

Transit Connected Vehicle (CV) Projects Update

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Topics

- Transit Safety Retrofit Package (TRP)
- CV Infrastructure - Urban Bus Ops Safety Platform (E-TRP)
- Transit Bus Stop Pedestrian Warning (TSPW) Application
- Integrated Dynamic Transit Operations (IDTO)

Transit Safety Retrofit Package (TRP)

- Applications included in the Safety Pilot Model Deployment
 - *Pedestrian in Signalized Crosswalk Warning (PCW) (V2I)*
 - *Vehicle Turning Right in Front of Bus Warning (VTRW) (V2V)*
 - Forward Collision Warning (V2V)
 - Emergency Electronic Brake Lights (V2V)
 - Curve Speed Warning (V2I)



Image Sources: Battelle and UMTRI, 2012



TRP Lessons Learned

- Transit drivers expressed acceptance of the TRP concept
- DSRC radios performed well – no TRP problems traced to DSRC performance
- Significant rate of false alerts for the PCW application
 - Doppler microwave-based detector technology is insufficient for the PCW application
 - WAAS-enabled GPS accuracy is insufficient for PCW application
- High rate of false alerts for the VTRW application due to GPS limitations

Project Report: [FHWA-JPO-14-142](#)

Independent Evaluation Report: [FHWA-JPO-14-175](#)

CV Infrastructure - Urban Bus Ops Safety Platform

- Design, build, and test an Enhanced TRP (E-TRP)
 - Enhanced Pedestrian in Crosswalk Warning (E-PCW)
 - Enhanced Vehicle Turning Right in Front of Bus Warning (E-VTRW)
 - Rear Camera Integration
 - Improved pedestrian detection sensing technology
 - Improved locational accuracy technology
 - DSRC radio remote management capability
- Greater Cleveland Regional Transit Authority (GCRTA)
 - 80 to 100 buses to be equipped
 - E-PCW at six locations
- Operations: September 20 16 – June 20 17



Image Source: Greater Cleveland Regional Transit Authority (GCRTA)

