

# Prototype Road Weather Performance Management (RWPM) Tool

## Installation Instructions & User Manual

[www.its.dot.gov/index.htm](http://www.its.dot.gov/index.htm)

**Final Report — July 20, 2016**

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<b>16. Abstract</b> <p>This document is the Installation Instructions and User Manual for the Road Weather Performance Management (RW-PM) Tool developed for the project on <i>Development and Demonstration of a Prototype Road Weather Performance Management Application that Uses Connected Vehicle Data</i> (RW-PM Tool Project). This document describes prerequisites for the tool and its components; installation instructions for data feeds, storage, and web-based and mobile applications; and user instructions for web-based application account management, web-based application access, and interface and functionality details for the web-based and mobile applications.</p> <p>The objective of this project is to utilize a Systems Engineering approach to prototype, test, deploy, and evaluate a Prototype RW-PM Tool that will demonstrate the potential for connected vehicle data to enhance and transform road weather performance measurement and management processes in DOTs. The Tool will provide a mechanism for the United States Department of Transportation (U.S. DOT) to assist DOTs in leveraging connected vehicle technologies and to advance the state of the art in road weather management.</p>					
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# Chapter 1 RWPM Tool Introduction

## 1.1 Summary of RWPM Tool Purpose and Functionality

- Purpose and rationale for the tool
  - Goal of RWPM Tool: Counteract, to the extent possible, the negative impacts of adverse weather events on roadway safety, mobility, and productivity
  - Highlight potential for Connected Vehicle (CV) data to enhance and transform road weather performance measurement and management processes in State DOTs
  - Provide a mechanism for US DOT to:
    - Continue engaging State DOTs, and
    - Advance the state-of-the-art in road weather management to take advantage of CV technologies
- Functions of the tool
  - Continuous, real-time management and optimization of adverse weather response
  - Real-time integration of:
    - Weather Responsive Traffic Management
    - Road Weather Treatment
    - Motorist Traffic and Road Weather Advisories
  - Leverages connected vehicle data to improve road treatment and traffic management response
  - Delivers traffic and road weather information to drivers to enable more informed decision
- Major components of the tool
  - RWPM Tool Processing Platform
  - RWPM Tool Mobile Application
  - RWPM Tool Website

## 1.2 Intended Users

- State DOT TMCs
- State DOT Road Maintenance
- State DOTs / Stakeholders who may benefit from road weather-based

## 1.3 OSADP

Source code is made available via OSADP by searching for “RW-PM” at: <http://www.itsforge.net/>.

# Chapter 2 Prerequisite Requirements

## 2.1 RWPM Tool – Cloud

- Microsoft Azure SQL database
- Microsoft Azure Cloud Services running the RWPM Azure worker roles, and the RWPM web API
- Pikalert instance
  - Demonstration ran on a virtual machine in the Azure cloud

## 2.2 RWPM Tool Website

### 2.2.1 Hardware Requirements / Recommendations

- Microsoft Azure Web App running the RWPM Portal

### 2.2.2 Software Requirements

- Modern internet browser supported by Windows 7 (i.e. Internet Explorer, Firefox, Chrome)

## 2.3 RWPM Tool Mobile Application Platform

### 2.3.1 Hardware Requirements

- OBD-II port
  - **Note:** Limitations of CAN data made available vary by vehicle manufacturer, model, and year
- Power port (12V DC)
- Cell phone data plan
- Cell phone running Android version 4.4 with Bluetooth
- Cell phone mount and power DC adapter

## 2.4 Aligning Data Sources

- The prototype RWPM tool uses Pikalert to generate maintenance response recommendations and INFLO to generate traffic management recommendations



- The prototype RWPM tool was designed to make use of Road Weather data sources (RWIS and Snow Plow AVL and Sensor data), Traffic Mobility Data Sources (Traffic Speed sensors), and Connected Vehicle Mobility Data
  - RWIS Sensor Data
  - Ameritrak Data Feed to Pikalert
  - INFLO

The following sections of this chapter contain software engineering implementation details developed during the course of Prototype RWPM Tool development. Chapter 3 contains additional installation and implementation details.

## 2.5 RWPM Web API Implementation Notes

### 2.5.1 Implements Components

- Data Collection
- RW Maintenance Dispatch Recommendation Dissemination
- Motorist Advisory Dissemination
- Traffic Control Recommendation Dissemination

### 2.5.2 Interfaces

- Data Collection Web API (Implements PP2 Data Collection)
  - PUT Vehicle Mobility Data
    - Parameters: none
    - Data: Message (B) Vehicle Mobility Data in JSON format
  - PUT Vehicle Road Weather Data
    - Parameters: none
    - Data: Message (A) Vehicle RW Data in JSON format
  - GET Vehicle Road Weather Data
    - Parameters: timestamp formatted 'yyyy-mm-dd hh:mm:ss'
    - Returns: Array of Message (A) Vehicle RW Data since provided timestamp
- Dissemination Web API (Implements PP6 RW Maintenance Dispatch Recommendation Dissemination, PP8 Motorist Advisory Dissemination, PP10 Traffic Control Recommendation Dissemination)
  - GET Motorist Alerts
    - Parameters: latitude, longitude, heading
    - Returns: (J) Motorist alerts which combines MAW Alerts, SPD-HARM, and Q-WARN for requested location

- GET All Motorist Alerts
  - Parameters: none
  - Returns an array of (J) Motorist Alerts that are currently active in the system
  
- GET RW Maintenance Recommendations
  - Parameters: none
  - Returns: An array of (I) RW Maintenance Recommendations currently active in the system

## 2.6 Networking

### 2.6.1 Web API Structure

The RWPM project is a Visual Studio 2013 Azure solution that contains the Data Collection web API project, Data Collection web role, and Dissemination web API. This solution will be deployed to the Microsoft Azure cloud computing system as a single cloud service.

The Data Collection web API project will have an interface to the data storage component, which is a Microsoft Azure SQL Server database that stores the input and output data for the system. The Data Collection web API project will have multiple interfaces to send and receive information to and from the RWPM cloud service, in-vehicle system, and portal. The data collection web API will receive vehicle mobility data and vehicle road weather data from other systems in the road weather performance measurement system and forwards the vehicle mobility data information on to the INFLO and Pikalert systems for their respective processing. The in-vehicle system will supply the mobility and road weather information by using an on-board GPS for position and movement information along with CAN information that will be used by Pikalert for its road weather status processing.

The Data Collection web role will retrieve the MAW output data and District alert data from the Pikalert MAW and EMDSS systems on a set timer interval of 5 minutes. The retrieved data will be stored in the data storage's maw outputs and district alerts tables. The data will be used by the dissemination subsystem for viewing by the RW Maintenance Dispatch Display, the Motorist Advisory Dissemination display, and the Traffic Control Dispatch Display.

The Data Collection web API will also have an output interface for retrieval of vehicle road weather data. This interface will have a date time as a parameter, and return all the vehicle road weather data stored in the Data Storage component since that date and time. This interface will be used by Pikalert to retrieve vehicle road weather data for use in its processing.

The Dissemination web API will have connections to both Pikalert's web API to retrieve (E) MAW alerts and (H) RW District Alerts, and INFLO to retrieve (F) WRTM SPD-HARM and (G) Q-WARN alerts for a particular location. The (E) MAW, (F) WRTM SPD-HARM, and (G) Q-WARN alerts will be combined into a (J) motorist alert message and sent to the connected vehicles mobile device. There will also be a web API call to get all the current (E) MAW, (F) WRTM SPD-HARM, and (G) Q-WARN alerts for display in the Traffic Control Dispatch Display. The (H) RW District Alerts will be parsed, filtered by location, and converted to (I) RW Maintenance Recommendations which can be retrieved from this web API for displaying in the RW Maintenance Dispatch Display.

# Chapter 3 Installation

## 3.1 Data Feed Implementation

### 3.1.1 Pikalert MAW Integration Implementation Notes

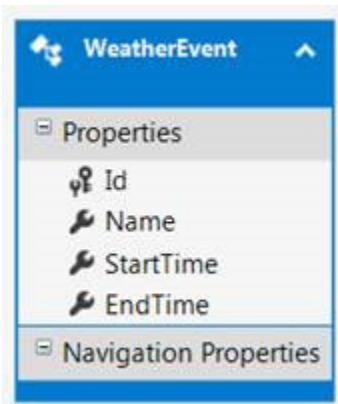
- The connected vehicle device (cell phone) will call the RWPM API at [URL]/MotoristAlert?latitude=&longitude=&heading=
- The RWPM MotoristAlert controller will call the Pikalert MAW using [URL link specific to deployment] to retrieve Pikalert MAW alerts
- The output will be combined into the road weather performance monitor MotoristAlert message with the QWarn and SpeedHarm alerts
  - The MAW portion of the MotoristAlert class will contain both numerical codes for conditions as well as text representation of the numerical codes. The lookup will be using the table at the end of this document.
- The connected vehicle will combine the messages and display the combined alerts to the driver

## 3.2 Data Storage Implementation Notes

### 3.2.1 Weather Event Table

This table will store weather events generated by the system, with their start time, end time, and a name field so that users can name weather events.

