Innovative Applications of Technology for Pedestrian Safety

PRESENTED BY:

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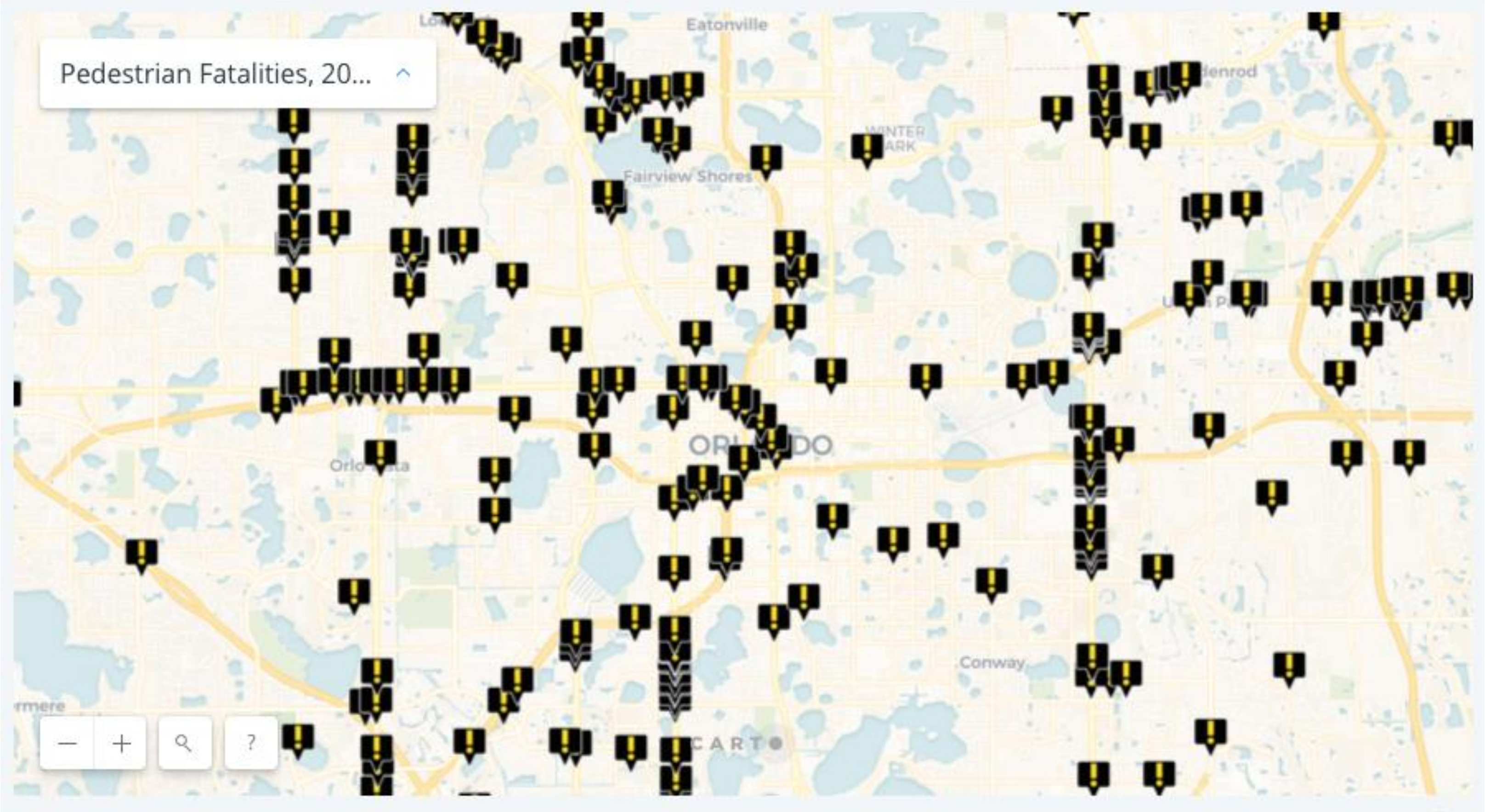
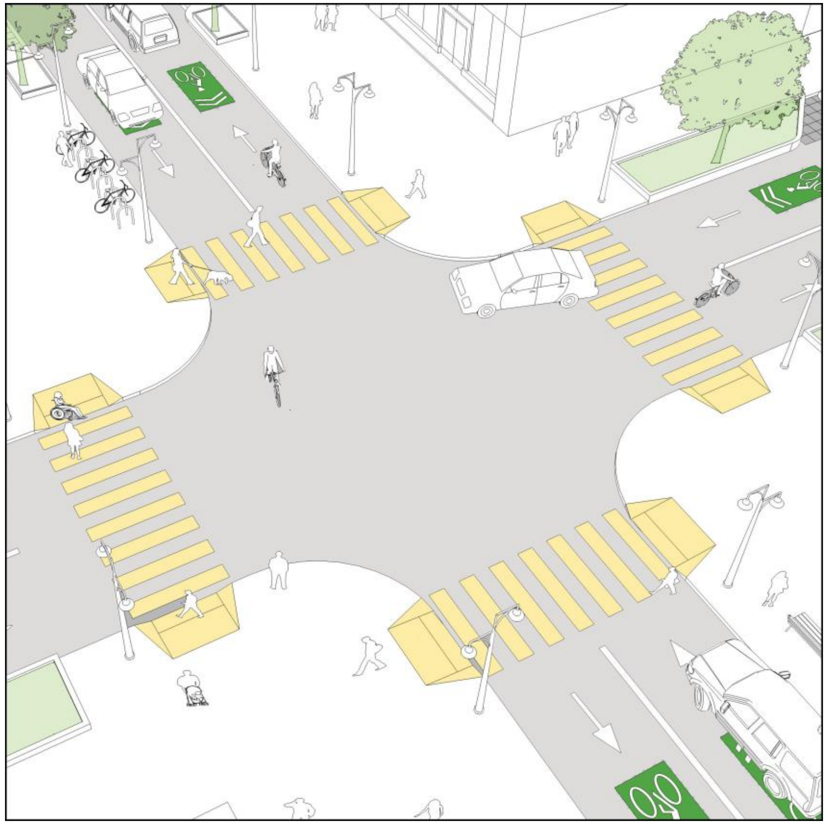
The Problem?
Keeping Pedestrians Safe

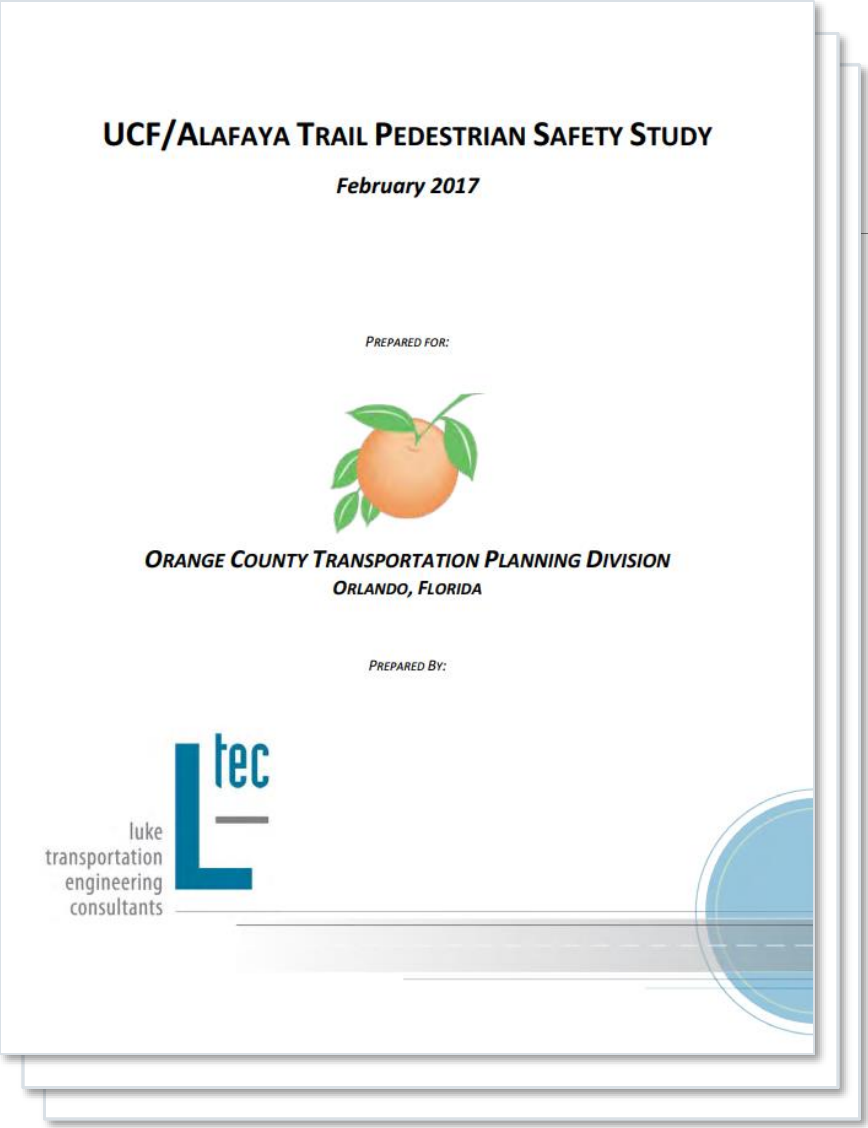
- Orlando recently named the “deadliest” city for pedestrians in the county
- From 2008-2017, a total of **656** registered pedestrian fatalities
- Major factors include lack of pedestrian facilities and streets designed for vehicles, not pedestrians





