

# NHTSA, DSRC, and V2X: The Future of Vehicle Communications

**Joe Averkamp**

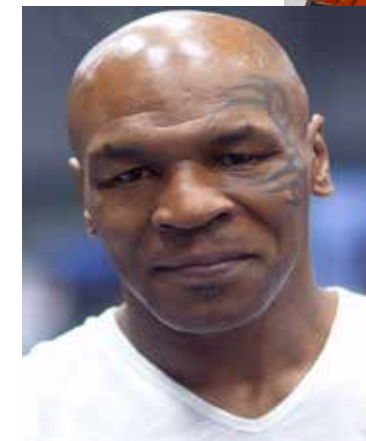
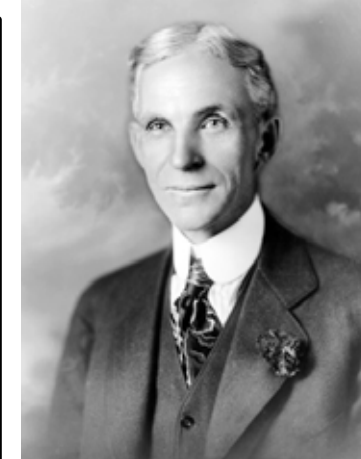
**ITS Georgia**

**October, 2017**

**Savannah, GA**

# How Could Things Go Differently

- “If I had given my customers what they asked for, it would have been a faster horse”
  - Henry Ford
- “Good hockey players play where the puck is; great hockey players play where the puck is going”
  - Wayne Gretzky
- “Everybody has a plan until they get punched in the mouth”
  - Mike Tyson



# NHTSA, DSRC, and V2I: Key Topics

## What's with all the acronyms?

- NHTSA = National Highway Transportation Safety Administration
- DSRC = Dedicated Short Range Communications
  - The communications standard that operates at 5.9 GHz (5900 MHz) and is being deployed for Vehicle-to-Vehicle (V2V) Safety
- V2I = Vehicle-To-Infrastructure Communications
  - DSRC or other wireless protocols to communicate with Roadside Systems



# Agenda

## NHTSA Notice of Proposed Rulemaking (NPRM)



## Vehicle-To-Infrastructure Deployment (V2IDC) Coalition



## Future Directions

# Connected Versus Automated Vehicles (or Connected and Automated Vehicles)

## Connected Vehicles

### Connected Vehicles

- Dedicated Short Range Communications (DSRC)
- 300 meter technology
- USDOT V2V approach

### Connected Cars

- Use Commercial Wireless Networks
- 3G, 4G LTE, 5G
- OnStar, Ford Sync, BMW Connect

## Automated Vehicles

### Capabilities

- Based upon maps locally stored in vehicle
- Use autonomous sensors on vehicle: GPS, Radar, Lidar, Video

**Connected Automated Vehicles--combine aspects of both**

### SAE Levels of Autonomy

- Level 1: Hands on assisted
- Level 2: Hands off-vehicle monitors and controls. Driver be ready *immediately*
- Level 3: Eyes off—vehicle manages, but driver be ready *in some period of time*
- Level 4: Mind off—in certain domains, vehicle manages all aspects
- Level 5: No wheel needed—vehicle manages all domains

# Notice of Proposed Rulemaking

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- In December, 2016, NHTSA announced plans for a rulemaking on V2V communications
  - NHTSA proposes to amend Federal Motor Vehicle Safety Standards (FMVSS) No. 150:
    - “to require all new light vehicles to be capable of Vehicle-to-Vehicle (“V2V”) communications, such that they will send and receive Basic Safety Messages to and from other vehicles”

# Notice of Proposed Rulemaking: Timeline For Adoption

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- January 12, 2017: Publication in Federal Registry
- April 12, 2017: Comments Due Regarding NPRM
- Effective date: Assuming a Final Rule in 2019
  - 2021: Begin phase in on new light vehicles sold
  - 2023: ALL new light vehicles sold would be required to comply



