Vol. 21/ No. 1/ Spring 2007

Road TTAP Talk

Full-Depth Reclamation with Cement Stabilization

(Hixson Ball Fields Roadway and Parking Areas, Chattanooga, TN)

by Ariel Soriano, PE, City of Chattanooga, Department of Public Works

Figures 1a, 1b, and 1c – Pavement Areas with Severe Distress & Poor Drainage

Introduction

The City of Chattanooga (hereafter referred to as Chattanooga) has over 1,200-centerline miles of roadway and numerous paved areas to manage. Like many municipalities in the United States, Chattanooga maintains and rehabilitates this massive infrastructure with limited resources and funding. In order to extend available resources, the City is evaluating and implementing the use of innovative materials and/or methods to extend the service lives of existing pavements and push the design lives for new projects from 20-years to 30- to 50-years. Two of the methodologies evaluated and implemented by Chattanooga are full-depth reclamation (FDR) and FDR with cement stabilization (FDRC).

Methodology

FDR and FDRC both use a pavement reclaimer (e.g. – Asphalt Zipper, Caterpillar RR-250, Roadtec SX-7, etc.) to pulverize the existing pavement structure to some predetermined depth. The reclaimed material, which normally requires some water addition to bring the material up to its optimum moisture content, is then graded and compacted in-place to form a new aggregate base or subbase as part of a new pavement structure.

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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.

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From the Director

As I sit here in my office writing this, spring seems to have finally arrived for good. I'd thought that about a month ago during a warm spell that had the flowers in full bloom and the trees leafing out. Unfortunately, Old Man Winter wasn't quite done, and a record cold snap cut short our lovely blooms. It makes you wonder about global warming.

I just finished teaching a series of TTAP classes during our spring training schedule. For several reasons, I really enjoy these classes. There are a lot of hard working and energetic people at work serving the cause of transportation in our region, and these classes give me a chance to meet a lot of them. Of course, teaching is part of my job, and I hope that I can help all who attend my classes. What may not be as obvious is that I also learn from you in these classes. Your shared experiences, suggestions, and comments all help me to direct and (hopefully) improve my course content.

I was privileged last week to get a sneak preview of Dr. Tom Urbanik's new traffic signal laboratory and training facility. A member of the UT Civil and Environmental Engineering faculty, Dr. Urbanik is a recognized expert in traffic signalization. His impressive laboratory has a range of equipment, most state-of-the-practice, but even including an ancient electromechanical controller or two. We're working with Dr. Urbanik to develop TTAP's traffic signal training and technical assistance capability. Stay tuned…

While I'm on the subject of training, we're tinkering with our Tennessee Academy of Transportation Engineering (TATE) curriculum, with the idea of adding more course options and revamping some of the existing courses. The signal classes I mentioned are one example. If you're in the program, these changes won't affect your progress–it's just part of the continuous improvement process.

I hope all of you have a great spring. As always, please feel free to contact TTAP for technical assistance, training, or information. We look forward to serving you.

FDRC involves incorporating 3- to 5-percent (by weight) Type I Portland Cement and water with the pulverized material into a relatively consistent mixture. The resulting material may then be graded and compacted in-place to form a new stabilized base or subbase for the new pavement structure.

In both cases, hauling away existing material and exposing the subgrade to potential precipitation is minimized or eliminated. A previous *RoadTalk* issue (Volume 20/No. 3/Fall 2006) contained an article by Barry Wilder, Southeast Cement Association, describing this step-by-step procedure.

FDRC Case Study

Chattanooga was given the task of rehabilitating the roadway and parking areas of the Hixson Ball Fields (Hixson, TN). Fortunately, they had just purchased a Model AZ-480HD Asphalt Zipper which made it possible to perform either FDR or FDRC in-house with its own grading and paving work force. Since the area is founded on silty clay soil and is often subjected to flooding (see Figures 1a, 1b, and 1c), choosing a pavement structure resistant to water infiltration and subsequent weakening was imperative. Therefore, the City chose FDRC to rehabilitate the 44,000-square foot paved areas which consisted of approximately 2-inches of asphalt surfacing over approximately 4-inches of aggregate base stone.

To establish water flow off the parking and roadway areas, the pavement was reclaimed to a depth of 8-inches (see Figure 2) and the resulting material was graded and compacted to achieve sheet flow off the pavement. When the initial grading was completed, cement was distributed over the area at a rate of approximately 3% by weight of reclaimed material [i.e., ~24-pounds per square yard (see Figure 3)]. City crews connected a water truck to the Asphalt Zipper's distributor bar and made another pass to mix the cement, water, and reclaimed material. Finish grading and final compaction were completed within a few hours following the mixing operation. The entire process took approximately three days. Within a few days, a 2-inch TDOT

Figure 2 – Pulverization with Asphalt Zipper

Figure 3 – Cement Over Graded Material

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Safe Motor Grader Operation

(Source: 2004 KS LTAP Worksplace and Equipment Safety Fact Sheet)

Advice for Operators:

Do read the operator's manual.
Do a pre-trip inspection.
Clean windows, lights, etc, and clean any debris from the floor of the grader.
Do not let anyone ride along - inside or outside the cab.
Look, then look again, before backing up.
Move your vehicle at a slow speed in congested areas.
Give the right-of-way to loaded vehicles.
Watch for overhead dangers.
Know your work area. Check weight limitations, types of surfaces, and clearances.
Report defective equipment.
Keep your mind on your job.
Select a safe parking area.
Shut down your grader according to the operator's manual.
Wear your hardhat.
Wear your seatbelt.
Wear your safety gloves and appropriate safety gear.
Remove the ignition key when leaving your grader unattended.
Ground your blade when leaving your grader unattended.
Use colored flags on each end of moldboard when blading.
Shift your blade to the center of the grader and lock it when your grader is parked.
Be aware that boarding and exiting the grader may put you in danger of slipping, tripping or falling. Use a three-point (two feet and one hand or one foot and two hands) approach when entering or exiting the cab.
Be sure your grader has the following on board:

- A slow moving vehicle triangle for the back of your grader,
- A visible fire extinguisher - know how to use it, and make sure it is properly charged,
- A hand shovel in good condition,
- The operator's manual.

Communicate with traffic.
Use flashing safety lights on your grader when blading.
Keep your headlights on whenever you operate a motor grader.
Be alert to traffic waiting to pass, and provide the driving public passing opportunities
Use signing and proper flaggers to warn traffic of work in progress or as warning if the grader is left unattended.

Make sure your signs and sign locations conform to the *Manual On Uniform Traffic Control Devices* (MUTCD).

Safety Equipment Suggestions

- Reflective vest
- Seat belt
- Road work ahead signs
- Hard hat
- Radio or Phone
- Close fitting clothing
- Work gloves
- Ear protection
- Safety work shoes

TMOST Workshops Added

Due to an overwhelming demand for TMOST (Tractor/Mower Operator Safety Training), we have added 4 more workshops in October. See Page 6 for the schedule.

Remember, the workshop is limited to 30 participants, so send in your registrations asap.

Shoulder Maintenance: Don't Defer It

Reprinted with permission from The Pennsylvania Moving Forward Newsletter, Volume 20, No. 4. Original article was provided by the University of New Hampshire Technology Transfer Center Newsletter, Fall 1999.

In the rush to complete projects before winter, some municipalities may have postponed shoulder work. However, deferral can result in shoulders that don't serve their purposes, which are just as important through the winter as they are the rest of the year. Those purposes are to:

- Provide side support to the pavement.
- Drain water away from the pavement into ditches.
- Provide a safe area for emergency use by vehicles.

While best completed in autumn, some shoulder work can be performed in winter, barring a long spell of sub-freezing, snowy weather. If the weather doesn't cooperate, best get to the work as soon as shoulders dry out enough to sustain repair in spring.

Drainage

To fulfill their drainage purpose, shoulders must not be higher than the pavement edge, and the shoulder slope should be steeper than the pavement slope. These characteristics are necessary to drain snowmelt as well as rainfall.

On high, rutted, or inadequately sloped shoulders, snow and ice may accumulate near the pavement-shoulder junction, creating a "dike" there. As rain and melting snow and ice drain from the road, the dike on the shoulder will direct the flow longitudinally along the pavement and shoulder at the junction, creating a mini-ditch.

As you know, this is a bad place to collect water, for the road is vulnerable here. Water will enter cracks in the pavement at the junction, as well as soak into the adjacent gravel or turf shoulder, where it will gain access to the road base and subgrade.

As the water migrates beneath the pavement and experiences freeze thaw cycles, it loosens and softens the base and subgrade material. Traffic loads displace the material by flexing the pavement into the soft spots. Quite quickly, the flexing pavement develops potholes and alligator cracks, further access points for water to accelerate the road's deterioration.

Support and Emergency Access

Shoulders that slope too greatly, however, tend to erode. Erosion will expose the pavement edge. Lacking support, the edge may crumble under vehicle loads. Once again, water gains a path to the road base and subgrade.

Eroded shoulder materials may accumulate in ditches, where they can impede ditch flow. Damming water in a ditch is as bad for your road's base and subgrade as diking it at the pavement-shoulder junction.

As an emergency pull-off for vehicles, a steep and eroded shoulder may make a driver's bad situation worse. Furthermore, a shoulder that drops off from the pavement edge can "trap" an errant vehicle's right tires, which may result in a loss of control or rollover as the driver attempts to regain the pavement.

Conditions to Repair

Shoulder repairs slow roadway deterioration and reduce shoulder erosion, thus preventing more costly roadway repair and minimizing the amount of sediment that reaches ditches and streams. Municipalities should repair dirt or gravel shoulders that exhibit one or more of the following conditions:

- The shoulder is higher than the pavement edge.
- The surface shows ruts or corrugations more than 1 inch deep.
- The slope is too close to level to promote good drainage.
- Cuts and gullies have exposed the pavement edge.
- There is more than a 2-inch drop-off to the shoulder from the pavement edge.