E-PCW Locations

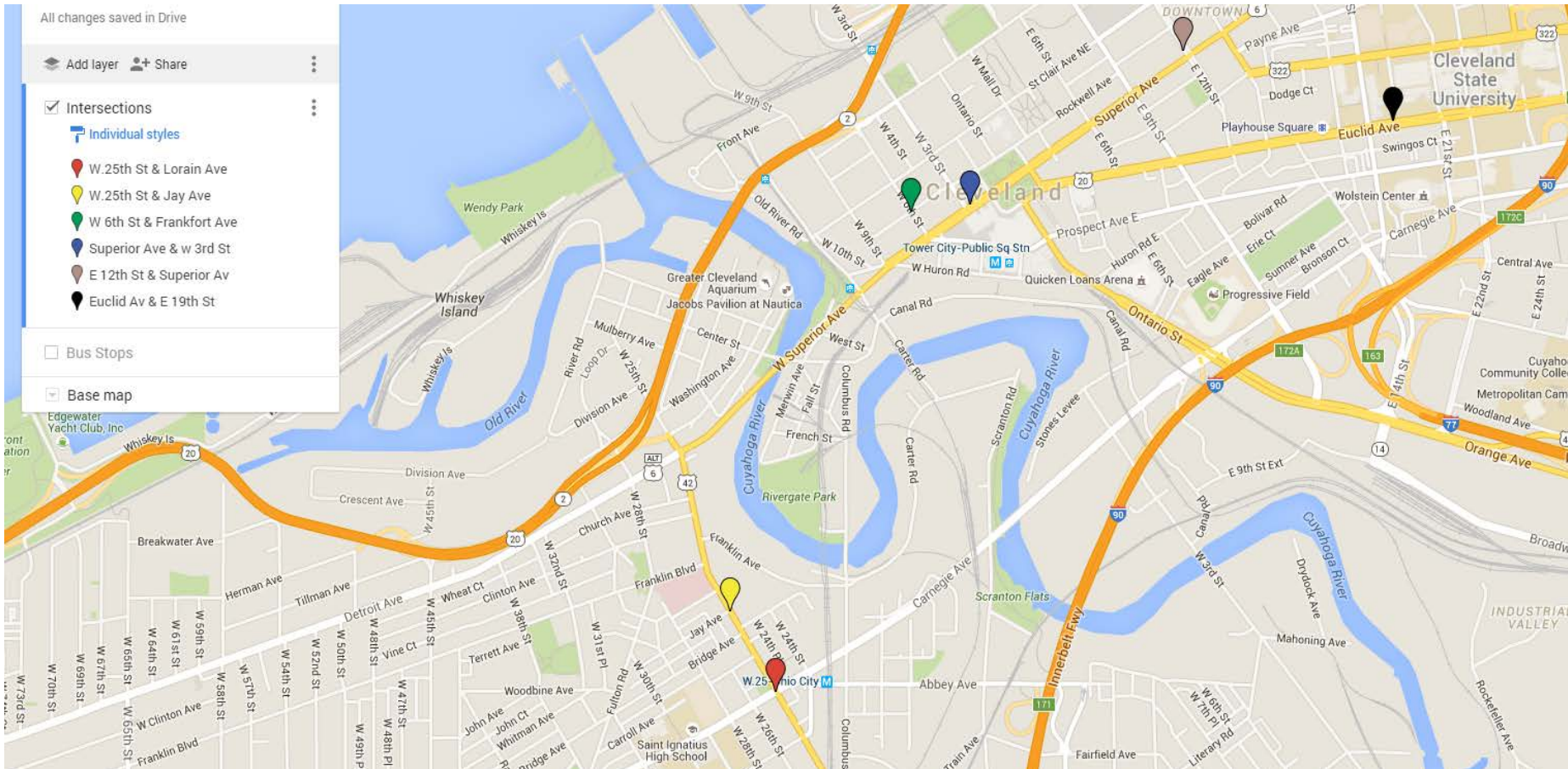


Image Source: Google Maps

E-TRP Evaluation

- Evaluation Areas:
 - System performance
 - Driver response to alerts
 - Return on investment
 - Operational efficiency
 - Driver acceptance
 - Pedestrian perception

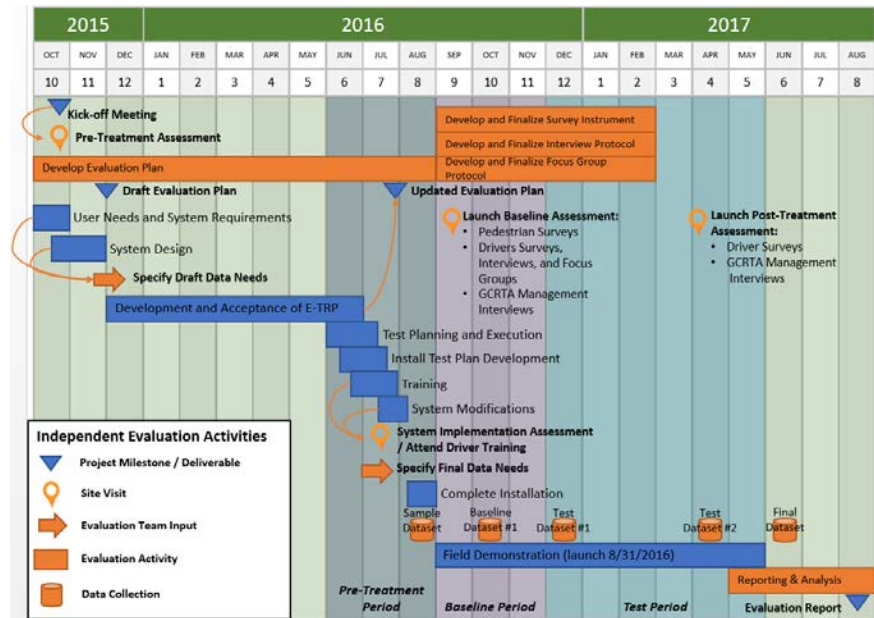


Image Source: ITS Roads

Transit Bus Stop Pedestrian Warning (TSPW) Application

- Design, build, test, and modify a prototype Transit Bus Stop Pedestrian Warning application:
 - Alerts pedestrians of buses approaching and departing stop (V2I & V2I2P)
 - Alerts bus drivers of pedestrians in roadway (I2V)
 - Alerts passengers alighting from buses about approaching motor vehicles (V2I2V)
- GCRTA
 - 80 to 100 buses to be equipped
 - Four bus stops to be equipped
- Operations: December 2016 – June 2017

ConOps: [FHWA-JPO-16-332](#)

SyRS: [FHWA-JPO-16-360](#)

Architecture & Design: [FHWA-JPO-16-401](#)

