



# Western Transportation I N S T I T U T E

University Transportation Center

2009 Annual Report



# Western Transportation Institute University Transportation Center

2009 Annual Report

*(For the period October 1, 2008 - September 30, 2009)*

College of Engineering  
Montana State University

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# Message From The Director

## Integrated Approaches to Complex Problems

For more than a decade, WTI has been a leader in rural transportation research, and more recently, an advocate of holistic, integrated approaches to that research.

We've made significant progress on several fronts. WTI has become a nationally recognized champion of rural transportation, articulating the unique needs of rural areas and why they matter to the transportation system as a whole. We have crafted innovative solutions to individual, but formidable transportation challenges in these areas, from identifying road materials that will hold up in severe weather conditions, to finding communications technologies that will work in the most remote locations.

Moving toward greater integration of our research is the logical next step. WTI has established technical expertise in our eight research program areas; when our researchers work together across disciplines, they can look at rural issues in a broader context and develop better and more comprehensive solutions.

We are convinced that this multi-disciplinary approach is the foundation of quality research. It promotes institutional teamwork that facilitates building from a wider body of knowledge, incorporating diverse specialized expertise, and ensuring rigorous evaluation from peers – all of which are hallmarks of successful projects. Well integrated research cannot always be achieved internally, which is why WTI often looks to collaborative partnerships. By working with other states, university institutes or private entities, we can take integration to the next level, gaining a wider range of perspectives and pooling additional resources. Finally, since applied research cannot be conducted without consideration of political and fiscal realities, WTI's integrated approach frequently incorporates stakeholder outreach, particularly among policy makers who have a "big picture" understanding of the practical feasibility and long-term implications of our work in the world around us.



# Message From The Director *continued*

Achieving research integration that incorporates all of these elements is an ambitious goal and a long-term process. In this report, you will read about some of our initial successes, along with the challenges we face along the way. For example, our Research Director describes some of the administrative hurdles to integration, such as adapting decades of research business practices based on individually funded and managed projects.

However, there are many promising examples of how we are thinking outside traditional boxes and conducting our research in a cooperative fashion. One of our successes this year is a project to enhance habitat connectivity for carnivores along I-90 in Washington. Administratively, this project has been “integrated” from the outset, with a cooperative funding arrangement that includes Washington Department of Transportation, the U.S. Forest Service, and Seattle City Light.

Another proud moment in recent months was the Open House to celebrate WTI’s new home, which offers expanded laboratory facilities for use in multi-disciplinary research projects. The Open House was attended by U.S. Senator Max Baucus, a long-time friend and supporter of WTI, who recognized our growing potential for attracting research partnerships that will benefit Montana, as well as the U.S. transportation system as a whole.

WTI will continue our efforts to move toward a fully integrated research program. We look forward to building on our skills and successes, and taking them to the next level of complexity, understanding and national relevance.



# 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.





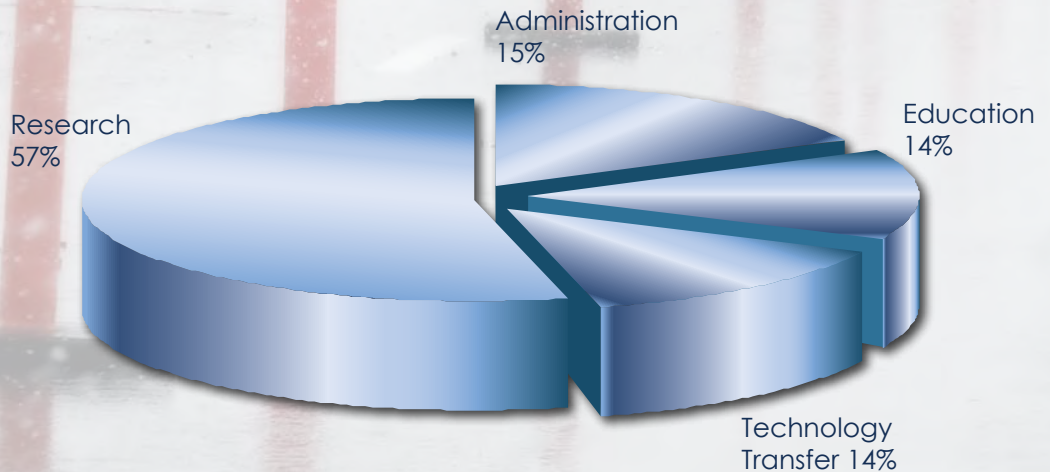
# Financial Statement

The following charts illustrate allocations and funding sources for the Western Transportation Institute's UTC programs during Year 3. The first shows the breakdown of expenditures and allocations of the federal portion (\$3,199,000) of the UTC program for Year 3. Approximately \$437,000 was allocated for the Education Program and \$1,817,000 has been committed for research project and laboratory/equipment funding. The remaining \$945,000 supports the administrative and technology transfer function of WTI.

The second figure depicts the Year 3 funding sources for the WTI UTC Program. The match for the USDOT portion is provided by state Departments of Transportation, and through the support of various private foundations.

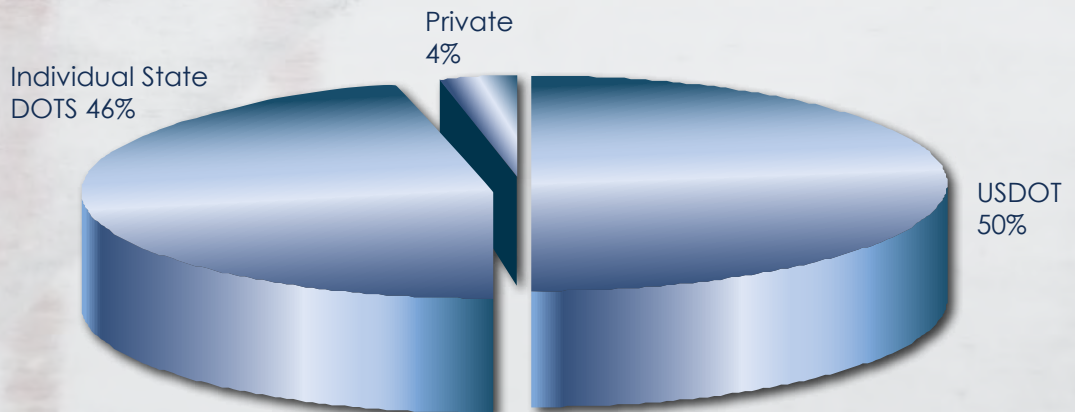
## Allocations for Year 3:

October 1, 2008 - September 30, 2009



## Funding Sources for Year 3:

October 1, 2008 - September 30, 2009



# Research

## Research Director's Message

### Challenges of Research Integration: Whose project is it?

WTI has a problem, and it's getting worse. Several years ago, faced with managing a growing research portfolio, WTI was re-organized administratively into eight program areas, each centered on a distinct area of study in rural transportation research. Simultaneously, the Institute proactively focused philosophically on trying to use its diverse and complementary program areas to look at issues in a broader context and to develop better and more comprehensive solutions. The good news is that WTI has made satisfying progress on the latter initiative; the bad news is that this success has exposed the inadequate nature of our "old school" administrative structure.

In particular, when it comes time to assign projects to specific program areas for administrative purposes, the question increasingly comes up "Whose project is it?" This question is not only asked because of the cross cutting technical content within many of WTI's projects, but also from individual researchers' desire for acknowledgement of the significant contribution they have made to the project's success. Obviously, this is a good problem, and one that will be solved as our old ways of doing business catch up with the way we actually are addressing the rural transportation challenges of today.

The following projects highlight to varying degrees the integrated nature of WTI's research efforts, and in doing so, beg the question "Whose project is it?"

- Is that a road ecology project, or a project to develop web based data collection methods and protocols for a variety of applications?
- Is that a water quality project, or a project to develop a new self sustaining power supply that can be used in this and other similar applications?
- Is that winter maintenance project, or a systems/computer science project?
- Is that a traffic operations project or an aviation project?

Note that while our efforts to adopt a broader perspective in tackling rural transportation challenges are encouraging, we still have a long way to go in this regard. The majority of WTI's integration efforts thus far have primarily occurred only on the solution side of a problem. That is, provided with what often is a relatively single (or just a few) issue problem, WTI works on an optimum cross-discipline based solution. Ideally, as researchers and sponsors collaboratively move ahead, the problems themselves will more frequently be framed in a broader context, allowing for far reaching and better solutions.



# Research

## Featured Projects

Within WTI's extensive research portfolio of active and recently completed projects, the following selected projects highlight how our researchers draw upon diverse technologies and expertise to develop and implement innovative solutions to the research questions they face.

### **Blaine County Wildlife Data Collection**

The Idaho Transportation Department and Blaine County, Idaho are investigating whether installing an animal detection system will help reduce the number of collisions between cars and large animals on Highway 75 near Ketchum. WTI's road ecology researchers led a research effort to identify and evaluate mitigation options for the site. As part of the data collection effort, researchers from the Systems Engineering program worked with the road ecologists to develop a web-based tool that the public could use to report sightings of dead animals along this stretch of roadway. The application had to be convenient to access, easy to use, and "attractive" in style, as well as include routines for post collection screening of the data's basic validity, as it will be used to help guide the selection of specific locations for animal detection systems and other mitigation efforts.

