



FHWA Issues Revised Proposal for Pavement Marking Retroreflectivity

by Matt Cate, P.E.

A supplemental notice of proposed amendments (SNPA) addressing minimum retroreflectivity levels for pavement markings was published in the Federal Register on January 4, 2017. The SNPA modifies the April 2010 proposal for minimum pavement marking retroreflectivity levels by offering a simplified set of standards. The Federal Highway Administration (FHWA) is currently seeking comments regarding the proposed changes to the Manual on Uniform Traffic Control Devices (MUTCD).

If adopted, the proposed amendments will add new language to the MUTCD that will require transportation agencies to maintain some markings at or above a specified level of retroreflectivity. These rules will be similar to those added to the MUTCD to address traffic sign retroreflectivity in 2008. The new standard will apply only to longitudinal markings (including center lines, edge lines, and lane lines) and only on roadways with a regulatory speed limits of 35 mph or greater.

Where applicable, longitudinal markings should be maintained so that their measured retroreflectivity does not fall below 50 millicandelas per square meter per lux ($\text{mcd}/\text{m}^2/\text{lx}$). Retroreflectivity values should be established using 30-meter geometry (entrance angle of 88.76° observation angle of 1.05°).

A number of guidance, option, and support statements accompany this standard. These statements provide additional information above and beyond the standard (mandatory practice) described above.

- Longitudinal markings should be maintained at or above $100 \text{ mcd}/\text{m}^2/\text{lx}$ on roadways with a speed limit of 70 mph or greater (guidance).
- Agencies should use one or more FHWA-approved methods to maintain pavement marking retroreflectivity. If using a method which has not been tested by FHWA, it should be the result of an engineering study which has demonstrated the ability to maintain markings at or above applicable retroreflectivity levels (guidance).
- Agencies may exclude certain types of markings from the minimum retroreflectivity levels described above (option). Examples include:
 - ▶ markings in areas where ambient lighting assures visibility,
 - ▶ markings on roadways where ADT is less than 6,000 vehicles per day,
 - ▶ dotted line extensions at intersections, major driveways, or interchanges,
 - ▶ curb markings,
 - ▶ parking space markings, and
 - ▶ shared-use path markings.
- Some special circumstances may cause markings to fall below minimum acceptable levels, but do not permanently exempt marking from these standards. Agencies will be considered to be in compliance if action is taken to restore retroreflectivity to appropriate levels in a timely fashion (support). These circumstances include:
 - ▶ isolated locations of unusual marking degradation,
 - ▶ periods preceding imminent resurfacing or reconstruction,
 - ▶ unanticipated events (including equipment breakdown and material shortages), and

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The views, opinions, and recommendations contained within this newsletter are those of the authors and do not necessarily reflect the views of FHWA and TDOT.

865-974-5255/1-800-252-ROAD
<http://ttap.utk.edu>

Matt Cate, P.E., Director
865-974-4614 (mcate@utk.edu)
Dr. David B. Clarke, P.E.,
Director Emeritus
865-974-1812 (dbclarke@utk.edu).
Frank Brewer, Training Coordinator
865-974-8251 (fbrewer1@utk.edu)
Dr. Airton G. Kohls, Engineer
865-974-0298 (akohls@utk.edu)
Daniel Herman, Technician
865-974-4608 (dherman2@utk.edu)
Spence Meyers, Database, Website &
Technical Assistance
865-974-6168 (meyers@utk.edu)
Jenny Jones, RoadTalk Editor
865-974-6549 (gohjones@utk.edu)
Mollie Mitchell, Administrative Specialist
865-974-1812 (mmitch6@utk.edu)
Diana Webb, Course Registration
865-974-5255 (dwebb21@utk.edu)

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From the Director

As I write this column on February 22, it appears that our short, mild winter might already be behind us despite the fact that spring does not officially arrive until March 20. Everywhere I look flowers and trees are blooming and I fear that my lawn mower will soon be emerging from hibernation. Hopefully this early escape from the clutches of Old Man Winter does not foreshadow another hot, dry summer.

