HOW CONNECTED VEHICLES CAN SAVE LIVES

MIKE PINA

U.S. Department of Transportation (USDOT)

Federal Highway Administration

Intelligent Transportation Systems Joint Program Office

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THE SCALE OF THE PROBLEM IN THE U.S.

SAFETY

- 37,133 highway deaths in 2017

- 7.2 million crashes in 2016

- Leading cause of death for ages 11, 16-24

Pedestrian fatalities declined about 2 percent, the first decline since 2013

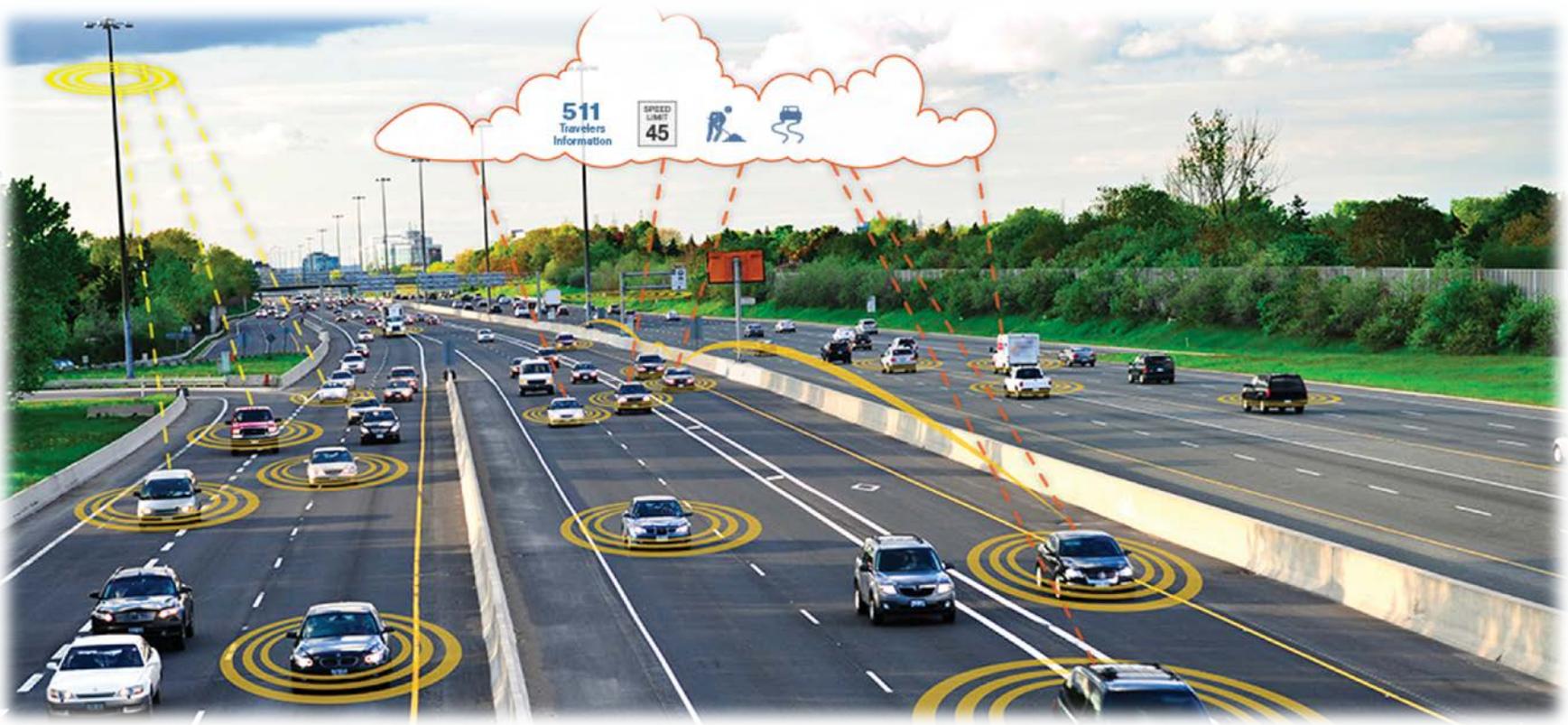**For the second year in a row, more fatalities occurred in urban areas than rural areas**

**Combination trucks involved in fatal crashes increased 5.8 percent**

WHAT IS CONNECTIVITY?

