About the Utah Transportation Center

The theme for the Utah Transportation Center (UTC) is “Innovative Engineering Against Hazards” and comes from the core expertise of the initial group of colleagues associated with the Center. For more than a decade, the transportation research expertise within the Department of Civil and Environmental Engineering (CEE) at Utah State University has been in areas addressing natural hazards such as earthquakes, landslides, and flooding. It was decided to mold the Center around this expertise and then reach out to other colleagues to provide expertise that can be applied to both hazards and other areas of transportation—congestion and transit being two prime examples.

This approach has been very successful during the first six years of the Center. In particular, the association of colleagues in Utah State University’s Department of Electrical and Computer Engineering (ECE), College of Natural Resources and most recently, the Energy Dynamics Laboratory and the Department of Consumer Sciences, has expanded the Center’s ability to look at transportation issues from a wide variety of perspectives. We anticipate continued expansion of these cross-discipline partnering efforts in the future.

The educational activities of the Center continue to be centered primarily around instruction by CEE faculty associated with the Center. These faculty teach an array of transportation-related courses in many disciplines of civil engineering: surveying, structures, hydraulics, operations, transportation design, planning, and engineering economics. Center research activities now focus on “State of Good Repair,” and also include transit and wildlife transportation corridor users. The Center’s principal research partner continues to be the Utah Department of Transportation (UDOT) and has grown to include the Utah Transit Authority (UTA). Our partnership with the Federal Highway Administration (FHWA) has continued as work on the Long Term Bridge Performance (LTBP) Program moves forward. Work with local agencies has continued through the Utah Local Technical Assistance Program (LTAP). Throughout all of our activities, the underlying emphasis on undergraduate and graduate student development continues to be a focus beyond the classroom. Students learn hands-on as they participate with Center faculty in their real-world research projects, serve local agency needs by providing technical assistance through the Utah LTAP Center, and learn from classroom instruction based on the latest in the ever-changing transportation field.

The technology transfer activities of the Center this past year have been three-pronged: (1) the presentation of papers at professional conferences—the annual Transportation Research Board meeting being the principal medium for these presentations; (2) peer reviewed journal publications (see page 8-11 for the list of presentations and publications); and (3) research dissemination to local agencies through the Utah LTAP Center.
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In many ways, the Utah Transportation Center has had a very successful year. Funding from the Center was used to support 18 masters students, two doctoral students and several undergraduate students (some through their work as technical assistants with the Utah LTAP Center). Providing these young engineers with the opportunity to work on transportation-related issues while obtaining an education continues to be a priority of the center. Many projects have been successfully completed. In particular a new post-tensioned connection for precast deck panels was testing at full scale, an inventory of the state’s road signs was completed and a crucial phase of the automated vehicle project was completed. Finally, six addition projects were initiated as part of the UTC partnerships with CAIT at Rutgers and North Dakota State University.

The Utah Transportation Center was pleased to have been part of a consortium of universities that was awarded a Tier 1 transportation center from the USDOT’s Research and Innovative Technology Administration under the University Transportation Center Program. The grant of $3.5 million lead by Rutgers University involves Utah State University, Columbia University, Princeton University, Virginia Polytechnic Institute, University of Virginia, University of Delaware, New Jersey Institute of Technology and the University of Texas-El Paso. The funding from this consortium is being used to study the shear behavior of prestressed concrete girders that have been in service for over 30 years, Accelerated Bridge Construction (ABC) deck panel connections and the development of a sign management system for departments of transportations.

In addition to the Tier 1 Center, we are also pleased to be a part of the Mountain-Plains Consortium. The theme of this Consortium is “Transportation Infrastructure and Operations to Support Sustainable Energy Development and the Safe Movement of People and Goods.” The Mountain-Plains Consortium is comprised of a group of regional universities lead by North Dakota State University and involves Utah State University, Colorado State University, South Dakota State University, University of Colorado Denver, University of Denver, University of Utah and the University of Wyoming. Funding from this Consortium will support three research projects: (1) a two-stage approach for estimating a statewide truck trip...
table, (2) the influence of changing prices on fuel consumption, diminished greenhouse gas emissions and lower fuel tax revenue, and (3) development of design guidelines for integral abutment bridges.

