

# Research Activities of the CAT Coalition IOO/OEM Forum

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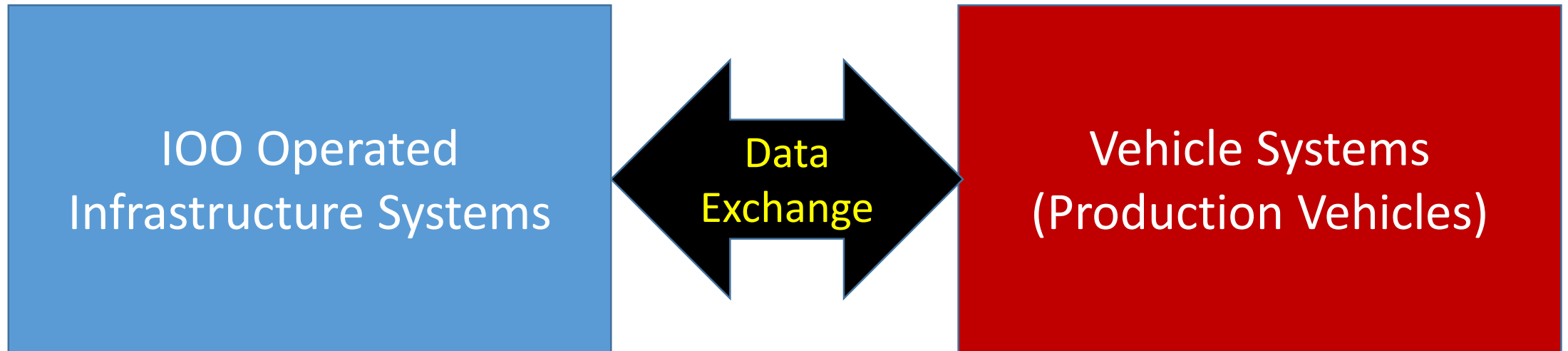
# Topics

- **Background on the IOO/OEM Forum**
- **Signalized Intersection (SPaT) Activities**
- **Work Zone Research Activities**
- **Next Steps**

