



# Quarterly



## ***Bringing the Nighttime Road to Life***

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### **Background**

The risk of dying in a crash at night is nearly three times the risk of dying in daylight hours. In 1998, about 27,000 people died in nighttime traffic crashes in the United States, even though only about 25 percent of travel is at night.

One of the reasons that nighttime driving risk is so much higher is because in the daylight the road is filled with more visual cues that help to guide drivers and keep them on the road. Though a single causal factor cannot be assigned to nighttime crashes, it is clear that an individual driver's night vision characteristics and a lack of adequate visual guidance information are significant factors. In either case, if cues that are essential for safe driving are inadequate at night, the potential for a driving or judgmental error to result in a serious crash is considerably increased. The situation is only made worse when other factors — e.g., fatigue, intoxication, inclement weather, higher speeds of travel on some roadways, etc. — combine with inadequate traffic control devices to make nighttime driving less safe.

The issue of visibility on rural roads — i.e., the greatest distance under given weather conditions to which it is possible to see — is of special interest when one considers that nearly 60 percent of all road fatalities in the United States occur on rural roads. The risk of dying in a rural road crash is more than twice as high as the risk of dying in a crash on an urban road or a non-rural Interstate.

There are many reasons that the risk of dying on a rural road is higher, including: differences in operating speeds, road geometry, functionality, and other factors. It is these factors that create the situation in which nearly 80 percent of all fatal rural road crashes are either run-off-the-road, intersection or head-on collisions. The possibility for any of these crash types is heightened at night and, for each, visibility is a key factor.

### **The Case for Retroreflectivity**

Visibility can be improved through a variety of means such as retroreflectivity, roadway lighting, and automobile headlights. Though retroreflectivity in the form of pavement markings and sign sheeting

does not resolve all of the problems, especially in wet or other adverse weather conditions, its relative low cost and versatility makes it a preferred alternative for most applications today.

At night, with many of the visual cues missing, the driver relies on the added retroreflective elements of signs and markings, such as edge lines and post-mounted delineators

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for curve preview and center lines for guidance in the curve. It is very possible that these will be the major visible elements to a driver on a road at night. The retroreflectivity of signs and markings can serve to

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provide positive visual guidance that helps drivers keep their cars in their lanes or on the road. They also offer the possibility to share critical warning, timely location and other information to drivers. The retroreflectivity of signs and markings is a critical ingredient in creating a much safer road environment.

As an example of the safety value added by retroreflectivity, consider a sharp curve on a rural road. In the daytime, there are many visual cues such as a line of trees or a guardrail that can alert the driver to the sharpness of the turn in time for a driver to alter their speed accordingly.

Road engineers also use pavement markings to reinforce these cues. A retroreflective edge line in this situation will provide the driver with a long-distance preview of the curve while the center line will provide other useful guidance through the turn.

Retroreflective materials are subject to deterioration brought on by the natural elements, and the ability for a sign, delineator or pavement marking to continue to provide quality information or guidance to a

driver decreases over time. If some minimum retroreflectivity is not maintained, the sign, delineator or marking will not accomplish the job it was intended to perform. While the Manual on Uniform Traffic Control Devices (MUTCD) has required since 1954 that signs and pavement markings shall be reflectorized or illuminated, the MUTCD contains no minimum in-service retroreflective requirements for signs or markings. (Note: ASTM D4956-89 Standard Specifications for retroreflective sheeting purchase specification used by the States is not to be confused with in-service minimum levels of retroreflectivity.) This fact coupled with the recognized importance of retroreflectivity to highway safety motivated the U.S. Congress to pass a law in 1993 that required the Federal Highway Administration (FHWA) to establish minimum maintained levels of retroreflectivity for signs and pavement markings.

#### **What Does This Mean to You?**

The minimum maintained levels of retroreflectivity that are accepted

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will have many potential impacts. First, it is likely that the guidelines will have the greatest impact on the maintenance of signs on the National Highway System (NHS). Beyond the NHS the impacts are less clear. Certainly, some States may require that all local road agencies adopt the minimum guidelines.

