As the new minimum sign retroreflectivity requirements introduced in Revision 2 to the 2003 Edition of the Manual on Uniform Traffic Control Devices come into effect in the coming years, many transportation agencies will need to upgrade non-compliant signs. While this requirement will impose a financial burden on agencies, the news is not all bad as drivers will certainly benefit from the improved nighttime sign visibility. The upgrade process provides agencies an opportunity to evaluate and update their sign inventories. With this opportunity in mind, here are five common sign mistakes to avoid when bringing your sign inventory into compliance with the new MUTCD standards.

1. **Know the difference between a curve sign and a turn sign.** According to Section 2C.06 of the MUTCD, the turn warning sign (90° angle) is for use in advance of alignment changes where the recommended speed is 30 miles per hour or less. The curve warning sign (arcing curve) is for use where the recommended speed is 35 miles per hour or greater. Posting the wrong sign in advance of a curve or turn sends the wrong message to drivers and could become a liability for the roadway agency in the event of a crash at the location.

2. **Object marker paddles are directional.** The MUTCD designates four types of object markers in Chapter 3C. Type 3 object markers, most commonly seen at bridges and culverts, identify a fixed object and direct drivers to one or both sides of the object. The diagonal yellow and black stripes should slope downward in the direction that drivers may pass around the obstruction. Using the

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**continued on page 3**
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.

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From the Director

I hope all of you are doing well as we come to summer’s close. The Labor Day weekend approaches and the mornings have a distinct coolness to them. I’m surely looking forward to fall. It marks the second half of our training season, and I hope you all can join us for a class or two. Please let me know if you have any special training needs. Of course, the other great thing about fall is that it’s “Football Time in Tennessee!” Hopefully all of your teams will do well this year.

Fuel prices appear to be easing up a bit, and that’s a good thing. I don’t feel like I’m making a mortgage payment every time I go to the pumps to fill up. It’s interesting, though, that I find myself thinking that regular gas at $3.45 a gallon is now a bargain. Two years ago, I never would have dreamed that I’d be paying $3.45/gallon and now I accept that as normal. I don’t find I’m driving nearly as much, though, and I’d bet you all are thinking the same way.

I don’t pretend to understand the science of economics, but an economist colleague of mine told me that the sign of an increasing price trend is that price declines always bottom out higher than in previous cycles. I guess we tend to think about the peaks, but the valleys set the trend. If I understand this concept correctly, the fuel price trend is distinctly upward. Predicting where this takes us requires a crystal ball, but there are all sorts of dire predictions, and I’m sure you’re hearing many of the same ones I am.

During the summer, I had the opportunity to hear a presentation by John Horsley, Executive Director of AASHTO. Mr. Horsley made some chilling statements. Over the past five years, highway material costs have increased an average of 50 percent. Revenues are declining because of the decrease in driving and an increase in fuel efficiency. By 2010, the highway program will have to be cut $20 billion unless additional revenues are found. By 2015, the purchasing power of the highway dollar will have declined by 80 percent, and $75 billion will be needed to maintain purchasing parity.

We are in the early stages of the drafting of the next highway re-authorization bill. By all accounts, it will be a battle. Increasing fuel taxes seems to be the current “live wire” of politics, so where additional revenues will come from to meet critical needs is an open question. One thing’s for sure, though—we’re all going to have to work smarter to make do.

No doubt we live in interesting times. Could we be at the brink of major change in our transportation policies? Only time will tell.

As always, please feel free to contact TTAP for technical assistance, training, or information. We look forward to serving you.

[Signature]
5. Never use the word “Dangerous” on a warning sign. How many times have you seen a warning sign that reads only “Dangerous Curve” or “Dangerous Intersection Ahead”? Wouldn’t you like to know why this location is dangerous? Better yet, if this spot is so dangerous, why hasn’t someone fixed it already? Always give the driver as much information as you can. Instead of these signs, use one of the standard curve, turn, or intersection warning signs found in Chapter 2C of the MUTCD. If the location is an intersection in a curve, the MUTCD provides guidance on the use of combined intersection/curve warning signs. Finally, these signs may be used with supplemental advisory speed or distance plaques to provide drivers with additional information necessary to safely negotiate the roadway ahead.

