UNITED STATES
DEPARTMENT OF TRANSPORTATION

# CAMP & Vehicle-to-Infrastructure Applications

**Carl K. Andersen**

**U.S. Department of Transportation**
**Federal Highway Administration**

**3 December 2014**

# CAMP Agreement

- Eight Work Areas
  - Program Administration
  - Safety Applications
  - Mobility Applications
  - Environmental Applications
  - Automation
  - Security
  - Non-motorized Road Users
  - Positioning

# V2I Consortium

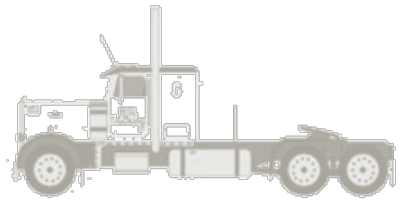
- 10 Light Vehicle Manufacturers + Volvo Truck
  - Ford
  - GM
  - Chrysler
  - Honda
  - Nissan
  - Mazda
  - Subaru
  - Hyundai-Kia
  - Mercedes-Benz
  - VW-Audi

# On-going Efforts

- Safety
  - Develop, test, validate up to 5 V2I Safety applications
- Mobility
  - Assess feasibility of prototyping CACC system

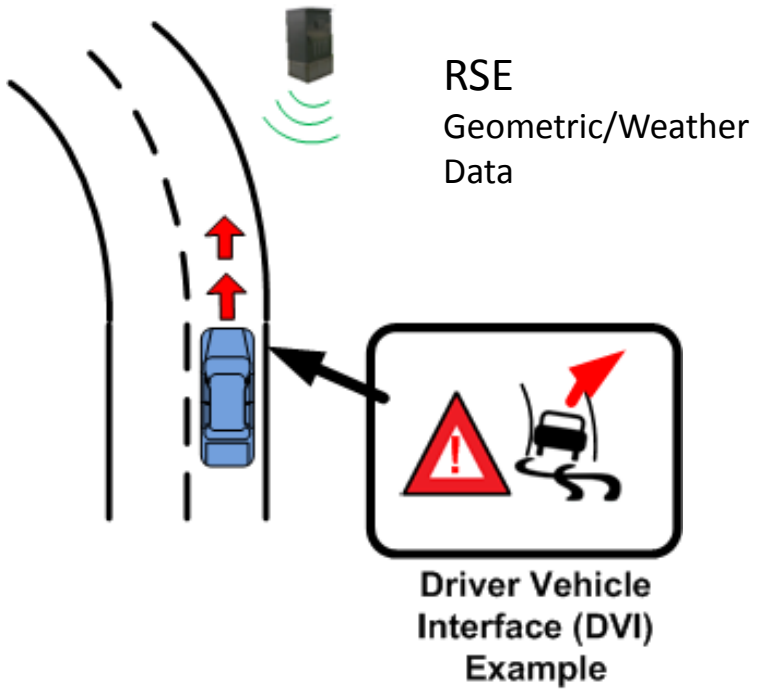
# V2I Safety Applications

| V2I Safety Applications | |
|---|---|
| Curve Speed Warning | CSW |
| Red Light Violation Warning | RLVW |
| Spot Weather Information Warning | SWIW |
| Reduced Speed Zone Warning | RSZW |
| Stop Sign Gap Assist | SSGA |
| Smart Roadside | SRI |
| Transit Pedestrian Warning | |



