

Road Weather Management And Connected Vehicles

September 26, 2012

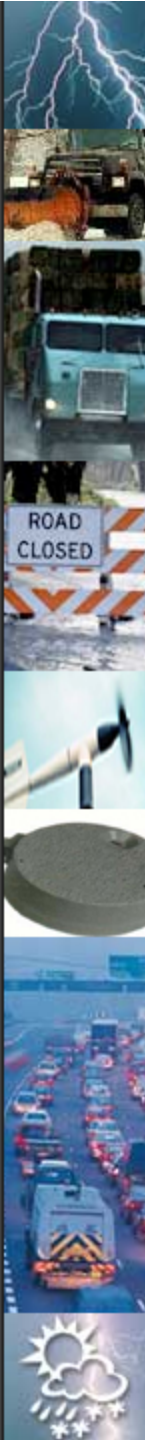
Paul Pisano

Team Leader, Road Weather
& Work Zone Management
FHWA



Dale Thompson

Program Manager, Data
Capture and Road Weather
RITA



Topics

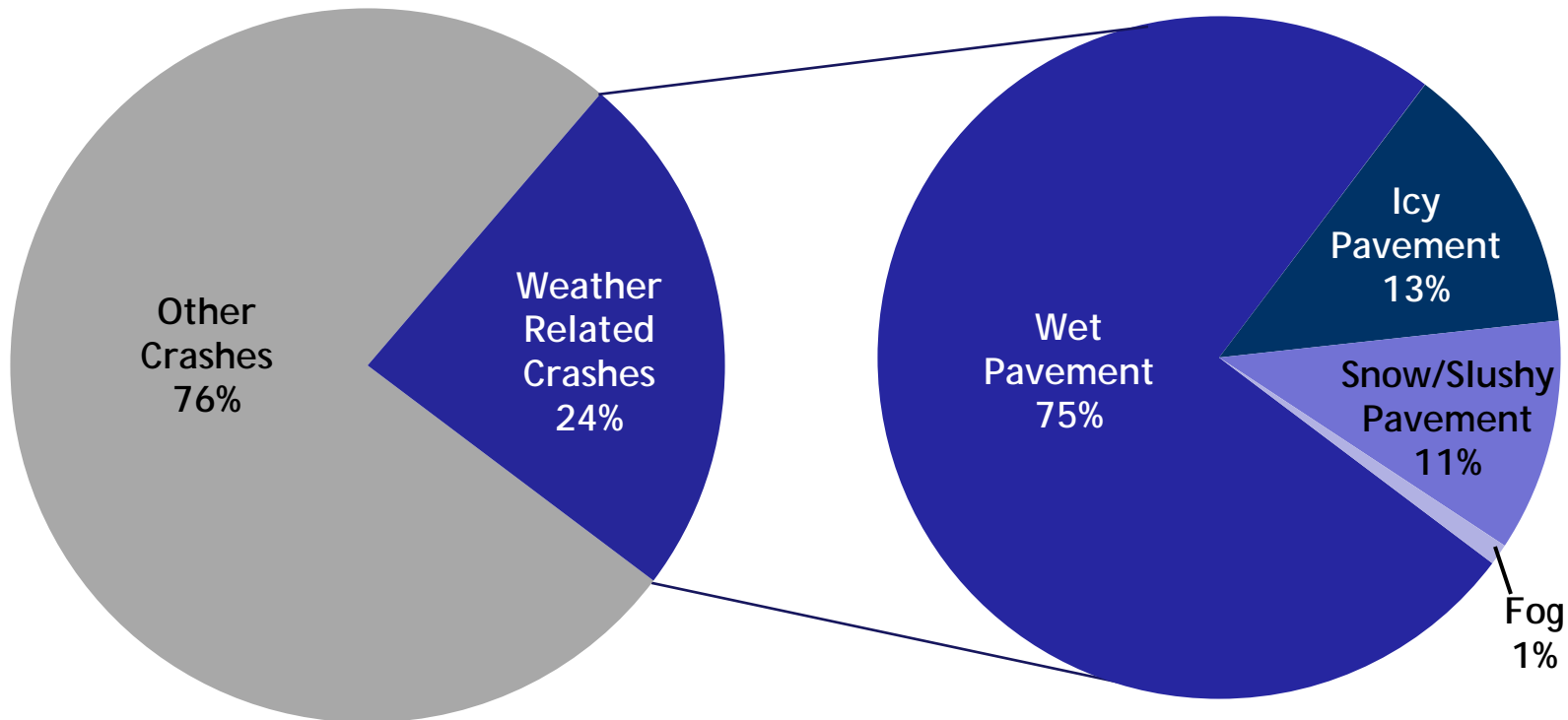
- Background
- Applications Concepts and Prototyping
- Benefit-Cost Analysis
- Vehicle Data Needs



