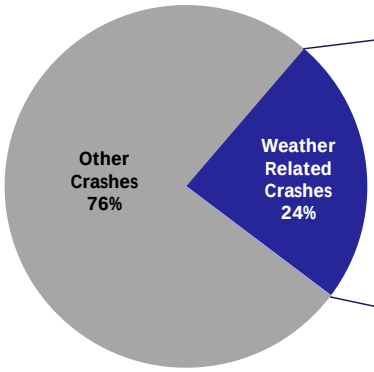
Winter Maintenance Conference
Gaylord, MI
October 17,2013

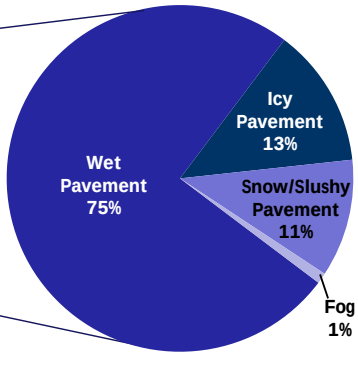
FHWA Update
Gabriel, Guevara, PE

Statistics: 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*

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Other Weather Impacts on Transportation

- Mobility
  - About 25% of non-recurring delays on freeways is due to weather
  - Congestion costs about $9.5B/yr. for 85 urban areas
- Productivity
  - Weather-related delays add about $3.4B/yr. to freight costs
- Environment
  - Chemicals used for anti-icing affect watersheds, air quality and infrastructure

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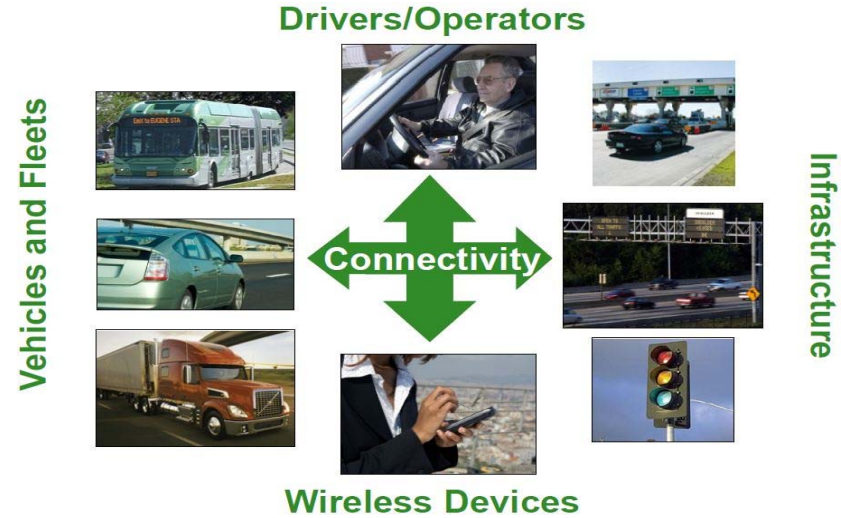
Greater Situational Awareness Can Be a Solution



Source: USDOT

CV Solutions

- Ability to prevent 80% of crash scenarios
  - Driver advisories
  - Driver warnings
  - Vehicle control
- Improve Mobility
  - Increase highway capacity by 50%
  - Reduce delay at signalized intersections by 25%
  - Reduce incidence response time by 30%
- Improve Environment
  - Reduce fuel consumption
  - Reduce emissions

Safety Applications

V2V
- Forward Collision Warning (FCW)
- Emergency Electronic Brake Light (EEBL)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)

V2I
- Curve Speed Warning (CSW)
- Red Light Violation Warning (RLVW)
- Stop Sign Gap Assist (SSGA)
- Smart Roadside
- Transit Pedestrian Warning

Source: USDOT

Benefits of Connected Automation

- Full benefits of vehicle automation achieved only through safety assurance and connectivity
- Vehicle-to-vehicle communications can enhance and enable system performance among locally connected vehicles
- Vehicle-to-infrastructure communications can optimize overall road network performance, safety, and reliability

