Center for Accelerating Innovation

U.S. Department of Transportation
Federal Highway Administration





On-Ramp to Innovation
every day counts

Weather-Responsive Management Strategies

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NJDOT
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Topics of Discussion

- ✓ Weather Responsive Management Strategies (WRMS)
- ✓ Weather Savvy Roads Initiative (EDC4) & WRMS (EDC5)
- ✓ Case Examples of State Implementations
- ✓ Deploying the WRMS solution

FHWA "Every Day Counts" (EDC) Program

Identify and rapidly deploy proven, but underutilized innovations to:

- ✓ Save time, money and resources
- ✓ Shorten the project delivery process
- ✓ Enhance roadway safety
- ✓ Reduce traffic congestion
- ✓ Improve environmental sustainability
- ✓ Integrate automation

For more information: https://www.fhwa.dot.gov/innovation/everydaycounts/

FHWA "Every Day Counts" (EDC) Program

- **EDC Rounds: 2-year cycles**
- **5th Round (2019 – 2020) 10 innovations**
- **To date: 4 rounds, over 40 innovations**

Current EDC-5 Innovations

1. **Advanced Geotechnical Methods in Exploration**
2. **Collaborative Hydraulics**
3. **Project Bundling**
4. **Reducing Rural Roadway Departures**
5. **Safe Transportation for Every Pedestrian (STEP)**
6. **Unmanned Aerial Systems (UAS)**
7. **Crowdsourcing for Operations**
8. **Value Capture: Capitalizing on the Value Created by Transportation**
9. **Virtual Public Involvement**
10. **Weather-Responsive Strategies**

For more information: https://www.fhwa.dot.gov/innovation/everydaycounts/

Moving from **Weather-Savvy Roads (WSR) to Weather Responsive Management Strategies (WRMS)**

EDC-4 (WSR)

Integrating Mobile Observations (**IMO**), as well as Pathfinder

Goal: Improve mobile data collection

…from fleet vehicles using advanced sensing and vehicle-based technologies

24 states **deployed or enhanced their IMO** efforts under EDC-4

EDC-5 (WRMS)

Maintenance and Traffic Management

Goal: Use mobile data for weather-responsive strategies

…to improve traffic and maintenance management during adverse weather

23 states are working to **deploy or enhance WRMS** as part of EDC-5

EDC-4: Integrating Mobile Observations (IMO)

Collect weather and road condition data:

- ✓ Supplemental data from ancillary sensors.
- ✓ Built on vehicle-based technologies.
- ✓ Provide a detailed view of the weather and road conditions.

Source: City of West Des Moines

Benefits to DOT:

- ✓ Cost-efficient way to support maintenance, traffic, and performance management strategies.
- ✓ Proactive management of roadway systems before the negative impacts of road weather occur.
- ✓ Improved safety, mobility, and economy given ability to more effectively maintain a high level of service on roads.

Source: Michigan DOT

For more information: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/roadweather.cfm

EDC-5: Weather-Responsive Management Strategies (WRMS)

Use of road weather data to:

- ✓ Improve management strategies
- ✓ Reduce environmental impacts

Mitigates the impact of numerous unsafe conditions:

- ✓ Winter weather (snow, ice, sleet)
- ✓ Hurricanes
- ✓ Flooding
- ✓ Fog

Source: Gerry Broome, AP

Source: Minnesota DOT

The Motivation

Road Weather remains an area of focus due to…

Safety issues

- ~21% of crashes due to rain, ice, snow, and fog
- ~6,000 fatalities
- +445,000 injuries

Mobility problems

- ~25% of non-recurring delays
- ~$3.45 billion added to freight costs annually

Environmental concerns

- affect on water sheds, air quality, and infrastructure

WRMS Strategies

- ✓ Provide relevant and timely information
- ✓ Appropriate traffic intervention methods
- ✓ Mitigate the impacts

- **Traveler Information** - mobile data
- **Winter Maintenance** – resource management and decision-making
- **Debris Removal** - high winds, flooding, and burn scar areas

Weather Events

Implementing WRMS for a variety of events

These events lead to…

- Reduced road friction
- Reduced vehicle maneuverability
- Slower speeds
- Reduced roadway capacity
- Increased crash risk
- Significant infrastructure damage
- Increased speed variance
- Debris flow, erosion, and flooding

Weather Events

WRMS mobile applications can include a weather layer with "Track A Plow" or plow images.

WRMS Application: **Maintenance Decision Support System (or MDSS)** leverages available road and weather condition information to make recommendations about the location, timing, and type of de-icing material for maintenance staff to apply.

