Road Weather Management Program Decision Support Tools

Gabe Guevara

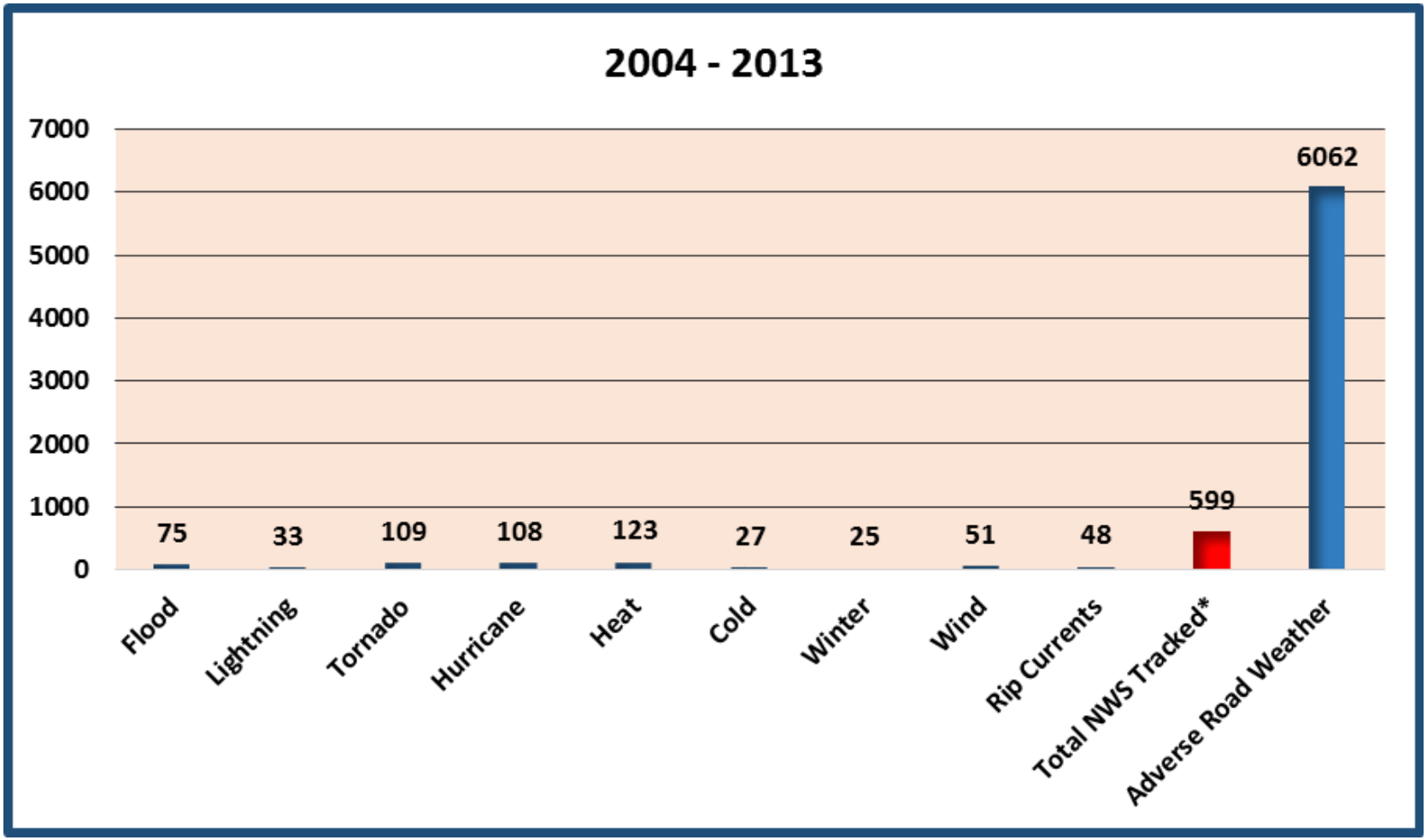
Road Weather Management Program

Federal Highway Administration

Table Of Contents

- The Problem
- Weather vs Road Weather
- Weather Data Environment
- Integrated Mobile Observations
- Pikalert System
- Integrated Modeling for Road Condition Prediction
- Road Weather Performance Measures
- Contact Information

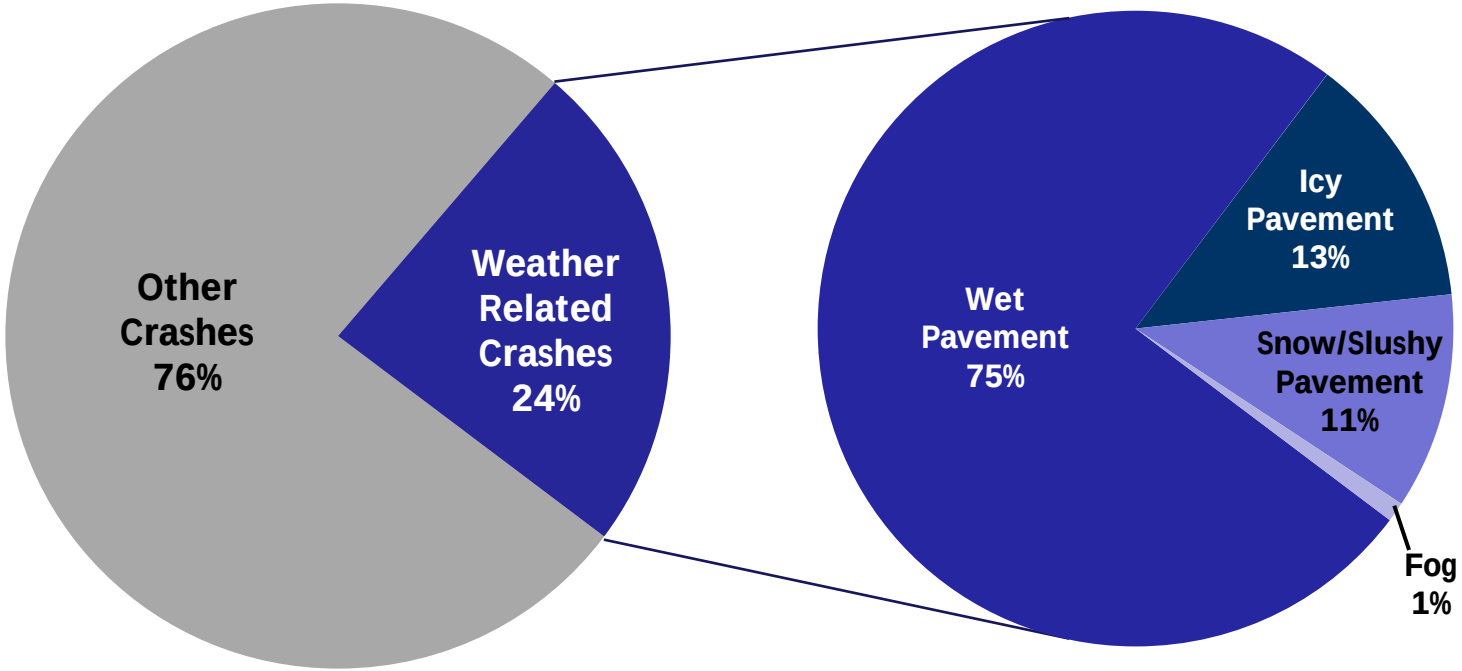
Average Annual Fatalities Under Adverse Weather



