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The Cornerstone Spring 2014

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Department of Civil & Environmental Engineering, "The Cornerstone Spring 2014" (2014). *The Cornerstone*.

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THE CORNERSTONE

A Publication from the Department of Civil and Environmental Engineering at the University of Tennessee

An Exciting New Era Begins For Civil and Environmental Engineering at UT



CEE Celebrates
Opening and Dedication
of John D. Tickle
Engineering Building



Dr. Lee Han
Revolutionizing the
World of Transportation



CEE Engineers
Create "Canstruction"
Soldiers for Charity



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Department Head's Message from Dr. Dayakar Penumadu



It is with great pleasure that I am sharing the news from the Department of Civil and Environmental Engineering at the University of Tennessee, Knoxville. The John D. Tickle Engineering Building, which now houses our entire academic program, was dedicated on October 4, 2013, and is providing unprecedented infrastructure and resources to our students, faculty, and staff.

The five-story, one hundred and ten thousand square-foot building, named for COE alum Mr. John Tickle, chairman and owner of Strongwell Corporation, anchors a new gateway to the campus and provides an improved link between Neyland Drive and the Hill. The \$23.1 million new facility was made possible through major private support from John and Ann Tickle and public funding from the State of Tennessee, creating a true public/private partnership to ensure unsurpassed educational excellence for Tennesseans. The move to the new building brought a lot of excitement and at the same time it was bittersweet to leave Estabrook and Perkins Hall, where many of our successful alumni were educated over the past century; those buildings were home to our long-time faculty, staff, and administration for many years.

As I reflect back on the outstanding accomplishments of the department in the past five years, it is with great excitement and promise that I can say confidently that we are destined for great success, building on a solid foundation of accomplishments.

The incoming student quality is at an all time high, the rigor of teaching is at the top, scholarship productivity of our faculty is unprecedented, and sponsored research expenditures are currently on an average at half-a-million dollars per year for each faculty member. Our undergraduate student numbers are rock solid and steady for the past five years, and we have seen a substantial growth in our doctoral students. The growth in PhD students has come at a cost of reduced number of sponsored masters level students, a need we will address with the help of endowments and alumni support in the coming years. Faculty recruitment brought us highly qualified personnel at the ranks of assistant, associate, and full professor, and some of them are featured in this newsletter. The student chapter of the American Society of Civil Engineers has reached a level of maturity in the way it operates and its biweekly/monthly meetings are a pleasure for all to participate.

While the rest of the country was struggling with budget challenges, difficulty in replacing retired lines or vacancies, our department and this college partnered with the state and Oak Ridge National Laboratory to continue to fill the vacancies and grow to meet the demands of the large increase in the overall enrollment in engineering and societal need for science, technology, engineering, and math (STEM) majors. As a nation, we are struggling with the challenges of energy, environment, economy, and rapidly decaying infrastructure. Our graduates will play a critical role in addressing many of these issues and will be the pioneers of innovation in developing resilient and sustainable built infrastructure, clean air, clean water and related transformative environmental technologies, and computationally intensive transportation science and engineering solutions.

Please stay in touch by visiting our webpage or reach us via Facebook, twitter, or e-mail. We will very much appreciate knowing how you are doing.

Best Regards,

Dayakar Penumadu
Fred Peebles Professor and Head of the Department

The Cornerstone
Department of Civil and Environmental
Engineering • Spring 2014

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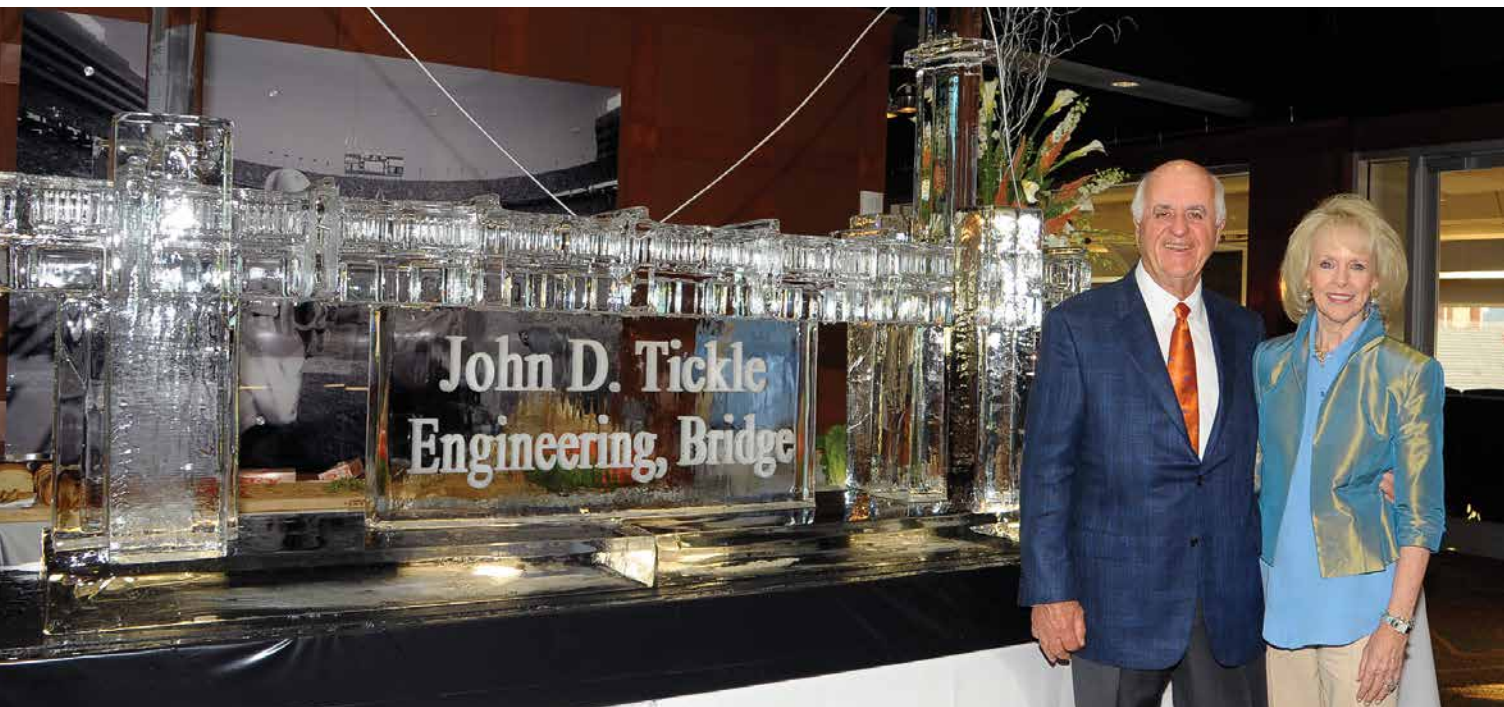
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PAN: E01-1330-002-14 DOP: 4/14
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THE UNIVERSITY OF TENNESSEE **UT**
KNOXVILLE
Department of Civil &
Environmental Engineering
COLLEGE OF ENGINEERING

CEE Celebrates Opening and Dedication of the John D. Tickle Engineering Building



Building donors John and Ann Tickle with an ice sculpture of the John D. Tickle Engineering Building at the VIP dinner held the evening prior to the dedication ceremony.

