

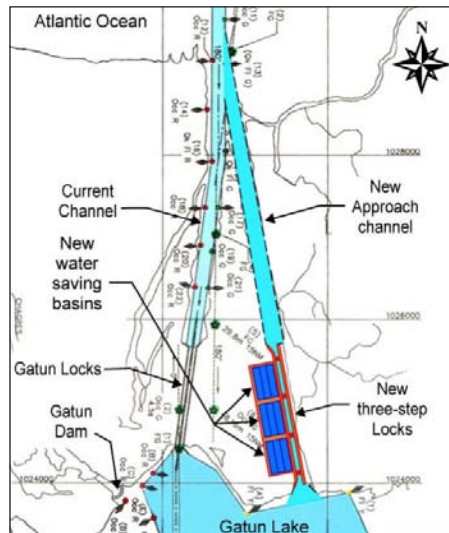
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## Understanding the Consequences of Canal Expansion

The Panama Canal Authority (ACP) plans to open a third lock by 2014, which will significantly change the capacity of the canal for inter-ocean goods movements. In addition to significantly adding capacity for containerized vessels, the expansion of the Canal will also decrease current the congestion in the locks for all types of canal transits—bulk, roll-on/roll-off, and container ships.



Exporters of grain and agricultural products in the Midwest will potentially be directly affected by these changes as all-water routes are improved and land bridge requirements reduced. While some studies have considered the availability and positioning of containers following an expansion, to date no research has looked closely at the export side of the equation. Following a record year for agricultural exports from the United States, and the Obama Administration's call for a doubling of exports over the next five years, researchers from CFIRE have begun investigating the impact of Canal expansion.

CFIRE Deputy Director Jason Bittner leads a research team including CFIRE Researcher Bob Gollnik on a project to analyze these changes to the canal: Understanding the Economic, Environmental and Energy Consequences of the Panama Canal

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## From the Director's Chair



It's springtime and change is upon us. There's new growth on the trees and plants, birds appearing after a long winter, and the winding down of another semester here at the University of Wisconsin–Madison. For me, it's time to clean up my office, get my bicycle tuned up after riding through the winter, and to recycle the stacks of magazines and reports that I won't get a chance to

read. It's also time to look forward to the summer's work. CFIRE will select its new projects this month. We'll also submit our budget for the coming grant year. It's time to look ahead, and also to look our accomplishments to date.

There are also a number of significant changes on the national front. The first round of TIGER grants highlights a shift to favoring discretionary spending on a large number of non-traditional, federally supported projects. The High Speed Passenger Rail awards also broke new ground. The most significant change for me, and for many of us in the freight community, is the strong directive from the US DOT that supports removing more freight from the highway system. This announcement came hard on the heels of indications of economic recovery, with especially good news from the sectors of the economy that have been downtrodden for years—steel and heavy manufacturing, including autos and other manufactured goods. This policy could require a substantial shift in how the US DOT views the commitment to US highway system that's been in place for more than fifty years. These policies are included in the recently published draft of the US DOT strategic plan, now open for public comment.

We at CFIRE are very much in favor of optimizing multimodal freight movements—and much of the Center's efforts focus on sustainable freight. We consider sustainability to require a combination of economic, environmental, and social factors. The Obama Administration has provided a bold vision of an environmentally sustainable freight network: “our goods movement hierarchy—where we want to keep goods movement on water as long as possible, and then on rail as long as possible and truck it for the last miles.” However, a policy that for environmental reasons prioritizes water transportation over rail and truck transportation—and rail over trucks—omits key economic and social factors vital to a truly sustainable freight system.

Let's first consider economic sustainability. Freight moves across the US and internationally in its current modal distribution because it is the lowest cost option. Shippers do not make decisions based on modes and third party logistics providers are generally mode agnostic. Shipping and logistics decisions are ruled by time and cost factors.

And while it's true that the system does have inherent inefficiencies, most of these inefficiencies cannot be blamed for congestion, infrastructure deterioration, or a multitude of other problems that many associate with trucking. We cannot ignore the fact that while trucks can serve nearly every community in the US, there simply isn't enough rail infrastructure to allow trucking to be confined to “the last mile” in most cases.

It's also important to be mindful of the number of jobs that rely on the trucking industry and the movement of freight in trucks. Removing trucks is tantamount to removing jobs from an already sluggish economy. We must also consider whether the government should be in the business of endorsing—and funding—one transportation mode and one set of private sector service providers over the others.

From CFIRE's perspective, the social sustainability of the freight system is just as important as environmental and economic sustainability. The US DOT strategic plan also does not seem to pay enough attention to the social sustainability of the freight system—especially the consequences of intermodalism. At present, there are few intermodal connectors built in a way that allows for the progression from water to rail to trucks that the US DOT envisions. Constructing these intermodal terminals in the midst of growing megaregions poses a significant challenge, both in terms of infrastructure and in terms of how such massive freight facilities might be integrated into livable communities.

From our point of view at CFIRE, the recent policy announcements from the US DOT and its draft strategic plan create more questions than answers. A truly multimodal freight transportation system requires significant investment in the infrastructure of all three surface modes, as well as the leadership and funding required to make the modes work together as efficiently as possible. Let's rely on the strengths of each mode to create a synergy of freight that will support the most efficient way to move goods, create jobs, and provide the foundation for a strong economy.

A parting note—this is my final column as Acting Director. Dr. Teresa Adams returns from her sabbatical at the US DOT this summer and I'll continue on as CFIRE Deputy Director. My nine months in the driver's seat passed quickly, sometimes in a blur.

Jason Bittner  
Acting Director (and Deputy Director)

Continued from page 1

Expansion on Midwest Grain and Agricultural Exports (CFIRE 03-18).

Bittner and Gollnik are approaching this project from several angles. They are analyzing goods movement data from a number of sources, including the FHWA Freight Analysis Framework, the National Agriculture Statistics Service, individual state trade organizations, and IHS Global Insight. The team also received select data from the ACP agricultural research department. Researchers are also conducting in-depth interviews with industry and public sector representatives to identify emerging trends and opportunities for grain and agricultural exports. And, they are conducting a survey in order to better understand the changing transportation decisions that canal expansion might cause for the commodities under analysis here — commodities that are critical to the economies of the Midwest states.

“The opportunity to improve the market reach for Midwest products is incredibly valuable. We know that our agricultural and manufacturing bases in the Midwest are threatened by foreign competition and the lack of new investment in infrastructure here. This Panamanian investment stands to benefit US importers and exporters alike,” said Bittner. “We also are anticipating that the Obama Administration’s call for increasing freight-related uses on the inland waterways systems will improve the timeliness of US exports through the Gulf of Mexico and Panama Canal.”

Bittner and Gollnik recently visited the Panama Canal to gather data and information, conduct a series of interviews with representatives from the Panama Canal Authority (ACP) and MIT Terminals in Colon, and to meet with key officials. They also took a full transit tour of the Canal.

“Being on site at the Canal, you really get a sense of its importance in the global economy,” said Bittner. “The engineering accomplishment, the vision, the sacrifices that were made to bring it to reality is impressive. It truly is an engineering marvel and one that is making global connectivity a reality.”