Weather-Related Crashes

Total Annual Crashes
Average = 6,301,000

Weather Related Crashes
By Road Weather Condition*



*Crashes that occurred under adverse conditions; additional factors such as rain, snow, and fog are not disaggregated from pavement conditions in this graphic. The percentage due to fog is for those crashes that occur under foggy conditions, but not wet, icy, or snowy pavement conditions.

Source: *Road Weather Management Program, Table: Weather-Related Crash Statistics (Annual Averages), Available at: http://www.ops.fhwa.dot.gov/weather/q1_roadimpact.htm*

Weather vs Road Weather

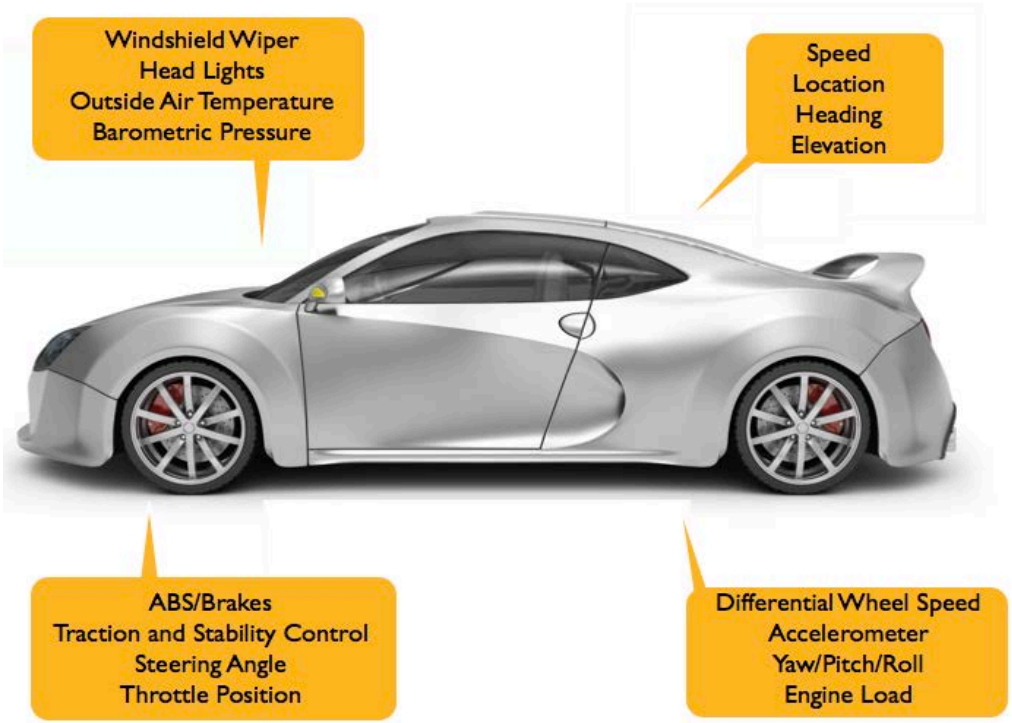
Weather

- Definition: *The state of the atmosphere* with respect to wind, temperature, cloudiness, moisture, pressure, etc.
- How will it affect me? Clothing, utility usage, outdoor activities, etc.
- The forecast message: Broad and generalized for any audience.

Road Weather

- Definition: *The state of the roadway and driving environment* with a focus on precipitation type, pavement and subsurface temperature, pavement conditions, visibility, wind speed and direction, humidity, etc.
- How will it affect me? Closed roads, reduced speeds, hazardous driving, tire friction loss, etc.
- The forecast message: Specific to impacts and catered to motorists making decisions.

Connected Vehicles



Images: USDOT, NCAR

WEATHER DATA ENVIRONMENT (WxDE)

