



*UNITED STATES*  
**DEPARTMENT OF TRANSPORTATION**

# **Next Generation Mobility Management in Connected Vehicle Environment**

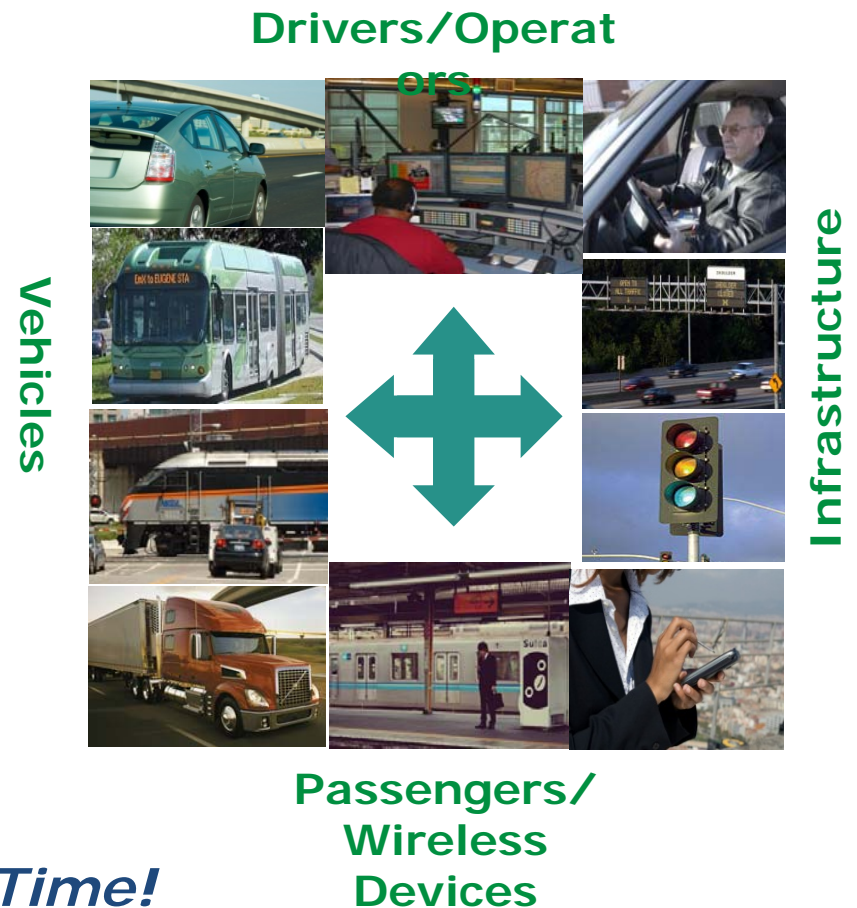
**2012 National Rural ITS Conference**  
September 19, 2012

**Yehuda Gross**  
USDOT ITS Joint Program Office

**Gwo-Wei Torng**  
Noblis, Inc.

# Connected Vehicle Research

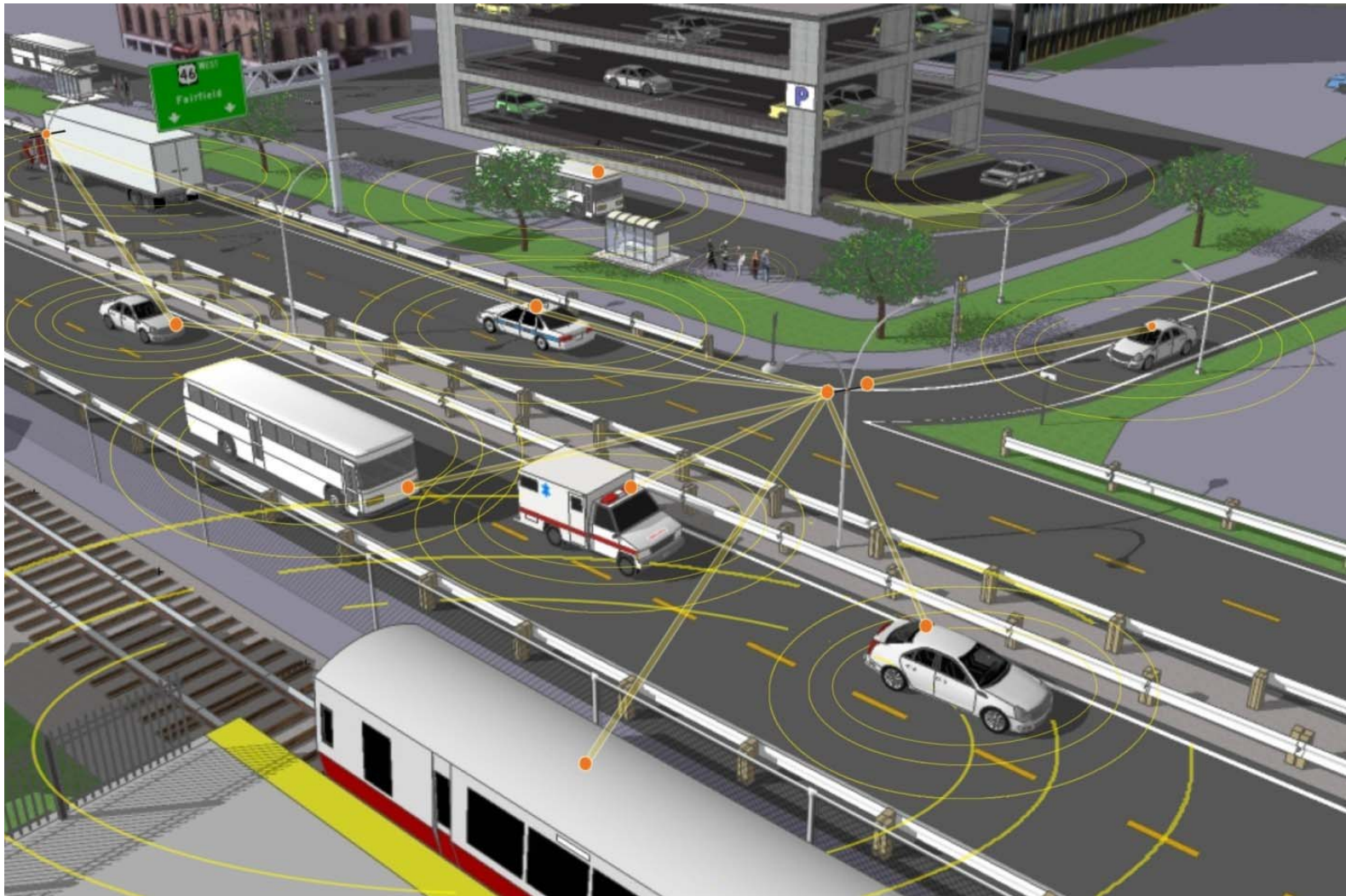
- Connected Vehicle is a suite of technologies and applications that use wireless communications to provide **connectivity**:
  - Among vehicles of all types
  - Between vehicles and roadway infrastructure
  - Among vehicles, infrastructure and wireless consumer devices



