

2004-2005 Annual Report



Upper Great Plains Transportation Institute • North Dakota State University

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The Upper Great Plains Transportation Institute is an independent research and education center at NDSU. Administratively, it is directly responsible to the university provost. The institute conducts research related to the immediate and long-term transportation needs of the region and disseminates information through conferences, workshops and seminars. The research program is guided, in part, by an advisory council composed of representatives of various organizations, industries and agencies affecting or affected by transportation. The program areas focus on specific transportation issues, but, united within the UGPTI, they share expertise, staff and other resources to form an overall program with the flexibility to address emerging challenges and opportunities.

Advisory Council



- Row 1: Dave Sprynczynatyk-Chair, ND Department of Transportation; Bob Kjelland, ND Farmers Union; Russ Hanson, Association of General Contractors; Roger Johnson, ND Department of Agriculture
- Row 2: Gary Ness, ND Aeronautics Commission; Steve Strege, ND Grain Dealers Association; Dave MacIver, Greater ND Chamber of Commerce
- Row 3: Mark Wolfe, Phoenix International, Inc.; Greg Nelson, ND Grain Growers Association; LeRoy Ernst, ND Motor Carriers Association
- Row 4: Judge Barth, ND Wheat Commission; Jim Boyd, ND Department of Commerce
- Row 5: Dan Zink, Red River Valley & Western Railroad; Tony Clark, ND Public Service Commission; John Mittleider, ND Farm Bureau

Director's Message

A black and white photograph of a street scene, possibly a parking lot or a road with cars. The image is heavily stylized with a grid pattern overlaid on it, creating a sense of motion or a digital overlay. The scene includes several cars parked or moving, and trees in the background. The overall aesthetic is high-contrast and somewhat abstract due to the grid overlay.

Transportation is fast becoming a field that embraces engineering, economics, planning, business, operations, computer science, statistics, psychology and materials science while incorporating new fields like nanotechnology and radio frequency identification.

At the same time more employers recognize the importance of transportation and logistics and are searching for students with academic backgrounds in those fields. Entrepreneurs and managers increasingly recognize that smart supply chain management has a significant impact on profit. Similarly, managers in government and non-profit agencies know savvy transportation management can mean better service with limited budgets.

In that environment, NDSU and the Upper Great Plains Transportation Institute have a unique opportunity to expand its status as a national academic leader in transportation. We stand solidly on more than 40 years of research and academic achievement. Our graduates and staff have the expertise and know-how to address transportation and logistics challenges anywhere and we have the people and programs in place to meet the challenges and opportunities of the coming years.

Developments are in place which will increase the annual budget of the Institute from about \$6 million to \$10 million. These developments include:

- An increase in funding for the competitively selected regional transportation centers, the Mountain-Plains Consortium, from \$1 million to \$2 million per year.
- Expansion of the Small Urban and Rural Transit Center from \$400,000 to \$1.2 million annually.
- Development of a Masters in Military Logistics which will attract 30 to 40 students each year.

- Establishment of an associate degree in transportation at Bismarck State University.
- A new Rural Transportation Safety and Security Center with an annual budget of \$500,000.
- Expansion of the Transportation Learning Network focusing on technical training for four regional state DOTs, including North Dakota.
- An increase in core funding for the Institute from \$243,000 per year to \$400,000 per year.

While the establishment and expansion of our programs is exciting, what's really important is the results they yield for rural and small urban transportation in the Upper Great Plains and across the nation.

This report documents our work from the past year. You'll see how we collaborate with universities, agencies, businesses, researchers, faculty, professionals and leaders around the world. You'll learn how we share college-credit courses, workshops and seminars electronically to tap the best expertise available and provide the best possible educational experience for students and professionals. All of this effort is directed at providing the expertise to address the challenges of moving people and goods more effectively and efficiently.

I am pleased to share with you the results of our efforts and I look forward with excitement to sharing future reports of our progress. Thank you for your continued interest in the Upper Great Plains Transportation Institute.



Advanced Traffic Analysis Center



The Advanced Traffic Analysis Center (ATAC) enhances transportation systems in small to medium-size cities by using advanced traffic analysis and Intelligent Transportation Systems to improve safety and mobility. The center’s primary role is to support decision makers responsible for planning, operating and funding transportation systems at the local, regional and state level. Primary efforts focus on intelligent transportation systems, traffic operations and travel demand modeling.

Traffic Operations Roundtable Launched

In an effort to share ideas and experiences and expand partnerships, ATAC has organized a regional Traffic Operations Roundtable.

“We found there was not a lot of communication occurring among traffic engineers from different areas,” notes ATAC researcher Shawn Birst. “This effort brings them together to share ideas and experiences and learn about new technologies and analysis tools. There was definitely interest in this among traffic engineers across the region.”

A second reason for bringing the group together is to gather input for ATAC’s programs, Birst says. “One of ATAC’s focus areas is related to traffic operations. By bringing this group together with ATAC as the facilitator, we’re able to obtain input from professionals in the region which can guide our research and outreach efforts.”

The group, which includes about 20 traffic engineers from Fargo, Grand Forks, Bismarck, Minot, Dickinson, Williston, the NDDOT and the Minnesota DOT, met twice in 2005. The first meeting, in Fargo, was an organizational meeting that involved planning, sharing and goal setting. The next meeting, in Minot, included presentations related to various vehicle detection technologies, traffic signal controllers, and included a tour of the city’s traffic operations department and the Burlington Northern Santa Fe railroad yard.

The roundtable serves its members in three ways. Members share their personal experiences and practices that could help the rest of the group. Product vendors provide presentations and demonstrations to the group to learn about new technology and practices. Finally, the group will be a forum for training and tours featuring traffic analysis tools and hardware.

Based on the success of the first year’s meetings and the enthusiastic response of the participating traffic engineers, ATAC is promoting the concept on a more national level. “ATAC is spearheading a national Small Urban and Rural Traffic Operations Coalition which is being supported by FHWA and the majority of the national transportation organizations, including AASHTO, ITE, and TRB,” said Ayman Smadi, Director of ATAC.



OTHER PROJECTS:

Traffic Operations Projects

Traffic Signal Warrant Analysis in West Fargo. Evaluated traffic operations to examine the feasibility of installing a traffic signal at 13th Ave. and 6th Street E. ATAC used traffic and pedestrian data to examine pedestrian gaps, model the corridor performance using the CORSIM traffic simulation model, and made recommendations. Two ATAC undergraduate students assisted in traffic data collection and analysis and in preparing the traffic simulation model.

Traffic Impacts of an Extended-Stay Motel on the NDSU Campus. Assisted the NDDOT in evaluating the traffic impacts from a proposed extended-stay motel. The expected motel size and utilization were used to estimate daily trips. These trips were converted to potential vehicle flows and assigned to the adjacent road network. Staff analyzed traffic operations on affected roads, with special focus on 19th Ave. N.