Source: USDOT

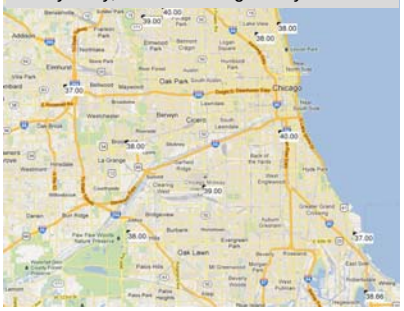
Road Weather CV Applications

- **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

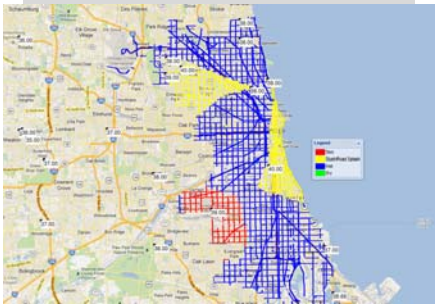
Source: USDOT

The Potential of Higher Resolution

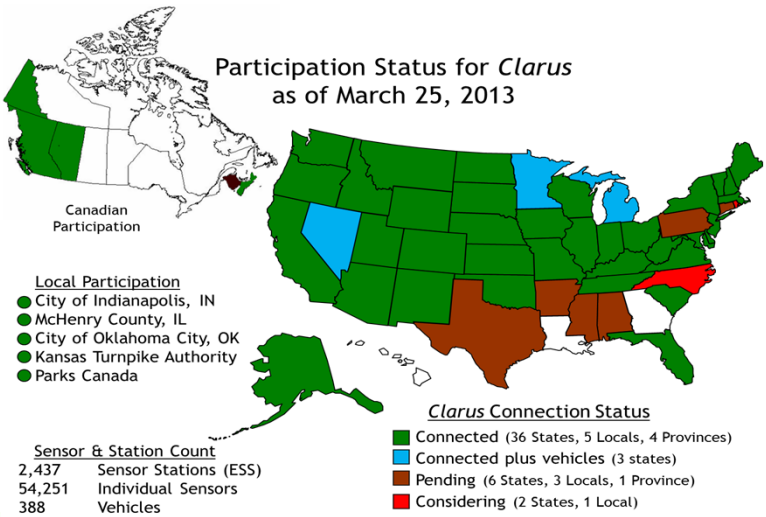
Today
A 60% chance of snow, mainly afternoon.
Sunny early, then becoming cloudy.



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



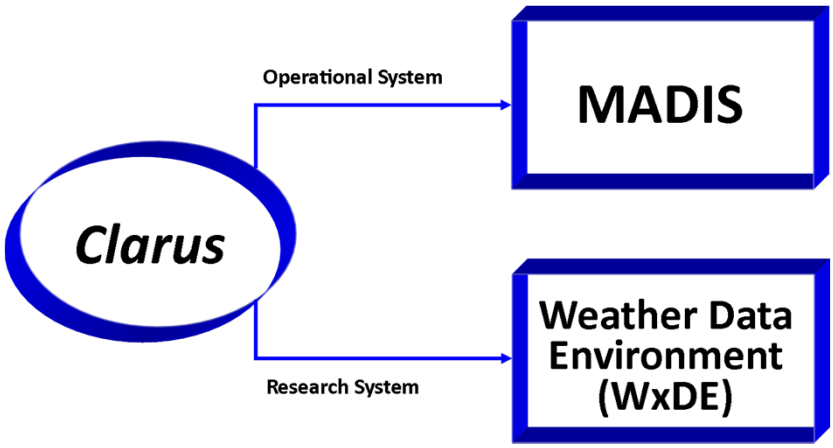
Clarus States Map (Decommissioned June, 2013)



Sensor & Station Count

2,437	Sensor Stations (ESS)
54,251	Individual Sensors
388	Vehicles

Clarus Transition Track



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Weather Data Environment

- Develop a WxDE that:
  - Manages and archives real-time weather data from both static and mobile sources
  - Incorporates VDT functionality
  - Supports the development of connected vehicle applications
  - Integrates with other Real-Time Data Capture and Management Program environments
- Other data sources being considered
  - Naturalistic Driving Study (SHRP-2)
  - Weather Telematics and other private data sources

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The RWMP Applications Development Partnership…

Partnership with States…

- Selection based on
  - Fleet
  - Maturity of the maintenance ITS program
  - Integration of mobile obs into state's application – MMS, MDSS, MODSS, TIS….
  - Other factors/synergies (multi-state, corridor, etc.)
  - Willingness to make data and lessons learned widely available /open source

Vehicle-based Probe Data

Speed and Heading
Adaptive Cruise Control
Location & Elevation
Hours of Operation

Sun/Rain Sensor
Windshield Wiper Setting
Headlight Status
Ambient Air Temperature

Anti-lock Braking System (ABS)
Brake Status
Stability Control
Traction Control

U.S. Department of Transportation 15

RWMP efforts under the Connected Vehicle Dynamic Mobility Applications Program….

