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Missouri Transportation Bulletin

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Inside:

Boosting Roadway Safety with Rumble Strips

Approximately one-third of all traffic fatalities and serious injuries in the United States annually are due to run-off-road crashes. In 2000, almost 16,000 deaths were attributed to these types of accidents. Such statistics have caused the transportation community in recent years to take steps aimed at keeping motorists on the road, rather than relying on clear roadsides and traffic barriers to minimize crash severities. One answer: rumble strips. Richard Powers of the Federal Highway Administration's (FHWA) Office of Safety Design says, "Our primary goal is to reduce single-vehicle crashes and fatalities, and rumble strips have proven to be a cost-effective way to keep motorists on the roadway."

Rumble strips are raised or grooved patterns constructed primarily along paved shoulders. When vehicle tires pass over the strips, they produce a sudden rumbling and vibration in the car. Both the sound and the vibration alert fatigued or distracted drivers that they are beginning to drift off the

FHWA is spearheading a movement to increase nationwide use of rumble strips. A new technical advisory released by FHWA in December 2001, *Roadway Shoulder Rumble Strips*, contained the latest information on the state-of-the-practice design and installation of rumble strips, including recommendations for minimizing the adverse effects rumble strips may have on bicyclists using roadway shoulders. The advisory, which also includes an extensive list of reference materials on rumble strip use and effectiveness, is posted on the Web at www.fhwa.dot.gov/legsregs/directives/techadvs/t504035.htm.

Numerous States have performed studies on the effectiveness of rumble strips, with the resulting statistics revealing dramatic success rates. In 1985, the California Department of Transportation (DOT) performed a before-and-after study where it installed rumble strips along sections of Interstates 15 and 40 in San Bernardino County. The study revealed a 49 percent decrease in the number of run-off-road crashes in the areas with rumble strips. Recent follow-up evaluations of freeway segments where shoulder rumble strips have been in place for 3 or more years have shown a 33 percent average reduction in run-off-road accidents.

In the early 1990s, Pennsylvania performed an extensive review of the effectiveness of shoulder rumble strips. As part of this project, the Pennsylvania Turnpike developed a shoulder rumble strip that it called the Sonic Nap Alert Pattern (SNAP). Following the installation of SNAP, the monthly number of run-off-road accidents decreased by 70 percent. A report on the project can be viewed on the Web at safety.fhwa.dot.gov/fourthlevel/rumble/state_penn.htm.

The Delaware DOT's US Route 301 Centerline Rumble Strip Project provides some of the most compelling evidence concerning the success of rumble strips. After experiencing a high fatality rate from head-on collisions on Route 301, the Delaware DOT installed centerline rumble strips along the roadway. The result was a 90 percent decrease in the head-on collision rate and a zero fatality rate. These improvements were achieved despite a 30 percent increase in traffic. The project was awarded one of the 2001 National Highway Safety Awards by FHWA.

In addition to increased safety, rumble strips have been shown to cut costs. Several States have analyzed the benefit/cost ratio of shoulder strips, and the results are as dramatic as the accident reduction rates. New York State

(continued on next page)

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Thruway data indicates a benefit/cost ratio ranging from 66:1 to a high of 182:1. The Nevada DOT found that with a benefit/cost ratio ranging from 30:1 to more than 60:1, rumble strips are more cost-effective than many other safety features, including guardrails, culvert-end treatments, and slope flattening. And a Maine DOT survey of 50 State DOTs identified a benefit/cost ratio of 50:1 for milled rumble strips on rural Interstates nationwide.

Looking at the future, to build on current rumble strip successes, additional installations and evaluations of centerline rumble strips and shoulder rumble strips on two-lane rural roads are needed.