Grand Forks Century Elementary School Safety Study. Worked with the City of Grand Forks to analyze existing conditions for the area surrounding Century Elementary School, identify traffic operations and pedestrian safety issues, and propose methods for addressing these issues. Graduate and undergraduate student assistants played a key role in data collection and analysis.

Other Traffic Operations Projects/Activities

- Evaluated ramp traffic operations on US 281/I-94 interchange in Jamestown and worked with the NDDOT to examine sight-distance, safety, and traffic operations.
- Analyzed Main Avenue traffic in West Fargo.
- Analyzed driver behavior at 1st Ave. S. and 9th Street in Jamestown.

Travel Demand Modeling Projects

Grand Forks/East Grand Forks Model Update. ATAC is significantly updating the GF/EGF MPO's travel demand model. Enhancements include upgrading the software system used for the model, updating socio-economic and transportation network data, and converting all of the model network and other data into a GIS platform. One PhD student and one MS student have the primary responsibility of obtaining all the supporting socio-economic and traffic data used in updating and calibrating the model.

Other Travel Demand Modeling Projects. In Fargo, ATAC staff developed Main Avenue and 45th Street traffic projections. They also established I-29 user cost estimates for 2006 construction. ATAC also generated I-29 corridor traffic volumes and conducted 12th Ave. sub-area analysis.



ITS

North Dakota Regional ITS Architecture. ATAC helped the Bismarck-Mandan MPO, the Fargo-Moorhead Metropolitan Council of Governments, the Grand Forks-East Grand Forks MPO and the NDDOT develop ITS architectures to meet Federal Highway Administration's requirement. An ATAC computer science Ph.D. student translated the data flows and logical relationships of the ITS architecture and coded them into the Turbo Architecture software. The student also helped present the activities to technical panels and prepare final reports.

North/West Passage Red River Bridge Anti-Icing and DMS System. ATAC worked with URS Consultants from Minneapolis and Communications Consultants Inc. of Fargo to develop a project-level architecture, devise communications alternatives, and support the RFP development. In addition to the bridge anti-icing system, the architecture included a future dynamic message sign to be installed on the North Dakota side of the Red River Bridge as well as two surveillance video cameras to assist in traffic management and incident response.

North Dakota Statewide ITS Plan. The North Dakota Statewide ITS Plan is the product of a multi-year effort undertaken by the NDDOT to guide ITS deployment in the state. ATAC facilitated the plan development, including obtaining input on critical transportation issues, identifying ITS solutions, developing ITS projects for deployment, and preparing a final report. Graduate and undergraduate students collect data, develop GIS maps with ITS device locations, and prepare presentation material.

VMS Composer prototype. Developed software which facilitates composing messages for NDDOT DMS in accordance with state and national guidelines. The software was developed by graduate students working with ATAC. The students presented the software to maintenance engineers and prepared a user manual.

Developed inventory and performance report forms for ITS and communication devices as part of the NDDOT ITS Communications Plan.

National ITS perspective. Mike Freitas, manager of the Integrated Corridor Management Systems Initiative at the U.S. Department of Transportation ITS Joint Program Office spoke at a September 2004 seminar hosted by ATAC. NDSU faculty and students, and state and local transportation agency staff attended.

Technical Assistance. Assisted the NDDOT in developing specifications and systems engineering analysis in support of ITS project deployment, including video cameras, communications, automated bridge treatment systems (de-icing) in Bismarck, Fargo, and Grand Forks.



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Agricultural and Industrial Freight Center



The **Agricultural and Industrial Freight Center** promotes the efficient use of resources and enhances the competitiveness of agricultural products in the region. Staff members evaluate transportation industry trends, policy, and rates – all factors that are critical to maintaining product quality and helping businesses and producers reach key markets. They also examine supply chain management and transportation-related economic development initiatives to enhance the competitiveness of agribusinesses in the region.

Rail Service Survey Completed

When the U.S. Department of Agriculture’s Transportation Services Branch wanted a comprehensive overview of rail service provided to agricultural shippers in the United States, the agency came to the Agricultural and Industrial Freight Center at the Upper Great Plains Transportation Institute.

Administrators at USDA knew that, with the center’s history of compiling monthly reports on grain movements, it was ideally suited to collecting data and opinions from shippers across the country.

Center director Kim Vachal notes that the USDA frequently testifies on behalf of shippers and is an advocate for shippers in state and federal hearings and actions involving agricultural freight. In that capacity it frequently receives complaints from shippers and shipper associations about service and rates.

“The USDA wanted to gauge the service shippers were receiving as a whole rather than the bits and pieces they typically hear,” Vachal explained.

In March of 2005, researchers conducted a survey by mail of all grain shippers served by the Union Pacific and the BNSF railroads, the two railroads that serve the majority of shippers in the United States. “We asked them about the quality and price of the service they’d received and their expectations for the coming year,” Vachal says. By that point in the year, most shippers would have made an assessment of the previous year and contracted much of their rail shipping for the coming year.

In addition, the study examined how much service shippers of various sizes had already contracted for the coming year. “We found that the shippers using the BNSF purchased their shipping further out. But that was to be expected because those shippers were also found to be relatively more dependent on rail for shipping their grain,” Vachal says.

The information will provide valuable background for USDA officials called by shippers or elected officials to investigate high shipping surcharges and service problems. “The USDA now has a picture of grain rail rates and service nationwide,” Vachal says. “This will help them determine if rates and service for individual shippers and regions are in-line or deserves further investigation.”

The researchers also collected e-mail addresses of shippers so subsequent surveys would be faster and cheaper. Although the USDA has not committed to future surveys, “This survey could serve as a baseline and future research could reveal changes and trends in rail use and service for grain shipping,” she says.



OTHER PROJECTS:

Grain movement database. Grain movement reports from each elevator in North Dakota are summarized to describe distribution patterns and shipment characteristics – including destination, mode (rail or truck), origin, time, and commodity. The data are available in annual reports and monthly updates and are used to encourage competition within the grain industry and to identify research needs and market trends.

U.S. Grain Rail Market Indicator(s) and Factors Indicative of Containerized Grain Exporters. Researchers are identifying and assessing the existing and potential information that can be used as indicators of U.S. railroad and rail grain shipper activity, industry performance and market trends. They are also studying the characteristics of containerized grain exports to improve market development efforts and policy recommendations.

Implications of Supply Chain Management for Agricultural Producers and Processors. Researchers are creating resource modules to inform small and medium-sized agricultural producers and processors about emerging supply chain management trends in food marketing channels, and explore how such trends can be expected to influence their future business relationships with commercial food buyers. Primary topics include: the influence of business consolidation and differentiation on retail vendor selection, evolving practices and regulations related to food safety and food security, niche agricultural product marketing techniques such as identity preservation and product segregation practices, and technological applications used to maintain and monitor product integrity and quality.

Quarterly Refrigerated Truck Report and Global Grain Container Trade Inquiry. A quarterly refrigerated truck market report data system was designed and staff also implemented an automated quarterly refrigerated truck market report data system. The format of the report was revised and is now updated automatically with quarterly report information. Staff also investigated the potential to conduct research and provide ongoing market assessment of international grain container shipments, especially those originated by principal competitors.