- **Vehicle-to-vehicle** and **vehicle-to-infrastructure** communications enable the vehicle to exchange data with nearby vehicles and roadside infrastructure
- Different communications technologies (e.g., LTE, DSRC, Satellite) are utilized depending on the performance requirements of the applications
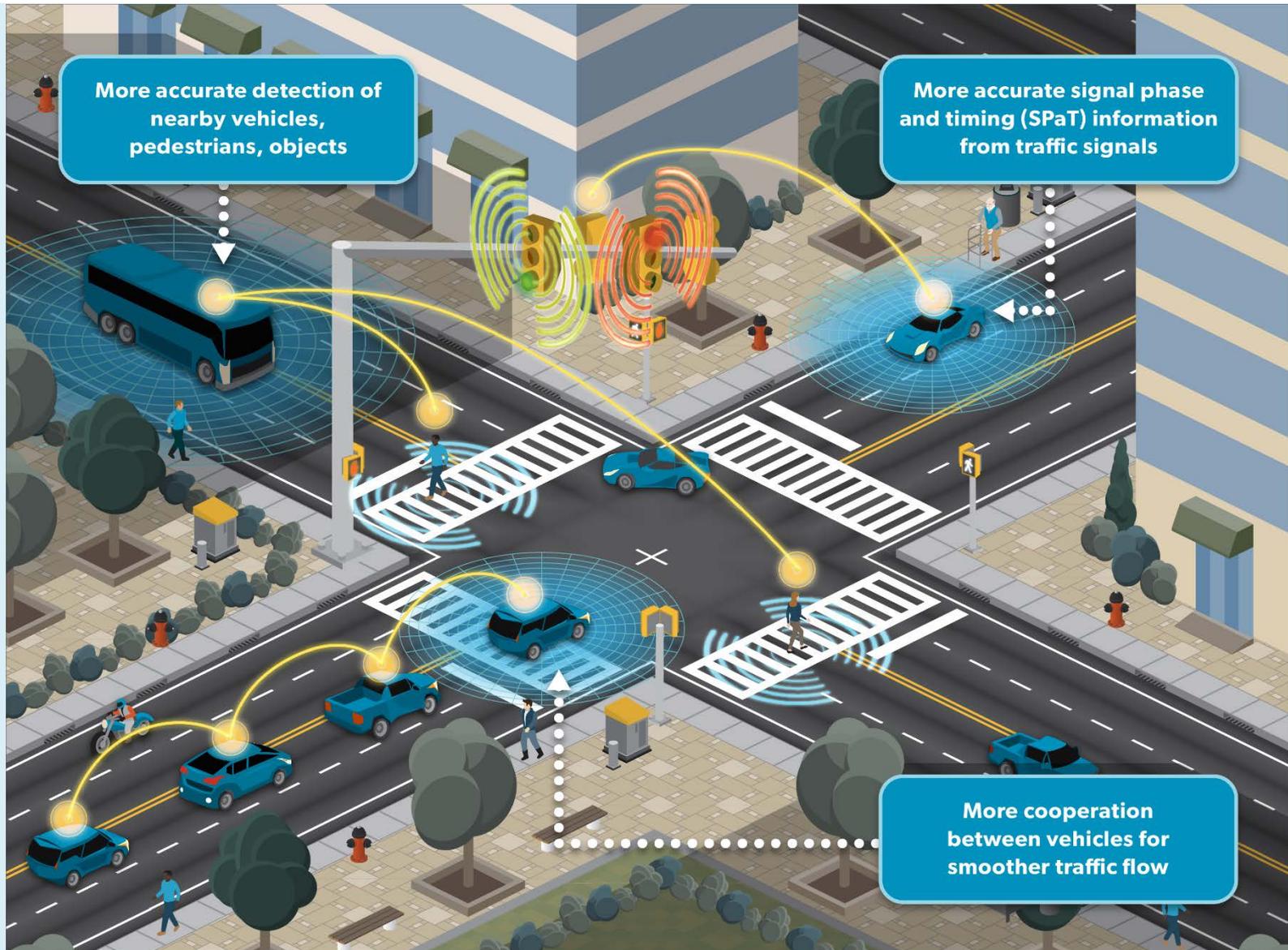
Imagine a Transportation System in which
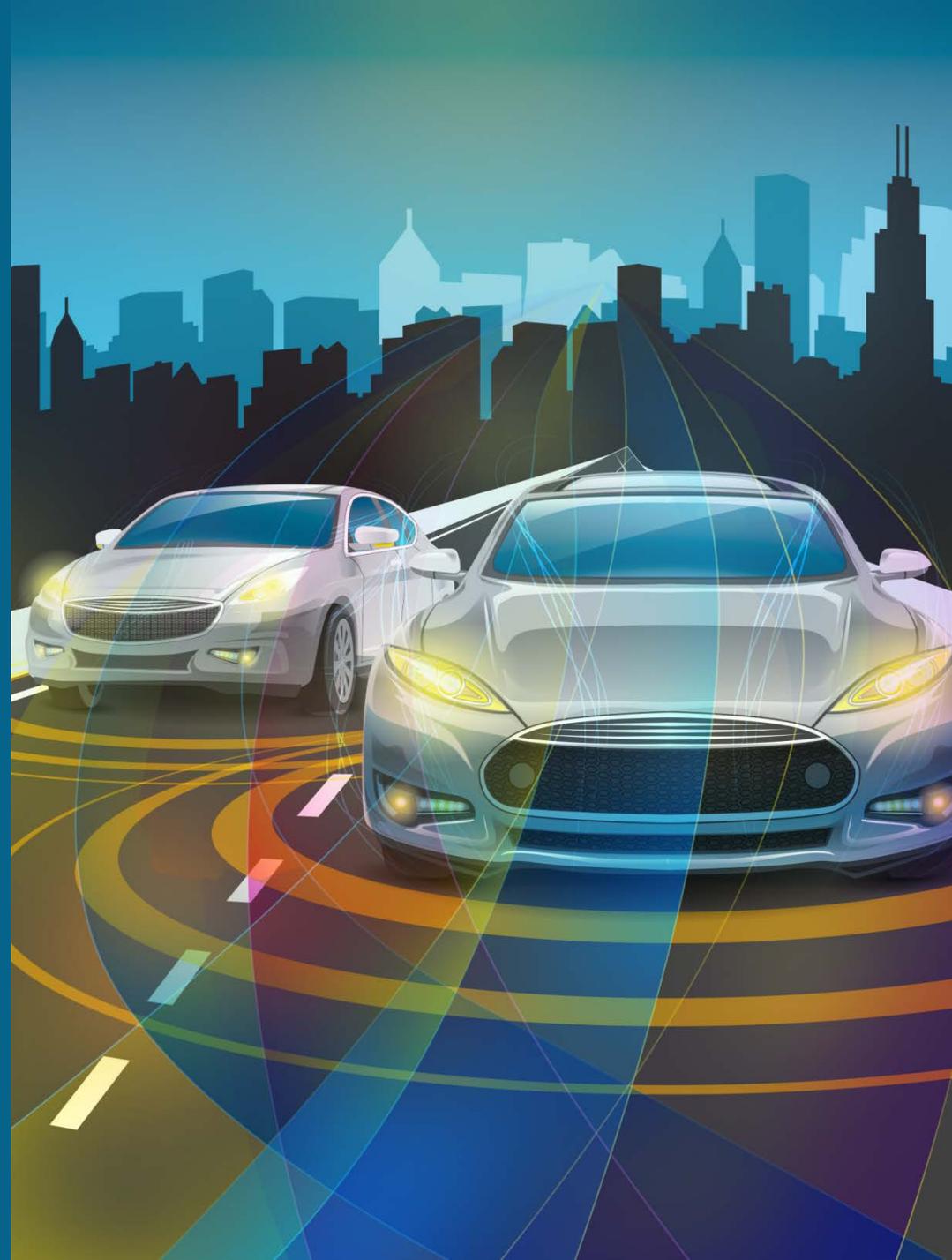**VEHICLES CAN SENSE**
Things That You Can't.

