16 Students Participate in 2008 Summer Scholars Program

Five PhD students, two MS students, and nine BS students were among the sixteen students employed as summer research assistants through the University Transportation Center for Materials in Sustainable Transportation Infrastructure’s (UTC-MiSTI) 2008 Summer Scholars Program at Michigan Technological University (Michigan Tech).

These research investigations provide dual benefits. The first is that they provide an undergraduate research experience for students yielding valuable insight and understanding of university-based research. This knowledge will benefit them as Transportation professionals and in some cases may provide a positive experience which may lead to graduate enrollment and studies at Michigan Tech to continue building a career as a research professional. The second benefit derived from this program is the opportunity for faculty to pursue new research ideas with the support of hourly undergraduate and graduate student assistants.

Projects proposed by faculty are reviewed by the Center’s external Technical Advisory Council (TAC). The projects must support the theme of the Center, with a potential to benefit state and national transportation agencies, and have a scope of work that can be accomplished over the 14 week summer semester. The 2008 projects, seven in total, included investigations to predict RAP content in asphalt pavements and evaluating characteristics of carbon in fly ash.

The program’s success can be seen in Darrell Cass’ example. His internal investigation lead to an externally funded project and helped him develop the confidence in his own abilities to go on to graduate school. Darrell is highlighted later in this newsletter on page 6.

For additional details on the studies, the UTC-MiSTI 2007-2008 Annual Report contains brief summaries of the 2008 Summer Scholar Program internal research initiatives.

TRAC Pipeline Scholarships

In the fall of 2008, the University Transportation Center for Materials in Sustainable Transportation Infrastructure (UTC-MiSTI) presented its first TRAC (Transportation and Civil Engineering) Pipeline Scholarship to Morgan Hansen. The Center has entered into an agreement to support the Michigan Department of Transportation’s (MDOT) efforts to attract talented young students to pursue four-year degrees in transportation engineering. Students submit resumes, and eligible students are identified and interviewed by MDOT to gain acceptance into the program. Completion of the TRAC program through high school or middle school math, science, and civics classes is the primary criteria to become eligible for an internship with MDOT. UTC-MiSTI is providing up to 15 scholarships to Michigan youth to attend Michigan Technological University to pursue a BS in Civil Engineering.

Beyond the $2,500.00 scholarship, the TRAC Pipeline provides other benefits to youth recipients. As an example, Morgan had an opportunity to work on a sponsored research project during the academic year, giving her valuable insight into university based research, and additional experience as a student research assistant.
Director’s Corner

A goal of the UTC program, and something we do very well here at Michigan Tech, is to provide a solid engineering education program to support the transportation industry. Education under-pins all UTC-MiSTI activities, and is inextricably linked to the other UTC program areas of research, workforce development, and technology transfer. As a compliment to their classroom education, the UTC-MiSTI provides research opportunities to undergraduates through participation in sponsored research and the Center’s Summer Scholars Program. We support pre-college outreach and transportation career awareness through involvement in our state’s annual Construction Career Days, the MDOT sponsored TRAC program and TRAC Pipeline. Also, we are developing a comprehensive technology transfer program to provide continuing education for transportation professionals at all career levels. From the K-12 classroom, to the research lab or the DOT workplace, the UTC-MiSTI’s focus is engineering education to foster the transportation workforce of the future.

Michigan Tech’s Civil Engineering program has the largest undergraduate enrollment in the state and a growing graduate program. In the short time the Center has been in existence we’ve already seen the impact the UTC-MiSTI program has made by providing opportunities for people to discover transportation as an educational pursuit, leading to careers in the transportation industry. Darrell Cass and Morgan Hansen, whose profiles are featured in this issue, are two examples of students who are engaged in this process.

The UTC-MiSTI is capitalizing on the expertise of the faculty and staff at Michigan Tech to enrich the educational environment and promote sustainability through the wise use of materials. New faculty like Jacob Hiller and Post-Doctoral Research Associate Yogini Deshpande are engaged with the Center to provide course development and research opportunities in the area of sustainability and materials. Overall, the faculty and staff at Michigan Tech are all finding ways to integrate sustainability into their activities. Through this newsletter we will introduce you to just a few of these successes.

- Larry
UTC Students of the Year
Bates and Kueber selected as the UTC-MiSTI’s 08 and 09 Students of the Year

Each year, the University Transportation Center for Materials in Sustainable Transportation Infrastructure (UTC-MiSTI) selects a UTC Student of the Year to represent the Center in Washington, D.C. at the annual Transportation Research Board conference. At a special evening event, the Council of University Transportation Centers (CUTC) recognizes these students for their academic achievement and research in transportation.

