The Use of Connected Vehicle Observations in Applications for Highly Impacted Users of the Road




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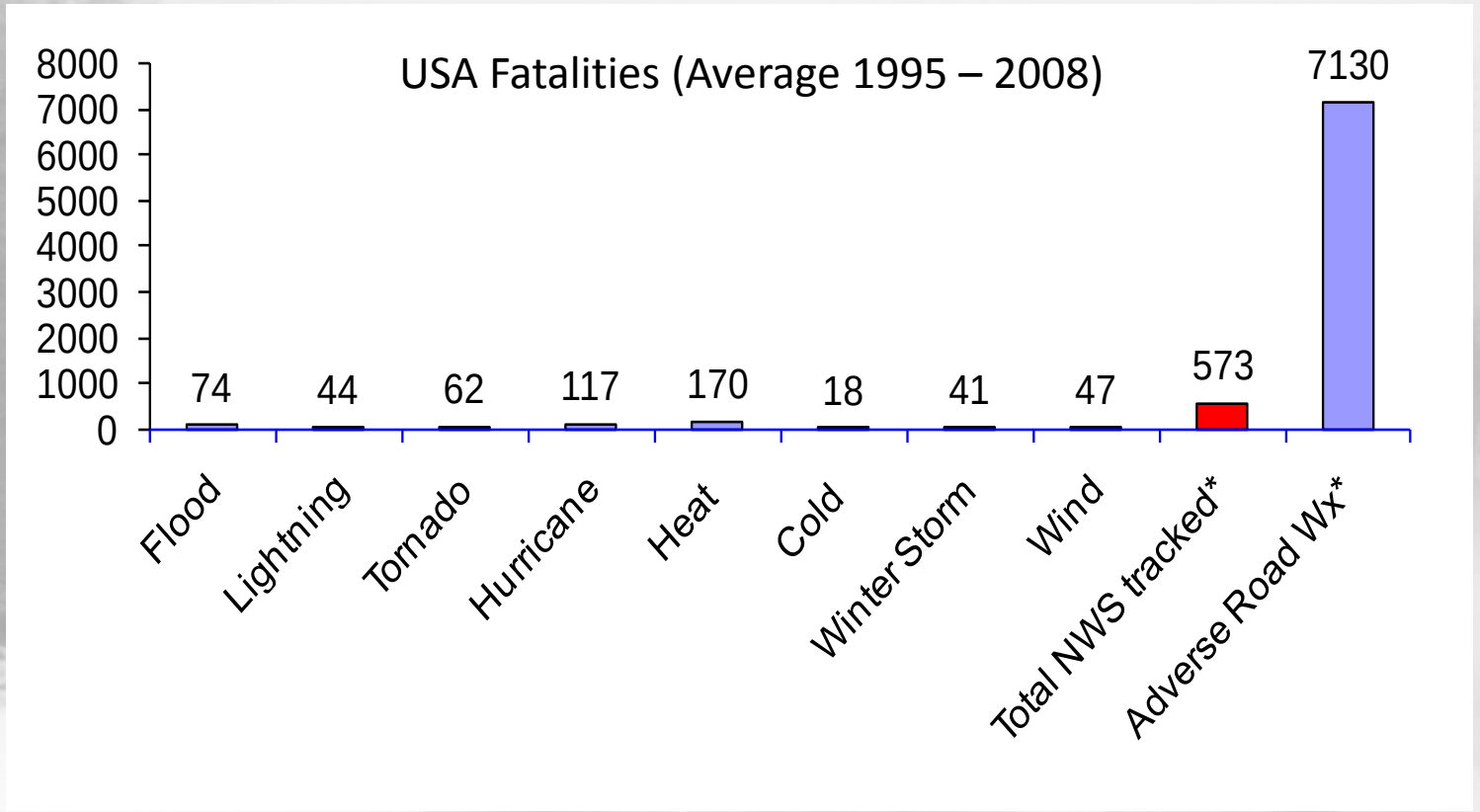
Paper: 71

U.S. Department of Transportation
Federal Highway Administration

Motivation



Updated statistics from:
Pisano et al. (2008) - http://ams.confex.com/ams/pdfpapers/133554.pdf

