TTAP ROADTALK

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2005 Training Schedule

by Frank Brewer

TTAP is putting together its list of courses for the coming year. This is not a simple task. We are looking at the titles offered in the past and the evaluations you have provided from those courses. With your help and suggestions we hope to tailor the list to items you would like to attend.

Some titles being considered are:

- **Plan Reading for the Work Crew** - What do these marks on the wooden stakes mean? What is going to be a cut or fill and how much earth will be moved?
- **Basic Surveying** - using a hand level, shooting elevations for ditches or drainage pipe, etc.
- **Work Zone/Flagging** - always a favorite.
- **Portland Cement Design** - what mix recipes to use for those small jobs.
- **TDEC Permits** - what process is used to apply for those permits.
- **Grant Applications** - what funds may be available to Cities and Counties.

continued on page 8

Winter Chills (and Potholes in your Road)

by Matt Cate

Winter is here and potholes are soon to follow. Undoubtedly drivers in your jurisdiction are quick to let you know of new potholes, especially on well-traveled roads. Potholes aren't just a nuisance; they can also damage vehicle components or cause a loss of driver control.

What is a pothole? The FHWA's Strategic Highway Research Program (SHRP) defines a pothole as a bowl-shaped hole in the pavement surface, with a minimum length or width of six inches. Potholes can also have varying degrees of severity. Low severity potholes are less than 1 inch deep. Medium severity potholes are between 1 and 2 inches deep. High severity potholes are more than 2 inches deep. High severity potholes should be repaired as soon as possible to minimize the risk of vehicle damage or other harmful events.

Now that we know what a pothole is, let's take a look at why they occur. Typically a pothole begins to form when water enters the subgrade through cracks in the pavement surface. In subfreezing temperatures, this trapped water expands as it freezes, pushing the pavement and base material upward. As the water melts, a void is left and the pavement and base material are forced downward by the weight of traffic. Over time, additional freeze/thaw cycles repeat the process and traffic breaks down the pothole edges, making the hole even wider and deeper.

Knowing what a pothole is and how it gets there is one thing, but how do we make them go away? Most pothole patching is performed using cold-mix asphalt manually placed into the hole by maintenance crews. There are several different techniques that utilize cold mix asphalt, including "throw-and-go," "throw-and-roll," semi-permanent repair, and spray injection.

The most common form of patching is throw-and-go, where the crew simply shovels enough asphalt into the pothole so that it is "filled." While best results are

continued on page 5

In this issue...

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.

Dr. David B. Clarke, P.E., Director
Frank Brewer, Assistant Director, Training
Matt Cate, E.I.T., Technical Assistance Coordinator
Justin Maderia, Graduate Research Assistant
Keith Kaiser, Graduate Research Assistant
Linda Capps, Sign Grant Technician
Jenny Jones, RoadTalk Editor
Mollie Mitchell, Administrative Specialist
Annette Jones, Course Registration
Julie Robinson, Course Materials

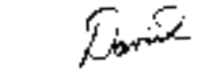
FIELD REPRESENTATIVE
Vacant

From the Director

I hope that all of you had a very happy holiday season. With luck, you'll have been blessed with the comforts of home and family and with mild weather that will have allowed you the time to enjoy both.

As I drive the roadways of our beautiful state, I'm constantly thinking about what we can do to help motorists make their trips safely so that they, too, can share the blessings of home and family. I know from personal experience how important this is. Eight years ago, during the Christmas season, I had stayed in Knoxville while the remainder of my family journeyed north to visit relatives. I returned home that evening from Christmas shopping to find a highway patrolman waiting at my doorstep. There had been a terrible single car crash, I was told, and I was needed immediately at a northeast Tennessee hospital. While the consequences were severe, someone was looking out from above, and I did not lose any of my loved ones. Though I can not recommend spending ten days at Christmas sitting in an intensive care unit, it was a small price to pay considering how blessed I was that everyone survived.

I share this story with you for a reason. There is a similar drama, many without the fortunate outcome I experienced, every time we have a serious crash on our roads and streets. Tennessee, in common with other southeastern states, has a much higher fatal crash rate on secondary roads than the nation as a whole. How many people will suffer rather than celebrate the holiday season as a result of a tragic crash? We all need to be on the lookout for conditions that will make our roads and streets safer. This should be our eternal goal. The greatest gift that we can give anyone is the safe arrival home of their loved ones.



Use of Chain Saw

by Frank Brewer

Winter is on the way! Along with the cold and unpleasant weather we must expect storms of different types. Quite often, as a consequence of these storms, we will encounter fallen trees that must be removed. This usually requires a chain saw.

