Keeping Counties Moving: Innovations in Infrastructure, Goods Movement and Vehicle Technologies

National Association of Counties

June 21, 2017

Tips for viewing this webinar

- The questions box and buttons are on the right side of the webinar window.

- This box can collapse so that you can better view the presentation. To unhide the box, click the arrows on the top left corner of the panel.

- If you are having technical difficulties, please send us a message via the questions box on your right. Our organizer will reply to you privately and help resolve the issue.

Webinar recording and evaluation survey

- This webinar is being recorded and will be made available online to view later or review at www.naco.org/webinars.

- After the webinar, you will see a pop-up box containing a webinar evaluation survey. Thank you in advance for completing this survey – your feedback is very important to us!

Question & Answer instructions

- Type your question into the “Questions” box at any time during the presentation, and the moderator will read the question on your behalf during the Q&A session.

Keeping Counties Moving: Innovations in Infrastructure, Goods Movement and Vehicle Technologies

National Association of Counties
June 21, 2017

Connected and Autonomous Vehicles (CAV)

Connected vehicles (CV) are those that can communicate with other vehicles, infrastructure and devices.

Autonomous vehicles (AV), or driverless cars, are vehicles equipped with technology that enables them to operate without human assistance. There are six levels of automation.

Today's Speakers

Andy Alden
Executive Director
I-81 Corridor Coalition
Group Leader: EcoTransportation and Alternative Systems,
Virginia Tech Transportation Institute

Keeping Counties Moving

Innovations in Infrastructure, Goods Movement and Vehicle Technologies

Andy Alden

Executive Director: I-81 Corridor Coalition

Group Leader: EcoTransportation and Alternative Systems

Manufacturing and Marketing Changes

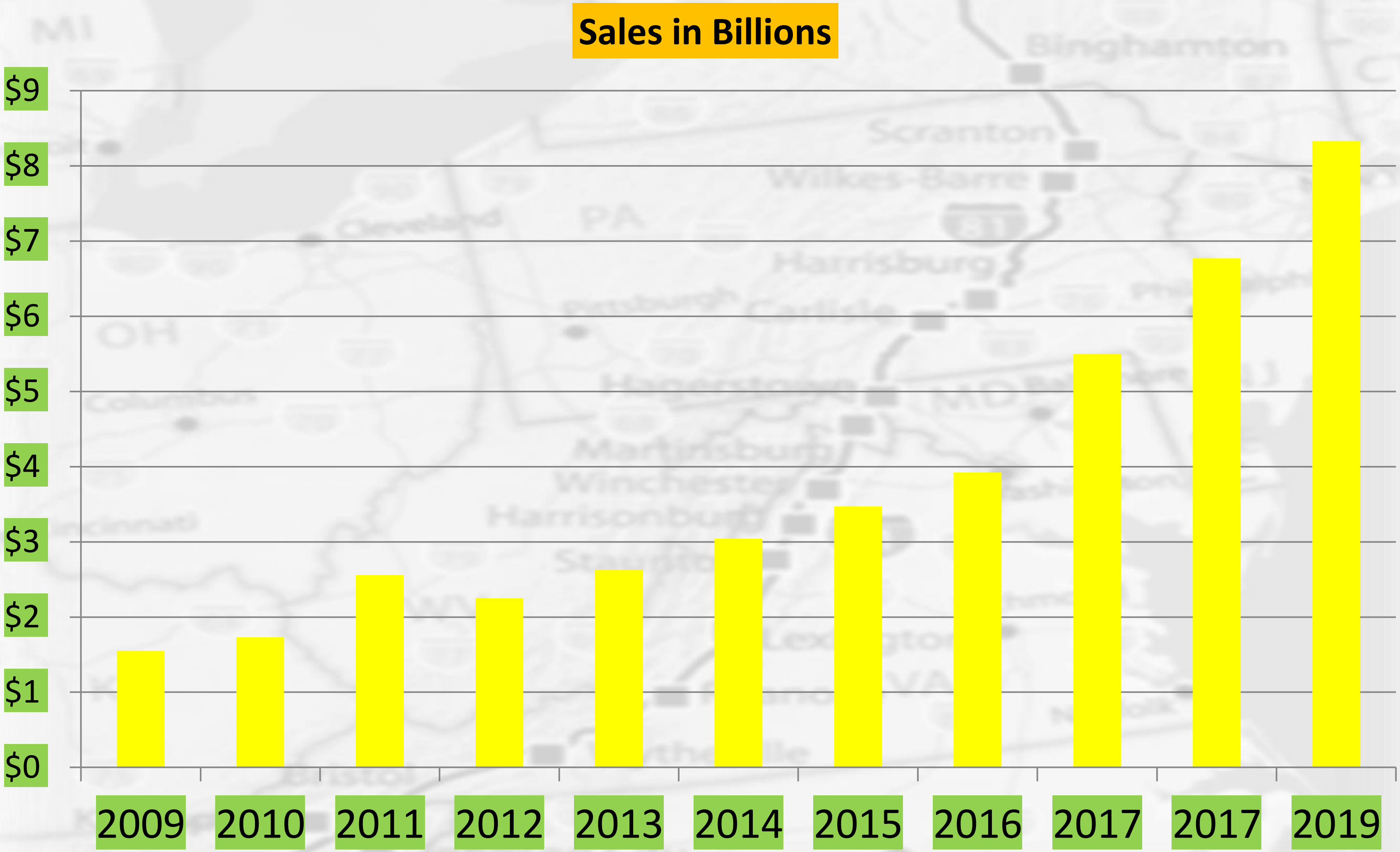
- Manufacturing
  - Origins – Global economy
  - Just-in-time
- How we buy things
  - E-Commerce
- Goods movement
  - Port-centric
  - More handling & transfers
  - Timeliness


From MaritimeConnector.com

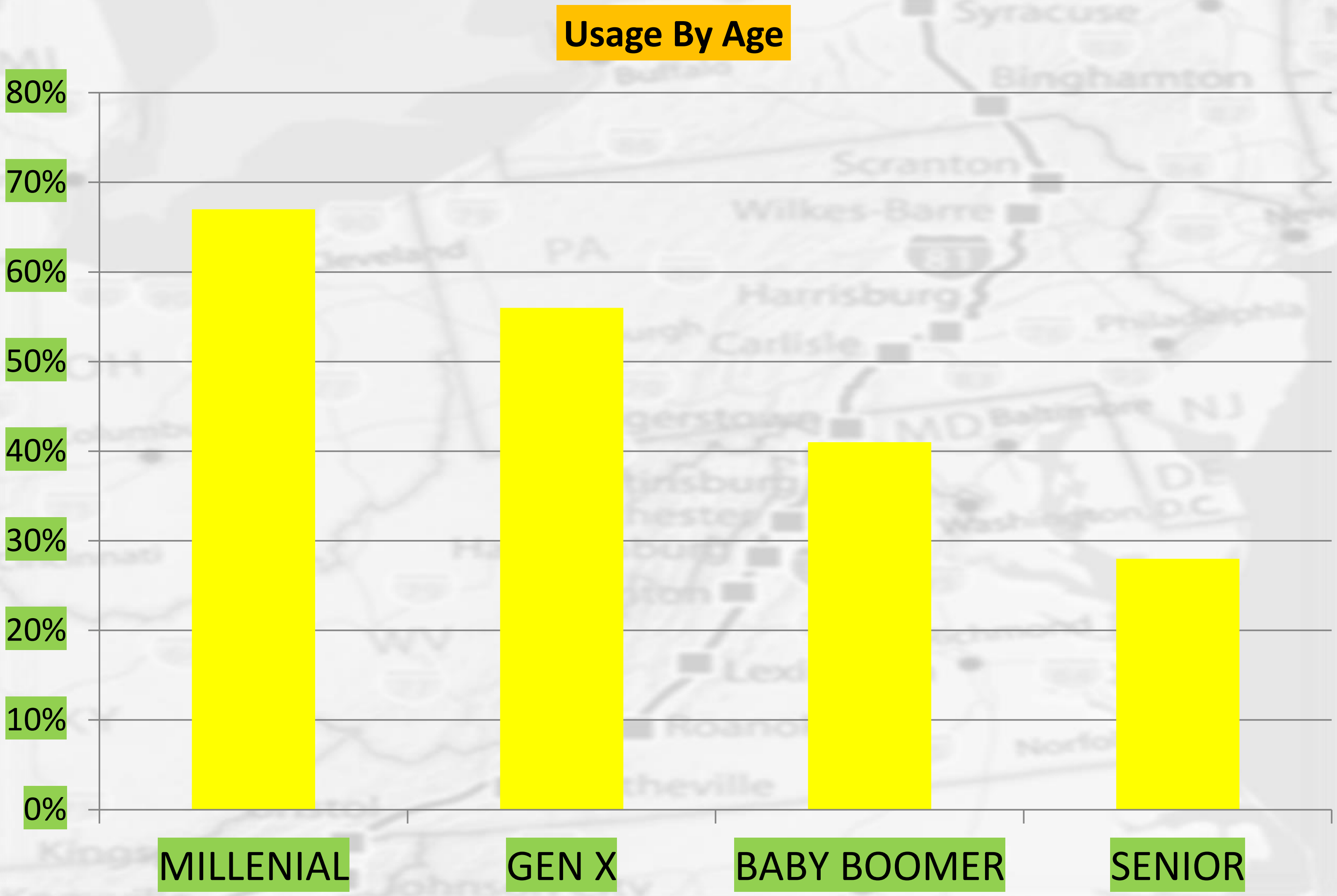
E-Commerce Trends

- 23% yearly e-Commerce growth
- 51% of Americans prefer to shop online
- 68% of millennials prefer online
- Parents spend 61% more online than non-parents
- Urban shoppers > suburban shoppers > rural shoppers
- 25% of online purchases made while in physical retail store

E-Commerce Sales Growth



E-Commerce Purchases by Generation



Freight by the Numbers

- USDOT projects that freight levels will increase 40% by 2045 (Added capacity alone is not the answer)
  - Truck tonnage will increase 44%
- Over 500,000 trucking companies in the US
  - 97% have fewer than 20 trucks
- 70% of all goods (by weight) in the US move by truck
  - 83% by value
  - 97% of all consumer goods
- Future modal shares are expected to shift more to truck
  - Over 80% of US communities are served only by truck
  - Shipments traveling >500 miles = only 13.4% of the truck freight.
  - If rail intermodal use doubled by 2020, market share will still be less that 2%
- Trucks transported 10.49 billion tons of freight representing 70.1% of total domestic tonnage shipped.
- Trucking represented $726.4 billion in gross freight revenues, representing 81.5% of the nation’s freight bill.