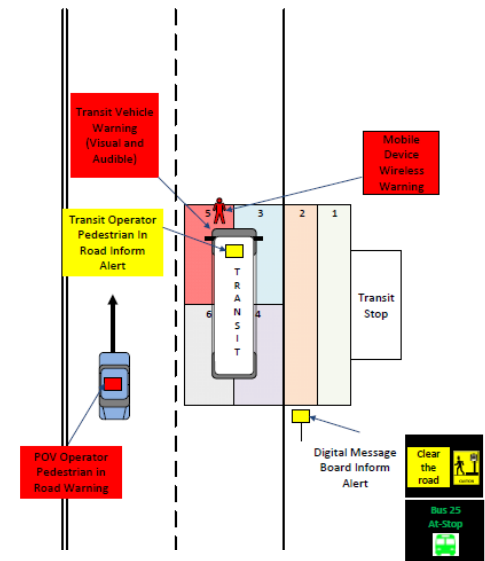


Image Source: Battelle

TSPW Locations

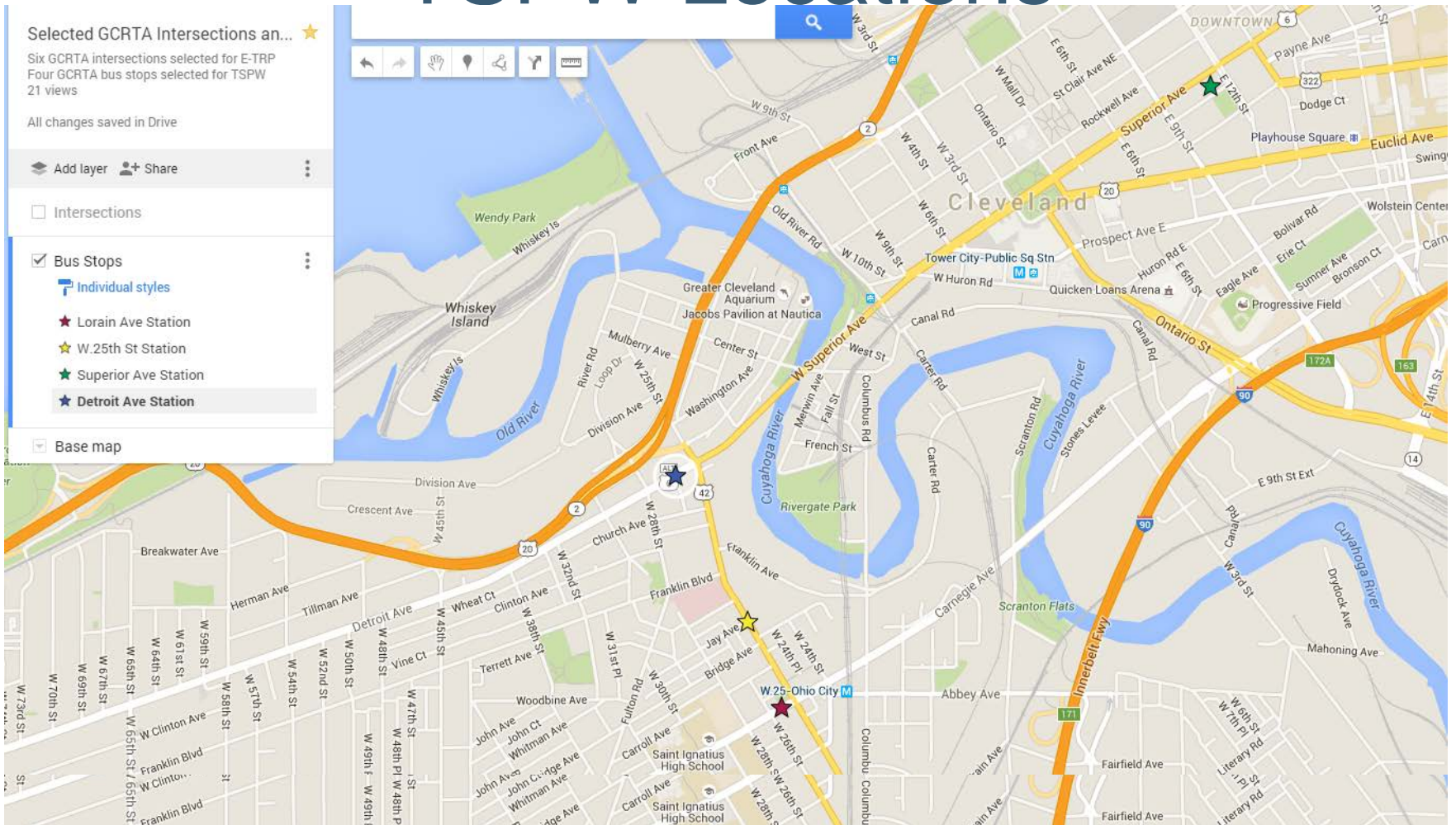


Image Source: Google Maps

TSPW Evaluation

- Evaluation Areas:
 - Application Performance
 - Warning accuracy
 - Missed alerts
 - Bus driver response to warning
 - Pedestrian response to warnings
 - User Acceptance
 - Ease of use
 - Perceived safety benefits
 - Ease of learning
 - Willingness to use

