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Road TTAP Talk

Lights Out - What to do now?

by Dr. Airton G. Kohls & Matt Cate

As daily commuters, motorists dislike being delayed at an intersection by a red traffic light indication and have usually strong opinions about its "ideal" operation. At the same time, the traffic light's ability to maintain safe and orderly operations at intersections may be taken for granted. Many drivers noticed the absence of these positive traffic signal benefits when a series of widespread and unusually severe storms caused extended power outages and extensive traffic control infrastructure damage across the southeast. Under these conditions it was immediately apparent that many drivers do not know what to do when traffic lights are not properly functioning or operating in the "dark" mode.

Tennessee Code Annotated (TCA) § 55-8-110 (c) addresses requirements for drivers who encounter a "dark" signalized intersection:

"The driver of any vehicle approaching an intersection that is controlled by a traffic-control signal that is inoperative because of mechanical failure or accident shall come to a full and complete stop at the intersection, and may proceed with due caution when it is safe to do so; provided, that if two (2) or more vehicles enter such an intersection from different directions at approximately the same time, after having come to full and complete stops, the driver of the vehicle on the left shall yield the right-of-way to the vehicle on the right. A traffic-control signal shall not be considered inoperative if the signal is operating in flashing mode. If a signal is operating in flashing mode, it shall require obedience by vehicular traffic pursuant to § 55-8-112."

If the intersection is in a flashing mode, it is still necessary for the driver to identify what type of flashing mode is being presented at the intersection. TCA § 55-8-112 provides the following information for flashing indications:

- Flashing CIRCULAR YELLOW indication – approaching vehicles are permitted to cautiously enter and proceed through the intersection;

- Flashing CIRCULAR RED indication – approaching vehicles shall stop and then proceed appropriately.

These rules do not apply to highway-railroad grade crossings with active control devices.

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From the Director

Mother Nature has just battered us here in beautiful East Tennessee during the late spring and summer. I'm not sure what we've done to deserve such fickle weather, but it certainly has been unprecedented. We've had tornadoes, tennis ball sized hail, high winds, heavy rains, and unbearable heat. In my area of Knoxville, many houses have tarp covered roofs and other damage, cars look like somebody took a ball peen hammer to them, beautiful old trees are splintered or uprooted, and piles of debris line the streets. During mid-June, I lost power for six days, leaving me with a renewed appreciation for air conditioning and refrigeration.

To deal with the effects of these major weather events, several of which have occurred back-to-back, utilities and public works agencies have worked long hours to clear trees from roads and streets, restore damaged signs and traffic signals, address power outages, unclog storm drains, route traffic around flooded roads and streets, and remove debris. They've done a simply outstanding job under punishing conditions of heat and humidity. For most of these unsung heroes, it's all in a day's work. But you all know that.

On the transportation front, it's been a quiet summer. Dominated by concerns over raising the national debt ceiling and other fiscal issues, our leaders in Washington haven't been very successful in dealing with critical transportation issues, such as reauthorizing our surface transportation program. Yes, a draft bill is working its way through committee in both chambers of Congress, but it's anybody's guess when it might end up on the President's desk. The reports I'm seeing indicate that could be a while.

Things continue to go well here at TTAP. We're grateful to our sponsors at TDOT for providing us with a grant to purchase some needed new equipment, including a total station, some traffic counters, and a new supply of the ever popular work zone flip books. These will help us serve you better. We've been busy with short courses, technical assistance calls, and the other activities we perform for you. I've been especially gratified to see the response to our courses, despite the continuing economic doldrums.

I want to again plug the TTAP signal training program being developed by our Dr. Airton Kohls. We have a wonderful laboratory for teaching "hands on" and also plan to bring courses to locations across the state. Please contact Dr. Kohls at 865-974-0928 or email him at akohls@utk.edu if you have any questions. He's also available for technical assistance regarding signals and associated hardware.

It's hard to believe that football season is a short 50 days away as I write this. That time is going to pass quickly! Meanwhile, I hope that the remainder of your summer goes well. If we can help, please don't hesitate to call or email. TTAP looks forward to assisting you.

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Responsive or Emergency Maintenance

After a storm hits, it is time for maintenance crews to re-establish normal operation of traffic control at intersections. An initial assessment of the condition of the intersection and the potential establishment of temporary traffic control is necessary. Servicing can range from a simple reset of the conflict monitor to replacing shattered or broken signal faces, visors, preemption devices, and ruptured span wires. Typical damage from storm lightning and resulting power surges includes load switch replacement and sometimes the replacement of a conflict monitor or the controller itself. It is also very important to check that the controller's internal clocks were not disrupted by storms, especially where time-of-day control is used. It is good practice to check if signal timing settings are still in accordance with design plans.