Regardless of the summer forecast, we have a hot topic coming up in Nashville. Governor Haslam has proposed the state's first gas tax increase since 1989. The IMPROVE Act would pave the way for more than 960 transportation projects across the state. As proposed, the plan would also bring \$39 million in new transportation funding for cities and \$78 million in new funding for counties. In Washington, the Trump Administration has raised the possibility of a major (up to \$1 trillion) infrastructure initiative that would address ground, air, rail, and waterway transportation needs across the nation. While few would argue that our transportation systems need more support, the tax increases and credits which would bring new funding and investment at either the state or national level are likely to meet some resistance.

Roadway safety continues to be an area of emphasis in Tennessee. Seatbelt use is at its highest observed level (89%) since statewide observational surveys began in 1986. New cars are built to provide more crash protection than ever before, and in many cases they include advanced technology designed to help drivers prevent crashes. Much emphasis has been placed on safer roadways and improved guidance for drivers. Law enforcement agencies across the state devote time and energy to traffic enforcement in an effort to reduce the frequency and severity of crashes. Despite these advances, Tennessee's year-to-date traffic fatality total (125) stands at 11 more than on the same date in 2016. Some of this problem can be attributed to historically high vehicle miles of travel across the nation. Some may be the result of distracted driving. Regardless, we cannot afford to relax our efforts to make the state's roads safer for all Tennesseans.

Finally, I am excited that our traffic sign retroreflectivity survey provided a valuable look at the ongoing sign maintenance efforts of many agencies. In a time of spam, unsolicited emails, and overflowing inboxes, the number of responses to the survey (77) indicates that this is still an important issue. While most survey participants (82%) are aware of the MUTCD's minimum retroreflectivity standards, only 12% indicated that their agency is currently in full compliance. Most are struggling to attain full sign retroreflectivity compliance without increased funding, and proposed retroreflectivity standards for pavement markings will only make this task more difficult. TTAP will certainly use this information to guide our future activities.

That's all for now. Please do not hesitate to contact me if there is anything that TTAP can do to help you meet your community's transportation needs.



- ▶ loss of retroreflectivity (damage) resulting from winter maintenance activities (primarily plowing).

The SNPA also proposes that, if adopted, the new pavement marking retroreflectivity standard will have a compliance date which is 4 years from the effective date of the final rule.

For those familiar with methods to maintain traffic sign retroreflectivity, the list of approved management techniques for pavement markings will look familiar. The following procedures are approved for use in the “Methods for Maintaining Pavement Marking Retroreflectivity” report (FHWA-SA-14-017):

- Visual nighttime inspection
 - ▶ Calibrated marking procedure
 - ▶ Consistent parameters procedure
- Measured retroreflectivity
 - ▶ Handheld units
 - ▶ Mobile units
- Expected service life
- Blanket replacement

Additionally, this FHWA report identifies several retroreflectivity techniques which have not been demonstrated to produce consistent results when attempting to compare in-service markings to a known retroreflectivity standard. As a result, use of these techniques will not place an agency in compliance with the new standards. Examples of techniques in this category include: sun over the shoulder, comparison panels, lane line counting, control markings, windshield markings, and comparison light boxes. Agencies using an unapproved technique are not protected when individual markings or locations fall below the values indicated in applicable standard or guidance statements.

To view the SNPA in its entirety, please visit the Federal Register website at <https://www.federalregister.gov/d/2016-31249>. The comment period for this proposed change to the MUTCD will close on May 4, 2017.

Additional Resources:

- Pavement Marking Retroreflectivity SNPA Proposed MUTCD Language: https://safety.fhwa.dot.gov/roadway_dept/night_visib/ppmr_mutcd_2016.cfm
- Assessment of Economic Impacts of SNPA Proposed Minimum Levels Of Pavement Marking Retroreflectivity: https://safety.fhwa.dot.gov/roadway_dept/night_visib/fhwasa14016.cfm
- Methods for Maintaining Pavement Marking Retroreflectivity: https://safety.fhwa.dot.gov/roadway_dept/night_visib/fhwasa14017/

Small Town and Rural Multimodal Networks

by Airton Kohls (Source: FHWA)

In many small towns and rural communities, active transportation (any form of human-powered transportation) is even more common than it is in urban areas. However, infrastructure to support active transportation is often limited or absent. Many small and rural communities are located on State and county roadways that were built to design standards that favor high-speed motorized traffic, resulting in a system that makes walking and bicycling less safe and uncomfortable. These roadways can be retrofitted and redesigned over time to provide a transportation network that better serves the safety, health, and economic interests of the community.