Weather Events

Flooding

Flood Forecasting and Response (Delaware)

- **Robust RWIS network**
- **Equipped vehicle fleet - mobile RWIS and dash cams**
- **Nine drones for flood response, according to event severity**

Weather Events

Dust Storms

Dust Detection System (Arizona)

- **11 sensors on a 10-mile corridor of I-10.**
- **Automatic VSL activation (lowers in 10 mph increments)**
- **Automatic ramp closures when 35 mph speeds reached**

Weather Events

Wildfires

Burn Scar Management (California)

- **New RWIS, NWS mobile RWIS**
- **Collaboration with NWS, law enforcement, cities, and counties, to forecast information and proactively close highways when mudslides predicted**
- **Plan to expand efforts to other predicted events (e.g., winter weather)**

Data Sources to Support WRMS

Sources include agency fleets, private vehicles, 3rd parties, agency operators, road users, and agency infrastructure

In-Vehicle Equipment

- Plow and Material Sensors
- Friction/Grip Sensors
- Atmospheric and Pavement Condition Sensors
- Video and Camera Images
- Automatic Vehicle Location (AVL)/Global Positioning System (GPS)

Other Data Sources

- Fixed RWIS
- National Weather Service Data
- Road User Reports
- Operator Reports
- 3rd Party Data
- Mobile Observations & Connected Vehicle Data

Guidelines for Deploying Connected Vehicle-Enabled Weather Responsive Traffic Management Strategies. https://rosap.ntl.bts.gov/view/dot/31928

WRMS Applications

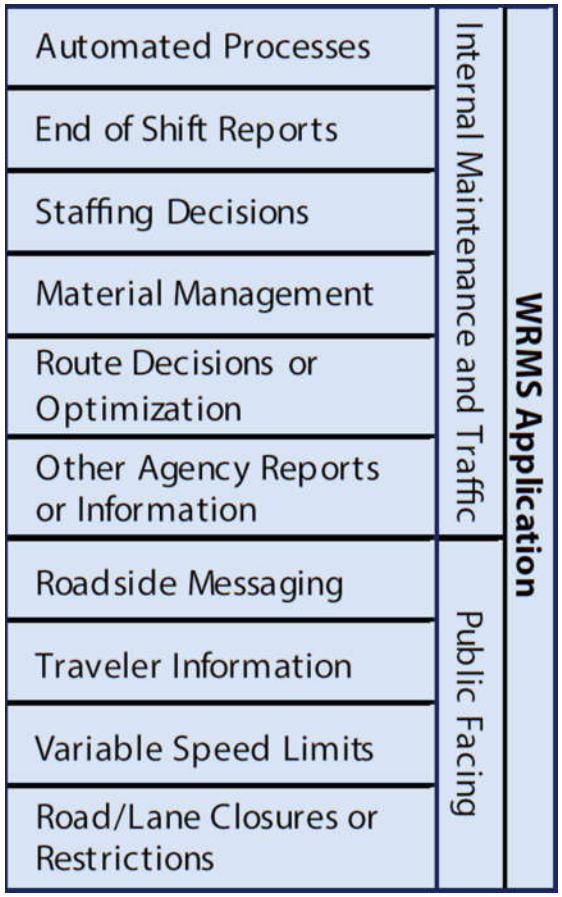
Internal Applications

- **Automated Processes**
- **Resource Management**
  - End of Shift
  - Staffing
  - Material management
  - Route management
- **Agency Reporting:**
  - Condition/Performance

Agency needs dictate a variety of applications:

Public-Facing Applications

- **Roadside Messaging**
- **Traveler Information**
- **Variable Speed Limits**
- **Road/Lane Closures & Restrictions**