Additional Concerns

- Unexpected crossings at non-signalized/marked locations
- Lack of visibility/warning for both driver and pedestrians



UCF/ALAFAYA TRAIL PEDESTRIAN SAFETY STUDY

February 2017

PREPARED FOR:

ORANGE COUNTY TRANSPORTATION PLANNING DIVISION
ORLANDO, FLORIDA

PREPARED BY:

Local Case Study

Completed in February 2018

- **Orange County requested pedestrian safety study**
- **Focused on roadways near University of Central Florida (UCF) campus:**
  - **SR 434 (Alafaya Trail)**
  - **University Boulevard**
  - **McColluch Road**
- Total 250 vehicle-pedestrian and vehicle-bicyclist incidents between 2006-2016
  - 11 fatalities, 207 injuries reported

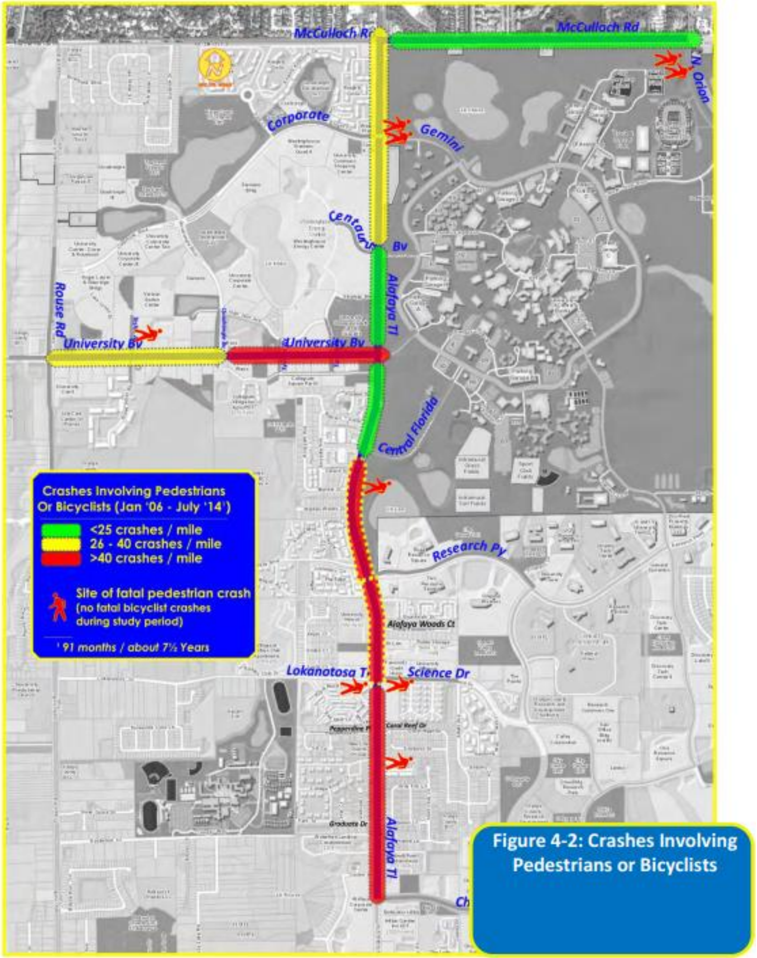


Figure 4-2: Crashes Involving Pedestrians or Bicyclists

Local Case Study

Completed in February 2018

- Orange County requested pedestrian safety study
- Focused on roadways near University of Central Florida (UCF) campus:
  - SR 434 (Alafaya Trail)
  - University Boulevard
  - McColluch Road
- **Total 250 vehicle-pedestrian and vehicle-bicyclist incidents between 2006-2016**
  - **11 fatalities, 207 injuries reported**

Local Case Study

Completed in February 2018

- Suggested improvements include:
  1. Geometric intersection improvements (e.g. reduction of turn radii, widening sidewalk, landscaping, etc.)
  2. Signal operation and timing changes
  3. Addition of mid-block pedestrian crossing of SR 434 (Alafaya Trail) and University Boulevard

TECHNOLOGY

OPTIONS FOR PEDESTRIAN SAFETY

Current State of the Industry

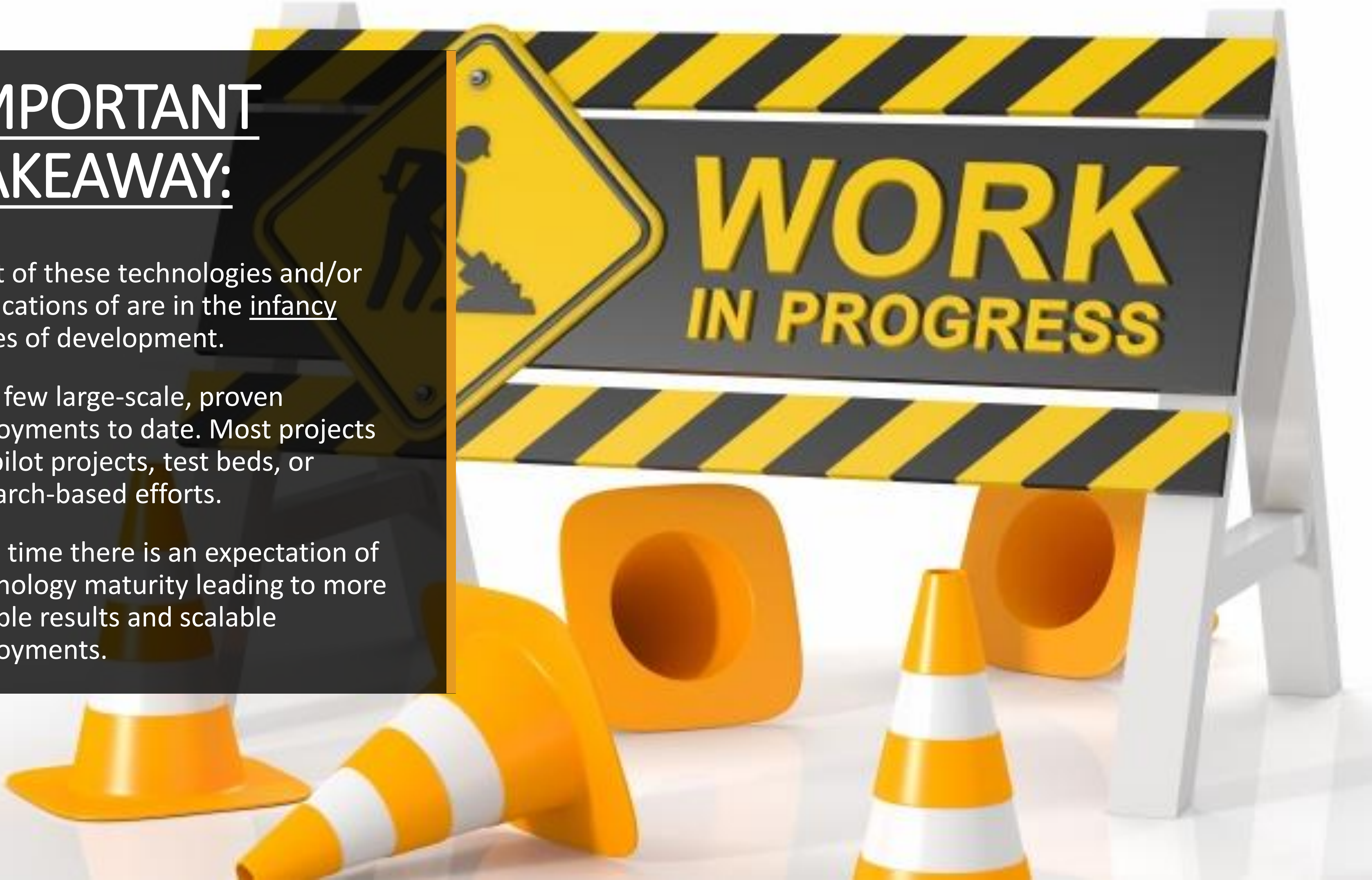
- FDOT District 5 project to survey the present state of the industry, design and deploy a test case solution for segments of the SR 434 (Alafaya Trail) corridor.
- Vendors demonstrated solutions at the Traffic Engineering Research Lab (TERL) in Tallahassee including:
  - Passive Pedestrian Detection
  - Computer Vision and Machine Learning
  - Connected Vehicle (CV)

