Role of ITS in Improving Safety in Road Transport

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Peter F. Sweatman

UNIVERSITY OF MICHIGAN
TRANSPORTATION RESEARCH INSTITUTE

What Are Intelligent Transportation Systems (ITS)?

- Broad range or transportation system applications that are intended to address safety, congestion and sustainability.

- Crosses all transportation modes

- Range from OEM safety devices to traffic signals

- Create transactions with consumers, or end users

"Surface transportation in the United States is at a crossroads. The mobility we prize so highly is threatened. Many of the nation's roads are badly clogged. Congestion continues to increase, the conventional approach of the past – building more roads – will not work in many areas of the country, for both financial and environmental reasons."

A Strategic Plan for Intelligent Vehicle-Highway Systems,

IVHS America, 1992

Where Are We Today?
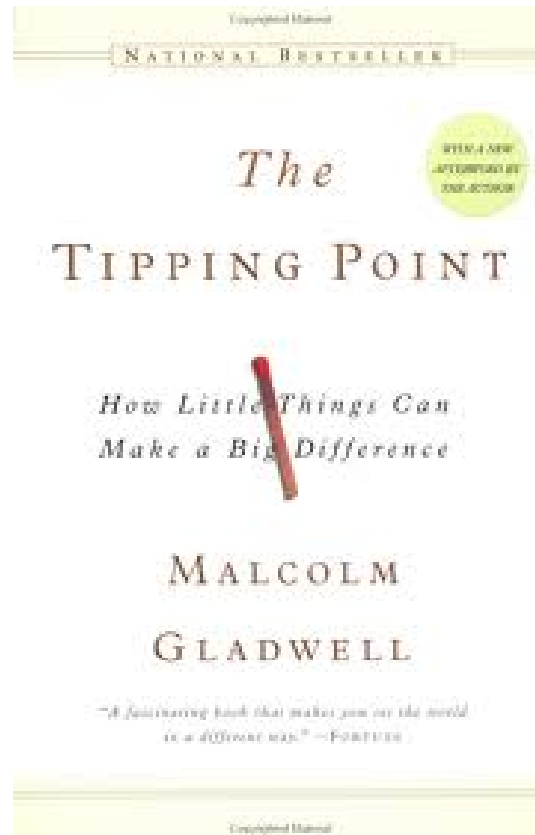
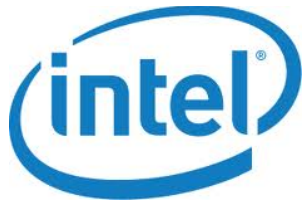# We Are Living in a Connected World With New Mobility Choices

Connectivity Has Changed
the Face of Commercial Vehicles as Well

Companies Involved in Transportation are Changing

And This is Only the Beginning

Connected Vehicles are the Future

Examples of Other Coming Policy Changes

- Pay as you drive insurance
- Mileage based user fees
- Electronic tolling/freight management
- New payment technologies
- New sensor technology
- Smart parking
- Integrated corridors
- Smart cities
- Connections with the grid

MAP-21 Where Are We Today?

President Obama signed the Moving Ahead for Progress in the 21st Century Act (MAP-21) into law on July 6, 2012

- 27 Month Surface Transportation Reauthorization

- Policy took effect October 1, 2012

- $118 billion total ($105 billion for FY13 and FY14)
    - Current funding levels indexed to inflation
    - LUST Fund, Pensions, General Fund transfers to cover $10 billion annual deficit
- Provides States and Industry with certainty to start major capital projects and create jobs

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MAP-21: Top-Line Summary

- Consolidates or eliminates 60 federal programs
- Creates national goals and measures, statewide and metro area performance targets
- Expedites project delivery
  - Streamlines environmental review process
- Expands TIFIA and tolling, removes anti-PPP provisions
- Establishes National Freight Policy and National Freight Network
- Continues Highways/Transit split at 80/20

MAP-21: ITS Highlights

- **Performance Management: ITS needed to measure and improve safety, congestion, system reliability, freight movement**

- **Planning: States and metro areas must promote efficient system management and operations, incorporate performance targets**

- **Core Highway Programs: ITS eligible in all formula programs**

- **ITS Research: Restored to $100M per year**

- **Financing: TIFIA & Tolling expanded, PPP amendments out**

MAP-21: ITS Research, Safety and Innovation

- ITS Research and Development Program funded at <u>$100 million</u> per year
    - Senate bill had funded program at $50 million
    - Saves Connected Vehicle Program
    - Requires V2V and V2I Deployment Report in 3 Years
- Technology & Innovation Deployment Program – New $62.5 million per year program to provide competitive grants to accelerate adoption of "innovative technologies" across surface transportation system
    - ✓ Similar to but broader than the *Smart Technologies for Communities Act*
- Highway Research program includes focus on reducing congestion, improving operations and enhancing freight productivity
    - Includes active traffic and demand management, accelerated deployment of ITS, arterial management and traffic signal operations, congestion pricing, real-time information, road weather management, and other ITS strategies

