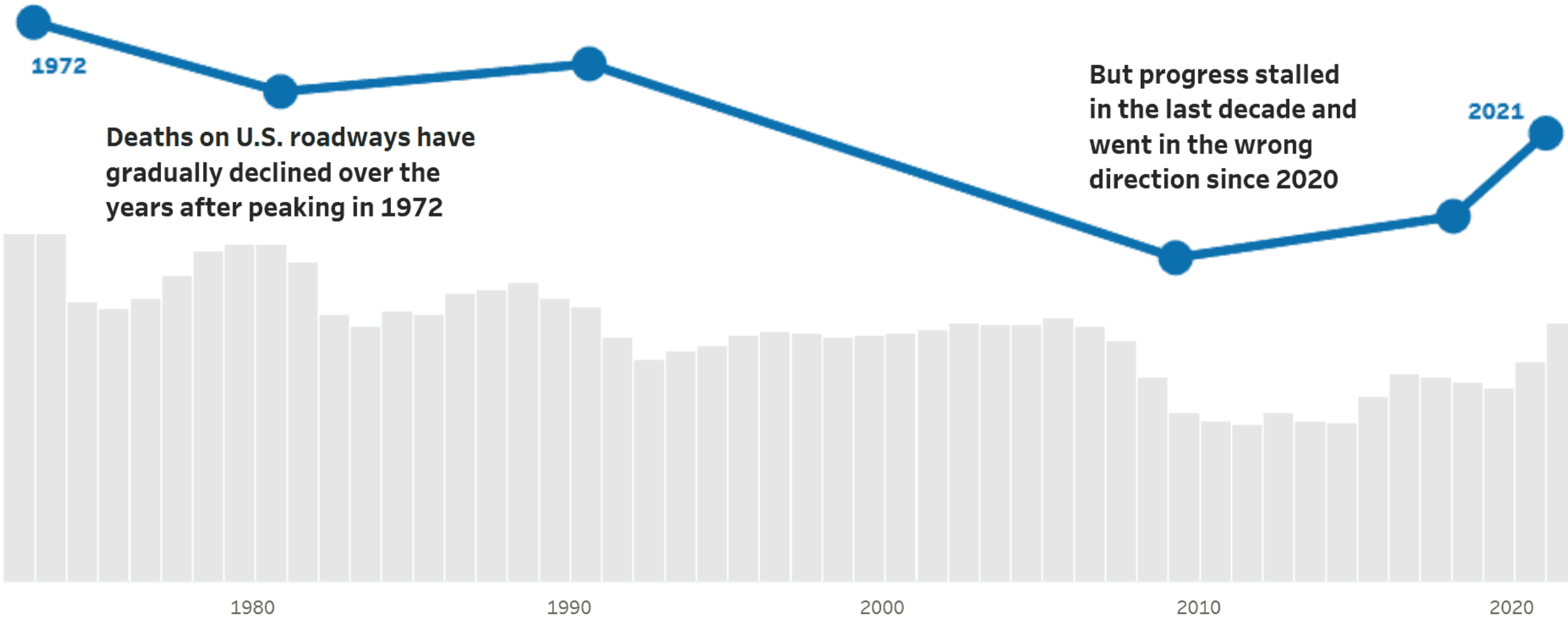
Addressing Roadway Safety

through Vehicle-to-Everything Technology and Artificial Intelligence

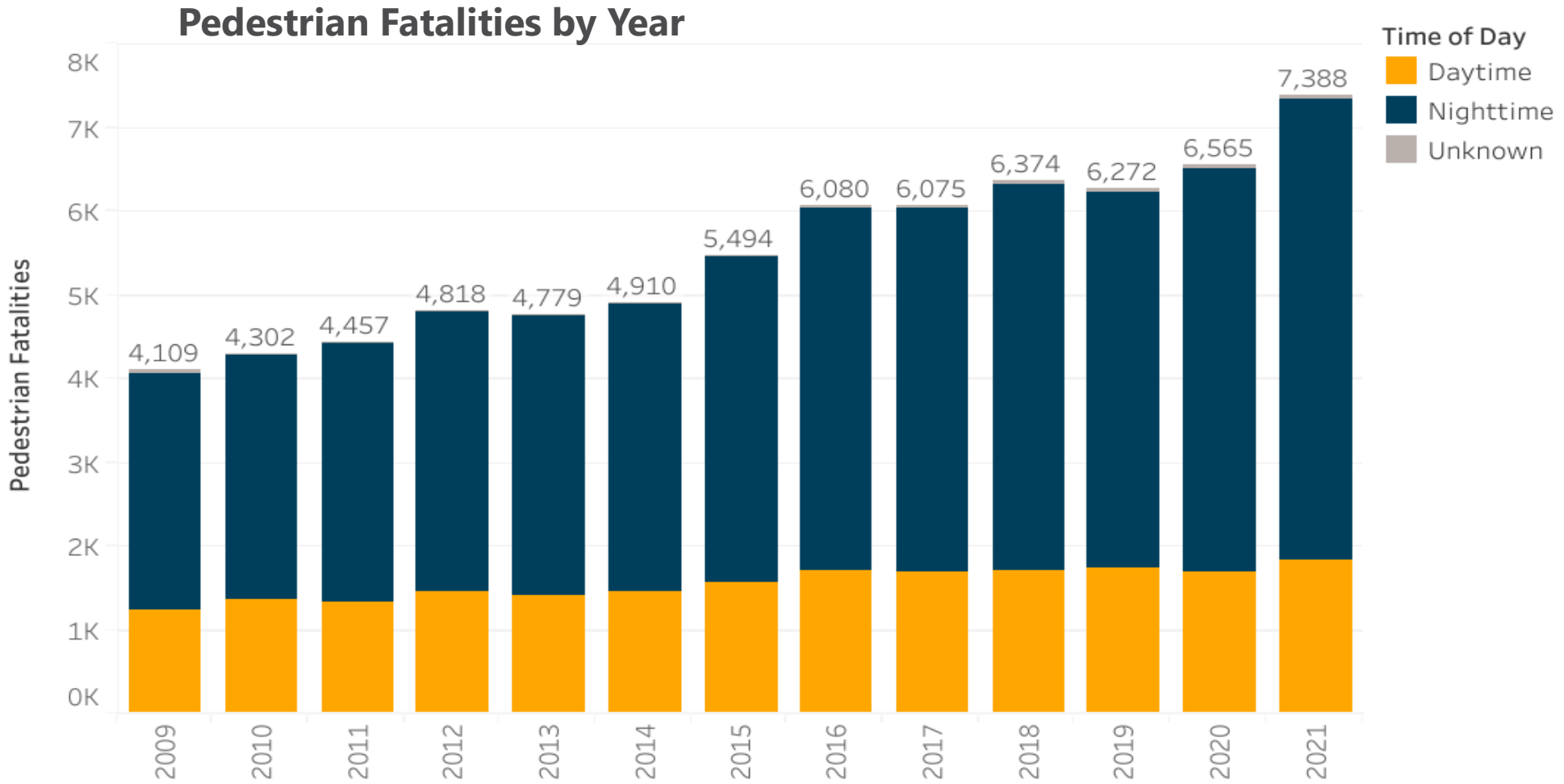
presented by:
Brian Cronin, Director:

U.S. Department of Transportation
Intelligent Transportation Systems Joint Program Office

A National Problem



Vulnerable Road User Crashes Increasing Significantly



(Source: NHTSA Fatality Analysis Reporting System (FARS))

Intelligent Transportation Systems and the Safe System Approach

ITS and Safe Road Users