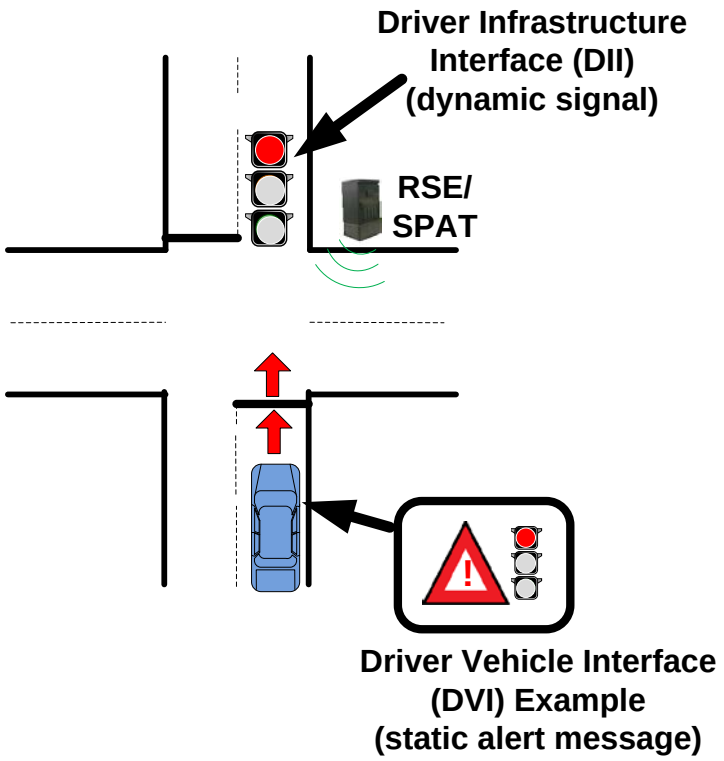
# V2I Safety – CSW

- Roadside Equipment (RSE): broadcast geometric and weather information under a Traveler Information Message (TIM) for use by in-vehicle device.
- In-vehicle Device: determine appropriate speed for that particular vehicle based on TIM.  Warnings can be tailored to the specific vehicle capabilities.
- Potentially could be linked to dynamic driver feedback signs until majority of vehicles are equipped.



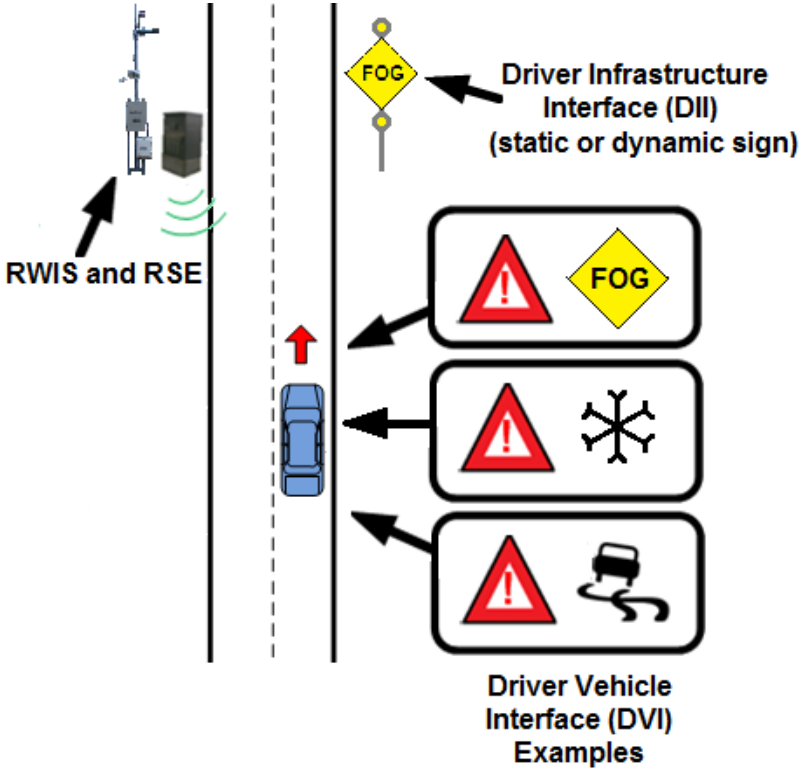
# V2I Safety – RLVW

- Roadside Equipment (RSE): broadcast Signal Phase and Timing (SPaT) message, Geometric Intersection Description (GID), and GPS correction.
- In-vehicle Device: determine if the vehicle is in danger of violating a red light.
- Traffic signal logic may be evaluated to determine if extension of all-red phase is warranted to prevent crashes involving early violators.