Crash Situation Under Adverse Weather

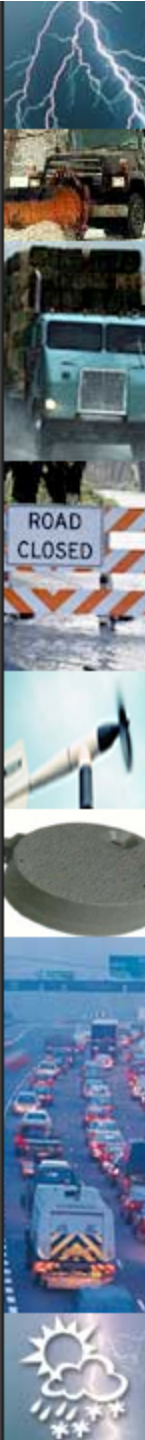
Total Annual Crashes
Average = 6,301,000

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-related Costs

- State DOTs spend:
 - \$2 billion/year on snow and ice control
 - \$5 billion/year on infrastructure repairs due to snow & ice
- Delays from snow, ice, and fog cost \$11.6 billion per year
- Delays due to weather cost trucking companies \$3.1 billion/year in the 50 largest cities
- Lost commerce due to storm-closed roads is \$3.82 billion in just 15 states



In order to make a difference...

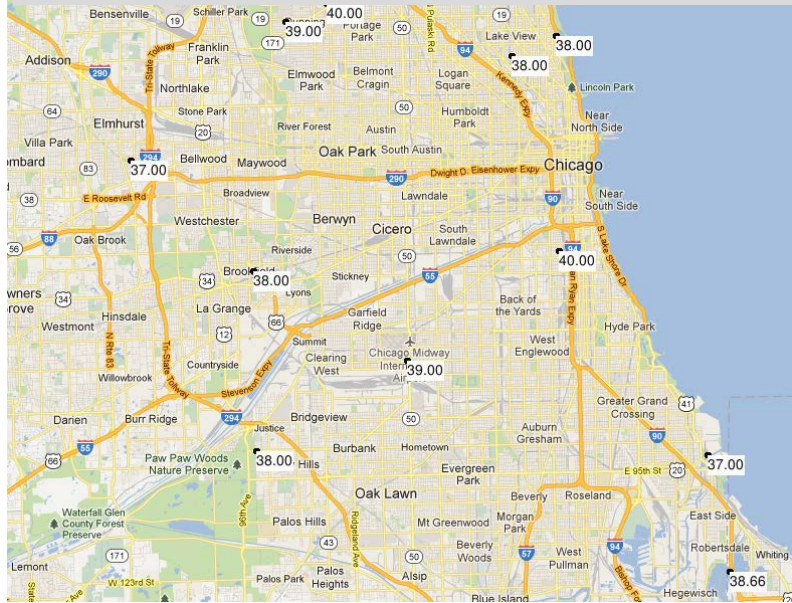
- Road managers and users need route-specific/segment-specific/spot-specific weather and road condition information to:
 - Reduce weather-related crashes by changing driver behavior
 - Actively manage traffic demand and capacity
 - Carry out winter maintenance activities more effectively and efficiently
 - Make better travel choices
- There are two ways to get the information:
 - Road Weather Information Systems
 - Connected Vehicles