All efforts support two goals:

1. Identify weather-related data elements to be included in the NHTSA decision

2. Demonstrate the value of connected vehicle data via the development, test and evaluation of a few key applications

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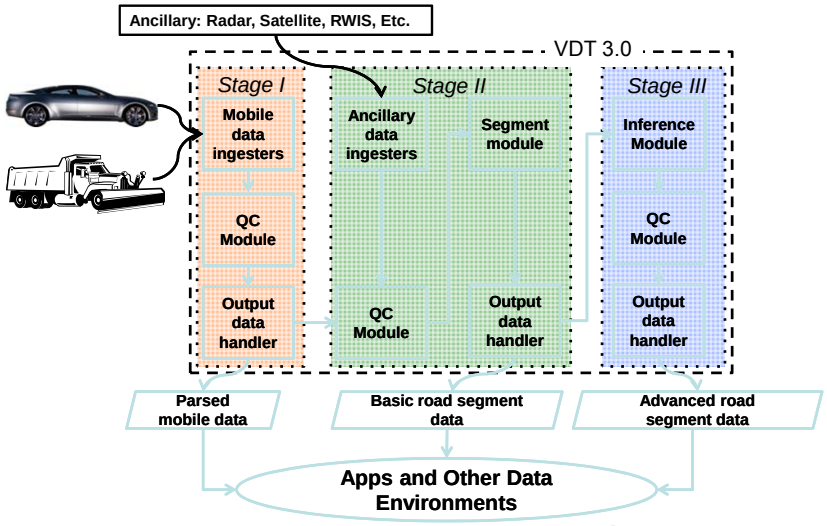
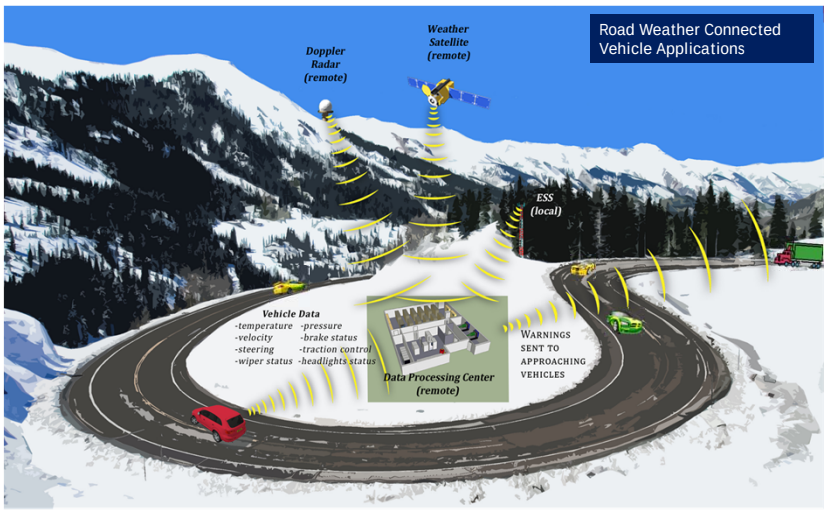
NCAR- Vehicle Data Translator

- Develop and test connected vehicle applications
- Enhance VDT to support applications
- Ingest vehicular data from State DOTs
- Demonstrate usefulness of mobile data in road weather applications
- Advance understanding of applications benefits
- Support the NHTSA rulemaking decision
- Provide outreach support / Address IP

Vehicle Data Translator (VDT)



Connected Vehicles and Road Weather Concept



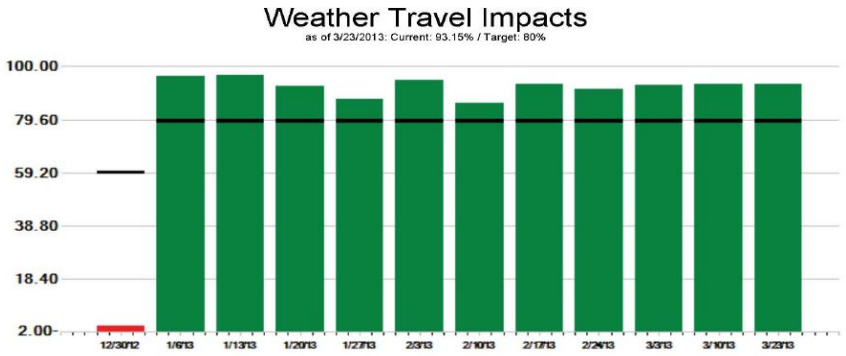
Source: NCAR

IMO 2.0

Participating states are serving as both providers of mobile data (CAN-Bus and external sensors) as well as users of the information / RdWx CV applications