- Bike & Pedestrian Safety Systems
  - Rectangular Rapid Flashing Beacon - ***PSC**
  - Leading Pedestrian Interval - ***PSC**
  - Pedestrian Hybrid Beacon - ***PSC**

***PSC**=Proven Safety Countermeasure

Source: Federal Highway Administration

ITS and Post-Crash Care

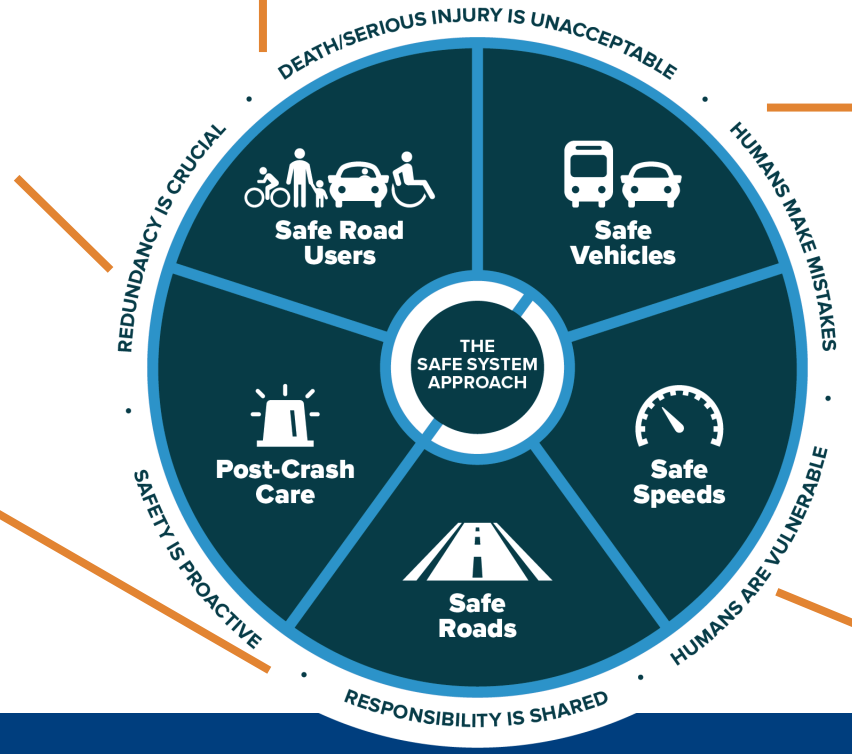
- Traffic Incident Management (TIM)
- Emergency Vehicle Preemption
- UAS for Crash Reconstruction

ITS and Safe Vehicles

- Connected Vehicles (CV)
- Advanced Driver Assistance Systems (ADAS)
- Automated Vehicles (AV)

