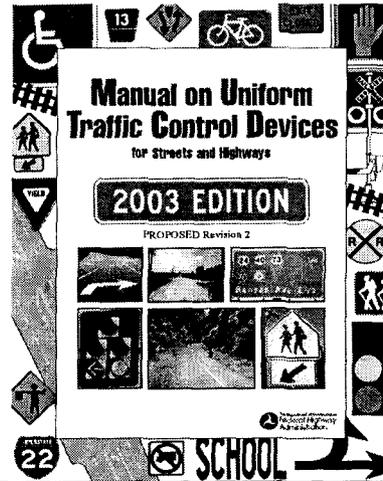


FHWA-2003-15149-5

Notice of Proposed Amendment: Maintaining Traffic Sign Retroreflectivity

Federal Highway
Administration
Office of Safety
Retroreflectivity Team



The Manual on Uniform Traffic Control Devices (MUTCD) is incorporated by reference in 23 CFR part 655, subpart F, approved by the Federal Highway Administration, and recognized as the national standard for traffic control devices used on all public roads. The FHWA has been developing a proposed change to the 2003 edition.

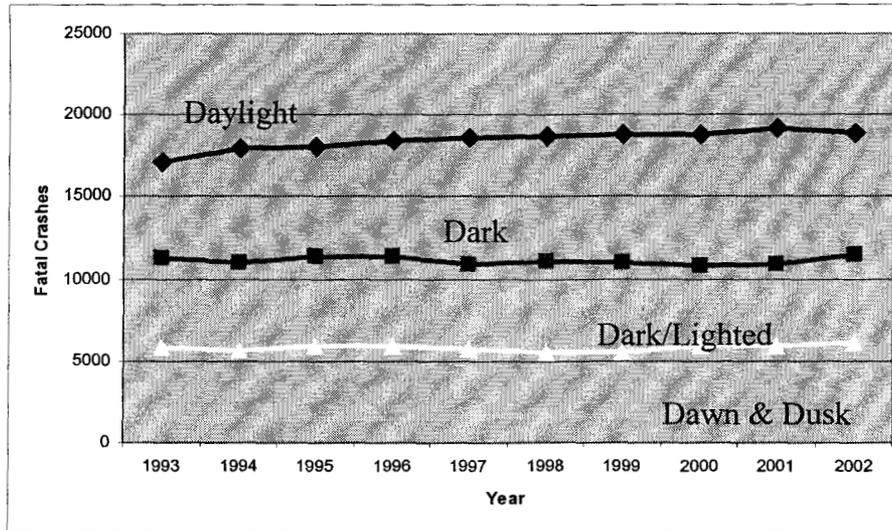
DEPT. OF TRANSPORTATION
DOCKETS
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Notice of Proposed Amendment

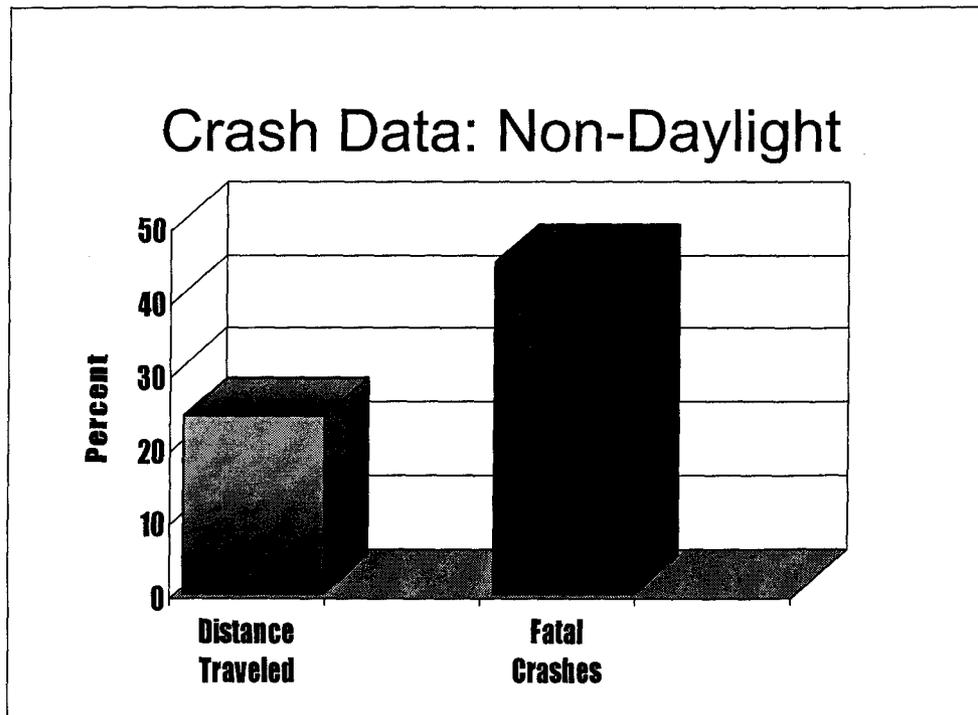
- Federal Register - July 30, 2004
- 2003 MUTCD Proposed Revision 2
- Maintaining Traffic Sign Retroreflectivity

On July 30, 2004, a Notice of Proposed Amendment to the MUTCD was published in the Federal Register. It is proposed as Revision 2, and is referred to as “Maintaining Traffic Sign Retroreflectivity.”

