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MAKING RURAL TRANSPORTATION AND TRAVEL SAFER, MORE EFFICIENT, AND MORE CONVENIENT

Conducting Research to Solve Everyday Challenges

Our last newsletter (August 2001: Issue 1, Volume 5) described how the Western Transportation Institute had refocused its research agenda by defining the four principal program areas of Weather and Winter Mobility, Transportation Management/Public Safety, Travel and Tourism, and Pavements and Materials. This has proven to be a successful framework for our research and demonstration projects. In addition, we continue to strengthen our research capabilities through the development of a multidisciplinary staff of students, professionals and associated faculty from engineering (mechanical, industrial, and civil), computer science, psychology, fish and wildlife, business, biology and economics. As a result of these efforts, WTI/MSU can successfully spearhead and manage a broad range of activities that are focused on "conducting research to solve everyday challenges."

The diversity of our research agenda will be clearly evident as you read the newsletter. In this issue WTI will provide updates on ongoing projects targeted at mountain pass winter operations, National Park transportation challenges, ITS and tourism, and innovative pavement and material solutions. The newsletter will also introduce new projects including collaborative measures to address animal-vehicle conflicts, development of "smart" tourist corridors, and applications of new technologies.

In addition to describing selected research activities, this issue will highlight our outstanding students and their accomplishments, as well as outreach activities such as the highly successful national Context Sensitive Design Conference.

In This Issue

Highway Repairs in Montana: Evaluating Materials and Methods for Sealing Pavement Cracks

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WTI has collected sufficient data from its research on sealing cracks in asphalt pavements to release preliminary conclusions on the effectiveness of certain sealant materials and sealing techniques.

Sealing or filling cracks in highway asphalt to prevent the intrusion of water into pavement structure has long been an accepted practice of the Montana Department of Transportation (MDT). The goals of this research project are to establish the most economical and effective methods of sealing cracks, and to better determine crack sealing's role within Montana's pavement management system (PvMS).

First begun in 1995, this study has involved the construction of four experimental test sites within larger crack sealing projects. The four sites are located on I-15 and I-90, major interstates with significant private and commercial vehicle traffic.

These test sites have included combinations of eleven sealant materials and six sealing techniques. Monitoring of the test sites includes visual inspections (for all of the sites) and nondestructive structural readings and surface distress identification under Montana PvMS (for one location). One expectation of these inspections is an estimation of crack sealing's useful life.

The two test sites near Conrad and Dutton, Montana were the first established. Cracks at these sites were filled in 1995 and 1996; annual condition surveys and/or crack inventories have yielded approximately six years of data. The cracks at the remaining sites near Tarkio and Helena, Montana were filled in 1998; these sites have yielded three years of data to date. The Conrad, Dutton, and Tarkio site evaluations are complete; the evaluation of the Helena site (which includes the additional tests for structural readings/surface distress) will continue through 2004.

A key component of the evaluation process was the identification of sealant failures. Modes of sealant failure were categorized as material, construction, or combination failures. Each of these failures permitted water to intrude into the pavement structure. During evaluations, failures were measured and recorded. Failures were then quantified for each crack as a percentage of total crack length.

With evaluations at three of the sites complete, the 2002 Annual Report for this project includes the following conclusions on material and technique performance:

- Similar performance has been observed for all sealant materials with cone penetration values (ASTM D 5329) greater than 90; all of these sealants remained flexible in cold temperatures.
- Routing transverse cracks, rather than leaving the cracks unrouted, improved the performance of the sealants.
- Routing does not appear to be necessary for sealing longitudinal cracks; "Band-Aid" and "Capped" configurations both performed well for three to four years of service.
- Construction workers operating the routers tended to prefer the shallow reservoir configuration, rather than the square reservoir configuration. When cutting the shallow reservoirs, the routers were easier to handle and the cracks easier to follow.
- One of the most interesting conclusions resulted from observations at the Helena site. The highest failure rates were recorded during the coldest months of the year when cracks are the widest. However, summer heat and the closing of cracks due to expansion of a pavement will tend to "heal" sealed pavements. Unfortunately, this healing occurs in Montana after what is typically the wettest period of the year. Consequently, any benefits related to the healing are reduced, as water will have the opportunity to enter the pavement prior to the sealing.

The goal of the structural analysis tests, performed only at the Helena site, is to determine whether the practice of sealing pavement cracks contributes to the long-term structural integrity of highway pavements. Semiannual evaluations are made with a falling-weight deflectometer (FWD); evaluations are made in spring and fall to provide a "wet" and "dry" evaluation each year. Preliminary results indicate that both sealed and unsealed test sections remain in good structural condition, and that the unsealed control test section is not yet showing greater structural deterioration than any of the sealed test sections. Since the evaluations at the Helena site are ongoing, investigators propose that the FWD tests may yield more conclusive data if testing could be expanded to occur at additional sites, similar temperatures, or for longer durations.

Another milestone achieved by this project in the last year is the creation of a single database that contains all of the results from each of the four test sites. Over the life of the project, data had been saved in a variety of incompatible formats. Thanks to the work of an industrious graduate student, Suresh Ganeshan, every crack at every site has been assigned an identification number and entered into the new database. Project researchers now have easy access to all data, and perhaps more importantly, they can use the database to analyze results across the four sites.

Saco Bridge Reconstruction Project Offers Unique Research Opportunity

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The resistance of concrete bridge decks to cracking is of great importance to their performance. In recent years, alternatives to traditional materials and building techniques have been developed and tested. However, researchers have had difficulty comparing performance data between bridges built using traditional and new methods, because of the influence of too many other variables. WTI is launching a new research project that takes advantage of a unique opportunity to field test three types of bridge deck construction under almost identical conditions.

Near Saco, Montana, there are three bridges on Route 243 scheduled for replacement. The bridges have the same dimensions and are less than 1/10 of a mile apart from one another. In addition, one contractor will be selected to build all of the bridges. Since the three new bridges will experience the same vehicular loads and environmental conditions, and have a common quality of construction, the Montana Department of Transportation (MDT) recognized a chance to evaluate the relative performance of bridge decks having different designs.

The new bridges will be constructed with three different types of concrete bridge decks:

- a conventionally reinforced deck made with standard concrete, designed and constructed following standard practices of MDT's Bridge Bureau,
- a deck with reduced reinforcement made with standard concrete, designed following the empirical design approach presented in AASHTO standard specifications, and
- a conventionally reinforced deck made with high performance concrete (HPC) developed following FHWA guidelines.

WTI will conduct a research project to investigate the performance of the three design methods. Researchers will study the structural behavior of these decks under live loads and their long-term durability under environmental and vehicular demands.