Personally I am not real handy with a chain saw, but I have access to some accurate tips that I would like to share. This tip is on cutting spring poles. Spring poles are limbs or tree trunks that are bent over and are under a significant amount of tension. Once cut the poles will spring away to the direction of that tension. This spring back is very dangerous. The best way to manage spring poles is to avoid them. However, if a spring pole must be cut it should be done in a safe manner. The tip for the proper way to cut and release the tension of "spring poles" can be found in an article by Tim Ard of Forest Applications Inc. (http://www.forestapps.com/tips/springpole/springpole.htm).

If you are interested in a chain saw course, please contact TTAP at 865-974-8251 or 800-252-ROAD (7623).

Happy Holidays and a Happy New Year to all our readers

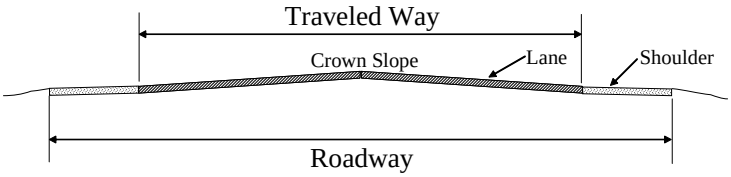
Maintenance of Drainage Facilities - Part 1

by Dr. David Clarke, P.E.

I had an old mentor who used to say that the three most important considerations in making a road last are drainage, drainage, and drainage! Carrying water off of and away from the roadway surface and underlying structure is extremely important. Excess water on the surface of the road presents a hazard to the motorist. Water infiltrating into the roadway structure degrades materials and reduces the load carrying capacity of the pavement and subgrade. Uncontrolled water erodes the slopes of embankments and cuts, resulting in damage and excessive silt loads to watercourses receiving runoff. Yes, there certainly is merit to my mentor's wise counsel.

A properly designed road project contains many elements intended to ensure that water is properly drained from the roadway. In fact, as much as 25 percent of roadway construction costs are related to the drainage system. Once construction is complete, however, maintenance forces must ensure that drainage elements continue to function as intended. In this article, we discuss the drainage system and some typical maintenance considerations.

While not always recognized as such, the cross slope of the traveled way is the first element in the roadway drainage system. The traveled way is that portion of the roadway upon which vehicles operate. In tangent sections and in shallow curves, the pavement is crowned. In other words, the center of the traveled way is higher than the edges, so that water runs towards the roadside. In curved sections, superelevation provides a uniform slope across the entire traveled way. For paved roads, the crown slope ranges from 1.5% to 2%. In locations of high rainfall, a 2.5% crown slope may be used. On unsurfaced roads, the crown slope may need to be as much as 6% to ensure adequate drainage.



Maintenance forces should be on the lookout for road surface conditions that hinder drainage. Some asphalt pavements are prone to rutting. Low spots in the road surface may also be found as a result of improper paving or from local failures of the pavement and/or subgrade. Rainwater collects in these shallow depressions, where it may infiltrate through cracks into the pavement structure. In addition, the collected water places drivers at risk of hydroplaning or loss of steering control. Ruts are especially hazardous in this regard because they are directly in the wheel path.

On unsurfaced roads, collected water leads to puddles, ruts, mud, and other undesirable conditions. Such conditions will degrade the road's ability to withstand traffic loads and present hazards and discomfort to drivers.

In winter, water in ruts and other depressions may freeze. I personally had experience in a neighboring state with a case where a driver was seriously and permanently injured when his vehicle encountered a puddle of frozen rainwater on an otherwise dry street, spun out of control, and struck a tree. The depression was caused by a localized fatigue failure of the pavement surface due, apparently, to truck traffic on the street. A small asphalt patch to restore the cross slope would have prevented this tragedy.

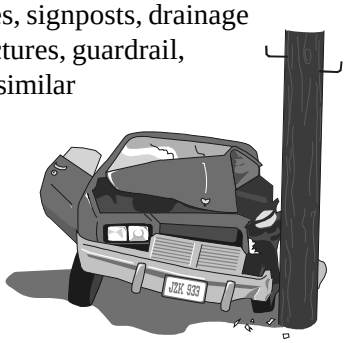
So, road maintenance forces should be on the lookout for surface conditions that allow water to remain on the road. When the road is unsurfaced, restoration of the surface crown can be performed by grading and, if necessary, adding additional material. For paved roads, localized patching or surfacing may be needed to address rutting. When resurfacing, supervisors should be careful to ensure that the design crown slope is maintained.

continued on page 7

Rural Road Safety: The "Forgiving Roadside"

by Matt Cate

In 2003, there were 1193 traffic-related fatalities in the state of Tennessee. Of these 1193 fatalities, 692 (58%) occurred on rural roadways. Looking further into the numbers, 579 (84%) of these rural fatalities occurred on two-lane rural roadways. For 43% of all fatal crashes, the first harmful event (the first event in a crash to cause property damage or injury) was a collision with fixed objects such as trees, utility poles, mailboxes, signposts, drainage structures, guardrail, and similar



objects. By comparison, only 39% of crashes involved collision with another vehicle as the first harmful event.

