Mountain-Plains Consortium

2001 annual report

MPC Theme

The theme of the Mountain Plains Consortium is "RURAL AND INTERMODAL TRANSPORTATION." It is predicated upon the spatial and economic character of the region and a set of critical issues common to Region 8 and the broader Mountain-Plains geographic region.

MPC Vision

To be a regional and national leader in rural and intermodal transportation and a North American center for cooperative education and information exchange.

Colorado State University
North Dakota State University
University of Utah
University of Wyoming

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Table of Contents

Message from the President of North Dakota State University

Joseph Chapman

In the 14-year history of the Mountain-Plains Consortium, the level of activity and interest in transportation education and research has risen greatly at North Dakota State University. Today, we have faculty and students in many departments across campus who are interested and participating in these programs. We view transportation as a primary growth area in the university. It is a vital, multi-disciplinary field that energizes people from many backgrounds and disciplines.

Our vision is for the center to be a regional and national leader in rural and intermodal transportation and a North American center for cooperative education and information exchange. Our partnerships and cooperative programs with Colorado State University, University of Utah and University of Wyoming are an essential part of this effort. The synergy created by the consortium has expanded opportunities and knowledge throughout the region, and created a greater awareness of rural and intermodal transportation issues and options.

This report describes our progress and accomplishments during the 2000-01 fiscal year and provides a brief history and overview of the Mountain-Plains Consortium. We are especially proud of our efforts to attract new students and faculty to transportation through our multi-disciplinary distance learning programs. We're also excited to announce that we have begun work to develop a doctorate program in transportation and logistics. We look to the future with great enthusiasm and a renewed commitment to excellence in transportation education, research and public service.

Director's Message

Denver Tolliver

The Mountain-Plains Consortium (MPC) was created in 1988 as a result of the University Transportation Centers (UTC) Program. MPC has been the designated center for federal region VIII since the program's inception. It is one of ten competitively-selected regional centers. It is located at North Dakota State University, and includes Colorado State University, University of Utah, and University of Wyoming. The MPC theme is *Rural and Intermodal Transportation.* Within this general theme, seven research focus areas have been defined:

- Rural transportation safety
- Rural transit
- Low-volume roads and bridges
- Intermodal freight and logistics
- Environmental impacts
- Tourism and recreational travel
- International cross-border traffic

This report describes our activities and progress during Fiscal Year 2001, which covers the period from July 2000 through June 2001. The report also includes a description of the MPC universities, a brief history of the consortium, and a summary of our main strategies and objectives.

As described in *The Year in Review,* this year has been both productive and formative. On the educational front, the MPC universities offered 28 graduate-level transportation courses, including new courses in *Railroad Planning & Design* and *Safety of Transportation*. In addition, many related courses were offered by the participating academic departments of Civil and Environmental Engineering, Construction Management, Agribusiness and Applied Economics, and Business Administration.

During FY 2001, a program plan was developed for a new logistics minor and the groundwork was laid for the development of a doctoral degree in Transportation and Logistics. In addition, the MPC initiated a distance education short-course program for DOT professionals and offered two courses via the TEL8 telecommunication network – *Preparing for the Professional Engineer's Exam* and *Corrosion Science*.

On the research front, MPC published ten new peer-reviewed reports. Moreover, MPC faculty continued the research seminar series via the TEL8 network.

In the area of human resource development, we expanded our internship and student recruitment activities. Three of those activities are highlighted in this year's report – The Colorado Internship Program, the Utah Future Engineers Program, and the NDSU Transportation Student Association.

In FY 2001, we continued our key partnerships with the Southwest University Transportation Center at Texas A&M University, the Intermodal Transportation Institute at the University of Denver, the University of Manitoba Transportation Institute, and state transportation departments in Region 8. We strengthen our relationship with state DOTs through coordinated distance education and training initiatives and through the activities of the recently formed DOT Support Center.

I have highlighted only some of our accomplishments and initiatives during the year. Many additional activities are described in the remainder of this report. I encourage you to visit our website at http:/ /www.mountain-plains.org, or contact us by mail at: Mountain-Plains Consortium, North Dakota State University, 430 IACC Building, Fargo, ND 58105.

The Mountain-Plains Consortium

The Universities

Colorado State University

CSU is governed by the State Board of Agriculture as a public land grant institution with a rural, agricultural mission. Current enrollment is more than 22,000 students. Baccalaureate degrees are offered in 55 departments in eight colleges, including agricultural sciences, applied human sciences, business, engineering, liberal arts, natural resources, natural sciences and veterinary medicine and biomedical sciences. CSU offers 40 doctoral and 61 master degree programs. Primary transportation graduate educational and outreach activities occur in the College of Engineering, with related activities in business, applied human sciences, and natural resources. Currently, 24 faculty have capabilities and activities pertinent to transportation. Graduate courses are available in civil engineering, mechanical engineering, earth resources, business, remote sensing and construction management. The College of Business offers an MBA degree and houses the Institute of Transportation Management, which serves public and private sector organizations. A $12 million expansion of the University Libraries recently was completed, and access is provided to more than three million items in four facilities in a modern computerized setting.