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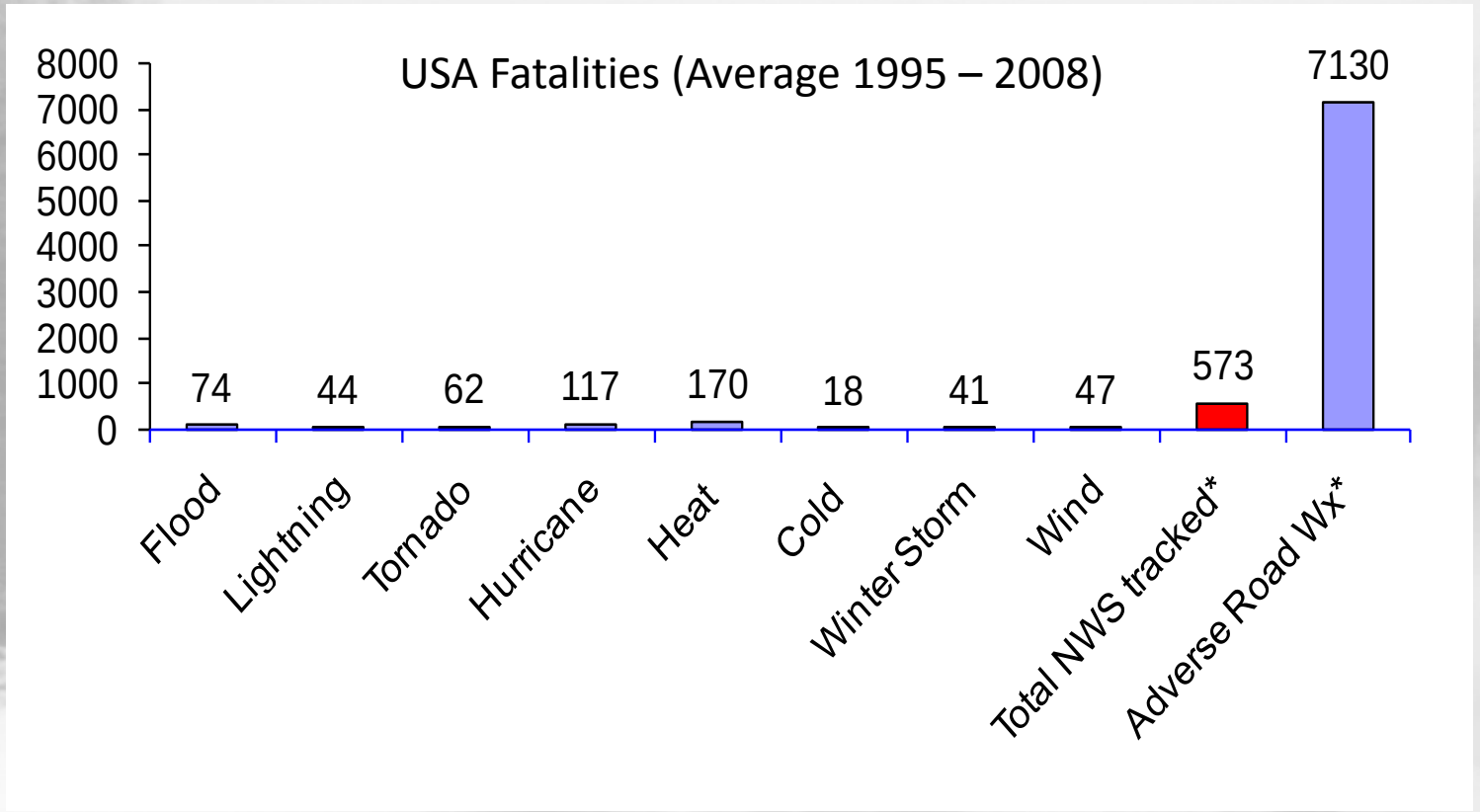
Motivation