The year did not pass however without some sad news in the passing of our UTC Advisory Board Member Jim McMinimee. Jim had always been an advocate for advancing transportation research. During his time at UDOT, he became a national leader for his efforts to develop and utilize Accelerated Bridge Construction (ABC) Techniques for both bridge replacement and rehabilitation. Upon retiring from UDOT, he took his experience to Washington as the implementation manager for the second Strategic Highway Research Program (SHRP2). Despite his busy schedule, Jim found time to serve on our UTC Advisory Board. His contributions to the UTC are many and he will be missed.

We look forward to working throughout the year with our new partners to provide solutions to some of the nation's transportation issues.

**Highlights & Happenings**

**Developing Design Guidelines for Integral Abutment Bridges**

Temperature effects for bridges have traditionally been incorporated in design by allowing for expansion and contraction through the utilization of bearings and joints. However, bearing and joints have been locations of serviceability issues throughout the state due to the winters in Utah. Bridges built with integral abutments, on the other hand, offer advantages for both seismic and maintenance issues. Despite the benefits, proper accounting of bridge behavior due to changes in temperature has been found to be essential for integral abutment bridges.

In order to investigate whether temperature effects for integral abutment bridges are being properly taken into account in the design process in the state of Utah, a study was initiated. The primary goal of the study was to determine whether changes to the UDOT design manual were needed to accurately account for changes in bridge temperature. The design parameters we are looking to investigate involve span length, skew and bridge geometry.

To meet the overall goal of the project, a Technical Advisory Committee was formed involving UDOT engineers, consulting engineers and university expertise. It was determined that bridge data, analytical modeling and temperature readings would be needed. As such, a three-part study was implemented.

With the cracking observed at the north abutment of the 400 South Bridge on I-15 in Salt Lake City (Figures 1 and 2), it was selected to provide the data to meet the intended goals of the study. Contact targets were placed on each span of the bridge and were used to

*Figure 1: 400 South I-15 bridge*
monitor changes in bridge movement. The measured bridge movements, in addition to temperature readings, were used to compare with predicted behavior according to a finite-element model developed for the bridge. This modeling scheme was then used to investigate critical bridge parameters when considering temperature effects for general integral abutment bridges.

The impact of this study will be focused on the design implications for integral abutment bridges. The findings will be used to develop design guidelines for the UDOT Bridge Design Manual. These guidelines will aid engineers in accurately accounting for the temperature effects during the design process.

Currently the investigators have nearly completed monitoring changes in temperature and movements for the 400 South Bridge on I-15. The finite-element modeling has already been started with an initial parametric study completed. With the guidance of the Technical Advisory Committee, model refinements and additional parametric studies are planned. These results will be used to provide design recommendations.

For more information regarding this project, please contact USU Principal Investigator Paul Barr at paul.barr@usu.edu, or UDOT Research Division Project Manager Abdul Wakil at awakil@utah.gov.

from an article by Paul Barr, Ph.D., Utah State University, Joshua Sletten, P.E., UDOT Structures Division, and Abdul Wakil, P.E., UDOT Research Division of the same title which appeared in UDOT Research Newsletter, Summer 2012

UTC Students Take Part in Annual TRB Meetings in Washington DC

Several USU transportation students participated in the TRB Annual Meetings which took place in Washington, DC, January 22-26, 2012. They, along with their faculty co-authors, presented papers on a variety of transportation-related topics including:

- “Development of a Work Zone Safety Audit Risk Assessment Tool,” presented by Tomas Lindheimer, Kevin Heaslip, William Louisell & Kevin Gardiner
- “Development of a Demand Uncertainty Based Model to Estimate Network Reliability,” presented by Ali Soltani Sobh, James Fishelson, Kevin Heaslip & John El Khoury
- “Enhancement of the Double Projection Method Designed for Traffic Assignment,” presented by Donghyung Yook, Kevin Heaslip & Anthony Chen
- “Road Network Redundancy Measures: Route Diversity and Network Spare Capacity,” presented by Xiangdong Xu, Anthony Chen, Sarawut Jansuwon & Kevin Heaslip

italics indicates student authors
In 2007, UDOT initiated a research project with Dr. Patricia Cramer of Utah State University to evaluate how well different wildlife crossing structures in Utah work for passing mule deer, elk, and moose. Since then, additional camera images collected at the crossings through June 2011 have been analyzed, and the study results are now available in the final research report to UDOT on the Research Division website.