North Dakota StateUniversity

NDSU is a land grant institution with an annual enrollment of approximately 9,700 students and more than 800 faculty and academic staff at the central campus in Fargo. The university offers 21 doctorate and professional degree programs, 45 master's degree programs, and 76 baccalaureate degree programs. Currently, 14 graduate faculty with doctorate degrees are associated with the graduate transportation options. Collectively, these faculty members encompass a wide range of educational experience and expertise. NDSU is also part of a tri-college system, which includes Minnesota State University-Moorhead and Concordia College in Minnesota. The network promotes educational and research interchange among faculty and allows students to take courses at more than one institution for undergraduate credit.

University of Utah

The University of Utah has an annual enrollment of about 25,000 students and offers 74 undergraduate degree programs, more than 50 teaching majors and minors, and 93 graduate majors. Students are enrolled from all 29 Utah counties, all 50 states, and 102 foreign countries. There are 16 colleges. The College of Engineering is divided into seven academic departments – civil, mechanical, chemical, electrical, bioengineering, material science, and computer science – with 115 regular faculty and 180 adjunct, clinical, and research faculty. Collectively, these departments earned $50 million in external research funding in 1998. The College of Engineering has several well-equipped laboratories specializing in structural, geotechnical, hydraulic, environmental, traffic, and materials engineering.

University of Wyoming

UW is a land grant institution with an annual enrollment of about 12,000 students. The university has eight colleges and offers the master degree in 84 fields. UW's academic program features a multidisciplinary approach that expands the educational backgrounds of its MPC graduate students, and other students studying transportation areas. Supporting courses for the program are available in statistics, computer science, and management. Included, for example, are GIS training in the Department of Geography, management training in the business college, special courses and research programs that respond to the multidisciplinary needs of statewide transportation planning, analysis of recreational travel behavior and tourism, and management systems.

Milestones and Historical Accomplishments

The Mountain-Plains Consortium was established in 1988 in response to the University Transportation Centers Program. MPC was selected as the center for federal Region 8 in the initial competition held by USDOT. MPC won a subsequent re-competition during the ISTEA era, as well as the most recent competition following the passage of TEA-21.

From 1988 through 2001, MPC produced a library of 136 research reports and 40 student theses or dissertations, while attracting new faculty to the field of transportation. During 1988-2001, MPC funded 58 different principal investigators and developed or adapted 20 transportation graduate courses for delivery over the TEL8 distance learning network. The MPC universities also continued to teach most of their preexisting transportation courses and exceeded the targeted maintenance of effort funding levels specified by USDOT. During this period, MPC funds were used to leverage funding from agencies such as state and local transportation departments, USDA, FTA, FRA, and the American Association of Railroads.

The following list of milestone achievements provides only a cursory view of the cumulative accomplishments of the Mountain-Plains Consortium. This year's accomplishments add to its history of achievement and growth in transportation education, research, and technology transfer activities in Region 8.

2001
- First NDDOT engineer graduates from the Master of Science program after completing all courses via TEL8
- NDSU curricula committees approves program plan for minor in Logistics
- MPC initiates short course program for state DOT personnel and offers two short courses via TEL8

2000
- MPC five-year strategic plan approved

1999
- MPC universities deliver 18 graduate courses over TEL8 network under cooperative agreement
- MPC wins TEA-21 competition for Region 8
- University of Utah joins Consortium
- Memorandum of agreement signed with Southwest University Transportation Center covering education and research exchanges

1998
- Tenth-year program plan is approved

1997
- Ninth-year program plan is approved
- Started North American Educational and Research Exchange with University of Manitoba (1997)

1996
- Eight-year program plan is approved
- TEL8 research seminar series started
- Research partnership established with American Association of Railroads
- Cooperative agreement signed by MPC universities for annual exchange of graduate courses via TEL8
- Joint MPC-state DOT program planning committee established

1995
- MPC wins re-competition during ISTEA era
- TEL8 used to deliver 44 hours of TRB sessions to state transportation departments in Region 8
- Seventh-year program plan is approved
- Partnership established with American Short Line Railroad Association and FRA, resulting in the establishment of a national short line railroad database
- First graduate courses exchanged among MPC universities

