LED STOP Signs

What are LED STOP Signs?

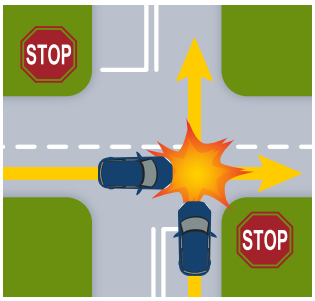
Light-emitting diode (LED)-enhanced STOP signs are the familiar octagonal red signs with white lettering that also include red LEDs on the outer edge of the sign. The LEDs are configured to either operate continually, or to only flash when a detection system senses a vehicle approaching the sign.

Key Functions

Drivers approaching an intersection receive heightened visual input via the flashing LEDs, which:

- Increases conspicuity and awareness of the STOP sign under normal and low-visibility conditions
- Attempts to increase driver compliance and caution at stop-controlled intersections

Figure 1: Enhanced LED STOP Sign



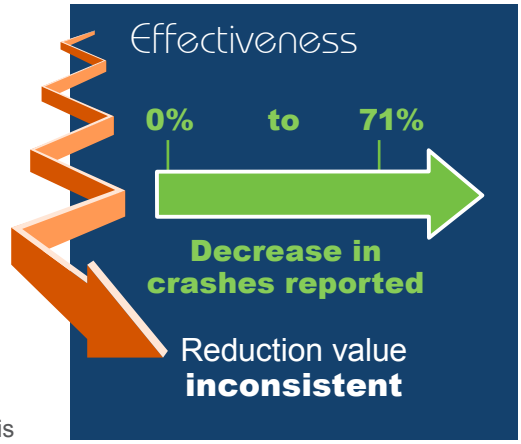
What is the purpose of LED STOP signs?

The purpose of LED STOP signs is to capture the driver's attention through supplemental visual input. It is intended to increase stopping compliance and prevent right-angle crashes by alerting drivers of upcoming roadway changes so they do not unintentionally run the STOP sign. Right-angle crashes are the most common type of crash that result in a fatality or serious injury at through-stop controlled intersections. Although some crashes involve drivers running a STOP sign, nearly two-thirds of angle crashes are attributed to drivers not selecting a large enough gap between their car and the approaching vehicle on the major road to safely complete a crossing or turning maneuver. This type of right-angle crash is not addressed by the installation of an LED STOP sign.

How effective are LED STOP signs?

Research[1] documents three primary performance measures for LED STOP signs: (1) deceleration rates of approaching vehicles, (2) the fraction of vehicles making a complete stop, and (3) change in the frequency of crashes at the intersection. The research included the following results[1]:

1. Adding LED STOP signs did not substantially change driver reaction to slow their vehicles as they approached the intersections – reported reductions were in the range of 1 to 3 miles per hour with slightly higher reductions at night.
2. The LED STOP signs did not change the fraction of vehicles making complete stops at the intersections (when minor approach drivers did not encounter opposing vehicles on the major approaches).
3. The estimated crash reduction was determined to be approximately 42 percent. However, this estimate is not statistically significant because of the small number of right-angle crashes at intersections with the LED installations. The statistical analysis indicates that the reduction may range between 0 and 71 percent; a more precise number cannot credibly be supported by the data.



What are the most suitable applications for LED STOP signs?

> *"Flashing LED STOP and YIELD signs should only be considered for installation in situations necessitating enhanced visibility of the sign. When usage is limited to special circumstances, flashing LED STOP and YIELD signs may be effective safety countermeasures."*
>
> *Section 6-5.07, MnDOT Traffic Engineering Manual*

Installing LED STOP signs reactively in response to one severe crash at one intersection is not likely to be an effective approach because of a low density of severe right-angle crashes at through-stop intersections, only a minority of crashes involve running the STOP sign, and a lack of consistent crash reduction estimate. Instead, a potentially more effective approach would be to install LED STOP signs selectively at the few intersections along a system that have actually experienced multiple crashes from drivers running stop signs. Alternatively, broader effective deployment across a system should include intersections identified to be high-risk based on a data-driven evaluation and where sight lines to the STOP sign are restricted by road geometry or topography.

Guidance from the MnDOT Traffic Engineering Manual (TEM) suggests that at least two of the following criteria should be met for the intersection to be considered for LED STOP sign installation:

- Limited visibility on approach to the intersection
- History of crashes documented to be caused by a failure to stop and deemed preventable by implementation of conspicuity improvements
- At a rural junction of two or more high speed trunk highways to warn drivers of an unexpected crossing of another highway
- At a rural junction of a trunk highway and a local road which has no STOP controlled intersection within five miles

In addition, the TEM advises that alternative improvements should be considered at the intersection prior to selecting a LED STOP sign, such as:

- Installing a STOP AHEAD sign or pavement message
- Increasing the size of the STOP sign or adding a second sign on the left side
- Adding retroreflective strips to the STOP sign support
- Install transverse rumble strips
- Add a STOP bar

Cost

- Per Intersection: $2,000 to $6,000
- Includes one LED-enhanced STOP sign on two approaches, sizes between 30" and 48"
- Cost primarily covers the LED and commonly solar charging equipment

Are there additional considerations?

If an agency decides to install an LED STOP sign at a particular intersection, it is recommended to document why that intersection was selected and why other similar intersections were not. Minnesota tort law provides a variety of immunities from accusations of negligence when an agency can clearly demonstrate their thought process leading to the decision to implement. END

References

1. Davis, G. and J. Hourdos. 2014. *Estimating the Crash Reduction and Vehicle Dynamics Effects of Flashing LED STOP Signs.* MnDOT Report 2014-02. http://www.its.umn.edu/Publications/ResearchReports/reportdetail.html?id=2330. Accessed June 2017.
2. Arnold, E. and K. Lantz. 2007. *Evaluation of Best Practices in Traffic Operations and Safety: Phase I: Flashing LED STOP Signs and Optical Speed Bars.* Report VTRC 07-R34. http://www.virginiadot.org/vtrc/main/online_reports/pdf/07-r34.pdf. Accessed June 2017.
3. Minnesota Department of Transportation (MnDOT). 2015. *Traffic Engineering Manual, Chapter 6 – Traffic Signs and Delineation.* http://www.dot.state.mn.us/trafficeng/publ/tem/. Accessed June 2017.