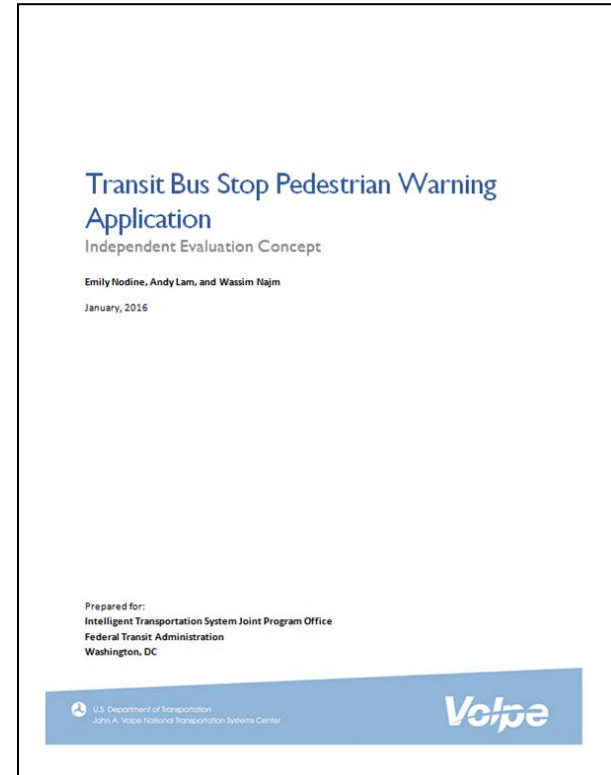


Image Source: The Volpe Center

Integrated Dynamic Transit Operations (IDTO)

- Integrated bundle of three mobility applications:
 - Connection Protection (T-CONNECT)
 - Increases the likelihood of making successful transfers, particularly when these transfers are multi-modal or multi-agency
 - Dynamic Transit Operations (T-DISP)
 - Ability to access real-time information about available travel options, including costs and predicted time
 - Extends demand response services to support dynamic scheduling and routing based on traffic conditions, vehicle capacity, ridership and origin-destination
 - Dynamic Rideshare (D-RIDE)

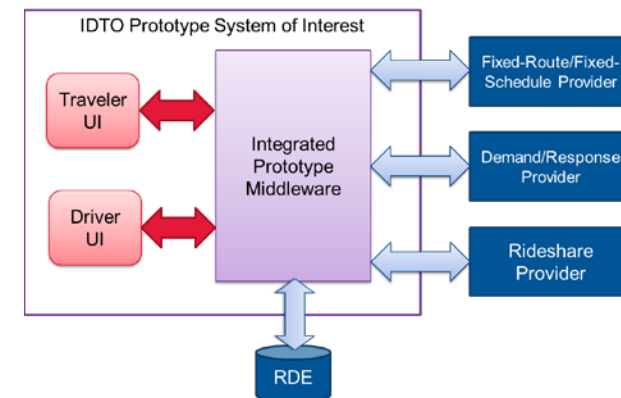
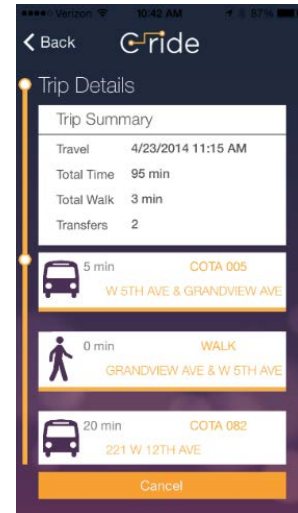


Image Source: Battelle

IDTO Findings & Lessons Learned

- Proof-of-concept prototype was successfully demonstrated
- Lack of true standards and availability of reliable automatic vehicle location (AVL) data were the biggest technical challenges
- Data sharing, privacy, and operational impacts were the biggest institutional challenges
- T-CONNECT scenarios indicated average net travel time savings of:
 - ~4 minutes (for connections to services with 15-minute headways)
 - ~27 minutes (for 40 - minute headways)
- T-CONNECT and T-DISP are cost-effective applications

Project Report: [FHWA-JPO-16-276](#)

Impacts Assessment Report: [DOT-VNTSC-FHWA-16-11](#)

For More Information

<http://www.its.dot.gov/index.htm>

The screenshot shows the homepage of the ITS Joint Program Office. At the top, it features the United States Department of Transportation logo and navigation links. Below this is a search bar and a main navigation menu. The central banner area is split into two sections: on the left, a graphic for the 'ITS 2015-2019 STRATEGIC PLAN' with the text 'Planning for the Future of ITS'; on the right, a yellow call-to-action box for the 'ITS Strategic Plan' with a 'LAUNCH NOW' button. Below the banner are three columns of content: 'Connected Vehicle Basics' with an image of cars and a 'EVENTS' button; 'HOT TOPICS' with a list of subjects and a 'Submit' button for updates; and 'RESEARCH AREAS' with a list of topics.

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