



# Traffic Incident Management Research with CARMA<sup>SM</sup>

Maryland Connected & Automated Vehicles Working Group

August 11, 2020



U.S. Department of Transportation  
Federal Highway Administration

**SAXTON**  
LABORATORY

# What is the CARMA<sup>SM</sup> Program?



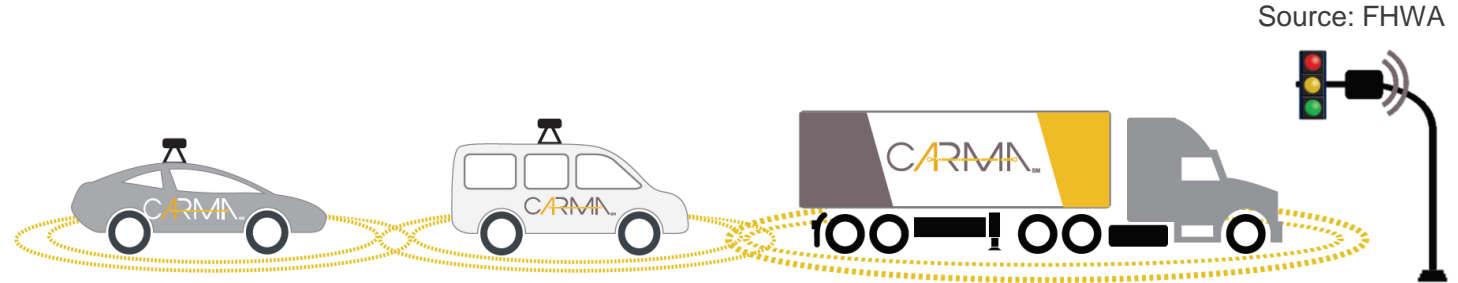
The FHWA's initiative focused on improving the transportation system by leveraging emerging automated driving technology and vehicle-to-everything (V2X) technology to enable increased safety and operational performance in moving people and goods.







# Cooperative Driving Automation



**SAE**  
INTERNATIONAL™  
**J3216\***

Cooperative Driving Automation (CDA): Automation that uses machine-to-machine (M2M) communication to enable cooperation among two or more entities with capable communications technology and is intended to facilitate the safer, more efficient movement of road users, including enhancing performance of the dynamic driving task (DDT) for a vehicle with driving automation feature(s) engaged.

*Publicly released May 2020.*

\*SAE International. SAE J3216: **Taxonomy and Definitions for Terms Related to Cooperative Driving Automation for On-Road Motor Vehicles.** SAE International. Warrendale, PA, 2020.  
[https://www.sae.org/standards/content/j3216\\_202005/](https://www.sae.org/standards/content/j3216_202005/). Last accessed: July 2020.



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## How can CDA help?

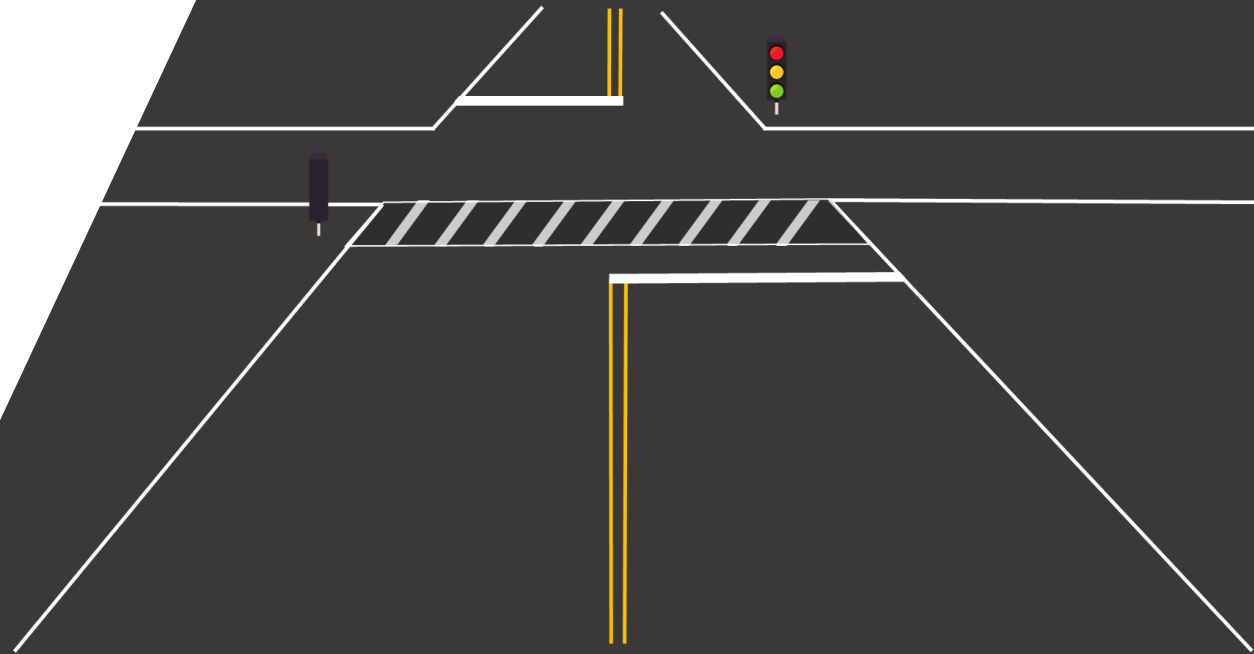
Leverages information from infrastructure and all connected roadway users to improve safety and mobility.

