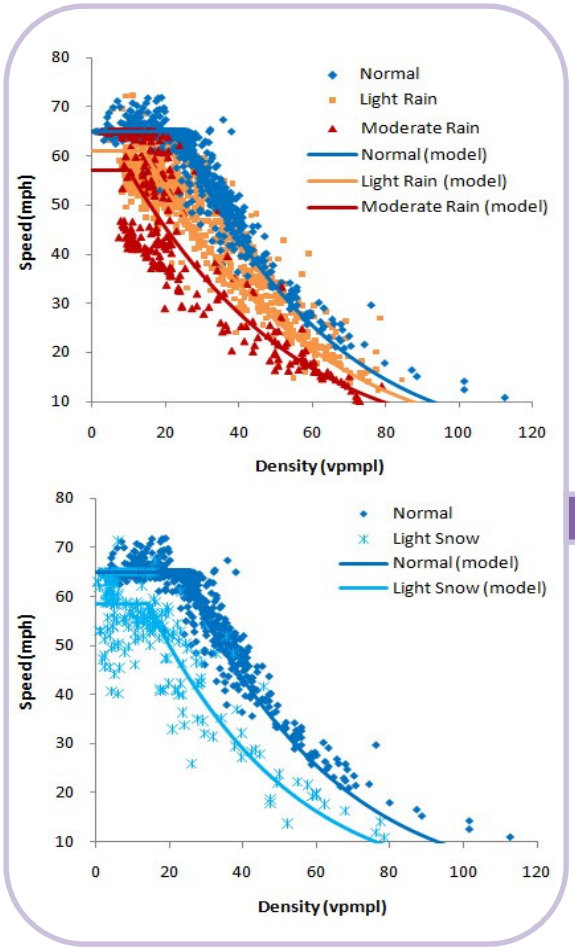
NOTE: The use of Portable Electronic Devices, such as cell phones, while driving is a distraction. Consult the caveat on page 7 for more information.

Right-hand page

Weather-Responsive Traffic Estimation and Prediction System (TrEPS)

- Project Purpose: Capture Weather Effects in a Dynamic Traffic Assignment Model to:
  - Assess the **impacts of adverse weather on transportation networks**.
  - Evaluate **effectiveness of weather-responsive traffic management (WRTM) strategies** in alleviating traffic congestion due to adverse weather conditions.

Phase I - Model impacts of adverse weather on transportation networks (2009)



TrEPS

DYNASMART

Weather Scenario Specification

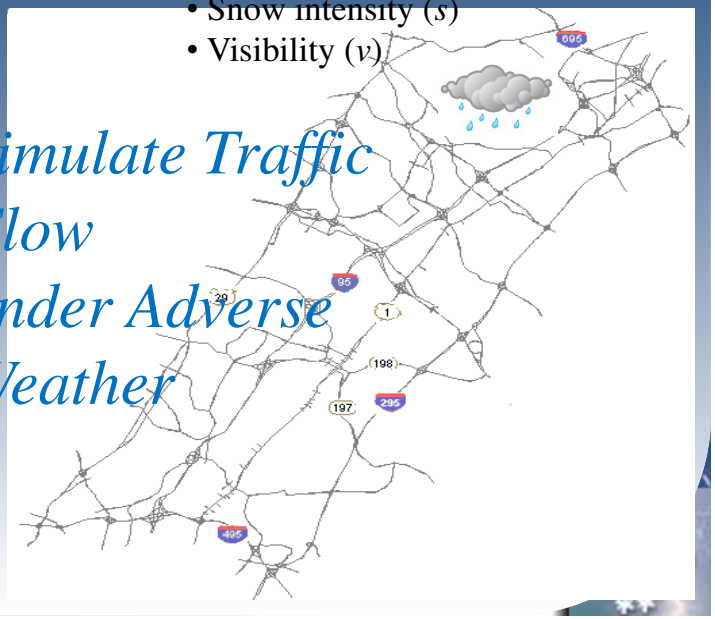
- Rain intensity (r)
- Snow intensity (s)
- Visibility (v)