Overnight June storms in the Knoxville area severely affected power supply to several major intersections that ended up being controlled by Knoxville Police Department officers. Mr. John Hunter, Division Chief for the City of Knoxville's Traffic Engineering Division, said that at the peak of the storm approximately 100 out of 389 signalized intersections presented some type of failure. Mr. Bill Medley, from Progression Electric, said that about 50 intersections around the region received physical damage to traffic signal equipment due to last April's hail storm. In addition to replacement of broken or missing visors, some signal installations required minor electrical repairs. In some cases repairs are still pending due to back-ordered parts.

Emergency Maintenance also demands advance planning by agencies. A standard operating procedure (SOP) should be developed to identify traffic signal problems and emergencies and to notify personnel when response maintenance is required. The SOP should include steps for both normal working hours and for off-hours, during holidays and weekends. The identification of responsibilities by all parties involved in responding to service calls is also relevant. Establishing priorities in what is considered an emergency (signal faces hanging over the roadway, exposed electrical wires or completely dark intersections) is definitely necessary. Finally, documentation of the condition of the intersection upon arrival is equally important.

Preventive Maintenance

Although it is hard to predict the potential extent of damage related to storms of the magnitude that affected our region, it is essential for agencies to be prepared for the possibility of such events. Agencies should routinely follow a maintenance program to optimize the performance of the system but also to minimize system failures. During summer, it is essential to check the operation of cabinet fans to prevent equipment from overheating. Cabinet filters should also be cleaned to ensure acceptable temperature levels. It is also important to check the entire traffic signal infrastructure for cracks or bad insulation to prevent water damage to electrical components. Tightening screws, checking gaskets and checking all mounting hardware may prevent future problems caused by wind during storms. It is also good practice to have replacement parts such as load switches, conflict monitors and controllers readily available.

Investing in a traffic signal battery backup system may turn useful during potential storm power outages. Major intersections assembled with LED traffic signals may benefit from such a backup system by helping maintain an acceptable level of operation, usually for a period of 6 to 8 hours.

An additional safety measure that can be implemented by agencies is the installation of yellow retroreflective borders on traffic signal backplates. This low-cost safety treatment will help in situations where a signalized intersection is in complete darkness by allowing drivers to more easily identify the intersection. The MUTCD allows the use of a portable or part-time (folding) STOP sign that is electrically or mechanically operated at a signalized intersection. The stop sign should only be displayed during a power outage and should be removed or obscured immediately upon restoration of power.

Traffic safety during or after weather emergencies is greatly increased if drivers remember a few simple rules: come to a complete stop at an intersection where traffic signals are not working, yield the right-of-way appropriately, correctly interpret and respond to flashing lights when active and proceed when it is safe to do so. Agencies operating and maintaining traffic signals can contribute by developing a plan for emergency maintenance of traffic signals and performing preventive maintenance to potentially minimize future costs and traffic signal failures.

Intersection Safety at Local Rural Roads

by Dr. Airton Kohls & Matt Cate

Three million miles of local roads are maintained and operated by local administrators, township managers, and public works officials in more than 38,000 counties, cities, villages, towns and tribal governments across the United States. One issue common to all local agencies is traffic safety.

In 2008, 56 percent of the 37,261 fatalities on US roadways occurred in rural areas. More than 20 percent of all traffic fatalities in the US occur at intersections and over 80 percent of intersection-related fatalities in rural areas occur at unsignalized intersections. Rural areas face a number of highway safety challenges due to the nature of their facilities. Local rural roads also encompass a wide range of surface types, including paved facilities, gravel roads, and dirt roads. In contrast to higher volume facilities, many local rural intersections lack suitable design standards, delineation and signing. In many cases, rural roads were not professionally designed, but rather "evolved" over time to their current geometric configuration.

The 2009 State of Tennessee Strategic Highway Safety Plan (SHSP) identifies a number of key areas that must be addressed to meet its stated goal of reducing the annual statewide total of highway fatalities to less than 900 by the end of 2012. The SHSP identifies a number of education, enforcement, engineering, and emergency response strategies that are key to this safety goal. The SHSP includes Intersection Safety as one of eight enhanced emphasis areas. The Federal Highway Administration also provides valuable information through its Local and Rural Road Safety Program (http://safety.fhwa.dot.gov/local_rural). FHWA's *Intersection Safety: A Manual for Local Rural Road Owners (*http://safety.fhwa.dot.gov/local_rural/training/fhwasa1108/) details a number of intersection safety countermeasures available to local governments. The following process, taken from this manual, can be used to assess interesection safety and determine whether countermeasures should be deployed.