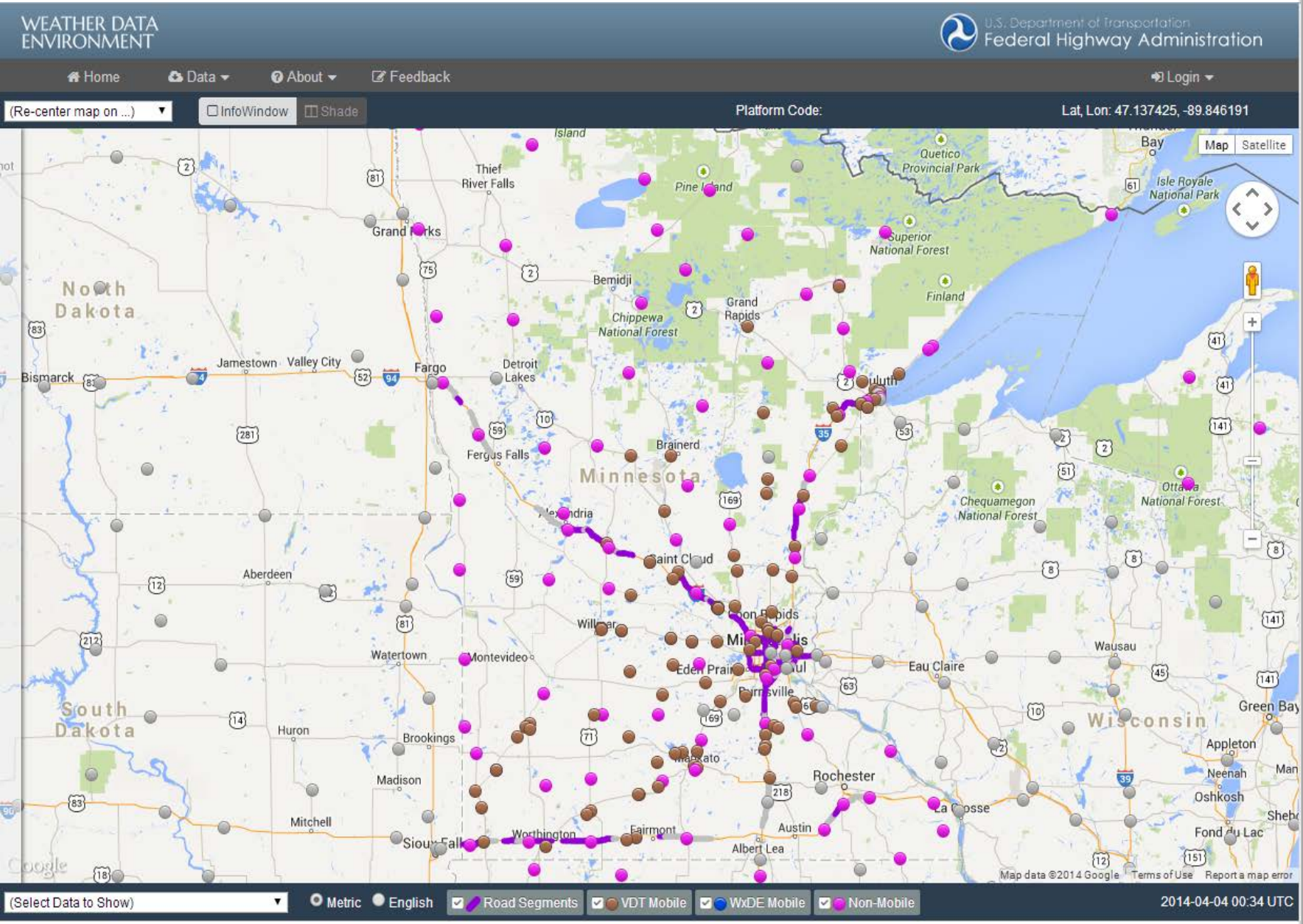
https:// wxde.fhwa.dot.gov

The Weather Data Environment (WxDE) & Its Purpose

- The WxDE is a system that collects, quality checks, archives, and disseminates road weather observations
- The purpose of the Weather Data Environment (WxDE) is to provide a data and interoperability platform to meet the weather-related research needs of the community, especially for Intelligent Transportation Systems (ITS)

Elements in the WxDE

- Collection of Data
  - Road Weather Information Systems (RWIS)
  - Mobile Vehicles
  - Weather observations from the National Weather Service (NWS) – used for quality checking
  - Metadata about the contributors, sites, stations, sensors, observations, quality checks, and more
- Quality Checking of Observations
- Dissemination of Data
  - Map Graphical User Interface (GUI)
  - On-Demand Query
  - Subscription Service


WEATHER DATA ENVIRONMENT
U.S. Department of Transportation
Federal Highway Administration
Home
Data
About
Feedback
Login
(Re-center map on ...)
InfoWindow
Shade
Platform Code:
Lat, Lon: 47.137425, -89.846191
Map
Satellite
North Dakota
South Dakota
Minnesota
Wisconsin
Bismarck
Jamestown
Valley City
Fargo
Grand Forks
Thief River Falls
Detroit Lakes
Bemidji
Grand Rapids
Chippewa National Forest
Superior National Forest
Quetico Provincial Park
Isle Royale National Park
Finland
Brainerd
Fergus Falls
Aberdeen
Watertown
Montevideo
Willmar
Eau Claire
Wausau
Green Bay
Appleton
Oshkosh
Fond du Lac
Rochester
La Crosse
Austin
Albert Lea
Fairmont
Worthington
Brookings
Huron
Madison
Mitchell
Chequamegon National Forest
Map data ©2014 Google
Terms of Use
Report a map error
(Select Data to Show)
Metric
English
Road Segments
VDT Mobile
WxDE Mobile
Non-Mobile
2014-04-04 00:34 UTC


ROAD CLOSED

INTEGRATED MOBILE OBSERVATIONS (IMO)

Integrated Mobile Observations (IMO)

Objectives:

- Better understand how to capture, communicate, and process data from the vehicle's internal codes and external road weather sensors placed on the vehicle
- Identify uses for and incorporation of the data in new and established applications
- Assess the impact and results of utilizing the data in applications

Outcomes:

- Used to enhance decision making by traffic operators, maintenance managers, and travelers

Integrated Mobile Observations (IMO) Project

Goal: Exploring the feasibility of using vehicle-based data to improve transportation safety & mobility

Minnesota DOT

- ~550 Vehicles
- Data
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Brake Status
- AVL & Cellular