1994
- Sixth-year program plan is approved
- TEL8 telecommunications network started, connecting MPC universities with state transportation departments in Region 8 and FHWA site

1993
- Fifth-year program plan is approved
- Multi-disciplinary graduate transportation educational program is started, with options in Civil Engineering and Agricultural Economics
- Non-residency graduate transportation option for NDDOT engineers initiated using Interactive Video Network

1992
- Fourth-year program plan is approved

1991
- Third-year program plan is approved
- MPC establishes outstanding graduate student award

1990
- Second-year program plan is approved
- Reorganization of MPC to include four Region 8 universities

1989
- Regional Conference and Planning Meetings with LTAP Center Directors
- First-year program plan is approved

1988
- Mountain-Plains Consortium is founded and selected as Region 8 Center

Program Goals, Strategies and Focus Areas

The desired UTC program outcome is "to increase the number of Americans who are prepared to design, deploy and operate the complex transportation systems that will enhance America's economic competitiveness in the 21st century." MPC has developed a series of program goals and five-year strategies to help realize the desired outcome. They are detailed in the 1999 MPC Strategic Plan, which is available at our website.

Four key words help to define MPC's strategies and programs – multi-university, multi-disciplinary, multi-modal, and multi-national. We are continuing our pre-existing programs at the four universities while developing new multi-disciplinary educational, research, and technology transfer programs. Collectively, these programs coordinate and integrate concepts from many disciplines including engineering, planning, economics, business, geography, computer science, and operations research. Our educational programs feature resident and non-resident courses and use traditional and innovative delivery media. They also feature a mixture of undergraduate, graduate, and continuing education components. Our research focus areas encompass the surface modes of highway, transit, and railroad, as well as intermodal freight movements.

Our focus area in International Cross-Border Traffic addresses multinational transportation issues, as do much of our educational and technology transfer activities. One of our major strategies is to engage universities in Canada, Mexico, and the United States in a broader partnership to foster exchange and dissemination of knowledge in the midcontinent region.

This section of the report defines our focus areas and summarizes MPC's program goals and prime strategies. These strategies are organized under the guiding UTCP goals of education, research selection and performance, technology transfer, and human resources.

Educational Goal: A multi-disciplinary program of course work and experiential learning that reinforces the transportation theme of the Center

MPC Program Goals

- A multi-disciplinary attitude and environment that fosters interchange among students, academic departments, and transportation disciplines.
- A multi-university educational and research program in which transportation is viewed as a crosscutting, high-priority area of emphasis at each institution.
- A collaborative environment that features coordination and regular communication among all transportation centers and institutes in Region 8.
- A North American perspective in which Canadian and Region 8 universities cooperatively assess educational and research goals, and undertake demonstration projects to refine the scope of potential international partnerships.

Prime MPC Educational Strategies

- Continue to expand the MPC transportation curricula to encompass more disciplines and provide coverage of all modes.
- Continue to work with state transportation departments, LTAP Centers, and the TEL8 Board of Directors to meet the educational needs of mid-career transportation professionals in the region.
- Foster exchange and partnerships between U.S. and Canadian universities in curricula development and course delivery, especially in the field of international transportation and logistics.
- Foster distance learning and offer students more options by further integrating the graduate and continuing education programs of MPC institutions.
- Develop a strong internship program to provide students with first-hand experience in rural and intermodal transportation.
- Expand the dialogue and collaboration among academic departments at each MPC university through interdepartmental seminars, meetings, and regularly-scheduled events.
- Further integrate graduate, undergraduate, and community/junior college educational programs to introduce transportation concepts early in the higher educational process.
- Work with K-12 and community colleges to better inform students about modern transportation careers.

Research Selection Goal: An objective process for selecting and reviewing research that balances multiple objectives of the program

Research Performance Goal: An ongoing program of basic and applied research, the products of which are judged by peers or other experts in the field to advance the body of knowledge in transportation

MPC Research Program Goals

- A balanced research program in rural and intermodal transportation that reflects priorities of major client groups and USDOT's strategic goals.
- A library of research material in rural and intermodal transportation which is valued and used by practitioners, researchers, and students.

- Awareness among transportation researchers and practitioners of multi-disciplinary problem-solving techniques and intermodal transportation issues.
- Access to educational programs and research findings for graduate students and transportation practitioners throughout the region, regardless of location.
- Access to transportation research findings by researchers and practitioners in related fields such as rural economic development planning, and health and human services planning.