<u>IMPORTANT TAKEAWAY:</u>

Most of these technologies and/or applications of are in the <u>infancy</u> stages of development.

Very few large-scale, proven deployments to date. Most projects are pilot projects, test beds, or research-based efforts.

Over time there is an expectation of technology maturity leading to more reliable results and scalable deployments.



Passive Pedestrian Detection

Historically, pedestrians request permission to cross an intersection leg with a pedestrian pushbutton.

The pushbutton sends the request to the signal controller to activate the appropriate pedestrian crossing phase.

Actuated pedestrian crossings require appropriate pedestrian involvement for

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Passive Pedestrian Detection

Passive pedestrian detection systems identify pedestrians and send requests for crossing phases automatically, without the interaction of the user. Can be accomplished in a number of manners: radar, video, etc.

FLIR Trafisense is a thermal imaging detector that can be deployed for passive pedestrian detection for both intersection and midblock crossings.

System can be utilized for pedestrian and/or bicyclist detection, dependent upon need.

Passive Pedestrian Detection

Benefits:

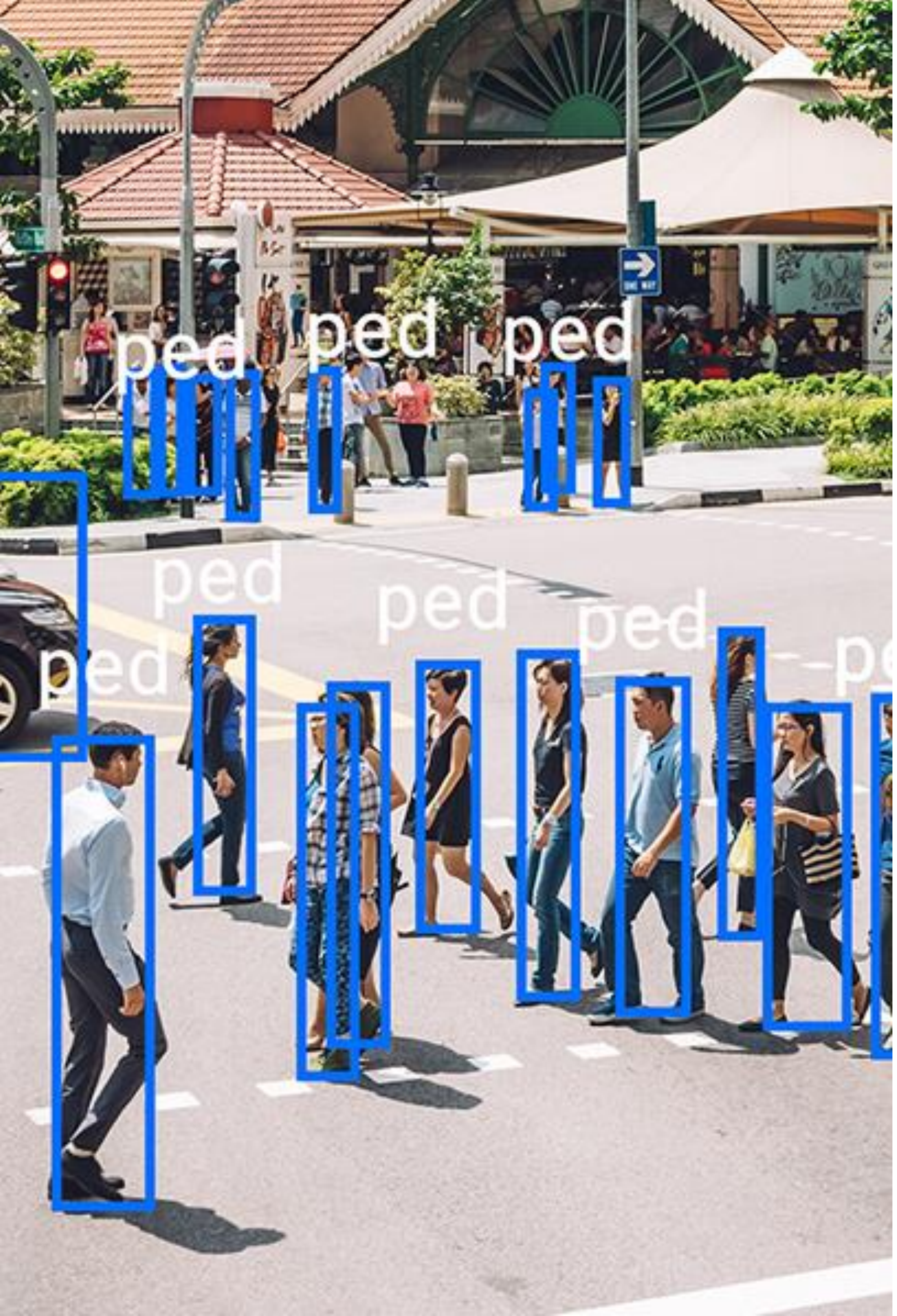
Reduction of crossings during "DON'T WALK" phases

Provide earlier warning to drivers of approaching pedestrians

Challenges:

Increased false calls

Enhanced cost



Computer Vision and Machine-Learning

Computer Vision is the process of identifying the presence of predefined objects, like a pedestrian, from an image, such as a video feed.

Machine-Learning is a branch of artificial intelligence in which systems continually identify patterns in data in order to independently adapt with minimal human interaction.

Together these two concepts are capable of detecting, classifying, and tracking pedestrian movements for actions and analysis.

Computer Vision and Machine-Learning

MioVision TrafficLink systems utilizes software and video feeds from a bug-eye camera to detect, classify, and track objects, including pedestrians.