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MAP-21: Freight Safety

- **Commercial Motor Vehicle Safety Enhancement Act**
  - mandates electronic logging devices to record hours of service
- **National Freight Policy**
  - Goal: "use advanced technology to improve the safety and efficiency of the national freight network"
  - Eligible expenditures: "intelligent transportation systems … truck parking systems … "
- **Highway Research and Development program (FHWA)**
  - $115 million per year for "highway safety, infrastructure integrity .."
  - Includes active traffic and demand management, accelerated deployment of ITS, arterial management and traffic signal operations, congestion pricing, real-time information, road weather management, and other ITS strategies

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CCV Safety Applications Projects

- **Develop and test connected commercial vehicle safety applications:**
  - ☐ **Dedicated short-range communications (DSRC)**
  - ☐ **Driver alerts**
  - ☐ **Vehicle-to-vehicle (V2V)**
  - ☐ **Vehicle-to-infrastructure (V2I)**
- **Deploy equipped vehicles in the Safety Pilot Model Deployment**
  - ☐ **In fleet operations**
  - ☐ **Data acquisition systems**
  - ☐ **Deployment includes 2800+ vehicles**

CCV Safety Applications Project: Goals

- **Support USDOT Safety Pilot objectives for commercial vehicles including:**
  - ☐ **Demonstrate safety-related applications in a real-world environment**
  - ☐ **Collect data for safety benefits estimates to support NHTSA 2014 agency decision process for commercial vehicle implementation**
  - ☐ **With other platforms, evaluate DSRC technology aspects including scalability, security, and interoperability**
  - ☐ **Valuable data for a variety of R&D uses**
- **Share results with the commercial vehicle community**

CCV Safety Applications Project: Team

- **Multi-Modal USDOT Contract and Advisory Team**
  - ITS Joint Program Office
  - National Highway Traffic Safety Administration
  - Federal Motor Carrier Safety Administration
  - Federal Highway Administration

- **Project Team**
  - **Battelle**
    - Program Manager and Driver Clinic Conductor
  - **Mercedes Benz Research and Development North America (MBRDNA)**
    - Connected Vehicle Safety Applications Developer
  - **DENSO INTERNATIONAL North America Research Laboratory (NARL)**
    - Onboard Equipment Platform and Wireless Communications Supplier
  - **UMTRI: University of Michigan Transportation Research Institute**
    - Data Acquisition System, Integration, Performance & Field Testing
  - **Meritor WABCO**
    - Commercial Vehicle Crash Avoidance Systems Supplier
  - **Daimler Trucks North America (DTNA) Advanced Engineering NAFTA**
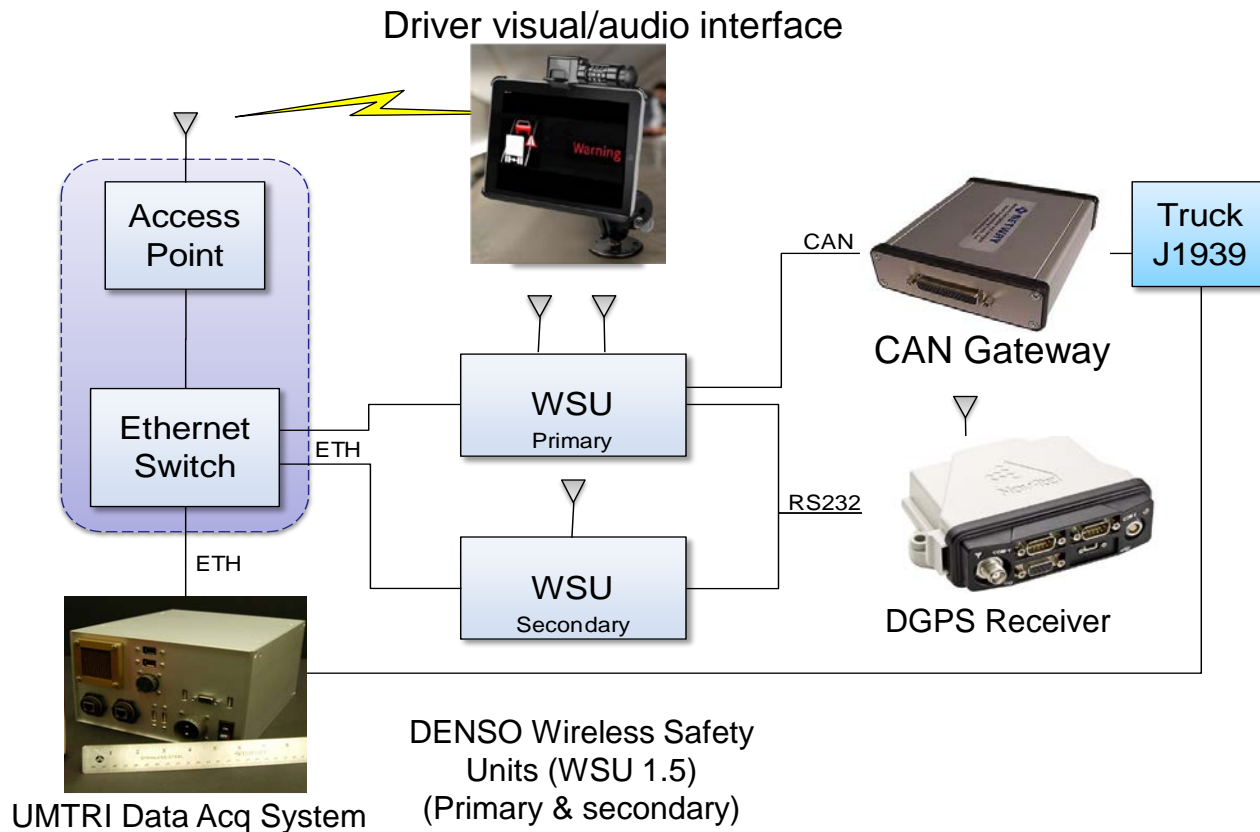   - Heavy Truck OEM and CAN Integration Support