***Same order of magnitude for distracted driving and drunk driving fatalities**

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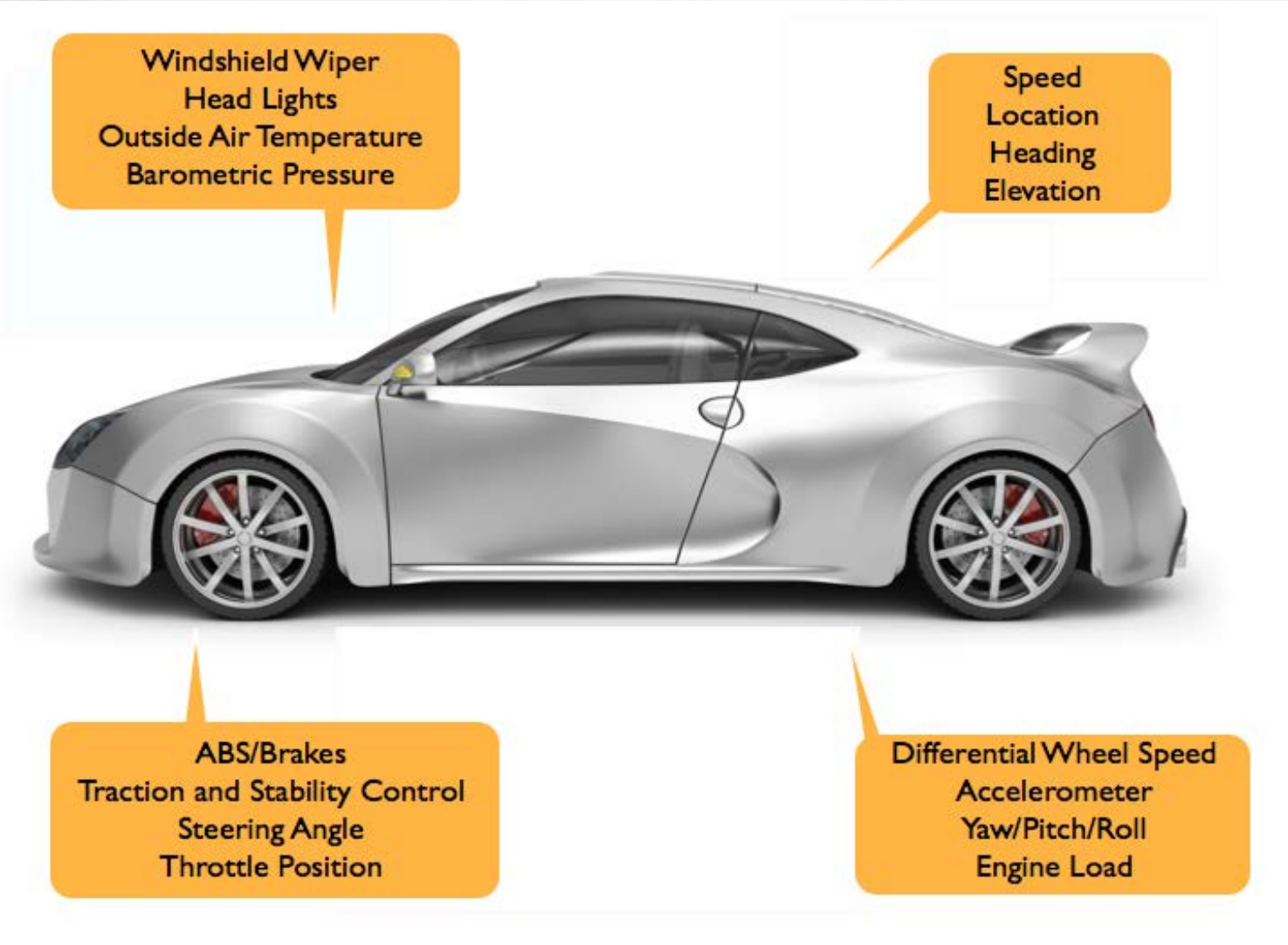
Connected Vehicles



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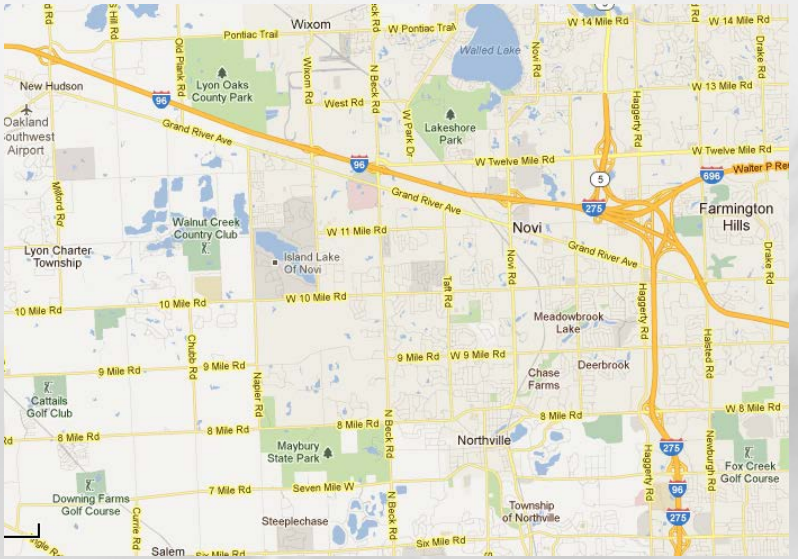
Past Studies - Detroit Testbed