**Table 3-1. Weather Event Table**



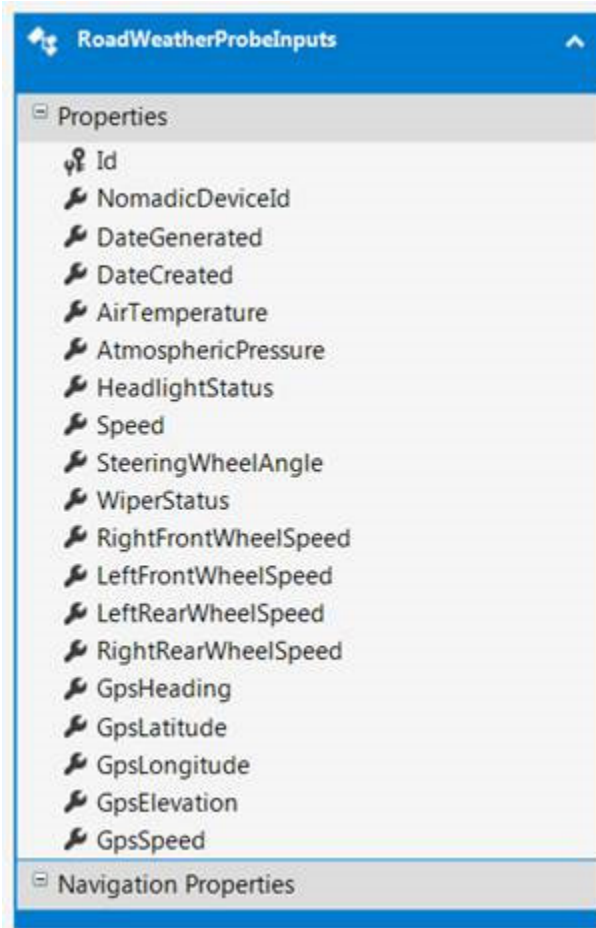
WeatherEvent	
[-] Properties	
🔑 Id	
🔑 Name	
🔑 StartTime	
🔑 EndTime	
[-] Navigation Properties	

Source: Battelle

### 3.2.2 Road Weather Probe Inputs

This table will store the (A) Vehicle Road Weather Data being collected by the mobile device and sent to the system through the Data Collection Web-API.

**Table 3-2. Road Weather Probe Inputs Table**



The screenshot shows a mobile application interface with a blue header bar containing the text 'RoadWeatherProbeInputs'. Below the header is a list of properties under the heading 'Properties'. Each property is preceded by a small icon of a hand holding a pen. The properties listed are: Id, NomadicDeviceId, DateGenerated, DateCreated, AirTemperature, AtmosphericPressure, HeadlightStatus, Speed, SteeringWheelAngle, WiperStatus, RightFrontWheelSpeed, LeftFrontWheelSpeed, LeftRearWheelSpeed, RightRearWheelSpeed, GpsHeading, GpsLatitude, GpsLongitude, GpsElevation, and GpsSpeed. At the bottom of the list is a section titled 'Navigation Properties'.

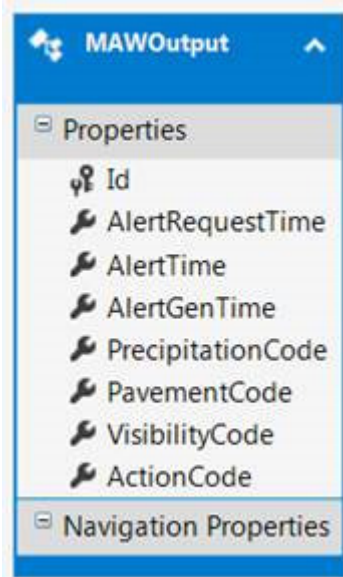
Property Name
Id
NomadicDeviceId
DateGenerated
DateCreated
AirTemperature
AtmosphericPressure
HeadlightStatus
Speed
SteeringWheelAngle
WiperStatus
RightFrontWheelSpeed
LeftFrontWheelSpeed
LeftRearWheelSpeed
RightRearWheelSpeed
GpsHeading
GpsLatitude
GpsLongitude
GpsElevation
GpsSpeed

Source: Battelle

### 3.2.3 MAW Output Table

This table will be used to store all outputs created by the Pikalert MAW application.

**Table 3-3. MAW Output Table**

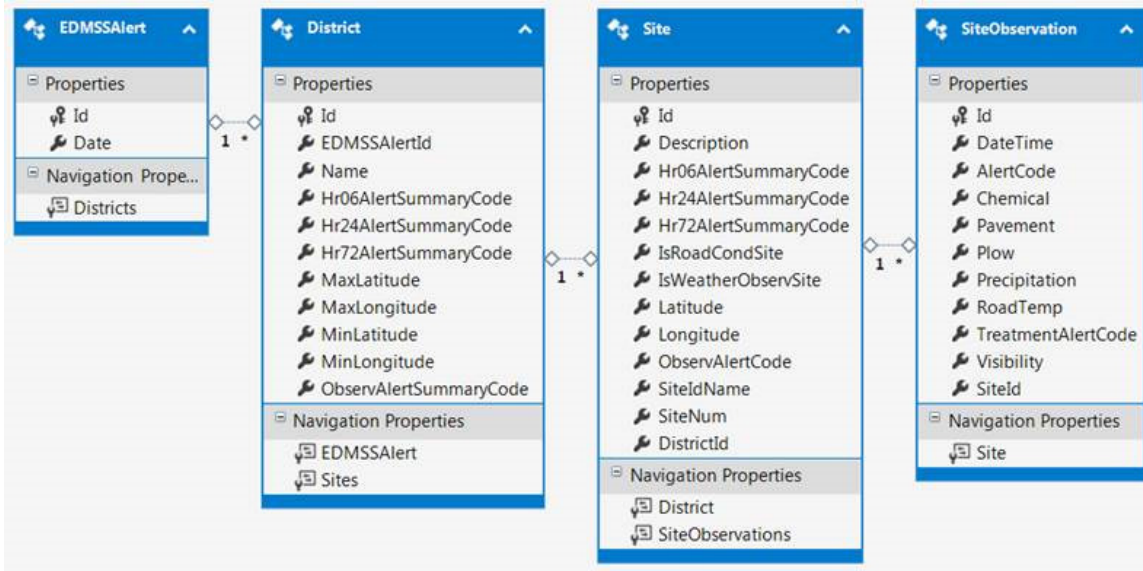


Source: Battelle

### 3.2.4 EMDSS Alerts

The EMDSS alerts will be stored in the following table structure. The output from the Pikalert EMDSS comes as a (H) RW District Alert message format. The table structure mirrors the (H) RW District Alert format so that all data captured from the Pikalert EMDSS can be stored.

**Table 3-4. EDMSS Alert Table**



Source: Battelle

### 3.3 Installing RWPM Tool Web-Based Application

The web based application will be deployed to Azure using Visual Studio. Please see Microsoft’s documentation on how to deploy to Azure here: <https://azure.microsoft.com/en-us/documentation/articles/web-sites-deploy/>

### 3.4 Installing RWPM Tool Mobile Equipment

The Tool uses vehicle data captured by the installed VITAL OBD-II module and RWPM mobile application on the cell phone, roadside traffic information, and road weather sensors to provide a DOT with more detailed real-time data on road and traffic conditions to assist in responding to adverse weather.

The mobile application can be installed on an Android device by publishing the application to the Google Play store and installing from the Google Play application.

# Chapter 4 Web-based Application Account Creation and Maintenance

## 4.1 Account Registration (User Creation)

The Account Creation function (available in the RWPM main menu by selecting the **User Management** option) enables users with Admin level access to create and register new users. This includes assigning for new users a username (Email), password, and permission (access) levels as described in the Access Levels section and as shown in the **Registration** page in Figure 4-1 below.

### 4.1.1 Access Levels

Four different permission (access) levels are available per RWPM site. For example, an RW Maintenance Admin might have Elevated permission for the RW Maintenance site, Read only for the Motorist site, and Elevated for Traffic Control Site.

- Admin – Full control of site functionality
  - Creating users
  - Modifying maintenance recommendations and motorist alerts
  - Rejecting maintenance recommendations and motorist alerts
  - Starting and stopping weather events
  - Viewing data both on map and in detail
- Elevated – Control of some site functionality
  - Modifying maintenance recommendations and motorist alerts
  - Rejecting maintenance recommendations and motorist alerts
  - Starting and stopping weather events
  - Viewing data both on map and in detail
- Read Only
  - Viewing data both on map and in detail

## 4.2 Account Maintenance

The Account Maintenance function (available in the RWPM main menu by selecting the **Hello e-mail address!** option) enables each individual user to change their password per the **Manage** page in Figure 4-2 below.