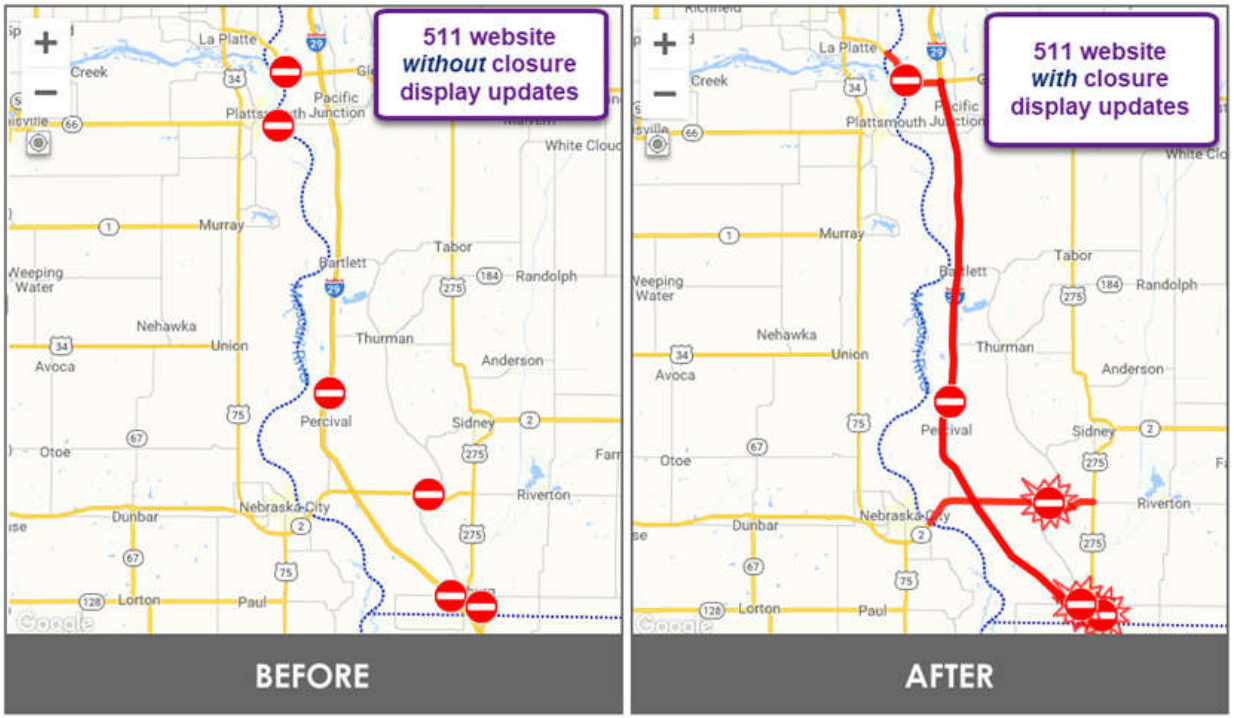
Examples of EDC-5 WRMS State Initiatives

States DOT	Weather Responsive Management Strategies
Colorado DOT	Statewide route optimization using real-time and historical data
Maryland DOT	Expansion of mobile RWIS across state
New Hampshire DOT	Augmenting existing technology in rural areas with AVL & mobile RWIS
Illinois DOT	Data integration for decision-making and performance management
New Jersey DOT	Traveler information and maintenance management thru vehicle data
Oklahoma DOT	Integrating plow data and RWIS data for forecasting predictions for more responsive treatment strategies
Montana DOT	Data sharing technology in rural locations

Transportation Agencies Implementing WRMS

States/Local Agency	Weather Responsive Management Strategies
Michigan DOT	Traveler Information System Roadside Maintenance
Minnesota DOT	Web-Maintenance Decision-Support System (WebMDSS) Motorist Advisory Warning and 511 Traveler Information Fleet Management and Vehicle Maintenance Info
Nevada DOT	Winter Maintenance Treatment Recommendations Material Usage Tracking Traveler Information System
South Dakota DOT	Traveler Information System (Condition and Threat Forecasts)
Utah DOT	Traveler Information using Data from Mobile App
Wyoming DOT	Dynamic Message Signs (Traveler Information) Variable Speed Limit
West Des Moines, IA	Traveler Information Material Management Snow Plow Location/Route Optimization

Agencies Reduce Flooding Impacts on the Public through Enhanced Traveler Information



Source: Iowa Department of Transportation

At left, an example of what road closure alerts looked like before system updates.

The image on the right shows an example of road closure alerts with updates, which shows the extent of the closures through a "painted line."

Benefits

- Safety
- System Performance
- Operations
- Costs
- Environmental Impacts

Benefits to Date…

Traveling Public

- Safer pre-trip & en-route decision making
- Better roadway coverage
- Unified & Localized messaging
- Increased accuracy

Agency

- Better sharing of resources
- Enhanced alerting
- More efficient condition reporting
- Optimized resource usage
- Automated agency processes