System is able to differentiate cars, trucks, bicyclists, and pedestrians for classification.

miovision

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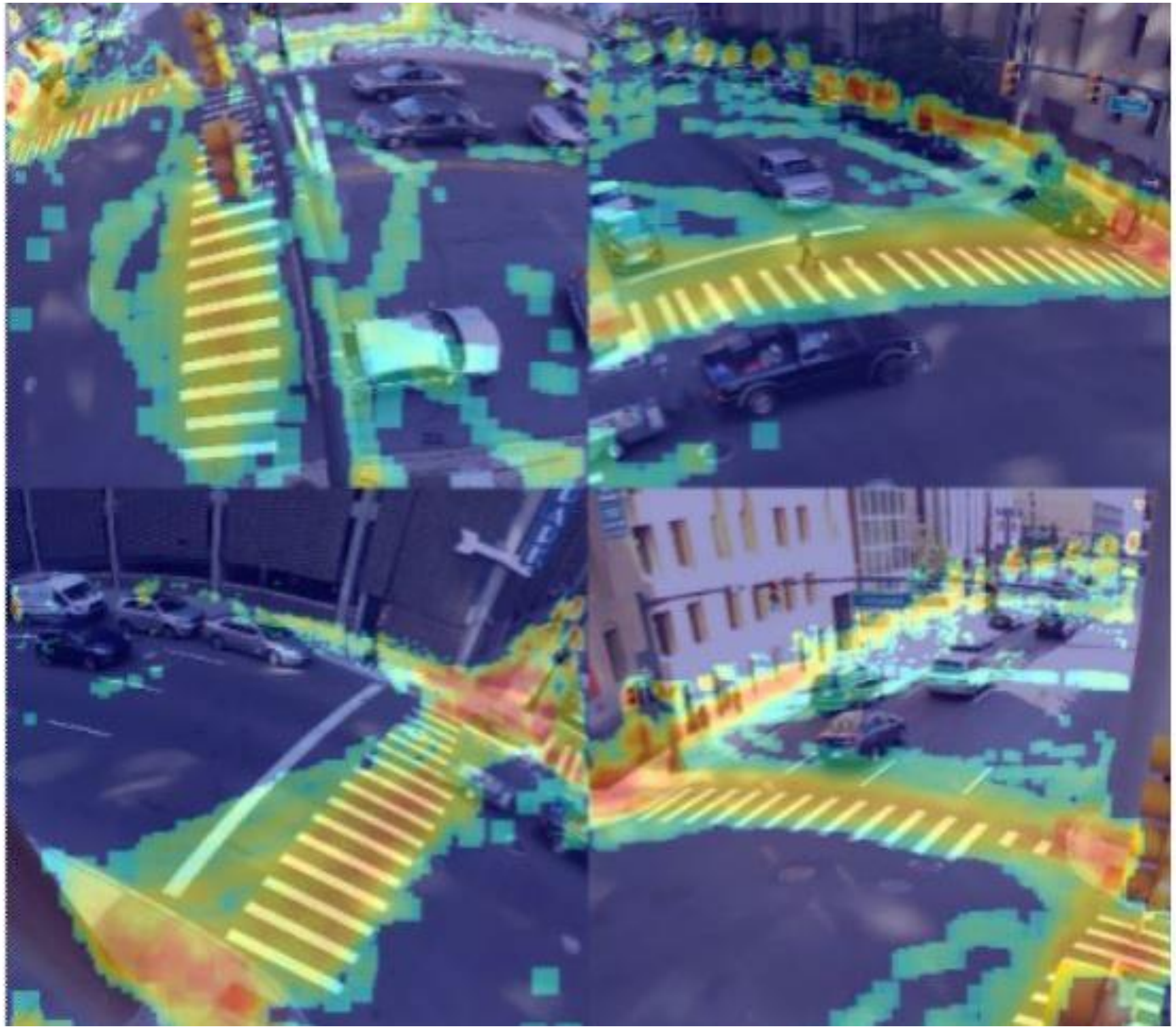


Computer Vision and Machine-Learning

System provides the ability to obtain real-time and historical pedestrian data.

Available data sets include pedestrian volumes, relative origin-destination, and more.

Computer Vision and Machine-Learning

Benefits:

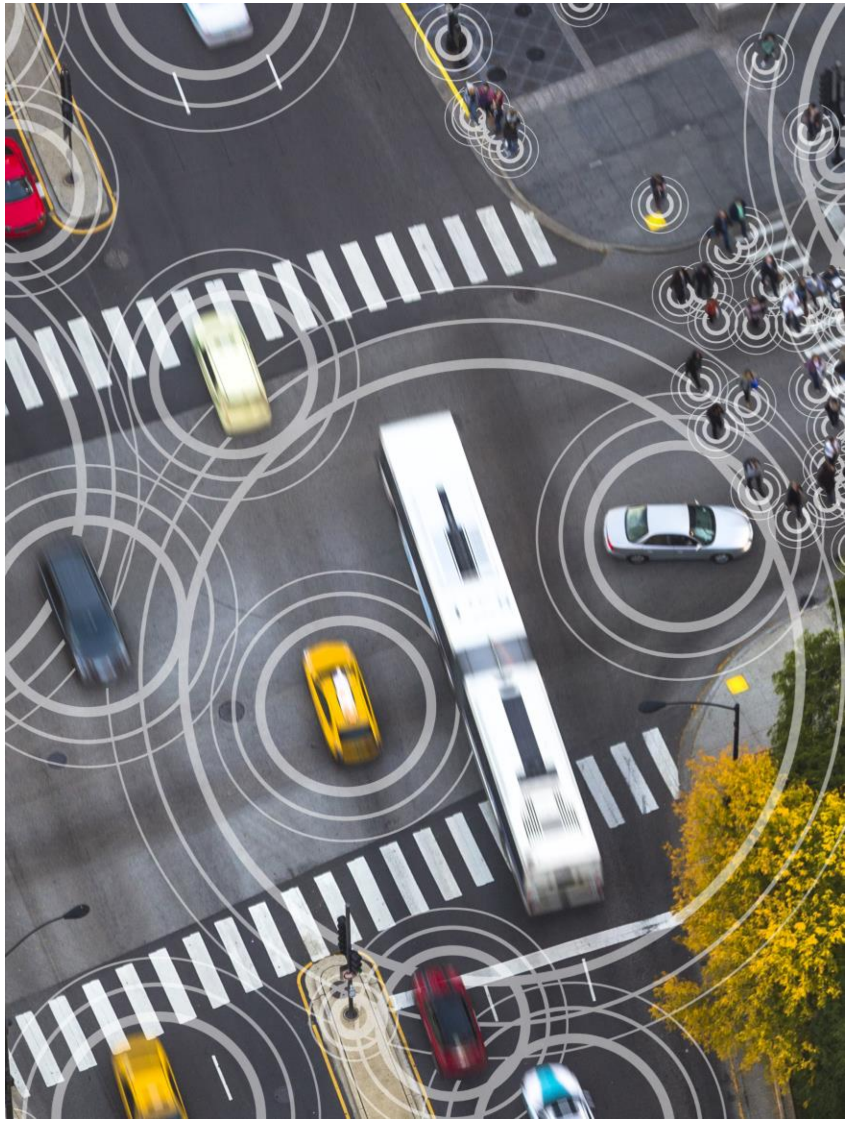
Extend pedestrian WALK intervals when necessary

Provide accurate, real-time data sets

Determine potentially dangerous trends in pedestrian movements

Challenges:

To date very few proven deployments for pedestrian safety in the US



Connected Vehicles

The implementation of technology that allows vehicles to communicate with the driver, other vehicles, roadside equipment, the “cloud”, or any other desired device by various communication methods.

Connected vehicle (CV) technology can be utilized in any number of applications providing benefits in safety and efficiency.

Connected Vehicle Terminology

- BSM – Basic Safety Message
- DSRC – Dedicated Short-Range Communication
- OBU – On-Board Unit
- PSM – Personal Safety Message
- RSU – Roadside Units
- V2V – Vehicle to Vehicle
- V2I – Vehicle to Infrastructure
- V2P – Vehicle to Pedestrian

- **Dedicated Short-Range Communications (DSRC)** – two way, short-to-medium range wireless communication utilizing the 5.9 GHz radio band
- **Roadside Unit (RSU)** – device with a fixed position relative to the roadway capable of transmitting and receiving DSRC-based messages to vehicles
- **On-Board Unit (OBU)** – vehicle mounted device capable of DSRC communications in order to transmit and receive messages from roadside equipment and other vehicles