A dream came true for the Department of Civil and Environmental Engineering (CEE) in 2013 as faculty, staff, and students began moving into the brand new, state-of-the-art John D. Tickle Engineering Building, located on Neyland Drive next to Neyland Stadium, in August. The transition included relocation of faculty, student, and administrative offices; instructional laboratories; classrooms; student workspaces; research laboratories; and departmental workshops from their previous locations in Perkins, Estabrook, Berry, and East Stadium Halls.

In addition to housing the CEE department, the Department of Industrial and Systems Engineering is also located in the \$23.1 million, five-story, one hundred and ten thousand square foot facility. The Tickle building anchors a new gateway to campus and features a pedestrian bridge that includes fiberglass-reinforced large I-beams, which provides a closer link between Neyland Drive and the Hill.

The building and the bridge are both made possible by the generosity of

John and Ann Tickle, augmenting the original funding from the State of Tennessee in a public-private partnership.

John Tickle graduated from UT in 1965 with a bachelor's degree in industrial engineering. He was president of Morrison Molded Fiber Glass Company in his hometown of Bristol, Virginia, before he purchased it and named it Strongwell in 1997. Today, Strongwell is a worldwide operation, with the Bristol division serving as its headquarters.

Ann Tickle graduated with a bachelor's degree from the College of Education, Health, and Human Sciences. She hosted the popular syndicated series *Romper Room*—which predated *Sesame Street*—at a Bristol TV station from 1969 to 1976 and she is currently extensively involved in philanthropic work.

In addition to the Tickle's, three other couples provided significant funding for the building: UT industrial engineering graduate Chad Holliday, chairman of the Bank of America and the former CEO of DuPont, and his

wife Ann; Jim Gibson, former CEO of Pressure Tube Manufacturing LLC, and his wife Jill; and Eric Zeanah, president of American Accessories International, a Knoxville-based company, and his wife Elaine.

The Tickle Building has twenty-four laboratories, three conventional classrooms, one lecture hall, three student workspaces, and sixty-three faculty and graduate student offices. The laboratories include a high-bay area for structural testing and asphalt road surface testing as well as a geotechnical laboratory. The three classrooms promote collaborative learning through the use of moveable chairs and Smart Boards.

Dedication events began on October 3, 2013, with an elegant reception and dinner on the seventh floor of the Neyland Stadium East Skybox, a location that showed a magnificent view of the Tickle building, which was dramatically lit for the evening by Bandit Lites. An impressive fireworks display capped off the evening.

On Friday, October 4, Tickle helped to dedicate the building named in his



The ribbon-cutting team at the dedication ceremony for the John D. Tickle Engineering Building on October 4, 2013 (left to right): COE Board of Advisors Chair Bill Eversole; building donor Jim Gibson; building donor and COE Board of Advisors Chair-elect Eric Zeanah; CEE department head Dayakar Penumadu; UT Chancellor Jimmy G. Cheek; primary building donors John and Ann Tickle; COE Dean Wayne T. Davis; UT President Joe DiPietro; ISE department head John Kobza; CEE student and event speaker John Scobey; and COE Associate Dean for Research and Technology Bill Dunne.



A demonstration in the Tickle building's civil and environmental engineering concrete lab during tours after the dedication ceremony.

honor in front of a crowd of over five hundred UT students, faculty, and staff as well as engineering donors, alumni, and supporters from across the country. The ceremony took place under a tent on a beautiful fall day.

Speakers at the event included Chancellor Jimmy G. Cheek, UT President Joe DiPietro, civil and environmental engineering student John Scobey, COE Dean Wayne Davis, and Tickle.

After the dedication, the Tickle's, UT administrators, and honored guests cut the ribbon in front of the facility and then enjoyed a reception on the

building's fourth floor. Open houses, demonstrations, and receptions took place in all of the seven engineering departments later that day, along with a networking luncheon hosted by student engineering organizations.

The dedication ceremony and related events were part of the college's recognition of 175 years of engineering instruction at the University of Tennessee.

The John D. Tickle Building was designed by Grieve Associates Architects of Knoxville, working in association with three engineering firms: Cannon & Cannon Inc. and IC



John Scobey, civil and environmental engineering student and guest speaker at the dedication event.



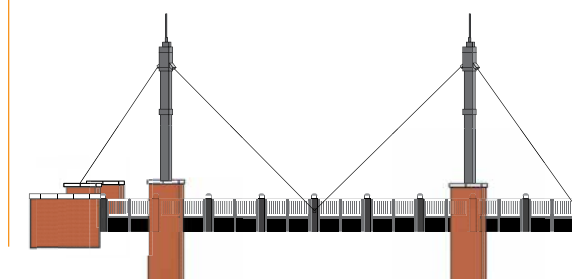
Members of the UT student chapter of the American Society of Civil Engineers welcomes visitors at the networking luncheon.



Dayakar and Marie Penumadu greet guests at the reception prior to the dinner the evening before the John D. Tickle Engineering Building dedication.

Thomasson Associates Inc., both of Knoxville, and Ross Bryan Associates Inc. of Nashville. Messer Construction of Knoxville was the general contractor.

For more information about the building, visit enr.utk.edu/tickle.



New Faculty



Dr. Kimberly Carter

Carter received her PhD in environmental engineering from the University of Arizona in 2009. She worked as a post-doc at the National Energy Technology Laboratory, developing methods for analyzing metal constituents in coal syngas and determining the organic composition of produced waters from the Marcellus shale region. Carter's current research interests include degradation of organic compounds used in wastewaters for different industries.



Dr. Timothy Truster

Truster received a PhD in civil engineering from the University of Illinois at Urbana-Champaign in the spring of 2013. During the summer, he remained in Illinois as a postdoc in collaboration with the Air Force Research Laboratory.

His research interests are in the area of developing numerical methods for high fidelity modeling of materials and structures. Previous and ongoing application areas include the modeling of failure in polymer-matrix composites, prediction of energy dissipation in mechanical joints associated with friction, investigating fatigue life of metallic pressure vessels, and modeling heterogeneous microstructures of active materials called elastomers.



Dr. Asad J. Khattak

Khattak is a Beaman Professor of Civil & Environmental Engineering and Transportation Program Coordinator in the CEE department. He is the editor-in-chief of *Science Citation Indexed Journal of Intelligent Transportation Systems*, and associate editor of *International Journal of Sustainable Transportation*. He is a special adviser to the *Journal of Safety and Security* and serves as an editorial advisory board member for *Transportation Research, Part C*, and *Analytic Methods in Accident Research*. Khattak's research focuses on various types of innovations related to intelligent

transportation systems, transportation safety, and sustainable transportation. During 2006-2013, he was Frank Batten Endowed Chair Professor of Civil Engineering at Old Dominion University (ODU), where he developed and directed ODU's transportation research initiatives and educational programs. He is an internationally recognized scholar, with ninety-five scholarly journal articles and has obtained more than \$7.6 million in research funding.