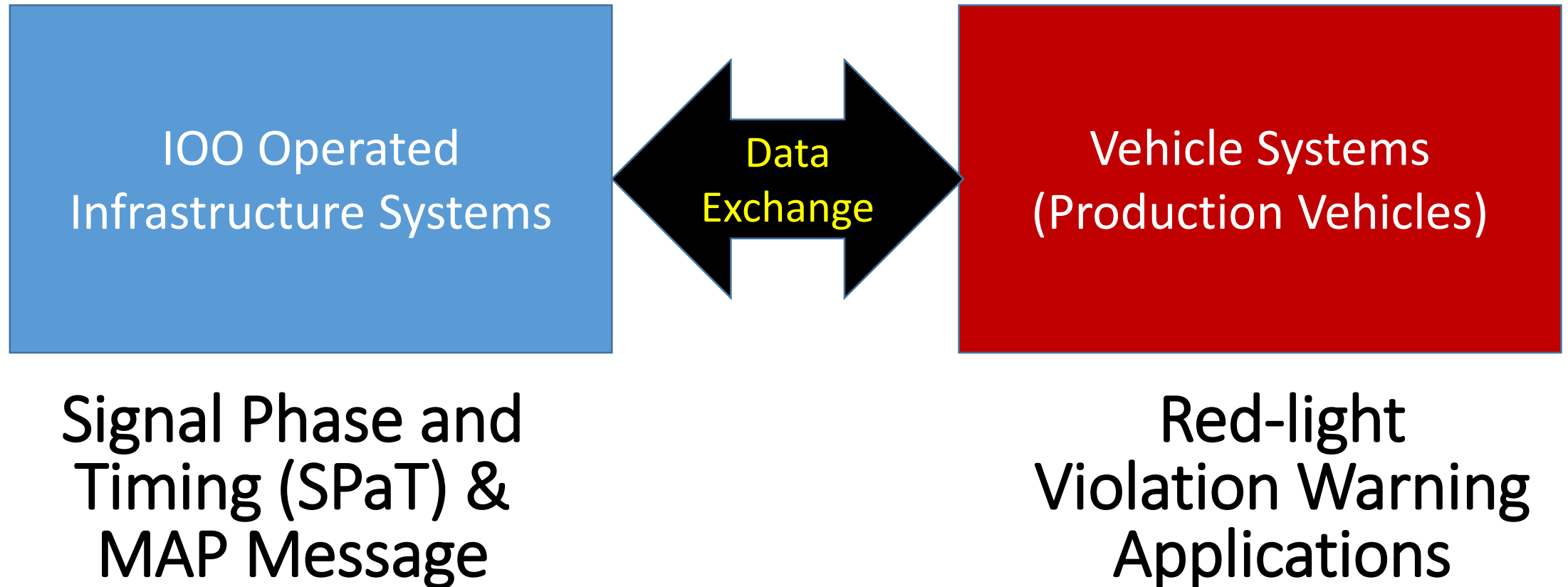
# Background on the IOO/OEM Forum

- Created to allow a small group of individuals representing both IOOs and OEMs to work on tasks and discuss the needed data exchanges between vehicles and the infrastructure.
- Initially met in late 2016 – with input from the CTSO (then STSMO) CAV working group during the August 2016 annual meeting
- Focus narrowed to three applications:
  - Red Light Violation Warning (using SPaT)
  - Reduced Speed Zone – Lane Closures (emphasis on work zones)
  - Connected Automation

# IOO/OEM Forum



# Signalized Intersections



# SPaT Message:

- From the Signal Controller
- Current Signal Status for each approach
- Expected time of next signal phase change
- Whether pedestrian cross walks are activated
- Others