How Connected Vehicles Work

1   A wireless device in a car sends basic safety messages 10 times per second

2   Other nearby cars and roadside equipment receive the messages

3   Drivers get a warning of a potential crash

*Connected vehicles have the potential to reduce non-impaired crash scenarios by **80%***
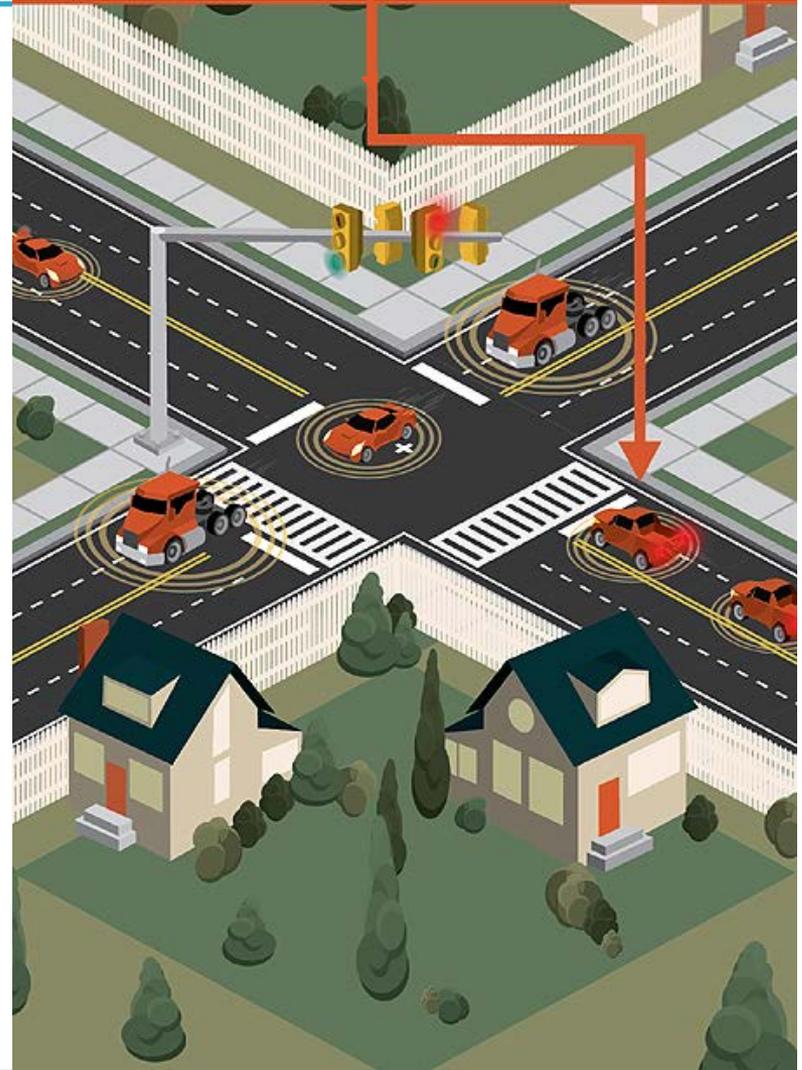
*Source: NHTSA

INTERSECTION MOVEMENT ASSIST

Warns the driver when it is not safe to enter an intersection—for example, when something is blocking the driver's view of opposing or crossing traffic

RED LIGHT VIOLATION WARNING

Issues a warning to a driver who is about to run a red light

CURVE SPEED WARNING

Alerts a driver if the current speed is too fast for an approaching curve.
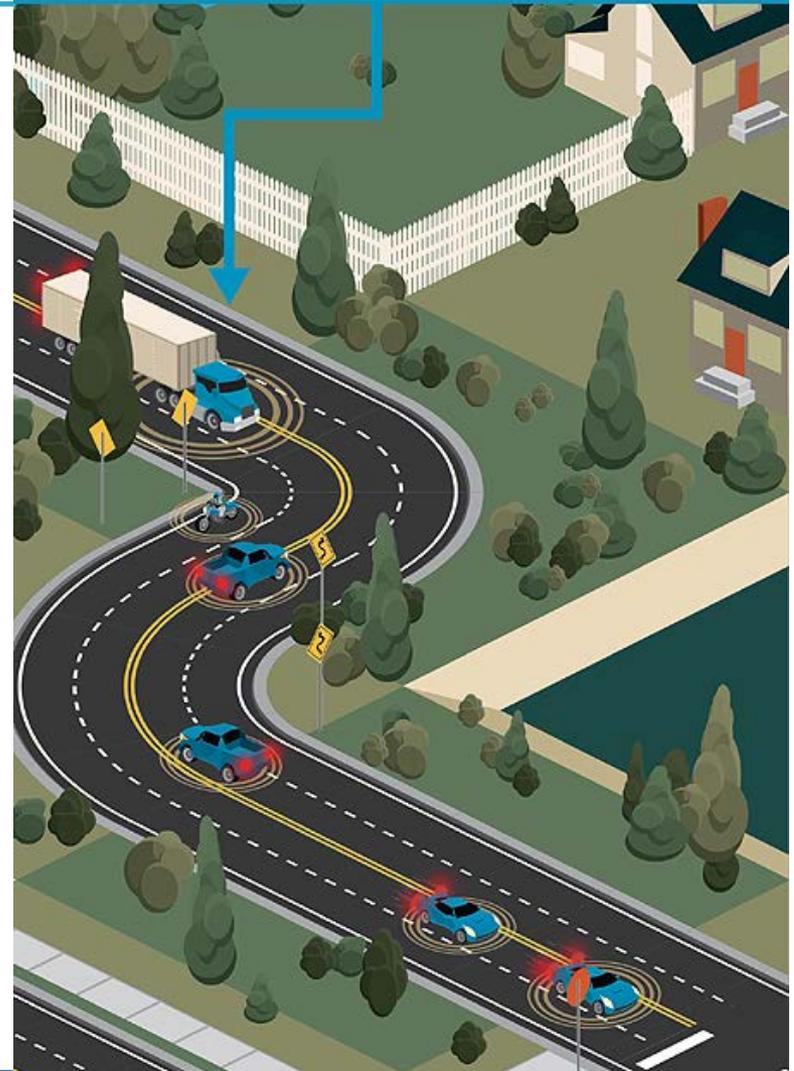
WORK ZONE FATALITIES ARE A SERIOUS ISSUE FOR PUBLIC WORKS AGENCIES

