

University Transportation Center Annual Report 2008

## Western Transportation Institute University Transportation Center

2008 Annual Report

(For the period October 1, 2007 - September 30, 2008)

College of Engineering Montana State University

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## **Message from the Director**

At the risk of stating the obvious, the economy is going to dominate the national political and policy agenda for the foreseeable future. Initiatives that nurture new economic development will take center stage. At the same time, it is critical to strengthen the foundation of our economy in order to ensure **long-term** stability.

A strong transportation network is one of the cornerstones of a vibrant economy. Without it, employees can not get to their jobs, goods can not be delivered, and service providers can not connect with their clients. And, if these things don't happen, the economy just won't grow.

So, how do we ensure that our transportation system will be stable in the long-term?

• Develop a comprehensive network. To be nationally and globally competitive, American businesses will need to move goods and services efficiently from and to every corner of the country. This means that transportation initiatives must address rural infrastructure and operations needs as well as urban ones, and promote safe and seamless travel across multiple jurisdictions. A comprehensive network is also multi-modal: we need to enhance and coordinate air, rail, bicycle, and pedestrian transport and travel options.

• *Promote sustainability*. In transportation, sustainability has several connotations. As the physical infrastructure ages, we must ensure that it is maintained, reinforced, or reconstructed in order to lengthen or sustain its functional lifespan. Increasingly, however, sustainability also refers to transportation that is energy efficient, uses renewable construction materials, or minimizes adverse impacts on the surrounding environment.

• *Nurture professional capacity.* A strong transportation system must have well-trained professionals to lead, design, construct, and maintain it. The shrinking number of engineers entering the transportation field has serious implications for the long-term development and management of an efficient transportation network. Initiatives must include education, training and outreach to prepare the next generation of practitioners – in fact, you might just call this one more aspect of "sustainability."

The Western Transportation Institute is dedicated and well-prepared to support all these initiatives. Our mission has always been to develop innovative solutions for rural transportation challenges, which in turn enhance the national transportation infrastructure as a whole. In addition, we have a firm foundation of expertise in many of the other areas; in particular, we have conducted state-of-the practice research on many "green highway" issues, including environmentally sensitive winter maintenance products, geosynthetic and recycled building materials, context-sensitive design practices, and habitat connectivity for wildlife.

Developing a modern, safe, efficient, and long-lasting transportation system will be one of the first steps toward revitalizing the economy. WTI looks forward to bringing our experience, enthusiasm, and dedication for transportation to this national partnership – working together toward a bright future for the entire country.

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## **Management Structure**

The University Transportation Center management approach is designed to accomplish the following objectives:

- to provide for high quality, multi-discipline research, education, and technology transfer;
- to provide the Center's oversight members with clear, concise and accurate reports of Center activities so that they may adequately guide the long-term development of the Center;
- to utilize WTI/MSU resources (research and training facilities, human resources, physical facilities and institutional support capabilities) to maximize efficiency; and
- to establish clearly-defined roles, responsibilities, policies and procedures for all staff.

Management of the Center requires attention to the selection and conduct of research, education, and technology transfer activities, as well as careful control of expenditures. WTI has established a process of management of the Center's research, education, and technology transfer activities and utilizes the systems, policies, and procedures already in place that have been developed by WTI or that have been in place at MSU to manage funds, equipment, and personnel.

Financial administration of Center monies occurs both in-house and through the MSU Office of Sponsored Programs (OSP). The two entities perform different yet complementary aspects of financial management. The Director and Center Management rely on both sources of information to make financial decisions and oversee program development.

The Center Director manages personnel both directly and through a team approach that

follows the chain of command shown in the accompanying figure. In addition

to regular meetings with key staff, the Director maintains an open door policy to address conflicts or problems of a more sensitive or serious nature. Personnel are encouraged to express their concerns and provide input both in writing and verbally. WTI management staff (Research Director, Assistant Directors, and Program Managers) are required to meet annually with the Director for a performance review. This review provides the Director with the opportunity to assess the employee's performance in the preceding year. In addition, employees are provided the opportunity to assess their satisfaction or displeasure with their level of responsibility, challenges, workload, compensation and other issues related to WTI and Center management.



## **Financial Statement**

The charts illustrate allocations and funding sources for the Western Transportation Institute's UTC programs during Year 2. The first figure shows the breakdown of expenditures and allocations of the federal portion (\$2,858,100) of the UTC program for Year 2. Approximately \$412,000 was allocated for the Education Program and \$1,537,100 has been committed for research project and laboratory/equipment funding. The remaining \$909,000 supports the administrative and technology transfer function of WTI.

The second figure depicts the Year 2 funding sources for the WTI UTC Program. The match for the USDOT portion is by Montana State University and the Civil Engineering Department, state Departments of Transportation, industry, and through the support of various foundations.



## Research

WTI has been pioneering research to address rural transportation needs for more than a decade. In continuing our leadership role we have expanded our capabilities to address crucial and emerging challenges with the brightest minds and most advanced technologies available. Moreover, we are gratified that we are helping to raise awareness and support for rural transportation issues at the national level.

Why does rural matter? And why now? For one, by all accounts, **rural areas are facing a phenomenal period of growth and development,** accompanied by large increases in travel within and through these areas. For example, the Western Governors Association predicts that 42 million more people and cars will be added to the western transportation system by 2030. Recent migration and land use studies indicate an increase in rural and frontier populations based on "ex-urban flight," described as urban residents who are bypassing moves to traditional suburban areas in favor of rural destinations that offer greater quality of life. As travel continues to grow on rural highways, we must ensure that these roadways can safely handle more cars, more modal options, and more travelers in a safe, efficient and timely manner while protecting the environment and wildlife.

Secondly, a healthy economy demands a strong transportation infrastructure. With an increased focus nationally on economic matters, we must ensure that goods and services can move efficiently and cost-effectively across and throughout every region of the country. **Therefore, national transportation policy must address the whole transportation network** – not just isolated urban hotspots where congestion is highly visible, but also the large rural regions that hold the country together.

Rural roads comprise 80 percent of national road miles (3.1 million rural road miles).

Rural roads carry 40 percent of vehicle miles traveled.

90 percent of rural roads are 2-lane or less.

There are over 450,000 rural bridges.

source: FHWA

## Research Research

WTI is in an excellent position to take a leading role in rural transportation research because rural issues are our only focus and we live what we study. With our location in Southwest Montana, we see firsthand not only what the issues are, but how they fit together. Therefore we take an **integrated approach to our research**. Instead of looking at one specific challenge from one specific perspective, we try to look at issues in a broader context and develop more comprehensive solutions. In this way, we conduct research that



is high quality, collaborative and nationally relevant, and the findings make significant contributions to the advancement of traditional methods and state-of-the-art technologies in rural transportation.

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## Research Program Overview - continued

In addition, in the last two years, WTI has made major advancements in **enhancing our testing capabilities and facilities.** At our MSU campus location, we have advanced laboratories to conduct leading edge research in the areas of human factors and safety, corrosion, materials, transportation management and operations, systems engineering, and development. In the field, we are

## Ecological Validity



Simulation

HOR ......

TRANSCEND Test Track Naturalistic

partnering with state and federal agencies to develop TRANSCEND, an outdoor cold region test facility/track located in central Montana. WTI's comprehensive facilities allow us to spearhead, develop and test a research idea from the conceptual stage, through the lab testing and "off-the-grid" field testing, and finally to trial and full deployment. The following selection of projects highlights how our researchers benefit from our research partnerships, expanded facilities and multidisciplinary collaboration to achieve innovative results.