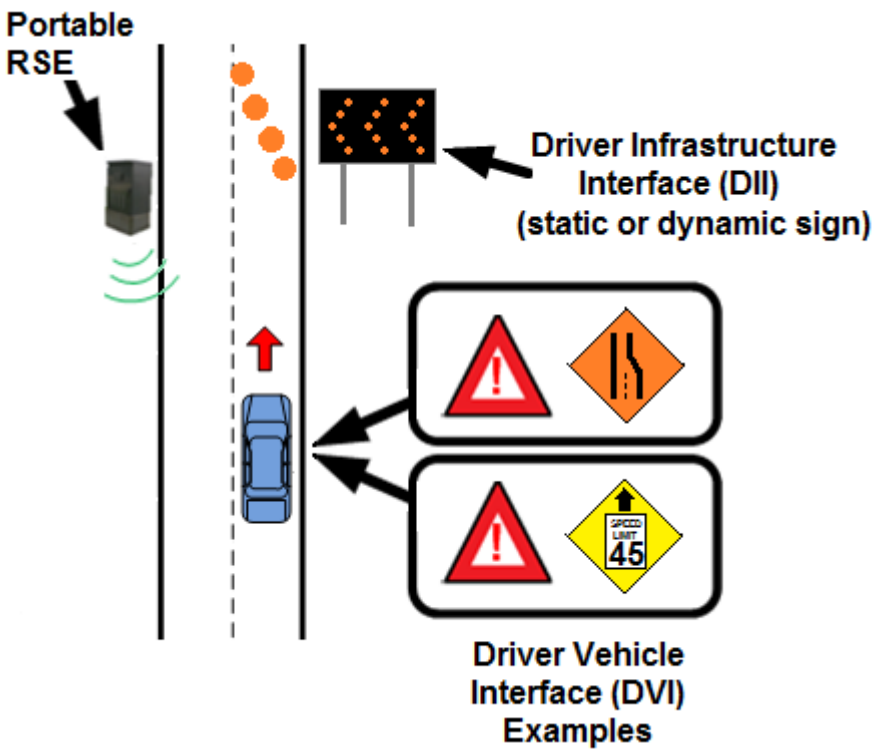
# V2I Safety – SWIW

- Roadside Equipment (RSE): connection with TMC and other weather data collection sites/services.
- Weather events and locations broadcast to vehicles in real-time.
- In-vehicle Device: issues alert or warning to driver.