Fatal Crashes By Light Condition (FARS)



One of FHWA's primary goals is to improve safety on the nation's roads. Approximately 42,000 people have been killed on U.S. roads each year for the last 8 years. This graph shows the fatal crashes in the United States in the past 10 years, broken out by light condition. As you can see, most fatal crashes occur during daylight hours, approximately 18,000 per year. However, we also have significant numbers of fatal crashes in non-daylight hours as well. It is these crashes we hope to better address with attention to retroreflective sign maintenance.



These nighttime fatal crashes are most significant when comparing to the amount of travel at night.

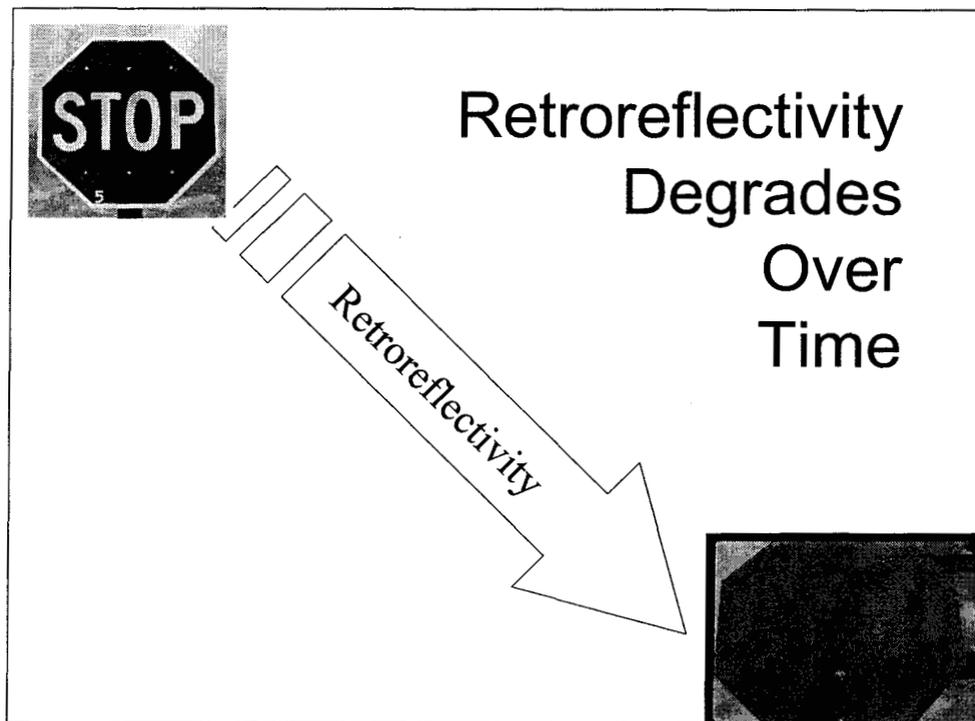
Look at this chart which shows nighttime fatal crash data for the nation:

$\frac{1}{4}$ of the travel occurs during the dark, but almost $\frac{1}{2}$ of the fatal crashes occur during that time. This is a huge disparity that deserves attention.

It is well known that this is caused by many factors, including the obvious ones of drunk driving and fatigue.

But we also hear many say that 90% of crashes are caused by driver error.