When the data-gathering phase of this project is complete, researchers will turn their attention to a set of economic, environmental, and energy consumption analyses. The project team will provide a detailed characterization of air emissions across these changing transport routes, a comparable analysis of energy consumption across the relevant freight modes, and an economic assessment of future export volumes. They will use these results to provide recommendations for state and public officials. Other recommendations will likely be forwarded through the Mississippi Valley Freight Coalition states to explore

the needed improvements of the inland waterways system to take advantage of the new capacity on the Canal.

For more information about this project and others, visit [cfire.wistrans.org](http://cfire.wistrans.org).

## Wisconsin Rail Plan 2030 Workshop

The Wisconsin Department of Transportation (WisDOT) is currently developing a statewide rail plan, scheduled for completion in Fall 2010. On May 26, 2010, WisDOT held a workshop in Stevens Point, Wisconsin the plan and gather feedback.

The Wisconsin Rail Plan 2030 builds upon Connections 2030, the statewide twenty-year multimodal plan, by establishing a vision for rail transportation through 2030, prioritizing infrastructure investment strategies, and defining statewide rail policy. The plan will also meet anticipated federal legislative requirements that were established by the Passenger Rail Improvement and Investment Act of 2008 (PRIIA).

More than seventy transportation professionals from public agencies and the private sector, including CFIRE Researcher Bob Gollnik, attended this one-day meeting. Focus groups first combined attendees with diverse interests and later those with similar backgrounds. Discussions focused on passenger, commuter, and freight rail, transit, shipping, the environment, and livable communities. Attendees also worked to prioritize the rail issues for the State to consider while completing the plan, focusing heavily on issues surrounding potential impacts of increased passenger rail service and facilities, as well as freight rail preservation and infrastructure needs.

"Given current economic conditions, the rail plan could not come at a better time. The combination of high-speed rail funding for the Madison-Milwaukee line and increasing demand for freight railroads highlights the importance of an efficient statewide rail system for Wisconsin's economy. This increased demand for rail across the board carries new opportunities for expanding capacity and services," commented Gollnik.

A panel with representatives from Amtrak, Canadian National, Wisconsin & Southern, and the Southeast Wisconsin Regional Planning Commission provided closing remarks based on their unique perspectives.

The Wisconsin DOT plans to post a summary of this workshop in the coming weeks. For more information, visit the [Wisconsin Rail Plan 2030](http://Wisconsin Rail Plan 2030) website.

## Recommendations for Reauthorization

In anticipation of the debate on the next federal transportation authorization bill, the Technical Committee of the Mississippi Valley Freight Coalition (MVFC) has defined regional positions on reauthorization predicated on the similarities of the states and the relative differences between the Mississippi Valley region and other major freight-moving regions of the country.

### Programs

The MVFC makes the following program recommendations:

- Support the AASHTO-recommended programs that apportion \$18 billion over six years from the highway account to the states for freight programs; and \$42 billion over six years from new sources, half of which should be apportioned to the states and half assigned to projects of national significance.
- Ensure that apportionment criteria reflect the interests of the region and are based on the region's share of manufacturing GDP, railroad mileage, taxed diesel fuel, share of rail activity, and other economic measures.
- Ensure that project selection criteria also reflect the interests of the region and consider the economic importance of the project in terms of total employment or percentage of GDP.

### Rail Transportation

The MVFC supports the development of a national rail policy and investment program that includes the following aspects:

- Expanded rail intermodal and shorter-haul services.
- Public incentives to support expanded capacity and services, in the form of direct capital funding and tax credits.
- Publicly funded projects included in state rail plans.
- Expanded funding for rail-crossing improvements.

### Maritime Transportation

The MVFC recommends support for the maritime mode with the following provisions:

- Expanded investment in dredging.
- Additional investment in locks and dams on both the rivers and lakes.
- Removal of existing legislative obstacles (harbor maintenance tax) to the expanded use of maritime transportation.
- Additional investment in maritime research.
- Additional tax provisions to encourage investment in new or expanded maritime resources.
- Support for demonstrations of new maritime services such as containers on ship or barge, roll-on/roll-off operations, ferry operations, etc.

### Institutional Issues

The states of the MVFC should work with AASHTO, the US Department of Transportation, and Congress to develop the following institutional changes:

- A redefined role for the US DOT that will allow it to better coordinate the activities of the states and private companies in planning, constructing, and operating an intermodal freight transportation system.
- An expanded understanding and use of regional groupings of states—such as the MVFC and others—to address issues of concern to those states.
- A refined methodology for states to voluntarily join together to cooperate in interstate arrangements.
- Improved legislation and technical standards to enable states to elect tolling as a revenue measure and to support uniform collections technology.
- Guidance at the federal level to help state agencies protect the public interest in public/private partnerships (P3s).
- Requirements for the US DOT and state DOTs to plan and develop freight transportation projects in a multimodal manner and to include intermodal connectivity.

### Performance Measures

The MVFC recommends the use of performance measures.

- Embrace performance measurement and the use of measures for effective management and accountability.
- Work toward appropriate use of measures as tools for understanding, managing, and improving performance.
- Insist that measures be developed that reasonably reflect the needs and situations of specific states and regions as well as the nation.
- Commit to the effort required to define, refine, and report meaningful measures.

### Truck Size and Weight

The MVFC should support the 97,000 pound, six-axle truck configuration recommended by the American Trucking Association, if:

- The industry is willing to pay additional fees to compensate for the costs incurred by the public sector.
- The units are powered sufficiently so that they can accelerate safely in traffic.
- The units have sufficient braking capability to stop safely in emergency situations.

These recommendations were recently published, both as a comprehensive report and as outreach materials.



Visit [mississippivalleyfreight.org](http://mississippivalleyfreight.org) for more information about these reauthorization recommendations and to download a series of one-page flyers.

## Blended Biodiesel for Reducing Freight Emissions

According to the “Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level” study, published by the FHWA in April 2005, heavy duty vehicles are the largest contributors to US freight-related nitrogen oxide and particulate emissions, emitting approximately 33 percent and 25 percent of all mobile-source nitrogen oxide and particulate matter emissions, respectively. These emissions pose risks to both public health and the environment. In addition, greenhouse gas emissions from trucking increased by 80 percent between 1990 and 2007, while greenhouse gas emissions from all transportation activities increased only 29 percent during the same period.

