



Final Rule:

Maintaining Pavement Marking Retroreflectivity

Paul LaFleur, P.E.

Roadway Departure Program Manager

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U.S. Department of Transportation
Federal Highway Administration

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<http://safety.fhwa.dot.gov>



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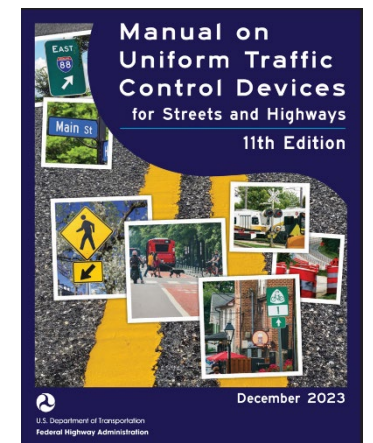
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Federal Register

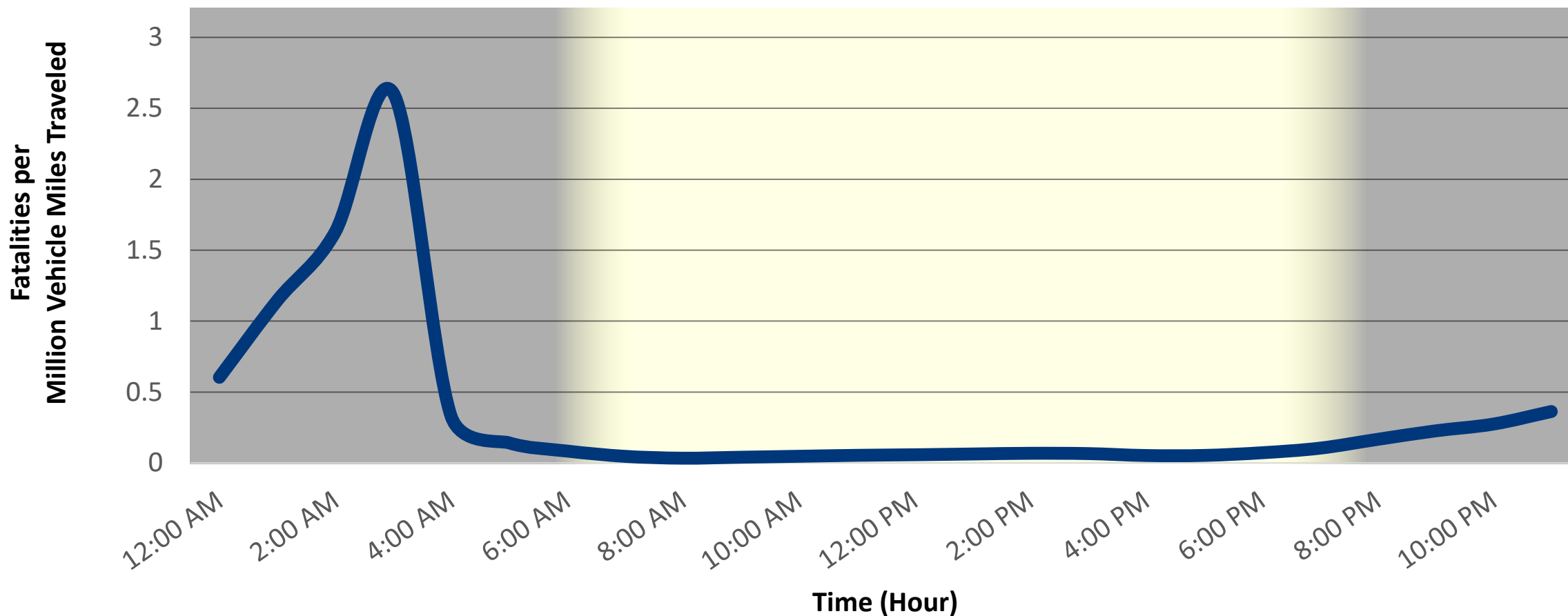
- Federal Register – August 5, 2022
- 2009 MUTCD Revision 3
- Maintaining Minimum Pavement Marking Retroreflectivity
- Effective date: September 6, 2022
- <https://www.federalregister.gov/d/2022-16781>
- Incorporated into 11th Edition of MUTCD





The Problem: Nighttime vs. Daytime Fatality Rates

Fatality Rate per Million VMT by Hour (2015-2019)





Why is Retroreflectivity Important?