On average, in 2015:

- A work zone crash occurred once every **5.4** minutes.

- Every day, **70** work zone crashes occurred that resulted in at least one injury.

- Every week, **12** work zone crashes occurred that resulted in at least one fatality.

There were an estimated **96,626** *crashes in work zones, an* **increase of 7.8%** *over 2014.*

https://ops.fhwa.dot.gov/wz/resources/facts_stats/safety.htm

CONNECTED AND AUTOMATED VEHICLES CAN HELP

WORK ZONE WARNING

Alerts a driver to use caution when traveling through a work zone
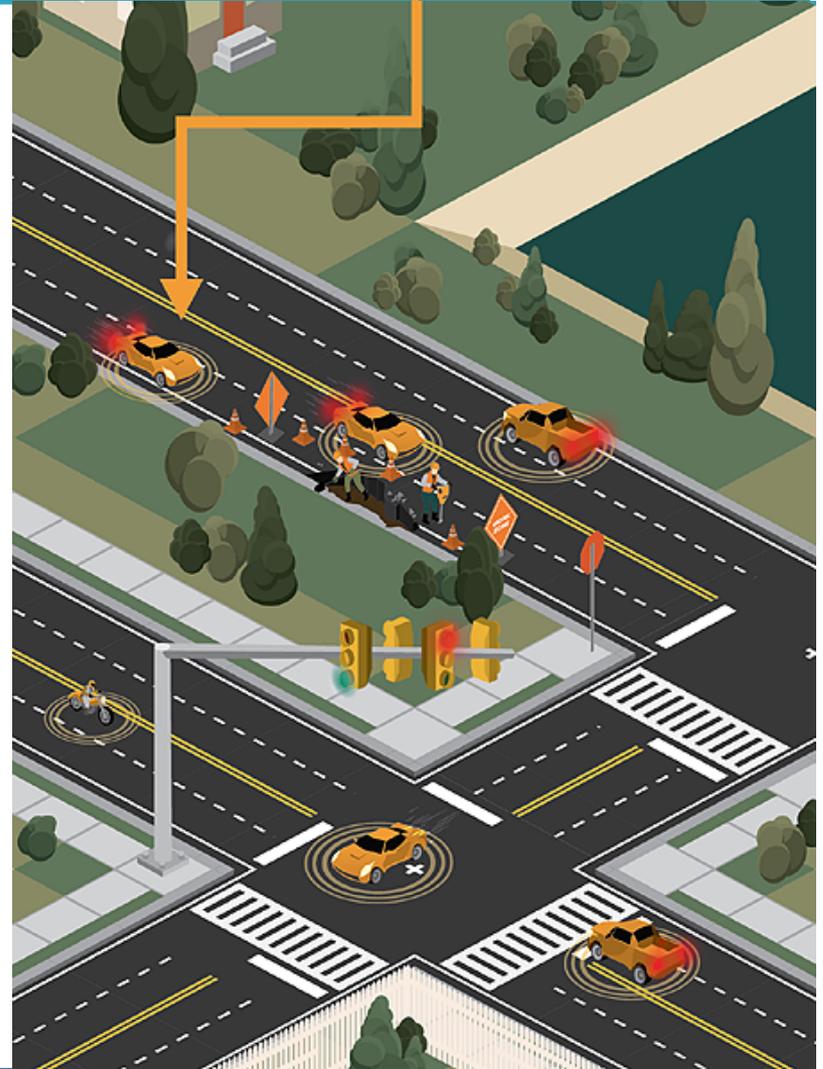
CONNECTED VEHICLE APPLICATIONS CAN ALSO PREVENT CRASHES WITH PEDESTRIANS

- Transit Bus Stop Pedestrian Warning

- Mobile Accessible Pedestrian Signal System

- Pedestrian in Signalized Crosswalk

TRANSIT BUS STOP PEDESTRIAN WARNING

- Warns pedestrians of transit buses approaching/departing a bus stop, as well as warns bus drivers of the presence of pedestrians

- Warns pedestrians getting off a bus of any vehicles near the bus stop that may be out of view, helping to avoid potential collisions

Illustrative purposes only

MOBILE ACCESSIBLE PEDESTRIAN SIGNAL SYSTEM

- Allows visually impaired pedestrians to communicate with traffic signals via smart phones, as well as provides audio cues to help safely navigate the crosswalk

- Drivers also receive alerts of a visually impaired pedestrian in the crosswalk

Connected V2P Application

PEDESTRIAN IN SIGNALIZED CROSSWALK

- Warns the bus driver if a pedestrian is crossing the street as the bus is making a turn

Connected V2P Application

CONNECTED VEHICLES ARE ON OUR STREETS TODAY

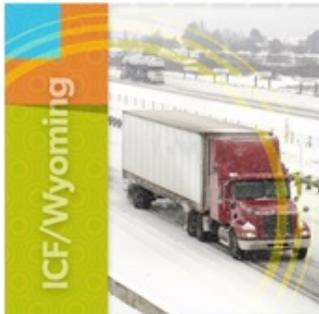**V2V SAFETY TECHNOLOGY IS NOW STANDARD IN CADILLAC CTS SEDANS**

CONNECTED VEHICLE SAFETY PILOT: ANN ARBOR, MI

A major road test and real-world implementation involving:

- 73 miles of instrumented roadway with 27 roadside units in Ann Arbor, MI

- Over 2,800 vehicles equipped with a variety of device types

- Various V2V and V2I applications

- Testing of prototype security mechanisms and device certification processes

- 1 year of data collection to support 2013 NHTSA decision

SAFETY PILOT MODEL DEPLOYMENT SITE PLAN: ANN ARBOR, MICH.