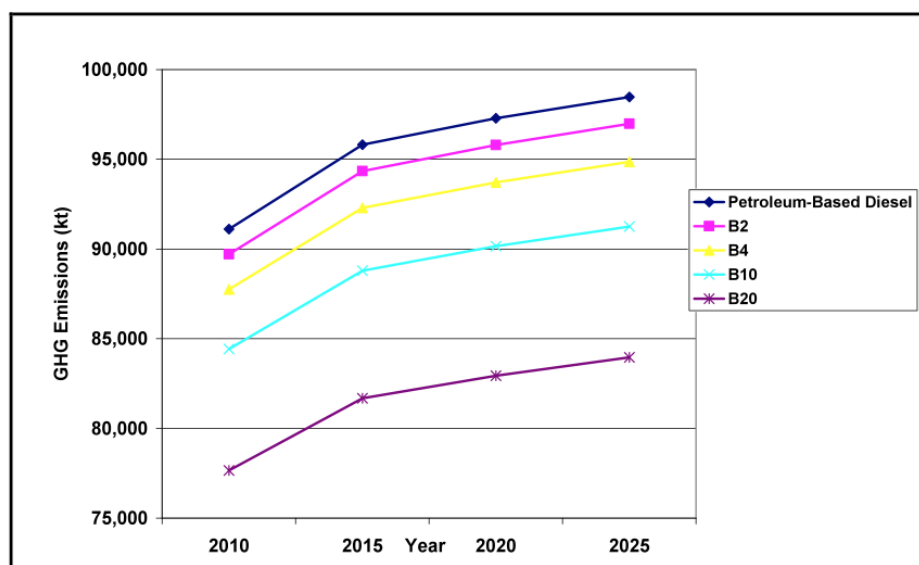
One possible near term alternative solution to these problems is to increase the blending of biodiesel. This project—Assessment of Biodiesel Scenarios for Midwest Freight Transport Emission Reduction (CFIRE Project 02-10)—was conducted by Paul Meier (principal investigator), Anjali Sauthoff, and Tracey Holloway and was funded by CFIRE and the UW Energy Institute. This study addresses the potential emissions benefits of biodiesel blending for use in heavy-duty diesel vehicles in Illinois, Indiana, Michigan, Ohio, and Wisconsin, examining whether these biodiesel blends offer a potential short-term, low-cost way to reduce freight-related emissions. The project team evaluated transportation end-use emissions to quantify particulate matter and nitrogen oxide and greenhouse gas emissions from heavy-duty diesel vehicles, assuming biodiesel blending replaced an increasing percentage of the petroleum-based diesel projected for freight transport. This study evaluated four scenarios of biodiesel blending, with blend percentages ranging from 2 percent to 20 percent, which can be used in current, unmodified diesel engines without maintenance and performance issues. Emissions from these scenarios were compared to a reference case scenario in which heavy duty transport was fueled by 100 percent petroleum diesel.

The results of this study suggest that the use of biodiesel blends may only slightly reduce particulate matter emissions and may have little impact on nitrogen oxide emissions.

“Identifying the appropriate emission factors requires more research attention. Much of the newly emerging

heavy duty vehicle technologies have yet to be tested in the context of biodiesel blend use,” commented Meier.

Still, the estimated effect of biodiesel blends on these pollutants was limited relative to the larger emissions reductions anticipated from technology and fuel mandates. Over the entire transportation sector, major reductions in particulate matter and nitrogen oxide emissions are anticipated between 2010 and 2025 as a result of improvements to vehicle exhaust controls, vehicle efficiency, and fuel modifications. Over this same time period, however, emissions of greenhouse gases are to increase.



Projected GHG emissions from region 3 heavy duty diesel vehicle fleet reflecting an increase in total emissions from 2010 to 2025.

The study showed that biodiesel blends may be effective in diminishing greenhouse gases based evaluation using the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model. The challenge lies in producing adequate quantities of biodiesel in a sustainable manner, as current projections for soy-based biodiesel are limited.

“Greenhouse gas benefits are currently difficult to incentivize given the absence of regulation to address climate change. In the meantime, other multi-pollutant strategies, such as improving trucking fleet fuel efficiency, reducing freight idling, more fuel-efficient modes of freight movement, or some combination of these alternatives should be considered,” said Meier.

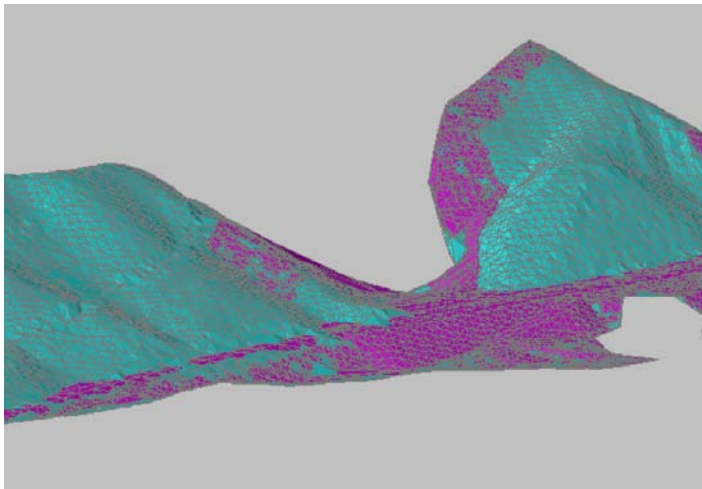
For more information about this project and others, visit [cfire.wistrans.org](http://cfire.wistrans.org).

## AMG and 3D Design Terrain Models

Automated Machine Guidance (AMG) uses three-dimensional (3D) digital models of design surfaces to guide construction equipment in the field. AMG has a number of clear benefits, including lower construction costs, greater accuracy, less repeat work, and less staking. Contractors report productivity gains as high as 40 percent.

AMG and 3D design software have developed rapidly in recent years. However, adoption of these technologies has been much slower, slowed in part by their spatial nature and increased complexity. However, there are also institutional, cultural, and legal obstacles to the implementation of 3D design technologies at State Highway Agencies (SHAs).

This study—3D Design Terrain Models for Construction Plans and GPS Control of Highway Construction Equipment (CFIRE Project 02-05)—was funded by CFIRE and the Construction and Materials Support Center. Dr. Awad Hanna was the principal investigator; the project team also included Alan Vonderohe and Cassie Hintz.



A 3D View of Short, Hilly Section Surfaces

This research aimed to identify and articulate the benefits of, and impediments to, the adoption of 3D design and AMG by the transportation industry. Building on the work of the National Cooperative Highway Research Program (NCHRP) and others, the project team added their own experience from recent work with the Wisconsin DOT to develop and implement a specification for AMG construction of highway subgrade.

The project consisted of four parts. Researchers conducted a nationwide survey of all SHAs and seven class I railroads. Based on the results of these surveys, three SHAs—Minnesota, Wisconsin, and North Carolina DOTs—were selected for case studies. The project team then compared earthwork

calculations done with 2D data (average-end-area) and 3D data (surface-to-surface). This study also included a description of 3D design software to help guide SHAs when evaluating software for implementation.

### Survey Results

The survey was divided into three sections (design, contracting, and construction) and was administered to all fifty SHAs and seven class I railroads. Multiple responders were allowed from each organization so that they could reply only to questions in their area of expertise. The survey response rate was 70 percent.

Eighty-two percent of responding SHAs use AMG, but only 32 percent of these have specifications. Automated machine guidance requires 3D digital models of design surfaces and 80 percent of responding SHAs give contractors primary responsibility for producing these models from 2D plans. Only 19 percent of all responding SHAs have fully adopted design methods that produce a 3D model. Furthermore, 60 percent of respondents assert that engineering consultants rarely or never provide 3D digital data to construction contractors to aid in 3D model development. Survey respondents recognize 3D design model issues as the most important impediment to wider use of AMG.