### **Autonomous Sensing System to Monitor Water Quality**

WTI is teaming with Montana State University's Department of Electrical and Computer Engineering to develop a system that will monitor water quality along roadways. The system uses novel devices (such as microbial fuel cells (MFCs)), in conjunction with sensors, microcontrollers and transceivers, to in situ monitor and collect real-time measurements of sediments and other contaminants that occur from highway runoff. The system will not only have environmental benefits, it will facilitate operations for highway construction and maintenance agencies. A particularly innovative element of the system is the MFC, which offers a power source that is self-sustaining (relying only on organic material already in the water) and environmentally friendly. Additionally, the MFCs could be used as power sources for other applications. This research has attracted support from two state transportation departments and the National Cooperative Highway Research Program.

### **Lab Testing of Mixed Liquid Deicers**

WTI has begun a new project to establish a decision making process for deploying deicers based on a robust set of laboratory testing procedures and other performance criteria (e.g., cost and environmental impacts). The project integrates knowledge from WTI's previous research on environmentally friendly road materials and best practices for winter maintenance. In addition, the project complements research being conducted for the Clear Roads pooled fund initiative, a partnership of departments of transportation in states that experience extreme weather conditions. The deicer decision making process will be facilitated by developing an artificial neural network (a form of artificial intelligence that mimics the operation of biological neurons) trained to act on various input parameters to suggest an "optimum" deicer strategy.

### **Integration of Aviation Weather Systems with Road Weather Systems**

WTI, in partnership with the Mineta Transportation Institute (MTI) at San Jose State University, is exploring whether aviation meteorological data systems can be integrated with road weather data systems, as a cost-effective way to expand access to key weather information. The project includes the development of a prototype weather information system in rural California that aggregates data from Automated Weather Observation Systems (used by airports) and Road Weather Information Systems (RWIS) into an easily accessible and understandable computer interface. The project has the potential to increase safety for both air and surface travelers, without the installation of additional sensors or other major infrastructure.



# Research

## Project Status 2009

Following is a list of Center research projects. New projects were selected between October 1, 2008 and September 30, 2009.

New Projects	Principal Investigator
Deicer Interaction with Portland Cement Concrete Pavements and Bridge Decks	Xianming Shi
Examining Paved Road Impacts on Birds	Angela Kociolek
An Assessment of Habitat Connectivity and Fracture Zones for Carnivores Within & Between the I-90 & US 2 Corridors, Washington	Robert Long
Development of a Toolkit for Cost-Benefit Analysis of Specific Winter Maintenance Practices, Equipment and Operations	Xianming Shi
Laboratory Testing of Mixed Liquid Deicers and Use of Multiple Performance Characteristics for Deicer Selection/Design	Xianming Shi
Northwest Passage Rural Vehicle Infrastructure Integration Demonstration Project	Gary Schoep
Channelized Right-Turn Lanes at Signalized Intersections: Traffic Control Empirical Investigation	Ahmed Al-Kaisy
Animal Detection System for Reliability Testing	Marcel Huijser
Highway 3 Transportation Corridor: Wildlife Movement & Mitigation Assessment	Tony Clevenger
Using Naturalistic Data to Evaluate Safety & Operational Characteristics of Highways	Pat McGowen
Evaluation of an Animal Warning System Effectiveness	Marcel Huijser
An Experimental Assessment of Swimming Capabilities of Selected Trout Species for Barrier Assessment, Barrier Design, Fishway and Culvert Design, and Retrofits	Matt Blank
Warm Mix Asphalt Paving Strategies for Use in Montana Highway Construction	Steve Perkins

New Projects <i>(continued)</i>	Principal Investigator
Steel Pipe Pile/Concrete Pile Cap Bridge Support Systems: Confirmation of Connection Performance	Michael Berry
Interim Evaluation of Three Instrumented Bridges in Saco, Montana	Eli Cuelho
Montana Rest Area Usage: Data Acquisition and Usage Estimation	Ahmed Al-Kaisy
Ongoing Projects	Principal Investigator
Effects of Defensive Vehicle Handling, Phase 3	Laura Stanley
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
Banff Wildlife Crossings	Tony Clevenger
Impacts of Barriers on Topeka Shiner Populations	Matt Blank
Durability of Corrosion Resistant Mineral Admixture Concrete	Xianming Shi
Rural Transportation and ITS Outreach and Assessment	Steve Albert
Ant Colony Optimization for Transportation Optimization Problems	Doug Galarus
Effects of 4 Lane Highways on Desert Kit Fox and Swift Fox	Tony Clevenger
Integration of Aviation Automated Weather Observation (AWOS) w/RWIS	Doug Galarus
Developing a Standard Test Method for Measuring Geosynthetic Soil Resilient Interface Shear	Eli Cuelho

# Research

## Project Status 2009

Ongoing Projects <i>(continued)</i>	Principal Investigator
Mobile Communications Briefcase	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 SEITP	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 Huijser/ Rob Ament
Developing Regional Ecosystem Framework for Terrestrial & Aquatic Resources along the I-70 Corridor, Colorado	Marcel Huijser

Ongoing Projects <i>(continued)</i>	Principal Investigator
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 Wildlife Monitoring of Fish Passage	Matt Blank
Replacing Thermal Sprayed Zinc Anodes on Cathodically Protected Steel Reinforced Concrete Bridges	Xianming Shi
Completed Projects	Principal Investigator
Wildlife-Highway Crossing Mitigation Measures and Associated Costs/Benefits: A Toolbox for MDT	Marcel Huijser
Electrochemical Rehabilitation of Salt Contaminated Concrete – A Lab Study	Xianming Shi
Automated Cost Recovery	David Kack
Mitigation of Moisture & Deicer Effects on Asphalt Thermal Cracking	Tongyan Pan
Innovative Coating System for the Corrosion Prevention of Galvanized Steel	Xianming Shi
Blaine County State Highway 75 Wildlife Data Collection and Mitigation Research Project	Marcel Huijser
California Oregon Advanced Transportation System Phase 3	David Veneziano
National Wildlife Collision Study	Marcel Huijser
An Autonomous & Self Sustained Sensing System to Monitor Water Quality Near Highways	Xianming Shi
Highway 93 South Mitigation Feasibility Study in Kootenay National Park	Marcel Huijser



# Research

## Success Story

### **WTI Attracts New Partners to Road Ecology Initiatives**

WTI is a national leader in the advancement of road ecology. Internally we have nurtured our staff and technical expertise, and externally we are building an increasing number of innovative partnerships to expand research in this field.

This year, WTI initiated a project that is attracting new partners to the study of habitat connectivity. As part of the improvement of Interstate 90 over Snoqualmie Pass in Washington State—which will ultimately include numerous wildlife crossing structures—WTI is conducting wildlife monitoring on behalf of the Washington Department of Transportation. To complement this effort, WTI researchers initiated a UTC supported project specifically focused on carnivores. The project uses DNA identification and tracking methods to determine whether roads are inhibiting the natural patterns of movement for carnivores in the region and thereby potentially threatening their long-term viability.

From the outset, WTI recruited a broad spectrum of public and private research partners to work together on this effort. The collaboration includes the USDA Forest Service, Conservation Northwest, the I-90 Wildlife Bridges Coalition, Seattle City Light, North Cascades National Park Complex, and the Washington Department of Transportation. The project is expected to have a number of research benefits, such as the identification of barriers to carnivore movement and potential habitat linkages, the detection of rare carnivores that may inhabit the region, and the collection of data that will facilitate ongoing highway mitigation and monitoring efforts. Furthermore, the project presents a successful example of how identification and integration of common interests can also enhance how research is conducted and advanced:

- The project pools UTC funds with partner funds to increase the resources available for the research,
- The project raises awareness of an emerging issue (habitat connectivity) among a new group of stakeholders, and
- The project provides a funding collaboration model that can be replicated in other regions or for other issues.







# Research

## Awards and Recognition

### **Road Ecology Research and Deployment Wins Prestigious Award at ITS America**

The Intelligent Transportation Society of America (ITS America), the leading national organization for the promotion of advanced transportation systems, has honored WTI's road ecology research partnerships with a 2008 "Best of ITS" Award. WTI's "Partnerships for Deploying Animal Vehicle Crash Mitigation Strategies" was one of eight programs or projects honored in the category of "Best New Innovative Practices."

The award recognized WTI's integrated efforts to advance the development of new technologies that detect the presence of animals along the roadside, and highlighted the Animal Vehicle Pooled Fund Study, the Roadside Animal Detection Systems (RADS) testbed, and the National Wildlife Vehicle Collision Reduction Vehicle Study. "Individually, these projects have achieved important goals such as enhancing the capabilities of an individual animal detection system, or producing valuable comparison data on the reliability of nine different systems," said WTI Director Steve Albert. "Our integrated knowledge of these projects has allowed us to advance further and faster, both overall and within each of these efforts."

This work also represents a huge collaborative effort among the many public and private partner agencies who participated in the various components of this research. Partners included the FHWA; Western Federal Lands Highway Division; US Fish and Wildlife Service; USDA Forest Service; U.S. Humane Society; the Sand County Foundation; the Center for Excellence in Rural Safety (University of Minnesota); Turner-Fairbank Highway Research Center; the Louis Berger Group, Inc.; Calonder Energy, Camrix Engineering; Goodson and Associates, Inc; ICx Radar Systems; Vikon International, Inc.; Xtralis, and the State Departments of Transportation in Alaska, California, Indiana, Iowa, Kansas, Maryland, Montana, Nevada, New Hampshire, New York, North Dakota, Oregon, Pennsylvania, Wisconsin, and Wyoming.