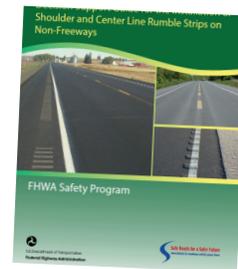
This FHWA guide is a resource for practitioners developing and promoting multimodal networks in small and rural communities. The opportunities for road design highlighted in this document build on a broad range of existing national design guidelines and references. This guide translates existing street design guidance and best practices for bicycle and pedestrian safety and comfort to the rural context, and provides examples of how to interpret and apply these design practices to create safe, accessible, and comfortable multimodal networks.

Some of the common transportation challenges in small towns and rural areas include roadway operations of agricultural vehicles on auto oriented roadways, lack of transportation options, constrained terrain, state highways being often the main street, climate and maintenance. To address these issues, this FHWA guide proposes several mixed traffic facilities, for example bicycle boulevards, yield roadways and the use of advisory shoulders. In addition visually and physically separated facilities are also proposed as well as opportunities for speed management, school connections, multimodal main streets and bridge retrofits.

To download a free copy of FHWA Small Town and Rural Multimodal Networks, go to:
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/small_towns/fhwahep17024_lg.pdf

Shoulder and Center Line Rumble Strips on Non-Freeways

by Airton Kohls (Source: FHWA Safety Programs)



Center line and shoulder rumble strips are proven safety countermeasures for reducing roadway departure crashes, including head-on crashes and run-off-road (ROR) crashes. According to a recent study from the National Highway Traffic Safety Administration, or NHTSA (DOT HS 811 500), ROR left or right crashes account for 64.4 percent of all single vehicle crashes and, of those, 95.1 percent of the time the critical reasons were driver related. Further analysis indicated the dominant critical reasons for passenger cars were internal driver distraction, steering overcompensation, poor directional control, too fast for curve, and sleeping. The dominant critical reason for large trucks was sleeping. According to the Fatality Analysis Reporting System (FARS) data, approximately 55 percent of fatal crashes are those targeted by rumble strips. Moreover, for rural two-lane highways, that number increases to approximately 66 percent. Another 2009 NHTSA study reported that approximately 66 percent of ROR events were departures to the right and 31 percent were to the left.

Rumble strips are a relatively low-cost countermeasure and economic analyses have indicated benefit-cost (B/C) ratios that exceed 100 to 1 (i.e., 100 dollars saved for every 1 dollar spent). For this reason, shoulder rumble strips have been installed nearly system wide for the Interstate system and most freeways and expressways. However, agencies have had varying degrees of success installing center line and shoulder rumble strips on multilane and two-lane roadways. The three primary concerns for rumble strips for these highway types include the following:

- Inconvenience for bicyclists. Standard rumble strip dimensions used by most agencies are difficult to traverse if bicycle gaps are not provided, as they make the rider uncomfortable and may lead to loss of control.
- External noise pollution. Rumble strips alert motorists through noise and vibration. The noise generated by rumble strips is different than background traffic noise and is intermittent. This can create a disturbance for nearby residents and for special environmental conditions (e.g., noise-sensitive wildlife habitats) if there are frequent incidental contacts.
- Pavement durability. There is concern that milling rumble strips into longitudinal joints or into the wearing course will allow water infiltration causing premature pavement deterioration.

FHWA Safety program has released a Decision Support Guide for the Installation of Shoulder and Center Line Rumble Strips on Non-Freeways (http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/fhwas16115/fhwas16115.pdf). The purpose of this guide is to inform agencies on center line and shoulder rumble strip installation. It describes methods for identifying appropriate locations for installation, assessing the potential crash reductions and benefit to cost ratio, and developing performance metrics for safety. Additionally, this guide discusses special considerations for rumble strip installations, identifies variability in current practices, and provides a decision-support framework for installing rumble strips.