Supply-side Parameter Calibration

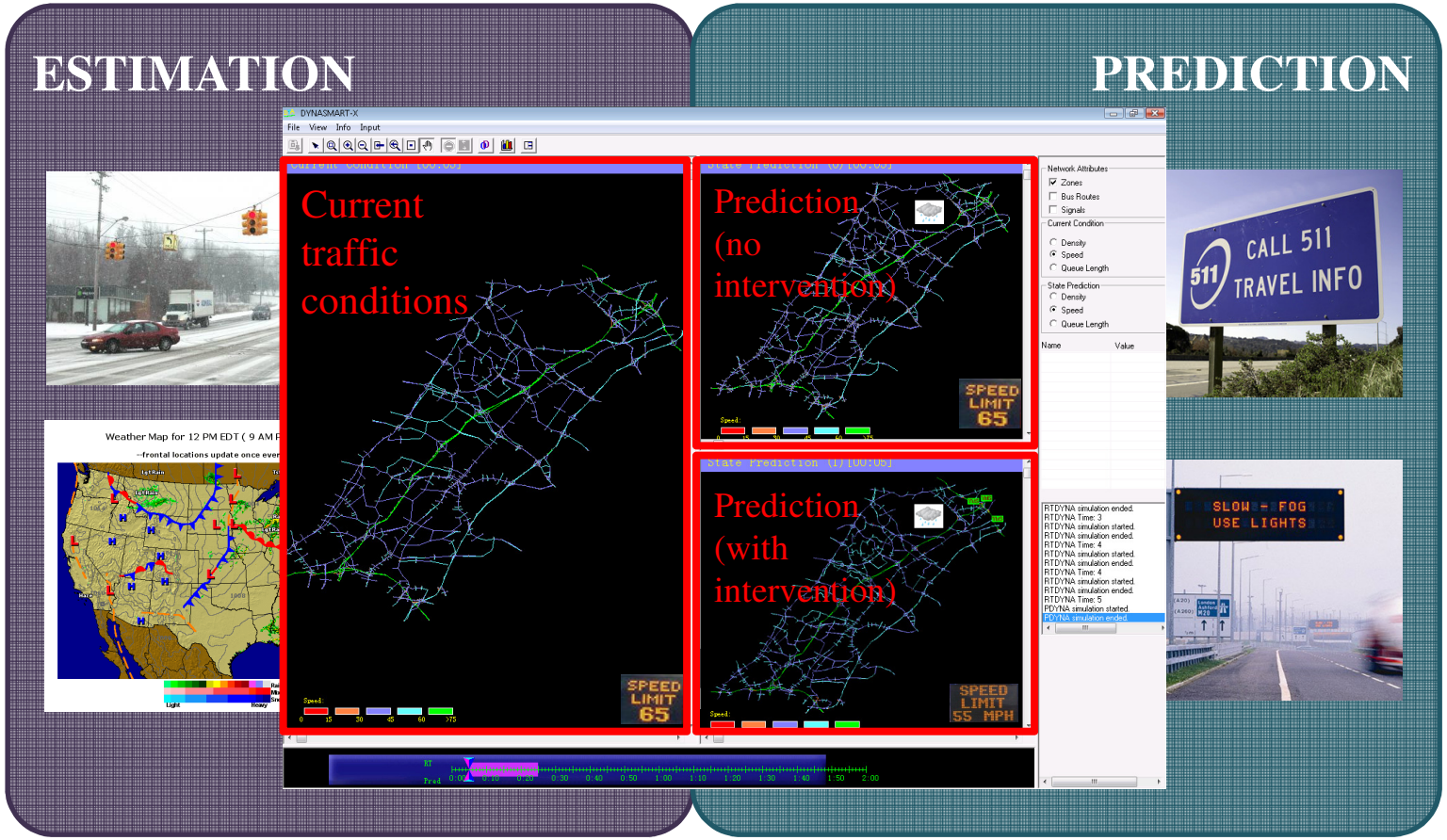
***Weather Adjustment Factor* (WAF)**

- Free-flow speed,
- Saturation flow rate,
- Section capacity,
- etc.

Simulate Traffic Flow under Adverse Weather



Phase II- Implement and Evaluate WRTM Strategies using TrEPS Models



Study Networks

- Three study networks calibrated and set-up for implementation
  - Salt Lake City
  - Long Island
  - Chicago

