Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6828: Develop Guidelines for New Vehicle Detectors at High-Speed Signalized Intersections

Background

The traditional vehicle detection method that has been used by the Texas Department of Transportation (TxDOT) on high-speed signalized intersection approaches for many years involved multiple detection points, with inductive loops being the early favorite in terms of technology. However, TxDOT districts began adopting video-imaging detectors to replace loops as video began to show sufficient improvement, even though they were not as accurate as loops. Later, following disappointing results from video implementation, TxDOT began investigating and installing newer detectors with hopes of both safety and operational advances but without full knowledge of how well the new detectors worked. Most of the newer systems overcame the challenges of traffic interference and compromised pavement integrity that plagued loops, and some appeared to improve detection performance over video. Based on this background, this research project:

- Determined current TxDOT-specific needs for new vehicle detectors.
- Identified the most promising detectors for both stop line and dilemma zone detection.
- Developed guidelines on each new technology and established recommended settings to guide TxDOT on installation and use of each detector and combination of detectors.

What the Researchers Did

In the initial task, the research team proposed a list of seven detectors and the methodology of testing for consideration by TxDOT. The test plan also included where to test, and test metrics for collecting and analyzing data. Table 1 lists the remaining detectors after determining that one of the initially selected detectors should be dropped.

In the second task, researchers conducted full-scale field tests first at the Texas A&M University Riverside Campus and then at four TxDOT intersections in the Houston and Austin Districts. The weather/light conditions that were available were day/dry, light transition/dry, day/rain, and night/dry; the speeds were 50 mph and 70 mph.

What They Found

Table 2 shows the resulting correct detection rates based on the controlled Riverside Campus environment and a very simple test scenario of constant speed and a single vehicle in the detection zone at a time.

What This Means

Table 3 provides selected key guidelines for the detectors.

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Table 1. Detectors Selected for Field Testing.

Detector	Technology	Upstream/ Stop Line
Aldis GridSmart	Video	Both
FLIR VIP with IR Camera	Video	Both
Iteris Vantage Vector	Doppler radar	Upstream
	Video	Stop line
Trafficware Pods	Magnetometers	Both
Wavetronix SS Advance	Doppler radar	Upstream
Wavetronix SS Matrix	Doppler radar	Stop line

Table 2. Correct Detection Rates.[a]

	50 mph				70 mph			
Detector	Day, Dry	Trans, Dry	Night, Dry	Day, Rain	Day, Dry	Trans, Dry	Night, Dry	Day, Rain
FLIR VIP Stop Line[b]	94.01%	95.74%	98.14%	97.67%	97.39%		99.44%	95.65%
Iteris Stop Line[b]	93.83%	100.00%		71.43%	78.79%	100.00%		0.00%
Iteris Trip at 485 ft	79.01%	93.33%		95.24%	87.88%	72.73%		56.41%
Iteris Trip at 566 ft					39.39%	72.73%		48.72%
Wavetronix Matrix[b]	101.30%		97.56%	106.90%	97.92%			90.00%
Wavetronix Advance	94.81%		97.56%	96.55%	97.92%			96.67%
Aldis Upstream	75.46%	67.77%	98.90%	85.78%	6.55%	0.00%	100.00%	0.00%
Aldis Stop Line[b]	79.60%	87.60%	98.14%	100.43%	92.09%	100.00%	100.00%	100.00%
Pod at stop line	92.81%	96.69%	97.67%	91.81%	98.98%	100.00%	98.89%	98.55%

[a] Shaded cells indicate no data for that condition.

[b] Stop line correct detection rates consider stuck-on and dropped calls as correct detections for detectors noted.

Table 3. Guidance on Use of Selected Detectors.

Detector	Guidance: Salient Points
Aldis GridSmart	Single CAT5 cable and easy video recording are key features. Location of single fisheye camera is critical to optimized performance.
FLIR VIP with IR Camera	Not best for upstream and only where standard cameras do not work well. Midday hot weather causes higher than expected number of misses. Sensor adjustment was more complicated than that for other sensors. Higher initial cost than standard cameras.
Iteris Vantage Vector	Initial cost is lower than some alternatives. The radar missed more vehicles at 70 mph than 50 mph, so its use at the highest speeds may be inappropriate. Firmware is being modified. Place radar on near side of intersection to optimize range.
Trafficware Pods	Treat Pods as loop replacements at similar cost but still intrusive. Latency of up to 200 milliseconds requires modest position adjustment for upstream detection.
Wavetronix SS Advance	Easy installation and setup. Excellent results for all vehicular speeds/classes and weather conditions. Recommend using the SS-200E (Extended Range) instead of SS-200. Set controller extension time to 1.0 second. Higher initial cost may be offset by lower life-cycle cost.
Wavetronix SS Matrix	Detection accuracy is good in typical Texas weather conditions. Consider tall vehicles and possibility of false detections in adjacent lanes. Higher initial cost may be offset by lower life-cycle cost.

For More Information

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