While we cannot control the actions of every driver on the roadway, there are steps that can be taken to (1) reduce the occurrence of crashes on these two-lane rural roadways and (2) reduce the severity of those crashes which are not prevented. While there are some obvious solutions to many of these crashes, such as straightening curves and widening roadways, many are not economically feasible. However, there are ways to address problems in specific areas.

To address the issue of run-off-the-road crashes, the American Association of State Highway and Transportation Officials (AASHTO) has prepared a document called the *Roadside Design Guide*. One of the key concepts laid out in the guide is that of the clear zone. The clear zone is the area outside of the travel lane available for a vehicle to safely recover and return to the roadway or come to a safe stop. The width of clear zone needed will vary with the speed, geometry, and average daily traffic (ADT) of the roadway. As an example, a straight roadway section with a design speed of 40 mph, an ADT of 600 vehicles per day, and no slope away from the road would require a clear zone of only 7-10 feet from the edge of the lane. In contrast, a straight roadway section with a design speed of 65 mph, a fore slope (fill slope) of 1:4 (rise:run) and an ADT of 15,000 vpd (vehicles per day) would require a clear zone of 38-46 feet. The clear zone is increased for foreslopes (or fill slopes) and reduced for backslopes (cut slopes). Additionally, the width of the clear zone on the outside of the curve is increased in proportion to a combination of radius and design speed.

The clear zone should be free of large fixed objects and side slopes that could result in vehicle overturning. Of course we all know that this is rarely possible in the real world. If there are hazardous objects in the clear zone, here is a list for the treatment of such items, in order of preference:

1. Remove the object
2. Redesign the obstacle so that it can be safely traversed (often applicable for embankments and drainage structures)
3. Relocate the object to a point where it is less likely to be struck
4. Reduce likely impact severity by using a breakaway device (use for signs, utility poles, mailboxes, etc.)
5. Shield the obstacle with a longitudinal barrier (guardrail or similar)
6. Delineate the obstacle if none of the above alternatives is appropriate (increases visibility of the object to the driver)

Some other things to remember:

- Foreslopes (fill slopes) with a slope of 1:4 or flatter are considered recoverable. These slopes will allow the driver to safely recover control of the vehicle and steer back onto the roadway without a significantly increased danger of rollover.
- Foreslopes between 1:4 and 1:3 are considered to be traversable. These slopes will allow the driver to maintain some control for slowing or stopping but likely will not allow the driver to steer back to the roadway. These slopes are not considered to be obstacles but should not be included in any calculation of available clear zone.
- Foreslopes steeper than 1:3 are considered to be critical slopes. This means that an errant vehicle is likely to overturn on this slope.
- Trees with an existing or expected diameter of greater than 4 inches are considered to be fixed objects and should be treated in the same

continued on page 6

achieved if the hole is dry and cleared of debris, it is not a necessity. Once the hole is filled, the maintenance crew then moves on to the next pothole with no additional attention to the material. While this is the quickest way to patch a pothole, it may also be the least effective method.

An improved version of the throw-and-go is the throw-and-roll method. As before, the hole does not need to be dry for the patch to be applied. The cold mix asphalt is placed into the hole, and then compacted using the tires of the truck or other vehicle being used by the maintenance crew. The tires should make multiple passes across the patch to ensure that the material is packed into place. The finished patch should have some crown so that water flows away from the newly patched pothole. The throw-and-roll method is the minimum recommended level of patching for potholes.

The next step beyond the throw-and-roll method is the semi-permanent repair. In this method, all water and debris should be removed from the pothole before the patch is applied. The edges of the pothole should be saw-cut so that the face of the surface is nearly vertical and the material is solid (with minimal cracking). Once the edges are cut, the cold-mix material is placed in the pothole and compacted using a vibratory plate compactor or a small single-drum vibratory roller. While this approach is much more time-consuming than the throw-and-roll method, the resulting patches generally last much longer.

