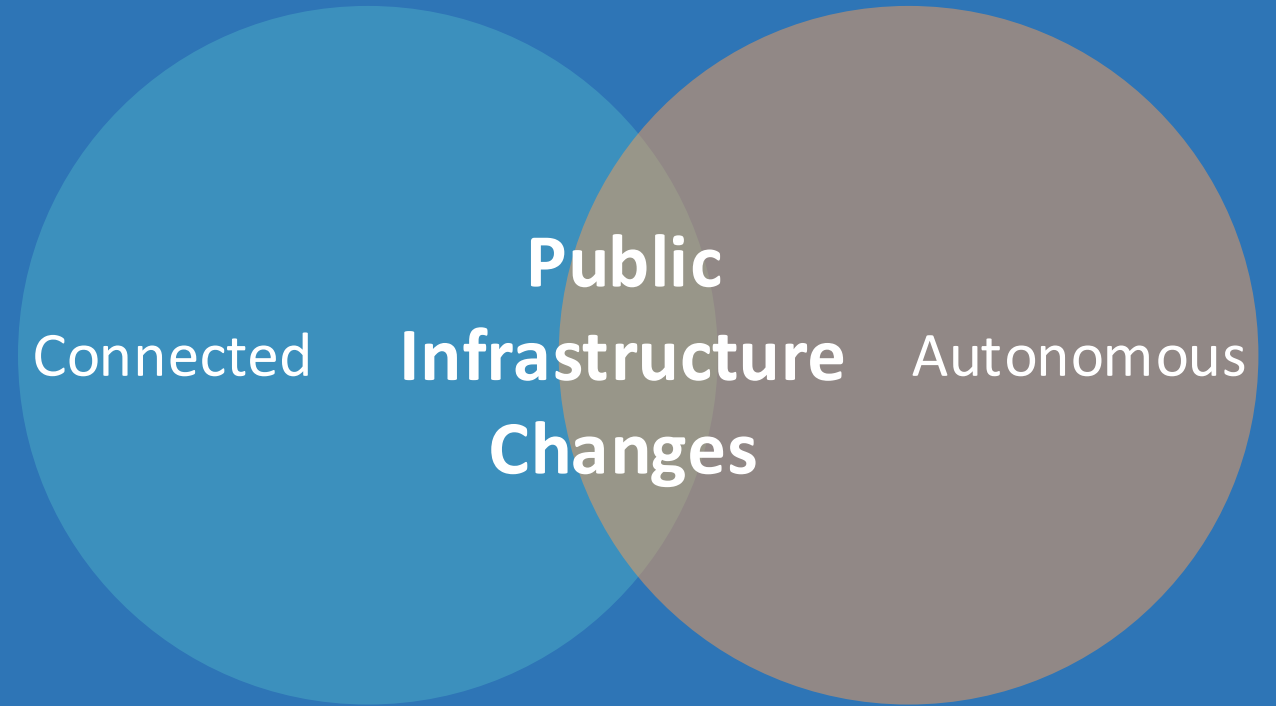# Connected/Autonomous Vehicles and Public Infrastructure

Connecting vehicles to each other and public infrastructure

# Introduction

- Connected vehicles (CV)
- Autonomous vehicles (AV)
- Connected/autonomous vehicles (CAV)

Connected

**Public Infrastructure Changes**

Autonomous

*Connected:*

- Vehicles connected to each other
- Vehicles connected to public infrastructure

*Autonomous:*

- Level 4: High automation
- Level 5: Full automation

# Acronyms



- V2V = Vehicle to vehicle
- V2I/I2V = Vehicles to infrastructure
- V2P = Vehicles to pedestrians
- V2X = Vehicles to everything
- DSRC = Dedicated short-range communication
- NHTSA = National Highway Traffic Safety Administration

# Background

- V2V
  - Ability to vehicles to wirelessly push and pull information to each other about the speed and position of surrounding vehicles (e.g., safety warnings)

- V2I and I2V
  - Ability of vehicles to pull information from public infrastructure (e.g., signals)
  - Ability of public infrastructure to push information to vehicles (e.g., safety warnings)