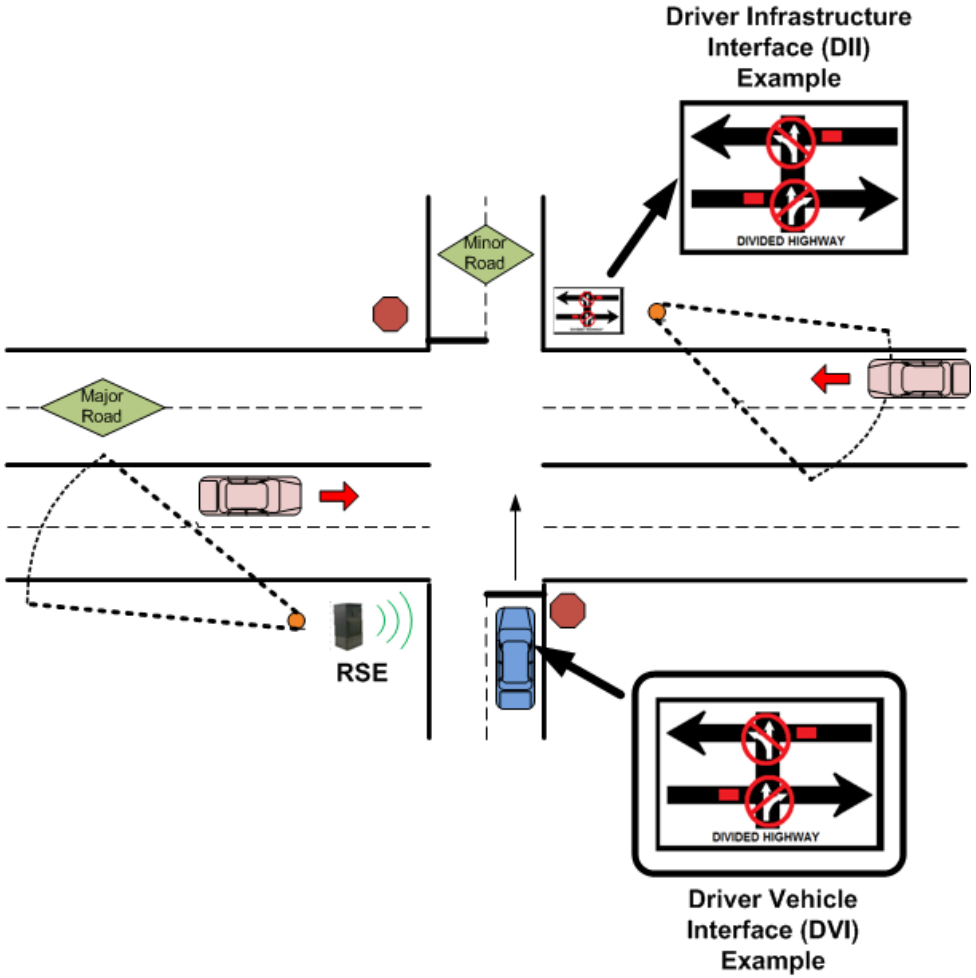
# V2I Safety - RSZW

- Roadside Equipment (RSE): connection to TMC and/or local network in work zone.
- Speed limit / work zone information provided to vehicle.
- In-vehicle device: issues alert to driver to reduce speed, change lanes, and/or prepare to stop.



# V2I Safety - SSGA

- Roadside sensors: detect on-coming traffic.
- Roadside Equipment (RSE): broadcast traffic status.
- In-vehicle Device: determine if there is any danger for vehicle on the minor leg.

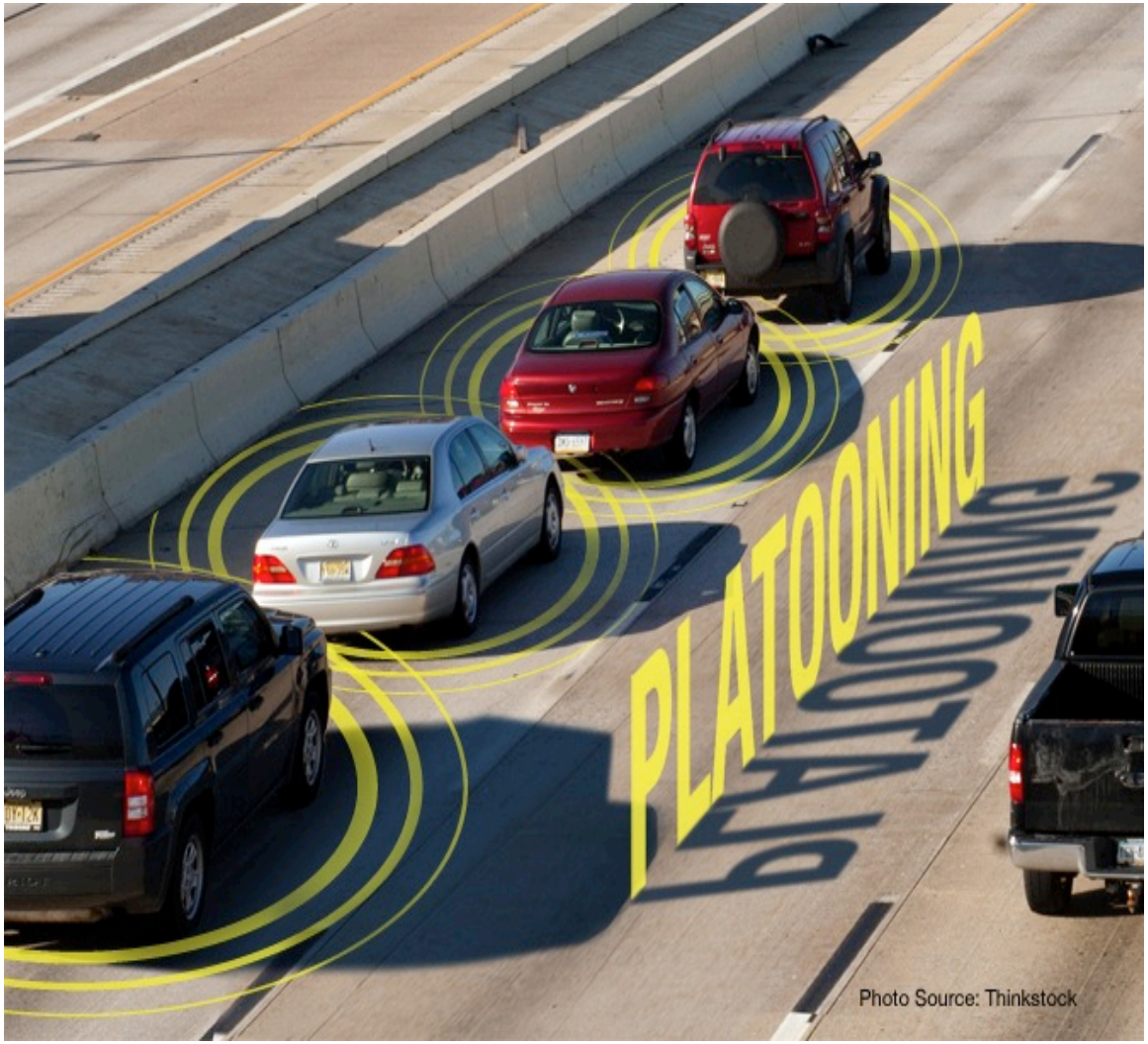



- Not designed to provide warnings of potential crashes due to stop sign violations!