The “Dangerous Curve” sign in this photo is unnecessary – the curve warning sign gives drivers more information. Note that the damage to these signs would significantly reduce nighttime visibility.

As John Tidwell demonstrates, this stop sign is low enough to be obscured by pedestrians, parked or moving vehicles, and roadside vegetation.

The object markers on either side of this roadway are properly placed to guide traffic between the signs and over the bridge.

“Slow Children at Play” signs like this one do not convey a clear message to drivers.

5. “Slow Children at Play” signs are not MUTCD-compliant. While these signs are still popular with parents and other members of the public, they do not convey a clear and enforceable message to drivers. These signs may also create a false sense of security among neighborhood children and parents. A better use of time and money is the installation of a regulatory speed limit sign. The speed limit sign offers a clear definition of safe behavior to all drivers and is easily enforceable.

4. “Slow Children at Play” signs are not MUTCD-compliant. While these signs are still popular with parents and other members of the public, they do not convey a clear and enforceable message to drivers. These signs may also create a false sense of security among neighborhood children and parents. A better use of time and money is the installation of a regulatory speed limit sign. The speed limit sign offers a clear definition of safe behavior to all drivers and is easily enforceable.

3. Minimum sign mounting heights are 5 feet for rural areas and 7 feet for urban areas. These sign height requirements, described in Section 2A.18 of the MUTCD, are measured from the bottom of the primary sign to the height of the nearest pavement edge (not the ground below the sign). Urban areas are defined as any location where parking or pedestrian movements occur. These minimum heights ensure that the sign is visible in normal conditions.

As John Tidwell demonstrates, this stop sign is low enough to be obscured by pedestrians, parked or moving vehicles, and roadside vegetation.

Five Common (but Easily Avoided Traffic Sign Errors continued from page 1
Signs are a low cost safety improvement to reduce run off the road crashes. Install signs in a safe location so they do not become a roadside hazard.

The Manual on Uniform Traffic Control Devices (MUTCD) describes where to place signs (see pages 3-4 of this note). A new version of the MUTCD is expected in 2009. The comment period for proposed changes closed on July 31, 2008 (http://mutcd.fhwa.dot.gov).

According to a General Motors study, 85% of run off the road incidents recover safely within 30 feet of the roadway, in the clear zone.

Although not always possible, a 30-foot clear zone is a worthy goal. The fewer hazards in clear zone, the safer motorists will be.

The following list illustrates methods to create a clear zone and improve roadside safety:
1. Remove the obstacle.
2. Redesign the obstacle for safe traversal.
3. Relocate the obstacle.
4. Make the obstacle breakaway.
5. Shield the obstacle.
6. Delineate the obstacle.

Sign Hazards
According to the MUTCD, “Sign posts and their foundations and sign mounting, shall be so constructed as to hold signs in proper and permanent position, to resist swaying in the wind or displacement by vandalism. In areas where ground mounted sign supports cannot be sufficiently offset from the pavement edge, sign supports should be of suitable breakaway or yielding design.”

Sign Placement
When possible, place signs where they are not likely to be struck by out-of-control vehicles. Consider the following when installing signs:
• Place signs outside the clear zone.
• Avoid placing signs on curbs.
• Avoid installing signs on the outside of horizontal curves.

Avoid placing signs next to lane drops or places where the pavement narrows.
• Provide an unobstructed view of signs along the roadway.
• If possible, place signs behind guardrails or other barriers.
• Avoid placing signs in the bottom of the ditches.
• Space signs so they don’t obstruct the view of each other.

(Recommended spacing is 150 to 200 feet apart. Do not cluster signs together.)

Sign Posts
A sign post must be durable and structurally adequate. Posts should fail in a safe and predictable manner if struck by a vehicle.

Sign post construction and foundations are critical. Use safe sign supports.

Posts must be able to hold a sign in the proper position and withstand normal wind yet safely yielding when struck by a vehicle.
Correct Sign Installation Improves Safety, continued from page 4

Use two or more sign posts when signs are large (over 50 square feet).