## Weathershare

WTI researchers from the Systems Group worked with the Winter Maintenance program to develop the WeatherShare system for the California Department of Transportation. Weathershare streamlines and integrates available road weather data into a single source, which is quickly and easily accessible by incident responders, operations and maintenance personnel, and the traveling public. In addition to routine use for roadway operations, officials in California also used WeatherShare to monitor and plan response activities during recent wildfires. Originally created for rural transportation districts, Caltrans now plans to deploy the system statewide.

## National Wildlife Vehicle Collision Reduction Study

On behalf of the Federal Highway Administration, WTI researchers from the Road Ecology program (in partnership with the Louis Berger Group, Inc.) have completed a national study that details the causes and impacts of Wildlife Vehicle Collisions (WVCs). This Report, submitted to Congress in late 2007, synthesizes and analyzes research from the U.S., Europe, and Australia, and may be the most thorough work ever done on this topic. Moreover, the study identifies and evaluates 34 different techniques for reducing the number

of wildlife-vehicle collisions. Ongoing phases of the project call for the development of both a manual of best mitigation practices and a training course, in order to educate transportation professionals about collision reduction methods that work, and how they can begin to incorporate them into their own highway projects.

## Benefit-Cost Analysis of Maintenance Decision Support System

WTI's Winter Maintenance researchers collaborated with the Safety and Operations program to demonstrate the benefits of Maintenance Decision Support Systems (MDSS). An MDSS is an integrated software application that provides transportation agency managers and maintenance engineers with real-time road treatment guidance for each maintenance route, based on the current and forecast road weather conditions, the resources available and local rules of practice. The MDSS pooled fund study, led by South Dakota and now including thirteen state Departments of Transportation, developed and demonstrated an operational MDSS for winter maintenance. WTI's evaluation of the MDSS developed a cost-benefit model and applied it to one of the pooled fund states as a case study. The results show that the use of MDSS is able to reduce materials usage, reduce delay, and improve safety, which in turn can lead to labor and equipment cost savings. The benefit cost model will also provide an important tool for highway maintenance agencies considering investment into MDSS to improve winter maintenance practices.



## Researc

## Inhibitor Longevity & Deicer Performance Study

On behalf of the Pacific Northwest Snowfighters Association, WTI Winter Maintenance researchers are conducting a multi-state pooled fund study to evaluate the cost effectiveness of corrosion inhibitors in deicing chemicals. Corrosion inhibitors are added to chloride-based deicers to minimize their corrosive impact on transportation infrastructure. Through extensive testing in the WTI Corrosion Lab and in the field at the Lewistown TRANSCEND Cold Regions facility, researchers are answering important questions regarding the longevity and performance of inhibitors under various conditions. State DOTs can use this information to decide whether or not to use corrosion inhibited products, how they should be stored, and how long they will remain effective in storage. In the long-term, the findings may reduce winter maintenance costs, and reduce the corrosion and environmental impacts due to snow and ice control operations.

## **COATS, Phase III: Integrated Corridors**

In partnership with the California and Oregon Departments of Transportation, WTI Safety and Operations researchers are demonstrating the potential of Integrated Corridor Management (ICM) to enhance safety and mobility in rural locations. ICM initiatives, promoted by the FHWA, coordinate and connect individual transportation network operations in order to allow cross network travel management; however, they have primarily been deployed in urban locations. WTI is working with Caltrans and ODOT to develop an ICM plan for a rural region in Northern California and Southern Oregon, which will include elements such as multi-jurisdictional cooperation and data sharing, ITS deployments, and traveler information improvements. Stakeholders expect that the ICM plan can be used to enhance winter maintenance operations, freight movements, and motorist safety throughout the region. Moreover, it is expected that this project will provide guidance to other rural areas by identifying what is required to develop and implement ICM for a rural corridor.



## Research

## Cumulative List of Projects

New Research Projects	
Weathershare - Phase 2	Doug Galarus
Redding Responder - Phase 2	Doug Galarus
Automated Safety Warning System Controller	Doug Galarus
Bozeman Pass Post Fencing Monitoring	Angela Kociolek
Durability of Corrosion Resistant Mineral Admixture Concrete	Xianming Shi
Rural Transportation and ITS Outreach and Assessment	Steve Albert
National Wildlife Collision Study	Marcel Huijser
Integration of Aviation Automated Weather Observation	
(AWOS) with RWIS	Doug Galarus
Inhibitor Longevity and Deicer Performance Study	Xianming Shi
Facilitating Special Event Congestion	Suzanne Lassacher
Development of Standardized Test Procedures for	
Deicing Compounds-Clear Roads	Xianming Shi
WTI System Engineering & Integration of Transportation	
Technology (SEITTP)	Doug Galarus
Establishing Best Practices of Removing Snow and Ice from	
California Highways	Eli Cuelho
Snoqualmie Pass Monitoring Plan	Tony Clevenger
Lab Investigation of Deicer Impacts on Concrete	
Microstructure and Pavement Friction Coefficient	Xianming Shi
Rural EMS Driver Safety Research Program: Phase I, Feasibility Study	Nic Ward
Nature of the Aggregate-Asphalt Bond: A Laboratory Study	Tongyan Pan
Field Investigation of Geosynthetics Used for Subgrade Stabilization	Eli Cuelho
Fate & Transport Behavior of Anti-Icers & Deicers in Airport Soils	Tongyan Pan
Portable TMC-TMS Communications Demonstration	Doug Galarus
Benefit-Cost Analysis of Maintenance Decision Support System:	
A Case Study for the State of Colorado	Jared Ye
US 93 Wildlife Monitoring Marcel Hu	ijser/Rob Ament
Developing Regional Ecosystem Framework for Terrestrial &	
Aquatic Resources along the I-70 Corridor, Colorado	Marcel Huijser
Roadkill Observation Collection System (ROCS), Phase III	Rob Ament
COATS Phase IV	David Veneziano

Validation of Rehabilitation Strategies to	
Extend the Service Life of Concrete Bridge Decks	Tongyan Pan
I-90 Snoqualmie Pass East: Pre-Construction	
Multiplife Mersing of Fich Decessor	
wildlife Monitoring of Fish Passage	Matt Blank
Replacing Thermal Sprayed Zinc Anodes on	Matt Blank

## **Ongoing Research Projects**

Effects of Defensive Vehicle Handling, Phase 3	Laura Stanley
Banff Wildlife Crossings	Tony Clevenger
Impacts of Barriers on Topeka Shiner Populations	Matt Blank
California Oregon Advanced Transportation System-Phase 3	David Veneziano
Ant Colony Optimization for Transportation Optimization Problems	Doug Galarus
Effects of 4 Lane Highways on Desert Kit Fox and Swift Fox	Tony Clevenger
An Autonomous & Self Sustained Sensing System to	
Monitor Water Quality Near Highways	Xianming Shi
Developing a Standard Test Method for Measuring Geosynthetic	
Soil Resilient Interface Shear	Eli Cuelho
Mobile Communications Briefcase	Doug Galarus

## **Completed Research Projects**

Marcel Huijser
Xianming Shi
David Kack
Tongyan Pan
Xianming Shi
Marcel Huijser
Marcel Huijser

## National Association of Development Organizations (NADO) Research Foundation 2008 Excellence in Regional Transportation Awards

The 2008 Excellence in Regional Transportation Awards marked the second year that transportation-related programs and projects were recognized for their innovation and impact on communities throughout the nation. This year, 34 organizations from 21 states were recognized for their innovative and excellent approaches to regional transportation planning and program implementation. A special roundtable reception highlighting the award winning projects was held during the National Rural Transportation Peer Learning Conference in August 2008 in Duluth, Minnesota.

