TECH TRAN
TECHNOLOGY TRANSFER ASSISTANCE PROGRAM

Missouri Transportation Bulletin

■ Research, Development & Technology Division
Missouri Department of Transportation
■ Federal Highway Administration
■ Local Technical Assistance Program

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Inside:

Accessibile Sidewalks and Trails – *New Guidelines*

The Americans With Disabilities Act of 1990 (ADA) was a major addition to our many existing civil rights laws. ADA was the formal acknowledgment that a significant portion of the U.S. population was being unintentionally discriminated against because of the many physical barriers that were built into the system. As a result, many ADA design guidelines covering various topics were developed and issued over the past 10 years. However, design, construction, and maintenance guidelines for features within the public highway and street right of way were debated and deferred during this time period. With no detailed guidance covering the public right of way, an enormous number of opportunities to improve accessibility were missed on projects involving sidewalks, trails, and signals.

The proper design, construction, and maintenance to make our public right of way accessible are relatively simple if one understands the mobility needs and limitations (or capabilities) of the disabled and the needed design details. To help in this understanding, some excellent and easy-to-read references were recently published. The references are:

1. Accessible Rights-of-Way: A Design Guide, November 1999 - http://www.access-board.gov/publications/PROW%20Guide/PROWGuide.htm

2. Designing Sidewalks and Trails for Access, Part I of II, July 1999 (http://www.fhwa.dot.gov/environment/bikeped/access-1.htm)

3. Designing Sidewalks and Trails for Access, Part II of II, September 2001, yet to be added to the website (Publication # FHWA-EP-01-027, HEPH/8-01 (10m)E)

4. Building a True Community, January 10, 2001 (http://www.access-board.gov/prowac/commrept/index.htm)

5. Accessible Pedestrian Signals - http://www.access-board.gov/research&training/pedsignals/pedestrian.htm

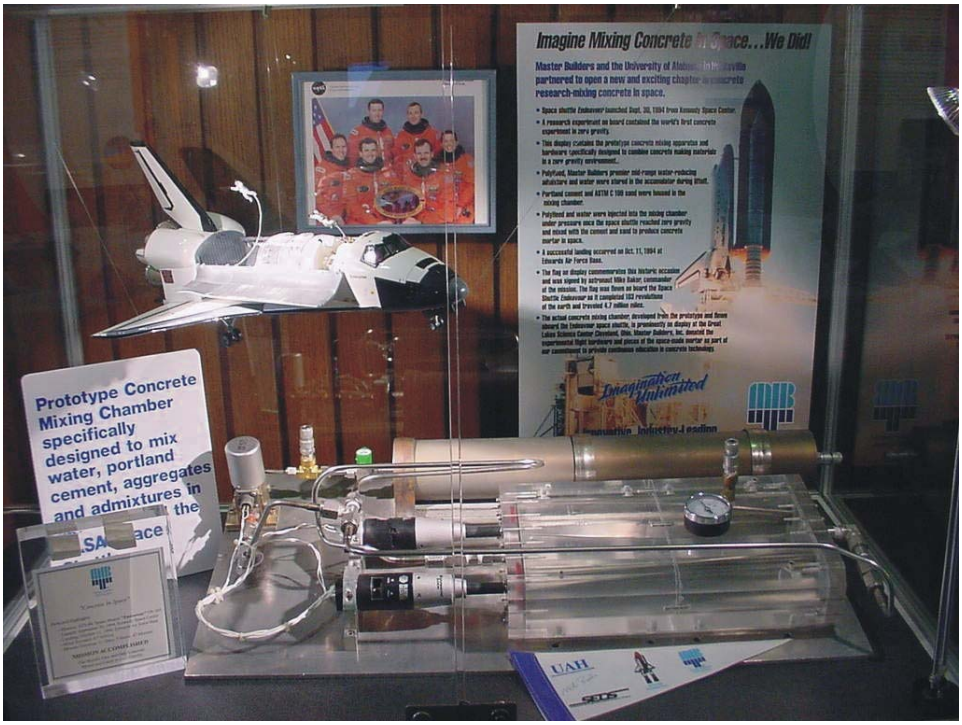
6. Other references - http://www.access-board.gov/indexes/pubsindex.htm

The fax-in order form for hard copies of references 2 and 3 can be found at http://www.fhwa.dot.gov/environment/bikeped/index.htm

These references point out the fact that accessibility can't be an afterthought to designs but have to be an integral part of the project from the very start. Accessible public right of way is more than three lines shown on a plan sheet depicting ramps at mid block or intersection corners. These references describe the user or design persons (wheel chair, walkers, crutches, visually, or hearing impaired) and their special needs. They illustrate problems and present solutions.