However, other States may not go that far. But, the mere existence of minimum guidelines could create a situation in which local agencies are compelled for one reason or another, e.g., liability issues, etc., to begin applying the minimum guidelines in their regular practice. As well, from strictly a safety point of view, minimum guidelines will provide a valuable tool for road engineers to use on roads that have high traffic volumes or for high-hazard locations. For all of these reasons, it is essential that road managers and engineers stay abreast of the development of the guidelines and consider how they will have an impact in their future road programs.

In another vein, the costs associated with implementing minimum maintained levels of retroreflectivity for signs have been examined. Based on the average condition of road signs in 1994, the FHWA estimated in 1998 that 5 percent of signs under the state jurisdictions and about 8 percent of those under local jurisdictions would not meet the proposed minimum maintained and would therefore need to be re-

placed. This translated to a cost of about \$32 million for the State agencies combined and about \$144 million for the local agencies combined. These are costs associated with replacing all signs at one time.

The report concluded, however, that on a practical level, sign replacement rates would probably not be accelerated above current levels and many agencies would not likely feel any impact of implementing the minimum maintained levels of retroreflectivity. The report went fur-

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## T<sup>3</sup>S Tentative 2002 Workshop Schedule

The tentative 2002 schedule for T<sup>3</sup>S workshops has been established!

We introduced Barry Saunders to you in 2001 and he will be returning in 2002 with a new topic on *Harassment in the Work Place*.

We will also be offering a new course on *OSHA Requirements for Public Works* that will be presented by the OSHA Office of Voluntary Programs.

Dr. J Hetherington, an adjunct professor from Clemson, will also be presenting a new topic in the fall relating to *Disaster Preparedness*.

Topics relating to stormwater have always been popular, and in response to past requests, this year we plan to offer a “hands-on” work-

shop on *Use of HEC-RAS Computer Software*. Due to the hands-on computer use required, space will be limited for this course.

A highly-requested topic concerns the *Use of Herbicides to Control Roadway Vegetation*. A new speaker, Bruce Pinkerton, has agreed to speak on this topic later in the year.

As in the past we will also have topics concerning *asphalt pavements* and *concrete pavements*; and the ever popular course, *Maintenance of Unpaved Roads*, which has always been well attended.

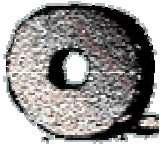
As stated in the last newsletter, T<sup>3</sup>S will host the *Southeastern Local Roads Conference* in September

(see article on page 6). We encourage you to make plans now to attend this exciting conference to be held in Myrtle Beach, SC. More details will be forthcoming in the next newsletter as the conference program is finalized.

We also plan to reschedule the *Asphalt Crack Seal Repair* class that was postponed due to the September 11<sup>th</sup> crisis.

While the schedule shown in the table below is tentative, 2002 promises to be an excellent year for T<sup>3</sup>S workshops, with a number of first-time offerings of topics that were suggested by you, our customers. We look forward to seeing you at some workshops this year.

Topic	Speaker	Date	Location
Harassment in the Workplace	Barry Saunders	Jan 22 Jan 23	Charleston Columbia
OSHA Requirements for Public Works	SC Dept of Labor, Licensing & Regulation	Feb	Charleston Columbia
South Carolina Highway Conference	SCDOT	Mar 27-29	Clemson
Concrete Pavement Topic	ACPA	April	Charleston Columbia
Hands-On HEC-RAS Software Training	Dr. Nadim Aziz	May	Columbia
Unpaved Roads	John Hopkins	August	Charleston Columbia
Southeastern Local Roads Conference		Sep 22-24	Myrtle Beach
Disaster Preparedness	Dr. J Hetherington	Oct	Charleston Columbia
Use of Herbicides for Roadside Vegetation Management	Bruce Pinkerton	Nov	Charleston Columbia
Asphalt Pavement Topic		Dec	Charleston Columbia



