Home of Missouri's LTAP
MLTRC
Missouri Local Transportation Resource Center
UMR
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WINTER ◆ 2003

in this issue

MLTRC OFFERS LOCAL ROADS WORKSHOP
A series of workshops across Missouri as part of its proactive training program.

MACTO: A New NACE Affiliate Organization in Missouri
This spring MACTO will hold its first meeting in conjunction with the TEAM annual conference.

PERMEABILITY OF MODOT'S TYPE 5 BASE
Inadequate drainage has been identified as the most common cause of pavement failure.

MARCH 30 - APRIL 1
2004 TEAM Annual Conference
Chateau on the Lake, Branson, MO
Program/Attendance Info: Mike Fritz
fritzm@mail.modot.state.mo.us
www.modot.org/TEAM

APRIL 4 - 8
NACE 2004 Annual Conference
Rosen Plaza Hotel, Orlando, FL
www.countyengineers.org

APRIL 7 - 8
2004 Missouri Concrete Conference
University of Missouri-Rolla
banalesv@umr.edu
573.341.4200

MAY 10 - 12
55th Annual Missouri Traffic & Safety Conference
Holiday Inn Select, Columbia, MO
Charlie Nemmers 573.882.0071

MLTRC OFFERS LOCAL ROADS WORKSHOP SERIES

This spring, as part of its Proactive Training Program, the Missouri Local Transportation Resource Center (MLTRC) will offer a series of Local Roads Workshops across Missouri. A workshop will be held in each of the ten MoDOT districts and will consist of three sessions:

(1) Gravel Road Maintenance, (2) Flagger Training, (3) Work Zone Traffic Control and Safety

Workshop sessions are suitable for introductory level transportation professionals or as refresher courses for the more experienced individual. Professional Development Hours (PDHs) are available for all sessions.

Workshops cost $25.00 per person for all three sessions, or $10.00 per person per session for only one or two sessions. All offerings are subject to sufficient paid registration, and for a full refund, cancellations must be received by the last day to register.

DISTRICT	LOCATION	CLASS	DATE & TIME	LAST DAY TO REG
1	MoDOT District 1 Office Conference Room 3602 North Belt Highway St. Joseph, MO 64502	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 13, 8 am – 1 pm April 13, 1 pm – 5 pm April 14, 8 am – 1 pm	March 30
2	MoDOT District 2 Office Training Room US Route 63 Macon, MO 63552	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 26, 1 pm – 5 pm April 27, 8 am – 1 pm April 27, 1 pm – 5 pm	April 12
3	MoDOT District 3 Office Conference Room S. Route 61 Hannibal, MO 63401	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 28, 1 pm – 5 pm April 29, 8 am – 1 pm April 29, 1 pm – 5 pm	April 14
4	MO Dept. of Nat. Res Conference Room 500 Northeast Colbern Road Lee's Summit, MO 64086	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 15, 8 am – 1 pm April 15, 1 pm – 5 pm April 16, 8 am – 1 pm	April 1
5	Troop F Highway Patrol Conference Room US 50 at Shamrock Road Jefferson City, MO 65102	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	March 15, 8 am – 1 pm March 15, 1 pm – 5 pm March 16, 8 am – 1 pm	March 1
6	MoDOT District 6 Office Conference Room 1590 Woodlake Drive Chesterfield, MO 63017	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	CANCELLED March 17, 1 pm – 5 pm March 18, 8 am – 1 pm	March 3
7	MoDOT District 7 Office Conference Room 3901 East 32nd Street Joplin, MO 64802	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 6, 8 am – 1 pm April 6, 1 pm – 5 pm April 7, 8 am – 1 pm	March 23
8	MoDOT District 8 Office Conference Room 3025 East Kearney Street Springfield, MO 65801	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 8, 8 am – 1 pm April 8, 1 pm – 5 pm April 9, 8 am – 1 pm	March 25
9	University of Missouri-Rolla Rm. 121, Butler-Carlton Hall Civil Engineering Rolla, MO 65409	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	April 1, 8 am – 1 pm April 1, 1 pm – 5 pm April 2, 8 am – 1 pm	March 18
10	MoDOT District 10 Office Conference Room 2675 North Main Street Sikeston, MO 63801	Gravel Road Maintenance Flagger Training Work Zone Traffic Control & Safety	March 30, 8 am – 1 pm March 30, 1 pm – 5 pm March 31, 8 am – 1 pm	March 16

Fill out the registration card included in this issue, or call MLTRC toll free at 866.667.6237.

THE FINE PRINT:

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Summer issue — *April 20*
Fall issue — *July 20*
Winter issue — *October 20*

MLTRC reserves the right to edit content for length and clarity. Please include your name, address, phone number, and email address with all submissions. Digital images submitted to accompany articles must be submitted in JPEG or TIFF format at a resolution of at least 300DPI.