- Michigan DOT
  - Instrument and deploy 20 snow plows and ~40 passenger vehicles and light-duty trucks with CV technologies
  - Input mobile & ancillary collected data into their Dataprobe application to evaluate pavement condition, measure performance, and make the data available to other weather-related application & data environments
- Minnesota DOT
  - 305 heavy duty trucks and 30 light duty trucks
  - Implement and operate applications (Enhanced MDSS, Information for Maintenance or Fleet Management Systems, Records Automation, and Motorist Advisory Warning)
- Nevada DOT
  - 45 vehicles (mix of plows, light duty vehicles, and passenger cars)
  - Enhance Maintenance Management System (MMS)

Sample CV Usefulness for State DOTs

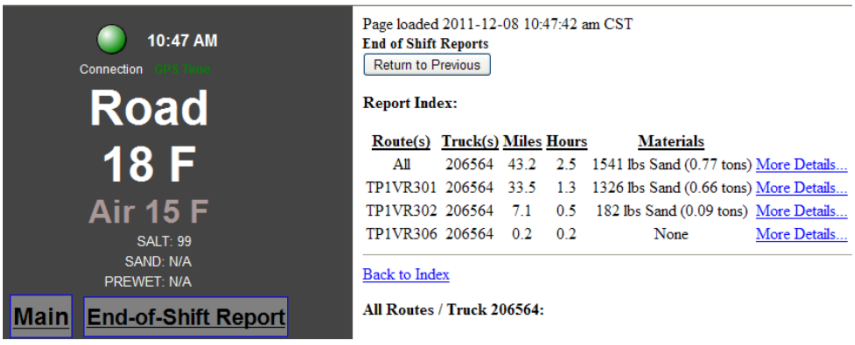


Regain normal speeds in two hours or less, 80 percent of the time for winter weather events.