The I-81 Corridor

The Impacts of Change and Growth

The I-81 Corridor

- Six states
- Extends from I-40 in TN to the Canadian Border in NY
- Appalachian track
- Relatively rural
- Diverse weather
- Varying topography

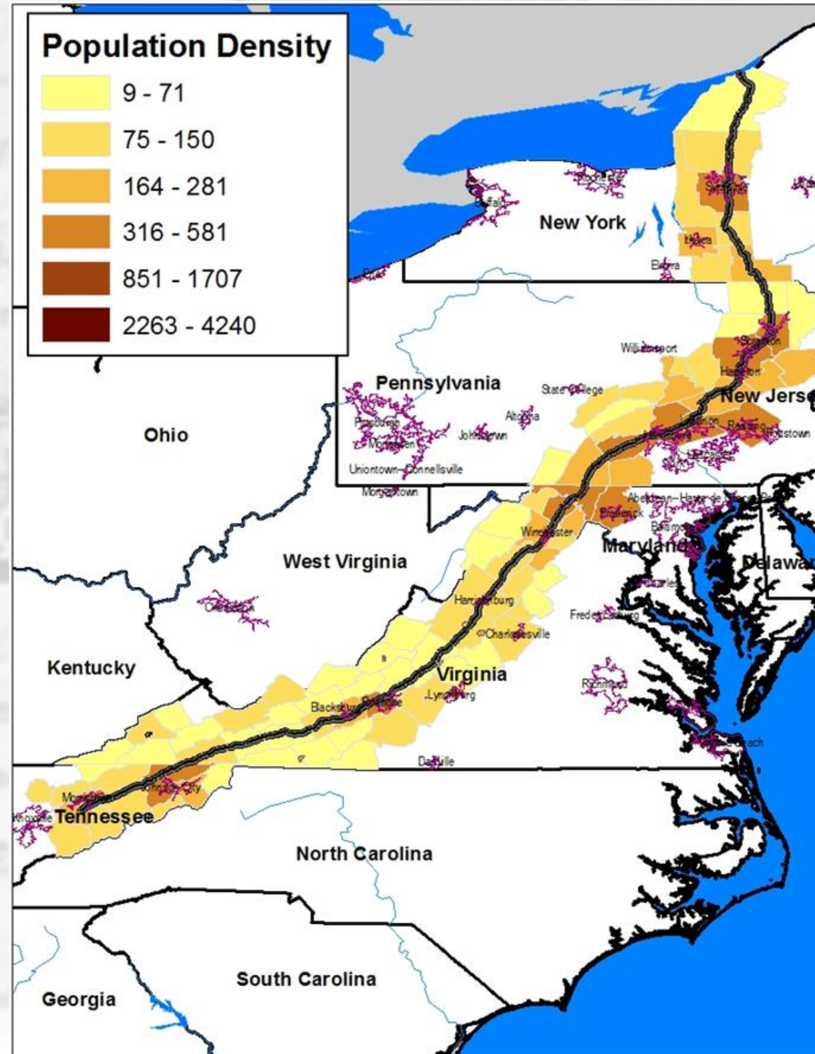
State	mile	km
TN	75.66	121.76
VA	324.92	522.91
WV	26.00	41.84
MD	12.08	19.44
PA	232.63	374.38
NY	183.60	295.48
Total	854.89	1,375.81

Notable Facts

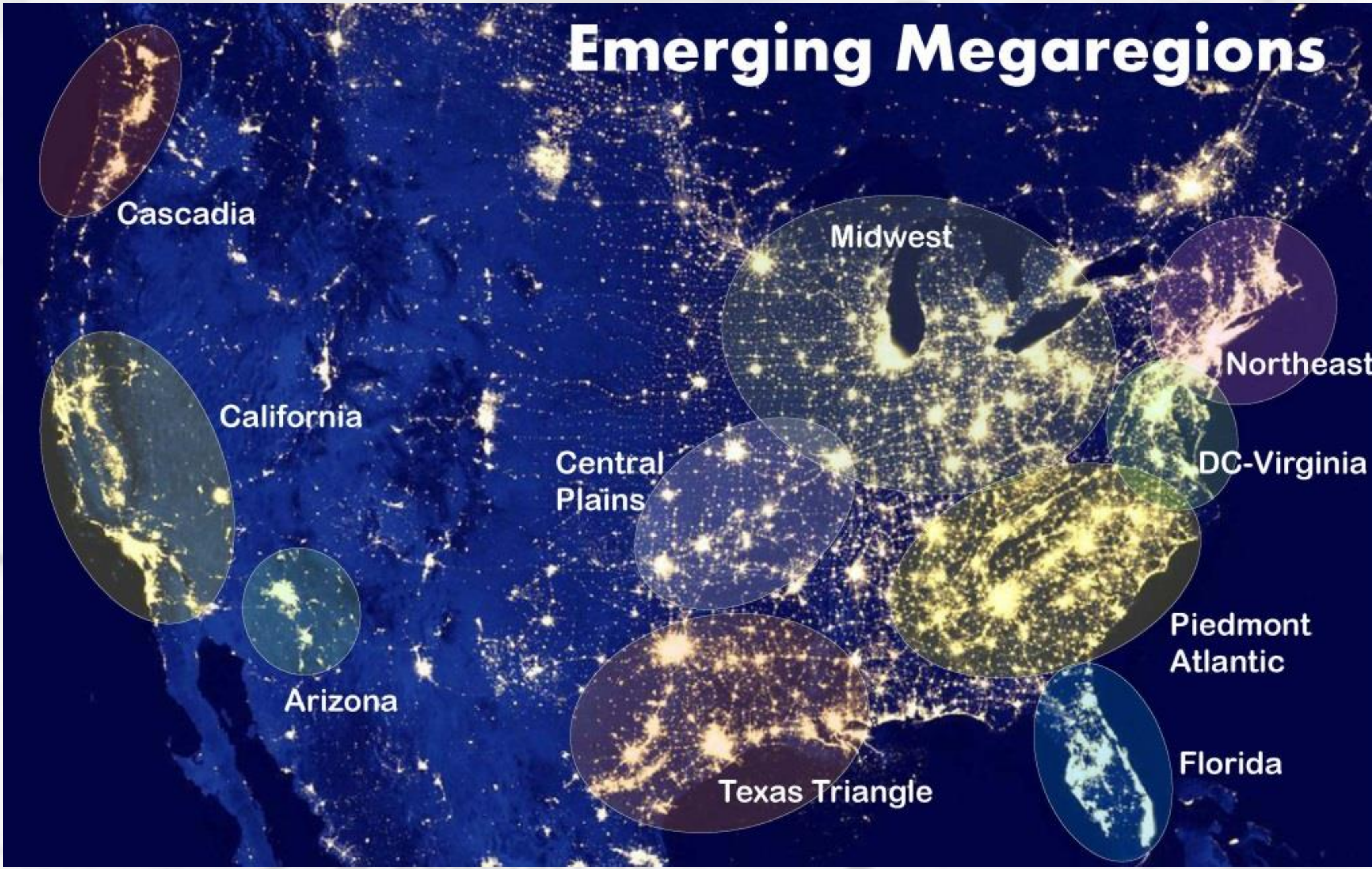
- Overall traffic has more than doubled in the last 20 years and tripled in urban areas
- Truck traffic growth in the corridor outpaces the national average
- Portions of I-81 in PA, WV, and VA are part of the National Primary Freight Network

The I-81 Corridor - Population

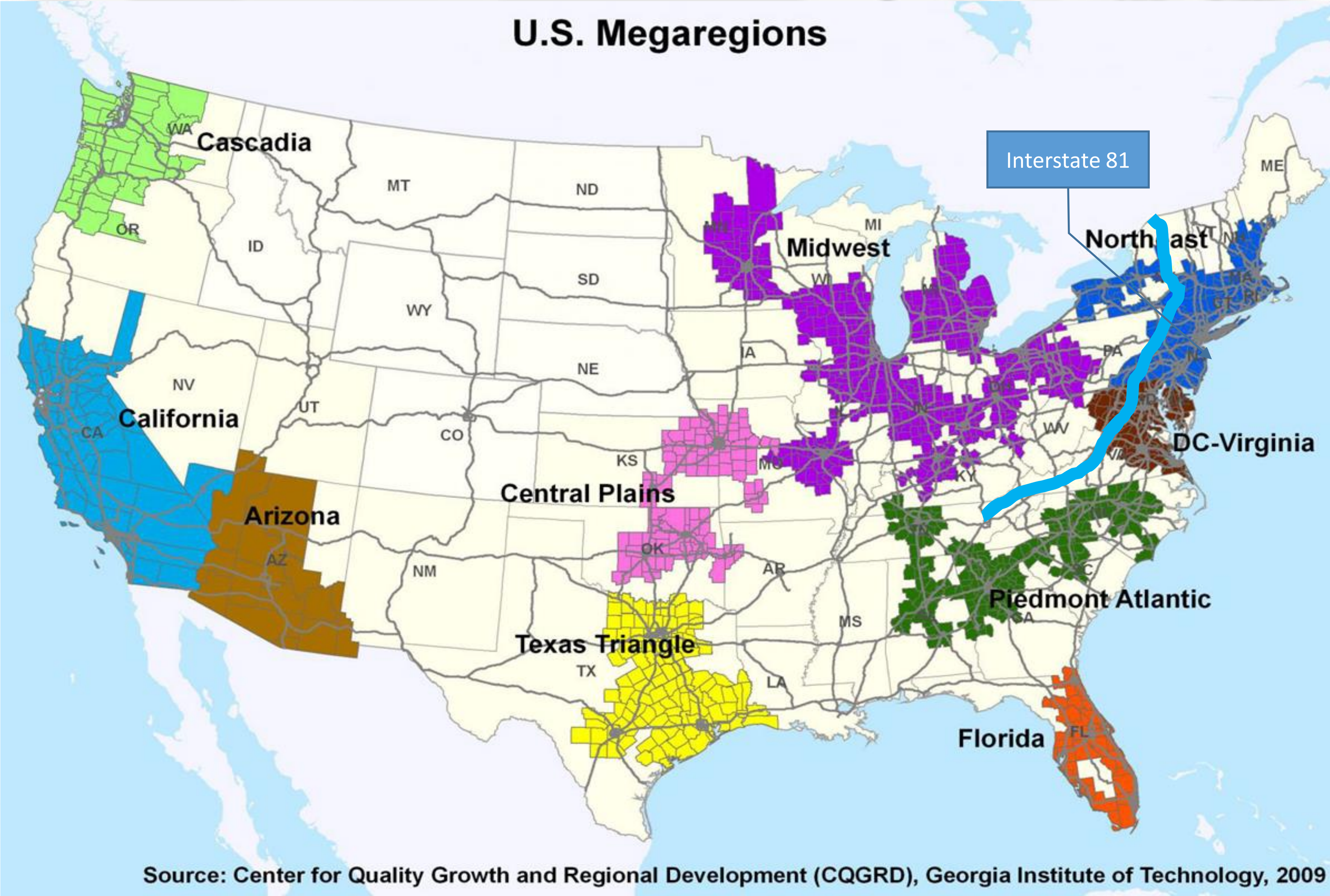
- Growing population
- FHWA Megaregion service
- 50% of Americans live within 500 miles