Michigan DOT

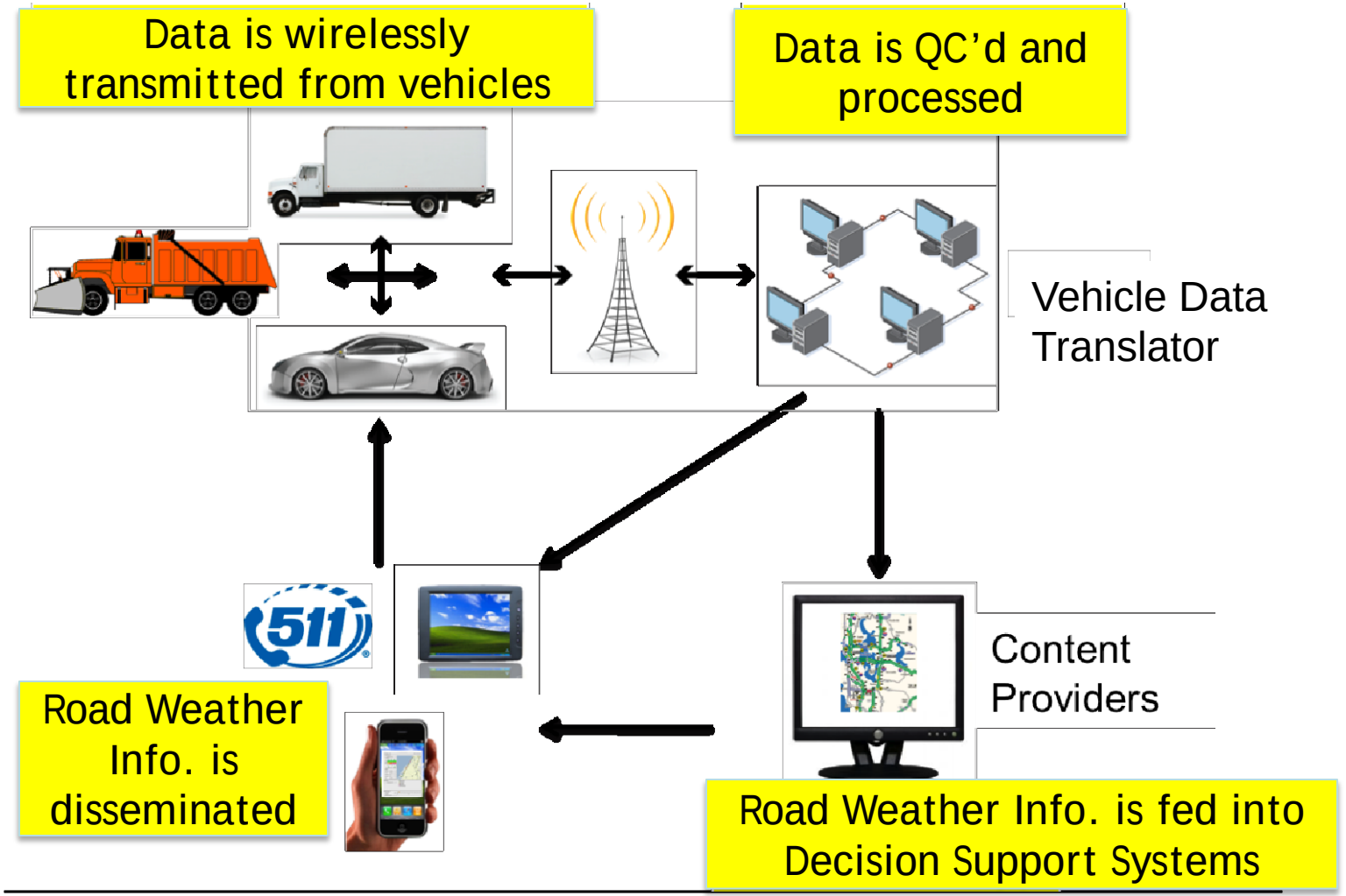
- ~50 Vehicles
- Data
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Brake Status
  - Accelerometer
- Bluetooth & Cellular

Nevada DOT

- ~20 Vehicles
- Data
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Maintenance Status
- Radio & Cellular

PIKALERT SYSTEM

Diagrammatically, this looks like…



Vehicle Data Translator (Pikalert® VDT)

- Software that creates highly detailed weather and road condition nowcasts and forecasts
- Inputs:
  - Vehicle-based measurements (vehicle actions, pavement conditions, atmospheric measurements)
  - Traditional weather data sources

