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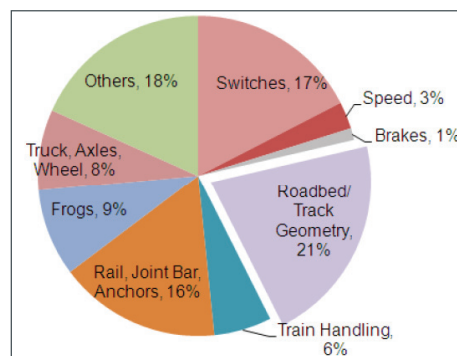
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A New Method for Stabilizing Railway Beds

Railways play an integral role in multimodal freight transport. There is also great potential for the expansion of the freight rail system. However, increases to railway car tonnages, speed limitations due to poor track conditions, and maintenance costs associated with degradation of rail track substructures all limit expansion. Ever increasing volume, tonnage, and speeds on our nation's rail system are stressing rail substructure to levels never before evaluated or considered in depth. Existing ballast is composed of palm-sized rocks ranging from 35-70 mm in diameter with sharp edges and angular geometry. This ballast serves as a crucial material for structural support of rail tracks and trains and provides fast drainage during precipitation. The structural integrity of seriously fouled ballast (i.e., containing fine particles) can compromise track stability and ultimately cause train derailments. According to the Freight Rail Administration's 2007 Railroad Safety Statistics report, poor track bed and track geometry caused 21 percent of 1,980 derailments in the United States in 2007.



These derailments cost \$256 million in 2007. Consequently, costly

ballast maintenance activities are routinely performed, especially on tracks serving heavy-axle-load unit trains. Despite advancements in maintenance technology, railroads annually invest billions of dollars in maintenance activities, including the removal and replacement of ballast. This cost of these activities is about \$500 million annually for Class 1 freight track in the United States.

The first phase of this project identified the mechanistic effects of fouling on railroad ballast and its application to predict railway maintenance planning. The research team includes Dr. Tuncer B. Edil (PI), Dr. James Tinjum, and graduate research assistant Ali Ebrahimi. Undergraduate research assistant Andrew Keene joined the research team for the second phase of the project.

Researchers designed and constructed a large-scale testing device to systematically characterize ballast behavior under traffic loading. As a result their initial tests, researchers broadened scope of this project to incorporate a prototype large-scale track model (LSTME) that would allow testing of a simulated cross-section of a railway track and substructure.

Due to the success of the LSTME, the project team developed a protocol for the testing method to be submitted for publication in the American Society for Testing and Materials (ASTM) *Geotechnical Testing Journal*.

After a year of experimental work and over 120 tests that simulated

Continued on page 6...

From the Director's Chair



We're nearing the end of another semester here at the University of Wisconsin–Madison. Students are studying for exams and preparing their final project presentations. I'm wrapping up my first semester back teaching after my sabbatical with the US DOT on the TIGER grant program. I'm happy to say that we're all very busy, while also looking forward to the holidays and the winter break.

Even though it's also nearing the end of the shipping season as ice closes in on the Great Lakes, as well as on our inland rivers and canals, we've turned some of our thoughts here at CFIRE to maritime freight issues. CFIRE is an affiliate of the Great Lakes Maritime Research Institute (GLMRI); we're also partnering with GLMRI and MARAD on Great Lakes shipping revitalization.

We've recently kicked off a project—the Southeast Wisconsin Freight Access and Mobility Study—that will examine possible enhancements to multimodal freight access and mobility in the Greater Milwaukee area. The infrastructure of the Port of Milwaukee and its capacity for moving loads of certain heights, weights, and lengths will play a central part in this project. As part of this project, researchers will also create an inventory of commodities shipped on the Great Lakes in order to suggest improvements to modal distribution and infrastructure that might support greater economic development in the Midwest.

We've also taken maritime freight and its related issues as the topic of our first-ever multi-UTC collaborative graduate seminar (see page 3). We're looking forward to working with TransNow, METTRANS, and the Texas Transportation Institute to bring together faculty, students, and industry experts from across the country and across the maritime freight field to present a unique learning opportunity to our students, and the students of the other three UTCs.