Khattak graduated from Northwestern University and he has held positions at the University of California at Berkeley, the University of Oxford in England, and the French National Institute for Transport and Safety Research.



Dr. Joseph Amoah

Amoah joined the CEE department in August as a lecturer. Prior to coming to UT, Amoah worked at AMEC and St. Johns River Water Management District in Florida performing water supply impact

studies, water quality modeling, coastal estuarine habitat restoration, and design of water infrastructure systems. Amoah received his PhD from Florida A&M University with concentration in water resources. He currently teaches several undergraduate courses in water resources and environmental engineering. Amoah's professional experience includes environmental regulatory agencies and private consulting as a licensed engineer.



Dr. Jon Hathaway

Hathaway received his PhD from North Carolina State University in 2010, where his doctoral research focused on microbial fate and transport in urban systems. After spending two

years working for one of the nation's top ecological consulting and design firms, Hathaway became a CEE faculty member in the area of water resources concentration. He teaches and performs research in the area of sustainable urban water with a focus on minimizing the effect of urban runoff on hydrology and water quality in surface waters.



Dr. Thanos Papanicolaou

Papanicolaou is the CEE department's Goodrich Chair of Excellence and a tenured full professor. Prior to joining the department, Papanicolaou was a Donald E. Bently Faculty Fellow of Engineering and professor of civil and environmental

engineering at the University of Iowa, and was affiliated with IIHR Hydroscience & Engineering, and researcher for the Center for Global and Regional Environmental Research and Policy Center. Papanicolaou was assistant professor and associate professor of civil and environmental engineering at Washington State University prior to his appointment with the University of Iowa. Papanicolaou is a member of numerous professional and scientific societies, serves on several editorial boards, is a technical advisor of several federal agencies, and was a 2008 National Civil Engineering Prize Award recipient. He is a distinguished member of the Iowa Academy. He has co-authored more than eighty refereed papers, numerous reports, and approximately three hundred conference proceedings. According to Google Scholar, the number of citations of his papers reaches an impressive total of one thousand twenty-four. Since 2008 alone, his papers have been cited six hundred and seventeen times.



Dr. Shashi Nambisan

Nambisan joined the CEE department in January 2014. He came from Iowa State University in Ames Iowa, where he was a professor and the director of the Institute for Transportation (CTRE). He received his PhD from the University

of California, Berkeley, and his MS from Virginia Tech. Nambisan has been a Principal Investigator (PI) or Co-PI for around one hundred and fifty sponsored projects since 1989. The projects have addressed and responded to local, statewide, regional, and national issues in transportation and information systems management (safety, management, policy analysis, planning, infrastructure development, air quality, and operations). Nambisan's efforts have primarily related to the development and deployment of technology based decision support tools.

Faculty News

ASCE Presents Award to CEE Research Group



Dr. John Ma

The American Society of Civil Engineers (ASCE) recently recognized a group from the Department of Civil and Environmental Engineering with the Raymond C. Reese Research Prize for 2013 for the paper, "Transverse Joint Details with Tight Bend Diameter U-Bars for Accelerated Bridge Construction." Honorees from the department are Dr. Zhongguo John Ma, associate professor; Samuel Lewis, graduate student; Zhiqi He, doctoral candidate; and Dr. Edwin Burdette, professor. Dr. Ci Cao, assistant professor in civil engineering at Dalian University of Technology in China, a recent a former doctoral candidate in the department, and Dr. Catherine French, professor of civil engineering at the University of Minnesota, were also recognized as authors of the paper.



Dr. Edwin Burdette

Drs. Fu and Huang Awarded ORNL's 2013 Significant Event Award



Dr. Joshua Fu

Dr. Joshua Fu, an associate professor in the CEE department, and Dr. Kan Huang, a research associate, have been awarded the Significant Event Award from ORNL for their contributions to the project "Arctic Black Carbon Initiative" funded by the Department of Energy. The project centered on black carbon (BC), a substance that is formed from incomplete combustion of fossil fuels, biofuels, and biomass. It has significant warming effects and human health impacts. In the Arctic region, this warming effect is especially essential due to the fact that the deposition of BC on snow could significantly reduce the surface albedo and promote snowmelt. The UT team in this awarded project contributes significantly to the sources and amounts of BC emissions in Russia, where little recorded information is available. A most recent BC emission inventory for Russia was established during the project, including identifying missing sources and updating various emission sectors. Preliminary modeling results using the new Russian emission inventory evidently reduced gaps between observations and model simulation, partly accounting for the strongly underestimated BC concentrations over the Arctic from previous modeling effects. The contributions from the civil engineering team will have profound implications on demonstrating BC emissions reduction opportunities in domestic Russia and also alleviating climate change throughout the Arctic region.



Dr. Kan Huang

CEE Department Head Penumadu Presents Invited Lecture at ESS, Visits Recent COE Alumnus



From left, Dr. Dayakar Penumadu visits with recent COE graduate Dr. Michelle Everett and her husband Chris Everett in Lund, Sweden, on April 20, 2013.

Dr. Dayakar Penumadu, the Fred Peebles Professor and head of the Department of Civil and Environmental Engineering, visited the European Spallation Source (ESS) in Lund, Sweden, in April 2013 to present an invited lecture on the "Accomplishments and Future Needs for Energy Selective Neutron Imaging Considering Diffraction Contrast," at the Fifth NEUtron WAVElength Dependent Imaging Workshop (NEUWAVE-5) 2013. Penumadu was joined by his PhD student, Robin Woracek.

While in Sweden, Penumadu met with Dr. Michelle Everett, a recent National Science Foundation (NSF) IGERT trainee who completed her PhD studies in March 2013 in the Department Materials Science and Engineering at UT. Everett now works at the European Spallation Source as a laboratory manager. She operates the on-site scientific laboratories and organize the development of support facilities at ESS for neutron science in parallel with those for neutron technologies.

Everett's PhD advisor at UT was Dr. Claudia Rawn and the principal investigator for the multi-disciplinary NSF IGERT grant is Dr. David Keffer. The project also received support from the Sustainable Energy Education and Research Center (SEERC).



Dr. Dayakar Penumadu

Penumadu was also one of three Principal Investigators (PIs) of a multidisciplinary team recently recognized by the UT Chancellor's Office with a Multidisciplinary Research Award at the Chancellor's Honors Banquet Ceremony in April 2013 for the research project "Transformational Scintillation Materials for Neutron and Gamma Detectors and Education Integration." The US Department of Homeland Security (DHS) had tasked the group with developing needed radiation measurement capabilities through a \$2 million grant from NSF and DHS. In addition to the significant intellectual contribution, the team mentored many UT undergraduate and graduate students through the project, and the results of this research has been presented at conferences around the globe and has forged partnerships with researchers in Germany and Switzerland. The other two PIs were Dr. Lawrence Miller, a professor in the Department of Nuclear Engineering and Dr. Chuck Melcher, director of the Scintillation Materials Research Center and a research professor in the Department of Materials Science and Engineering.