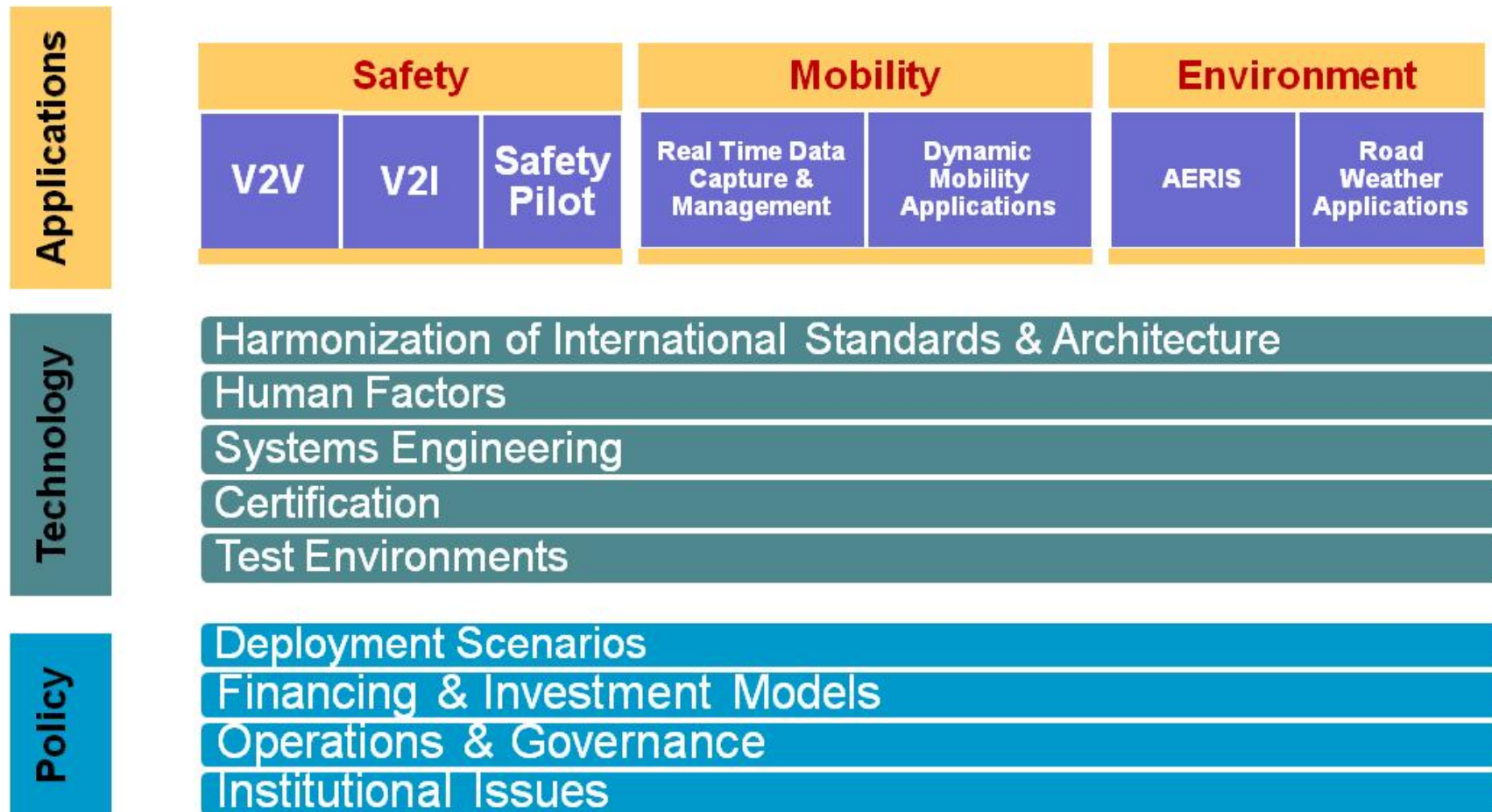
**All Roads, All Modes, All The Time!**

# *Connected Environment*

---



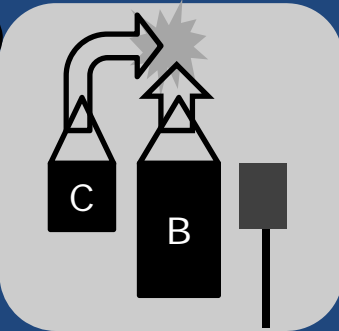
# Connected Vehicle Program Structure





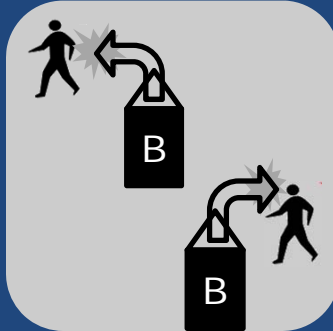
# High Priority Transit Safety Scenarios

1



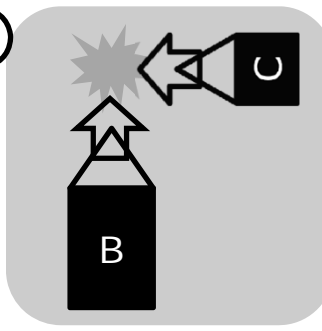
**Right-Turn-In-Front  
Crash (V2V)**

2



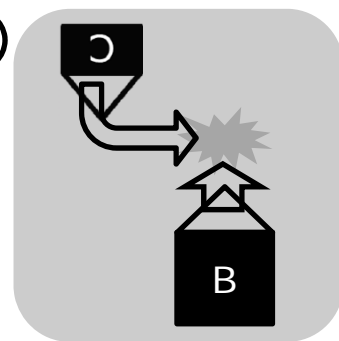
**Pedestrian vs. Turning  
Bus Crash (V2I)**

3



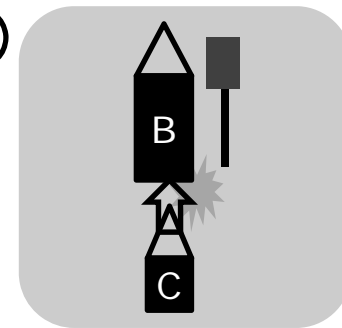
**Bus Angle Crash  
At Intersection**

4



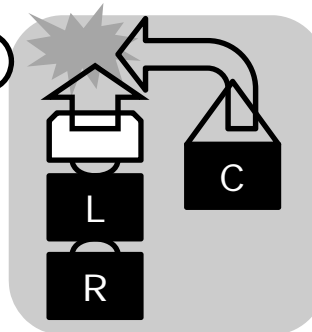
**Left-Turn Head-On  
Crash**

5



**Rear-End Crash  
At Stop/Intersection**

6



**Left-Turn Crash At  
Light Rail Grade Crossing**



# ***Pedestrian vs. Turning Bus Crashes***

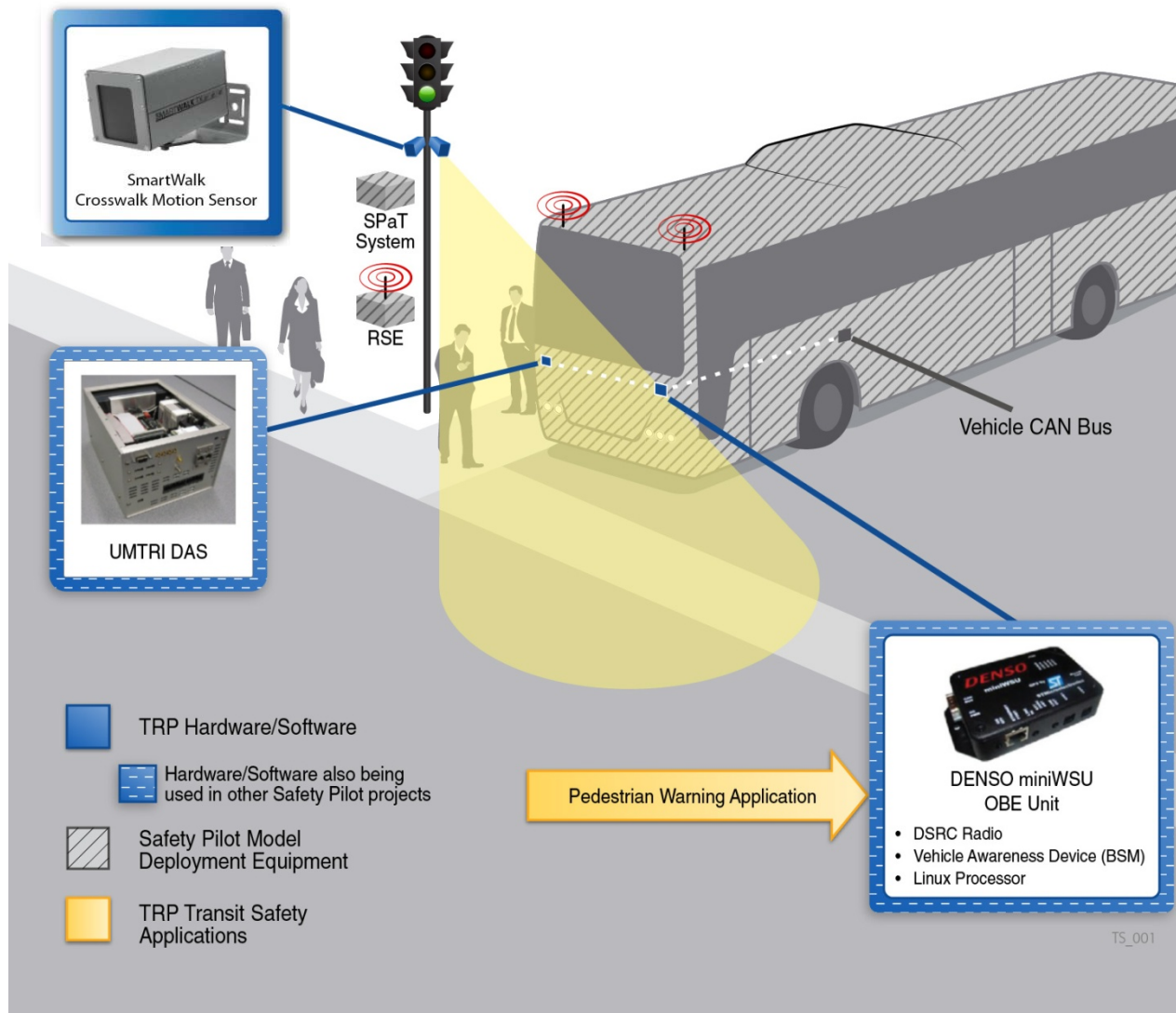
---

A pedestrian is crossing the street as the bus is making a turn

- Challenging scenario due to fact that pedestrians not equipped with safety awareness devices and so are difficult to detect
- Application will have to rely on infrastructure input as a proxy for actual pedestrian movement – **a V2I Application**