U.S. Population Distribution



Interstate-81 Services Key Regions

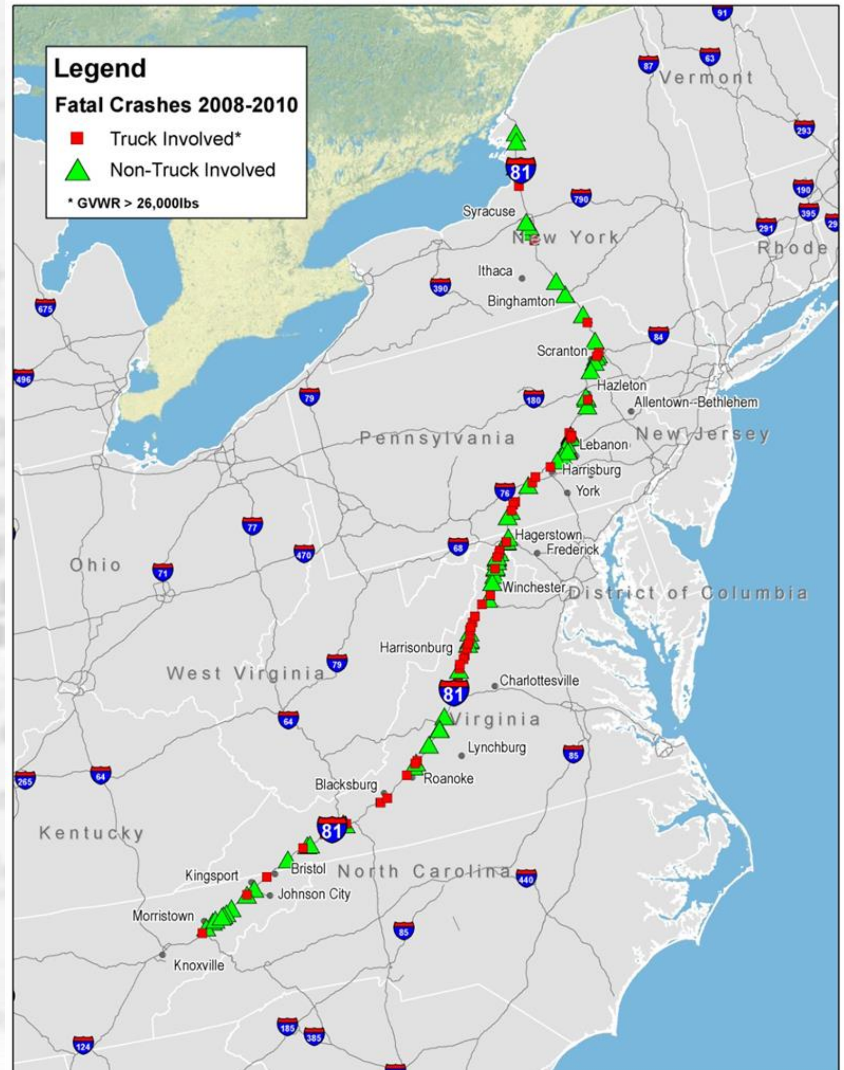


The I-81 Corridor - Freight

- Primary north-south freight corridor along the eastern part of the U.S.
- Trucks ~38% of volume
- Designed for 15% truck volume
- Freight traffic growth exceeds the national average
- Panamax traffic through eastern seaboard ports
- New, large manufacturing and distribution centers

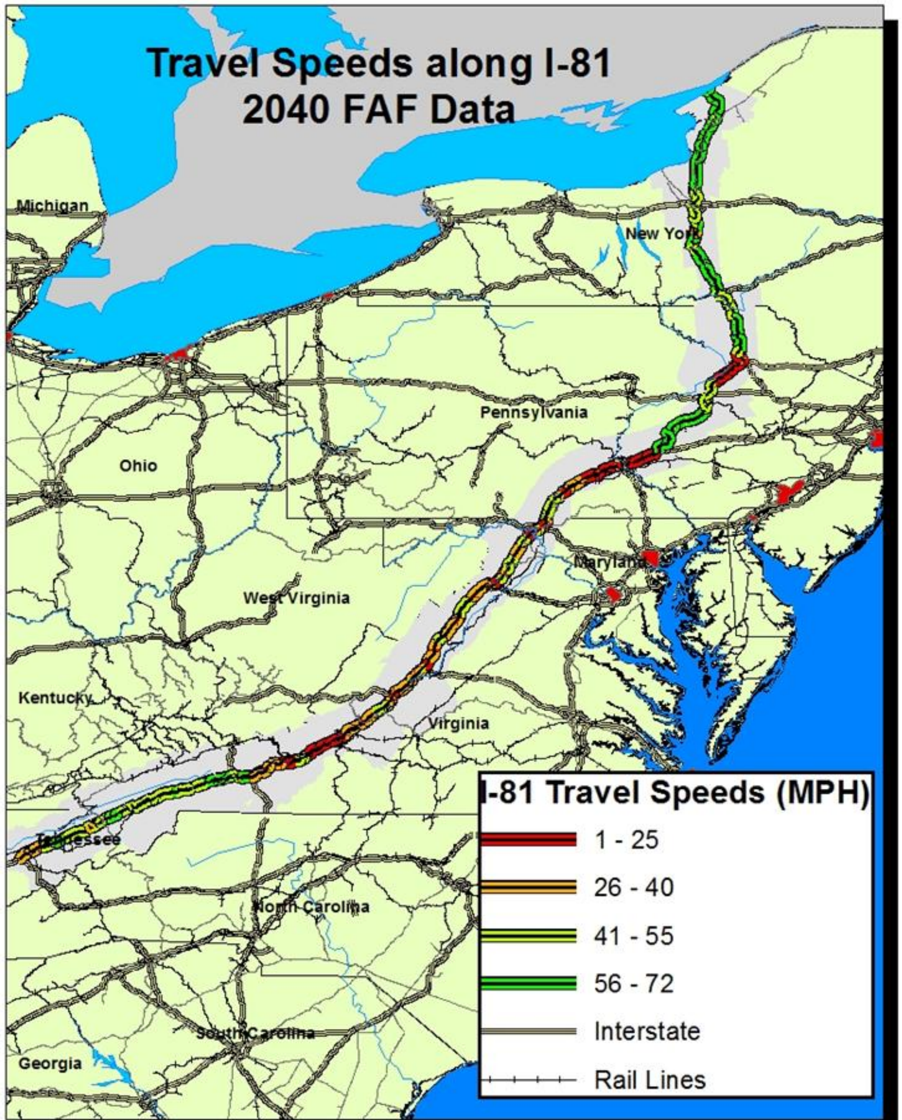
The I-81 Corridor - Safety

- Crash incident impacts on system reliability
  - Driver
    - Error
    - Distraction
    - Drowsiness
    - Drug impairment
  - Vehicle failure
  - Weather
  - Terrain
  - Mixed traffic flow
- ~35% fatal crashes involve trucks (not over-represented)



System Reliability – Congestion

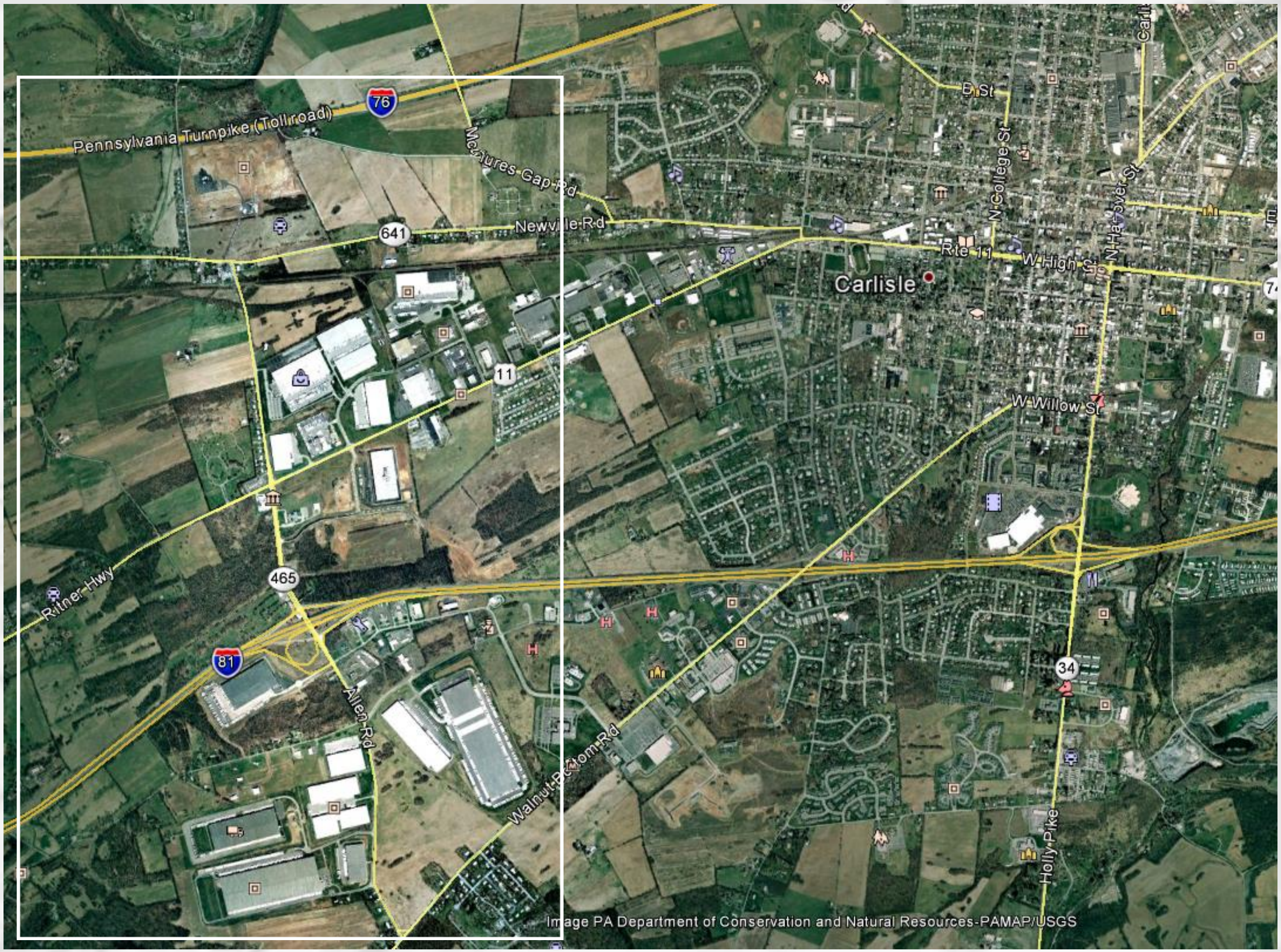
- Economic driver
- Quality of life
- Safety
- Air quality