- Infrastructure requires public approvals

- All of the above require connected vehicles



Roadside equipment and standardized in-vehicle devices support V2V and V2I

# Today's Situation

- Auto manufacturers focused on sensors and cameras for detection and cellular for communications (not V2V)

- No current requirement today for in-vehicle (V2V) equipment

- Federal rulemaking
  - *Federal Motor Vehicle Safety Standards; V2V Communications (December 2016)*



"…safety applications enabled by V2V and V2I could eliminate or mitigate the severity of up to 80 percent of non-impaired crashes, including crashes at intersections or while changing lanes."

- NHTSA, December 2016

# Federal Rulemaking by NHTSA

- Requires V2V equipment for new vehicles
  - Dedicated short-range communication
- Safety emphasis
- Message details and authentication
- Detection and reporting
- Security and privacy
- Co-benefits to infrastructure
- Phased-in over time (TBD)
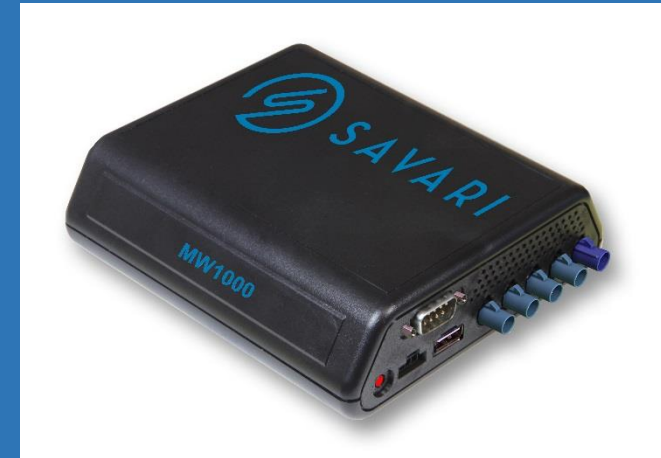


DSRC on-board device example (multiple manufacturers today)

# NHTSA – Safety Emphasis

- Digital Basic Safety Message (BSM)

- Intersection Movement Assist (IMA)

- Emergency Electronic Brake Light (EEBL)

- Forward Collision Warning Forward Collision Warning (FCW)

- Blind Spot Warning (BSW)

- Lane Change Warning (LCW)

- Do Not Pass Warning (DNPW)

# V2I – Public Infrastructure

- DSRC roadside units (at intersections and other locations to enhance safety)

- New hardware unit in traffic controller

- Backhaul communications to traffic management center (optional)

- Map data for intersections with GPS corrections

- All of the above … available now
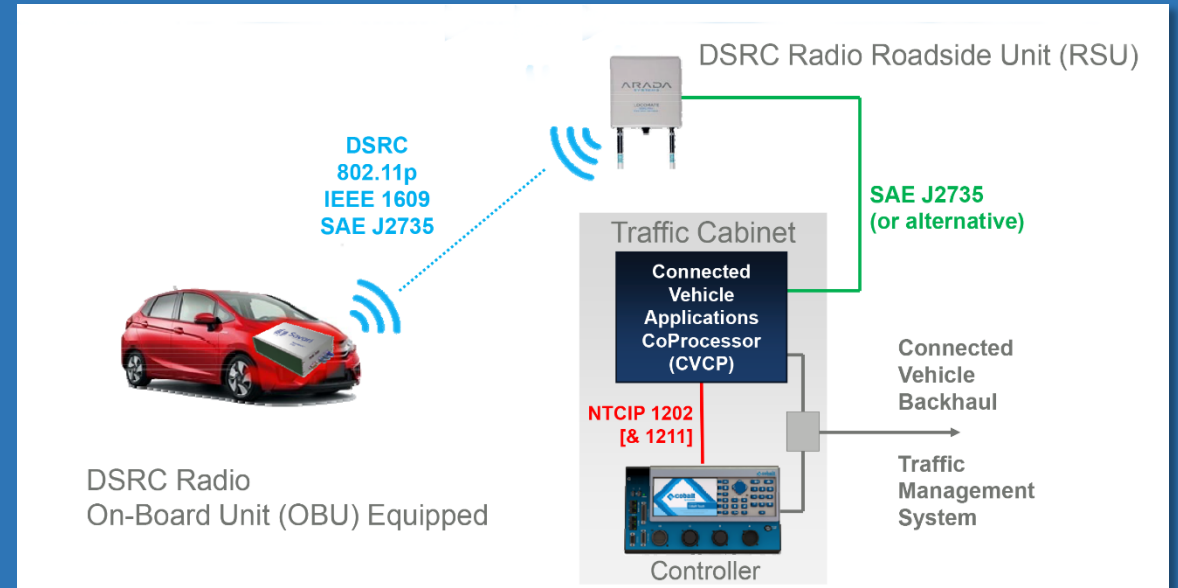
# Potential Scenarios