A final option for pothole patching is to utilize the spray injection method. This approach relies on specialized equipment to produce a pavement patch of similar quality to the semi-permanent method in a shorter amount of time. While the spray-injection method can vary depending on the equipment manufacturer and material in use, the basic steps are as follows:

1. Water and debris are blown from the pothole using compressed air.
2. The bottom and sides of the pothole are sprayed with a tack coat of binder.
3. Asphalt and aggregate are blown into the pothole.
4. The patched area is covered with a layer of aggregate.

The method that you choose to patch potholes may depend on a variety of factors, including budget, weather conditions, and equipment availability. As stated above, the throw-and-roll method should be viewed as a minimum approach. It can be performed in less-than-ideal weather conditions with a minimal amount of labor and expense. It may be that the throw-and-go must be performed as a temporary solution until conditions allow for a semi-permanent or spray-injected patch to be applied. Also keep in mind that the applicable standards for highway work zones (as described in Chapter 6 of the *Manual on Uniform Traffic Control Devices*) should be met for any maintenance activities, including pothole patching, regardless of the weather conditions.

Web Resources:

Materials and Procedures for Repair of Potholes in Asphalt-Surfaced Pavements, developed by the Federal Highway Administration through the Strategic Highway Research Program (1999), http://www.tfhrc.gov/pavement/ltpp/pdf/99168.pdf.

Distress Identification Manual for the Long-Term Pavement Performance Program, Federal Highway Administration (2003), http://www.tfhrc.gov/pavement/ltpp/reports/03031/03031.pdf.

Materials Available

TTAP has received CDs and publications from a variety of sources. As part of TTAP's mission to provide information on the latest materials and techniques being used in the transportation field, we make these materials available to you, the city and county transportation officials of Tennessee. We have multiple copies of some materials, while others can only be loaned for short-term use. A complete listing can be found on our website **ctr.utk.edu/ttap/** If you have an interest in any of the materials listed below, please call 1-800-252-ROAD or (865) 974-5255.

Publication:

- NCHRP Report 532: Effective Methods for Environmental Justice Assessment (NCHRP, 2004)
- Testing Equipment for Asphalt, Concrete & Soil (Humboldt, 2004)

CD ROM

- Comprehensive Intersection Resource Library (FHWA, 2004)
- Interactive Highway Safety Design Model (IHSDM, 2004)
- Winter Maintenance Training Materials - Volume 2 (Salt Institute, 2004)

Railroad At-Grade Crossing Safety

by Frank Brewer

On November 9th and 10th, I attended a seminar on Railroad and Highway Traffic Safety and Operations. One of the topics was safety regarding at-grade highway railroad crossings. The several different means of passively signing the at-grade crossing and the different types of active controls or safeguards were discussed.

Drivers encounter at-grade highway railroad crossings throughout the highway/roadway system. We, as maintainers of this system, attempt to make these crossings safe.

It was pointed out that every two hours there is a train vs. motor vehicle or train vs. pedestrian incident within the United States. Oddly, enough there are more incidents at crossings with active warning devices than crossings that are signed only. Active devices include: flashing lights, bells, gates, and even traffic signals that are activated on the approach of a train.

The passages of trains are not predictable. Day after day as we drive past these crossings we may never encounter a train. We see the crossings as obstacles in our way and lose respect for the danger they represent should a train be coming. Trains are big. Trains are heavy. Trains do not stop on a dime. Trains cannot swerve to avoid a crash! Persons have difficulty judging the speed of on-coming trains. Because of these reasons, the crossings are marked with the several types of warnings mentioned above. Too often these warnings are dismissed or ignored.

People feel that they can beat the train. If you lose this race you lose catastrophically. Even if you tie, you lose catastrophically. To underscore this situation, on the last day of the seminar one of the instructors received an emergency call. He was informed of a fatal train vs. vehicle incident which had just occurred in South Carolina. The crossing had a flashing light warning device. Two vehicles crossed after the lights activated. The third vehicle pulled up to the track, paused, and then crossed. They were struck by the on-coming train that was traveling at 45 mph. All five occupants in the vehicle were killed.

Give more thought to the at-grade crossings! Always expect a train!

For more information you can visit Operation Lifesaver website, http://www.oli.org/. Be Safe.

Rural Road Safety, *continued from page 4*

manner as any other object in the roadside environment.

- Small traffic signs (less than 50 ft^2 surface area) may use base bending or yielding posts, or may be placed with breakaway devices.
- Traffic signal supports generally should not utilize breakaway supports due to the potential risk that the loss of signal control at the intersection may present. These supports should be placed as far away from the roadway as is practical, especially when roadway speeds meet or exceed 50 mph.