The objective of the live load tests of the bridge decks is to determine how each type of deck structurally transfers wheel loads from their point of application into the supports and to determine the magnitudes of the stresses and strains that develop in the decks as they perform this function. The live load tests will be conducted using at least two types of vehicles (i.e. a 4-axle single unit and a 5-axle tractor, semi-trailer). The first set of live load tests will be conducted immediately after construction of all three bridges. The second set of tests will be conducted two years later, near the end of the project.

Long-term monitoring will take several forms. Embedded strain gauges will be used to measure the magnitude of strains resulting from drying shrinkage, temperature changes, freeze-thaw cycling when saturated, settlement, and creep. A history of the vehicle loads experienced by the decks will be generated by continuously monitoring a limited number of channels of the live load instrumentation in the decks. Settlement and movement of the bridge support structures and structural elements will periodically be monitored by WTI to check the position and elevation of reference points on each bridge structure. Finally, the development of cracks in the decks will be monitored by periodically mapping the cracks.

Ultimately, the various data collected on the performance of each deck will be collectively used to develop a comprehensive explanation of deck behavior under live loads and environmental fluctuations. In addition, researchers will try to determine the possible impact of those demands on the service life of the decks. The eventual

Bridge 1

Bridge 2

Bridge 3

benefits of this research and analysis will be a better understanding of structural behavior that may influence structural design, and perhaps, an indication of the deck system that offers best long-term performance in the most cost-effective fashion.

Saco Public High School to Benefit from Research Project

The long-term monitoring of the performance of the three bridges requires that researchers have access to ambient air temperatures and other external weather conditions at the bridge sites. To obtain this data, WTI has purchased a remote weather station that has the ability to monitor temperature, humidity and barometric pressure, as well as wind speed and direction. Information will be stored on site and downloaded by WTI using the Internet.

The weather station will be physically located at Saco High School. Using a predetermined IP address, students will have free access to all data collected by the weather station through the Internet. The information will be a valuable resource to students in science classes and for other school projects.

WTI to Evaluate Wildlife Crossings on US 93

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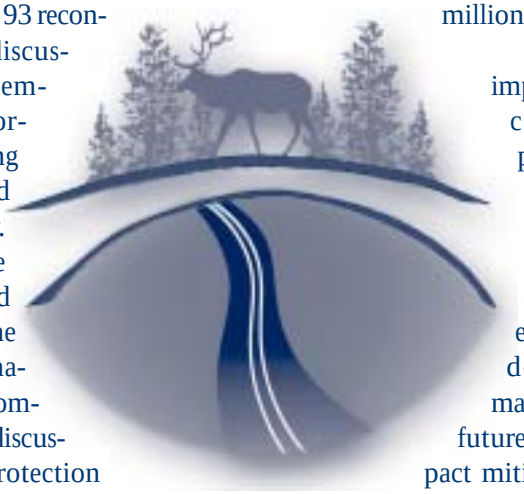
WTI has been selected to develop and manage an evaluation of planned wildlife crossing structures on US Highway 93 (US 93). The magnitude of the reconstruction project provides an excellent opportunity to not only study how well these crossing structures work, but also to develop recommendations that can guide future highway projects.

The US 93 reconstruction project crosses the Flathead Indian Reservation along the west side of the Rocky Mountains. This land is the home of the Confederated Salish and Kootenai Tribes (CSKT) of the Flathead Nation. Throughout the US 93 reconstruction design discussions, the CSKT emphasized the importance of maintaining their cultural and home land integrity. Out of respect to the people, wildlife, and land that support the holistic spirit and nature of the CSKT community, the design discussions prioritized protection of natural processes such as hydrologic function, seed/plant dispersal, and movement of fish and wildlife between habitat areas.



The Flathead Reservation is home to various wildlife species such as grizzly bears, deer, antelope, elk, coyote, painted turtles, bighorn sheep, numerous fish and bird species, amphibians and reptiles. For this reason, fish and wildlife crossings became a major focal point in US 93 reconstruction design process. The CSKT took a pro-active approach and recommended that consulting engineers from Skillings-Connelly, Inc. and landscape architects from Jones and Jones Architects work with wildlife biologists to develop design guidelines for wildlife crossings that respected tribal priorities.

On December 20, 2000, the CSKT, the Federal Highway Administration (FHWA), and the Montana Department of Transportation (MDT) signed a Memorandum of Agreement allowing for the reconstruction of US 93 from Evaro to Polson. The initial design of this 56.3 mile project includes an unprecedented 42 fish and wildlife crossing structures and 14.7 miles of deer proof fencing. The projected cost for this wildlife mitigation component of the reconstruction project is more than nine million dollars.

Given the scope, it is important that a scientifically-based research plan be implemented to evaluate the effectiveness of the US 93 wildlife crossing structures and that the evaluation results are developed into best management practices for future wildlife-highway impact mitigation projects. The CSKT and MDT selected WTI to coordinate and manage this research effort.

WTI has outlined a draft ten-year plan (three pre-construction, three during construction, three post-construction, one data analysis) for the US 93 wildlife crossing structure evaluation. The research plan centers on comparisons of data relating to highway impacts on resident wildlife populations collected before and after construction of the crossing structures.

Specifically, the drafted goals of the long-term project are:

- determine what effect US 93 wildlife crossing structures have on the frequency of animal vehicle-collisions

• determine what effect US 93 wildlife crossings have on mitigating fragmentation of animal populations

• identify best management practices and further research

As a first step, MDT has contracted with WTI to begin pre-construction data collection and finalization of the evaluation plan. WTI has received funding from FHWA and MDT to complete these preliminary tasks over an 18-month period, with a completion date of August 31, 2003.

Two types of data will be collected during this phase of the evaluation: 1) tracking of wildlife approaches and crossings of US 93, and 2) US 93 wildlife mortalities. The first type of data collection will be used to address the wildlife's use of the crossing structures once installed. Researchers will look at the proposed locations of crossing structures and how animals cross US 93, before and after crossing structures and fencing are installed. Traditional research methods (observation sessions, surveying animal tracks) will be employed, possibly along with high-tech methods (i.e. event-triggered photography,) to collect data on wildlife approaches to the highway, movements across US 93, and failed attempts to cross US 93. Researchers will also document habitat and topographic characteristics of wildlife highway approach paths at locations of crossing structures. This data will assist in the evaluation of crossing structure design and placement and how it accommodates or fails to accommodate wildlife.

The second type of data collection involves compiling information on wildlife vehicle crashes and the resultant wildlife mortalities. In addition to collecting existing data and conducting roadkill inventories, researchers also plan to develop a wildlife-vehicle incident reporting system that facilitates reporting by motorists of wildlife mortalities through the use of simple, standardized forms. These data will help determine if US 93 crossing structures help reduce animal-vehicle collisions.