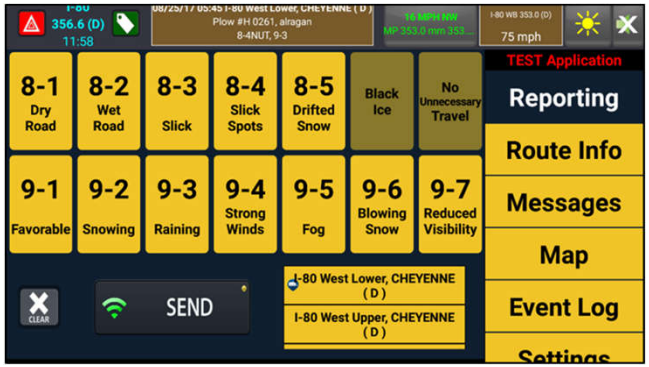
Common Challenges

- **Remote areas**
- **Buy-in**
- **Hesitance**
- **Funding**

Traveler Information using Data from Mobile App

Source: Utah DOT

Wyoming: plow app - Road Condition report



Source: Wyoming DOT

WRMS Deployment Funding Sources

- **State Transportation Innovation Councils (STIC) Incentive Program**
  - ✓ **Up to $100,000 per STIC per year to standardize an innovation**
  - ✓ https://www.fhwa.dot.gov/innovation/stic/
- **Accelerated Innovation Deployment (AID) Demonstration Program**
  - ✓ **Up to $1 million available per year to deploy an innovation not routinely used**
  - ✓ https://www.fhwa.dot.gov/innovation/grants/

NJDOT Weather-Responsive Management Strategies

NJDOT awarded the AID grant:

- **Vehicles -** maintenance trucks and safety service patrol
- **Data -** streaming video & pavement weather sensor info
- **Application** - data usage
  - **Field and TMC situational awareness**
  - **Vehicle positioning**
  - **Operational decision-making**

Source: New Jersey DOT

Source: New Jersey DOT

Closing Thoughts

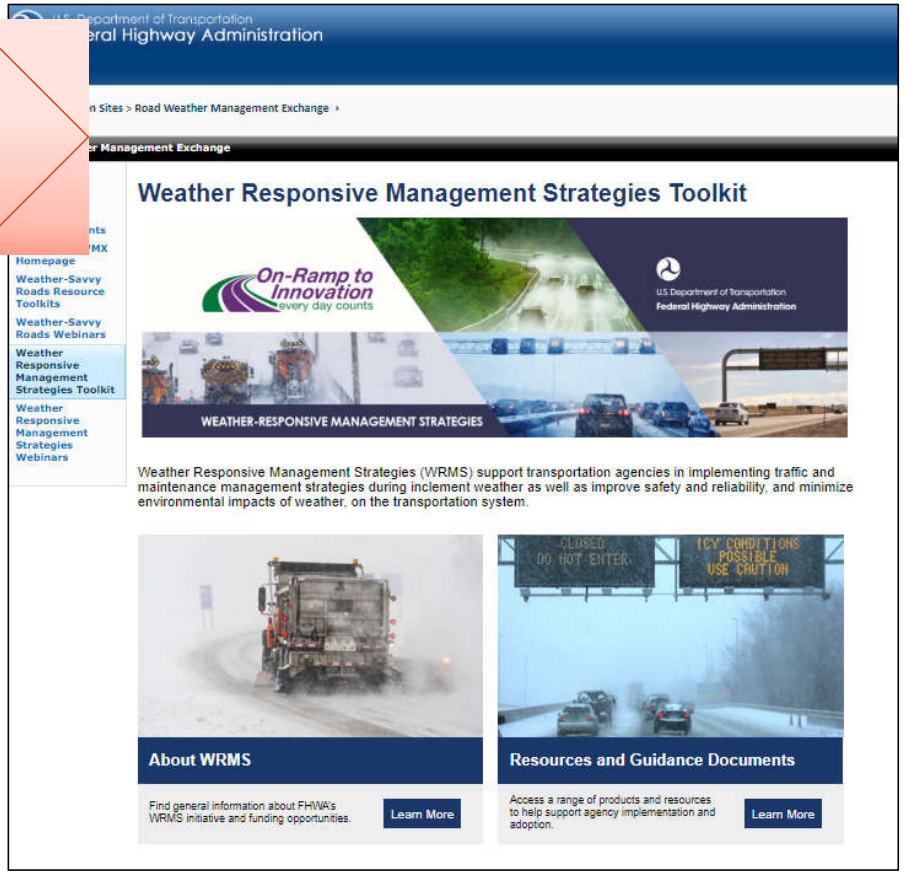
- **WRMS apply to all weather conditions**
- **Traffic and Maintenance**
- **WRMS → mobile and CV data**
- **Significant benefits**

Resources and Technical Support Activities

WRMS Toolkit:
https://go.usa.gov/xyGzN
one-stop source for all WRMS implementation-related materials

Technical Support:

- Webinars
- Workshops
- Peer exchanges
- On-site technical assistance
- Training materials/training
- Case studies
- Fact sheets
- Marketing materials



Thank you!

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