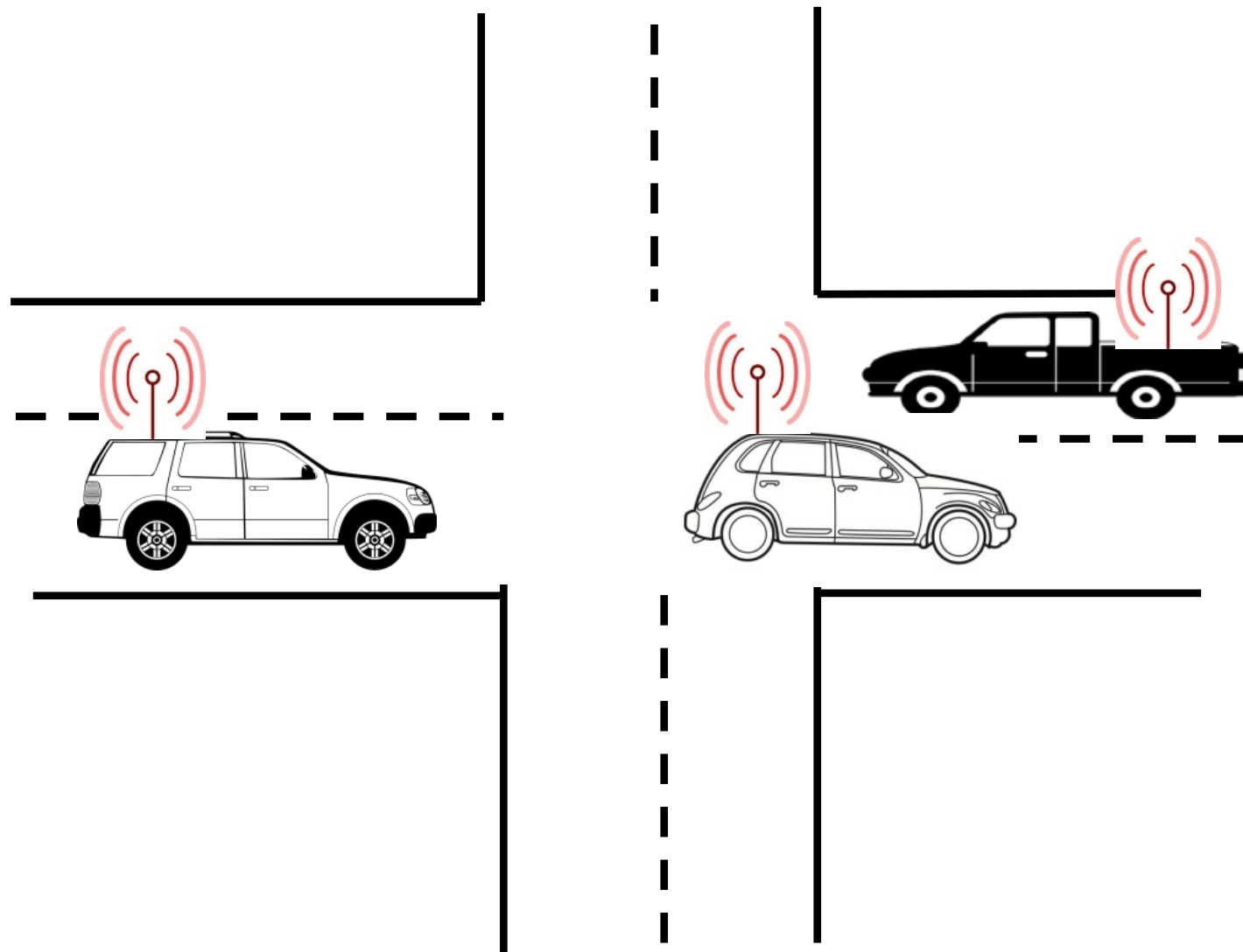
# Interesting Comments To NPRM

- 5G Automotive Alliance (5GAA) Proposes use of 5G Wireless
  - Cellular V2X Protocol based upon LTE= C-V2X:PC5
  - Members include:
    - Qualcomm
    - BMW, Audi, Daimler
    - Nokia, Ericsson, Huawei
  - Proponents argue for improved performance and spectrum efficiency