The other major element of this initial contract is the development of a final evaluation plan. WTI will first establish Measures of Effectiveness (MOEs) for its research efforts to ensure that the deliverables from the evaluation are applicable to future projects. The final evaluation plan will contain prioritized components, detailed in concordance with the MOES, to achieve the goals and objectives. The plan will serve as the primary planning document used to solicit additional funding in a compartmentalized manner. Work orders will be developed from it as different tasks are funded.

Future expansions of the evaluation plan under consideration by WTI include:

• Documentation of the distribution, density, and movements of specific species of wildlife residing near the US 93 reconstruction project

• Public relations activities, such as a website, project updates, satisfaction surveys and educational outreach

WTI takes on the lead role of Project Management for this evaluation project. However, the success of the research plan relies heavily on the expertise and resources of key stakeholders, such as CSKT, MDT, and FHWA. WTI will also seek out and coordinate additional research partners, possibly to include MSU, University of Montana, Salish Kootenai College, American Wildlands, and other public and private groups.

Currently, pre-construction components of the evaluation are underway. Baseline field data collection methodologies will be piloted this summer. The final evaluation plan is scheduled to be completed by August 2003.

CANAMEX: WTI to Develop Smart Tourist Corridor Action Plan

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The North American Free Trade Agreement (NAFTA), which created a set of preferential economic relationships among Canada, the United States and Mexico, underscored the importance of strengthening north-south economic and transportation linkages. As part of NAFTA, Congress designated several major trade routes, including one 1500 mile corridor that connects Mexico to Canada via Arizona, Nevada, Utah, Idaho and Montana.

WTI has been selected to begin the implementation of initiatives generated by the CANAMEX Coalition, which is charged with stimulating the economies of communities along this trade corridor. The Coalition chose WTI because much of the Corridor lies within rural areas of the five states and because the application of ITS within the Corridor is critical to project success. WTI will work closely with ITS Coordinators and other staff of the five participating states. The five states will each contribute $80,000 over a two-year period to the development of the first Action Plan, for a total project budget of $400,000.

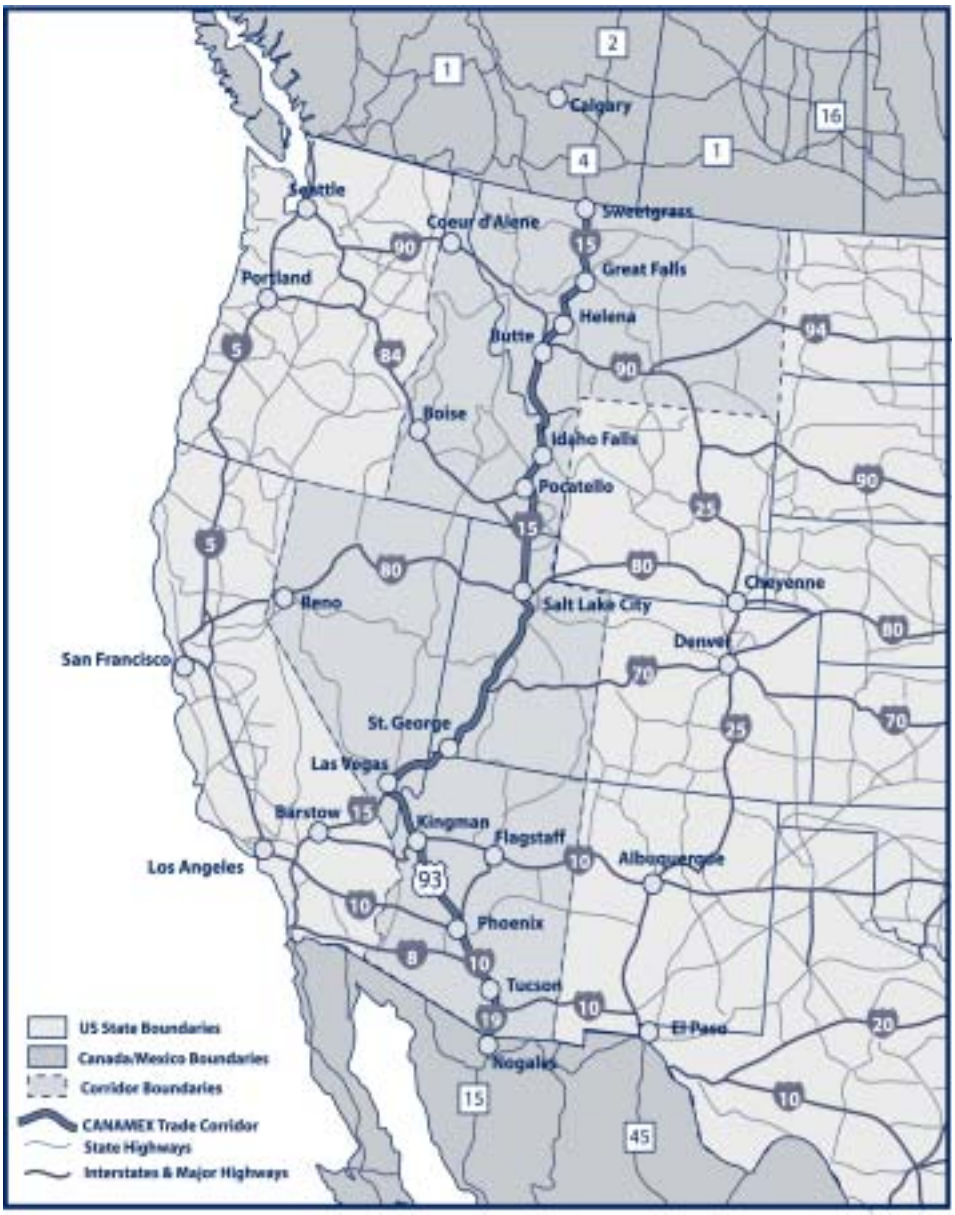
Recognizing the opportunities and challenges presented by the region's expanded role in international trade and transportation, the governors of the five states executed a Memorandum of Understanding that created the original CANAMEX Corridor Plan. The Plan provides a framework for accomplishing the primary goals of stimulating economic development along the Corridor, enhancing global competitiveness of the CANAMEX states, establishing the Corridor as a leader in the use of emerging technologies, and identifying the most critically needed transportation and telecommunications infrastructure that will facilitate the safe and efficient movement of people and goods over the next thirty years.

The CANAMEX Corridor Plan identified five initiatives that would enable the Coalition to achieve their conceptual goals. One of these initiatives is the development of a "Smart Tourist Corridor," a principal travel route that uses Intelligent Transportation Systems (ITS) and other transportation planning methods to improve safety and enhance services available to tourists. In the fall of 2001, the Coalition voted to focus its initial implementation efforts on the Smart Tourist Corridor Initiative.

