**Measure Name:** LED-enhanced signage

**Definition:** Use of LED-enhanced signage to increase grade crossing visibility and discourage unsafe activity.

**Tags:**

*Type of Incident*:

- ☐ Non-Motorized Users Only
- ☒ Motor Vehicles Only
- ☐ Both

*Intervention Strategy*:

- ☐ Data: application and planning
- ☐ Education: outreach and messaging
- ☐ Enforcement: policy development and rulemaking
- ☒ Engineering: technological and physical deterrents

*Type of Problem*:

- ☐ Non-Motorized Users Violating Warning Devices
- ☒ Motor Vehicles Violating Warning Devices
- ☐ Vehicle ROW Incursion
- ☒ Vehicle Congestion
- ☐ Blocked Crossing
- ☐ Vehicle Hang-up

*Measure Category:*

- ☐ Risk Assessment
- ☐ Policy and Enforcement
- ☐ Collaboration, Training, and Education
- ☐ Public Communication
- ☐ Physical Barriers
- ☒ Detection and Lighting
- ☐ Infrastructure Modification
- ☐ Post-Incident Management
- ☒ Warning Devices

## Description

LED-enhanced signage refers to the installation of light-emitting diode (LED) grade crossing warning and regulatory signs at locations where crossing visibility is reduced, or risk of vehicle congestion is high. These include the Crossbuck (R15-1), DO NOT STOP ON TRACKS (R8-8), Advance Warning Sign (W10-1), STOP (R1-1), and YIELD (R1-2) signs as listed in the Manual on Uniform Traffic Control Devices (MUTCD) [1]. LED-enhanced signs are believed to increase driver compliance over non-LED signs, based on multiple studies [2] [3] [4]. Focusing LED-enhanced signage on grade crossing locations with traffic congestion issues that result in vehicles stopping on the tracks can help to improve safety.

LED-enhanced signs can either be set to constantly flashing, as was demonstrated in two recent studies [2] [3], activated at specific times such as from sunset to sunrise or during rush hours, or triggered by a presence detection system [4]. The latter was demonstrated in a recent field-test of an NYR9-5 sign, which is the New York version of the R8-8 sign, integrated with a laser-triggered queue detection system. In that configuration, the LEDs on the sign illuminated when the laser system detected stopped vehicles downstream from the crossing. The LEDs induced additional attention to the sign from drivers upstream of the crossing to not stop on the tracks.

LED-enhanced signs can be installed by rail carriers at crossings, or by the local roadway authorities on the roadway approaches.

Additional search terms: *illumination, congestion*

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## Advantages

- LED-enhanced sign may increase a motorist's ability to see and comply with grade crossing warning signs. [2] [3] [4]
- LED-enhanced Advance Warning Signs and Crossbuck signs may be effective in reducing vehicle speeds at night on approach to passive grade crossings. [2]
- In locations with vehicle congestion issues that result in vehicles stopping on the tracks, LED-enhanced R8-8 signs may offer a low-cost option. [3] [4]
- Signs can be either connected to commercial power or installed in a solar-powered stand-alone configuration.

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## Drawbacks

- There is the potential for light pollution to affect nearby people and animals.

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## Notable Practices

- LED-enhanced signs should be implemented when an engineering analysis determines that unsafe conditions such as vehicles stopping on the tracks or vehicles not slowing down ahead of passive crossings regularly occur.
- When considering the implementation of LED-enhanced signs, it is helpful to understand the time of day (e.g., daylight/night, peak rush hours) that violations tend to occur. This will inform whether continuously flashing signs, those that only flash at specific times, or those that may need to be sensor-activated should be used.
- Before installing new LED-enhanced signs, coordinate with nearby communities to ensure that the installation will not be disruptive. [3]

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## References

[1] Federal Highway Administration. (2012). Manual on Uniform Traffic Control Devices.

> Document Excerpt: The Manual on Uniform Traffic Control Devices (MUTCD), by setting minimum standards and providing guidance, ensures uniformity of traffic control devices across the nation. The use of uniform TCDs (messages, locations, sizes, shapes, and colors) helps reduce crashes and congestion, and improves the efficiency of the surface transportation system. Uniformity also helps reduce the cost of TCDs through standardization. The information contained in the MUTCD is the result of years of practical experience, research, and/or the MUTCD experimentation process. This effort ensures that TCDs are visible, recognizable, understandable, and necessary. The MUTCD is a dynamic document that changes with time to address contemporary safety and operational issues.