Engineers responsible for our highway and street system should refer to these to properly design pedestrian facilities. Further, each jurisdiction should evaluate their standard drawings for sidewalks, trails, and signals against the guidelines and make improvements.

Overall, the United States has made tremendous progress in making public and private facilities accessible. However, we still have much to do for our disabled population to allow them to become totally independent.



Concrete Mixed in Space

Master Builders Inc. In Cleveland Ohio requested a presentation on the Automated Concrete Analysis System (ACES) so they could consider participating in the upcoming pool fund study which will complete the verification and validation which is the final phase of development. Chris Baumgart, and Steve Cave from the Honeywell Corp. in Albuquerque New Mexico and Nelson Cook of MODOTs Research, Development, and Technology made the presentation.

A tour of the Master Builders Laboratory included several new and several not so new testing methods.

The Concrete Mixing Device and two 1 inch. cubes of concrete which had been mixed aboard one of the Space Shuttles is on display in the laboratory.

The 53rd Annual Missouri Traffic and Safety Conference

The 53rd Annual Missouri Traffic and Safety Conference is scheduled for May 13-15, 2003 at the Holiday Inn Select in Columbia. As in the past the afternoon of May 13th will have two 3-4 hour technical workshops (one on Access Management for Arterial Streets and the other, by popular demand, on the MUTCD). The Traffic and Safety Conference will run from eight o'clock on May 14th through noon on the 15th. An excellent agenda, with dual tracks for enforcement and engineering, has been put together including the "Improving Local Traffic Flow" panel session that was so well received last year. Please call Charlie Nemmers at the University of Missouri-Columbia (573-882-0071) or John Schaefer at MoDOT (573-751-2845) for more information. Registration forms will be mailed out in March.

Missouri Concrete Conference

University of Missouri-Rolla
April 9-10,2002
The 2002 Missouri Concrete Conference will be held on Tuesday and Wednesday, April 9-10, 2002 at the University of Missouri-Rolla. Presentations at the conference include:

Effects of excess water on concrete, traffic opening criteria for new slabs, joint sawing, resealing sawed joints, keyed longitudinal joints, architectural flatwork, ACI building code update, precast residential concrete walls, acceptance of concrete, use of larger stone to prevent cracking, pervious concrete, high performance concrete in bridge decks, MoDOT's new QC/QA program, September 11, UMR's new concrete labs, new Missouri cement plant, and MoDOT update: dowel bar inserters, new smoothness spec, pavement type selection process, and pre-acceptance material list.

The conference should be of interest to contractors, public agencies, consulting engineers, testing labs, aggregate producers, ready mix, cement and admixture suppliers, and equipment technical reps.

For conference program information contact Dr. Dave Richardson, Confer-

ence Director (573-341-4487; richardd@umr.edu) and for registration information contact Engineering Continuing Education, Room 105 ME Annex, University of Missouri–Rolla, Rolla, MO 65409-1560, (573-341-4200; suep@umr.edu).

MoDOT to Contract LTAP Program

The Missouri Department of Transportation is currently reviewing proposals to contract the Missouri LTAP program for the next three (3) years. The program began in 1984 and has been serving Missouri's counties and municipalities for 18 years. The purpose of LTAP is to serve as an information clearinghouse for cities and counties on transportation. Training is key and is the heart of the LTAP program. Traditionally the Missouri LTAP has provided training to the locals on Gravel Roads, Work Zone Safety, Traffic Counting and etc…

From 1984 thru 1988 the LTAP program was contracted to the University of Missouri – Rolla. From 1988 to the present the program has operated out of the MoDOT office. It is anticipated that a contractor will be named by May.

