# Midwest Transportation Consortium 2006-2007 Annual Report


ctre
Center for Transportation
Research and Education

IOWA STATE
UNIVERSITY

Iowa State University's Center for Transportation Research and Education is the umbrella organization for the following centers and programs: Bridge Engineering Center • Center for Weather Impacts on Mobility and Safety • Construction Management & Technology • Iowa Local Technical Assistance Program • Iowa Traffic Safety Data Service • Midwest Transportation Consortium • National Concrete Pavement Technology Center • Partnership for Geotechnical Advancement • Roadway Infrastructure Management and Operations Systems • Statewide Urban Design and Specifications • Traffic Safety and Operations

## About the MTC

The mission of the University Transportation Centers (UTC) program is to advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research, and technology transfer at university-based centers of excellence. The Midwest Transportation Consortium (MTC) is the UTC program regional center for Iowa, Kansas, Missouri, and Nebraska. Iowa State University, through its Center for Transportation Research and Education (CTRE), is the MTC's lead institution.

## Disclaimer Notice



## Non-discrimination Statement

# Introduction

The Midwest Transportation Consortium (MTC) began year 8 by having the funding it receives from the Research and Innovative Technology Administration doubled, and by losing its regional grant to a consortium led by the University of Nebraska-Lincoln. Fortunately, the MTC later won a Tier I grant through a national competition. In the future, we plan to continue many of the programs we have conducted in the past, reduce our number of partners due to a decrease in resources, and more tightly define our theme.

MTC partners during year 8 (all consortium universities) include the Universities of Missouri at Columbia (UM-C) and St. Louis (UMSL), Lincoln University, and the University of Northern Iowa (UNI). The University of Missouri at Kansas City (UMKC) is officially part of the consortium, but due to personnel changes has largely been inactive.

## Preview

As part of the ongoing MTC program, members have established an effective network that promotes the education of future transportation professionals and the development of new knowledge on how to manage transportation infrastructure and services in a more sustainable manner. The MTC has a track record of developing outstanding students; these students are now becoming leaders in the private sector, government, and academia.

The MTC has also supported the development of an extensive research portfolio related to sustainable transportation asset management. Finally, the MTC has dedicated itself to the dissemination of research results through an ongoing technology transfer program, special workshops, and special publications (such as *Go!* magazine).

This document provides a progress report for the year of operation of the MTC, which ran from October 2006 through September 2007.

## Research

The increase in federal funding received in year 8 allows us to resurrect our competitive research program. During year 7, the MTC used a modest amount of research funding ($30,000) to fund two small projects at Missouri State University and one at Wichita State University. These have been completed and the research reports are on the MTC web site. In year 7 we continued to retain a competitive research program, although it was very small.

In year 8, the MTC distributed RFPs to all universities in region 7 with a transportation research program. Although pre-proposals were received from a couple of non- consortium universities, only one small grant was awarded to the University of Iowa (U of I) ($30,000). This was a profound act for Iowa State University (ISU) and U of I, since the two universities had been competitors rather than collaborators for nearly a decade. Several of the year 8 projects, including the U of I project, are still in progress; the researchers will continue to spend their remaining funds, and most of the projects will be completed during the summer and fall of 2008.

Although year 8 was the largest year for the MTC's research program, the educational component of the MTC budget continued to consume the most resources. The results of

competitive research selection during year 8 are listed in Table 1. The funds shown in Table 1 are the federal portions of the projects. Some projects had their funding reduced, and some were postponed for equity reasons. All rankings were developed from a peer review.

| PI Name | Lead University | Proposal Title | Category | MTC Funds Requested | Matching Funds | Cumulative MTC Funding |
|---|---|---|---|---|---|---|
| Tom Maze | Iowa State University | Management of Rural Expressways for Improved Safety and Operational Performance | Rural Highway Policy | $62,500 | $62,500 | $62,500 |
| Shauna Hallmark | Iowa State University | Achieving Efficiency in Meeting Safety, Operations, Maintenance, and Air Quality Goals | Traffic Operations | $70,000 | $70,000 | $132,500 |
| Brent Rosenblad | University of Missouri – Columbia | Bridge Deck Integrity Measurements for Asset Management | Structures | $40,000 | $40,000 | $172,500 |
| Wooseung Jang | University of Missouri – Columbia | A Decision Support System for Optimal Depot and Fleet Management | Fleet Operations | $48,500 | $48,500 | $221,000 |
| Shauna Hallmark | Iowa State University | Validating Methods to Estimate Vehicle and Driver Exposure | Safety | $40,000 | $40,000 | $150,000 |
| Glenn Washer | University of Missouri – Columbia | Remote Health Monitoring for Asset Management | Structures | $45,000 | $45,000 | $266,000 |
| Sam Kiger | University of Missouri – Columbia | Bridge Vulnerability Assessment and Mitigation Against Explosions | Structures | $50,000 | $75,000 | $316,000 |
| Linda Boyle | University of Iowa | Assessing the Spatial and Temporal Differences in Midwestern Crashes Relative to National Data: Implications for Public Policy Decisions | Safety | $30,000 | $30,000 | $346,000 |
| Charles Nemmers | Iowa State University | Synthesis Study: Effectiveness of Safety Corridor Programs in Region 7 States | Safety | $32,000 | $32,000 | $378,000 |
| Neal Hawkins | Iowa State University | Iowa Pavement Marking and Sign Management System | Asset Management Systems | $60,000 | $60,000 | $438,000 |
| Tim Strauss | University of Northern Iowa | The Spatial Scale Of Clustering Of Motor Vehicle Crash Types And Appropriate Countermeasures | Safety | $31,740 | $32,675 | $469,740 |
| J. Erik Loehr | University of Missouri-Columbia | Integration of Asset Management Systems with Load and Resistance Factor Design (LRFD) | Structures | $50,000 | $50,000 | $519,740 |
| David J. Plazak | Iowa State University | Development of a Comprehensive Framework For Managing Decisions Regarding Highway Bypasses | Rural Highway Policy | $40,000 | $40,000 | $559,740 |