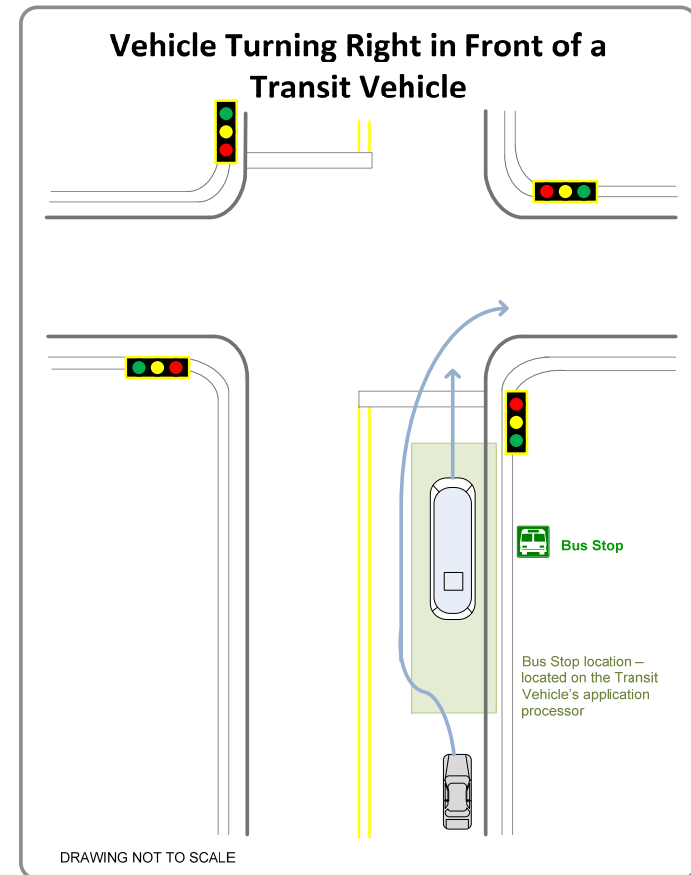


# *Design Illustration of Pedestrian vs. Turning Bus Safety Application*



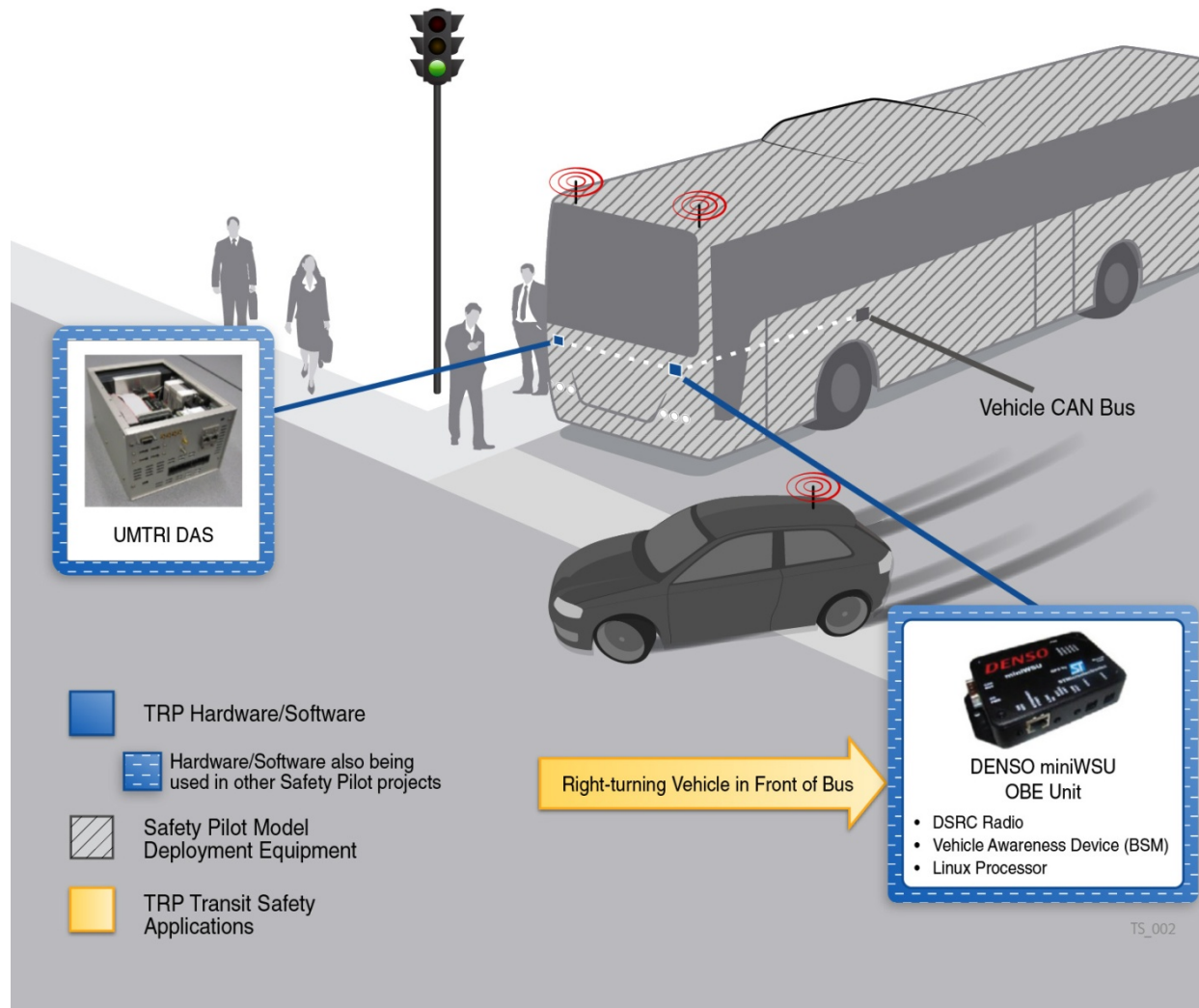
# *Right-Turn-In-Front Crashes*

A motor vehicle turns right in front of the transit vehicle as it starts from a bus stop located in front of an intersection – a V2V application





# Design Illustration of Right-Turn-In-Front Safety Application



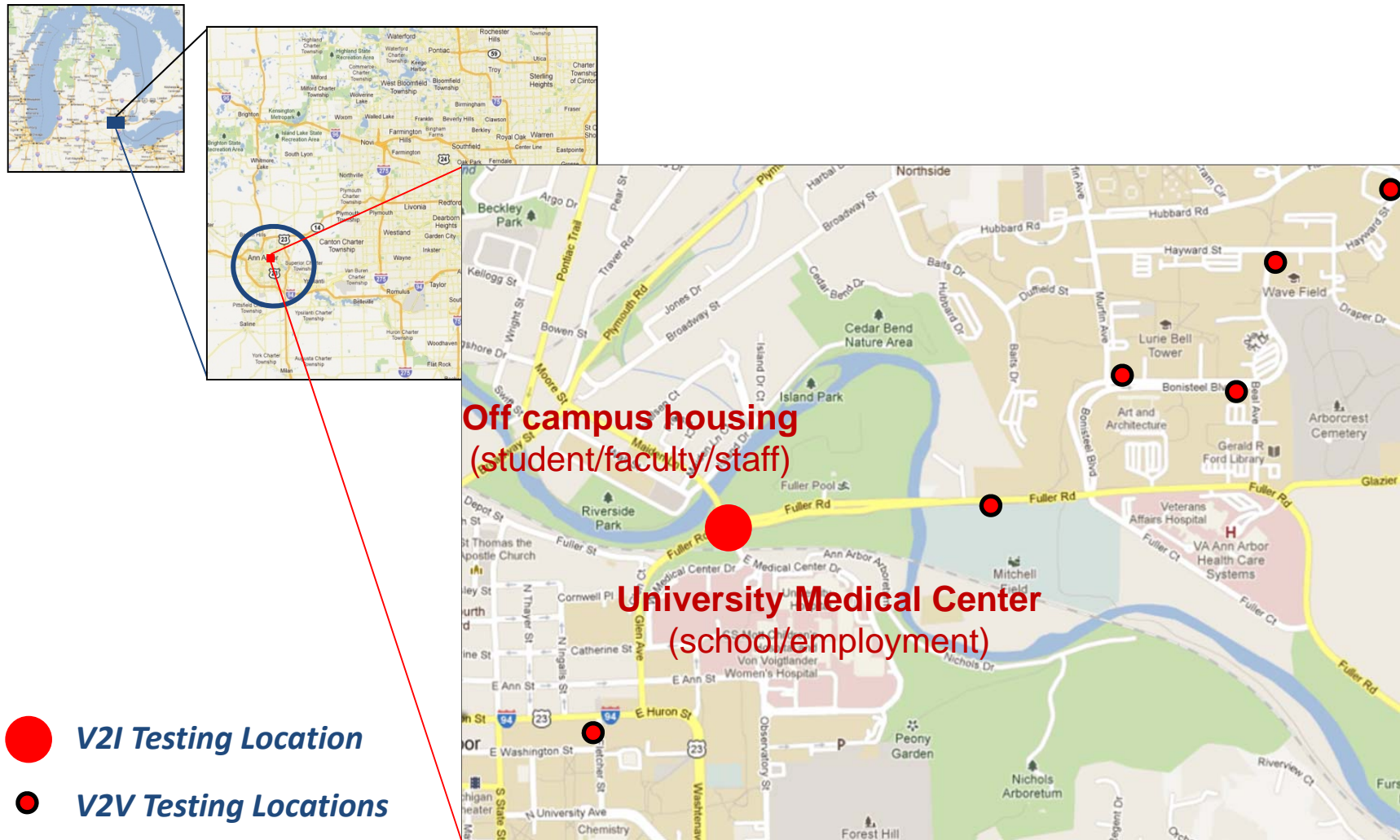
# Transit Safety Research Next Steps

---

- Evaluate the outcomes of two safety applications
- Conduct more detailed analysis of transit crashes and prioritize future transit safety research
- Continue engaging transit stakeholders
- Collaborate with existing and future research for potential transit adaptation