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1 (866) MO-ROADS

MACTO: A New NACE Affiliate Organization in Missouri

In fall 2003, the Missouri Association of County Transportation Officials (MACTO) was formed. The group is an affiliate of the National Association of County Engineers (NACE). Membership in the association includes county engineers, public works directors, road and bridge administrators, county transportation officials, and county employees engaged in the survey, design, construction, or inspection of county bridges and highways in the state of Missouri.

MACTO has several objectives:

- to promote the cooperation of county transportation officials in Missouri and increase their efficiency as public officers;
- to further the best interest of the general public through the application of sound engineering principles in the construction and maintenance of bridges and highways under county jurisdiction; and
- to provide educational means to those effecting and effected by the construction and maintenance of bridges and highways under county jurisdiction.

This spring MACTO will hold its first meeting in conjunction with the Transportation Engineers Association of Missouri (TEAM) annual conference. The MACTO meeting will take place immediately following the final session of the TEAM conference from 12:00 to 1:00 P.M. on April 1, 2004, at the Chateau on the Lake in Branson, Missouri. For meeting details or information on how to join MACTO, contact David Mink:
Email: dmink@boonecountymo.org
Phone: 573.449.8515

2004 MISSOURI CONCRETE CONFERENCE

WHEN: April 7–8, 2004
WHERE: University Of Missouri-Rolla
WHO: Contractors; public agencies; consulting engineers; testing labs; aggregate producers; ready mix, cement and admixture suppliers; and equipment technical representatives.

Presentation topics will include the following:

- Floor slab moisture problems
- tilt-up
- steel-free bridge decks
- recycling concrete
- optimizing mixtures
- ready mix operations
- available certification programs
- experience with the maturity method
- joint-forming with the bobsled
- variable width pavers
- slab surface texturing
- thin overlays
- changes in cement
- cylinders-cores-size
- lightweight profilometers
- mix expectations
- curing
- MoDOT's new QC/QA program
- MoDOT's new bridge deck mix.

For conference registration information contact Engineering Continuing Education:
University of Missouri-Rolla
Room 105 ME Annex
Rolla, MO 65409-1560

Phone: **573.341.4200** • Email: **banalesv@umr.edu**

55th Annual Missouri Traffic and Safety Conference and Seminars

This event is set for May 10-12 at the Holiday Inn Select in Columbia, Missouri. In support of the continuing development of the Professional Engineer, the conference has been structured to provide 15 PDHs or 1.5 CEUs.

Again this year there will be two concurrent technical seminars on the afternoon of Monday, May 10. The conference will continue with its "Improving local traffic flow" panel; Mr. Fred Ranck, from the Federal Highway Administration is back by popular demand and will present a technical seminar on Traffic Intersection Safety; and on Tuesday, May 11, the program again has separate tracks for engineers and for other transportation safety professionals involved in enforcement, training, and emergency response.

The conference is filled with speakers and topics put together to directly address issues and needs in Missouri. Local highway, traffic safety, and public works officials are especially invited to attend.

Registration brochures will be mailed out in early March 2004. Please call Charlie Nemmers at 573.882.0071 to register.

MLTRC LOCAL ROADS WORKSHOP SERIES

First & Last Name: _____

Job Title: _____

Agency: _____

Address: _____

City: _____ State: _____ Zip: _____

Daytime Phone: _____ Fax: _____

Email: _____

Check the district and sessions you wish to attend:

MoDOT DISTRICT	DATES	SESSIONS
❒ District 1 - St. Joseph	April 13 April 14	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 2 - Macon	April 26 April 27	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 3 - Hannibal	April 28 April 29	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 4 - Kansas City	April 15 April 16	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 5 - Jefferson City	March 15 March 16	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 6 - St. Louis	March 17 March 18	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 7 - Joplin	April 6 April 7	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 8 - Springfield	April 8 April 9	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 9 - Willow Springs	April 1 April 2	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety
❒ District 10 - Sikeston	March 30 March 31	❒ Gravel Road Maintenance ❒ Flagger Training ❒ Work Zone Traffic Control and Safety

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MLTRC — *Home of Missouri's LTAP*
University of Missouri-Rolla
Civil, Architectural & Environmental Engineering
210 Butler-Carlton Hall, 1870 Miner Circle
Rolla, Missouri 65409-0030

PUBLICATIONS

The Workforce Challenge – Recruiting, training, and retaining qualified workers for transportation and transit agencies. 186 pages

Implementing Local Agency Safety Management – Describes the process developed by Washington State to help localities implement a Safety Management System (SMS). The goal of a SMS is to reduce the number and severity of highway-related crashes through a collaborative effort that includes engineering, education, enforcement, and emergency services. 4 pages.

Sign Installation Guide – Contains information needed to install traffic control signs on National Forest System Roads (NFSR) in accordance with the Manual of Uniform Traffic Control Devices (MUTCD) and EM-7100-15, Sign and Poster Guidelines for the Forest Service. It provides a quick visual reference to field personnel placing and maintaining the most often used signs and markers. 18 pages.

United States Pavement Markings – Pavement markings are used to convey messages to roadway users. They indicate which part of the road to use, provide information about conditions ahead, and indicate where passing is allowed. 7 pages.