Student News

Caleb Drummer Receives Scholarship from ACEC of Tennessee



Caleb Drummer (second from left) is congratulated on his scholarship by (left to right) COE Dean Wayne T. Davis; David T. Harrell of Vaughn and Melton; CEE Department Head Dayakar Penumadu; and Associate Dean for Academic and Student Affairs Masood Parang.

Caleb Drummer, a senior in the Department of Civil Engineering, was one of two students out of twelve applicants to receive a \$1,000 scholarship from the American Council of Engineering Companies (ACEC) of Tennessee in 2013.

The selection committee, including David T. Harrell, PE, of the Vaughn & Melton engineering consulting company, evaluated Drummer in five areas: his grades, an essay, his work experience, recommendations from faculty, and extracurricular college activities. He maintained a 4.0 GPA and the committee found his essay and work experience to be excellent. In his essay, Drummer wrote about the role or responsibility of the consulting engineer in mitigating the impact of natural disasters. He has

worked as an assistant and research student in the Department of Civil and Environmental Engineering.

Drummer received an outstanding recommended by Dr. Edwin Burdette, the Fred. N. Peebles Professor in the Department of Civil and Environmental Engineering.

"I am very thankful for ACEC and their scholarship program," said Drummer. "It is an honor to have received this scholarship and will really help with paying for tuition. I am always thankful to organizations who lend financial support to help students achieve their goal of becoming an engineer."

For more information about the ACEC, visit www.acectn.org.

ASCE Teams Rank High at Miami Conference



The UT ASCE 2013 Steel Bridge Team members included, from left, Tyler Rogers, John Scobey, Nathan Foust, Eric Knowles, and Tyler Henderson. Not pictured is Luis Venegas.

Students of the UT chapter of the American Society of Civil Engineers (ASCE) delivered strong performances during the ASCE Southeast Regional Conference held March 14-16, 2013, in Miami, Florida.



The UT ASCE teams brought home numerous awards from the 2013 ASCE Southeast Regional Conference in Miami, Florida.

The UT team's overall ranking was sixth place out of twenty-four teams. In the conference's three main events, UT-ASCE teams were ranked second in the Professional Paper category; fourth in Steel Bridge Overall; and eleventh in Concrete Canoe Overall.

Other rankings included fourth place in the Environmental category; fifth in Concrete Bocce; fifth in Wind

Engineering; seventh in Concrete Testing; eighth in Hydraulics; eighth in Visual Display; twelfth in T-shirt; fourteenth in Geotechnical Engineering; fourteenth in Plan Reading; fifteenth in Surveying; fifteenth in Balsa Tower; and eighteenth in a category titled Mystery.

CEE grad student wins NSF fellowship



Hannah Woo participated in the National Science Foundation's Graduate Research Fellowship Program (GRFP).

Hannah Woo, a graduate student studying with Dr. Terry Hazen in the Department of Civil and Environmental Engineering (CEE), was selected to receive a 2013 National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Fellowship. Her selection was based on an assessment of her outstanding abilities and accomplishments, as well as her potential to contribute to strengthening the vitality of the US science and engineering enterprise.

The purpose of the NSF GRFP is to help ensure the vitality and diversity of the scientific and engineering workforce of the United States. The program recognizes and supports outstanding graduate students who are pursuing research-based Master's and doctoral degrees in fields within NSF's mission.

CEE Undergrad Norwood Does Co-op with Brasfield and Gorrie



Jennifer Norwood co-oped at Brasfield and Gorrie recently.

Civil and environmental engineering major Jennifer Norwood enjoyed a co-op experience in 2013 at Brasfield and Gorrie located in Kennesaw, Georgia.

"I worked in the project manager's office with the project managers," she said. "Tasks I worked on included: updating drawings (marking with RFI responses and slip-sheeting new addendums), reviewing submittals, taking site progress photos twice a week, and creating RFIs."

Norwood said that the assignment taught her the importance of doing her part on the projects she worked on quickly and correctly, no matter how small.

"Attitude is so important," said Norwood. "After time went on, they noticed that everything I did was done promptly and with a smile. They started giving me bigger projects and assignments. I learned a lot of what working with project management on a start-up of a jobsite with a general contractor is like and I learned good engineering practices."

Students can learn more about co-op experiences through the Office of Engineering Professional Practice. For information, visit www.coop.utk.edu, e-mail coop@utk.edu or call 865-974-5323.



Taekwan Yoon won the Southern District Institute of Transportation Engineers (SDITE) Student Paper Competition.

Taekwan Yoon Wins SDITE Student Paper Competition

Taekwan Yoon, a civil and environmental engineering graduate student studying with Dr. Chris Cherry, won the Southern

District Institute of Transportation Engineers (SDITE) Student Paper Competition, a nine-state contest.

The paper was titled "Development of Optimization Model for an Electric Vehicle Fleet." It was displayed during the 2013 SDITE Annual Meeting in April of 2013 in Charlotte, North Carolina. Yoon received the award during the Annual Banquet on Tuesday, April 7, 2013.

CEE Student Brandy Manka Wins RISER Presentation Award



Brandy Manka won a Presentation Award through the Research and Instructional Strategies for Engineering Retention (RISER) program.

Brandy Manka, a sophomore in civil and environmental engineering, won a Research and Instructional Strategies for Engineering Retention (RISER) Presentation Award in the summer of 2013 for her

poster "Hydrologic, Sediment, and Water Quality Impacts of Growing Switchgrass in East Tennessee."

Manka is a RISER-sponsored undergraduate research assistant for Dr. John Schwartz. As a member of the research team, she contributed to a 2013 Integrated Biomass Supply Systems (IBSS) project, funded by the USDA, measuring rates of sediment and nutrients from bioenergy switchgrass plots near Vonore and Sweetwater, Tennessee. Manka's entry in the poster session illustrated her contributions to the research team.

The poster session awarded two top poster presenters to select a professional conference of their choosing, funded by the NSF. Dr. Claudia Rawn manages the RISER program on the UT campus.

Graduate Students Win NSF Awards



Zane Pannell and Stephanie Hargrove, from left, received National Science Foundation awards for international research.

Three University of Tennessee transportation graduate students, including two in the Department of Civil and Environmental Engineering (CEE), were awarded the National Science Foundation (NSF) East Asia and Pacific Summer Institute Awards to participate in collaborative research with international faculty and students in host countries.

Zane Pannell and Stephanie Hargrove of CEE, and geography graduate student Genge He, conducted research—which they proposed—that went through NSF's standard panel review process, with researchers in China (Pannell and Hargrove) and Japan (He). The summer institute funds research efforts for around eight weeks in the host countries.

Center for Transportation Research News

CTR Earns \$5.5 Million DOT Grant



Dr. Stephen Richards



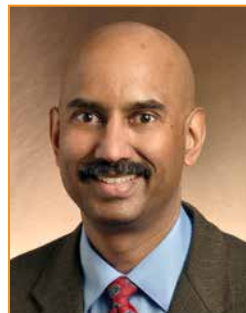
DeAnna Flinchum



Dr. Lee Han



Dr. Chris Cherry



Dr. Shashi Nambisan

The College of Engineering's Center for Transportation Research (CTR) has won a \$5.5 million federal award for the Region 4 University Transportation Center, the Southeastern Transportation Center (STC). This grant renews the center's national leadership in transportation safety research. STC's operational structure reflects the consortium's regional, multi-university nature. Directing the consortium are CTR's Dr. Stephen Richards and DeAnna Flinchum.