### **Senator Max Baucus Salutes WTI's Research Accomplishments**

During a ribbon cutting ceremony to celebrate WTI's new facilities, U.S. Senator Max Baucus commended WTI for its achievements and the national relevance of its transportation research. Baucus has played an integral role in WTI's growth since its inception, having advocated for language to designate WTI as a "University Transportation Center" in the last two Highway bills.

The Senator emphasized how initiatives to improve the national transportation system depend on advancements developed throughout the country. "The effort to figure out how to meet transportation needs, big and small, begins in places like WTI," Baucus said. "It starts right here with analytical thinking, innovation, and applied research. The Western Transportation Institute is a real credit to Montana and their research will help the nation develop a modern 21st century transportation network."



# Education

## Program Overview

To meet the needs of a dynamic transportation workforce, the Western Transportation Institute's Education Program supports a multidisciplinary educational environment with an emphasis on rural transportation issues. WTI's approach encompasses K-12 outreach to ensure a steady stream of students into the transportation pipeline, experiential learning at the undergraduate and graduate levels through innovative coursework and research opportunities, and extracurricular activities to support professional development at all levels. WTI staff provides mentorship to undergraduate students through the unique UTC-funded Undergraduate Research Program. Graduate students pursuing advanced degrees in transportation are supported financially through sponsored projects or UTC-funded fellowships. The Center also supports professional development activities for students at all levels such as paper presentations at national conferences. Continuing education opportunities for practicing transportation professionals enhance technical skills in a continuously changing environment. The combined initiatives of the Education Program encourage and support transportation workforce development along the entire education to career continuum. Selected activities from WTI's various UTC supported education functions are highlighted below.

### Professional Development

Road Ecology has become an integral part of the transportation landscape, and as such there is increasing demand from transportation professionals and others for continuing education on this relatively new subject. To help meet this demand, video from portions of a Road Ecology workshop held at the MSU Western Transportation Institute was posted on-line. The workshop was hosted by American Wildlands, the Wildlife Conservation Society and the Yellowstone to Yukon Conservation Initiative to share the latest in highway mitigation science, the successes of public-private partnerships, and recent innovations in road ecology. Workshop content is of interest to practicing transportation professionals, land resource managers, conservation groups, students, and the general public. Viewers have the option of signing up to receive continuing education units (CEUs) for the course. Twenty-three people completed the course over the past year.



# Education

## 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 sponsors two programs that directly support this goal, the Undergraduate Research Experience (URE) program, and a graduate student fellowship program. Highlighting the URE program, each year five undergraduates are competitively selected to participate in a unique academic year-long research opportunity. The program provides a one-on-one mentoring relationship with a professional researcher at WTI, paid hands-on research experience, assistance in developing valuable skills in data collection, analysis, and interpretation and instruction and experience in communicating research results to a broader audience.

Two students from the URE program this year were invited to present the results of their research to legislators and other state officials during a poster session at the state capitol rotunda in Helena. Andy Creighton (mentored by Laura Fay and Xianming Shi), an undergraduate in Chemical Engineering, presented his Deicer Longevity Study. Benji Tornberg (mentored by Mike Berry), a Civil Engineering undergraduate, presented his research titled “Performance of Reinforced Concrete made with Recycled Materials.”

Civil Engineering undergraduate Cody Glasnapp’s research paper “Fuel Cost Parameter in Transportation Demand Models,” was selected for the Institute of Transportation Engineers (ITE) District 6 best student paper award (mentored by Pat McGowen). District 6 is the largest district in ITE and includes 13 western states. Further, two students that participated on a two-phase URE project entitled “Design and Evaluation of a Pedestrian/Cyclist Sensing Device”, Penny Atkins and Gordon Nelson (mentored by Laura Stanley and Gary Schoep, respectively), jointly presented their project to the campus and local community during the 2009 Student Research Celebration at MSU. Penny also presented her research at the 2009 Image Conference and Exhibition in St. Louis, MO in July.

In addition to the opportunities provided through the URE and graduate student fellowship programs, WTI hires undergraduate and graduate research assistants to provide support on grant sponsored projects. In 2008-2009, forty-two undergraduate students and nineteen graduate students contributed to transportation research projects at WTI over the past year. Research assistants represented a myriad of academic disciplines and student research support added value to thirty-eight different projects (as outlined in the table on the following page).



# Education

## Student Research Involvement

October 08-September 09

Undergraduate Graduate

An Autonomous Sensing System for Water Quality Monitoring (NCHRP – IDEA)	2	
Avalanche Mitigation		1
Building Green: Environmentally Friendly Concrete	1	
Cyclic Pullout Testing	1	
Design and Evaluation of a Cyclist Sensing Device (URE)	2	
Development of A Cold Region Rural Transportation Research Test Bed in Lewistown, Montana	1	
Development of Toolkit for Cost-Benefit Analysis of Specific Winter Maintenance Practices, Equipment & Operations	1	
Deploying Portable Traveler Information Systems		1
Effects of Defensive Vehicle Handling Training		1
Establishing Best Practices - Snow/Ice Removal in California	2	1
Extend the Service Life of Concrete Bridge Decks	1	1
Field Investigation of Geosynthetics Used for Subgrade Stabilization	1	1
Fuel Cost Parameter in Transportation Demand Models (URE)	1	
Human Factors in Safety Research		1
I-90 Snoqualmie Pass -Pre-Construction Wildlife Monitoring Program, 2009-2010	1	1
Impacts of Barriers on Topeka Shiner Populations		1
Inhibitor Longevity & Deicer Performance Study – PNS	2	
Lab Investigation of Prewet Solid Deicing Salts Exposed to Traffic	1	
Long-term monitoring and DNA approaches for Restoring Landscape		1
Montana Rest Area Usage: Data Acquisition & Usage Estimation	1	1
Moose Wilson Road Traffic Management		1

# Education

## Student Research Involvement

Undergraduate Graduate

October 08-September 09

Professional Capacity Building for Communication Systems	1	
Rail Impacts on Grizzlies		1
Redding Incident Management Responder-Phase 2	2	
Reinforced Native Grass Sod		1
Replacing Thermal Sprayed Zinc Anodes on Cathodically Protected Steel Reinforced Concrete Bridges	1	
Rural EMS Drivers Safety Research Program		1
Rural Traveler Information (One-Stop Shop)	1	
Rural two-lane highways		1
Safe Passages Research (REU)	8	
Snow/Ice Removal Best Practices		1
US 93		1
UTC Lab Testing of Mixed Liquid Deicers	1	
UTC Right-Turn Lanes at Signalized Intersections: Traffic Control		1
UTC Rural EMS Drivers Safety Research Program: Phase 1 Feasibility Study	1	
UTC Systems Engineering Development & Integration Lab: Phase II	1	
Validating the Durability of Corrosion Resistant Mineral Admixture Concrete	6	
Weather Share Phase 2	3	

The Western Transportation Institute also continued its NSF-funded three-year Safe Passages Research Experience for Undergraduates (REU) Program in 2009, hosting an additional eight multidisciplinary undergraduate students from eight different colleges and universities nationwide. The interdisciplinary student teams produced final technical reports and presentations on each of their topics. The students represented Chemical, Electrical, Civil, and Environmental Engineering disciplines as well as Wildlife Ecology and the Natural Sciences.



# Education

## Extracurricular Activities

In 2008-2009, WTI participated in a number of events to increase student exposure to transportation related opportunities at MSU. WTI and the Montana Department of Transportation (MDT) jointly hosted a presentation and open house for interested MSU students from all majors in October. Approximately 50 students attended the event, which included tours of WTI's various research labs, including the driving simulator lab, the Transportation Research Application and Instrumentation Laboratory (TRAIL), the Systems Engineering Development and Integration Laboratory, the Corrosion and Sustainable Infrastructure Laboratory (CSIL), and the materials lab. Students also toured the MDT Design Unit. In addition to internal efforts, WTI participated in the Fall and Spring career fairs at MSU to support multidisciplinary student recruitment efforts to transportation research.

WTI actively supports a number of extracurricular activities that build interest in transportation. WTI Research Ecologist, Marcel Huijser, hosted a number of excursions to US Highway 93 in northwest Montana for approximately 75 students from the University of Montana.

## UTC Outstanding Student of the Year

Mike Sawaya was selected as the 2009 WTI/UTC Outstanding Student of the Year. Mike has extensive experience in the area of conservation biology. He received a Bachelor of Science in Wildlife Biology at the University of Montana in 1997. For the past eleven years, Mike has been studying bears, cougars and wolves using methods ranging from radio-telemetry to noninvasive genetic sampling. After receiving his Bachelors degree, he spent three years working on the Greater Glacier Bear DNA Project in Glacier National Park and then five years working for the Hornocker Wildlife Institute and the Wildlife Conservation Society on the Yellowstone Cougar Project in Yellowstone National Park. Mike's desire to gain a better understanding of the effects of transportation systems on wildlife populations and developing ways to mitigate those effects led him to pursue a graduate degree through the Road Ecology Program at the Western Transportation Institute. Mike is currently working on his PhD in Fish and Wildlife Biology in the Ecology Department at Montana State University. Mike's research with WTI focuses on evaluating the conservation benefits of wildlife crossing structures for black and grizzly bear populations in the Bow Valley of Banff National Park, Alberta. Mike's drive, energy, professionalism, and dedication to research in this area continually impress his research advisors and collaborators.