**Table 1. Year 8 projects funded**

Similar to previous years, ISU continued to spin out new initiatives in 2007 and created the Sustainable Transportation Systems Program, a research program focusing on the implications of the biofuel economy (see more at www.ctre.iastate.edu/stsp/index.cfm). One early project involved backing the evaluation of a hybrid-engine school bus, with support from several Iowa agencies, individual school districts, and the Iowa Department of Education.

### *Partnering and sharing*

The MTC research program has always played two roles. The first role is as the primary funding source for a competitive research program. When adequate funding is available, a competitive research program is conducted through a proposal solicitation to all universities in the region that also have a transportation research program.

The second role is to leverage non-federal funds with year 8 funds. For example, the MTC has leveraged a project involving planning and geometric design of expressway intersections in the state of Iowa. Although this represents hundreds of millions of dollars worth of investment for the Iowa DOT, the MTC will assist the Iowa DOT with its expressway task force through cost-sharing faculty and support of scholars working on this project alongside Iowa DOT planners and engineers. Although the MTC only contributed a small amount of

funding to this project, the result will be a safer and more innovative design of the Iowa expressway system. Through this project, the MTC will impact driver safety throughout Iowa and many states in the region and the country. In December 2007, the Iowa Division of the Federal Highway Administration (FHWA) hosted a workshop on expressway intersection design and safety, via FHWA's video system, led by Tom Maze and Tom Welch (Iowa DOT). More than 100 participants from 23 State Transportation Agencies across the country attended the workshop

During year 8, the MTC partnered with other research-funding organizations to leverage support for its research projects. Each of these projects will acknowledge the MTC funding, and the findings will be published as the findings of the University Transportation Center on Region 7.

## Education

The focus of the MTC has always been on the development of human capital. The majority of our funding has always been devoted to student assistantships. Even with the boost in funding in 2007, the MTC spent nearly half (49%) of its federal resources on its educational program. We will not know the total amount spent (federal and non-federal) on the educational program during year 8 until the year 8 program is closed out.

We find that having a large educational program is synergistic with the research program, since students on assistantship work for sponsors on projects related to the theme of the center. For example, the MTC's theme is "sustainable asset management," and several students worked on the development and management of the Iowa DOT's asset management systems or and UMC students worked on research projects regarding the Missouri Department of Transportation (MoDOT) abridgement of the databases of soils and natural materials.

The students' matching funds are paid by the state transportation agency, and the students gain valuable experience through the projects. However, the projects are not selected competitively; rather, the students are matched to existing projects, and only the students are supported through the grant. The projects would have existed with or without student involvement, but the students' involvement deepens the scope of the project.

### *Transportation Scholars Program*

In 2006, there were over 30 students enrolled in the transportation scholars program at ISU alone. The number of students in the ISU scholars program dropped into the 20s in 2007. This was due in part to cyclic enrollments and the natural winding down of general spending on transportation projects throughout the country. At the end of the transportation scholars' year in spring 2007, enrollment was not at its highest, but the program continued to grow consistently over time. The federal grant is an opportunity to build programs at the universities that will continue even if the U.S. DOT University Transportation Centers Program (UTCP) ends.

### *New programs*

Two years ago, MTC members proudly announced that UMSL was developing a transportation PhD program in their business college. This year UMSL has started a PhD program in logistics and supply change management—predominately through the MTC center program. Because this is the only transportation PhD program in the St. Louis metropolitan area, it has the opportunity to provide a long-lasting impact on an important national transportation hub.

The MTC has also been the driving force behind establishing a Master of Science (M.S.) program in geography with an emphasis in transportation at UNI. Although the program is small (between one and three M.S. students graduate from the program per year), these students have gone on to work for organizations that range from regional planning agencies to the Union Pacific and Santa Fe Railroads.

### *Current program improvements*

At UM-C, the Transportation Infrastructure Center has continued to build its program on the projects started by the MTC. UM-C has been working to build important ITS-related research facilities (ITS laboratory Translab), and through funding related to the UTC grant, UM-C has added to its existing structures and materials laboratory.

In 2007, a room within the main civil engineering building at ISU was converted to the Kiewit Student Study Center and Highway Design Classroom (www.ccee.iastate.edu/news/fall-2007-cceenews/renovated-study-center-and-classroomfall-2007.html). The instruction and facilities developed are as high-quality as those at any university in the country.

### *Workforce development*

Also in 2007, *Go!* Magazine (www.go-explore-trans.org/index.cfm) was started with seed funding from the MTC. Other private and public sector sponsors subsequently joined in funding. *Go!* is an online magazine focused on all aspects of transportation, with a goal of encouraging adolescents' interest in the field of transportation. *Go!* not only presents material of interest to young people, but it also attempts to keep interactive contact with its readers through the internet. So far the MTC has received only positive comments about *Go!*, along with a growing sponsorship group.

Although the sponsors change from year to year, *Go!* receives sponsorship from transportation labor groups, other university transportation centers, consultants, professional societies, etc. It is difficult to measure the effectiveness of *Go!*, but growing readership and a growing sponsorship imply that the magazine is having an impact.