For example:

- Enhanced sensing.
- Intersection optimization.
- Congestion mitigation:
  - Work zones.
  - Traffic incidents.
  - Weather.



An automated vehicle (AV) sees this...





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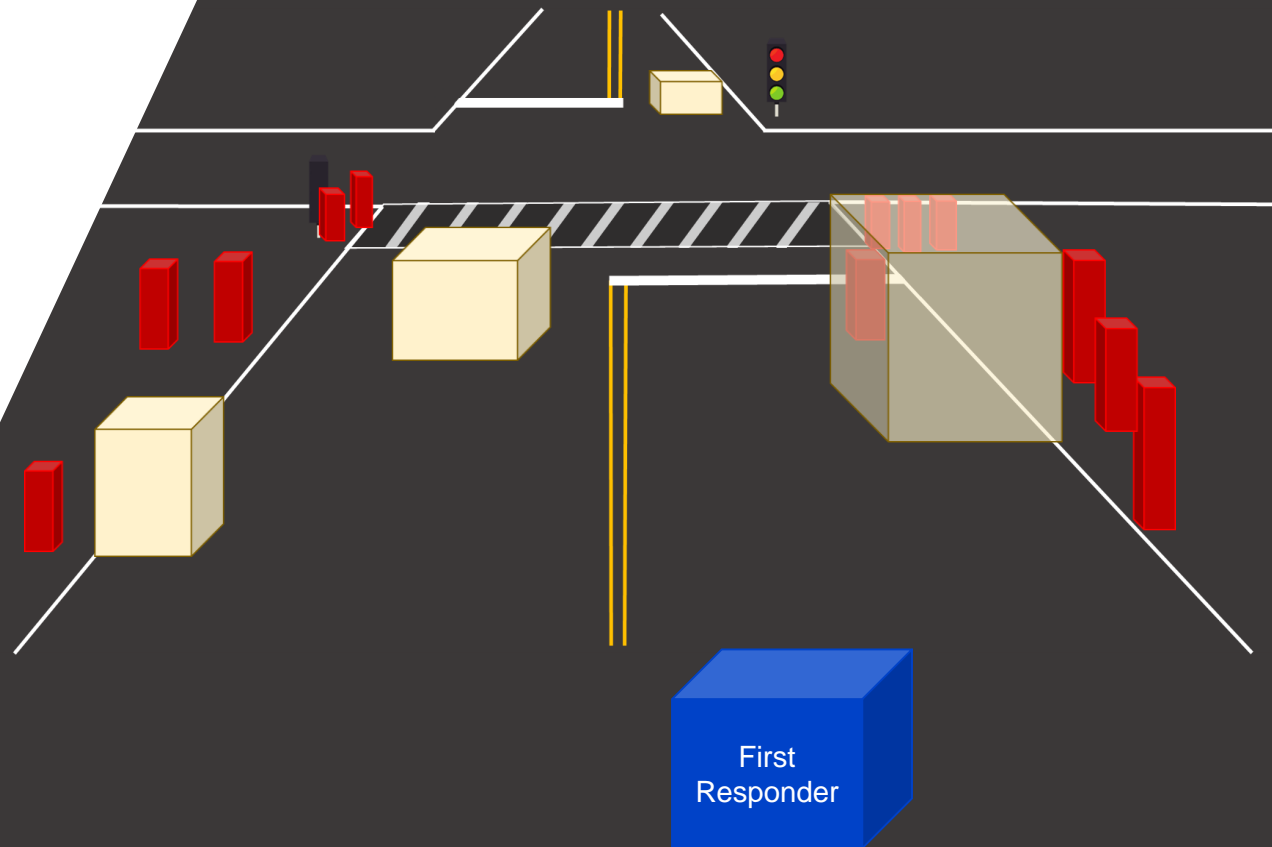
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How do you **detect** the objects you can't see?