# Education

## Outreach

The Western Transportation Institute hosted sixteen high school students during the 2009 Summer Transportation Institute (STI) in June. The STI is a two-week intensive summer program that explores the interdisciplinary field of transportation and introduces participants to a wide range of careers and academic programs available to them after high school. The students live on the MSU campus during the program and participate in a diverse curriculum that includes a variety of hands-on laboratories, design and build competitions, field trips, and guest speakers. Participants in this year's STI came from various parts of Montana as well as New Mexico, Indiana, and California.

WTI also sponsored an "Introduce a Girl to Engineering" event during Engineering Week. Over one hundred Girl Scouts participated. The girls spent two hours among a variety of hands-on activities facilitated by MSU engineering student chapter organizations. The activities allowed students to experience the different engineering disciplines.

## Student Success Stories

WTI student research assistants are active and productive researchers. A large number of co-authored publications, project final reports, and professional conference presentations are produced each year by both undergraduates\*\* and graduates\* as listed below.

### Publications

Al-Kaisy, A. and \*Durbin, C. (2009) "Platooning on Two-Lane Two-Way Highways: An Empirical Investigation" *Journal of Advanced Transportation*, Volume 43, Number 1, pp. 71-88.

Al-Kaisy, A. and \*Karjala, S. (2008) "Indicators of Performance on Two-Lane Rural Highways: An Empirical Investigation" In *Transportation Research Record 2071*, *Journal of the Transportation Research Board*, pp. 87-97.

Yang, Z., 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. *Construction and Building Materials*, 2009, 23(6), 2283-2290.



# Education

## Student Success Stories *continued*

### **Presentations**

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## Education

### Awards and Recognitions

In addition to co-authored papers, WTI students received recognition for their contributions in a given field. WTI Graduate Fellow Tiffany Holland received a Dwight David Eisenhower Transportation Fellowship to present her work on wildlife mitigation measures along US Highway 93 at the Transportation Research Board annual meeting.

Graduate Fellow Eric Bendick produced a film about transportation effects on wildlife and mitigation measures developed to reduce those impacts. The film “Division Street” has been screened at over 20 locations throughout the country and received a number of awards at film festivals in the US and abroad. The success of Eric’s thesis film is helping to build public awareness about transportation impacts on the environment.

Justin Krohn, an undergraduate researcher at WTI for several years, was awarded a SMART scholarship by the Department of Defense over the summer. Only one of three students in Montana to receive such a scholarship, Justin said of his time at WTI, “my four years at WTI have been critical in my development.”



# Technology Transfer

## 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." Effective technology transfer is flexible and always evolving, taking advantage of new opportunities that complement or enhance established methods. WTI takes a proactive approach, and is willing to develop or sponsor specialized forums that reflect our expertise or address underserved needs of the stakeholders in the rural transportation community. As a result, our technology transfer program incorporates a variety of approaches, including:

- Partnership Development – partnership development, through outreach and mentoring activities enhances technology transfer through exchange of information and successful research practices
- Conferences and Workshops – in addition to sponsoring traditional face-to-face forums, we are expanding our use of webinars as a cost-effective method of connecting experts with local practitioners
- Publications and Presentations – WTI researchers continue to expand audiences for their publications and presentations, with a growing participation in the international research community
- Electronic Information Resources – Research resources on the WTI website continue to develop and the WTI newsletter has been converted to an electronic format to expand its reach.

The following sections describe our technology transfer initiatives in more detail, along with descriptions of a few highlighted success stories.

### Partnership Development

WTI conducts ongoing outreach to new and existing partners, in order to expand the research community and facilitate technology transfer through the exchange of expertise and ideas.

#### WTI Kicks Off North American Wildlife Crossing Design Competition

In response to an emerging critical priority for both transportation and natural resource agencies to make highways safer for both motorists and wildlife, WTI and the Woodcock Foundation initiated the North American Wildlife Crossing Design Competition (NAWCDC). The competition will raise international awareness and promote realistic context sensitive solutions for safe, efficient, cost-effective, aesthetically pleasing and environmentally friendly mitigation for the impacts of busy roadways that pass through important wildlife habitats.

Wildlife crossing structures, constructed either over or under transportation corridors, have had demonstrated success decreasing wildlife-vehicle collisions and maintaining connectivity for wildlife. The competition will select a North American site where the expansion of the highway will require a wildlife crossing structure. Competitors will be encouraged to explore creative new approaches, materials, and designs that address the fundamentals of transportation engineering and wildlife ecology. The competition is being developed to engage landscape architects, engineers, ecologists and others, in the interdisciplinary nature of road ecology with a real-time, in-situ application.

A kick off meeting in Banff National Park took place in October 2008 where partners WTI and the Woodcock Foundation met with various interested individuals and Dr. Nina-Marie Lister from Ryerson University, who is serving as a consultant on the project. This steering committee has been working to engage a broader community in the competition process and the partners are seeking additional experts to guide the development of the competition. Corporate, agency, professional, and foundation sponsors are also being contacted to help fund the competition. The competition, now nicknamed ARC – a reference to the arc diagram which is a visualization of actual wildlife crossing data, will begin in 2010.

# Technology Transfer

## Program Overview *continued*

### Nurturing Future Collaborators: WTI mentors New UTCs

As a long-established UTC with a history of successful research collaborations, WTI receives frequent requests to visit or meet with newer UTCs, who wish to learn about WTI's strategic, organizational, and management practices. While in some industries this might be viewed as creating and educating new competitors, WTI views this as a mentoring opportunity to nurture productive collaborators, and establish working relationships that will lead to future partnerships.

In past years, WTI has met with representatives from the University of Alaska, the University of Vermont, and Oregon State University, either prior to their federal designation as a UTC or shortly thereafter, in order to assist with their start-up activities. Most recently, WTI Director Steve Albert traveled to Oklahoma State University last fall to make a presentation on WTI's approach to research, and to share lessons learned on a variety of topics, including:

- Evaluating and selecting research opportunities
- Leveraging funding resources
- Communicating and working with sponsors
- Successful business development and marketing
- Exchanging information and technical expertise
- Building successful teams and partnerships

Response to these forums has been overwhelmingly positive. Several of the UTCs stated that WTI's guidance and recommendations helped get their research programs underway more quickly, while also encouraging them to develop a long-term approach. "Steve really gave us the 'big picture' – a greater understanding of the charge of a University Transportation Center," said Tony Dark, Director of the Oklahoma Transportation Center. "It gave us a great strategic sense," added Richard Watts, Research Director for the Transportation Research Center at the University of Vermont; "a way to think about our transportation research so it stays nimble and relevant."

Albert believes that the entire UTC system benefits from this mentoring process. "Every successful UTC builds up the national reputation and integrity of the program at large," said Albert; "Besides, each UTC has its own strengths and expertise that we can draw on when we work together in future collaborations – in the long run, we can achieve a lot more through our mutual success."



# Technology Transfer

## Conferences and Workshops

Throughout the year, WTI initiates, coordinates, and sponsors conferences and workshops in a variety of formats and sizes, in order to reach a broad range of professionals with an interest in the advancement of transportation research.

### **World Usability Day**

The Western Transportation Institute hosted a workshop on November 13, 2008 to mark World Usability Day. Transportation was the focus of the 2008 World Usability Day, an event founded in 2005 by the Usability Professionals' Association to ensure that services and products important to human life are easy to use and can be operated by users to achieve specified goals effectively and safely. A mode of transportation is considered "usable" if it is easily accessible and safely moves a wide range of people. Usable transportation modes must be sustainable and not conflict with the local ecology.

The workshop at WTI, one of over 200 that took place worldwide last November, included presentations on topics of safety, accessibility, and sustainability within different transportation modes, including road vehicles, public transit, bicycling and pedestrians. In addition to the wide variety of information, participants also toured WTI's suite of advanced driving simulators used to study driver behavior and traffic engineering.

### **WTI Hosts Webinars**

The Association of Pedestrian and Bicycle Professionals (APBP) sponsors various webinars throughout the year. The on-line courses provide an excellent opportunity to share knowledge and for high-quality professional training regarding the state-of-the-practice; further, Professional Engineers can use some of 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:

APBP Webinar: What's in the new AASHTO Guide for the Development of Bicycle Facilities?

This web briefing, hosted on October 15, 2008, presented the soon to be released (2009) version of the AASHTO Guide for the Development of Bicycle Facilities, the national guideline for planning and design of bikeways in the U.S. The new edition is the first to be developed as an NCHRP research project under the direction of a panel of experts.

Presenters Jennifer Toole, ASLA, AICP, and Eric Mongelli, P.E., both of Toole Design Group, explained to webinar participants how the new AASHTO edition differed from previous versions, and the major research and practice experience that prompts new design guidance among other changes. The twenty participants included WTI research staff and MSU students, as well as staff from the City of Bozeman, the Montana Department of Transportation, Gallatin County, and private engineering firms.



# Technology Transfer

## Conferences and Workshops *continued*

APBP Webinar: Bring SmartTrips Home

WTI hosted this webinar on December 17, 2008. SmartTrips programs use individualized marketing to change travel behavior by offering information and support for shifting some car trips to walking, bicycling and transit trips. These programs were pioneered in Europe and Australia and more recently have been implemented in Portland, OR, where the programs yielded a 9 -13% reduction in drive-alone car trips. Individual marketing is gaining momentum nationally and internationally. Two Non-motorized Transportation Pilot Program (NTPP) communities are implementing SmartTrips programs, and America Bikes is considering whether to include SmartTrips in its campaign platform for the next federal transportation bill.