Erosion Control Handbook for Local Roads – This manual will assist counties, townships and local units of government by providing guidelines and methods for effective erosion control practices on low volume roads. 118 pages.

Shipboard Automatic Identification System Displays - Meeting the Needs of Mariners – Examines the technical and human factors aspects of shipboard display of Automatic Identification Systems (AIS) information. Includes an assessment of the state of the art in AIS display technologies, an evaluation of current system designs and their capabilities, and a review of the relevant human factors aspects associated with operating these systems. 197 pages.

A Concept for a National Freight Data Program – The effectiveness and efficiency of the nation's freight transportation system depend on reliable data to inform decisions at all levels of government and in the private sector; accurate data on goods movement are needed to address issues involving congestion, economic competitiveness, safety and security, and the environment. 114 pages.

Marine Board Annual Report 2002-2003 –
2002-2003 annual report of the Marine Board. 30 pages.

United States Road Symbol Signs – A guide to roadway symbols. Symbols provide instant communication with roadway users, overcome language barriers, and are becoming standard for traffic control devices throughout the world. 4 pages.

Accessible Rights-of-Way: A Design Guide – Covers regulatory requirements for accessible public rights-of-way. 148 pages.

Transportation Research Record, No. 1832: Bituminous Paving Mixtures 2003 –
A compilation of various studies. 223 pages.

TCRP Report 95: Road Value Pricing, Traveler Response to Transportation System Changes – This chapter focuses on automobile-oriented pricing, including discussion of its impact on other travel modes. The emphasis is on area-wide, corridor, and individual facility pricing schemes for urbanized areas, although one particularly instructive example of an inter-city value pricing project is offered. 67 pages.

TCRP Synthesis 49: Yield to Bus - State of the Practice – This report will be of interest to transit agency staff and those who work with them in dealing with Yield to Bus (YTB) programs. Offers information on existing YTB programs and documents transit agency experiences for the benefit of others considering implementation of similar programs. 78 pages.

Remote Sensing for Transportation - Products and Results: Foundations for the Future – These proceedings summarize the highlights from the conference on Remote Sensing for Transportation. Objectives of this conference were: Enhancing communication between the transportation ad remote sensing communities, developing a common understanding of current successful applications of remote sensing to transportation, and crafting strategies for implementation of remote sensing in transportation. 87 pages.

Transportation Research Record, No. 1822: Transportation Security and Infrastructure Protection – A compilation of various studies. 55 pages.

Transportation Research Record, No. 1823: Pavement Rehabilitation and Accelerated Testing 2003 – A compilation of various studies. 162 pages.

Transportation Research Record, No. 1825: Rail Road Research - Intercity Passenger Transportation, Track Design and Maintenance, and Hazardous Materials Transport – A compilation of various studies. 74 pages.

Transportation Research Record, No. 1828: Pedestrians and Bicycles 2003 – A compilation of various studies. 132 pages.

Transportation Research Record, No. 1820: Water Transportation, Ports, and International Trade – A compilation of various studies. 81 pages.

NCHRP Report 496: Prestress Losses in Pretensioned High-Strength Concrete Bridge Girders – Presents guidelines to help bridge designers obtain realistic estimates of prestress losses in high-strength pretensioned concrete bridge girders and thus achieve economical designs. 63 pages.

TCRP Report 93: Travel Matters - Mitigating Climate Change with Sustainable Surface Transportation – Designed to present information on climate change and to examine how greenhouse gas emissions from transportation may be reduced. 59 pages.

Transportation Research Record, No. 1834: Concrete 2003 – A compilation of various studies. 106 pages.

NCHRP Report 490: In-Service Performance of Traffic Barriers – Presents the findings of a research project to develop a practical procedures manual for conducting in-service performance evaluations of roadside barriers. 150 pages.

NCHRP Report 495: Effect of Truck Weight on Bridge Network Costs – Contains the findings of a study to develop a methodology for estimating the impact of changes in truck weight limits on bridge network costs. Describes the research effort and the recommended methodology and illustrates application of the methodology. 135 pages. *A software module for automation of the recommended methodology also is included.*

TCRP Report 96: Determining Training for New Technologies: A Decision Game and Facilitation Guide – Study to help managers identify the necessary training for new technologies. This study used cognitive task analysis to design a simulation game that would allow managers to rapidly acquire the decision skills needed for identifying the necessary training for new technologies. 31 pages.

NCHRP Synthesis 322: Safety Management Systems – Provides an overview of current transportation agency practices, recent literature findings, and in-depth reviews of two model state safety management systems (SMS) initiatives. Overall, findings continue to support that the key benefits derived from the SMS process are increased coordination, cooperation, and communication among state agencies and improvement to data analysis and collection procedures, as well as collaborative strategic plans. 42 pages.

NCHRP Report 508: Accelerated Laboratory Rutting Tests: Evaluation of the Asphalt Pavement Analyzer – Presents the findings of a research project to determine the suitability of the Asphalt Pavement Analyzer, which is a loaded-wheel tester, (1) as a general method of predicting rutting potential and (2) for use in field quality control and quality acceptance operations. 120 pages.

