“Innovative Engineering Against Hazards”
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 the past 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: 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 four years of the Center. In particular, the association of colleagues in Utah State University’s Department of Electrical and Computer Engineering (ECE) and the College of Natural Resources has expanded the Center’s ability to look at transportation issues from a wide variety of perspectives. We anticipate continued expansion of those 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 continue to focus on “engineering against hazards,” and have also expanded to include transit and even 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 into the pilot phase. Work with local agencies has also expanded with our consolidation of the Utah Local Technical Assistance Program (LTAP) under the auspices of the Center. 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 curriculum.

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 9-11 for the list of presentations and publications); and (3) utilizing the Utah LTAP Center for dissemination of Center research results to local agencies.

The Utah Transportation Center is located on the campus of Utah State University, in Logan, Utah. Since its founding in 1888, Utah State University has evolved from a small, agricultural college to one that is nationally and internationally recognized for its intellectual and technological leadership in land, water, space, and life enhancement.
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This annual report summarizes our fourth, and last “official” year of Utah Transportation Center (UTC) funding under SAFETEA-LU. And, while we all know the bad news—that there is no new surface transportation authorization bill, nor is there likely to be one in the near future—the good news is that a longer term continuing resolution has provided funding for the University Transportation Centers Program for another full fiscal year. And so we enter the fifth year for the Utah Transportation Center.

The hallmark of the UTC for the past four years has been consistent growth. This growth ranges all the way from the amount of external funding, to the number of students involved, to the number of faculty participating in the Center. The one number that everyone, from our Advisory Board to our elected representatives, like to see is our leverage number that indicates the amount of funding that is brought to our Center aside from the base RITA funding. This number has increased from 1.65:1 in our first year to 2.85:1 this year. We anticipate that in our fifth year this number will increase substantially due to our part in the Long Term Bridge Performance program, and a large grant from the Department of Energy to study the electrification and automation of the Nation’s roadways (see related article, page 4).

I am more than pleased to relay the message that our new structures lab (the SMASH lab) that opened in the spring of 2009 and was featured in last year’s annual report, has been busy since the day it opened testing many different types of salvaged bridge girders and answering many significant questions for the Utah Department of Transportation, from girder end shear capacity to residual pre-stress values (see related article, page 6).

It is an honor to welcome to our Advisory Board, Mr. Ahmad Jaber, P.E., of the Utah Department of Transportation who will be replacing Jim McMinimee as our UDOT representative. Jim, who recently retired from UDOT, has agreed to continue to serve on the Board as a consultant. This is great news for the UTC, as Jim has been a great contributor to our success. We look forward to working with Ahmad in the future, and know that he will represent UDOT well.

For the first time in our history we were able to have all of our Advisory Board members attend our annual Advisory Board meeting, held on June 28th, which was combined with a visit from RITA Administrator, Peter Appel (see related article, page 2). So this year’s annual meeting was a very special one, and a great success I might add. It was great to have Ad-
ministrator Appel visit and receive his advice and counsel, as well as to receive the ever valuable input from our Advisory Board (see related article, page 3).

In closing I continue to reflect on the inability of the Congress and the President to produce a satisfactory surface transportation authorization bill. I am beginning to believe that it will not be until the beginning of a second Obama administration (if there is one) before we will have a bill. Though the wait is not good for any of us in the field of transporta-
tion, I would readily accept the wait rather than have a poor bill done sooner. We must have a very forward-looking, long-term bill that appropriately addresses the need for additional revenue and the critical issues of infrastructure improve-
ment and the environment, which includes sustainability and livability.

HIGHLIGHTS & HAPPENINGS

RITA ADMINISTRATOR VISITS UTC

On June 28, 2010 the Utah Transportation Center (UTC) was privileged to receive a visit from RITA Administrator, Peter Appel. The visit was combined with the annual Advisory Board meeting for the UTC.

The objective of the combined meeting was to introduce Administrator Appel to not only the UTC researchers and students, but to those professionals that serve on the Advisory Board who also contribute significantly to the success of the Center.

Mr. Appel began the day by visiting with Utah State University President, Dr. Stan Albrecht (see photo) and Michael Kennedy, the University’s Director of Government Relations. Dr. Albrecht is very familiar with the Utah Transportation Center and its activities, and is very supportive of transportation research and education at Utah State University.

The rest of Mr. Appel’s visit consisted of an overview of the Utah Transportation Center’s history and current activities. This was followed by presentations on five current UTC projects and an open discussion with comments by the Administrator.