For more information on using rumble strips, contact Richard Powers of FHWA at 202-366-1320 (email: richard.powers@fhwa.dot.gov) or visit FHWA's Rumble Strips Web site at safety.fhwa.dot.gov/programs/rumble.htm. (Reprinted with Permission of the FHWA, May 2002, Focus Publication)

University of Missouri-Rolla Awarded the Missouri LTAP Center Contract

The Missouri Local Transportation Resource Center (MLRTC)

The University of Missouri Rolla has been awarded the contract to administer LTAP program for the next three (3) years (2002 –2004). The program's new name will be the The Missouri Local Transportation Resource Center. The LTAP program has been in existence for 18 years since 1984. From 1984 thru 1988 LTAP was administered by the University of Missouri Rolla. From 1988 to the present the program has been administered in house by MoDOT. Dr. Mohammad Quershi will direct the program at the University of Missouri – Rolla. Effective July 1, 2002 a new toll free phone number will go into effect at MLRTC. It is 1-866-MO-ROADS.

For more information, you can also access the MLTRC website at www.umr.edu/~mltrc.

MLTRC
MISSOURI LOCAL TRANSPORTATION RESOURCE CENTER

New Director of the Missouri Local Transportation Resource Center

Dr. Mohammad Qureshi has served as an Assistant Professor in the Civil Engineering Department at the University of Missouri –Rolla since August 2000. He has experience in the areas of traffic impact studies, traffic operations, highway safety, highway-rail crossing policy, data collection procedures, and statistical analysis of transportation data. Dr. Qureshi has published papers on signalized intersection operations and rail-highway grade crossing policy. Dr. Qureshi received his B.S. and M.S. in Civil Engineering from the University of California, Berkeley and his doctorate from the University of Tennessee in August of 2000.

The Missouri Local Transportation Resource Center will be seeking an energetic individual to serve to handle primary day-to-day operation of the center. Primary responsibilities will include responding to requests for information or technical assistance, maintaining a client database, and managing the center's library of information. The position will come with full benefits including reduced fees for courses at UMR. The individual selected will be considered for admission to graduate school.

The MLTRC is also looking for recent MoDOT retirees to serve as Ambassadors and Circuit Riders. Duties for these positions are still being developed. These positions will be part-time appointments.

Formal job announcements on these positions will be published at a later date. For more information, please contact Dr Mohammad Qureshi at 573-341-4693 or qureshim@umr.edu.

QuickZone 1.0: A Better Approach to Work Zone Planning

How will the construction or rehabilitation project that you're planning affect motorists? What will be the costs of traveler delay caused by your project? What might be the effect of contractor-suggested changes in the approved Traffic Control Plan? QuickZone 1.0., a new software program available from the Federal Highway Administration (FHWA), can help answer those questions and more.

QuickZone compares the traffic impacts for work zone mitigation strategies and estimates the costs, traffic delays, and potential backups associated with these impacts. For example, if a highway agency planned to widen a shoulder, QuickZone could estimate the costs of doing work at night instead of during the day or diverting the traffic to one road versus another road during different phases of construction. The costs, traffic delays, and potential backups can be estimated for both an average day of work and for the whole life cycle of construction.

"QuickZone can help State and local traffic, construction, operations, and planning staff, as well as construction contractors, better perform their job by making them aware of the effect that different work zone phasing has on the motorist from both a cost and delay standpoint. This benefits everyone from highway officials to construction workers to motorists and improves overall work zone safety," says Deborah Curtis of FHWA's Mobility and Safety Integrated Product Team.

The software provides information in a spreadsheet form. A user need only have Microsoft Excel 97 or higher running on a Windows-based PC to use the application. To run the program, the user would enter data on the planned work zone, such as:

- Location
- Any projected detour routes
- Anticipated volumes of traffic
- Construction dates and times.

The program then displays the amount of delay in vehicle hours, the maximum length of the projected traffic queue, and the costs associated with the work activity.

QuickZone can also analyze the advantages of various strategies for minimizing the projected traffic delays. These mitigation strategies might include retiming signals on detour routes to help traffic flow more smoothly, planning a media campaign to publicize the planned work zones, or using traveler information systems that allow drivers to plan ahead and choose other routes if possible.