Primary Model Deployment Routes

University of Michigan Campus/Medical Center (Primary Driver Recruitment Area)

Proposed Curve Warning Locations

UMTRI Facilities (Showcase, Facilities, Equipment and Data Storage)

Roadside Equipment Co-Located with Freeway ITS Installation

Roadside Equipment Co-Located with Actuated Traffic Signal

Roadside Equipment/ SPaT-Enabled Traffic Signal

Prototype Solar/ Cellular Roadside Equipment Installation

The Safety Pilot Model Deployment includes more than 73 lane-miles of instrumented roadways.

CONNECTED VEHICLE PILOTS

ICF/Wyoming

- Reduce the number of severity of adverse weather-related incidents in the I-80 Corridor in order to improve safety and reduce incident-related delays.
- Focused on the needs of commercial vehicle operators in the State of Wyoming.

New York City

- Improve safety and mobility of travelers in New York City through connected vehicle technologies.
- Vehicle to vehicle (V2V) technology installed in up to 10,000 vehicles in Midtown Manhattan, and vehicle to infrastructure (V2I) technology installed along high-accident rate arterials in Manhattan and Central Brooklyn

Tampa (THEA)
Tampa Hillsborough
Expressway Authority
EXPRESSWAY

- Alleviate congestion and improve safety during morning commuting hours
- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the transportation challenges.

WYDOT PILOT DEPLOYMENT OVERVIEW

Wyoming I-80 Corridor – Connected Vehicle Map

Approach:

- Equip fleet vehicles (combination of snow plows, maintenance fleet vehicles, emergency vehicles, and private trucks) that frequently travel the I-80 corridor to transmit basic safety messages (BSMs), collect vehicle and road condition data and provide it remotely to the WYDOT TMCs

- Deploy DSRC roadside equipment (RSE) to supplement existing assets and initiatives

- Road weather data shared with freight carriers who will transmit to their trucks using exiting in-vehicle systems

NYCDOT PILOT DEPLOYMENT OVERVIEW

New York City Department of Transportation – Connected Vehicle Map

LEGEND: ● Indicates at least one fatality (2012–2014) ●—● Connected Vehicle Roads

Approach:

- Equip up to 8,000 vehicles (taxis, buses, commercial fleet delivery trucks, and City-owned vehicles) that frequently travel in Midtown Manhattan and Central Brooklyn to transmit and receive connected vehicle data

- Install V2I technology at high-accident rate arterials:

  □ Upgrade 310 traffic signals along 1st, 2nd, 5th, and 6th Avenues in Manhattan and Flatbush Avenue in Central Brooklyn (emergency evacuation route)

  □ Deploy Roadside equipment (RSE) along FDR Drive

TAMPA (THEA) PILOT DEPLOYMENT OVERVIEW
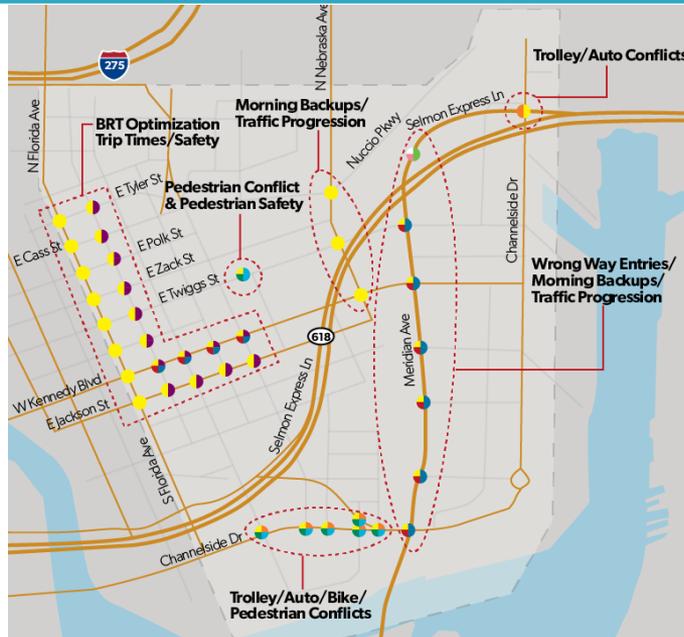
Tampa Hillsborough Expressway Authority – Connected Vehicle Map

LEGEND: Connected Vehicle Application

V2I Safety
- Curve Speed Warning
- Pedestrian in Signalized Crosswalk
- Mobile Accessible Pedestrian Signal (PED-SIG)

V2V Safety
- Emergency Electronic Brake Light
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Vehicle Turning in Front of Bus

Mobility
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (Transit)

Agency Data
- Probe-enabled Traffic Monitoring

Approach:

- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the following transportation challenges:

  - Morning peak hour queues, wrong-way entries, pedestrian safety, bus rapid transit (BRT) signal priority optimization, trip time and safety, streetcar trolley conflicts, and enhanced signal coordination and traffic progression.