# On-going Efforts

- Safety
  - Develop, test, validate up to 5 V2I Safety applications
- Mobility
  - Assess feasibility of prototyping CACC system

# Cooperative Adaptive Cruise Control

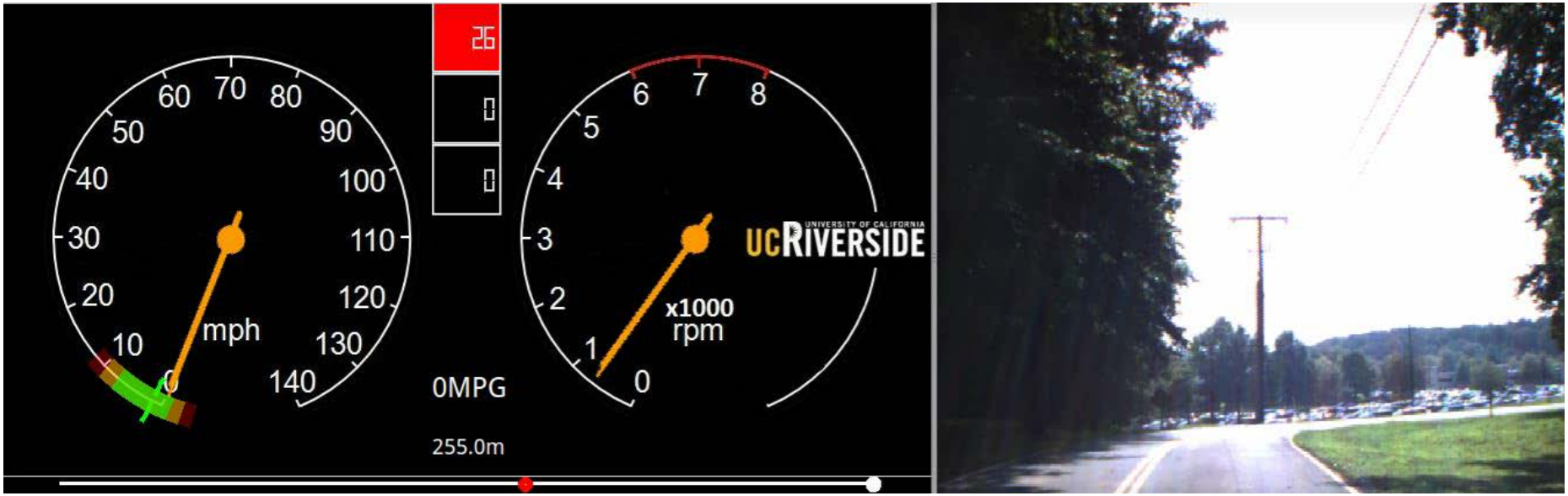


# Proposed Efforts

- Data Capture
  - Advanced Messaging Development
  - Teamed with VTTI
- Environment
  - Eco-Approach/Departure
  - Teamed with TTI
- Road Weather
  - Data flow from vehicles
  - Teamed with VTTI

# AERIS EcoDrive Demonstration

Slightly Reduce Speed to Avoid Stop at Red Light



# AERIS EcoDrive Study Results

## Reduced Fuel Consumption

| Speed (mph) | Average Fuel Savings (ml) | SD | Average % Improvement |
|---|---|---|---|
| 20 | 13.0 | - | 2.5% |
| 25 | 111 | 10.9 | **18.1%** |
| 30 | 76.0 | 15.7 | 11.2% |
| 35 | 73.8 | 19.6 | 6.3% |
| 40 | 107 | 14.6 | 9.5% |

# Safe and Connected Automation

- **Safe**
  - Meets requirements for functional safety, cybersecurity, and system performance
- **Connectivity**
  - Includes all types of communication with vehicles and infrastructure (Wi-Fi, DSRC, Cellular, etc.)