The Action Plan to be developed by WTI will focus on three areas:

- Definition of the Elements of a Smart Tourist Corridor. The Action Plan will attempt to define and develop an array of services that must be available to tourists and other travelers within the Corridor. Access to information regarding safe travel, travel services, lodging and tourist attractions would, for example, be essential components. However, the plan will also identify innovative ways to improve how travelers obtain the information, so that it is accessible in advance, en-route, from multiple sources and across state lines.
- Development of a Corridor Operations Plan. The primary purpose of a Corridor Operations Plan is to enhance traveler safety and improve incident management. The Plan will not only identify incident types and how better to manage them, but also how to improve real-time incident information available to travelers so they can make informed decisions. For example, the Plan will attempt to identify how State transportation databases and software can be more compatible so that they can "talk to each other," as well as how ITS technologies (such as Dynamic Message Signs, wireless access to the Internet, or interactive kiosks) can be used to improve the dissemination of information to travelers.

• Identification of a Technological Infrastructure. Development of a technology framework is necessary to assure that the elements of the Smart Tourist Corridor and the Corridor Operations Plan can be provided conveniently, efficiently and effectively. While each of the five CANAMEX states has deployed an ITS infrastructure, most of the attention and investment to date has been in urbanized areas. The Action Plan will identify needs throughout the Corridor service areas. The supporting infrastructure component will identify existing telecommunications, what's needed to fill in the "gaps," interoperability, and related issues. It will look at both physical needs (field devices, facilities, etc.) and functional ones (software, partnerships, other agreements, etc.)



Above: CANAMEX corridor

Over the course of the project, there will be three "activity horizons" at which WTI will identify recommended activities for consideration by the CANAMEX Coalition. The first of these will occur no later than June 30, 2003 so that federal funds may be sought in conjunction with the reauthorization of the Transportation Equity Act of the 21st Century (TEA-21). The second and third horizons will identify recommended activities at points five and ten+ years respectively from Project inception.

Some of the stakeholders anticipated to have significant interest in participating in the development of the Smart Tourist Corridor Action Plan include the traveling public, Tribal Governments, Chambers of Commerce, federal agencies such as FHWA and the National Park Service, State Tourism Directors, AAA, tourist attraction managers, economic development agencies, the hospitality industry, and local government agencies located within the Corridor.

Geosynthetics:

Numerical Modeling Project Complete; Development of Design Methods for 2002 Pavement Design Guide Initiated

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A recently completed project on numerical modeling of geosynthetic reinforced pavements has provided the necessary background allowing WTI to continue its work in this field by embarking on the development of design methods compatible with national and international mechanistic-empirical pavement design guides.

The completed project, "Numerical Modeling and Design Development of Geosynthetic Reinforced Flexible Pavements," was finished last fall, with the final report dated October 1, 2001. The purpose of this project was to develop a design model for geosynthetic reinforced pavements that could be used by any State DOT. While most states use some form of the current or previous AASHTO standard pavement design guide, each state typically has a slightly different approach, meaning the model needed to be suitable for users of various pavement design methods.

The final outcome of this project was the development of a finite element response model that explicitly accounted for the structural contribution from a layer of geosynthetic reinforcement. Mechanistic response measures were extracted from the response model and included the vertical compressive strain in the top of the subgrade and the bulk stress in a representative zone of the base aggregate layer. These measures were used in empirical distress models to relate the response measures to long-term pavement performance. Performance predictions from the model were compared between sections with and without reinforcement for a variety of pavement variables including thickness of the asphalt concrete and base aggregate layers, strength/stiffness of the subgrade and mechanical properties of the geosynthetic. In addition, predicted performance was compared to and validated against large-scale reinforced pavement test sections.

Performance improvement was expressed in terms of a Traffic Benefit Ratio (TBR), defining the extension of service life of the pavement, a Base Course Reduction Ratio (BCR), defining the percentage reduction of base aggregate permissible for equal service life, or a combination of the two. More than 450 cases were analyzed in a parametric study. The improvement factors were related to the variables contained in the parametric study though regression equations. A spreadsheet program was developed that performed these calculations for specified input pavement design parameters. The method allows for a pavement design cross-section, designed by any recognized method, to be revised according to the benefit factors computed from the spreadsheet program. (The spreadsheet program can be downloaded from the following website address: www.mdt.state.mt.us/departments/researchmgmt/grfp/grfp.html)

A design guide was prepared which used the spreadsheet-based design model as its calculation driver. The design guide allows pavement engineers to use and specify geosynthetics for roadway reinforcement applications in a generic and non-proprietary method. The final report contains examples to illustrate the use of the design model (including cost-benefit information), and suggestions for how the model can be extended to situations not specifically addressed in the project.

The model developed in this first project met the needs of participating states by not being tied to a specific pavement design method. However, this feature of the model limits its applicability in other situations. Specifically, it is not sufficiently compatible with mechanistic-empirical (ME) design methods, because the descriptions of reinforcement benefit are not an integral part of the components of ME methods. The FHWA is interested in seeing states moving

towards the adoption of ME methods. In addition, many European countries are using or developing design guides based on ME concepts. This emphasis on mechanistic-empirical design methods has resulted in a new project that draws upon the work of the completed one.

The objective of the new project, "Development of Design Methods for Geosynthetic Reinforced Flexible Pavements," is to develop methods in which reinforcement is described within the context of the components of mechanistic-empirical design methods. This change will allow the methods to be incorporated into the 2002 Pavement Design Guide currently being developed through NCHRP Project 1-37A and similar European design guides.

The 2002 Pavement Design Guide (and its European equivalents) will provide significant advances in terms of a designer's ability to increase pavement design reliability, particularly when non-traditional pavement loads, geometries or materials are used. However, these guides are not currently capable of addressing structural benefits offered by the addition of a reinforcement layer, such as a geosynthetic or steel-mesh. The goal of this project is to develop design methods for incorporation into these documents that will result in the construction of better, longer-lasting pavements.

The research tasks proposed by this project fall into several categories. Material testing will be conducted to define basic material properties and to assess how reinforcement changes those properties. Material testing of geosynthetics will determine inherent properties of the geosynthetic, as well as its interaction with surrounding materials. Response models (that incorporate the introduction of a reinforcement layer) will be developed to obtain key stress, strain and/or deflection response parameters. These parameters are used in Damage Models that provide for predictions of long-term pavement performance, defined typically in terms of permanent surface deformation (rutting) and asphalt concrete fatigue cracking.

Above: A layer of reinforcement is added during road construction.

Results from the research tasks will be used to conduct the evaluation of design methods. The components of the mechanistic-empirical model from the research stage will be combined together and used to compare to results from various reinforced test sections. A final report will be prepared, and perhaps more importantly, project staff will participate in a variety of national and international activities to share findings and ensure implementation of the results.