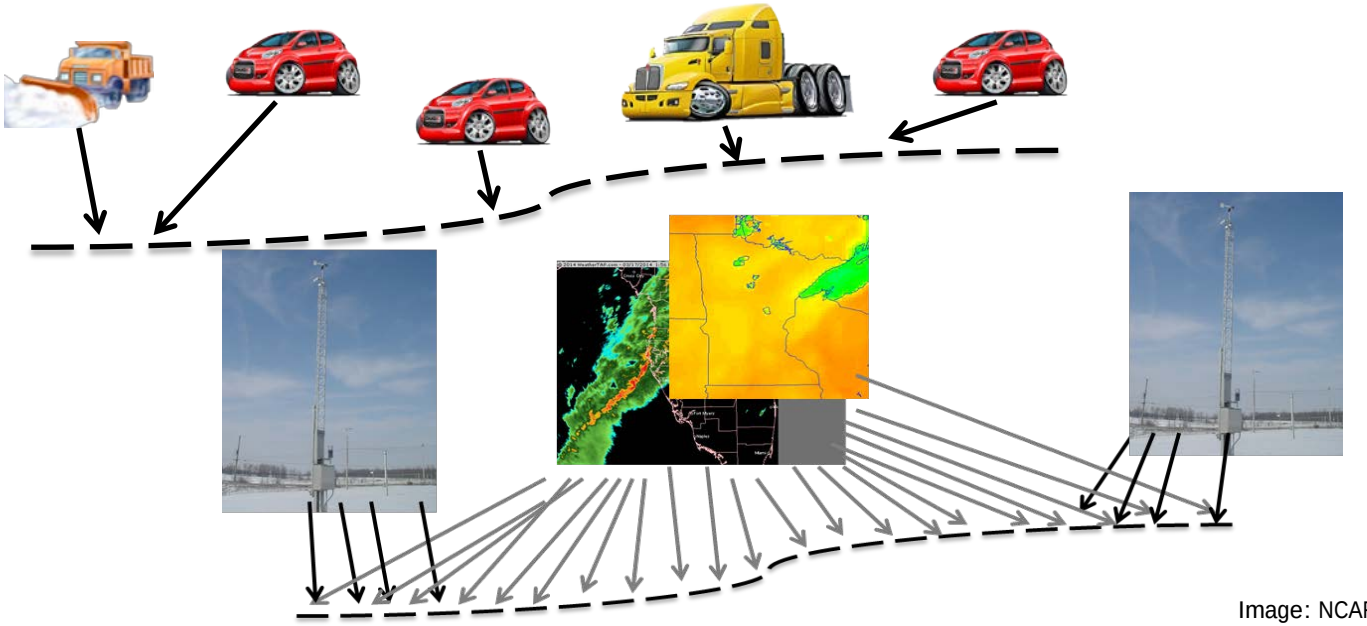


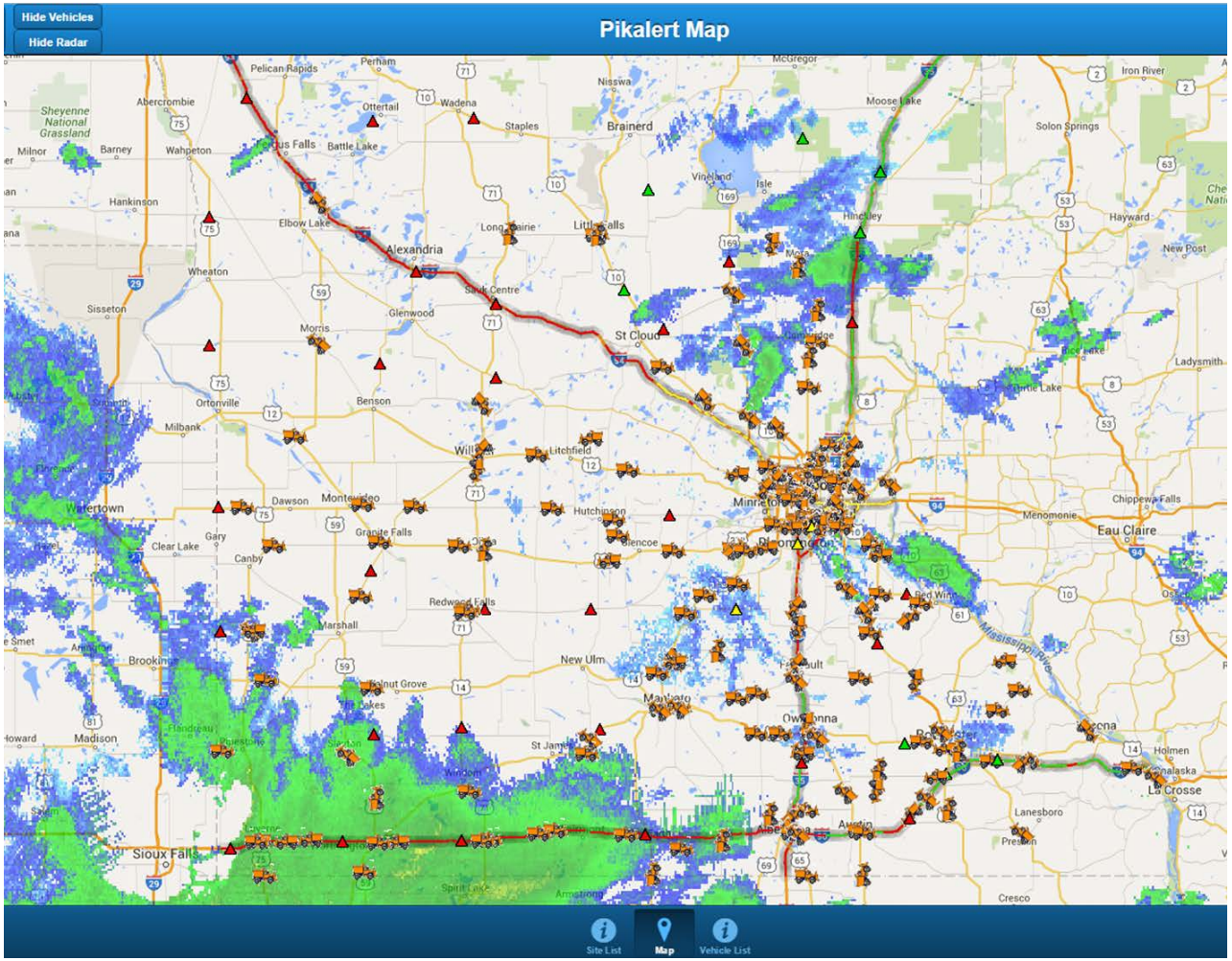
Image: NCAR

Enhanced Maintenance Decision Support System (EMDSS)

- Produces road weather forecasts and winter maintenance treatment recommendations
- Aids maintenance managers and other personnel in key decisions of treatment type, timing, rates, and locations
- The plow truck becomes a connected vehicle.

Image: USDOT

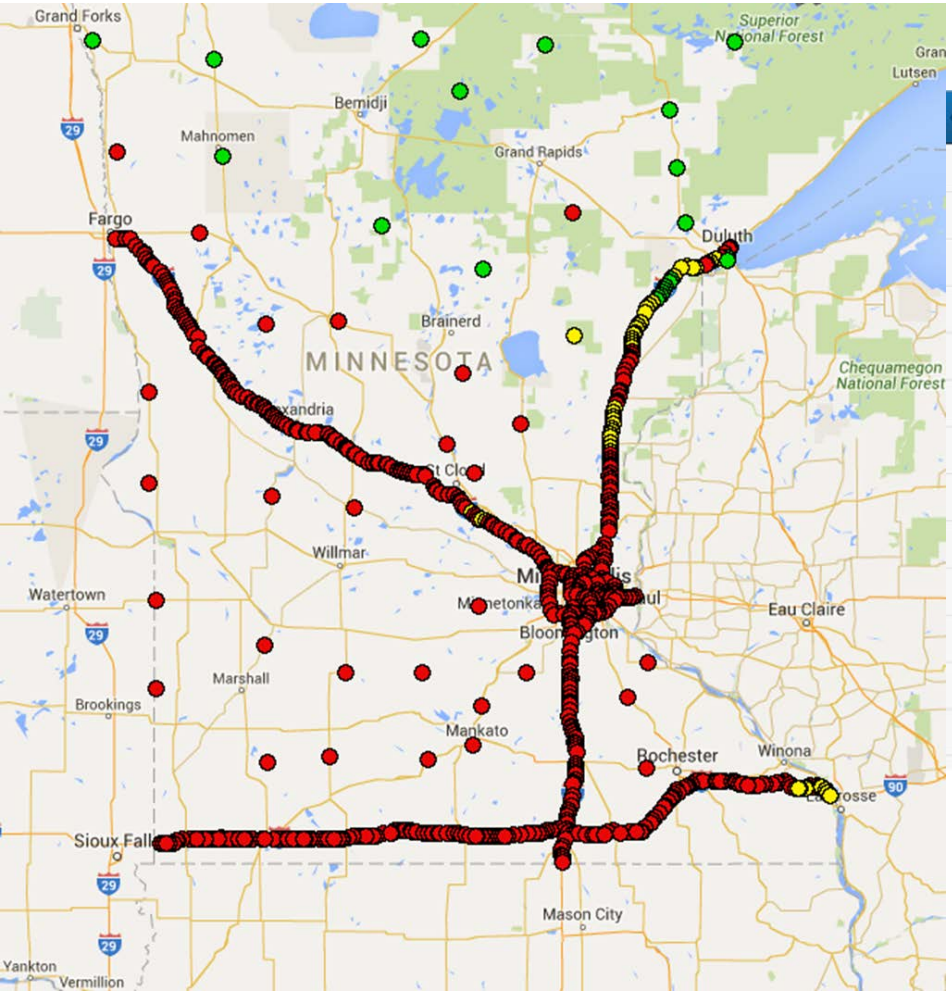
EMDSS Display – Vehicle Locations, Radar, Road Segment Trouble Areas