RWPM Home   RW Maintenance   Motorist Advisories   Traffic Control   User Management   About   Contact   Hello zeng@battelle.org!   Log off

## Registration

Create a new account

Email

Password

Confirm password

Select Permissions

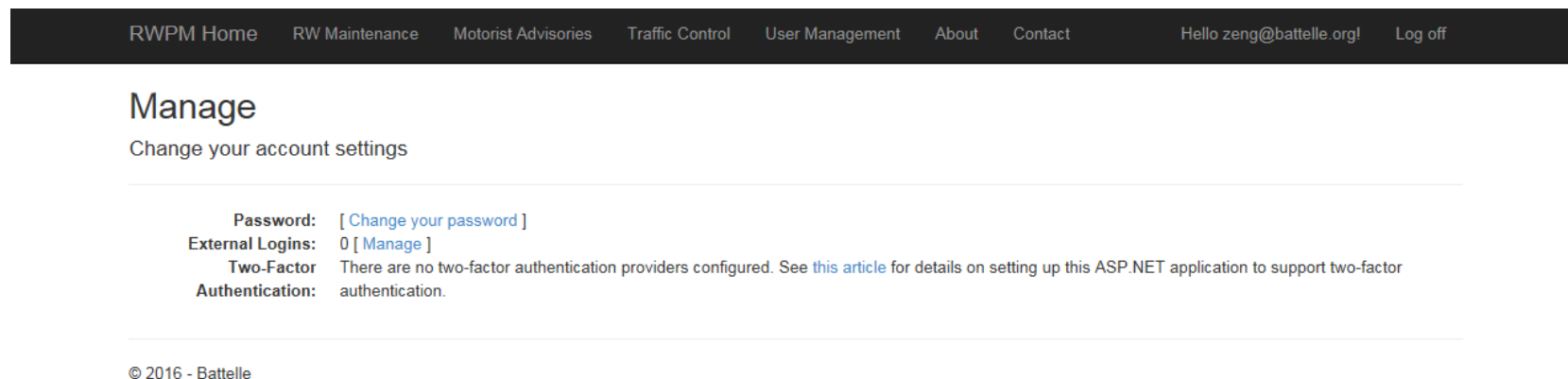
- Battelle
- RWMaint\_Admin
- RWMaint\_Elevated
- RWMaint\_ReadOnly
- MotorAdv\_Admin
- MotorAdv\_Elevated
- MotorAdv\_ReadOnly
- TrafCont\_Admin
- TrafCont\_Elevated
- TrafCont\_ReadOnly

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Source: Battelle

**Figure 4-1. Account Creation (Registration) Page**





Source: Battelle

**Figure 4-2. Account Maintenance (Manage) Page**

# Chapter 5 Web-Based Application Login Procedure

## 5.1 New User Login

Credentials will be supplied by the administrator who created the account. Users are asked to log into the system and change their password by clicking on their user name in the upper right corner of the page and selecting “Change your password”. The user will be prompted to enter their current password and the new password. Password requirements include one upper case character, one lower case character, one number, one special character and must be at least 8 characters in length.

## 5.2 Standard Login

Requires using a registered e-mail and registered or user-revised password. Refer to Figure 5-1 below.

- Single sign on, with a landing page that has links to the other 5 sites
- Three different site access levels control what data is visible and actions that the users is permitted to perform.

Source: Battelle

**Figure 5-1. RWPM Login Page**

# Chapter 6 Web-Based Application Interface and Functionality

## 6.1 Website Structure

RWPM Web-Based application was developed in Microsoft Visual Studio 2015 and contains five separate Microsoft Azure web site projects, allowing the RWPM tool to utilize cloud computing services as described in Chapter 2. Each website uses the same authentication method, so that users can access them with the same credentials. The users will be restricted by which sites that are allowed to visit, and by the access level that they have in that site. There will be a landing home page that will contain the links to the other sites that the authenticated user is allowed to visit.

## 6.2 Site Map

- Home Page
  - RW Maintenance
    - Administration
      - RW Maintenance Recommendation Management (this is where modifications and rejection of recommendations occur)
      - User Management
      - Weather Event Management (Start / Stop Weather Event)
    - Map View (display all active RW Maintenance Recommendations)
    - RW Maintenance Recommendation Detail (Full Details of a selected RW Maintenance Recommendation)
  - Motorist Advisory
    - Administration
      - Motorist Advisory Management (this is where modifications and rejection of alerts occur)
      - User Management
    - Map View (display all active Motorist Alerts; MAW, SPD-HARM, Q-WARN)
    - Motorist Alert Detail (Full details of a selected motorist alert)
  - Traffic Control
    - Administration
      - User Management
      - Weather Event Management (Start / Stop Weather Event)
    - Map View (display all active SPD-HARM, and Q-WARN alerts)
    - SPD-HARM and Q-WARN Alert Detail (Full details of a selected alert)

## 6.2.1 RWPM Home Page

Once successfully logged in, the user is navigated to the **RWPM** Home (landing) page. Figure 6-1 and the following figures below present a sample **RWPM** Home page for a user with Admin level access.

## 6.2.2 Main Menu Options

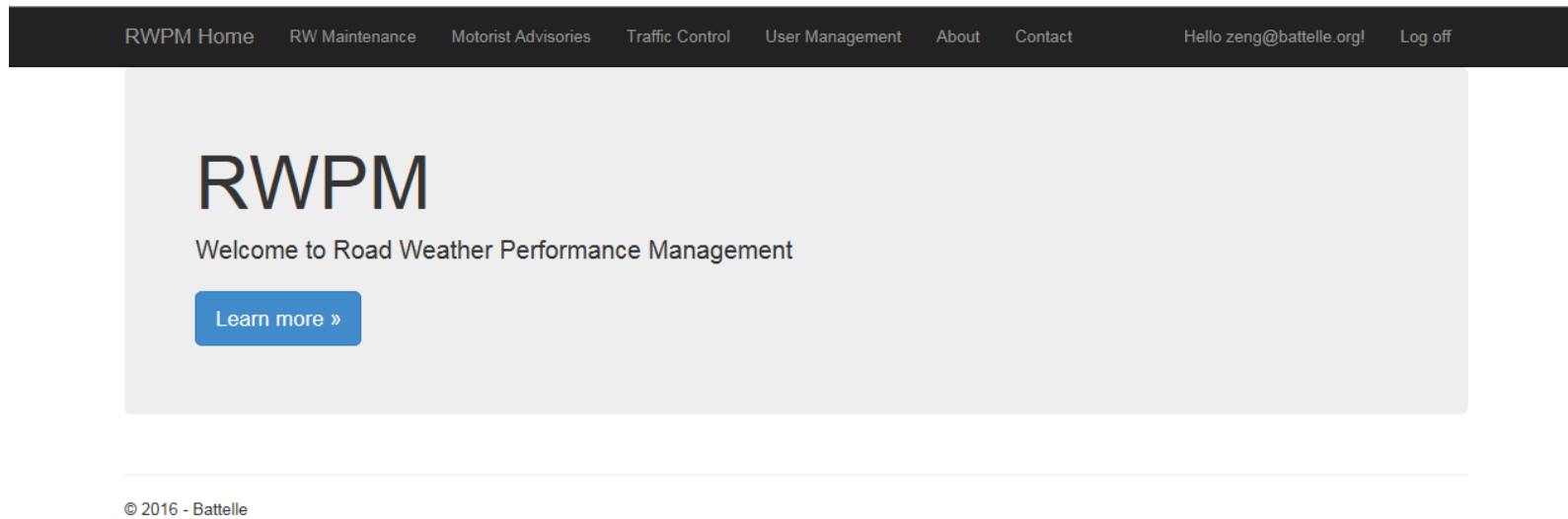
Main menu options appear on a black banner on the RWPM Home page and all other pages (although it is not shown in many of the figures following Figure 6-1).

From the **RWPM** Home page, the user can **Log off**, navigate to one of the three real-time integrated RWPM Sites (**Road Weather Maintenance** page, **Motorist Advisories** page, or **Traffic Control** page), or navigate to the **Weather Events** site from within any of the real-time integrated RWPM sites.

Additionally, the user can navigate to the **Manage** page (**Hello e-mail address!** option) and, provided assigned permission allows, the **Registration** page (**User Management** option). Both of these pages are described in Chapter 4.

The user can also access a short summary of the RWPM program by selecting the **About** menu item and obtain contact information for the RWPM Tool by selecting the **Contact** menu item.

Finally, the **RWPM** Home page can be returned to from any other page in the application by selecting **RWPM Home** from the main menu.

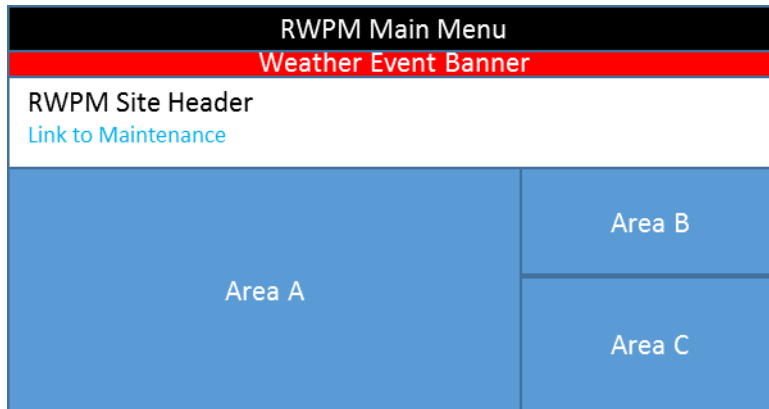


Source: Battelle

**Figure 6-1. RWPM Home Page**

### 6.2.3 Interface Design for the Real-Time Integrated RWPM Site Pages

The interface through which information is controlled and displayed is shared by each of the RWPM Tool sites. The following figure depicts the general interface areas.