Timothy J. Bates (TJ) was selected as the 2008 University Transportation Center for Materials in Sustainable Transportation Infrastructure Student of the Year. As a MS student at Michigan Technological University (Michigan Tech), his research involved examining the effects of potassium acetate as a runway deicer on hardened portland cement concrete. TJ maintained a 4.0 GPA, was a Phil Youngs Memorial Fellowship recipient, served as Director of the 2007 North Central Conference Concrete Canoe Competition and was selected as a 2007 UTC Summer Research Scholar. In addition, he presented in Washington D.C. and was published as first author in the conference proceedings of the RAC 07 (Recent Advances in Concrete Technology Conference). His presentation and paper are titled, "Comparison of Field and Laboratory Concretes Exposed to Potassium Acetate Runway Deicer."

In 2009, Melanie Kueber was selected as the UTC-MiSTI Student of the Year. She holds a BS in Civil Engineering from Michigan Tech and a MS in Project Management from Northwestern University. She is currently pursuing her PhD in Civil Engineering through the UTC-MiSTI at Michigan Tech. Her research is exploring technologies to increase the use of fly ash as a sustainable alternative to virgin portland cement. Her professional experience includes five years with the Illinois Department of Transportation and three years with the consulting firm of Christopher B. Burke, Ltd. Melanie is a registered Professional Engineer in the states of Illinois and Michigan.

Melanie returned to Michigan Tech to pursue her PhD in May 2007 as a UTC-MiSTI Summer Scholar. In the fall of 2007 she was selected as a National Science Foundation Integrated Graduate Education Research Trainee (IGERT) and in May 2008 as a UTC-MiSTI Summer Scholar Mentor. Melanie was an invited presenter at the American Coal Ash Association mid-year conference in July 2008 and is published in the Journal of Engineering Design and Technology. She is on the team conducting research in support of NCHRP 18-13 Specifications and Protocols for Acceptance Tests of Fly Ash Used in Highway Concrete. Melanie plans to pursue an academic appointment upon graduation.

Update: Since graduation TJ has moved to De Pere, Wisconsin, a "suburb" of Green Bay, where he began work with the Structural Group, Inc. As a structural engineer with the Structural Group he works closely with Structural Preservation Systems, a sister company and one of the largest and most respected concrete repair contractors in the United States. The majority of the projects he’s involved with focus around the repair and maintenance of heavy industry facilities (oil, gas, power generation, etc.).
Dr. Jacob (Jake) Hiller is supporting the efforts of the UTC-MiSTI by advising graduate and undergraduate students and conducting research in the area of pavements and sustainable materials.

Dr. Jacob Hiller joined the Department of Civil and Environmental Engineering in August 2007 as the Donald and Rose Anne Tomasini Assistant Professor of Transportation Engineering. Dr. Hiller came to Michigan Technological University (Michigan Tech) from the University of Illinois at Urbana-Champaign where he earned his PhD in Civil Engineering. He also holds a MS and BS in Civil Engineering from Michigan State University.

Dr. Hiller’s research focuses on mechanistic-empirical design and rehabilitation of rigid pavements, fatigue of concrete, pavement sustainability, stress relaxation and creep, micro-structural evaluation, environmental impacts of concrete, accelerated pavement testing, and use of fracture mechanics in concrete pavements. He is also interested in promoting a sustainable transportation infrastructure.

Dr. Hiller was awarded as the Bengt F. Friberg Best Young Author by the International Society for Concrete Pavements for a paper titled “Large-Scale Airfield Concrete Slab Fatigue Tests” (with J.R. Roesler and P.C. Littleton) at the 8th International Conference on Concrete Pavements. He also received the B. F. McCullough award for Best Poster Presentation at this same conference for his poster titled “Development of Innovative Mechanistic Empirical Fatigue Analysis for Jointed Plain Concrete Pavements.” Additionally, Dr. Hiller was honored with numerous fellowships including the Illinois Chapter of American Concrete Pavement Association Graduate Fellowship, Federal Highway Administration Eisenhower Graduate Transportation Fellowship, Portland Cement Association Research Fellowship Grant, and the MSU Department of Civil and Environmental Engineering Graduate Fellowship.