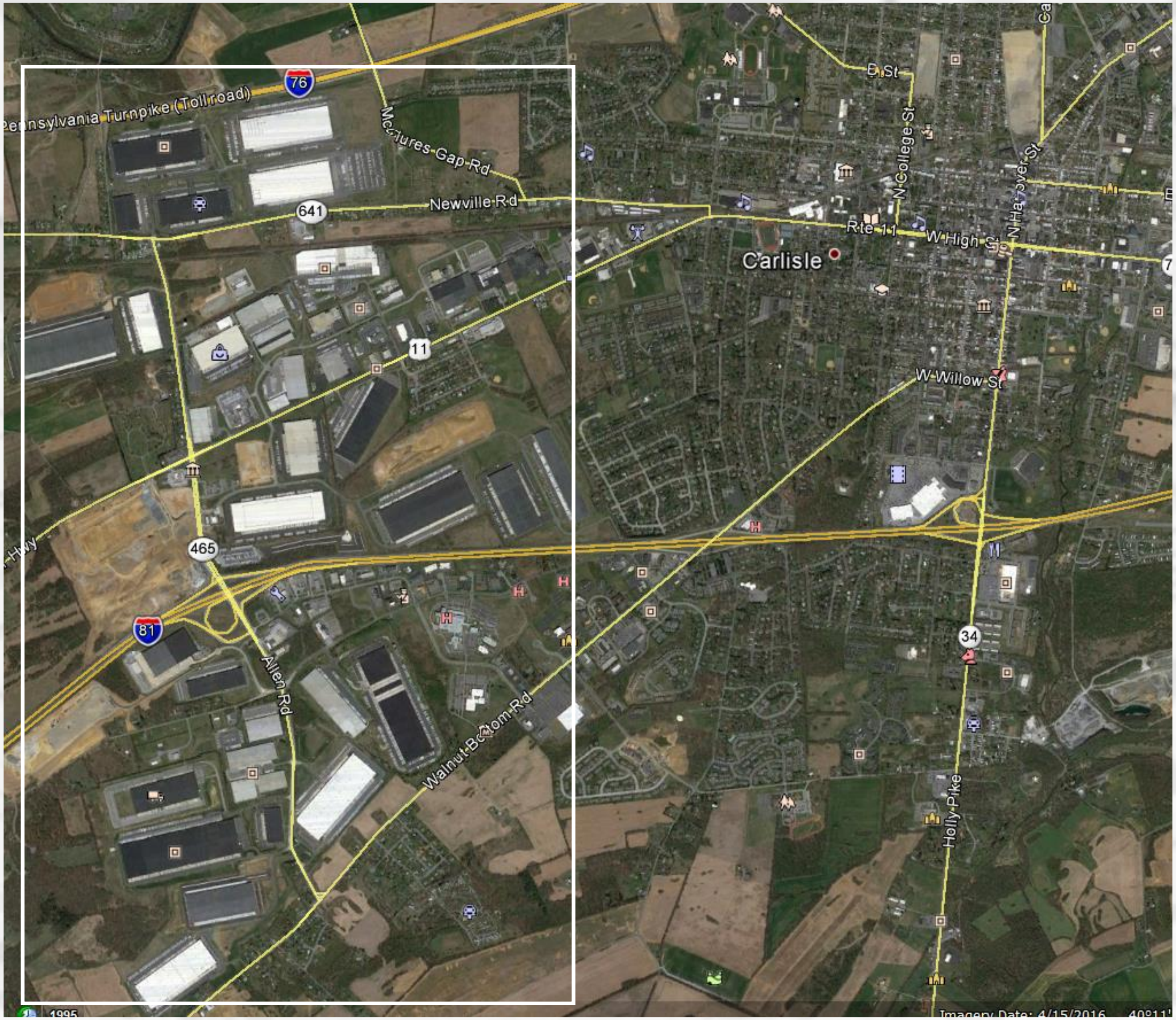
Truck Freight Distribution Center Growth

Carlisle, PA -1999

Carlisle, PA - 2003



Carlisle, PA - 2016



The I-81 Corridor Coalition

Coalition History

- Established in 2007
- Rick Rovegno (PA) recognized:
  - Increasing safety problems
  - Increased freight traffic
  - Lack of coordination across jurisdictional borders
- First based at Shippensburg University
- Moved to VA Tech under former VDOT Commissioner Ray Pethtel (retired)
- Alden named Executive Director, July 2016

Coalition Composition

State
- Transportation Agencies
- Police

Regional/Local
- MPOs
- Planning Districts
- Counties
- Municipalities
- Fire & Rescue

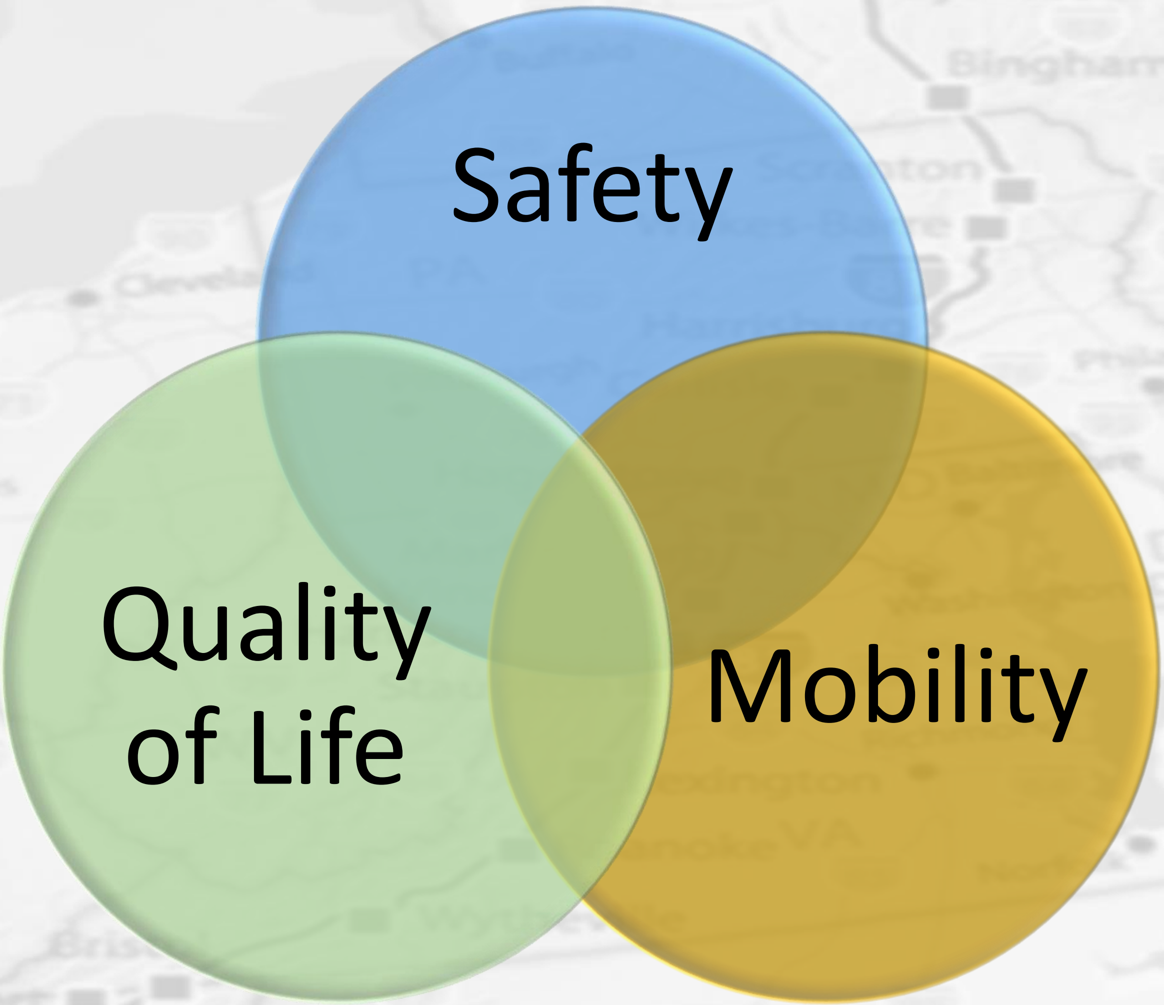
Federal
- DOT (FHWA)

Corporate/Industry
- Railways
- Manufacturers
- Shipping & Logistics

Other
- Economic Development
- Higher Education
- Interest Groups
- Individuals

Coalition Focus

Overarching Issues



Safety

- Drowsy driving
  - Truck parking inadequate
  - New electronic onboard hours-of-service regulations
- Mixed traffic and high truck numbers create safety issues
- Better coordination of response activities by public safety groups and interoperable communications is/are required both within and across states.
- Weather events and -related communications can be improved with unified messaging across affected states.
- Event response coordination and standardization across regions/states is needed.
- Multi-jurisdictional hazmat response development.

Travel Mobility and Continuity

- Regulation standardization
  - Automated vehicles
  - Truck weight exemption for auxiliary power units
- Congestion, bottlenecks (changing no. of lanes)
- Standardized messaging (fixed and dynamic)
- Expedited incident response and clearing
- Work zone safety may be enhanced with improved traveler alerting and interstate standardization of operations (e.g. zipper merge)

Ray Engel, NYS Thruway

Quality of Life

- Air quality
- Sound and local truck traffic nuisances
- Employment and economic stability/growth
  - High tech businesses are attracted to high tech areas with good transportation infrastructure, green energy, communications, educated workforces, progressive policies.
  - Businesses moving goods and services along the corridor require predictable travel times. Congestion and incident-related delays have associated hits on bottom lines.

Incidents

Cumberland Co. officials, PennDOT mulling costs of proposed I-81 barriers

by CBS 21 Web Staff | Tuesday, April 26th 2016

The Cumberlar

Fiery wreck hurts two after lumber truck blows tire on I-81 North in Montgomery County

Three injured in I-81 crossover crash near Carlisle Sunday

Joshua Vaughn The Sentinel Mar 27, 2017 3

Tractor-trailer crash shuts down all lanes of I-81 near Chambersburg

Nov 24, 2016

Truck Crash Causation

- Driver drowsiness
- Driver distraction
- Equipment failure
- Light vehicle drivers
- Curve rollovers
- Shifting loads

The Costs of Crashes

"When employees cannot get to work our lines do not run!!! – Cost Impact $700/min or $42,000 per hour"

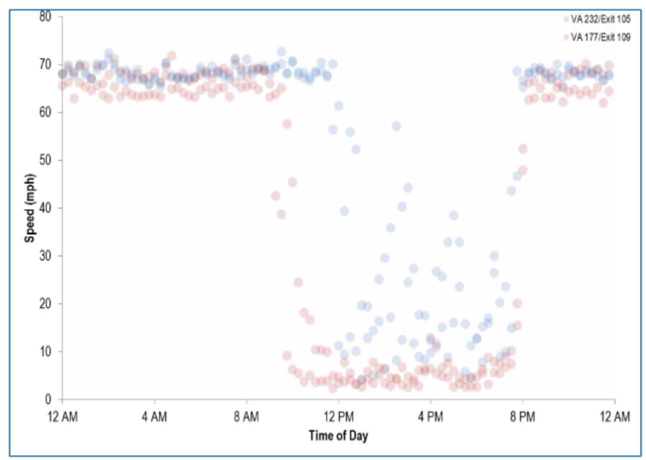
"When our components do not make it to vehicle assembly plants!!! – Cost Impact $1,500/min or $90,000 per hour"

Impact of Incidents

INTERSTATE 81

I-81 Example Crash

- Incident involving tractor-trailer
- Duration: 12 hours
- Est. queue length: 8 miles
- Vehicle hours of delay: 16,355
- Est. delay cost: $612,000



VDOT

Source: Center for A[redacted]nology- Regional Integrated Transportation Infor[redacted]