TCRP Report 95: Land Use and Site Design, Chapter 15 – Presented here is information on the relationships between land use/site design and travel behavior, drawn primarily from research studies that have attempted to measure and explain the effects. 133 pages.

Transportation Research Record, No. 1833: Freight Policy, Economics, and Logistics; Truck Transportation – A compilation of various studies. 102 pages.

NCHRP Synthesis 320: Integrating Freight Facilities and Operations with Community Goals – Identifies practices that have been or are being used by the private-sector freight companies and public transportation agencies in citing their facilities, modifying their operation, and managing their community relations. "Good neighbor initiatives" and balancing practices employed by metropolitan planning and economic development organizations, local governments and others are also recognized. 58 pages.

NCHRP Report 503: Application of Fiber Reinforced Polymer Composites to the Highway Infrastructure – Contains the findings of a study to develop a strategic plan for guiding the application of fiber reinforced polymer composites in the highway infrastructure. Describes the research effort and presents the strategic plan. 75 pages.

NCHRP Report 502: Geometric Design Consistency on High-Speed Rural Two-Lane Roadways – Discusses geometric design consistency, particularly for rural roads. Presents rules on geometric design consistency suitable for us in an expert system such as the Interactive Highway Safety Design Model (IHSDM). 75 pages.

NCHRP Report 501: Integrated Safety Management Process – Presents the findings of a research project to develop an integrated safety management process. The process is a tool to assist in integrating safety-related implementation actions by proposing a method for bringing together agencies within a jurisdiction that are responsible for highway safety. 115 pages.

NCHRP Report 504: Design Speed, Operating Speed, and Posted Speed Practices – Examines the relationship between design speed and operating speed through a survey of the practice and a thorough analysis of geometric, traffic and speed conditions. 93 pages.

NCHRP Report 497: Financing and Improving Land Access to U.S. Intermodal Cargo Hubs – Presents guidance on the most effective strategies for financing improvements to cargo hub and intermodal freight facilities. These focus on existing and emerging funding sources and on developing partnerships between government agencies, cargo hub operators and users, and local communities. 160 pages.

Shorter Duration, Safer Work Zones, More Satisfied Travelers: Successful Applications of Full Road Closure in Work Zones – Provides a summary of how departments of transportation in Oregon, Kentucky, Michigan, Ohio and Delaware used full closure to perform road rehabilitation/reconstruction and the benefits they experienced. 2 pages.

Transportation Research Record, No. 1830: Highway Safety, Traffic Law Enforcement, and Truck Safety – A compilation of various studies. 76 pages.

Transportation Research Record, No. 1839: Transportation Finance, Economics, and Economic Development 2003 – A compilation of various studies. 190 pages.

Transportation Research Record, No. 1849 – A compilation of various studies. 230 pages.

TCRP Report 98: Resource Requirements for Demand-Responsive Transportation Services – Documents a methodology for determining the resources required (i.e., vehicles and vehicle service hours) to provide demand-responsive transportation (DRT) for different levels of demand and different levels of service in a given service area. 41 pages. *Accompanied by a software tool on CD-ROM that can provide a preliminary estimate of the number of vehicles required for a new or modified DRT service.*

NCHRP Synthesis 323: Recruiting and Retaining Individuals in State Transportation Agencies – Contains information culled from surveys responses from transportation agencies and selected state employees. This information is combined with and reviews applicable literature to yield a compendium of successful practice, including those that might have the greatest potential for success and implementation in other state and province DOTs. 59 pages.

Transportation Research Record, No. 1837: Geomaterials 2003 – A compilation of various studies. 88 pages.

Transportation Research Record, No. 1841: Bus, Paratransit, Rural Public and Intercity Bus, New Transportation Systems and Technology, Capacity and Quality of Service – A compilation of various studies. 134 pages.

Transportation Research Record, No. 1843: Human Performance, Simulation, User Information Systems, and Older Person Safety and Mobility – A compilation of various studies. 112 pages.

Transportation Research Record, No. 1831: Travel Demand and Land Use 2003 – A compilation of various studies. 239 pages.

TCRP Report 90: Bus Rapid Transit; Volume 2: Implementation Guidelines – Identifies the potential range of bus rapid transit (BRT) applications through 26 case studies and provides planning and implementation guidelines for BRT. 250 pages. *Part of a two-volume set.*

Transportation Research Record, No. 1829: Bituminous Binders 2003 – A compilation of various studies. 54 pages.

Transportation Research Record, No. 1835: Transit: Planning and Development, Management and Performance, Marketing and Fare Policy, and Intermodal Transfer Facilities – A compilation of various studies. 136 pages.

NCHRP Research Results Digest, No. 282: Fiber Reinforced Polymer Composites for Concrete Bridge Deck Replacement – Summarizes the findings from the final report on NCHRP Project 10-55, "Fiber Reinforced Polymer Composites for Concrete Bridge Deck Reinforcement". 3 pages.

