

### Minimum Retroreflectivity Levels for Traffic Signs

New MUTCD Criteria



U.S. Department of Transportation  
Federal Highway Administration

### Overview

- Retroreflectivity briefing
- Rule-making efforts
- Final Rule summary
  - Minimum Values
  - Require maintenance methods
- Minimum pavement marking levels

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*Improving the nighttime visibility and conspicuity of traffic signs to reduce deaths and injuries*



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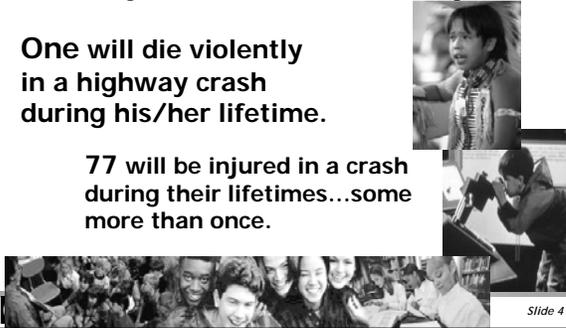
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### Our Youth

Of every 100 children born this year...

**One will die violently in a highway crash during his/her lifetime.**

**77 will be injured in a crash during their lifetimes...some more than once.**



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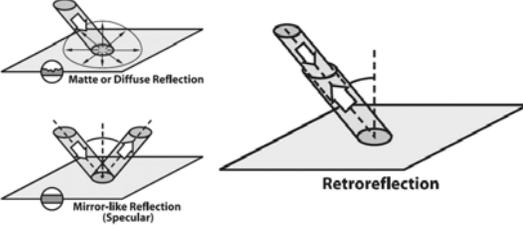
### "Show Me the Money"



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### Retroreflection Briefing



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### Retroreflective Elements

Glass spheres and microsized prisms are the current technologies used to make sign materials retroreflective

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### Cone of Retroreflection

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### Nighttime Driving

**Daytime**

Many cues available  
Driver task relatively easy

**Nighttime**

Few cues remain  
Task more difficult

*Retroreflectivity provides nighttime guidance*

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### Night Travel and Crashes

Time of Day	Fatalities per Million Miles Travel (2004 - 2006)
Nighttime	~3.0
Daytime	~1.3

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### Retroreflectivity Fades

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### Background

1993 DOT Appropriations Act - "The Secretary of Transportation shall revise the MUTCD to include a standard for a minimum level of retroreflectivity that must be maintained for traffic signs and pavement markings which apply to all roads open to public travel."

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## Recent FHWA Research

- Overhead guide signs and street name signs  
- FHWA-RD-03-082
- National sign workshops  
- FHWA-SA-03-002
- Updated sign levels  
- FHWA-RD-03-081
- Economic impacts report #2  
- FHWA-HRT-07-042
- Sign retroreflectivity maintenance methods  
- FHWA-HRT-08-026


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## Rule-Making Summary

- 1985 - Advanced Notice of Proposed Amendment
- 1992 - Congressional Directive
- 1998 - AASHTO Resolution to FHWA
- 2004 - Notice of Proposed Amendment
- 2006 - Supplemental Notice of Proposed Amendment
- 2007 - Final Rule


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## Final Rule



- Published on Dec 21, 2007  
- Vol 72, No. 245
- Revision #2 of the 2003 Edition of the MUTCD
- Effective Jan 22, 2008


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## Compliance Dates

Jan 22, 2012	Identify and begin using method(s)
Jan 22, 2015	Replace identified regulatory, warning, and ground-mounted guide signs
Jan 22, 2018	Replace identified street name and overhead guide signs


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### New MUTCD Language

Section 2A.09 Maintaining Minimum Retroreflectivity

“Standard:

Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3”


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### New MUTCD Language

Section 2A.09 Maintaining Minimum Retroreflectivity

“Support:

Compliance... is achieved by having a method in place and using the method to maintain the minimum levels established in Table 2A-3. Provided that... a method is being used, an agency would be in compliance... even if there are some individual signs that do not meet the... levels at a particular point in time.