The 5 Step Process

First, identify intersection safety issues by collecting crash history, roadway, and exposure information from state and local crash databases, law enforcement crash reports and citations, observations by law enforcement or road maintenance crews, public notifications and hospital records. Record and tabulate the information for safety analysis. Analyze the data and select and install countermeasures. Finally, assess the intersection safety treatment after installation.

Countermeasures

Deciding which countermeasures to install to address a safety issue can be challenging. When appropriate, an agency should seek engineering expertise from a state or local engineer or through TTAP's technical assistance program.

Low cost countermeasures

Enhanced Signing and Delineation – Improved traffic control devices can be used at unsignalized intersections that are not clearly visible to approaching motorists, particularly on the major road. The strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning crashes related to poor driver awareness of the interesction presence.

Improved Maintenance of Stop Signs – All stop-controlled intersections should have damaged signs replaced without undue delay, and a suitable schedule for inspection, cleaning, and replacement of stop signs should be established.

Provide a Stop Bar on Minor Road Approaches – This strategy is appropriate for locations with crashes related to lack of driver recognition of the intersection.

Overhead Supplementary Stop Signs – The strategy of mounting a stop sign over the roadway is appropriate for unsignalized intersections with patterns of right-angle crashes related to lack of driver awareness of the presence of the intersection.

Install Flashing Beacons at Stop-Controlled Intersections – This is appropriate to be used at stop-controlled intersections to supplement and call driver attention to stop signs. It helps mitigate patterns of right-angle crashes related to stop sign violations.

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Moderate and high cost countermeasures

Install Splitter Islands on the Minor Road Approach - This is appropriate for intersections where the speeds on the minor road are high.

Install Transverse Rumble Strips – Rumble strips provide an auditory and tactile sensation to motorists approaching the intersection. Can be used at any Stop or Yield approach intersection, often in combination with advance signing to warn of the intersection ahead. Due to noise generated, care must be taken to minimize impacts to nearby residences and businesses.

Clear Sight Triangles on Stop-Controlled or Yield-Controlled Approaches – This is appropriate for intersections with restricted sight distance and patterns of crashes related to lack of sight distance where sight distance can be improved by clearing roadside obstructions without major construction.

Provide Right-Turn Lanes – Right turn lanes are appropriate for unsignalized intersections with a high frequency of rear-end crashes resulting from conflicts between vehicles turning right and following vehicles .

Provide Bypass Lanes on Shoulder at T-Intersections – Bypass lanes are effective at three-legged unsignalized intersections on two-lane highways with moderate through and turning volumes, especially intersections that have a pattern of rear-end collisions involving vehicles waiting to turn left from the mainline.

Provide Left-Turn Lanes – Left turn lanes can be effective at unsignalized intersections with a high frequency of crashes resulting from the conflict between (1) vehicles turning left and following vehicles and (2) vehicles turning left and opposing through vehicles.

Provide Offset Left-Turn Lanes – Offset left turn lanes are effective at unsignalized 4-legged intersections with a high frequency of crashes between vehicles turning left and opposing through vehicles. This treatment can be applied at intersections on divided highways with medians wide enough to provide the appropriate positive offset, and also on approaches without medians if sufficient width exists.

Realign Skewed Intersection - Skew realignment is appropriate at unsignalized intersections with a high frequency of crashes resulting from insufficient intersection sight distance and awkward sight lines at a skewed intersection.

Improve Lighting – This strategy should be considered at unsignalized, unlit intersections with substantial patterns of nighttime crashes. In particular, patterns of rear-end, right-angle, or turning crashes on

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the major road approaches to an unsignalized intersection may indicate that approaching drivers are unaware of the presence of the intersection.

Change Horizontal and/or Vertical Alignment – Realignment may be appropriate for unsignalized intersections with restricted sight distance due to horizontal and/or vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be addressed by less expensive methods.

Install Roundabout – Roundabouts can be appropriate for rural locations. In particular, unsignalized intersections with a history of right angle crashes are good candidates for roundabout installation. Additional right-of-way may be necessary to install a roundabout, as its geometric footprint differs from a traditional intersection.

Source: Intersection Safety – A Manual for Local Rural Road Owners. US Department of Transportation Federal Highway Administration, FHWA-SA-11-08

Developing a Formal Sign Retroreflectivity Plan

by Matt Cate, P.E.

Since the 2008 introduction to the Manual on Uniform Traffic Control Devices (MUTCD), the Federal Highway Administration's new minimum retroreflectivity requirements for traffic signs have attracted the interest and concern of roadway officials at all levels. While these standards will make nighttime driving safer for a larger percentage of our nation's drivers in the long term, they also create significant short-term financial and workload issues for many agencies.