## Do You Re-invent the Wheel?

### *The New T<sup>3</sup>S Listserve May Be Just What You Need!*

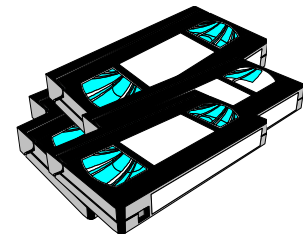
T<sup>3</sup>S is always looking for ways to make your job easier for you. Some of our “sister” LTAP organizations manage e-mail listserves that allow individuals to ask their peers and neighbors questions about specific problems so as not to “re-invent the wheel”. Anyone who is currently on our mailing list is eligible to join the listserve as long as you have access to e-mail. If you are not on our mailing list, but would like to participate in this endeavor, give us a call and we will add you to the listserve. T<sup>3</sup>S will use the listserve to inform you of “hot topics” of which we are notified between newsletter mailings, but, primarily, we want the listserve to be a problem-solving tool for you. If you have a question or problem for which you don’t have a solution, you can request help from the listserve. Your question or problem will be sent to individuals on the distribution list and if there is someone that has already solved your problem, you will be notified by our office of the response.

The list will be maintained by the T<sup>3</sup>S office, and we will make every effort to protect your confidentiality. We are currently working with Clemson’s Department of Computer and Information Technology to create a secure listserve. The list will only be effective if we have participants like you who are willing to share your knowledge and expertise with others. Please give us a call if you have any questions regarding this new service.

If you would like to be part of this listserve, please complete form on page 7 and mail or fax it to us. You can also e-mail us at [t3s@ces.clemson.edu](mailto:t3s@ces.clemson.edu). We look forward to hearing from you.



## SHOP on-line with T<sup>3</sup>S



“Tis the season” to go shopping and we would like to tell you about the latest addition to our T<sup>3</sup>S web site, [www.ce.clemson.edu/t3s](http://www.ce.clemson.edu/t3s). Our video catalog has been on-line for about a year, but now you will be able to order videos straight from the catalog by simply choosing the videos of your choice and adding them to a shopping cart. Each video has a selection box and all you have to do is click in that box. A description of the video is also available. Once you have made your selection, you simply click on “order selected videos” at the bottom of the catalog and your order will automatically be sent to our office for processing.

As a reminder, we are still under the same guidelines as before. We are able to lend the videos to anyone for viewing and training, but if you want to purchase them, we can only allow purchases if the videos do not have copyright protection.

We also now have our publications listed on line and will be working diligently to have a “shopping cart” available for them as well in the near future.

T<sup>3</sup>S endeavors to give you the best service possible, and we will continue to implement new products and services to enhance our program and make your access to us easy and convenient.

***Happy Shopping!***

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ther to state that the development of a sign inventory program that includes retroreflectivity measurements would lead to making investments in a planned manner that, in the long run, are likely to reduce the overall maintenance and replacement rates of traffic signs in the future.

### What's Being Done?

The FHWA has been performing retroreflectivity research to improve nighttime driving safety since the early 1980s. Some of the areas covered in this research included studies on the service life of signs, sign and pavement marking management systems, and traffic sign and pavement marking retroreflectometers. Following the Congressional requirement in 1993, the FHWA also completed research on what levels of retroreflectivity are needed to safely guide drivers at night and analyzed the economic impacts to the public if minimum retroreflectivity values are established. The overall goal of all of these studies was to obtain information necessary to establish minimum maintained levels of retroreflectivity and to develop management programs and measurement devices that will be needed by the States and others to maintain traffic control devices at an adequate level. Thirty two States were actively involved with the FHWA in this research.