This discussion was followed by a tour of the SMASH (Structural Testing) Lab and lunch. It was a great opportunity to demonstrate to Administrator Appel the success that a Tier II university transportation center can have, even in a difficult economy.
UTC HOLDS ANNUAL ADVISORY BOARD MEETING

On June 28, 2010 the Utah Transportation Center (UTC) held its annual Advisory Board meeting in Logan, Utah on the campus of Utah State University. This meeting was combined with a visit from RITA Administrator, Mr. Peter Appel.

The Advisory Board meeting began at 8:30 a.m. in the Sant Engineering Research Building with a breakfast which was followed by an overview of the Center’s activities given by UTC Director, Dr. Kevin Womack. The meeting was attended by all the Advisory Board members (see back page), UTC Associate Director Dr. Marvin Halling, and Mr. Peter Appel.

Following the introductory overview of the Center, there were five presentations given on current UTC projects:

- Long Term Bridge Performance Program (Dr. Marvin Halling)
- SMASH Lab Projects (Dr. Paul Barr)
- Automated Electric Transportation and Corridor Pricing Projects (Dr. Kevin Heaslip)
- Camera Based Passenger Counting in Transit Systems (presented by Dr. Womack on behalf of Dr. Scott Budge)
- Utah Wildlife Highway Crossings (presented by Dr. Womack on behalf of Dr. Patricia Cramer)

After the project presentations, there was an open discussion between the Board members and Mr. Appel, which reviewed the success of the Center, and took a look at the future of the Utah Transportation Center, the University Transportation Centers Program and federal transportation research in general.

A tour of the SMASH experimental laboratory was followed by lunch. Mr. Appel had to excuse himself after lunch to catch a flight to southern California.

After bidding farewell to Mr. Appel, the Board took up the discussion of the budget and funding of projects for the 2010-11 fiscal year. They board made the decision to fund the following UTC projects for the upcoming fiscal year:

- Seismic Strength of Highway Embankments (Drs. Bay and Rice), $44,043
- Integrated Corridor Pricing Modeling (Dr. Heaslip), $35,100
- Transportation Infrastructure Resiliency (Dr. Heaslip), $112,320
- Low Mobility Travel Needs in Cache Valley (Dr. Chen), $42,120
- Automated Transit Passenger Counting—Continued (Dr. Budge), $50,608
When I met with Dr. Kevin Heaslip in his office in early fall, we covered a lot of ground. Even though the semester was just underway, he was already busy meeting with students at the undergraduate and graduate level to ensure that their needs were being met as part of the Transportation Engineering emphasis in Utah State University’s Civil & Environmental Engineering Department.

Whether it’s encouraging the development of the transportation engineers of tomorrow, or the possibilities that transportation engineering can unlock in creating a better tomorrow for everyone, Dr. Heaslip’s passion for the possibilities comes through loud and clear.

Since Dr. Heaslip came to USU in August 2008, he has worked with 26 undergraduate students. These students have had the opportunity to submit papers to TRB and five students were even able to attend TRB in January 2010, with five more anticipated to take part in 2011. Thirteen graduate students (including 6 who have advanced from the undergraduate level at USU) are now taking their next steps into the future of transportation with mentoring from Dr. Heaslip.

But, it’s not just with the students, but with the research, that Dr. Heaslip shows his passion. One particular project that has Dr. Heaslip’s passions on fire is Automated Electric Transportation (AET). In collaboration with the University of California, Berkeley and Texas A&M, Dr. Heaslip and his USU colleagues hope to take the next steps toward a greener, more efficient transportation future.

The overall project includes looking at how to make driving a productive time. This includes how to dynamically charge vehicles while driving. And along with that, how to automate driving. This project is a long-term one, with a vision of the future that can only now be anticipated.

He continues to work on projects at the state and local level, with an eye to serving the needs of our partners on the ground. That work includes serving as faculty liaison for the Utah LTAP (Local Technical Assistance Program) Center, which is now under the auspices of the Utah Transportation Center. The Utah LTAP Center is part of a national network of State LTAP Centers who take research developed at universities and at the state and federal level to local governments as they deal with the complexities of transportation-related issues.

Through all his work, Dr. Heaslip knows the value of building relationships. From his efforts to meet the needs of his students, to working to address the needs of local communities today, and his research in meeting the transportation needs of tomorrow, Dr. Heaslip shares a vision of the future that includes manpower and innovation.
As our vital transportation systems age, improvements need to be made to meet the needs of the traveling public today and into the future. One way transportation agencies are addressing that need is through Accelerated Bridge Construction or ABC.

The Utah Department of Transportation (UDOT) has been one of the foremost agencies to use this method. One primary reason for its use is that it allows as little interruption to current traffic flow as possible, while still making critical improvements to the transportation system.