Grain Transportation Report Weekly Data and Mexico Grain Transportation Report. Staff provided weekly and monthly rail and market updates for the grain transportation report. They also developed and provided rail origin, and other requested information, for the quarterly report of primary U.S. bulk grain transportation rates to Mexico.

Agricultural Transportation Information Center for Research and Policy. This ongoing cooperative effort is intended to increase transportation market awareness and transparency for agricultural producers, communities and businesses, through cooperative data gathering, dissemination and outreach activities.

Regional Freight Transportation Center Established. Improving freight movement in the region stretching from Chicago to the Pacific Northwest is the focus of a new research and outreach center at NDSU, Washington State University and the University of Washington. The Northern Plains-Pacific Northwest Center for Freight Mobility is funded through a \$500,000 appropriation in the 2005 U.S. Department of Transportation Appropriations Act and will evaluate economic changes and trends and the resulting impact on infrastructure and freight transportation providers. Transportation security will also be a focus of the center.



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North Dakota DOT Support Center



The **DOT Support Center** (DOTSC) provides intellectual capital to the NDDOT to solve complex problems. The center also addresses regional issues within North Dakota and surrounding states. The center's roadway design section is supervised by on-site DOT design staff to employ, train and utilize undergraduate students in DOT design projects. The real-life experience for engineering students helps them bring valuable marketable experiences to employers after graduation. The center's student information technology center integrates NDSU computer science and management information systems students with real-world information technology issues and projects related to the DOT.

Helping NDDOT Meet Ride Quality Goals

The NDDOT is smoothing out bumps in the state's roads without creating budgetary potholes with help from Kurt Johnson at the UGPTI's DOTSC.

The DOT set a goal of improving ride quality in North Dakota 10 percent by 2008. The department assembled a committee of district engineers, bridge engineers and others in the department to find the best way of doing so. Contractors and Johnson were also asked to participate.

After addressing 'hot spots,' troublesome areas in each district, the task became more difficult. The group needed to address and prioritize projects across the state. First, the committee ranked roads by the amount of traffic that used them: Interstates as the highest priority, interregional highways next, followed by state corridors, district corridors and smaller collector roads.

"Ride quality targets for interstates would be higher with other highways lower," Johnson explains. "When ride quality drops below that target level, we need to make improvements, but we didn't know where to set those targets."

To that end, Johnson analyzed ride quality data on more than 3,600 miles of road that had been improved over the past nine years. His goal was to determine how much ride quality was improved under various methods of resurfacing or rebuilding. With specially equipped vehicles, the DOT collects ride-quality data on roads across the state and Johnson was able to compare data from before and after construction projects to measure how effective contractors were in producing smooth roads and how long various rebuilding strategies lasted.

Based on the data from his analysis, the DOT worked with the North Dakota Association of General Contractors to add stricter specifications for ride smoothness to two contracts for asphalt repaving during the summer of 2005. "If we have better roads up front, we should be able to expect those pavements to provide acceptable ride quality for a longer period of time," Johnson says.

With that in mind, the DOT paid premiums to contractors this summer on two projects where finished roads were smoother than what was specified in the contracts. Similarly, penalties were written into the contracts for poor ride quality. Johnson notes that studies in South Dakota indicate that every dollar invested up front to improve ride quality yields a \$7 return in extended life or reduced maintenance.

The DOT will continue to evaluate that approach in the coming year. "The smoother you make pavement, the more expensive it is," Johnson notes. "What's the point of diminishing return? Also, we want to know the effect these stipulations have on the original bid process."



OTHER PROJECTS:

Software Conversions. Information technology students assisted the NDDOT in converting a number of existing programs to run with updated software programs. Conversions included moving Quattro Pro solutions to Microsoft Excel solutions. A number of Basic programs were converted over to visual basic.net programs. The Materials and Research PARTS program was converted from a series of stand alone Quattro Pro spreadsheets to a database coupled with input screens and reports.

Software Tools. The students also developed specialized software tools to assist the staff support efforts. A tool was developed to solve any of the equation variables within the 1986 AASHTO Flexible Design Equation.

DOTSC also developed a statistically based transverse crack rating program to measure severity, extent and depth. It is based on the Micro Paver PCI random sampling and uses deduct curves and statistical confidence levels. The program estimates the amount of crack subsidence and estimates quantities of crack sealing material required.

NDDOT Staff Assistance Projects:

Contract Management and University Research Coordination. The DOTSC student design center continues to teach undergraduate engineering students roadway design through hands-on involvement in projects ranging from Interstate reconstruction and interchange reconstruction to asphalt overlays and improved safety features on two-lane highways. Under the direction of a DOT engineer, students complete plans and specifications for the projects.

An effort to increase access for the NDDOT to university-wide intellectual knowledge was stepped up. For example, when the department had issues with paint flaking off steel bridge beams, a meeting was set up with the university's polymers and coatings group to see if it could provide some assistance. Efforts are also beginning to utilize more of the expertise within the university's civil engineering department.

Pavement Preservation Assistance: Work continued in support of the pavement preservation initiative. The effort consisted primarily of meeting support and performance analysis of preservation strategies. A preliminary review of the new strategy using a small-scale surfacing machine to correct depressed cracks was investigated as well as identification of potential project candidates. The decision trees developed for the ride activities were expanded to include pavement preservation strategies



Support was also provided to the pavement management unit. That support primarily consisted of analyzing the adjustments needed to correlate the prior Pathways profile data output to the new Pathways data. A review and recommendation to update the department's pavement management system was also provided.

Load Carrying Capacity Objective: An analysis of pavement damage during spring thaw was developed and the results prompted a change to the load restriction policy. The new policy places a greater emphasis on axle weight rather than gross vehicle weight and removes spring road restrictions from the top three levels of highway in the state to aid in the economic movement of goods during this eight-week period.

Other Support Effort: Support of other business objectives included analysis of maintenance service levels and change in geometric and performance standards for each highway performance classification system.

Reassessment of the NDDOT Organizational Health: Assistance was provided to the NDDOT to complete an updated assessment of the organization's health. An employee satisfaction survey was modified to capture information about new issues of concern and to assess perceptions of change over time. Assistance was provided in the collection and analysis of the new survey information and a report summarizing the findings was provided to the department. In 2005, a survey tool is being developed to easily update the survey via the web.

Investment and Performance Classification Studies: The objective of this task is to support NDDOT strategic plan objectives 3.2, Refine and implement highway modal investment strategy, and 3.3, refine and implement roadway classification system. As part of this effort the HERS-ST program for statewide modal investment was updated and subsections of the database corresponding to district boundaries for future local investment analysis were included. The analysis included the safety impacts of potential modal and performance classification alternatives. A final report and executive summary was provided to the department.