Visibility is critical for nighttime driving

Daytime - many cues available



Nighttime - few cues remain





Revisions to Three Sections of the MUTCD

- Section ~~3A.03~~ ^{3A.05} – Maintaining Minimum Retroreflectivity
- Introduction – Compliance Date (Table I-2)
- Section ~~1A.11~~ ^{3A.05} – Methods Publication





MUTCD Section 3A.05

Section 3A.05 Maintaining Minimum Pavement Marking Retroreflectivity





MUTCD Section 3A.05 Paragraph 1

Standard:

Except as provided in Paragraph 5 of this Section, a method designed to maintain retroreflectivity at or above 50 mcd/m²/lx under dry conditions shall be used for longitudinal markings on roadways with speed limits of 35 mph or greater.

NOTE: mcd/m²/lx means millicandelas per square meter per lux



MUTCD Section 3A.05 Paragraph 2

Guidance:

Except as provided in Paragraph 5 of this Section, a method designed to maintain retroreflectivity at or above 100 mcd/m²/lx under dry conditions should be used for longitudinal markings on roadways with limits of 70 mph or greater.

NOTE: mcd/m²/lx means millicandelas per square meter per lux



MUTCD Section 3A.05 - Summary of Values

Maintaining Minimum Retroreflectivity

Standard: 50 mcd/m²/lx – Speed limits 35 mph or greater.

Guidance: 100 mcd/m²/lx – Speed limits 70 mph or greater

NOTE: mcd/m²/lx means millicandelas per square meter per lux



MUTCD Section 3A.05 Paragraph 3

Guidance:

The method used to maintain retroreflectivity should be one or more of those described in “Methods for Maintaining Pavement Marking Retroreflectivity” (FHWA-SA-22-028), 2022 Edition, FHWA or developed from an engineering study based on the values in Paragraphs 1 and 2.





MUTCD Section 3A.05 Paragraph 4

Support:

Retroreflectivity levels for pavement markings are measured with an entrance angle of 88.76 degrees and an observation angle of 1.05 degrees. This geometry is also referred to as 30-meter geometry. The units of pavement marking retroreflectivity are reported in $\text{mcd}/\text{m}^2/\text{lx}$, which means millicandelas per square meter per lux.



MUTCD Section 3A.05 Paragraph 5: Option

Optional Exclusions to an Agency's Method:

- Where ambient illumination assures that the markings are adequately visible
- Streets or highways that have an ADT of less than 6,000 vehicles per day
- Dotted extension lines (Section 3B.08)
- Curb markings
- Parking space markings
- Shared-use path markings





MUTCD Section 3A.05 Paragraph 6: Support

Exclusions (Non-Longitudinal Markings):

- Transverse markings
- Word, symbol, and arrow markings
- Crosswalk markings
- Chevron, diagonal, and crosshatch markings





MUTCD Section 3A.05 Paragraph 7: Support

Special Circumstances:

- Isolated locations of abnormal degradation
- Periods preceding imminent resurfacing or reconstruction
- Unanticipated events such as...
- Snow maintenance operations





Summary of Minimum Values for Longitudinal Markings

	Standard		<i>Guidance</i>
Speed Limit	<35 mph	≥35 mph	<i>≥70 mph</i>
Retroreflectivity Level	n/a	50 mcd/m²/lx	<i>100 mcd/m²/lx</i>

Optional Exclusions:

- Ambient illumination
- Less than 6,000 ADT
- Dotted extension lines
- Curb markings
- Parking spaces
- Shared-use paths



Methods for Maintaining Pavement Marking Retroreflectivity

https://safety.fhwa.dot.gov/roadway_dept/night_visib/pm_methods_fhwasa22028.pdf

- Measured Retroreflectivity
- Consistent Parameters Nighttime Visual Inspection
- Calibrated Pavement Markings Nighttime Visual Inspection
- Service Life Based on Historical Data
- Service Life Based on Monitored Markings
- Other Methods (combination or based on engineering study)



Measured Retroreflectivity Method

- Measure markings with standard retroreflectometer (handheld or mobile)
- Compare measured values with minimum values
- Often combined with other methods