We're particularly excited to host the seminar's presentations on maritime freight topics unique to the Great Lakes, the St. Lawrence Seaway, and the Mississippi River system. We're pleased to confirm that Eric Reinelt, Director of the Port of Milwaukee, and Pat Ries, Commercial Manager at Consolidated Grain and Barge Company will both speak about maritime shipping in the context of this seminar.

This sort of collaboration is especially important as both time and financial resources become more constrained. Through the use of common, affordable

videoconferencing technology, our students will have interactive conversations with experienced practitioners, industry experts, and their student peers. And while the technology may not be perfect, it allows us interaction and collaboration that would otherwise cost thousands of dollars and a great deal of time to orchestrate. Technology-driven collaborative learning will become ever more common and CFIRE is looking to shape the use of these innovative methods for teaching the next generation of transportation professionals.

These maritime freight-related projects are just a few of the things we're working on at CFIRE. Like many of you, we're also getting ready for the 2011 Transportation Research Board Annual Meeting. We'll be presenting the results of our research on permitting in the North/West Passage Corridor Coalition, the effect of the widening of the Panama Canal on agricultural freight in the Midwest, operational resiliency of freight corridors, and the creation of a compendium of best practices and expertise for local roads administrators. In addition, many CFIRE faculty and staff members serve on TRB committees, making for a full week of meetings and presentations. And, as in past years, we're co-hosting the Wisconsin Transportation Reception on Sunday, January 23, 2011 (see below). We hope to see you there.

As we come to the end of one busy year and look to begin another, we at the National Center for Freight and Infrastructure Research and Education wish you a merry and safe holiday season—and a happy new year.

Teresa Adams, PhD
CFIRE Director

You are invited to the
2011 Wisconsin Transportation Reception
 During the TRB Annual Meeting



Sunday, January 23, 2011
5:30 p.m. - 7:30 p.m.
 Marriott Wardman Park Hotel
 Thurgood Marshall Ballroom East
 2660 Woodley Road, NW
 Washington, D.C.

2011 Sponsors

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« Wisconsin Traffic Operations & Safety Laboratory	« Recycled Materials Resource Center
« TransSmart Technologies	« Construction & Materials Support Center
« Mead & Hunt	« Great Lakes Maritime Research Institute
« ITS Wisconsin	« Wisconsin Department of Transportation
« CH2M Hill	« TAPCO
« HNTB	« Lakeside Engineers
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Freight Coalition Renamed

The Mississippi Valley Freight Coalition (MVFC) is now the Mid-America Freight Coalition (MAFC). The coalition's Technical Committee voted on October 26, 2010 to change the name of the coalition to the Mid-America Freight Coalition (MAFC), effective immediately. This change is consistent with the new name of the American Association of State Highway Transportation Officials (AASHTO) region to which the coalition's ten member states belong. Formerly the Mississippi Valley Conference (MVC), this AASHTO region is now known as the Mid-America Association of State Transportation Officials (MAASTO).

The Mid-America Freight Coalition is a regional organization that cooperates in the planning, operation, preservation, and improvement of transportation infrastructure in the Midwest. The ten coalition states share key interstate corridors, inland waterways, and the Great Lakes. These ten states are: Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. The MAFC is staffed by the National Center for Freight and Infrastructure Research and Education (CFIRE) and coordinated in conjunction with the Wisconsin Department of Transportation (WisDOT).

"CFIRE is committed to working with the coalition state DOTs. The MAFC provides us with rich opportunities for research, education, and outreach activities of our national UTC," said CFIRE Director Teresa Adams.

The Mid-America Freight Coalition began in 2002 as the Upper Midwest Freight Corridor Study, operated as the Mississippi Valley Freight Coalition from 2006 to 2010, and has been authorized and funded through 2012. During the coming two-year period, the coalition will focus its research and outreach efforts on commercial vehicle operations training, economic analysis training, and the creation of a regional freight plan. The departments of transportation of the ten member states provide two thirds of the \$750,000 funding for the 2011-2012 MAFC program; one third is provided by CFIRE.

