

## **0-6875-03: Automated and Connected Vehicle (AV/CV) Test Bed to Improve Transit, Bicycle, and Pedestrian Safety— Phase III**

### **Background**

Public transit vehicles, pedestrians, and bicyclists share roads in urban, suburban, and rural environments in Texas. Signalized intersections in urban areas are complex shared spaces where crashes involving transit vehicles, bicyclists, and pedestrians can occur. This research explored the potential of automated and connected vehicle (AV/CV) technology to reduce or eliminate these crashes. In Phase III, the smart intersection developed and pilot-tested in Phase II was deployed at the George Bush Drive/Penberthy Boulevard intersection on the Texas A&M University campus. The system was operated, monitored, and evaluated over a 14-month period from April 2020 to June 2021.

COVID-19 influenced the project. Just as the system was coming online in March 2020, shelter in place began, and Texas A&M University pivoted to online classes, which continued through summer. The fall 2020 and spring 2021 semesters were a combination of in-person and online classes. As a result, fewer pedestrians and bicyclists used the intersection. In addition, project panel meetings and the Roundtable Forum were held virtually.

### **What the Researchers Did**

Working with the City of College Station and Texas A&M University Transportation Services, researchers installed the smart intersection at George Bush Drive/Penberthy Boulevard as shown in Figure 1.



**Figure 1. Smart Intersection at George Bush Drive and Penberthy Boulevard.**

The smart intersection includes Texas A&M University buses turning at the intersection automatically communicating with the traffic signal to provide visual and audible alerts to pedestrians and bicyclists waiting to cross the

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street. The equipment at the intersection includes a Siemens M26 controller, a laptop computer and modem, FLIR infrared sensors, a Coda wireless dedicated short-range communication (DSRC) radio, two fiber-optic supplemental bus signs, and two Polara accessible pedestrian systems. DSRC radios, antennas, and related equipment were installed on 10 Texas A&M University buses, which were assigned to route 8 (Howdy Route), which turns left at the intersection.

The smart intersection determines if a bus will be turning at the intersection. The cameras and sensors detect pedestrians and bicyclists waiting to cross the street, and a supplemental bus sign above the pedestrian signal and an audible message, “caution bus turning,” are activated

### **What They Found**

The smart intersection was operated, monitored, and evaluated over a 14-month period. Visual observations and reviews of the data logs from Texas A&M Transportation Services and the signal controller indicated that the system operated properly during the demonstration. Surveys of pedestrians and bicyclists crossing at the intersection conducted in June 2021 indicated that 60 percent reported seeing the supplemental bus signs or hearing the announcement. Further, 60 percent of those individuals reported finding the visual and

audible alerts helpful, and 91 percent responded that the alerts would be helpful for all or some people crossing at the intersection.

An analysis of crossing behavior using video recordings before and during the demonstration showed an increase from 25 percent of pedestrians and bicyclists looking at the pedestrian sign for a long time in the before condition to 33 percent looking at the supplemental bus sign and pedestrian sign for a long time during the demonstration.

A survey of Texas A&M University Transportation Services bus operators provided positive feedback on the smart intersection. A total of 93 percent of the operators responding to an online survey were aware of the system, and 63 percent responded that it helped alert pedestrians and bicyclists to turning buses; 21 percent responded that they were not sure of the impact, and 16 percent suggested that it was not helpful.

### **What This Means**

The successful deployment and operation of the smart intersection and the positive feedback from pedestrians, bicyclists, and bus operators highlight that the use of AV/CV and other advanced technologies benefit all user groups. These results support the Texas Department of Transportation’s goal of making the roadway system safer for all users.

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