Although the majority of SHAs have not fully implemented 3D design methods, many agencies are in the process of planning for adoption of them. There are significant benefits associated with 3D design methods beyond support for AMG. The highest ranked additional benefit is detection and elimination of design errors prior to construction, followed by improved visualization, and having a more comprehensive representation of design intent.

However, significant impediments must be overcome by agencies prior to adoption of 3D design methods. The majority of respondents recognize lack of resources, agency lack of knowledge, entrenched business practices, lack of functionality in currently installed software, and required staff training as major obstacles. Ongoing technological advances are addressing lack of functionality, but the other identified impediments beg for education, training, and shared perspectives of agency missions. In addition, translation of data across different software platforms has historically been a problem, but AASHTO and TRB continue to strive for data compatibility standards and vendors have reported to be cooperating.

Legal factors also hinder the transfer of 3D digital data between designers and construction contractors. Only 11



percent of responding SHAs provide any legal standing for 3D digital data in contract documents. Primary issues include electronic signatures, transfer of liability as related to data exchange, data security, and auditability of plans. Professional licensure for those responsible for 3D model development is also an issue. Although the long-term goal of seamless data transfer might not be realized until 3D design models have legal standing equal to that of 2D plans, there are many other aspects of achieving the goal that are less complex, less fraught with obstacles, and far easier to address in the short term.

There are significant differences in the extent of use of AMG among regions. In the Mississippi Valley Region, 100 percent of responding SHAs use it. On the contrary, only one-third of Northeast Region respondents indicate that they do. There is also considerable variation in the adoption status of 3D design methods among regions. In the Southeast and West Regions, there is a fairly even distribution in the number of agencies that have fully adopted, are planning for adoption, or are considering adopting 3D design methods. However, in the Northeast Region, there are far more agencies in the process of adopting 3D design methods than there are in other categories of adoption status. Also, there are more agencies in the Mississippi Valley Region planning for adoption of 3D design methods than there are in other categories of adoption status.

### Case Studies

Case studies of the Minnesota, North Carolina, and Wisconsin DOTs revealed several keys to overcoming impediments to adoption of 3D design methods: buy-in and support from upper-level management; cross-cutting, well-executed implementation planning, with short-term and long-term objectives; management-level oversight and coordination of large, interdependent initiatives; champions: individuals or small groups with vision and commitment who take leadership roles and are persistent at moving forward; timely, well-designed, and delivered education and training at multiple levels within the SHA; and internal and external stakeholder participation in planning and implementation processes.

### Earthwork Calculations

The majority of SHAs are still using the average-end-area method to compute earthwork quantities. The surface-to-surface method is possible when 3D models are available, and this method is considered to be more accurate than average-end-area. Moreover, if 3D models are available, the surface-to-surface method is easier than average-end-area because there is no need to generate cross sections.

The project team compared earthwork quantities calculated using the surface-to-surface and average-end-area methods for six different sites, using data provided by the North Carolina and Wisconsin DOTs and two

construction contractors from Wisconsin. They computed volumes using the average-end-area method at cross section intervals ranging from 10 to 100 feet to determine effects of cross section interval on the difference between surface-to-surface and average-end-area results. In most cases, researchers found that increasing the cross section interval used in average-end-area earthwork calculations led to larger percentage differences between average-end-area and surface-to-surface results. For large projects, differences in earthwork quantity estimates are large enough to cause considerable cost discrepancies among methods, particularly when 100-foot cross section intervals are used. Cross section intervals of 50 or 100 feet are commonly used in practice when computing earthwork quantities using average-end-area.

### Software Descriptions

Means for describing various aspects of 3D design software must be available when assessing alternative choices for implementation. Factors such as support for improved work flows and objectives, ease of use, and software and database structures and relationships need to be considered as well as cost, training, and complexity of implementation (technological and institutional). The project team described a software system using three methods (i.e., user interface, business process hierarchy, and software and database architectures) and provided examples.

### Recommendations

Based on the findings of this study, the project team developed recommendations for SHAs in the following stages of implementing AMG and 3D design: seeking buy-in and commitment from upper management; seeking specification development for AMG; moving towards adoption of 3D highway design technology; seeking to develop or improve 3D data flows from design to construction; or seeking broader integration of multiple 3D technologies. For each context, researchers provide a series of recommended actions, tuned to their specific phase in the adoption of AMG and 3D design technologies.

“As in so many other areas of endeavor, technological advances in highway design and construction have far surpassed necessary changes in institutional arrangements, business practices, and legal aspects. This project confirmed, with hard data, a number of expectations in this regard and revealed some keys to success in moving forward. If people in the right places make the right decisions and are persistent in their efforts, the future is bright for much greater realization of short and long-term benefits of technology adoption,” said Vonderohe.

For more information about this project, consult the final report at [cfire.wistrans.org](http://cfire.wistrans.org).

## Regional OSOW Permitting in the North/West Passage Corridor

The North/West Passage Corridor Coalition includes the eight states along the I-90/94 Interstate corridor from Washington to Wisconsin. The coalition is dedicated to integrating traveler information, promoting cross-border cooperation and coordination of operations, maintenance of ITS infrastructure, and the integration of ITS projects for planning and programming.



The states of the North/West Passage Corridor, recognizing the importance of the efficient movement of freight-hauling trucks along the corridor, recently conducted a review the available methods for a regional permitting process for oversize and overweight (OSOW) trucks.

MVFC Facilitator Ernie Wittwer and CFIRE Researcher Bob Gollnik led a project—North/West Passage Corridor-Wide Commercial Vehicle Permitting (CFIRE Project 03-09)—funded by the North/West Corridor Coalition to investigate the available methods for a regional OSOW permitting process in these states.

The project team employed a multi-pronged methodology for evaluating the potential for a regional OSOW permitting process. They conducted a thorough literature review and analyzed the websites of the Western Association of State Highway and Transportation Officials (WASHTO), the Southeastern Association of State Highway and Transportation Officials (SASHTO), and the New England Transportation Consortium (NETC) to understand the workings of each compact and how they issue OSOW permits.

In addition to this review and analysis, researchers identified a set of questions that they used during interviews and to construct an online survey. These questions focused on the details of the permitting process from an agency perspective, and focused on the legal, administrative, and technical aspects of participation in a regional permitting compact. The project team surveyed 14 states in WASHTO, SASHTO, and NETC. They also surveyed the State of Missouri, which provided the perspective of an agency not currently participating in a permitting compact. All of the eight states in the North/West Passage Corridor Coalition were interviewed in

order to better understand their permitting processes and their concerns about change.

The project team also contacted truckers or trucking associations in all of the states participating in this study. Truckers were asked questions designed to elicit a better understanding of their views of the permitting process, including what works well and where there are opportunities for improvement.

The project team identified three technically feasible approaches to implementing a regional OSOW permitting process in the states of the North/West Passage Corridor Coalition.

