

# Prototype Road Weather Performance Management (RW-PM) Tool and Minnesota Department of Transportation (MnDOT) Field Evaluation

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## Background and Objectives:

FHWA's Road Weather Management Program developed a Prototype Road Weather Management (RW-PM) Tool to help DOTs maximize the effectiveness of their maintenance resources and efficiently adjust deployments dynamically, as road conditions and traffic flow evolve during road weather events.

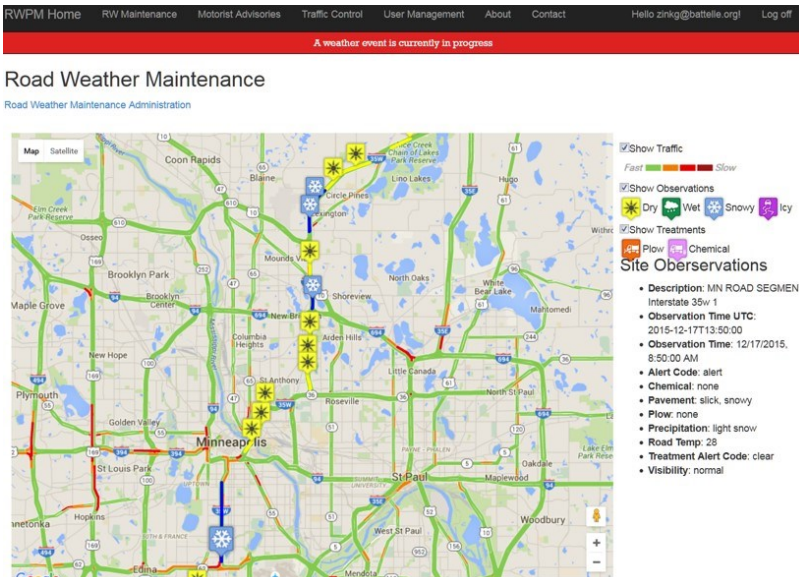
Adverse road weather conditions can significantly degrade traffic mobility, reducing speed and road capacity, and increasing delays and travel time. The RW-PM Tool counteracts the negative impacts of adverse weather events by:

- ◆ Enabling real-time RW-PM data capture, analysis and response
- ◆ Helping to maximize efficiency/effectiveness of resources
- ◆ Refining and optimizing RW-PM response measures
- ◆ Integrating traffic mobility and road weather for informed decisions by drivers, traffic management and maintenance

## Prototype RW-PM Tool System Description:

The tool leverages connected vehicle (CV) inputs and existing data sources to provide real-time traffic mobility, and road weather conditions. CV data provides RW-PM Tool users rich, high resolution road weather data, and it simultaneously provides DOT and CV operators integrated real time mobility data and advisories.

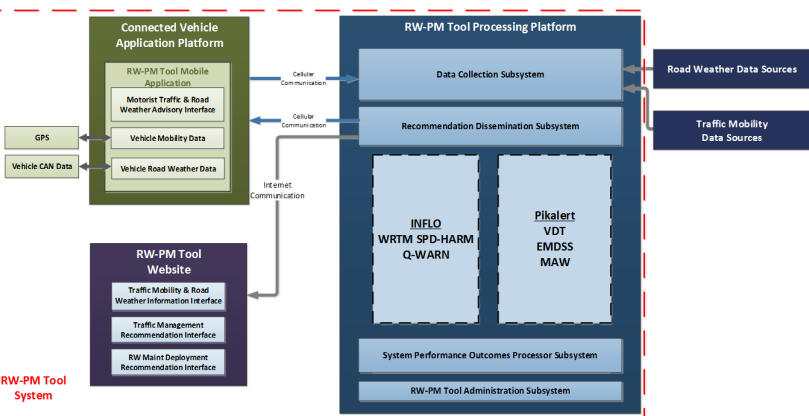
The tool integrates in real-time weather responsive traffic management, road weather treatment, and motorist traffic and road weather advisories. The major tool components include the Processing Platform, the Website, and the Connected Vehicle application. These are connected via a Microsoft Azure Cloud-based database and services.



RW-PM Tool Website Application Interface (Source: Battelle)

The three primary pages presented by the Website are Road Weather Maintenance, Motorist Advisories, and Traffic Control. Layers of information are chosen on each page through checkboxes, and selected information is overlaid upon a scalable map provided by Google.