## Connected Systems

- Increased deployment of standard V2V systems in early 2020s
- Increased installation of V2I infrastructure concurrent with vehicle systems
- Combination of DSRC and higher-speed cellular systems support infrastructure and auto manufacturer needs

*or*

## Independent Actions

- No standard V2V system finalized
- Vehicle manufacturers focus on cellular connections to own systems (no V2V)
- Reserved radio spectrum for DSRC released for other uses
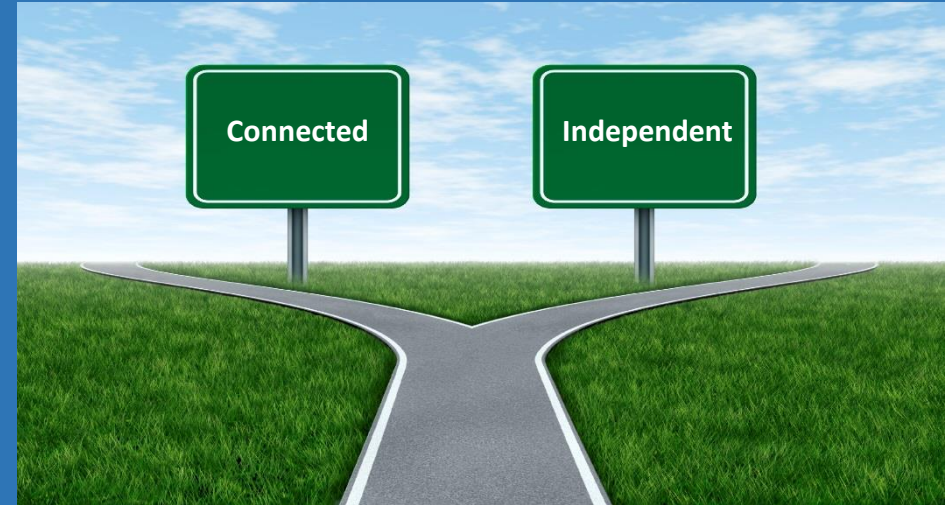
# Recent AV Policy Efforts