Motorist Advisory and Warning (MAW) System

- Displays road weather alerts and hazard forecasts to decision makers ranging from DOT personnel to the traveling public
- Uses VDT output and a road weather forecast to provide these alerts
- Pre-trip: web-based display
- On the road: mobile application

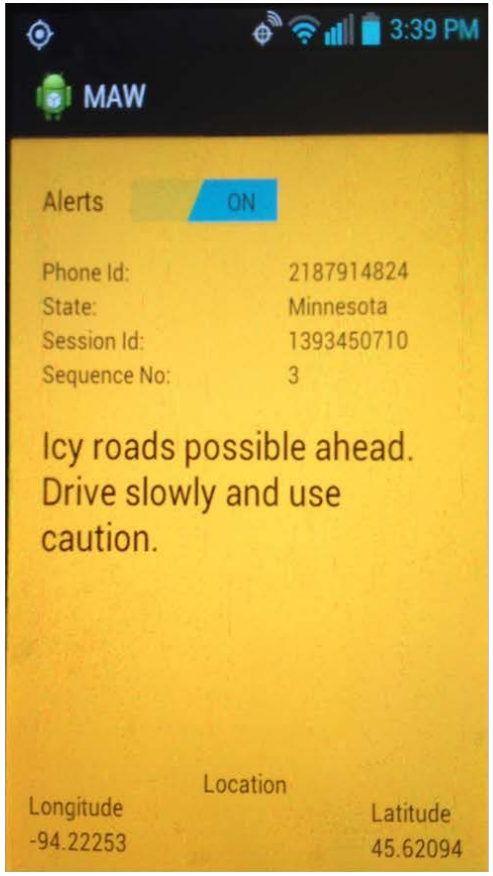
MAW Web-based Display

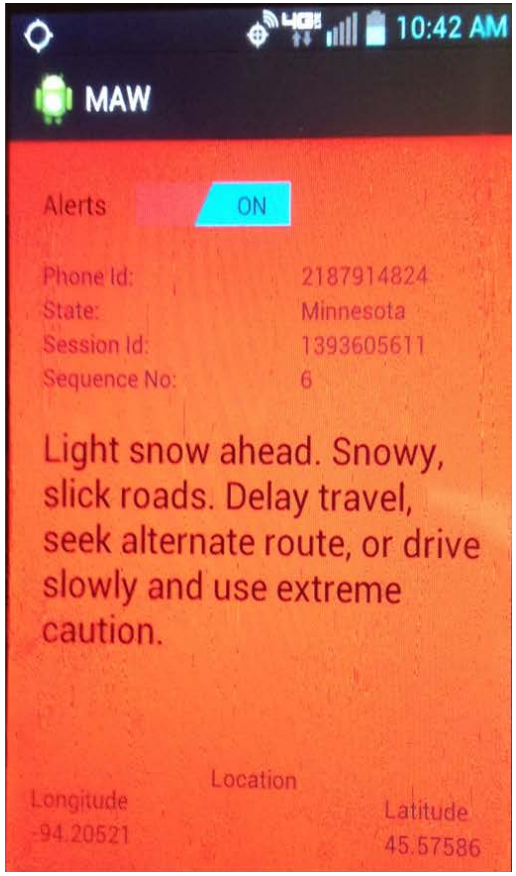


Back | New Prague MN-19 Mile Post 149

Mon 11/30 10:25 am	●	**Warning:** Precip: none, Pavement: icy, Visibility: haze
Mon 11/30 11:00 am	●	**Advisory:** Precip: light snow, Pavement: wet, Visibility: normal
Mon 11/30 12:00 pm	●	**Advisory:** Precip: light snow, Pavement: wet, Visibility: normal
Mon 11/30 1:00 pm	●	Clear
Mon 11/30 2:00 pm	●	Clear
Mon 11/30 3:00 pm	●	Clear
Mon 11/30 4:00 pm	●	Clear
Mon 11/30 5:00 pm	●	Clear
Mon 11/30 6:00 pm	●	**Warning:** Precip: moderate snow, Pavement: slick, icy, Visibility: low
Mon 11/30 7:00 pm	●	**Warning:** Precip: heavy snow, Pavement: slick, icy, Visibility: heavy snow
Mon 11/30 8:00 pm	●	**Warning:** Precip: light snow, Pavement: slick, icy, Visibility: normal
Mon 11/30 9:00 pm	●	**Warning:** Precip: light snow, Pavement: slick, icy, Visibility: normal
Mon 11/30 10:00 pm	●	**Warning:** Precip: light snow, Pavement: slick, icy, Visibility: normal

MAW Mobile Application



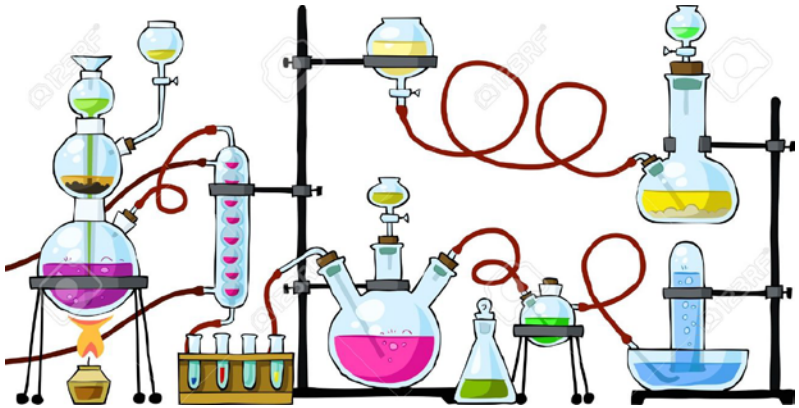


INTEGRATED MODELING FOR ROAD CONDITION PREDICTION (IMRCP)