**Figure 1. *Go!* website header and logo**

## Consortium Organization and Theme

The Midwest Transportation Consortium (MTC) is one of ten regional University Transportation Centers (UTCs) located in the ten federal regions of the United States. These ten centers were established through a regional competition. The MTC is now entering its eighth and final year of existence. The MTC is the UTC for Region 7, which includes the states of Iowa, Kansas, Missouri, and Nebraska.

The MTC is organized as a constellation of five cooperating educational institutions. Two schools make up the administrative core of the consortium and employ the center director, Dr. Tom Maze at Iowa State University, and associate director, Mr. Charles Nemmers, at the University of Missouri-Columbia (UM-C).

The other three schools are involved in the education and research functions of the consortium: the University of Missouri at St. Louis (UMSL), the University of Northern Iowa (UNI), and the historically black institution, Lincoln University. All three schools had essentially no involvement in transportation education and research when the MTC was established.

Administrative core (2 schools)

- Iowa State University (ISU)
- University of Missouri – Columbia (UM-C)

Junior partners: mainly educational (3)

- University of Missouri – St. Louis (UMSL)
- University of Northern Iowa (UNI)
- Lincoln University (Jefferson City, Missouri)

A diagram of the consortium organization is shown in Figure 2 below.

### *Duties*

- ISU performs most of the administrative functions of the consortium, including the reviewing and contracting of MTC-funded competitive research projects and educational competitions.
- UM-C provides a single point of administration for the participation of the three University of Missouri system campuses, including the administration of all budgets and contracts. UM-C also coordinates some of its activities with Lincoln University, which is located nearby in central Missouri.

The University of Missouri-Kansas City (UMKC) is shown on our diagram since it was one of our original partners, though UMKC's transportation program is essentially dormant.

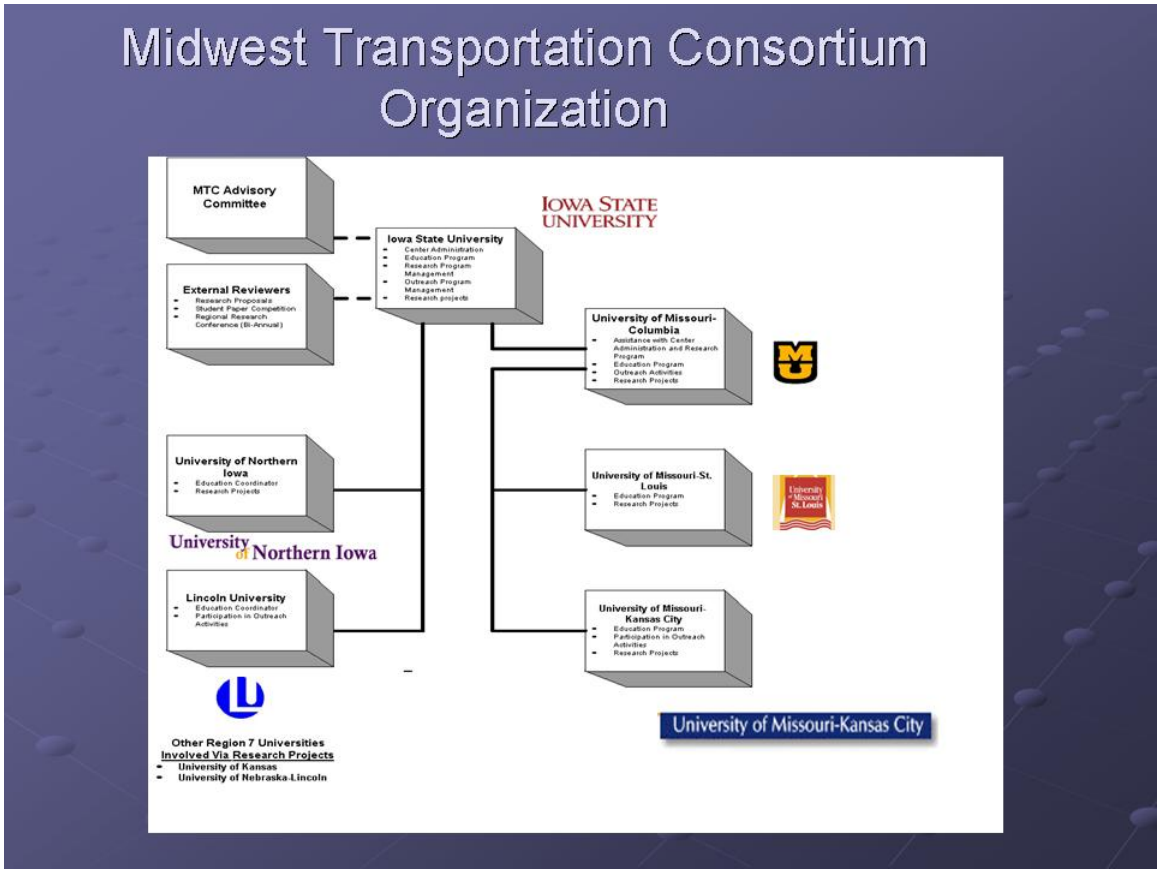


**Figure 2. MTC organization**

### *Theme*

The theme of the MTC is "Transportation Management Systems and Operations Focusing on Sustainable Asset Management." As such, institutions that are part of the MTC are working to prepare students to be leaders in an industry that is quickly evolving from a paradigm of *building* transportation systems and infrastructure to *managing* transportation systems and infrastructure for best results. The MTC aims to integrate operations, management, and renewal disciplines with traditional construction.