WTI invited interested community partners to participate in the webinar, during which they learned about evaluating their own local community and what resources exist to determine if SmartTrips is the right approach. Effective materials, maps, and incentives were presented, as well as how to modify Portland's program for other locales. Webinar presenters were Linda Ginenthal, manager of the Transportation Options Division at Portland Department of Transportation, who oversees Portland's SmartTrips program, and Jessica Roberts, Alta Planning + Design, who is working to implement SmartTrips for NTPP communities.

Following the webinar, participants at WTI discussed how to apply the presentation concepts locally. "By bringing people together to view webinar presentations as a community and providing a forum for discussion afterwards, WTI is helping interested parties get to know each other and work towards a common goal," said Rebecca Gleason, WTI Researcher and organizer of the webinar. "Instead of individuals sitting in their cubicles watching the presentation alone, we can discuss potential ideas that may work in our community. Timely group discussions can prevent duplication of effort and help to prioritize local needs."



# Technology Transfer

## Conferences and Workshops *continued*

### **Road Dust Management Practices and Future Needs Conference**

More than ninety participants, representing three countries, gathered in San Antonio, Texas in November for the 2008 Road Dust Management Practices and Future Needs Conference. As the first conference of its kind, the event brought together researchers, vendors, practitioners, Local Technical Assistance Programs, and environmental groups to present, discuss, and prioritize current and future road dust management best practices and to create a “road map” for the future.

Focused on moving beyond small-scale experimentation and on to full-scale implementation of dust control, the ultimate goal was to generate a plan for achieving wider, environmentally sustainable, and cost-effective implementation of dust control Best Management Practices on unsealed roads and adjacent areas. The conference provided an unprecedented opportunity for these disparate groups to engage in a high level of cross-talk and dialogue and laid the ground work for better communication and outreach for the future.

Conference participant, Jerold Vincent, Tetra Technologies, Inc., emphasized the significance of the networking opportunities. “As a manufacturer of calcium chloride, a widely used dust control material, it was very beneficial to discuss common issues and practices with a full range of people from public officials, to vendors, to college professors.”

Keynote speaker presentations, each with insights from a national, research, vendor/construction, or maintenance perspective, provided participants with critical background information on past, continuing, and new dust management efforts. Keynotes included Michael Long, Chair, TRB LVR Committee, Oregon Department of Transportation; David James, University of Nevada, Las Vegas; Ron Wright, Idaho Transportation Department; and Ken Skorseth, South Dakota State University.

The conference was a huge success that culminated in the development of a strategic plan including performance measures, protocols, education, outreach, and the formation of a strong network of constituents. More than twenty vendors, consultants, government and university researchers, and university transportation center personnel committed to serve as champions to help move these conference outcomes forward.

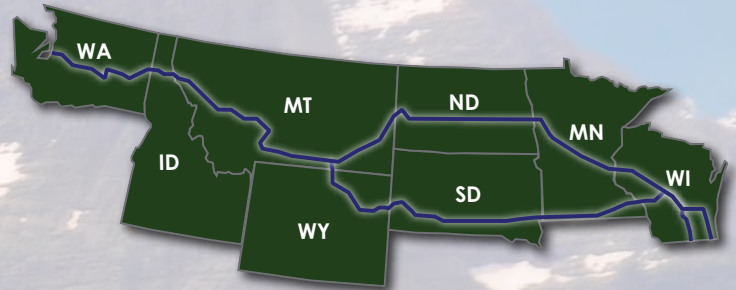
Co-chaired by Roger Surdahl, FWHA Central Federal Lands, and Western Transportation Institute’s (WTI) Steve Albert, the event was sponsored in part by EnviroTech Services, Inc.; North American Salt; Bureau of Indian Affairs; FHWA - Federal Lands Highway; National Park Service; United States Fish and Wildlife Service; United States Forest Service; and WTI. Additional input and planning assistance was provided by the United States Geological Survey; National Association of County Engineers; University of Nevada at Las Vegas; University of California at Davis; Department of Environmental Quality & Environmental Management in Clark County, Nevada; Local Technical Assistance Program; San Diego State University; Idaho Transportation Department; and Midwest Industrial Supply, Inc.



### WTI Hosts 2009 North/West Passage Annual Meeting

In March, the Western Transportation Institute hosted the 2009 North/West Passage Annual Meeting at the WTI offices in Bozeman. Steering committee members representing state departments of transportation (DOTs) from each member state, Washington, Idaho, Wyoming, North Dakota, South Dakota, Minnesota, and Wisconsin, came together for two days to discuss and review the strategic plan, program direction, and current projects including the North/West Passage Traveler Information Website, regional permitting, and expanded corridor-wide truck parking facilities.

Bob Koeberlein of Idaho Department of Transportation and WTI's Steve Albert presented "Rural IntelliDrive: Modifying Driver Behavior through Risk Management and Pricing." The presentation highlighted significant operational and travel-related challenges of the corridor, including the fact that 25% of all nationwide ice/frost



fatal crashes and 1 in 5 of all nationwide fatal crashes caused by animals occur in NWP states. IntelliDrive is an in-vehicle system that could be used to better inform drivers of safety risks in rural areas.

"Enhancing traveler safety and roadway operations has been the cornerstone of WTI research since its inception. A pioneer in the development and deployment of Intelligent Transportation Systems in rural locations, WTI has recognized that incremental steps, institutional support, and multi-jurisdictional coordination are key elements for Integrated Active Transportation System (IATS) solutions," remarked Bill Legg, North/West Passage Program Chair following the IntelliDrive presentation. "The North/West passage Steering Committee recognizes that driver behavior adaption and in-vehicle technologies may address rural safety and reduce fatalities, so we look forward to providing guidance to WTI on this project."

Committee members were able to tour WTI's suite of laboratories, and researchers were on hand to answer questions. This presented a unique opportunity for the participating states to see firsthand the resources WTI has on-site for advanced transportation research, including the Transportation Research, Applications, and Instrumentation Laboratory (TRAIL), the Driving Simulator Suite, and the TRANSCEND facility – all key components in the development of IntelliDrive.



# Technology Transfer

## Conferences and Workshops *continued*

### **Western States Rural Transportation Technology Implementers Forum Attracts Record Participation**

The 3rd Annual Western States Rural Transportation Technology Implementers Forum (WSRTTIF) in Mount Shasta, California was hailed as a success by attendees and organizers alike. This unique, two-day event 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.

The 2008 Forum had record participation with 39 attendees from seven western states (CA, ID, MT, NV, OR, WA, WY). WTI and Caltrans have formed a solid partnership to provide ongoing support, planning, and coordination, to ensure that the Forum will continue to grow and develop. The WSRTTIF Steering Committee includes Sean Campbell, Caltrans Division of Research and Innovation; Ian Turnbull, Caltrans District 2; Doug Galarus, Program Manager of the WTI Systems Engineering Development and Integration group; and Leann Koon, WTI Systems group Research Associate.

This year's presentations covered diverse topics. Doug Galarus of WTI gave an in-depth presentation 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 information they collect to assist maintenance personnel or feed messages to extinguishable message signs (EMS). Ted Bailey and Matt Neeley, ITS engineers for 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.

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 guidance. The extended presentation time, limited attendance, and informal atmosphere facilitated and 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.

The Forum also included equipment displays and a half day of technical demonstrations. The morning of the second day was dedicated to live demonstrations of Rural ITS technology and "hands-on" question and answer periods. Gary Schoep and Larry Hayden brought the Civil Engineering/WTI trailers from Montana to California to demonstrate their technological and communications capabilities. Additionally, 30 minute segments were reserved for briefings on specific Rural ITS research projects and product development, which included presentations by promising student assistants and other young professionals.





# Technology Transfer

## Conferences and Workshops *continued*

### **National Rural Summit on Traffic Safety Culture 2009**

Attempts to make our transportation system safer cannot succeed by just focusing on the driver, the vehicle, and the environment. The cultural factors that define our values and govern our behavior must also be considered. Following this integrated approach, Montana State University and the Western Transportation Institute, along with the AAA Foundation for Traffic Safety, the Federal Highway Administration, and the Montana Department of Transportation hosted the first annual National Rural Summit on Traffic Safety Culture on June 22, 2009.

More than 60 safety researchers, practitioners, and policy makers gathered in Big Sky, Montana to increase their understanding and unify their concern about the role of traffic safety culture on behavioral factors and attitudinal barriers to public and political acceptance of traffic safety interventions. Presenters and panelists from University Transportation Centers, state departments of transportation, and research centers around the country led sessions defining culture, its influence on behavior, and its use to improve traffic safety.

“This conference really gave focus, definition and attention to one of the toughest highway safety challenges we face in this country,” observed Joseph Toole, Associate Administrator for Safety, Federal Highway Administration. “As we look around the world and even in our own 50 states, it is apparent that there are places where people simply take greater personal responsibility for safety, and that is reflected in fewer deaths and injuries. In the USDOT, our hope is that we can learn from those examples and help others work toward such positive cultural changes.”

The summit led directly into the Driving Assessment Conference held June 22-26, 2009, also in Big Sky, Montana, allowing participants to maximize time and travel by attending both events. WTI hosted a dinner for the Driving Assessment Conference participants at the WTI offices in Bozeman and provided tours of the Driving Simulator Suite.