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### MUTCD Table 2A-3

Sign Color	Criteria	Sheeting Type (ASTM D4956)			
		Beaded			Prismatic
		I	II	III	III, IV, VI, VII, VIII, IX, X
White on Red	CR ≥3	35 / 7			
Black on Orange or Yellow	Bold or Text ≥48"	x	50		
	Fine or Text <48"	x	75		
Black on White	—	50			
White on Green	Overhead	x / 7	x / 15	x / 25	250 / 25
	Shoulder	x / 7	120 / 15		

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- ### Sheeting Types (ASTM 4956-04) That Can Be Used:
- All prismatic sheeting may be used for all signs.
  - High Intensity Beaded (Type III) and Super Engineer Grade (Type II) may be used for all signs except for the white legend on overhead guide signs.
  - Engineer Grade (Type I) may be used for all signs except for:
    - a. the white legend on guide signs,
    - b. the white legend on street name signs, and
    - c. all warning signs.
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### Sheeting Types That Can Be Used (cont.)

Even though a particular type of sheeting might initially meet the minimum retroreflectivity levels when new, it might quickly degrade to below the minimum retroreflectivity levels.

The use of higher performance sheeting, even though it has a higher initial cost, might provide a better life-cycle cost for the agency.

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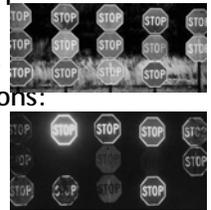
### New MUTCD Language

Section 2A.09 Maintaining Minimum Retroreflectivity

“Guidance:  
...one or more of the following assessment or management methods should be used...”

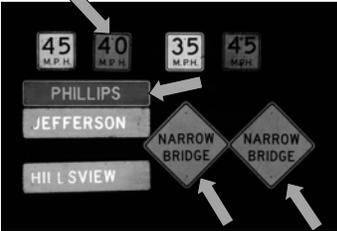
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- ### Sign Maintenance Methods
- Visual nighttime inspection
  - Measured sign retroreflectivity
  - Expected sign life
  - Blanket replacement
  - Control signs
  - Any combination of above
  - Other methods based on engineering studies
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- ### Visual Inspection Method
- Nighttime visual inspection by inspector trained on the procedures and the rule
  - Conduct on regular basis
  - Must use one of the options:
    - Calibration signs
    - Consistent parameters
    - Comparison panels
- 
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### Calibration Signs Option

- “Calibrate” eyes with calibration signs
- Calibration signs are near minimum retro
- Evaluate signs compared to calibration signs



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### Consistent Parameters Option

- Inspection process replicates criteria used to develop minimum levels
  - Inspector - older driver (>60 years)
  - SUV type vehicle
  - Cutoff headlamps (properly aimed)



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### Comparison Panels Option

- Small panels at/near minimum retroreflectivity levels
- Clipped to sign - viewed from distance
- Replace sign if panel is brighter



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### Measured Retroreflectivity Method

- Measure signs with retroreflectometer
- Procedure in ASTM E1709
- Average of 4 measurements
- Compare average to minimum
- Not all signs need to be measured
  - Measure marginal signs



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### Expected Sign Life Method

- Determine expected life of sheeting types used in geographical area
- End of life based on retro values in supplemental document
- Set up replacement program that ensures individual signs are replaced prior to the end of service life expectancy
- Periodic nighttime or instrument inspections to verify

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### Indicating Sign Age

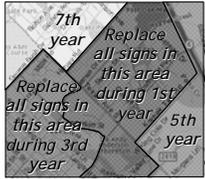
- Stickers on front or back of sign to show when fabricated or installed



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### Blanket Replacement Method

- Divide agency into areas/corridors
- Relate number of areas to replacement cycle (based on service life)
  - Replace all signs in an area/ corridor each replacement cycle
    - 10 yr life, → 10 areas
    - Annual replacement in each area



The diagram shows a grid of areas. Text overlays indicate replacement cycles: '7th year' in the top right, 'Replace all signs in this area during 1st year' in the center, '5th year' in the bottom right, and 'Replace all signs in this area during 3rd year' in the bottom left.



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### Control Signs Method

- Select signs to represent all signs in the field
  - Control signs in maintenance yard
  - Selected field signs (near HQ)
- Monitor control signs
  - Replace all equivalent signs when control signs near minimum levels
  - Other methods determine replacement
- Control signs need to adequately represent all signs in the field



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### Combining Alternatives

- Combination of methods
  - Use one or more of the methods together
  - Support and reinforce each other
- Possibilities
  - Visual inspection to identify signs to be measured
  - Measured retro of control signs



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### MUTCD Language

Section 2A.22 Maintenance

Guidance:  
Maintenance activities should consider proper position, cleanliness, legibility, and daytime and nighttime visibility (see Section 2A.02). Damaged or deteriorated signs should be replaced.

To assure adequate maintenance, a schedule for inspecting (both day and night), cleaning, and replacing signs should be established. Employees of highway law enforcement, and other public agencies whose duties require that they travel on the roadway, should be encouraged to report any damaged, deteriorated, or obscured signs at the first opportunity.