For more information about QuickZone, contact Deborah Curtis at FHWA, 202-493-3267 (email: deborah.curtis@fhwa.dot.gov). To obtain a copy of the software, contact the McTrans Center at the University of Florida, 352-392-0378 (fax: 352-392-6629; email: mctrans@ce.ufl.edu; Web: mctrans.ce.ufl.edu). (Reprinted with Permission of the FHWA, December 2001, Focus Publication)

MoDOT's Smart Work Zone Technology at Work in Wentzville

On May 22, 2002, the Quixote *Intellizone* was implemented as a freeway work zone speed advisory system located on Eastbound I-70 near Wentzville Parkway and Pearce Boulevard, which is just west of St. Louis. The *Intellizone* system consists of three mobile count units per lane, mobile command unit and two variable message signs (VMS) units. The three mobile counter units measure the speed, density and flow of the traveling public within the work zone. The mobile command unit will take information from the three mobile counter units on average speed and send signals to the VMS units to indicate an appropriate message located approximately two miles and five miles upstream from the mobile counter units. The mobile command units communicate with the VMS units using line-of-sight or cellular communication. VMS units will provide a standard warning of the construction zone under free flow conditions. When traffic queues cause significant speed reductions the VMS units will warn of the reduced speed ahead by displaying the downstream speed.

For further information of the Quixote Intellizone system please contact Dan Smith at (573) 526-4329. If interested in other work zone systems tested please logon at the following address http://www.matc.unl.edu/research/MwSWZDI.

Transportation Socio-Economic Indicator Web Page is Up!

MoDOT's work with the Office of Social and Economic Data Analysis (OSEDA) has resulted in the release of a transportation- related web site designed to provide transportation planners and decision-makers with relevant social and economic information. This site, while still in its development stages, is designed to provide MoDOT and it's partners with the most current and accurate data needed by census information users in transportation.

The front page of the MoDOT/ OSEDA site shown below provides a gateway into the different geographies needed for transportation planners.

See the MoDOT/OSEDA web page at: http://oseda.missouri.edu/~diana/oseda/modot_web_project/.

Or for general information or data related to social/demographic or economic data, see the OSEDA website at: http://www.oseda.missouri.edu/

Training on how to best use social and economic in planning and transportation decision-making will take place this fall in several locations across the state. A sign-up for the training sessions will be included in the next LATAP newsletter. For more information on this project please email Ernie Perry at perrye1@mail.modot.state.mo.us.

We want to hear from you ...

Let us know if your address has changed.

Mike Shea, LTAP Director
Phone: 573-751-0852
e-mail: sheam@mail.modot.state.mo.us

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Work Zone Research from A to Z

With the increased emphasis on improving mobility and safety in work zones nationwide, numerous transportation agencies and others are conducting a range of work zone-related research activities. Now an easy-to-use compendium developed by the Federal Highway Administration (FHWA) puts this collected information at your fingertips. The compendium, which is in Microsoft Access database format, contains information on work zone research, development, and technology transfer projects.

Through interviews conducted with FHWA staff, literature reviews, Web site searches, and attendance at research presentations, FHWA identified 332 recent and ongoing research projects (1997 to present). Each project was documented and classified based on its applicability to different phases of work zone activity (e.g., design, operations) and related subject areas (e.g., worker safety, traffic management). The database provides users with the capability to conduct keyword searches and generate reports that include such details as:

- Basic project identifying information (including title, description, performing agency, completion date, and point of contact)
- Format of available project information
- Relevant phases of work zone activity
- Related subject categories.

Analysis of information in the compendium shows that the largest portion of the documented projects were related to work zone operations. Traffic management was the most often cited related subject in the work zone studies area.

As the number of work zone studies increases, so does the likelihood of repeat studies. With the release of the compendium, FHWA hopes to cut down on the number of redundant research efforts, thereby helping transportation agencies and related researchers more effectively spend their limited research budgets. "This is one tool that transportation agencies can use to help maximize their overall efforts related to work zones, and ultimately improve safety and mobility for travelers and workers during construction and reconstruction efforts," says Jim Sorenson of FHWA.