ITS and Safe Roads

- Active Traffic Management (ATM)
- Smart Work Zone Technologies
- Road Geometry Warnings
- Highway-Rail Crossing Safety Systems
- Intersection Collision Warning Systems
- Road Weather Warning Systems
- Wrong Way Driving Warning Systems



ITS and Safe Speeds

- Speed Safety Cameras - ***PSC**
- Variable Speed Limits - ***PSC**
- Curve Speed Warnings
- Reduced Speed Warnings
- Automated Work Zone Speed Enforcement

Intelligent Transportation Systems and the Safe System Approach (1)

ITS and Safe Road Users

- Bike & Pedestrian Safety Systems

ITS and Post-Crash Care

- Traffic Incident Management (TIM)
- Emergency Vehicle Preemption
- UAS for Crash Reconstruction

ITS and Safe Vehicles

- Connected Vehicles (CV)
- Advanced Driver Assistance Systems (ADAS)
- Automated Vehicles (AV)

ITS and Safe Roads

- Active Traffic Management (ATM)
- Smart Work Zone Technologies
- Intersection Collision Warning Systems
- Road Weather Warning Systems

ITS and Safe Speeds

- Speed Safety Cameras
- Variable Speed Limits
- Automated Work Zone Speed Enforcement

Intelligent Transportation Systems and the Safe System Approach (2)

- ITS and Safe Vehicles
- ITS and Safe Speeds
- ITS and Safe Roads
- ITS and Post-Crash Care
- ITS and Safe People

(Source: What Is a Safe System Approach? | US Department of Transportation)

What Is V2X?

- Vehicle-to-everything (V2X) technology enables vehicles to communicate with each other, with other road users such as pedestrians and cyclists, and with roadside infrastructure.
- V2X is a powerful tool for reducing the number of deaths and serious injuries on our nation's roadways to the only acceptable number: zero.

What Are the Benefits of V2X?

Safety

Mobility

Environment

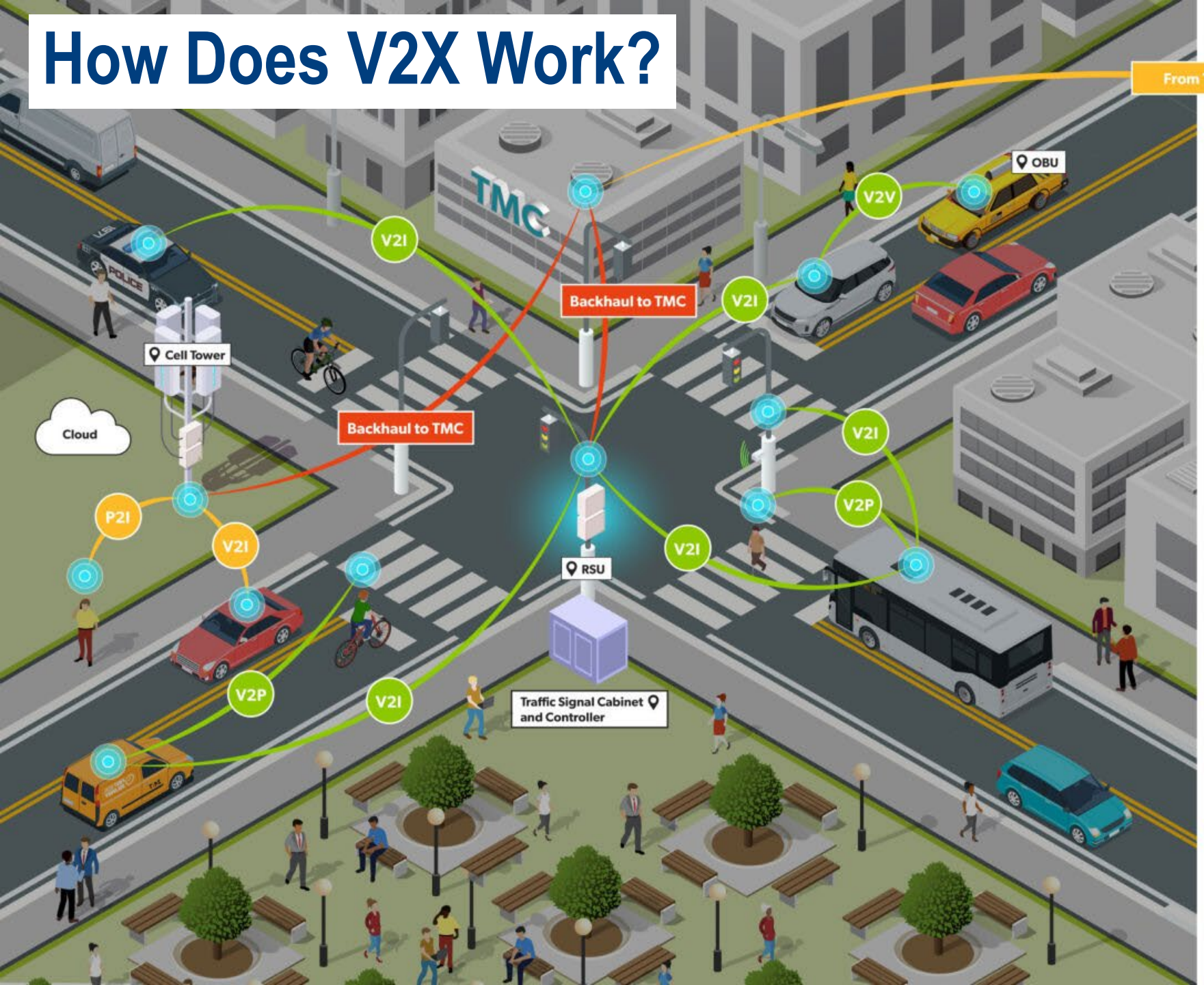
"Not only does V2X technology save lives, but it also enhances mobility, bolsters efficiency, and reduces negative environmental impacts."