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TANDBERG AudioScience

Mountain-Plains Consortium



The **Mountain-Plains Consortium** (MPC) conducts research, education and training on transportation infrastructure and the movement of passengers and freight. It is a competitively selected university program sponsored by the U.S. Department of Transportation attracting the nation’s best talent to study transportation and develop new transportation strategies and concepts. The consortium includes NDSU, Colorado State University, University of Utah, and University of Wyoming. The UGPTI’s academic programs are largely supported by MPC. Those programs are highlighted on pages 36-39.

MPC Partners with Northern Plains Tribal Technology Center

MPC is partnering with the Northern Plains Tribal Technology Center located at the United Tribes Technical College in Bismarck, N.D. to make highway planning and safety tools available to tribal transportation planners in the region.

The effort was launched when MPC director Denver Tolliver and UGPTI associate research fellow Jill Hough made presentations at the Tribal Transportation Planning Conference in Bismarck in 2003, addressing highway and transit planning methods. In addition, Tolliver presented an overview of the MPC program and its technology transfer capabilities.

Later that year, Tolliver made an invited presentation at the Tribal Workforce and Transportation Conference in Las Vegas on techniques for evaluating highway performance and the benefits of highway investments. In his presentation, Tolliver illustrated how the Highway Economic Requirements System is used to analyze investment options for state highways passing through reservations. As a result of the presentation, a follow-up workshop was held in Billings, Mont., to discuss the development of similar highway planning tools for tribal transportation planners.

In April 2004, Tolliver presented an overview of potential planning models to tribal transportation planning and Bureau of Indian Affairs officials at a regional conference in Aberdeen, S.D. In addition, MPC sponsored a very successful half-day workshop on low-volume road safety at the 2004 Tribal Workforce and Transportation Conference in Las Vegas. At the conference, Eugene Wilson, formerly of the University of Wyoming, covered a broad range of road safety issues, including procedures for performing safety audits of reservation roads. As a result of enthusiastic feedback from the conference, follow-up workshops and presentations are being planned.

“The road safety audit is a low-cost, practical method of improving safety on reservation roads and saving lives,” Tolliver notes. “Several studies have shown that accident and fatality rates are higher on reservation roads than other rural highways. Therefore, this cooperative effort is expected to yield substantial safety benefits.”

The Mountain-Plains Consortium also drew transportation experts from Colorado, Minnesota, Montana, North Dakota, Washington and Wyoming together via video conference during National Transportation Week in May to share ideas for improving transportation on Indian reservations through cooperation with tribal officials.



“It was a great session. I think we all learned a great deal and we look forward to doing it again,” Tolliver noted. The video conference was jointly sponsored by MPC and the Northern Plains and Colorado Tribal Technical Assistance Programs. The video conference, “Interfaces Between Tribal and State Transportation Planning,” focused on three key topics for state and tribal transportation planners:

- Recent changes to the Indian Reservation Road Inventory and the need to represent state and local highways in the inventory.
- Issues and new approaches to accident reporting on reservation roads.
- Case studies of cooperative state and tribal planning.

Because of MPC’s history of working with and providing support for Indian tribes in the region, MPC was asked to provide expertise for a reservation road safety audit. MPC funded the participation of a low-volume road expert, Kurt Johnson. In May 2005, Johnson participated in a roadside safety audit on the Standing Rock Indian Reservation which straddles the North Dakota-South Dakota border near the Missouri River. Johnson was selected to participate because of his expertise in pavement and pavement engineering. He was part of a team that included tribal authorities and representatives from the Federal Highway Administration, the North Dakota and South Dakota departments of transportation, the Federal Highway Administration’s Tribal Technical Assistance Program and the Bureau of Indian Affairs.

OTHER PROJECTS:

Video Conferences Featured During Transportation Week. The MPC was the center of regional activities celebrating National Transportation Week in May, hosting 17 transportation-focused video conference sessions designed to bring researchers and practitioners together. The sessions used the Transportation Learning Network, a network that connects NDSU and its MPC partners, Colorado State University, the University of Utah and the University of Wyoming, with state departments of transportation in the region to share information and technology. The educational and research sessions during the week ranged from a discussion of rural school bus logistics to a presentation by Eric Peterson, deputy administrator of the U.S. Department of Transportation’s Research and Innovative Technology Administration. “While it is 890 miles between Fargo, N.D., and Helena, Mont., and another 1,250 miles between Fargo and Salt Lake City, the MPC universities and state transportation departments have used technology to overcome these distances,” Peterson noted. Dave Sprynczynatyk, director of the NDDOT, also praised the effort. “The TLN is an effective and cost-effective way of providing training. Logistically, we just couldn’t do it any other way. The network saves us a great amount of money and a great amount of time.”



Interactive Effects of Traffic- and Environmental-Related Pavement Deterioration. Denver Tolliver of the UGPTI and Khalid Ksaibati of the University of Wyoming are cooperating to create a pavement, traffic and environmental database that can be used to formulate statistical models of pavement deterioration. Once the models are proven to be accurate they can be used in highway planning and pavement management.

Network Planning Model for Local and Regional Railroad Systems. Researchers will develop a model to evaluate investments in or changes to a railroad system. Analysis tools used by large Class I railroads may not fully reflect the impact of decisions on the 500 local and regional railroads across the country that operate on a smaller scale. In short line systems, network effects such as circuitous routing of overhead traffic, reductions in economies of density on mainlines, and reduced access to key crop production or industrial areas are important factors that must be considered in conjunction with traditional benefit measures such as track maintenance and train-operating costs savings. Moreover, rail network viability affects the regional highway system, energy consumption, emissions, and safety. The prototype model will be used to update the North Dakota Department of Transportation's State Rail Plan.

ITE Student Chapter at NDSU Field Trip. The Institute of Traffic Engineers student chapter at NDSU organized a two-day field trip for 16 of its members to Minneapolis and St. Paul. The students visited the following locations: Minnesota DOT Regional Transportation Management Center, Hiawatha Light Rail, Minneapolis/St. Paul International Airport, Benshoof and Associates, Army Corps of Engineers Locks and Dams, and the North Central Section of Institute of Transportation Engineers. The students experienced technical demonstrations, rode in light rail trains, observed the lock and dam system on the Mississippi River, and had a lunch discussion with consulting engineering firms about issues in the transportation field.

Students Attend Transportation Research Board Meeting. Eight graduate students from NDSU attended the 2005 Annual Meeting of the Transportation Research Board in Washington D.C. in January. The meeting gave students an opportunity to learn about transportation research and innovations from around the world. More than 9,500 transportation researchers, practitioners, and administrators attended the five-day meeting.



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Small Urban & Rural Transit Center



The **Small Urban & Rural Transit Center (SURTC)** provides transit stakeholders, users, providers, suppliers and agencies information and training on improved management and operations and technology to increase the mobility of small urban and rural residents through improved public transportation. Research focuses on transit coordination, mobility planning and ITS applications. An “Introduction to Public Transportation” graduate course has been developed and offered in several states via interactive video and staff help faculty integrate transit concepts and issues into their coursework.

