



TTAP Begins Retroreflectometer Loan Program

by Matt Cate, P.E., Technical Assistance Coordinator

In April TTAP completed its first two traffic sign retroreflectivity workshops. The full classrooms and variety of agencies represented indicate to me that many agencies are already making progress towards meeting the new

traffic sign retroreflectivity requirements established in Revision 2 to the 2003 Edition of the *Manual on Uniform Traffic Control Devices*. Many more agencies are likely to join this group as the first retroreflectivity compliance dates approach in early 2012.

see Department of Transportation and the Federal Highway Administration to obtain three handheld sign retroreflectometers for use by local agencies in the sign management process. Each of these units is a RoadVista Model 922 handheld retroreflectometer with an extension pole. These units will be available to any local agency in Tennessee on a first-come, first-served basis.

The standard loan period will be six weeks, with two-week extensions available as demand permits. While six weeks will not permit a complete sign inven-



Some signs, such as this badly worn stop sign, require little more than a brief visual inspection to determine that they will not meet new sign retroreflectivity standards.



Other signs, such as this orange construction warning sign, present a more difficult decision when considering new nighttime visibility requirements

As we discussed the various sign management techniques available to local roadway agencies, it became clear to me that almost all of these approaches at some point require agencies to establish or verify the exact retroreflectivity levels of signs or comparison panels. The only reliable method to record the retroreflectivity level of a sign (a value measured in units of candelas per lux per square meter) is to use a retroreflectometer. These measurement units are highly accurate and easy to operate but may fall beyond the purchasing power of many agencies.

In recognition of this fact, TTAP has partnered with the Tennes-

continued on page 3

In this issue...	
TTAP Begins Retro-reflectometer Loan Programs	1
From the Director.....	2
Cost Effective Pothole Repairs	4
Ten Essentials of a Good Road	6

RoadTalk is a publication of the Tennessee Transportation Assistance Program (TTAP). TTAP is part of a nationwide Local Technical Assistance Program (LTAP) financed jointly by the Federal Highway Administration (FHWA) and Tennessee Department of Transportation (TDOT). Its purpose is to translate into understandable terms the latest state-of-the-art technologies in the areas of roads, bridges, and public transportation to local highway and transportation personnel.

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.

Director

Dr. David B. Clarke, P.E.

Training Coordinator

Frank Brewer

Technical Assistance Coordinator

Matt Cate, P.E.

Engineering Associate

Jonathan Watson, E.I.T.

Safety Circuit Rider

John Tidwell, P.E. (retired)

Technician

Linda Capps

RoadTalk Editor

Jenny Jones

Administrative Specialist

Mollie Mitchell

Course Registration

Wilma Wilson

Course Materials

Julie Asbell

The University of Tennessee does not discriminate on the basis of race, sex, color, religion, national origin, age, disability, or veteran status in provision of education programs and services or employment opportunities and benefits. This policy extends to both employment by and admission to the University. • The University does not discriminate on the basis of race, sex, or disability in the education programs and activities pursuant to the requirements of Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) of 1990. • Inquiries and charges of violation concerning Title VI, Title IX, Section 504, ADA, the Age Discrimination in Employment Act (ADEA), or any of the other above referenced policies should be directed to the Office of Equity and Diversity; 1840 Melrose Avenue; Knoxville, TN 37996-3560; telephone (865) 974-2498 (TTY available). Requests for accommodation of a disability should be directed to the ADA Coordinator at the Office of Human Resources Management; 600 Henley Street; Knoxville, TN 37996-4125. • PA# R01-1313-097-014-09.

From the Director

I'm amazed by how time seems to pass in proportion to the amount of gray hair on my head. We're nearly halfway through 2009 and it seems only a couple of days since New Year's Day! School has already let out here in Knox County and at the University and everyone is planning their summertime.

Of course, for many of you, summer is the high season for work activities. It's a key time of year for keeping our transportation systems in good repair. This spring, we've had sufficient rain to finally take us out of drought status. Even though April's showers bring May flowers, they also bring a host of roadway maintenance headaches. With all the recent rain, we may be reaching for our favorite headache relief strategies a bit more than in the past several years. I'm already hearing about a lot of problems with drainage facilities that haven't seen a whole lot of recent use. Besides growing flowers, those rains also nurture a lot of nuisance vegetation that must be sprayed or cut back. But, that's life in the roadway (and railway) maintenance business!