Source: Battelle

**Figure 6-2. Interface Design for the Real-Time Integrated RWPM Site Pages**

The RWPM Site Header and Weather Event banner (if applicable) are displayed immediately beneath the main menu. The main menu is presented as a series of white text options on a black banner. The RWPM Site Header displays in black text on white background, and indicates the name of the RWPM site selected from the main menu. It also contains beneath it in smaller font blue text a link to the Events Administration area for users with other than Read Only access levels. If a weather event is in progress, a red banner with white lettering indicating this state is displayed in the area above the RWPM Site Header and below the main menu.

Information and control of the selected RWPM Site is presented in Areas A-C, shown in blue in Figure 6-2 above. Area A presents a scalable map, provided by Google. Superimposed upon this map for each RWPM site, and automatically updated periodically, are layers of information including Google Traffic (speed) information and RWPM details selected in Area B.

Google Traffic details appear as a colored overlay over roads. Green represents a 'normal' speed of traffic. Yellow represents 'slower than normal' traffic conditions. Red indicates 'congestion'. Dark red indicates 'stopped, nearly stopped, or stop-and-go traffic'. Grey indicates that data is not available.

Finally, in Area C, Observations or Properties (depending on the site) of the selected displayed icon/segment. The selected icon will appear noticeably larger in size than non-selected icons. A description of the selected icon or segment (if applicable) appears as the first detail of Area C, and is followed by other observation or property details as described below for each site. If no icon/segment is selected in Area A, Area C will remain blank.

Checkboxes in Area B are used to make multiple display selections for display in Area A. On the RW Maintenance page, checkboxes permit simultaneous display of Weather Observations, Google Traffic, and Pikalert Road Treatment Recommendations. On the Motorist Advisories page, checkboxes permit simultaneous display of INFLO Motorist Advisories Sent to In-Vehicle

Display, Vehicle Properties, and Google Traffic. On the Traffic Control page, checkboxes permit simultaneous display of Google Traffic, DOT Traffic Speed Sensors, and INFLO Motorist Advisories.

The resolution of the Google Map displayed will dictate the information displayed by location shown. The resolution scale can be controlled by mouse scroll. When scaled to show large areas, icons and icon segments may be partially or fully occluded by other icons – including a selected icon. In this case, the refresh order will determine which icons are “painted over” other icons. In order to clearly see all icons and icon segments (where applicable), the user must “zoom in” to a scale permitting display of individual icon and icon segments. See Figure 6-3 and Figure 6-4 below.

## 6.2.4 Road Weather (RW) Maintenance Page

In addition to Google Map and Traffic information described above, the Road Weather Maintenance page can display RWIS/DOT-based Weather Observations and/or Pikalert Road Treatment Recommendations, as shown in Figure 6-3 and Figure 6-4 below. All observations and recommendations are displayed using Google’s Map Icons Collection. When both Observations and Treatment checkboxes are selected, Treatment Recommendation icons will appear in Area A instead of Weather Observation icons, once updated. The Pikalert segment represented by each icon (Observation or Treatment) is painted onto the roadway in the color of the icon displayed.

Only one Weather Observation icon can be displayed for a selected Icon representing the current pavement condition for a selected road segment:

- **Dry** (yellow sun icon),
- **Wet** (green rain cloud icon),
- **Snowy** (blue snowflake icon), or
- **Icy** (fuchsia slippery road icon).

Treatment recommendations include:

- **Plow** (orange snowplow icon), and/or
- **Chemical** (pink snow treatment icon)

Both Treatments can simultaneously apply, and if that is the case the Plow icon will be displayed as it is assumed that plowing must typically precede chemical application.

Selecting either an Observation or Treatment icon, or their associated painted segment, on the map will generate the same Site Observations in Area C. The following details are updated every 5 minutes with details provided by Pikalert:

- **Description** – presents a description of the selected DOT road segment selected
- **Observation Time UTC** – time in UTC for the information presented
- **Observation Time** – time in local time (time zone where web application is used) of the information presented

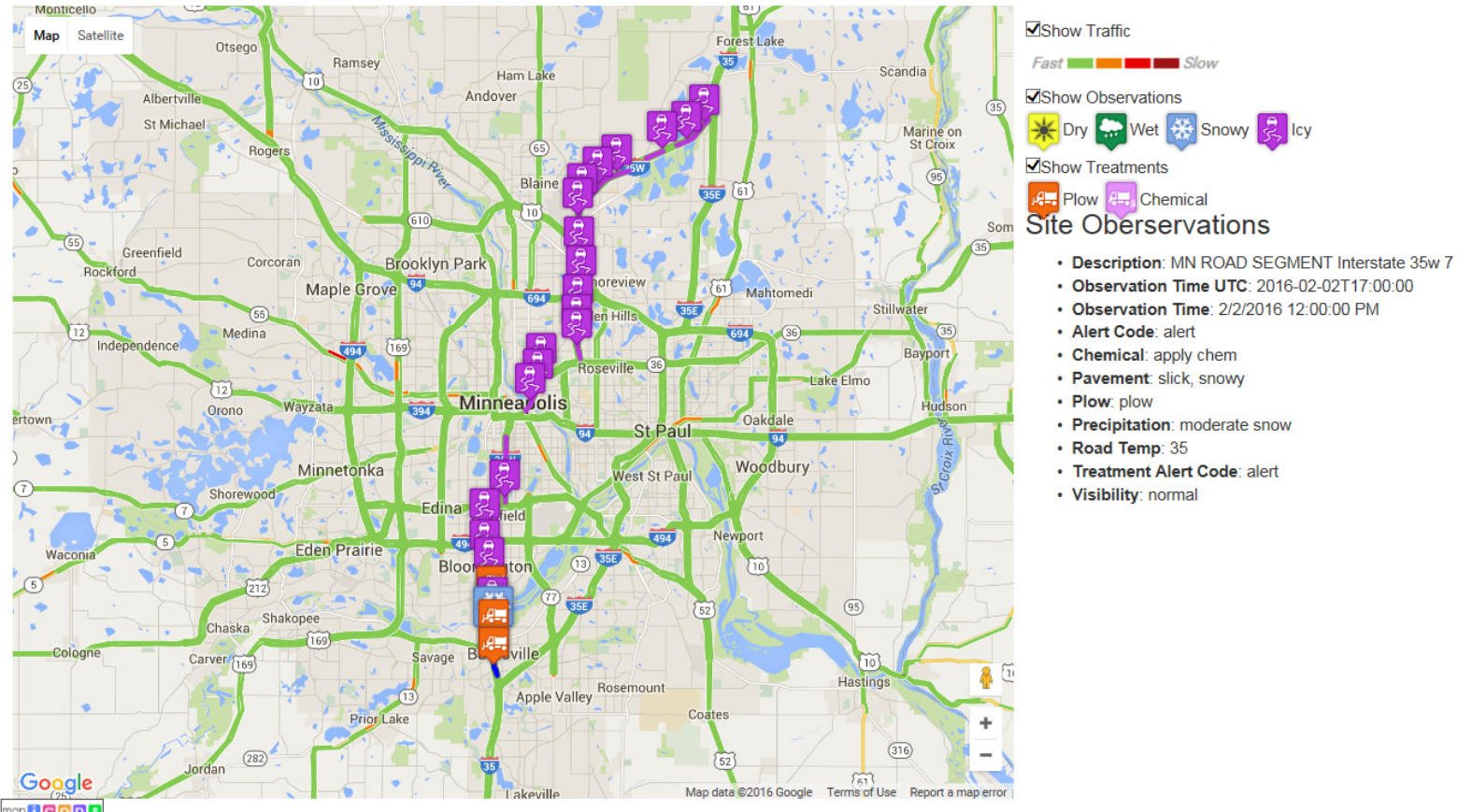


- **Alert Code** – Clear, Alert, or Warning is presented for Pavement Condition
  - Clear if Dry; Warning if Wet; Alert if (Slick,) Snowy or Icy
- **Chemical** – None or Apply Chemical
- **Pavement** – Dry, Wet, Snowy, or Icy (RWPM Pavement conditions and their corresponding Pikalert pavement conditions are below)
  - **Dry**
    - Clear
  - **Wet**
    - **Wet Roads**
    - **Hydroplaning Possible**
  - **Snowy**
    - **Snowy Roads**
    - **Snowy, Slick Roads**
  - **Icy**
    - **Icy Roads**
    - **Icy, Slick Roads**
    - **Black Ice**
    - **Icy Roads Possible**
    - **Icy, Slick Roads Possible**
- **Plow** – None or Plow
- **Precipitation** – None, Light/Moderate Rain, Heavy Rain, Light/Moderate Mixed, Heavy Mixed, Light/Moderate Snow, Heavy Snow
- **Road Temp** – in degrees Fahrenheit
- **Treatment Alert Code** – Clear or Alert (Alert means Chemical and/or Plow recommendation)
- **Visibility** – Normal, Heavy Rain, Blowing Snow, Heavy Snow, Fog, Low Visibility