Integrated Model for Road Condition Prediction (IMRCP)

Incorporates real-time and/or archived data and results from an ensemble of forecast and probabilistic models

- atmospheric and road weather
- traffic
- work zones
- incidents
- special events
- demand



- Travelers
- Transportation operators
- Maintenance providers

Weather & Traffic Model Review - Complete
Concept of Operations - Complete
Detailed Requirements – Almost Complete

Potential Opportunities for Change

- Improve the precision of road weather condition effects (e.g., wet, slushy, icy) in traffic models
- Enable link-specific traffic impacts on road weather condition forecasting (e.g., mechanical wear/packing)
- Forecast network traffic conditions for operations
- Forecast route travel times and reliabilities
- Estimate incident likelihood based on current and forecast conditions
- Enable forecast-aware routing for travelers
- Identify strategies for forecast-aware traffic management
- Identify strategies for pre-positioning of emergency response assets based on forecasts and incident likelihoods
- Identify strategies for winter maintenance route prioritization based on weather and traffic forecasts
- Integrate new data sources and types of data
  - Data from social media
  - Trajectory/probe data
- Reduce the time needed for TMC/maintenance operations to analyze and respond to changing conditions

Example Application Scenarios

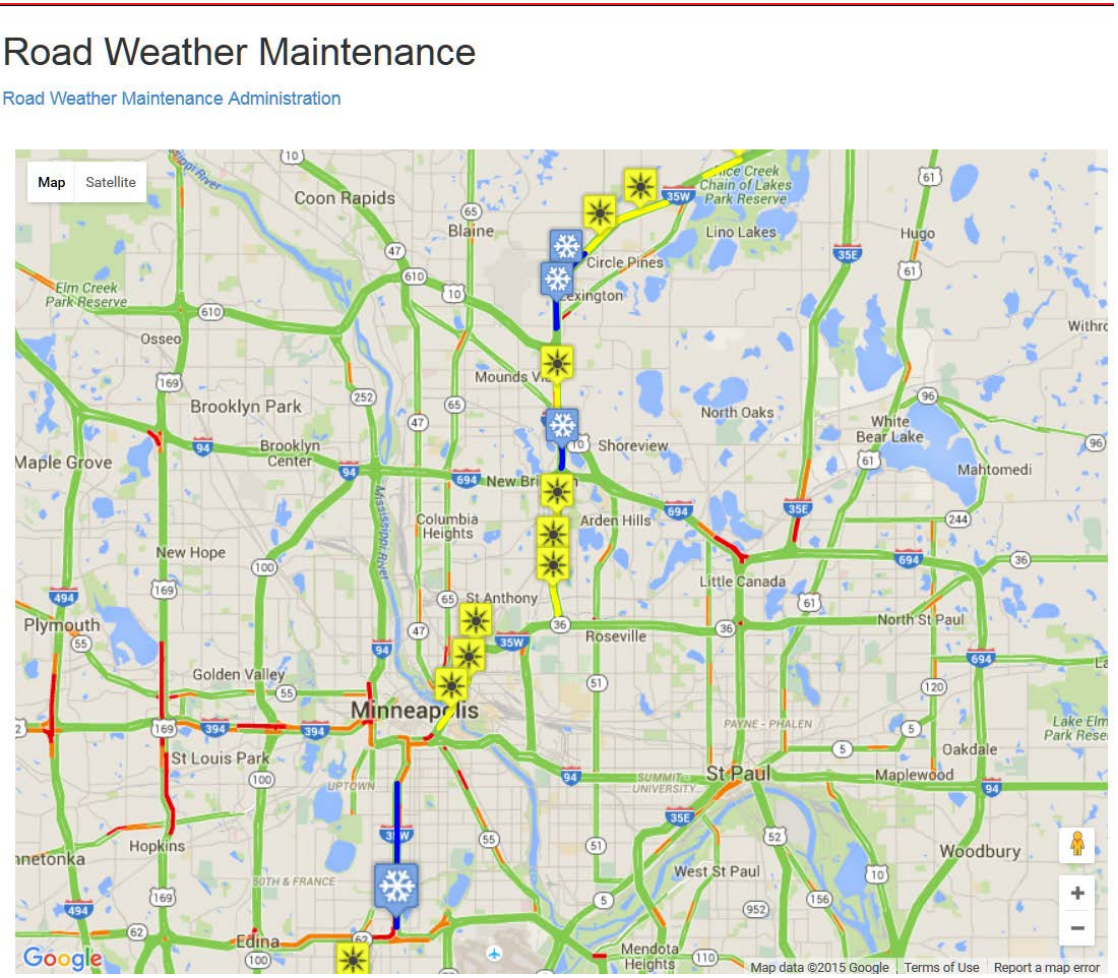
- Enhanced transportation system management and operations
  - Forecast-aware variable speed limits
  - Enhanced motorist advisories and warnings
  - Enhanced intelligent signal controls
- Traffic-aware winter maintenance decision support
- Weather- and traffic-aware routing optimization
  - Commuters
  - Long-haul freight
  - Emergency responders

ROAD WEATHER PERFORMANCE MEASURES (RW-PM) TOOL

Road Weather Performance Measures (RW-PM) Tool

- Integration of traffic mobility, road weather maintenance and motorist advisory analysis and information with real-time continuous data.
- Continuous updating of traffic control, RdWx maintenance and motorist advisory recommendations as RdWx conditions evolve throughout weather events.
- Publish traveler information into vehicles.