"The members and staff of the Coalition are energized to begin developing a regional freight plan that will combine the efforts of each of the states to define a vision of how freight could move through the region," said MAFC Facilitator Ernie Wittwer.

Even though the name of the coalition is changing, its mission remains the same. The MAFC will remain focused on the planning, operation, preservation, and improvement of freight transportation infrastructure and networks in the coalition's ten member states.

Multi-UTC Freight Seminar in Spring 2011

The National Center for Freight and Infrastructure Research and Education (CFIRE) is joining with three other freight-related University Transportation Centers (UTCs) to conduct a collaborative, multi-university maritime freight seminar in the Spring 2011 semester. Each of the UTCs—CFIRE, METTRANS (University of California, Long Beach), TransNow (University of Washington, Seattle), and the Texas Transportation Institute (Texas A&M University)—will lead 2-4 of the seminar sessions.

This collaborative seminar, entitled Maritime Freight and Associated Issues, will meet weekly for eight weeks and discuss a wide range of freight-related maritime issues, including the following topics: global transportation trends and their potential impact on West coast port competitiveness; port-related sustainable economic development; Great Lakes ports and the Port of Milwaukee, marine terminal and drayage coordination using GPS data; institutional issues and port mitigation policies; grain movements on the inland waterway network; short-sea shipping; and an overview of the St. Lawrence Seaway operations. Each topic will be presented by an expert in the field, either from one of the UTCs or from a governmental agency or private company.

"We have selected topics to give students an awareness and sense of place by focusing on how local maritime facilities fit into the global picture. CFIRE will host presentations on shipping on the Great Lakes, the St. Lawrence Seaway, and the Mississippi River," said CFIRE Director Teresa Adams. "The focus will be on agriculture, bulk commodities, heavy industry, and wind turbines. Our collaborators will host presentations that characterize maritime shipping in their regions."

Speakers, educators, and students from the four UTCs will interact in real time via a videoconference. At the University of Wisconsin—Madison, this collaborative seminar forms the first half of the Spring 2011 Transportation Management and Policy colloquium.

For more information about the Transportation Management and Policy program, visit the Nelson Institute of Environmental Studies (nelson.wisc.edu).

Contributors

Content and photographs for this edition of the CFIRE News were contributed by Teresa Adams, Jason Bittner, Eli Ebrahimi, Bob Gollnik, Andrew Keene, Dan Kleinmaier, Josh Levine, Steve Wagner, Greg Waidley, and Ernie Wittwer.

Understanding the Value of Delay for Truckers and Shippers

It's been well-established that highway congestion exists and affects the efficient movement of freight. However, it's not always clear what the economic impact of these delays and bottlenecks is, and how it affects the decisions of truckers, shippers, and carriers. As a result of this lack of information, freight planning decisions are made in the absence of defensible benefit-cost analyses or a clear

understanding of the value of delay (VoD) to truckers, shippers, and carriers.

CFIRE is conducting a multi-part set of research projects that seeks to develop models to derive the value of delay for freight movements and to use these estimated values of delay to evaluate congestion and to rank order bottlenecks and congestion areas for improvement. The first project phase—Assessing the Value of Delay to Rank Order Congestion Cost in Freight Movement Performance Evaluation (CFIRE 03-15) led by CFIRE Director Teresa Adams—focuses primarily on conducting preference surveys with truckers and developing generalizable value estimation models based on the survey results. The field survey is being conducted to more accurately determine the value of time to truck drivers completing the last leg of a commercial delivery.

To account for a broad geographic range, CFIRE is collaborating with the Texas Transportation Institute (TTI) to gather and compare survey results from Eastern Texas to the data gathered in Southern Wisconsin and Illinois. In the course of completing the survey, drivers provide background demographic information and then offer an assessment on how much their time is worth relative to six different situations presented to them. The background information includes the type of carrier they work for, the typical length of their routes, the typical cargo they deliver, truck size, typical trip lengths, how their routes are decided, the manner in which they are paid, toll payment responsibilities, the frequency of altering routes to avoid congestion, and the level of flexibility they have within their delivery schedules. The drivers are then asked to attach a dollar value to multiple delivery scenarios. In terms of the time-value questions, they are asked how much they would value being only 15 minutes late, on-time, and 15 minutes early if they were on pace to be 30 minutes late. In three more valuation questions, the drivers are theoretically on time, but are asked how much they would value being 15 minutes early, 30 minutes early, and 45 minutes early. The resulting answers will then be compiled to estimate an average value of time for drivers in the last portion of their deliveries.