A weather event is currently in progress

## Road Weather Maintenance

Road Weather Maintenance Administration



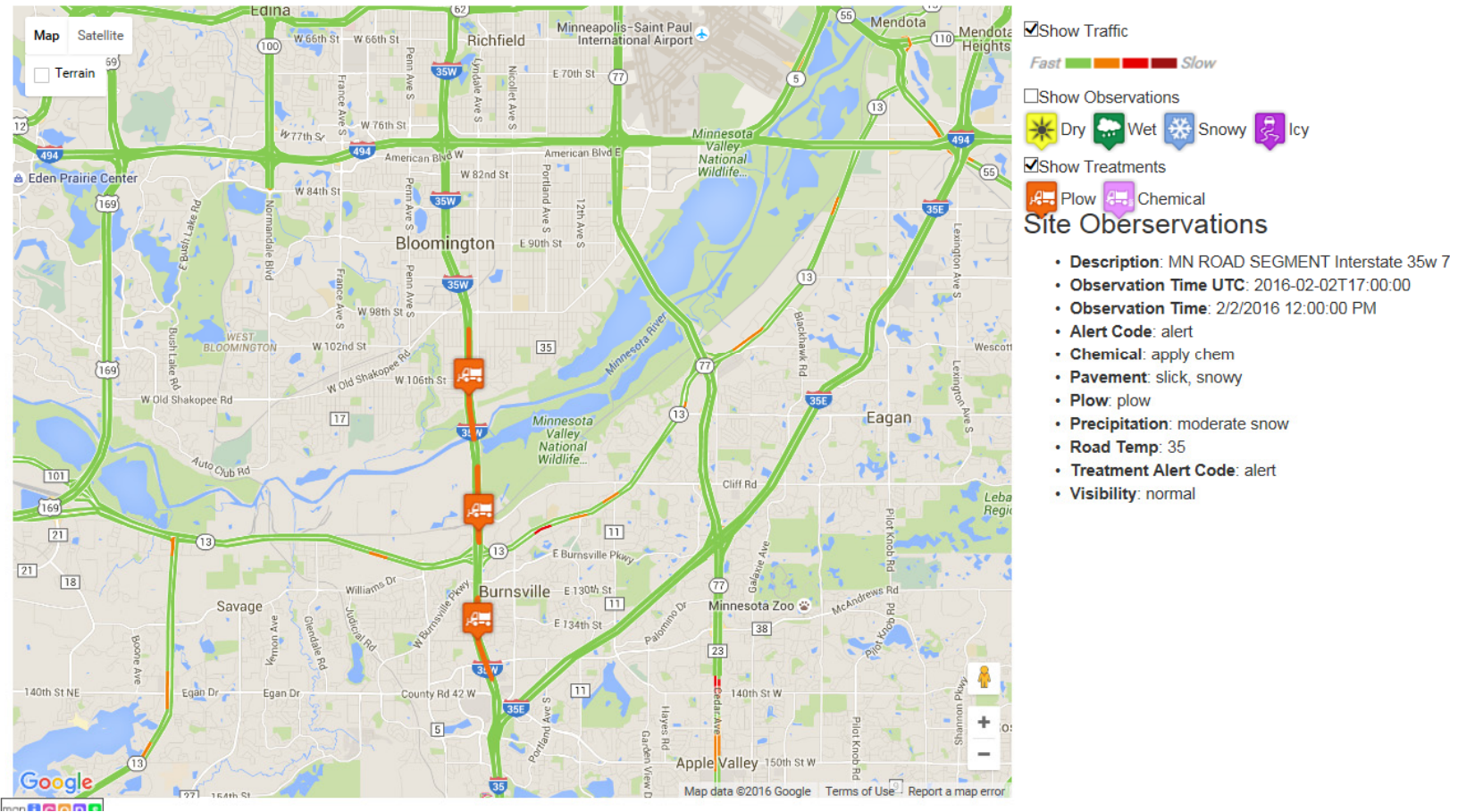
Source: Battelle

Figure 6-3. Road Weather Maintenance Page during a Weather Event

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Intelligent Transportation Systems Joint Program Office

# Road Weather Maintenance

Road Weather Maintenance Administration



Source: Battelle

**Figure 6-4. Road Weather Maintenance Page – Zoomed in View to Show Painted Segments for Select Treatment Recommendations**

U.S. Department of Transportation, Office of the Assistant Secretary for Research and Technology  
Intelligent Transportation Systems Joint Program Office

## 6.2.5 Motorist Advisories Page

In addition to Google Map and Traffic information described above, INFLO Queue Warnings (i.e., traffic backups), INFLO Speed Harmonization Warnings (recommended speeds), and the position of Connected Vehicles are displayed upon selection. Queue Warnings are displayed as maroon-colored pointer icons, Speed Harmonization Warnings are shown as purple-colored pointer icons, and connected vehicles are displayed as blue cars in Area A. See Figure 6-5 and Figure 6-6 below.

Queue and Speed Harmonization warnings are motorist advisories which will be sent to connected vehicles as well as displayed on the web application. These warnings can be canceled through the web application by users with Admin-level access by selecting the “Remove Speed Harm Alert” button (as shown in Figure 6-5 below) or “Remove Queue Warn Alert” button presented in Area C for the selected motorist advisory. Doing so removes the icon from the Motorist Advisories page.

When a Speed Harmonization warning is selected in Area A, the properties for that warning are presented in Area C, including:

- Recommended Speed
- The location (presented by mile marker) where the recommended speed should begin
- The distance (in miles) for which the recommended speed should be maintained
- Justification for the speed harmonization warning (typically congestion)

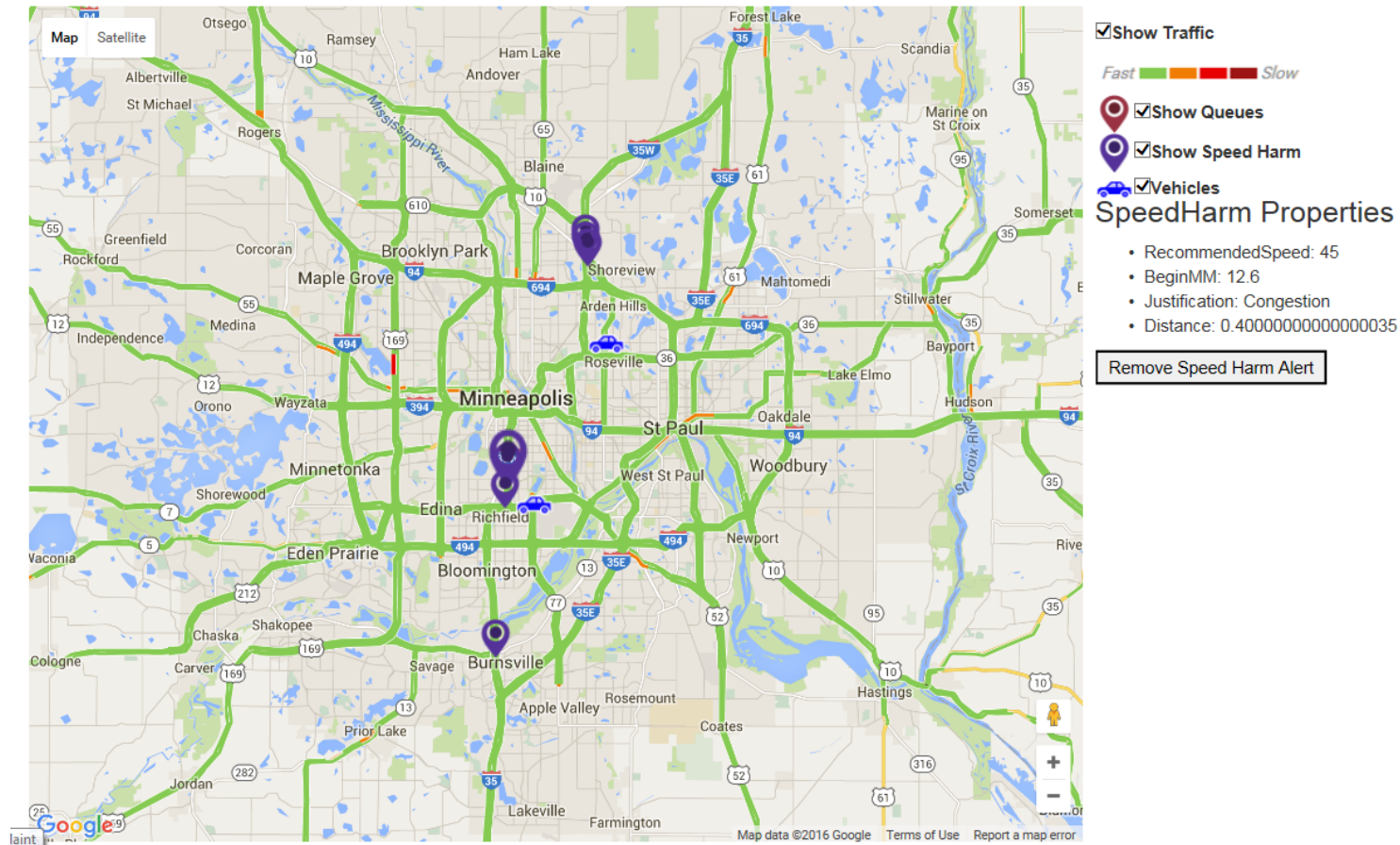
Connected Vehicle information is fed into the RWPM system INFLO and Pikalert components. Various Connected Vehicle details are presented in Area C for the vehicle selected in Area A, including:

- **Observation Time UTC** – time in UTC for the information presented
- **Observation Time** – time in local time (where web application is used) of the information presented
- GPS Heading
- **GPS Speed** – presented in miles per hour
- **Speed** – presented in miles per hour
- **Headlight Status** – true denotes that headlights are “on”
- **Air Temperature** – presented in degrees Celsius
- Atmospheric Pressure - presented in mmHg
- **Individual Wheel Speeds** – presented in meters per second
- Steering Wheel Angle
- **Wiper Status** – true denotes that wipers are “on”

# Motorist Advisories

Motorist Advisory Administration

Displays all active Motorist Alerts; MAW, SPD-HARM, Q-WARN.



