Road Weather Management Program

AASHTO/TRB Joint Maintenance Conference: Highway Safety & Reliability (Winter Maintenance and Highway Safety and Reliability) - 7/22/2015

Gabe Guevara, P.E.
FHWA Office of Operations
Road Weather Management Team
Table Of Contents

- Statistics
- Weather vs Road Weather?
- Integrated Mobile Observations
- Road Weather Team
Average Annual Fatalities from Adverse Weather (2003 - 2012)*
Weather Related Crashes

Total Annual Crashes
Average = 6,301,000

Weather Related Crashes
By Road Weather Condition*

- Wet Pavement 75%
- Icy Pavement 13%
- Snow/Slushy Pavement 11%
- Fog 1%

Other Crashes 76%
Weather Related Crashes 24%

*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
Trends of Fatal Crashes with RWMP R&D

Weather-Related Fatal Crashes

- MDSS
- Clarus
- WRTM Strategies
- VDT
- WxDE
- CV Applications
What is 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, umbrellas, emergency shopping, etc.
- How do I get it? Meteorologists, NWS, Internet, etc.

**Road Weather**
- Definition: the state of the roadways with respect to wind, temperature, precipitation type, pavement temperature, subsurface temperature, subsurface moisture, pavement conditions, visibility, relative humidity, etc.
- How will it affect me? Closed roads, reduced speeds, weight restrictions, tire friction loss, etc.
- How do I get it? HHHMMMMMM. . .
Vehicle Data

- Windshield Wiper
- Head Lights
- Outside Air Temperature
- Barometric Pressure

- Speed Location
- Heading Elevation

- ABS/Brakes
- Traction and Stability Control
- Steering Angle
- Throttle Position

- Differential Wheel Speed Accelerometer
- Yaw/Pitch/Roll
- Engine Load
Integrated Mobile Observations (IMO)

The Road Weather Management Program (RWMP) launched an innovative project to explore the feasibility of using vehicle-based data to support weather-related transportation safety & mobility. The IMO project examines how this data can be collected from vehicles and used to enhance decision making by traffic operators, maintenance managers, and travelers.
IMO Objectives

The USDOT established several 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
Minnesota DOT

- ~550 Vehicles
- **Mobile Observations**
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Brake Status
- **Automated Collection and Dissemination of Road Weather Mobile Observations**
- AVL & Cellular
Michigan DOT

- ~50 Vehicles
- Mobile Observations
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Brake Status
  - Accelerometer
- Automated Collection of and Dissemination of Road Weather Mobile Observations
- Bluetooth & Cellular
Nevada DOT

- ~20 Vehicles
- Mobile Observations
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Maintenance Status
- Automated Collection and Dissemination of Road Weather Mobile Observations
- Radio & Cellular
Pikalart®
Vehicle Data Translator

The Pikalart Vehicle Data Translator (Pikalart VDT) is software that creates highly detailed weather and road condition outputs (e.g., “nowcasts” and forecasts) based on:

• inputs of vehicle-based measurements (i.e., vehicle-systems statistics, road conditions, and the surrounding atmosphere) and
• other, more traditional weather data sources.
Pikalbert Road Weather Hazard Module (RWH)

- Uses road segment statistics files to create road-specific hazards
- Specifies precipitation, pavement condition, and visibility conditions based on combination of ancillary and mobile data
- May run on road segments with no mobile data, but has improved quality and reliability with mobile observations
- Developed using a combination of mobile data analysis and physical models of atmospheric behavior
VDT Example

Variables: speed, location, pavement temperature, air temperature, dewpoint temperature, friction, yaw/pitch/roll, ABS, Stability/Traction Control, Collision

Variables: QC’d data from canbus and external, average temperature, average speed, precipitation type, slickness, visibility, etc.

End-user Communication: 511, In-car display/voice infrastructure, smart phones, etc.

Tailored Content: Traffic Models, Forecast drive times, Forecasted Hazards, etc.

Content Providers

VDT
VDT Matches Vehicle Data & Weather Data to Road Segments

- Assigned to user-configured road segments by GPS location and time stamp.
- Road segment length and update frequency configurable (default: 1-mile segments and 5-min update).
- Weather data are assigned to same road segments based on user-configured parameters such as distance to segment.
Enhanced Maintenance Decision Support System (EMDSS)

- Produces road weather forecasts and treatment recommendations to aid maintenance managers and other personnel in key decisions of treatment type, timing, rates, and locations
- EMDSS builds on traditional MDSS by incorporating VDT output, giving high resolution forecasts that make use of mobile data
Why Enhanced?

Avg. Air Temp - 31°F
Dewpoint - 29°F
Pavement Temp – 29.6°F
Precip – Mixed
Condition – Slush
Visibility - LOW

Avg. Air Temp - 30°F
Dewpoint - 29°F
Pavement Temp – 27.3°F
Precip – Snow
Condition – ICE
Visibility - Moderate
EMDSS Display
Motorist Advisory and Warning (MAW) System

- Displays road weather alerts and forecasts of hazards to provide traveler information to decision makers from DOT personnel to the traveling public
- Uses RWH output and a road weather forecast to provide these alerts
- A web-based display can be used for decisions before traveling, a phone application provides information when on the road
MAW Web-based Display

- Tues 11/19 2:00 pm: no advisories
- Tues 11/19 3:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 4:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 5:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 6:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 7:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 8:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 9:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 10:00 pm: Advisory: moderate rain, wet, normal
- Tues 11/19 11:00 pm: no advisories
- Weds 11/20 0:00 am: no advisories
- Weds 11/20 1:00 am: no advisories
MAW Phone Application

Alerts: ON

Phone Id: 2187914824
State: Minnesota
Session Id: 139345182
Sequence No: 3

No alert.

Alerts: ON

Phone Id: 2187914824
State: Minnesota
Session Id: 1393450710
Sequence No: 3

Icy roads possible ahead. Drive slowly and use caution.

Alerts: ON

Phone Id: 2187914824
State: Minnesota
Session Id: 1393605611
Sequence No: 6

Light snow ahead. Snowy, slick roads. Delay travel, seek alternate route, or drive slowly and use extreme caution.

Longitude: -94.22256
Latitude: 45.62103

Longitude: -94.22253
Latitude: 45.62094

Longitude: -94.20521
Latitude: 45.57586
Road Weather Team

- Road Weather Management Program, Office of Operations
  - Paul Pisano, Team Leader
  - Roemer Alfelor
  - Gabriel Guevara

- Booz Allen
  - Ram Kandarpa, Program Manager
  - Brenda Boyce, Project Manager