Historic Bridges Available

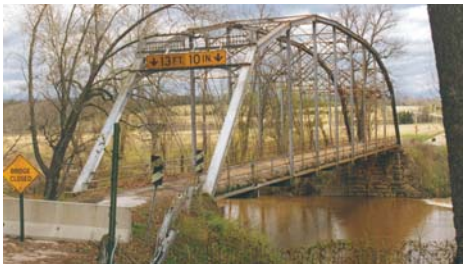
Upper Blackwell Road Bridge
Section 6, Township 38N, Range 4E
Jefferson County, Missouri
The bridge, constructed in 1930/31, consists of three Pratt through trusses totaling 415 feet. One Pratt truss is an eight panel rigid-connected through truss, while the other two Pratt trusses are pin-connected through trusses, one being eight panels, the other six panels. Roadway width is 12.9 feet and consists of an asphalt-covered timber deck over steel stringers. A steel stringer approach span exists at one end. The Upper Blackwell Road Bridge over Big River is available for adaptive reuse. The prospective purchaser accepting ownership of the bridge will be responsible for the dismantling, transport, reassembling and maintaining the structure in accordance with the "Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings." If purchased, the deed will include preservation covenants. The bridge is eligible for listing in the National Register of Historic Places.

Contact: Steven Oldham, Deputy Director of Public Works, Jefferson County Courthouse, PO Box 100, Hillsboro, MO 63050, (636) 797-5569

Grundy County, Missouri: Historic bridge available for adaptive reuse and removal. This is a 179-foot long, single-span Parker through truss bridge across Honey Creek. Interested parties please contact Steve Dasovich, SCI Engineering, Inc. 130 Point West Blvd., St. Charles, MO 63301 636-949-8200

Franklin County, MO: The "Noser Mill Bridge" (F-424) carrying old Route 185 over the Bourbeuse River two miles south of U.S. Route 50 is available for adaptive reuse at a new location, or in place. If the bridge is transferred to another party, the transfer deed may include preservation covenants that require the new owner to preserve, and maintain the bridge in accordance with established standards for historic bridges. Monies may be available for reuse of the bridge.
Description: The National Register of Historic Places-eligible bridge was constructed in 1902 by the Midland Bridge Company. It is 190 feet long and consists of a 10-panel pin-connected Parker through truss, with four steel stringer approach spans. It features decorative finials and portal cresting. The roadway width is 15 feet.
Interested Parties: Contact Randall Dawdy, Cultural Resources Section, Missouri Department of Transportation, P.O. Box 270, Jefferson City, Missouri 65102, phone: (573) 526-3591, FAX: (573) 526-1300, or email: dawdyr@mail.modot.state.mo.us, by October 31, 2002.

Noser Mill Bridge



Cooper County, Missouri: Historic bridge available for adaptive reuse and removal. This is a 228-foot long, pin-connected Pratt through truss bridge across the Lamine River on Mt. Moriah Road. Interested parties please contact Steve Dasovich, SCI Engineering, Inc. 130 Point West Blvd., St. Charles, MO 63301 636-949-8200

Gasconade County, Missouri
The "Gasconade River Railroad Bridge (Bridge No. 21)" is available for adaptive reuse. This NRHP eligible bridge was constructed in six spans from with Span 5 built in 1896 and Spans 1, 2, 3, 4, and 6 were built in 1902 by various contractors for the Missouri Pacific. The four through riveted truss skew spans (ranging in length between 129 ft and 146 ft) and two beam spans (each 92.5 ft long), will be match-marked, dismantled, and stored for further handling by the responsible party accepting ownership. If interested, responsible parties, considered being those showing appropriate financial (including necessary financial resources and insurance coverage) and organizational strength should contact Bill Stapp, Union Pacific Railroad, Omaha, Nebraska 402-271-2046

Gasconade River Railroad Bridge

Update on MoDOT and OSEDA Census Data Implementation Project

Release of census data from the U.S. Census Bureau continues with the bulk of the information needed by transportation agencies expected to be released by the fall of 2002. MoDOT is continuing its work with the Office of Social and Economic Data Analysis (OSEDA) at the University of Missouri-Columbia to collapse the tremendous amount of data available into useable information for transportation planning and project development.

OSEDA is developing manageable and accurate data sets specific to transportation that may be of use to your organization. Additionally, OSEDA will offer training for transportation professionals on using this information in the planning and project development process. Specific areas that can be addresses with social and economic census data include; understanding transportation needs, estimating the impacts of transportation projects on the community, using census data to estimate Title VI and Environmental Justice impacts, how the data can be used to understand and communicate with the public, and the use of this data in transit, rail and waterways planning.

The information and training developed through this project will be made available to planning groups and communities this fall. This summer, we will again provide the opportunity for groups and individuals to sign up to attend training sessions – check this newsletter later this year for sign-up information. Training will be offered at several locations across the state.

Check the OSEDA website for additional information on the release of 2000 census data and a summary of this project at: http://www.oseda.missouri.edu/.