# MTC Educational Activities

One of the primary missions of the MTC is to develop future leaders—the human capital—for the transportation industry in our four-state region. Today's students will become tomorrow's transportation experts, managers, and teachers. The MTC accomplishes this mission in a variety of ways:

- supporting a portion of over 20 graduate research assistantships at our member institutions,
- organizing student competitions,
- supporting student travel, and
- sponsoring a unique multi-university, interdisciplinary transportation seminar each spring.

## 2006 MTC Scholar of the Year

Each year the MTC selects one student as scholar of the year based on that student's strong record of research and scholarship. For 2006, Iowa State University PhD student Joshua Hochstein was named MTC Student of the Year. Hochstein, a two-time Dwight David Eisenhower Transportation Fellowship winner (2005 and 2006), researches traffic safety data analysis, roadway design, and rural expressway intersections.


**Figure 3. Joshua Hochstein (right) was named MTC Student of the Year for 2006; presentation made at 2007 TRB Annual Meeting**

During his studies, Hochstein co-presented a paper on expressway intersection crashes at TRB with Aemal Khattak, Linna Zhang, and Suid Ching Tee and co-authored a paper on work zone safety and mobility with Tom Maze and Garrett Burchett. Hochstein is assisting Dr. Maze with NCHRP 15-30, "Median Intersection Design for Rural High-Speed Divided Highways." In addition, Hochstein serves as secretary of the Iowa State Transportation Student Association (TSA).

In 2001, Hochstein received his Bachelor of Science (B.S.) degree in civil engineering with highest distinction from the University of Nebraska-Lincoln. That year he also received his Engineer in Training (E.I.T.) certification from the Nebraska Board of Engineers and Architects. As he pursues his PhD in civil (transportation) engineering at Iowa State, Hochstein is concurrently finishing the thesis requirement for a Master's degree in civil engineering at the University of Nebraska-Lincoln.

## MTC Students at TRB 2007

The MTC helps students fund their travel and attendance at the Transportation Research Board's (TRB) Annual Meeting. The TRB Annual Meeting attracts almost 10,000

transportation researchers and practitioners from around the globe and is an extremely rich learning experience for students. Six students were actively involved in presenting or preparing papers for 2007 TRB sessions. A few are serving as the young members of
All student papers presented for the years 2000 through 2006 (the term of the UTC regional center) are available on the MTC website at www.ctre.iastate.edu/mtc/papers/.
technical committees.

The MTC sent approximately 20 graduate and undergraduate students to TRB and supported all or part of their travel. The MTC works with Iowa State University's Transportation Student Association (TSA) to maximize the number of students who can attend. Very often this involves raising money from local consultants and organizing golf tournaments and other fundraisers. In addition, TSA is able to apply for certain grants for assistance from ISU.

**Figure 4. ISU Students at TRB Annual Meeting**

## Transportation Scholars Conference 2006

In mid-November of each year, the MTC coordinates and hosts a student paper competition for its four-state region. The competition has been open to all students in Region 7 and to all transportation topics (not just those on the theme). The Transportation Scholars Conference seems to have become more competitive every year. A $1,000 cash award is given to the winner of the paper competition and the paper competition winner is also used as one of the primary criteria for selection of student of the year award.

In 2006, the winner of the student paper competition was Mustafa Birkan Bayrak, ISU, for his paper entitled "Backcalculation of Layer Moduli for Jointed Plain Concrete Pavement Systems Using Artificial Neural Networks." This was the last paper competition for the asset management-themed regional UTCs, and this competition reflected that theme very well. Other students presented research on the following topics:

- Fiber-reinforced sand as a construction material
- High-performance concrete in bridge decks
- Flexible pavement performance analysis
- Current pavement maintenance practices
- Safety performance of offset right-turn lanes on rural expressways
- Surface wave measurement in soils testing
- Low-cost rural traffic calming techniques for small communities
- Measuring the effectiveness of seat belts in reducing traffic crash injuries
- Winter maintenance management systems

## MTC Spring Transportation Seminar Series

Each spring, the MTC plans and hosts a seminar series for transportation students at all MTC universities. The seminar is intended to give MTC students and guests from a variety of transportation disciplines (civil engineering, construction engineering, logistics, planning, and geography) a "big picture" overview of current issues and cutting-edge developments in the transportation field. Each seminar is broadcast in real-time to students at ISU, UNI, and two sites in Missouri via Internet-based compressed videoconferencing technology.

Table 2 below indicates the spring 2007 speakers and topics for the seminar series. Even though the MTC regional center partner universities in Missouri will no longer be official partners in the new Tier 1 UTC, they continue to participate in the seminar series. The U of I will be added as a site in future years. UNI has recorded each seminar on streaming video and broadcasts the seminar though their web server. The seminar can then be viewed anywhere there is Internet service. In the future, we will make more potential viewers aware of this opportunity.