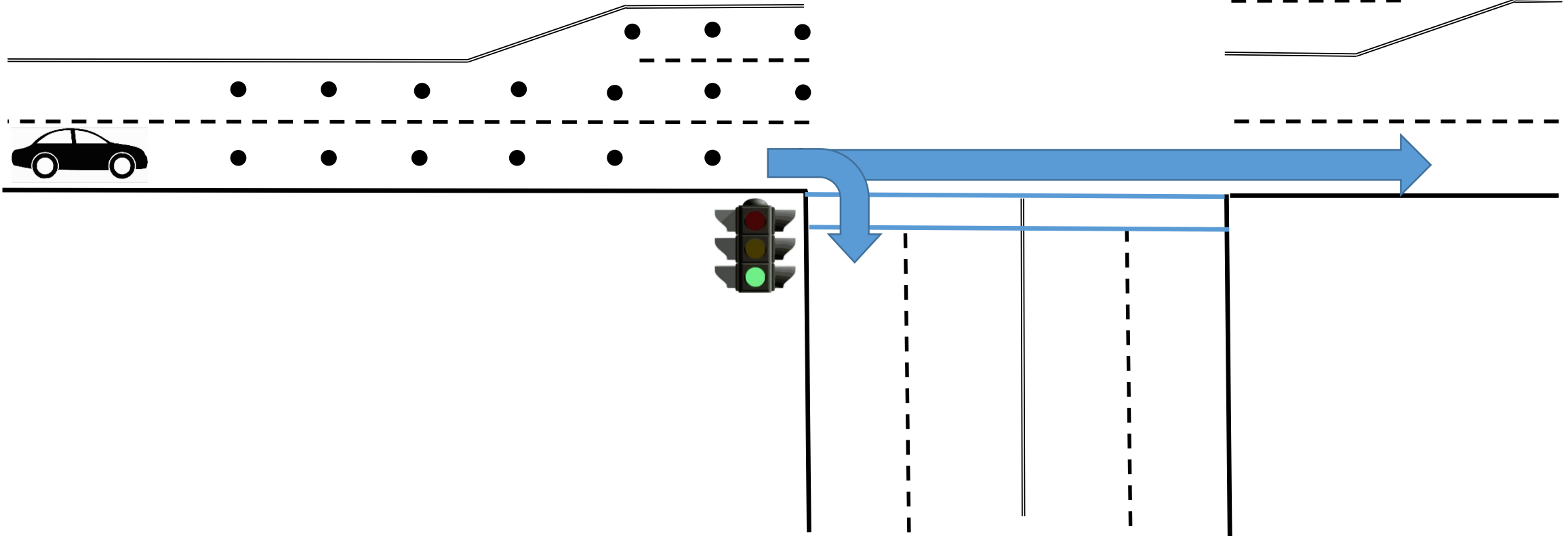


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# MAP Message:

- Details of all lanes
- Nodes (lat/long) of all approaches
- Crosswalks
- Connections from Ingress to Egress



# The Business Side of Signalized Intersection Broadcasts

- Approach to creating the geographic description (MAP message)
- Costs of integrating with the signal controller
- Cost of updating MAP message as geometries change
- Cost of validating the accuracy of data & uptime
- Cost of Securing the data

*Fully understanding the steps and costs will allow DOTs to predict the extent to which they can provide “CAT Ready” Signalized Intersection Broadcasts*



# Signalized Intersections

IOO Operated  
Infrastructure System

SPaT/MAP  
Data

IOO/OEM Forum Resources:

- SPaT infrastructure System Model ConOps
- SPaT Challenge Verification Document
- CCI Document

Systems  
(on Vehicles)

W  
op

# Clarifications for Consistent Implementation (CCI)

- There is inherent and intended flexibility in the standards and system architecture documents that V2I data exchanges are based on.
- IOOs want to deploy intersection systems that successfully communicate with every production vehicle that is eventually equipped with on-board units
- OEMs want their production vehicles to be interoperable and successfully receive application-specific messages from every signalized intersection that is broadcasting
- ***IOOs and OEMs must agree on concise interpretations and clarifications on known ambiguities that might prevent national interoperability for V2I data exchange.***

# Clarifications for Consistent Implementations (CCIs) Connected Signalized Intersections

## Communications Agnostic

- **Some ambiguity clarifications will benefit all Signalized Intersection V2I systems:**
  - *DSRC Roadside communications*
  - *Cellular V2X Roadside communications*
  - *Internet / signal controller data outputs of SPaT/MAP*
- **Some clarifications are specific to RLVW & DSRC**
- **Placeholders for other communications specific clarifications**

**Cooperative Automated Transportation  
Clarifications for Consistent Implementations (CCIs)**

To Ensure National Interoperability

**Connected Signalized Intersections**

DRAFT Version 1.9.1

April 2019

# Clarifications for Consistent Implementations (CCIs) Connected Signalized Intersections

## Document Update

- **3 states have compared the CCI with their deployments**
- **Working with CV Pilot Sites for their input on the clarifications**
- **Planning an updated version for wider circulation this fall**