Potential of Connected Vehicles

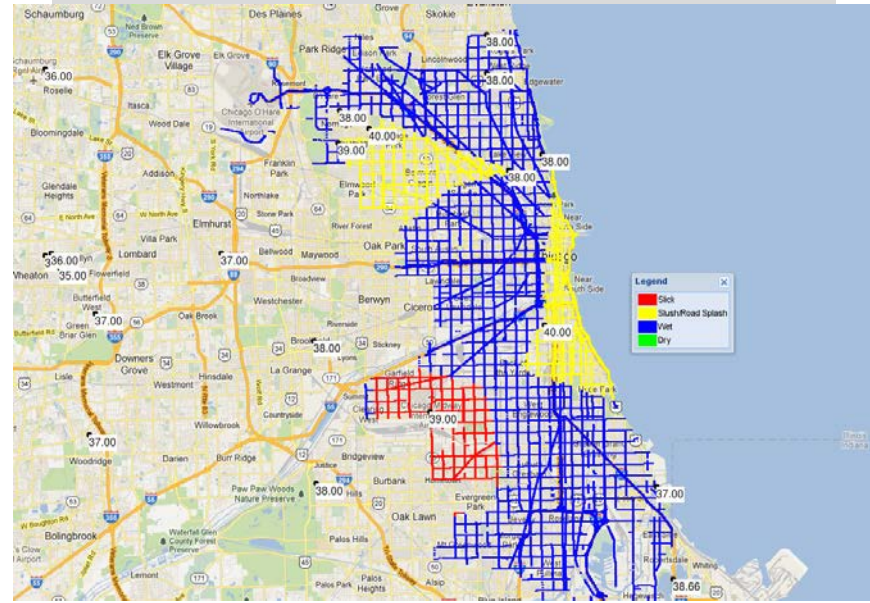
Today

A 60% chance of snow, mainly afternoon. Sunny early, then becoming cloudy.



Future

Connected vehicles provide continuous picture of what's happening on the roadways



U.S. DOT Connected Vehicle Efforts

- Develop ConOps
 - Engage stakeholders to validate RdWx applications (i.e. vehicle data) needs and benefits
 - Conduct Benefit-Costs Analyses
- Identify specific weather-related vehicle data requirements for RdWx applications
- Develop, test and evaluate RdWx applications
- Conduct controlled experiments to characterize specific weather-related vehicle data elements



Road Weather CV Applications

- Enhanced Maintenance Decision Support
- Information for Maintenance and Fleet Management Systems
- Weather-Responsive Traffic Management
 - Variable Speed Limits
 - Signal Timing Optimization
- Motorist Advisories and Warnings
- Information for Freight Carriers
- Information and Routing Support for Emergency Responders

