TECH BRIEF

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Flashing Beacons

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Description

Beacons are flashing lights intended to draw a driver's attention towards the associated traffic control.

Flashing beacons supplement stop signs and are intended to reinforce awareness of existing stop signs. Two different types of intersection beacons are typically used, including standard overhead beacons mounted over the intersection and sign mounted beacons that may be mounted on the stop sign or "Stop Ahead" and "Intersection Ahead" signs.

Placement

Standard overhead beacons include the following:

- Red flashers placed facing the stop-controlled approach and yellow flashers placed facing the unstopped approaches for two-way stop controlled intersections
- Red flashers placed to face all approaches at all-way stop controlled intersections (Antonucci et al. 2004)

Flashing beacons can also be used on stop signs or stop ahead signs.

Stop sign-mounted beacon (Stein and Neuman 2007)

Antonucci et al. (2004) suggest that flashing beacons are the most effective at intersections with patterns of right angle crashes related to lack of driver awareness. Additionally, they need to be properly placed so they are visible to drivers on the corresponding approach.

Flashing beacons are addressed in Section 4B.04: Alternatives to Traffic Control Signals of the *Manual on Uniform Traffic Control Devices* (MUTCD) (FHWA 2009).

Effectiveness of Stop Sign-Mounted Beacons in Reducing Crashes

Several studies have evaluated the effectiveness of beacon installation. Table 1 summarizes the studies where crash reductions were found. Each study is also described in the following sections.

National Studies

Srinivasan et al. (2012) evaluated the effectiveness of flashing beacons at stop-controlled intersections. Standard overhead beacons, beacons on stop signs, and actuated beacons were included in the study. Geometric data, traffic data, and crash data were obtained for stop-controlled intersections with flashing beacons at 64 sites in North Carolina (NC) and 42 sites in South Carolina (SC).

A before and after Empirical Bayes method was used to study the safety effectiveness. They found an 11.9 percent reduction in angle crashes (standard error (SE) = 5.4) for standard overhead beacons which included data from NC and SC. A 58.2 percent (SE = 16.3) reduction in angle crashes was reported for standard stop sign mounted beacons, which included data from NC and

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Table 1. Crash Reduction for Installation of Intersection Flashing Beacons

Studies	Location	Number of sites	Beacon type	Crash type	Change in crashes
Srinivasan et al. 2012	NC & SC	84	Standard overhead	Angle	-11.9% (5.4)
		5	Stop sign	Angle	-58.2% (16.3)
Pant and Park 1999	OH	7	Standard overhead	Fatal	-56%
				Angle	-19%
Murphy and Hummer 2007	NC	34	Standard overhead	Total	-12%
				Injury	-9%
				Severe injury	-40%
				Frontal impact	-9%
				Ran stop sign	-26%
Brewer and Fitzpatrick 2004	TX	4	Standard overhead	Preventable	-43%
Stackhouse and Cassidy 1996	MN	8	Standard overhead	Total	-39%
		4	Stop sign & intersection ahead signs	Total	-40%

SC. A 14.0 percent (SE = 9.8) reduction in angle crashes was found for actuated beacons using data from NC.

Pant and Park (1999) performed a comparative study of the effectiveness of standard overhead beacons at beacon-controlled intersections in rural areas of Ohio. A before-and-after analysis was performed by comparing the accident data at seven two-way beacon-controlled intersections with the availability of two to three years of accident and traffic-volume data. A decrease of 56 percent in fatal crashes was noted as well as a decrease of 19 percent for angle crashes. They did report that the differences were not statistically significant.

The beacons did reduce vehicular speeds in the major directions of traffic, especially at intersections with inadequate stopping sight distance.

Murphy and Hummer (2007) developed crash reduction factors for standard overhead beacons at 34 four-leg two-way stop-controlled rural intersections in North Carolina. An Empirical Bayes analysis was conducted which accounted for increases in traffic volume. Results showed a decrease of 12 percent in total crashes, a 40 percent decrease in severe injury crashes, a 9 percent reduction in frontal impact crashes, and a 26 percent reduction in "ran stop sign" crashes.