Want to Know More About Gravel Road Maintenance and Design?

A New Manual on "Gravel Roads – Maintenance and Design Manual" is out for your use. South Dakota LTAP in conjunction with the FHWA are pleased to offer this new manual. The Missouri LTAP wishes to thank Ken Skorseth author and South Dakota LTAP Field Service Manager for his efforts in putting this manual together. The following is the forward to the manual.

There are over 1.6 million miles of unpaved roads (53% of all roads) in the United States. In some nations, the road network is predominantly unpaved and generally consists of gravel roads. This manual was developed with a major emphasis on the maintenance of gravel roads, including some basic design elements.

Gravel roads are generally the lowest service provided to the traveling public and are usually considered greatly inferior to paved roads. Yet, in many rural regions, the volume of traffic is so low that paving and maintaining a paved road is not economically feasible. In many cases, gravel roads exist to provide a means of getting agricultural products in and out of farm fields, timber out of forests, or as access to remote areas such as campgrounds and lakes. Many gravel roads serve rural residents as well. Many of these roads will remain unpaved due to very low traffic volume and/or lack of funds to adequately improve the subgrade and base before applying pavement layer(s). In some countries, economic constraints mean gravel roads are the only type that can be provided.

The purpose of this manual is to provide clear and helpful information for doing a better job of maintaining gravel roads. It is recognized that very little technical help is available to small agencies that responsible for managing these roads. Gravel maintenance has traditionally been "more of an art than a science" and very few formal standards exist. This leads to many arguments between grader operators, managers, and motorists over questions such as: What is enough surface crown? What is too much? What causes corrugation? This manual contains guidelines to help answer these and other questions about the maintenance of gravel roads.

This manual is designed for the benefit of elected officials, managers, and grader operators who are responsible for designing and maintaining gravel roads. The information provided the manual is as nontechnical as possible without sacrificing clear guidelines and instructions on how to do the job right.

These manuals will go fast. If you would like a copy please contact Donna Ridenhour at 573-751-3002.

Pothole Repair

Pothole repair in asphalt concrete pavements is one of the most common highway maintenance operations. To better understand the performance and cost-effectiveness of various cold-mix materials and procedures, the Strategic Highway Research Program (SHRP) undertook the most extensive pavement maintenance experiment ever conducted. The primary objective of the pothole experiment was to determine which combinations of materials and patching procedures provide the most cost-effective repair of potholes in asphalt concrete-surfaced pavements.

Several patching techniques were used with the various cold mixes: **Throw-and-Roll:** material is placed in a hole which may be filled with water and debris, and then compacted by four to eight passes of the truck tires. **Edge Seal:** a throw-and-roll procedure plus edge sealing, using asphalt tack and sand on the road surface**. Semi permanent:** water and debris are removed from a hole, the sides are squared up and coldpatch material is compacted by rollers or vibratory compactors; **Spray Injection:** water and debris are blown out of a pothole, virgin asphalt and aggregate are sprayed into the pothole, and a layer of aggregate is placed on top of the patch.

Evaluations

The performance of the materials and procedures was observed to determine the most cost-effective repairs. Initial evaluations were made at 1, 3, and 6 months then semiannual inspections were performed for the next eighteen months. Two main types of data were collected. The first was survival data, consisting of the number of patches still in service along the test site. The second type gauged distresses including bleeding, cracking, dishing, edge disintegration, missing patch, raveling, and shoveling present in the surviving patches.

Key Findings

- The throw-and-roll technique proved as effective as the semi-permanent procedure. The semi-permanent procedure has higher labor and equipment costs and lower productivity. Thus, the throw-and-roll procedure is more cost-effective in most situations.
- Pothole patches are intended to be temporary repairs, but the success rate observed in this project indicated that materials are available that can remain in service for several years.
- The spray-injection repairs performed as well as the comparable control patches at all sites. This effectiveness, however, depends on the expertise of the operator.
- Of eight agencies that participated, three switched from inexpensive cold mixes to materials provided through the project, one purchased a spray-injection device to replace conventional cold-mix patching procedures.

Recommendations

- Use high-productivity operations in adverse weather. The prime objective of a patching operation should be to repair potholes as quickly as possible. The throw-and-roll and spray-injection procedures produced high-quality repairs very quickly in all cases.
- Use the best materials available. Poor-quality patching material quickly offsets any savings from the purchase of a less expensive cold mix. Consider crew safety, user delay costs and repatching costs in calculating operation costs.
- Aggregate and binder compatibility should be tested on a small scale. This testing is necessary when new combinations are being used and there is no record of past performance.