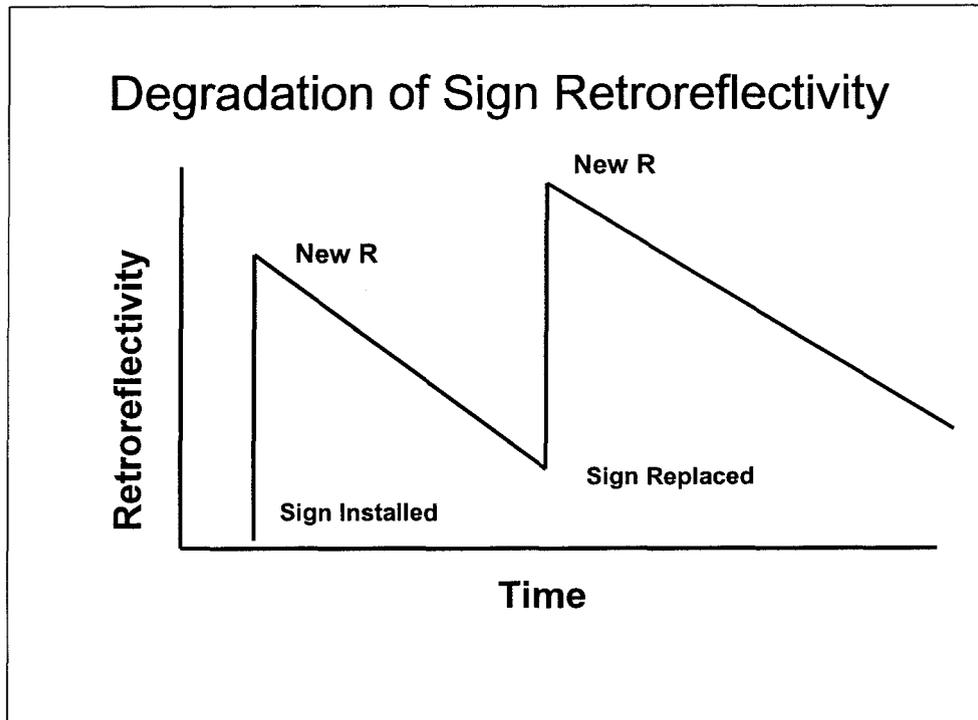
If so, what is causing this driver error problem at night? And what can we do to **REDUCE THE NUMBER OF DRIVER ERRORS**? The FHWA expects that improvements to the nighttime visibility of traffic signs will help drivers navigate the roads at night and thus promote safety and mobility.



The existing MUTCD requires that traffic signs be illuminated or retroreflective to enhance nighttime visibility. Most sign faces are made with retroreflective sheeting material.

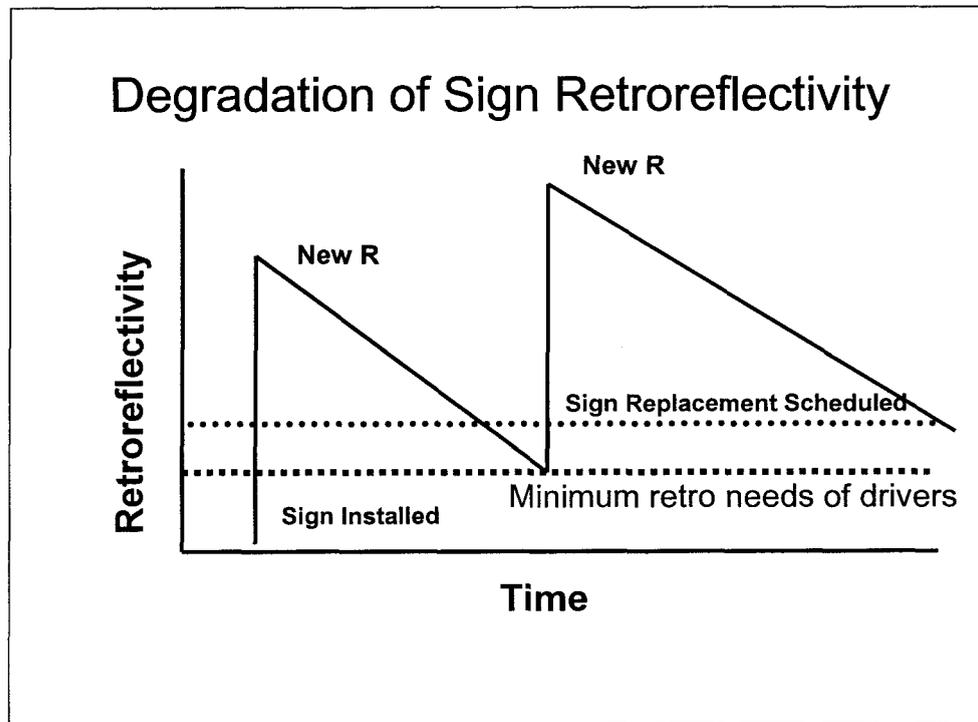
Retroreflectivity is the property of a material to redirect light back towards its source. In the case of a traffic sign, light is redirected back from the sign towards the vehicle's headlamps. Because a driver's eyes are relatively close to a vehicle's headlamps, some of the redirected light from a sign makes it to the driver's eyes, making the sign visible to the driver.

Unfortunately, the retroreflectivity of signs gradually deteriorates over time making signs less visible at night. As signs lose their retroreflective properties, their effectiveness in communicating regulatory, warning, and guidance messages to road users diminishes to the point where they reach the end of their useful life. Another way to say it is that they no longer meet the needs of the driver.