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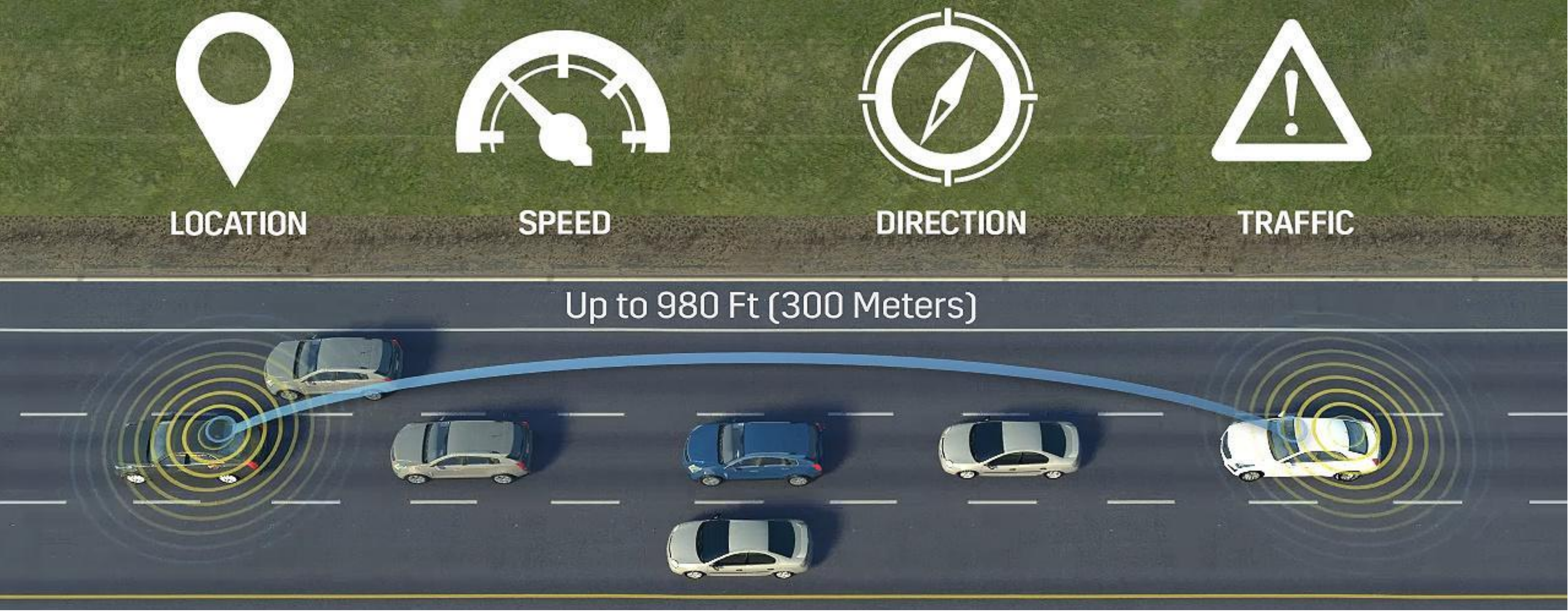
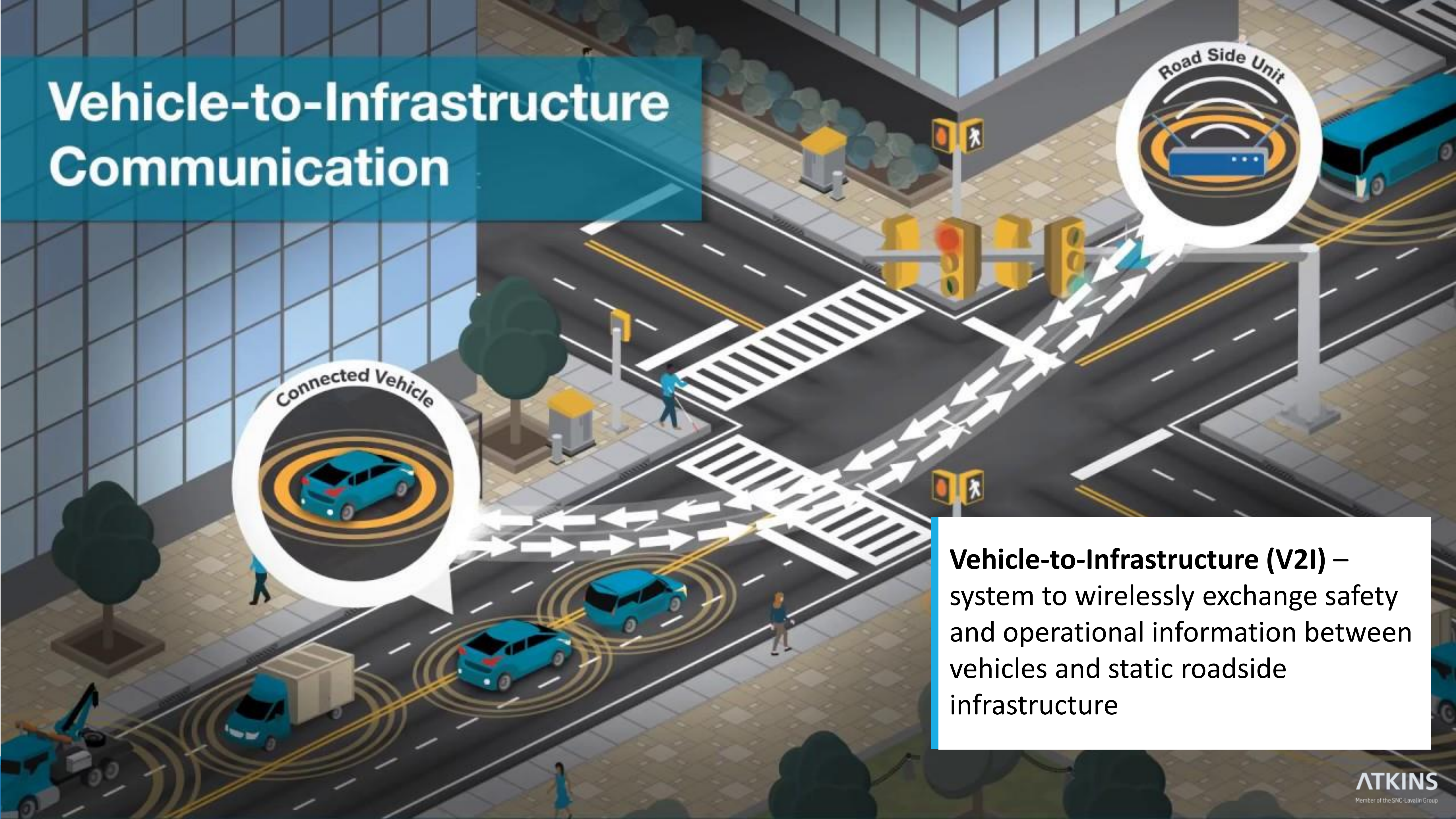


Vehicle-to-Vehicle (V2V) – system to wirelessly transmit and receive basic safety message information between vehicles, defined by Society of Automotive Engineers (SAE) Standard J2735.

Basic Safety Messages (BSM) - data structure containing a timestamp and vehicle size, position, speed, heading and acceleration transmitted 10 times a second.

Vehicle-to-Infrastructure Communication

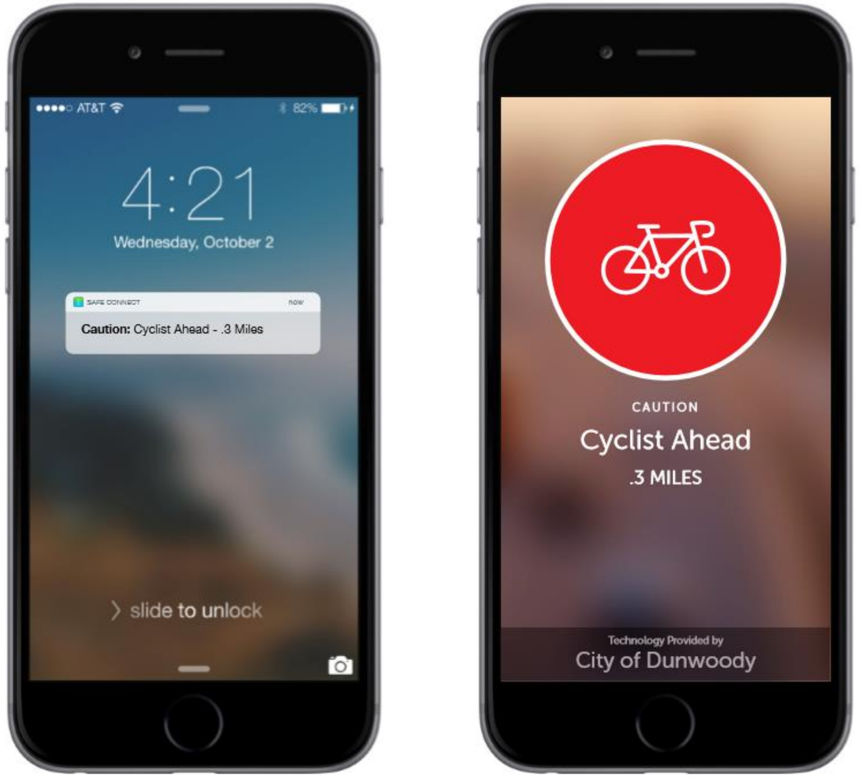


Vehicle-to-Infrastructure (V2I) – system to wirelessly exchange safety and operational information between vehicles and static roadside infrastructure