# Technology Transfer

## Conferences and Workshops

### **2009 National Rural ITS Conference, Advancing Rural ITS to the Next Level**

The 2009 National Rural Intelligent Transportation Systems (NRITS) Conference took place August 23-27 in Seaside, Oregon. Nearly 300 conference attendees had the opportunity to visit over 35 vendor displays and participate in a wide variety of sessions, professional tours, and activities.

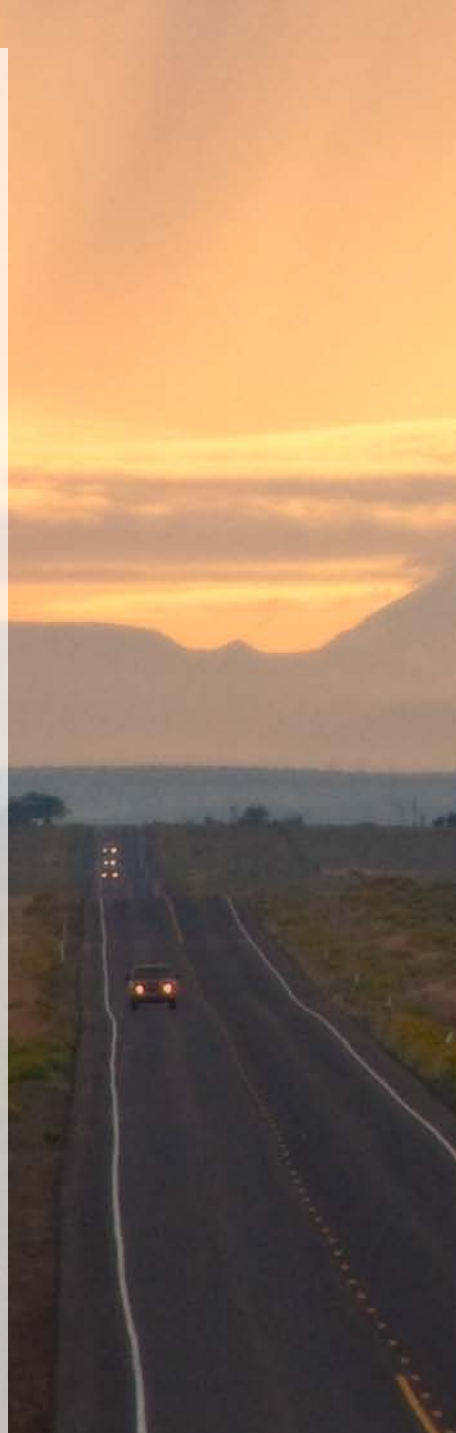
This year's conference theme was Advancing Rural ITS to the Next Level. Keynotes for the Opening Session, Dennis Foderberg, SEH Inc., Bill Legg, Washington State Department of Transportation, Shelly Row, ITS Joint Program Officer, USDOT, and WTI's Steve Albert, outlined the evolution of rural ITS. These experts guided attendees from rural ITS' beginnings, to current status, to goals and actions for the future.

"We are at a point where we need to move beyond rural ITS deployments that simply meet localized or isolated system needs," said Bill Legg in his presentation entitled Rural ITS - What's next? How do we get there? "We need to have a blue print on where we want to be and a clear vision on how that fits within an overall framework of national, regional, state, and local objectives for the next 10-20 years."

Armed with knowledge of the past, present, and future, conference participants then had three full days of more than 30 session opportunities, workshops, and tours, to learn more about what their organizations' roles in the future of rural ITS could be. WTI Engineers and Researchers Ahmed Al Kaisey, Doug Galarus, Laura Stanley, David Veneziano, and Shaowei Wang, along with WTI Director Steve Albert were scheduled session speakers. Their presentation topics included rural IntelliDrive applications, project deployment, personnel development, systems engineering, and integrating enforcement to address rural safety.

"The 2009 National Rural ITS conference was a great success, with many describing it as the 'best NRITS yet.' This was definitely the place to be, with participants from across the public and private sector engaged to focus on all aspects of how ITS can improve rural transportation," said Roderick MacKenzie, CTO & VP of Programs, Intelligent Transportation Society of America. "Strong participation, an excellent program and a beautiful location all combined to contribute to a great outcome. Kudos to the Oregon Chapter of ITS America for all their hard work in hosting a great meeting. I'm already looking forward to NRITS 2010 in West Virginia!"

This year's conference was sponsored in part by Athey Creek Consultants; CH2M Hill; David Evans and Associates; Federal Highway Administration; ITS America; ITS Canada; ITS Oregon; Oregon Department of Transportation; Open Roads Consulting, Inc.; Oregon Transportation Research and Education Consortium; Parametrix; PBS&J; Telegra, Inc.; Telvent Transportation, North America; USDOT ITS Joint Program Office; and the Western Transportation Institute.



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### **Christopher Strong**

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- Strong, C., Shi, X., and Ye, Z. "Safety Effects of Winter Weather: State of Knowledge and Remaining Challenges." *TRB 88th Annual Meeting Compendium of Papers DVD*, Transportation Research Board, Washington D.C., 2009. Paper number 09-3353.

### **David Veneziano**

- Veneziano, D., Wang, S., and Shi, X. "Relationship between Precipitation Variation and High-Risk Wet Accident Locations in the State of California." *TRB 88th Annual Meeting Compendium of Papers DVD*, Transportation Research Board, Washington D.C., 2009, Paper number 09-0540.

### **Nic Ward**

- Hofman, G.M., Summers, C.G., Ward, N.J., Bhargava, E., Rakauskas, M.E., & Holleschau, A.M. (in press). "Use of a Driving Simulator to Assess Performance under Adverse Weather Conditions in Adults with Albinism." *Archives of Ophthalmology*.
- Creaser, J., Ward, N.J., Rakauskas, M.E., Shankwitz, C., & Boer, E. "Effects of alcohol impairment on motorcycle riding skills." *Accident Analysis and Prevention*, 41, 906 – 913. 2009.
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- Rakauskas, M.E., Ward, N.J., Boer, E., Bernat, E., Cadwallader, M., Patrick, C. "Combined effects of alcohol and distraction on driving performance." *Accident Analysis and Prevention*, 40, 1742 – 1749. 2008.



## Jared Ye

- Ye, Z., Veneziano, D., and S. Lassacher. "Analysis of Manual Traffic Control at All-Way Stop-Controlled Intersections During Special Events." Proceedings of the 88th Annual Meeting of the Transportation Research Board, Washington DC.
- Ye, Z., Shi, X., Strong, C.K. "Use and Cost-Benefit of Weather Information in Winter Maintenance." Paper # MMC09-019. TRB Transportation Research Circular E-C135: Maintenance Management 2009 - Presentations from the 12th AASHTO-TRB Maintenance Management Conference. Annapolis, Maryland. July 19-23, 2009.
- Ye, Z., Shi, X., Strong, C.K., "Cost-Benefit Analysis of the Pooled-Fund Maintenance Decision Support System - Case Studies." Paper # MMC09-020. TRB Transportation Research Circular E-C135: Maintenance Management 2009 - Presentations from the 12th AASHTO-TRB Maintenance Management Conference. Annapolis, Maryland. July 19-23, 2009.
- Ye, Z., Shi, X., Strong, C.K., and Greenfield, T. H. "Evaluation of the Effects of Weather Information on Winter Maintenance Costs." TRB 88th Annual Meeting Compendium of Papers DVD, Transportation Research Board, Washington D.C., 2009, Paper number 09-2664.
- Ye, Z., Strong, C.K., Shi, X.\*, Conger, S., and Huft, D. "Benefit-Cost Analysis of Maintenance Decision Support System." TRB 88th Annual Meeting Compendium of Papers DVD, Transportation Research Board, Washington D.C., 2009, Paper number 09-2775.
- Ye, Z., and D. Lord, "Estimating the Variance in Before-After Studies." Journal of Safety Research, Vol.40, Issue 4, 2009, pp.257-263.