WTI and Research Associate Jaydeep Chaudhari were honored for Chaudhari's work on the "Assessment of a Campus Transit Program." Chaudhari performed this assessment while completing his Masters Degree from Auburn University. Conducted in 2006, the research evaluated the efficiency of Auburn University's campus transit in Auburn and Opelika, Alabama. The assessment led to multiple recommendations streamlining the service, including migrating to alternative fuels and the introduction of a GPS-based program so riders can locate their buses online. After the suggestions were implemented, ridership increased from 13,000 in 2006 to 17,000 in 2007, making a significant impact on users' mobility.

## WTI Student One of Top 10 in Google Android Developer Challenge

Jeffrey Sharkey, a recent graduate of Montana State University's computer science program, and former WTI student placed among the top 10 entrants in the Google Android Developer Challenge, earning him a \$275,000 cash prize. The contest was designed to promote program development for Android, Google's new cell phone operating system. Sharkey's entry, CompareEverywhere, uses a cell phone's camera to read the barcode on any product. The program then uses the phone's Internet connection to search Web sites for information about that product, such as reviews, prices, excerpts, online vendors, and nearby stores selling that item.

Sharkey received the 2007 UTC Outstanding Student of the Year Award at WTI and was a recipient of the WTI Graduate Transportation Fellowship. He completed his Masters degree in Computer Science in May 2008.

## U.S. National Science Foundation Travel Stipend Award

Laura Stanley, an MSU College of Engineering professor and WTI Researcher, was awarded a \$2500 travel grant to attend "Women in Industrial Engineering Academia - Turkey-U.S. and the Middle East" held in Ankara and Instabul, Turkey. The July 2008 workshop focused on the current environment for women academics in this field and presented workable solutions to problems of recruitment, retention and advancement.

## Research

## **Future Initiatives**

WTI will continue to strengthen our expertise across our eight focus areas. With the solid foundation we have already established, we plan to build on our integration efforts to address cross-cutting issues of national import:

**Green Highways.** The FHWA is encouraging initiatives that promote environmentally sensitive, "green" highways. Much of WTI's past experience and current expertise is related to these highway themes. WTI's work on animal vehicle collision research, recycled construction materials, transit development, context sensitive design, environmentally safe winter treatment practices, and other issues will contribute to a variety of green transportation efforts.

**Rural Traffic Safety Culture.** WTT's depth of experience with ITS safety deployments, combined with the addition of a second driving simulator, increase our capacity to spearhead comprehensive, nationally significant safety studies. Traffic crashes represent the largest cause of fatal injury for nearly all age groups, especially in rural America. Rural states such as Montana have the highest traffic fatally rates, both in terms of exposure (VMT) and population risk (per capita). WTI can play a leading role to increase understanding and unify concern amongst traffic safety researchers, practitioners, and policymakers about the role of traffic safety culture on (1) behavioral factors that increase rural (and national) traffic crash risk; and (2) attitudinal barriers to public and political acceptance of traffic safety interventions.

Airport Maintenance and Operations. In the coming year WTI will be utilizing its expertise in corrosion, weather monitoring and forecasting, multi-modal connectivity, infrastructure condition assessment, and ecology/environmental impacts to address aviation issues in rural America. WTI looks forward to complementing our current skill base, leveraging TRANSCEND Research Facility at the Lewistown Airport, and expanding our research portfolio from surface transportation to addressing surface and air issues to meet local, state and federal needs.



## Education Program Overview

The Western Transportation Institute's Education Program employs a comprehensive approach to student recruitment, retention, advancement, and placement. WTI offers summer programs for high school students to explore educational and career opportunities in transportation, as well as a comprehensive summer research program for non-MSU undergraduate students. Throughout the 2007-2008 academic year, WTI supported 74 undergraduate and graduate students through paid research and mentoring opportunities, including five graduate students who completed their degrees while working under the Research Assistant program or supported by Transportation Awards. WTI students also achieved publication success through articles and professional presentations. Professional skill enhancement opportunities were provided to students through forums, guest speakers, and sponsorships to annual meetings. The combined initiatives of the Education Program encourage and support transportation workforce development along the entire education to career continuum.

## Curriculum

Graduate students that work on transportation research at WTI are spread across almost every college on the MSU campus. WTI fosters multidisciplinary student involvement with the understanding that significant improvements in the transportation system can only be made when professionals of many different disciplines work together. However, many graduate research assistants at WTI receive minimal if any exposure to transportation in their home departments. To address this, WTI established a one hour weekly seminar to provide students with a broader knowledge and understanding of transportation and, thus, equip them to have a greater impact as transportation professionals. The seminar featured guest speakers from WTI and the transportation industry as well as material on transportation legislation, funding, and research methods. Dr. Patrick McGowen (Civil Engineering) facilitated the course, which will continue to be offered each fall on an annual basis.

The Western Transportation Institute works closely with academic departments to broaden the range of transportation course offerings and faculty with transportation expertise. Two recent joint appointments (WTI and the Industrial Engineering Department) will greatly expand coursework and student research opportunities in transportation safety and human factors. Drs. Nic Ward and Laura Stanley are already broadening student exposure to human factors in transportation. In addition to his teaching course load in Industrial Engineering, Dr. Ward is currently working with a student team from a senior Management course. The students will develop a business plan to evolve WTI's suite of driving simulators into the nation's premier simulation research facility in rural traffic safety and visualization. Dr. Laura Stanley is advising an Undergraduate Research Experience participant on a project to design and evaluate a pedestrian/bicyclist sensing system. Both faculty members are mentoring graduate student research and participating in WTI's Graduate Transportation Seminar.

## **Student Research and Support**

The WTI Education Program seeks to enhance student experiential learning by increasing the number of students involved in real world transportation research at the center. The UTC Program supports two such programs. At the undergraduate level, the Undergraduate Research Experience (URE) program competitively selects two to four undergraduates each year to participate in a unique academic year-long research opportunity. In 2007-2008, four participants were selected to work with research mentors at WTI on the following projects.

- Justin Hauck (Civil Engineering) Freeze-Thaw Durability of Corrosion Resistant Admixture Concrete
- Brian Herting (Civil Engineering) Self-Repairing Concrete Using Cage-Like Smart Micro-Aggregates
- Matthew Johnson (Civil Engineering) Design of a Novel Microbial Fuel Cell

Education

• Kevin Volkening (Chemical Engineering) Evaluation of Alternate Anti-icing and Deicing Compounds

At the graduate level, the Graduate Transportation Award supports students pursuing advanced degrees on a transportation topic. The Award covers tuition and a monthly stipend. Fourteen graduate students from six different academic departments were supported by Transportation Awards over the past year. Three students completed their degrees in the following areas.

- Jeff Sharkey (MS, Computer Science) Automated Radio Network Design Using Ant Colony Optimization
- Heather Brooks (MS, Civil Engineering) Axial Capacity of Piles Supported on Intermediate Geomaterials
- Sarah Karjala (MS, Civil Engineering) Estimating Quality of Traffic Flow on Two-lane Highways

In addition to UTC funded opportunities, students are actively involved as paid research assistants on sponsored projects at WTI. Two Graduate Research Assistants completed their Masters degrees over the reporting period.