Steps should be taken to see that weeds, trees, shrubbery, and construction, maintenance, and utility materials and equipment do not obscure the face of any sign.

A regular schedule of replacement of lighting elements for illuminated signs should be maintained.



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### Value of Inspection

Inspectors can identify deficient signs that may not meet the minimum retroreflectivity levels



The photograph shows three signs stacked vertically. The top sign is a rectangular 'ONE WAY' sign with an arrow pointing left. The middle sign is a rectangular sign for '6th Ave' and '600 N'. The bottom sign is an octagonal 'STOP' sign with a handwritten 'STOP' in black marker over the printed word.



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### Computer Sign Management

- Agencies use computers to manage process
  - Track many elements
  - Help plan and budget
- Computers track:
  - Sign type & sheeting
  - Location
  - Installation date
  - Expected sign life
  - Other factors



The photograph shows a person from the side, sitting at a desk and working on a computer. There are two monitors on the desk, one of which displays a graphical interface.



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## Pavement Marking Retroreflectivity Standards - Status -

- Initial research conducted in 1990s
- Recent research just completed
- Impacts report just completed
- Workshops completed in summer 2007
  - *Input from public agencies*
- AASHTO & ATSSA submitted recommendations
- FHWA beginning work on NPA
  - *no target date*


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## Keep In Mind

- Congressional directive applies to signs and markings
- FHWA will establish MUTCD standards for pavement markings
  - *Solicited agency input for pavement markings in summer 2007*
  - *Looking for solutions*
  - *Win-Win-Win for Drivers-Agencies-FHWA*


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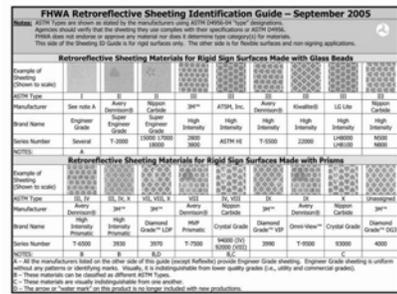
## FHWA Supporting Material



- FHWA Retro Web Site  
[www.fhwa.dot.gov/retro](http://www.fhwa.dot.gov/retro)
- 4-page summary
- FAQs
- Research Reports


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## Sign Sheeting ID Guide




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## Some Common Questions

- What about..
  - *Engineering grade sheeting ?*
  - *Fluorescent signs ?*
  - *Blue and brown signs ?*

*See FHWA FAQs for more questions:*

[www.fhwa.dot.gov/retro](http://www.fhwa.dot.gov/retro)


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## Can I use Eng Grade Shtg?

- Yes, but not for all signs
- Where Engineering Grade cannot be used:
  - *Yellow and orange signs*
  - *Legends on guide signs*


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### Fluorescent Signs

- Fluorescent versions of sign colors may be used. Minimum retro is same as for non-fluorescent versions.
  - *fluorescent yellow & fluorescent yellow-green*
    - Use retro values for yellow
  - *fluorescent orange*
    - Use retro values for orange


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### Blue & Brown Signs

- Not yet included in minimum levels
- Pending report contains recommended blue and brown levels
  - *FHWA-HRT-08-029*





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### Show Me the Money

- National Highway System
- Interstate Maintenance
- Surface Transportation Program
- Highway Safety Improvement Program
  - *High Risk Rural Roads Program*
  - *Rail/Hwy Crossing Program*
- Federal Lands Highway Program
- Transportation Enhancements
- Safe Routes to School
- National Scenic Byways Program
- Recreational Trails Program
- State and Community Highway Safety Grant Program (Section 402)
- State Planning and Research Funds




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### Summary

- New regulation in place
- Must use an assessment or management method in MUTCD
- Must begin to make decisions now in order to meet compliance dates
- Consider life-cycle costs, not just initial costs, when replacing signs


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### Additional Information

- More information about sign and marking retroreflectivity can be found at
  - *FHWA: [www.fhwa.dot.gov/retro](http://www.fhwa.dot.gov/retro)*
  - *ATSSA: [www.retroreflectivity.net](http://www.retroreflectivity.net)*
- Expert Contact Information
  - *FHWA Retroreflectivity Team Leader*
    - Greg Schertz, 720-963-3764
  - *FHWA Research Office*
    - Carl Andersen, 202-493-3366
  - *FHWA Safety Office*
    - Matt Lupes, 202-366-6994


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### Discussion / Questions