# How Does V2V for Safety Work?

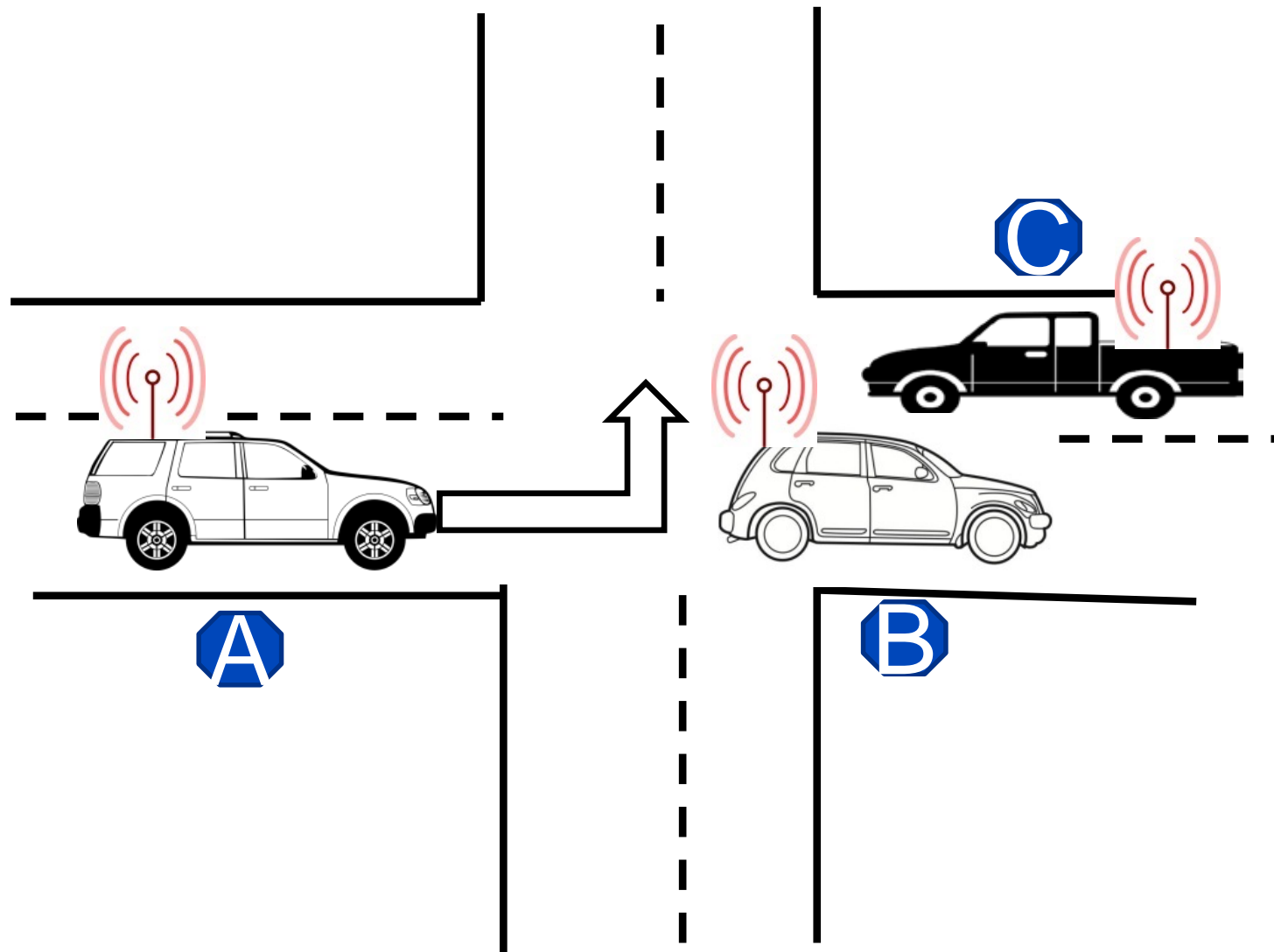


- Vehicles Equipped with DSRC for V2V Safety broadcast a Basic Safety Message (BSM) 10 times per second
  - DSRC range ~ 300 meters
- BSM includes:
  - Location
  - Direction of Travel
  - Speed
  - Security Credentials
  - AND is Anonymous
- Other vehicles receive the BSM and decide:
  - Given other vehicle's trajectory "Is a crash likely or imminent?"
  - Should the vehicle alert the driver?