Prime MPC Research Strategies

- Conduct research that advances the state of knowledge in *Rural and Intermodal Transportation* and addresses critical issues within the seven focus areas.
- Follow an open structured process of research selection that includes peer review and input from universities, USDOT, state transportation departments, and other transportation practitioners.
- Conduct an annual site visit of each university in which the center director and USDOT liaison meet with university program directors and principal investigators to review the status of research projects and assess the performance of each university.
- Hold quarterly MPC executive committee meetings to review research performance and monitor overall program performance.
- Conduct peer review of MPC research reports and require principal investigators to deliver a seminar over the TEL8 network for each funded research project. (All MPC-funded research must be presented to state transportation department practitioners, graduate students, and faculty at other MPC universities.)
- Encourage principal investigators to derive journal articles and technical papers from MPC reports and student theses.

Technology Transfer Goal: Availability of research results to potential users in a form that can be directly implemented, utilized or otherwise applied

MPC Program Goals

- A library of research material in rural and intermodal transportation that is valued and used by practitioners, researchers, and students.
- Awareness among transportation researchers and practitioners of multi-disciplinary problem-solving techniques and intermodal transportation issues.
- Access to educational programs and research findings for graduate students and transportation practitioners throughout the region, regardless of location.
- Access to transportation research findings by researchers and practitioners in related fields, such as rural economic development planning and health and human services planning.

Prime MPC Technology Transfer Strategies

- Continue to participate in the TEL8 telecommunication network and work with the TEl8 programming committee to plan an annual program of education and training events for state transportation departments in Region 8.
- Exchange knowledge with other universities and state transportation departments in the western United States and Canada through the Midcontinent Transportation Knowledge network and other alliances.

- Cooperate and coordinate activities with LTAP and Tribal Technical Assistance Centers. (Two of the LTAP centers in the region are co-located at MPC universities and two of the universities have ties to Tribal Technical Assistance Centers.)
- Require each principal investigator to deliver seminar over the TEL8 network for each funded research project.

Human Resource Goal: An increased number of students, faculty, and staff who are attracted to and substantively involved in the undergraduate, graduate, and professional programs of the Center

Human Capacity-Building and Program Marketing Strategies

- Disseminate information about transportation topics, programs, and careers to college freshmen and sophomores, and to high schools and community colleges.
- Work with student organizations and chapters of national organizations such as ASCE, ITE, and CLM to raise awareness of transportation issues and careers.
- Promote cooperative ventures such as internships, mentor programs, etc., with business and governmental agencies.
- Lead and participate in general transportation awareness campaigns.
- Conduct activities such as career days and facilitate the distribution of brochures and related materials.
- Enter into cooperative ventures with Native American LTAP centers, Outward Bound, and related organizations to reach reservations and other areas of the region populated by minorities.

FOCUS AREAS

Rural and Intermodal Transportation provides a basic direction for the Center's activities. However, the theme is quite broad for guiding the research and technology transfer components of the program. Therefore, seven definitive focus areas have been developed, providing further guidance to MPC faculty in developing research and technology transfer projects and assisting each university in concentrating its efforts in areas of excellence and specialization. The focus areas also provide common ground for several or all universities to collaborate on joint projects.

Rural Transportation Safety

Safety is a top priority for the USDOT and state transportation departments in the region. Much of MPC's previous research has focused on rural safety issues and potential solutions for state and local highways. Although several MPC focus areas encompass safety topics, an umbrella focus area has been created to emphasize the importance of rural transportation safety. In the next five years, MPC research will highlight emerging technologies such as rural road safety audits, which have the potential to significantly improve safety on low-volume rural highways, and potential applications of GIS and ITS technologies to highway safety. As noted earlier, many safety-related issues will be addressed by projects in other focus areas such as Low-Volume Roads and Bridges and Rural Transit.

Rural Transit

Transit plays a role in all of the market-travel segments discussed earlier. This is important, as transit may be the only travel option for households without automobiles and for elderly and handicapped residents. Critical transit planning and research issues in Region 8 include cost-effectiveness of transit systems in sparsely populated areas; transportation of economically disadvantaged and aging rural residents; access to jobs and training for people making transitions from welfare-to-work; use of ITS and other advanced technologies for rural public transit; connectivity between small towns and urban and metropolitan centers; and improved access to university campuses.

Intermodal Freight and Logistics

This focus area encompasses topics of importance to business, government, and the transportation industries. Most of the prospective research falls into one of the following categories: railroad track and bridge rehabilitation and engineering; heavier rail car weights and transloads; location and operation of intermodal facilities and terminals; railroad cost-of-service, market structure, and productivity; issues in regulatory economics (e.g., pricing, abandonment, and competitive access for shippers); commodity flow and truck traffic analysis; farm-to-market access and critical issues in agricultural logistics; supply chain management and critical issues in manufacturing logistics; truck economics; heavy truck factors in highway and bridge design and operation; use of ITS technologies in commercial vehicle operations and truck safety; and rural plant location criteria and infrastructure demands.