**Table 2. Spring 2007 transportation seminar series**

| Date | Speaker | Topic |
|---|---|---|
| Jan. 12 | Hillary Isebrands (CTRE/ISU) | International Roundabouts Scanning Tour |
| Jan. 19 | Susan McCubbins/Josh Scott (MoDOT) | I-435 and Front St. Interchange in Kansas |
| | City (An Innovative Design) | |
| Feb. 2 | Carlos Schwantes (UMSL) | What We Can Learn From Transportation History |
| Feb. 9 | Chris Gutierrez (Kansas City SmartPort) | International Intermodal Freight |
| Feb. 16 | Robert C. Brown (ISU Office of Biorenewables) | Biofuels and Transportation |
| Feb. 23 | James Cooper (University of Glasgow) | Public Transportation in Low Density Rural Areas |
| March 9 | Mike Tully and Sunshine Yang (Aerial Services, Inc.) | Photogrammetry and Transportation Data Acquisition |
| March 23 | Larry Frevert (National President Elect of American Public Works Assn. and HDR, Inc.) | Future Infrastructure Management Issues |
| March 30 | Libby Ogard (Prime Focus LLC) | Leveraging Private Sector Railroad Assets |
| April 6 | Gary Davis (University of Minnesota) | Crash Causation |
| April 13 | Allen Hines (Consultant ) | Crash Reconstruction |
| April 20 | Dick Hemmingsen (Initiative for Renewable Energy and Environment, University of Minnesota) | The Future of Transportation Energy |
| April 27 | Kevin Keith (MoDOT Chief Engineer) | Missouri DOT's 800 Bridge Program |

Slides from many of the seminar presentations dating back to 2002 are available in PDF format on the MTC web site at www.ctre.iastate.edu/educweb/past_seminars.htm.

## New PhD Program at UMSL

MTC partner UMSL recently announced the approval of the PhD program in business administration with an emphasis in logistics and supply chain management. Accepting student applications for the first time during the fall semester of 2007, this UMSL PhD program is the only program in the St. Louis region and the state of Missouri specializing in logistics and supply chain management. There are currently three students enrolled in the PhD program.

## Transportation Graduate Education Certificate Program

During the summer of 2006, and in subsequent conference calls, several of the current regional UTCs have been working together to establish a transportation graduate distance learning certificate program. Several universities would offer graduate courses through a distance learning format. The groups would certify a series of courses to represent a curriculum in graduate transportation education.

The program is beginning to take shape, and a curriculum committee has been formed and has started identifying candidate classes. The MTC universities and several other universities have contributed $10,000 in support of this effort. Prior to our involvement, Tom Humphrey (the group's consultant and former Region 1 UTC director) has been working with several industry groups (e.g., AASHTO, ITE, APTA) to establish interest in the certificate.

Although ISU is no longer the home of the regional UTC, the university does plan on participating in the distance learning programs and supporting the University of Nebraska-Lincoln (UNL) while it asserts itself as the new UTC lead for the region. At this point, it is unclear how the certificate program will eventually materialize, but ISU plans to continue to support the program.

# Research Program

All MTC-funded projects are expected to provide technology transfer of research results. Many of the results of funded projects have been presented at conferences and workshops, such as regional workshops on asset management, the past National Transportation Asset Management Workshops, the Transportation Research Board's Annual Meeting in January, and the Mid-Continent Transportation Symposium—a program shared on alternating years by CTRE and the Midwest Regional UTC at the University of Wisconsin-Madison.

Printed research summaries have been prepared for selected projects, and web documentation has been prepared for all completed projects. When the symposium is at ISU, a compendium of papers is published. A prior conference proceeding description, including a description of the conference in 2007, can be found at www.ctre.iastate.edu/pubs/index.htm#proc.

The MTC normally uses a two-round selection process that is normally conducted in the fall of the year.. During first round one, 2–3 page research prospectuses are submitted by principal investigators (PIs) from any academic institution in U.S. DOT Region 7. This includes the states of Iowa, Kansas, Missouri, and Nebraska. Submitted prospectuses are rated and ranked by academic reviewers from outside the region. About 30%–50% of prospectuses are selected for further development. During round two, detailed proposals are requested. Matching funds must be guaranteed with a letter of commitment for match (50% match must be provided at a minimum, including cash and/or "soft" match).

During the 2006–2007 funding year, the MTC had its largest research program ever. Pre-proposals were solicited and peer reviewed. For those that were most highly rated and fit the theme, the PI was asked to develop a full proposal following very specific MTC guidelines. Because the award amount for the federal grant was not determined until the very end of the federal fiscal year, the peer reviewers were under pressure to select projects so the PIs could plan their work starting in the spring semester.

Rather than soliciting a second blind review of the proposals, senior managers (Maze, Nemmers, and Plazak) at the MTC reviewed the proposals and selected the projects. All projects selected are listed in Table 1. All the selection criteria are listed in the request for proposals. Several criteria were used including fitting the theme, PI diversity, balance of topics, and adequate matching support.

Since we knew the research program was going to grow during 2007, in late March 2006 the MTC conducted a research focus group meeting in St. Joseph, Missouri, to generate research interest by non-federal research funders. The theme of this meeting was traffic operations and traffic safety research. Individuals from all four states were invited and attended. The announcement of this meeting and the meeting final report are contained on the MTC web site at www.ctre.iastate.edu/mtc/news/2006/research_forum.htm.

**Figure 5. Associate Director Charles Nemmers leading a research focus group on work zones**

The topics identified at this meeting were used as a focal point for project selection during year 8. Investigators will be encouraged to select topics from this list and involve regional participation in the project (from local and state agencies in Iowa, Kansas, Missouri, and Nebraska) and beyond. This is typically a great method for gaining buy-in from non-federal sponsors.

As can be seen from the meeting report, the Iowa, Missouri, and Kansas DOTs were well represented as was the Nebraska Governor's Highway Safety Representative. The Federal Highway Administration (FHWA) division offices in Iowa, Kansas, and Missouri were represented, and Mr. Michael Trentacoste, director of FHWA's Office of Safety Research and Development, attended the meeting. Many of the topics were ultimately selected.