This article only scratches the surface when it comes to roadside safety. The AASHTO *Roadside Design Guide* and *A Policy on Geometric Design of Streets and Highways* (the "*Green Book*"), the Federal Highway Administration's *Manual on Uniform Traffic Control Devices*, and other industry and government publications will help to paint a more complete picture for proper design and implementation for roadside safety.

To assist both state and local agencies in a successful reduction in the annual number of highway fatalities, the National Cooperative Highway Research Program (NCHRP) is developing a number of guides which deal with treatments for specific emphasis areas. There are currently 13 of a planned 22 guides available for download at this time (visit http://safety.transportation.org/guides.aspx to download these reports).

The Federal Highway Administration maintains a website with a complete listing of all roadside safety hardware which meets the performance requirements detailed in the NCHRP Report 350. In addition to a listing of approved industry standard or proprietary products, the website also includes documentation of the formal approval for each device. The website may be viewed at http://safety.fhwa.dot.gov/fourthlevel/pro_res_road_nchrp350.htm.

Maintenance of Drainage Facilities, *continued from page 3*

If possible, observe the roadway area in question during a rainstorm to confirm the proper flow of water.

While a topic for more detail in a future article, it is worth mentioning that sealing cracks in the pavement surface is important. We want water to flow off of the pavement, not into it! Water that seeps into the pavement through surface cracks can lead to a host of ills. So, crack sealing is part of drainage management.

Once water reaches the edge of the traveled way, its next path depends upon the design of the roadway cross-section. In a design having curbs and gutters (typically in an urban area), the water reaches the curb and then flows along the gutter to a catch basin inlet. For roads having shoulders rather than curbs, the water flows across the shoulder towards the edge of the right-of-way.

In a curb and gutter design, it is important for the road to always have a slight longitudinal grade (0.3%-0.5%) leading to catch basin inlets. If the road is level, water may pond at the curb rather than entering the basin.

Shoulders also slope away from the roadway centerline, generally at a higher rate than the traveled way. The amount of shoulder cross-slope depends on the surface type. AASHTO recommends 2%-6% for asphalt or concrete surfaces, 4%-6% for gravel or crushed rock, and 6%-8% for turf. In curved sections, the shoulder slope on the outside of the curve may break in the opposite direction of the traveled way superelevation so that water does not run off of the shoulder and across traffic lanes.

Beyond the shoulders or, in the case of a curb and gutter section, the catch basin inlet, the water must go somewhere. Alas, we're out of room, so we'll have to continue our drainage saga next issue.

TALK TO TTAP

We are always looking for your comments, ideas and suggestions to help make the TTAP program more useful to you.

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.

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

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

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

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Please fax your form to TTAP at (865) 974-3889 or mail to TTAP; Suite 309 Conference Center Building; Knoxville, TN 37996-4133.

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Tennessee Transportation Assistance Program
Center for Transportation Research
The University of Tennessee
Suite 309 Conference Center Building
Knoxville, TN 37996-4133
Tel: 865-974-5255/1-800-252-ROAD
Fax: 865-974-3889

E-mail: TTAP@utk.edu
Web: ctr.utk.edu/ttap

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Federal Highway Administration

2005 Training Schedule, *continued from page 1*

NPDES and Asphalt Pavement Maintenance are also popular. As we had to cancel the November scheduled Asphalt Pavement Maintenance, it will be a course we will try to get scheduled as early as possible.

In 2004, TTAP has delivered 27 courses to over 500 people. In all, fifteen different topics were covered, including an old favorite topic - Work Zone/Flagging and a new topic on Context Sensitive Design. TTAP strives to offer topics that provide the best and most useful information and subject matter that will serve the needs of our local agencies. The list of titles will include professional/personal development courses for the attendees and courses to help make roadways safer for the road worker as well as the road user.

We certainly hope that we are able to meet your training needs. TTAP wants to bring the training to you or close enough to limit your driving times and overnight stays. We will work with you to prepare and schedule a closed course if there is sufficient demand or if you are able to combine with another agency to share the training.

As soon as we finalize our courses we will post the information on our website. We will also use email and the US mail to spread the word on our new schedule. You may also contact TTAP at 865-974-5255, 800-252-ROAD (7623), or ttap@utk.edu for information.

Check our web site for schedule:

http://ctr.utk.edu/ttap/htm/train.htm

Hope to see you soon in one of our workshops!