1. **Expand WASHTO.** The Western Association of State Highway and Transportation Officials (WASHTO) is a regional permitting compact made up of 12 states in the west and south, including three of the eight states in the North/West Passage Corridor. While this is clearly the most immediately feasible approach, the non-WASHTO states have raised a number of concerns about the approach used by WASHTO. For some, it would be a step backward technologically. For others it may have an impact on workload. For still others, the envelope approach to allowable loads is too restrictive. In short, none of the five non-WASHTO states seem willing to embrace this approach in its current form.
2. **Use a common system, such as the Bentley GOT Permits system,** used by South Dakota and Nebraska (as well as Alabama, New Jersey, and West Virginia). While this is by far the most technologically elegant option because it allows self-issued permits for a wide range of loads, it also comes with a high cost. A reasonable estimate puts that cost at \$1–3 million per state.
3. **Use a virtual system, such as the approach being taken by Minnesota and Wisconsin in their effort to better share resources between states.** This effort centers upon an open-source interface that would allow carriers to apply for permits from several states simultaneously. The states would then process the permits individually and return them to the applicant. The drawback of this system is that it has not yet been developed; as such, the cost cannot be accurately determined.

Each of these options has its attractions and its drawbacks. However, there are still a number positive actions that could be taken in the near term, all of which involved improved communication and planning among the states. Based on the interview and survey responses from both the states and truckers, the project team recommends two approaches to bridge the OSOW permitting gaps between the two AASHTO regions (WASHTO and the Mississippi Valley) in the North/West Passage Corridor Coalition.



- Harmonizing regulations among the states could provide a significant savings to specialized carriers that move large loads across the states. Some of the issues at hand seem manageable, not requiring legislative action in most states.
- Harmonizing curfews and holidays so that restrictions tend to blend at the state line will prevent crews from sitting idle as they wait for the curfew to pass. This is most obvious in those states adjacent to major urban areas, such as the Twin Cities or Denver. These cities want loads to move at night in off-peak traffic periods. Could those adjacent states provide some exceptions to haulers who are moving through these urban areas?
- Harmonizing escort requirements will also save time and money. Consider a load that went through two states, a park, and a reservation, requiring four different escort arrangements. Did this improve the safety of the movement, or did it simply add needless costs?
- Standardizing signing and lighting requirements is also manageable. States should be able to agree on the message and the dimension of the signs to best deliver that message.
- Standardizing available permitting requirements and other information will also help truckers. Some states now have a large amount of information available online in an understandable language and format. Others have much less information available, and it is often much less understandable.
- A common user interface will significantly increase customer comfort and satisfaction. Coupling this with an effort to standardize the required information would go even farther.

These items are relatively simple and provide a solid foundation for further improvements to the regional permitting process in the North/West Passage Corridor Coalition.

“This project demonstrates an understanding on the part of the Northwest Passage states that public sector rules and requirements can produce unintended costs for the trucking industry. This project is one step toward reducing those costs,” said Wittwer.

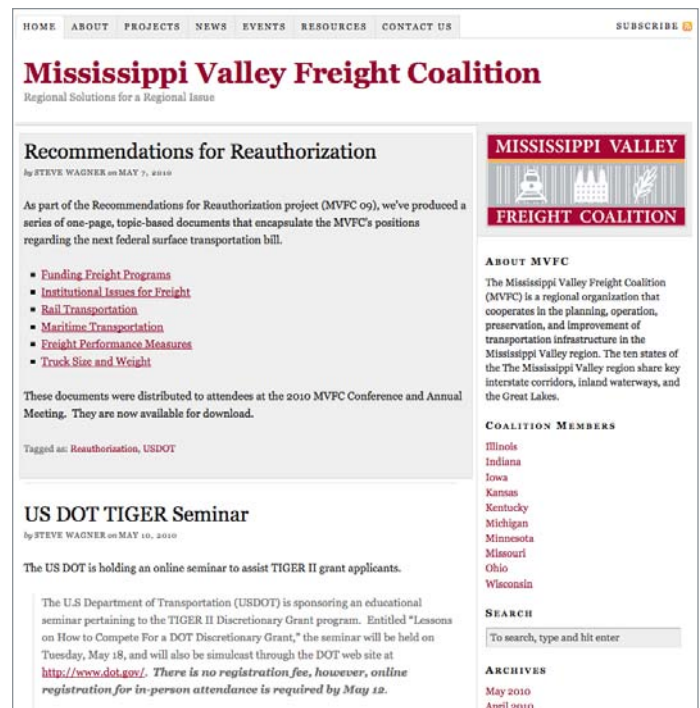
The project team also recommends a dual-track method for improving communications among the states and with the trucking industry. In one track, state representatives could begin to discuss the potential for expanding WASHTO and how some of the problems might be addressed. On another track, these representatives could engage carriers in order to identify the regulatory issues where change might have the greatest benefit. Following these parallel tracks will produce progress over time and lay the groundwork for greater improvements in the future.

For more information about this project, consult the final report at [cfire.wistrans.org](http://cfire.wistrans.org).

## New MVFC Website Now Live

The website of the Mississippi Valley Freight Coalition recently underwent a major overhaul, just in time for the 2010 MVFC Conference and Annual Meeting.

The centerpiece of the new MVFC website is a new blog, which the CFIRE and MVFC communications staff uses to provide updates about events, research, and news relevant to the ten coalition states and the freight community. You can read this blog on the website itself, or subscribe to the RSS feed. Updates to the blog are also automatically pushed to the CFIRE Twitter time line.



The screenshot shows the website's navigation bar with links for HOME, ABOUT, PROJECTS, NEWS, EVENTS, RESOURCES, CONTACT US, and a SUBSCRIBE button. The main heading is "Mississippi Valley Freight Coalition" with the tagline "Regional Solutions for a Regional Issue". A featured article titled "Recommendations for Reauthorization" by Steve Wagner is displayed, with a list of topics including Funding Freight Programs, Institutional Issues for Freight, Rail Transportation, Maritime Transportation, Freight Performance Measures, and Truck Size and Weight. A sidebar on the right lists coalition members: Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. It also includes a search bar and an archives section for May 2010 and April 2010.

In addition to the new blog, the website has a simpler design that both makes more readable and easier to navigate. You can also easily search the entire website.

If you have thoughts about the new design of [mississippivalleyfreight.org](http://mississippivalleyfreight.org) or a news item to suggest for the blog, send us an email at [cfire@engr.wisc.edu](mailto:cfire@engr.wisc.edu).

## FHWA FPMweb Tool Now Available

The FHWA Office of Operations, in partnership with the American Transportation Research Institute (ATRI) has released the FPMweb tool, which measures operating speeds of trucks along 25 freight-significant Interstate highway routes.

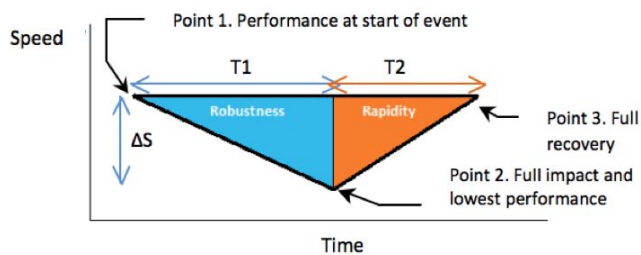
For more information, visit [Travel Time in Freight Significant Corridors](#) at the FHWA.