CFIRE research assistants Dan Kleinmaier and Josh Levine (see sidebars) have targeted several Midwest truck stops. Thus far, they have visited truck stops near Janesville, Racine, Mauston, and Cottage Grove in Wisconsin and the Belvidere Oasis in Illinois. In the future, they will visit a highway oasis in Illinois and truck stops in the Eau Claire area of Wisconsin. They have chosen these diverse areas in an effort to obtain a more representative sample of trucks moving throughout the state. It also allows them to talk with drivers coming into Wisconsin from different

Student Spotlight: Dan Kleinmaier



Dan Kleinmaier has been working as a research assistant at CFIRE since the summer of 2009.

In the past, Kleinmaier has worked extensively on the Costs and Benefits of Increasing Load Size for Certain Circumstances of Freight in Wisconsin (CFIRE 01-05) project, which considered the effects of

weight limits of cargo containers among Midwest states. More recently, he co-wrote a paper on the transportation challenges associated with the construction of wind farms and presented these findings at the 2010 Great Lakes Wind Collaborative annual meeting and the 2010 E-Hub Conference.

Currently, Kleinmaier is working on three CFIRE projects. As part of the Assessing the Value of Delay to Rank Order Congestion Cost in Freight Movement Performance Evaluation (CFIRE 03-15) project, he is working with Josh Levine (see sidebar, opposite) on surveying motor carrier drivers about the value of time and delays for motor carrier drivers. On the Aligning Oversize and Overweight Truck (OSOW) Permit Fees and Policies with Agency Cost (CFIRE 03-17) project, he is helping with the analysis of permitting costs on oversize and overweight loads. He is also participating in the evaluation of permitting options as part of phase 2 of the North/West Passage Corridor-Wide Commercial Vehicle Permitting (CFIRE 05-02) project.

Kleinmaier is working toward a dual Masters in Public Affairs and Urban and Regional Planning, with a certificate in Transportation Management and Policy. After he graduates, he plans to work in the comprehensive regional planning and policy field to address problems related to transportation, energy use, and greenhouse gas emissions.

You can reach Dan at dkkleinm@wisc.edu.

locations whether on I-90, I-94, I-39 or I-43. Each new site offers opportunities to meet some of the nation's hardest working men and women as they carry loads throughout the state. These in-person surveys also allow the research team to interact with motor carriers and gain a richer understanding of the industry. For instance, Kleinmaier and Levine found that different truck stops are frequented by different types of truckers. Some cater largely to more local or regional drivers while others serve as a rest for those

making cross country deliveries. By traveling to different types of truck stops they have been able to vary the types of drivers, local, regional or long-haul, that they were able to talk to. "We have talked with drivers from all over the country, many credentialed by and working in all of the lower 48 states," said Kleinmaier. "Most of the truckers have been very helpful in completing the surveys. They have offered insight that is not readily available beyond these personal interactions."

Student Spotlight: Josh Levine



Josh Levine has been working as a research assistant at CFIRE since the Winter of 2006.

In the past, Levine has worked on the Developing a Local Roads Website Compendium of Best Practices (CFIRE 03-07) project, in the course of which was primarily responsible for creating and populating much of the content in the compendium. He also contributed to "Transportation for a Sustainable Future: Sustainable Freight Transportation in Megaregions," presented at the 2010 Mid-Continent Transportation Research Forum. More recently, he co-wrote a paper on the transportation challenges associated with the construction of wind farms and presented these findings at the 2010 Great Lakes Wind Collaborative annual meeting.