5

Principal Focus Areas

System Reliability

Crash Incidents

Technology Application

Prevention

Management

Future Corridor

A Focus on Road Freight > Trucks

Incident Prevention

With a focus on trucks

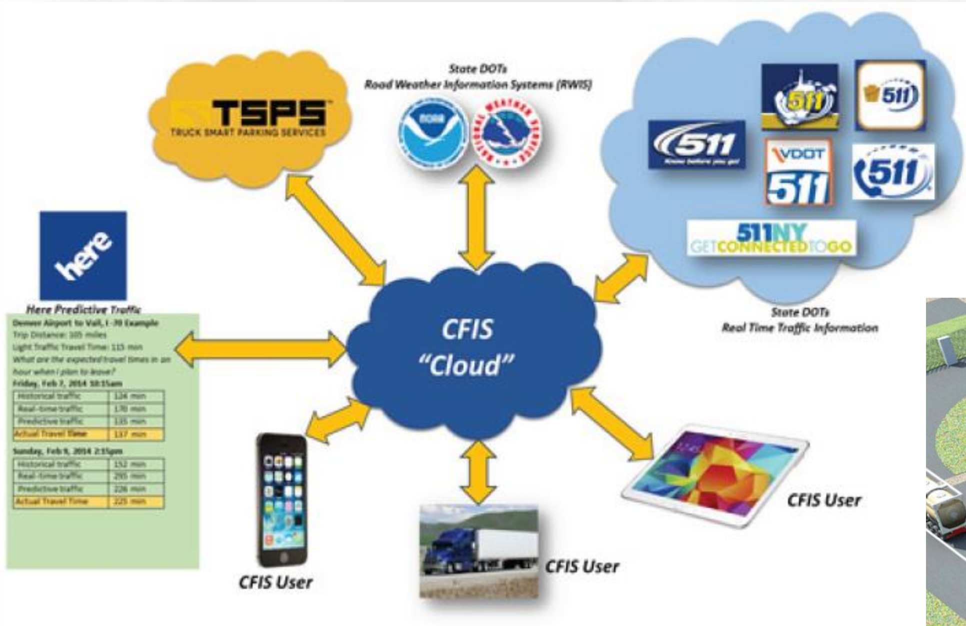
- Distraction
- Drowsiness
- Equipment safety
- Providing better traveler information

TRUCK PARKING SHORTAGE

- Virginia Truck Parking Study (2015)
- Virginia has 7,454 truck parking spaces (public & private
- Based on the estimated demand, there are shortages of:
  - 5,000 truck parking spaces statewide
  - 842 truck parking spaces along I-81
  - Includes 692 space shortage from TN line to I-64

Initiatives – Freight Advanced Traveler Information Systems with Parking (FRATIS-P)

FAST Act Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD)



Collaboration with Schneider on HOS data

Photo from: Horn Logistics

Incident Management

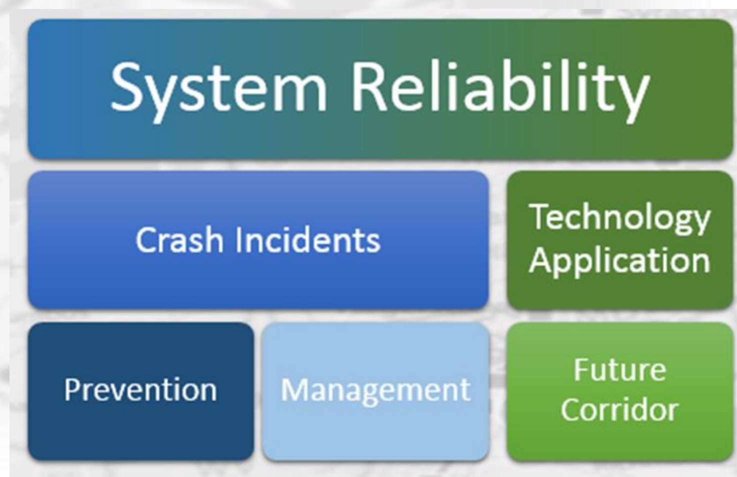
- Better laws
- Better policies
- Enabling contractors
- Heavy duty towing and recovery readiness programs
- Better methods
- Training
- Remove barriers
- Crossover improvements

Incident Management Tabletop Exercises

- Incident scenarios played out
- Multi-agency
- Multi-jurisdiction
- Multi-state
- Identification of issues
  - Communication
  - Response activities
  - Jurisdiction
  - Trans-boundary

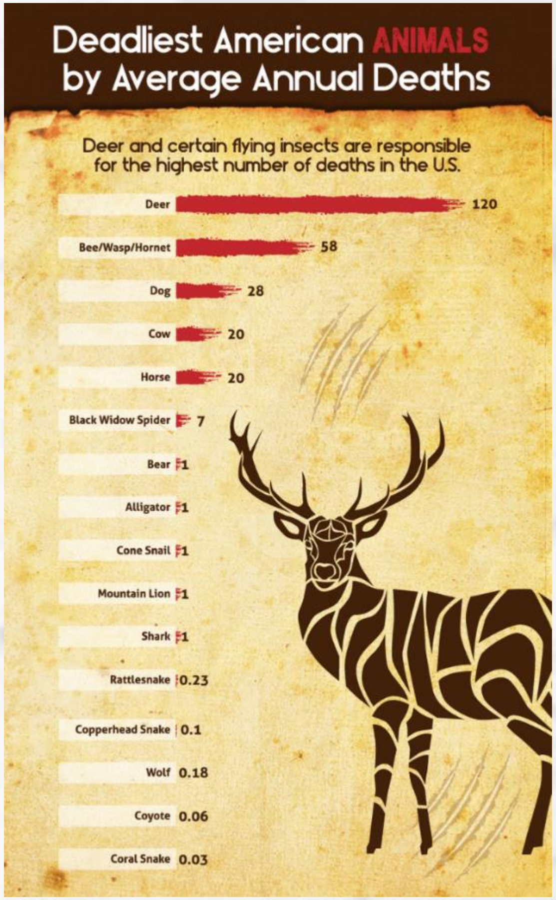
Future Corridor

- Partner with corridor state agencies and others
- Apply for federal designation
- More efficient, safe, and cost-effective transportation
  - Corridor-wide roadside and vehicle communications (Connected Vehicle)
  - Enabling automated/autonomous vehicles with policy and supporting infrastructure (e.g., truck following distance)
  - Use of unmanned aerial systems (UAVs) for support of surface transportation
  - Freight information systems with reserved parking and distributed supporting infrastructure
  - Rail
    - Truck intermodal transfer
    - Passenger service
  - Progressive policy models for highway funding, use incentives, etc.



Future Technology Applications

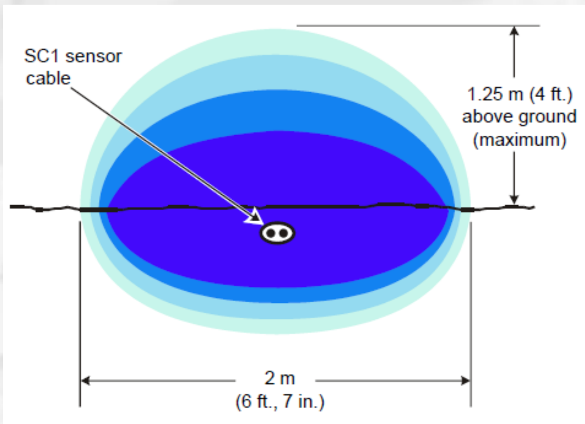
Animal-Vehicle Conflict Prevention - Motivations

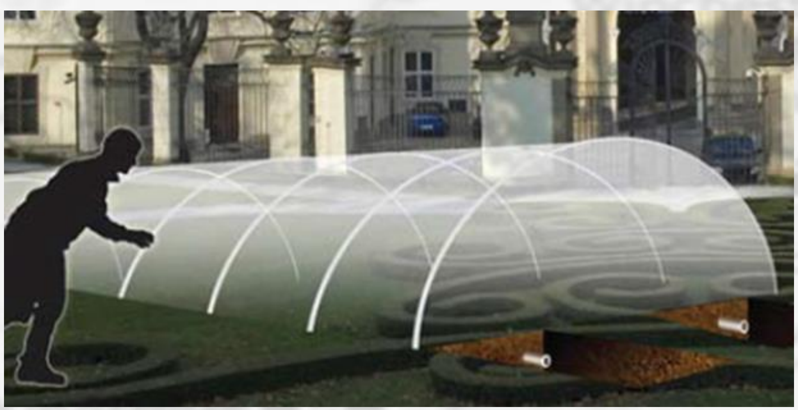


- One million crashes yearly and increasing
- $4 billion direct damage
- ~150 human deaths and increasing
- Ancillary costs
  - Incident management
  - Carcass management/disposal,
  - Disruption
- Ecological impact
- Driver trauma
- Conflict versus collision?

Roadside Animal Detection

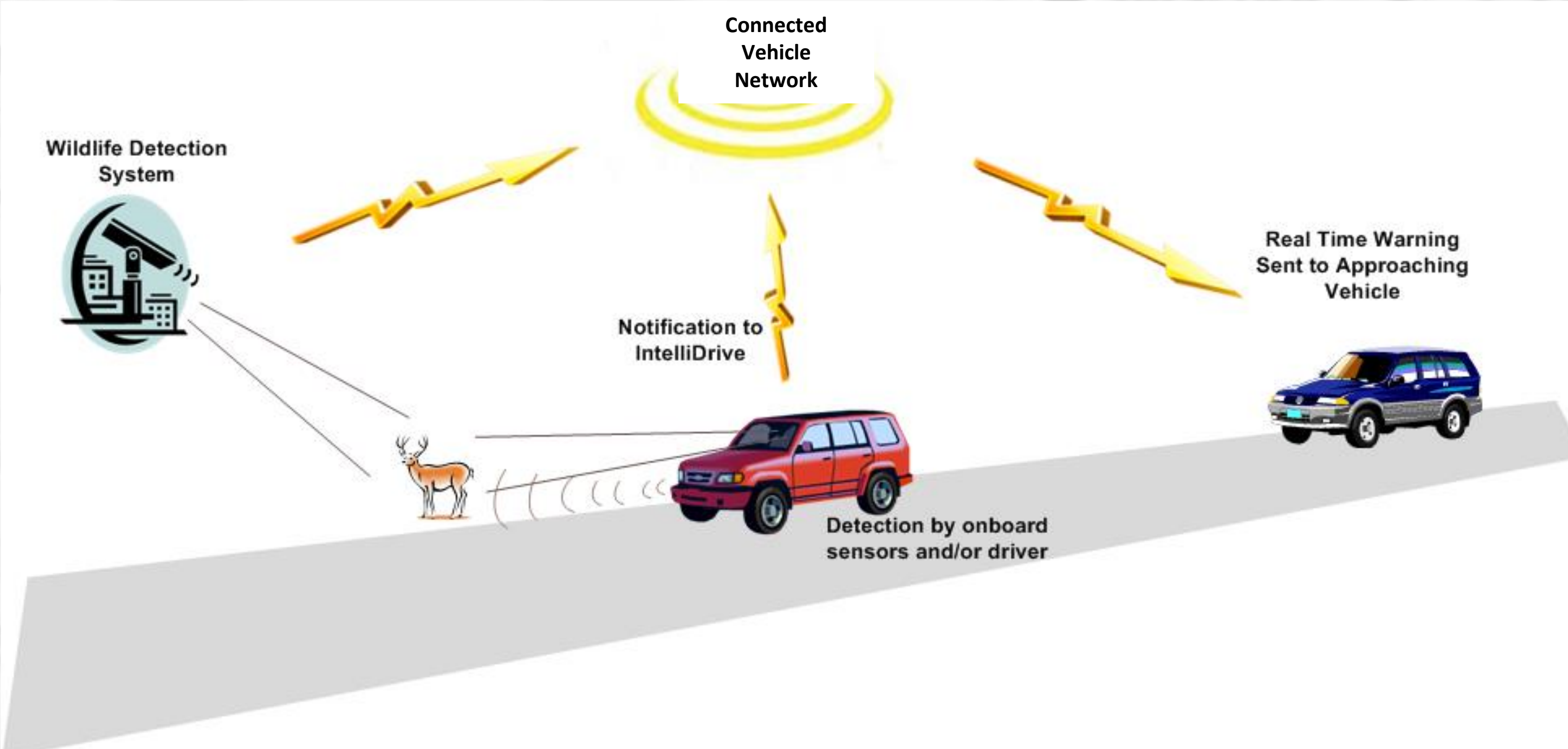
Buried Cable Detection System





- Buried cable senses the presence of animals
- 2nd system currently being installed and being tested on public road