TCRP Research Results Digest, No. 61: Traveler Response to Transportation System Changes – This digest is one of a series of products from TCRP Projects B-12, B-12A and B-12B. 23 pages.

NCHRP Research Results Digest, No. 280: Continuing Project to Synthesize Information on Highway Problems – A staff digest of the progress and status of NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems." 11 pages.

CTBSSP Research Results Digest, No. 2: Commercial Truck and Bus Safety Synthesis Program: A Status Report – Staff digest of the progress and status of the Commercial Truck and Bus Safety Synthesis Program. 5 pages.

TCRP Legal Research Digest, No. 19: Impact of the Americans with Disabilities Act on Transit Operations – Prepared under TCRP Project J-5, "Legal Aspects of Transit and Intermodal Transportation Programs". 46 pages.

Library continued on page 4

NACE 2004 ANNUAL CONFERENCE

WHEN: APRIL 4–8, 2004
WHERE: ROSEN PLAZA HOTEL
ORLANDO, FLORIDA

Each spring over 350 National Association of County Engineers members and other attendees gather for the NACE annual conference. The NACE 2004 Annual Meeting and Management & Technical Conference will be hosted by the Florida Association of County Engineers & Road Superintendents.

TENTATIVE SCHEDULE OF EVENTS

General Session Topics:

- Reauthorization of TEA-21
- All Safety is Local
- People Mapping
- Delegate "hot topics" round table luncheon

Technical Session Topics

Transportation Track

- Homeland Security Issues and Transportation
- Context Sensitive Design
- Systems Preservation Tips
- Product Demonstration Showcases
- ITS Awareness & Rural ITS Toolbox Technology Track
- Road Materials—the Choice is Yours
- Compliance with NPDES Permitting & Drafting a Storm Water Pollution Prevention Plan
- Traffic Calming & Roundabouts that Really Work
- Saving on Flood Insurance
- International Scans on Bridges, Warranties & Traffic Systems

Management Track

- Contracting Options for Locals
- Budgeting Methods to Improve Maintenance Operations
- Making Maintenance Systems Work for You
- Mock Trial
- Employee Management Techniques

FOR REGISTRATION INFORMATION, LOG ON TO THE NACE WEBSITE: WWW.COUNTYENGINEERS.ORG

Library continued...

TCRP Research Results Digest, No. 63: Synthesis of Information Related to Transit Problems – Staff digest of the progress and status of TCRP Project J-7, "Synthesis of Information Related to Transit Problems". 7 pages.

NCHRP Research Results Digest, No. 276: Business Needs for Pavement Engineering – Summarizes the primary thrust areas of "business needs" for pavement engineering adopted by the AASHTO Joint Task Force on Pavements. 7 pages.

NCHRP Research Results Digest No, 281: Aggregate Tests for Portland Cement Concrete Pavements: Review and Recommendations – Summarizes the findings from NCHRP Project 4-20C, "Aggregate Tests Related to Performance of Portland Cement Concrete Pavements: State of the Knowledge." 28 pages.

TCRP Research Results Digest, No. 64: International Transit Studies Program – This TCRP digest summarizes the mission performed March 27 to April 11, 2003, under TCRP Project DJ-3, "International Transit Studies Program." 26 pages.

TCRP Research Results Digest, No. 64: International Transit Studies Program – Summarizes the mission performed march 27 to April 11, 2003, under TCRP Project J-3, "International Transit Studies Program". 26 pages.

ITS/Operations Resource Guide 2003 – A comprehensive listing of over 400 documents, websites, training courses, software tools, and points of contact related to innovative transportation operations strategies such as intelligent transportation systems (ITS). 328 pages.

TRB Special Report, No. 274: Cybersecurity of Freight Information Systems – This report lays the groundwork for a study of the cybersecurity of the information systems that facilitate efficient delivery of the goods and materials essential to the nation's economy. 80 pages.

Transportation Research Board Publications Catalog 2003 – Lists all publications produced by TRB since publication of the 2002 Catalog. 39 pages.

Superpave QC/QA Short Course Manual 1998 – 250 pages.

Pocket Guide to Transportation – Transportation data and information for use in both public and private transportation decision making. 46 pages.

NCHRP Leveraging Resources for Better Transportation – Brochure describing the NCHRP. 13 pages.

TR News, No. 228 – Features articles on innovative and timely research and development activities in all modes of transportation. This issue focuses on Highway Infrastructure Preservation. 52 pages.

ITE Journal, August 2003 – This issue focuses on improving transportation for emergencies. 81 pages.

ITE Journal, September 2003 – This issue focuses on education and workforce development. 67 pages.

ITE Journal, October 2003 – A compilation of various transportation related articles. 69 pages.

APWA Reporter, November 2003 – APWA Reporter covers all facets of public works for APWA members, including industry news, legislative actions, management issues, and emerging technologies. 37 pages.