Dr. Hiller has served as Secretary for the 2nd Workshop on Advanced Characterization, Modeling, and Design of Concrete Pavements at UC-Berkley Richmond Field Station in August 2008 as well as Secretary for Workshop on Fracture Mechanics for Concrete Pavements: Theory to Practice, Copper Mountain, Colorado, August 2005. He has been affiliated with the Transportation Research Board since 2002. Dr. Hiller is a member of International Society for Concrete Pavements (ISCP), the American Concrete Institute (ACI), and American Society of Civil Engineers (ASCE). In addition, Dr. Hiller is a technical reviewer for numerous publications and journals and has been published himself in the International Journal of Concrete Pavements, the Journal of Transportation Engineering, the Journal of Performance of Constructed Facilities, the Transportation Research Record, and the ACI Materials Journal, among others.

Currently, Dr. Hiller is continuing his research on “Field Evaluation of Built-in Curling Levels in Rigid Pavements” sponsored by the Minnesota Department of Transportation and “Efficient Use of Recycled Concrete in Transportation Infrastructure” with the Michigan Department of Transportation. At Michigan Tech, Dr. Hiller teaches classes in Pavement Design, Advanced Pavement Design, Civil Engineering Materials and is involved with the Pavement Design, Construction and Materials Enterprise Program. He is also advisor for Chi Epsilon of which he has been a member since 1996.
Michigan’s 2009 Construction Career Days were held on April 21 & 22, 2009 at the Ingham County Fairgrounds in Mason, Michigan and provided an opportunity for more than 2000 Michigan youth to gain insight into the spectrum of rewarding careers in civil infrastructure construction. Students were able to meet with University and Community College admissions representatives at the event. They also had an opportunity to operate bulldozers, front end loaders, motor graders, excavators, and cranes. Through hands-on exhibits, youth participants tested their skills in a crane simulator and at designing and testing their own bridge. The UTC-MiSTI’s platinum sponsorship provided transportation support for 34 buses from 26 school districts in Lower Michigan. Through the first two years, this annual event has provided career awareness and education for more than 3700 Michigan youth. Other event sponsors include Michigan CAT (Caterpillar), the Operating Engineers Local 324, MDOT and the FHWA.
Written by Morgan Hansen

My name is Morgan Hansen and I’m from Kalamazoo, Michigan. I graduated from Kalamazoo Central High School in the spring of 2008. My decision to enroll at Michigan Technological University (Michigan Tech) was very easy - I had always wanted to go into engineering and be enrolled at a small university.

During my time at Kalamazoo Central I was active in swimming, lacrosse, and band. I was dual-enrolled my senior year at Kalamazoo Valley Community College. During my senior year, I was approached by my AP Calculus teacher, Dan Carlson, about an internship he heard of from a colleague. This internship through the Michigan Department of Transportation (MDOT) was for graduating seniors in the Kalamazoo area who were interested in becoming a Civil Engineer.

After hearing about this internship, I wanted to learn more. I went to see the Electromechanical Engineering teacher, Ken Briggs, and he went over the requirements with me. We verified that my experience learning the bridge building program (TRAC Bridge Module) and my design of a bridge that fit required parameters, made me eligible to apply for the program. Once that was completed, I had to write a resume and send it to Lansing. A few weeks later I was contacted about an interview and a few weeks after that I received notice that I had been selected. At this point the program coordinator still wasn’t exactly sure what we would be doing; it was the pilot year for the program and all they knew is that the internships would be related to Civil Engineering.

At the beginning of the job we were sent out with the bridge inspection crew. On the first day we learned how to inspect an overpass. We counted cracks in the concrete, looked for spalling in the areas with rebar, and looked for transverse cracks on the deck of the bridge. During the process we also took pictures of everything from the beams to the approaches on the deck, so we could take them back to the office to know what exactly was being explained in the report.

When we were done with bridge inspection our next task was surveying. We went out with the crew and on the first day learned how to use GPS, how to find, mark and record points, and how to use a total station. After that we went to South Haven to work on a roundabout project. We used GPS to find MDOT’s property lines and then set the stakes. Through this process we learned how to also deal with public affairs; some people are not very happy when they see you standing in “their” property pounding in stakes or spray painting the concrete, even though the state owns it.

The TRAC internship I obtained through MDOT was a great experience and really opened my eyes to the world of civil engineering.