Personal Safety Message (PSM)

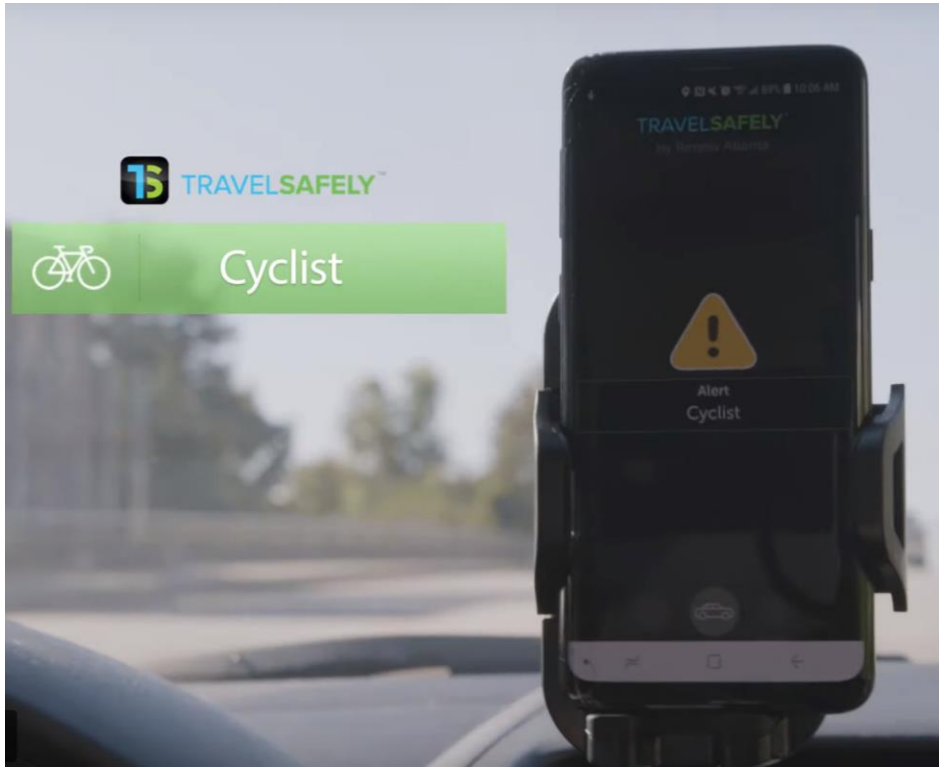
Similar to the BSMs for cars, personal safety messages (PSM) provide the location, heading, speed, acceleration of a vulnerable road user with a timestamp.

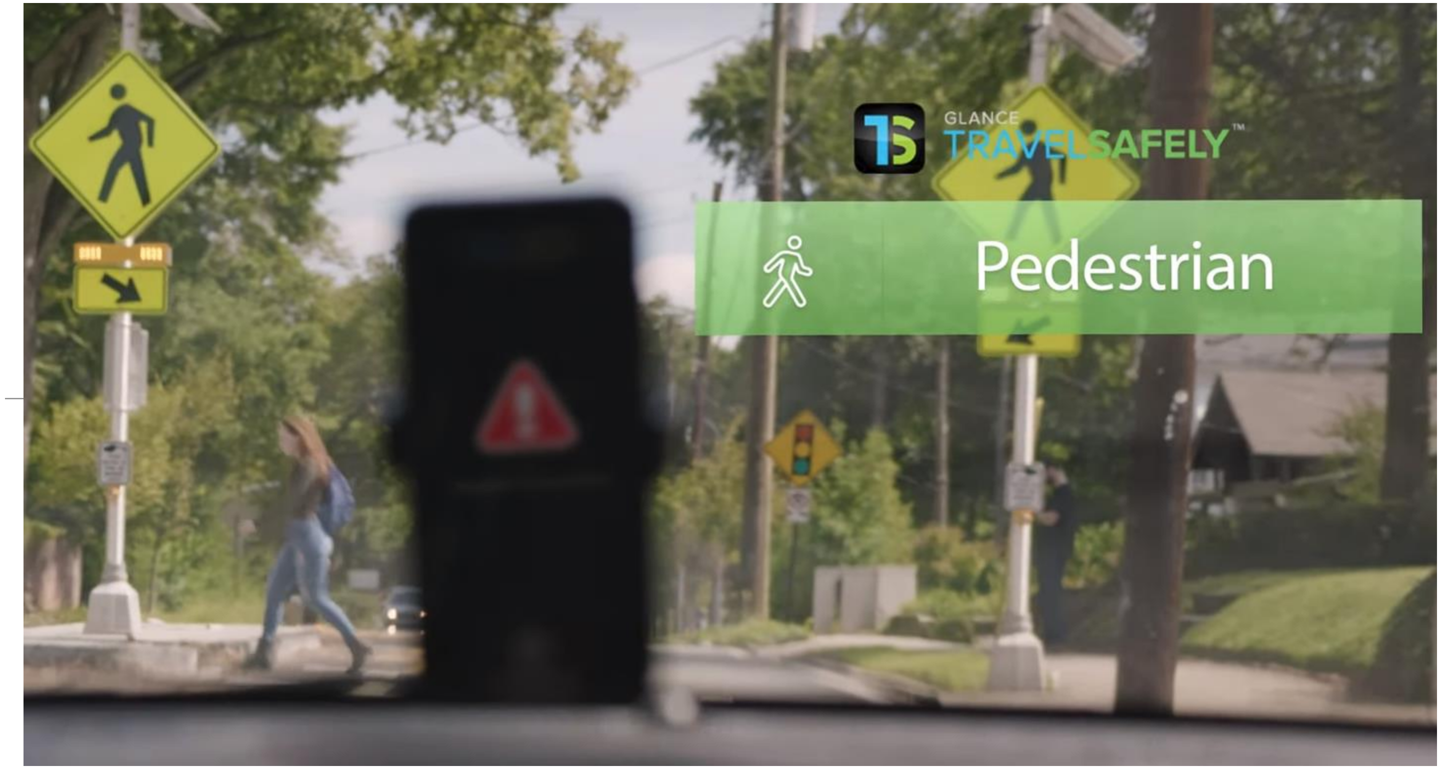
Connected Vehicle



TravelSafely by Applied Information is a smartphone-based solution providing connected vehicle applications to pedestrians, bicyclists, and motorists.

By using cellular communications and data transfer via the “cloud”, TravelSafely provides users V2V and V2P applications without the need for installation of OBUs.