Until recently, little information was available about the levels of retroreflectivity necessary to meet the needs of drivers and thereby define the useful life of signs. If you take a look at this plot, the initial vertical line indicates the first time a sign is installed. It has a relatively high retroreflectivity value and would probably be very visible to a driver. Over time, the retroreflectivity degrades and eventually the sign is replaced to bring it up to another good level of retroreflectivity. However, we have never known what the proper time was for that replacement. We never really knew what retroreflectivity level was needed by drivers.

FHWA research has led to the development of minimum maintained levels of sign retroreflectivity for currently available materials, vehicle fleet characteristics, and capabilities of the driving population.



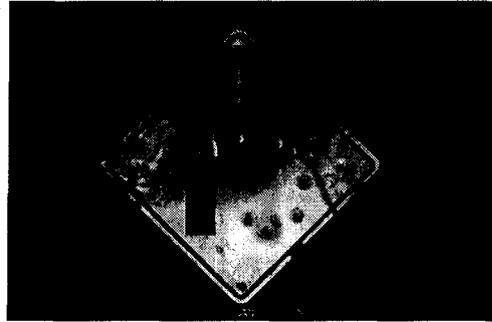
For example, through recent research, we now know what is considered the minimum retroreflective levels drivers need, and therefore when those signs should be targeted for replacement.

The purpose of traffic control devices, as well as the principles for their use, is to promote highway safety and efficiency by providing for the orderly movement of all road users. Those devices notify road users of regulations and provide warning and guidance needed for the safe, uniform, and efficient operation of traffic. These principles apply during the day, AND at night, which makes it important that we replace signs before the retroreflectivity wears out..

In actual practice, IF we don't notice the sign is worn out until it reaches the minimum retro needs of drivers, the retroreflectivity might end up below that yellow line by the time the sign is actually replaced. The orange dotted line indicates how an inspection, or assessment, would catch a sign in time to have it replaced before the retroreflectivity is too low to meet driver's needs.

Congressional Legislation

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."



In addition to the basic need to make signs visible at night, there was national legislation in 1993 that said "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."

This proposed amendment for maintaining sign retroreflectivity addresses the legislative mandate after researching the needs of the drivers and receiving input from many individuals, groups, and associations.

One word that is worth spending a minute discussing is the term "standard." Some people's first thought of a "standard" is a "number", a "value." Certainly, a number could be a standard. But, let's look at an ASTM definition...

“Standard”

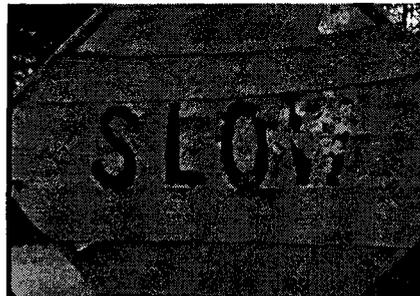
“Concept established by authority, custom, or agreement to serve as a model or rule in a measurement of quality or the establishment of a practice or procedure.” (ASTM)

A “concept...”

Based on this definition, a “standard” does not need to be a “number”, but can be a “concept”. That is the approach FHWA took in meeting the legislative mandate to include a “standard” in the MUTCD.

Proposal

- <http://mutcd.fhwa.dot.gov>
- Section 1A.11
Relation to Other Documents
- Section 2A.09
Minimum Retroreflectivity
- Section 2A.22
Maintenance



The proposed amendment can be reviewed at the normal FHWA MUTCD web site <http://mutcd.fhwa.dot.gov>. There are 3 sections in the Manual that are proposed to be modified. The first is 1A.11, which is a list of references. We are proposing to add one reference document, which is an FHWA document titled *Maintaining Traffic Sign Retroreflectivity*. It provides guidance information for public agencies, including a table of proposed minimum levels of retroreflectivity. The Proposed amendment also includes changes to Section 2A.09 and 2A.22, which I will explain in more detail.

Proposed Section 2A.09

Guidance:

One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity"

The existing section 2A.09 is currently blank. It was reserved, with the expectation that this rulemaking would be used to add text. This proposal adds text with one of the primary sentences being this one: "...One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity".

I will spend some time now looking at this sentence carefully and pointing out what I would consider to be key points.

Proposed Section 2A.09

Guidance:

One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity"

The sentence proposes the use of **METHODS**, either assessment or management methods, to maintain sign retroreflectivity.

Proposed Section 2A.09

Guidance:

One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity"

The next important point is that it is a "should" condition, as a guidance statement.

For those of you familiar with the MUTCD, you basically can have a standard, or guidance, or option, or support. In this case, FHWA is proposing a "guidance" statement. Let's take a look at the MUTCD definition of "guidance."

“Should”

“Guidance”

Recommended, but not mandatory, practice in typical situations with deviations allowed IF engineering judgment or engineering study indicates the deviation to be appropriate.