Low-Volume Roads and Bridges

About 75 percent of the nation's 3.7 million miles of roadway are rural in nature. Nearly two-thirds of rural mileage is under local control. According to the National Bridge Inventory, about 80 percent of U.S. bridges are located on secondary roads, and half are local in function. Use of secondary and local roads is low, representing about 20 percent of daily traffic. However, more than half of the nation's traffic fatalities occur on rural roads and bridges.

Changes in the farm sector are impacting rural highway demands. These trends include increased farm size, mechanization and productivity, and larger trucks and farm equipment. Abandonment of light-density rail lines and longer farm-to-market trips are increasing heavy truck use. Many rural counties have hundreds of highway bridges in disrepair, but are able to address only two to three annually, as low commodity prices, declining tax bases, and reductions in the purchasing power of intergovernmental assistance limit the ability of local governments to maintain low-volume roads and bridges.

The majority of prospective research for this focus area falls into the categories of financing methods and issues; cost-effective design and maintenance practices; impacts of seasonal load restrictions and extreme weather conditions on the mobility of people and goods; impacts of rail line abandonment and other railroad system changes on rural highways; and highway and bridge safety, especially in two-lane rural roads.

Environmental Impacts

Much of the research conducted under this heading is linked to projects in other MPC focus areas such as enhancing tourism through mitigation of congestion, road and bridge management projects, and the development of master plans for recreational access. Some specific areas of environmental research that have relevance to regional planning and policy analysis are freight and hazardous materials movements; reduction of congestion-related air pollution; potential for alternate modes in heavily traveled corridors; studies of high altitude, low-emissions fuels; and safe and effective dust control. Hazardous materials issues include commodity flows and volumes; monitoring and vehicle identification procedures; routing; risk assessment and management; emergency response; and classification of new materials. Clearly, hazardous materials research has safety as well as environmental implications.

Tourism and Recreational Travel

Several of the most visited national parks and ski areas in America are located in Region 8. Many rural tourist areas are characterized by large seasonal variations in demand and congestion during peak periods. In general, the seasonal and daily traffic impacts of tourism and recreational travel must be better understood and documented. Specific research needs include travel demand characteristics, behavioral modeling, marketing effectiveness, potential roles for new technologies, and measurement of tourism output and traffic generation factors. It is also important to understand the complex relationship between tourism/recreational travel and the preservation of natural resources in the region, and the potential impacts of tourism on "edge communities." Finally, an aging populace will demand more local transit options and alternative modes of access along corridors

International Cross-Border Traffic

Most of the prospective research projects in this focus area fall into one of the following categories: cross-border variations in truck configurations, lengths, weights, and operational practices; cross-border variations in pavement design and management practices; application of advanced technologies such as automatic vehicle identification, electronic tolls and vehicle clearance, and advanced traveler information systems to improve efficiency of cross-border truck movements; merger and consolidation of North American railroads and interchange of cross-border freight movements; variations in rail car ownership and use among nations; international interline information systems and intermodal hubs; international tourism and cross-border recreational travel; and supporting infrastructure investments.

Management Structure

The management structure of the Mountain-Plains Consortium involves three main components – the Center Director and administrative staff, four University Program Directors, and the Executive Committee. In addition, the TEL8 Board and Programming Committee play important roles in program planning and implementation. The roles and responsibilities of each administrative component are discussed in this section. The MPC Program Planning flowchart illustrates the main sources of input and process used to develop an annual program of activities and research projects.

