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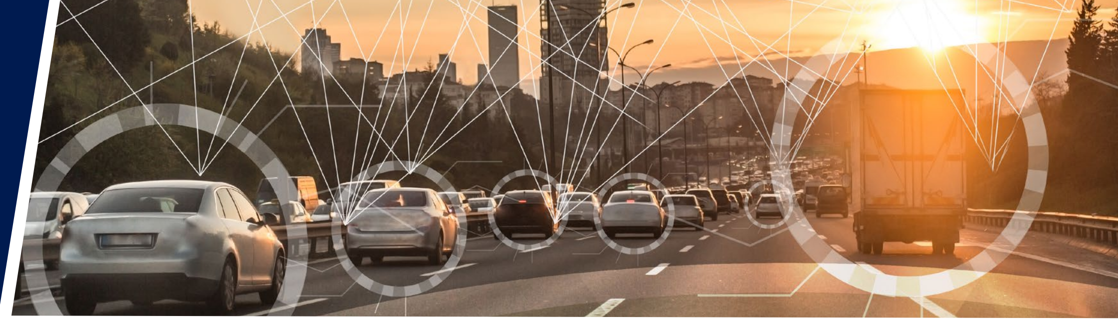

VEHICLE-TO-PEDESTRIAN (V2P) TECHNOLOGY TEST BED

This fact sheet outlines the testing environment developed by the Vehicle-to-Pedestrian (V2P) research team evaluating the safety effectiveness of market-ready products to improve vulnerable road users' safety. This project is funded through U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office (JPO).

INTRODUCTION

Collisions involving pedestrians and bicyclists comprise a large proportion of traffic fatalities every year. With the surge of connected vehicle (CV) technology and push for increased adoption of alternative travel modes, V2P systems are being developed to detect and communicate the presence of at-risk pedestrians or bicyclists through augmented sensors and communication systems, potentially reducing the number of vehicle-pedestrian collisions.

To assess the potential safety effectiveness of V2P systems for improving pedestrian safety, researchers at the Federal Highway Administration's (FHWA) Turner-Fairbank Highway Research Center (TFHRC) have established a multifunctional Pedestrian Technology Test Bed, along with a standardized, holistic, and flexible assessment plan strategy. The vision for the test environment is to support continued research, investigation, and demonstration of connected pedestrian/bicyclist systems, products, concepts, standards, and applications intended to maximize road user safety.

PEDESTRIAN TECHNOLOGY TEST BED AND ASSESSMENT APPROACH

Building on the knowledge gained from prior V2P research, the team developed a versatile assessment plan to investigate the safety effectiveness of market-ready V2P technologies and document their strengths and limitations. The plan includes eligibility criteria for selecting a V2P system for testing, the test cases under which the system should be evaluated, and the performance criteria for evaluating those systems.

Selected systems are required to perform in at least one of the chosen test cases, provide a measurable communication output to the pedestrian, cyclist, and/or driver, function within the environment provided (either at the Pedestrian Technology Test Bed or off-site), and have proper installation validated by the research team.

Four test cases representing the majority of scenarios in which pedestrian vehicle collision fatalities occur are outlined in the assessment plan:

1. **Straight:** A vehicle is traveling straight, on a straight road, and a pedestrian/cyclist makes a perpendicular crossing.
2. **Parallel:** A vehicle is traveling straight, on a straight road, and a pedestrian/cyclist is traveling straight along the roadway.