• Lily Liang (MS, Electrical Engineering) Use of Wireless Multi-hop and Ad-hoc Routing for Communications Between Highway Traffic Sensors in Rural Areas

• Chad Bohannon (M S, Computer Science) Performance Evaluation of Routing Protocols for QOS Support in Rural Mobile Ad Hoc Networks

In all, twenty-five graduate students and thirty-one undergraduates participated as paid research assistants on one or more transportation projects at WTI over the past year. Research assistants represented nine different academic departments on campus and student research support added value to thirty-four different sponsored projects (as outlined in the table on the next page).

## Education Student Research Involvement

Undergraduate

Graduate

Advanced CMS1AURORA22Automated Cost Recovery11An Autonamous Sensing System for Water Quality Monitoring (NCHRP - IDEA)21An Autonamous Sensing System for Water Quality Monitoring (NCHRP - IDEA)21Develop Standardized Test Procedures for Delicing Compounds - Clear Roads11Cyclic Pullout Testing211Effect of Chloride-Based Deicers on Reinforced Concrete Structures311Evaluation of Alternate Anti-Icing & Deicing Compounds Using NaCl & MgCl as Baseline Deicers111Evaluation of Alternate Anti-Icing & Deicing Compounds Using NaCl & MgCl as Baseline Deicers111Feasibility Study on Self-repairing Concrete Using Cage-like Smart Micro-aggregates111Field Investigation of Geosynthetics Used for Subgrade Stabilization111Fredoryer Summit Evaluation (CDATS Showcase)111Inhubro Longevity & Deicer Performance Study - PNS111Inhubro Longevity & Deicer Performance Study - PNS111MANETS55555MDSS11111Optimal Sensor Placement111Optimal Sensor Placement111
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Redding Incident Management Responder 1
Reinforced Native Grass Sod
Road Ecology Film: "Division Street"
Rural EMS Drivers Safety Research Program 3
Snow/Ice Removal Best Practices 1 1
TMC-TMS Communications 2
TRAIL 3
US 89 1
US 93
UTC Safety and Operations Program Development 1
Validating the Durability of Corrosion Resistant Mineral Admixture Concrete 9
Weather Share Phase 2 3

Over the summer of 2008, the Western Transportation Institute hosted eight non-MSU undergraduate students from colleges and universities nationwide in a unique ten-week summer research program. The Safe Passages Research Experience for Undergraduates (REU) Program is funded by the National Science Foundation and was established to explore the complex issue of simultaneously providing for safe passage of humans, wildlife, and aquatic organisms through rural transportation corridors. Interdisciplinary student teams collected data in the field and produced final technical reports and presentations on five distinct but interrelated projects:

 Assessment of Aquatic Connectivity for Fish Across the Gallatin River Corridor

- Effectiveness of the Animal Detection System on Highway 191 in Yellowstone National Park
- Field Validation of the FishXing Model
- Special Traffic Enforcement Programs on US 191
- Centerline Rumble Strip Sensor Verification on US 191

The program was designed to enhance students' ability to work on interdisciplinary teams and to integrate a variety of strategies in addressing a given problem. One participant said, "I liked that what we were studying was relevant to real world engineering problems, and I liked the multidisciplinary aspects of combining civil engineering with ecology, geology, and environmental studies." REU participants represented four states and Puerto Rico and six different science and engineering majors.

## **Extracurricular Activities**

WTI actively supports a host of extracurricular activities that build interest in transportation and enhance professional skills for students planning transportation careers. Del Huntington of Kittelson

& Associates (a Portland, Oregon transportation engineering firm) moderated a mock public meeting for forty MSU civil engineering students. Huntington designed the role-playing scenario, known as "Road Trip," to help educate transportation engineers about the subtleties of transportation project public meetings; a common job requirement but something for which students typically receive almost no preparation in college.

WTI hosted guest speaker Dr. John Gaber, Professor in the Community Planning Program at Auburn University. Dr. Gaber spoke to the ITE Student Chapter and at the College of Engineering seminar series on methodologies technical professionals can utilize to more productively incorporate community input into design decisions. His talk, "Sometimes the Community is Right: Technical Professionals Learning from the Community," focused on two case studies where transportation projects were significantly improved by the incorporation of public feedback.

The Intelligent Transportation Society-Rocky Mountain (ITS-RM) student chapter organized a technical tour to Calgary, Alberta. Students representing Civil Engineering and Computer Science visited the driving simulator laboratory at the University of Calgary, and toured transportation projects in the city as well as the Transit Operations Center and the Traffic Management Center. ITS-RM members were also able to visit wildlife crossing structures on the Trans-Canada highway through Banff National Park and to learn about WTI's long-term evaluation of highway mitigation measures through this ecologically rich area.

WTI sponsored four students (3 graduate, 1 undergraduate) to attend the 2008 Transportation Research Board Annual Meeting in Washington, DC. Three of the students presented papers during TRB sessions.

## Education UTC Outstanding Student of the Year

Jeffrey Sharkey received the 2008 UTC Outstanding Student of the Year Award. Jeff was a participant in the Summer Research Experience for Undergraduates (REU) program at WTI in 2005. When he completed his B.S. in Computer Science at the University of Minnesota - Duluth, he returned to MSU to work towards his Masters degree. Jeff was a recipient of the WTI Graduate Transportation Fellowship and completed his Masters degree in Computer Science in May 2008. As part of his M.S. thesis research, Jeff applied Artificial Intelligence to solve various transportation problems, such as network design problems for Transportation Management Systems (TMS). Jeff's paper entitled "Radio Network Design for Rural Transportation Applications using Artificial Intelligence" was presented at a poster session during the 2008 Transportation Research Board Annual Meeting.

Jeff is a professional and enthusiastic researcher. In addition to his thesis work, he provided valuable assistance on a number of different projects within the Systems Engineering, Development and Integration Program at the Western Transportation Institute. Project Manager, Doug Galarus, felt the UTC award was welldeserved. "Beyond fulfilling the research requirements of his fellowship," commented Galarus, "Jeff has willingly assisted me and other staff on numerous projects, providing professional solutions in record time."

Until his graduation in May 2008, Jeff was an active member of the ACM and ITSA student professional organizations at Montana State University, and represented WTI at a number of conferences, including ITS America and Google Developer Day. This year he also received a nationally prestigious award from Google (described under "Awards and Recognitions on page 12").



## Education

## Outreach

WTI hosted its fourth successful Summer Transportation Institute for high school students. The program involved promising tenth, eleventh, and twelfth grade students from a mix of backgrounds and hometowns. STI hosted eleven participants from five different Montana towns and three out-of-state participants (representing California and Oklahoma). Students lived on MSU campus for two weeks while learning about career opportunities in transportation. The program provided a comprehensive academic program, which included guest speaker presentations, field work, hands-on laboratories, and field trips. Students learned about all modes of transportation and gained leadership skills while working on team design-build projects. Highlights included a field trip to the Montana Department of Transportation headquarters in Helena and thirty minute discovery flights with flight school instructors from Summit Aviation. In addition, the participants learned about college preparation and career planning. A transportation career panel discussion was held with professionals from private consulting, academia, and the Montana Department of Transportation.

### **Job Placement**

Three graduate fellowship recipients completed their Masters degrees over the reporting period. One student obtained a position as a Geotechnical Engineer for an engineering consulting firm in Anchorage, Alaska. A second went on to become a transportation consultant at Fehr and Peers in Denver, Colorado. Jeff Sharkey (Computer Science), the highly honored student described in previous sections, was contemplating numerous career offers and opportunities at press time.