Center Director

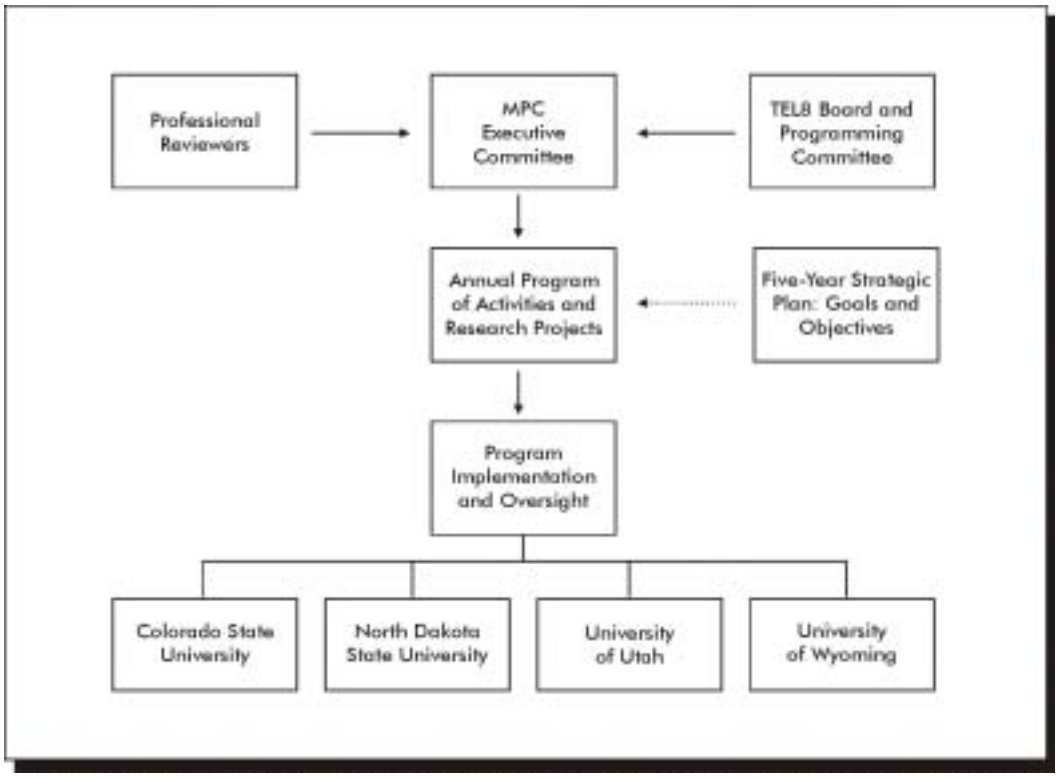
The Mountain-Plains Consortium is located at the Upper Great Plains Transportation Institute on the main campus of North Dakota State University. Dr. Denver Tolliver is the MPC program director. He is actively involved in planning and administrative activities at all levels and sites. Although the Center Director is an employee of the lead university, he represents all four institutions, not just NDSU. He administers the program in a synergistic way that takes advantage of the unique strengths and resources of each university and produces the greatest positive impact for the consortium. Kathy McCarthy of NDSU is the assistant administrator for the Center. Beverly Trittin of NDSU provides technical support and additional administrative services.

University Program Directors

Each university in the consortium has a designated *university program director*. The four university program directors perform local oversight and management of approved activities at each university and serve as coordinators of transportation activities on their respective campuses. They implement the MPC strategic plan at each institution in a coordinated manner, which considers the vision and theme of the Center and the strategies and activities of all consortium partners. The program directors are Dr. Richard Gutkowski, Colorado State University; Dr. Ayman Smadi, North Dakota State University; Dr. Peter Martin, University of Utah; and Dr. Khaled Ksaibati, University of Wyoming.

Executive Committee

The Center Director, the four university program directors, and a USDOT liaison form a committee to oversee program planning and administrative functions for the grant period. The six-member Executive Committee meets several times each year to monitor implementation strategies, collaborate with other centers in the region, and perform other planning and administrative functions. The Executive Committee has final responsibility for research project selection.



Management Structure of the Mountain-Plains Consortium

Telecommunication Support Network

The four MPC universities are members of a regional telecommunication network known as TEL8. The TEL8 network also includes five state transportation departments in Region 8: North Dakota, South Dakota, Montana, Wyoming, and Utah. The system carries a two-way interactive audio and video signal to conference and class rooms at the respective sites. TEL8 greatly enhances and improves the cost-effectiveness of the MPC administrative processes. It results in substantial travel cost savings and maximizes use of scarce faculty and administrative time.

TEL8 Board & Programming Committee

The state transportation departments in the region provide substantial input to the MPC Director and Executive Committee regarding educational and research needs. Much of this interaction results from a close working relationship between the MPC Executive Committee and the TEL8 Board of Directors. The four university program directors are members of the TEL8 board. The MPC Executive Committee and TEL8 Board hold an overlapping meeting each year. The TEL8 Executive Director and Program Director attend part of the MPC Executive Committee meeting and the Center Director attends part of the TEL8 Board meeting. The TEL8 programming committee, which meets several times each year, brings together representatives from the five state transportation departments and the MPC universities to collectively plan a regional education and training program.

Professional Input and Review

Although TEL8 is a primary source of state transportation department input, the MPC research selection process benefits greatly from professional input and review. Each year, professionals from federal, state, and local transportation departments and private industry review MPC research problem statements. In 1999-2000, practicing engineers and administrators from Colorado, North Dakota, Utah, and Wyoming state transportation departments (including the chief engineer of the NDDOT) provided key input and critical review during the research selection process. Professionals from USDA, Federal Highway Administration, Federal Transit Administration, and the American Association of Railroads also reviewed proposed problem statements. In this way, we ensure that we are researching problems of regional and national significance, which will provide value to our primary customers the end users of the research.