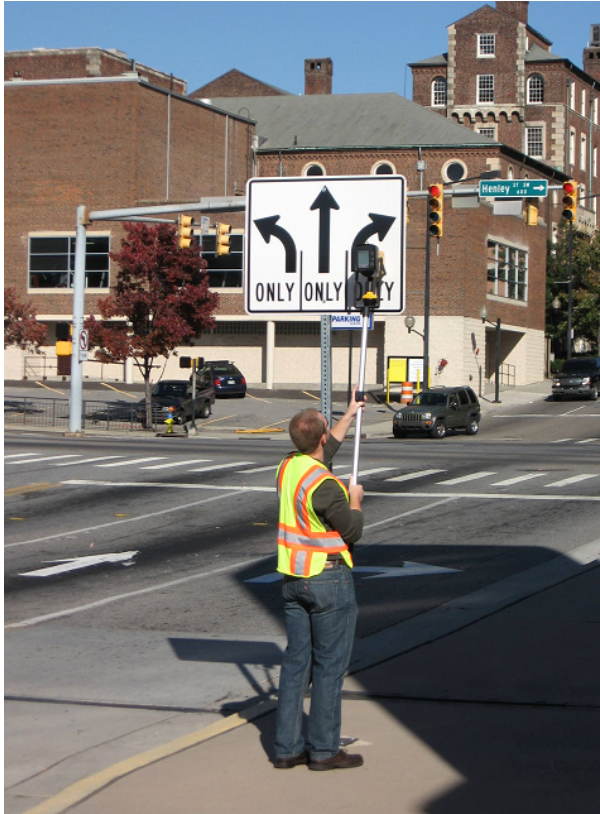
Since my last column, the first round of stimulus money (American Reinvestment and Recovery Act) has been awarded. At the local level, most of this funding has gone to sorely needed bridge projects. What will happen after the economy is stimulated is anybody's guess. If I was a betting person, my wager wouldn't be on this leading to an economic recovery, because I don't think it addresses our fundamental problems. It will put some people to work for a time, though, and leave some permanent infrastructure improvements. That's good.

Working smart and keeping tight control of budgets is essential for survival in this economic climate. I look for budgets to remain very tight, and revenues to be flat or declining—at least over the next year. We've been fortunate to have seen some relief from the sharp materials price escalation of the past year or two. Fuel prices are sharply down, though may again be on the upswing. Focus on the essential activities and purchases and hold off on the "nice to haves" and you should do fine.

One "nice to have" that TTAP will have to do without is the Safety Circuit Rider program. We've been fortunate to have been able to offer this program for the past three years, but funding support is no longer available. We'll continue to promote safety through our technical assistance and continuing education activities. Perhaps, when times are better, the Circuit Rider can again resume his rounds.

As always, we at TTAP look forward to serving you. Please don't hesitate to contact us. Our mission is to help you make the best use of your resources.





The retroreflector is easy to operate, with or without the extension pole.

tory evaluation for many agencies, it will allow time to check the performance of borderline signs, select existing signs for use as calibration signs or comparison panels, or complete retroreflectivity measurements for all signs on a subset of the local roadway network.

There is no rental fee for retroreflector users. However, there are a few basic requirements to ensure that the devices can be utilized by agencies for years to come.

- Please treat these devices with care. While the retroreflectometers are not delicate, they are still precision optical instruments. Shock, moisture, or extreme temperatures may adversely affect the long-term performance of the device.
- Secure the devices at all times. Please do not leave this expensive equipment unattended in an unlocked car or in the bed of your truck.

- The retroreflectometers must be insured for their full replacement value (approximately \$11,000) if shipped from location to location. This will allow TTAP to repair or replace the unit if it is lost or damaged in the shipping process. Agencies may opt to meet in person to pass the retroreflector to the next user.
- We may ask you to share your newfound retroreflector knowledge with the next user. You may encounter hurdles (and solutions) that will prove valuable to other users.

If you would like to borrow one of TTAP's retroreflectometers, or if you would simply like to learn more about the new MUTCD traffic sign retroreflectivity requirements, please contact TTAP at 1-800-252-7623 or TTAP@utk.edu.