Reprinted with permission from the Rhode Island Technology Center's newsletter "Links & Nodes", Fall 2001, Volume 11, Number 2.

Missouri State Surplus Equipment

The Missouri Revised Statute, Chapter 226 Section 226.150 allows the state to sell unnecessary tools or equipment. General Services has compiled a list of equipment and vehicles that include light duty passenger cars and trucks, utility trucks, vans, dump and platform trucks, heavy duty trucks, tractors and mowers, backhoes, forklifts, loaders, motor graders, drills and augers, cranes, trailers, air compressors, sweepers and miscellaneous equipment. This equipment is available for sale at prices determined by General Services to cities, towns, counties and political subdivisions prior to its sale at auction.

Advantages of purchasing state surplus equipment usually result in the acquisition of well-maintained product meeting state specifications at a reduced cost, and may reduce time and manpower in processing and evaluating requisitions and awards for bid. If a political subdivision is interested in this program, they can call Alan Lepper at 573-526-7931 for items for sale, pricing and payment specifics.

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

Future Events

April 9-10, 2002
Missouri Concrete Conference
The 2002 Missouri Concrete Conference will be held at the University of Missouri-Rolla.
For conference program information contact Dr. Dave Richardson, Conference Director (573-341-4487; richardd@umr.edu) and for registration information contact Engineering Continuing Education, Room 105 ME Annex, University of Missouri–Rolla, Rolla, MO 65409-1560, (573-341-4200; suep@umr.edu).

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The Missouri Transportation Bulletin is published by the Technology Transfer Assistance Program of the Missouri Department of Transportation, Jefferson City, Missouri. The opinions, findings or recommendations expressed in this Bulletin are not necessarily those of MoDOT or the Federal Highway Administration.

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Bringing the Nightime Road to Life

Patrick Hasson, Safety Engineer, FHWA Midwestern Resource Center,
Ernie Huckaby, Rudy Umbs

Background

The risk of dying in a crash at night is nearly three times the risk of dying in daylight hours. In 1998, about 27,000 people died in nighttime traffic crashes in the United States, even though only about 25 percent of travel is at night.

One of the reasons that nighttime driving risk is so much higher is because in the daylight the road is filled with more visual cues that help to guide drivers and keep them on the road. Though a single causal factor cannot be assigned to nighttime crashes, it is clear that an individual driver's night vision characteristics and a lack of adequate visual guidance information are significant factors. In either case, if cues that are essential for safe driving are inadequate at night, the potential for a driving or judgmental error to result in a serious crash is considerably increased. The situation is only made worse when other factors — e.g., fatigue, intoxication, inclement weather, higher speeds of travel on some roadways, etc. — combine with inadequate traffic control devices to make nighttime driving less safe.

The issue of visibility on rural roads — i.e., the greatest distance under given weather conditions to which it is possible to see — is of special interest when one considers that nearly 60 percent of all road fatalities in the United States occur on rural roads. The risk of dying in a rural road crash is more than twice as high as the risk of dying in a crash on an urban road or a non-rural Interstate.

There are many reasons that the risk of dying on a rural road is higher, including: differences in operating speeds, road geometry, functionality, and other factors. It is these factors that create the situation in which nearly 80 percent of all fatal rural road crashes are either run–off–the–road, intersection or head–on collisions. The possibility for any of these crash types is heightened at night and, for each, visibility is a key factor.

The Case for Retroreflectivity

Visibility can be improved through a variety of means such as retroreflectivity, roadway lighting, and automobile headlights. Though retroreflectivity in the form of pavement markings and sign sheeting does not resolve all of the problems, especially in wet or other adverse weather conditions, its relative low cost and versatility makes it a preferred alternative for most applications today.

At night, with many of the visual cues missing, the driver relies on the added retroreflective elements of signs and markings, such as edge lines and post-mounted delineators for curve preview and center lines for guidance in the curve. It is very possible that these will be the major visible elements to a driver on a road at night. The retroreflectivity of signs and markings can serve to provide positive visual guidance that helps drivers keep their cars in their lanes or on the road. They also offer the possibility to share critical warning, timely location and other information to drivers. The retroreflectivity of signs and markings is a critical ingredient in creating a much safer road environment.