Accountability for Decisions

Many key decisions and actions flow from committee meetings and other deliberations. However, the MPC Executive Committee retains decision making responsibilities. All UTCP funded activities conducted on the four campuses are approved first by the Executive Committee. The Center Director ultimately is held accountable for all decisions pertaining to UTCP activities and the use of UTCP funds.

Annual Site Visits

The Center Director and USDOT liaison visit each campus, annually. The site visits provide opportunities for the director and USDOT liaison to meet with principal investigators and program managers on each campus and to gauge progress toward program goals and objectives. The director also holds teleconferences as needed to evaluate progress and ensure that milestones are being met.

Regional Coordination

The director communicates with directors of the other centers in Region 8 on a regular basis. The University of Denver and Montana State University are invited to attend at least one meeting each year. At this meeting, the centers identify ways of coordinating activities and discuss avenues for collaboration and partnership.

Executive Committee

Denver Tolliver
Executive Director

Denver Tolliver is director of the Mountain-Plains Consortium and adjunct professor of agribusiness and applied economics and civil engineering at North Dakota State University. He has been involved in the University Transportation Centers program, and in the administration of the MPC since 1992. In addition, he has served as coordinator of the NDSU graduate transportation programs since 1994 and currently chairs the transportation graduate degree program development committee. He holds a doctorate degree in Environmental Design & Planning and a master's degree in Urban and Regional Planning from the Virginia Polytechnic Institute.

During his career, Dr. Tolliver has served as principal investigator for more than 30 USDOT, USDA, and state research grants, and testified before the Interstate Commerce Commission or Surface Transportation Board on 22 occasions. He has published more than 50 technical reports and journal articles, and authored a book on highway impact assessment techniques. He has developed and taught courses in Transportation Economics, Industrial Traffic Management, Rural & Non-Metropolitan Transportation Systems, Administration of Transportation Agencies, Statewide Transportation Planning, and Rural Public Transportation Systems. In addition, he is team-teaching a course in Railroad Planning & Design during fall semester.

Dr. Tolliver's primary research interests are freight transportation, highway planning, and environmental impact analysis. His current projects include: development of a statewide freight traffic database, development of integrated highway and land-use models for analyzing the traffic effects of large agribusiness facilities, and the benefits of increased investment in county and city roads. He currently serves on the Local & Regional Railroad Freight Committee of the Transportation Research Board and is past president of the Agricultural and Rural Transportation Chapter of the Transportation Research Forum.

Richard Gutkowski
Colorado State University

Dr. Gutkowski, Ph.D., P.E., is a professor of civil engineering at Colorado State University (CSU). He has B.S. and M.S. degrees in civil engineering from Worcester Polytechnic Institute and completed a Ph.D. from the University of Wisconsin, Madison. Gutkowski is director of the Structural Engineering Laboratory at CSU's Engineering Research Center.

He is program director for CSU's membership in the Mountain-Plains Consortium for Transportation Research and Continuing Education where he manages research, graduate education, technology transfer and student internship programs. He was active in development of TEL8, a nine-site regional transportation telecommunications network for research and graduate education, and manages CSU's site and is representative to the TEL8 board.

Gutkowski has participated extensively in international activities. He has been an Invited Professor at the Swiss Federal Institute of Technology (SFIT), Lausanne, Switzerland; and arranged formal university cooperation programs with the SFIT and Wroclaw Technical University in Poland. He directed a 1994 NATO Advanced Research

Workshop (ARW) on "Challenges to Improving a Deteriorated Transportation Infrastructure within Poland and Its Neighboring Countries." Gutkowski was one of 20 invited participants in the NATO Symposium on "The Role of NATO in Scientific Cooperation in Central Europe." He was an invited expert at a 1986 UNIDO workshop on Timber Bridge Awareness in Latin American Countries. In 1990, Gutkowski presented a workshop on Design of Timber Bridges in Akita-shi, Japan, for the Ministry of Forestry and the Japanese Society of Civil Engineers.

He has published and presented more than 150 papers and reports and guided numerous theses and dissertations. Gutkowski wrote "Structures: Fundamental Theory and Behavior" (two editions) and co-authored the chapter "Composite Construction in Wood and Timber" in the Handbook of Composite Construction. He has co-edited proceedings for the above NATO Advanced Research Workshops.

Ayman Smadi
North Dakota State University

Dr. Ayman Smadi is director of the Upper Great Plains Transportation Institute's Advanced Traffic Analysis Center. With his leadership, ATAC assists second-tier cities, state departments of transportation and others in conducting operational and planning level traffic analysis. ATAC also facilitates the use of advanced traffic modeling tools through technical support, hands-on training and research. The Center supports intelligent transportation systems deployment, including planning, integration, evaluation and funding arrangements for advanced traffic signal control and traveler information systems, incident management systems and integration of advanced systems.