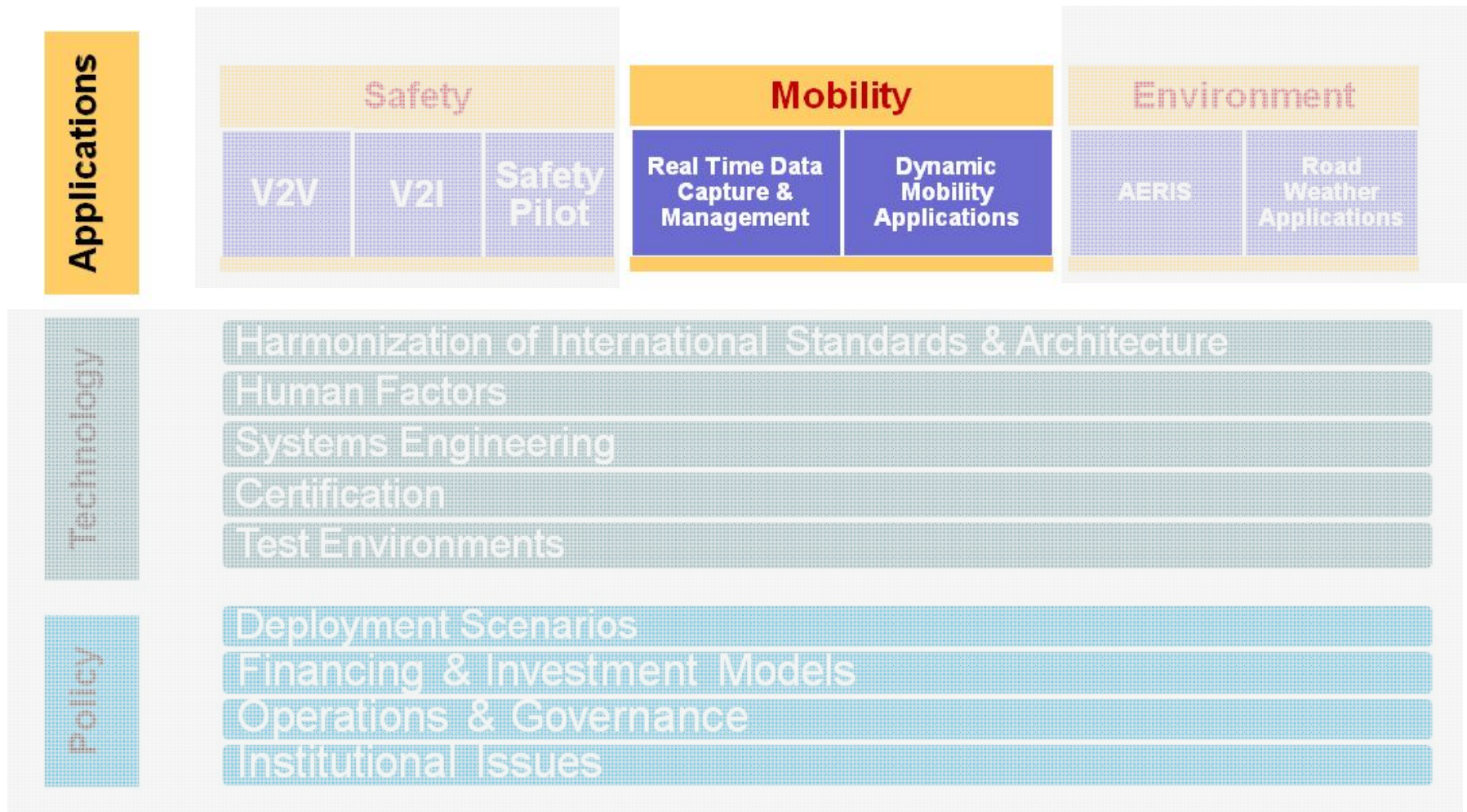


# Safety Pilot Model Deployment: Transit Applications Test Locations



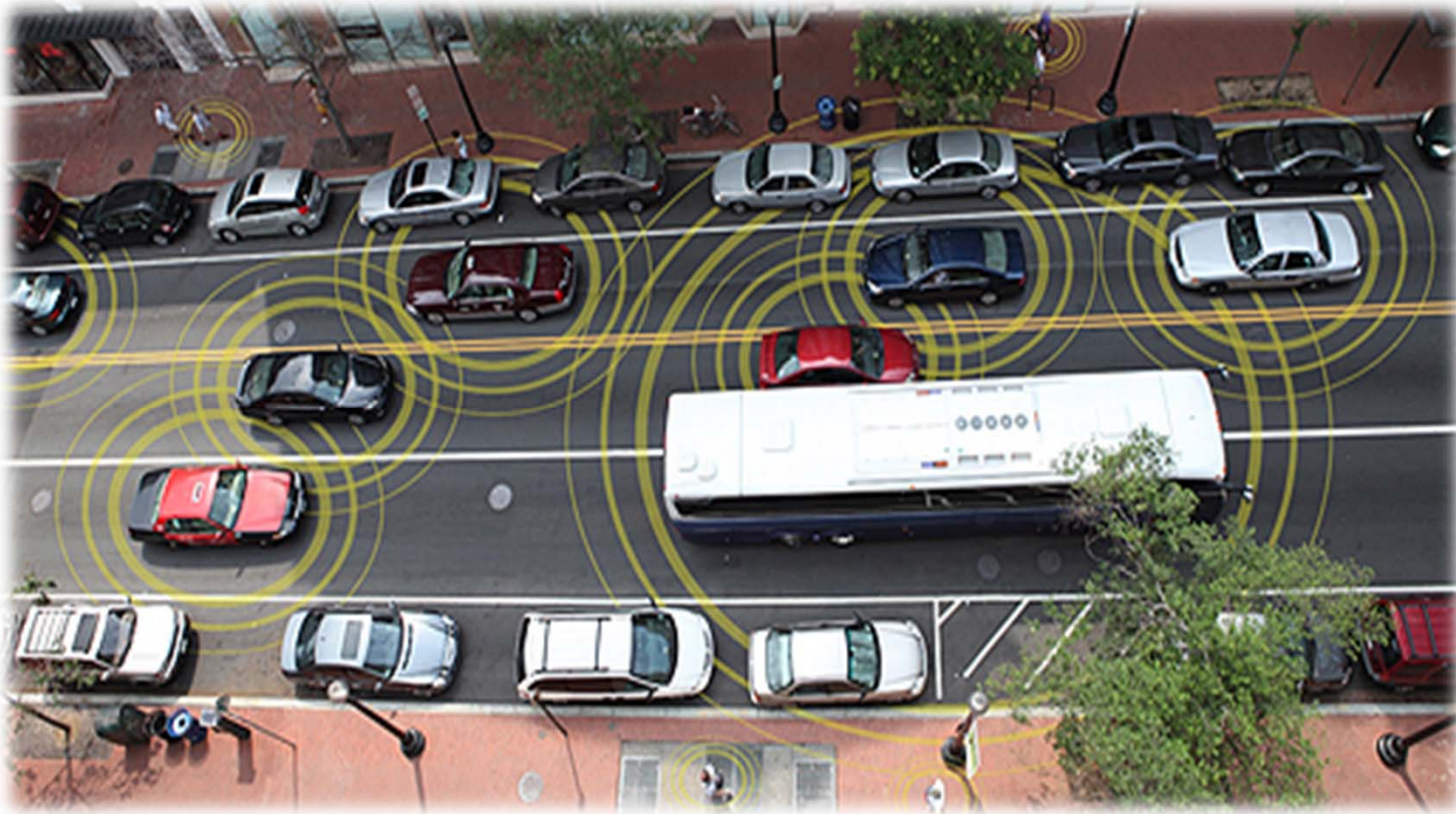


# *Transit for Mobility*



# *Connected Vehicle Research for Mobility*

---



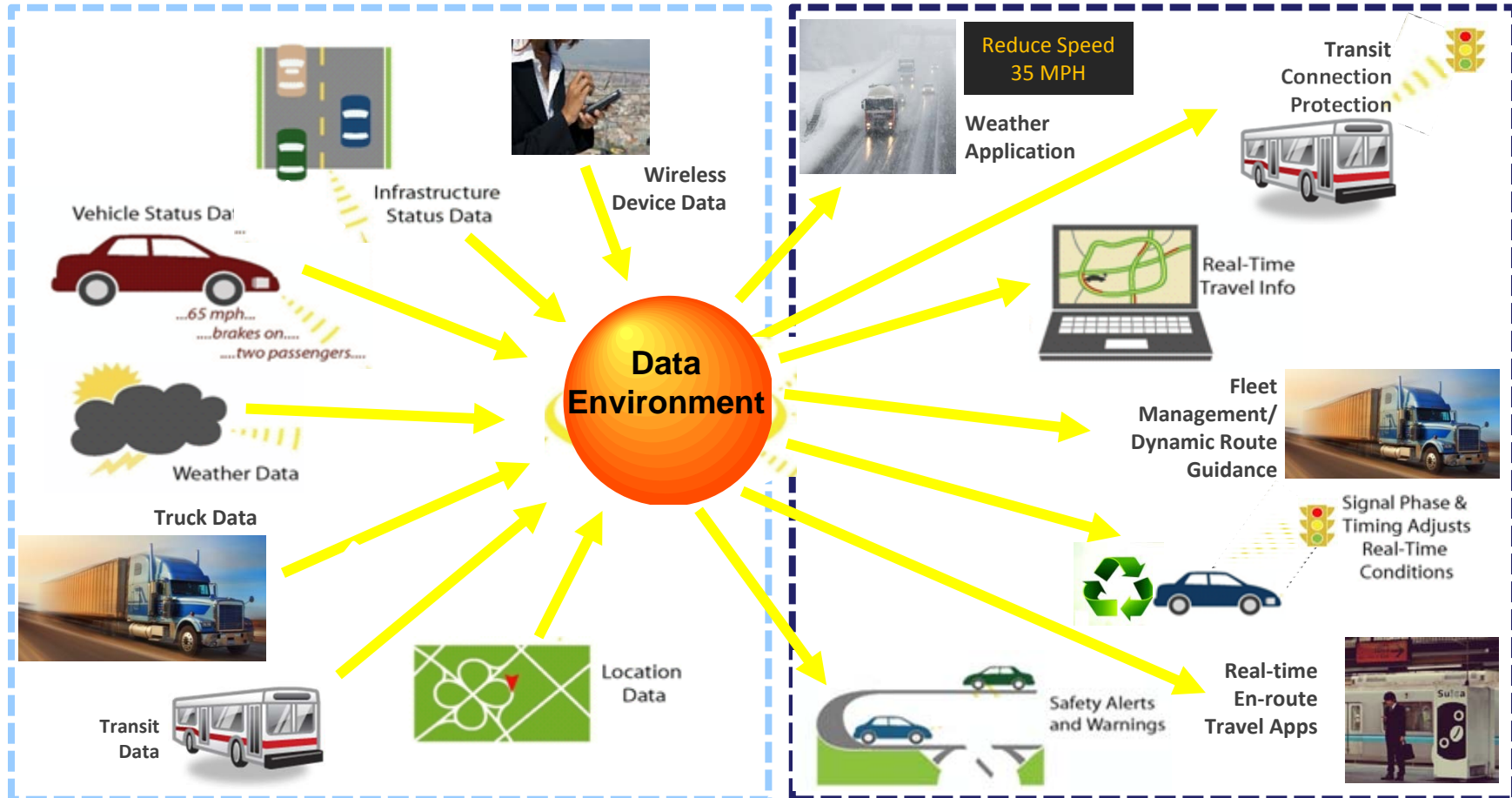
Integrated data environment further supports **intermodal mobility management** capability