Source: Battelle

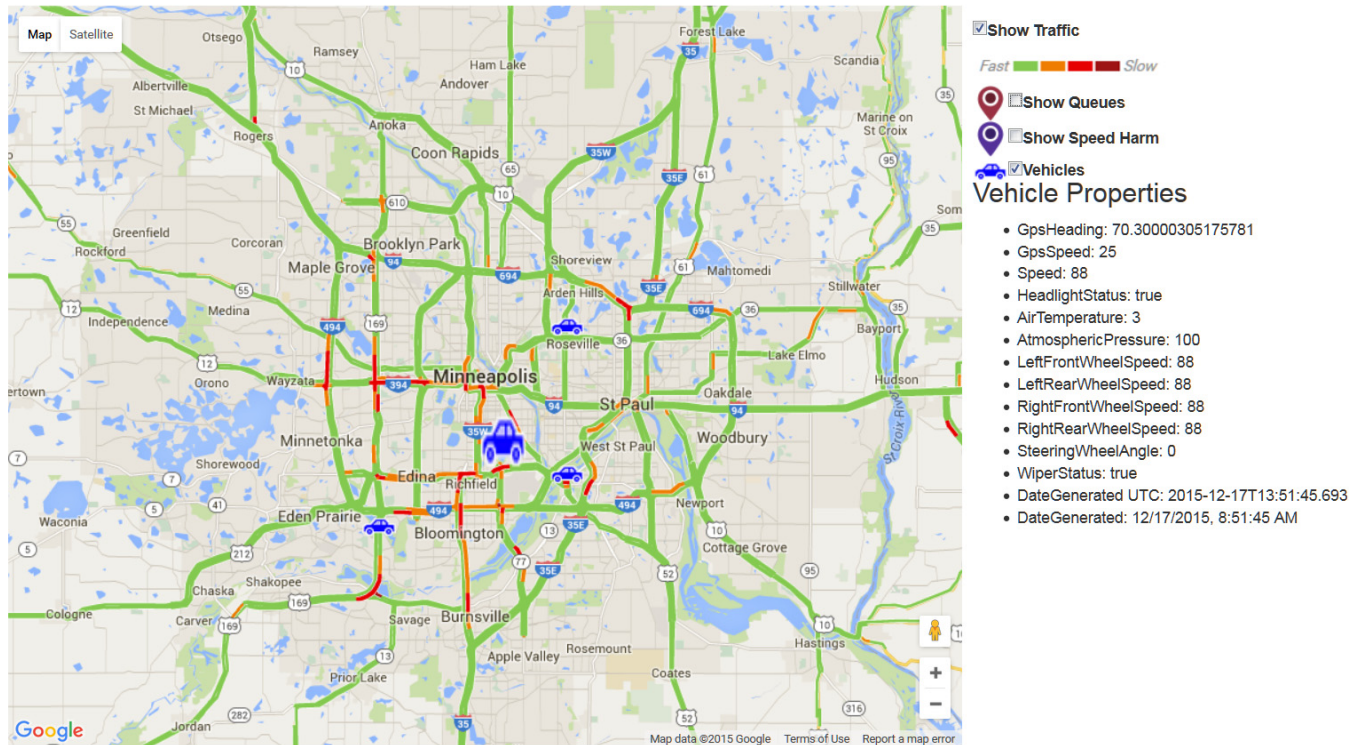
**Figure 6-5. Motorist Advisories – INFLO Speed Harmonization Alert Selected**

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Intelligent Transportation Systems Joint Program Office

## Motorist Advisories

[Motorist Advisory Administration](#)

Displays all active Motorist Alerts; MAW, SPD-HARM, Q-WARN.



Source: Battelle

**Figure 6-6. Motorist Advisories – Vehicle Selected**

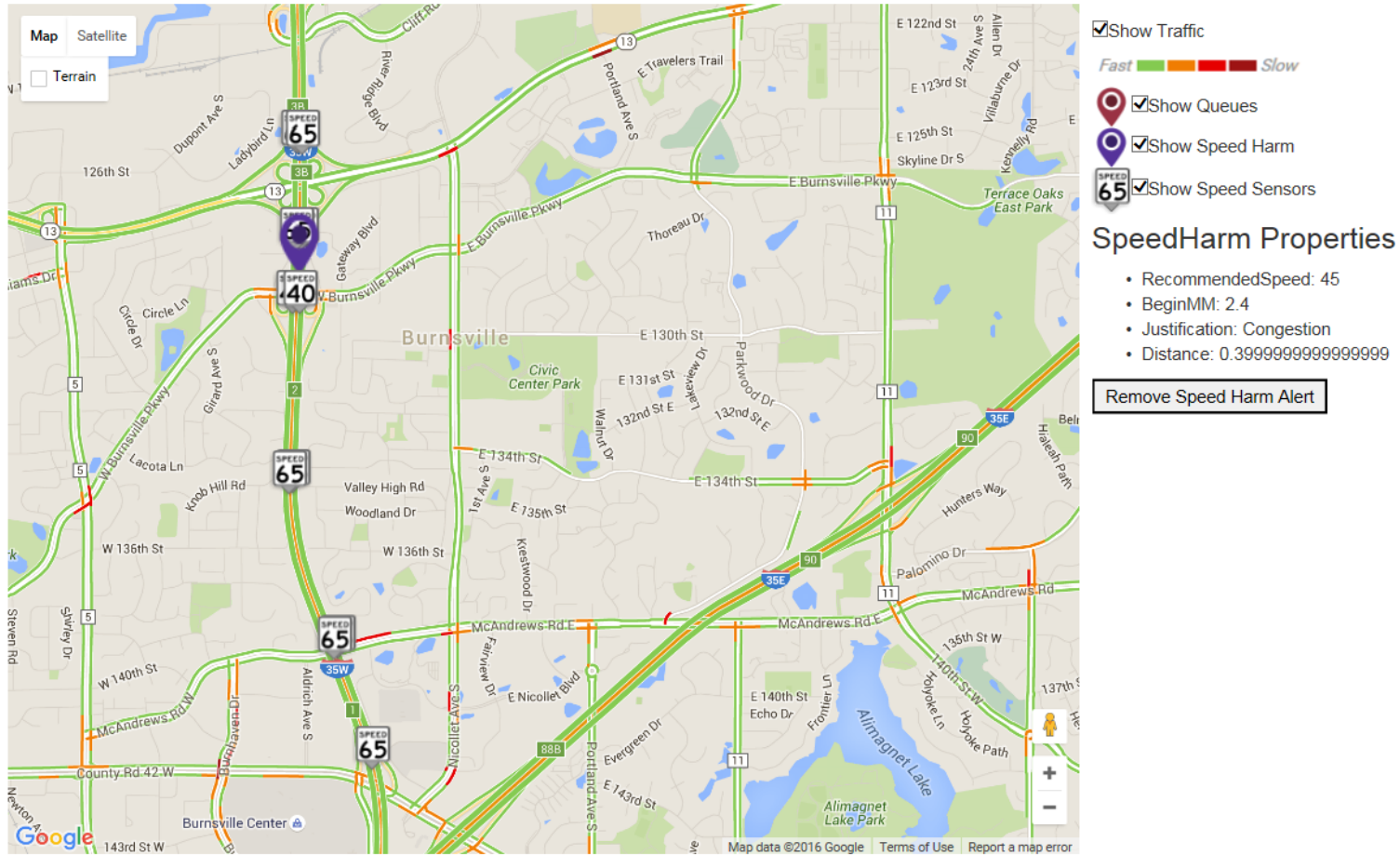
## 6.2.6 Traffic Control Page

In addition to Google Map and Traffic information described above, INFLO Queue and Speed Harmonization Warnings described in the Motorist Advisories section and DOT traffic speed sensor details will be displayed where available. This page displays the same Traffic Backups (Queue) and Recommended Speeds (Speed Harm) advisories generated by the system that are available to display on the Motorist Advisories page and that are sent to the connected vehicles.

Speed sensor data appear as Speed icons for each road segment and direction. Speeds are presented in 5 mph increments and are rounded down. For example, 54 miles per hour is displayed as “SPEED 50” and 56 miles per hour is displayed as “SPEED 55”. See Figure 6-7 below for an example of the presentation of speed sensor data and how they can be used to validate Speed Harmonization warnings.

# Traffic Control

Traffic Control Administration



Source: Battelle

Figure 6-7. Traffic Control

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## 6.2.7 Weather Events

Weather events can be started and concluded automatically, or manually. A list of previously-concluded weather events, as well as an event in progress (if applicable), is presented in the Weather Events page (see Figure 6-8 below). These events can be accessed for users other than those with Read Only access by choosing the blue Administration link located under the header of the Road Weather Maintenance, Motorist Advisories, or Traffic Control pages.

