## Implementation Considerations

* Due to low power usage, solar applications make the use of this treatment flexible enough for nearly any location.
* LEDs may be set to flash 24 hours a day or be vehicle or pedestrian activated.

**Manual on Uniform Traffic Control Devices (MUTCD) Specifications**

* **If used, the LEDs shall be the same color as the sign legend, border, or background. If flashed, all LED units on an installation shall flash simultaneously at a rate of more than 50 and less than 60 times per minute. The uniformity of the sign shall be maintained without any decrease in visibility, legibility, or driver comprehension during either daytime or nighttime conditions. *MUTCD, Section 2A.08*.**
* **MUTCD, Section 2A.08 contains further information that should be consulted when installing a sign with embedded LEDs.**
* **Lighting elements for illuminated signs (e.g. LED-embedded signs) should be replaced on a regular maintenance schedule. *MUTCD, Section 2A.22*.**

## Costs

During the course of the 2007 Virginia Transportation Research Council study, the costs for 48-inch, 36-inch, and 30-inch signs embedded with LEDs were estimated at $1,860, $1,640, and $1,600, respectively. This included the cost of the solar power supply, but did not include an additional $175 for post and anchor or the cost of installation.

**2009 MUTCD - http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm**

### Section 2A.07 Retroreflectivity and Illumination

**Support:**

**01 There are many materials currently available for retroreflection and various methods currently available for the illumination of signs and object markers. New materials and methods continue to emerge. New materials and methods can be used as long as the signs and object markers meet the standard requirements for color, both by day and by night.**

**Standard:**

**02 Regulatory, warning, and guide signs and object markers shall be retroreflective (see** [**Section 2A.08**](http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A08)**) or illuminated to show the same shape and similar color by both day and night, unless otherwise provided in the text discussion in this Manual for a particular sign or group of signs.**

**03 The requirements for sign illumination shall not be considered to be satisfied by street or highway lighting.**

**Option:**

**04 Sign elements may be illuminated by the means shown in** [**Table 2A-1**](http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#table2A01)**.**

|  |  |
| --- | --- |
| **Means of Illumination** | **Sign Element To Be Illuminated** |
| **Light behind the sign face** | * **Symbol or word message** * **Background** * **Symbol, word message, and background (through a translucent material)** |
| **Attached or independently mounted light source designed to direct essentially uniform illumination onto the sign face** | * **Entire sign face** |
| **Light emitting diodes (LEDs)** | * **Symbol or word message** * **Portions of the sign border** |
| **Other devices, or treatments that highlight the sign shape, color, or message:**  **Luminous tubing**  **Fiber optics**  **Incandescent light bulbs**  **Luminescent panels** | * **Symbol or word message** * **Entire sign face** |

**06 Light Emitting Diode (LED) units may be used individually within the legend or symbol of a sign and in the border of a sign, except for changeable message signs, to improve the conspicuity, increase the legibility of sign legends and borders, or provide a changeable message.**

**07 Except as provided in** [**Paragraphs 11**](http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A07_para11) **and** [**12**](http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A07_para12)**, neither individual LEDs nor groups of LEDs shall be placed within the background area of a sign.**

**08 If used, the LEDs shall have a maximum diameter of 1/4 inch and shall be the following colors based on the type of sign:**

1. **White or red, if used with STOP or YIELD signs.**
2. **White, if used with regulatory signs other than STOP or YIELD signs.**
3. **White or yellow, if used with warning signs.**
4. **White, if used with guide signs.**
5. **White, yellow, or orange, if used with temporary traffic control signs.**
6. **White or yellow, if used with school area signs.**

**09 If flashed, all LED units shall flash simultaneously at a rate of more than 50 and less than 60 times per minute.**

**10 The uniformity of the sign design shall be maintained without any decrease in visibility, legibility, or driver comprehension during either daytime or nighttime conditions.**

**Option:**

**11 For STOP and YIELD signs, LEDs may be placed within the border or within one border width within the background of the sign.**

**12 For STOP/SLOW paddles (see** [**Section 6E.03**](http://mutcd.fhwa.dot.gov/htm/2009/part6/part6e.htm#section6E03)**) used by flaggers and the STOP paddles (see** [**Section 7D.05**](http://mutcd.fhwa.dot.gov/htm/2009/part7/part7d.htm#section7D05)**) used by adult crossing guards, individual LEDs or groups of LEDs may be used.**

**Support:**

**13 Other methods of enhancing the conspicuity of standard signs are described in** [**Section 2A.15**](http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A15)**.**

**14 Information regarding the use of retroreflective material on the sign support is contained in** [**Section 2A.21**](http://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A21)**.**