To learn more about the new traffic sign retroreflectivity standards, visit the MUTCD website at <http://mutcd.fhwa.dot.gov> or the FHWA Nighttime Visibility site at http://safety.fhwa.dot.gov/roadway_dept/retro/#signretro

SIGN UP FOR THE TRAFFIC SIGN RETROREFLECTIVITY WORKSHOPS:

**OCTOBER 6, 2009
(CHATTANOOGA)**

**OCTOBER 8, 2009
(KNOXVILLE)**

CHECK OUT OUR WEBSITE:

CTR.UTK.EDU/TTAP

FOR OTHER WORKSHOPS OFFERED BY TTAP.

Cost Effective Pothole Repairs

by Stefanie R. Fishman, Project Assistant, New Hampshire LTAP Center

Potholes form when water becomes trapped beneath the pavement surface. Water can enter the road base through surface cracks or from the road sides. The water freezes, often causing frost heaves. The ice melts from the top down, leaving a trapped pool of water. As vehicles run over it, the unsupported surface layer collapses. The pothole expands as traffic hits the hole.

In the summer, highway departments can take preventive measures such as sealing cracks and improving drainage. In the winter and spring the only alternative is pothole patching. To ensure a longer-lasting pothole patch, crews must apply the right combination of materials and procedures.

Materials

Although hot-mix asphalt patches last longer than cold-mix, crews must keep the material hot during the patching operation. Therefore, cold mix is usually used. Cold mix is less expensive, easier to use, and can be stockpiled.

Three types of cold mix can be used: local cold mix, agency-specified cold mixes, and proprietary cold mixes. Local cold mix is a blend of local aggregates and liquid asphalts, either cutbacks or emulsions. When highway departments specify cold mixes, asphalt plants will produce the material according to these specifications using high-quality aggregates and modified liquid asphalts. Proprietary cold mixes are commercially produced blends of carefully matched aggregates, liquid asphalts, and additives. By applying cold-mix in the following techniques, highway departments can make repairs that will last for many months.

Repair Techniques

Repairs can be performed during a variety of weather conditions, ranging from clear spring days to harsh winter storms, with temperatures from 0° to 100F. Repairs are generally performed as an emergency repair under harsh conditions or as a routine maintenance, scheduled for warmer and drier periods. Highway departments have successfully used three methods for pothole patching: throw-and-roll, semi-permanent, and spray injection. The method of choice depends on how much an agency can spend, the equipment available, and productivity needed.



Throw-and-Roll

The throw-and-roll method consists of the following steps:

- Place mixture into the pothole which may or may not be filled with water and debris. Use any type of hand tool such as a shovel or pitchfork to fill the hole. Fill the hole so that there is a crown in the center.
- Compact the material by rolling over it 6 to 8 times with truck tires. Some crews have found it useful to cover the patch with sand before rolling a truck over the patch to prevent material from sticking to tires.
- Check the level of the patch to make sure the center of the patch is $\frac{1}{4}$ " to $\frac{1}{2}$ " above the pavement surface.
- If the patch is low add more cold mix and repeat the patching steps again.

This method is similar to the standard "throw-and-go", "dump-and-run" or the "pitch-and-pat" methods except truck tires compact the patches. Compaction provides a tighter patch for traffic to drive over it without creating depressions and it provides better water runoff. The extra 1 to 2 minutes to compact the patches will produce a significantly better patch.

continued on page 5

Semi-permanent

Semi-permanent patching is the most widely recommended method of repair. It includes the following procedures:

- Remove water and debris from the pothole, using a broom, shovel, compressed air or whatever is available.
- Straighten pothole edges making sides as vertical as possible. This can be done using a jackhammer, pavement saw, or milling machine, etc.
- Place the mix by hand using a shovel and rake. Placement should be made in no more than 3" lifts.
- Compact patch from the center towards the edges to provide better compaction at the edges and corners. Hand devices such as a vibratory plate compactor or single-drum vibratory rollers are recommended for this task.

This repair requires more equipment and workers than the throw-and-roll or spray injection methods, but results in a very tightly compacted patch.

Spray Injection

This method is quick, provides a long-lasting patch, and uses low cost materials. However, it requires a skilled operator to obtain a good patch and the equipment cost is higher than for the other procedures. The spray-injection procedure consist of the following steps:

- Blow the hole clean and dry of water and debris.
- Spray a tack coat of binder on the sides and bottom of the pothole.
- Blow asphalt and aggregate into the pothole. The compaction is provided by the velocity or the aggregate sprayed into the hole.
- Cover the patch with a layer of aggregate.

Winter Patching

The best results are obtained by scheduling repair work during dry, warm weather. However, potholes usually form in wet and cold weather. In such cases, careful selection of materials and procedures is important to obtain a long-lasting patch.