The sponsors of this project include FHWA, several Scandinavian research organizations, European road agencies and geosynthetic manufacturers. Research will be conducted by WTI; SINTEF Civil and Environmental Engineering in Trondheim, Norway; the University of Maryland; and Christopher Consultants. The project is scheduled for completion in October 2003.

For additional information, visit the following website: www.coe.montana.edu/wti/wti/display.php?id=89

ITS Projects Deployed in Yellowstone Region

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The Greater Yellowstone Rural Intelligent Transportation Systems (GYRITS) project was initiated in January 1997 to move rural ITS forward by demonstrating and evaluating ITS in a rural environment. Following the completion of a strategic plan, individual projects were selected for development. In recent months, three GYRITS projects have reached important milestones.

Idaho Dynamic Variable Message Signs: Travel in the Yellowstone area can be dangerous due to mountainous roads and severe weather. Because of the small number of alternative routes, it is important that drivers be informed of adverse road conditions as far in advance as possible. State Departments of Transportation (DOTs) are working to improve the quality of this information through better coordination across state lines. In addition, GYRITS includes several projects to expand the use of Dynamic Variable Message Signs (DVMS) to alert drivers to changing road conditions.

The Idaho Transportation Department identified six highway sites with high rates of auto accidents. All six are located on curves subject to icy conditions in winter. In 2000, eight portable DVMS units were purchased at a cost of $128,000; six were put into use by the end of that year at the chosen locations. Maintenance workers can activate the units and update the messages to warn motorists of imminent icy curves in the road.

During the two winter seasons that the signs have been in place, WTI collected speed and crash data and conducted motorist surveys. The speed and crash data does not yet show conclusive evidence that the DVMS are decreasing the number of accidents; WTI plans to follow-up with one more year of data collection. However, an overwhelming majority of motorists surveyed responded that they not only noticed the signs, but that they found the information helpful and adjusted their driving accordingly.

The Idaho DVMS project has yielded other benefits as well. The open architecture allows for a variety of messages beyond icy conditions. The units were occasionally used to alert drivers to the presence of large animals near the road during periods of migration. Since the units can be easily transported to other locations, the DVMS were also used during the summer of 2001 to warn motorists of upcoming construction sites.

Wyoming Dynamic Variable Message Signs: Highway 14A in Wyoming is a popular route to Yellowstone National Park for visitors coming from the east. Many of the out-of-state motorists are driving large recreational vehicles (RVs). Near the town of Lovell, there is a stretch of Highway 14A where motorists descend an eight to ten percent downgrade for several miles. The road

flattens out momentarily, but then quickly goes into a curve and sharp descent that are difficult for drivers to see in advance. This location has been the site of numerous crashes, including two fatalities.

WTI is coordinating with the Wyoming Department of Transportation to use DVMS in conjunction with smart technologies to improve safety along this stretch of road. Last summer sensors were installed in a section of the road preceding the trouble spot. The sensors can classify the vehicle and measure its speed. I vehicle is a large (i.e. an l or commercial truck) an is exceeding a safe speed, a DVMS unit is activated, flashing a message such as "Curve Ahead, Slow Down".

WTI collected pr installation speed ar crash data in the summ of 2000. This summe when the system is in us researchers will contin the evaluation process l collecting new speed ar crash data, and by co ducting motorist survey

YNP Automated V hicle Identification Sy tem: In an effort to decrease the waiting time for motorists at Yellowstone National Park (YNP) entrances, YNP is currently installing the first phase of an Automated Vehicle Identification System (AVI). This project is funded through the Federal Highway Administration (FHWA) and administered through the Montana Department of Transportation (MDT).

Currently, all vehicles entering YNP must stop at an entrance station. If the motorist is an employee, the attendant checks for the appropriate sticker on the vehicle windshield and then allows the employee to pass. If the motorists are tourists, the attendant sells (or checks for) an entrance pass and provides them with information regarding safety, facility availability and attractions.

The Automated Vehicle Identification System at YNP is a modification of auto- ted toll collection seen on many major eways in urban areas. Motorists using the ystem will attach an electronic tag to their vehicle. When they approach the entrance, they will be directed to a designated AVI lane, where an antenna will ead the identification number on the tag. he computer at the entrance station will ess the account for that tag and autho- entrance. If cleared, the driver will re- ve a signal to proceed.

In the first phase of implementation, P will test this system at the North En- nce, near Gardiner, Montana, and the rtheast Entrance, near Cooke City, Mon- a. The first group to receive the elec- nic tags will be permanent YNP employ- . The equipment has been installed at h of these sites and the system should running within a few months.

The goal of this project is not only to reduce the wait time for employees, but also to increase the amount of time entrance staff can spend advising tourists. If the initial implementation is successful, the user group will be expanded to include vendors, residents and annual pass holders. There are also tentative plans to install the system at the West Entrance, near West Yellowstone, Idaho.

WTI measured pre-installation delay times last summer. This summer, WTI will measure post-installation delay times and conduct user interviews.

Roadside Animal Detection: New Project Will Test Multiple Systems

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WTI plans to expand its research of animal vehicle crash mitigation by embarking on a new project to test the effectiveness of numerous systems designed to detect animals along the roadway.

Animal vehicle collisions are a common safety problem in many areas of Montana and the nation. Traditional solutions are expensive (i.e. overpass crossing structures), have limited effectiveness (i.e. static warning signs), or have unintentional environmental impacts (i.e. animal-proof fencing which protects animals from injury but creates habitat fragmentation). In search of a better solution, WTI is currently participating in a pooled-fund study ("Animal Vehicle Crash Mitigation Using Advanced Technologies") to demonstrate and evaluate animal detection systems that alert motorists with dynamic signing. Specifically, that project will deploy two or three roadside demonstration sites that will detect animal presence on the roadway/roadside and activate signing to warn the motorist.

Currently, however, there is very little clear information on the accuracy and reliability of the different sensors available to detect large animals. The pooled fund study will evaluate this, but only for two or three specific vendors at different locations. For this reason, WTI will soon begin a follow-up project to test multiple detection technologies. The "Roadside Animal Detection Systems Test-bed (RADS Test-bed)" will:

- provide accurate monitoring of animal presence through infrared cameras,
- allow several animal detection vendors to drop their systems into the test-bed, and
- ultimately allow for the deployment of dynamic warning signs that will be triggered when animals are detected on the roadside.

The goal of this project is not only to deploy a successful animal detection/driver warning system, but also to provide baseline data on the accuracy of various systems.

The goal of this project is not only to deploy a successful animal detection/driver warning system, but also to provide baseline data on the accuracy of various systems.

