Project Summary
Texas Department of Transportation

# 0-5845: Alternative Vehicle Detection Technologies for Traffic Signal Systems

## Background

The Texas Department of Transportation (TxDOT) has been using video imaging vehicle detection systems (VIVDS) for signalized intersection control for a number of years, in most cases replacing inductive loops. Even though the accuracy of VIVDS for any presence detection is known to be inferior to inductive loops, and even more so during inclement weather, in changing light conditions, and during nighttime, agencies have continued to install VIVDS due to their positive aspects. However, this research project investigated detectors that would be viable candidates to replace video and inductive loops. Decision criteria for selecting three detectors came from TxDOT, other agencies, manufacturers, the literature, and the knowledge base from previous Texas Transportation Institute (TTI) research.

## What the Researchers Did

TTI conducted a literature search and contacted agencies to determine the state-of-the-practice with respect to non-VIVDS options for signalized intersection detection. Researchers then developed an experimental design to conduct field studies at live intersections where mounting detectors would replicate current practice. TTI proposed a short list of detectors to the Project Monitoring Committee (PMC) before proceeding with testing. In addition to the detectors selected, TTI also proposed methods and locations to use in the field testing phase. Upon approval from the PMC, TTI tested Global Traffic Technologies (GTT) magnetometers, Sensys Networks magnetometers, and the Wavetronix SmartSensor Advance radar. The test location for both magnetometers was College Station, and the test location for the radar was in the Austin area. The manufacturers were involved in setting up all three sites.

## What They Found

- Both magnetometers are “point detectors” with accuracies approaching that of inductive loops for stop line detection.
- GTT detectors mount 24 to 36 inches below the pavement surface – usually in a horizontal bore. Post-construction horizontal boring is expensive. More viable options are installing the necessary conduit before construction at new intersections, or installing them underneath bridges.
- The Sensys Networks magnetometer requires a short lane closure and mounts flush with the pavement surface, communicating with the roadside via wireless communication. It is subject to damage from surface operations such as milling.


### Research Performed by:

Texas Transportation Institute (TTI),
The Texas A&M University System

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- The Wavetronix SmartSensor Advance radar only provides dilemma zone detection, not detection at the stop line. The function of this detector is to monitor main street vehicle distance and speed from the intersection to predict each vehicle's arrival in the dilemma zone.
- Optimum performance of the radar requires setting the appropriate passage time in the controller (0.5 sec to 1.0 sec) and the appropriate range of dilemma zone values (default is 2.5 sec to 5.5 sec). Detector location is the other critical consideration – it should be at the stop bar or not more than about 2.5 sec travel time upstream of the stop bar.
- Detection accuracy of all three detectors is within a desirable range. Both magnetometers over-counted vehicles at the stop line, but did not miss vehicles except some motorcycles. The radar detected gaps in traffic better than video and exhibited detection accuracy that was on par with video in good weather. It is not affected by weather or light, so its accuracy under adverse conditions would exceed video.
- Initial costs using these detectors increase generally with the number of lanes and speeds. For both stop line and dilemma zone detection, the Sensys Networks is usually the least expensive even if GTT boring is excluded. For dilemma zone detection only, the Sensys Networks detector is the least expensive for one through-lane but the Wavetronix SmartSensor Advance radar is the least expensive for two or three through-lanes.

## What This Means

Findings of this research indicate that there are viable options that TxDOT can and should consider for replacement of video imaging systems and inductive loops. However, a decision by TxDOT to remove all detection from the pavement would eliminate Sensys Networks magnetometers from further consideration. These detectors should not be ruled out if short lane closures are acceptable, where railroad tracks create challenges for wired options, or where short-term detection needs override the anticipated change.

*For More Information:*

0-5845-1 Alternative Vehicle Detection Technologies for Traffic Signal Systems: Technical Report

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