Road Weather Maintenance

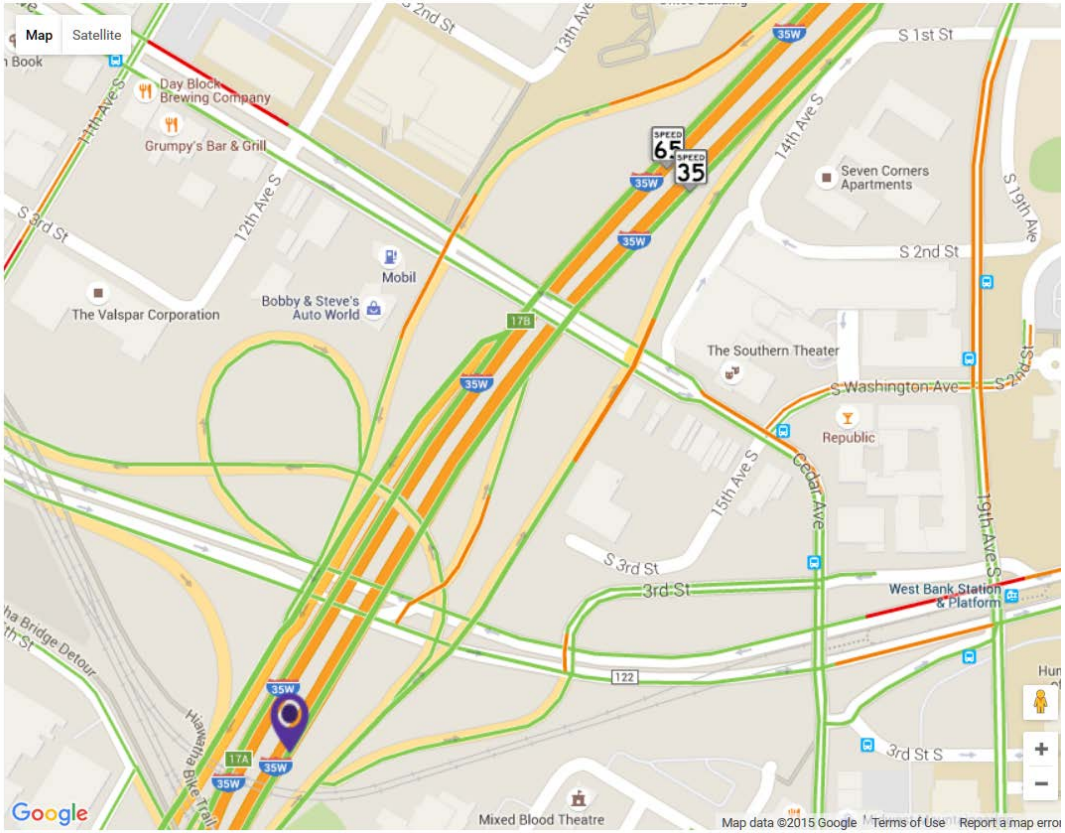


- Displays the Road Treatment Recommendations from Pikalert
- Each site shows an icon based on its current pavement condition

Traffic Control

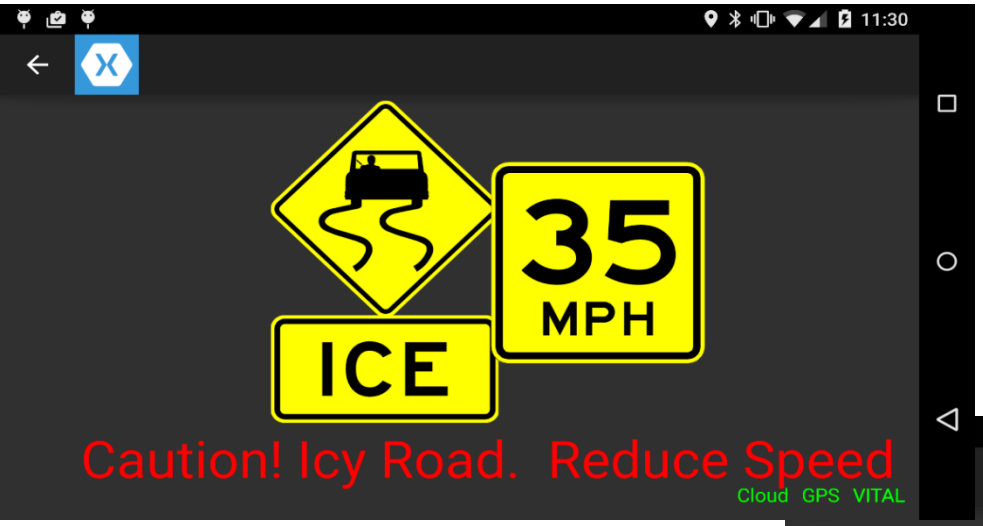
Traffic Control

Traffic Control Administration

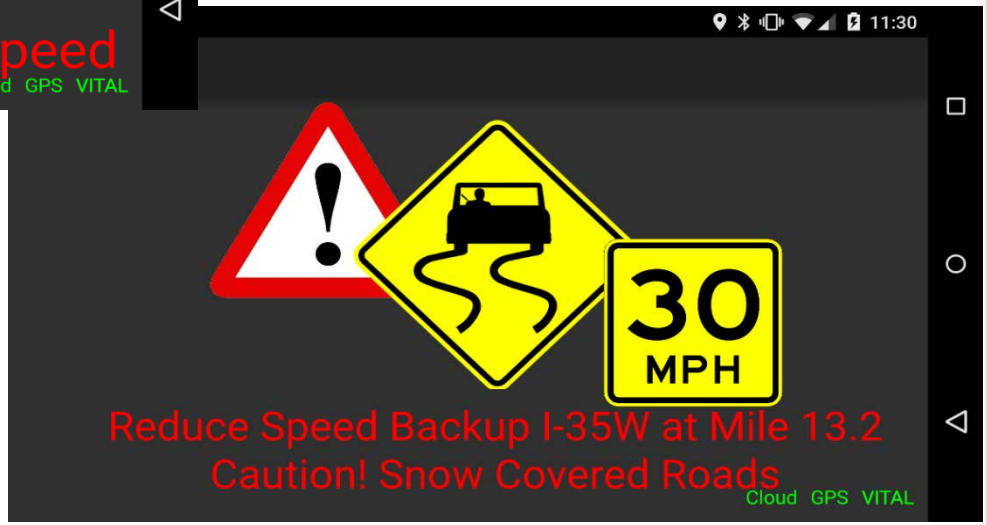


- Displays the Traffic Backups (Queues) and Recommended Speeds (Speed Harm) Advisories. (Also sent to the connected vehicle application.)
- Displays the speed sensor information from MnDOT.

Sample Motorist Advisories



Icy Conditions Ahead With Speed Recommendation



Backup (Queue) with Speed Recommendation (Speed Harm) and Snow Covered Roads

Road Weather Management Team Contact Information

Paul Pisano
Team Leader
(202) 366-1301
Paul.Pisano@dot.gov

Gabe Guevara
(202) 366-0754
Gabriel.Guevara@dot.gov

Roemer Alfelor
(202) 366-9242
Roemer.Alfelor@dot.gov