Recognizing that there are already many different models of hand-held retroreflectivity measuring devices available today, the FHWA began to develop mobile units capable of measuring the retroreflectivity of signs and markings while

driving at highway speeds. A van capable of measuring the retroreflective qualities of pavement markings was introduced and demonstrated a few years ago. Private industry is now manufacturing and

*A final rule could be issued in 2001 for signs and 2002 for pavement markings.*

selling these units as well as providing contractual support for their operation and maintenance. Similar vans for measuring the retroreflective qualities of signs are now in development by the FHWA. In relation to the FHWA efforts, an AASHTO task force is actively reviewing completed research on this subject and intends to make a recommendation to FHWA on minimum maintained levels of retroreflectivity. The FHWA will consider this recommendation and other information before it issues a notice of proposed rulemaking (NPRM). After analyzing the comments to the NPRM, a Final Rule could be issued in 2001 for signs and 2002 for pavement markings. The rules will address plans to implement minimum maintained levels of retroreflectivity for each. The Federal Register notice invites the widest possible review and comment by the public.

### Other Steps to Improve Visibility

Recognizing that retroreflective devices have their limitations in some circumstances, the FHWA is also examining a host of other possibilities for making roads safer at night. For instance, there has been preliminary research on the use of ultraviolet

headlights in automobiles. These headlights will allow drivers to use their low beam level yet see fluorescent traffic control devices as if they had their high beams on. This allows drivers to see better at night but does not create the glare problems associated with standard headlights. The FHWA, in cooperation with Volvo and others, will be performing an extensive demonstration project with UV headlights and fluorescent signs and pavement markers.

Another area of interest is phosphorescent materials that could be incorporated into traffic control devices so that they will glow at night. This is an area that is developing rapidly and leading to new materials that glow for longer and longer periods. It is likely that in the next 5 years, or less, there will be materials that can glow all night or for days at a time. These products may help to overcome some of the limitations of retroreflective materials. Finally, there have been tremendous advances in the development of LED lights for use in augmenting pavement markings and several products are available today. Generally, the LED lights are small solar-powered markers that are installed in the pavement. Though most of the current applications of these lights have been outside of the United States, it is recognized that there may be value in using these devices in some hazardous locations. Currently, there is a proposal to install LED lights in a heavy fog area in California.

### Conclusion

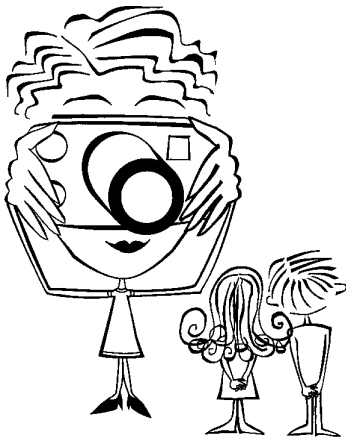
Retroreflectivity is a critical element for helping the U.S. Department of Transportation achieve its

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## Reminder—T<sup>3</sup>S to Host SE Local Roads Conference Sept. 22–24, 2002 in Myrtle Beach

Mark your calendars now for the next SELRC. The 2002 conference will be held in Myrtle Beach, SC on September 22–24, 2002 at the Wyndham Myrtle Beach Resort. The conference will be hosted by your SC LTAP Center (T<sup>3</sup>S) and is a collaboration of the Federal Highway Administration (FHWA) and the LTAP Region IV states that include KY, TN, NC, GA, AL, MS and FL.

City, county, and DOT personnel, as well as local elected officials and private sector employees are invited and encouraged to attend. This is an excellent opportunity for SC county and municipal personnel to obtain up-to-date information on a wide range of topics relating to local roads.



### ***Taking Great Pictures of Your Kids***

Canon Inc., the camera manufacturer, offers this advice this holiday season on how to take better pictures of your children:

- ◆ Do your shooting on days they feel and look good. Snap some candid shots rather than posed, looking-at-the-camera pictures.
- ◆ For outdoor photos, morning or pre-dusk will avoid harsh, overhead sunlight.
- ◆ Experiment with different camera angles. It's best to get down to eye level with your child, but try a few shots from above and below.
- ◆ Keep clothing simple. Wild designs and patterns can detract from the subject.
- ◆ Try extreme close-up shots and fill the frame to create photos with feeling.