- Summer 2008, April 2009 and Winter/Spring 2010
- 10 well-equipped vehicles (6 Jeeps, 3 Ford Edges, 1 Nissan Altima)
- Over 30 days of weather-targeted testing



Key PoC Data Elements	
Barometric Pressure	Brake Status
External Air Temperature	Brake Boost
Date (Year, Month, Day)	Accelerometer (lateral, long.)
Time (Hour, Minute, Sec.)	Yaw Rate
Location (lat/lon)	Headlight Status
Elevation	Traction Control
Vehicle Heading	Stability Control
Vehicle Velocity	Wiper Status
Hours of Operation	ABS Status

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Papers

Chapman, M., Drobot, S., Jensen, T.L., Johansen, C., Mahoney, W.P., Pisano, P., McKeever, B. , 2010: Diagnosing Road Weather Conditions with Vehicle Probe Data: Results from Detroit IntelliDrive Field Study. *Transportation Research Record,* ***2169, 116-127.***

Amanda R. S. Anderson, Michael Chapman, Sheldon D. Drobot, Alemu Tadesse, Brice Lambi, Gerry Wiener, Paul Pisano, 2011: Quality of Mobile Air Temperature and Atmospheric Pressure Observations from the 2010 Development Test Environment Experiment. *Journal of Applied Meteorology and Climatology,* ***Volume 51, Issue 4 (April 2012) pp. 691-701***

Project Reports: http://ops.fhwa.dot.gov/weather/resources/publications.htm

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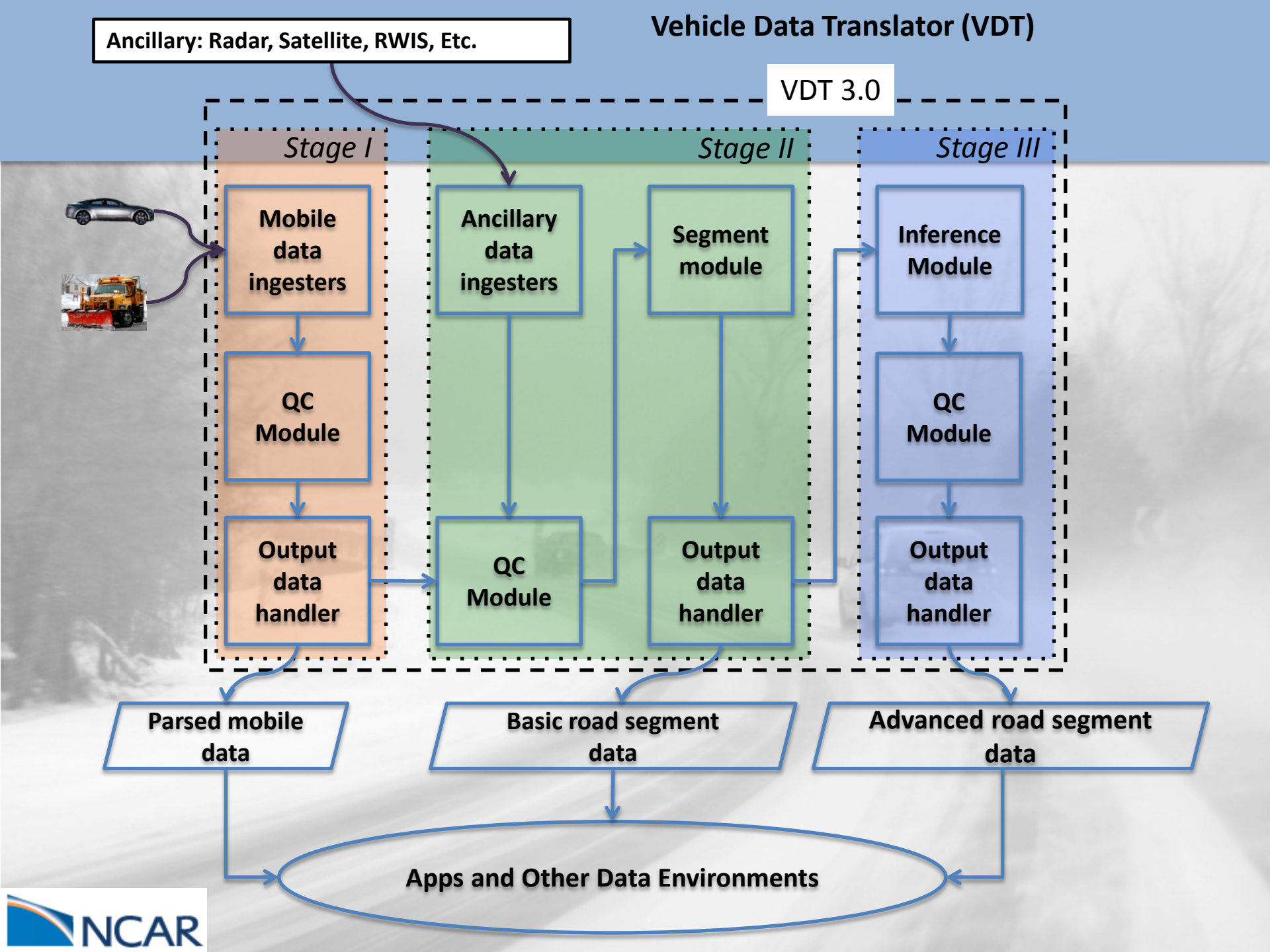
Vehicle Data Translator (VDT)