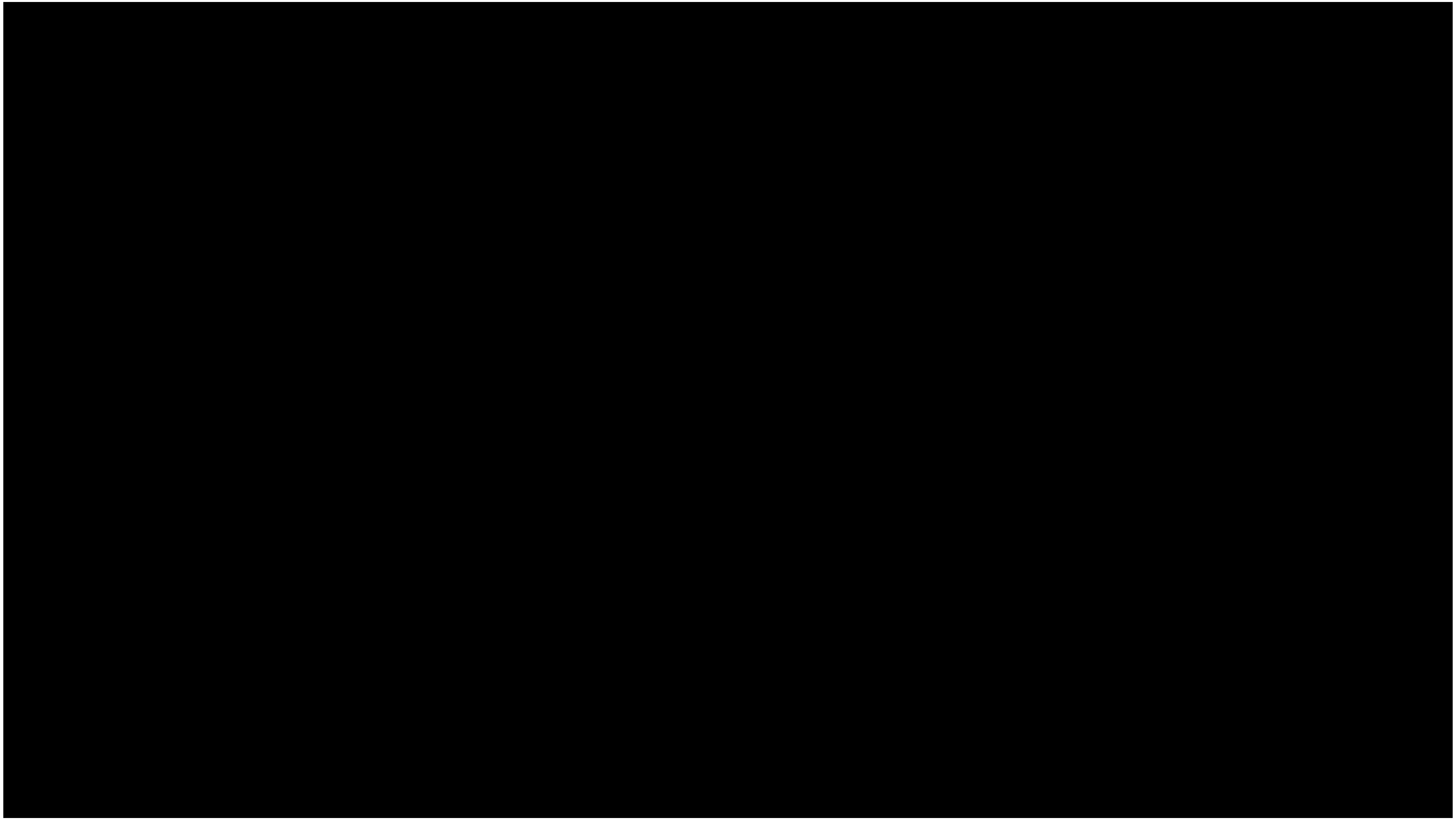
Benefits:

Provides CV capabilities simply by downloading a smartphone application

Existing application alert both the driver and the bicyclist or pedestrian

Challenges:

Limited penetration of the TravelSafely app with drivers, bicyclists, and pedestrians



Connected Vehicle

Tampa Hillsborough Expressway Authority (THEA) is currently in the process of implementing a CV pedestrian detection and warning system.

Deployment for the midblock crossing for the Hillsborough County Courthouse on E Twiggs Street connecting the parking facility to the building.

Connected Vehicle

THEA deployed a system of Quanergy LIDAR (Light Range and Detection) sensors in order to detect, classify, and track pedestrians in the midblock crossing.

Once detected, a high visibility beacon begins flashing to alert the drivers of an impending pedestrian crossing.

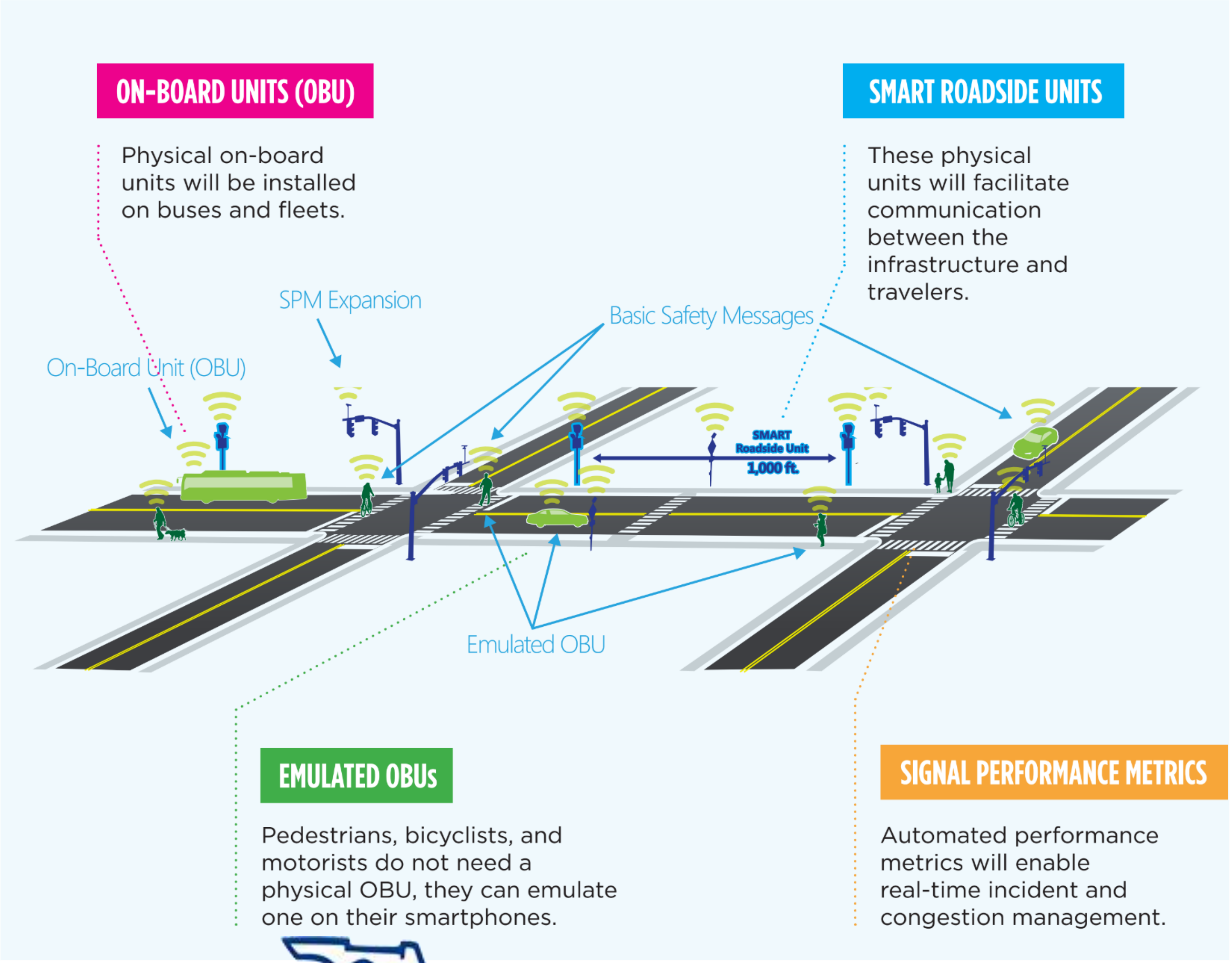
Additionally, SIEMENS RSUs transmit Traveler Information Message (TIM) to the heads-up display on approaching vehicles outfitted with an OBU as part of the THEA CV Pilot project.

SIEMENS

QUANERGY

Present Issues with Connected Vehicle

- Lack of OBU penetration in vehicles interacting with the systems
- Lack of proven large-scale deployments, infancy of technology
- Limited number of CV applications, still in concept "phase"



FDOT

PedSafe (District 5)

Along SR 434 (Alafaya Trail) near the UCF campus, multiple pedestrian detection and warning technologies are being deployed:

1. LIDAR detection and RSU
2. OBU emulator development
3. Passive pedestrian detection w/ thermal imaging

Deployments will be located at signalized intersections and along corridor between.

Provide advanced notification to drivers when approaching pedestrian in roadway.

NOTE: This effort is a primarily research-based, UCF will conduct analysis post-deployment.