Mobility Study Completed

SURTC completed an 18-month comprehensive look at transportation methods, demographics and geography in North Dakota to find ways to improve mobility for the state’s residents.

The study was conducted for the NDDOT and SURTC researchers offered recommendations to DOT officials.

“There is no one silver bullet that will meet all of the mobility needs across the state,” said Jon Mielke, the SURTC researcher who led the project. “That’s because everybody’s mobility needs are different and unique.”

DOT director Dave Sprynczynatyk said he hopes the plan will eventually lead to the development of a mobility index that will allow the DOT to identify areas that require service enhancements and to continually monitor progress that is being made toward the achievement of mobility goals.

“Our ultimate goal is to compare existing service with needs to determine where the gaps are. Based on that, we’ll develop a plan on how best to meet those needs and fill the gaps,” says Jon Mielke.

The effort was launched in April 2004 with a meeting of representatives from nearly two dozen public transportation-related organizations and agencies including social service agencies, transit providers, disability advocacy agencies, and the North Dakota Association of Counties. Those representatives formed a steering committee for the study. They identified key issues and outlined concerns faced by transit providers.

The study is part of a statewide strategic transportation plan adopted in 2002 by the NDDOT to provide a shared vision for North Dakota’s transportation system. The plan’s goals call for a transportation system that allows optimum personal mobility. One of the initiatives is the development of a statewide personal mobility plan.

A copy of the report “Personal Mobility in North Dakota: Trends, Gaps, and Recommended Enhancements” (DP-165) and the executive summary is available for download at www.surtc.org/research/reports.php.



OTHER PROJECTS:

Research

ITS in Coordination. In an FTA funded study, researchers are identifying impacts of intelligent transportation systems (ITS) technology on transportation coordination efforts in Kearney, Neb., suburban Detroit, Mich., and on a statewide basis in North Dakota. The study will give policy makers a better understanding of how to direct funding for activities related to ITS and coordination of transit services. The project will also show researchers and transit professionals how ITS has been successfully and unsuccessfully used.

Vanpool Revival? SURTC and the North Dakota Department of Commerce are exploring the feasibility of establishing vanpools across the state. Federal incentives and the economic climate of North Dakota have changed significantly since vanpools were last active in the 1970s and 1980s. The study will include surveys of major employers as well as employees.

Bus Manufacturing. Researchers are evaluating the manufacturing chain for small buses and vans used for rural and specialized transportation services. Frequent changes in ownership, low profitability and wide swings in demand have plagued the industry. Researchers will look at financial health of the industry, bus purchasing trends, purchasing policies and federal laws and regulations to evaluate their impact on the industry.

Campus Transit. For the third consecutive year, SURTC surveyed students at NDSU, Minnesota State University Moorhead and Concordia College to learn their attitudes toward transit and how they use the Metropolitan Area Transit system. The studies determined when and where the heaviest student ridership took place, allowing MAT to adjust accordingly.

Paratransit Service Analysis. MAT currently goes beyond the requirements of the Americans with Disabilities Act (ADA) in serving the Fargo-Moorhead area with its paratransit service. However, continuing to do so will be a challenge in the face of a growing metropolitan area and increasing costs. MAT contracted with SURTC to study the challenges and determine possible solutions.



Training

CCTM Study Guide. Transit managers across the country will benefit from the work of SURTC staff and cooperators who updated the study guide for the Community Transit Association’s Certified Community Transit Manager program. SURTC staff worked with SURTC steering committee members to integrate real-world thinking into the guide.

SMART Approach. Through the Community Transit Association, Detroit’s Suburban Mobility Authority for Regional Transportation (SMART) approached SURTC to update its training programs to help drivers maintain their required certifications. Far-flung suburbs and use of small buses and other vehicles make the program a good fit with SURTC and could serve as a pilot for other similar efforts. Transit officials in Utah have already expressed interest.

Education

Intro to Public Transit: Nineteen students from four states participated in an “Introduction to Public Transportation” course offered for the second time during spring semester 2005. The class features transit case studies, online discussions and presentations on research projects. Lectures are recorded and streamed via the Internet for student accessibility.

Student Design. Staff worked with architecture instructors and students in a contest to design a high-tech bus shelter for the Fargo area. One of the designs is slated to be built on the NDSU campus and the others are serving as a source of inspiration for a project to design a prototype bus shelter for cold climates.

Professional Training. SURTC coordinates at least two training sessions each year for transit agency professionals. Efforts have included website development, and marketing and business skills. In addition, SURTC has forged a strong relationship with the Dakota Transit Association and is helping that organization with its efforts to provide training to drivers and transit managers.



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Biennial Strategic Transportation Analysis Center



The **Biennial Strategic Transportation Analysis Center** addresses key issues in North Dakota transportation. Each biennium, the program focuses on a transportation and/or economic issue deemed of high importance to the state with the goal of improving the competitiveness of firms through transportation enhancements in North Dakota. The 2005 effort focuses on the economics of the motor carrier industry.

Transportation Conference Draws Freight Experts from Across Region

About 70 transportation experts from five states and two Canadian provinces met in Fargo June 15-16, 2005, at the Ramada Plaza Suites to discuss ways of removing barriers to truck transportation across the region.

“The majority of trade within our region is between neighboring states and provinces and an efficient transportation system is essential in maintaining the health of our economy,” noted NDDOT director David Sprynczynatyk. “This conference is a first step in improving our truck transportation system to serve the region’s businesses and facilitate competitiveness.”

With the passage of the North American Free Trade Agreement, the value of trade between many of the states and provinces within the region has grown significantly, making it imperative for states and provinces to develop a more efficient and economically competitive truck transportation system.

Conference topics included: differences in truck size and weight regulations, differences in truck permitting regulations, safety issues and economic impacts. The conference was hosted and organized by the Upper Great Plains Transportation Institute at NDSU and the North Dakota Department of Transportation. Attendees included federal, state and provincial transportation officials, transportation researchers, trucking company representatives and commercial carrier safety officials.

The conference grew out of the NDDOT’s Strategic Plan, which called for improvement in the performance of transportation corridors and facilities, coordination of statewide load limits, and evaluation of opportunities and impacts of regional uniform truck size, weight and permitting systems.

Based on issues raised during the conference and in reviewing regulations governing freight shipments across the region and on previous research, UGPTI specialists developed a comprehensive report identifying barriers that inhibit the flow of freight across the region and the challenges of removing those barriers.

“The economics for shippers and the motor carrier industry lean toward higher gross vehicle weights, especially for perishable products such as potatoes and sugar beets,” noted Mark Berwick, UGPTI research fellow. “Higher load limits and larger truck sizes could significantly reduce total transportation costs, increase profitability of companies and have a positive effect on the efficiency of freight flows and competitiveness of our region.”



However, Berwick said, “Officials in the region will have to weigh those benefits against factors such as increased wear on roadways, costs of implementing changes, and impacts on highway safety.” And there will be other impacts in the freight industry, as well. A move to larger trucks or truck configurations will have different impacts on larger carriers than smaller carriers depending on their existing inventory of equipment.”