## Corridor Resiliency Performance Measures

CFIRE Director Teresa Adams, with the help of project assistants Edwin Toledo-Duran and Ravi Pavuluri, recently completed an exploratory data project that examined ways to measure the resiliency performance of a freight corridor. The Freight Resiliency Performance Measures (CFIRE Project 03-23) study used data from the American Transportation Research Institute (ATRI) to further both the FHWA's Freight Performance Management (FPM) program and the ongoing research of the Mississippi Valley Freight Coalition (MVFC).

In this study, the researchers used these data to illustrate measures for freight transportation resiliency of an interstate corridor. The availability of travel speeds and relative truck counts prior to, during, and after two significant weather events enabled the researchers to compute and illustrate two resiliency performance measures: robustness and rapidity. The project team used resiliency triangles to visualize the magnitude of the impact of a disruption, and to evaluate these performance measures.

The resiliency triangle (see below) is a disaster research concept. The system experiences a sudden loss of function from damage and disruption. The system slowly returns to the pre-disaster performance level. The depth of the triangle shows the severity of damage, the length of the triangle, the duration of the recovery period.

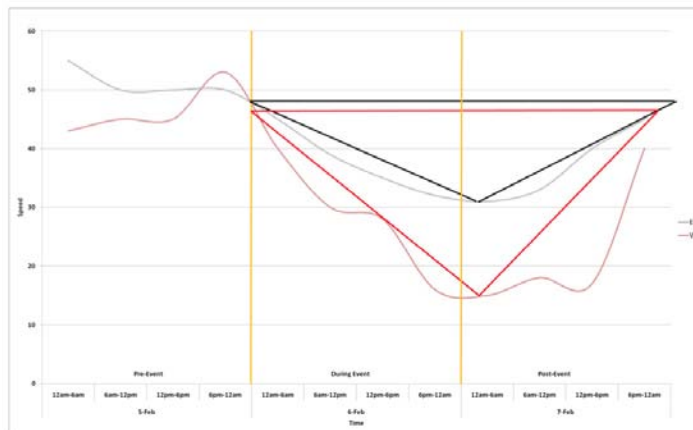


The resiliency triangles derived using the ATRI geospatial truck location data differ from the standard triangle. Rather than a sudden abrupt loss of function, the impact of significant weather events was more gradual.

The shape and areas of the resiliency triangle provide information about robustness of the highway system network and the rapidity with which it recovers from disruption. Two other resiliency measures, redundancy and resourcefulness, could not be represented with the data set provided by ATRI.

The project team used truck count and speed data along the I-90/94 corridor from Hudson to Beloit in Wisconsin. The Hudson to Beloit Corridor was segmented using the 59 intersections as limits to define 58 segments along the corridor. The corridor is the critical backbone for freight

and passenger mobility and accessibility in Wisconsin. The corridor also supports significant pass-through freight and passenger travel between Chicago and Minneapolis and beyond. Using ATRI data, researchers were able to analyze resiliency by tracing truck entries and exits along the corridor and travel speed through the corridor.



Resiliency triangles (see above) were created for truck speed during severe weather events in February and June 2008. The triangle angles indicate the system performance loss, the duration of time until performance deteriorates to the poorest performance, and then the duration of time to recover. Based on the shape of the resiliency triangles from these events, the project team was able to establish high, moderate, and low criteria for the robustness and rapidity resiliency measures.

The first portion of the resiliency triangle represents robustness, from the point where performance starts to deteriorate due to an event to the lowest performance point. If the triangle has a gentle downward slope then the system performance is deteriorating slowly because the system has the robustness to withstand the disaster forces. Conversely, a rapid loss in performance indicates low robustness because the disaster forces the system to deteriorate quickly. For the more robust sections of the Hudson to Beloit interstate corridor, researchers posited that alternate routes provided redundancy for those sections. However, their analysis did not evaluate use of alternate routes.

The second portion of the resiliency triangle represents rapidity, from the lowest performance point to the point where performance returns to the average pre-event level. If this closure angle has a steep slope, the system recovered quickly. If the slope is gradual, then the system did not recover quickly.

For more information about this project, consult the final report at [cfire.wistrans.org](http://cfire.wistrans.org).

## MVFC 2010 Conference and Annual Meeting

The 2010 Mississippi Valley Freight Coalition (MVFC) Conference and Annual Meeting was held on April 27-29 at the Millennium Hotel in the Queen City of Cincinnati, Ohio.

More than eighty representatives from MVFC state DOTs, MPOs, academia, and the private sector attended this year's conference, which was hosted by the Ohio DOT, the Indiana DOT, and the Kentucky Transportation Cabinet. The conference was organized by the CFIRE staff.

The conference started with two parallel sessions about current MVFC projects. Peter Lindquist from the University of Toledo gave a presentation on Midwest FreightView. CFIRE Director Teresa Adams and project assistant Kaushik Bekkem talked about Corridor Resiliency.

Attendees then reconvened for the first general session, during which CFIRE Director Teresa Adams and Acting Director Jason Bittner welcomed attendees and talked about the MVFC and CFIRE. MVFC Facilitator Ernie Wittwer reviewed the agenda for the rest of the conference, and got attendees out of their seats to introduce themselves to their peers.

Mark Policinski, Director of the OKI Regional Council of Governments, gave the conference's first keynote address. After lunch, attendees once again split up to attend one of two parallel sessions. Peter Lindquist from the University of Toledo and Kazuya Kawamura and Jane Lin from the University of Illinois-Chicago talked about the Commodity Profiles project. CFIRE Researcher Bob Gollnik and Ernie Wittwer led an interactive workshop that sought feedback about the freight outreach materials now in production for the MVFC.

The rest of the afternoon was devoted to presentations and discussion about freight from a national perspective. Chris Smith from AASHTO talked about the upcoming reauthorization of surface transportation legislation. Adrienne Gildea provided the perspective of CAGTC on funding freight infrastructure in the context of reauthorization. Teresa Adams talked about her experience working at the US DOT on one of the TIGER grant selection teams. Dennis Falkenburg from Appian, Inc. gave a presentation about the impact of reauthorization on freight in the Midwest.

After a short break, representatives from state DOTs and MPOs convened for a working dinner that provided them with the opportunity to network and to learn about how other agencies are incorporating freight into their planning and programming activities, as well as how they advance freight planning in their agencies.

The second day of the 2010 MVFC Conference and Annual Meeting was devoted panel discussions about different aspects of freight transportation.

The panel on water transportation was moderated by Rich Cooper from the Port of Indiana and included Bob Goodwin (MARAD), Rick Morgan (USACE), and Patrick Donovan (West Virginia Public Port Authority). The panel on freight rail was moderated by Matt Dietrich from the Ohio Rail Development Commission and included Greg Levy (Wheeling & Lake Erie Railway Company), Chris Luebbers (Norfolk Southern), and Carl Warren (CSX Intermodal).