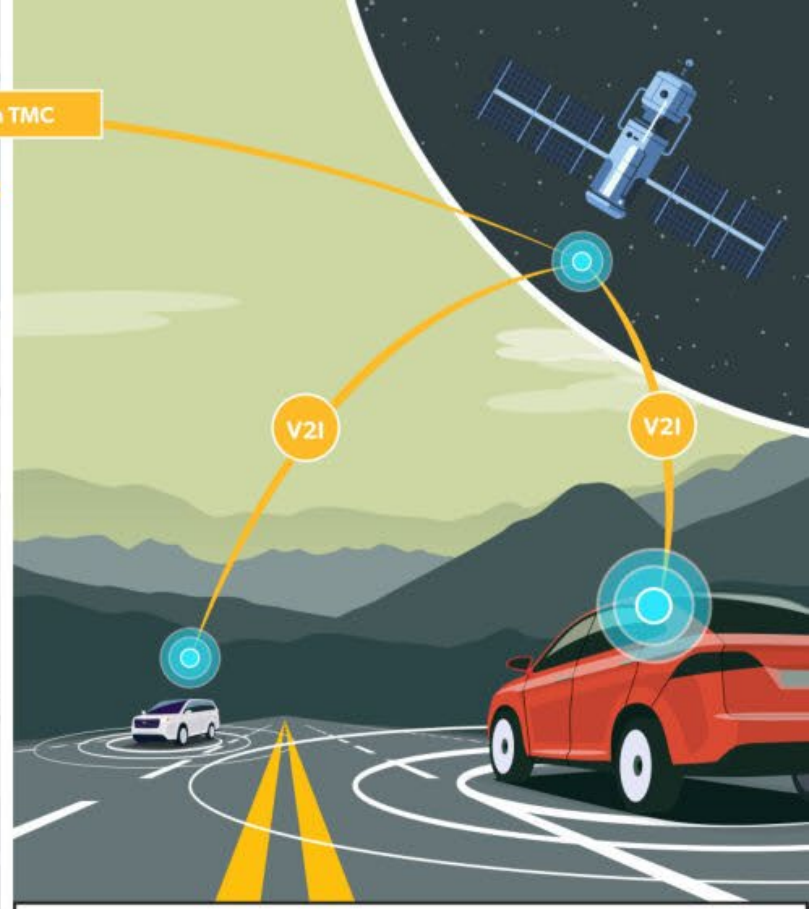
– *Draft National V2X Deployment Plan*

How Does V2X Work?

Secure wireless technologies such as satellite, broadcast, or cellular communications enable cars, trucks, buses, and other vehicles to “talk” to each other, mobile devices, traffic signals, and other types of infrastructure.

How Does V2X Work?





V2X Communication Using the 5.9 GHz Safety Band (e.g., LTE-V2X Sidelink)

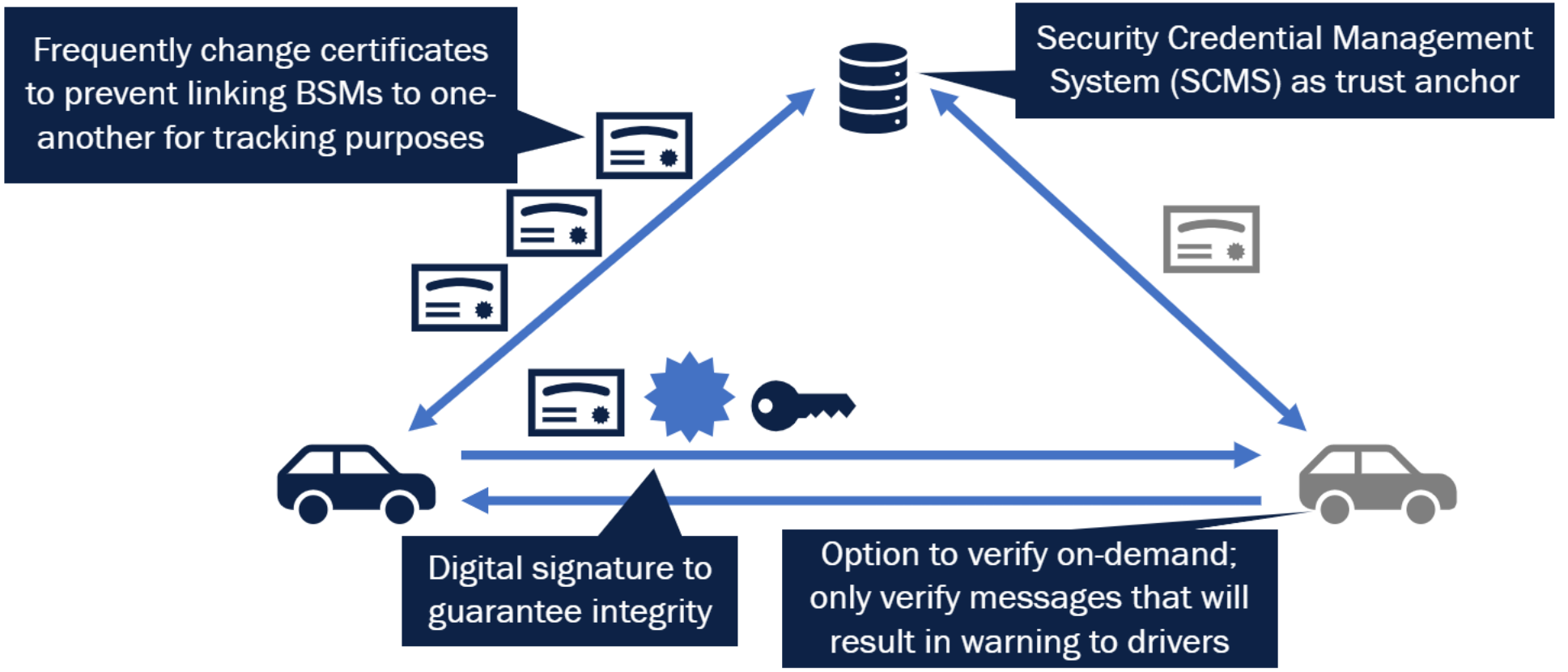
V2X Communication Outside the 5.9 GHz Safety Band (e.g., LTE Uu Link, Satellite)