The following are a few sources of information that you may find helpful to address the aforementioned primary concerns for the use of rumble strip on non-freeway highways:

Bicycle Accommodation:

Rumble Strip Implementation Guide:
Addressing Bicycle Issues on Two-Lane Roads
http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/bike_ig/rmbl_bikes_imp.pdf



Use of Center Line Rumble Strips and Delineators to create a buffer on Highway 14 in Minnesota

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Example of Bicycle Gap – Photo: Doug Ryan, Adventure Cycling Association

Noise Issues:

Rumble Strip Implementation Guide: Addressing Noise Issues on Two-Lane Roads

http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/media/RumbleStripGuide_Noise/noise_bpg.pdf

Pavement Issues:

Rumble Strip Implementation Guide: Addressing Pavement Issues on Two-Lane Roads

http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/media/RumbleStripGuide_Pavement/pavement_bpg.pdf

This FHWA Guide also provides several case studies. For example, the picture on page 4 depicts a stretch of Highway 14, a major arterial in southern Minnesota, spanning from South Dakota to Wisconsin. A buffer consisting of a double striped yellow line with rumbles on each side of delineators was used as an interim typical section during a five year project to expand the highway to a four-lane expressway. The location had a significant above-average rate of fatal head-on crashes and the design proved to be effective, reducing fatal head-on and severe head-on injury crashes to zero.

MUTCD – Clarifications of Existing Standards and Guidance on New and Innovative Control Devices

by Airton Kohls (Source: FHWA HOTO-1 and HRT-10-06)

On January 5, 2017, FHWA issued a memorandum to clarify the status of several types of traffic control devices currently allowed for use by the 2009 Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) under various types of approval, and to provide an update on the evaluation of several other types of traffic control devices under consideration for Interim Approval.

The following are traffic control devices permitted without additional approval from FHWA:

Bicycle Lane Markings Through Intersections:

Extensions of bicycle lanes are compliant with the MUTCD and can be marked as would be an extension of any other lane. The provisions of Section 3B.08 - Extensions Through Intersections or Interchanges - apply to bicycle lanes. Among other guidance, Section 3B.08 states that “Where highway design or reduced visibility conditions make it desirable to provide control or to guide vehicles through an intersection or interchange ... dotted line extension markings consisting of 2-foot line segments and 2- to 6-foot gaps should be used to extend longitudinal line markings through an intersection or interchange area.” It should be noted that chevron markings are not permitted to be used in bicycle lanes or bicycle lane extensions, nor are shared-lane markings. Bicycle lane extensions through intersections can include standard bicycle lane arrows, bicycle symbols, or pavement word markings. Additionally, green-colored pavement can be used to enhance conspicuity if the installing jurisdiction has received approval under Interim Approval 14 (see below).

High Visibility Crosswalk Markings:

Since the publication of the 2009 MUTCD, a study on crosswalk markings was completed on behalf of the FHWA. This study, Crosswalk Marking Field Visibility Study (FHWA Publication FHWA-HRT-10-068), produced several recommendations for revisions to the MUTCD. These recommendations were to add bar pairs as a “usable crosswalk pattern”, to provide typical dimensions for marking patterns, and to consider

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making bar pairs or continental markings the default marking for all crosswalks across uncontrolled approaches with some exceptions. It is important to note that bar pairs are compliant with the 2009 MUTCD and can be used by any jurisdiction choosing to do so. Many jurisdictions already use the bar pair crosswalk marking. It is likewise also compliant with the MUTCD if a roadway agency should choose to accept the recommendation that bar pairs or continental markings be the default crosswalk marking across uncontrolled approaches. While providing typical dimensions for crosswalk markings is under consideration for the next edition of Standard Highway Signs, many State and local roadway agencies include these specifications in their roadway design guides.