### **Student Success Stories**

WTI students are encouraged to be productive, professional researchers who co-author publications and make professional conference presentations each year. Undergraduate Adam Lundstrom contributed to TRB's Airport Cooperative Research Program (ACRP) Synthesis 6: Impact of Airport Pavement Deicing Products on Aircraft and Airfield Infrastructure. The report explores how airports chemically treat their airport pavements to mitigate snow and ice, and the chemicals used. The report also examines the effects of pavement deicing products on aircraft and airfield infrastructure, and highlights knowledge gaps in the subject. Undergraduate Olivia Yu was a co-author on a recent publication in the journal of Environmental Management [Ament, R., Clevenger, A.P., \*Yu, O., and A. Hardy. 2008. An Assessment of Road Impacts on Wildlife Populations in U.S. National Parks. Environmental Management, 42(3):480-96]. The article synthesizes information obtained from a system-wide survey of resource managers in national parks to assess the magnitude of their concerns on the impacts of roads on park wildlife.

# Education

WTI students were especially well represented at the 87th Annual Meeting of the Transportation Research Board in January 2008 (student authors are marked with an asterisk):

Shi, X., \*Lundstrom, A., Akin, M., and Pan, T. Impact of Airport Pavement Deicing Products on Aircraft and Airfield Infrastructure. Poster prepared for the Airport Cooperative Research Program, Transportation Research Board, National Academies, the 87thAnnual Meeting of Transportation Research Board, Washington D.C., 2008.

Fay, L., \*Volkening, K., \*Gallaway, C., and Shi, X. Performance and Impacts of Current Deicing and Anti-icing Products: User Perspective versus Experimental Data. 87th Annual Meeting of Transportation Research Board, Washington D.C., 2008, Paper number 08-1382.

\*Sharkey, J. and Galarus, D. Radio Network Design for Rural Intelligent Transportation Systems using Artificial Intelligence (08-1033). Poster presentation at the 87th Annual Meeting of Transportation Research Board, Washington D.C., 2008.

\*Karjala, S. and Al-Kaisy, A. Indicators of Performance on Two-Lane Rural Highways: An Empirical Investigation. Poster presentation at the 87th Annual Meeting of Transportation Research Board, Washington D.C., 2008.

\*Karjala, S. and Al-Kaisy, A. Car-Following Interaction and the Definition of Free-Moving Vehicles on Two-Lane Rural Highways. Poster presentation at the 87th Annual Meeting of Transportation Research Board, Washington D.C., 2008.

Additional student conference papers include:

\*Stark, J., C. Zabinski, T. Dougher, and L. Rew. Establishment Success of Multispecies Sod Along a Moisture Gradient. Presented at the Invasive Species in Natural Areas Conference, Missoula, MT, 2008.

Yang, Z. X., Shi, X., \*Creighton, A. T., and Peterson, M. M. Effect of Styrene-Butadiene Rubber Latex on the Chloride Permeability and Microstructure of Portland Cement Mortars. International Materials Research Conference (IMRC), Chongqing, China, 9-12 June 2008.

Finally, PhD candidate Michael Sawaya (Ecology) received the 2007 Budweiser Conservation Scholarship from the National Fish and Wildlife Foundation.



**Program Overview** 

The goal of WTI's technology transfer program is to "increase availability of research results to potential users in a form that can be directly implemented, utilized or otherwise applied." WTI accomplishes this goal by understanding stakeholder needs, developing a practical method for delivering research results to potential users, and providing leadership and vision on the technical content of the materials. For many years WTI has championed the needs of practitioners, leading efforts to organize national and regional workshops and conferences that address critical current and emerging issues in transportation. One method WTI has used to accelerate the availability of research results, and putting them into practice is by aligning the development of conference and workshops with our research focus areas such as Safety and Operations, Systems Engineering Development and Integration, or Winter Maintenance and Materials. By sponsoring, partnering, developing and providing leadership to these national events, WTI is able to bring the research findings to the table and make conferences address the state-of-the practice as a beginning point for understanding rather than an ending point. Some of the partnerships and events which WTI has led over the past year include the following: Western States Implementers Forum (California) (see pg 32), National Rural Emergency Medical Services Summit (Idaho), Montana Society of Engineers Joint Engineers Annual Conference, and the 2008 National Rural ITS Conference (Alaska) (see pg 25).

WTI continues to identify and implement new methods to disseminate information quickly and efficiently to the widest possible audience. Over the past year, we have hosted webinars for transportation professionals in the local area, hosted smaller workshops to bring together researchers and implementers, and provided support for our research staff to present their research findings at professional conferences. We have also reexamined our newsletter format and distribution as well as investigated optimizing our website for search engines.



## **Conferences and Workshops**

## **Technology Transfer**

## At the Crossroads: Transportation and Wildlife—Highway 3 Transportation Corridor Workshop

The southern Canadian Rocky Mountains are a key connection between the Crown of the Continent Ecosystem (centered about Waterton-Glacier International Peace Park) and the Banff, Jasper, Kootenay, and Yoho mountain parks complex to the north. Maintaining landscape connectivity is crucial for the well being of the many native wildlife species that currently thrive in the region. In January, 2008 the At the Crossroads: Highway 3 Transportation Corridor Workshop convened in Fernie, BC. The workshop was sponsored by the Misstakis Institute, Yellowstone to Yukon, the Wildlife Conservation Society, The Calgary Foundation, and WTI. The two day event focused on the Highway 3 transportation corridor, and was designed to understand efforts to minimize and mitigate adverse road and rail impacts on wildlife populations and ecological connectivity.

The workshop convened a variety of research scientists and agency specialists with experience on highway wildlife mitigation strategies, ungulate movement and collision zones, and carnivore movement opportunities. These specialist joined transportation planners, the local conservation community and allied interests to develop a better understanding of wildlife research in the southern Canadian Rockies.

Dr. Tony Clevenger, WTI, Senior Research Scientist, opened the workshop with a presentation, "Overview: Potential Solutions to Transportation-Wildlife Conflict." Leading scientists provided three presentations on ungulates and five on carnivores, followed by a discussion period. Day two focused on the influence of science on transportation planning and included two presentations and a final discussion period. WTI's Rob Ament, Research Scientist, presented "Wildlife-Vehicle Collision Reduction Study."

Agreement was reached by the 21 workshop participants and 11 presenters to create a report that synthesizes existing research to identify key movement zones (focus on multi-species), rank the zones for conservation action and identify the most feasible transportation mitigation options and recommendations for each site.



## Conferences and Workshops - continued

## WTI hosts Webinars

The Institute for Transportation Engineers (ITE) sponsors several webinars throughout the year. The on-line courses provide an excellent opportunity for high-quality professional training regarding the state-of-the-practice; further, Professional Engineers can use these courses to maintain their licenses. By hosting a seminar, WTI staff and partner participants can obtain training without paying for travel costs, thus reducing per person expenditures and strengthening relationships within the local transportation community. WTI hosted two webinars during the past year:

## ITE Webinar: Transportation Impact Analyses for Site Development

On February 12, 2008, WTI and the Montana Department of Transportation Design Team brought together eight professionals and five students for the "Transportation Impact Analyses for Site Development" webinar. This training was developed to provide an overview of identifying the steps and tools involved in traffic access and impact studies for site development.

The thirteen participants learned to determine the role of transportation impact analysis (TIA) in site development process and the steps to perform a TIA. They also learned how to identify key characteristics of a proposed development and to apply typical analysis tools.