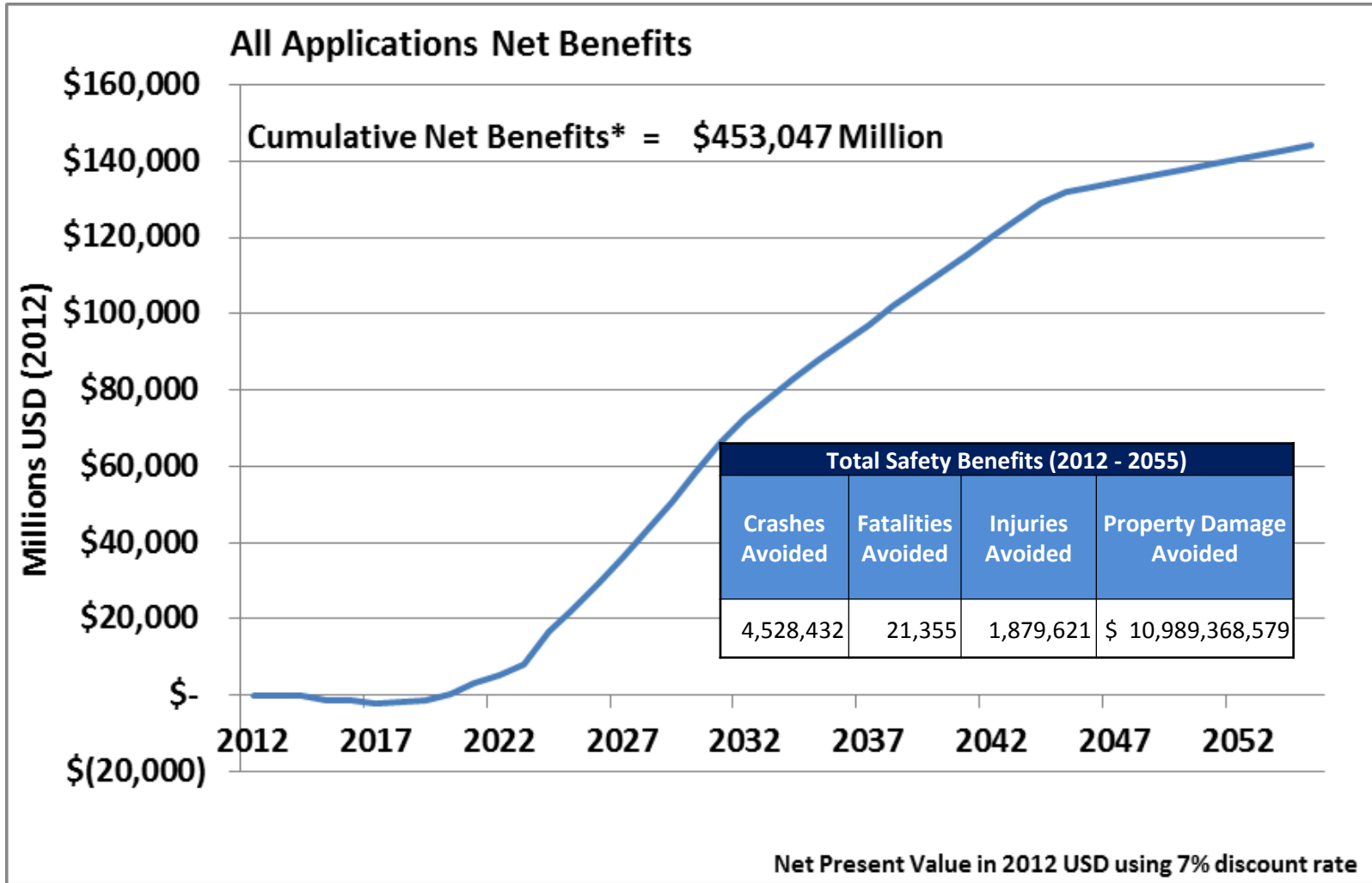


Applications Benefit-Cost Analysis

- Estimate potential national costs and benefits resulting from the implementation of RdWx connected vehicle applications
- Being developed in two phases:
 - Phase I
 - Focuses on safety aspects of the applications
 - Due for completion October, 2012
 - Phase II
 - Focuses on mobility and environmental aspects
 - Due for completion December, 2012
- Will help establish the most critical weather-related vehicle data elements



Road Weather Applications - Net Benefits



Integrating Mobile Observations (IMO) Project

- Lessons Learned

- CAN-Bus/OBD data from vehicle probes is relatively easy to get and transmit
- Decoding/interpreting the Parameter Group Numbers (PGNs) and Suspect Parameter Numbers (SPNs) is very **difficult**
- The effort has resulted in **significant progress** identifying Wx-relevant PGNs and SPNs and creating a data dictionary, but there's still room for improvement
- CAN-Bus/OBD data was successfully transmitted over 700MHz radio and Common Cellular Carrier Networks
- Mobile data has been successfully integrated into *Clarus* and a couple of state applications



Priority Vehicular Data (best guess)

BSM Part 1

- Brake system status
 - Brake applied status
 - Traction control status
 - Anti-lock brake status
 - Stability control status

BSM Part 2

- Vehicle status
 - Exterior lights
 - Wipers
 - Brake system status
 - Roadway friction
 - Rain sensor
 - Ambient air temperature
 - Ambient pressure
 - Yaw rate

- “Black Ice” warning requires near-instantaneous information while other algorithms operate with data rates from once per second to once every 30 seconds
- 15 observations per segment (e.g., 1 mile) per time step (e.g., 15 min) should be sufficient for confidence in the application outputs
- Bandwidth required for data transmission is minimal (85-365 bytes)



Next Steps

- Demonstrate value of connected vehicle data via the development, testing and evaluation of key applications
- Carry out the Phase II Benefit-Cost analysis with focus on mobility, environment and other benefits
- Validate weather-related vehicle data elements in support of USDOT (NHTSA) Rulemaking decision