Latest Status/Results

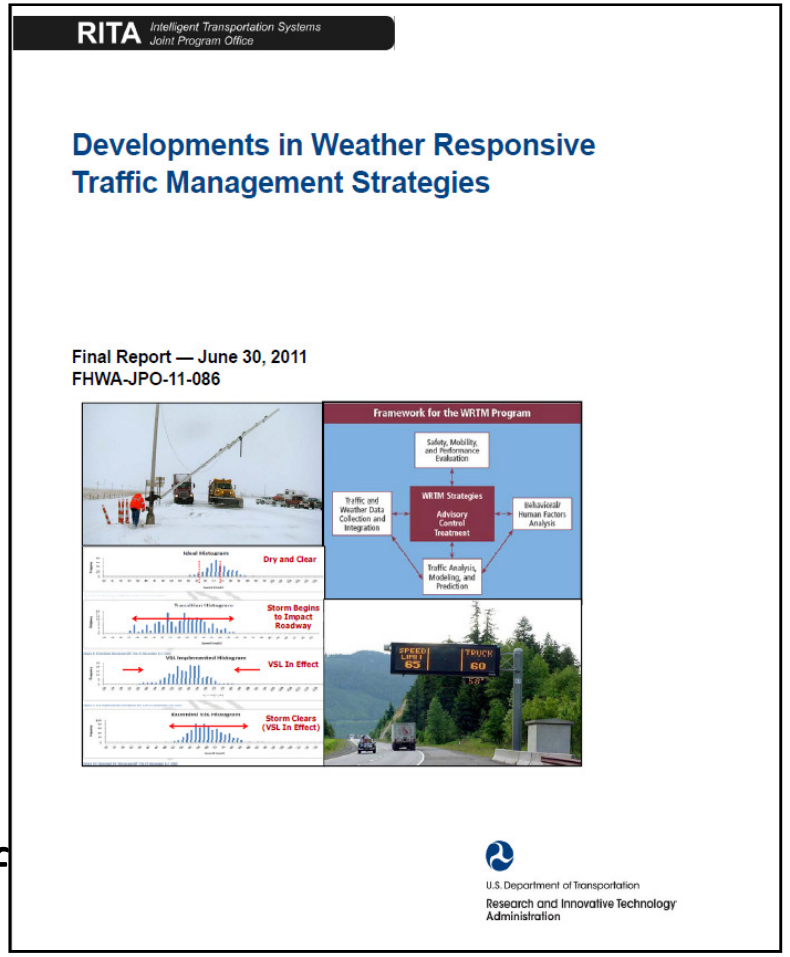
- TrEPs demonstrated and evaluated in the three cities using number of WRTM strategies
  - Variable Speed Limits
  - With or Without Diversion using DMS signs
  - Without WRTM
- Report forthcoming

Developments in Weather Responsive Traffic Management Strategies

- Project Purpose: Investigate what strategies exist, where they have been used, the benefits realized, and how to improve, implement, and evaluate them as part of transportation operations.

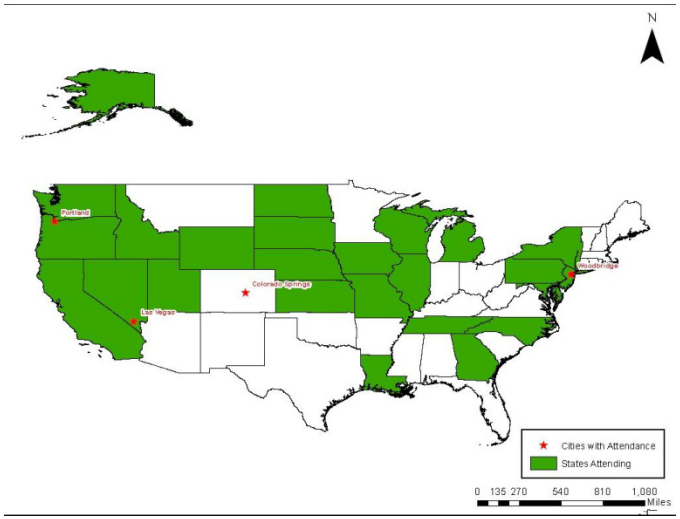
Developments in Weather Responsive Traffic Management Strategies

- Battelle Institute, TTI, and McFarland Management
- Contains:
  - Review of WRTM Strategies
  - Improvements to WRTM Strategies
  - FiveWRTM ConOps
  - Evaluation Approaches and Procedures
- Available at: http://ntl.bts.gov/lib/42000/42900/42965/wrtm_final_report_06302011.pdf



Stakeholder Coordination: WRTM Workshop

- October 6-7, 2011, Portland OR
- Jointly with the TMC Pooled Fund Program
- 26 State DOT's, 2 cities, 1 turnpike authority
- Objectives: Discuss existing practices, identify needs, and create a stakeholder group



Workshop Recommendations

- Refine/Implement Concepts of Operations for WRTM Strategies
- Conduct a series of webinars and tech transfer activities
- Provide guidance on the 1201 Rule
- Include private sector and academia in stakeholder group
- Create a peer exchange group
- Coordinate research activities with relevant pooled fund efforts and coalitions
- Continue to develop and deploy guidelines for consistent Road Weather Messages
- Coordinate with other Operations programs such as ICM, ATDM, Freight, etc.
- Apply performance/effectiveness measures, monitor and compile evaluation results

Training/Outreach

- NTOC Webinars
  - Active Traffic Management and Weather *(March 20, 2012)*
  - Using Social Media During Weather Events *(April 19 2012)*
  - Weather Responsive Traffic Signal Management *(May 31 2012)*
  - Webinar transcripts available through NTOC
  - http://www.ntoctalks.com/web_casts_archive.php
- CITE Training
  - Weather Responsive Traffic Management (WRTM)
  - Offered October to December 2012

Road Weather Management

Anytime, Anywhere Road Weather Information

Contact Information:

Roemer Alfelor
roemer.alfelor@dot.gov
202-366-9242
www.fhwa.dot.gov/weather