Backhaul to TMC

Abbreviations:

V2X - Vehicle-to-Everything
V2V - Vehicle-to-Vehicle
V2P - Vehicle-to-Pedestrian/Bicyclist
V2I - Vehicle-to-Infrastructure
P2I - Pedestrian-to-Infrastructure
RSU - Roadside Unit
OBU - Vehicle On-board Unit
TMC - Traffic Management Center
LTE - Long-Term Evolution

Security Credential Management System



Real World Deployment:
School Bus Safety in Georgia

The Fulton County School System and its partners equipped two school buses with cellular V2X technology giving them priority at signalized intersections on their routes.

Source: Applied Information

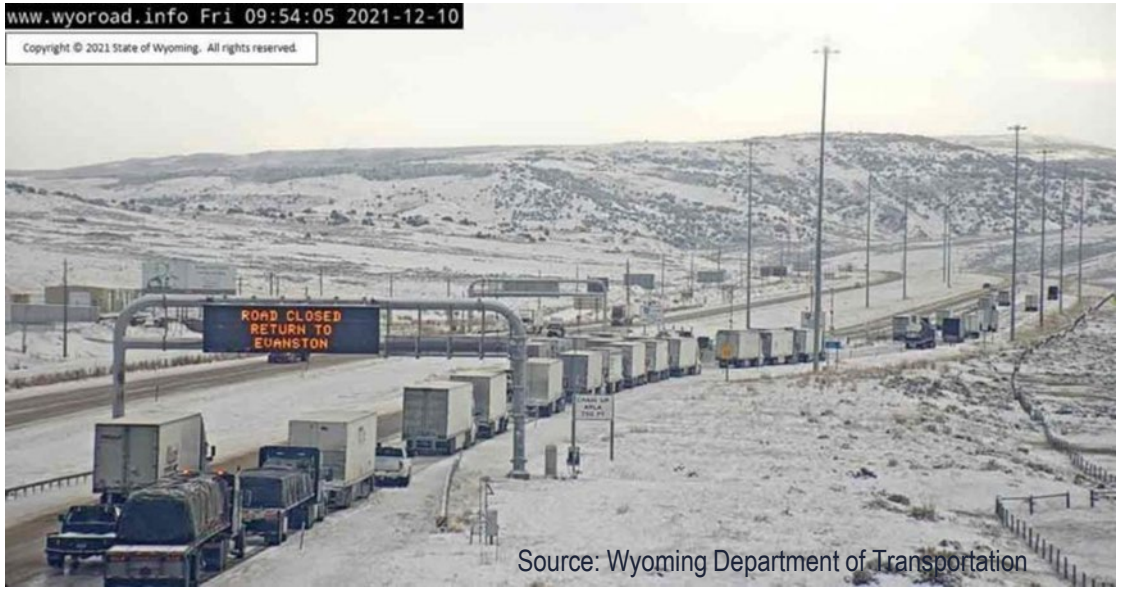
Results

- Buses arrived on time more frequently (13.3% decrease in travel time), giving students time to eat breakfast before class.
- With fewer unscheduled stops, students were less likely to stand up and engage in unsafe behavior on the bus.
- Fuel economy improved, reducing harmful emissions.

https://www.itskrs.its.dot.gov/2023-b01804

Real World Deployment:
Data Exchange in Wyoming

The Wyoming Department of Transportation ingests road closure information from their counties and provides centralized data feed for third parties to consume for statewide closure information.