# V2V Safety: Potential Applications

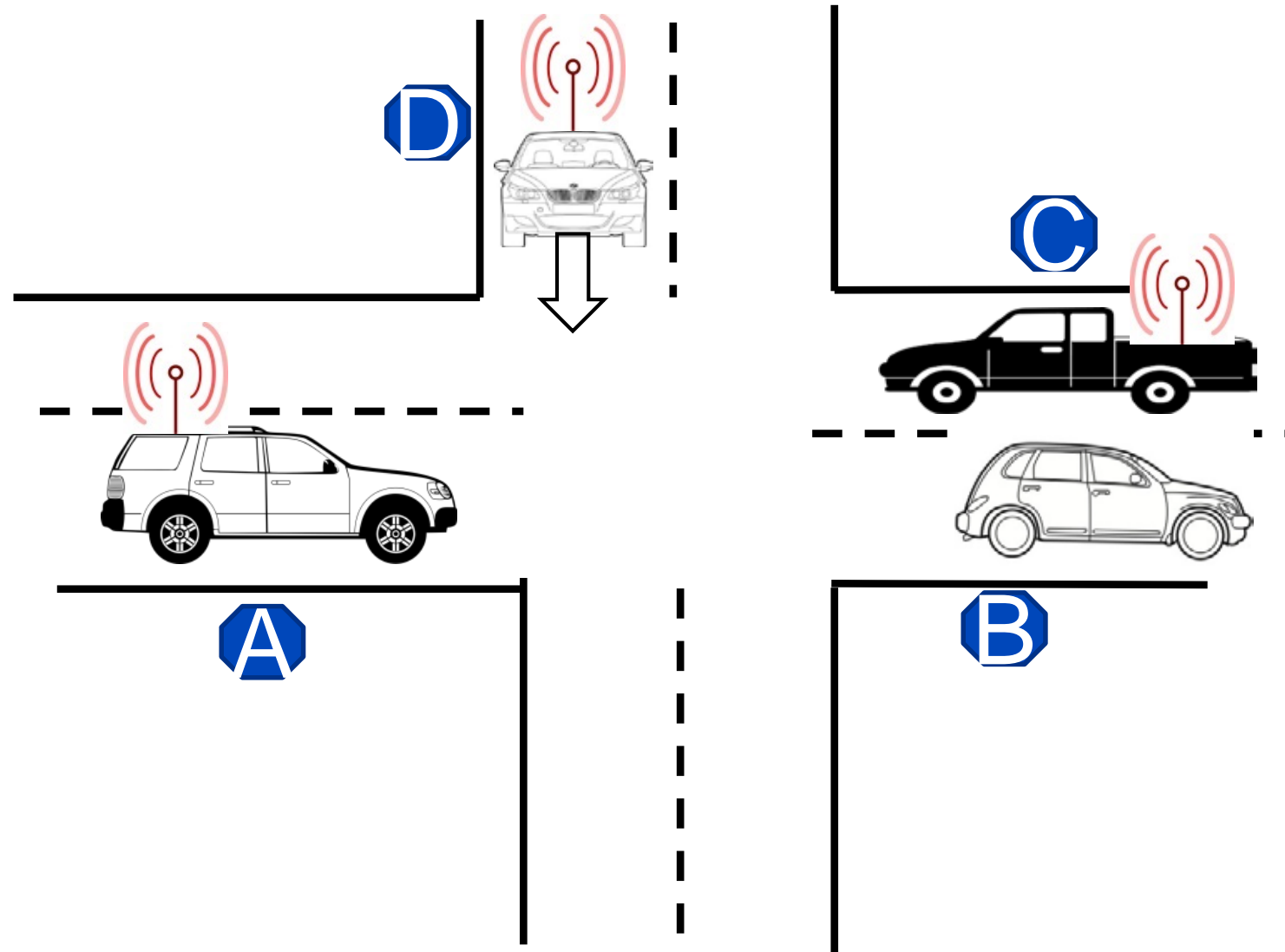
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- Forward Collision Warning: Warns of stopped, stalled vehicles ahead
  - Do Not Pass Warning: Warns of oncoming traffic in opposing lane when attempting to pass
  - Left Turn Assist: Warns of vehicles crossing the path of a left turn
  - Intersection Movement Assist: Warns of lateral crossing vehicles at an intersection
  - Others

# Application: Left Turn Assist



- White SUV (A) approaches intersection and signals left turn
- Black pick up truck (C)
  - Is 90 feet away from Vehicle A
  - Approaching intersection at 60 mph (88 feet/sec)
  - Vehicle A's speed is 15 mph (22 feet/sec)
- Vehicle A will ALERT THE DRIVER!
- Vehicle C will ALERT THE DRIVER!