- California Legislative
  - May 2018 Assembly Transportation Committee hearings on driverless vehicle safety issues
- California driverless testing (SB 1298)
  - California Office of Administrative Law approved the driverless testing regulations in February 2018
  - Department of Motor Vehicles now reviewing applications
  - 11 major requirements including related to technology, training, reporting, and notification
- Local
  - Association of California Cities Orange County reviewing local roles and responsibilities
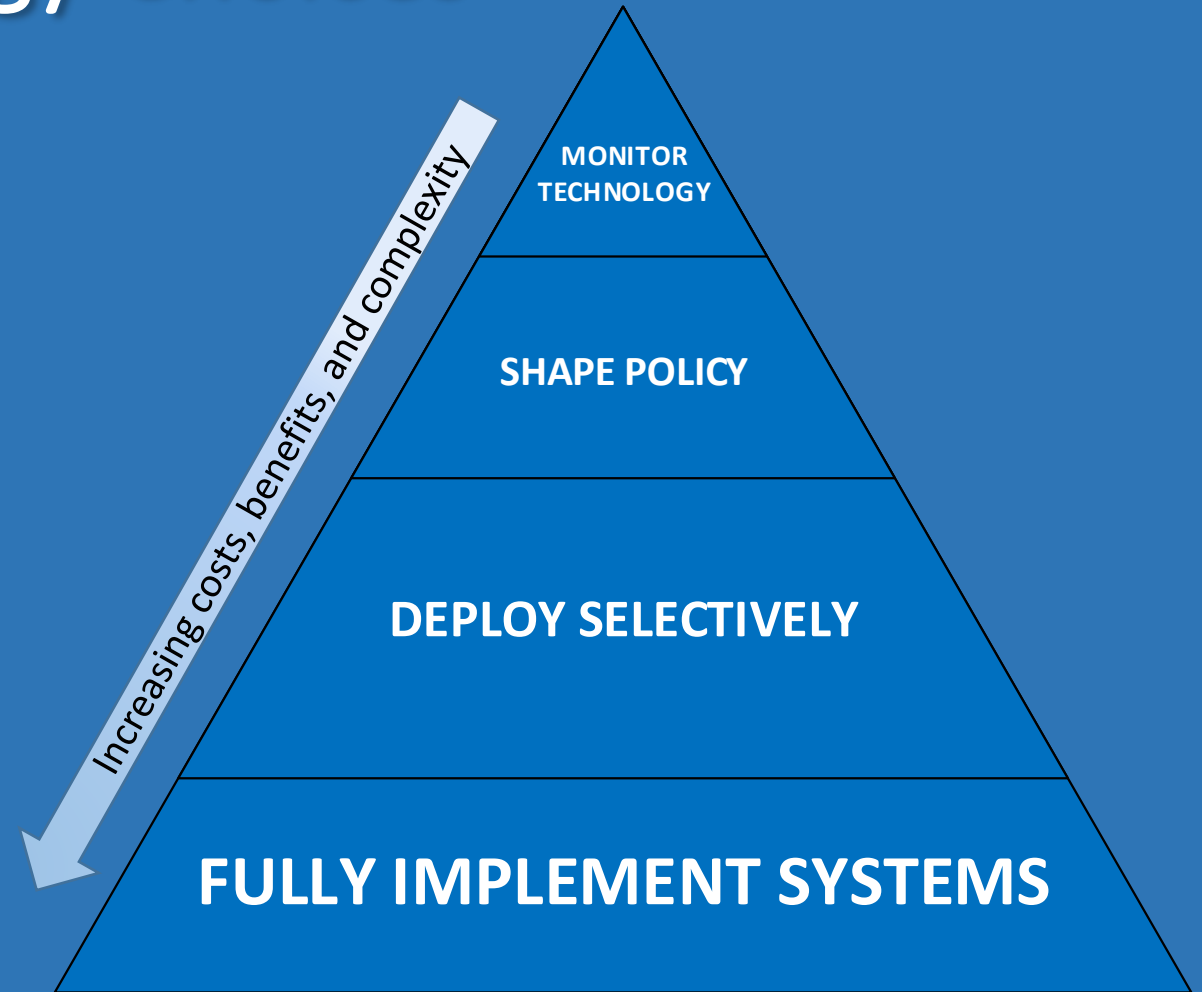
# Today's Opportunities/Issues

- Technology exists today and costs declining

- V2I relies on broad deployment of V2V

- Current federal rulemaking V2V uncertain

- Each local agency has authority and responsibility for its own transportation infrastructure

- Maintaining striping and signage improves safety for all vehicle types included connected, autonomous, and others

# Emerging OCTA Roles

- Monitor rulemaking, testing, and implementation efforts
- Help shape technology choices by local agencies such as:
  - Continued upgrades to Advanced Traffic Controllers (~400 deployed to date)
  - Use of non-propriety hardware and software systems
  - Study benefits/costs of fiber optic/other connections between local systems
- Continue dialogue through Technical Advisory Committee and Traffic Forums
- Evaluate long-term autonomous vehicle benefits in 2018 Long-Range Transportation Plan
- Selectively implement appropriate technologies