Update: Morgan is the UTC-MiSTI’s first TRAC Pipeline scholarship recipient. Through an agreement with the Michigan Department of Transportation, the UTC-MiSTI is awarding $2,500.00 scholarships annually to students who have participated in the TRAC program through their high school or middle school, have been subsequently selected as an MDOT TRAC Intern, and continued their interest by enrolling in the Civil Engineering program at Michigan Tech. After a successful freshman year at Michigan Tech, Morgan is back working with MDOT this summer.
Written by Darrell Cass

I went to high school at Mid-Peninsula High School in Rock, Michigan where I participated in football, basketball, baseball, track, and golf. I was pretty much an all-around student with a GPA of 3.3 and always held an interest in math, science, and technology. Throughout my senior year, I was captain of the football team, homecoming king, and vice president of National Honor Society. I graduated with the first class of the millennium in 2001 with about $4000 in scholarships. My original plan was to attend the local community college for two years, and then transfer to Michigan Technological University (Michigan Tech) to pursue a degree in Civil Engineering.

I started my post secondary education at Bay De Noc Community College in Escanaba, Michigan in the fall of 2001. I was also holding a part-time job at the local automotive parts store. I was enjoying living on my own and supporting myself. Soon, school just seemed to take too much of my time, and at that time I couldn’t see why I needed an education, given the fact that I was taking care of myself by working at the parts store. Eventually, school became secondary to me and before I knew it all my scholarship money was gone. All I had to show for it was 20 credits from Bay College. At about the same time I was offered a better job working full-time in the parts department of the local Ford dealership. I quickly accepted this offer with the plan that I would go back to school some day. I began working full-time and after working there for four years I was making roughly $24,000/yr. and soon came to realize that I wasn’t building the career I thought I would. Living paycheck to paycheck, it seemed I had more bills and always needed more money. By this time, it was apparent to me that this was not where I wanted to be in life and maybe I should find a new career.

This is when I decided to go back to school. After a lot of criticism over the previous four years from people saying I would never go back to school once I quit, I decided to prove them wrong. Instead of continuing at Bay College, I decided to transfer the credits I had and enroll at Michigan Tech in the fall of 2005. I can honestly say this is the best decision I have made so far in my life.

Starting college after four years of being out of the academic loop was pretty rough. Classes seemed hard, but I wouldn’t let myself fail again. With the possibility of failure in mind, I used this as motivation to get through the first year. After that, it kept getting easier and soon enough, I graduated with my Bachelor of Science in Civil Engineering in the spring of 2009. I couldn’t believe it: I was going to be the first to graduate with a college degree in my family and they were so proud.

One thing emphasized at Michigan Tech that I think every student should take advantage of is gaining experience in your related field. For my first two summers at Michigan Tech, I had internships working for the Michigan Department of Transportation (MDOT) at their Ishpeming Transportation Service Center, working as a Highway Design and Construction Aide. This experience has been very valuable to me, it has given me insight on the principles behind engineering and problem solving along with key relationships with industry personnel.

In the summer of 2008, I wanted to stay in Houghton, Michigan where I could take summer classes to keep me on schedule for my anticipated graduation date of May 2009. To make some extra money, I decided to apply for the University Transportation Center’s Materials in Sustainable Transportation Infrastructure (UTC-MiSTI) Summer Scholar Program. This by far has been the most valuable experience I have gained in both my academic and professional careers. I assisted Dr. Amlan Mukherjee in estimating the environmental and economic impacts of Hot Mix Asphalt when compared to Warm Mix Asphalt. I also worked with Dr. Devin Harris and Dr. Yogini Deshpande on the monitoring of structural health in concrete. Throughout these projects, I discovered my interest in sustainability and materials, and how they can be applied to today’s construction methods. Research projects like these promise to result in practical applications of sustainability.

As a result of this program, I established working relationships in the Department of Civil Engineering here at Michigan Tech and in doing so the internal research investigations of the UTC-MiSTI Summer Scholar program lead to an externally funded research contract. In addition, with the support of this contract, I have made the decision to attend Graduate School where I am pursuing my Master of Science in Civil Engineering. Who would have thought?
The American Society of Civil Engineers (ASCE) Infrastructure Report Card for America has given a ‘D’ grade to the current state of our nation’s transportation infrastructure systems and it is projected that $1.6 trillion is needed to improve the overall condition over the next five years. To better steward the available resources, highway agencies are relying more and more on rehabilitation of infrastructure as a primary option, as compared to reconstruction of deteriorated infrastructure.