The conference and resulting report provides background for decisions about interstate and international freight corridors. “The more information we can provide about the benefits and costs of changes to freight regulations and the impacts of those changes, the better the decisions made about those regulations will be,” Berwick said.

For more information, view presentations and the final report, North Dakota Strategic Freight Analysis, online at www.ugpti.org/conference/.



OTHER PROJECTS:

Intermodal Freight Possibilities Examined. Researchers explored the feasibility of establishing a logistics center including an intermodal freight loading facility by surveying potential shippers in the region. They identified current and potential volumes of containerized freight in the region to estimate the viability of the current facility near Glyndon, Minn., and the feasibility of an enhanced facility. The researchers found that the volume of containerized freight shipped from the region is growing by about 7 percent a year and is estimated



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Transportation Learning Network



The **Transportation Learning Network** is an interactive video conferencing network linking the transportation departments in Montana, North Dakota, and Wyoming and the Mountain-Plains Consortium universities. TLN supports quality transportation through a network of people and technology that serves TLN members by enhancing communication, education, professional development, technology transfer, and research.

Comprehensive DOT Technical Training Initiative Planned

The UpGPTI through the TLN is launching a four-state initiative to provide technical training to department of transportation professionals.

Departments of Transportation in North Dakota, Montana, South Dakota and Wyoming face similar challenges. Workloads are increasing. The size of middle management is decreasing. Requirements for career-long learning and certification are escalating. Budgets are flat. And competition for trained people is fiercer than ever, notes Gary Berreth. “What’s needed is an innovative approach that will help the agencies in our region address these challenges,” he says.

Berreth was an administrative transportation engineer when he retired from the NDDOT in 2005 after a 37-year career there. Upon retirement he joined the UGPTI. He and Julie Rodriguez of UGPTI are leading the DOT technical training initiative.

Department of transportation administrators from the four departments met to discuss their technical training concerns and agreed to cooperatively investigate the feasibility of developing a program to innovatively provide quality technical training in a more cost effective manner. Because of UGPTI’s previous experience with training, especially through TLN (formally Tel 8), the Institute was a logical candidate to coordinate this effort, Berreth says.

TLN is one mechanism for delivering technical training and can serve as a base for complementing or branching off into other innovative training options, he notes. Guidance for the initiative will be provided by an advisory group consisting of an executive management representative from each of the four DOTs, the director of the Mountain-Plains Consortium, and the director of UGPTI.

Berreth is working with the departments to document their training resources, processes, needs, and concerns. After this information has been compiled a report will be prepared summarizing results along with recommendations to cooperatively improve technical training efficiencies for the representative agencies. The report will be reviewed by the advisory group to determine the extent of implementation of recommendations.

If approved, the next phase of the project, to be implemented in 2006 and 2007, will focus on developing training curriculums and packages that may include instructor-led training, train-the-trainer programs, self-study courses, online training, distance education efforts via the TLN, or other innovative training techniques. “We’ll look at a variety of educational approaches so we can come up with what is most effective and efficient,” Berreth says.



OTHER HIGHLIGHTS:

New Name and Equipment for TLN. Tel8 upgraded its equipment, re-evaluated its mission and staffing and changed its name in the past year. “The changes position us to take advantage of new technology and expand our programming and service,” says Julie Rodriguez. “Our new name, Transportation Learning Network, reflects those changes.” Rodriguez is the executive director of the network. Installation of new equipment was complete in February 2005 and marked the network’s shift from ISDN technology to Internet-based video conferencing. “The change has doubled the quality of our transmissions,” Rodriguez notes. “In addition, the Internet-based video conferencing reduces costs and expands the availability of the network to many more users.”

Currently, 24 sites participate in TLN events and another 10 locations in North Dakota will soon be added. The network facilitates technical training, transportation short courses, peer sessions, graduate-level classes, professional management and leadership courses, and seminars.



Technical presentations. Researchers and practitioners shared information and research results in technical seminars. Topics included: Development of a Ride Preservation Program, Regional ITS Architecture and Weigh-in-Motion. Other programs focus on training staff for professional certification or bringing them up-to-date on new practices or regulations. For example, training was held on the new Manual on Uniform Traffic Control Devices and Innovative Contracting Procedures and sessions were held to prepare staff for the Professional Engineer’s exam.

Staff development. DOT staff across the region have access to staff development opportunities via the TLN that would otherwise require expending time and expense for travel and accommodations. Examples include FranklinCovey workshops and other workshops such as legal aspects of supervision and managing stress.



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Transportation Safety Systems Center



The **Transportation Safety Systems Center (TSSC)** based in Lakewood, Colo., develops and maintains software used by state and federal safety specialists nationwide at weigh stations and ports-of-entry for inspecting commercial vehicles. Additional software is used by safety specialists during on-site reviews of commercial carriers. In addition, the center is also extensively involved with safety-related research and analysis to improve targeting of enforcement efforts and to enhance software programs.

TSSC Integrates Driver Conviction Data into Inspection Selection Process

Driver-related factors contribute to more than 90 percent of all crashes involving commercial vehicles. Consequently, researchers at the Transportation Safety Systems Center are working to integrate information on driver traffic convictions into the algorithm and software that commercial vehicle inspectors use to select drivers and vehicles for safety inspections.

“A commercial driver with a history of certain past traffic convictions has up to 100 percent greater likelihood of a future crash. Because drivers are such an important factor in commercial vehicle safety, we wanted to find a way to focus the inspection process more on drivers,” said Brenda Lantz, TSSC director.

Working with the Federal Motor Carrier Safety Administration, specialists determined how to link information in federal safety inspection and crash databases with state department of motor vehicle driver records. Through the federal crash and inspection records, drivers could be linked to the company that employed them.

“Based on that data, we were able to create a driver conviction measure and then a carrier driver conviction measure which factored in the seriousness and number of offenses committed by a carrier’s drivers,” Lantz explained.

“As a result, enforcement agencies are better able to target high-risk carriers. The system also provides risk-assessment information on smaller carriers that may not be captured in other systems,” she notes.

“Good carriers put a lot of resources into the front end of developing safe drivers and keeping safe drivers,” Lantz said. Conversely, carriers that are less rigorous in hiring and keeping safe drivers tend to have other safety concerns as well.

The system was tested in Tennessee and Ohio in 2004 where commercial vehicle inspectors were given hand-held computers, Personal Digital Assistants (PDAs), connected wirelessly to the software and databases to use in their assessments. “The inspectors just loved it,” Lantz said.

Since then, the system has been pilot-tested in eight states. Lantz says in those states, the number of trucks taken out of service for safety violations increased by 8 to 10 percent and preliminary crash data appear to indicate that use of the system is cutting crash rates in those states during the time frame of the pilot test.