Weather permitting, municipalities should repair asphalt shoulders if they are cracked or if a seam has opened between shoulder and travel surfaces.

How to Repair Them

Municipalities can correct poor conditions on dirt and gravel shoulders by reshaping and replenishing.

Reshaping corrects the first three conditions above: high places, ruts and corrugations, and slopes that are too close to level. With a motor grader, crews should shape and smooth the shoulder to the appropriate slope and compact it to ensure that it is not higher than the pavement edge.

Replenishing corrects the final two conditions above: cuts and gullies, and drop-offs. After reshap-

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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.**

Workshop	Date/s	Locations	Instructor/s
Travel Demand Modeling with TransCAD	June 12-14	Nashville	Paul Ricotta
Urban Uses of Concrete	Jul 31	Nashville	Various
Urban Transportation Planning	Sep 6-7	Nashville	Dave Clarke
Signs & Pavement Markings	Sep 12	Jackson	Matt Catt
Work Zone Traffic Control/Flagging	Sep 17	Jackson	Frank Brewer
Work Zone Traffic Control/Flagging	Sep 19	Nashville	Frank Brewer
Work Zone Traffic Control/Flagging	Sep 20	Chattanooga	Frank Brewer
TMOST(Tractor/Mower Operator Safety Training)	Oct 1	Jackson	Jim Green
TMOST(Tractor/Mower Operator Safety Training)	Oct 2	Nashville	Jim Green
TMOST(Tractor/Mower Operator Safety Training)	Oct 3	Knoxville	Jim Green
TMOST(Tractor/Mower Operator Safety Training)	Oct 4	Chattanooga	Jim Green
GeoTech Design/Earthwork: What makes a Good Sub-grade	Oct 4-5	Nashville	Eric Drumm
Design of At-Grade Intersections	Oct 15	Knoxville	Alan Childers
Drainage Rehabilitation	Oct 30	Jackson	Dave Clarke
Introduction to Geometric Design	Nov 13	Nashville	Matt Catt
Pavement Rehabilitation	Nov 27	Nashville	Dave Clarke

TN Safety Circuit Rider (SCR) Program Update

We are continuing to work with counties across the state as part of the Tennessee Safety Circuit Rider (SCR) Program. Lawrence County has completed our half-day roadway safety training workshop and Houston and Tipton Counties have set a training date. Houston County is the first to select a safety improvement project as part of the SCR program. After an extensive inventory of all local roadways within the county, the Houston County Highway Department has located all bridges and culverts that lack needed object marker paddles. The Highway Department has submitted a grant application to TDOT in hopes of funding a significant portion of the costs associated with this safety project. While we continue to reach out to many counties, we welcome your phone calls if you think that your county would be a good fit for the Safety Circuit Rider Program. Call Matt Cate at 1-800-252-7623 or email mcate@utk.edu for more information.

411 Grade E asphalt surface was placed on the stabilized base course and subsequently striped to finish off the project (see Figures 4a, 4b, and 4c).

Figures 4a, 4c, and 4b – Finished Product After 5-Days Work

Cost Comparison

The following cost comparison shows the difference between conventional reconstruction [provided by two contractors] and FDRC:

Conventional Construction	**FDRC**
• Remove Existing Pavement Materials • Prepare Subgrade • Build New Conventional Pavement Structure (i.e. – 6-inches aggregate base / 3-inches asphalt surfacing) • ~ 2 – 3 Weeks	• Materials Cost - $15,388 • Staff & Equipment Cost - $26,875 • 5-Day Construction – 3-Days Reclaiming/Grading/Mixing Cement/Compacting – 2-Days Paving
~ $130,000	**$42,263**
FDRC Was Approximately 33% The Cost Of Conventional Construction	

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Safety Corridor Program

Maintaining vehicle and pedestrian safety is a major public challenge but moving promising safety initiatives from the planning room into actual practice has also proven to be a daunting task for safety experts. Because of this, many states are considering the Safety Corridor concept as a way to help reduce crash and fatality rates in identifiable problem areas. Washington is one such state. What makes Washington State's effort unique is a high level of integration of all safety interests throughout the entire process.

Safety professionals are invited to participate in a Product Demonstration Showcase (PDS) of the Washington State DOT process scheduled for August 23 & 24, 2007 in Vancouver, WA. The Showcase will cover all aspects of the process that was used to bring the Safety Corridor Program to life.

To register, or for more information please

Visit www.utahltap.org

Call Keri Shoemaker (Utah LTAP Center) 435.797.2931

Call Mathew Enders (Washington LTAP Center) 860.705.6907

Shoulder Maintenance: Don't Defer It, *continued from page 5*

ing and compacting the shoulder, crews add, spread, and compact additional gravel.

Shoulders must support vehicle loads. Their materials, therefore, should be similar to those of the road base. Before reshaping and replenishing, it may be necessary to remove organic debris, clays, silts, and other unsuitable materials.

Repair of asphalt shoulders is similar to repair of asphalt pavements. Suitable weather is required to seal cracks on the shoulder and gaps between shoulder and pavement.