Potential research partners across UT include Department of Civil and Environmental Engineering (CEE) faculty Dr. Lee Han, Dr. Asad Khattak, Dr. Chris Cherry, and Dr. Shashi Nambisan, in the areas of applying big data to safety improvements and exploring spatial differences in safety; Department of Industrial and Systems Engineering faculty Dr. Mingzhou Jin and Dr. Rapinder Sawhney, for

transportation engineering and simulation modeling; Dr. Mary Holcomb, Department of Marketing and Supply Chain Management, for logistics and network design; and, Dr. Shih-Lung Shaw, Department of Geography, for transportation planning and modeling.

The program supports the Secretary of Transportation's strategic goal to improve public health and safety by reducing transportation related fatalities and injuries.

The STC research agenda addresses key research needs cited in the Moving Ahead for Progress in the 21st Century Act (MAP-21), namely to improve highway safety and infrastructure integrity. The STC research topics are:

- Crash Modification Factors and the Highway Safety Manual

- Integrated Simulation and Safety
- Exploring Socio-Demographic Characteristics and Culture Factors in Differential Safety Performance across Geography
- Big Data for Safety Monitoring, Assessment, and Improvement

Full details about each initiative are given at stc.utk.edu/research.

The consortium represents a prestigious group of university based transportation safety programs. Besides UT, the member institutions are the University of Kentucky, the University of South Florida, the University of Central Florida, the University of Alabama, the University of Alabama Birmingham, the University of North Carolina Chapel Hill, North Carolina A&T State University, and Clemson University.

CTR Names Khattak Special Advisor to Journal



Dr. Asad Khattak

The Center for Transportation Research (CTR) has named Dr. Asad J. Khattak as special advisor to *Journal of Transportation Safety & Security*, the international peer-reviewed journal established by CTR in 2009. In this capacity, Khattak will work closely with CTR and the Southeastern Transportation Center (STC) to further the scope and direction of safety related research.

Prior to joining the faculty of the Department of Civil and Environmental Engineering, Khattak collaborated with CTR, participating in its research, education, and outreach programs, and he has advised on research

initiatives for the STC, CTR's US DOT Region 4 University Transportation Center.

Khattak's safety work covers a broad spectrum of topics that relate to automobile, bicycle, and pedestrian modes as well as incident management and the role of incidents and accidents during evacuations. His research has contributed directly to development of the work zone procedure in the Highway Safety Manual. In addition, his research covers innovations related to intelligent transportation systems and sustainable transportation.



Federal Highway Administration Recommends UT CTR Program to National Audience

The Federal Highway Administration (FHWA) has listed the University of Tennessee's Traffic Signal Academy as one of its recommended training programs. The FHWA website says, "Developed by the University of Tennessee's Center for Transportation Research (CTR), this course offers a comprehensive discussion on standards, warrants, installation and maintenance guidelines, liability issues, design, operations and maintenance of traffic signal systems."

Transportation workforce development is a major activity for CTR, and its Traffic Signal Academy, established in 2010, is one of the highlights of this effort. Headed by Dr. Airton Kohls, the academy helps transportation agencies optimize their existing traffic signal operations, improve benefit-to-cost ratios, maintain signal hardware, and stay abreast of changes in technology.

Traffic signal operations play an important safety role on our roadway systems; however, according to the 2012 National Traffic Signal Report Card, the

overall quality of traffic signal operations in the US is poor and may soon fail to keep pace with changes in population growth and traffic patterns. Academy instructors apply innovative concepts resulting from academic research and established best practices to help agencies develop improved signal timing policies and procedures.

Transportation professionals and workers from across the US have participated in the academy's continuing education program. Kohls developed the academy's program and curriculum, and can customize the five-day series of workshops to suit an agency's requirements and bring the training to locations across the US. Locally, workshops are conducted at the CTR Traffic Signal Laboratory, located at the National Transportation Research Center in West Knoxville. The lab is a fully functioning, closed-loop traffic control system that demonstrates the complexities involved in setting up and maintaining traffic signal cabinets, detection, and communication systems.

Research Focus: Faster Than Real Time

CREATING A TRAFFIC SIMULATION SYSTEM SO ADVANCED, IT MAY REVOLUTIONIZE THE WORLD OF TRANSPORTATION



Dr. Lee Han takes his students behind the wheel at UT's Transportation Systems Laboratory.

Approximately one hour after a 9.0 magnitude earthquake occurred off the coast of Japan in 2011, a powerful tsunami hit the country's northeast coastline. Surging water obliterated entire cities in just minutes, leaving emergency personnel very little time to figure out how to effectively evacuate the area while trying to save the lives of residents trapped under rubble and debris.

This is the type of nightmare scenario that has inspired Dr. Lee Han, UT professor of civil and environmental engineering, to devise a revolutionary traffic planning system to deal with such emergencies.

Together, Han and his phalanx of students are building the foundation for a faster-than-real-time traffic simulation program that operates more than 1,000 times quicker than anything currently available.