The compendium will be posted this month on FHWA's Work Zone Web site at www.ops.fhwa.dot.gov/wz/techshar.htm. To obtain a copy of the Compendium on CD-ROM, contact Marianna Rizzo of FHWA at 202-366-9631 (email: marianna.rizzo@fhwa.dot.gov). Other related tools available include FHWA's *Work Zone Best Practices Guidebook* (www.ops.fhwa.dot.gov/wz/bestprac.htm) and QuickZone, a user-friendly tool to estimate and analyze delays in work zones for both the planning and construction or operations phases of projects. To obtain a copy of QuickZone, contact the McTrans Center at the University of Florida, 352-392-0378 (fax: 352-392-6629; email: mctrans@ce.ufl.edu; Web: mctrans.ce.ufl.edu). For more information on QuickZone, see article in December 2001 *Focus*.

For more information on the compendium, contact Tracy Scriba at FHWA, 202-366-0855 (email: tracy.scriba@fhwa.dot.gov) or Jim Sorenson at FHWA, 202-366-1333 (email: james.sorenson@fhwa.dot.gov). (Reprinted with Permission of the FHWA, May 2002, Focus Publication)

Inside:

Purvis Inducted Into the University of Missouri-Rolla Academy of Civil Engineers

Ray Purvis is MoDOT's State Research, Development and Technology Engineer. While a student at UMR, Ray "co-oped" with MoDOT and joined the Department on graduation in 1974. Since that time, he has held various assignments in MoDOT and now is the State's Chief RDT Engineer. Ray is the Missouri representative on the AASHTO Research Advisory Committee, and is the Chairperson of MOTREC, a research partnership between MoDOT, UMC and UMR. He has been the recipient of two AASHTO Trailblazer Awards. Ray is currently preparing for the Deaconate Program in the Roman Catholic Faith. This five-year program will culminate with Ray's ordination as a Deacon in May of next year. Married to Donna for 28 years, they have two adult children, Jeff who graduated from UMR and Laura who is a student at Central Missouri State University.

Installation and Initial Performance of 60" ADS N-12HC® HDPE Pipes

Research Investigation 01-037
June 2002

Introduction

Highway drainage pipes are built using metal, clay, concrete or plastic. Since the early 1930's, MoDOT has continued to conduct various studies to monitor and evaluate the durability and performance of culvert pipe materials used in Missouri. Metal pipes are considered highly susceptible to corrosion, and a majority of the metal or steel pipe failures can be attributed to corrosion. Concrete pipes are susceptible to corrosion due to exposure to a low PH or the presence of sulfates in soil or water. High-density polyethylene (HDPE) is being used as drainage pipe because it is lightweight, corrosion resistant, easy to install, and has a low maintenance cost. However, as a newer material, the long-term performance of HDPE pipe is still under evaluation.

Statement of Problem/Scope of Work

Polyethylene pipe has been installed in Missouri since 1983 and continues to perform. In 1999, the first 60" (1500mm) N-12 HC® HDPE pipe was installed in St. Clair County, MO. Before this, the HDPE pipes being installed had smaller diameters because there is no AASHTO designation for plastic pipes with diameters larger than 48". One year later, another 60" HDPE pipe was installed in Franklin County, MO.

These two 60" HDPE pipes were installed as crossroad culverts to evaluate their performances. For such large diameter flexible pipe, one main concern is its wall stability. This study approached this issue by monitoring the pipe deflections and joint separations.

Figure 1
60" (1500mm) N-12 HC® HDPE Pipe

Current Research Results

MoDOT District 7 maintenance crews installed the first pipe (referred to as Pipe 1) in June of 1999 on Route B, St. Clair County. The second 60" pipe (referred to as Pipe 2) was installed in August 2000 on Route FF, Franklin County by Krupp Construction.