This study is unique in that it examined wildlife crossings and other structures across the entire state, a feat not undertaken by any other state in the U.S. or province in Canada. In this study, remote motion-sensed cameras were used at 14 designated wildlife crossing culverts and bridges, and 21 existing culverts and bridges built for other purposes. Between 2008 and June 2011 the 35 cameras recorded 23,957 mule deer passages through designated wildlife crossings, and 1,093 passages under existing culverts and bridges. During that time there were 45 elk passages, 127 moose passages, and several passages by other species of wildlife recorded. Many of these sites had wildlife fencing (up to 8 feet high).

Bridge designs monitored had 89 to 98% success rates, meaning 2 to 11% of the mule deer approaching the structure repelled away, while the rest went through. Culverts had between 75 and 95% success rates. Culverts that were over 120 feet long had the lowest success rates.

Based on the photographic evidence, UDOT wildlife crossings are working for mule deer. The most successful crossing designs for passing mule deer are those that minimize lengths under the road and maximize the width or span of the structure. Future research will help determine if any designs work in passing skittish elk in Utah, and if placing wildlife fencing at existing box culverts and bridges can motivate mule deer and elk to use these structures.

The potential impact of implementing the research results is that wildlife crossing structures would be more consistently designed and constructed to pass mule deer, and potentially elk, under or over highways. This would contribute to fewer wildlife-vehicle collisions, thus increasing safety for motorists and maintaining wildlife populations. The research results have helped to coordinate efforts between multiple agencies in locating and building new wildlife crossing structures in Utah.

This study continues with funding from the Utah Division of Wildlife Resources and conservation organizations. For more information, see the research report or contact Dr. Cramer at patricia.cramer@usu.edu.

Deer used new arch wildlife crossings, I-70

Wildlife culvert near Wellsville, US 89/91

from an article by David Stevens, P.E., UDOT Research Division, of the same title which appeared in UDOT Research Newsletter, Summer 2012
HELPING LOCAL AGENCIES... TRAINING THE NEXT GENERATION

The Utah LTAP Center, outreach arm of the Utah Transportation Center, provides many different services, all with the same goal in mind—to help local cities, towns and counties with the work they do to serve the traveling public. That help comes in many forms.

Like all the LTAP Centers around the country, training is the primary focus of assistance to local transportation agencies. However, there are more ways that the Utah LTAP Center serves the local transportation community, while training up the next generation of transportation professionals! One way in particular is special transportation projects.

Many local agency personnel are spread thin, and some projects only need to be done occasionally. With that in mind, the Utah LTAP Center works to provide the personnel and expertise to conduct these critical temporary services so that cities, towns and counties can keep on doing the day-to-day work they do so well. Using college student technical assistants, who are directly supervised by the Center Director, helps keep costs low as well as gives these students a chance to see what is happening in the real world of transportation engineering.

Some of these special services are highlighted below:

Transportation Asset Management Software (TAMS) PAVEMENT PROJECTS. A TAMS Pavement Project begins with an initial bid of the foreseen work. Center staff obtain information on the current street network, including the amount of money being spent per year and the types of treatments currently in use.

As part of the project, Center staff drive every street segment of the jurisdiction and rate it based on surface cracks and distress. There are a total of nine categories of distress. The governing or worst distress will ultimately decide the RSL number which helps approximate how many years of service life a particular street segment has left.