CONNECTED AND AUTOMATED VEHICLES CAN BENEFIT THE DISABLED

DEVELOPING THE ATTRI APPLICATIONS

Wayfinding and Navigation:

CITY COLLEGE OF NEW YORK

ABLELINK

PATHWAYS SOLUTIONS
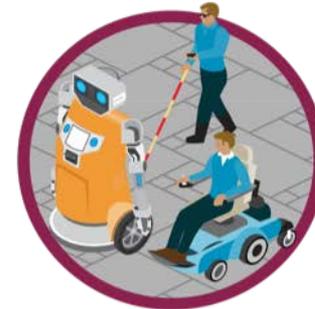
TRX SYSTEMS

Pre-Trip Concierge and Virtualization:

ABLELINK

Safe Intersection Crossing:
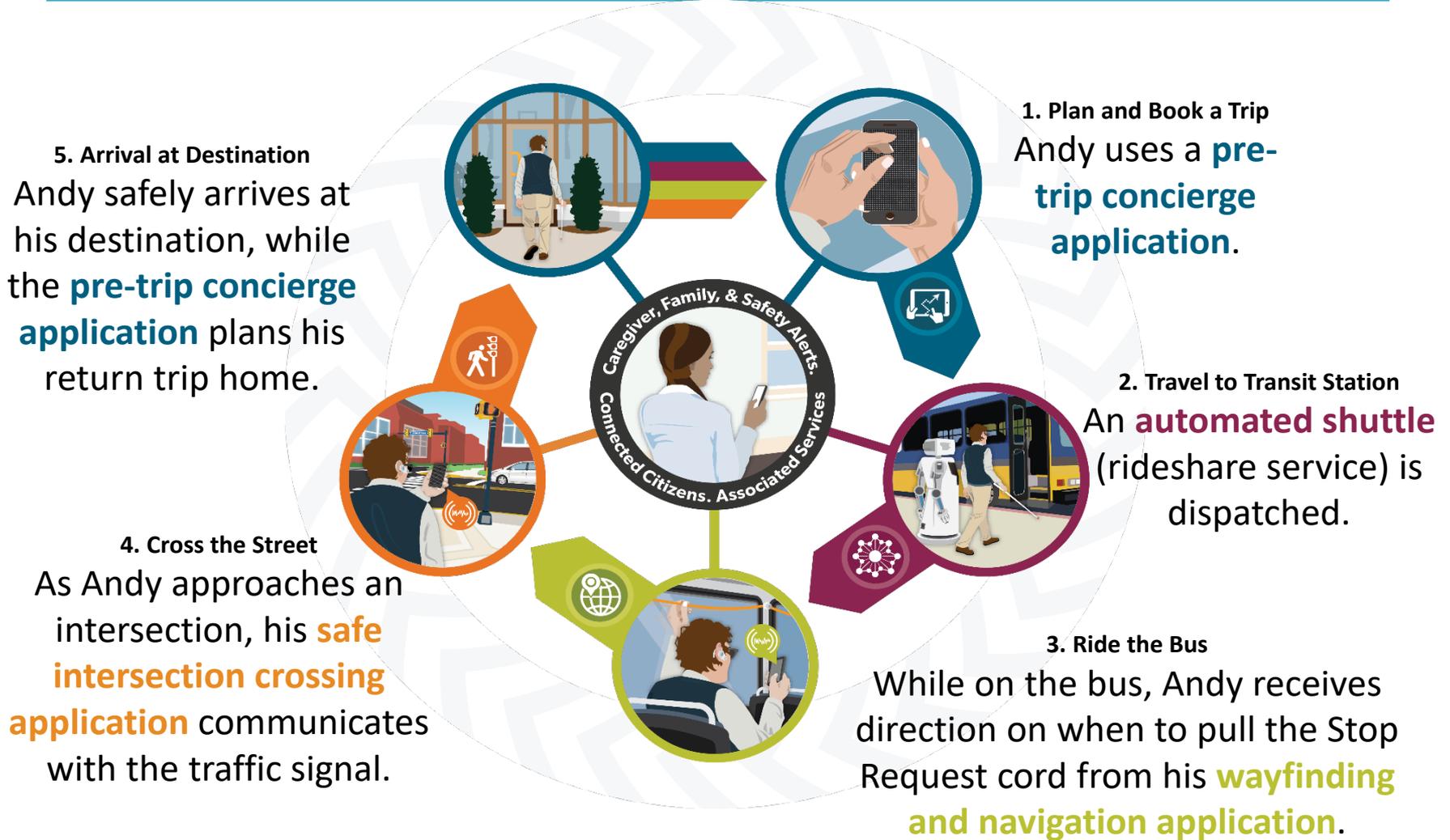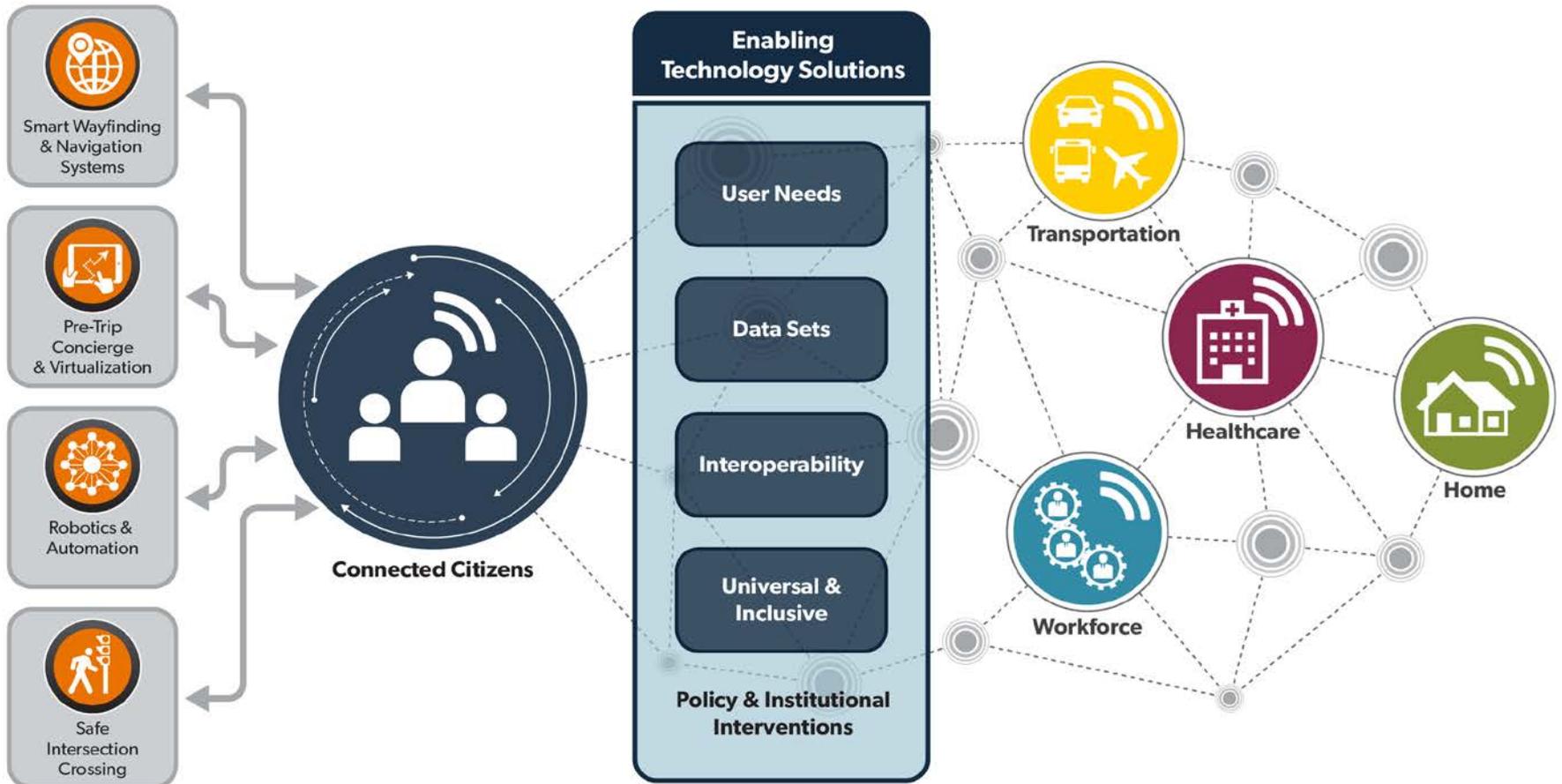
CARNEGIE MELLON UNIVERSITY