We plan to make this meeting an annual event. Neal Hawkins is a researcher on CTRE's staff but is also a shared employee with the Iowa DOT (1/4 of his time is with the Office of Traffic and Safety). Hawkins will be responsible for this annual event. Next year we intend to include safety and traffic managers not from just the states in Region 7 but all the states that surround Iowa (South Dakota, Minnesota, Wisconsin, and Illinois).

The MTC had funded 39 different research projects at nine lead universities in three states through competitive solicitation. UNL in the region's fourth state, Nebraska, has been involved in an MTC project as a subcontractor. MTC competitively selected projects are listed below. Not included are the myriad of projects the MTC promoted by providing a student to influence the advancement of a project.

- Iowa State University (18)
- Missouri State University (2)
- University of Kansas (1)
- University of Missouri-Columbia (9)
- University of Iowa (1)
- University of Missouri-Kansas City (1)
- University of Missouri-St. Louis (2)
- University of Northern Iowa (4)
- Wichita State University (1)

## Expenditures

The MTC concentrates on education and human capital development, believing that a new generation of leaders is needed to help make the transition from the building era to the managing era. The need for leadership is even more pressing today, given the large number of retirements among today's leaders in the transportation industry.

The MTC's emphasis on creating new transportation professionals is illustrated in the distribution of funding. Typically, more than half of the resources managed through the MTC go to support the educational program of the MTC. The majority of these funds support graduate assistantships and undergraduate students completing degrees that will support a career in transportation. In the last year, our education program declined in size, but it still consumed most of the resources managed. The management of the MTC saw the focus of resources predominately on educational programs as a success, as the focus indicates the attractiveness of our transportation education program and the need to provide new human capital to transportation interest in the Midwest and throughout the U.S.

The MTC has a number of primary focus areas for its expenditures:

- Funding graduate assistantships for the next generation of industry leaders
- Developing new courses and new course materials for transportation asset management
- Getting new faculty members and researchers involved in transportation and transportation asset management activities
- Providing regional leadership in advancing transportation asset management through competitively-funded research projects and technology transfer activities
- Making a national contribution through participation

Figure 6 below shows that over the course of the MTC program to date, we have emphasized the use of funds to support students working on research assistantships (the education portion of our budget). This is consistent with our plan for the MTC and our objective of focusing on the generation of future human capital.

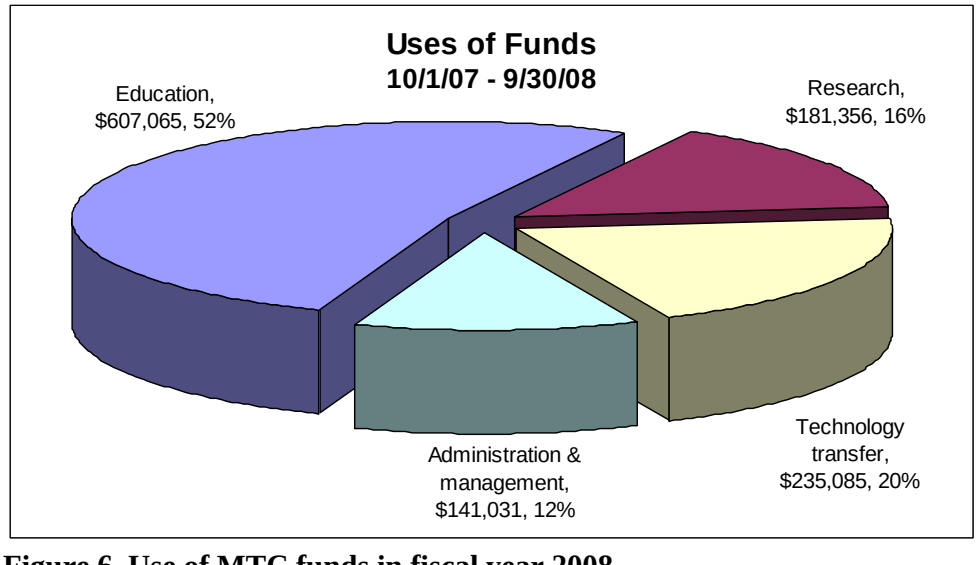


**Figure 6. Use of MTC funds in fiscal year 2008**

About 1/3 of our funds have focused on our competitive research program, although we expect that as the matched funds are totaled at year's end, we will see a great deal of growth in the competitive research program in year 8.