# Application: Intersection Movement Assist



- White SUV (A) and Black pick up truck (C) have green light
- Vehicle D approaches at high speed and is on a trajectory to run the red light
- Vehicles A and C receive BSMs from Vehicle D and determine a collision is imminent (Vehicles are always receiving BSMs)
- Vehicle A will ALERT THE DRIVER!
- Vehicle C will ALERT THE DRIVER!

# NHTSA Cost-Benefit Analysis

- USDOT conducted a series of studies:
  - Safety Pilot Model Deployment & Driver Clinics
  - Worked with automakers in Collision Avoidance Metrics Partnership (CAMP)
- Cost-Benefit Created Based Upon ONLY Left Turn Assist and Intersection Movement Assist



Table I-1 From NPRM			
Annual Cost-Benefit Analysis*			
Total Annual Costs	Per Vehicle Costs	Crashes Prevented and Lives Saved	Monetary Benefits
\$2.2 Billion - \$5.0 Billion	\$135-\$301	Crashes: 424,901-594,569 Lives Saved: 955- 1,321	\$53 Billion - \$71 Billion

\*Year 30 after ruling takes effect

# What Are Automakers Doing To Prepare?

- Mary Barra, GM Chairwoman and CEO announced at ITS World Congress in 2014 that Cadillac would include DSRC on 2017 models
- **Mar 9 ,2017 Cadillac announces**  
“**NEW YORK** — Cadillac introduces Vehicle-to-Vehicle (V2V) communications this month in the CTS performance sedan, beginning with 2017 interim model year cars in production now. V2V-equipped vehicles share information that can be used to alert drivers to upcoming potential hazards, laying the groundwork for a connected, safer future.”
- Other automakers working to establish cooperative V2V framework



# Shifting Gears: Vehicle-to-Infrastructure (V2I)

# Shifting Gears: Vehicle-To-Infrastructure Deployment Coalition

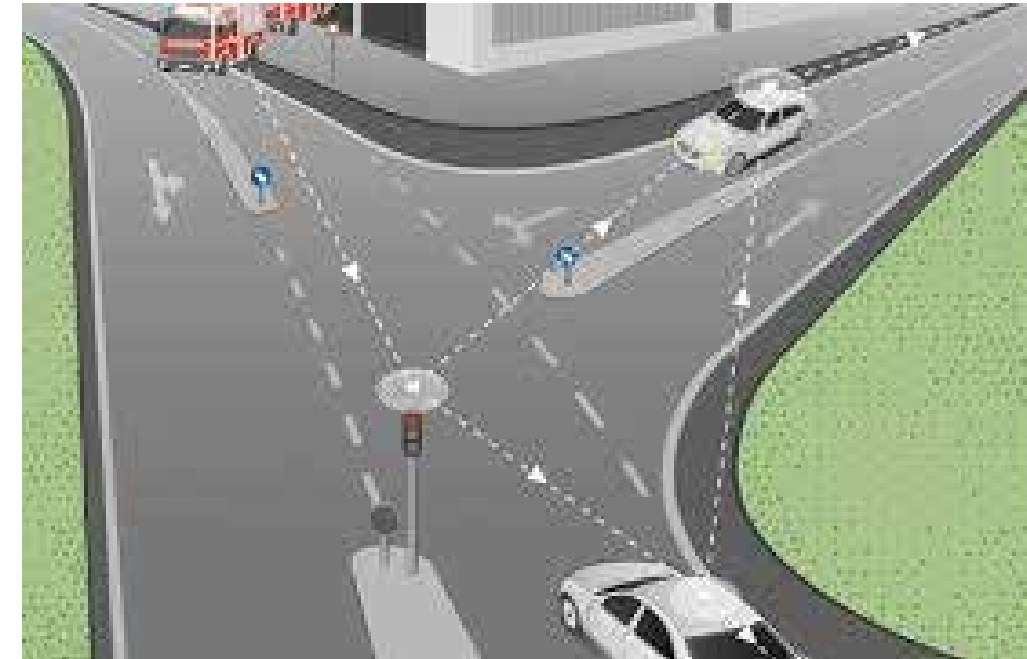
- Given that FHWA will not issue a rule for DSRC but is looking to states to create guidelines for V2I deployment
  
- Vehicle-to-Infrastructure Deployment Coalition was formed by:
  - American Association of State Highway Transportation Officials (AASHTO)
  - ITS America
  - Institute of Transportation Engineers (ITE)