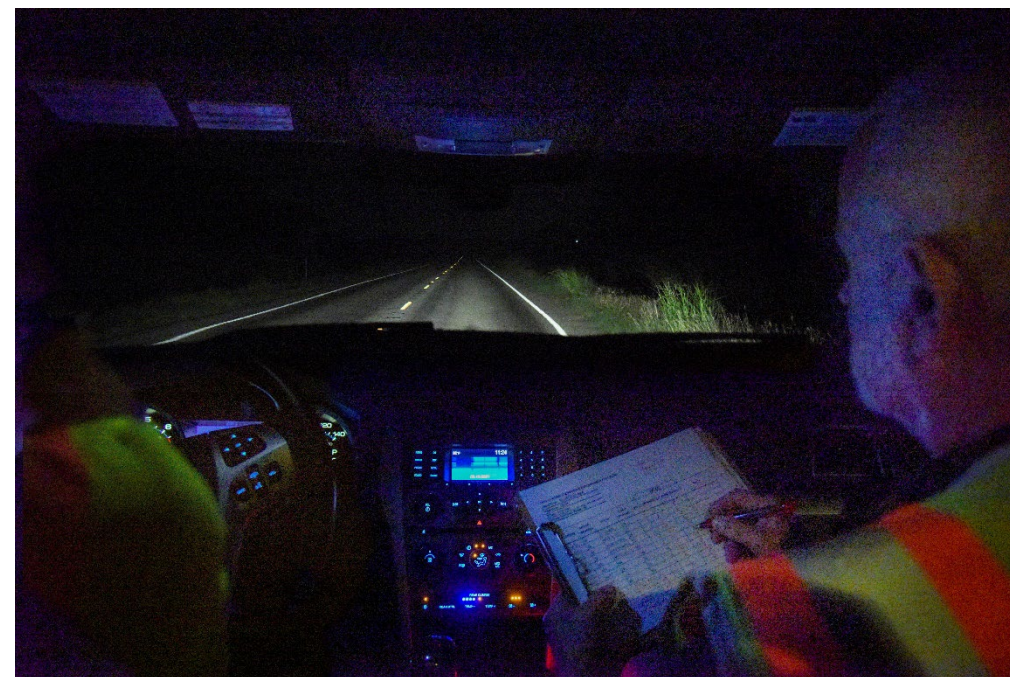




Consistent Parameters Nighttime Visual Inspection Method

Tie to minimum values by using consistent parameters as used to develop the minimum values:

- Trained inspector, older driver (60+)
- Passenger vehicle
 - (sedan preferred)
- Low beam headlamps
 - (properly aimed)





Calibrated Pavement Markings Nighttime Visual Inspection Method

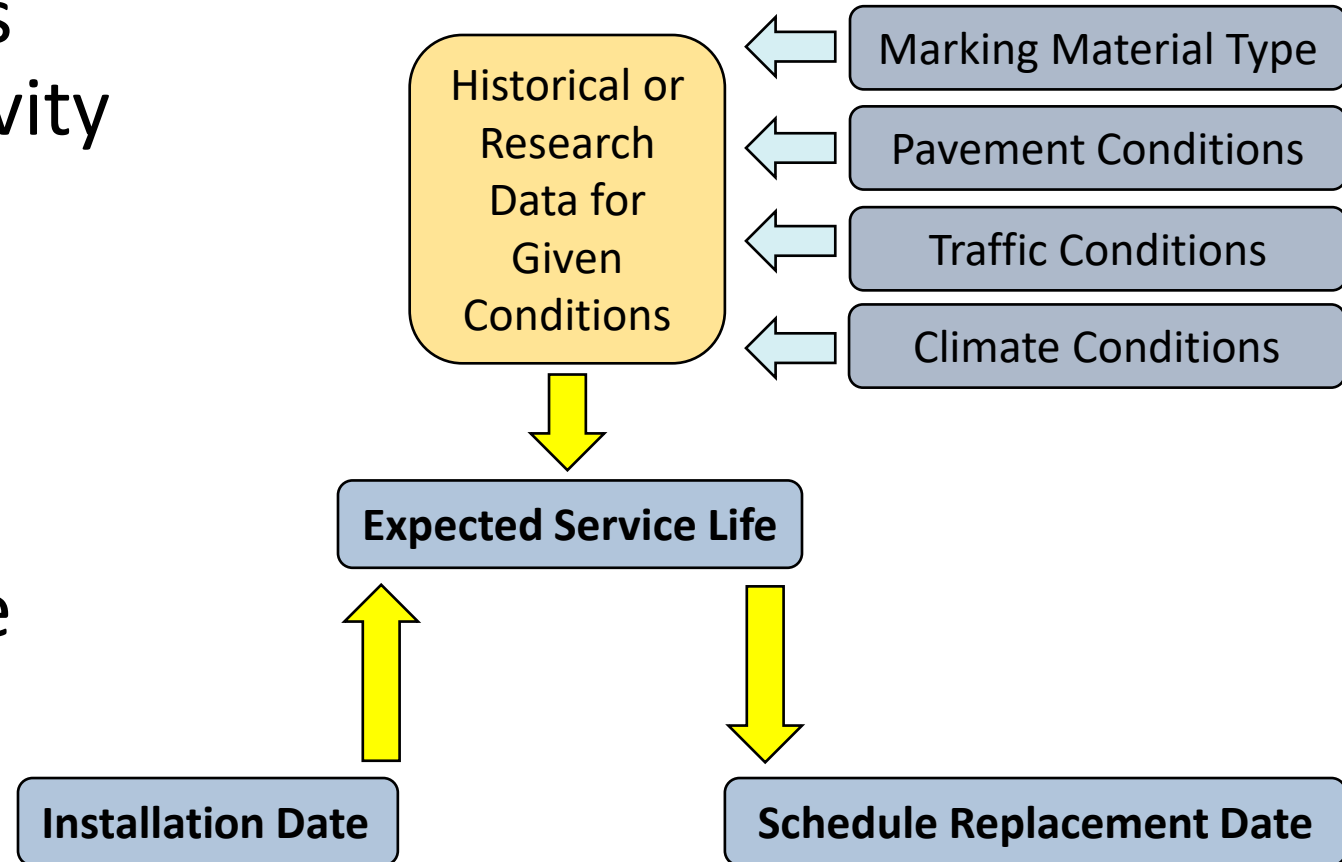
- Calibrate” eyes with calibration markings
- Calibration markings have known retroreflectivity that is at or above the minimums
- Evaluate in-service markings compared to the calibration markings