When the word “should” is used in the MUTCD, it is a guidance statement. The MUTCD definition of “guidance” is “Recommended practice, but not mandatory, practice in typical situations with deviations allowed IF engineering judgment or engineering study indicates the deviation to be appropriate.” Therefore, guidance statements are generally thought of as the right thing to do. BUT, if an engineer decides it is appropriate, deviations could be made.

Proposed Section 2A.09

Guidance:

One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity"

The 3rd key point about this sentence is that it refers to retroreflective levels in the separate FHWA document "Maintaining Traffic Sign Retroreflectivity." There are no proposed values or levels in the actual MUTCD.

Proposed Section 2A.09

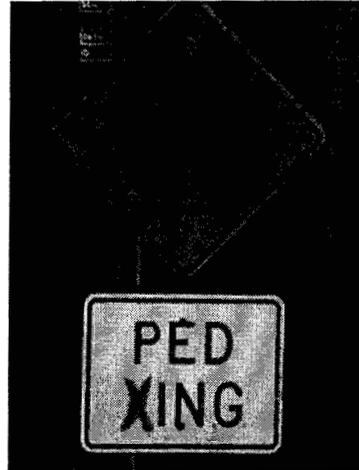
• Guidance:

One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity"

I would like to go back now to the methods and provide more information about what is in the proposed amendment. In proposed Section 2A.09, it lists several methods that are considered to be acceptable for maintaining sign retroreflectivity.

Assessment/Mgmt. Methods

- A. Visual Nighttime Inspections
- B. Measured retroreflectivity
- C. Expected Life
- D. Blanket Replacement
- E. Control Signs



There are five methods listed.

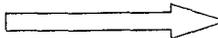
1. Visual nighttime inspections
2. Measured retroreflectivity
3. Expected Life
4. Blanket replacement
5. Control signs

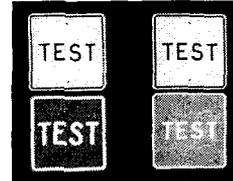
I'll spend a few minutes briefly describing each of these methods. First up is using visual inspections at night.

Method A: Visual Nighttime Inspection

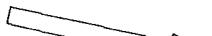
Trained sign inspector, Moving vehicle

PROCEDURE OPTIONS:

1. Calibration Signs 



2. Consistent Parameters

3. Comparison Panels 



This method will be a type of nighttime inspection.

It would be very important that the inspector be trained in the proper procedures for conducting the evaluation. The inspections are conducted from a moving vehicle.

If an agency decides that visual nighttime inspections are the best method for them, they could have 3 different procedures to choose from on how to conduct the inspections. Those 3 procedures are called calibration signs, consistent parameters, and comparison panels.

let's take a look at the first procedure that might be used, which is called "calibration signs."

Using this procedure, the agency obtains sample signs that are at or near the minimum levels. The night of the inspection, the inspector views the sample signs from the inspection vehicle. The inspector goes out and conducts the inspections that night and visually makes a determination on each actual sign whether it is nearing the minimum limit of the sample signs viewed earlier that night. Keep in mind that the inspectors will need to be trained on the proper techniques to use for this visual inspection method.

There is a 2nd procedure that could be used in lieu of the sample sign procedure. This is called the Consistent Parameters procedure. Remember that the minimum levels needed by drivers were determined by research. The researchers selected specific factors such as headlamp design, vehicle type

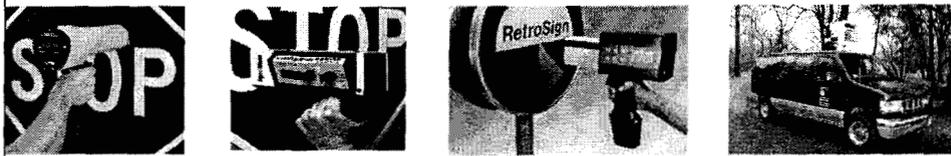
Assessment/Mgmt. Methods

- A. Visual Nighttime Inspections
- B. Measured retroreflectivity
- C. Expected Life
- D. Blanket Replacement
- E. Control Signs

We just covered the Visual nighttime Inspection Method, which included 3 different alternative procedures. Now I'll discuss the 2nd method, called Measured Retroreflectivity.

Method B: Measured Retroreflectivity

- Measure signs with retroreflectometer
- Compare measured values with minimum values
- Replace signs when measured values approach minimums



Basically this method means measure your signs. Those signs approaching a retro value near the minimums established by FHWA research would be scheduled for replacement. There are several handheld retroreflectometers on the market today. There is also 4 prototype mobile units developed by FHWA which have shown that the technology of measuring signs at highway speeds is feasible.