CCV Safety Applications Project: Activities

■ **System architecture & platform implementation**

■ **Safety application development & performance testing**

■ **Interoperability with other connected vehicle devices**

 □ **Broadcast-only vehicle awareness devices**

 □ **Light vehicle fleets (integrated; retrofit)**

 □ **Transit fleets (retrofit)**

 □ **Roadside equipment**

USDOT &
Other Contractors

■ **Driver Acceptance Clinics**

■ **Provide vehicles for Model Deployment by the Safety Pilot Test Conductor**

 □ **11 Instrumented commercial vehicles**

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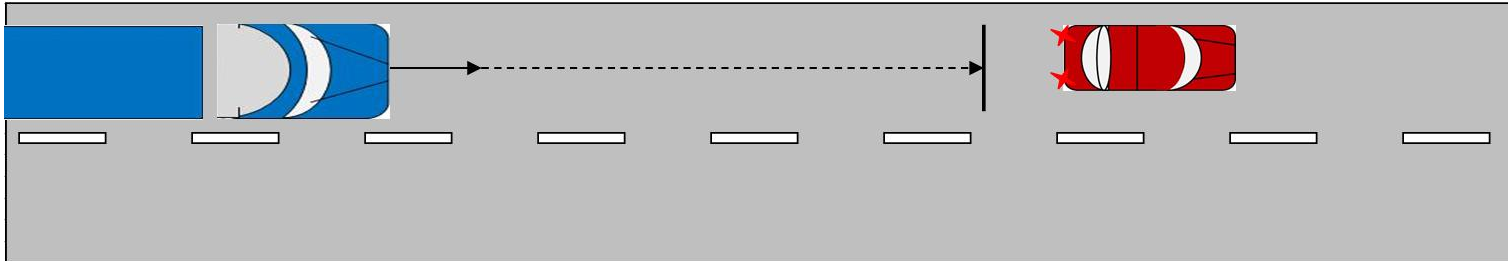# CCV Safety Applications Project: Architecture and Components

Leveraging CAMP architecture & foundational software:
• Mercedes Benz RDNA – Applications, Driver interface
• DENSO – Wireless safety unit platform

Driver visual/audio interface

Access Point

Ethernet Switch

ETH

WSU Primary

WSU Secondary

CAN

CAN Gateway

Truck J1939

RS232

DGPS Receiver

ETH

UMTRI Data Acq System

DENSO Wireless Safety Units (WSU 1.5) (Primary & secondary)

CCV Safety Applications Project: Applications Overview

- **Forward Collision Warning - Helps drivers avoid or mitigate rear-end vehicle collisions in the forward path of travel**
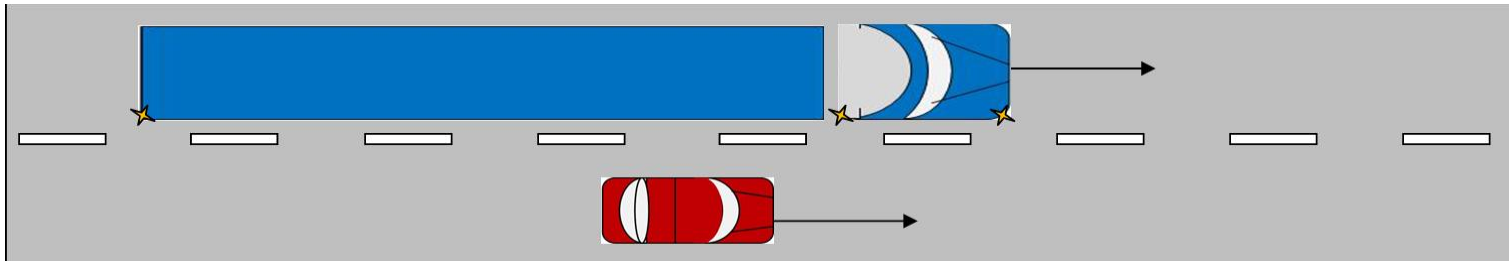