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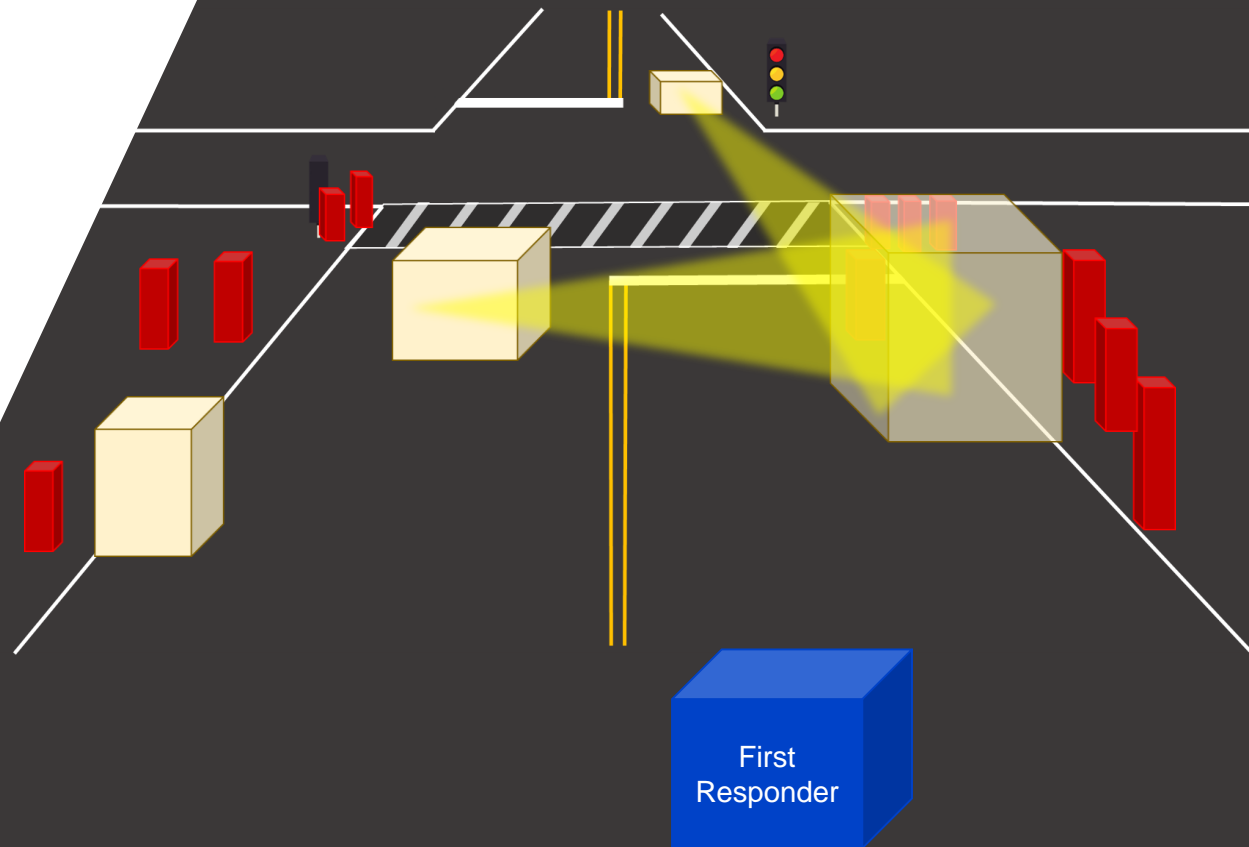
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Can you use sensor data from **other** vehicles?