Source: Wyoming Department of Transportation

Results

- Accurate road closure data is now provided to motorists using 3rd party navigation apps, including potentially lifesaving road closure notifications in severe winter weather.
- The technology improves safety and facilitates the efficient movement of freight through the state's heavily traveled I-80 corridor.

Real World Deployment:
TSP Equipped Snowplows in Utah

The Utah Department of Transportation equipped snowplows to receive traffic signal priority in five V2X-equipped corridors in the Salt Lake City area.

Source: Utah Department of Transportation

Results

- Roadway crash rates decreased on V2X-equipped roads (-3.87 per million vehicle miles traveled) compared to non-equipped roads.
- Roadway crash severity decreased compared to non-equipped roads.
- Snowplows stopped fewer times, improving efficiency of operations.

https://www.itskrs.its.dot.gov/2023-b01752

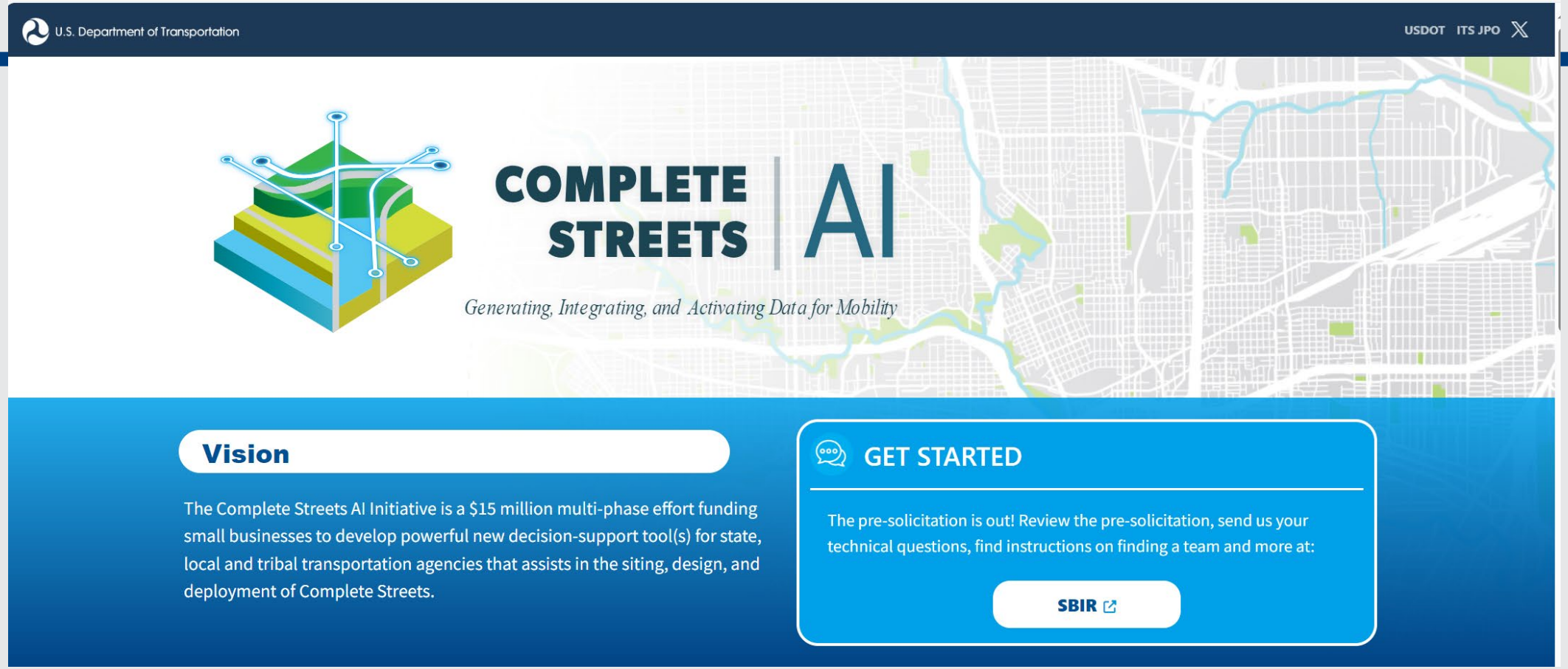
An Open-Source Success Story:
CDA SunTrax Testing and Collaboration

Video Credit: Federal Highway Administration

The Artificial Intelligence (AI) Executive Order advances an urgent and coordinated, Federal Government-wide approach to development and use of safe, secure, and trustworthy AI