Sign Installation Tips
• Bury posts in firm ground 3.5 to 4.0 feet deep.
• Loose or sandy soil may require deeper post placement.
• Use breakaway sign supports to enhance roadside safety.
• Bolt sign panels to the post with oversized washers.
• Use sign connections that prevent vandalism.

Sign Height
The MUTCD states, “signs erected at the side of the road in rural districts shall be mounted at a height of at least five feet, measured from the bottom of the sign to the near edge of the pavement.”

Where there is parking and/or pedestrian movement or where obstructions are present, the clearance to the bottom of the sign must be at least seven feet. The height at the bottom of a sign, mounted below another sign, may be one foot less than the appropriate height specified above.

Lateral Clearance
Signs should be at least six feet from the shoulder. When there is no shoulder, 12 feet away from the edge of the roadway. In urban areas, a minimum of two feet is recommended, a clearance of one foot from the curb face is permissible where the sidewalk width is limited or where existing poles are close to the curb.

Sign Panels
Bolt sign panels to the post using oversized washers. Oversized washers:
• Prevent the panel and post from separating on impact.
• Prevent the sign from breaking loose from the post when hit by a vehicle.
• Prevent the bolt from pulling through the sign panel from wind vibrations.

Set the bottom of the sign panel a minimum of seven feet above the pavement or ground. Do not confuse this with the mounting height of five foot above the roadway surface. The new MUTCD will require a seven-foot mounting height. A seven foot mounting height reduces the possibility that the sign and the post might hit the car’s windshield.

U-Channel Steel Posts
The U-channel rolled steel post is the most commonly used small sign support. It is considered breakaway as it will bend or break away at the post/base connection at the ground line when it is hit.

Maximum Post Sizes for U-Channel Steel Posts

<table>
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<th>Maximum Size Panel</th>
<th>Post Size</th>
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<tbody>
<tr>
<td>18” x 24”</td>
<td>2 lb./ft</td>
</tr>
<tr>
<td>30” x 30”</td>
<td>3 lb./ft</td>
</tr>
<tr>
<td>36” x 36”</td>
<td>2 @ 2 lb./ft</td>
</tr>
</tbody>
</table>

Purchase posts to breakaway on impact and at ground level.

The U-channel steel post manufacturer must certify that posts and hardware have the same chemistry, mechanical properties, and geometry used in the FHWA tests and will meet the FHWA change in velocity requirements.

All U-channel steel posts must be galvanized according to ASTM A-123. The connecting bolts can be cadmium plated according to ASTM A-165 or zinc plated according to ASTM B-633.

Drive the post base into the ground. Do not encase in concrete. The posts base is 3.5 feet in length.

When installation is completed, no more than four inches of the base should be above the ground.

Refer to the manufacturer’s wind-load charts for determining post size for other sign panel sizes.

Splicing U-Channel Steel Posts
To splice U-Channel steel posts, follow these steps:
• Drive a 3.5 foot base post to within approximately 12 inches above ground level.
• Place one bolt and cut washer in the fifth hole from the end and tighten the threaded space securely onto the bolt.
• Drive the base post to four inches above ground level.
• Place the remaining bolt and cut washer in the first

continued on page 7
Education and training opportunities are available through the University of Tennessee Center for Transportation Research (CTR), Southeast Transportation Center (STC), and Tennessee Transportation Assistance Program (TTAP). This listing of courses currently available includes both TTAP and TATE courses that are offered in conjunction with the University of Tennessee Department of Civil and Environmental Engineering and the Tennessee Section of the Institute of Transportation Engineers. Local roadway departments can benefit from all of the workshops. Because of this, we ask that you please share this listing with others who might be interested in our workshops. TTAP is always eager to meet your research and training needs. If you have a special course in mind or would like a course held on site especially for your employees, please contact Wilma Wilson at 1-800-252-ROAD.

*CEU and PDH credit hours available.