As an example of the safety value added by retroreflectivity, consider a sharp curve on a rural road. In the daytime, there are many visual cues such as a line of trees or a guardrail that can alert the driver to the sharpness of the turn in time for a driver to alter their speed accordingly. *(continued on next page)*

Inside:

Road engineers also use pavement markings to reinforce these cues. A retroreflective edge line in this situation will provide the driver with a long-distance preview of the curve while the center line will provide other useful guidance through the turn.

Retroreflective materials are subject to deterioration brought on by the natural elements, and the ability for a sign, delineator or pavement marking to continue to provide quality information or guidance to a driver decreases over time. If some minimum retroreflectivity is not maintained, the sign, delineator or marking will not accomplish the job it was intended to perform. While the Manual on Uniform Traffic Control Devices (MUTCD) has required since 1954 that signs and pavement markings shall be reflectorized or illuminated, the MUTCD contains no minimum in-service retroreflective requirements for signs or markings. (Note: ASTM D4956–89 Standard Specifications for retroreflective sheeting purchase specification used by the States is not to be confused with in–service minimum levels of retroreflectivity.) This fact coupled with the recognized importance of retroreflectivity to highway safety motivated the U.S. Congress to pass a law in 1993 that required the Federal Highway Administration (FHWA) to establish minimum maintained levels of retroreflectivity for signs and pavement markings.

What Does This Mean to You?

The minimum maintained levels of retroreflectivity that are accepted will have many potential impacts. First, it is likely that the guidelines will have the greatest impact on the maintenance of signs on the National Highway System (NHS). Beyond the NHS the impacts are less clear. Certainly, some States may require that all local road agencies adopt the minimum guidelines.

However, other States may not go that far. But, the mere existence of minimum guidelines could create a situation in which local agencies are compelled for one reason or another, e.g., liability issues, etc., to begin applying the minimum guidelines in their regular practice. As well, from strictly a safety point of view, minimum guidelines will provide a valuable tool for road engineers to use on roads that have high traffic volumes or for high–hazard locations. For all of these reasons, it is essential that road managers and engineers stay abreast of the development of the guidelines and consider how they will have an impact in their future road programs.

In another vein, the costs associated with implementing minimum maintained levels of retroreflectivity for signs have been examined. Based on the average condition of road signs in 1994, the FHWA estimated in 1998 that 5 percent of signs under the state jurisdictions and about 8 percent of those under local jurisdictions would not meet the proposed minimum maintained and would therefore need to be replaced. This translated to a cost of about $32 million for the State agencies combined and about $144 million for the local agencies combined. These are costs associated with replacing all signs at one time. The report concluded, however, that on a practical level, sign replacement rates would probably not be accelerated above current levels and many agencies would not likely feel any impact of implementing the minimum maintained levels of retroreflectivity. The report went further to state that the development of a sign inventory program that includes retroreflectivity measurements would lead to making investments in a planned manner that, in the long run, are likely to reduce the overall maintenance and replacement rates of traffic signs in the future.

What's Being Done?

The FHWA has been performing retroreflectivity research to improve nighttime driving safety since the early 1980s. Some of the areas covered in this research included studies on the service life of signs, sign and pavement marking management systems, and traffic sign and pavement marking

retroreflectometers. Following the Congressional requirement in 1993, the FHWA also completed research on what levels of retroreflectivity are needed to safely guide drivers at night and analyzed the economic impacts to the public if minimum retroreflectivity values are established. The overall goal of all of these studies was to obtain information necessary to establish minimum maintained levels of retroreflectivity and to develop management programs and measurement devices that will be needed by the States and others to maintain traffic control devices at an adequate level. Thirty two States were actively involved with the FHWA in this research.

Recognizing that there are already many different models of hand–held retroreflectivity measuring devices available today, the FHWA began to develop mobile units capable of measuring the retroreflectivity of signs and markings while driving at highway speeds. A van capable of measuring the retroreflective qualities of pavement markings was introduced and demonstrated a few years ago. Private industry is now manufacturing and selling these units as well as providing contractual support for their operation and maintenance. Similar vans for measuring the retroreflective qualities of signs are now in development by the FHWA. In relation to the FHWA efforts, an AASHTO task force is actively reviewing completed research on this subject and intends to make a recommendation to FHWA on minimum maintained levels of retroreflectivity. The FHWA will consider this recommendation and other information before it issues a notice of proposed rulemaking NPRM). After analyzing the comments to the NPRM, a Final Rule could be issued in 2001 for signs and 2002 for pavement markings. The rules will address plans to implement minimum maintained levels of retroreflectivity for each. The Federal Register notice invites the widest possible review and comment by the public.

