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Department of Transportation

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**Federal Highway
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PROJECT SUMMARY

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Evaluation of Interstate Pavement Marking Retroreflectivity

Overview

With new federal minimum pavement marking retroreflectivity requirements looming on the horizon, the South Carolina Department of Transportation initiated a research project to develop a systematic methodology to quantitatively evaluate pavement marking materials used on South Carolina's interstate highways. The project began with a number of objectives—all of which were accomplished. These included conducting a literature review of previous work, surveying state DOT's of their pavement marking practices, comparing different devices for collecting retroreflectivity, and developing models that could predict the degradation of retroreflectivity over time.

Literature Review and Survey of States

The literature review focused on numerous aspects of pavement marking retroreflectivity including the latest technical information on pavement marking standards, human factor issues, and previous research that compared retroreflectometers or investigated the lifecycle of different pavement marking materials. The literature review has indicated that there are many unique aspects of this project. Probably the most unique aspect of this project is the extensive amount of field data that was collected. This study began with over 160 sites (149 were used for most of the analyses) that spanned the entire state of South Carolina. Having such a vast amount of data was critical to see how pavement marking performed under varying conditions over time.

Some significant findings of this research were not found to be in total agreement with the findings of similar research conducted in other states. For example, some retroreflectivity degradation models that have been developed in other states did not consider an initial value in retroreflectivity. This research has indicated that the initial retroreflectivity value is absolutely critical in determining the lifecycle of pavement markings based on retroreflectivity. Further, this research has indicated that pavement marking retroreflectivity degrades linearly after a significant period after the marking is initially placed (in most cases, a year or more). Other research has indicated that this period is usually less than a month.

The survey of states was very helpful in providing the research a basic source of information on the states' approaches toward pavement marking management and the measurement of retroreflectivity. While many answers were of limited scope, the survey provided a great deal of information that helped guide this research. In addition, the survey helped to confirm the research project is covering new ground.

Retroreflectometer Conclusions and Recommendations

Pending legislation will make it imperative that SCDOT monitors their vast inventory of pavement markings on a regular basis. Thus, the SCDOT should have significant use for pavement marking retroreflectometers in the future. This research recommends that SCDOT collect a representative sample of pavement marking retroreflectivity on sites throughout the state. This sample should be monitored based on a predetermined schedule with consideration given to initial retroreflectivity readings. The degradation models developed on this project are only applicable to thermoplastic and epoxy. The models could be a valuable tool in estimating time intervals when pavement marking retroreflectivity should be checked. Their use on roads other than Interstates has not been verified. Water-based markings were not addressed in this research.

While mobile units can give a continuous reading and are safe, they can be cost prohibitive. Having handheld units in the district offices may be a better alternative thus the individual district offices can conduct their own sample rather than relying on a state vehicle that must be shared. The LTL 2000 clearly out performed the other handheld retroreflectometers on this project. But all of the units were in general agreement as long as care was taken when readings are collected.

Prediction of Pavement Marking Lifecycle

This research has investigated several factors having significant impact on retroreflectivity degradation and successfully developed statistical models of degradation rates. The analysis identified that the most significant factors influencing performance of pavement markings include pavement surface type, marking material, marking color, and maintenance activities. Marking color, however, may possibly be biased. White edge markings appear to experience higher wear because vehicles, especially trucks, ride the outside lane edge. Yellow markings occur on the inside lane edge, which may be expected to see less tire encroachment.

The models indicate that pavement marking retroreflectivity degrades at a rate of between 0.03 to 0.16 mcd/m²/lx per day depending on the material used, which side of the road it is placed, and whether the surface is asphalt or concrete. This results in an approximate annual degradation of between 10 and 70 mcd/m²/lx per year.

It is important to note that maintenance activities such as snowplowing will greatly influence the degradation of pavement making retroreflectivity. The applicability of the degradation models in situations where snowplowing has occurred is unclear. It is recommended that the SCDOT take sample readings on pavement sections soon after snowplowing activities are complete.

Wayne Sarasua and David Clarke (Clemson University) and William J. Davis (Citadel) were Principal Investigators on this research. The project was conducted in cooperation with several equipment vendors. For further information, contact Terry Swygert at SCDOT: 803.737.6652; swygerttl@scdot.org