Assessment/Mgmt. Methods

- A. Visual Nighttime Inspections
- B. Measured retroreflectivity
- C. Expected Life
- D. Blanket Replacement
- E. Control Signs

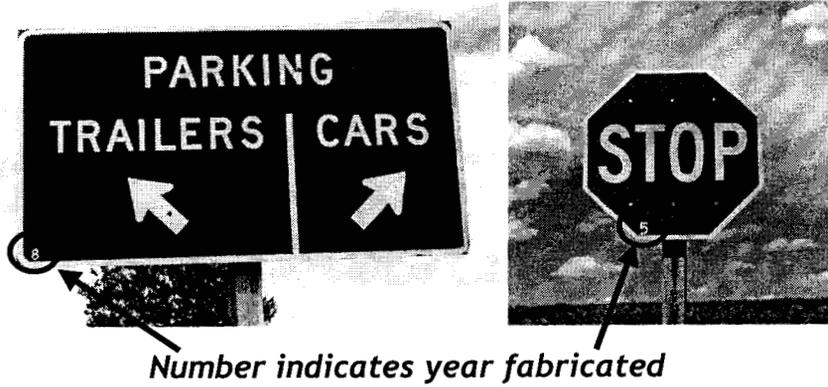
The 3rd method is called "Expected Life."

Method C: Expected Life

- 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 signs are replaced prior to the end of service life expectancy
- Periodic inspections or measurements to verify

This proposed method is based on expected life of a given sheeting material. For this method, an agency would determine the expected life of the sheeting they are using in their geographical area. The expected life time period could be determined by an agency's evaluation, or by borrowing the results of research from an area near them. The end of life retroreflectivity value would be from the FHWA reference document. The agency would then establish a program that would ensure signs are replaced on a cycle that would ensure they are replaced prior to no longer meeting the driver's needs. A part of this method would probably be periodic nighttime inspections to verify that the method is working.

Wyoming Expected Life



Here is an example from Wyoming which has been using an expected life method for several years. They place the date of fabrication on the face of the sign and have a pre-established number years for when the sign should be replaced.

Assessment/Mgmt. Methods

- A. Visual Nighttime Inspections
- B. Measured retroreflectivity
- C. Expected Life
- D. Blanket Replacement
- E. Control Signs

Method "D" is called "Blanket Replacement."

Method D: Blanket Replacement

- All signs in area/corridor, or signs of a specific type, are replaced at specific intervals
- No need to track individual signs
- Intervals based on the expected life of material

This proposed method is also based on expected life of a given sheeting material. For this method, an agency would determine the expected life of the sheeting they are using in their geographical area. The expected life time period could be determined by an agency's evaluation, or by borrowing the results of research from an area near them. The end of life retroreflectivity value would be from the FHWA reference document. So far, this method is the same as the expected life method. However, with this method, an agency does not need to track individual signs. All signs in an area, or along a corridor, are replaced at the same time, based on the expected life.

Assessment/Mgmt. Methods

- A. Visual Nighttime Inspections
- B. Measured retroreflectivity
- C. Expected Life
- D. Blanket Replacement
- E. Control Signs

The last method is called "Control Signs"

Method E: Control Signs

- Replacement of signs based on performance of control signs
- Control signs monitored to determine end of service life for associated signs
- Field signs represented by control samples are replaced prior to reaching minimum levels

This method uses control signs to determine when to replace a larger set of signs. For example, you might have a District-wide signing project. You could have a small number of extra signs that would be installed in a maintenance yard. The retroreflectivity of those control signs is tracked and all the associated signs are replaced when the retroreflectivity of the control signs approaches the suggested levels.

Another way would be to use a sampling of the signs installed as the control signs. Those few signs are monitored to determine when the larger group of signs are all replaced.

Proposed Section 2A.09

Guidance:

One or more of the following assessment or management methods should be used to maintain sign retroreflectivity above the minimum levels identified in FHWA's "Maintaining Traffic Sign Retroreflectivity"

Now back to that proposed sentence in 2A.09. The last part of it references a FHWA document called "Maintaining Traffic Sign Retroreflectivity." That document contains additional information on each of the assessment/management methods and also provides the minimum retroreflectivity levels determined appropriate by FHWA.

Minimum Levels in Referenced Document (cd/lux/m²)

Sign Color	Conditions	Retroreflective Sheeting Material (ASTM D4956-01a) (legend//background)					
		I	II	III	VII	VIII	IX
White on Red	≥ 3:1	35 // 7					
Black on Orange or Yellow	≥ 48" or Bold	X	50				
	< 48" or Fine	X	75				
Black on White		50					
White on Green	Overhead	x // 7	x // 15	x // 25	250 // 25		
	Shoulder	x // 7	120 // 15				

This is the table of those values in that reference document. Across the top of the table the columns are labeled by sign color, some special conditions, and then the type of sheeting. Lets go back to the first column, sign color. The first color combination is white on red. This would cover stop signs, yield signs, and do not enter. For now, let's skip the 2nd column. In the 3rd part of the table, it has a 35 over a 7. This means that the legend, or white part of the sign should not fall below an R sub A (coefficient of retroreflection) of 35, which is measured in candelas per lux per meter squared. It also means that the red background should not fall below 7. If either the legend or the background is below their respective value, the sign does not meet the need of drivers.

