



Signs and Pavement Markings for the MUTCD that Meet the Needs of the Driver

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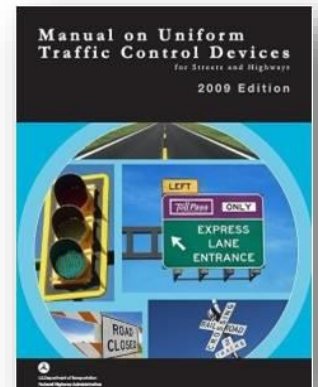
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Nighttime driving is statistically more risky than daytime driving—the nighttime crash rate is about three times higher than the daytime crash rate. While many factors are at play during nighttime conditions, drivers generally acknowledge that their nighttime visibility of the roadway and roadside is significantly reduced compared to their daytime visibility. Traffic signs and pavement markings are made with retroreflective materials to help increase their visibility during nighttime conditions. Retroreflective materials are unique in that they shine headlamp light back toward the driver.

The Manual on Uniform Traffic Control Devices (MUTCD) requires most signs and pavement markings to be retroreflective but until recently, it did not provide guidance or define how retroreflective signs and pavement markings should appear to meet the needs of the nighttime driver. As a way to increase nighttime safety, the MUTCD was revised in January 2008 to include minimum retroreflectivity maintenance levels for traffic signs to help ensure that nighttime drivers can see and read the signs in time to react safely. Agencies had until June 13, 2014 to identify and use one of the sign retroreflectivity management methods listed in the MUTCD to maintain regulatory and warning sign retroreflectivity at or above the minimum retroreflectivity levels in Table 2A-3 of the MUTCD. Agencies are expected to add signs other than regulatory or warning to their method as resources allow.



The new MUTCD minimum sign retroreflectivity levels were based on the nighttime needs of older drivers to see and read traffic signs. As a result, the minimum criteria provide guidance for agencies to ensure that their signs are adequately bright enough for all drivers at night. In addition, Table 2A-3 restricts the use of some retroreflective sheeting materials for signs because even when new and unweathered, those materials do not meet the nighttime needs of older drivers.

The Federal Highway Administration (FHWA) is now working on developing minimum retroreflectivity levels for pavement markings. As the FHWA moves forward on their pavement marking efforts, their supporting research has produced new safety- related findings regarding pavement markings.

In January 2013, research was presented at the Transportation Research Board's Annual Meeting that included statistical correlations between pavement marking retroreflectivity and safety. Previous research on this topic had provided mixed results and sometimes counterintuitive findings. Using data from Michigan, the researchers evaluated relationships between crashes and longitudinal pavement marking retroreflectivity. The retroreflectivity data consisted of pavement markings measurements representing white edge lines, white lane lines, yellow edge lines, and yellow centerlines.

The data included crashes and retroreflectivity measurements from 2002 to 2008. Only nighttime crashes that occurred at non-intersection and non-interchange segments during the non-winter months (between April and October) were considered (wet crashes were also excluded). While statistically significant findings were identified for both rural two-lane highways and freeways, a specific example of the findings for edge lines on rural two-lane highways demonstrates that nighttime and single vehicle nighttime crashes can be reduced by 9.5 percent when the edge line retroreflectivity is increased by 100 mcd/m²/lx. The findings for centerline pavement marking retroreflectivity showed that as the retroreflectivity decreases to 150 mcd/m²/lx and less, the effects in terms of nighttime crashes become statistically significant.

Not only does the retroreflectivity of the pavement markings appear to be linked to safety, but so does the width of the pavement markings. Recent research results from an FHWA-funded study performed by TTI show that wider edge lines on rural two-lane highways are a cost-effective, statistically-sound approach to reducing run-off-the-road crashes and fatalities. Overall, the findings demonstrated that wider edge lines on rural two-lane highways can reduce non-winter, non-intersection/non-interchange run-off-the-road crashes 15% to 30%. Interestingly, findings from these analyses do not support the use of wider edge line pavement markings for multilane highways.

In the past, many states adopted wider edge lines (six-inch instead of four-inch) for a variety of reasons but adoption has been slow and uncoordinated without sound empirical findings to support the policy change. The recent study sponsored by the FHWA included data from three states (Michigan, Kansas and Illinois) and provides information that agencies can use to make sound decisions about the use of wider edge lines. The study included rural two-lane highways as well as multilane highways. Although it is well known that causation is hard to establish based on observational studies, results from the statistical analyses consistently indicate that wider edge line pavement markings on two-lane rural highways lead to lower crash frequencies and reduced severity.

Wider edge lines are an effective countermeasure in their own right and can also be considered in combination with other countermeasures such as rumble strips. Ongoing research at TTI is starting to identify how wider edge lines and rumble strips mitigate different crash types. While rumble strips address crashes where the driver is distracted, drowsy, or otherwise inattentive and can be effective even when obscured by snow or rain, wider edge lines seem to be most effective where the driver is looking at the roadway/stripping, or where the driver's peripheral vision is picking up the marking.

Traffic safety professionals continue to improve the signs and pavement markings on our nation's highway to provide a safer and more comfortable driving experience. As research findings continue to better define the relationships between nighttime visibility and roadway safety, agencies can develop specifications and practices to ensure adequate visibility for nighttime drivers.

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