Aggregates for winter patching should be high quality, crushed aggregate with few fines. The binder should be emulsified asphalts with some anti-strip additive to prevent stripping of the asphalt. The mixture should be workable at low temperatures to allow both easier handling and compaction.



The most important aspect is that the binder-aggregate-additive mixture be compatible. Since winter patching seldom allows the time to use the semi-permanent procedure, use the throw-and-roll method with a high quality or highway department specified mix to provide a longer-lasting patch.

Spring Patching

Patches placed in the spring have a longer life than those in the winter because of the more favorable weather and the end of the freeze-thaw cycle. Spring patching can be done by any of the procedures discussed above: the throw-and-roll, semi-permanent, or spray injection procedures. Cost and the availability of equipment and workers should be the most important criteria.

Managers should make sure that material stockpiled over the winter is workable in a range of temperatures. Materials workable at very low temperatures tend to be very sticky and hard to use at higher temperatures. High-quality crushed aggregate with few fines, and emulsified asphalt, should be used for spring patching. Antistripping additives are recommended to keep asphalt from stripping away from aggregates.

The Strategic Highway Research Program Manual of Practice titled "Materials and Procedures for Repair of Potholes in Asphalt-Surfaced Pavement." provides additional details and illustrations of the methods discussed above. The manual can be found online at <http://www.tfrc.gov/pavement/ltp/pdf/99168.pdf>

Ten Essentials of a Good Road

10 basic tips to help maintain and keep your roads in good condition.

reprinted with permission from the National Association of County Engineers (NACE)

1. KEEP WATER AWAY FROM THE ROAD.

Drainage cannot be overemphasized in road construction and maintenance. Water affects the entire serviceability of a road. Too much water in the base material weakens the road. Water allowed to remain on top of a gravel or black topped road weakens the surface and, combined with traffic, causes potholes and cracking. If improperly channeled, water causes soil erosion and a breakdown of pavement edges. Whether it is mud in the spring or frost heaves in the winter, the presence of water in roads is nothing but trouble.

A good surface drainage system is the best way to lessen water damage on a road. Proper surface drainage prevents water from infiltrating the pavement surface and removes water from the driving lanes in a constant thin sheet to the side ditches, which carries the water away from the roadway. A surface drainage system has four main components: road crown, shoulders, ditches, and culverts.

The road crown, or superelevation of the road surface, drains water off the road surface.

Shoulders are an extension of the road surface and allow for the continued flow of water to the ditches.

Ditches are used to carry water away from the roadway. They need to be kept clean and protected from erosion. Water left in the ditch can sometimes leak back into the base.

Water collected and carried in the ditch has to be directed away from the roadway at frequent intervals, sometimes using culvert pipe.

Culverts usually channel water from one side of the road to the other, helping to control the flow of water and slowing it down to reduce erosion.

Road managers are guided by the principles that water runs downhill, that water needs outlets at the bottom of all grades, and that puddles mean problems.

2. BUILD ON A FIRM FOUNDATION.

A highway wears out from the top, but it falls apart from the bottom. This is another way of saying that the road base determines the service-life of a road. The base supports everything above it, including traffic.

Without adequate support, the road will deteriorate rapidly.

A good road requires a suitable foundation composed of stable material. A road material is stable if it has negligible soil settlement with a change in moisture content and does not deform excessively under repeated loads whether the material is wet or dry.

3. USE THE BEST SOILS AVAILABLE.

The supply of natural, good quality soils and aggregates is beginning to disappear. Blended or crushed gravel is a more expensive alternative. The quality of soils used by a road manager often depends on local availability and budget. In deciding what is available, consider the long-term consequences of using lower quality material. Using inferior base material may require excessive maintenance during the road's life and, perhaps, expensive rehabilitation. The adage "pay me now or pay me later" applies to road building.

4. COMPACT SOILS WELL.

The more dense the material is, the stronger it is. When soil is improperly compacted, future traffic loads or changes in moisture content can cause settling and failure of the roadway.

Compaction is achieved by pressing soil particles together, which expels some of the air from the mass, making the material more dense. Well-graded soils having a fairly even distribution of particle sizes will compact more easily than poorly graded soils that have mostly one particle size. Crushed or angular particles will compact to a more stable condition than rounded particles of similar size. A certain amount of moisture is necessary for good compaction.