Once the inventory is complete and every road segment has been given a condition rating, a technical report is prepared containing all the data that was gathered during the survey. This report includes a scenario based off the local agency's current budget and treatments to give them a look at how their current system is working. The report also provides an optimal/suggested plan, that enables them to see what different treatments (with varying costs) could do for their system. This is one of the unique benefits of this project. The report is then delivered to the city along with a tutorial and help on the use of the TAMS software. Overall, the main goal of the TAMS pavement project is to help local agencies see the amount of cost they can expect to spend as well as recommendations and an up-to-date inventory of where their current street network is in terms of Remaining Service Life.

Transportation Asset Management Software (TAMS) SIGN PROJECTS. Similar to the TAMS Pavement Project, this type of project focuses on the sign network of the local jurisdiction. Each sign is inventoried by driving to the location and inputting it into the system via laptop or GPS. The Signs module is capable of creating a map of signs to go along with a street map, and it can determine a cost of replacement for signs that have been surveyed based on inspection. With the map that is created, local agencies can determine the number of street signs and what types of signs complete, the Center director presents the collected data to the elected council if desired. The TAMS project is then delivered to the city along with a tutorial and help on the use of the TAMS software. Overall, the main goal of the TAMS pavement project is to help local agencies see the amount of cost they can expect to spend as well as recommendations and an up-to-date inventory of where their current street network is in terms of Remaining Service Life.

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they are. It is an excellent tool for creating a mapped inventory as well as a list inventory. A full technical report is also composed with the full inventory and suggestion of signs that need to be replaced as well as signs that are near replacement.

**Traffic/Turning Count Projects.** These types of projects are contracted by either engineering firms or local agencies that do not have the equipment for traffic counting or are not able to spare the personnel to easily collect their own data. The LTAP Center uses Nu-Metrics traffic analyzers and MiVision Scout Unit counters (cameras). Trained staff are also available to conduct on-site turn counts. At the end of the project, the city or town is given the raw data to use in their decision-making process.

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**Saying Farewell to UTC Advisory Board Member, Jim McMinimee**

We were saddened to learn of the death of UTC Advisory Board member, James C. (Jim) McMinimee in Washington DC on May 10, 2012 at the age of 51. Jim was born in Ames, Iowa, graduated from high school in Littleton, Colorado and received his bachelor’s degree in engineering from the University of Utah. It was then that Jim began a 25-year career of dedicated service with the Utah Department of Transportation.

During his time with UDOT, Jim served as Region 2 director (the youngest in UDOT history). He also worked on Olympic operations for the 2002 Winter Olympic Games, and later served as Director of Project Development and Chief Engineer.

He brought national recognition to himself and the State through his pioneering work in accelerated bridge construction and CMGC contracting. Later he worked as a consultant for ARA and AASHTO.

Jim served faithfully as a founding member of the UTC Advisory Board until his death. His insight and expertise will be sorely missed.

We extend our deepest condolences to Jim’s wife, Sally, and their children.

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**Center Names Student of the Year—James Fishelson**

James Fishelson was born and raised on Long Island, New York, and enjoyed playing football and wrestling in high school. After completing his undergraduate work at Yale University, he drove from New York to Key West to the Arctic Ocean in a 1938 Dodge. He became interested in transportation infrastructure issues and the challenge posed by a rapidly developing, urbanizing, and interconnected world, during this trip, as well as during time spent working and studying in places such as Vietnam, Russia, the Philippines, and Kazakhstan.

He came to Utah State University for their Automated Electric Transportation (AET) project—a concept for network-automated vehicles electrically powered via in-motion energy transfer from the roadway itself. His thesis, titled “Modeling Automated Electric Transportation Platoons“ focuses on modeling platoons of vehicles in an AET system, and being able to demonstrate the capacity and safety improvements that AET can provide over traditional roadways. He is particularly interested in the potential for AET as a sustainable solution to the congestion issues of the world’s sprawling megacities. Mr. Fishelson was selected as this year’s student of the year for not only his past academic achievements but his potential future impact within the transportation area.
NEW PROJECTS

UTC 1201 “Forensic Testing of Prestressed Girders,” Dr. Paul J. Barr, PI. Funded by Tier 1 CAIT at USU.
UTC 1202 “Accelerated Bridge Construction Deck Testing,” Dr. Marv W. Halling, PI. Funded by Tier 1 CAIT at USU.
UTC 1203 “Sign Management,” Dr. Kevin Heaslip, PI. Funded by Tier 1 CAIT at USU.
UTC 1204 “A Two-Stage Approach for Estimating a Statewide Truck Trip Table,” Dr. Anthony Chen, PI. Funded by the Mountain-Plains Consortium.
UTC 1204 Develop Design Guidelines for Integral Abutment Bridges,” Dr. Paul J. Barr, PI. Funded by the Mountain-Plains Consortium.