Brewer and Fitzpatrick (2004) investigated various treatments for rural highways and intersections in Texas by analyzing crash data before and after installation of the measures. They evaluated four intersections where flashing overhead beacons were installed and found that the crash rate was reduced by 43 percent (0.49 to 0.28 crashes per month) from the period of three years before to three years after the improvement was installed.

Goldblatt (1977) conducted a study to evaluate the operational effects of continuously and vehicle-actuated flashing traffic control devices. The study was conducted at a research facility. Three advance warning device configurations were evaluated at five intersections. The study found that speeds were lower with the use of flashing intersection beacons at stop-controlled approaches compared to those with stop signs only or vehicle-actuated intersection beacons.

Stackhouse and Cassidy (1996) compared accident experience at rural intersections for three years before and after period-installation of various warning beacon configurations. Twelve intersections were included in the study. All were four-ways with stop control on the minor approaches. Eight of the twelve intersections had overhead flashers installed, and a 39 percent reduction in accidents after installation of the overhead flashers was reported.

Stackhouse and Cassidy (1996) also conducted a survey to test driver understanding and response to overhead and sign-mounted beacons. They found that for most drivers both overhead and sign-mounted flashing beacons warned drivers that the intersection was potentially more dangerous. Drivers indicated that they were much more likely to prepare to stop when a red flasher was present than for a yellow flasher. Drivers also indicated that they were more likely to come to a full stop when red overhead flashing beacons were present than for pedestal-mounted red flashers on stop signs. Approximately one-third of drivers stated that under some conditions they had been confused by the meaning of flashing lights. About 38 percent of young drivers and 46 percent of older drivers believed that if an overhead flashing red light was present for the minor approach that, additionally, an overhead flashing light was also present for the major approach. This may lead drivers to assume that the major road traffic stops in all cases when a flashing red overhead beacon is present.

Advantages

- Helpful when additional warning is needed as a supplement to stop signs
- Relatively inexpensive and quick to implement
- Can be used in conjunction with other strategies

Disadvantages

- Works best with single lane approaches
- If not properly placed, beacon is not visible
- Requires a power source
- Some agencies have reported confusion with amber/red configurations with drivers assuming intersection is all red

References

Antonucci, Nicholas D., Kelly Kennedy Hardy, Kevin L. Slack, Ronald Pfefer, Zikhron Yaacov, and Timothy R. Neuman. *A Guide for Reducing Collisions at Signalized Intersections*. NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan Volume 12, Transportation Research Board. 2004.

Brewer, Marcus A. and Kay Fitzpatrick. *Preliminary Evaluations of Safety Treatments on Rural Highways in Texas*. Report FHWA/TX-05/0-4048-5. Texas Transportation Institute. 2004.

Goldblatt, R. B. "Effect of Flashing Beacons on Intersection Performance." *Journal of the Transportation Research Record* 644 (1977): 91-95.

Murphy, B. G. and J. E. Hummer. "Development of Crash Reduction Factors for Overhead Flashing Beacons at Rural Intersections in North Carolina." *Journal of the Transportation Research Board* 2030 (2007): 15–21.

FHWA. *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD). U.S. Dept. of Transportation, Federal Highway Administration, Washington, DC, 2009.

Pant, P. D. and Y. Park. "Comparative Study of Rural Stop Controlled and Beacon Controlled Intersection." *Journal of the Transportation Research Record* 1692 (1999): 164-172.

Srinivasan, Raghavan, Jongdae Baek, and Forrest Council. *Safety Evaluation of Transverse Rumble Strips on Approaches to Stop-Controlled Intersections in Rural Areas*. Report Federal Highway Administration, Highway Safety Information System, 2012.

Stackhouse, S. and P. Cassidy. *Warning Flashers at Rural Intersections*. Report MN/RC - 1998/01. Minnesota Department of Transportation, St. Paul, MN, 1996.

Stein, William J. and Timothy R. Neuman, *Mitigation Strategies for Design Exceptions*. Federal Highway Administration, Office of Safety. 2007.