QCh in VDT 3.0

- Time Step Test
- Persistence Test
- Spatial Tests (IQR and/or Barnes)
- Climate Range Test
- Data Filtering Test
- Neighboring Vehicle Test (NVT)
- Model Analysis Test (MAT)
- Combined Algorithm Test (CAT)

System Description: http://ntl.bts.gov/lib/43000/43200/43279/FHWA-JPO-11-127_Final.pdf

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Verification

Percent of observations correctly classified

	VDT 2.0	VDT 3.0
Precipitation	66%	89%
Pavement Condition	24%	52%
Visibility	58%	79%

- All algorithms improved for VDT 3.0
- Still room for more improvement
  - Mixed/ice precipitation cases needed
  - Pavement condition needs better verification, slick algorithm over-alerts
  - Better visibility verification, specific categories

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ITS Mobile Observation (IMO) Study

Data from Two US State DOTs

Minnesota

- Data (both CANbus and external) - 10 light duty and 78 heavy duty vehicles
- Applications – End of shift reports and Pavement and Air Temperature Forecasts
- Communication - Cellular

Nevada

- Data (both CANbus and external) – 10 light duty and 10 heavy duty trucks along I80
- Sensor comparison analysis and Trouble Code application
- Communication - Radio

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IMO Study

Data from States

	MnDOT Dates	MnDOT Obs	NDOT Dates	NDOT Obs
CAN	14 Sept 2011 – 12 Mar 2012	8,655,540	7 July 2011 – 12 Mar 2012	33,870
Outer Sensors	01 Jan 2011 – 12 Mar 2012	2,485,341	25 May 2011 – 12 Mar 2012	218,035

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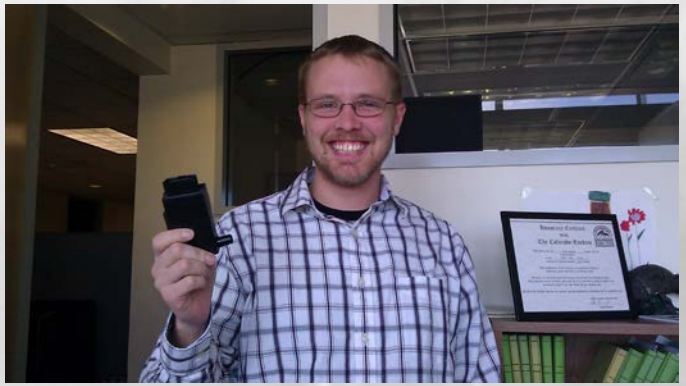
DOCS - 2011