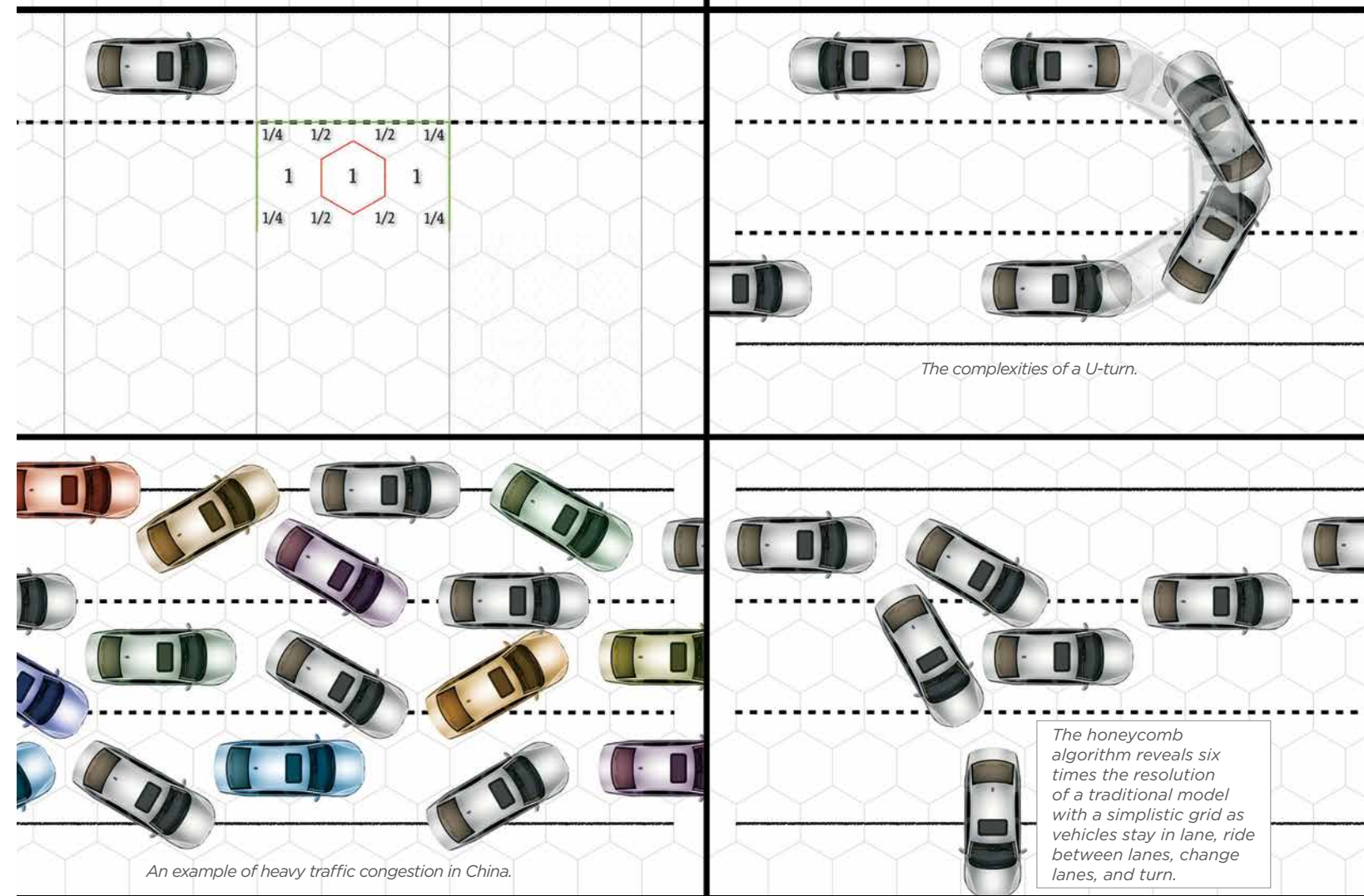
At UT's Transportation Systems Laboratory (TSL), Han and his team continually test, compile data, and develop multiple models in preparation for everything from everyday traffic congestion to extreme emergency management.

In describing his work, Han mentions the terms "microscopic" and "large scale" at the same time. While

constructing large-scale models capable of projecting a range of predictive scenarios for decision making in time to avert citywide or regional catastrophe, traffic engineers must also ground those systems in the behaviors and experiential learning of individual drivers; the "microscopic" evidence from where, as Han says, "the rubber meets the road."

For example, realistic field situations where vehicles, road configurations, traffic laws, driving customs and cultures, lighting, and weather conditions are vastly different must be considered. In order to extend and generalize the research, Han's students have traveled to many different countries to collect driving behavior data.

In traffic simulation, it is also critical to overcome the sequential nature of traditional models—a major constraint holding back the potential gains of applying complex parallel computational sciences. At the microscopic level, sequential in the context of driving refers to the idiosyncratic behaviors and reaction times of drivers as they follow behind other vehicles, change lanes on the interstate at high speed, look for gaps to turn, navigate stop-and-go city driving, and idle in frustrating traffic jams.



The benefits of a successful, large-scale traffic simulation system are many: smoother driving on shorter commutes; increased safety and fuel savings; emission reductions; and heightened security in the event of terrorist attacks, mass evacuations, and major accidents.

However, this complex technique requires massive amounts of real-time data of all different types to ensure the simulations in the lab are closely mimicking and timely relevant to the real world. The system must be dynamic enough to keep up with the endless stream of data from a growing number of highway and on-board wireless sensors.

The computational tasks of handling both the data and calculations are clearly daunting; however, they have been addressed by a Joint Directed Research and Development grant that allows Han to take advantage of the petascale supercomputing facilities at the nearby Oak Ridge National Laboratory.

"The shared ambition of tackling a very challenging sequential problem with parallel means has been a driving force behind the collaboration," Han says. He has begun to ponder the complex algorithms required for multiple models that can be crunched simultaneously by ORNL's

Titan supercomputer, capable of processing 20 petaflops, or 20 trillion calculations, per second.

Several of those models are based upon the structure of the honeycomb, an organizing principle for developing new algorithms that captures the critical importance of both the boundaries—highway edges, lane lines, and vehicular bodies known as "force fields"—and the "holes"—openings in traffic flow—in the space on the road.

"Anyone who has traveled widely can appreciate the importance of models and calculations that exploit the shifting force fields and holes in traffic, because for drivers in many cultures, lane lines are merely a suggestion," Han says.

As Han's traffic flow optimization and simulation models continue to undergo validation and refinement, the promise of a safer world without traffic jams crawls closer to reality. And while no one can predict the future, the ability to make predictions and test them ahead of time in a virtual environment will make it easier to keep up with the present—especially when disaster strikes or chaos threatens.

By Theresa Pepin
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Natural Resilience

Communities of microbes build relationships to make the modern world less toxic



Dr. Terry Hazen

When an explosion on the Deepwater Horizon drilling platform occurred in 2010, just over four million barrels of crude oil were released into the Gulf of Mexico. Hundreds of people and a variety of technologies were quickly deployed to help restore the area. But arguably, the most effective cleaning agent came in the form of naturally occurring oil-devouring bacteria.

Dr. Terry Hazen, UT/ORNL

Governor's Chair for Environmental Biotechnology, is an environmental biologist who specializes in bioremediation. In other words, he examines how bacteria break down and detoxify hazardous materials.

In the wake of the Gulf disaster, Hazen seized the opportunity to advance his research. The result was a paper he co-authored that appeared on the cover of *Environmental Microbiology*, titled "Deep-Sea Bacteria Enriched by Oil and Dispersant from the Deepwater Horizon Spill." It documented microbial communities and their natural ability to remove spilled oil from the environment.

"We are trying to look at and understand environmental systems from the molecular level right up through the ecosystem level and everything in between," Hazen says. "There's a lot of hidden information. Ultimately, we want to understand how organisms create a community, as well as the resilience of the community."

By studying the relationship between these communities, scientists hope to be able to calculate how they will react

"We are trying to look at and understand environmental systems from the molecular level right up through the ecosystem level and everything in between."

Terry Hazen
UT/ORNL Governor's Chair for
Environmental Biotechnology

when pollutants such as hydrocarbons are introduced and, in turn, how that affects the overall ecosystem.

Certain microbes—primarily bacteria and fungi—are known to break down oil into carbon dioxide and water through a process similar to human digestion by harnessing the released energy to sustain themselves. Over millions of years, some bacteria developed the ability to produce enzymes specific to different aspects of the oil-degradation process. Basically, the bacteria have evolved to be picky eaters.

Hazen and his team investigated a group of organisms in the Gulf of Mexico that preferred to feast on alkanes—a saturated hydrocarbon consisting only of hydrogen and carbon atoms that is typically the dominant component in fuels. The team found that after the alkane-eating bacteria finished eating, the community structure changed and other bacteria stepped up to the buffet line.

Photo: US Coast Guard photo
Chief Petty Officer Bob Laura



Ships and drilling rigs continued to recover oil two months after the Deepwater Horizon explosion.