Robotics and Automation:

CARNEGIE MELLON UNIVERSITY

TO ENABLE THE COMPLETE TRIP

5. Arrival at Destination
Andy safely arrives at his destination, while the **pre-trip concierge application** plans his return trip home.

1. Plan and Book a Trip
Andy uses a **pre-trip concierge application**.

2. Travel to Transit Station
An **automated shuttle** (rideshare service) is dispatched.

4. Cross the Street
As Andy approaches an intersection, his **safe intersection crossing application** communicates with the traffic signal.

3. Ride the Bus
While on the bus, Andy receives direction on when to pull the Stop Request cord from his **wayfinding and navigation application**.

Caregiver, Family, & Safety Alerts. Connected Citizens. Associated Services
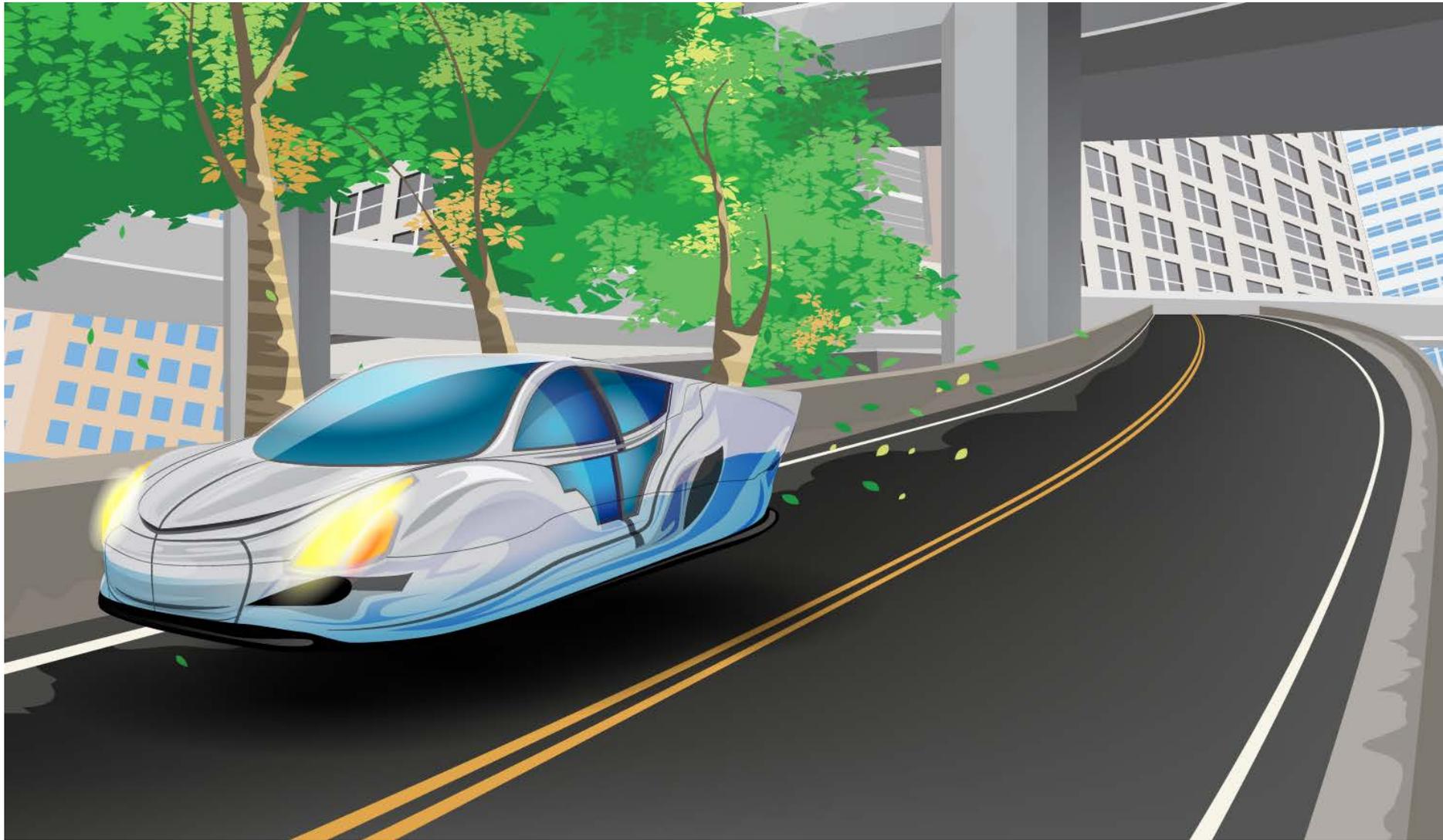
ATTRI AND OTHER POSSIBILITIES