Ohio DOT Director Jolene Molitoris gave the conference's second keynote address. After lunch, attendees gathered for a panel discussion economic development and transportation. This panel was moderated by Joanna Pinkerton from the Ohio DOT and included David Holt (Conexus Indiana), Ed Wolking (Great Lakes Manufacturing Council), and Dan Ricciardi (Columbus Region Logistics Council).



The second day of the conference was rounded out by a tour of the historic Union Terminal Tower A museum and the CSX Queensgate Yard, where attendees viewed intermodal container movements.

The third day of this conference was devoted entirely to the MVFC business meeting. Ernie Wittwer facilitated a discussion about the current state and future direction of the MVFC.

The final program and presentations from the 2010 Conference and Annual Meeting are available at [mississippivalleyfreight.org](http://mississippivalleyfreight.org). The next issue of the MVFC Freight Notes will include an expanded summary of the conference and meetings.

### Freight & HazMat Problem Statements

The National Cooperative Freight Research Program (NCFRP) and Hazardous Materials Cooperative Research Program (HMCRP) have issued a **request for problem statements** to identify research needs for NCFRP's and HMCRP's FY 2011 program. Due July 30, 2010.

## Transportation Management & Policy Program

Each semester, CFIRE hosts a reception for the students in the Transportation Management and Policy (TMP) program. Students currently enrolled in the TMP practicum (CEE 722) and the TMP colloquium (CEE 970) present the results of their group projects. Students, faculty, and staff share a buffet lunch, sponsored by a donation from Cambridge Systematics, Inc. CFIRE also awards the Muzi Fellowship during this reception.

### TMP Colloquium

Students in the Transportation Management and Policy (TMP) program take two one-credit colloquium modules as part of the TMP curriculum. These colloquia provide students with the opportunity to discuss transportation issues with leaders in the field. Each semester, the topic and guest speakers vary. Students also work in small groups on projects related to the topic at hand. The theme for the Spring 2010 TMP Colloquium was Hazardous Materials Transportation.

At the Spring 2010 TMP program reception, colloquium students presented the results of their small-group projects.

Jessie Durst, Xiaojia Bi, Austin Outhavong, Tony Smick, and Edwin Toledo-Duran gave a presentation entitled “Transport of Biohazards,” in which they analyzed the methods that the US transportation system uses to move different types of hazardous biological materials.

Mamata Shrestha, Shang-Ching Kuei, Kaushik Bekkem, Dan Kleinmaier, and Joshua Levine gave a presentation entitled “Post 9/11 Regulations and Significant Impacts for Highway, Rail, and Water Transportation Modes,” which outlined the expanded—and frequently bewildering—mass of regulations related to the transportation of hazardous materials that have arisen since September 11, 2001.

### TMP Practicum

In the Transportation Management and Policy (TMP) program, students take a practicum course where they work on a solution to a real-world transportation-related problem.

At the Spring 2010 TMP program reception, two groups of practicum students presented the results of their practicum projects.

Kaushik Bekkem, Shang-Ching Kuei, Mamata Shrestha, Tony Smick, and Edwin Toledo-Duran gave a presentation entitled “Assessing the Yahara Region’s Transportation Needs,” in which they talked about the results and preliminary analyses of a survey designed and administered by the group that gathered information about the use of public transit in Dane County. The data and results of this survey will be made available to the newly formed Dane County Regional Transit Authority.

Erica Bickford, Sara Drescher, Spencer Gardner, Joshua Levine, and Bickey Rimal gave a presentation entitled “Cost Estimation for Charter Street Biomass Supply Chain,” which detailed their transportation analysis of the supply chain for biomass for the Charter Street plant at the University of Wisconsin–Madison. This plant is in the process of converting from coal-fired boilers to natural gas and biomass. This group also created a MS Excel tool for performing cost estimations for three different types of biomass.

After each student group finished presenting their findings, they answered questions from the faculty and staff members in the audience.



## Smith Awarded Muzi Fellowship

Adam Smith has been awarded the 2010 Andrew Muzi Yellow Jersey Fellowship. Smith's passion for bicycling, his volunteer work on the UW Campus Transportation Committee and the Bus Pass Advisory Committee, his work on campus transportation sustainability projects at Carlton College, and his internship with the Rails-to-Trails Conservancy all contributed to the winning of this award.



Smith is currently working toward completion of a dual Masters degree in Urban and Regional Planning and Public Affairs at the University of Wisconsin–Madison. After he graduates, he intends to embark upon a career path where he can help shape livable, sustainable communities where bicycles and the people who ride them can flourish.

“The Muzi Award is an important recognition of the opportunities that cycling holds to improve quality of life in our communities. It is also a recognition of how much work is left to be done in taking advantage of these opportunities,” said Smith. “I am honored to receive this Award and excited to join the growing ranks of transportation professionals who view bicycles as a critical addition to a truly multimodal transportation system. Cycling holds an important part of the answer in our efforts toward the creation of cities and towns that are healthy, sustainable, and enjoyable, and the Muzi Award underscores the need for expanded bicycle infrastructure.”

CFIRE awards this \$500 scholarship to a bicycling enthusiast and student in the Transportation Management and Policy Program. The award is sponsored by the Dane County Bicycle Association “to honor the lifetime contribution of Andrew Muzi to cycling in the Greater Madison Area.” The award recipient is a cycling enthusiast who upon graduation plans to assume a professional position that will influence the future design of facilities and infrastructure that support safe and effective bicycling.

## Southeast Regional Transportation Workforce Development Conference

The Southeast Regional Transportation Workforce Development Conference, sponsored by the Southeast Transportation Center, is one of a series of regional transportation workforce development conferences conducted around the US and hosted by University Transportation Centers (UTCs). These conferences are part of a larger national effort to help shape the future of the transportation workforce in years to come. The CFIRE-sponsored 21st Century Transportation Workforce Summit held on December 8-9, 2008, was also part of this series.

CFIRE Research and Education Coordinator Greg Waidley attended this conference and brought back some valuable insights on education and transportation workforce development.

Speakers from the Tennessee Department of Education, the Tennessee legislature, the Federal Highway Administration, and the transportation industry spoke provided a perspective about educating and training the transportation workforce of the future.

Representatives from the State of Tennessee also talked extensively about the recent award of \$500 million of federal Race to the Top funding. These funds will be used to improve under-performing schools, augment teacher training programs, and extend the Science, Technology, Engineering, and Mathematics (STEM) network in Tennessee. “It’s probably the most exciting thing going on in Tennessee right now,” said Waidley.

Tennessee was one of only two of the forty applicant states to secure this funding. The State of Tennessee’s complete revision of assessment tests to make them more rigorous combined with a total re-write of the curriculum to prepare students for these more stringent examinations seems to have contributed to the State’s success in garnering these funds. Students will not only be better prepared for their assessment tests, but also for their post-secondary endeavors, whatever they might be. The political will to carry out these plans was also crucial; all eight candidates in Tennessee’s upcoming gubernatorial election signed on to support these efforts.

“A common thread was that no matter where your post secondary education plan may take you—be it a university, two-year college, or straight into the workforce—all students graduating from high school need the same skill sets in order to be successful,” commented Waidley.

For more information about this conference, visit the [Southeast Transportation Center](#).