## ITE Webinar: Developing Trends in Bike Facilities Planning and Design

Over the last 10-12 years, the field of bicycle transportation has become one of the fastest growing niches of transportation planning and engineering. However, despite a great deal of interest and research, many current practitioners are not familiar with methods to accommodate this particular non-motorized mode of transportation. This web briefing, hosted on April 15, 2008, used case studies to highlight state-of-the-art practices.

The eighteen participants included WTI research staff and students as well as staff from the City of Bozeman, Montana Department of Transportation, Gallatin County and a private engineering firm. At the conclusion of the course participants were able to evaluate the options available to solve challenges of incorporating non-motorized transportation into a predominantly motorized transportation network.

"Hosting a webinar is a great way to bring together engineers, planners, students and stakeholders from the university, city, county, and DOT to learn about important transportation issues. These webinars are a good forum for participants to learn about WTI and meet others in the community who are working toward creating a more multi-modal transportation system," said Rebecca Gleason, WTI researcher and organizer of the webinar.



## Washington Wildlife-Crossings Field Course

The Washington Wildlife Crossings Field Course was conducted in Roslyn, Washington June 2-4, 2008. The three day event drew on the vast range of expertise from biologists, engineers, planners, and others engaged in creating successful wildlife crossings. This advanced-level course tackled the more complex issues that transportation professionals face in the field of road ecology.

The Southern Rockies Ecosystem Project (SREP) again served as host and lead organizer. Joining SREP as hosts were the Washington State Department of Transportation, the U.S. Forest Service, and the I-90 Wildlife Bridges Coalition. The course also received generous support from the Center for Transportation and the Environment, Western Environmental Law Center, Yellowstone to Yukon Conservation Initiative, Conservation Northwest, Defenders of Wildlife, The Wilderness Society, URS Corporation, U.S. Fish and Wildlife Service, Wilburforce Foundation, The Brainerd Foundation, the Bullitt Foundation, and WTI.

Trisha White with Defenders of Wildlife, and a national expert on surface transportation policy and wildlife-vehicle collision prevention, led course attendees through a comprehensive agenda of presentations, discussion sessions, and field tour activities. The course provided a constructive forum for sharing experiences and exploring new ideas, perspectives, and concepts. Presentations by more than 30 speakers were given to address the complex issues of planning, design, funding and monitoring of wildlife crossings.

The course location at Washington State's Snoqualmie Pass East– the site of a major planned transportation and wildlife crossings project on Interstate 90 – provided an exceptional opportunity for course participants to visit and learn from a project that is currently underway. Participants had the opportunity to experience first-hand the hurdles, as well as the achievements, that resulted in a comprehensive proposal to construct a suite of wildlife crossings along this stretch of interstate.

The course drew a total of 114 participants from the U.S. and Canada, including biologists, engineers, planners, consultants, state transportation agency officials, non-profits and foundations, and state elected representatives. Based on the positive evaluations received from attendees, SREP and other event hosts hope this year's course will facilitate communication and information sharing between these multi-disciplinary groups as well as build enthusiasm for wildlife crossings throughout Western North America.





## 2008 National Rural ITS Conference, North to the Future

Hosted by the Alaska Department of Transportation and Public Facilities of Anchorage, and attended by nearly 300 participants from 36 states and four countries, the 2008 National Rural ITS Conference kicked off on September 3. The three day event held in Anchorage was sponsored by the Alaska University Transportation Center; Cambridge Systematics, Inc.; Horizon Lines of Alaska; ITS Alaska; ITS America; Lynden, McDowell Group; Open Roads Consulting; PBS&J; Quixote Transportation Technologies; Telvent; Thompson Engineering; USDOT ITS Joint Program Office; Wostman & Associates, Inc.; and WTI.

Population growth is extending into what has previously been considered extreme rural settings. User expectations for transportation system performance are increasing. Rapid technology changes offer many opportunities. These opportunities, however, come with significant challenges, and future funding availability often brings program sustainability into question. Add to this the increasing impact of climate change on all facets of society, and it is rapidly evident that rural ITS has challenges similar to what other transportation programs face.

Keynote speakers, who included Shelley Row, Program Director, ITS Joint Program Office, USDOT; Klaus Banse, President – ITS Columbia; and Burr Stewart, Strategic Planning Manager – Port of Seattle; discussed many of these topics in their presentations during the Opening Session. "NRITS 2008 addressed key issues facing rural transportation today and how to address them across jurisdictional boundaries and multi-modal transportation services," said Jack Stickel, ADOT&PF. "The ITS Information Assembly clearly was the highlight for me....the opportunity to discuss ITS solutions to meet real-world challenges."

With representation of over 26 vendors and 38 sessions to choose from, there was no shortage of valuable information. "NRITS 2008 exceeded my expectations," said Jill Sullivan, ADOT&PF. "The venue was wide open for great networking opportunities, and, the concurrent sessions provided so much intrigue that we heard over and over again how difficult it was to choose which session to attend. If I had to pick my favorite part of NRITS, it would be the connections made throughout the entire time with so many ITS professionals."

## WTI Develops Online Course

WTI has developed a free online Road Ecology course for professional development. Registration and content can be accessed via http://www. wti.montana.edu/Education/continuing\_education.aspx Enrollees can earn 0.2 continuing education units. Course content includes mitigation of barrier effects and landscape fragmentation by roads, modifying behavior near roadways, and engineering considerations for fish passage under roads.

## **Books**

Long, R. A., P. MacKay, W. J. Zielinski, and J. C. Ray, editors. 2008. Noninvasive Survey Methods for Carnivores. Island Press, Washington, D.C.

## **Peer Reviewed Publications**

## Ahmed Al-Kaisy

Al-Kaisy, A. and Durbin, C. "Evaluating New Methodologies for Estimating Performance on Two-Lane Highways." Canadian Journal of Civil Engineering (2008): Volume 35, Number 8, pp. 777-785.

Al-Kaisy, A., Hardy, A., and Nemfacos, C. "Static Warning Signs of Occasional Hazards: Do They Work?" The Institute of Transportation Engineers, ITE journal, (June 2008).

Rakha, H., Ingle, A., Hancock, K., and Al-Kaisy, A. "Estimating Truck Equivalencies for Freeway Sections" In Transportation Research Record 2027, Journal of the Transportation Research Board (2007): pp. 73-84.

## **Rob Ament**

Ament, R., Clevenger, A.P., Yu, O., and A. Hardy. "An Assessment of Road Impacts on Wildlife Populations in U.S. National Parks." Environmental Management (2008): 42(3):480-96.

### Adam Ford

Ford, A. and L. Fahrig. "Movement Patterns of Eastern Chipmunks (Tamias striatus) Near Roads." Journal of Mammalogy (2008): 89(2):895-903.

Ford, A. and L. Fahrig. "Diet and Body Size of North American Mammal Road Mortalities." Transportation Research Part D: Transport and Environment (2007): 12(7): 498-505.

## Tuan Anh Nguyen

Nguyen Tuan Anh., Lu Yuzhuo, Yang Xinghong, and Shi Xianming. "Carbon and Steel Surfaces Modified by Leptothrix Discophora SP-6: Characterization and Implications." Environ. Sci. Technol. (2007): 41 (23), 7987–7996.

## Tongyan Pan

Tutumluer, E., and Pan, T. "Aggregate Morphology Affecting Strength and Permanent Deformation Behavior of Unbound Granular Materials." Journal of Materials in Civil Engineering, American Society of Civil Engineers, ASCE(2008): Vol. 20, No. 9.