WHAT IS THE NEXT TRANSPORTATION INNOVATION?

AUTOMATION IN TRANSPORTATION IS NOW A TANGIBLE REALITY

AUTOMATED VEHICLES ARE...COMING SOON

The New York Times

Ford Promises Fleets of Driverless Cars Within Five Years

By NEAL E. BOUDETTE   AUG. 16, 2016

WIRED
Technology

Toyota to launch first driverless car in 2020

By BECCA CADDY

Thursday 8 October 2015

TESLA

All Tesla Cars Being Produced Now Have Full Self-Driving Hardware

The Tesla Team • October 19, 2016

MIT Technology Review

Robotics

**2021 May Be the Year of the Fully Autonomous Car**

BMW and Ford have each announced an aggressive time line for producing self-driving cars.

by Jamie Condliffe   August 17, 2016

Mark your calendars: automakers plan to put truly autonomous cars on our roads in the next five years.

Many manufacturers are targeting 2020 (or potentially sooner) to introduce Level 3 and 4 automated vehicles...
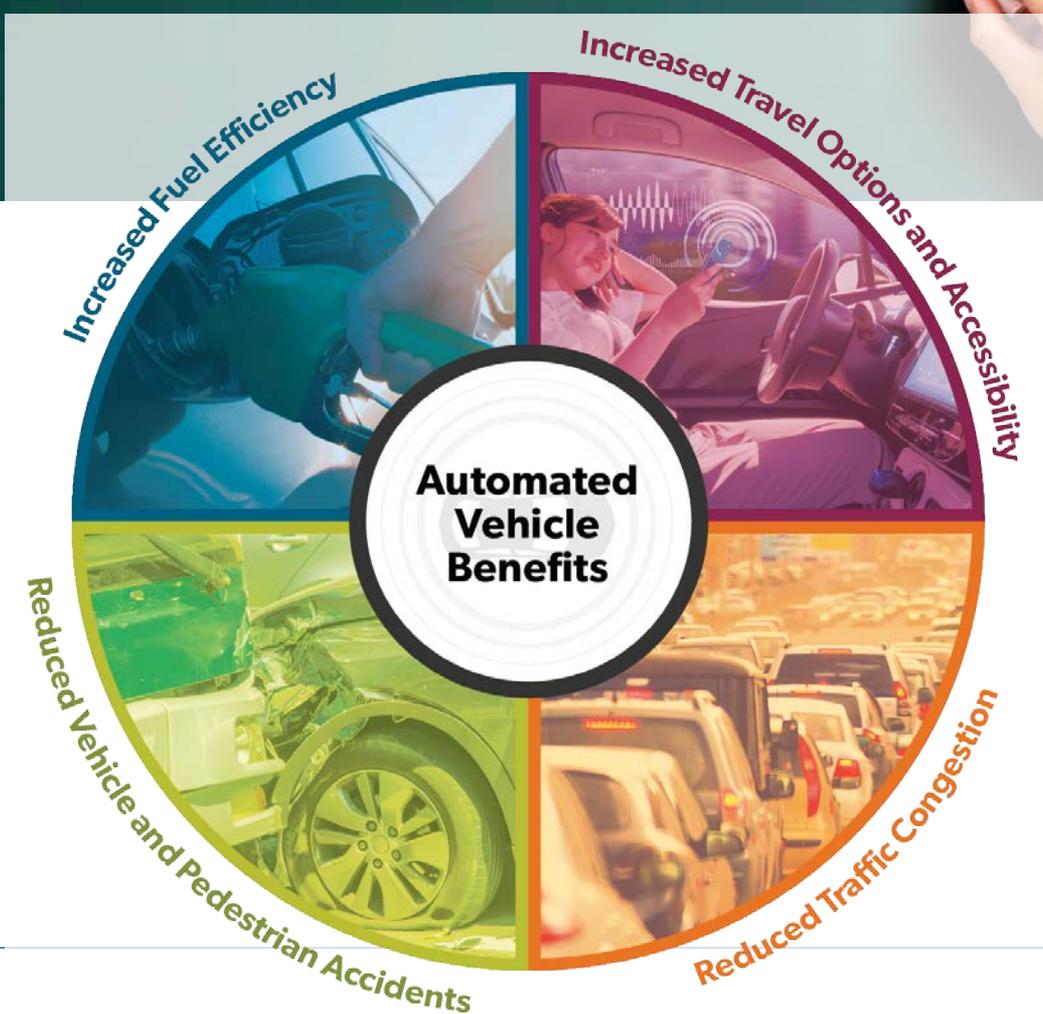
QUESTIONS?

FOR MORE INFORMATION

Mike Pina

USDOT / ITS JPO

Mike.pina@dot.gov

Twitter: @ITSJPODirector

Facebook: www.facebook.com/DOTRITA

Website: www.its.dot.gov