APWA Reporter, Dec. 2003/Jan. 2004 – The APWA Reporter covers all facets of public works for APWA members, including industry news, legislative actions, management issues, and emerging technologies. 44 pages.

World Highways, September 2003 – This issue of "World Highways" discusses tolling issues and examines some of the technological developments that are in place to make tolling more user-friendly. 66 pages.

World Highways, October 2003 – This issue covers road safety, from safety barriers to speed cameras. 98 pages.

ITS International, July/August 2003 – Periodical covering Worldwide transportation issues. 74 pages.

ITS International, September/October 2003 – Periodical covering various transportation issues. 66 pages.

ELECTRONIC PUBLICATIONS

Interactive Highway Safety Design Model (IHSDM) Preview CD-ROM – Road safety evaluation software that marshals available knowledge about safety into a more useful form for highway planners and designers. Provides and overview of the functions and capabilities of IHSDM and features an exercise for using IHSDM. Preview only. 203 megabytes.

For a complete library listing visit http://campus.umr.edu/mltrc/library/index.html

Research, Development and Technology
Quarterly
www.modot.org/services/RDT Missouri Department of Transportation Published quarterly since 1996

TECH BRIEF

Permeability of MoDOT's Type 5 Base

INTRODUCTION:

The pavement structure is the most costly element of the highway system, and its premature failure is of major concern (Figure 1). Inadequate drainage has been identified as the most common cause of pavement failure (Figure 2). Prior to the current study, there was no quantitative evidence as to whether Missouri Department of Transportations's (MoDOT) Type 5 roadway base provided effective drainage beneath pavements.

PROCEDURE:

The objective of this project was to characterize the hydraulic conductivity of the base materials used beneath pavements throughout Missouri. Materials included Type 5 base material from various sources and an alternate rock fill base material. The scope of the work performed included the following:

- determination of grain size distribution of the base materials;
- estimation of the hydraulic conductivity of the base materials using empirical equations;
- determination of the hydraulic conductivity of Type 5 base material in the laboratory and in situ (Figures 3 and 4); and
- determination of the drainage characteristics of the base material using pavement design software.

In addition, preliminary investigations of the strength of the Type 5 base under static and cyclic loading conditions were performed.

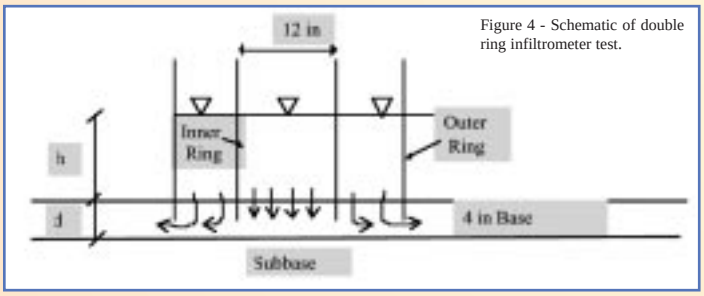

Figure 4 - Schematic of double ring infiltrometer test.

RESULTS:

The results of field (in-situ) and laboratory permeability testing showed MoDOT's predominant pavement base "Type 5" (and the upper "working" surface of the 2-foot rock fill alternative) has hydraulic conductivities that are several orders of magnitude (10-3 to 10-5 cm/s) lower than the freely-draining value of 1 cm/sec (Figure 5). In essence, these materials should be classified as undrained. Using the measured hydraulic conductivities in the FHWA's DRIP 2.0 analysis for evaluating pavement performance resulted in drainage quality rankings of poor to very poor based on the 1986 AASHTO *Guide for Design of Pavement Structures*. Given these findings, it is concluded that Missouri pavements might require more frequent maintenance if better drainage is not provided.

Figure 1 - Pavement failure

Figure 2 - Inadequate Drainage.

Figure 3 - Double ring infiltrometer test.

Preliminary strength testing was performed on the Type 5 base in order to quantify the strength behavior. Results of cyclic triaxial tests under saturated, undrained conditions performed on compacted, Type-5 base showed the saturated base loses strength with increasing number of load cycles. Drained cyclic tests resulted in the same behavior. The findings indicate that the Type 5 base does not allow moisture to escape (drain) sufficiently fast enough during traffic loading resulting in build up of excess porewater pressure and loss of strength in the layer.

continued on the back cover...

TAGs PART IV: *Keeping Up with Missouri's Bridges*

The Bridge TAG reviews and initiates research and development activities regarding Missouri's bridges. Included are research studies carried out within MoDOT and contracted out to the state's universities. The TAG also reviews many new products to see if they are beneficial to building or maintaining our bridges. Missouri has 8,227deficient bridges—more than one-fourth of all the state's bridges. These are in need of immediate repair or replacement due to deterioration or because they no longer meet current design standards. There is a great need to find ways to more efficiently repair and replace such bridges for the state, cities, and counties saddled with the problem. As if this were not enough, Missouri has the New Madrid fault running through the southeast which necessitates the retrofitting of old bridges and augmentation of new bridge designs to withstand earthquakes. Additionally, with the recent terrorist attacks, MoDOT is concerned about the security of Missouri's bridges.