RDT personnel observed both installations. Since the installations, pipe deflections have been monitored. Based on field observations and data analysis, this study concludes that Pipe 2 is performing better than Pipe 1. The most distinguishable factor, which may contribute to this performance difference, is the different compactions these two pipes experienced during the installations. Pipe 2 had much better compaction than Pipe 1 both in bedding and backfilling procedures.

AASHTO Section 30(Installation) now recommends the deflection be less than 5% of the actual inside diameter 30 days after installation. MoDOT Standard Specifications 730.7 specifies that the internal diameter of the pipe should not be reduced by more than 5% of its base inside diameter when measured not less than 30 days following completion of installation. 42 days after installation Pipe 1 had a maximum deflection of 7.3%, exceeding AASHTO Section 30 recommendations and MoDOT specifications, which is not acceptable. Two years and four months after the installation, the maximum deflection was measured as 8.4%, which is not accept-

able, either. Since excessive deflection may lead to pipe cracking, Pipe 1 may require maintenance or replacement sooner than Pipe 2 due to installation procedures, and most likely not due to the actual material or manufacturing of the pipe itself.

Figure 2.
Pipe 1 Bedding Compaction

Figure 3.
Pipe 2 Bedding Compaction

Pipe 2 did not get a perfect installation, but it is performing well. The two-week-after-installation deflection was rather small. One year after the installation, the maximum deflection was 5%, and the deflections at other points were considerably lower.

Both pipes have joint separations. Pipe 1 had a maximum of 1 3/8" two years after installation, while Pipe 2 had a 2" maximum one year after its installation. But considering the bell overlaps the spigot by 9.57", there may be no threat of leaking. Existence of long-term undermining is not known at this time.

Recommendations

Both pipes should be inspected yearly to monitor their performances and be documented accordingly. Any immediate repairs necessary will then be forwarded to the appropriate maintenance personnel. If there are other large size HDPE pipes to be installed in Missouri, this study recommends proper installation procedures be followed.

For more information, please contact Julie Yin at 573-522-1947 or e-mail: yinx1@mail.modot.state.mo.us.

Expert Team Conducts Peer Exchange of MoDOT's RD&T Program

April 29th – May 2nd, Jefferson City
The Missouri Department of Transportation hosted a Peer Exchange of its research program April 29 - May 2, 2002 in Jefferson City. Members of the Peer Exchange Team included the following:

- Richard L. McReynolds, Kansas Department of Transportation, Team Leader
- Peter Clogston, FHWA, Missouri Division
- David Lippert, Illinois Department of Transportation
- Moy Biswas, North Carolina Department of Transportation
- Leanna Depue, Central Missouri State University
- Bill Schonberg, University of Missouri, Rolla
- Roger Port, FHWA, Tennessee Division (retired)
- Richard Pain, Transportation Research Board
- Ray Purvis, Missouri Department of Transportation

The expressed objectives of the peer exchange were to:

- Verify and/or improve research-related processes
- Increase effectiveness of research, development and technology transfer efforts to best serve MODOT strategic goals and objectives
- Benchmark performance

Several common themes emerged from the discussions:

- Expand communications to improve effectiveness and knowledge of the research process
- Importance of policy research
- Importance of implementation and measurement processes
- Enhance customer service and delivery strategies to meet diverse customer needs
- Efficiency and "the need for speed" to meet MoDOT needs

Implementation Plan

The RD&T office is currently drafting a proposal to implement several of the key planned actions recommended by the Peer Exchange Team. Review and approval of these actions is anticipated by MoDOT management.

The Opening Peer Exchange Session on April 29, 2002 at the RDT office in Jefferson City. Seated from Left to Right is peer exchange leader Dick McReynolds Research Director for the Kansas DOT, Kevin Keith Chief Engineer for MoDOT, team member Bill Schonberg, Professor and Chairman of University of Missouri - Rolla CE Department and Ken Fryer, State Project Operations Engineer for MoDOT.

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