- **Emergency Electronic Brake Lights - Helps drivers avoid or mitigate rear-end collisions with braking vehicles in the forward path of travel**
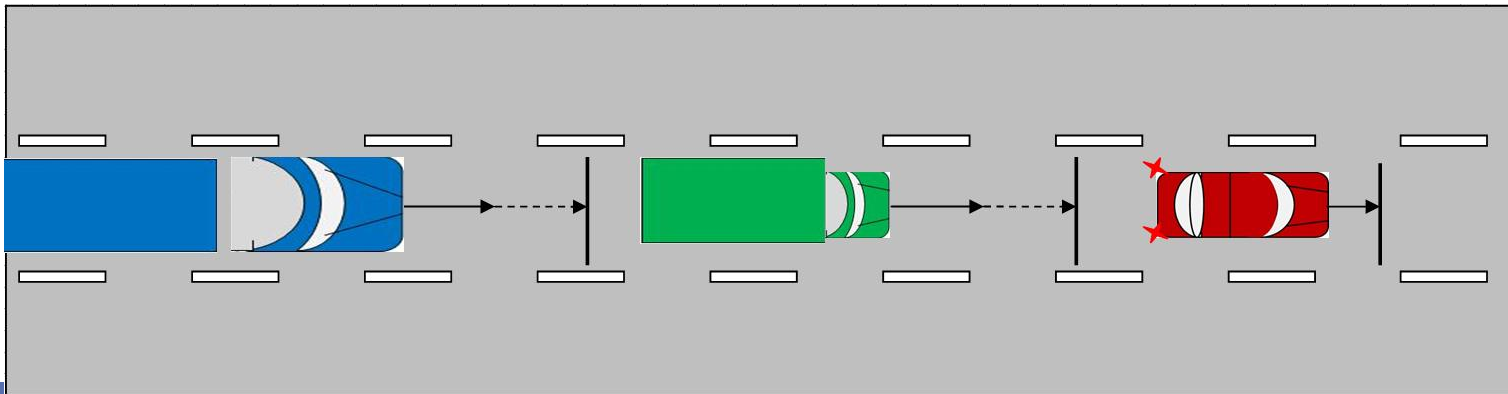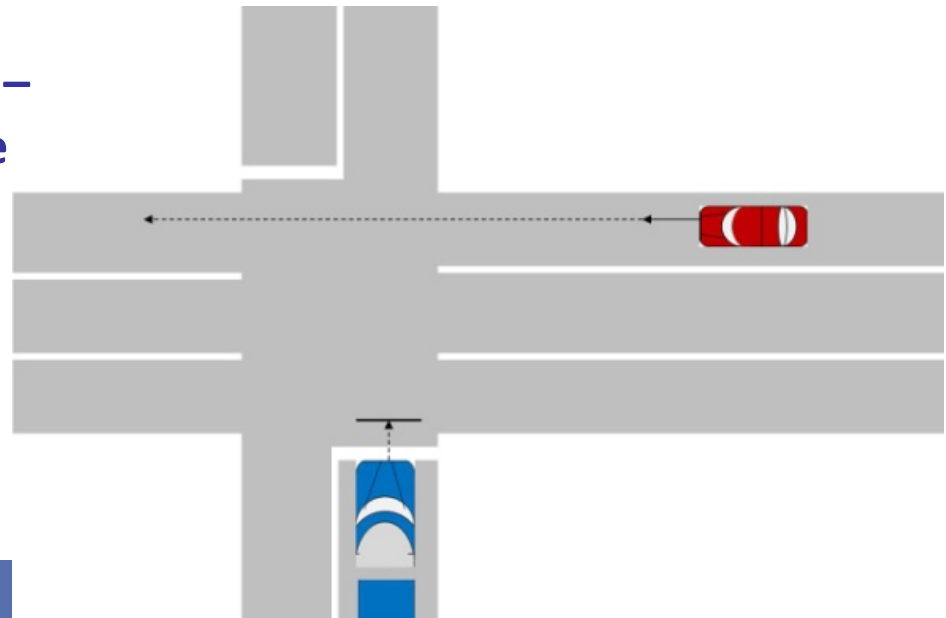
CCV Safety Applications Project: Applications Overview

- **Blind Spot Warning/Lane Change Warning - Helps drivers avoid or mitigate collisions with vehicles in or approaching blind spot**
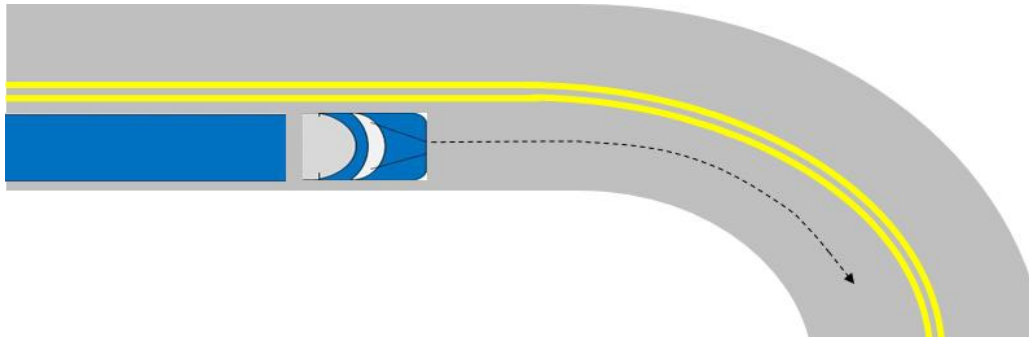

- **Intersection Movement Assist – Helps drivers avoid or mitigate vehicle collisions at stop sign controlled and uncontrolled intersections**

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CCV Safety Applications Project: Applications Overview

- **Curve Overspeed Warning – Warns drivers of excessive speed entering into a curve**

- **Bridge Height Inform – Informs driver of low bridge ahead**

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CCV Safety Applications Project:
Integrated Trucks and Retrofit Kit Trucks