# Technology Transfer

## Presentations

### Steve Albert

- “Peering at the Future-Regarding Rising Fuel Prices and Transportation,” Wheeler Conference, Billings, MT, October 2008
- “Building Successful Partnerships,” 2008 ODOT-OTC Research Day, Oklahoma City, OK, October 2008
- “Why Dust Management is Important,” Road Dust Management Conference, San Antonio, TX, November 2008
- “Greater Yellowstone Rural ITS Priority Corridor-Rural AHS Case Study,” ITS World Congress, New York, NY, November 2008
- “Future of Transportation in Montana,” 2009 Economic Outlook Seminar, Helena, Great Falls, Havre, MT, January 2009
- “Conducting Research to Address Real World Challenges,” Bozeman Rotary Club, Bozeman, MT, January 2009
- “Future of Transportation in Montana,” 2009 Economic Outlook Seminar, Kalispell, Billings, Butte, Bozeman, MT, February 2009
- “Rural Intellidrive: Modifying Driver Behavior Through Risk Management and Pricing,” NW Passage Meeting, Bozeman, MT, March 2009
- “Focusing On the Next Generation and Rural Intellidrive Where We Are At,” NRITS 2009 Conference, Seaside, OR, August 2009
- “Future: Culture, Policy, Technology Integration,” NRITS 2009 Conference, Seaside, OR, August 2009

### Ahmed Al-Kaisy

- “Beyond 3D: Progressive Visualization for Geometric Design,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Static Warning Signs of Occasional Hazards: Do They Work?” The Canadian Multidisciplinary Road Safety Conference, Saskatoon, Canada, June 2009
- “Weather Adaptive Traffic Control: Practice, Technology, and Future Outlook,” National Rural ITS (NRITS) Conference 2009, Seaside, Oregon, August 2009

### Rob Ament

- “National Wildlife Vehicle Collision Reduction Study: Results,” Cabinet-Purcell Mountain Corridor Project Annual Meeting, Cranbrook, BC, October 2008
- “Steep Cut Slope Composting; Field Trials and Evaluation,” International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009

### Michael Berry

- “Performance of 100% Fly Ash Concrete with 100% Recycled Glass Aggregate,” TRB 2009 Annual Meeting, Washington, DC, January 2009
- “An Alternative “Green” Concrete Produced Without Portland Cement,” World of Coal Ash Semi Annual Meeting, Lexington, KY, May 2009

### Jaydeep Chaudhari

- “Havre Coordination Plan,” Havre TAC meeting, Havre, MT, February 2009
- “Rural Transportation Districts’ Research Needs,” California Department of Transportation Rural District meeting, (Video Conference) March 2009

### Anthony Clevenger

- “Mitigating Habitat Fragmentation,” Portland Zoo Public Presentation, Portland, OR, October 2008
- “The Changing Landscape of Transportation: Designing Roads to Conserve Wildlife Populations,” Portland Zoo Public Presentation, Portland, OR, October 2008



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## Presentations *continued*

### **Eli Cuelho**

- “Subgrade Stabilization Project in Montana,” 2009-Annual TRB Conference, Washington, DC , January 2009
- “Field Construction of Trafficking of an Unsurfaced Geosynthetic-Stabilized Road,” Geosynthetics 2009 Conference, Salt Lake City, UT, February 2009

### **Jaime Eidswick**

- “Building Public-Private Partnerships for Transportation,” Building Public-Private Partnerships for Transportation, Anchorage, AK , June 2009

### **Douglas Galarus**

- “Development of a Prototype Traveler Information System for Rural Work Zones-Parts 1, 2, &3,” 15th World Congress on ITS, New York, NY, November 2008
- “Development of A Dynamic Message Sign Specification for Caltrans,” 15th World Congress on ITS New York, NY, November 2008
- “Rural TMC-TMS Communications-An Evaluation of Alternatives,” 15th World Congress on ITS, New York, NY, November 2008
- “Wireless Network Solutions-Moving Beyond Fiber,” NRITS-2009, Seaside, OR, August 2009
- “Personnel Development for Next Generation IRS Systems,” NRITS-2009, Seaside, OR, August 2009
- “Tech Transfer From the Implementer’s Perspective,” NRITS-2009, Seaside, OR, August 2009
- “An Application of Systems and Software Engineering Process to Project Development,” NRITS-2009, Seaside, OR, August 2009

### **Susan Gallagher**

- “Safe Passages Research Experience for Undergraduates Program,” NSG Education Awardees Conference, Washington, DC, February 2009

### **Rebecca Gleason**

- “Bicycles: A Sustainable Transportation Choice,” 2008 World Usability Day Conference, Bozeman, MT, November 2008
- “Guide to Promoting Bicycling on Federal Lands,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Bicycle on Federal Lands: A Win- Win Investment,” George Wright Society Conference Portland, OR, March 2009
- “Bozeman Area Bicycle Board’s Work and Local Bicycling and Transit Opportunities and Challenges,” Sustainable Transportation - What Does it Mean to You - Gallatin Valley Bike Club, Bozeman, MT, May 2009
- “Challenges Faced by Federal Land Managers with Regard to Trails and Bicycling and Solutions Implemented,” Montana’s Mountain Bike Landscape, Bozeman , MT, June 2009

### **Marcel Huijser**

- “Wildlife-Vehicle Collisions, Impacts and Mitigation measures,” University of Montana, Missoula, MT, November 2008
- “Wildlife-Vehicle Collisions, Impacts and Mitigation measures,” Montana State University, November 2008
- “Wildlife-Vehicle Collisions, Impacts and Mitigation measures,” Montana Fish Wildlife and Parks Meeting, Kalispell, MT, March 2009
- “Design and Implementation of Selected Mitigation Measures and Cost-benefit Analysis,” Transportation Research Board Webinar, Washington D.C., May 2009
- “Wildlife-Vehicle Collisions, Impacts and Mitigation measures,” Town meeting-Living with Wildlife Advisory Board, Durango, CO, June 2009
- “New FHWA Manuals for Mitigation Measures aimed at Reducing Wildlife-Vehicle Collisions and Providing Safe Crossing Opportunities,” International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009



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## Presentations *continued*

- “Quantitative Comparison of the Reliability of Animal Detection Systems and Recommended Requirements for System Reliability,” International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009
- “Cost Justification & Examples of Cost-Benefit Analyses of Mitigation Measures aimed at Reducing Collisions with Large Ungulates in the US and Canada,” International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009

### **David Kack**

- “Evaluating the Use of Route Match Software in Billing MET Transit: An Overview of the Skyline Transit system,” 18th Conference on Rural Public & Intercity Bus Transportation, Omaha, NE, October 2008

### **Angela Kociolek**

- “Motorists as Citizen Scientists: The Benefits of a Wildlife Reporting Website,” International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009

### **Robert Long**

- “Applied Wildlife Research in the Washington Cascades,” Barn Beach Preserve, Leavenworth, WA, February 2009
- “Western Transportation Institute: Applied Wildlife Research in the Washington Cascades,” Presentation to Seattle Philanthropic Foundations, February 2009
- “Western Transportation Institute: Applied Wildlife Research in the Washington Cascades,” Meeting of the Washington Wildlife Habitat Connectivity Working Group, Cle Elum, WA, April 2009
- “Monitoring the Effectiveness of Wildlife Crossing Structures: The I-90 Snoqualmie Pass East Project,” Yakima Basin Science and Management Conference, Ellensburg, WA, June 2009
- “The Cascades Carnivore Connectivity Project: Evaluating Habitat Connectivity for Carnivores in Washington’s Cascades Mountains,” Presentation to staff of North Cascades National Park Complex, Sedro Woolley, WA, August 2009

- “Noninvasive Methods for Surveying and Monitoring Martens, Fishers and Sables,” 5th International Martes Symposium, Seattle, WA, September 2009
- “The Importance of Pre-Construction Data for Planning and Evaluating Wildlife Crossing Structures,” Poster presented at the International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009
- “Modeling and Communicating about Connectivity in Washington and Neighboring Landscapes,” Wild Links 2009, Osoyoos, BC, September 2009

### **Paula MacKay**

- “Applied Wildlife Research in the Washington Cascades,” Barn Beach Preserve, Leavenworth, WA, February 2009
- “The Importance of Pre-Construction Data for Planning and Evaluating Wildlife Crossing Structures,” Poster presented at the International Conference on Ecology and Transportation (ICOET), Duluth, MN, September 2009

### **Tongyan Pan**

- “Validation of Rehabilitation Statistics to Extend Service Life of Concrete Bridge Decks,” Kick off meeting for Service Life of Concrete Bridges, Sacramento, CA, October 2008
- “Competant Molecular Dynamics Analysis of Chistle Transport in Hydrated Cement product,” 2009-Annual TRB Conference, Washington, DC, January 2009

### **Michael Sawaya**

- “Bears and Barbed Wire: Banff’s DNA Monitoring of Crossings,” 2009-Annual TRB Conference, Washington, DC, January 2009



# Technology Transfer

## Presentations *continued*

### **Xianming Shi**

- “Benefits and Costs Associated with Maintenance Decision Support System,” MDSS Pooled Fund Technical Panel Meeting, Sioux Falls, SD, October 2008
- “Impact of Airport Pavement Deicing Products on Aircraft and Airfield Infrastructure,” The Partners in Environmental Technology Technical Symposium, Sponsored by SERDP and ESTCP under the U.S. Department of Defense, Washington, DC, December 2008
- “An Autonomous and Self-Sustained Sensing System to Monitor Water Quality at Distributed Point Locations,” The Partners in Environmental Technology Technical Symposium, Sponsored by SERDP and ESTCP under the U.S. Department of Defense, Washington, DC, December 2008
- “Benefit-Cost Analysis of Maintenance Decision Support System,” 2009-Annual TRB Conference Washington, DC, January 2009
- “Safety effects of Winter Weather: State of Knowledge and Remaining Challenges,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Laboratory Evaluation of Alternative Deicers: the Path to Decision-Making based on Science and Agency Priorities,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Relationship Between Precipitation Variation and High-Risk Wet Accident Locations in the State of California,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Evaluation of the Effects of Weather Information on Winter Maintenance Costs,” 2009- Annual TRB Conference Washington, DC, January 2009
- “Pooled Fund Research Professor Inhibitor Longevity and Deicer Performance Study,” Pacific Northwest Snowfighters Association Spring Meeting, Spokane, WA, May 2009
- “Feasibility Investigation of Self-healing Cementitious Composite Using Oil Core/Silica Gel Shell Passive Smart Microcapsules,” Invited paper by the 2nd International Conference on Smart Materials and Nanotechnology in Engineering (SMN2009), Weihai, China, July 2009