"Once particular hydrocarbons were degraded, the community switched and organisms that could effectively compete for what was left began to compete for food," Hazen says. "We saw a natural progression of keystone species in the community as the oil degraded."

The discovery got Hazen thinking about the pattern of succession and how species composition changes when different hydrocarbons are introduced into the environment. He decided to recreate the Deepwater Horizon conditions in a lab to study transformations within the microbial community and determine which specific members could degrade oil, regardless of whether or not dispersants were used.

"Ultimately, we learned that microbial communities in the Gulf of Mexico have a high potential for degradation of oil and have adapted rapidly to the introduction of hydrocarbons," Hazen says.

This knowledge could prove highly beneficial for similar cleanup and restoration efforts in the future. By knowing how microbial communities will behave in specific hydrocarbon-heavy areas, researchers will be better prepared to assist with immediate restoration. It also could potentially save money by curtailing the use of expensive chemical dispersants.

Interestingly, Hazen found that the bacteria do not just incorporate the oil into their bodies; they completely convert it into proteins, carbohydrates, and their DNA structure. The next step is to investigate how the molecular-level transformation affects biological processes on the systems level.

"We want to understand how currents and weather affect the overall community," Hazen says. "That's why I say we are taking a biological systems approach."

Understanding how these other factors influence microbial communities will help scientists evaluate how global climate change could alter their hydrocarbon degrading abilities.

As the demand for crude oil increases, the chances of future spills occurring also increase. Because of his work on the Deepwater Horizon spill, Hazen was named lead investigator for a multidisciplinary, multi-university research team funded by BP to study potential deep-sea drilling sites around the world and assess the environmental risks.

"This research will potentially give us some really exciting results," Hazen says. "All of these sites are quite deep and might have different types of crude oil, which may help us understand the hydrocarbon transformations occurring in the microbial community and how different or similar they are at each site."

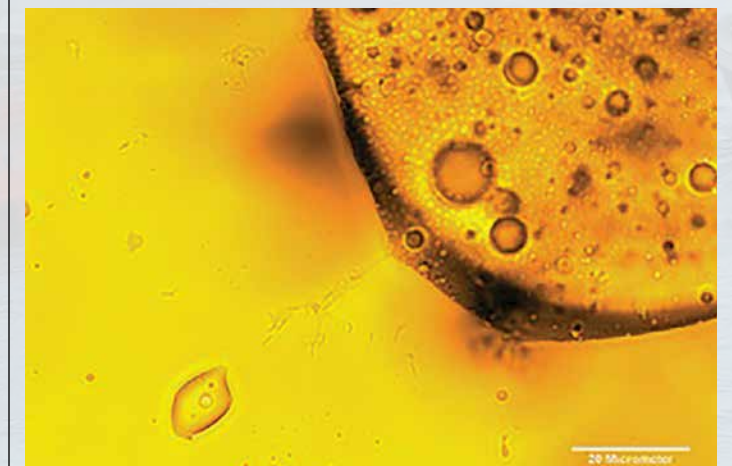
Once scientists understand how the many variables affect microbial communities, they should be able to predict how the microbes will react to the introduction of hydrocarbons in their environment. Will they be as hungry as the ones in the Gulf? Or will the community structure change completely?

Hazen's previous work on bioremediation technologies has led to five patents. He recently submitted a proposal for a collaborative strategic environmental research development program that would involve scientists from a variety of disciplines in studying the resilience of our natural world.

"Mother Nature has an incredible resiliency to clean herself up after we make a mess," Hazen says. "I'm worried about the fact that in the Gulf of Mexico, she's had too many catastrophic events, and how resilient she actually is, but my hope is that this research will help us understand how resilient Mother Nature can be in the future."

By Amanda Womac

Reprinted by permission from *Quest Magazine*



Bacteria attacking a droplet of oil. Surface sample taken from the Deepwater Horizon oil spill.

CEE Engineers Create “Canstruction” Soldiers for Charity



Students work on the Canstruction project at the Knoxville Convention Center.



The CEE Canstruction team: (left to right) Trey Pippin, Sarah Howell, Steve Harvey, CEE professor Dr. Jenny Retherford, Emily Dahlstrom, Jonathan Skinner, Javan Reynolds, Marvin Martinez, Aaron McClellan (student team leader), and Kyle Scobie (Messer representative, team corporate sponsor).



The Department of Civil and Environmental Engineering (CEE) team was awarded for its unique sculpture at the first Knoxville Holiday Canstruction that took place at the Knoxville Convention Center November 23-December 3, 2013.

Students and faculty from CEE and the Department of Industrial and Systems Engineering (ISE), led by CEE lecturer Dr. Jennifer Retherford, joined four other local teams of architects, engineers, and construction companies to compete in a massive can-sculpture competition presented by Messer Construction Co. Holiday-themed sculptures constructed of canned foods were built and displayed at the Knoxville Convention Center, with the canned items donated to Second Harvest Food Bank following the contest.

Nine judges representing media, arts organizations, nutritionists, tourism organizations, and local food

production companies convened to select the winners of competition and scored each structure in four categories. A “People’s Choice Award” was decided through a public vote on the Knoxville Canstruction Facebook page.

The COE team won “Best Meal” and “Honorable Mention” for its sculpture “CANcracker.” The sculpture included two large nutcrackers with a moving mouth and motion-censored sound effect built with cans to prepare a balanced meal of chili with peanuts and fruit dessert. The team was selected for creating the most nutritious meal to help fight hunger in East Tennessee and for earning the second-most points among the jurors. The team was also awarded the coveted “People’s Choice Award” for receiving the most votes in an online poll.

The Knoxville Holiday Canstruction donated more than ten thousand cans of food to help Second Harvest Food Bank of East Tennessee. Second Harvest targets the working poor—those who are employed but might not receive benefits or earn sufficient wages—serving one hundred and fifty-eight thousand people each month. The engineering team held a canned-food drive in November in conjunction with Canstruction, adding one hundred and forty cans of food to the overall donation.

Staff News

CEE Business Manager Earns Degree in Business Administration

Samantha Allen, business manager for the Department of Civil and Environmental Engineering, graduated December 13, 2013, from the University of Tennessee, Martin, with a bachelors’ degree in business administration.

Allen began working toward this degree in 2007, and has completed a major in management and a minor in marketing in six and a half years while working full time. In addition, she is graduating summa cum laude and ranks in the top five percent of a class of almost four hundred students.