CV Animal-Vehicle Conflict Prevention



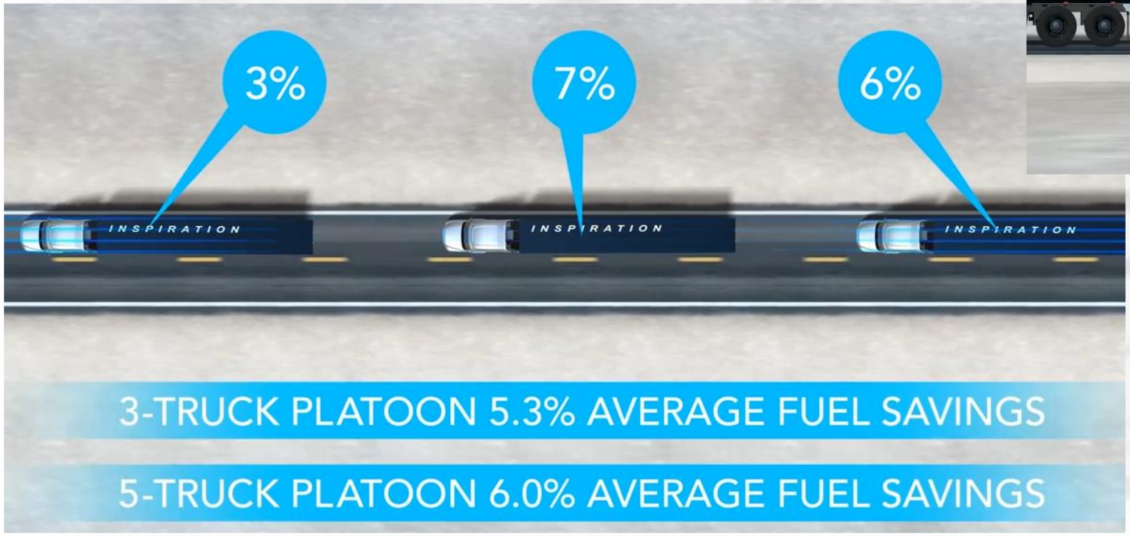
Wildlife detection performed through some combination of:

- Vehicle sensors
- Roadside sensors
- Driver notification

Truck Platooning

- Communication between trucks required
- Sub-standard headway
- Slope and speed limiter effects – vehicle matching
- Safety impacts
- Fuel economy enhancement

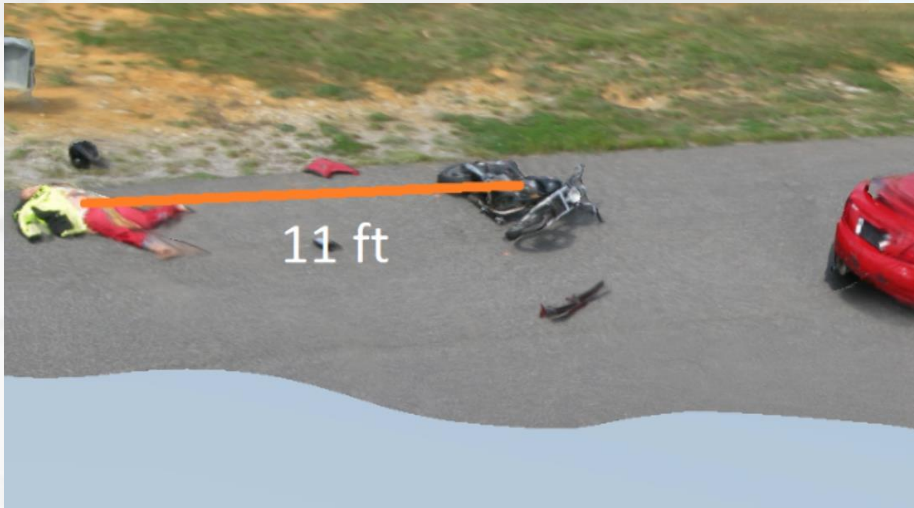
Images from Freightliner

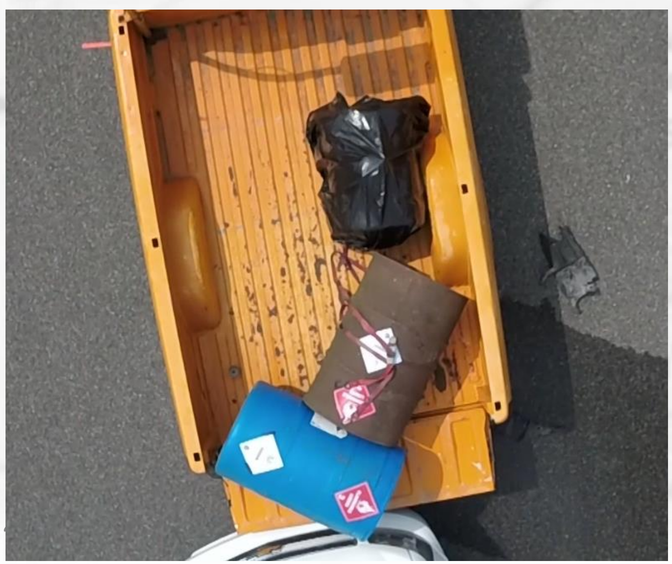


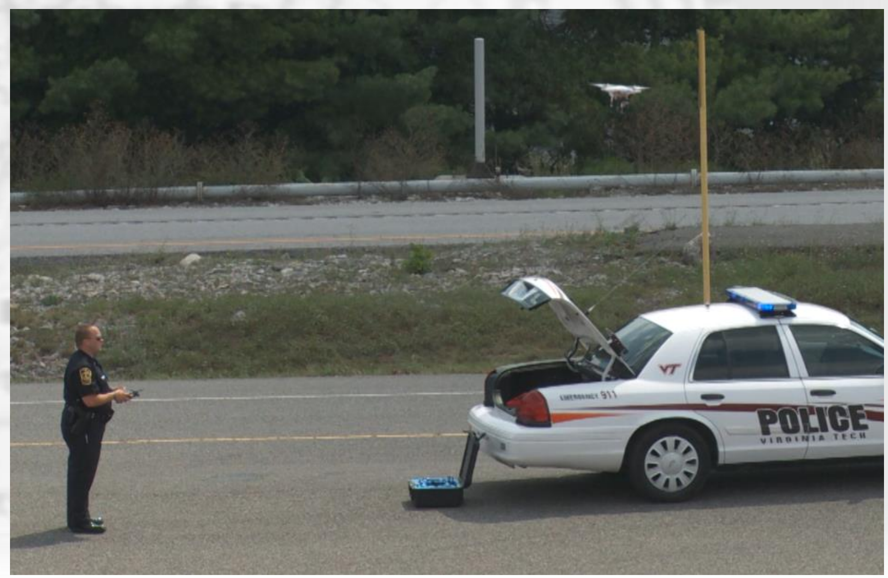
UAV Parcel Delivery

Images from UPS

UAV for Incident Response







UAV Ambulance

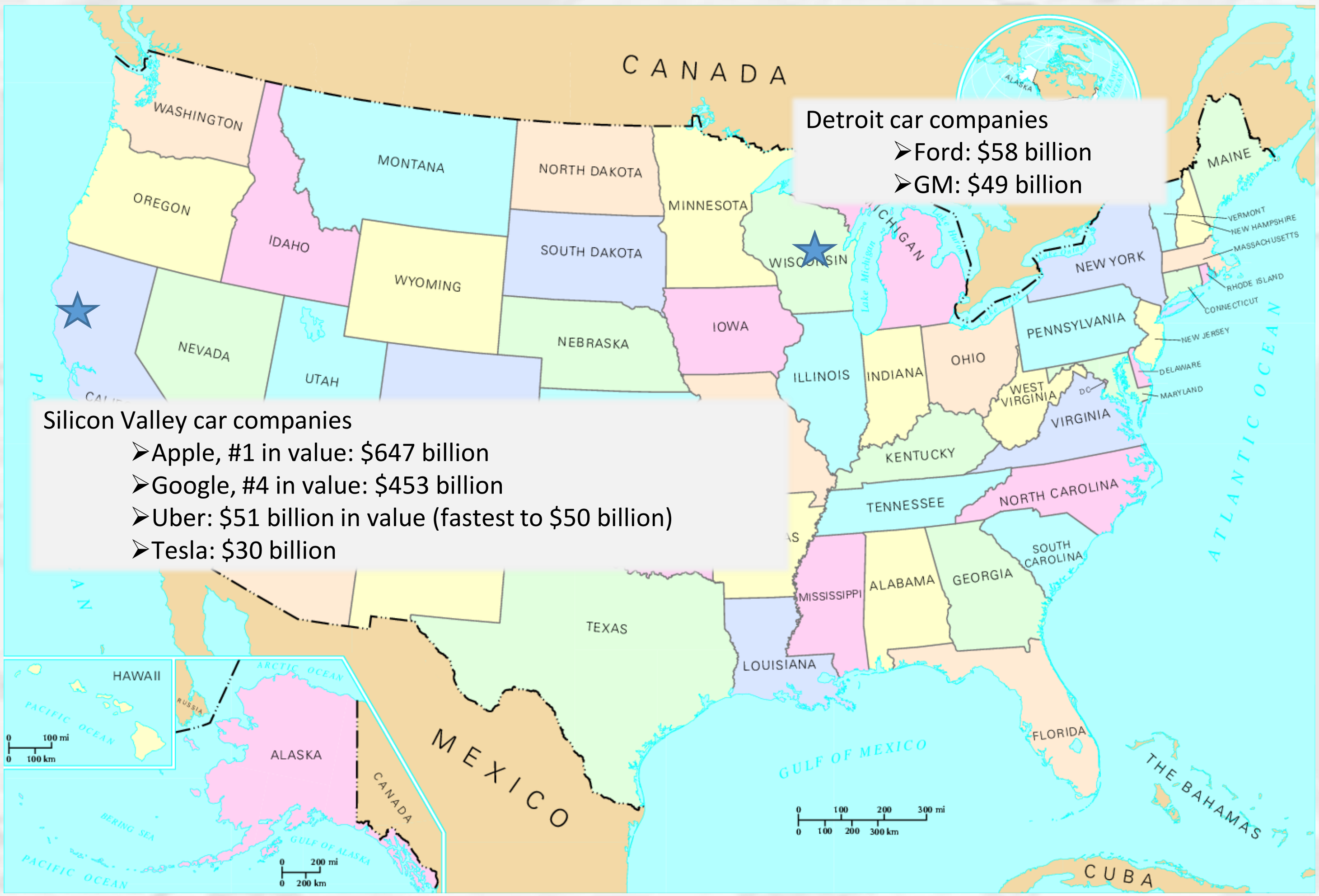
- Automatic External defibrillator
- Poison antivenin

Images from Alec Momont

Research

Ensuring the Safety of Connected and Automated Vehicles

A Shift in Automotive Systems



Detroit car companies

- ➢Ford: $58 billion
- ➢GM: $49 billion

Silicon Valley car companies

- ➢Apple, #1 in value: $647 billion
- ➢Google, #4 in value: $453 billion
- ➢Uber: $51 billion in value (fastest to $50 billion)
- ➢Tesla: $30 billion

Level of Automation

	SAE Level	Name	Steering, acceleration, deceleration	Monitoring driving environment	Fallback performance of dynamic driving task	System capability (driving modes)
Human monitors environment	0	**No automation** the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems	👤	👤	👤	
Human monitors environment	1	**Driver assistance** the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task.	👤	👤	👤	Some driving modes
Human monitors environment	2	**Partial automation** the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task	👤 🚗	👤	👤	Some driving modes
Car monitors environment	3	**Conditional automation** the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene	🚗	🚗	👤	Some driving modes
Car monitors environment	4	**High automation** the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene	🚗	🚗	🚗	Some driving modes
Car monitors environment	5	**Full automation** the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver	🚗	🚗	🚗	All driving modes

Source: Adapted from SAE Standard J3016 (SAE, 2014).