During the summer of 2008, UDOT used ABC to replace several bridges. Five of those bridges, on I-80 in the Salt Lake Valley, were chosen for further study.

The particular focus of the research was to determine what, if any, impacts the moving process had on bridge elements. The use of Self Propelled Modular Transporters (SPMT) was of primary interest. Up to this point, no study had ever been done to determine the impacts of moving a bridge superstructure using SPMT, and UDOT wanted to learn from these bridge projects in order to improve the process in the future.

To that end, UDOT asked the Utah Transportation Center to help with this undertaking. Center Associate Director, Dr. Marvin Halling, along with research assistant, Erik S. Rosvall, were given the task to evaluate the induced stresses due to lifting and moving the highway bridges using SPMT during the ABC process.

UDOT engineer, Ms. Shana Lindsey, was responsible for facilitating the instrumentation, data collection and processing. Instrumenting and monitoring the bridges on-site was done under contract with OSMOS USA with Mr. Tom Winant acting as lead.

The data collected during this process was then used for further study by Dr. Halling and Mr. Rosvall at the Utah Transportation Center at Utah State University (USU). Some of the effects that were studied included dynamic, thermal and lifting stresses.

This research provided UDOT with critical analysis to allow them to better understand and determine if adjustments need to be made when using the ABC process and SPMT in the future projects.

A report, co-written by Erik Rosvall, Dr. Marvin Halling and Shana Lindsey will also be appearing in Transportation Research Record: Bridge Engineering, December 2010.
The design of prestressed concrete bridge girders has changed significantly over the past several decades. Specifically, the design procedure to calculate the shear capacity of bridge girders that was used forty years ago is very different than the procedures that are recommended under the current AASHTO LRFD Specifications. As a result, many bridge girders that were built forty years ago do not meet current design standards, and in some cases warrant replacement due to insufficiently calculated shear capacity. However, despite their insufficiently calculated capacity, these bridge girders have been found to function adequately in service with minimal signs of distress.

When the Utah Department of Transportation decided to replace the bridge at 45th South on I-215, as one of the first ABC replacement projects in Utah, the existing bridge provided an excellent opportunity to investigate the ultimate shear capacity of precast, prestressed bridge girders built during the 1960s and 70s.

The original bridge was built as a four span superstructure and had a significant change in elevation which resulted in water and deicing salts running down the length of the bridge. Each span was constructed with a fixed support on one end and an expansion joint on the other which allowed water and salt to enter the expansion joint and resulted in corrosion of the ends of the prestressed concrete girders. Using the bridge girders from this project, UDOT asked Utah Transportation Center colleagues, Dr. Marvin Halling and Dr. Paul Barr, to determine the ultimate capacity of the girders and investigate strengthening procedures.

Six AASHTO Type 2 girders were salvaged during the demolition and shipped to the Systems, Materials and Structural Health (SMASH) Laboratory at Utah State University. With guidance from the TAC committee and Daniel Hsaio, the research process included testing one set of control girders, then using carbon fiber reinforced polymers (donated by The Chemical Company BASF) which were applied to the remaining girders in five different configurations. The retrofitted girders were then tested similarly to the baseline tests so that direct comparisons could be made.

The results of Dr. Barr and Dr. Halling’s research have provided the Utah Department of Transportation with the quantified values of the ultimate shear capacity of forty-year old girders. These measured capacities were compared with code-based calculated values. Recommendations were provided for methodologies to more accurately calculate this capacity as well as a carbon fiber retrofitting scheme to increase the capacity.

Photos courtesy of Dr. Paul Barr.
Utah Transportation Center Names Student of the Year: Steven Petroff

The Utah Transportation Center is pleased to announce that Steven Petroff has been selected as their Student of the Year.

Steven is a graduate student at Utah State University working to complete an MS degree in Civil Engineering. He is working with Dr. Marvin Halling on the FHWA Long Term Bridge Performance (LTBP) Program and is responsible for developing an instrumentation plan for the Utah pilot bridge and conducting preliminary testing.

He is also heavily involved with the logistics of additional testing and instrumentation of the California and Minnesota pilot bridges. Steven has been responsible for procuring bids and quotes on various instruments as well as processing the purchase orders.

His work includes organizing weekly coordination meetings with the USU research team as well as participation in meetings involving additional LTBP research teams across the country.

Steven was raised in Richmond, Utah and attended Sky View High School in Smithfield, Utah. After graduating from high school, he lived in various parts of Portugal while serving a two year religious mission for The Church of Jesus Christ of Latter Day Saints.