Currently, Levine is working on the Assessing the Value of Delay to Rank Order Congestion Cost in Freight Movement Performance Evaluation (CFIRE 03-15) project with Dan Kleinmaier (see sidebar, opposite) on surveying motor carrier drivers about the value of time and delays for motor carrier drivers. He also frequently helps with the assembly of grant proposals and conference posters.

Levine is working toward a Masters degree in Urban and Regional Planning with a certificate in Transportation Management and Policy. He was a Peace Corps volunteer in Niger from 2007 to 2009. After he graduates, he plans to work in a planning capacity for a public agency or an MPO to address issues of sustainability, social justice, and environmental responsibility in transportation.

You can reach Josh at jblevine2@wisc.edu.

The collection of data is nearing an end and the job of transcribing surveys into a model-friendly format is about to begin. The project team will use these results to come to a better understanding of the cost and value of trucker's time.

The second project phase—Measuring Shippers' Value of Delay on the Freight System (CFIRE 04-14)—focuses on developing a model for estimating the value of delay for highway freight shippers. The research team led by CFIRE Director Teresa Adams, with Bruce Wang from the Texas Transportation Institute and graduate research assistants from both CFIRE and TTI, will conduct a set of case studies of representative shippers as identified by a pilot survey.

For more information about these and other projects, visit cfire.wistrans.org.

Dan Kleinmaier and Josh Levine contributed to this article.

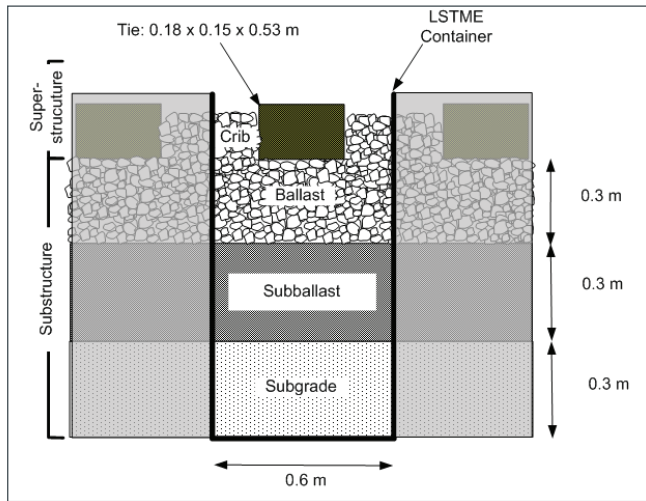
Trucker Talk

While surveying truckers about the value of delay, CFIRE research assistants Dan Kleinmaier and Josh Levine got a taste of the colorful colloquialisms that truckers use on CB radios. See if you can match these popular CB terms with their meaning.

- | | |
|-------------------------|---|
| 1. Bear | A. School bus |
| 2. Evel Knievel | B. Someone seeking directions |
| 3. Blinkin Winkin | C. Police officer |
| 4. Rollerskate | D. A police officer with radar gun |
| 5. Salt Shaker | E. A flatbed truck or trailer |
| 6. Alice in Wonderland | F. Cattle Truck |
| 7. Bear with a customer | G. Family car/truck/SUV |
| 8. Skateboard | H. Cop on a motorcycle |
| 9. Portable Barn Yard | I. A patrol officer who has pulled someone over |
| 10. Kojak | J. Snowplow |

Answers: (1.C)(2.H)(3.A)(4.G)(5.J)(6.B)(7.I)(8.E)(9.F)(10.D)

Continued from page 1...



traffic loading over railway tracks, researchers developed comprehensive look into ballast fouling and its effect on maintenance planning. This data set incorporated several types of ballast containing varieties of fouling contents, fouling types, moisture, and loading schemes. The project team found that unexpected failure and extreme deformational behavior of rail substructure occurred when excessive fouling and moisture was present. The results of this study were recently presented as “Controlling Parameters Affecting Deformational Behavior of Ballast in Railway Track” at the 2010 American Railroad Engineering and Maintenance-of-way Association (AREMA) Conference and the 2010 Mid-Continent Transportation Research Forum and published in the conference proceedings.