Why Automation? – Safety

Humans can be great drivers

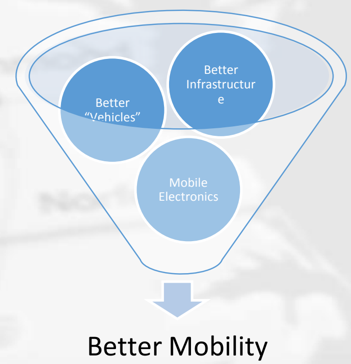
- An alert, attentive, sober driver is very good at avoiding crashes
  - Farber & Paley (1993) modeled driving behavior and found that an average U.S. driver will make approximately 3 million successful braking maneuvers with one failure during 25 years of driving
- Drivers cannot be relied upon to monitor and react under automated driving like they can in manual driving
- Previous VTTI studies have shown that drivers take their eyes off of the road for as much as 30 seconds in even partially automated driving

Machines don't get:

- Distracted
- Fatigued
- Drowsy
- Drug impaired
- Mad

Why Automation - Enhanced Mobility

- Population increasing
- Move to more urban areas
- Less “car”-centricity – a device rather than a statement
  - Shared ownership
  - Shared use
- Shift from cars to alternative modes
- Option diversity, dependability, and interconnection across modes
  - Rail and bus transit
  - Cars
  - Bicycles
  - Walking
- Enhanced mobility for vulnerable road users
  - Average population age increasing
  - Last Mile solutions



Why Automation? – Sustainability

- Congestion reduction - maybe
- Enabling EVs through self charging
- Parking automation
- Enabling
  - Multi-modalism
  - Public transit
  - Ride sharing
  - Shared ownership/use

ORNL surges forward with 20-kilowatt wireless charging for vehicles

Why Connectivity?

Real time awareness

- Wrong Way
- Environment
  - E.g. fog
- Temporal hazards (e.g.)
  - Work zones
  - Stalled cars
  - Icy roads
  - Obscured hazards

The Challenge of Acceptance

- Automated vehicles must be able to operate at a very high level to be acceptable and safe
- In addition to understanding the world around them, they must also understand the state of the driver
- Adequate time for the driver (e.g., more than 10 seconds) to assume control of the vehicle during system 'failure'
- To reiterate, these systems must be extremely reliable and robust to handle any roadway, traffic, or driver scenario

Research Testbeds

- Smart Road
- Automation Park
- Rural Testbed expansion
- Live Roadway Connector

Presentation End – Questions? Comments?

Andy Alden, M.S., P.E.

www.vtti.vt.edu/research/etat/

aalden@vtti.vt.edu

Virginia Tech Transportation Institute

Transportation Research Drive

Blacksburg, VA 24061

540-231-1526

www.i-81coalition.org

I-81CC@vtti.vt.edu

Virginia Tech Transportation Institute

Transportation Research Drive

Blacksburg, VA 24061

540-231-3589

Today's Speakers

Gary Piotrowicz, PE, PTOE
Deputy Managing Director/County Highway Engineer
Road Commission for Oakland County

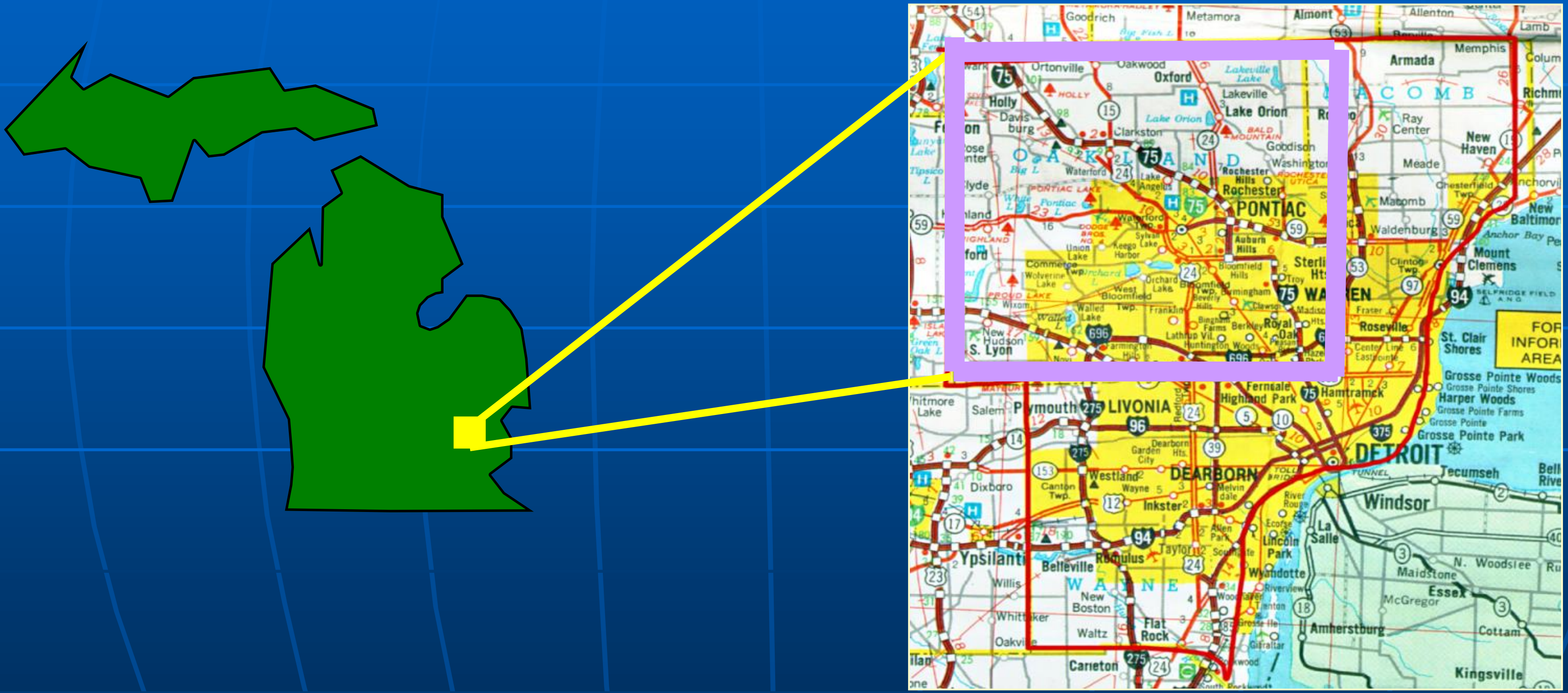
NATIONAL ASSOCIATION of COUNTIES NACo

ROAD COMMISSION for OAKLAND COUNTY

Partnerships to Implement Connected Vehicle Safety Initiatives

Presented by:
Gary Piotrowicz, PE, PTOE
Deputy Managing Director,
County Highway Engineer

Oakland County
Geographic Perspective



Oakland County

- over 900 square miles
- over 1.2 million people

- Among the wealthiest US counties
- Ranging from urban to rural
- Maintain over 2700 miles of road

RCOC's Compelling Need

- To accommodate large population and economic growth
- To offset billions in unmet road improvement requirements
- To mitigate accidents

ROAD COMMISSION for OAKLAND COUNTY

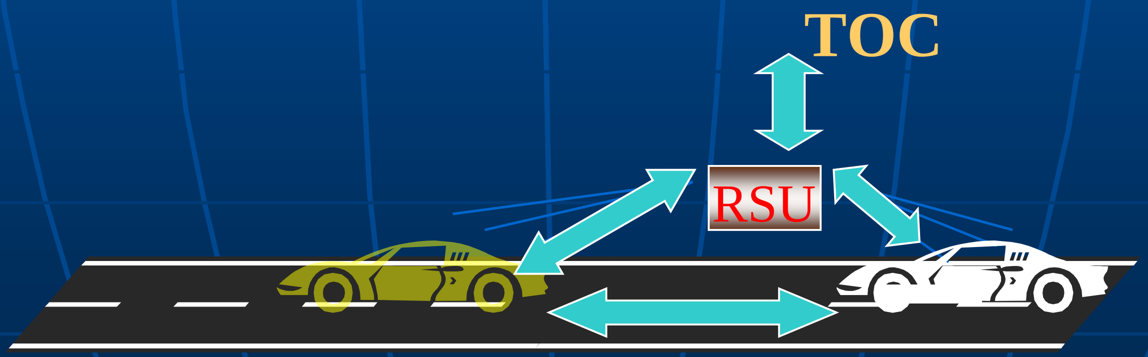
FAST-TRAC

Faster And Safer Travel - Through Traffic Routing & Advanced Controls

Connected Vehicles

- Create an “Enabling Communication Infrastructure” to support Vehicle-to-Vehicle and Vehicle-to-Infrastructure Communications… the “*Wireless Superhighway*”

- Goal is to enable a number of new applications that provide significant safety and mobility benefits



Connected Vehicles: A Paradigm Shift for Roadway Safety

- Move from passive safety to active safety
- Traditional roadway engineering and vehicle design was starting to see diminishing returns relative to safety
- The next big step, in terms of lives saved will come from crash avoidance

↓

CONNECTED VEHICLES

Could Connected Vehicles Have Avoided This??

RCOC and Connected Vehicles: An Ideal Relationship

- Home to the “Big Three” automakers and hundreds of major auto suppliers
- History of ITS leadership
- History of Safety leadership
- ITS field installation experience

RCOC wanted to be on the leading edge of this technology and shape its future……but how to get involved with minimal financial commitment????