The RADS Test-bed will be created by equipping a typical roadside environment (with high animal movement) with cameras, control cabinet, data logger, and related technical needs. Vendors with animal detection systems will be invited to set up their equipment on this test-bed. WTI will determine the sensors' accuracy in detecting animals in a real roadside environment through the use of infrared video surveillance. These results will be synthesized into a report for each detection technology that summarizes installation, maintenance and performance, as well as providing a cost-benefit analysis. After the animal detection vendors are evaluated, the most promising product will be permanently installed along with dynamic warning signs.

Th e project is scheduled to begin in

Presentations

OCTOBER 2001
Rural Traveler Needs: Results of Intercept Surveys in 5 Western States,
8th ITS World Congress, Sidney, Australia

California Oregon Advanced Transportation Systems: A Rural ITS Success Story, 8th ITS World Congress, Sidney, Australia

Institutional Barriers to ITS Deployment,
Transportation Technology Conference, Juneau, Alaska

Potential Partnership Opportunities to Improve Public Safety,
Transportation Technology Conference, Juneau, Alaska

Evaluation Methodologies Workshop,
ITS Rocky Mountain Annual Conference, Boise, Idaho

Tribal Transportation Initiatives,
2001 Billings Transportation and TERO Meeting, Billings, Montana

DECEMBER 2001
WTI Rural Intelligent Transportation Systems Projects,
Penn State Traffic Engineering and Safety Conference, State College, Pennsylvania

JANUARY 2001
Traveler Information En-route Needs and Available Services for Visitors to National Parks,
Transportation Research Board Annual Meeting, Washington D.C.

Roadside Animal Detection: *continued*

September 2002 and end by February 2009. WTI will attempt to evaluate vendors simultaneously and for shorter periods (i.e. three months instead of one year) in order to significantly compress the long-term schedule.

Support for this project comes from FHWA, vendor donated equipment, and a variety of other sources. Additional funding sources are under development. WTI hopes to enlist the participation of both public and private groups with an interest in animal welfare, wildlife preservation, highway safety, and related issues. The expertise and resources of these groups will make a valuable contribution to the long-term success of the project and the quality of its findings.

WTI Welcomes New Researchers

When Jaime Helmuth, E.I.T., joined the research staff in January of this year, WTI put her right to work. Only two weeks after her arrival, she was sent to Washington, D.C. to make a presentation to the Transportation Research Board on Traveler Information in National Parks.

National Parks is only one of Jaime's current assignments at the WTI. She will also be working on the California Showcase Project, which evaluates the benefits of intelligent transportation systems demonstration projects in rural areas of northern California/southern Oregon, and she will be developing the architecture, evaluation and marketing plan for the Greater Yellowstone Regional Traveler and Weather Information System (GYRTWIS).

Jaime is originally from Franklin, Massachusetts. She studied Civil Engineering at the University of Massachusetts — Amherst, receiving her undergraduate degree in 2000. She recently completed her graduate program in Civil Engineering at Texas A & M University, and will receive her Master's Degree in May. For her thesis, she conducted an exploratory study on "Visual Complexity in Highway Work Zones."

While completing her studies, Jaime also worked extensively in the transportation field. In Massachusetts, she was on the staff of Vanasse Hangen Brustlin, a large civil engineering firm, where she worked on railroad grade crossing and other highway design projects. She also gained significant research experience: at Texas A & M, she was a graduate research assistant at the Texas Transportation Institute.

Jaime and her pet hamster Angel are settling into life in Montana. She loves rollerblading and hiking, as well as indoor hobbies such as reading and cross-stitch.

Jaime can be reached via

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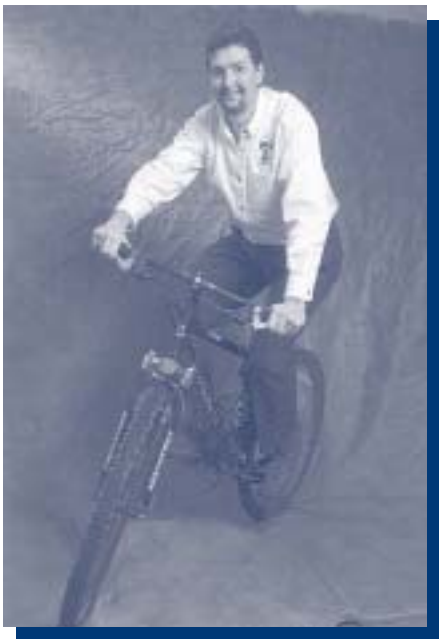
WTI would like to welcome Pat Wright, our new Senior Research Associate. Pat joined the research staff in November 2001, bringing his expertise in Intelligent Transportation Systems, traffic operations, and bicycle/pedestrian planning. His assignments at WTI include the Frontier Project, which tests the applicability of advanced transportation technologies in rural areas. Pat is currently working on the evaluations of two Frontier components: a travel time estimation system in Lincoln City, Oregon, and a high water warning system in Wise County, Texas. Pat will also be involved in the CANAMEX Corridor Study, which will examine a Smart Tourism Corridor and improve incident response operations for I-15.



Pat grew up near Pittsburgh in Elizabeth, Pennsylvania. He received his Bachelor's of Science in Civil Engineering from Georgia Tech, and then continued there for his graduate studies. For the past fifteen years, he has worked as a consultant at transportation engineering firms in many locations, including Atlanta, California, and most recently, Pennsylvania. One of his accomplishments in Pennsylvania was the development and presentation of workshops on pedestrian and bicycle engineering and planning. These workshops trained more than 500 local planners and traffic engineers throughout the state.

Pat is an active member of the Institute of Transportation Engineers (ITE). He currently serves as the President of the Mid-Atlantic section, which includes Pennsylvania, Delaware and southern New Jersey. As a member of the ITE Technical Committee (4D-2 Committee), he produced an important report on "Resolving Signing Standards for Light Rail Crossings at Grade".

Pat lives in Camp Hill, Pennsylvania with his wife Ann and four children — Rebecca, Jasmine, Justin, and Hannah. In his spare time, he enjoys outdoor activities that he can do with his family: camping, hiking, biking, and coaching his kids' soccer teams.

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Educational Outreach: WTI Participates in Campus and Community Events

Educational outreach events throughout the winter and spring have allowed WTI to share its resources and expertise with students of all ages. At these events, staff had the chance to provide students with information regarding career opportunities in transportation, and to excite them about issues, challenges, and cutting-edge research in the transportation field.

In January, WTI participated in "MSU Friday." For this event, MSU invites local high school students to spend the day on campus exploring the university. During lunch, MSU departments, organizations, and activity groups set up booths where students can ask questions. WTI's booth provided information about the diverse engineering programs on campus and careers in the transportation field. More than 500 students attended January's "MSU Friday", a new record for the event.