To make this empirical data useful to the rail industry, the project team also created software that predicts ballast lifetime and the maintenance intervals required to mitigate ballast-fouling conditions for various track conditions.

In addition, researchers collaborated with Dr. Dante Fratta to detect continual change of fines (fouling) and moisture in a rail track. As a result of this study, a coupled time domain reflectometry (TDR) method to couple with ground penetrating radar was proposed for accurate detection of moisture and fouling in ballast. The results of this study were presented as “Fouling Detection of Ballast by Electromagnetic Surveying” at the 2010 AREMA 2010 Conference and published in the conference proceedings.

“This has been a very successful project so far,” said Dr. James Tinjum. “We learned a lot about the rail transport industry and its structural problems. In turn, we developed our rail freight research

infrastructure, which is now poised for long-term and internationally recognized rail substructure research. We plan to be a world-class research institution in this area.”

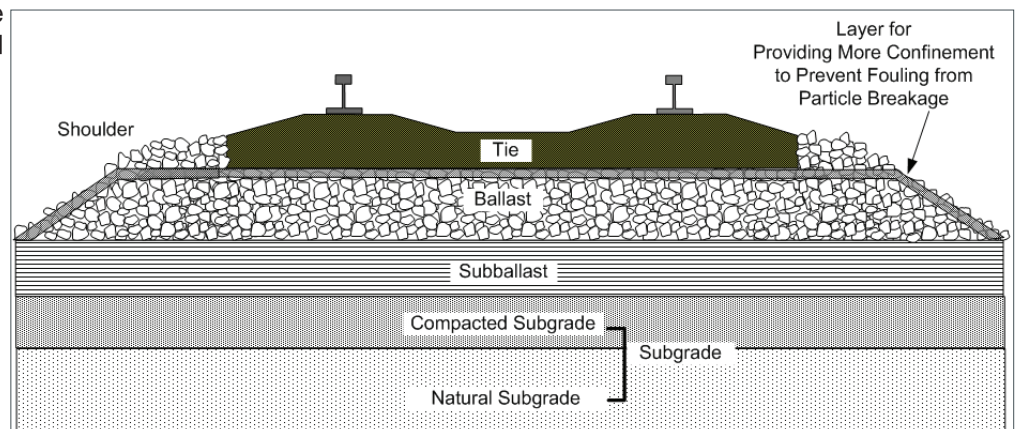
The project team will use these results as the basis for the next research phase: A Novel Approach to Mitigating Ballast Fouling and Enhancing Freight Rail Capacity (CFIRE 04-07). This CFIRE-funded project seeks to analyze methods and procedures for strengthening and enhancing the resiliency of ballast structure, while leaving current methods for track construction intact. In this phase of the project, researchers will assess the feasibility of strategically placed urethane reinforced layers within the ballast structure to mitigate ballast fouling and fines intrusion, thus reducing maintenance life cycle costs and increasing load capacity. These urethane layers are thought to enhance the structural capacity of ballast, in addition to providing a direct method of halting the fouling infiltration and generation process. Urethane layers of appropriate thickness (e.g., 5 to 10 cm) can be strategically placed within the ballast layer to mitigate the different mechanisms of fouling. Injecting urethane polymer foam in the voids of the ballast—called “urethane foam void filling and particle bonding”—creates this type of urethane layer.

“Our overall objective is to develop proven cost-effective methods of increasing service life of rail substructure. This will not only have cost benefits but also environmental benefits in terms of reduced green house gas emissions, energy consumption, and waste generation,” said Dr. Tuncer Edil. “Overall we hope to contribute to the greening of rail transport.”

A particular focus of this study has been a life cycle cost analysis and environmental impact assessment of the scenarios developed during research.

For more information about this and other CFIRE projects, visit cfire.wistrans.org.

Andrew Keene and Ali Ebrahimi contributed this article.