OTHER PROJECTS:

- Developed high-quality software in use by federal and state commercial safety specialists nationwide.
- Continued to assist FMCSA and state personnel in their partnership with the U.S. Customs and Border Protection to give inspectors the ability to identify and contain unsafe commercial motor vehicles and drivers before they reach our nation's roads. The work is also supported by the North Dakota Highway Patrol.
- In association with several partners, began work on FMCSA's five-year IT Modernization effort termed COMPASS. This project will transform all of FMCSA's current systems into an integrated service oriented architecture.



- Initiated a project to improve the quality of driver identification data collected for commercial vehicle roadside inspection and crash reports. Driver data from the reports is run through the Commercial Driver's License Information System and any non-matches are recorded. Potential factors contributing to the non-match rate will be identified and strategies will be recommended to help improve the validity of driver identification data collected.
- Conducted numerous presentations at national meetings regarding the research and software development completed by TSSC staff.



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Academic Programs



The UGPTI offers an interdisciplinary Ph.D. program in transportation and logistics and a transportation option in the master's degree programs in civil engineering and agribusiness. Graduates are prepared for careers in wholesale and retail business, construction, consulting, and government that require complex solutions to the challenges of moving people and products. A master's degree in military logistics will be offered Fall 2006. The UGPTI is working with Bismarck State College to offer an associate's degree program to help students develop technical and management skills needed by transportation service providers and their customers in North Dakota. Most of UGPTI's academic programs are largely funded by the Mountain-Plains Consortium.

UGPTI Prepares to Launch Master of Military Logistics Program

The Master of Military Logistics (MML) at NDSU is a 36-credit professional degree program targeted specifically at career military officers, Department of Defense civilians, and defense industry contractors. The program will be launched in the Fall 2006.

“We worked with the defense department to tailor this degree specifically to its strategic goals of joint officer development and logistics transformation,” noted UGPTI director Gene Griffin. “Because of its interdisciplinary and specialized nature, the MML degree will offer a unique curriculum not found elsewhere.”

About 20 students are expected to enroll in the 12-month intensive program. “Excellent support from NDSU administration and academic departments allowed us to assemble a program that fit the demands outlined by the Department of Defense,” Griffin said.

The MML will be offered by the Transportation and Logistics Program in conjunction with the NDSU departments of Industrial and Manufacturing Engineering; Marketing, Management, and Finance; Computer Science and Operations Research; Emergency Management; and the UGPTI. The program will focus on logistics and supply-chain management, transportation of material and equipment, international logistics, enterprise resource planning, adaptive logistics planning, change management, technologies for supply-chain management, and crisis management and homeland security. All courses will include military examples and case studies. In addition, the curriculum will include a synthesis course in military logistics case studies as well as a course designed to build the research and analysis skills of the students.

“Today's changing battlefield and global environments pose great challenges for the Department of Defense,” Griffin said. “Equally important, the military services face challenges in achieving peace after major hostilities. The extended global war on terror has added new complexities to traditional military operations. In peacetime, rapid responses are needed to natural disasters such as hurricanes, earthquakes, and tsunamis. A key requirement for meeting these challenges is a joint interdisciplinary approach to military logistics.”



The interdisciplinary nature of the program is unique because of its emphasis on:

- Joint military logistics and transportation
- Advanced supply chain management
- Integration of technology with supply-chain and enterprise resource planning
- The integration of homeland security and crisis management issues with military logistics
- The mix of management and planning courses included as technical electives

The unique challenges of military logistics—which are different from commercial logistics—are reflected in the program. Several courses are specifically designed to address military exigencies and priorities, and will include military logistics case studies. Moreover, the curriculum reflects the goal of integrating military and private-sector logistics.



OTHER HIGHLIGHTS:

Ph.D. Program Continues to Grow. The doctoral program in Transportation and Logistics grew to include 13 students. The program, launched in 2003, is designed to help students develop advanced knowledge and research skills in the rapidly growing fields of transportation and logistics. The doctoral program is a joint effort of the College of Agriculture, Food Systems, Natural Resources, the College of Business Administration, the College of Engineering & Architecture, and the MPC.

Associates Degree Established at Bismarck State College. The Transportation and Supply Chain Management program will allow students to obtain an Associate in Applied Science degree enabling them to work in the transportation industry in a variety of challenging and interesting jobs vital to the state and nation. It is anticipated that program graduates will either enter the workforce or pursue a related four-year degree at NDSU.



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Carla Pedersen
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Tara Schumacher
Jack Smith
Travis Spaeth
Matthew Stamness
Adam Vail
Jessica Wagner
Nicholas Zechmann



Zink Honored at Annual Awards Banquet

More than 125 people attended the UGPTI's Ninth Annual Awards Banquet Sept. 28, 2004 at the Fargo Holiday Inn to honor Ray Zink former North Dakota Department of Transportation Chief Engineer and the John M. Agrey Award winner.

Zink accepted the award from UGPTI Advisory Board chair and DOT director Dave Sprynczynatyk.

"A previous recipient of this award, Bob Bradley, was my predecessor at the DOT," Zink noted. "He told me to hire good people, tell them what to do, and get out of the way. This award is a tribute to those good people and to me for staying out of the way."



Zink said he credits his engineering degree from NDSU for getting his career off to a good start and says later collaboration with colleagues at NDSU was a great benefit to the DOT.

"There are never enough people and never enough money, so you find help wherever you can," he said. "One of the places we found help was the Upper Great Plains Transportation Institute. In visiting with other chief engineers around the country, they would ask me how to get that relationship with the staff at universities. I told them, that's the way it's always been in North Dakota."

During Ray Zink's more than 40 years with the NDDOT, he worked effectively with three governors, four NDDOT directors, members of both political parties and the workers of the DOT.

During his career he implemented major reforms within the department. He created the "master equipment operator" position which was instrumental in slowing turnover in the ranks of equipment operators and reinstating pride within the maintenance force. He also led the consolidation of maintenance sections leading to more efficient, productive employees and workstations. Finally, he established the low-load program to preserve the highway system by limiting the weight of tractor-trailer vehicles.

Originally from Bordulac, N.D., Zink earned a B.S. in engineering from North Dakota State University in 1959. He began his career with the NDDOT that same year as a draftsman and eventually became the department's chief engineer. He retired in 1999 as deputy director for engineering policy and director of the office of highway operations. After his retirement he was involved in transportation-related consulting work.

Zink also served as vice-chair of the American Association of State Highway Transportation Officials (AASHTO) Standing Committee on Highways. He also served on the AASHTO Committee for National Cooperative Highway Research Programs.

Zink and his wife, Alita, have four children and live in Bismarck.



Transportation Engineering Scholarships

At the banquet, Sprynczynatyk also recognized Dustin Kinnischtzke and Leo Schaefer, winners of the 2004 Transportation Engineering Scholarships awarded by the UGPTI.

Kinnischtzke is a graduate of Washburn High School. At NDSU he has made frequent appearances on the dean's list and is a member of Tau Beta Pi, an academic honor society. He has also been an active member of the student chapter of the American Society of Civil Engineers.

After completing his bachelor's degree in civil engineering, Kinnischtzke plans to earn a masters degree. His long-term goals include earning certification as a professional engineer and working for a transportation consulting firm.