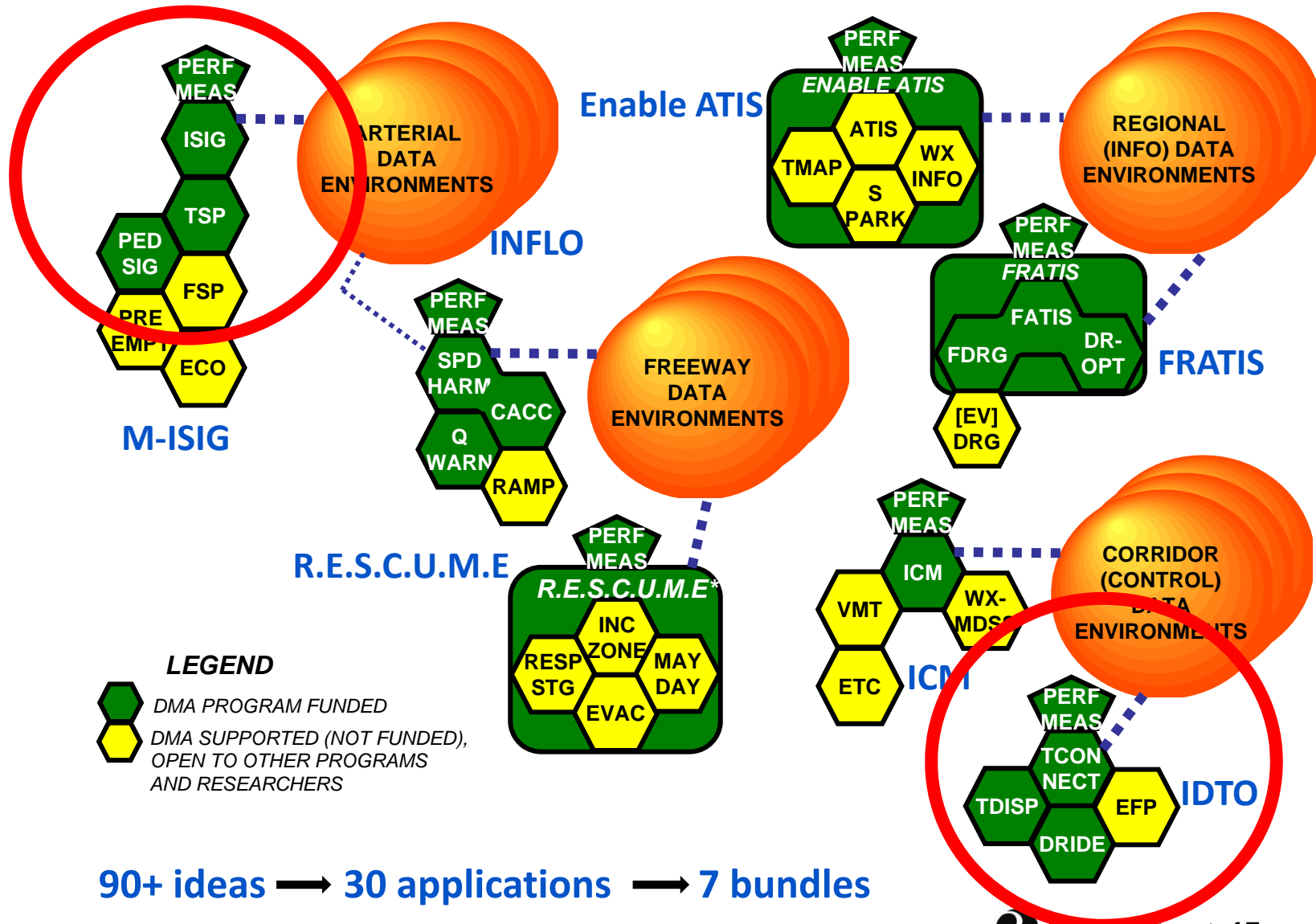
# Connected Vehicle Research for Mobility

## Real-time Data Capture and Management (DCM)

## Dynamic Mobility Applications (DMA)



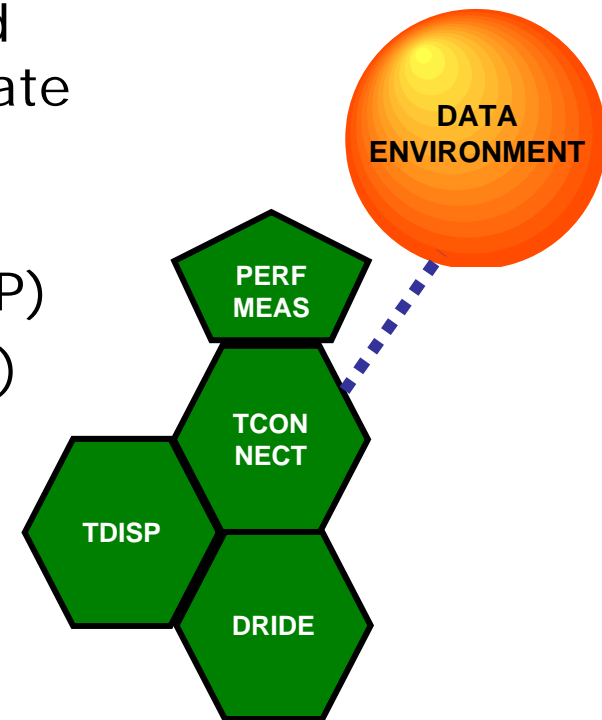
# Data Environments and Application "Bundles"



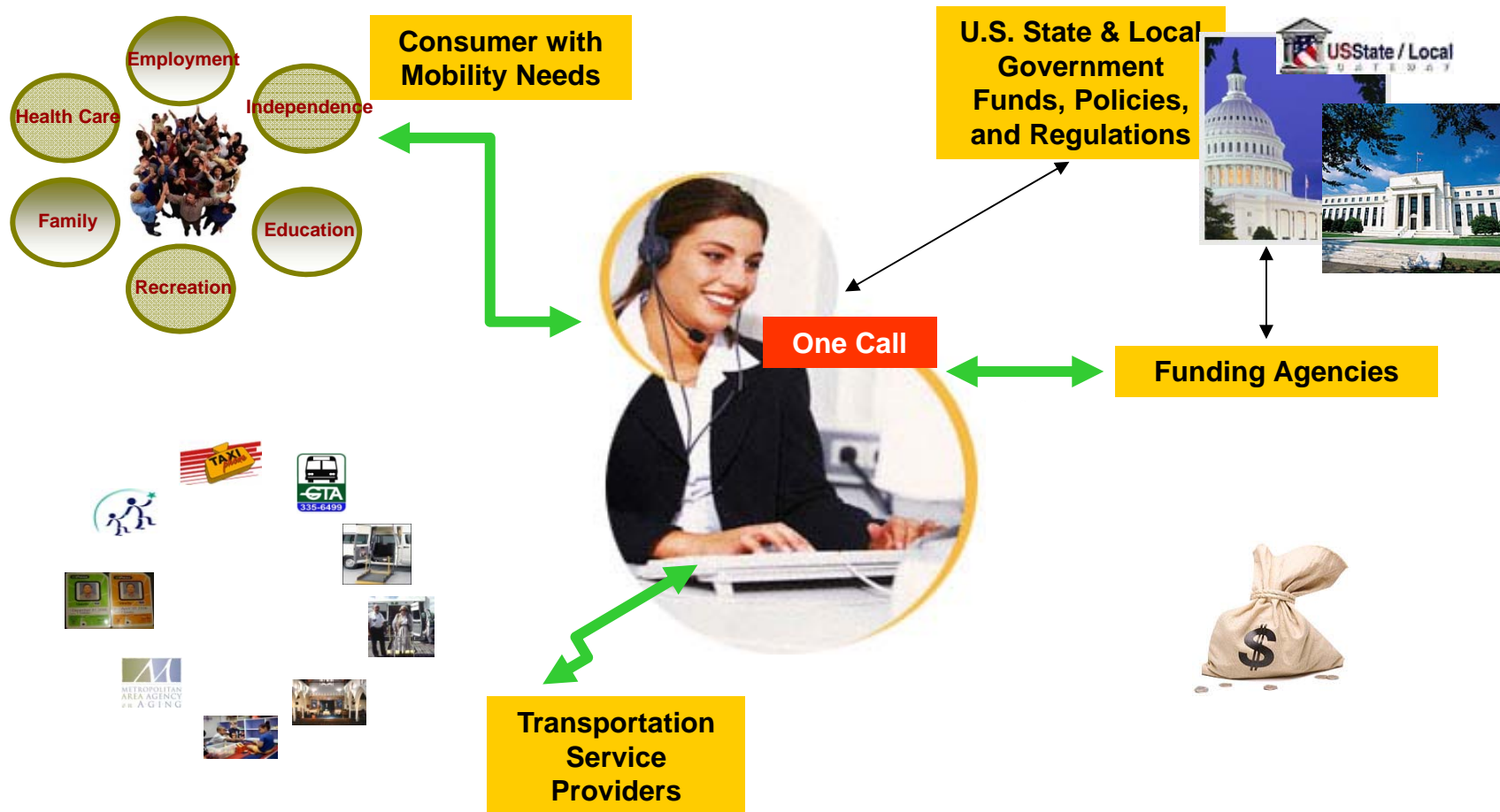
# ***Integrated Dynamic Transit Operations (IDTO) Bundle***