Now let's go back to the special condition. It says greater than or equal to 3 to 1. This is fully explained in the FHWA document, but what it means is that the retroreflective contrast ratio must be at least 3 to 1 when comparing the white to red. For example, if the white is 36 and the red is 18, that would be a contrast ratio of 36 divided by 18, or 2 to 1. This means the ratio is lower than 3 to 1, and therefore the sign should also be replaced.

Now lets take a look at the next row, which is for black on yellow and black on orange. Then you make a decision of whether the sign is greater than or equal to 48 inches, or smaller than that. In addition, all bold signs would fall in the 1st category and all fine symbol and legend signs would fall in the 2nd category. As an example, lets assume a bold symbol sign warning of a cross road. That sign is in the first category. Going across the row. it says a minimum value is

Research Conditions

- Dark, rural environment
- Straight, flat highways
- No glare sources
- Sign faces perpendicular to road

It should be noted that these values are considered minimums and that an agency may decide to use higher values for their own replacement criteria. The research that developed these values was conducted in a dark rural environment on straight/flat roadways, with no glare sources, and with signs perpendicular to the roadway. If any of these conditions are different in the field, an agency may want to provide greater retroreflectivity.

Proposed Exclusions

Option:

Highway agencies may exclude the following signs from the retroreflectivity maintenance guidelines described:

- A. Parking, Standing, Stopping signs
- B. Walking/Hitchhiking signs
- C. Adopt-A-Highway signs
- D. Blue/brown background signs
- E. Bikeway signs for exclusive use by ped/bikes

In the proposed amendment, there is an Option statement that says “Highway agencies may exclude the following signs from the retroreflectivity maintenance guidelines...” This does not mean these signs should not be retroreflective, as the basic retro requirements in the MUTCD still exist. However, what we are saying is that these signs would not be expected to fall under the recommended assessment/management methods as the more-critical regulatory/warning/guide signs discussed previously.

These sign exclusions would be for signs like parking, adopt-a-highway, and blue or brown background signs.

That covers all of the changes in section 2A.09.

Proposed Section 2A.22

Guidance:

All traffic signs should be kept properly positioned, clean, and legible, and should have (adequate) retroreflectivity levels as indicated in Section 2A.09. Maintenance activities should consider proper position, cleanliness, legibility, and daytime and nighttime visibility of a sign.

Yellow = Existing to remain

Red = proposed deleted

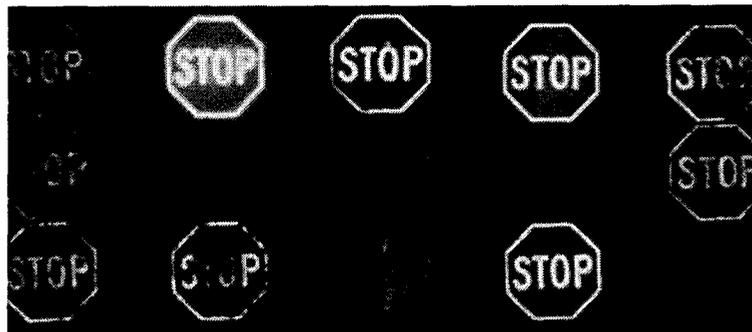
Green = proposed addition

Now I'll explain the very brief changes proposed for section 2A.22 which is the sign maintenance section in the MUTCD. Only one sentence has been proposed to be changed here. The part in yellow exists in the existing MUTCD. We are proposing to delete one word, "adequate", and add the part in green. So what is proposed would read, "All traffic signs should be kept properly positioned, clean, and legible, and should have retroreflectivity levels as indicated in Section 2A.09. Maintenance activities should consider proper position, cleanliness, legibility, and daytime and nighttime visibility of a sign."

What this will do is to provide some guidance on what is considered to be adequate, based on our most recent research.

Cost

Estimated to be less than \$100
million per year nationally



An impacts analysis was conducted to determine the overall costs to agencies nationwide to comply with the proposed amendment, above what is currently recommended in the MUTCD. That analysis showed the total costs to be less than \$100 million annually for all agencies cumulatively in the United States.

NOTE TO PRESENTER: The impacts analysis is posted on the docket. If people have questions about the analysis and need exact cost figures, refer them to the docket at <http://dms.dot.gov> and searching for the docket number (15149). If they ask what is currently required in the MUTCD, you can sure answer if you are knowledgeable with the MUTCD. One thing the existing MUTCD recommends is a schedule for inspecting, both day and night.