Pan, T., Nguyen, T., and Shi, X. "Assessment of Electrical Injection of Corrosion Inhibitor for Corrosion Protection of Reinforced Concrete Using Finite Element Analysis." Journal of the Transportation Research Board - Transportation Research Record (TRR) No. 2044, National Research Council, Washington, D.C. (2008): pp. 51-60, 2008.

Pan, T., He, X. and Shi, X. "Laboratory Investigation of Acetate-based Deicing/anti-icing Agents Deteriorating Airfield Asphalt Concrete." Journal of the Association of Asphalt Paving Technologists (AAPT) (2008): Vol. 77.

### **Xianming Shi**

Shi, X. "Impact of Airport Pavement Deicing Products on Aircraft and Airfield Infrastructure." ACRP Synthesis 6. Airport Cooperative Research Program, Transportation Research Board, National Academies, Washington, D.C. (April 2008).

## Peer Reviewed Publications - continued

#### David Veneziano

Veneziano, David, and Christopher Strong, "Application of Integrated Corridor Management to Rural Areas." Accepted for Publication and Presentation at the 15th World Congress on ITS, New York City, (November 20, 2008).

Hallmark, Shauna L., David Veneziano, Scott Falb, Michael Pawlovich, and Deborah Witt. "Evaluation of Iowa's Graduated Driver's Licensing Program." Accident Analysis & Prevention (July 2008): Volume 40, Issue 4, Pages 1401-1405.

#### Nic Ward

Rakauskas, M.E., Ward, N.J., Boer, E., Bernat, E., Cadwallader, M., Patrick, C. "Car Following Performance in a Driving Simulator During Conventional Distractions and Alcohol Intoxication." Accident Analysis and Prevention (2008): 40, 1742 - 1749.

Kuge, N., Yamamura, T., Boer, E.R., Ward, N.J., & Manser, M.P. "Study on Driver's Car Following Abilities Based on an Active Haptic Support Function." SAE Transactions Journal of Passenger Cars - Electronic and Electrical Systems (2007): 115(7), 157 - 169.

Brovold, S., Donath, M., Simons, S., Ward, N. & Shankwitz, N. "In-vehicle Technology to Correct Teen Driving Behavior: Addressing Patterns of Risk." Journal of Safety Research (2007): 38, 413 - 422.

Creaser, J.I., Rakauskas, M.E., Ward, N.J., Laberge, J.C., & Donath, M. "Concept Evaluation of Intersection Decision Support (IDS) Systems to Support Drivers' Gap Acceptance Decisions at Rural Stop-Controlled Intersections." Transportation Research Part F: Traffic Psychology (2007): 10, 208 – 228.

#### Jared Ye

Zhang, Y., Z. Ye. "Short-Term Traffic Flow Forecasting Using Fuzzy Logic System Methods." Journal of Intelligent Transportation Systems (2008): Vol.12, No.3, pp. 102-112.



## Presentations

### Michelle Akin

"WTI Winter Research Facility", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

### **Rob Ament**

"Developing and Evaluation of Devices Designed to Minimize Deer-vehicle Collisions: Phases I & II", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

### Jaydeep Chaudhari

"Other Approaches and Some Guidance on Travel Estimation and Forecasting," TRB Committee Conference, "Tools of the Trade", Portland, OR, September 2008

### Anthony Clevenger

"Basic Concepts and Application of Road Ecology and Long Term Monitoring and Research in Banff NP Canada", University of Lisbon, Road Ecology Seminar, Lisbon, Portugal, April 2008

"Banff's Highway Crossing Structures; Effectiveness & Future Development", Managing Environmental Impacts of Linear Corridors, Revelstoke, BC, November 2007

"Perspectives on Emerging Wildlife Connectivity Issues in North America", Caltrans Road Ecology Meeting, Asilomar, CA, January 2008

### Eli Cuelho

"Development of a Cyclic Pullout Test Protocol for Geosynthetics Used in Base Reinforcement Applications", 41st Annual Symposium on Geological Engineering and Geotech, Boise, ID, April 2008

"Small strain and Displacement Monitoring Methods for Geosynthetics Under Monotonic and Cyclic Loading", GeoAmericas 2008 Conference, Cancun, Mexico, March 2008

"Comparative analysis of micro-deval, L.A. Abrasion and Sulfate Soundness tests", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008 "Determining Geosynthetic Material Parameters for Base Reinforcement Applications", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

### Laura Fay

"Poster: Reinforced Native Sod Grass for Biostrips, Bioswales, and Sediment Control", International Erosion Control Association Conference, Orlando, FL, February 2008

"Performance & Impacts of Current Deicing and Anti-Icing products: User perspective Vs Experimental Data", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

#### **Douglas Galarus**

"Meshbox: Mesh Network Communication System for Intelligent Transportation Research Using Open Source Software", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

"Radio Network Design for Rural Intelligent Transportation Systems Using Artificial Intelligence", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Rural TMC-TMS Communications-An Evaluation of Alternatives", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

Presentation and demonstration of "Weathershare", Clarus Stakeholders Meeting, Reno, NV; Sacramento, CA, July 2008

"TMC-TMS Communications: Overview and Demonstration", Western States Technology Implementers Forum, Mt. Shasta, CA, May 2008

"One Stop Shop", COATS Steering Committee Meeting, Yreka, CA, October 2007

### Marcel Huijser

"The Reliability of Animal Detection Systems and Reliability Norms", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

"Habitat and Corridor Function of Rights of Way", 87th Annual Transportation Research Board Meeting, Denver, CO, July 2008

### David Kack

"Planning and Implementing a Public Transportation System in Bozeman, MT", American Planning Association Conference, Las Vegas, NV, April 2008

"An Evaluation of RouteMatch Software in the Billings MET Transit System", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

"Advanced Public Transportation Systems", Joint Engineers Conference, Helena, MT, November 2007

"Planning and Implementing of Public Transportation System in Bozeman, MT", American Public Transportation Association Transportation Conference, Reno, NV, April 2008

### Sarah Karjala

"Indicators of Performance on Two-Lane Rural Highways: An Empirical Investigation", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Car-Following Interaction and the Definition of Free-Moving Vehicles on Two-Lane Rural Highways", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

## Pat McGowen

"Mitigating Wildlife Vehicle Collisions", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

"Mitigation: The Old and New of Collision Reduction Techniques", Red Deer College Information Session, Calgary, Alberta, June 2008

## Tongyan Pan

Assessment of Electrical Injection of Corrosion Inhibitor for Corrosion Protection of Reinforced Concrete", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Laboratory Investigation of Acetate Based Deicers Deteriorating Airfired Asphalt Concrete", 2008 AAPT Annual Meeting, Philadelphia, PA, April 2008

## Mike Sawaya

"Evaluating Non-Invasive Genetic Sampling Methods Using a Radio-Marked Population of Cougars in Yellowstone", 9th Mountain Lion Workshop, Sun Valley, ID, May 2008

## Jeffrey Sharkey

"Radio Network Design for Rural Intelligent Transportation Systems Using Artificial Intelligence, 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Network Design Tool in Google Maps and Avtometer Network Design Using ACO", Google I/O Technical Conference, San Francisco, CA, May 2008

## **Xianming Shi**

"An Electrochemical and Microstructural Characterization of Steel-Mortar Admixed with Corrosion Inhibitors", International Materials Research Conference, Chongqing, China, June 2008

"Looking to the Future of Winter Maintenance: FAST, Vehicle-Based Sensor Technologies and MDSS", MDSS Showcase and Easter Snow Expo, King of Prussia, PA, August 2008