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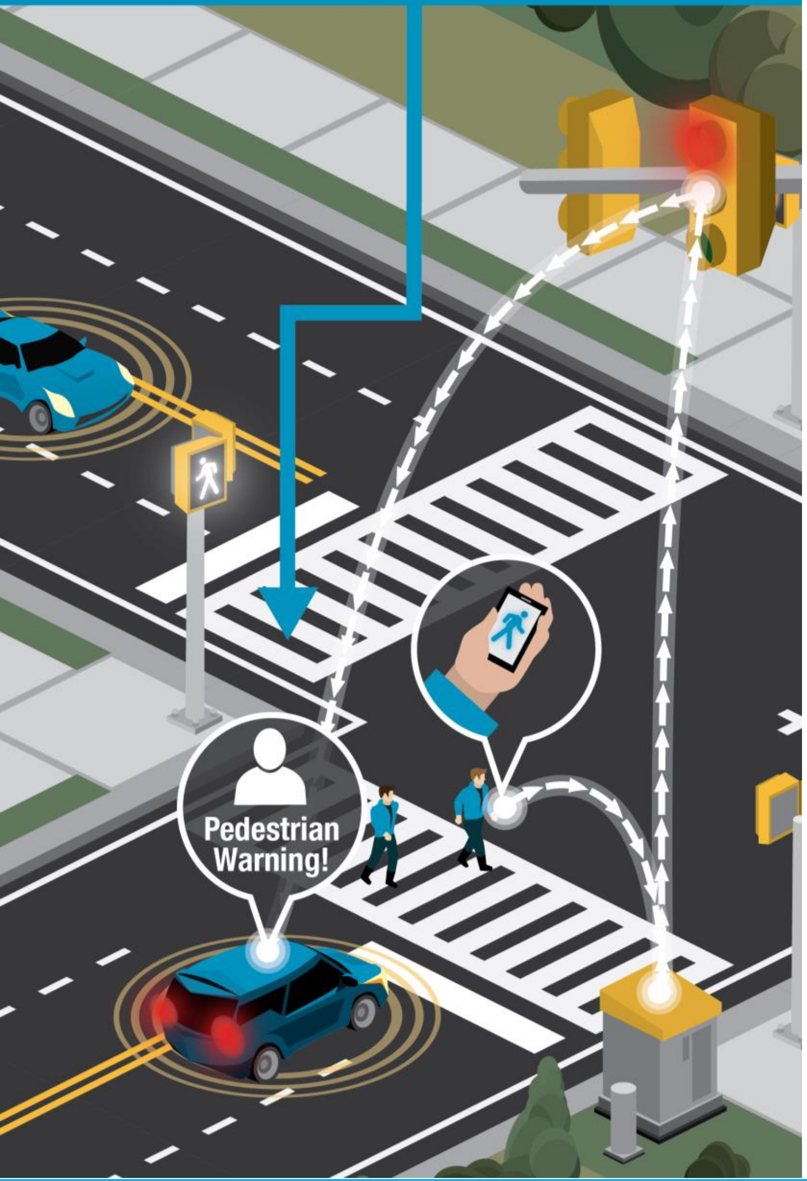
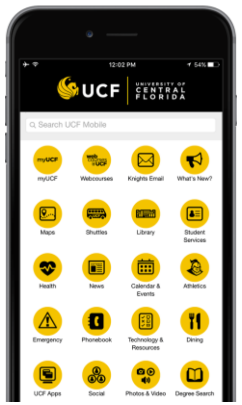
Pedestrian in Signalized Crosswalk
Warns the driver if a pedestrian is crossing in a signalized intersection



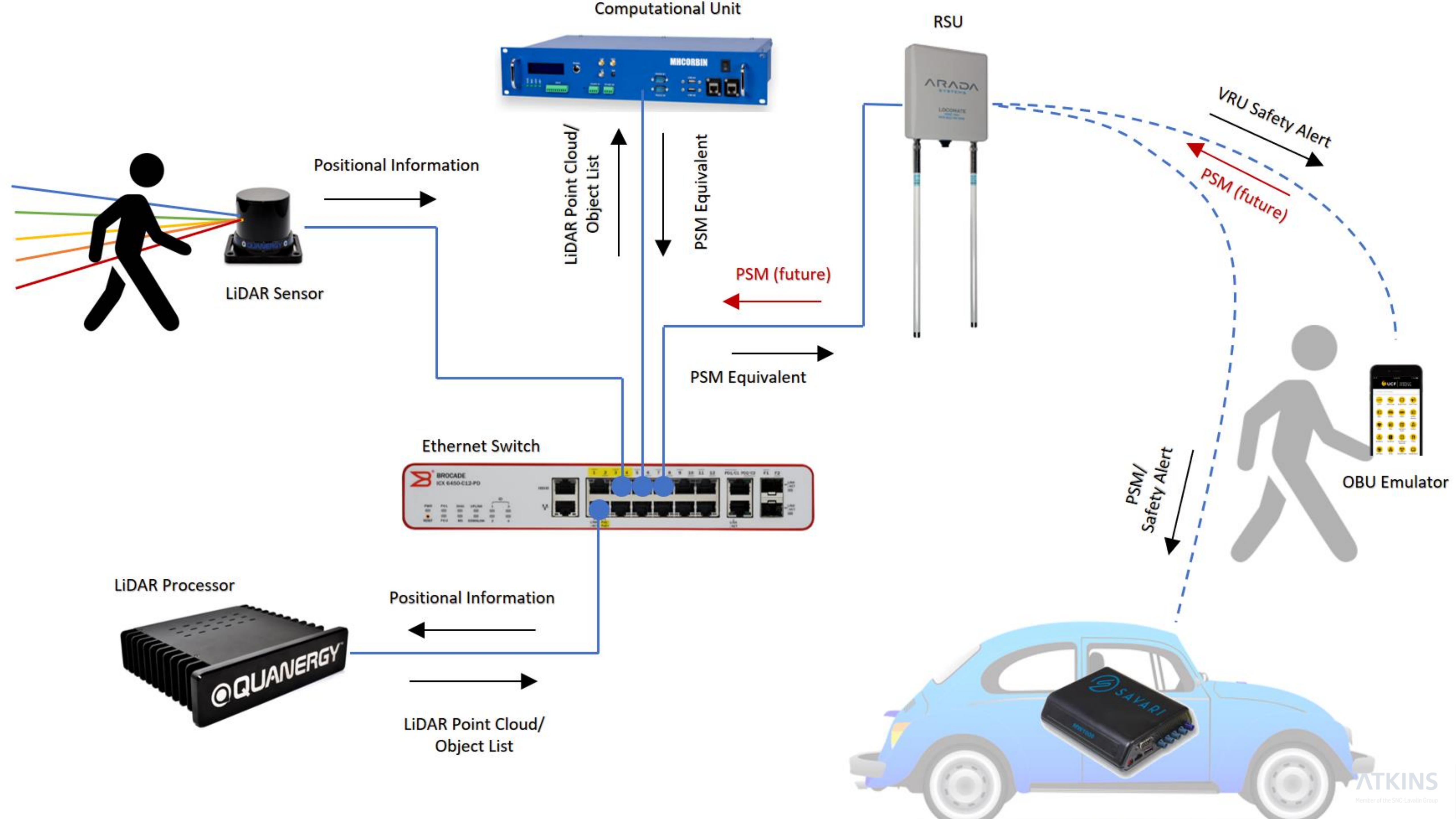
LiDAR Detection → X, Y Positional Tracking of Pedestrians w/ Time-Stamp

Processing Unit → Processor for Detection Inputs

Roadside Unit (RSU) → Broadcasts Application Messages (BSM, PSM)



OBU Emulator → Receives Application Messages, Visual/Audio Alert to Motorists, Pedestrians



Computational Unit
RSU
VRU Safety Alert
PSM (future)
Positional Information
LiDAR Point Cloud/ Object List
PSM Equivalent
LiDAR Sensor
PSM (future)
PSM Equivalent
Ethernet Switch
OBU Emulator
PSM/ Safety Alert
LiDAR Processor
Positional Information
QUANERGY
LiDAR Point Cloud/ Object List
ARADA
SAVARI
BROCADE
ATKINS

Questions?

THANK YOU FOR LISTENING.