- **For Safety Pilot, connected vehicle technology has been implemented on three Freightliner Class 8 Tractors**
  - **One high-roof sleeper, one mid-roof sleeper, and one day cab**
  - **Tractors also have Meritor WABCO OnGuard System, which is turned off during connected vehicle testing**

- **Eight retrofit kits will be installed on existing fleet trucks operating in the Model Deployment area (Ann Arbor, MI)**

  - 12 months of continuous use in revenue service


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CB antenna

DSRC antenna

Side/rear DAS camera

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CCV-IT rooftop antennas

CCV Safety Applications Project: Driver Acceptance Clinic Overview

- **Objective**

  - **Evaluate Driver Acceptance of V2V applications**
    - **Surveys and direct observation of driver responses to warnings**
    - **Drivers with valid CDL in good health**

  - **System Performance Tests**

  - **Coordinated with the Small Vehicle Clinics and Volpe Independent Evaluator**
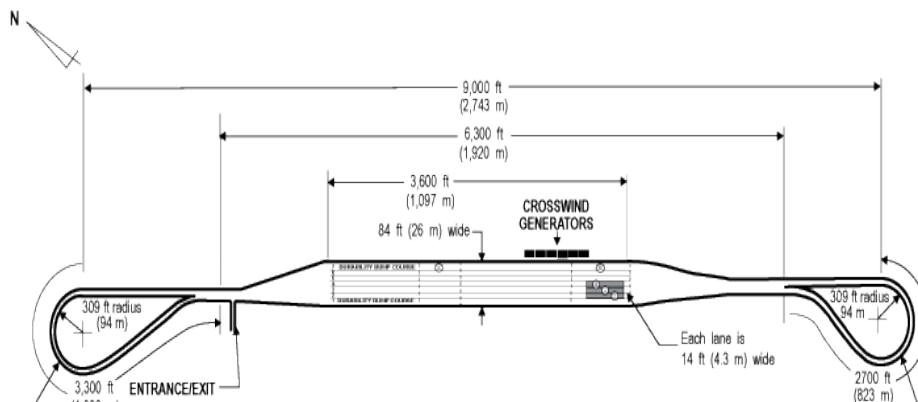
Site 1
Transportation Research Center
& Proving Ground
East Liberty, Ohio

Site 2
Former Alameda Naval Air Station

CCV Safety Applications Project: Status Update

- **Hardware installation completed on 4 "Integrated Trucks"**

- **Base applications development completed**
  - **Applications currently being refined through testing on local roads and tests tracks**

- **Integrated tractors currently participating in Safety Pilot interoperability testing with CAMP vehicles, Aftermarket Safety Devices and Vehicle Awareness Devices**

- **Driver Acceptance Clinics;**
  - **TRC (Ohio) in July**
  - **Alameda, California in August**

- **3 Integrated Trucks and 8 Retrofit Safety Device Trucks scheduled entered into Safety Pilot Model Deployment in Early September 2012**

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Connected Vehicle Safety Pilot

Jim Sayer

Program Manager

University of Michigan Transportation Research Institute

UNIVERSITY OF MICHIGAN
TRANSPORTATION RESEARCH INSTITUTE

What is Connected Vehicle Technology?

- **The use of wireless communications to share basic information about:**
  - **Vehicles:**
    - Position (GPS-based location, lat/long)
    - Speed
    - Heading (i.e., direction of travel)
  - **Infrastructure**
    - Signal phase, surface conditions
- **5.9 GHz DSRC**
  - **Like Wi-Fi, but a dedicated, optimized channel, secure and private**

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What is Connected Vehicle Technology?

- **Vehicle to Vehicle Communication (V2V)**
  - ☐ **Forward crash warning**
  - ☐ **Electronic emergency brake lamps**
  - ☐ **Intersection movement assist**
- **Vehicle to Infrastructure Communication (V2I)**
  - ☐ **Curve speed warning**
  - ☐ **Emergency vehicle signal preemption**
  - ☐ **Road surface condition**
- **Vehicle to Everything Else (V2X)**
  - ☐ **Pedestrians, cyclists, trains at grade crossings**

# What is Connected Vehicle Technology?

What is Safety Pilot?