Upcoming Events

International Symposium on Durable and Innovative Bridges
January 22, 2011, Washington, DC

www.trb.org

90th Transportation Research Board Annual Meeting
January 23-27, 2011, Washington, DC

www.trb.org

48th Annual Midwest Truckers Association Convention
February 4-5, 2011, Peoria, Illinois

www.midwesttruckshow.com

2nd International Conference on Construction Management

February 7-11, 2011, Orlando, Florida

www.trb.org

2011 Joint Rail Conference: Shared Corridors, Shared Interests
March 16-18, 2011, Pueblo, Colorado

www.trb.org

APA National Planning Conference
April 9-12, 2011, Boston, Massachusetts

www.planning.org

International Transportation Economic Development Conference

May 1-4, 2011, Charleston, West Virginia

www.trb.org

13th TRB National Transportation Planning Applications Conference

May 8-12, 2011, Reno, Nevada

www.trb.org

3rd International Conference on Roundabouts
May 18-20, 2011, Carmel, Indiana

www.trb.org

4th International Transportation Systems Performance Measurement Conference

May 18-20, 2011, Irvine, California

www.trb.org

MID-AMERICA



FREIGHT COALITION

SAVE THE DATE!
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& ANNUAL MEETING
MARRIOTT ST. LOUIS UNION STATION
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The Mid-America Freight Coalition (MAFC) is a regional organization that cooperates in the planning, operation, preservation, and improvement of transportation infrastructure in the Midwest. The ten states of the AASHTO Mid-America Association of State Transportation Officials (MAASTO) share key interstate corridors, inland waterways, and the Great Lakes. The MAFC is funded by the National Center for Freight & Infrastructure Research & Education and the DOTs of the ten member states.

Professional Development Courses

For more information about transportation-related professional development courses available through the University of Wisconsin–Madison Department of Engineering Professional Development, visit their website at epd.engr.wisc.edu/courses. Courses marked with an asterisk (*) are eligible for CFIRE scholarships.

Traffic Engineering Fundamentals
December 14-16, 2010, Madison, Wisconsin

Maintain Asphalt Pavements
January 11-12, 2011, Madison, Wisconsin

Soil Engineering for Roads and Pavements
February 7-8, 2011, Madison, Wisconsin

Pavement Design: New Approaches
February 10-11, 2011, Madison, Wisconsin

Traffic Engineering Fundamentals
February 15-17, 2011, Madison, Wisconsin

Highway–Rail Grade Crossing Safety Course
February 28–March 1, 2011, Philadelphia, Pennsylvania

Railroad Construction Project Management*
March 2-4, 2011, Philadelphia, Pennsylvania

Fundamentals of Railway Train Control and Signaling*
May 10-11, 2011, Madison, Wisconsin

About CFIRE

The National Center for Freight and Infrastructure Research and Education (CFIRE) at the University of Wisconsin–Madison is one of ten National University Transportation Centers. The CFIRE consortium includes the University of Wisconsin–Milwaukee, University of Illinois–Chicago, University of Toledo, and University of Wisconsin–Superior.

CFIRE's mission is to advance technology, knowledge, and expertise in the planning, design, construction and operation of sustainable freight transportation infrastructure through education, research, outreach, training, and technology transfer. Our vision is to be an internationally recognized authority and resource that creates knowledge, advances understanding, develops technologies, and prepares leaders to meet the nation's need for safe, efficient and sustainable infrastructure for the movement of goods.

Adams Named to ATRI Research Advisory Committee



CFIRE Director Teresa Adams has been named to the Research Advisory Committee (RAC) of the American Transportation Research Institute (ATRI). Her two year term will run from January 1, 2011 to December 31, 2012.

Participation on the ATRI RAC includes attendance at the two-day RAC Annual Meeting, scheduled each year in mid-March in Atlanta. At this meeting, committee members review and ultimately recommend a prioritized research agenda the trucking industry. RAC members also take part in an annual Research Update webinar, scheduled during the second week of August. RAC

members also participate in various ATRI research initiatives on an ad hoc basis.

ATRI is the trucking industry's not-for-profit research organization, which conducts transportation research to advance the industry's safety and productivity. The ATRI RAC is charged with developing a research agenda through identification of research of value to the trucking industry.

For more information about the ATRI Research advisory committee, visit atri-online.org.

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