Service Life Based on Historical Data Method

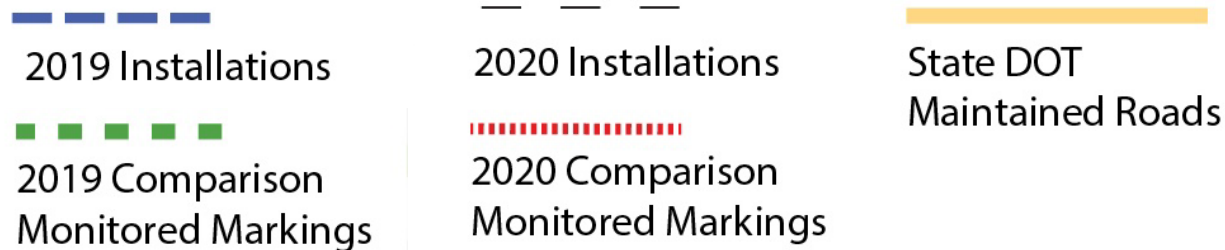
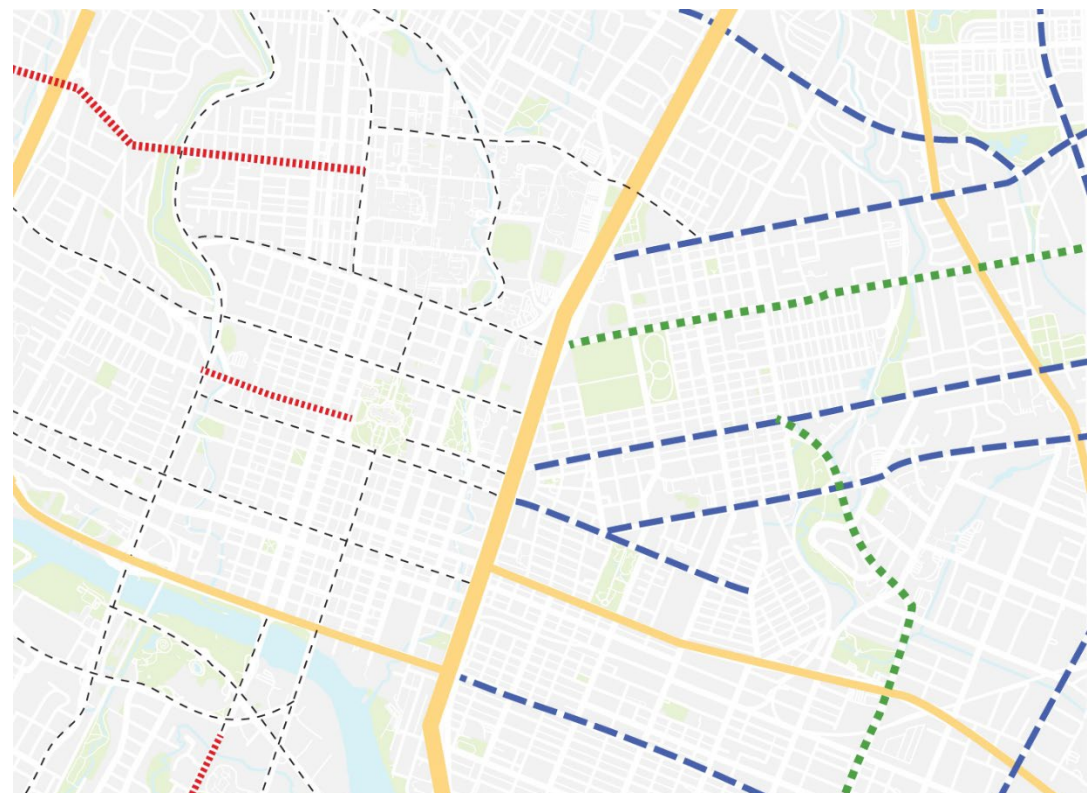
- Based on installation dates and historical retroreflectivity data or research results
- Markings are replaced at specific intervals
- Considers conditions that impact marking service life