**Cooperative Automated Transportation  
Clarifications for Consistent Implementations (CCIs)**

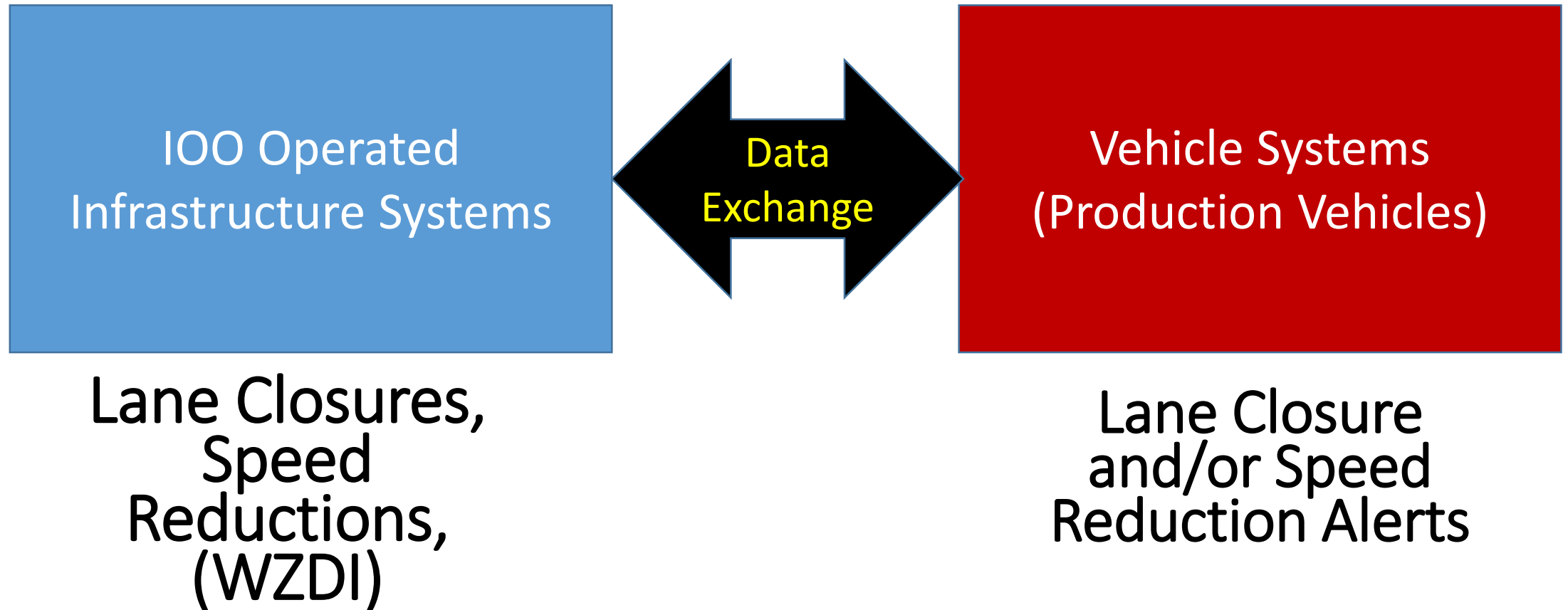
To Ensure National Interoperability

**Connected Signalized Intersections**

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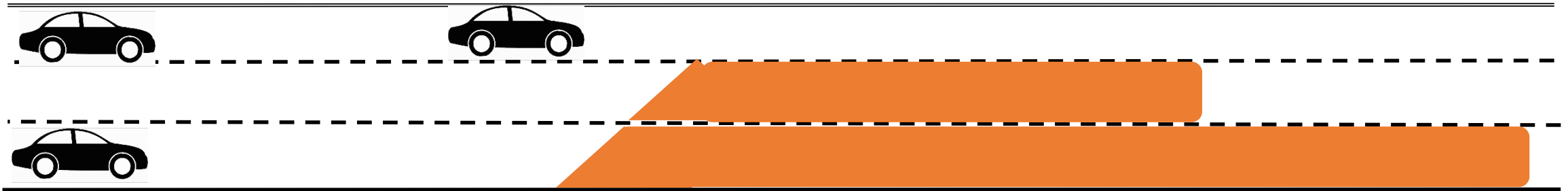
# Reduced Speed Zone Warning (RSZW) (Work Zones)



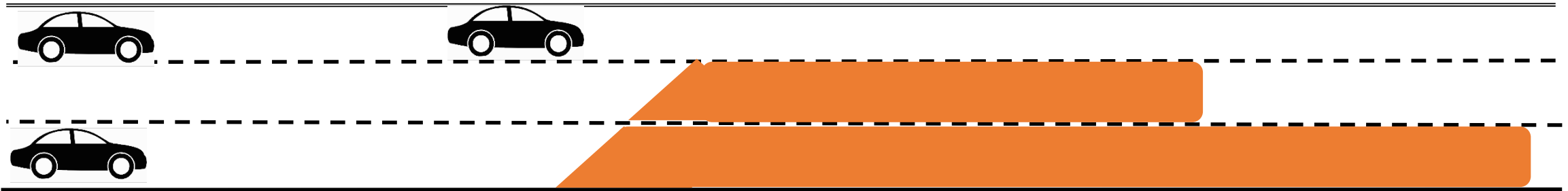
# High and Low Fidelity Work Zone Data

- **High Fidelity:** Detailed, lane specific data describing each lane through the zone.
- **Low Fidelity:** Higher level (not lane specific), intended to identify start of the zone, end of zone, etc.

