Project Summary

Texas Department of Transportation

0-5113: Improving Intersection Safety and Operations Using Advance Warning of End of Green System (AWEGS)

Background

An advance warning of end-of-green system (AWEGS) was developed in an earlier project conducted by the Texas Transportation Institute (TTI) for the Texas Department of Transportation (TxDOT). In 2003, Project 0-4260 developed AWEGS and identified numerous improvements that would enhance AWEGS operation and make it more robust for ease of implementation. The objective of Project 0-5113 was to improve the AWEGS algorithm, deploy the improved algorithm at existing AWEGS deployments, and install AWEGS at a new location.

AWEGS provides warning to motorists on high-speed approaches to isolated traffic signals about the onset of yellow by using flashing beacons on a "BE PREPARED TO STOP WHEN FLASHING" sign. AWEGS enhances the dilemma zone protection at intersections having conventional dilemma zone detectors by protecting vehicles traveling over the 85th percentile speeds up to the 99th percentile speeds. The AWEGS technology developed in Project 0-4260 was installed in two locations, one in Waco and one in Brenham. Both locations showed a reduction in red-light-running of approximately 40 percent.

What the Researchers Did

Researchers identified the following improvements to be made to AWEGS as part of Project 0-5113:

- Reduce false actuations.
- Improve truck detection and treatment.
- Design and evaluate overhead sign configuration.
- Develop failsafe operations due to detector failure.
- Provide warning about the presence of queues.
- Improve AWEGS interface.

False actuations occur when vehicles from a particular movement actuate detectors for other movements (typically left turns). False actuations can result in the beacons flashing unnecessarily. Researchers evaluated controller parameters, such as delay, and better detection technology, such as directional detection in video detection, for their effectiveness in reducing false actuations.

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Project Completed:
8-31-06

Safety and signing experts surveyed the Brenham site and provided comments and suggestions to improve sign visibility. Based on their feedback, a new type of flashing operation known as stutter flash was developed to improve the attention value of the sign. TTI researchers worked with TxDOT engineers to design an overhead sign. This overhead sign was installed on one approach in Brenham. The overhead sign in Brenham was evaluated by collecting speed profiles on the approach. Subsequently, the same sign design was implemented at the new AWEGS location in College Station installed as part of Project 0-5113.

TTI researchers evaluated the operation of AWEGS in the eventuality of the failure of advance detectors. The algorithm was modified to ensure that AWEGS would operate safely when either of the advance detectors fails. The use of stop bar detectors was investigated to develop a queue detection module to continue to flash the beacons at the beginning of green till the queue clears. This mode of operation improves intersection safety during high-volume conditions.

Numerous improvements were made to the AWEGS algorithm and its interface to make it easier to implement at future locations. Improvements to AWEGS included accounting for all types of left-turn treatments, a standardized algorithm for all locations, and the development of a failure notification system in case of AWEGS failure.

What They Found

TTI researchers found that the AWEGS technologies installed in Project 0-4260 continue to provide significant benefits by improving the dilemma zone protection on high-speed approaches. As a result of tasks performed in Project 0-5113, researchers found that incorporating delay for detectors in the signal controller proves to be an easy means to minimize false actuation. If false actuations persist, use of Autoscope® video detection to provide directional detection is a good way to minimize false actuations. TTI researchers also found that an overhead sign combined with stutter flash has a significant impact on the approach speeds. Studies revealed that there was an average of 10 mph reduction in the approach speeds at the advance detectors. This clearly reduces the number of high-speed vehicles on the approach.

The development of queue detection using stop bar detectors has improved safety by continuing to flash the beacons at the beginning of green when a queue is present. This feature was implemented in Waco and is operating satisfactorily. The enhancements to the algorithm and the interface made as part of Project 0-5113 make it much simpler to implement AWEGS at other locations across the state. The AWEGS location in College Station has been well received and has shown a 40 percent reduction in red-light-running on one approach and about 60 percent reduction on the other approach. This is a significant improvement in intersection safety.

The College Station location has higher average daily traffic (ADT) counts (greater than 20,000) compared to the remaining AWEGS locations. This results in a slightly higher advance warning being provided. For efficient and consistent AWEGS operation, AWEGS should be deployed at locations having an ADT of 15,000 or less.

What This Means

AWEGS is a technology proven to improve safety on high-speed approaches to signalized intersections. Significant improvements have been made under Project 0-5113, resulting in an updated and standardized algorithm running at all the AWEGS deployments in the state. The system is now mature for further implementation at other locations in Texas.

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