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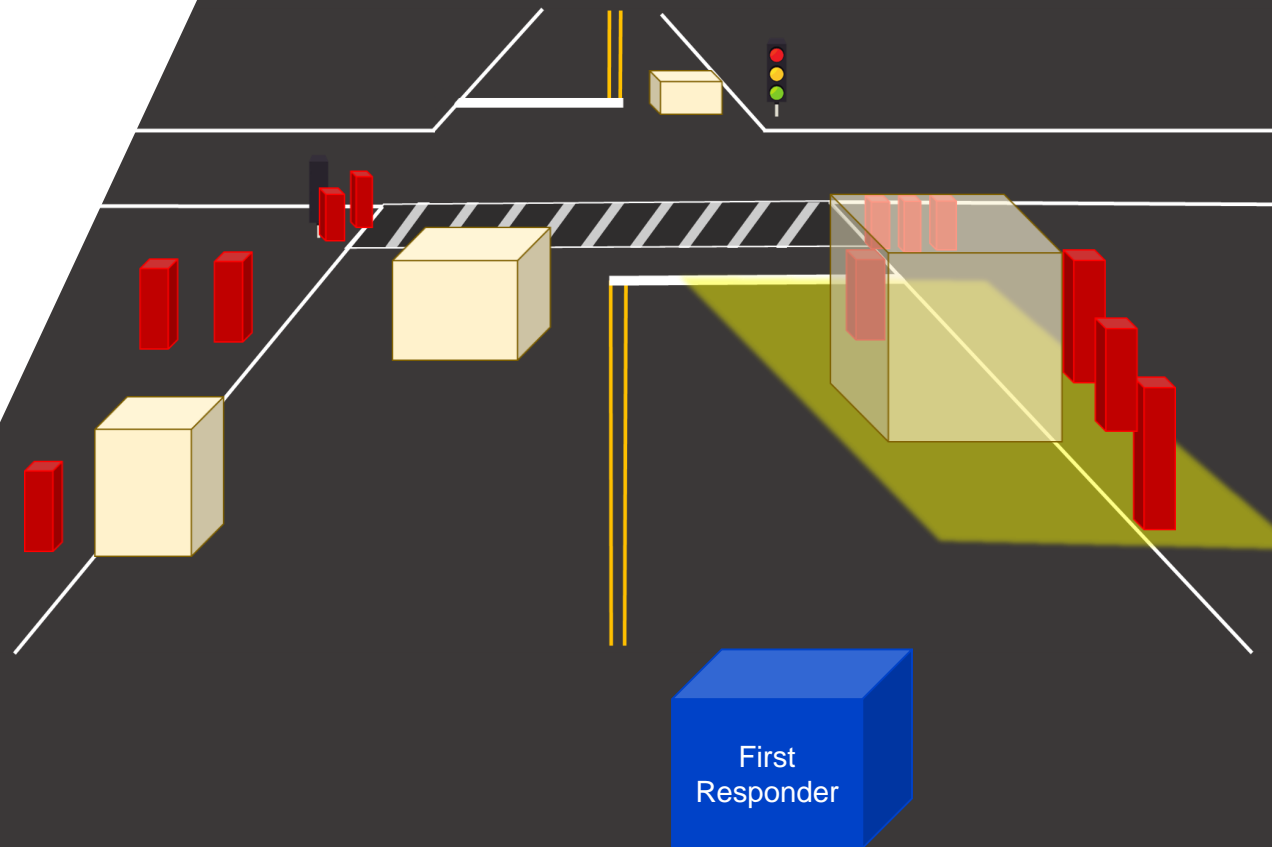
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Public transit vehicles could also participate in CDA through **shared perception**.