WTI staff participated in a similar event out in the community when they sponsored a booth at the School-to-Work Career and College Fair at Belgrade High School. This career fair, attended by 700 students, was designed to introduce high school students to career possibilities that they had perhaps never considered. WTI staff not only educated students about the many careers in the transportation field, but also advised them on where to focus their studies if they became interested in such a profession.

The MSU Department of Civil Engineering Spring Festival was held at the end of February. The event provides learning opportunities to students and faculty, as well as professional engineers seeking continuing education credits. More than 150 professionals and faculty attended the festival; 100 students also took part in the activities. WTI sponsored the participation of several presenters. Wayne Kittleson, P.E. and Mark Vandehey, P.E. gave a workshop on "Updated Procedures for Signalized/Unsignalized Intersections and Two-lane Roads." Since the timing of the Festival coincided with the 2002 Winter Olympics, WTI also invited Tim Harpst, P.E. to be a speaker. As a transportation official for the City of Salt Lake, Harpst gave an insider's view of the extensive transportation planning that was necessary to efficiently host the Olympic Games.

Later this year, WTI will partner with Bridges to bring tribal college students to MSU for summer internships. Bridges is a program coordinated by MSU's American Indian Research Opportunities (AIRO) office and is designed to assist tribal students make the transition from two-year colleges to a four-year university. Students accepted into the program perform lab research with faculty and graduate student mentors, enroll in summer courses, and live at MSU during a seven-week summer program. In March, fifteen students and tribal college coordinators from Fort Peck Community College visited WTI to learn more about educational and career opportunities in the transportation field. WTI Research Engineer Lisa Ballard provided an overview of the engineering and transportation fields and introduced the campus visitors to WTI's current research projects. One student from the group will be selected to perform research at WTI as an intern this summer.

For more information regarding the Education Program at WTI contact Susan Gallagher via

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or phone
(406) 994-7681

Andy Beddoe Named Outstanding Student for 2002

Congratulations to Andy Beddoe, who received the "Student of the Year" Award for 2002. The Research and Special Programs Administration of the U.S. Department of Transportation presents this award annually to one student at each University Transportation Center.

Andy received his B.S. in Mechanical Engineering at Montana State University and is currently pursuing a Masters of Science under the same department. He came to the WTI in January 2000 upon receiving a graduate fellowship in transportation and afterwards a research assistantship. His interests in transportation research include weather and surface conditions modeling and related safety concerns, bicycle and pedestrian issues, public transit, solar and fuel cell technology, and transportation planning.

Andy's experience has given him the opportunity to develop a diverse program, focusing his course work in Mechanical Engineering while simultaneously applying his graduate research directly to the transportation field. At WTI, he has gained experience in ITS application and advancement. His research on modeling albedo of thin layers of snow and ice on roads assisted in the development of a thermal model that is employed to predict pavement surface temperatures and hence road surface conditions along rural mountainous highways. The thermal model is an integral component of the Safe Passage project, a joint venture between WTI, MSU, and the Montana Department of Transportation to improve motorist safety on the I-90 corridor between Livingston and Bozeman, Montana.

In 2000, Andy was selected as one of three finalists in the Philip E. Rollhaus, Jr. International Safety Essay Contest. His paper discussed the role of new technologies in tomorrow's rural roadway safety around the world. Additional transportation activities in which he has participated include the ITE student chapter on campus, the Solar Vehicle Project at MSU, bicycle commuting and the bike advocacy board of Bozeman. Outside of the transportation world, Andy enjoys lots of outdoor recreational activities and playing the banjo with a local musical group.

WTI is pleased to announce that Andy joined the staff in March as a Research Associate. His diverse background will add depth to the research staff and help WTI become more multidisciplinary. His initial project assignments include the Greater Yellowstone Regional Traveler and Weather Information System (GYRTWIS) and the CalTrans Road Weather Information System (RWIS) projects, as well as staying on board with the Safe Passage project during its final evaluation year.

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Left to Right: Mary Peters, Administrator, Federal Highway Administration;
Andy Beddoe, Western Transportation Institute;
Jennifer Dorn, Administrator, Federal Transit Administration;
Ellen Engleman, Administrator, Research and Special Programs Administration

Staff Retreat: Learning New Ways to Work Together

In the summer of 2001, WTI held its first staff retreat. The retreat was created to improve staff management skills, improve group synergy and have fun. WTI research and administrative staff were required to attend this event, while faculty associated with WTI and student researchers were encouraged to attend. An external moderator, Bob Spiewak, from change@work© was hired to facilitate the meeting.

Mr. Spiewak's intent was to teach WTI staff about their organization, themselves and assist in facilitating group discussion. He began by describing the various phases of organizational growth, which prompted a discussion of the organizational status of WTI. The general consensus among the many WTI employees was that WTI is transitioning between the "Forming Phase" and the "Norming Phase", a developmental stage in which the organization is experiencing many changes, successes are being replicated, and a bureaucratic process is being established.

In addition to learning about WTI, participants learned insights about themselves and co-workers. Prior to attending the retreat, participants were asked to complete a "learning styles" survey on how they take in and process information and experiences. Results from the survey helped "categorize" individuals based on these criteria. This was helpful for many of the staff to identify and appreciate the personalities that make up WTI.

Breakout groups were also employed as part of the retreat to help foster group discussion, discuss strategic goals, identify strengths and weaknesses, and build unity. The discussion topics included communication, education and students, information sharing, employee motivation, WTI's role at MSU, and improving WTI research portfolios.

From each of these breakout discussions, action items were established. The top four action items identified at the retreat were to 1) improve weekly staff meetings, 2) improve monthly student meetings, 3) develop an evaluation tool to be utilized by research staff and students, and 4) integrate project management software and training. Other interesting action items included developing an orientation packet for new employees, restructuring the student fellowship program, sponsoring a student essay contest, creating a "Green Transportation" committee, and establishing WTI as a community transportation information resource.

In summary, WTI is currently undergoing many changes. During this transition period, it is essential that open lines of communication and a sense of order are maintained. With this growth, staff numbers will obviously increase, especially student researchers. Involving students at the retreat helped many of the staff see how essential this workforce is to the future success of the organization. WTI hopes to replicate this high quality event on a yearly basis to ensure that we stay on the road to success.

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New Administration Staff Joins WTI

WTI would like to welcome three new people to its administrative staff. Susan Gallagher arrived in March to take on the new position of *Program Coordinator*. She will be managing existing WTI education programs, such as student recruitment, graduate fellowships and undergraduate scholarships, as well as developing new education initiatives, such as a student internship program. Susan will also be providing logistic and budgeting assistance to the Showcase Project. Prior to WTI, she worked as an Administrative Assistant in the Media and Theatre Arts Department at MSU. Originally from New Mexico, Susan moved to Montana last summer after spending two years in Atyrau, Kazakhstan. There she served as the Program Director for ISAR (Initiative for Social Action and Renewal), an international association that provides grants, training, and technical assistance to community-based organizations in developing countries.