# Work Zone Data



# Work Zone Data



## Roadside Safety Message

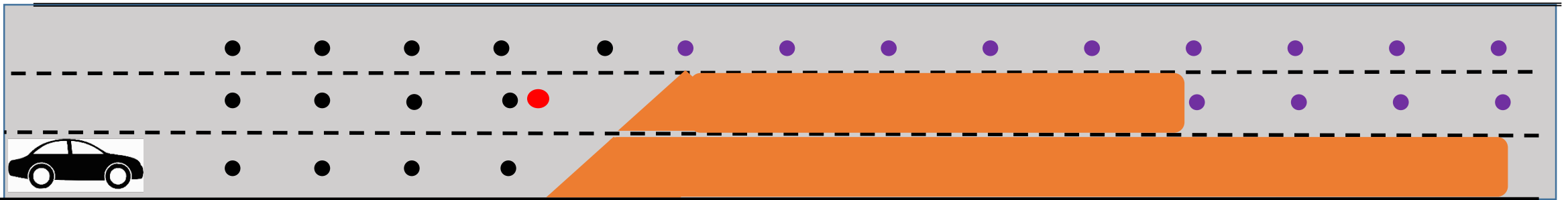
Location Details, Speed Reductions,  
Lane closures, etc.



# Work Zone Data

## Work Zone Description:

- Reference Point – Work Zone start
- Approach Nodes
- Work Zone Nodes



# The Business Side of Work Zone Data

- Approach to creating the data (manual vs. automated)
- Costs of creating and coding the Roadside Safety Message (with detailed location description)
- Cost of updating as Work Zone activities change
- Cost of validating the accuracy of data
- Cost of Securing the data

***Fully understanding the steps and costs of providing “CAT Ready” work zone data will allow DOTs to predict the extent to which they can support work zone broadcasts***

# Reduced Speed Zone Warning (RSZW) (Work Zones)

## Resources:

- RSZW-LC Model ConOps
- Map Software Toolchain
- Intent is to develop a CCI document

IOO Operated  
Infrastructure System

Lane Closures,  
Speed  
Reductions,  
(WZDI)

Vehicle Systems  
(Production Vehicles)

RSZW – Lane  
Closure  
Applications

# RSZW-LC Model ConOps

- Information to support IOOs considering deploying Work Zone Infrastructure Systems
- Flexible communication approaches given latency demands and settings
  - DSRC, including portable units
  - Cloud-based & cellular solutions (e.g. C-V2X)

Infrastructure System to Support the  
Reduced Speed Zone Warning – Lane Closure Application  
Model Concept of Operations

Version 2.2

May 2019

Prepared by:

IOO/OEM Working Group of the Cooperative Automated Transportation Coalition

# Work Zone MAP Software Toolchain

- Method for assembling the High Fidelity MAP data quickly and with minimal effort
- CAMP has developed the software
  - Testing in Michigan, Texas, and Arizona
- Goal of this group is to encourage testing and feedback from others
  - Planning a CAT Coalition webinar to introduce the toolchain
    - Background
    - High Fidelity vs. Low Fidelity Mapping Data
    - How to use the toolchain
    - Relationship to the WZDI
    - Others

# Recap & Next Steps

- SPaT Resources Available
  - SPaT Challenge portion of the CAT Coalition website
- Work Zone (RSZW) Resources Available:
  - Resources & IOO/OEM Forum portion of the CAT Coalition website
  - Work Zone software toolchain to be posted for download soon
  - Lessons learned document in development
- Work Zone Software Toolchain Webinar:
  - This Fall – after the software is available for download

Questions?