Demonstration of CANbus Study (DOCS)



External Sensors

Surface Patrol HD
Road Watch
AirMar
DSC111

GPS

Latitude
Longitude
Elevation

CANbus Parameters

Air Temperature
Air Pressure
Acceleration
Yaw, Pitch, and Roll
Steering Angle
Brake Status

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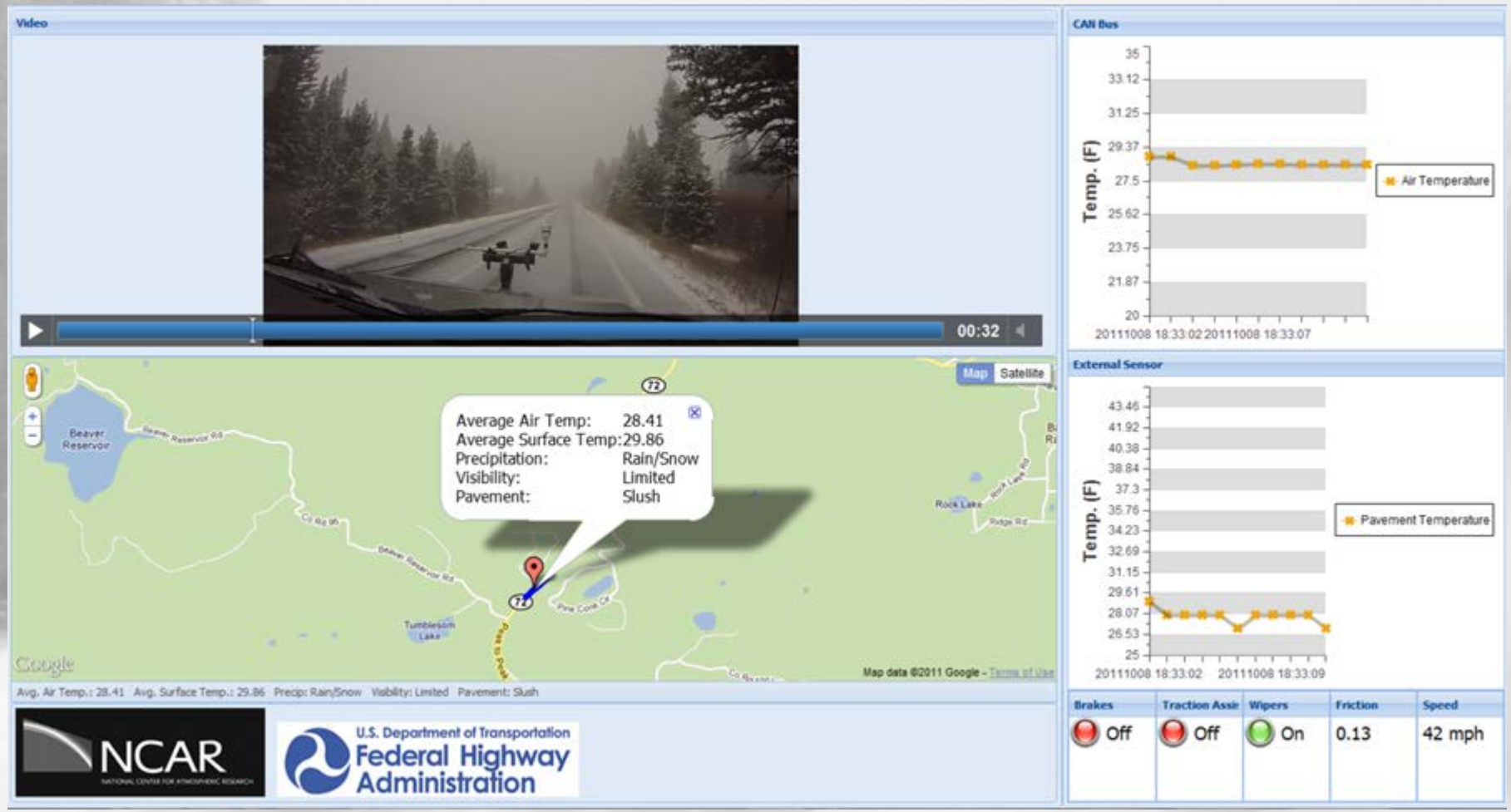
DOCS - 2011