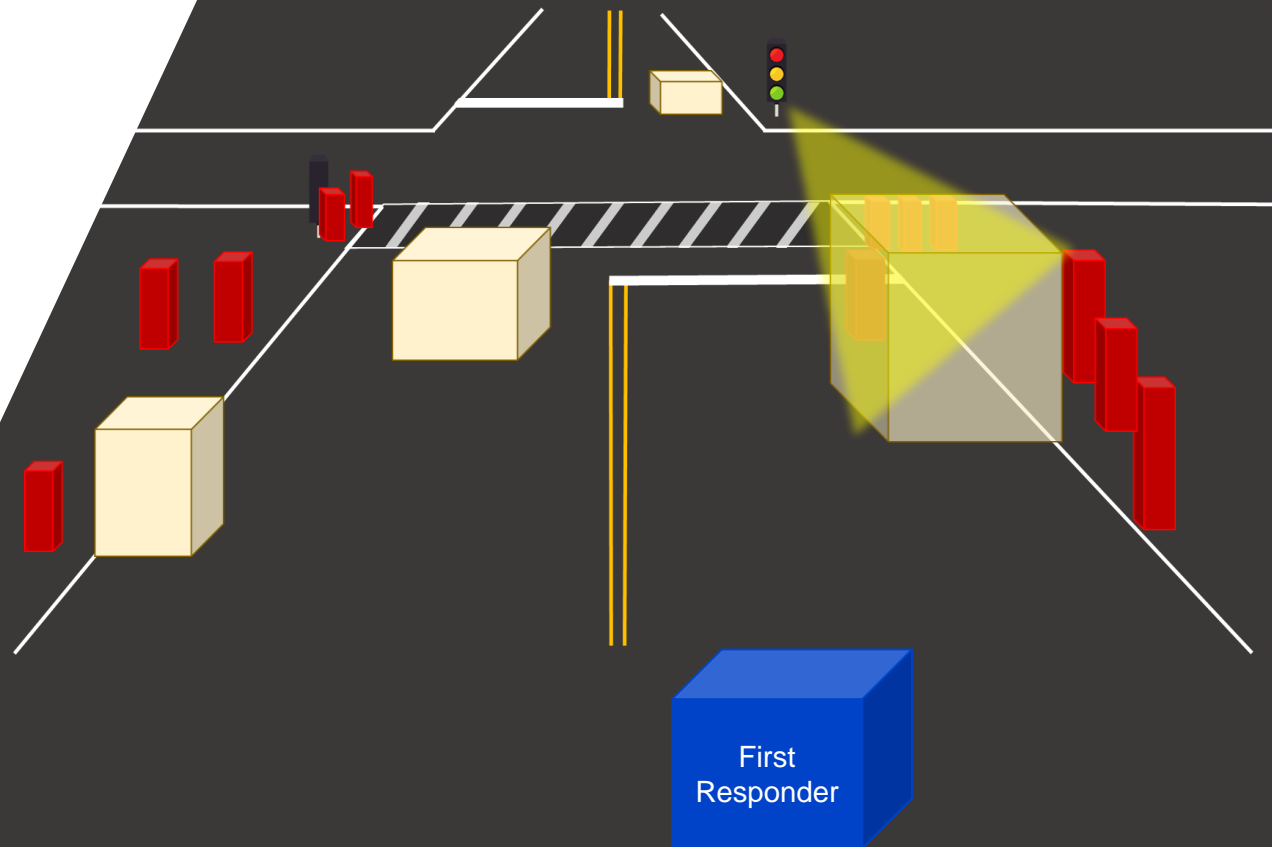
What about **infrastructure**?

## How can CDA help?

Leverages information from infrastructure and all connected roadway users to improve safety and mobility.