- **Safety Pilot is:**
  - □ **Model for a national deployment of the technology**
  - □ **Designed to determine the effectiveness of the safety applications at reducing crashes**
  - □ **Designed to determine the how real-world drivers will respond to the safety applications**
- **Safety Pilot will also test mobility and sustainability applications**
- **$26M, 2.5 year program**
- **1-year deployment began with official launch August 21, 2012**
  - □ **Transportation Secretary Ray LaHood & Governor Rick Snyder**
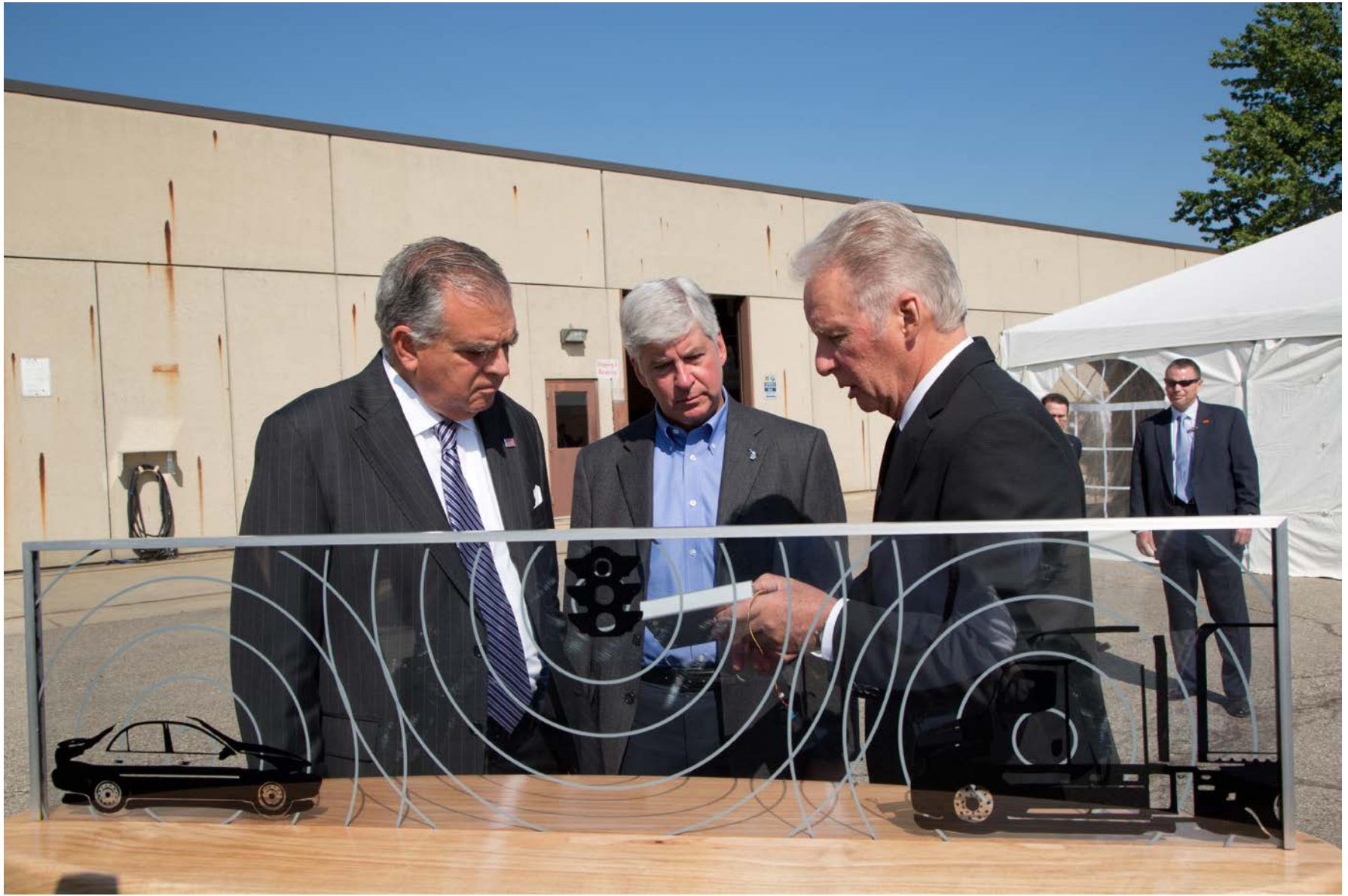
Test Conductor Team

A Community Effort

- **Working with a variety of local organizations**
  - ☐ **City of Ann Arbor, Ann Arbor Public Schools, Washtenaw Intermediate School District, UM Transportation, Con-way Freight, Sysco Foods, AAPD**

- **We need about 2600 lay participants just from northeast Ann Arbor, and the surrounding community**
  - ☐ **Over 4000 have signed up!**

Scope

- **2,836 cars, commercial trucks, and transit vehicles**
  - **Approximately 800 on the road**
- **73 lane-miles of roadway instrumented with 29 roadside-equipment installations**
  - **10 RSEs installed and operational**
- **A variety of different devices on vehicles**
  - **Vehicle Awareness Devices**
  - **Aftermarket Safety Devices**
  - **Retrofit Safety Devices**
  - **Integrated Safety Systems**

Example Equipment

Example Equipment

Vehicles & Devices Deployed

	Integrated Vehicles	Retrofit/ Aftermarket Devices	Vehicle Awareness Devices	
Passenger Cars	64	300	2215	
Heavy Trucks	3	16	50	
Transit		3	85	
Medium Duty			100	
	67	319	2450	**2836**

To Date	64	10	471	545

Vehicle-Based Data

|	Integrated Vehicles	Retrofit/ Aftermarket Devices	Vehicle Awareness Devices	
Passenger Cars	64	100	2215	
Heavy Trucks	3	4	50	
Transit		3	85	
Medium Duty			100	

■ VTTI DAS   ■ Basic Message Only

■ UMTRI DAS

Infrastructure Installations

- **Strategy for site location**
  - ☐ **Capture all traffic operating in northeast Ann Arbor, with focus on local residents and commuters**

- **Roadside Equipment at:**
  - ☐ **21 signalized intersections**
  - ☐ **3 curves**
  - ☐ **5 freeway sites**