Other Steps to Improve Visibility

Recognizing that retroreflective devices have their limitations in some

circumstances, the FHWA is also examining a host of other possibilities for making roads safer at night.

For instance, there has been preliminary research on the use of ultraviolet headlights in automobiles. These headlights will allow drivers to use their low beam level yet see flourescent traffic control devices as if they had their high beams on. This allows drivers to see better at night but does not create the glare problems associated with standard headlights. The FHWA, in cooperation with Volvo and others, will be performing an extensive demonstration project with UV headlights and flourescent signs and pavement markers.

Another area of interest is phosphorescent materials that could be incorporated into traffic control devices so that they will glow at night. This is an area that is developing rapidly and leading to new materials that glow for longer and longer periods. It is likely that in the next 5 years, or less, there will be materials that can glow all night or for days at a time. These products may help to overcome some of the limitations of retroreflective materials. Finally, there have been tremendous advances in the development of LED lights for use in augmenting pavement markings and several products are available today. Generally, the LED lights are small solar-powered markers that are installed in the pavement. Though most of the current applications of these lights have been outside of the United States, it is recognized that there may be value in using these devices in some hazardous locations. Currently, there is a proposal to install LED lights in a heavy fog area in California.

Conclusion

Retroreflectivity is a critical element for helping the U.S. Department of Transportation achieve its safety goal of reducing fatalities and injuries by 20 percent over 10 years. Although the FHWA has provided the primary guidance for many national efforts related to retroreflectivity, State and local highway officials have provided essential input throughout the process. Organizations such as the National Association of County Engineers, National Cooperative Highway Research Program, National Committee on Uniform Traffic Control Devices, American Association of State Highway and Transportation Officials, Institute of Transportation Engineers, State DOTs, the American Traffic Safety Services Association, the American Public Works Association and others have also been involved to ensure that the results of the extensive research activities and field evaluations are implemented reasonably and prudently through the rulemaking process. The FHWA expects that this cooperation will lead to minimum levels of retroreflectivity that will be maintainable, will increase nighttime safety on the roads, and will ultimately result in fewer crashes, injuries and fatalities on our roads at night. In addition, the planned, systematic replacement and maintenance of signs and markings could reduce their overall maintenance and replacement rates in the future. While these types of benefits are appealing, it must be reiterated that the ultimate goal in pursuing these efforts is to elevate the existing safety of U.S. roads for the benefit of the entire driving population.

MoDOT's Research Director recieves Award from UMR

Patricia L. Brake Lemongelli, P.E. recently received the Young Alumnus/Alumna Award from the University of Missouri-Rolla.

UMR's Young Alumnus/Alumna Award is presented to alumni 40 years of age or younger who have demonstrated a high level of achievement and leadership skill in their profession.

Lemongelli is a Research, Development and Technology Director/Research with the Missouri Department of Transportation. The Research, Development and Technology unit focuses on the department's research, new product investigations and technology transfer activities.

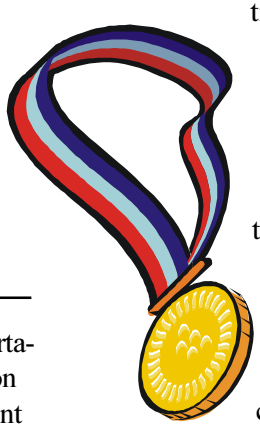
Ms. Lemongelli graduated from the University of Missouri-Rolla with a Bachelor of Science Degree in Civil Engineering in 1988. She is a registered Professional Engineer in the state of Missouri.

After joining the department in September 1988, Patty began her career as a construction inspector in District 5. She has also held positions in Design and Materials. Patty was a member of a special task force team to review research activities in the department. The Research, Development and Technology unit was created as a separate unit as a result of the recommendations from that task force. In her current role as Research, Development and Technology Transfer Director/Research, since April 1998, Ms. Lemongelli is responsible for the administration of the research efforts conducted by the department. This role includes the coordination of in - house research and contract research with Universities or other contracting agencies. Her experience in the area of concrete research has involved her in national committees with the Transportation Research Board, American Association of State Highway Officials Lead State Initiative for High Performance Concrete, the Innovative Pavement Research Foundation, the Midwest Concrete Consortium and others.

Patty and her husband, Ralph, have two daughters. They are active members of the Christ Community United Methodist Church in Jefferson City.