To deal with these and other problems, the Bridge TAG has investigated using space-aged products like Fiber Reinforced Polymers (FRP). FRP can be five times stronger than steel and has been used in everything from fishing poles to jet airplanes. It can be used for strengthening; as a replacement for steel reinforcement in concrete bridge decks; or as a substitute for a whole bridge deck.

The following are examples of research projects currently under the direction of the Bridge TAG:

Steel-Free Bridge Deck

The design of this bridge deck is currently being studied in a joint effort by the University of Missouri-Columbia and University of Missouri-Rolla. The reinforcing steel, which rusts and causes potholes in the bridge deck, is being replaced with a combination of both fiberglass reinforcing rods and carbon fiber reinforcing rods. To add toughness, polypropylene fibers will be mixed into the concrete forming the deck. After design and laboratory testing, a proposed bridge deck project will be picked to use the new deck design.

Strengthening of the Martin Springs Bridge

Externally bonded fiber reinforced polymer (FRP) laminates and near surface mounted FRP bars were used for the flexural strengthening of a concrete bridge in Rolla, Mo. The bridge is a concrete slab bridge built in 1926 and once had historic Route 66 traveling over it. The strengthening was done on the underside of the deck while the bridge stayed open to unrestricted traffic. Load testing was performed before and after strengthening. As a result of load tests the load posting of the bridge was removed.

Implementation of Seismic Retrofit for Type D Bearings

Type D rocker bearings—tall slender steel bearings which allow a bridge to move when it expands and contracts due to changes in temperature—have been widely used in Missouri bridges. In an earthquake these could fall over causing damage to the whole bridge or at least rendering it impassable. A tapered steel rod assembly, which tied these bearings and the steel girders down to the piers and would also dampen the effects of an earthquake, has been developed. This project will test the effectiveness of the design and ultimately lead to installing the dampening device on a bridge in southeast Missouri. Such devices would be an economical way to protect hundreds of bridges in this area.

BRIDGE TAG MEMBERS

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MoDOT wants to hear from you!

If you have a research idea that could benefit the state transportation system or a new product to be reviewed, please fill out the corresponding RIS

MISSOURI HIGHWAY AND TRANSPORTATION DEPARTMENT

RESEARCH IDEA STATEMENT

Check the appropriate area(s): ❒ Geotechnical ❒ Operations ❒ Pavements ❒ Traffic/Safety
❒ Social/Environmental/Economic ❒ Project Development/Bridge

IDEA TITLE: _____

IDEA STATEMENT: _____

_____

OBJECTIVE: _____

_____

_____

_____

APPLICATION(S)/BENEFIT(S): _____

_____

_____

_____

_____

KEY WORD *(Key words are needed to assist in literature search for research idea subject):*

_____

_____

DATE: _____

NAME: _____ **TITLE:** _____

ORGANIZATION: _____ **DIV/DIST:** _____

ADDRESS: _____ **CITY/ZIP:** _____

PHONE: _____

Complete and return to
Missouri Department of Transportation
Attn: Research, Development & Technology
PO Box 270
Jefferson City, MO 65102
FAX: (573) 522-8416

MISSOURI HIGHWAY AND TRANSPORTATION DEPARTMENT

PRODUCT LISTING/NEW PRODUCT EVALUATION REQUEST FORM

When request is submitted, enclose a completed copy of this form and the required information as indicated below.

❒ Manufacturer ❒ Fabricator ❒ Distributor ❒ Other _____

Business Name _____ Contact Name _____

Address _____ City _____ State _____ Zip _____

Telephone Number _____ Fax _____

Email _____ Website _____

Manufacturer _____

Name of Product _____ Model No. _____

Description and intended application of product: _____

_____

Key Words *(requested for literature search):* _____

List other states using the product: _____

What is the approximate unit cost of the product? _____

Is material available for laboratory evaluation? _____

(such as ASTM, AASHTO, NEMA, ANSI, etc.)

Is there a demonstration, trial, or installation evaluation? _____

Does the product comply with MoDOT specifications? ❒ Yes ❒ No

If yes, provide specifications name/number.

If no, attach separate explanation as to why not and why MoDOT should consider the product.

Does product comply with other specifications ❒ Yes ❒ No

In addition to this form, please submit the following:

1) Product data (mixing info, installation requirements, product brochures, specification sheets, etc.)
2) Decoumentation required by the MoDOT specification (if applicable)
3) Applicable test data
4) Unit cost data and whether the unit cost includes installation
5) Material Safety Data Sheet

SUBMITTED BY:

_____

Signature *Print Name* *Date*

Please send the new product evaluation request form and all other required information to the appropriate address below. Submittals related to the Traffic Signal and Highway Lighting Approved Products List should be submitted to Traffic Operations. Submittals that meet a current MoDOT specification and have a Qualified or Pre-Acceptance List should be submitted to Project Operations. All other submittals should be submitted to Research, Development and Technology. If a sample is required by the specification, submit the sample with a copy of the required documentation to the Central Laboratory. If the specification does not specify a sample or there is no specification, sample submittals will be required upon request.