[2] Hellman, A. D., & Lamplugh, A. (2016). Evaluation of LED Sign Technology at a Passive Highway-Rail Grade Crossing.

> Abstract: The U.S. Department of Transportation's (DOT) John A. Volpe National Transportation Systems Center (Volpe Center), under the direction of DOT's Federal Railroad Administration (FRA) Office of Research, Development, and Technology (ORD), conducted a research study that evaluated the effectiveness of light-emitting diode (LED) regulatory signs at a passive highway-rail grade crossing. In this study, a grade crossing in Swanton, Vermont had its existing Grade Crossing Crossbuck (R15-1) signs and Advance Warning signs (AWSs) (W10-1) replaced with flashing LED-equipped signs. Vehicle speed profiles were measured at four locations on the northbound approach lane of the crossing in three phases: with the original signs prior to any changes at the crossing, after the LED enhanced Crossbuck signs were installed, and after the LED enhanced AWSs were installed. Daytime and night-time data samples were analyzed separately. After the LED enhanced Crossbuck signs were installed, test results showed: 1) a statistically significant decrease of 2.9-3.3 mph in mean vehicle speed at night at the four measurement locations and 2) improvements of 1.5%-2.5% in the rate of mean vehicle speed decrease for both the daytime and nighttime data sets.

[3] Baron, W., and daSilva, M. (2019). Effectiveness of LED-Enhanced Signs in Reducing Incidents of Vehicles Stopping on Tracks.

> Abstract: The U.S. Department of Transportation Volpe National Transportation Systems Center conducted a study of the effectiveness of LED-enhanced R8-8 signs in reducing incidents of vehicles

stopping on the tracks. The researchers captured video at the Brighton Street crossing in Belmont, MA before and after LED-enhanced signs were installed. The signs were standard R8-8 panels that read "DO NOT STOP ON TRACKS," except that they had flashing white LEDs. Signs manufactured by two different companies were tested. Results showed the signs produced a 41 percent reduction in frequency of vehicles stopping on the tracks.

[4] Hellman, A. (2021). LED-Enhanced Sign Research to Reduce Vehicle Queuing at Highway-Rail Grade Crossings.

Abstract: Researchers studied the effectiveness of an integrated laser-triggered queue detection system/light-emitting-diode (LED)-enhanced "DO NOT STOP ON TRACKS" sign as compared to a baseline version with no lights. Testing was conducted at the Jay Street grade crossing on the Metro-North Railroad in the Village of Katonah, NY. The results of a before-and-after study showed that the number of vehicles stopped in the zonal area of the grade crossing decreased by 26.6 percent from the baseline to the post-installation configurations. A controlled testing program is recommended before a recommendation for wider use can be made.

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## Additional Resources

U.S. Department of Transportation. (2019). Highway-Rail Grade Crossing Handbook – Third Edition.

Abstract: The purpose of the Highway-Rail Crossing Handbook, 3rd Edition is an information resource developed to provide a unified reference document on prevalent and best practices as well as adopted standards relative to highway-rail grade crossings. The handbook provides general information on highway-rail crossings; characteristics of the crossing environment and users; and physical and operational changes that can be made at crossings to enhance the safety and operation of both highway and rail traffic over such intersections. The guidelines identified and potential alternative improvements presented in this handbook reflect current best practices nationwide

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## Related Measures

- Crossing illumination
- Dynamic Envelope Marking
- Pre-Signals
- Queue Cutters
- Approach Train Warning Detection System

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## Images


*Figure 1. Example of LED-enhanced Advanced Warning sign (W10-1) at a grade crossing in Swanton, VT*
*Image Credit: Volpe Center*


*Figure 2. Example of LED-enhanced Crossbuck sign (R15-1) at a grade crossing in Swanton, VT*
*Image Credit: Volpe Center*


*Figure 3. Example of LED-enhanced DO NOT STOP ON TRACKS sign (R8-8) at a grade crossing in Belmont, MA*
*Image Credit: Volpe Center*


*Figure 4. Example of LED-enhanced DO NOT STOP ON TRACKS sign (NYR9-5) at a grade crossing in Katonah, NY*
*Image Credit: Volpe Center*