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<tr>
<th>Title</th>
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<td>9</td>
<td>Jackson</td>
<td>Clarke</td>
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<td>September</td>
<td>16</td>
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<td>17</td>
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<td>October</td>
<td>6</td>
<td>Chattanooga</td>
<td>Bevin</td>
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<tr>
<td>Tractor Loader/Back Hoe Safety</td>
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<td>October</td>
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<td>Basic Traffic Studies</td>
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<tr>
<td>Geometric Design of 2-lane Roads &amp; Streets</td>
<td>November</td>
<td>20</td>
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New Signal Timing Manual Ready for Free Download

The FHWA Office of Operations has issued The Signal Timing Manual, the first comprehensive guide to current practices related to traffic signal timing. Property timed signals save gas by keeping traffic moving smoothly. All the elements of signal timing, from policy and funding considerations to timing plan development, assessment, and maintenance are covered. The manual is the culmination of research into practices across North America and serves as a reference for a range of practitioners, including traffic engineers, signal technicians, design engineers, teachers, and university students. It is available at http://www.signaltiming.com.
hole from the end and tighten the threaded spacer securely onto the bolt.

• Dig out approximately two inches from around the back of the base post to allow room for a sign post to be attached.
• Nest the sign post over the protruding base post bolts through the first and fifth holes of the top post.
• Place a lock washer and lock nut on each bolt.
• Tighten the nuts and tamp the earth around the base post firmly.

Source:
“Correct sign installation can increase motorist safety on local roadways”, Oklahoma LTAP News, Jan 2005, p.. 3-6

Meet Our New Staff...

We would like to welcome Jonathan P. Watson to our TTAP family. Jonathan graduated from the University of Tennessee in December 2006 with a bachelor’s degree in Civil Engineering and a master’s degree in Transportation Engineering in May 2008. He is originally from the small town of Riceville, TN, located about an hour south of Knoxville. Jonathan is a big sports fan and enjoys watching Tennessee football and basketball, the Braves, and the Titans. In his spare time he also enjoys hunting, fishing, and being outdoors. He is looking forward to meeting and working with the individuals of Tennessee in the future. He can be contacted at 865-974-5255, 1-800-252-7623, or by email at jwatso14@utk.edu.

How to Save Money on Gas

reprinted with permission from the Missouri-LTAP Spring 2008 Newsletter

Keep the tires inflated properly. This one is simple and a potential lifesaver. Underinflated tires waste fuel and wear out the tire tread. Also, check tires regularly for alignment and balance.

Buy the lowest grade (octane) of gasoline that is appropriate for your car. Check your owner’s manual for this information. As long as your engine doesn’t knock or ping, the fuel you’re using is fine. You can save hundreds of dollars a year.

Drive intelligently; don’t make fast starts or sudden stops. You’re just overexerting your engine and burning extra fuel. Gradual acceleration also helps automatic transmissions run better. Engine-revving wastes fuel, too.

Avoid long warm-ups. Even on cold winter mornings, your car doesn’t need more than a minute to get ready to go. Anything more and you’re just burning up that expensive fuel.

Get the junk out of the trunk. A weighed-down car uses more fuel. For every extra 250 pounds your engine hauls, the car loses about one mile per gallon in fuel economy. Carry only the basic emergency equipment and items you really need.

Pay cash at stations that charge extra for credit cards.

Don’t top off the gas tank. Too much gas will just slosh or seep out. Why waste those extra pennies?

Lighten up on the accelerator. The faster you drive, the more gas you use. Speed limits have gone up around most of the nation, but you don’t have to see your fuel consumption go up drastically as well. For example, driving at 55 mph rather than 65 mph can improve your fuel economy by two miles per gallon.

Combine errands into one trip and plan your stops for the most efficient route. You’ll save yourself time and money.

TALK TO TTAP

We are always looking for your comments, ideas and suggestions to help make the TTAP Program more useful to you. Please fill out and fax the form below to TTAP at (865) 974-3889 or mail to TTAP, Suite 309 Conference Center Building, Knoxville, TN 37996-4133.

1. Please send me more information on the following articles mentioned in this newsletter.

2. Please list any additional training workshops you would be interested in attending.

3. Please list topics for videos you would like TTAP to obtain.

4. Please list any other ideas or suggestions on how TTAP could assist you.

5. Please list your name and organization to verify for TTAP’s mailing list.

Name ________________________________
Address ________________________________
Title ________________________________
Organization ________________________________
Phone __________________ Fax __________________
Email __________________

Are you currently on TTAP’s mailing list?
   ___ yes    ____ no

Do you wish to be on the mailing list?
   ____ yes    ____ no