In the RW Maintenance page example above, selectable layers include traffic data (from Google), pavement condition observations, and treatment recommendations (from Pikalert®). Selecting an icon or its associated road segment presents detailed Site Observations like road temperature and visibility. Notification of an active weather event is shown as a red banner atop each page, depicted directly above "Road Weather Maintenance" above.

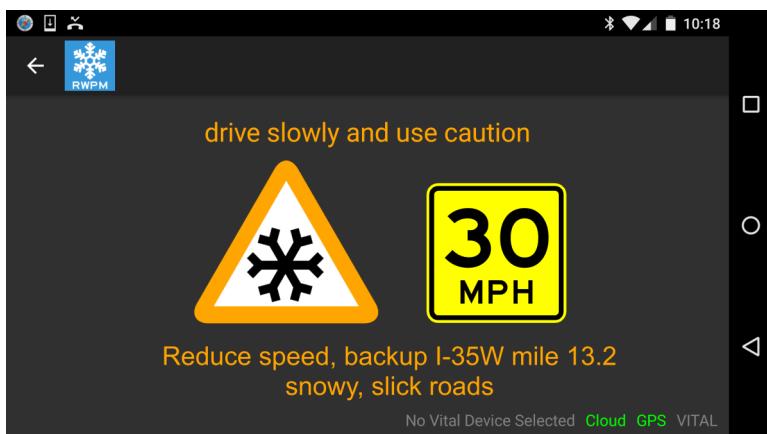


RW-PM Tool System Diagram (Source: Battelle)

**"Anytime, Anywhere Road Weather Information"**

In addition to traffic, the Motorist Advisories page displays queue warnings and speed harmonization alerts (from INFLO), and CV position and details (from CV GPS and OBD-II ). The Traffic Control page shows the same information plus speed sensor details, but not individual CV details. A separately-accessed Weather Event Details page provides summary performance statistics for Pikalert road segments during an active or historic weather event. Statistics include average speed (each direction), average road temperature, percent time of each pavement observation type, and percent time of each precipitation state.

The RW-PM Tool Mobile Application is the interface between the RW-PM system and the CV driver. It displays Motorist Alerts generated by RW-PM system and shares vehicle data with RW-PM system, inclusive of vehicle data from the vehicle OBD-II port and location data from the GPS. PII details are not captured or recorded by the RW-PM Tool or its equipment.



RW-PM Tool Connected Vehicle Application (Source: Battelle)

The RW-PM Tool mobile application runs on an android device with cellular and Bluetooth connectivity. It uses a cellular connection to send data to the RW-PM Cloud system using an RW-PM web API and Bluetooth connection to retrieve vehicle telemetry data from the vehicle's CAN bus via a Bluetooth enabled OBD-II reader.

In addition to the communication status of modules integrated with the CV application platform (Cloud, GPS, and OBD-II), the CV operator is presented relevant road weather and mobility-oriented Motorist Advisory alerts. Alerts are shown as graphical icons and supporting text, providing information describing conditions and recommendations (road weather, queue warnings, and speed harmonization). The screen capture above encourages the driver to slow down because the pavement condition

is reported as "snowy and slick," and additionally relays a recommendation to reduce speed to 30 mph due to a backup on I-35 West at mile marker 13.2.

### **MnDOT Field Evaluation:**

Evaluation of the RW-PM Tool was conducted by stakeholder assessment of system functionality and performance during weather events. The following bullets detail the RW-PM Tool integration and deployment:

- ◆ The Prototype RW-PM tool was deployed from 11/15/15-4/15/16
- ◆ Equipped and captured data from 9 light duty incident response vehicles that traversed the I-35 West corridor through Minneapolis
- ◆ Additionally, the RW-PM Tool captured MnDOT RWIS data and Snowplow data through Pikalert
- ◆ RW-PM used Pikalert Applications for Road Weather and INFLO Applications for Weather Responsive Traffic Management (Speed Harmonization)
- ◆ Traffic Speed Data Inputs used included Google Maps Traffic, MnDOT traffic sensors, and CV performance
- ◆ RW-PM determined traffic control, motorist advisory, and road weather maintenance recommendations during weather events
- ◆ Real time conditions and recommendations were presented on an internet accessible Web Page interface, with motorist and road weather maintenance advisories presented to CVs

### **Obtaining and Using the RW-PM Tool:**

The RW-PM Tool is free and available on DOT's OSADP. Obtain the tool and documents by searching for "RW-PM" at: <http://itsforge.net>. The tool and documentation outlining prerequisites, installation, and use are posted.

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