Example of bar pairs markings (FHWA-HRT-10-067)



Example of continental markings (FHWA-HRT-10-067)

Edge Line Markings at Highway-Rail and Light Rail Transit Grade Crossings:

Edge Line Markings extending through the track area at rail grade crossings are permitted under the 2009 MUTCD. In March 2016, the FHWA issued Official Ruling 8(09)-21 (I), which clarified that the extension of tubular markers was permitted across the track area, but the requester at that time did not inquire about edge lines in similar situations. Edge lines are permitted to be extended through the track area under the 2009 MUTCD without any additional approvals.

The memorandum also includes information on traffic control devices permitted under experimental approval (Green-Backed Shared-Lane Markings and Use of Bicycle Symbol on Signs) and on requests for interim approvals (Revision to Interim Approval 16 to Allow Conflicting Movements, Two-Stage Turn

Boxes and Use of Red-Colored Pavement in Transit Lanes). The memorandum can be found at: <http://mutcd.fhwa.dot.gov/resources/policy/tcdstatusmemo/index.htm>

The data collection and experimentation processes are critical to the progress of the MUTCD as it keeps pace with the state of the transportation engineering practice. It is critical that transportation agencies collaborate and share data and research on new and innovative traffic control devices and operations. FHWA division office in TN welcomes the opportunity to work with transportation agencies and is ready to provide assistance, direction, and guidance to any agency wishing to experiment or to utilize any of the traffic control devices discussed herein.

Tennessee Traffic Sign Retroreflectivity Survey

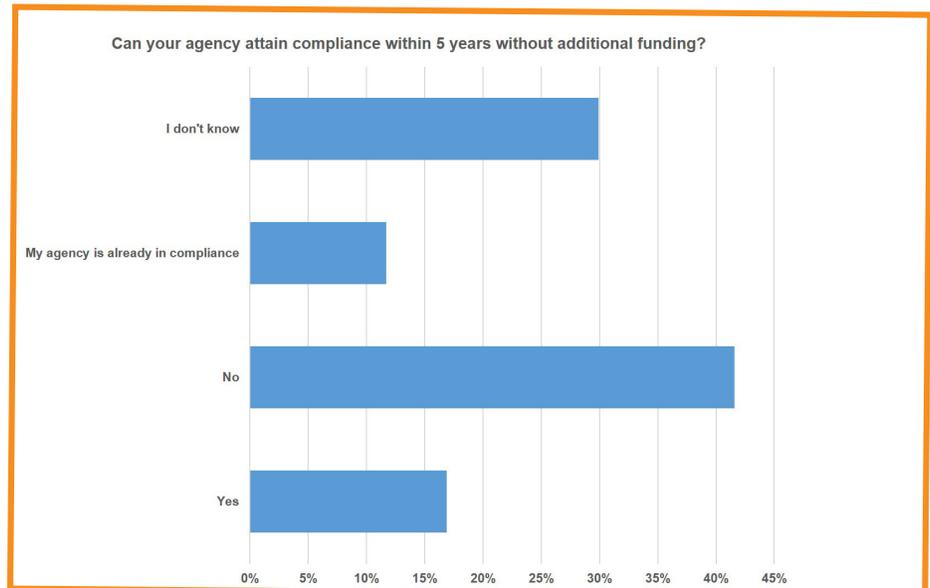
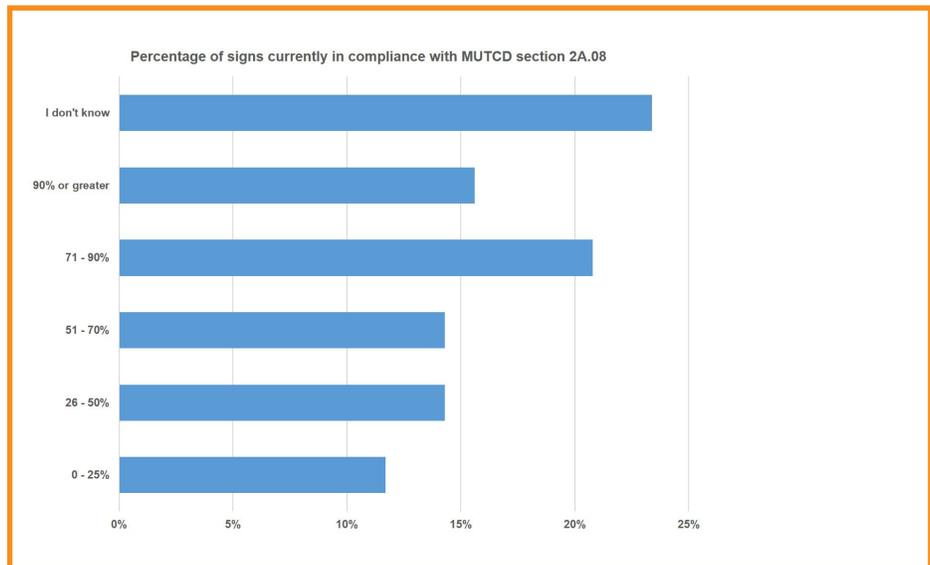
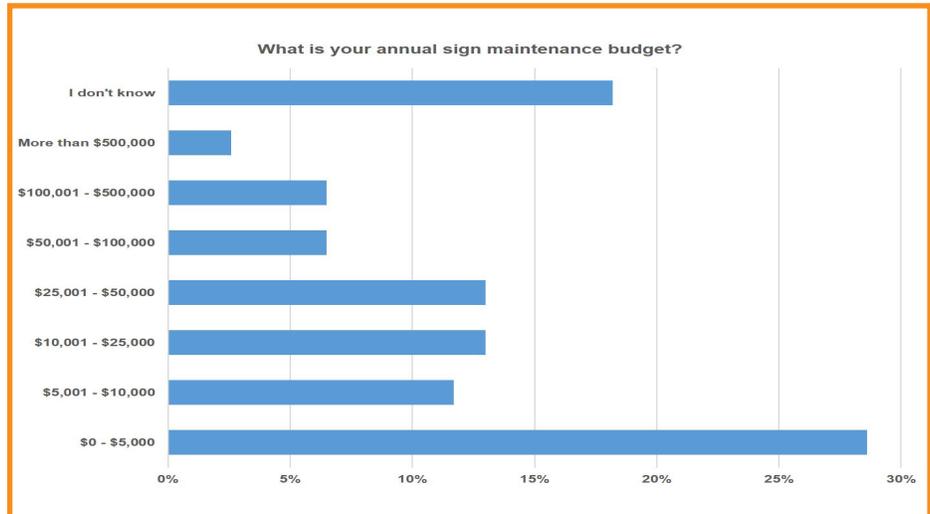
by Matt Cate, P.E.