Proposed Compliance Date

Ground mounted signs:
Phase-in over 7 years

Overhead signs:
Phase-in over 10 years

This standard is proposed to be implemented over a phase-in period of several years. All ground mounted signs would be allowed a phase-in period of 7 years from the time of Final Rule publication, and overhead signs would be allowed 10 years.

We believe this would allow agencies to replace their sheeting within a normal replacement period of a good sign maintenance program.

Summary

- Notice of Proposed Amendment
- A “should” condition
- Recommends using methods to assess and manage your signs
- Minimum levels established by research
- Minimum levels in a reference document

In summary,

This is a Notice of PROPOSED Amendment, not a final rule.

It is proposed as “guidance” with “should” language, not “shall” or “may”

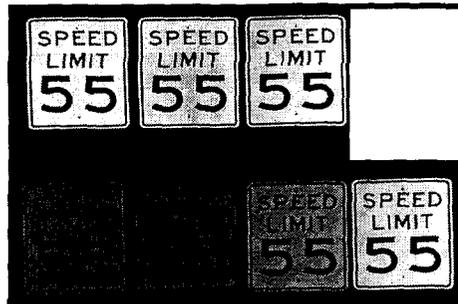
It recommends establishing METHODS to address the retroreflectivity of your signs

The minimum levels were developed through research using the latest sheeting types

Those levels are provided in a reference document, not the MUTCD itself

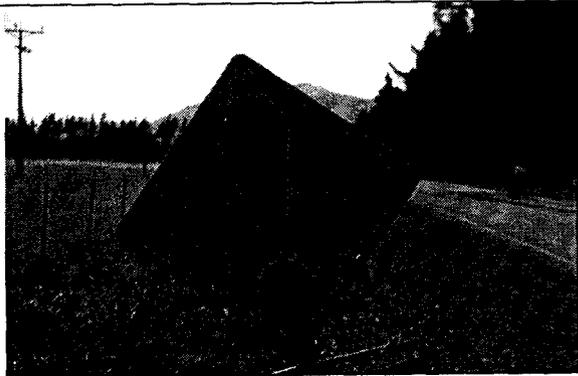
Rule Making Process

- Notice of Proposed Amendment published in *Federal Register*
69 Fed. Reg. 45623
- Public comment (90 days)
- Review comments
- Revisions
- Final Rule



As a Notice of Proposed Amendment, the FHWA is seeking your comments. There is a 90-day comment period. FHWA will review all comments submitted, make revisions we believe are appropriate, and then we anticipate publishing a Final Rule. No target date has been established for the Final Rule.

Your Comments



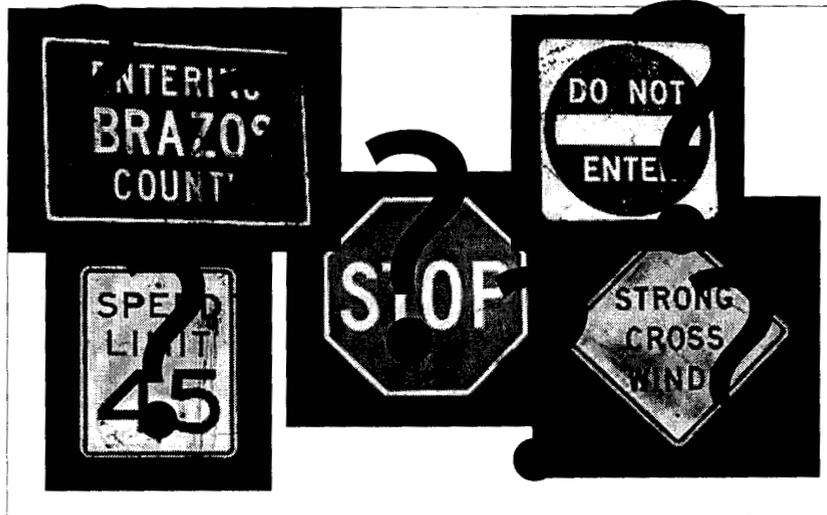
- Review:
<http://mutcd.fhwa.dot.gov>
- Review and/or Comment:
<http://dmses.dot.gov> (docket 15149)
<http://www.regulations.gov>
- October 28, 2004 deadline

The actual Notice can be reviewed at the mutcd web site.

Your comments can be submitted to either of two locations as noted here.

Keep in mind the October 28 deadline for submitting your comments.

Questions (limited to clarification)



I'll open it up to questions, but need to restrict it to only questions to clarify what I have said. Due to federal rulemaking regulations, I will not be able to answer any other type of questions. I also request that if you have comments to make, please submit them to one of the two web sites.