Safe, Secure, Trustworthy

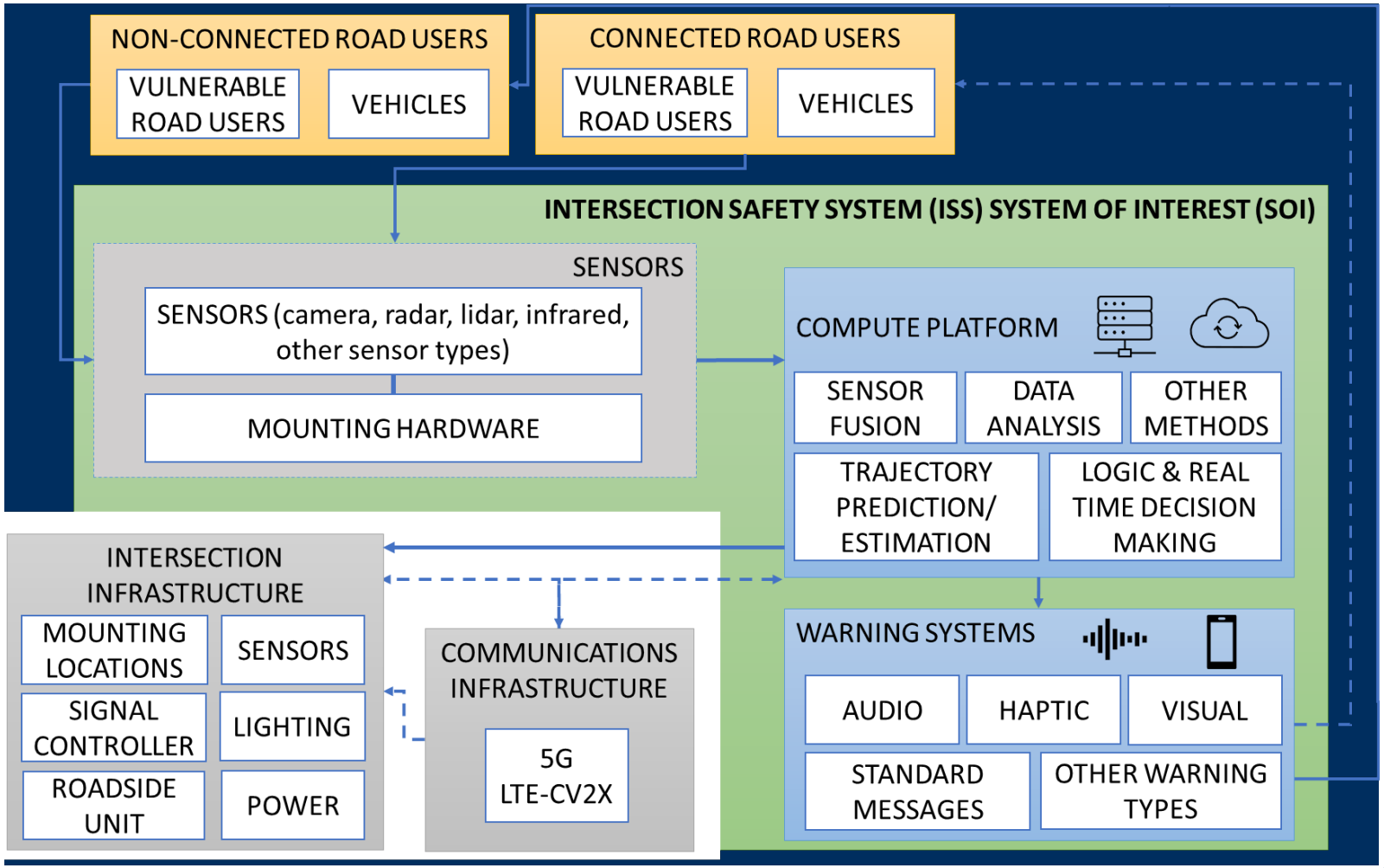
AI and Complete Streets



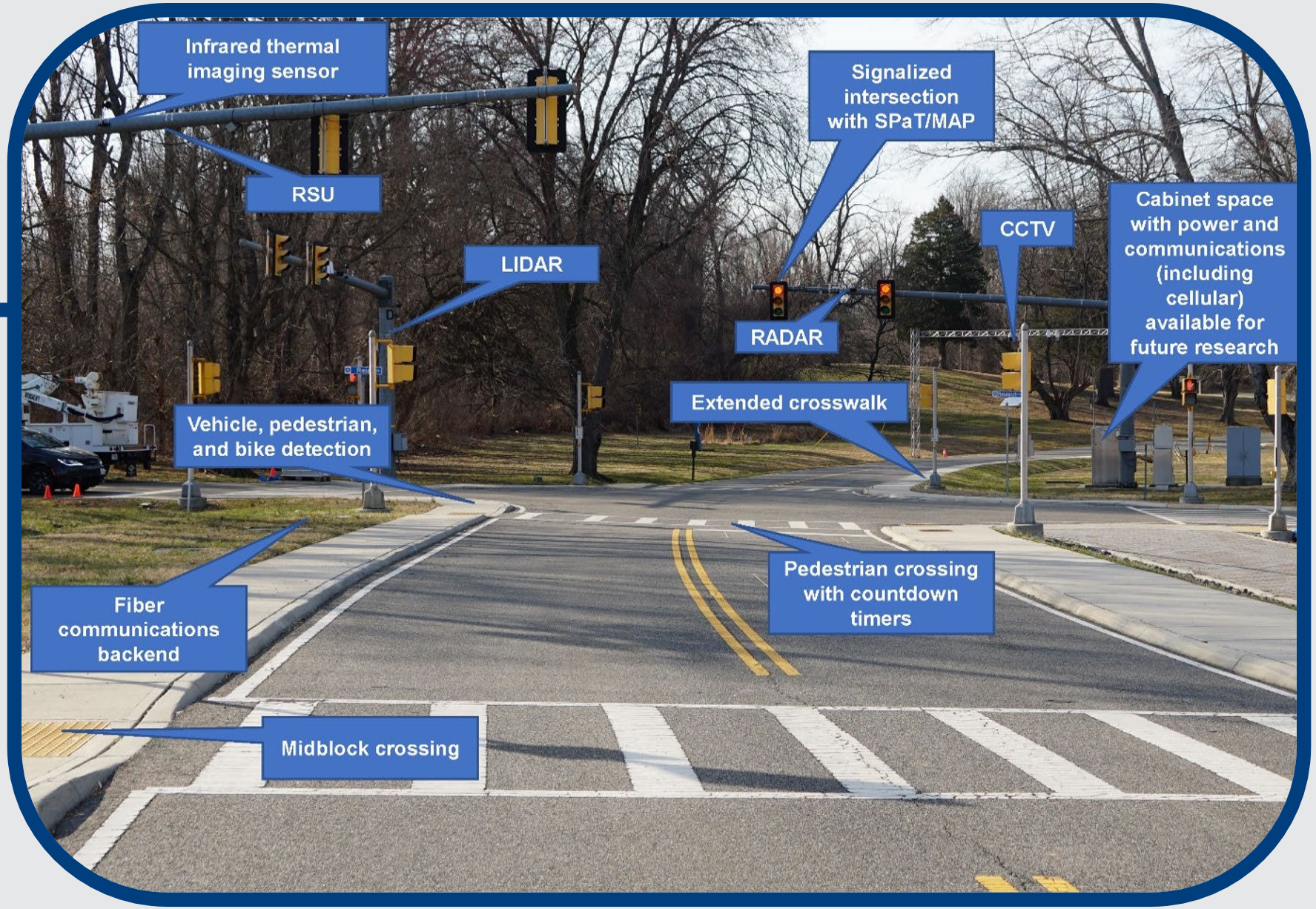
Video Credit: Federal Highway Administration