---

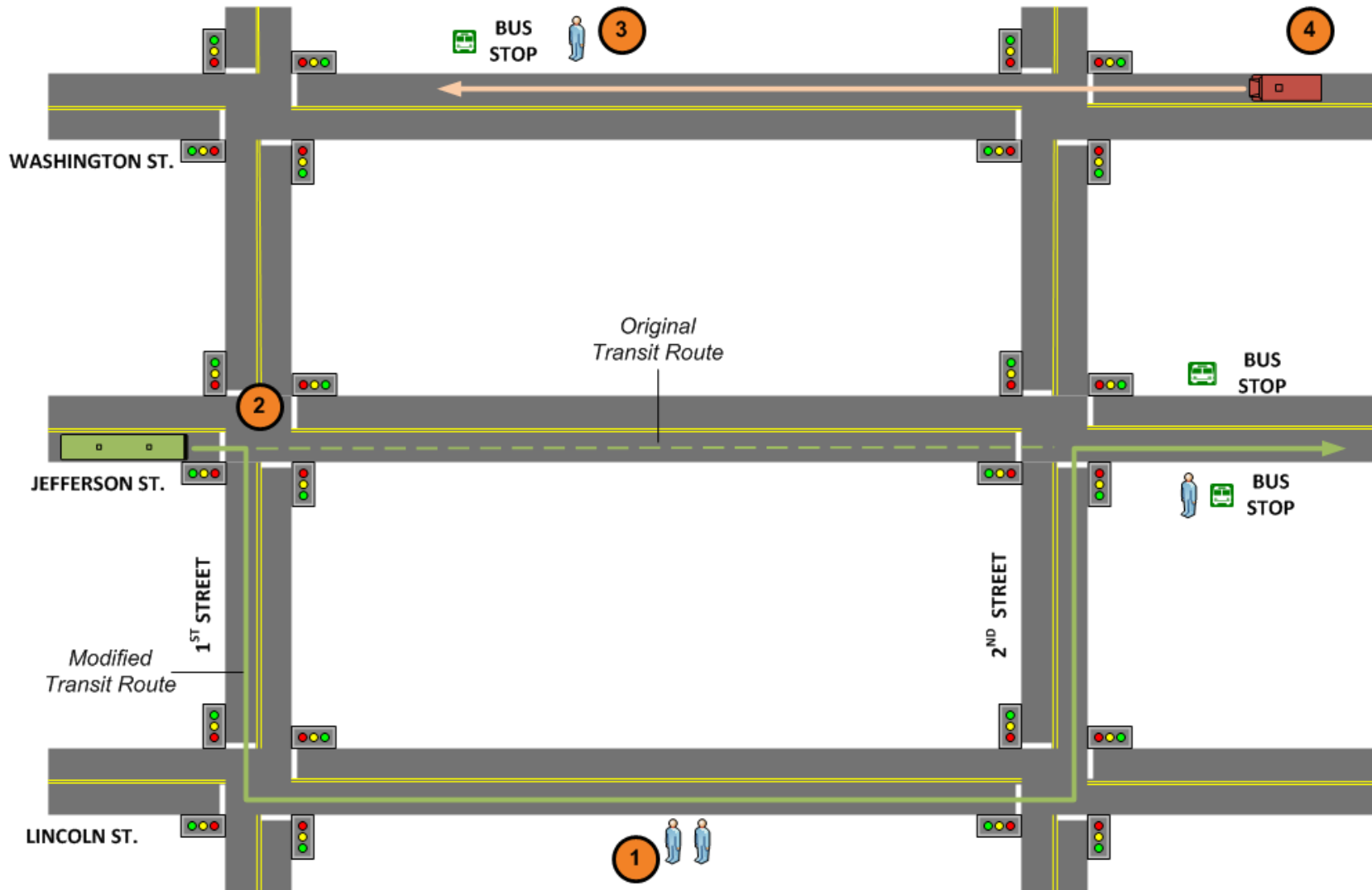
- One of the seven mobility application “bundles”
- Led by Federal Transit Administration (FTA)
- Integrated transit operations that provide dynamic scheduling, dispatching, and routing of transit vehicles, and facilitate passenger connection protection and dynamic ridesharing:
  - Dynamic Transit Operations (T-DISP)
  - Connection Protection (T-CONNECT)
  - Dynamic Ridesharing (D-RIDE)