- **2 SPaT enabled corridors**
  - ☐ **12 intersections, 6 per corridor**

- **Rich contextual data set**

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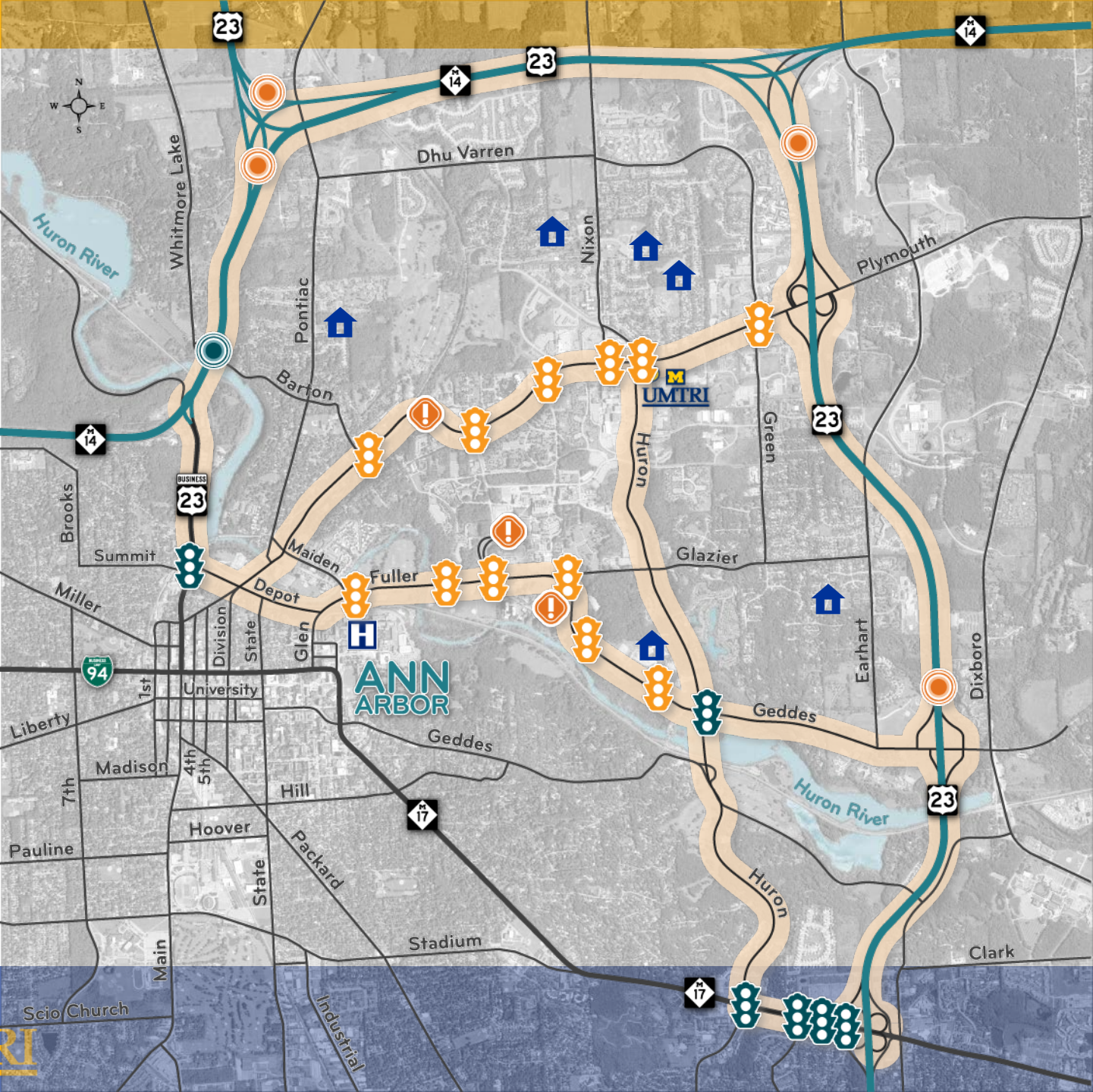
Ann Arbor USA – the future of mobility

- **Ann Arbor becomes the "sandbox" for connected vehicle technology testing and development**
- **More than 8 billion Basic Safety Messages (BSMs) collected to date**
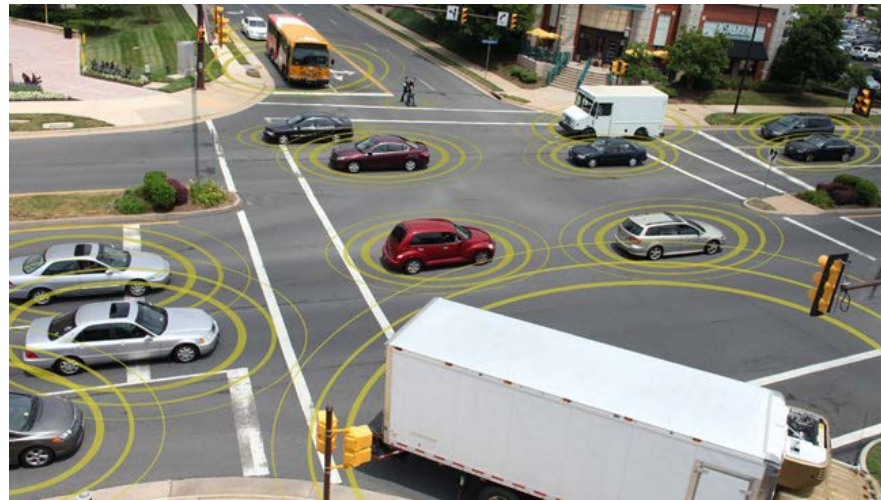
Stakeholder Utilization of the Site and Data Access