Intersection Safety System

Legend:
Required flow
Optional flow

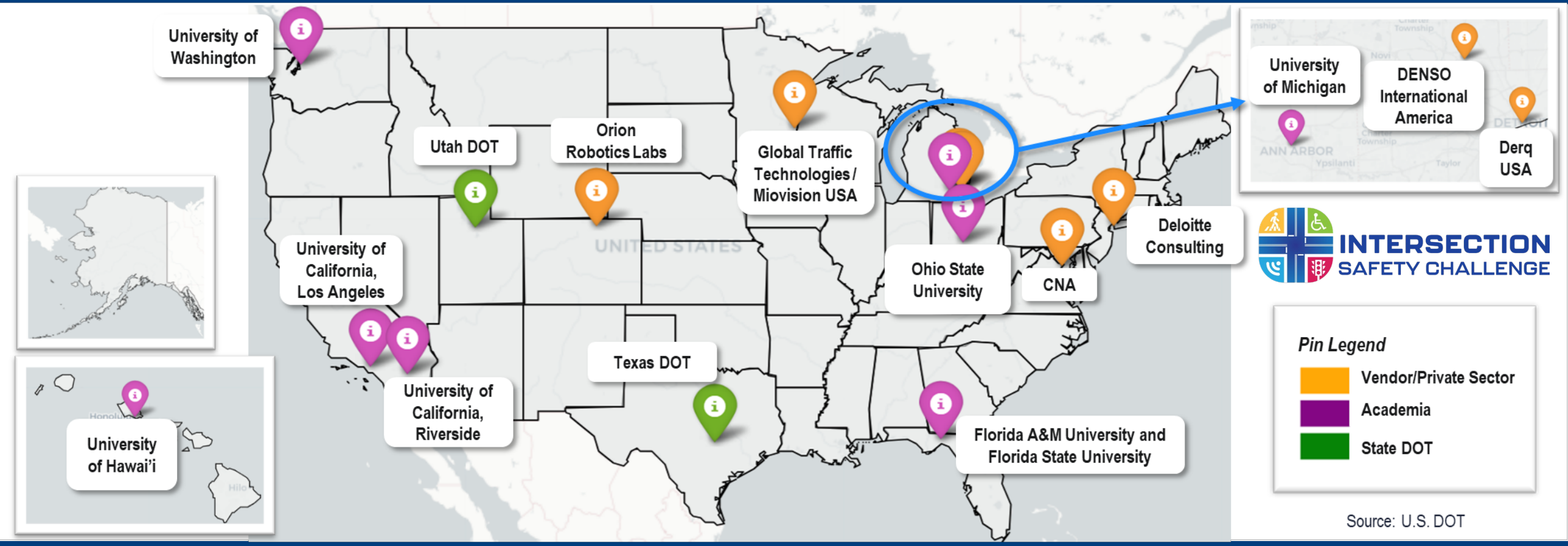


Sensor Fusion



Intersection Safety Challenge Stage 1A Winners*

** Names represent Concept Paper submission Lead Entities that may be part of a larger team*



Contact Information

Brian Cronin

Director,
Intelligent Transportation Systems
Joint Program Office

Brian.Cronin@dot.gov

Source: USDOT

Disclaimer

The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear in this presentation only because they are considered essential to the objective of the presentation. They are included for informational purposes only and are not intended to reflect a preference, approval, or endorsement of any one product or entity.