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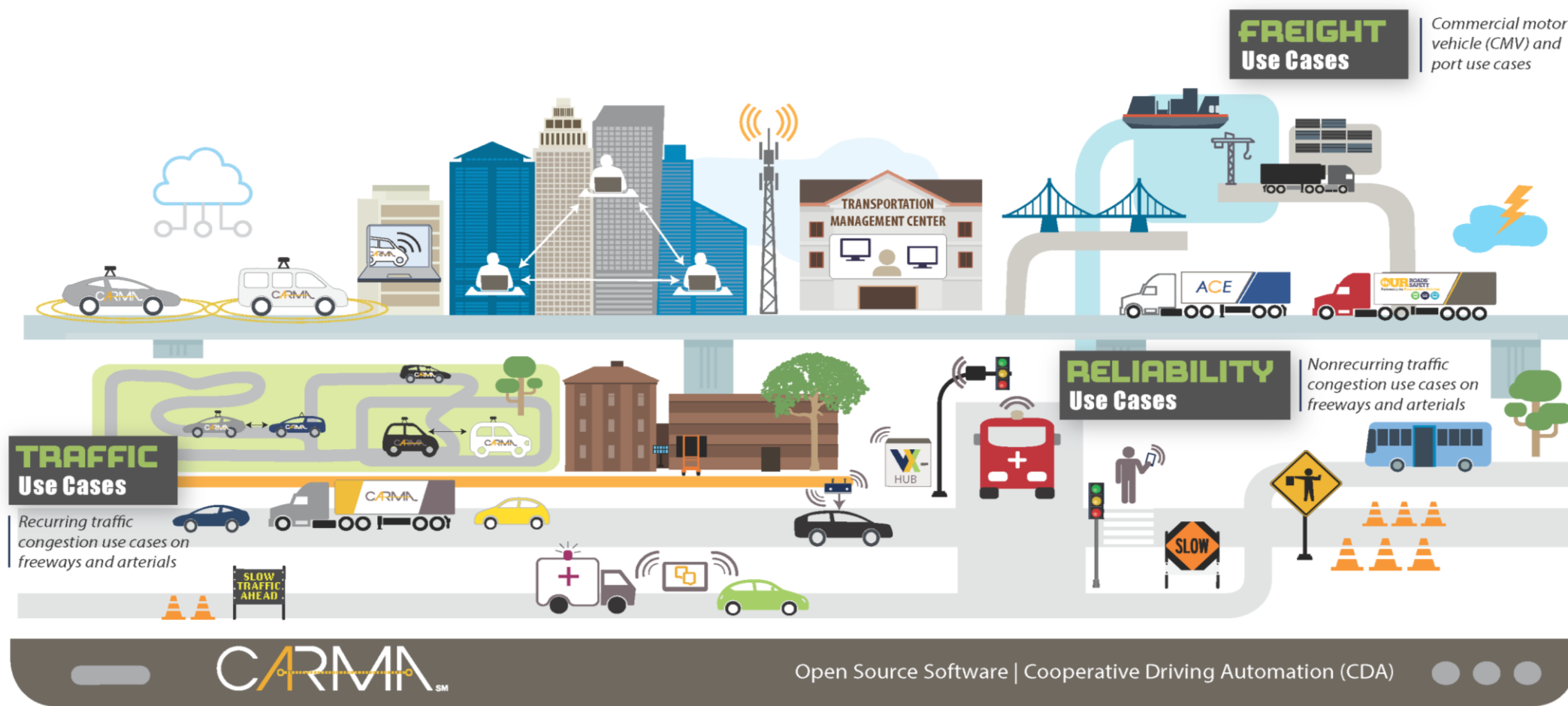
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# CARMA Ecosystem

A network of open source software (OSS) and support services focusing on how infrastructure can move traffic more efficiently by advancing Transportation Systems Management and Operations (TSMO) strategies.





SM

## CARMA Ecosystem

## PRODUCTS

- A CLOUD**  
Cloud-based management of transportation systems
- B PLATFORM**  
Vehicle automation platform for advancing CDA
- G MESSENGER**  
Connectivity added to non-automated vehicles
- D STREETS**  
Vehicle-to-infrastructure roadside platform

## EVALUATION

- F SIMULATION**  
CDA simulation and modeling
- F 1 TENTH**  
Scaled down test vehicles
- G TESTING**  
Test locations for CARMA and CDA partners

## ENGAGEMENT

- J COLLABORATIVE**  
Active community of users advancing CDA
- K SUPPORT**  
Support and knowledge sharing for implementers of the CARMA product suite



# CARMA<sup>SM</sup> Ecosystem: Use Cases



## TRAFFIC

Recurring traffic congestion use cases on freeways and arterials.

- Congestion.
- Transit.
- Traffic Signals.



## RELIABILITY

Nonrecurring traffic congestion use cases on freeways and arterials.

- Work Zones.
- Weather.
- Traffic Incident Management (TIM).



## FREIGHT

Commercial Motor Vehicle (CMV) and port use cases.

- Port Drayage.
- CMV.
- Truck Platooning.



# CARMA Ecosystem: Research Tracks



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Source: FHWA