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safety goal of reducing fatalities and injuries by 20 percent over 10 years. Although the FHWA has provided the primary guidance for many national efforts related to retroreflectivity, State and local highway officials have provided essential input throughout the process. Organizations such as the National Association of County Engineers, National Cooperative Highway Research Program, National Committee on Uniform Traffic Control De-

VICES, American Association of State Highway and Transportation Officials, Institute of Transportation Engineers, State DOTs, the American Traffic Safety Services Association, the American Public Works Association and others have also been involved to ensure that the results of the extensive research activities and field evaluations are implemented reasonably and prudently through the rule-making process. The FHWA expects that this cooperation will lead to minimum levels of retroreflec-

tivity that will be maintainable, will increase nighttime safety on the roads, and will ultimately result in fewer crashes, injuries and fatalities on our roads at night. In addition, the planned, systematic replacement and maintenance of signs and markings could reduce their overall maintenance and replacement rates in the future. While these types of benefits are appealing, it must be reiterated that the ultimate goal in pursuing these efforts is to elevate the existing safety of U.S. roads for the benefit of the entire driving population.

## Information Request and Address Change Form

To order any of the publications, videos, or other materials listed in this or other issues of *T<sup>3</sup>S Quarterly*, complete this form and mail it or fax it to **Sandra Priddy** at the address or phone number shown below.

**Transportation Technology Transfer Service  
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Clemson University, Box 340911  
Clemson, SC 29634-0911**

**Phone: 864.656.1456  
Toll free: 888.414.3069  
Fax: 864.656.2670**

### Listserve Request Form

Please complete the information below and mail it to the address listed above, fax to 864-656-2670, or e-mail the information to [t3s@ces.clemson.edu](mailto:t3s@ces.clemson.edu).

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Agency \_\_\_\_\_

Address \_\_\_\_\_

Phone Number \_\_\_\_\_ Fax \_\_\_\_\_

Email address \_\_\_\_\_

### Request Items

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Title: \_\_\_\_\_

Address: \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

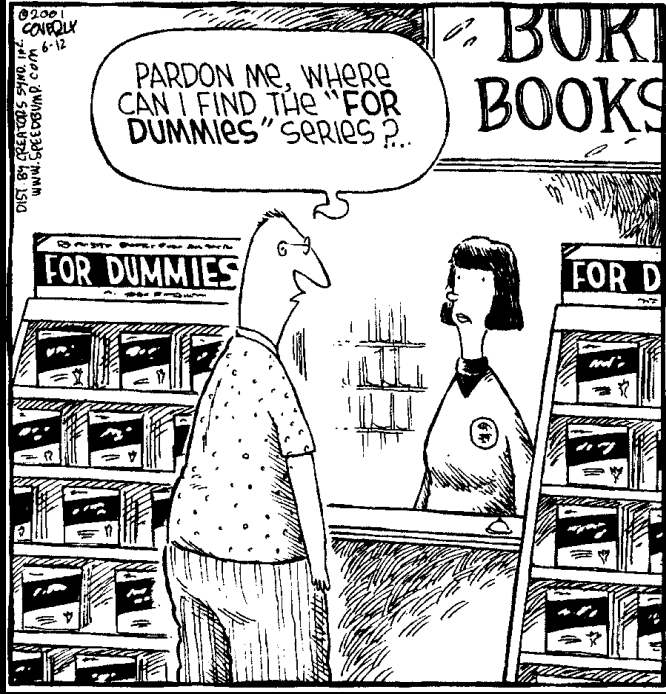
***This is a new address***

***Please add my name to your mailing list***

### Suggestions for Possible Future Workshop Topics

**SPEED BUMP**

**Dave Coverly**



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