MoDOT selected for Lifetime Pavement Achievement Award

The Missouri Department of Transportation is honored for national recognition with a Lifetime Pavement Achievement Award for Highways presented by the American Concrete Pavement Association (ACPA) in San Diego. Every year at their annual convention the ACPA selects one lifetime achievement candidate for three concrete construction categories: highways, local roads, and airfields. This year MoDOT received the highway category award for a project constructed in 1965 on Interstate 55 in Scott County between Benton and Sikeston. The 9" pavement was built by Denton Construction out of Michigan. The award notes excellent performance while far outlasting its original 20-year design life without requiring any resurfacing. For more information contact John Donahue at (573) 526-4334.



Earthquake Hazard Assessment Along Designated Emergency Vehicle Priority Access Routes

Introduction

Geologic conditions in southeast Missouri make this region one of the most seismically susceptible in the country, based on its damage potential from intrinsically susceptible soil, high ground water levels and vast expanses of flood sensitive ground. If a high magnitude earthquake struck southeast Missouri today, infrastructure in the area would be devastated. Levees and dams could be breached. Bridges across the Mississippi and Missouri rivers could collapse or be rendered unusable. Landslides, floods, soil liquefaction, and the failure of roadway bridges and overpasses would close extended sections of highway. The network of lifeline facilities and services required for commerce and public health in St. Louis, Sikeston, Cape Girardeau and surrounding communities would be devastated. Utilities, including electrical power, communications, oil and gas distribution, sewage disposal and water distribution, would be disabled until emergency repair crews were able to access these communities. Southeast Missouri would be effectively cut-off from the rest of the world and individual towns and communities isolated.

Statement of Problem/Scope of Work

The designated emergency vehicle priority access route into southeast Missouri includes portions of US 60. This route traverses varied geologic settings and includes or crosses many critical roadway features such as bridges, slopes, box culverts, and retaining walls. The extent of damage and survivability of these critical roadway features in the event of a major earthquake event is not fully known and would impact the ability to use these designated routes to provide emergency vehicular access in a timely manner.

This study involves the assessment of four critical bridges at two sites along US 60 and the development of an initial geotechnical database that will be part of a future regional geotechnical GIS database. The methodologies developed in this study will be used to establish an assessment protocol. The output-interpreted geotechnical data will be used for future prioritization and retrofit of deficiencies noted at the bridge sites studied.

Objectives

There were two primary objectives for this study. Objective 1 was to establish a geotechnical database for earthquake design and future use in a geographic information system (GIS) for the portions of US 60 and MO 100 in the counties of Butler, Stoddard, New Madrid, Franklin and St. Louis. Objective 2 was to conduct detailed earthquake assessments at two sites along designated emergency vehicle priority access route US 60.

Conclusions

Geotechnical GIS Databases

Databases have been established for earthquake design data for the US 60 corridor in Butler, Stoddard and New Madrid Counties and for the MO 100 corridor in Franklin and Saint Louis Counties. This includes appropriate data from Missouri Department of Transportation files.

Site Specific Earthquake Hazards Assessments

Detailed earthquake site assessments were conducted for two critical US 60 roadway sites (Wahite Ditch Site and St. Francis River Site). Site assessments included: subsurface exploration, and laboratory testing to identify subsurface materials and their engineering properties; evaluation of available seismic records and procedures to characterize the ground motions associated with various design earthquake events; and evaluation of the response of the subsurface materials and the existing bridge structures to the estimated ground motions.

The site assessments at these two locations included the following:

1. Estimates of peak magnitude and duration of ground surface motion (including amplification/damping) associated with various events at each site.

2. Evaluation of the susceptibility of each site to quake-induced slope instability, liquefaction and flooding.

3. Estimation of the shaking effects on the various types of existing bridge structures at each site.

4. Comparison of the ground motion and structural response parameters from site-specific earthquake analysis method with those from AASHTO response spectrum analysis method and provide preliminary guidance regarding selection of the analysis method at future sites.

5. Evaluation of modified site assessment techniques and establishment of a basis for using these modified techniques at other sites along designated emergency access routes.

Site-specific seismic response evaluations for the four study bridges were completed. Liquefaction potential, slope stability, abutment stability, flooding potential, and structure stability analysis were performed at both sites for selected "worst case scenario bedrock ground motions" with PE of exceedance of 2% and 10% in 50 year, respectively. Ground motion analysis utilized synthetic ground motions for a New Madrid and other, source zones. Results are presented in the report.

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