# *Integrated Vision of Mobility Management*

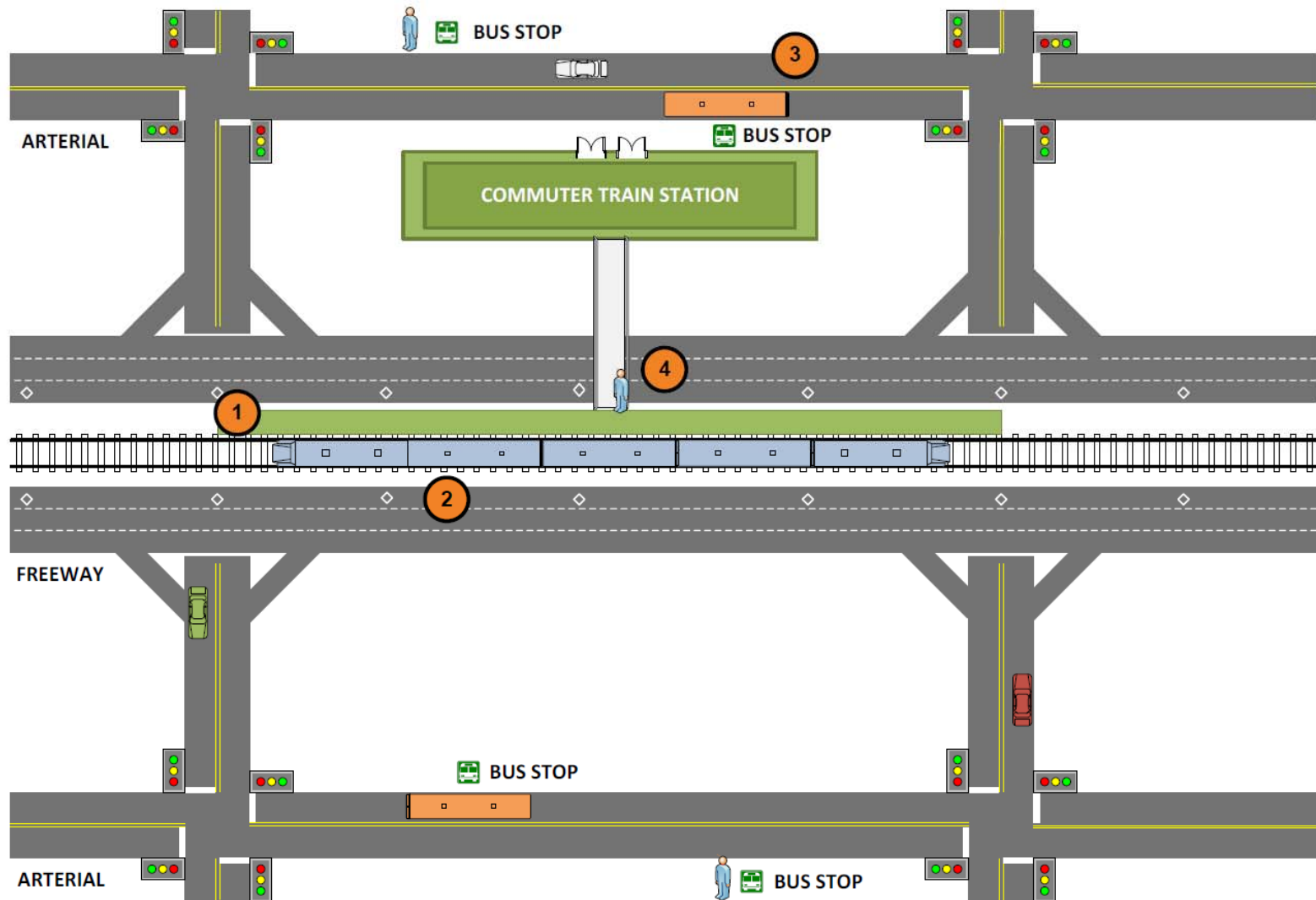


# T-DISP

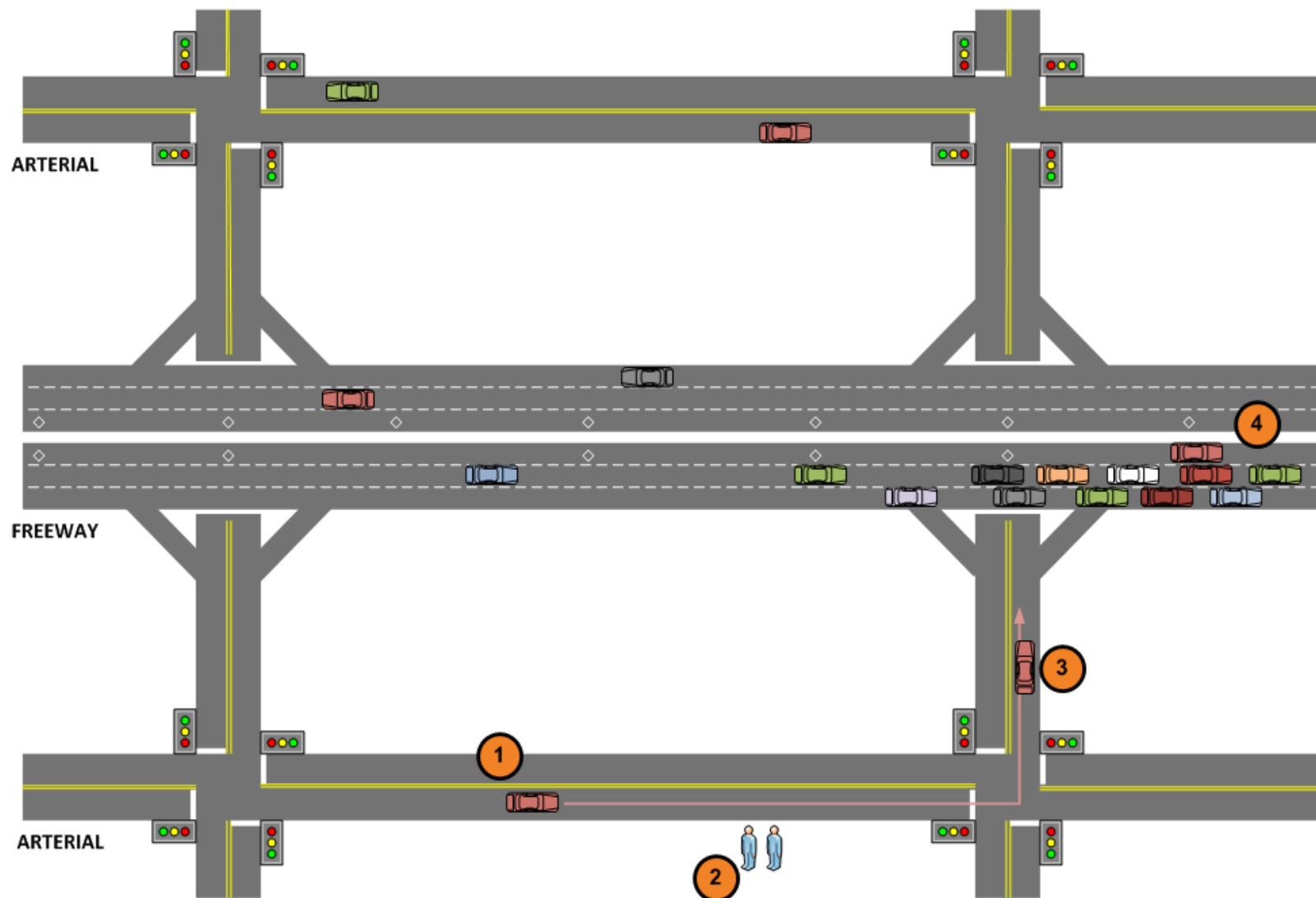




# T-CONNECT



# ***D-RIDE***



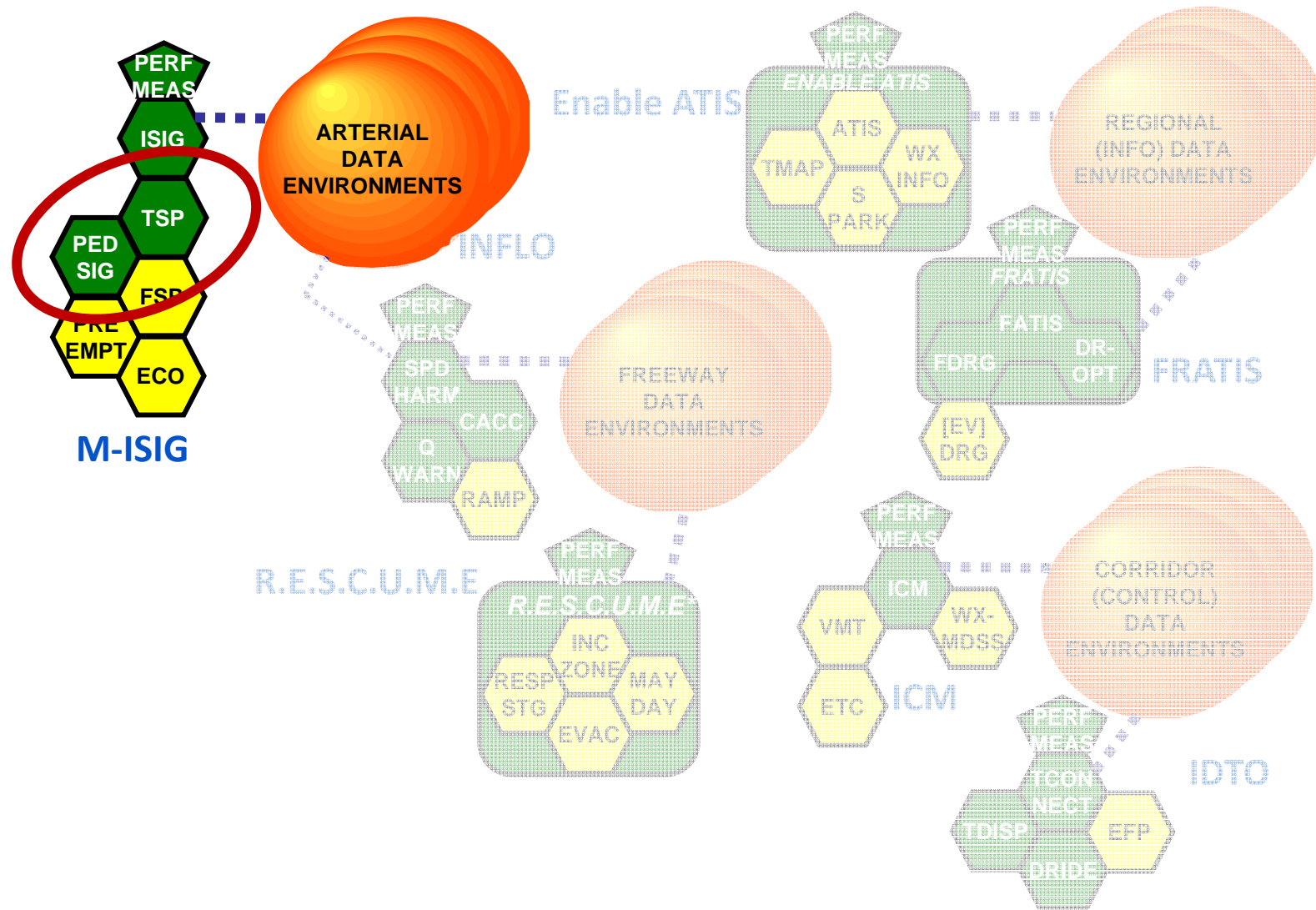
# *IDTO Next Steps*

---

- Complete IDTO functional and performance requirements
- Conduct IDTO prototype development and testing
  - *"Phased" development*
  - *Full-and-Open competition*
  - *Teaming among public/private sectors*
- Evaluate IDTO effectiveness and impacts
- Revise IDTO ConOps and requirements as needed
- Broaden field impacts thought knowledge transfer and stakeholder outreach

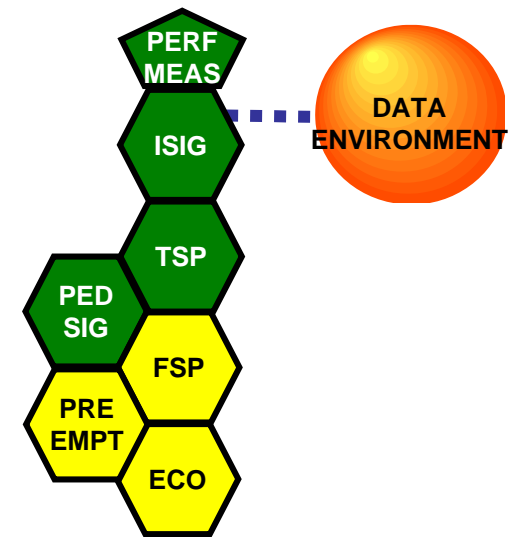


# Multi-Modal Intelligent Traffic Signal System (M-ISIG) Bundle



# M-I SIG

- Led by Federal Highway Administration (FHWA)
- Comprehensive traffic signal system for complex arterial networks (passenger vehicles, transit, pedestrians, freight, and emergency vehicles):
  - **Transit Signal Priority (TSP)**
  - **Mobile Accessible Pedestrian Signal System (PED-SIG)**  
Intelligent Traffic Signal System (I-SIG)
  - Freight Signal Priority (FSP)
  - Emergency Vehicle Preemption (PREEMPT)
  - Connected Eco Driving (ECO)





# *Transit Signal Priority (TSP)*

---

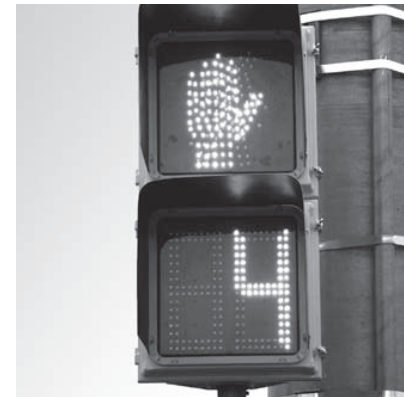
- Enables earlier, more accurate and continuous monitoring of transit vehicles as they approach and progress through the intersection, and potentially down an entire corridor
- Selects the most appropriate priority strategy based on knowledge of up-to-the second location and multiple conditionality criteria, such as:
  - Schedule/headway adherence
  - Passenger loads
  - Service type
  - Time of day
  - Peak direction
- Enables TSP on a network of arterials



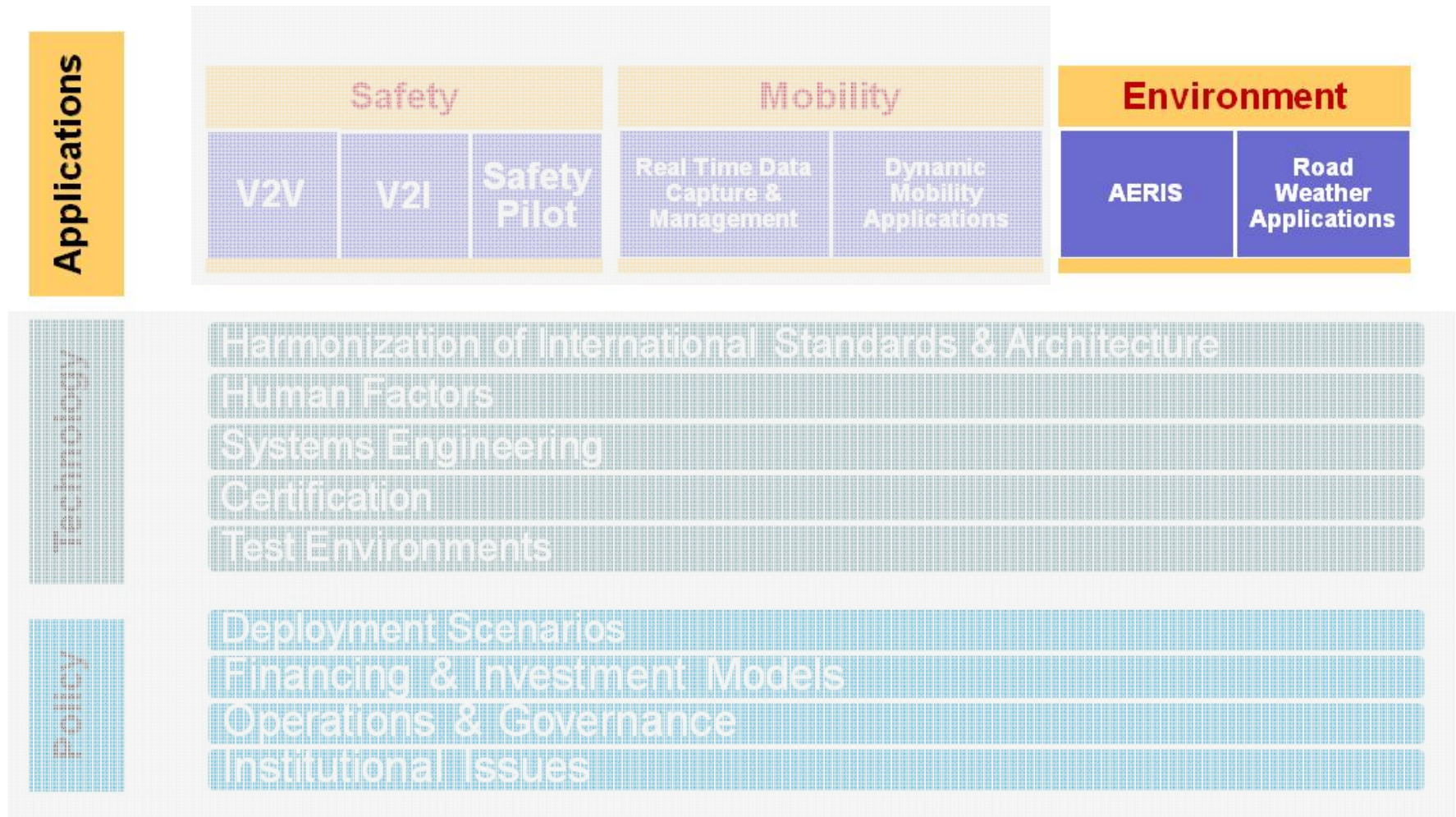
# *Mobile Accessible Pedestrian Signal System (PED-SIG)*