Left to Right:
Carla Little, Susan Gallagher and Neil Hetherington

Neil Hetherington began work in February as the *Graphic Design Technician*. He will take over the position currently held by Megan Mikkelsen, who will be leaving in May following her graduation from MSU. Neil will be responsible for the graphic design, format and layout of all WTI publications. He is a freelance graphic designer and runs his own firm, H Communications, with his wife, Turi. Previously, Neil produced the "Lone Peak Lookout" newspaper in Big Sky for three years. He is originally from Northern England, and came to Montana six years ago to teach skiing, snowboarding and telemarking. When not at WTI, Neil serves as an examiner for other snow sport instructors.

Carla Little joins the staff in the new position of *Technical Editor*. She will be editing reports and other documents for the research staff, and writing external publications such as the newsletter, project fact sheets, and the annual report. Carla comes from a government relations and legislative policy background, having served as a speechwriter and legislative analyst for the Lieutenant Governor of California, and as the Legislative Director for Santa Clara County, California. Carla, her husband John, and 5-year old daughter Elizabeth found their way to Montana last year after spending 3 years living and working in France.

Montana Workshop on Context Sensitive Design Inspires Knowledge Sharing

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More than 300 persons from throughout the nation attended the Context Sensitive Design Workshop, Transferring Lessons from our Collective Experiences, in Missoula, Montana, on September 5-7, 2001. Conference delegates hailed from 38 States and South Africa. The Montana Department of Transportation (MDT), WTI, and the Federal Highway Administration (FHWA) sponsored the information-sharing event. Organizers of the workshop recognized the need and demand for information about context-sensitive highway design to advance the state of the practice. Highway-design practitioners face increasing complexity and expanding stakeholder involvement in their projects. The workshop in Missoula provided a rich forum for continuous learning about context-sensitive design. Forty speakers over a three-day period presented on a wide range of projects, resource concerns, techniques, and challenges. Presentations and discussions demystified the context-sensitive design philosophy for project managers, stakeholders, and administrators. Project examples showed balance between functional and context demands and the process by which the balance was achieved.

What is Context Sensitive Design?

Context sensitive design (CSD) is a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. CSD is an approach that considers the total context within which a transportation improvement project will exist.

The event kicked off on Wednesday, September 5, with two all-day training sessions – one on roundabouts, and one on traffic calming. FHWA trainers spoke to a classroom of 50 participants on roundabout design and operation. Concurrent with the roundabout session, trainers from the University of Wisconsin presented to 60 students on traffic calming measures.

On Thursday morning, September 6, the workshop convened in full session. A full slate of speakers with first hand experience in CSD issues addressed the delegates. For example, MDT Director Dave Galt challenged designers to find a balance between competing interests, citing his own experience in delivering an effective state transportation program amid the increasing complexity of public concerns. Another speaker with extensive experience in this area was Reid Ewing of Rutgers University. He shared information about New Jersey's project development practices, appealed to project owners to "get it right" by designing for inclusion of different users, and concluded that it is important to regard community impact in facility design and design exceptions.

Later in the morning session, representatives from each of the FHWA-designated pilot states and organizations for context-sensitive design summarized implementation successes and challenges. The pilot states are Maryland, Kentucky, Utah, Minnesota, and Connecticut. The Central Federal division of the FHWA is a designated pilot organization. MDT, as the host state, presented about their emerging experiences.

Thursday afternoon and Friday morning were devoted to concurrent sessions. Session themes covered topics such as Selecting Appropriate Design Criteria; Respectful Communications; Determining Success; Public Involvement; and Landscape Design, Aesthetic Consideration, Habitat Connectivity and Innovation. Other highlights of the conference included scenic bus tours of MDT rural projects in environmentally and culturally sensitive areas, and an open dialogue closing session that allowed all conference attendees to share their collective experiences.

ITS Rocky Mountain Annual Meeting Focuses on National Operations Agenda

The National Operations Agenda Regional Forum and Intelligent Transportation Society (ITS) Rocky Mountain Annual Meeting, "Understanding All Our Operational Needs," was held in Boise Idaho on October 3-5, 2001. The theme of the conference was "National Operations Regional Forum" and featured speakers from the six state area of the ITS Rocky Mountain Chapter. This conference was hosted by the Ada County Highway District, Federal Highway Administration (FHWA), Idaho Transportation Department (ITD), Institute of Transportation Engineers (ITE), and the Western Transportation Institute. 150 people attended from 27 states and provinces.

To date, a majority of the dialogue on operations and the use of advanced technology has been about relieving congestion and increasing throughput when, in fact, the majority of U.S. roadways are rural - where congestion is not the issue. In addition, much of the dialogue has focused strictly on highway operations – failing to include the needs of different users or organizations that may be impacted by operational decisions. To remedy this, the Rocky Mountain Chapter of ITS America agreed to help host this conference to ensure that rural, multi-modal and intermodal needs were met. Secondly, the conference showcased current and planned activities by transportation, tourism, enforcement, trucking, public safety, and medical service organizations within the states of Colorado, Idaho, New Mexico, Montana, Utah and Wyoming.

The purpose of this conference was to encourage a western dialogue on the National Operations Agenda that will foster improvements in the operation and management of the transportation network. In addition to learning of State "Showcase Activities", participants attending this conference gained the tools necessary to integrate concepts from the national operations agenda into everyday operations. Specifically, participants left with the knowledge to:

- build public, private, inter- and intra-agency partnerships;
- develop performance measures and benchmarks;
- recognize opportunities for rural and inter-city integration;

facilitate institutional change; and assist in setting a regional and national operations research agenda.

Lessons learned and best practices were presented on a variety of topics including:

- Understanding the customer perspective on transportation services and systems;
- Using various detection technologies to meet rural and urban transportation system requirements;
- Implementing and sustaining effective transportation operations centers;
- Reducing delays and disruptions caused by incidents;
- Minimizing the adverse effects of work zones;
- Providing timely and accurate weather and roadway information to travelers;
- Providing reliable and quick response Mayday systems for travelers;
- Delivering convenient and coordinated state and regional public transportation services; and
- Developing different organization models to effect better operation and management of facilities.

The conference was deemed a great success; the 2002 Annual Meeting is already being planned and will be held in Salt Lake City, Utah. More information on this upcoming conference and other activities of ITS Rocky Mountain can be found on the organization website at http://www.itsrm.org or by contacting Meetings Northwest at 406-273-7224.

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