ONGOING PROJECTS

UTC 1001 “Work Zone Design Evaluation,” Dr. Kevin Heaslip, PI. Co-funded by UDOT and UTC.
UTC 1002 “Forecasting Network Traffic for Small Communities in Utah,” Dr. Anthony Chen, PI. Funded by UTC.
UTC 1004 “Investigation of the Use of Texel Cameras for Counting Passengers on Public Transportation, Phase II,” Dr. Scott Budge, PI. Funded by UTC.

COMPLETED PROJECTS

UTC0803 “ABC Deck Connections, Laboratory Testing and Evaluation,” Dr. Marvin Halling, PI. Co-funded by UDOT and UTC.
UTC1003 “Highway Wildlife Crossing Design Study,” Dr. Patricia Cramer, PI. Funded by UTC. “UDOT’s Calibration of AASHTO’s New Prestress Loss Design Equations,” Dr. Paul Barr, PI. Co-funded by UDOT and UTC.
UTC0703 “Strong Motion Instrumentation Plan for UDOT Bridges: Array Design, Typical Details, and Specifications,” Dr. Marvin Halling, PI. Co-funded by UDOT and UTC.
UTC0704 “Failure Modes Analysis of UDOT’s MSE Wall Inventory,” Dr. James Bay, PI. Co-funded by UDOT and UTC.
UTC0705 “Logan Bluff Landslide Risk Analysis,” Dr. Robert Pack, PI. Funded by UDOT.
UTC0706 “Wireless Broadband for Commuter Rail: ‘River of RF’,” Dr. Chris Winstead, PI. Funded by UTC.
UTC0801 “Development of a Decision Support Tool for Assessing Vulnerability of Transportation Networks,” Dr. Anthony Chen, PI. Co-funded by UDOT and UTC.
UTC0802  “Synthesis Study and Field Evaluation of In-Situ Culvert Rehabilitation in Utah,” Dr. Blake Tul-  lis, PI. *Co-funded by UDOT and UTC.*

UTC0804  “Investigation of the Use of Texel Cameras for Counting Passengers on Public Transportation,” Dr. Scott Budge, PI. *Funded by UTA.*

UTC0805  “Shear Capacity of Pre-stressed Girders,” Dr. Paul Barr, PI. *Co-funded by UDOT and UTC.*

UTC0901  “Long Term Bridge Performance Program, Supplemental Funding, Year 1,” Dr. Marvin Halling, PI. *Funded by UTC and FHWA.*

UTC0902  “Cache Valley Transit District (CVTD) Rider Surveys and Analyses,” Dr. Kevin Heaslip, PI. *Funded by the CVTD.*

UTC0903  “Cache Metropolitan Planning Organization (CMPO) Traveler Preference Study,” Dr. Kevin Heaslip, PI. *Funded by the CMPO.*

UTC0904  “Quality of Life in Cache Valley Study,” Dr. Kevin Heaslip, PI. *Funded by UTC.*

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**2011-12 Presentations & Publications**

**Presentations**

*listed alphabetically by lead author; Utah Transportation Center colleagues in bold*


**PUBLICATIONS**

*listed alphabetically by lead author; Utah Transportation Center colleagues in bold*


Many of the faculty and transportation engineering students associated with the Utah Transportation Center are housed in the Engineering Building on the main campus of Utah State University, seen here.
Funding by Source
Total budget for FY2012: $2,097,423 (includes funds from all sources)

Funding by Use
includes all funds expended and encumbered during FY2012
Advisory Board

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The Utah Transportation Center is housed in the Civil & Environmental Engineering Department in the College of Engineering, on the campus of Utah State University in Logan, Utah.