A weather event is automatically generated if 10% or more of the DOT segment stations (which may be inclusive of RWIS input) simultaneously reported pavement conditions as Snowy or Icy (per RW Maintenance page definitions). A weather event is automatically concluded if 90% or more of the DOT segment stations report pavement conditions as Snowy or Icy for a 10-minute span (this is 2 update cycles as Pikalert updates conditions every 5 minutes).

Automatically generated weather events will appear named as “Autogen” under Recent Events, with the associated local date and time directly following the name. Within each event row, inside brackets, are event time start and end date/times separated by a hyphen. An “End this event” link will be presented instead of an end date/time if the event is still in progress, and this link can be used to manually end the event.

While a weather event is in progress, performance data are collected and processed. This permits the presentation of select percentage-based summary statistics to be displayed for each DOT segment station location. This summary is available to view while the weather event is in progress, or after it has concluded, by selecting the View Details link at the end of automatically or manually initiated weather event rows.

The “Start new Weather Event” area, located beneath the area that events are listed (in Recent Events), is used to manually create a weather event. The user provides a name for the weather event to be created in the “Name for weather event” field and selects the “Create” button to manually create a new weather event. Manually created weather events can end automatically per the criteria listed above, or manually by selecting the “End this event” link.

Details for Weather Events are displayed by selecting the View Details link in the row of an active or concluded weather event. Figure 6-9 presents a sample of the Weather Event Details page shows. The Weather Event Details page shows on the Google Map a series of green-blue DOT segment station icons. Upon selecting an icon, a series of summary statistics will be displayed for the duration of the Weather Event (or to the current time for an active weather event). These statistics are presented as percentages or averages as follows:

- Average Road Temperature in degrees Fahrenheit
- % of time the various pavements conditions were experienced in the Weather Event period
- % of time the various precipitation conditions were experienced in the Weather Event period
- Average speed in both directions of the DOT segment

RWPM Home   RW Maintenance   Motorist Advisories   Traffic Control   User Management   About   Contact   Hello zinkg@battelle.org!   Log off

A weather event is currently in progress

## Weather Events

### Recent Events

- AutoGen 12/17/2015 1:37:40 PM [12/17/2015 1:37:40 PM - [End this event](#)] [View Details](#)

### Start new Weather Event

Name for weather event:

Create

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Source: Battelle

**Figure 6-8. Weather Events Page**

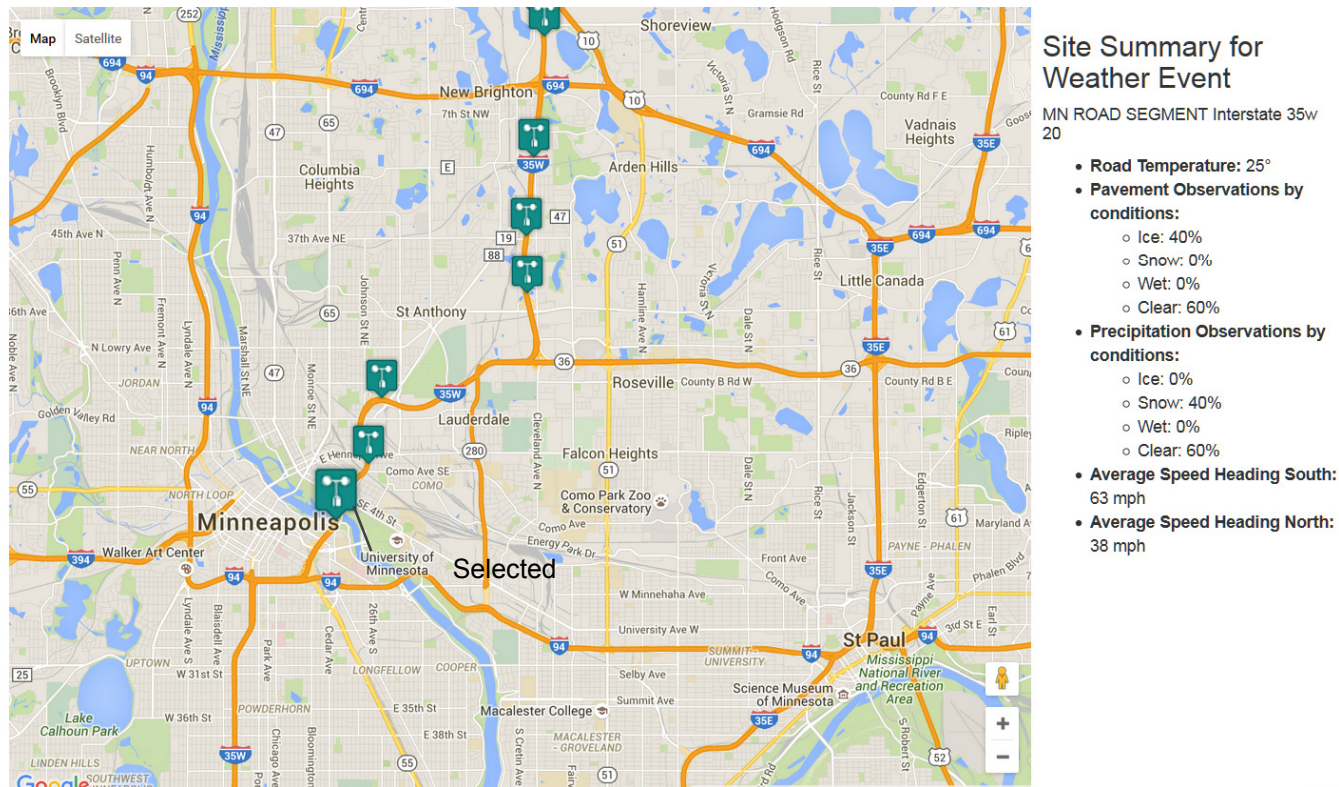
RWPM Home RW Maintenance Motorist Advisories Traffic Control User Management About Contact Hello zinkg@battelle.org Log off

**A weather event is currently in progress**

## Weather Event Details

Displays summary information for weather event for each site.

Weather Event: AutoGen 12/17/2015 1:37:40 PM [ 12/17/2015 1:37:40 PM - Currently In Progress ]



Source: Battelle

Figure 6-9. Weather Event Details

# Chapter 7 RW-PM Mobile Application Interface and Functionality

## 7.1 General

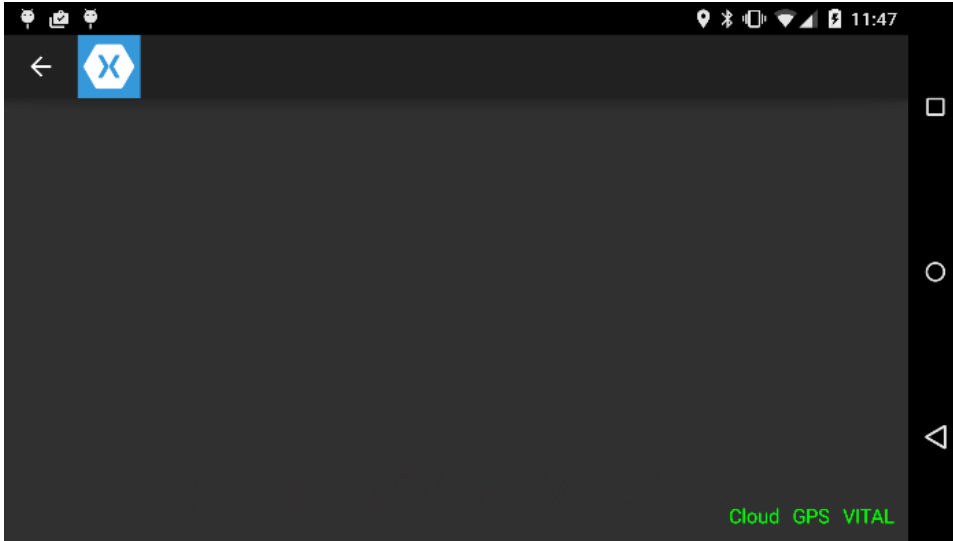
The intended operation for the Vehicle-Based RWPM mobile application is that it is activated at the start of the shift and allow it to run throughout the shift.

Operators should be assured that the equipment is not capturing or recording or using the operator's name or any identification information.

## 7.2 Interface Design

The RWPM Mobile Application is the main connected vehicle interface between the RWPM system and the driver. The Mobile Application displays Motorist Alerts generated by RWPM system and shares vehicle data with RWPM system, inclusive of vehicle data from the vehicle OBD-II port and location data from the GPS. The RWPM mobile application runs on an android device with cellular and Bluetooth connectivity. The RWPM mobile application uses a cellular connection to send data into the RWPM cloud system using the RWPM web API, and the Bluetooth connection to retrieve vehicle telemetry data from the vehicle's CAN bus using a Bluetooth enabled OBD-II reader.

The image shown in Figure 7-1 below shows the RWPM Mobile Application operating normally with no alerts or warnings. The green-colored "Cloud," "GPS," and "VITAL" labels respectively indicate that the RWPM Mobile Application is communicating normally with the RWPM system via the Cloud, receiving position data from the onboard GPS receiver, and receiving vehicle-based details through the OBD-II port. Lack of communications with any of these modules would be indicated by a red-colored "Cloud," "GPS," or "VITAL" label.