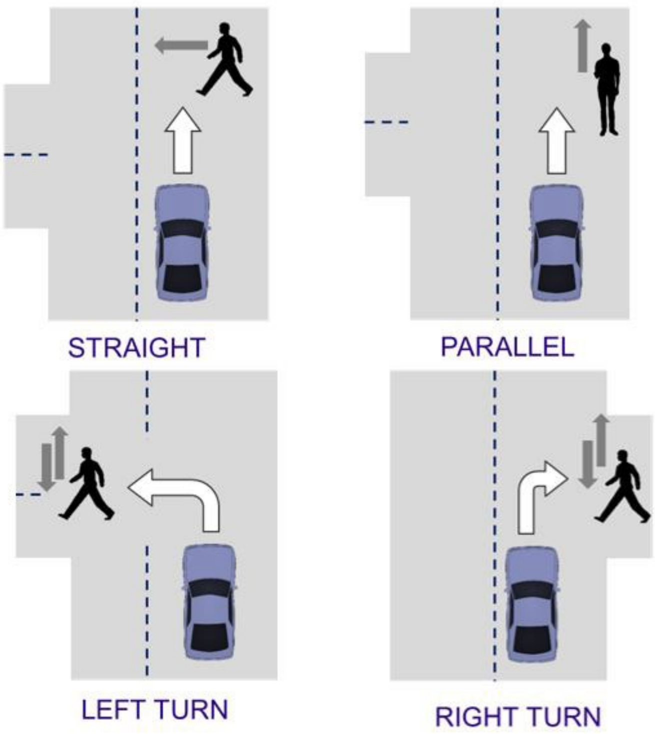

Figure 1. Illustration. Vehicle and Pedestrian Test Cases. *(Source: FHWA)*

3. **Left Turn:** A vehicle attempts a left turn at an intersection while a pedestrian/cyclist attempts a straight path roadway crossing.
4. **Right Turn:** A vehicle attempts a right turn at an intersection while a pedestrian/cyclist attempts a straight path roadway crossing.

Figure 2. Image. FHWA Pedestrian Technology Test Bed intersection and marked mid-block. *(Original photo © Google 2018. Illustrations added by FHWA.)*

The Pedestrian Technology Test Bed, located at TFHRC in McLean, Virginia, was used to implement the assessment plan with multiple market-ready V2P technologies. The Test Bed is comprised of two marked signalized intersections with pedestrian crosswalks, signal heads, and call buttons, as well as a marked mid-block crossing. The intersections are equipped with smart technology to enable wireless communication with equipped vehicles and other devices. The test environment also allows for investigation of different roadway characteristics such as geometry, road grade, and curvature, light, and weather conditions.

IMPLEMENTATION

Research revealed that very few market-ready systems with comprehensive V2P capabilities were available at the time of testing. The following three pedestrian safety technologies were considered for testing based on the types of sensors used and also the types of notification the technologies provide to the users. The technologies acquired for testing included:

- **Vehicle-Based:** This type of system detects pedestrians and alerts drivers through the vehicle or infrastructure. In some cases, technologies are also capable of intervening to prevent the crash if the driver fails to respond adequately. Two systems were tested under this category: a camera-based aftermarket safety device and a camera-radar fusion integrated detection and collision mitigation system.
- **Smartphone-Based:** This type of system detects vehicles and notifies a pedestrian when they are about to be in a dangerous situation using a hand-held device or infrastructure. Typically, these systems operate through a user's mobile phone. The software used was in the early-deployment stage; necessary hardware and software was installed at the Test Bed.
- **Infrastructure-Based:** This type of system has the potential to serve as a "bilateral detection and notification system" which will provide collision alerts to both drivers and pedestrians in parallel, if not only to the drivers at a minimum. No technology was acquired to test this category due to the lack of market readiness, however, comprehensive research was conducted to investigate its potential.

CONCLUSION

This project demonstrated the development of a standardized, holistic, and flexible assessment plan strategy and established a Pedestrian Technology Test Bed to assess the pedestrian safety benefits offered by emerging safety systems. The research team implemented the assessment plan and Test Bed to evaluate three different pedestrian safety systems which allowed for customizable installation, operation, and performance measurement of each system. Together, the results of this effort can be applied to common scenarios observed in pedestrian and bicyclist collisions to better understand the strengths and weaknesses of each technology in terms of improving vulnerable road user safety. Framing the safety effectiveness of technologies within a common perspective of accessibility, functionality, and applicability to known high-risk scenarios enables researchers to advance the development and effectiveness of safety technology for vulnerable road users.