## Toward Better Freight Transportation Data

Good decisions require good data—that was the underlying theme of the Transportation Research Board's Toward Better Freight Transportation Data: A Research Road Map workshop, held May 19-20, 2010.

Freight researchers from across the country met at the Beckman Center of the National Academies in Irvine, California to identify new data sources, linkages, methodologies, and applications—all with an eye toward supporting and improving the decision-making processes of shippers, carriers, and the planners and operators of public infrastructure.

CFIRE Acting Director Jason Bittner attended this workshop and participated in the day-long breakout session that focused on sharing freight transportation data. This group focused on developing better information about the available data sets and an inventory of data sources. They also discussed other questions such as how much data is enough, when is good data sufficient for decision-making, where a national or regional data repository should be hosted, and what the best case studies, tools, or contract templates for data sharing are.

“One of the biggest challenges to better management of the freight transportation network is the availability of—and willingness to share—data and information in a real time basis,” said Bittner. The research topics identified will

be fed into larger National Cooperative Freight Research Program topic areas and direct future TRB Committee work.

There were also breakout sessions devoted to using GPS data to forecast freight flows, using freight data to measure system performance, developing origin-destination matrices to support freight planning, and linking data sets and using technology to improve freight information.

On the second day of this two-day workshop, attendees reconvened for reports from each breakout group, which outlined the themes and general priorities that arose from their discussions. The conference closed with a workshop-wide discussion of crosscutting themes and priorities for developing a freight data research road map.

“Without a common platform, there is a good possibility of duplicative and unnecessary data-related research. Having best practices readily available is ideal for researchers in this area. No need to reinvent the process when there are common contracts, intellectual property protections, and the like,” commented Bittner.

A TRB E-Circular is being developed and will be available later this year to journal the results. More information is available at [www.trb.org](http://www.trb.org).

## Professional Development Courses

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

**Railway Bridge Engineering\***  
June 16-17, 2010, Philadelphia, PA

**Fundamentals of Railway Train Control and Signaling, Including PTC Systems\***  
September 15-16, 2010, Philadelphia, PA

**Highway Bridge Design**  
April 21-23, 2010, Madison, WI

**Proven Strategies for a Successful Rail Operation\***  
October 12-13, 2010, Madison, WI

**Effective Concrete Bridge Repair**  
October 25-27, 2010, Madison, WI

**Light Rail - Rapid Transit - Commuter Rail: Engineering Fundamentals for Modern Mass Transportation Systems\***  
November 15-17, 2010, Madison, WI

**Maintaining Asphalt Pavements**  
December 6-7, 2010, Las Vegas, NV

**Highway Bridge Design**  
December 6-8, 2010, Madison, WI

**Railway Bridge Engineering\***  
December 9-10, 2010, Madison, WI

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

## Contributors

Content for this edition of the CFIRE News was contributed by Teresa Adams, Jason Bittner, Bob Gollnik, Paul Meier, Ravi Pavuluri, Adam Smith, Edwin Toledo-Duran, Alan Vonderohe, Steve Wagner, Greg Waidley, and Ernie Wittwer.

## June 2010

### CUTC Annual Meeting

June 7-9, 2010, College Station, TX

[cutc.tamu.edu](http://cutc.tamu.edu)

### Joint Conference of Harbor Safety Committees and Area Maritime Security Committees

June 8-10, 2010, Jersey City, New Jersey

[www.trb.org](http://www.trb.org)

### NASCO Conference 2010

June 15-17, 2010, Des Moines, IA

[www.nascoiowa2010.com](http://www.nascoiowa2010.com)

### ASEE Annual Conference and Exposition

June 20-23, 2010, Louisville, KY

[www.asee.org/conferences/annual/2010/](http://www.asee.org/conferences/annual/2010/)

### North American Travel Monitoring Exposition and Conference

June 21-24, 2010, Seattle, WA

[www.trb.org](http://www.trb.org)

### Great Lakes Maritime Transportation Teacher Institute

June 21-25, 2010, Toledo, OH

[www.glmri.org](http://www.glmri.org)

### Teaching Mathematics Through Navigation

June 28-July 2, 2010, Houghton, MI

[www.glmri.org](http://www.glmri.org)

### Transforming the Marine Transportation System

June 29-July 1, 2010, Irvine, CA

[www.trb.org](http://www.trb.org)

## July 2010

### Mississippi Valley Conference Annual Meeting

July 6-9, 2010, Des Moines, IA

[www.mvc2010.com](http://www.mvc2010.com)

### Performance-Based Asset and Risk Management of the Highway Infrastructure System

July 11-15, 2010, Philadelphia, PA

### TRB Joint Summer Meeting

July 11-14, 2010, Minneapolis, MN

[www.trb.org](http://www.trb.org)

### AASHTO Subcommittee on Maintenance

July 11-15, 2010, Savannah, GA

[maintenance.transportation.org](http://maintenance.transportation.org)

### AASHTO RAC Meeting

July 26-29, 2010, Kansas City, MO

[research.transportation.org](http://research.transportation.org)

## August 2010

### Preserving our Highway Infrastructure Assets

August 3-6, 2010, Orlando, Florida

[www.irfnews.org](http://www.irfnews.org)

### ITE 2010 Annual Meeting and Exhibit

August 8-11, 2010, Vancouver, BC

[www.ite.org](http://www.ite.org)

### Mid-Continent Transportation Research Forum

August 19-20, 2010, Madison, WI

[www.mrutc.org/midcon/](http://www.mrutc.org/midcon/)

## September 2010

### International Conference on Sustainable Concrete Pavement Technologies

September 15-17, 2010, Sacramento, CA

[www.trb.org](http://www.trb.org)

### USA Rail 2010

September 13-15, 2010, Denver, Colorado

[www.terrapin.com/2010/usarail/](http://www.terrapin.com/2010/usarail/)

### 10th National Conference on Transportation Planning for Small and Medium-Sized Communities

September 22-24, 2010, Williamsburg, VA

[www.trb.org](http://www.trb.org)

## October 2010

### ARTBA National Convention

October 3-6, 2010, New York City, New York

[www.artba.org](http://www.artba.org)

### Wisconsin Motor Carriers Association Annual Convention

October 13-15, 2010, Wisconsin Dells, Wisconsin

[www.witruck.org](http://www.witruck.org)

### Transportation Systems for Livable Communities

October 18-19, 2010, Washington, DC

[www.trb.org](http://www.trb.org)

### Indiana Logistics Summit

October 26-27, 2010, Indianapolis, Indiana

[www.indianalogistics.com](http://www.indianalogistics.com)

### AASHTO Annual Meeting

October 28-November 2, 2010, Biloxi, Mississippi

[www.transportation.org](http://www.transportation.org)

# 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.

## LocalRoadsCompendium



*Collaboration to Enhance Wisconsin's Local Roads*

Visit the **Local Roads Compendium** for existing manuals, reports and articles, best practices, local project profiles, and communication resources — all compiled to assist local governments in managing their local roads systems.

Let us know what you think of this interactive resource at [cfire@engr.wisc.edu](mailto:cfire@engr.wisc.edu).

# localroads.wisc.edu

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