Source: Battelle

**Figure 7-1. No Alerts or Warnings**

The images shown in Figure 7-2 to Figure 7-4 individually show a road weather-based alert, a queue warning alert, and a speed harmonization recommendation alert. Each alert presents a graphical icon depicting the alert type and, when applicable, recommended speed, with supporting text presenting additional information describing conditions and/or the locations for which the alert applies.



Source: Battelle

**Figure 7-2. Icy Road Alert**

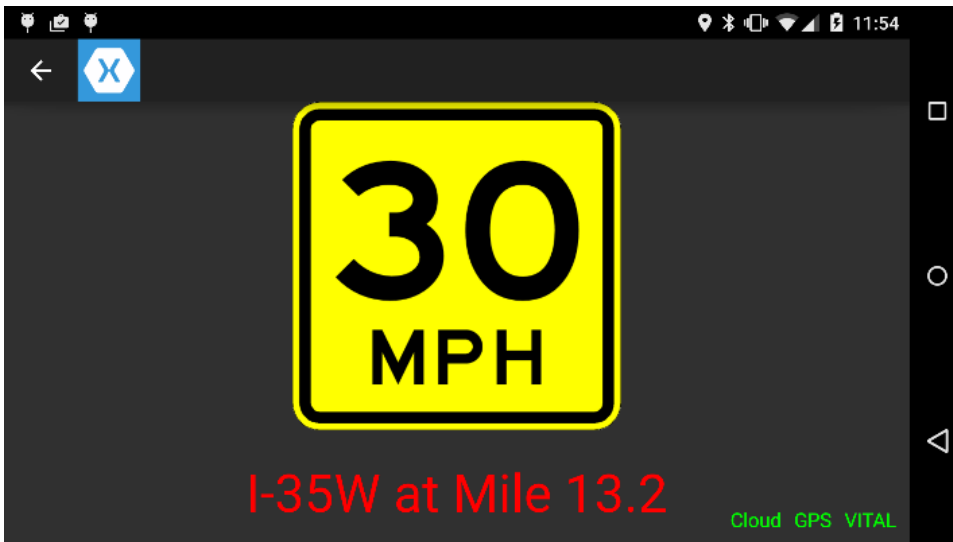
A Queue Warning alert is displayed when the vehicle is traveling toward a backup in traffic.



Source: Battelle

**Figure 7-3. Sample Queue Warning**

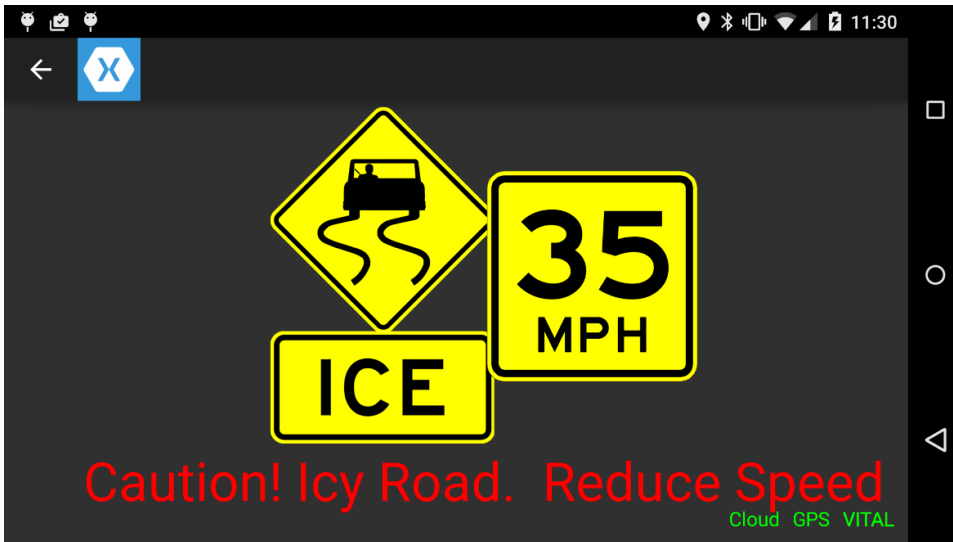
A Speed Harmonization Alert will be displayed when traffic is not traveling at normal speed, and a recommended speed has been calculated to reduce backups and queues.



Source: Battelle

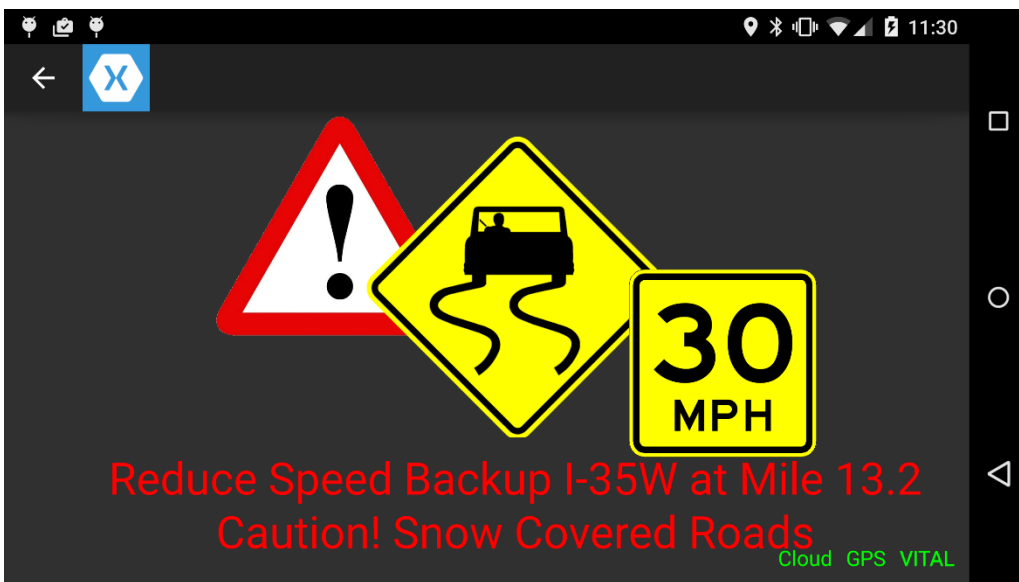
**Figure 7-4. Sample Speed Harmonization Alert**

More than one alert will simultaneously be displayed when Pikalert-based road weather and INFLO-based mobility alerts simultaneously apply. Two examples of integrated alerts that are likely are presented below in Figure 7-5 to Figure 7-6.



Source: Battelle

**Figure 7-5. Sample Road Weather and Speed Harmonization Alert**



Source: Battelle

**Figure 7-6. Sample Road Weather, Queue Warning, and Speed Harmonization Alert**

## 7.3 Operation

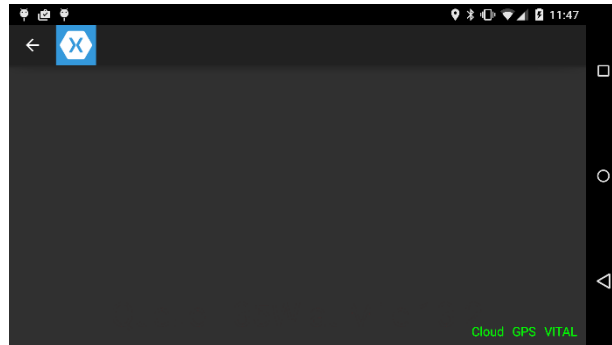
Below is a list of instructions for operators of the RW-PM mobile application.

### Operation

- The phone should be turned off and secured in the glove compartment or center console of the vehicle overnight.
- On starting your shift, please turn on the phone using the power button on the right side of the phone, plug in power, and secure it in the vehicle mount provided.
- Once the phone is on, unlock the phone by swiping up, and then launch the RWPM Mobile Application by tapping on its icon located on the main screen of the device.



- The application will launch, begin communicating with the VITAL module, and then begin sending data via Cellular to the Cloud database. When the application is working correctly, the display should look like the image to the right. The indicator text at the bottom should be green for “Cloud”, “GPS”, and “VITAL” which indicates that all operations are functioning properly.



- After several minutes, if the three indicators are not green, please close the application, power off the phone and start from the beginning.
- While the application is running, you may see alerts and warning on the mobile phone screen. **No action is needed when the alerts are presented.** Sample alerts that you may encounter while using the application can be found on the back of this card.
- At the end of your shift, please close the application by clicking on the triangle button on the bottom left of the screen (portrait) or bottom right (landscape), then power the phone off by holding the power button for three seconds and selecting power off.
- Please store the phone out of sight, in the glove compartment or center console of the vehicle. The VITAL module should remain plugged into the ODB-II port at all times.



# Chapter 8 RWPM Tool Support

Questions or request for support should be directed to:

**Gabe Guevara**

Road Weather and Work Zone Management Team

Federal Highway Administration

Phone: 202-366-0754

E-mail: [gabriel.guevara@dot.gov](mailto:gabriel.guevara@dot.gov)

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ITS Joint Program Office-HOIT  
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Washington, DC 20590

Toll-Free "Help Line" 866-367-7487  
[www.its.dot.gov](http://www.its.dot.gov)

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