This change in the industry has increased the need for qualified engineers who can assess the current condition of an infrastructure asset and specify methods of repair and preservation. Likewise, contractors are required to apply new techniques or perform work that for them may be “new territory”. Structural repair requires an in-depth understanding of structural stability, materials, and environmental interactions. For that reason, the University Transportation Center for Materials in Sustainable Transportation Infrastructure (UTC-MISTI) supported development of a new graduate level course at Michigan Technological University (Michigan Tech), CE5190 Repair and Rehabilitation of Concrete Structures.

The course includes the following fundamentals:

**Structural Damage Assessment**

Overview of common distress factors observed in structures and their causes and impact on service life of structures, terminology in the repair industry, typical damage/deterioration mechanisms for common civil engineering materials, methods of condition survey for damage assessment, destructive, semi-destructive and non-destructive techniques for damage assessment of concrete, steel, wood and masonry structures.

**Structural Repair**

Topics include: reasoning for repair, repair economics, structural repair versus structural strengthening, types of repair materials and applicability of it for pavements, structural elements and other structures, repair techniques for different infrastructure systems including pavements, bridges, fire damage, performance criteria for repair materials, assessment of durability of composite system.

**Strengthening**

Strengthening methods and materials for concrete and steel structures, FRP, carbon reinforced and other engineered composites for strengthening, durability of the strengthened system.

CE5190 prepares students for a career in the repair and rehabilitation industry by providing classroom and laboratory oriented instruction on key topics addressing structural rehabilitation. Students learn different examination and evaluation techniques including destructive and non-destructive methods for determining the current structural health. The course also discusses the advantages and differences in different repair and strengthening techniques currently adopted in the industry in relation to the economics and performance life of the structure. The course is taught in conjunction with current industry practices and ACI, ASTM codes.

**Repair as a Career Avenue**

Who is interested in assessment and rehabilitation? The better question may be, who isn’t? Interested parties include:

- Owners
- DOTs
- Structural Consultants
- Repair product manufacturers
- Contractors engaged in repair work
- Non-destructive testing manufacturers
- Insurance Companies
About University Transportation Centers

The University Transportation Centers (UTC) program, initiated in 1987 under the Surface Transportation and Uniform Relocation Assistance Act, authorized the establishment and operation of transportation centers in each of the 10 standard federal regions. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) reauthorized the UTCs for an additional six years and added four national centers and six University Research institutes (URI). The mission of the 14 UTCs was to advance U.S. expertise and technology transfer. The six URIs each had a specific transportation research and development mandate.

In 1998 the Transportation Equity Act for the 21st Century (TEA-21) reauthorized the UTC Program for an additional six years and increased the total number of Centers to 33. In addition to the ten regional Centers, which were to be selected competitively, TEA-21 created 23 other Centers at institutions named in the Act. TEA-21 established education as one of the primary objectives of a University Transportation Center and institutionalized the use of strategic planning in university grant management.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act, enacted on August 10, 2005, authorized up to $76.7 million per year from Federal FY2005-2009 funds for grants to establish and operate up to 60 University Transportation Centers throughout the United States. Twenty of these centers were competitively selected during 2006, and forty centers are located at institutions named in the legislation.

The UTC program is managed by the Research and Innovative Technology Administration, U.S. Department of Transportation.

About Michigan Technological University

Michigan Technological University is a leading public research university, conducting research, developing new technologies, and preparing students to create the future for a prosperous and sustainable world. Michigan Tech offers more than 120 undergraduate and graduate degree programs in engineering, forestry and environmental sciences, computer sciences, technology, business and economics, natural and physical sciences, arts, humanities and social sciences.

About the University Transportation Center for Materials in Sustainable Transportation Infrastructure

The University Transportation Center for Materials in Sustainable Transportation Infrastructure (UTC-MiSTI) at Michigan Technological University is a Tier II UTC. The Center conducts research, educational activities, technology transfer and workforce development in the areas of sustainability and infrastructure materials that address state and national transportation needs. Faculty, staff, students and industry work collaboratively to identify creative solutions to construct repair and maintain highway and airport pavements, bridges and rail systems.

Areas of material specialization include bituminous materials and asphalt binders; portland cement and ultra-high performance concretes; material characterization through petrographic analysis; aggregates, soils and geotechnical applications; and the use of recovered industrial materials including fly ash, slag, and cement kiln dust, and recycled asphalt and concrete materials. For more information on the activities of the UTC-MiSTI, visit the Center’s Website: www.misti.mtu.edu