Dustin Kinnischtzke

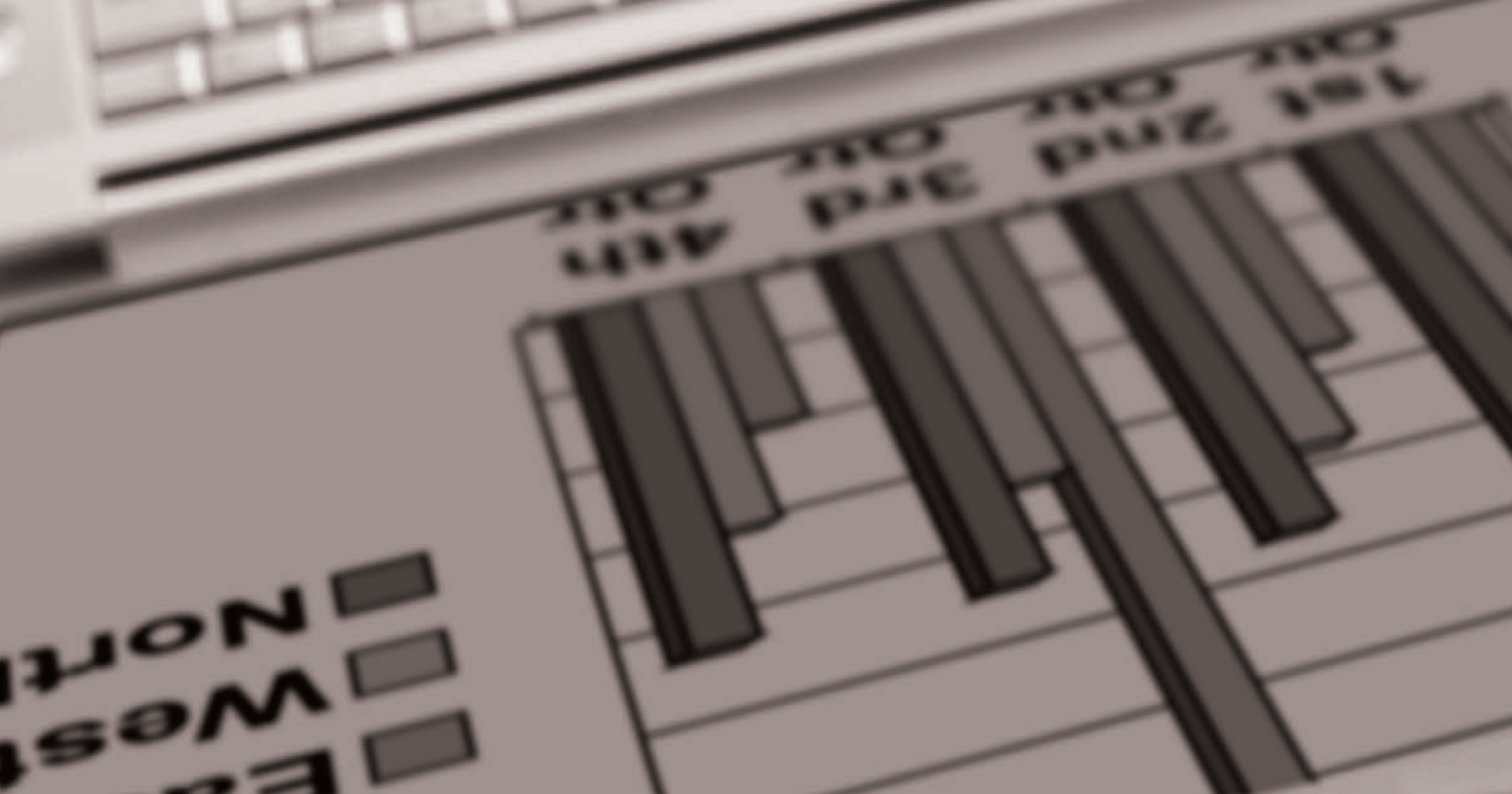
Schaefer is a graduate of Monticello High School and was a student at Dunwoody Institute in Minneapolis before coming to NDSU. He was on the dean's list each semester at Dunwoody and has continued that academic achievement each semester since coming to NDSU.

As an intern with SRF Consulting Group, Inc., Schaefer worked as a field inspector on city road projects and honed his interest in transportation and civil engineering. His long-term goal is to become a partner in a consulting firm. His main interest is in planning and designing bridges.



Leo Schaefer

2004-05 Publications



Department Publications

DP-156	Airfares to Small and Medium Sized Communities
DP-157	Bismarck-Mandan Metropolitan ITS Plan
DP-158	Transportation Quality Indices for Economic Analysis of Non-Metropolitan Cities
DP-159	Meeting Small Urban Transit Needs in North Dakota: A Case Study Perspective
DP-160	Enhancing Passenger Mobility Services in North Dakota through Increased Coordination
DP-161	Reassessment of North Dakota Department of Transportation Organizational Health
DP-162	NDDOT Workforce Analysis: A Necessary Step in Creating an Effective Strategic Human Capital Plan
DP-163	North Dakota Grain and Oilseed Transportation Statistics, 2003-04
DP-164	Annual North Dakota Elevator Marketing Report, 2003-04
DP-166	Metropolitan Area Transit Paratransit Service Boundary Study, 2004-05

Mountain-Plains Consortium Publications

MPC 04-156	Road Dust Suppression: Effect on Maintenance, Stability, Safety and the Environment (Phases 1-3)
MPC 04-157	Evaluating and Improving Pedestrian Safety in Utah
MPC 04-158	Evaluation of the Effectiveness of High Occupancy Vehicle Lanes
MPC 04-159	Laboratory Evaluation of Bottom Ash Asphalt Mixes
MPC 04-160	Evaluating the Effectiveness of QC/QA Programs in Region 8 States
MPC 04-161	Survey of Implementation Strategies by Rural Paratransit Agencies Using Low-Cost Software
MPC 04-162	Highly Flexible Crash Barriers
MPC 04-163	Composite Repair of Railroad Crossties through the Process of Shear Spiking
MPC 04-164	High Occupancy Vehicle Lanes Evaluation II - Traffic Impact, Safety Assessment, and Public Acceptance
MPC 04-165	Load Tests of Large Wood-Concrete Beams
MPC 04-166	Evaluation of UDOT's Video Detection Systems: System's Performance in Various Test Conditions
MPC 04-167	Effects of Environmental Exposure on Timber Railroad Bridge/Track Members and Connects
MPC 04-168	Investment in Rural Roads: Willingness-to-Pay for Improved Gravel Road Service in Freight Transportation
MPC-05-169	Small Urban University Transit: A Tri-Campus Case Study, 2004-05
MPC-05-170	Wyoming Freight Movement and Wind Vulnerability, 2004-05
MPC-05-171	Framework for Enhancing Scheduling Software for Small to Medium Size Paratransit Agencies, 2004-05



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