Samantha Allen

UT Engineering alumni work for these matching-gift companies and many others:

Alcoa. AT&T. ADP. Abbott Laboratories.
Accenture. Agilent Technologies. Alstom Power. Amsted Industries. Apple.
Armstrong. Atmos Energy. BASF. BP. Ball Corporation. **B&W Y-12.**
Bechtel. Boeing. Bridgestone/Firestone Americas. Brink's Co.
Brystal-Myers Squibb. Capital Group companies. Cardinal Health. Chevron.
Cisco Systems. Coca-Cola. ConocoPhillips. DCP Midstream. **Denso.**
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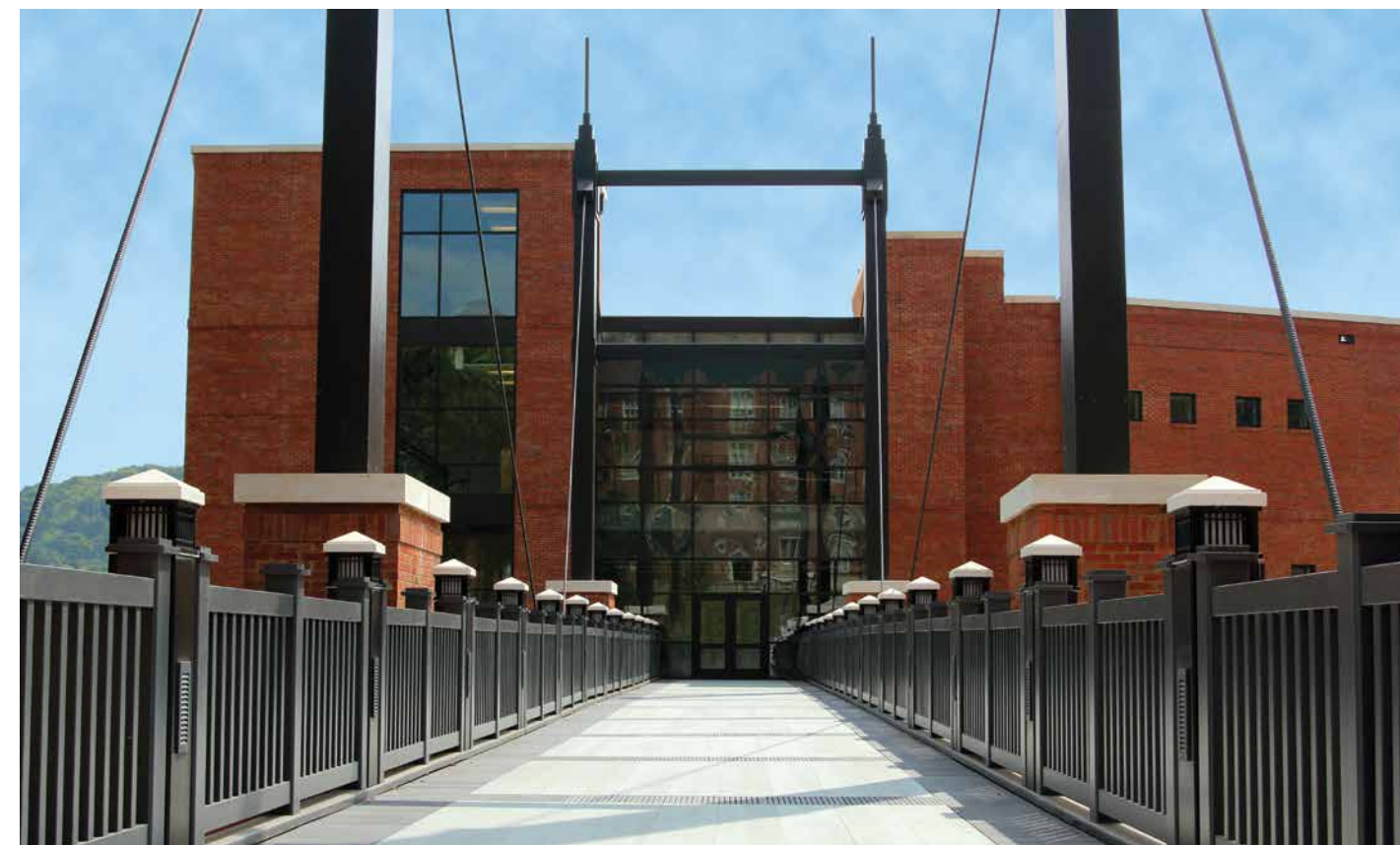
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The John D. Tickle Building

In late-March, approximately fifty students will travel to the 2014 ASCE Southeast Student Conference hosted by the University of South Florida in Tampa, Florida, where they will proudly represent UT in various competitions. Andrew Wagner, president of ASCE says, "ASCE allows students to gain the hands-on experience that complements our excellent technical knowledge obtained in the classroom."

The ASCE student chapter annually receives assistance from the Civil and Environmental Engineering Fund to cover expenses such as conference registration, travel, lodging, and the purchase of materials associated with the steel bridge and concrete canoe competitions. Contributions from alumni and friends enable students with the honor of representing UT to showcase their problem-solving skills and strengthen the department's tradition of excellence at ASCE competitions.

Other ongoing strategic priorities include growing the department's endowment, which promotes excellence by providing reoccurring solutions-oriented resources to the department, and establishing privately funded endowments for professorships and chaired positions to augment the pace at which we grow our research output and improve in the national rankings.

The John D. Tickle Engineering Building offers gift recognition opportunities in the form of classrooms, laboratories, and offices for alumni, friends, and corporate partners whom make philanthropic investments in the Civil and Environmental Engineering Excellence Endowment. Examples include the Ed Burdette Hardened Concrete Laboratory, Don & Marian Savage Hydraulics Laboratory, W. Mark Geldmeier Faculty Office, Strata*G Water Station, and the Ross Bryan Associates, Inc. Faculty Office. These tremendously visible spaces are testaments to legacies of investment in civil and environmental engineering education at UT. For more information, please contact Engineering Development at 865-974-2779.

Our dynamic transformation is part of UT's journey to become a Top 25 public research institution. Your participation in our journey impacts the educational experiences of our students and advances the future of the profession by empowering the department to invigorate the curriculum, ensuring a vibrant learning environment to better serve its students. Thank you for your generous support!

To make a contribution, please return the enclosed envelope.

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Ross Bryan Associates, Inc. invigorates UT Civil Engineering



The Department of Civil and Environmental Engineering would like to acknowledge Ross Bryan Associates, Inc., a Nashville, Tennessee, based structural engineering consulting firm, for its philanthropic investments in civil engineering education through the University of Tennessee. Ross Bryan's contributions target two strategic priorities - fellowships for master's students and the department's excellence endowment.

The Ross Bryan Associates Endowed Fellowship in Structural Engineering serves as a testament to Ross Bryan's commitment to advance engineering education within Tennessee. The inaugural Ross Bryan Fellowship, which will empower recipients to earn a master's degree in structural engineering, will be awarded for Fall 2014. In addition to its fellowship endowment, Ross Bryan is investing in the department's future strength via the Civil and Environmental Engineering Excellence Endowment.

This endowment enables the department to better respond to the demands of industry and to support students and faculty. For its contributions to this endowment, a faculty office within the John D. Tickle Engineering Building is recognized in honor of Ross Bryan. Dr. Ed Burdette currently occupies this office.

Ross Bryan continues to invigorate the curriculum, inspire the pursuit of structural engineering master's degrees, and promote future excellence within the department. The Department of Civil and Environmental Engineering is grateful for Ross Bryan Associates, Inc., engaging with students and faculty through its involvement in the geotechnical and structural engineering seminar series, serving on volunteer advisory boards at both the department- and college-level, and for its philanthropic investments which advance the academic mission of the department.