By conducting sign inventories, assessing the condition of existing signs, and in some cases even replacing all non-compliant signs years ahead of the applicable compliance date, many agencies have already made significant progress towards compliance with the sign retroreflectivity standards However, many agencies are beginning to shift their focus from the retroreflectivity and compliance status of individual signs to the development of a retroreflectivity management program. The MUTCD states that "Implementation and continued use of an assessment or management method that is designed to maintain traffic sign retroreflectivity at or above the established minimum levels" should be complete by January 22, 2012. Several agencies have contacted TTAP in recent months seeking clarification as to what this compliance date actually requires them to do.

While this statement does not require individual signs to meet the standards described in Section 2A.08 by next year, it does in effect create a "checkpoint" in the retroreflectivity process. Failing to meet this compliance date would not appear to create an immediate liability for roadway agencies, but it may be a sign of trouble on the horizon. While small agencies with a few hundred signs may be able to play catch-up late in the process and still meet the next (and most significant) compliance date in January 2015, large agencies with thousands (or tens or hundreds of thousands) of signs may find it difficult or impossible to complete the inventory, assessment, and upgrade processes on time.

So what does the first compliance date really instruct us to do? The activity of interest is an assessment or management method designed to achieve and maintain sufficient retroreflectivity. Several of these methods are identified in the MUTCD itself, but very little detail has been provided in the Manual in order to give agencies maximum flexibility. However, a November 2007 research report from FHWA, titled Methods for

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Maintaining Traffic Sign Retroreflectivity, does provides additional detail and discussion.

In addition to providing a discussion of each of the management or assessment methods identified by the MUTCD, this report also discusses the issue of documentation. The following passage from the 2007 report is useful for any agency assessing the 2012 compliance date:

"Regardless of which maintenance method is adopted by an agency, documentation of the sign management process is important in assisting agencies to achieve conformance with the MUTCD standard to maintain minimum retroreflectivity levels of traffic signs. Written procedures ensure that agency personnel properly follow the selected method, while maintenance records provide the agency with a systematic process for sign replacements and justification for the allocation of limited resources."

The report also emphasizes the importance of written records in assessing the validity of initial assumptions such as expected service life.

Online Resources:

- *Sign Retroreflectivity: A Minnesota Toolkit*. Minnesota Department of Transportation Research Report #2010RIC02. (http://bit.ly/pwTJBx)
- *Signs, Traffic Signals, Traffic Markings, Pavement Striping & Retro-reflectivity Policy* (Draft). City of Eagan, MN. (http://bit.ly/qJhQxA)
- *Dunn Township's Retroreflectivity Sign Policy*. Dunn Township, MN. (http://bit.ly/pD9Uh4)
- *Methods for Maintaining Traffic Sign Retroreflectivity*. Federal Highway Administration Publication No. FHWA-HT-08-026. (http://bit.ly/nHO7Oe)

With this in mind, it seems clear that full compliance with Section 2A.08 of the MUTCD will require documentation of the method (or combination of methods) selected by an individual agency. Because the MUTCD does not prescribe details such as inspection intervals and expected service life, it is important for the agency to include these as a part of its documentation. This documentation may also assign responsibility for inventory, inspection, and sign replacement to individual staff members or even across multiple departments. The resulting document should provide a sufficient level of detail to describe the agency's sign retroreflectivity practices and demonstrate compliance with the MUTCD in the event that these practices are challenged in court. This documentation will also allow the agency to maintain continuity and consistency as staff members retire or move into new positions.

Since most agencies have not reached this point in their retroreflectivity process, there are a limited number of sign retroreflectivity policies available for comparison. However, there are enough examples to get most agencies pointed in the right direction. The Minnesota Department of Transportation's *Sign Retroreflectivity: A Minnesota Toolkit* offers several sample sign retroreflectivity policies. While the toolkit is targeted to Minnesota's local agencies, much of the information is applicable to agencies across the country. Appendix B of the Minnesota toolkit contains three "generic" sample policies, addressing the needs of rural counties, metro counties, and townships respectively. The policy for rural counties is less than a full page in length, containing only basic information to detail an expected service life method. On the other end of the spectrum, the sample policy for cities and towns is seven pages long, with detailed discussion of objectives, sign inventory, assessment and replacement, sheeting materials, and ongoing replacement.

Other examples returned from a web search include a policy from Dunn Township, MN (population 855) and Eagan, MN (population 64,206). While none of these examples may be a perfect fit for your agency's needs, they do offer an excellent opportunity for comparison and contrast with your own ideas and plans.

If you need help preparing a formal retroreflectivity policy for your agency, TTAP can help! Contact us at 1-800-252-7623 or TTAP@utk.edu to request detailed technical assistance or additional resources.

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TALK TO TTAP

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