Service Life Based on Monitored Markings Method

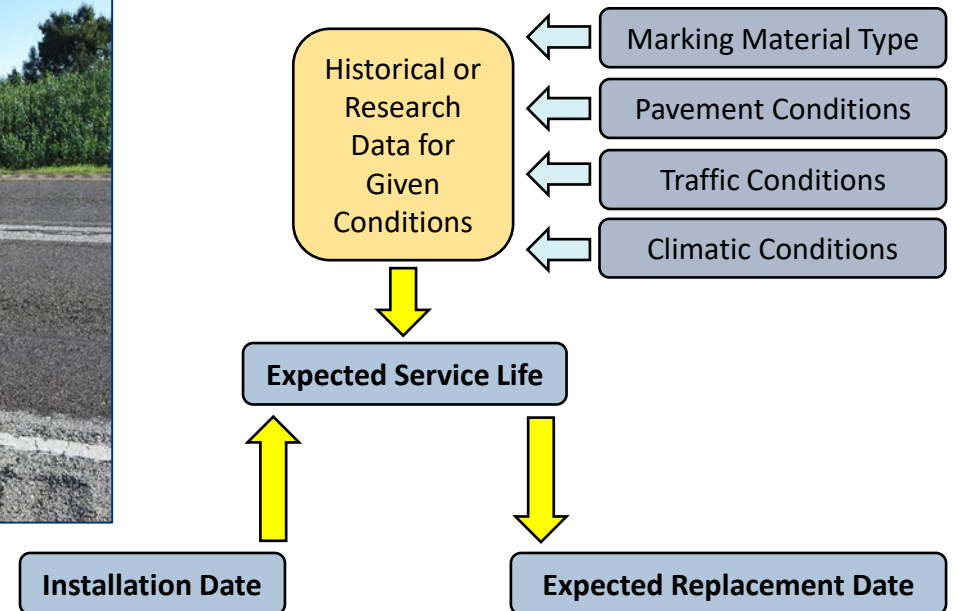
- Based on monitoring a sample of a larger group of “similar” markings through measured retroreflectivity or nighttime visual inspection
- All markings in the “similar” group are replaced when the monitored markings are near or at the minimum values