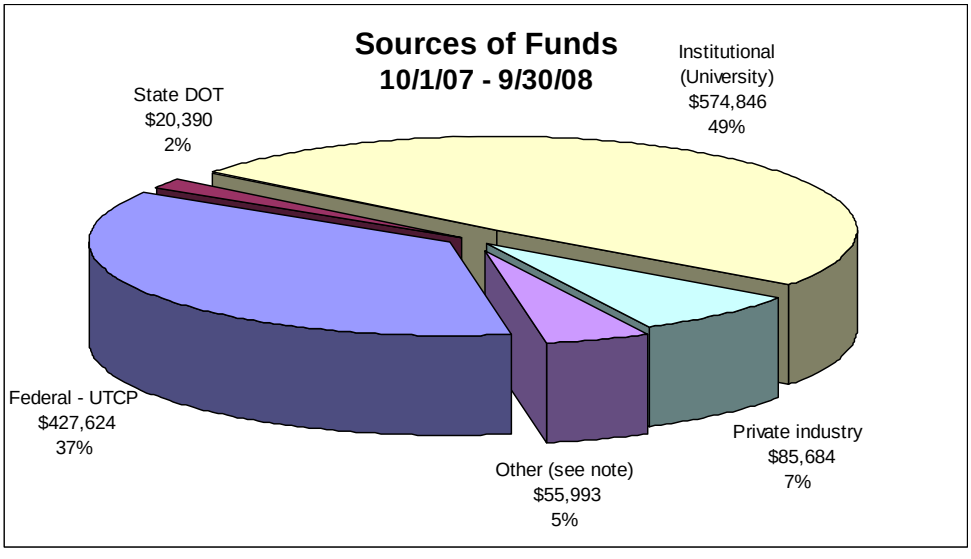


**Figure 7. Source of MTC funds in fiscal year 2008**

The source of MTC funding is shown in Figure 7 below. While our federal funding accounts for less than half of the total, institutional funding (from the universities themselves) accounts for about 1/3 of all expenditures. Institutional sponsorship includes overhead forgiven, tuition for students, funding from internal sources, and contributed faculty time.

## Outreach and Technology Transfer Program Highlights

This year's emphasis in terms of outreach and technology transfer has been on disseminating research results to the community of transportation practitioners through the worldwide web and the new tech transfer briefs summary series of publications. We have also published two issues of a newsletter, which was mostly distributed through the Internet.

All projects competitively selected through the MTC are listed on the MTC web site along with reports and technology transfer briefs. Technology transfer briefs are 2–4 page glossy handouts that we develop using as many graphics as possible as we interpret the implications of the research in layman terms. We often print 100–200 copies of each brief, but more commonly they are distributed electronically. An example of a technology transfer summary is shown in Figure 8 below.

Also during year 8 we held a workshop over the FHWA video conferencing system on innovative designs for at-grade, high-speed rural expressway intersections. Although it was hard for us to judge the exact audience size, there were participants from 23 states from Washington to Florida. At the Iowa site approximately 25 attended.

MTC
MIDWEST TRANSPORTATION CONSORTIUM

**RESEARCH PROJECT TITLE**
Synthesis of Procedures to Forecast and Monitor Work Zone Safety and Mobility Impacts

**DATE**
October 2005

**SPONSOR**
Federal Highway Administration Pooled Fund Study

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**MORE INFORMATION**
www.ctre.iastate.edu/mtc/projects/2005-01.htm

**KEY WORDS**
lane closure capacity—lane restriction—road closures—work zone capacity

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The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the sponsor(s).

The mission of the Center for Transportation Research and Education (CTRE) at Iowa State University is to develop and implement innovative methods, materials, and technologies for improving transportation efficiency, safety, and reliability while improving the learning environment of students, faculty, and staff in transportation-related fields.

ctre Center for Transportation Research and Education
IOWA STATE UNIVERSITY

**Optimizing Work Zone Road Closure Capacity**

tech transfer summary

**Objectives**

Improve understanding of the impact of a variety of traffic characteristics, roadway features, and environmental variables on the capacity of work zone lane closures.

**Problem Statement**

As urban and even rural multi-lane roadways become more congested, the proper timing of lane closures for construction or maintenance work becomes critical. The key is to leave enough capacity and avoid unacceptable delays and waiting lines upstream from the closure. The balance between traffic volume and the number of vehicles that can pass through a work zone determine the delay. For example, if a lane restriction reduces the maximum throughput to 1,300 vehicles per hour (VPH), but 1,500 vehicles arrive in an hour, then we would expect a 200-vehicle-long queue at the end of an hour (1,500 – 1,300 = 200). Assuming the volume of arriving traffic cannot be controlled, the queue length and, hence, the length of delays are a function of the remaining capacity.

Several states have policies, either written or unwritten, regarding when and under what conditions a lane restriction will be allowed for maintenance and/or construction work. These policies are based on an assumption of the capacity remaining when a lane restriction is implemented. Some states have even created manuals or lookup tables that designate when a lane can be restricted so that unacceptable queues are avoided.

**Mechanics of Lane Restriction Queuing**

Figure 1 illustrates the mechanics of queuing. It shows volume and speed for a work zone lane closure before a queue is formed, during the queue, and after the queue has subsided. On the upper part of the graph is a plot of the traffic volume (in five-minute intervals) passing the lane closure taper, which restricts traffic to one lane immediately before the work area. On the lower part of the graph is a plot of the speeds averaged over the same five-minute intervals. The left vertical line represents the time when the queue first starts, and the right vertical line represents the time when the queue ends.

*Continued on next page*

**Figure 8. Example of technology transfer summary**

In the last two years the management of the MTC spent the bulk of our time attempting to re-win the Region 7 regional transportation center. We launched an unsuccessful bid to continue as the regional transportation center. This was followed by a proposal to become a Tier 1 center which was successful. Writing two proposals and working with our consortium members became the focus of management for several months.

The good news from the two competitions is that the MTC will continue, but with new consortium members. After years of competition, Iowa's two major research universities—ISU and the U of I—will be joined together in the same consortium.

The MTC also co-sponsored the Mid-Continent Transportation Symposium at ISU during the summer of 2007. In 2008 the same conference will be held at the University of Wisconsin – Madison (MURTC). In 2007 more than 100 presentations were made on a variety of transportation topics; most resulted in published papers. There were over 300 attendees at the conference. When the event is in Ames, it is arguably the technology transfer event of the year for the region; attracting individuals from throughout the region and a handful from throughout the country (see www.ctre.iastate.edu/pubs/midcon2007/).

In November, 2007, the seventh National Asset Management meeting was held in New Orleans. The MTC co-sponsored this meeting, and MTC staff helped to plan the meeting. Furthermore, MTC was well represented on the agenda.