---

- Allows an “automated pedestrian call” to be sent to the traffic controller from the smart phone of registered blind users after confirming the direction and orientation of the roadway that the pedestrian is intending to cross.
- Integrates information from:
  - roadside or intersection sensors
  - new forms of data from wirelessly connected pedestrian-carried mobile devices
- Communicates wirelessly with the traffic signal controller to obtain real-time SPAT information
- Informs the visually impaired pedestrian as to when to cross and how to remain aligned with the crosswalk.

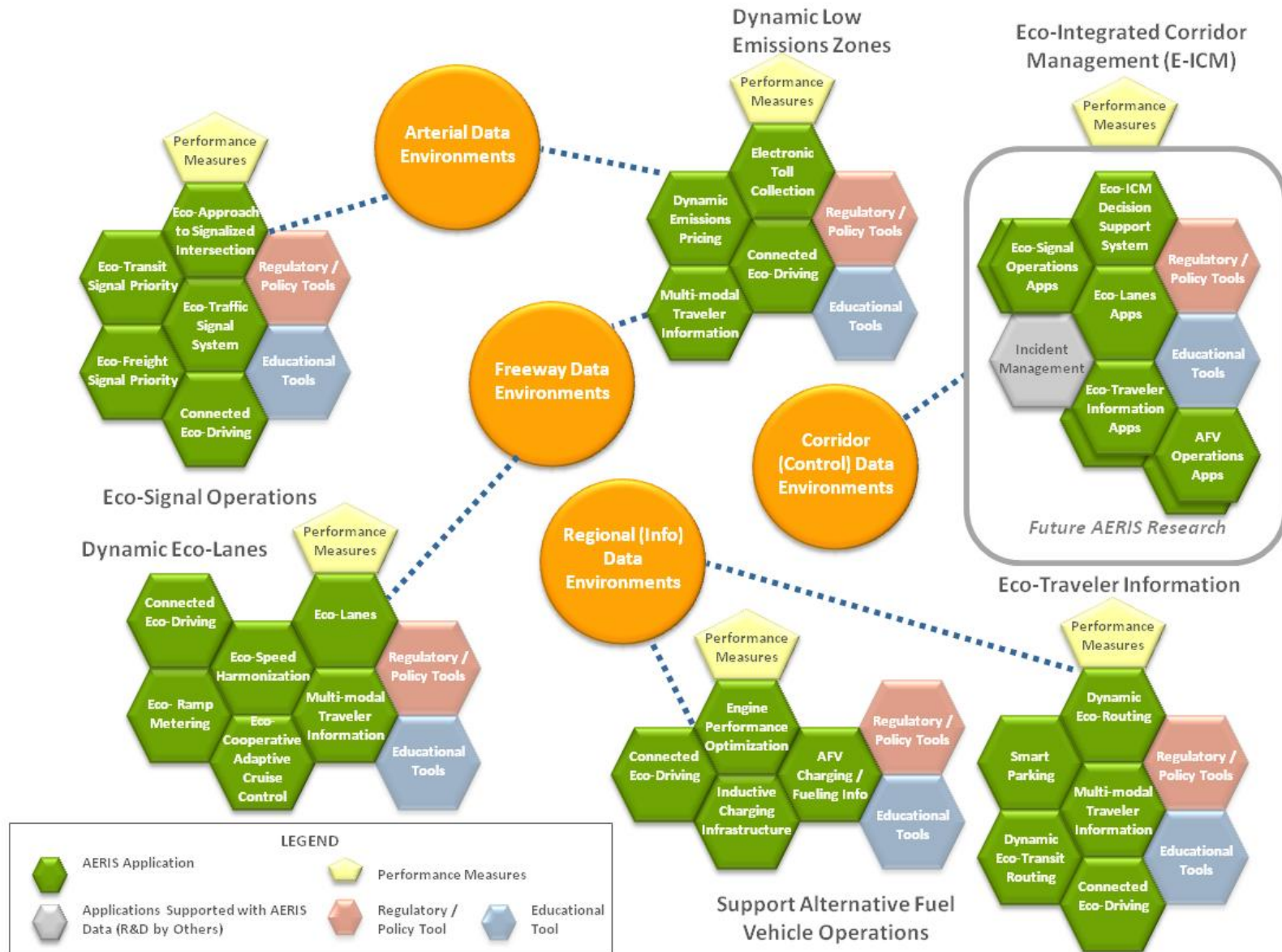


# Transit Connected Vehicle for Environment





# AERIS Transformative Concepts



# *Examples of Transit Roles in AERIS Transformative Concepts*

---

- **Eco-Signal Operations**
  - Eco-transit signal priority
- **Dynamic Eco-Lanes**
  - Transit dedicated lane and vehicle platooning
- **Dynamic Low Emissions Zones**
  - Incentivized choice transit travelers
- **Support for Alternative Fuel Vehicles**
  - AFV transit vehicles
- **Eco-Traveler Information**
  - Integrated intermodal traveler information supporting eco-traveling
- **Eco-Integrated Corridor Management**
  - Corridor load balancing and dynamic modal shift





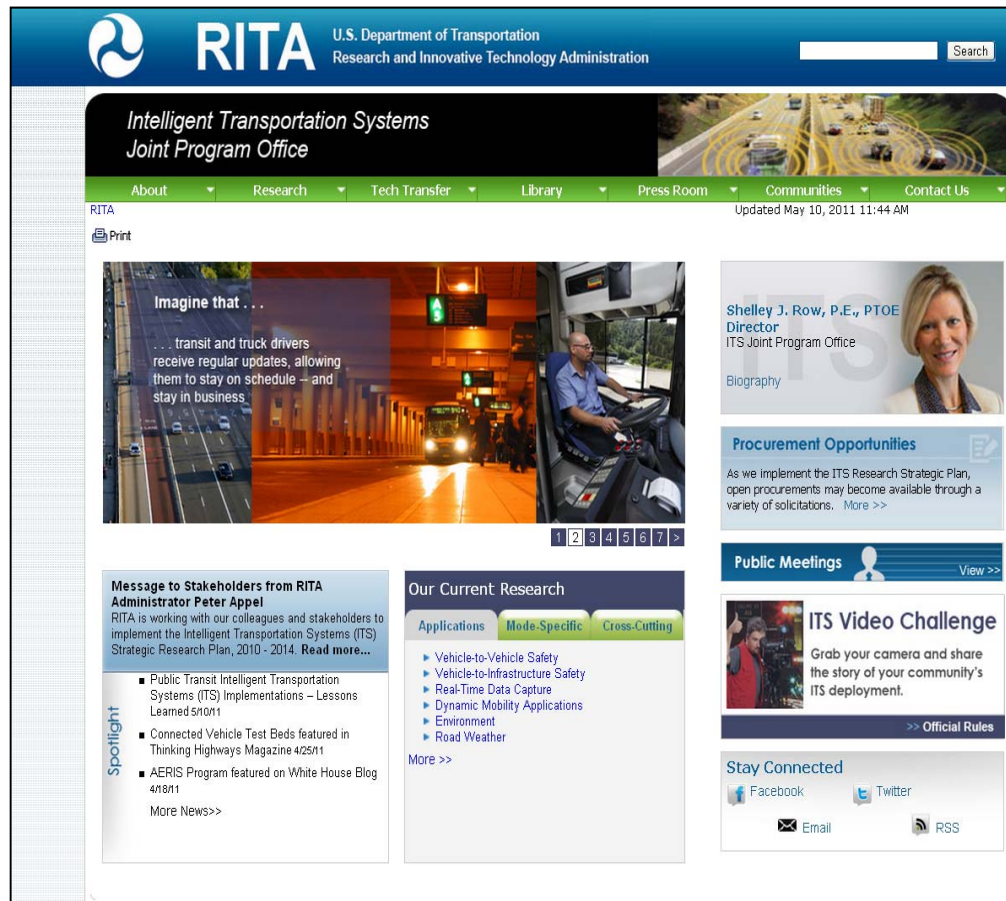
# *Stay Connected*

---

- [www.its.dot.gov](http://www.its.dot.gov)
  - Free webinars and public meetings
  - Conference sessions
  - Publications and news release
  - Procurement opportunities
- Peer-to-peer networking
- Transit connected vehicle stakeholders steering group
- Contact USDOT staff directly



# For More Information.....



**Yehuda Gross**

Program Manager

USDOT ITS Joint Program Office

202-366-1988

yehuda.gross@dot.gov

**www.its.dot.gov**