"Self-repairing Coating for Corrosion Protection of Aluminum Alloys: A Proof of Concept Using Cagelike Smart Particles", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Effects of Styrene-Butadiene Rubber Latex on the Chloride Permeability and Microstructure of Portland Cement Mortars", International Materials Research Conference, Chongqing, China, June 2008

"Chloride Permeability and Microstructures of Portland Cement Mortar Incorporating Nanomaterials", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

### Jennifer Stark

"Establishing Success of Multispecies Sod Along a Moisture Gradient", Invasive Species in Natural Areas Meeting, Missoula, MT, February 2008

"Benefit-Cost Analysis of Weather Information for Winter Maintenance: A case study", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Analysis of MDSS Benefits and Costs", 2007 National Rural ITS Conference, Traverse City, MI, October 2007

## **Chris Strong**

"Integrating Weather into Transportation Operations: A UDOT case study", 7th International Symposium on Snow Removal & Ice Control, Indianapolis, IN, June 2008

"The Value of Customized Weather Forecasts to Winter Maintenance Personnel: The UDOT Experience", 2007 National Rural ITS Conference, Traverse City, MI, October 2007

"Safety Evaluation of Yield-to Pedestrian Channelizing Devices", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Benefits and Costs Associated with Maintenance Decision Support Systems", 4th National Conference on Surface Transportation Weather, Indianapolis, IN, June 2008

"Benefit-Cost Analysis of Weather Information for Winter Maintenance: A case study", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Analysis of MDSS Benefits and Costs", 2007 National Rural ITS Conference, Traverse City, MI, October 2007

## David Veneziano

"Facilitating Special Event Congestion Management in Small Communities", ITE Intermountain Section Annual Meeting, Jackson, WY, May 2008

"Before and After Comparison of Fredonyer Summit Icy Curve Warning System", 2007 National Rural ITS Conference, Traverse City, MI, October 2007

"Facilitating Special Event Congestion; Management in Small Communities", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

"Estimating the Wet-Pavement Exposure with Historical Precipitation Data in CA", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

"Applying Integrated Corridor Management to the Rural COATS Region, Northwest Transportation Conference, Corvallis, OR, February 2008 "Applying Integrated Corridor Management to the Rural COATS Region", 2007 National Rural ITS Conference, Traverse City, MI, October 2007

### Nick Ward

"Traffic Safety Culture Research Issues", ITE 2008 Session, Miami, FL, March 2008

### Zhirui Ye

"Benefits and Costs of Weather Information in Winter Maintenance", 2008 National Rural ITS Conference, Anchorage, AK, September 2008

### Jared Ye

"Estimation of Large Truck Volume Using Single Loop Detector Data", 87th Annual Transportation Research Board Meeting, Washington, DC, January 2008

## Website

The WTI website is the cornerstone of the Technology Transfer Program, serving as the gateway to the latest information about our research. It is also serves as one of our most important methods of outreach, "introducing" us to potential collaborators. For these reasons, WTI has devoted considerable effort in 2008 to website enhancements that make it easier for interested parties to access information about WTI and our research.

Researchers who are not already familiar with our organization are likely to use a search engine to find the latest transportation research findings. In late Fall 2007 WTI research results were no longer appearing in the first three pages of the search engine results for several key terms (e.g. rural transportation research), raising the concern that our research results were no longer going to be found in an efficient manner. After some initial research which identified the challenges and complexities of this process, WTI contracted with O'Berry Cavanaugh Inc. (OC) to improve the search engine optimization of the WTI website. OC did extensive research on the design, location, server settings, and other components of the WTI website. They also examined the websites of other UTCs to see how the UTC website related to the affiliated university's website. Several challenges were discovered: the WTI website is so entrenched within the Montana State University website that search engines can't find it, the metatags and content on the web pages are not search engine friendly, and the web site is not research driven. OC developed a strategic plan for the WTI website, as well as an implementation schedule of changes that need to be made to optimize the site. Over the course of the next year many of the changes will be made, which should help the new optimized pages to once again rise to the top of the search engine rankings for key research terms.

Once the WTI website enhancements have been implemented, the Technology Transfer program will continue to explore other electronic tools that will expand access to our research. For example, WTI (in collaboration with other partners) is in the preliminary stages of developing a rural transportation clearinghouse and a rural transportation blog to facilitate the exchange of information, expertise, and ideas among researchers and practitioners.

## Newsletter

WTI published the last hard copy of the WTI newsletter in October 2007. After several months of research and development, the WTI newsletter will be published on a quarterly basis (instead of only twice a year), and it will be disseminated in an electronic format. This change has several key advantages: readers will receive more frequent and timely information about projects and research results, and WTI will reduce costs by eliminating printing expenses. WTI will be able to produce four electronic newsletters for less than two hard copy newsletters. The newsletter will be available via email as well as downloadable off WTI's website. The new format may allow WTI to reach a greater number of interested parties, expanding the educational and outreach potential of our newsletter.

The Western States Rural Transportation Technology Implementers forum held each year in Mount Shasta, California exemplifies the technology transfer goal of quickly placing research results into the hands of practitioners. The Forum, created by the California Department of Transportation (Caltrans) and WTI, is a two-day event that is specifically designed to give ITS implementers and engineers the opportunity to engage in detailed discussion about innovative engineering and communications projects addressing rural transportation challenges.

On the first day, presenters examined how solutions were developed, focusing on applications that have been deployed in the field or have been used in live traffic situations. Presentations were 90 minutes to two hours in length allowing the speakers to delve into the "nuts and bolts" of how a project works, including specific technical information. The extended presentation time, limited attendance, and informal atmosphere encouraged questions and open dialogue about equipment functionality, system performance, vendors, and other key information. Speakers discussed not only success stories, but also failures and problems, so participants could learn about what does and doesn't work and why.

Presenters covered numerous diverse topics. WTI Researcher Doug Galarus gave an overview of TMC (Transportation Management Center) to TMS (Transportation Management System) communication technologies and their potential application in rural environments. Ken Beals from Caltrans District 2 discussed RWIS (Roadway Weather Information Systems), and how to accurately use the RWIS information to assist maintenance personnel or to operate extinguishable message signs (EMS) that warn the public of potentially hazardous roadway conditions. Ted Bailey and Matt Neeley, ITS engineers from Washington DOT, presented the findings from several field tests of wireless and microwave vehicle detection systems. Oregon DOT's Galen McGill spoke about ODOT's extensive traveler information systems and services.

This year's Forum also included equipment displays and technical demonstrations. The morning of the second day was dedicated to live demonstrations of Rural ITS technology and "hands-on" question and answer periods. Participants were also encouraged to bring actual ITS equipment to the forum and make themselves available for informal "show and tell" sessions during breaks. Additionally, 30 minute segments were reserved for briefings on specific Rural ITS research projects and product development. Several of these briefings were presented by student assistants and young professionals who will be the next generation of ITS engineers and integrators. WTI Fellowship student, Jeff Sharkey, presented a portion of his thesis and discussed automated radio network design. WTI undergraduate research assistant, Justin Krohn, participated in a trailer demonstration and also gave an overview of his work on wireless mesh networks and the mesh boxes under development by the WTI Systems group.

Thirty-nine attendees from seven different western states (CA, ID, MT, NV, OR, WA, WY) participated in the 2008 Forum. WTI and Caltrans have formed a solid partnership to make the Forum a successful annual event, not only in regard to sponsorship, but also in the planning and coordination of the event. Plans are already underway for the next forum to be held in June 2009.