**Figure 9. 2007 Mid-Continent Transportation Symposium cover**

# Appendix A: Key Consortium Personnel

The key personnel of the Midwest Transportation Consortium include a director, an associate director, and educational coordinators at each consortium member school. As of the end of the 2006–2007 fiscal year, the key personnel were as follows:

## Consortium Director

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# Appendix B: Ongoing and Completed Projects 2006–2007

# 2006-2007 Midwest Transportation Consortium Ongoing and Completed Projects

## Ongoing Projects

| Principal Investigator | University | Project Title |
|---|---|---|
| Tom Maze | ISU | Management of Rural Expressways for Improved Safety and Operational Performance |
| Shauna Hallmark | ISU | Achieving Efficiency in Meeting Safety, Operations, Maintenance, and Air Quality Goals |
| Sam Kiger | UM-C | Bridge Vulnerability Assessment and Mitigation Against Explosions |
| Linda Boyle | U of I | Assessing the Spatial and Temporal Differences in Midwestern Crashes Relative to National Data: Implications for Public Policy Decisions |
| Neal Hawkins | ISU | Iowa Pavement Marking and Sign Management System |
| Tim Strauss | UNI | The Spatial Scale of Clustering of Motor Vehicle Crash Types and Appropriate Countermeasures |
| J. Erik Loehr | UM-C | Integration of Asset Management Systems with Load and Resistance Factor Design (LRFD) |
| David Plazak | ISU | Development of a Comprehensive Framework for Managing Decisions Regarding Highway Bypasses |
| Tim Strauss | UNI | Evaluation Framework for the Creation and Analysis of Integrated Spatially-Referenced Driver-Crash Databases |
| David Plazak | ISU | Roadway Alignments as Assets: Evaluating Alternatives for Valuing Major Highway Corridor Rights-of-Way |
| Omar Smadi | ISU | Iowa DOT Bridge Asset Management Using PONTIS: Data Integration, Performance, and Decision Support Tools |

## Completed Projects

| Principal Investigator | University | Project Title |
|---|---|---|
| Brent Rosenblad | UM-C | Bridge Deck Integrity Measurements for Asset Management |
| Wooseung Jang | UM-C | A Decision Support System for Optimal Depot and Fleet Management |
| Glenn Washer | UM-C | Remote Health Monitoring for Asset Management |
| Charles Nemmers | UM-C | Synthesis Study: Effectiveness of Safety Corridor Programs in Region 7 States, Phase I |
| Mehmet Bayram Yildirim | Wichita State University | Optimization of Intermodal Logistics Operations in Disaster Planning |
| Song-Charn Kong | ISU | Managing Early Adoption of Biodiesel by Commercial Fleets |
| John L. Kent | Missouri State University | Investigation of Methodologies Used by Less-than-Truckload (LTL) Motor Carriers to Determine Fuel Surcharges |
| Carlo D. Smith | Missouri State University | An Investigation into the Development and Adoption of Technologies, Policies, and Methods for Improving Fleet Fuel Performance |
| Tom Maze | ISU | Synthesis of Procedures to Forecast and Monitor Work Zone Safety and Mobility Impacts |
| Brent Phares | ISU | Development of Fatigue Design Procedures for Slender, Tapered Support Structures for Highway Signs, Luminaires, and Traffic Signals Subjected to Wind-Induced Excitation from Vortex Shedding and Buffeting |
| James Noble | UM-C | An Integrated Systems Approach to the Development of Winter Maintenance / Management Systems |
| Carlos Sun | UM-C | Secondary Accident Data Fusion for Assessing Long-Term Performance of Transportation Systems |
| Tom Maze | ISU | Implementation of HERS-ST in Iowa and Development / Refinement of a National Training Program |

| | | |
|---|---|---|
| Neal Hawkins | ISU | Planning, Developing, and Implementing the Iowa Pavement Marking Management System (IPMMS) |
| Ray Mundy | UMSL | Appointment Systems for Inland Waterway Traffic Control |
| Tom Maze | ISU | An Investigation of User Costs and Benefits of Winter Road Closures |
| Ramanathan Sugumaran | UNI | A Web-Based Implementation of Winter Maintenance Decision Support System (WMDSS) Using GIS and Remote Sensing |
| Shauna Hallmark | ISU | Evaluation of Different Methods to Calculate Heavy-Truck VMI |
| Ed Jaselskis | ISU | Improving Efficiency of Transportation Projects Using Laser Scanning |
| Kathleen Trauth | UM-C | Identification and Development of User Requirements to Support Robust Corridor Investment Models |
| Shauna Hallmark | ISU | Application of Advanced Remote Sensing Technology to Asset Management |
| Ray Mundy | UMSL | Research and Training of Private Transportation Providers for the Efficient and Effective Provision of Transportation Services |
| Shauna Hallmark | ISU | Addressing Integration Issues and Developing a Protocol for Integration of Global Positioning Systems Data with Linear Referenced Data in an Asset Management System |
| Carl Kurt and Joel Lee | University of Kansas | GIS-Based Integrated Rural and Small Urban Transit Asset Management System |
| Erik Loehr | UM-C | Decision-Support System for Management of Slope Construction and Repair Activities—An Asset Management Building Block |
| Anil Misra | University of Missouri-KC | Roadway Asset Management System Manual for Local Governments |
| Mohammed Salim, Marc Timmerman, Tim Strauss, and Michal Emch | UNI | Artificial Intelligence-Based Optimization of Management of Snow Removal |