USDOT: Current Capabilities and Future Plans for Surface Transportation Weather Support

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Presentation Overview

- Today’s Transportation Challenges
- The World of ITS
- Connected Vehicle Research
  - Technology
  - Weather Applications That Can Make a Real Difference
- Weather-related ITS Activities
- AMS Recommendations
- Transportation Weather Challenges
- Conclusion
Today’s Transportation Challenges

Safety
- 33,561 highway deaths in 2012
- 5.615 million crashes in 2012
- Leading cause of death for ages 4, 11-27

Mobility
- 5.5 billion hours of travel delay
- $121 billion cost of urban congestion

Environment
- 2.9 billion gallons of wasted fuel
- 56 billion lbs of additional CO₂

Data Sources:
- 2011 Annual Urban Mobility Report, Texas Transportation Institute (Feb 2013)
The World of ITS

- Integrated Corridor Management
- Connected Vehicle Research
  - Safety
    - Vehicle to Vehicle (V2V)
    - V2I (Vehicle to Infrastructure)
    - V2X
  - Mobility
    - Dynamic Mobility Applications
    - Real-Time Data Capture
  - Environment
    - AERIS
    - Road Weather / Clarus
- ITS Architecture and Standards
- ITS Professional Capacity Building
- ITS Knowledge Resources
- Automated Vehicle
“Connected Vehicle” vs. “Connected” Vehicles

Connected Vehicle Applications

- V2V Safety
- V2I Safety
- “Active” Mobility
- “Active” Weather
- “Active” Environment
- via BSM, SPaT messages

Infotainment

- Routing and navigation
- Mobility info
- Road weather info
- Environment info

- Streaming audio
- Commercial info and messages for travelers
- Vehicle status reports
- Internet services
- Insurance
- Social media
How the Technology Works

- **What it is**
  - Wi-Fi radio adapted for vehicle environment
  - Inexpensive to produce in quantity
  - Original 5.9GHz DSRC FCC spectrum allocated in 1999
  - FCC revised allocation in 2004 and 2006

- **How the technology works**
  - Messages transmitted 10 times/sec
    - *Basic Safety Message*: vehicle position, speed, heading, acceleration, size, brake system status, etc.
    - Privacy is protected

- **Benefits of DSRC technology compared to radar/laser technology**
  - Reduced price
  - Improved reliability (fewer false alarms; works in all weather conditions)
  - Increased range performance (addresses more crash scenarios)

- **Drawback of the technology**
  - Both vehicles need to be equipped to gain safety benefit

Source: USDOT
The following applications enable a vehicle to issue a warning to the driver based on wireless messages received from other vehicles:

- **Forward Collision Warning** – Vehicle immediately ahead is braking hard/stopped
- **Emergency Electronic Brake Light** – Unseen vehicle two or more cars ahead is braking hard/stopped
- **Blind Spot/Lane Change Warning** – Unseen vehicle in the driver’s blind spot during a lane change maneuver
- **Intersection Movement Assist** – Potential collision with another vehicle entering the intersection perpendicular to the vehicle
- **Do Not Pass Warning** – Unseen vehicle approaching in opposite direction during an attempted passing situation on a two-lane road
- **Left Turn Assist** – Vehicle making an unsafe left-hand turn at an intersection across the path of an oncoming vehicle

For different vehicle manufacturers to trust and react upon each others’ messages, **a security system will be needed** to manage security functions and mitigate misbehavior due to malfunction or malfeasance.
Weather Relevant Data

- Many cars collect data such as:
  - Temperature
  - Windshield Wiper Use
  - Anti-lock Brake Use
  - Steering patterns
  - Speed

- The USDOT’s Road Weather Management Program (RWMP) is assessing how to collect, process, and share weather data with:
  - Transportation Managers
  - Drivers
  - Travelers

- Transforming connected vehicle data from vehicles into a picture of current weather and road conditions

- Personalized weather information for drivers to reduce risk.
Data Usage to Improve Driver Safety in Dangerous Weather

- 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
Weather-Related ITS Research and Development Activities

- Integrated Mobile Observations (IMO)
- Vehicle Data Translator (VDT)
- Weather Data Environment (WxDE)
- Weather Responsive Traffic Management
- Data Capture and Management
- Prototype Operational Data Environment
- AERIS

Addresses issues related to climate change, greenhouse gases emissions, etc.)
AMS Recommendations

- AMS Mobile Observations Subcommittee identified “priorities” for the ITS Strategic Plan (2015-2019):
  - Standardization of mobile weather observation data
  - Standardization and collection of meta data and quality control algorithms
  - Collaboration between the transportation and weather communities
  - Research and resources provided for further VDT development
  - Research and resources provided for the inclusion of mobile observations for decision support and situational awareness
  - Broad Agency Announcements (BAAs) to solicit broader participation in weather research
  - Management of state DOTs’ fixed Road Weather Information System – Environmental Sensor Stations (RWIS-ESS) governed by meteorological standards
Weather-Related Fatalities

**Improve**
- Safety
- Mobility
- Productivity

**Reduce**
- Delay Costs
- Fatalities
- Environmental Impacts

![Average Annual Fatalities from Adverse Weather](chart)

<table>
<thead>
<tr>
<th>Category</th>
<th>Fatalities</th>
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<tbody>
<tr>
<td>Flood</td>
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<tr>
<td>Lightning</td>
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<td>Wind</td>
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<td>Total NWS Tracked*</td>
<td>594</td>
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<tr>
<td>Adverse Road Weather</td>
<td>6,253</td>
</tr>
</tbody>
</table>

*Note: The chart represents the average annual fatalities from adverse weather conditions, with a focus on those caused by Adverse Road Weather.
Adverse Road Weather Impacts

- Over 1.3 million crashes (23% of all crashes)
- 6,253 fatalities
- 480,338 injuries
- 3% to 40% average speed reduction
- $2.2 to $3.5 billion/year lost by trucking industry (delays)
- $2.3 billion/year on snow and ice control incurred by State DOTs

Source: USDOT

City/Region-Wide Major Transportation Disruptions:
- Ohio Turnpike, OH – Snow storm (March 2014)
- Atlanta, GA – Ice storm (January 2014)
- Boulder, CO – Record rainfall and flooding (September 2013)
Final Thoughts

- The USDOT initiated a game changer through connected vehicle research
  NHTSA Agency Decision (February 2014)
- Opportunity for interdisciplinary collaboration
  Great opportunities for the transportation and weather communities to contribute to each others mission
  Maintain and expand partnership among public, private, and academic sectors
  Build operational capabilities through technology transfer of effective road weather advances
  Coordinate with transportation weather research programs in other modes, such as aviation
  Explore value of mobile observations in Numerical Weather Prediction

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