Connected Vehicle Partnerships

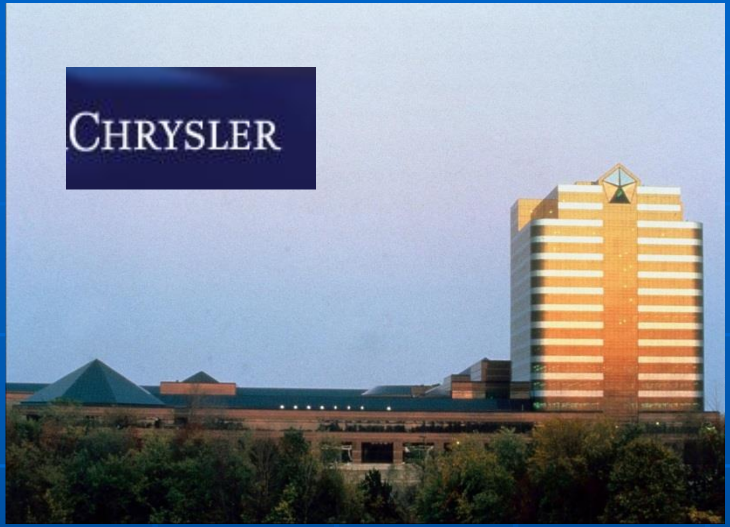
- RCOC would need to leverage relationships to develop new Connected Vehicle partnerships
  - Michigan DOT
  - USDOT
  - Auto Companies
  - Tier I Auto Suppliers
  - Other Private Companies
  - Other Countries

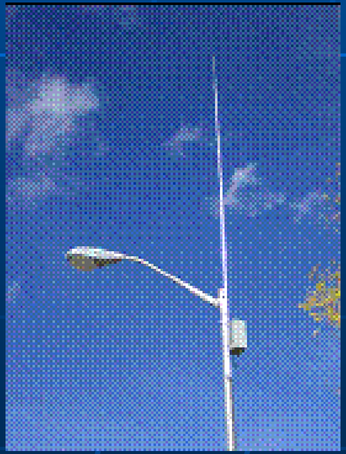
ROAD COMMISSION for OAKLAND COUNTY

Connected Vehicle Installations in Oakland County

Chrysler HQ Installation

- Installation of wireless network on traffic signals around Chrysler HQ
- Joint project between RCOC, MDOT, and Chrysler
- Chrysler instrumented "fast-feedback" cars to communicate across the wireless network
- Intent: Retrieve real-time probe and diagnostic data from vehicles





Ford/Lincoln

- Motorola wireless radio link to test Wi-Fi
- Link to run Wi-Fi Internet access point
- Software in Lincoln used to transfer data to Ford research labs

Motorola DSRC Test

- Motorola's first large-scale field test of DSRC communications
- Chose RCOC based on our knowledge and experience
- Learned about range, reliability, band width and installation issues
- Tested vehicle-to-vehicle and vehicle-to-infrastructure communications

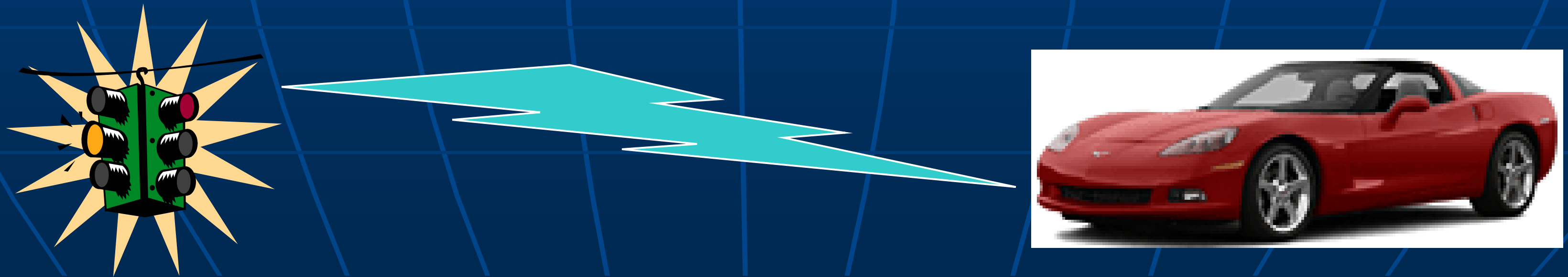
Cooperative Intersection Collision Avoidance System (CICAS)

- Partnership with CAMP (Automakers conducting pre-competitive research)

- Goal: Implement field trials to demonstrate improved intersection safety by alerting vehicles about to run a stop sign or traffic signal

- Three Oakland County test intersections

- Other field trials were in Virginia and California



Data Use Analysis and Processing (DUAP)

- Ongoing effort led by MDOT with stakeholders from all over U.S. & Europe
- Evaluate the use of Connected-Vehicle data for public-sector purposes:
  - Responding to safety concerns
  - Managing traffic
  - Managing transportation assets
- Goal: Answer the question “How can public agencies use Connected-Vehicle data?”

National Connected-Vehicle Proof of Concept (POC)

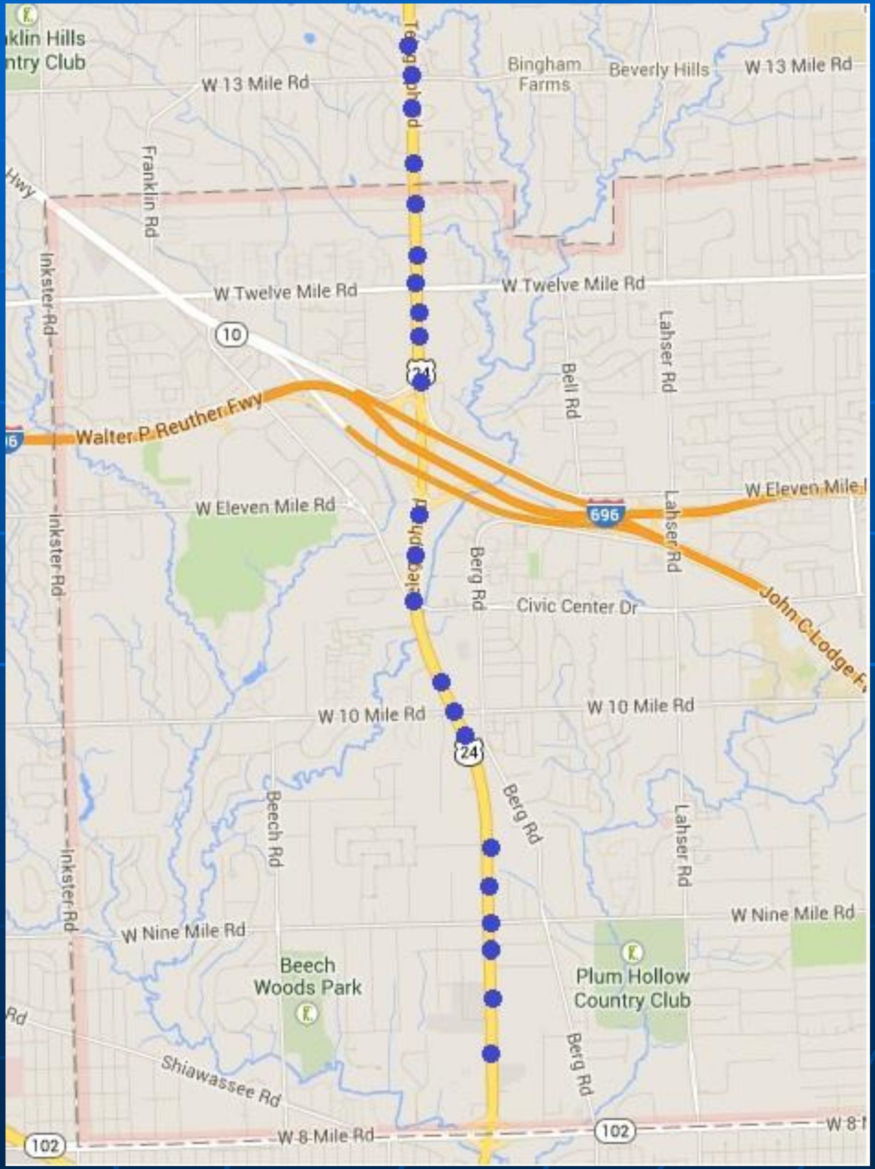
- Joint project with MDOT and FHWA
- First large-scale demonstration in the U.S.
- 55 Road Side Equipment units (RSEs) installed at 43 traffic signals
- Covered 45 square miles
- Successfully proved that data could be shared between infrastructure and vehicles in a timely, accurate and useful manner
- Many lessons learned

ITE Michigan Annual Meeting

- CV joint model deployment demonstration with MDOT & several consulting firms
- Applications included:
  - Intersection status with SPaT data
  - Slippery pavement
  - Bridge monitoring & height warning
  - Emergency-vehicle alerts
  - Freeway ramp merging
  - Parking availability

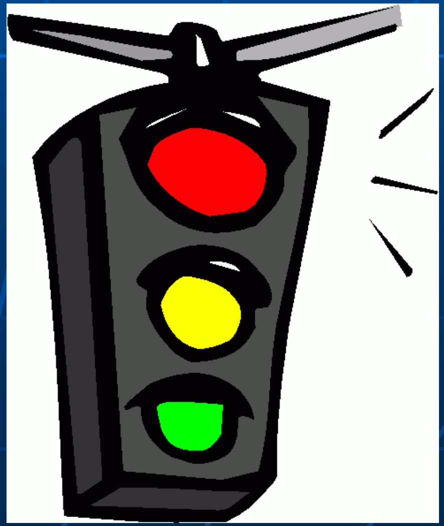
MDOT Telegraph Expansion Project

- 22 RSEs in Southfield
- Send SPaT information
- Open test bed



Taiwan SPaT Demo

- Joint project with MDOT and UMTRI
- Demonstrated in-vehicle wireless communication to give driver signal-timing and eco-drive information
- Cellular & DSRC communications tested



USDOT Safety Pilot Model Deployment (Ann Arbor, MI)

- Joint project with UMTRI, MDOT & CAMP
- Demonstration of Connected-Vehicle technologies in a real-world, multi-modal environment
- More than 2,000 vehicles equipped
- RCOC helped with technical installations even though not in Oakland County

RCOC Connected Vehicle Committee Involvement

- Connected Vehicle Deployment Coalition
- Michigan Connected Vehicle Task Force
- ITE Connected Vehicle Task Force
- Connected Vehicle Pooled Fund
- AASHTO Connected Vehicle Working Group
- Oakland County Connected Vehicle Task Force

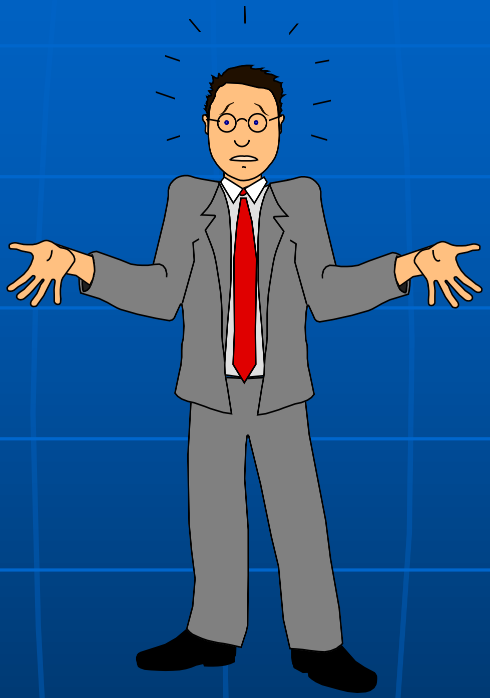
Oakland County Connected Vehicle Task Force

- Collect information from Connected Vehicle stakeholders, industry leaders and experts in order to develop an implementation plan and business model
- Task Force is partnered with:
  - Oakland County Economic Development
  - Tier I auto suppliers
  - DSCR manufacturer
  - Other private companies

Summary

- Partnerships are essential for RCOC to be involved in Connected Vehicles
- They allow RCOC to:
  - Provide input into the development of this new technology
  - Provide strategic direction
  - To actively participate in research by providing resources and technical expertise
  - Get direct understanding of local impact and benefits (lessons learned)
  - Support the "safety first" mantra

QUESTIONS???



ROAD COMMISSION for OAKLAND COUNTY

Question & Answer session

- Type your question into the "Questions" box and the moderator will read the question on your behalf.

THANK YOU!

Additional questions or feedback?

Contact Jenna Moran at jmoran@naco.org