Upon returning from Portugal, Steven immediately began college at USU in the spring of 2006, married his sweetheart and fellow USU student, Anarie White, a year later. He completed his BS degree in the spring of 2009. Congratulations to Steven!

Utah LTAP Center Provides Valuable Connection with Local Agencies

The LTAP Center bridges the gap between research and practice by translating the latest state-of-the-art research and technology in transportation into products and information for the use of local transportation agencies and personnel.

With the reauthorization of the LTAP Center at Utah State University, the program was also restructured to become a part of the Utah Transportation Center (UTC).

The Utah LTAP Center has been housed at Utah State University since its establishment in 1988 as the Technology Transfer (T²) Center. (The name was later changed to the Utah LTAP Center to more accurately reflect it's part in the FHWA National Local Technical Assistance Program.)

As part of the UTC, the Utah LTAP Center is better able to serve the needs of local Utah agencies with the latest in practical research conducted by UTC faculty colleagues and their counterparts around the nation.

The Utah LTAP Center also benefits from the expertise of undergraduate and graduate engineers-in-training who in turn receive practical
real-world experience as they assist local transportation agencies meet their needs. Their work includes assisting with the implementation of pavement and sign management programs, road safety audits, etc.

The director of the Utah LTAP Center is Mr. Nicholas R. Jones (see photo, below). Prior to becoming director, Mr. Jones served for 32 years as the Provo City Engineer. Mr. Jones is a licensed professional engineer.

Center Director Elected to Serve on CUTC Executive Committee

At the annual summer meeting of the Council of University Transportation Centers (CUTC), held on the campus of Texas A&M University in College Station, Texas, on June 8, 2010, Dr. Kevin Womack, Director of the Utah Transportation Center, was elected to a two year term on the CUTC Executive Committee. Dr. Womack’s term will run through the summer of 2012.

Dr. Womack is honored to serve in this new capacity and will now be serving on two national boards. That service includes membership on the American Society of Civil Engineers Board of Directors, and the CUTC Executive Committee.

2009-10 Utah Transportation Center Projects

New Projects

UTC1001  “Work Zone Design Evaluation,” Dr. Kevin Heaslip, PI. Co-funded by UDOT and UTC.
UTC1002  “Forecasting Network Traffic for Small Communities in Utah,” Dr. Anthony Chen, PI. Funded by UTC.
UTC1003  “Highway Wildlife Crossing Design Study,” Dr. Patricia Cramer, PI. Funded by UTC.
UTC1004  “Investigation of the Use of Texel Cameras for Counting Passengers on Public Transportation, Phase II,” Dr. Scott Budge, PI. Funded by UTC.
UTC1005  “Long Term Bridge Performance Program, Supplemental Funding, Year 2,” Dr. Marvin Halling, PI. Funded by UTC and FHWA.

Ongoing Projects

UTC0803  “ABC Deck Connections, Laboratory Testing and Evaluation,” Dr. Marvin Halling, PI. Co-funded by UDOT and UTC.

Completed Projects

UTC0701  “Evaluation of Bridges for Seismic Retrofit,” Dr. Keri Ryan, PI. Co-funded by UDOT and UTC.
UTC0702  “UDOT’s Calibration of AASHTO’s New Prestress Loss Design Equations,” Dr. Paul Barr, PI. Co-funded by UDOT and UTC.
Presentations listed alphabetically by lead author; Utah Transportation Center colleagues in bold


**Publications**

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


Chen, A., S. Pravinvongvuth and P. Chootinan. “Scenario-based multiobjective AVI reader location models under different travel demand patterns,” Transportmetrica 6(1), 53-78.


Funding by Source

Total budget for FY2010: $1,922,020 (includes funds from all sources)

Funding by Use

Includes all funds expended and encumbered during FY2010
Advisory Board

Dr. William Rahmeyer, P.E.
Advisory Board Chair and Head, Department of Civil & Environmental Engineering, Utah State University

James Christian, P.E.
Utah Division Administrator, Federal Highway Administration

Clair Fiet
Chief Technology Officer, Utah Transit Authority

Ian M. Friedland, P.E.
Technical Director, Bridge & Structures R&D, Federal Highway Administration

Ahmad Jaber, P.E.
Director, Systems Planning and Programming, Utah Department of Transportation

Jim McMinimee, P.E.
Consultant

Bruce Robinson
Deputy Associate Administrator, Office of Research, Demonstration & Innovation, Federal Transit Administration

Benjamin Tang, P.E.
Bridge Preservation Managing Engineer, Oregon Department of Transportation

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,