5. DESIGN FOR WINTER MAINTENANCE.

In areas that receive substantial snowfalls, roads that are designed for winter maintenance should be adequate for the rest of the year. Consider the following: if the traveled way is wide enough to allow a snowplow and a school bus to meet, it should be wide enough for the rest of the year.

If ditches and roadside areas are wide enough to store snow, chances are they will accommodate spring thaws and heavy water flows.

continued on page 7

Grades should be a minimum of 1% for drainage purposes and should not be greater than 10% if at all possible. If the road is steeper, it is difficult for heavy equipment to maneuver, especially in the wintertime.

Sight distance should be considered in designing a road. For safety's sake, a driver should be able to see 75 to 100 ft. up the road for every 10 mile per hour driving speed.

6. BUILD FOR TRAFFIC LOADS AND TRAFFIC VOLUMES.

Thin ice on a pond may support a young skater, but it will crack and break apart under the weight of an automobile. Similarly, a road built to serve residential traffic will break down when it starts carrying a number of large trucks. Road managers know that roads, like bridges, should be designed with the expected traffic type and volume in mind.

A rule of thumb is to design a road to accommodate the largest vehicles that will use the road under normal operation. If in doubt, design the road for the largest piece of equipment that maintains it in all kinds of weather.

Road managers can get information and guidance from their State transportation agencies about the type and thickness of pavement mixes to apply to a gravel road. Generally speaking, a low volume road with some truck traffic may provide good services with a "chip seal" or "sand seal." As traffic volumes and weights increase, cold-mix asphalt and hot-mix asphalt pavement may be better alternatives.

7. PAVE ONLY ROADS THAT ARE READY.

Some agencies make the mistake of paving over a road that is not properly prepared in their haste to get rid of another dusty gravel road. The result may be a complete waste of money. Paving will not cure the other problems that the gravel road may have. It still must be built of well compacted layers of free draining soil, be able to carry expected traffic loads, and be able to drain well. The cost of rebuilding a mistake is much higher than not making the mistake and doing it right the first time.

8. BUILD FROM THE BOTTOM UP.

A road that has a poor base and poor drainage cannot be adequately improved with a top dressing of gravel or new pavement. It may be necessary, in some cases, to dig out the old road, put in new materials, and build up the road in layers.

Before doing anything to correct a road surface problem, road managers should take into consideration what is causing the problem underneath. Improper drainage, insufficient depth of base, or poor quality gravel may be the culprit. These should be corrected before spending money on the surface.

9. PROTECT YOUR INVESTMENT.

Roads and bridges need regular maintenance to keep them from deteriorating. The increased weight and frequency of traffic on roads, combined with adverse weather conditions, means an increased rate of road and street deterioration. Regular road and bridge maintenance preserves our road investment and prevents costly major rehabilitation later on.

Maintenance activities include:

- Roadway surfaces: blading and shaping, patching, resurfacing; dust control; snow and ice removal.
- Drainage: cleaning and repairing culverts and ditches.
- Roadside: cutting bushes, trees, and grass; repair and prevention of roadside erosion.
- Bridges: clearing channels; repair of rails, decks, and structure; cleaning and painting.
- Traffic services: sign maintenance; cutting vegetation to maintain visibility.
- Special projects: restoration or improvements; emergency work such as removing slides, repairing washouts, and repairing retaining walls.

10. KEEP GOOD RECORDS.

Road managers know their roads like the back of their hands. Most of them are walking history books when it comes to the roads they manage every day. This knowledge is of little use, however, when the road manager is ill, moves, or retires.

Good record keeping makes roadwork much easier for everybody. It is easier to formulate budgets and to show the citizens a plan for roadwork. Recording which type of work was done on roads or bridges, when, and what materials were used can help a lot in making decisions later on.

Agencies can start by doing an inventory of all roads and bridges, listing length, width, surface types, culverts, problem areas, and other items. Placing these items on a map helps. Next comes listing and prioritizing needed improvements, putting a price tag on them, and taking care of a few problems each year.

Tennessee Transportation Assistance Program
Center for Transportation Research
The University of Tennessee
309 Conference Center Building
Knoxville, TN 37996-4133
Ph. (865) 974-5255/(800) 252-ROAD
Fax. (865) 974-3889
Email. TTAP@utk.edu
Web. <http://ctr.utk.edu/ttap>

Non-Profit Org.
U.S. Postage
PAID
Permit No.481
Knoxville, TN



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