- **Provide access to, and support for, use of the operating environment by other stakeholders**

- **Showcase facility to support stakeholder use of the site**

- **Support wide-spread dissemination of the data for use by a variety of researchers**
  - **Vehicle level and infrastructure-based data**
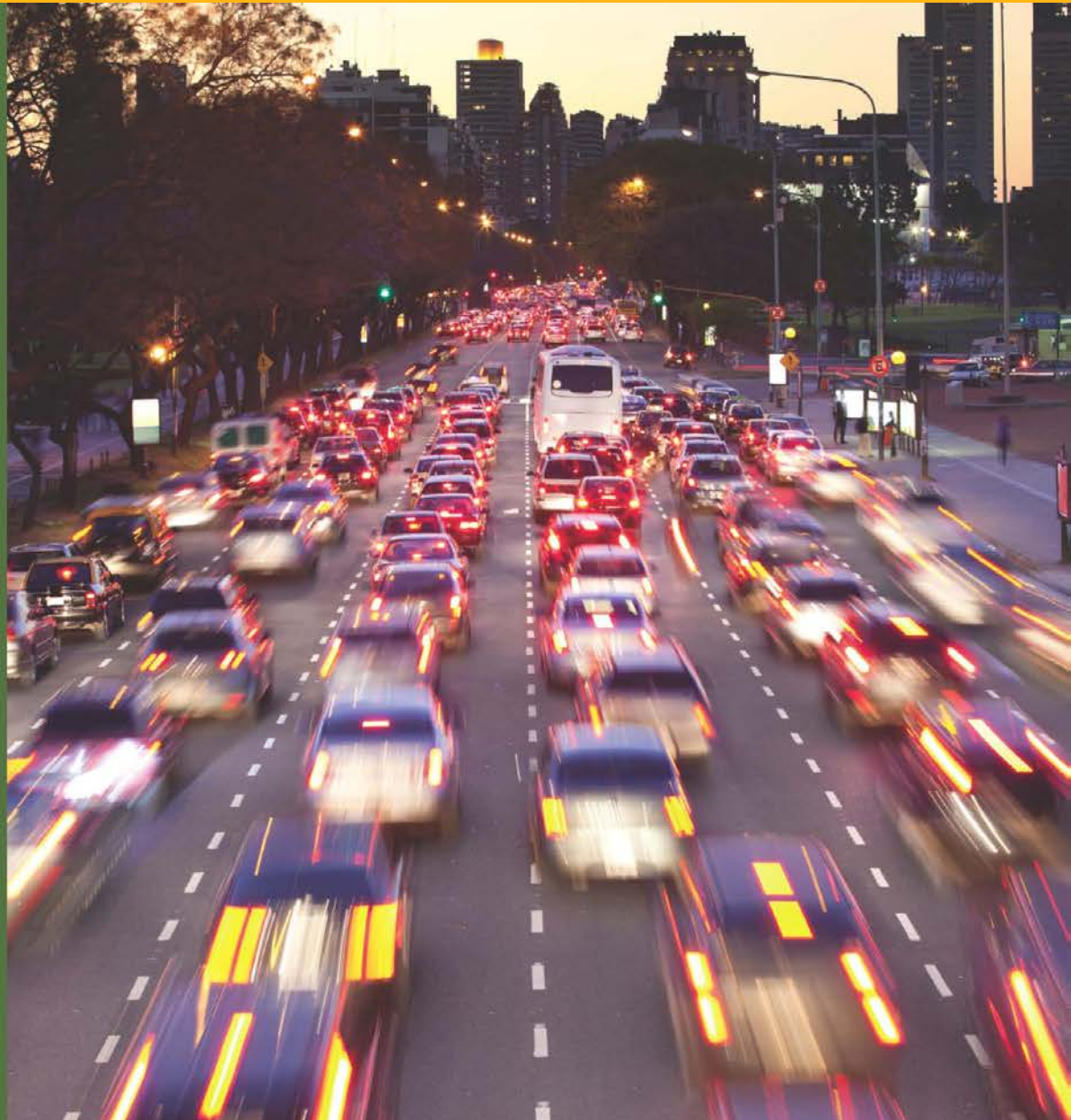
Key Events

- **NHTSA agency decision on national safety potential of V2X platform for light vehicles – by December 2013**
  - **Heavy trucks in 2014**

- **ITS World Congress in Detroit, September 14 – 18, 2014**
  - **Governor Rick Snyder chairs World Congress Board of Directors**
  - **Kirk Steudle (MDOT) and Mike Finney (MEDC) serve**
  - **Jim Barbaresso (HNTB) is chair**
  - **Program Chair is PS**
  - **Theme of connected, automated, electrified mobility**

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