Other Methods

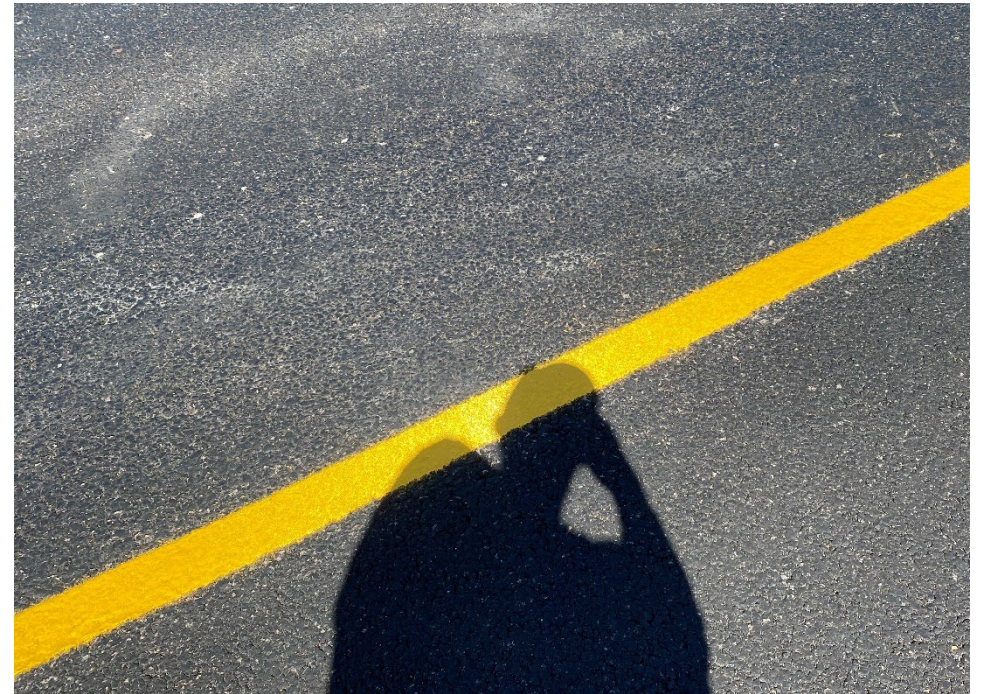
- Combine Methods
- Develop a method based on engineering studies that are based on minimum values





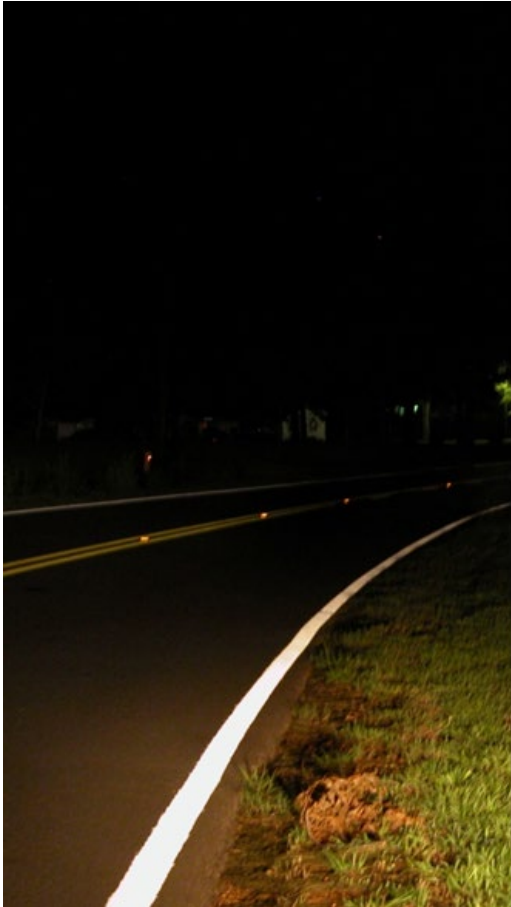
'Techniques' NOT Recommended as Methods

- Sun Over the Shoulder
- Comparison Panel
- Lane Line Count
- Windshield Marking
- Control Markings
- Comparison Light Box





Markings Must Be Maintained



Retroreflectivity requirements in Section 3A.01 apply to ALL pavement markings, even if an agency chooses not to include all markings in their method:

Standard:

Except as provided in Chapter 3H, markings that must be visible at night shall be retroreflective unless the markings are adequately visible under street or highway lighting. All markings on Interstate highways shall be retroreflective.





Videos





Videos

Pavement Marking – Implementation Tools





Frequently Asked Questions

- What markings are subject to minimum maintained retroreflectivity levels?
- Is a retroreflectometer required?
- Is an inventory required?
- Is documentation of my inspections required?
- Does an inspector have to be at least 60 years old?
- What if I cannot restore all markings according to the replacement schedule?





Resources

- **FHWA Nighttime Visibility Website:**
 - www.fhwa.dot.gov/retro
- **MUTCD Website:**
 - <http://mutcd.fhwa.dot.gov>
- **Methods for Maintaining Pavement Marking Retroreflectivity**
 - https://safety.fhwa.dot.gov/roadway_dept/night_visib/pm_methods_fhwas22028.pdf
- **FHWA Pavement Marking Retroreflectivity Site**
 - https://safety.fhwa.dot.gov/roadway_dept/night_visib/pavement-markings.cfm



What would you like to know more about?

Paul LaFleur, P.E.

Roadway Departure Program Manager

paul.lafleur@dot.gov



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