Traffic Operations
PO Box 270
2211 St. Mary's Blvd.
Jefferson City, MO 65102

Project Operations
PO Box 270
2211 St. Mary's Blvd.
Jefferson City, MO 65102

Central Laboratory
PO Box 270
1617 Missouri Blvd.
Jefferson City, MO 65102

Research, Development & Technology
1617 Misouri Blvd.
Jefferson City, MO 65102

FOR OFFICE USE ONLY:

Initial date received

All required documentation submitted? ❒ Yes ❒ No

Date of additional documentation receipt

Product Development / NP number assigned

TEAM
Transportation Engineers Association of Missouri

MARCH 30 - APRIL 1, 2004
The Transportation Engineers Association of Missouri (formerly the Highway Engineers Association) will hold its 94th Annual Conference.

For registration information, log on to the association website: www.modot.org/TEAM

The 94th Annual Conference of the

Transportation Engineers Association of Missouri

Schedule of Events (DRAFT)

Tuesday, March 30, 2004		
1:00 - 4:00 p.m.	Workshop A	Making Work Zones Work Better
1:00 - 4:00 p.m.	Workshop B	MoDot's Performance Based Specifications
1:00 - 4:00 p.m.	Workshop C	Access Management
1:00 - 4:00 p.m.	Technical Tour A	Table Rock Dam and Spillway Project
1:00 - 4:00 p.m.	Technical Tour B	Ozark Mountain High Road Field Trip & Technical Presentation
5:30 - 7:00 p.m.	**Welcome Reception in the Exhibit Hall**	
Wednesday, March 31, 2004		
7:00 - 8:00 a.m.	**Breakfast in Exhibit Hall**	
8:00 - 8:30 a.m.	General Session	Opening Session - Henry Hungerbeeler State and federal legislation and how it impacts MoDOT
8:15 - 9:00 a.m.	General Session	FHWA - Joe Toole
9:00 - 10:00 a.m.	**Morning Break in the Exhibit Hall**	
10:00 - 11:30 a.m.	Breakout Session 1	See Breakout Schedule
11:30-1:00 p.m.	**Luncheon Banquet in the Windsor Room**	
1:00 - 2:30 p.m.	Breakout Session 2	See Breakout Schedule
2:30 - 3:00 p.m.	**Afternoon Break in the Exhibit Hall**	
3:00 - 4:30 p.m.	Breakout Session 3	See Breakout Schedule
4:30 p.m.	**Adjourn for the Day**	
Thursday, April 1, 2004		
7:00 - 8:00 a.m.	**Breakfast in the Exhibit Hall**	
8:00 - 9:30 a.m.	Breakout Session 4	See Breakout Schedule
9:30 - 10:00 a.m.	**Morning Break in the Exhibit Hall**	
10:00 - 10:15 a.m.	General Session	TEAM Business Meeting
10:15 - 10:45 a.m.	General Session	Toll Study
10:45 - 11:15 a.m.	General Session	Pavement Selection, Dave Nichols, MoDOT
11:15 - 11:45 a.m.	General Session	Closing remarks - Kevin Keith
11:45 a.m.	**Conference Adjourns**	

continued...

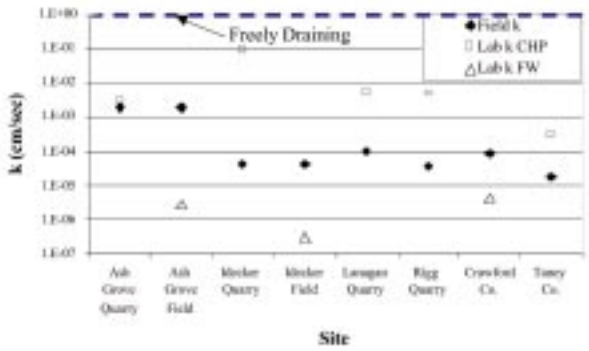
CONCLUSIONS:

Field and laboratory permeability testing showed the Type 5 base to have such low hydraulic conductivities as to be considered undrainable. Preliminary cyclic strength tests showed the base loses strength with increasing number of load cycles. This behavior could explain the premature deterioration of some pavements in Missouri. Providing adequately drainable bases will increase the effective performance life, as well as reduce maintenance frequency and replacement costs, for Missouri pavements.

RECOMMENDATIONS:

It is recommended that a more durable roadway base be developed, specifically one that provides an adequate working platform during construction and good drainage for extended lifetimes. Several tasks are recommended in order to gather high quality data (evidence)—a prerequisite for the development of an effective specification for roadway base in Missouri: a program of laboratory strength testing; in situ permeability testing; instrumented pavement sections; and development of a geographical information system-based pavement performance database should be undertaken. Such a program will provide the necessary evidence on which to initiate changes to Missouri's pavement base system which will provide higher performance, longer-lasting, and more economical pavement systems.

Figure 5 - Permeability of Type 5 Base from various locations.



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