# V2I Deployment Coalition

- V2I DC Approach is to create a single point of reference for stakeholders to meet and discuss V2I deployment related issues
- Create guidance for Infrastructure Operators
- Foster cooperation between:
  - Infrastructure Operators
  - Automakers



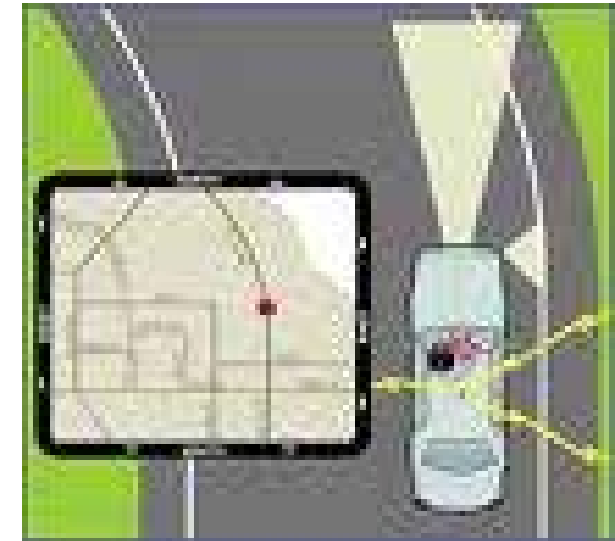
# TWG Chairs & Co-Chairs

<b>TWG</b>	<b>Chair</b>	<b>Co-Chair</b>
TWG: Initiatives	Greg Larson, Caltrans	Joe Averkamp, Conduent
TWG: Guidance	Faisal Saleem, MCDOT	Navin Katta, Savari
TWG: Standards	Ed Seymour, Texas A&M	Gary Duncan, Econolite

# Vehicle-To-Infrastructure Deployment Coalition

Focus On Four Key Applications:

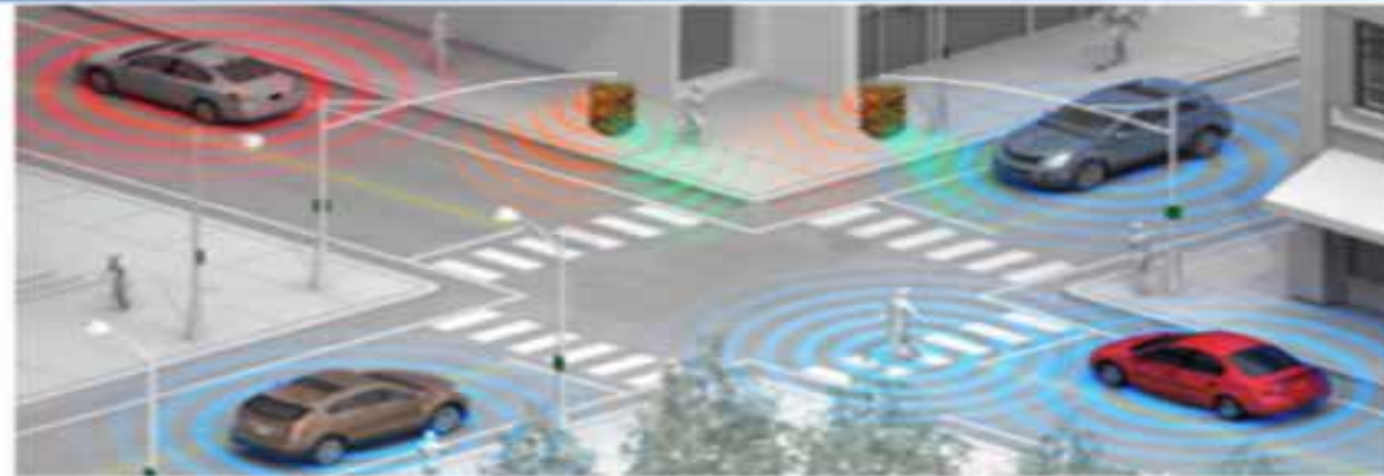
- Intersection Safety: Signal Phase and Timing
- Work Zone Safety—a critical area for Traffic Management Authorities
- Curve Overspeed Warning
- Approaching End of Queue Alerts