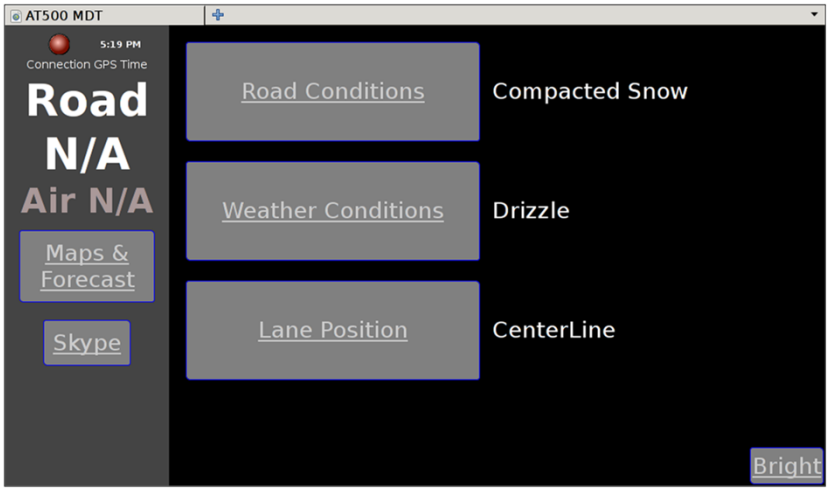
Green

Source: MDOT

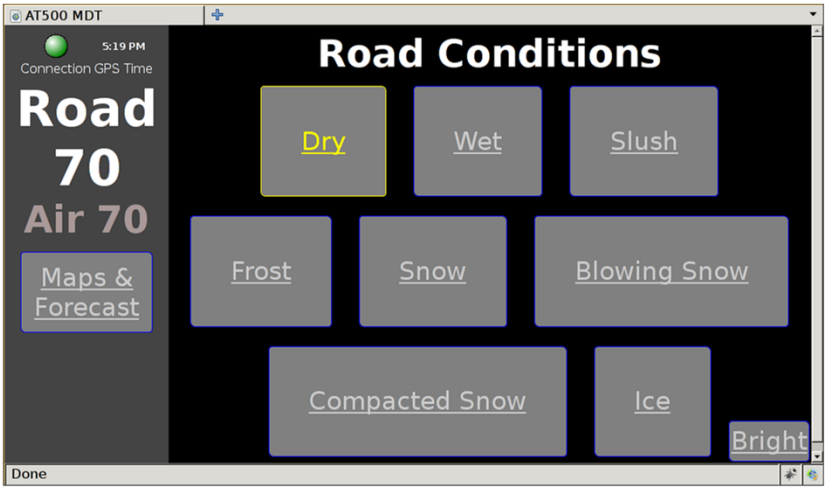
Results: Minnesota Application: End-of-Shift Report



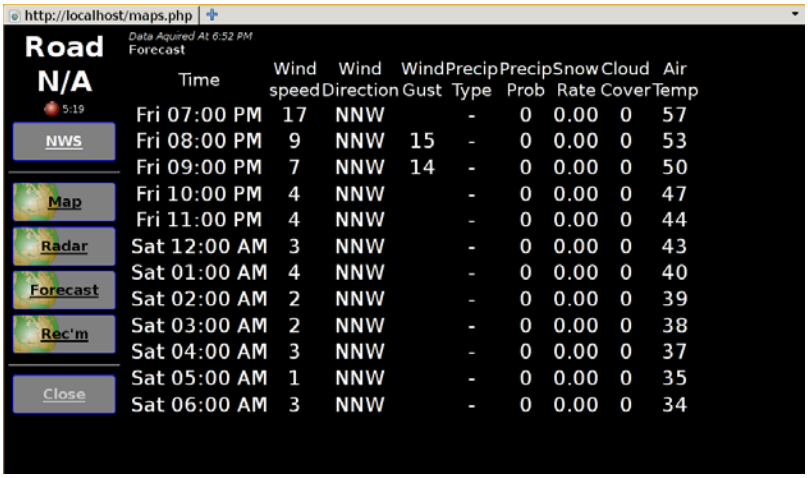
AT500 MDT
Main Screen



AT500 MDT
Road Conditions Input



AT500 MDT
Maps: Meridian Forecast



Time	Wind speed	Wind Direction	Wind Gust	Precip Type	Precip Prob	Snow Rate	Cloud Cover	Air Temp
Fri 07:00 PM	17	NNW		-	0	0.00	0	57
Fri 08:00 PM	9	NNW	15	-	0	0.00	0	53
Fri 09:00 PM	7	NNW	14	-	0	0.00	0	50
Fri 10:00 PM	4	NNW		-	0	0.00	0	47
Fri 11:00 PM	4	NNW		-	0	0.00	0	44
Sat 12:00 AM	3	NNW		-	0	0.00	0	43
Sat 01:00 AM	4	NNW		-	0	0.00	0	40
Sat 02:00 AM	2	NNW		-	0	0.00	0	39
Sat 03:00 AM	2	NNW		-	0	0.00	0	38
Sat 04:00 AM	3	NNW		-	0	0.00	0	37
Sat 05:00 AM	1	NNW		-	0	0.00	0	35
Sat 06:00 AM	3	NNW		-	0	0.00	0	34

Results: Nevada Application – Engine Fault Code Alerts

PPisano1
GNG1

Vehicle_1856
Vehicle_0556
Vehicle_0242
Vehicle_2165

Slide 26

PPisano1 Delete this slide - not weather related enough
DOT, 4/27/2012

GNG1 Please reconsider; this slides points to the value of collecting and integrating mobile data into the fleet management practices of the states
Gabriel.Guevara, 5/1/2012

Engaging Field Personnel

- CV technology education and training
- CV benefits awareness
- Encourage the integration of CV applications into current operations
- Monitor new deployments and track progress
- Track performance measures
- Document lessons learned

What is next…

- This project will be completed May 2014
- Further refinements to the VDT
- Follow-on work with these or other states
  - Share Lessons learned
  - Deploy/streamline technologies & techniques developed
- Refinement of Standards and communication protocols
- Work with the OEM's to be able to access the parameter ID's and their metadata
- Continue to cooperate with the Connected-Vehicle efforts, i.e., feed data into Clarus, the Research Development Environment, and collaborate with appropriate Dynamic Mobility efforts.

Thank you!

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