### **Laura Stanley**

- “Conventional Verses Moving Map Navigation Methods: Efficiency and Safety Evaluation,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Teen Driver Education at WTI,” Montana Traffic Education Conference, Great Falls, MT, April 2009
- “WTI Tour of Driving Simulator Suite,” Driving Assessment Conference, Big Sky, MT, June 2009
- “Black Box Technology in Transportation Safety,” NRITS-2009, Seaside, OR, August 2009
- “Augmented Speed Enforcement,” NRITS-2009, Seaside, OR, August 2009

### **David Veneziano**

- “Application of Integrated Corridor Management to Rural areas,” 2008 ITS World Congress, New York City, NY, November 2008
- “Analysis of Manual Control of All-Way Stop Controlled Intersections during Special Events,” ITE Conference on Planned & Unplanned Special Events, Phoenix, AZ, March 2009
- “COATS: A Decade of Rural ITS and Weather Data Transportation Applications,” NRITS-2009, Seaside, OR, August 2009

### **Shaowei Wang**

- “An Application of Systems and Software Engineering Process to Project Development,” NRITS-2009, Seaside, OR, August 2009
- “Caltrans WeatherShare System: A Look at Design, Development, and Usability,” 2009 Western States Rural Transportation Technology Implementers Forum, Mount Shasta, CA, June 2009

### **Nic Ward**

- “Retrieving Traveler Information on a Mobile Phone,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Future Synergy,” PATH, Caltrans Collaboration meeting, Richmond, CA, May 2009

### **Zhirui Ye**

- “Analysis of Manual Traffic Control at All-Way Stop Controlled Intersections During Special Events,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Special Event Traffic Management in Small Communities,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Benefit -Cost Analysis of Maintenance Division Support System,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Evolution of the Effects of Weather Information on Winter Maintenance Costs,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Safety effects of Winter Weather: State of Knowledge and Remaining Challenges,” 2009-Annual TRB Conference, Washington, DC, January 2009
- “Cost-Benefit Analysis of the Pooled-Fund Maintenance Decision Support System: Case Studies,” Transportation Research Circular, No. E-C135, Presented at 12th AASHTO/TRB Maintenance Management Conference, Annapolis, MD, July 2009
- “Use and Cost Benefit of Weather Information in Winter Maintenance,” Transportation Research Circular, No. E-C135. Presented at 12th AASHTO/TRB Maintenance Management Conference, Annapolis, Maryland, July 2009



# Technology Transfer

## Websites and Electronic/Internet Resources

Electronic information sharing resources are cost-effective tools for making research findings readily accessible to a wide audience. The WTI website has long been a cornerstone of our technology transfer program. Based on its success, we are in the process of implementing several promising expansions to our program, including a second website, a rural transportation clearinghouse, and a rural transportation blog. This section will summarize our progress on each of these projects, lessons learned, and remaining challenges to full implementation.

### Websites

Over the course of the past year, WTI launched a new research focused website at [www.westerntransportationinstitute.org](http://www.westerntransportationinstitute.org) to provide current research information and a forum for collaboration between transportation professionals (see “Rural Transportation Clearinghouse” below). This site complements our original, and more education focused website located at [www.wti.montana.edu](http://www.wti.montana.edu). The education site uses the same template as the Montana State University and College of Engineering websites and centers on our partnership with the MSU campus. As such, it is geared towards students, promoting the student fellowship program and employment opportunities.

The new website focuses on the research program, and making research results readily available. The decision to host two separate sites was driven by search engine optimization; the new website will be more prominent and accessible for users outside of the MSU campus, thus increasing the chances of our research results reaching the broadest possible audience. The website has also provided an opportunity to expand the amount of information available about our rural mission, each of our focus areas, and our expanded laboratory facilities.

### Rural Transportation Clearinghouse

Creating online forums for research professionals to collaborate and share research results has been a long-term goal of the technology transfer program at WTI. The rural clearinghouse is envisioned to be a one-stop-shop for aggregating documents, conference presentations and other content not currently posted on line by RIP or TRIS. Research professionals will be able to post and download relevant documents and even rate the documents on their usefulness. When fully implemented, the rural transportation blog will be a more informal forum for research professionals to share research results, lessons learned and provide ad hoc assistance to each other through bi-directional communication.

On the surface creating these online forums appeared to be a straightforward process. Given that the technology is readily available, we envisioned a short-term project that included buying the server and associated equipment, installing and configuring software, and publicizing the availability of the resource. WTI has completed the first task, and devoted considerable effort towards the second. However, we have learned that developing and managing a quality resource that is accurate and up-to-date on an ongoing basis is a much more complex process than originally anticipated.

The rural clearinghouse first hit a roadblock when the software developer asked WTI to create a hierarchy of key words that would be used to categorize the documents. We solved this problem by utilizing the transportation research thesaurus, developed by the Transportation Research Board to categorize the documents in the TRIS and RIP databases. This seemed like an excellent solution as the terms were already being used by research professionals utilizing TRIS and RIP.

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The next challenge came when the software developer asked us to validate the key word categorization results. A developer would enter a test document into the software, it would categorize the document based on a complicated algorithm, and WTI staff members would check to determine if the document was listed in the proper key word categories. The Communications staff members charged with implementing this project quickly realized that they lacked the depth of technical knowledge necessary to classify the documents to the level of detail required by the key word categories. Did the document about deicers also relate to management and if so management of what? Personnel? Equipment? While this issue could be resolved by having research staff members read and classify every document, this option was found to be too time-consuming and expensive, and would jeopardize the long-term sustainability of the project.

However, we have partially resolved this issue by using test documents from the TRIS database that already had key words assigned. The software proved it could categorize the documents accurately only 70% of the time. So as we began to enter documents into the database we had to accept that 30% of the documents would not be categorized correctly and thus might not be found by the users.

We continue to work to improve the accuracy of the clearinghouse. We have added a feature to the clearinghouse that allows researchers to select their own key words when uploading a document, and we are evaluating its effectiveness. Since researchers have a unique perspective on their own work, they may categorize it very differently than the average website user. This introduces yet another variable in our increasingly complex categorization schema.

We are encouraged by our progress, and at press time, the software developer was preparing to install the software on the WTI server and make the application live. To ensure that we offer a high quality and valuable resource, we will address other important issues in the coming year, such as copyright, determining the worth of documents and how to keep spam documents from being posted.

## **Rural Transportation Blog**

In parallel to the clearinghouse project, WTI began developing the rural transportation blog by purchasing and installing a software package that manages online communities. As soon as the blog was launched, a large roadblock appeared--researchers are already very busy conducting their actual research, so they did not have enough time to also write meaningful blog content. The blog was up and running, but with no useful content. Until there is research news posted that will attract the attention of readers, we cannot reach our vision of experts in the field finding each other, sharing knowledge, and having meaningful dialogue.

As an initial step, an administrative staff member has begun to post conference presentations and other related content on the blog. However, the blog is so far limited to one-way communication, due to the tight security restrictions, which are necessary to keep out the spammers who want to fill up the site with advertisements and adult content. Over the course of the next year, we will focus on the primary issue of how researchers can be encouraged within their busy schedules to fill the blog with state-of-the-practice technical content and lessons learned. In this way, the blog can begin to transition into an informative, valuable, and interactive resource.



# Technology Transfer

## Newsletter

November 2008 marked the first issue of WTI's newsletter in electronic format. Reaching an audience of approximately 2,900 with each mailing, four issues of the e-newsletter have been published in the last 12 months. Increasing the frequency of the publication has enabled WTI to report research results and outreach in a timelier manner. In addition, production of the newsletter in this format is faster and more efficient, resulting in substantial cost savings. WTI Communications and Information Technology staff successfully overcame initial distribution and security challenges, achieving targeted audience delivery by the third issue.

## Success Stories: Speaking Out for Rural America

Part of putting research results into action is bringing attention to unaddressed problems and needs. Research will not be funded, and solutions will not be deployed if their importance is not recognized by stakeholders and policymakers.

As part of our Technology Transfer program, WTI conducts extensive outreach to champion rural transportation issues to a wide range of audiences. This year, we have several examples of our successful efforts to raise awareness at the regional, state and national level.

### National Rural Summit on Traffic Safety Culture 2009

In 2009, Montana State University and the Western Transportation Institute, along with the AAA Foundation for Traffic Safety, the Federal Highway Administration, and the Montana Department of Transportation hosted the first annual National Rural Summit on Traffic Safety Culture. This event provided an opportunity to bring national attention to the unique transportation safety issues facing rural America, such as the growing level of traffic in these regions and the disproportionate number of fatal crashes that occur on rural highways. Moreover, WTI used the forum to initiate collaborations between transportation agencies and research centers to integrate safety initiatives with the latest research in driving behavior.

### Economic Outlook Seminars

In 2009, WTI Director Steve Albert and Program Manager David Kack served as keynote speakers for the Montana Economic Outlook Seminar, which is presented by The University of Montana and the Bureau of Business and Economic Research (BBER), and cosponsored by local area Chambers of Commerce. Albert and Kack traveled to nine cities around the state to help educate Montana leaders on critical economic issues, and facilitate an exchange of information and ideas among participants. Their role was to focus on the link between a strong transportation network and a healthy economy. For WTI, it was an opportunity to emphasize the importance of the rural transportation network in Montana, where 80% of the roadways are rural highways and serve as the backbone to economic generators such as freight movement and tourism. Participants also learned more about the linkages between transportation enhancements and national economic recovery initiatives.