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Not just for road maintenance…

Airport Ground Operations

Not just for road maintenance…

Freight Operations

Not just for road maintenance…

Emergency Medical

Not just for road maintenance…

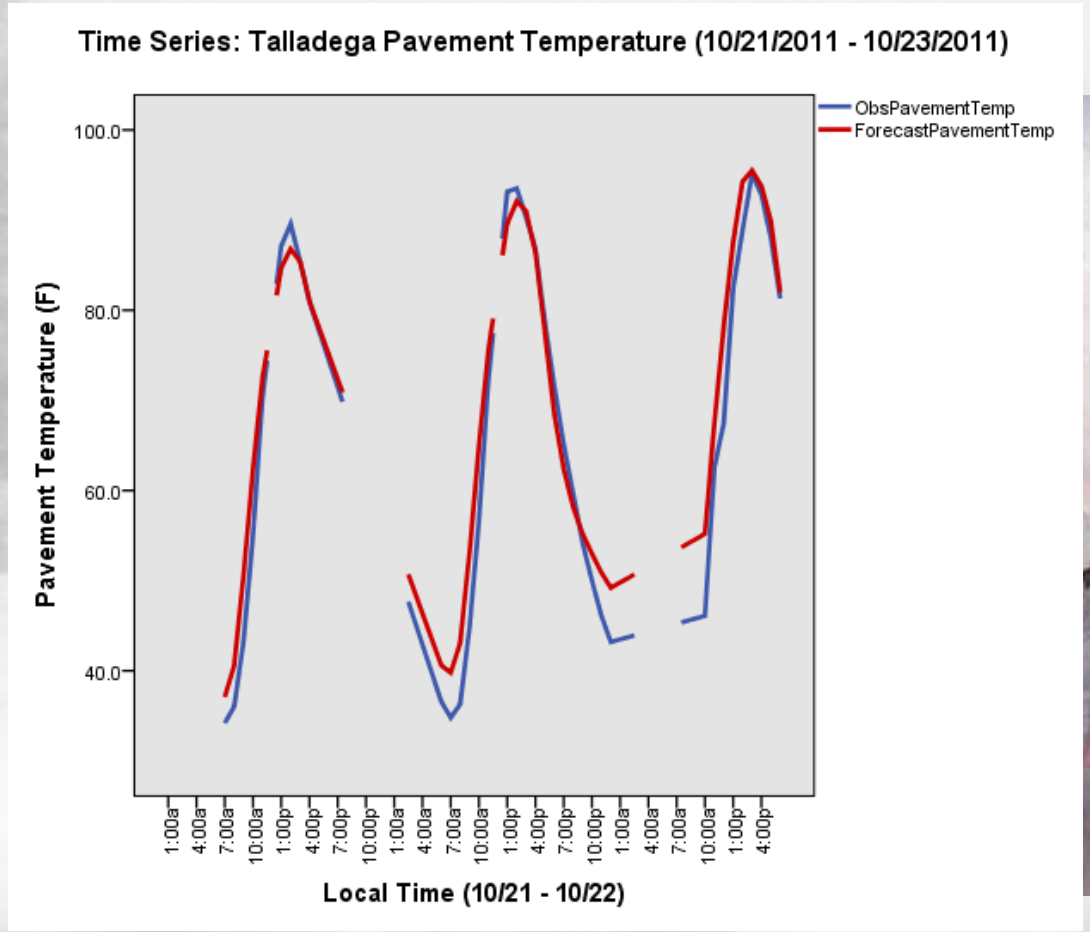
Traveling Public

Not just for road maintenance…

Other “connected vehicle” users?

Not just for road maintenance…

Other highly impacted users?



Pavement Forecast from METRo (Environment Canada)
Weather Forecast from DiCast (NCAR)

The Future

Near Term

- More weather-related CANbus and external sensor data from plows and other public vehicles
- Need controlled testing for VDT algorithm tuning
- Need more large uncontrolled dataset to analyze real-world data possibilities

Long Term

- Build large-scale segment and grid-based road weather impact diagnostic that can be fed to all users of the roadways
- Push road weather specific impact information into the vehicle without distraction

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http://www.rap.ucar.edu/wsap/themes/surf_trans.php