# Signal Phase and Timing Challenge

## The National Connected Vehicle Deployment Challenge

20 SPaT Intersections in 50 States by 2020



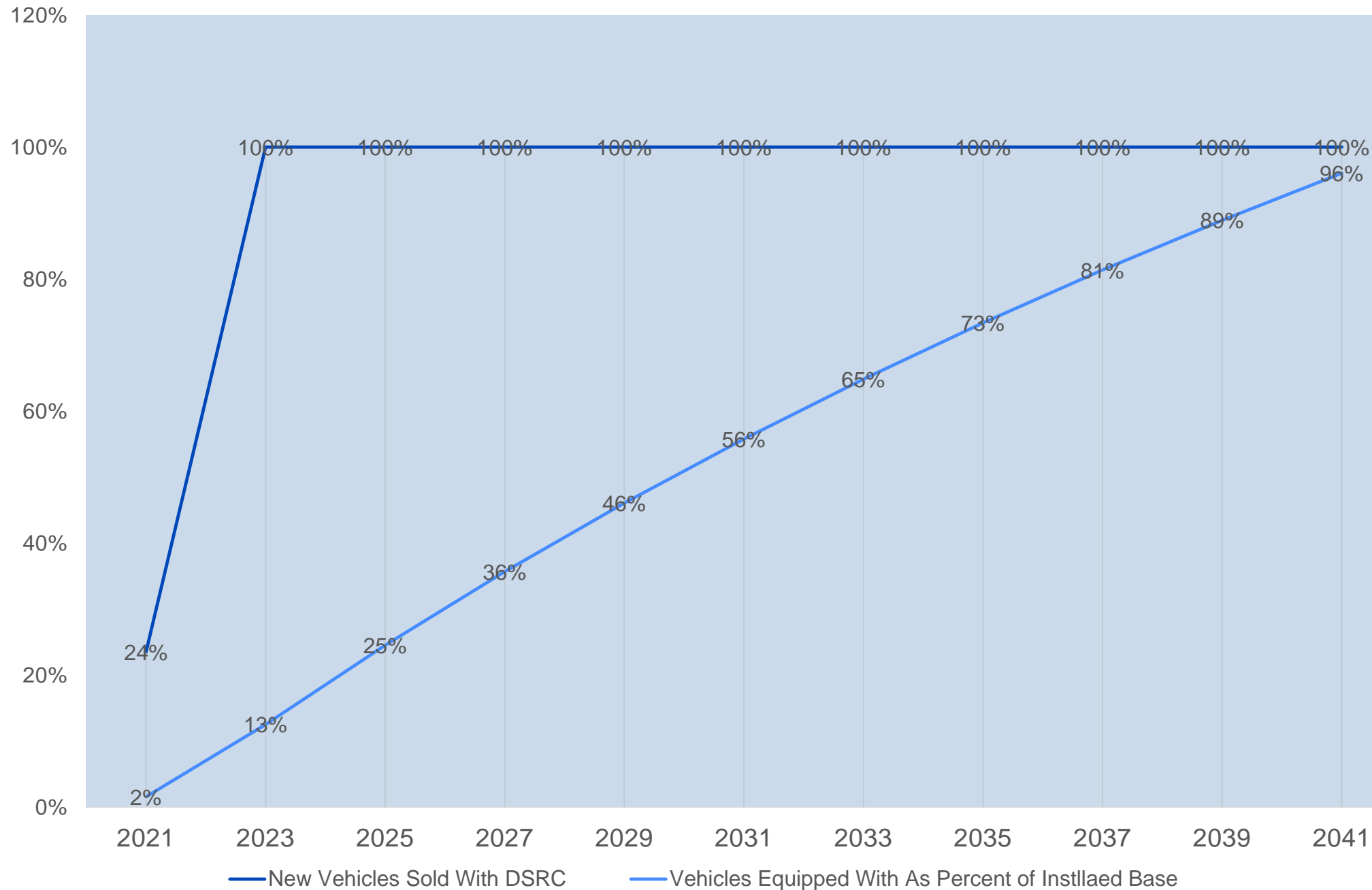
### The Challenge:

To Challenge state and local public sector transportation infrastructure owners and operators to cooperate together to achieve deployment of DSRC infrastructure with SPaT broadcasts in at least one corridor or network (approximately 20 signalized intersections) in each state by January 2020.