TTAP conducted an online survey in October 2016 to assess the state of traffic sign retroreflectivity compliance efforts in Tennessee. We received responses from 77 individuals representing cities (61), counties (14), and state agencies (1) spread across the state. Responses confirmed some widely-held beliefs, but there were some surprises as well.

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Almost 82% of survey participants said that they were familiar with the MUTCD's minimum requirements for traffic sign retroreflectivity. Those who answered "yes" to this question were asked to identify sources where this information was obtained. The Tennessee Department of Transportation was the most frequent response (54%), followed by TTAP (48%), and UT's Municipal Technical Advisory Service or County Technical Assistance Service (46% collectively). Finally, participants were asked how they would prefer to learn more about this topic. The most frequent response was "brochures and technical guides" (39%), followed by "classroom training," "online training and webinars," and "newsletter articles and email bulletins" at 36% each.

TTAP will use the survey to guide future training and technology transfer efforts, and we have also shared these results with interested parties at TDOT, FHWA, and even the Tennessee General Assembly. Some of the most interesting survey results are summarized on the right. To see complete survey results, please visit our website at http://ttap.utk.edu/techtransfer/pdfs/retro_survey.pdf



Tennessee Transportation Assistance Program
Center for Transportation Research
The University of Tennessee
309 Conference Center Building
Knoxville, TN 37996-4133
Ph. (865) 974-5255/(800) 252-ROAD
Fax. (865) 974-3889
Email. TTAP@utk.edu
Web. http://ttap.utk.edu

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