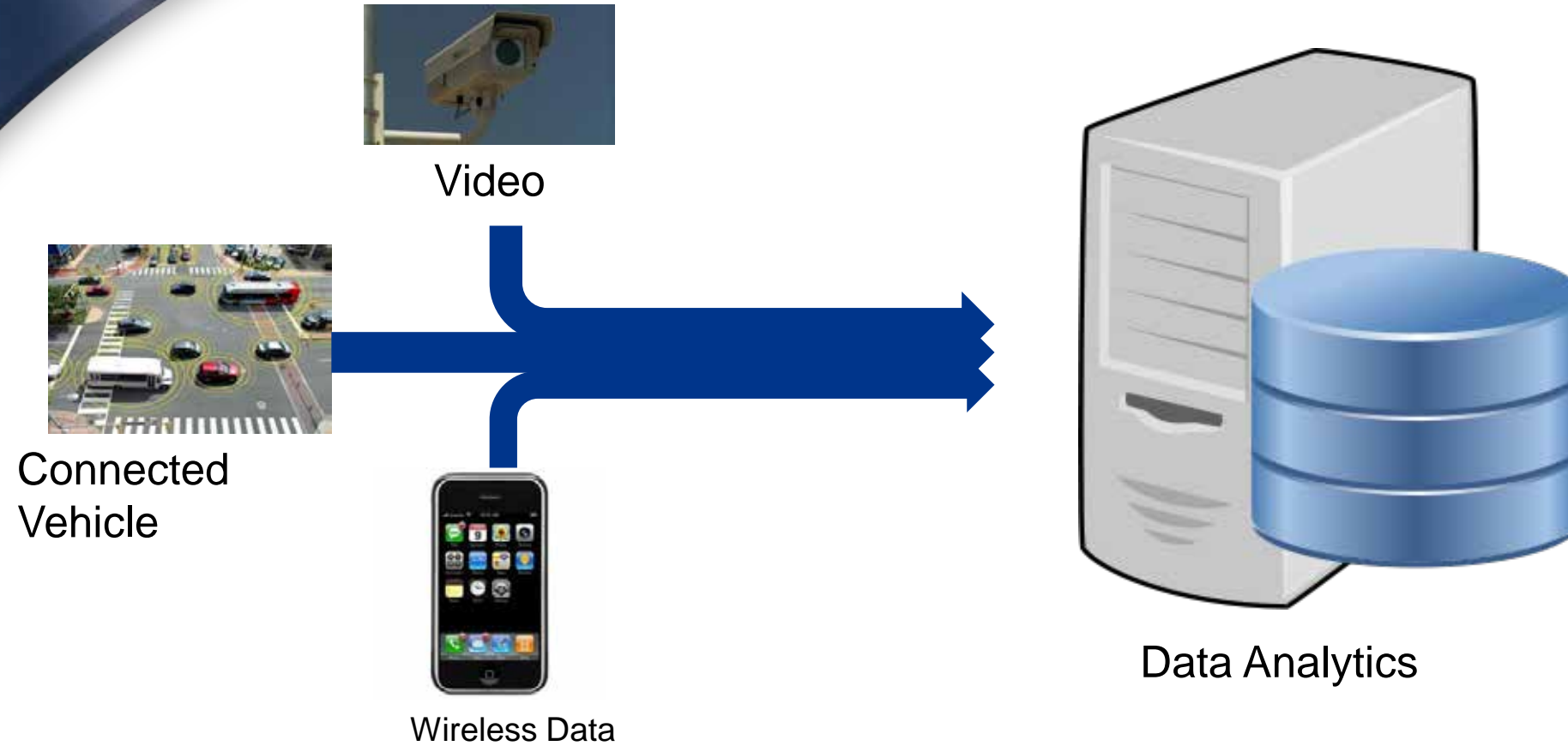
# How Can Roadway Systems Leverage DSRC?

DSRC Penetration Rate of Total Vehicle Base (US)



- 100% Penetration Occurs Around 2040
- Many safety benefits will be delivered earlier
- Mobility benefits can be realized at lower penetration
- Speed measurement can be derived at much lower penetrations
- In-vehicle signage can be delivered at lower penetration rates
- V2IDC applications:
  - Work Zone Mgmt
  - Curve Overspeed
  - End of Queue

# Data Fusion: Making Data More Available



- Need to fuse Connected Vehicle Data with other sources
- Connect intersections and other ITS information points
- Publish Data for Applications to use

# Thank you

[joseph.averkamp@conduent.com](mailto:joseph.averkamp@conduent.com)

[www.Conduent.com](http://www.Conduent.com)



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