Smadi also is North Dakota State University's program director for the Mountain-Plains Consortium.

Responsible for extensive research, Smadi studies transportation systems and planning, traffic engineering, intelligent transportation systems and computer modeling. Computer modeling supports the development and management of viable research and teaching. He uses a comprehensive, multi-disciplinary approach to research, service, education and training. His work helps public transportation agencies as they face funding challenges while the demand for more and better services continues to increase. Smadi conducts and manages significant research grants.

Efficient transportation is essential for both business and consumer, locally and globally. Smadi's expertise in intelligent transportation systems, traffic engineering and safety, transportation network analysis and computer modeling, and transportation planning and freight transportation demand modeling contribute to that efficiency. Efficiency, in turn, contributes to safe and productive use of roadways at the best dollar value.

Smadi, an advanced research fellow, began his work at the Institute as a research associate and adjunct professor in civil engineering in 1993. In 1996 he became the NDSU program director for the MPC and in 1998 became ATAC director. He received a doctorate in civil engineering from Iowa State University, Ames; a master of science degree in civil engineering from the University of Oklahoma, Norman; and bachelor of science degree in civil engineering from Yarmouk University, Irbid, Jordan.

Peter T. Martin
University of Utah

Peter T. Martin earned a bachelor of science degree in civil engineering from the University of Wales in 1975, a master of science degree in transportation engineering from the University of Wales in 1987 and a doctorate in "Real-Time Transportation Modeling" from the University of Nottingham, England, in 1992. From 1975 to 1984, he practiced as a civil

engineer in highway planning, design and construction. He earned membership of the UK Institution of Civil Engineers (professional registration) in 1978.

Martin has authored 58 academic and professional papers and has been invited to lecture on Intelligent Transportation Systems issues in Europe, Asia and North America. He has advised traffic engineers in India, China, and the U.S. on the installation of advanced traffic signal systems.

Currently, Martin is supporting the development of an Advanced Traffic Management System associated with the I-15 Reconstruction project of the Salt Lake Valley, Utah. He is building the "Utah Traffic Laboratory," which will allow real-time connection to the Utah DOT ITS Traffic Operations Center.

Martin is an experienced communicator with an approachable style. He relies on a wide range of effective teaching techniques and to communicate. Martin's distance teaching courses rely on e-mail and innovative exploitation of the Web. He has been an associate professor of civil and environmental engineering at the University of Utah since 1994.

Khaled Ksaibati
University of Wyoming

Dr. Ksaibati received a bachelor of science degree (1984) in Civil Engineering from Wayne State University. He later completed his master of science degree (1986) and Ph.D. (1990) from Purdue University. While completing his doctorate, Ksaibati worked full time for the Indiana Department of Transportation as a pavement structural engineer between 1988 and 1990.

Ksaibati has been a member of the civil engineering faculty at the University of Wyoming (UW) since 1990. He started his academic career as assistant professor and was promoted in 1997 to associate professor. In 1998, Ksaibati took a sabbatical leave from UW and joined the staff of the Florida Department of Transportation (FDOT). For a whole year, Ksaibati provided training, consulting, and technical support to FDOT. Several research papers, reports, and presentations resulted from the research work done in cooperation with FDOT.

Ksaibati is director of the Wyoming DOT Certification program at the UW. Between 200 and 250 highway professionals are certified every year in aggregate, asphalt, and concrete. In addition, Ksaibati is an executive committee member of the Mountain-Plains Consortium. He also is a member of the TEL8 board that consists of nine partners representing universities, DOTs, and the Federal Highway Administration.

Currently Ksaibati is a member of five Transportation Research Board committees dealing with various aspects of pavements. He also is a member of two ASTM committees related to pavement smoothness. Ksaibati also served on various ITE committees and is the faculty advisor of the student chapter of ITE at UW. In addition, he served on several NCHRP research panels.

Ksaibati is the author or co-author of more than 29 technical refereed papers primarily in the areas of pavement design, performance, maintenance, and rehabilitation. Ksaibati also is the author or co-author of 33 other publications. His research has been supported by the Wyoming Department of Transportation, Federal Highway Administration, PacifiCorp, and other DOTs.

Ksaibati is also involved in consulting work on several projects for the SBIR, Florida DOT, and the Wyoming Contractor Association.

Key Faculty

Colorado State University

Bryan Hartnagel

Dr. Bryan Hartnagel joined the Department of Civil Engineering at Colorado State University in August 1998. He has a bachelor of science, master of science and Ph.D. in civil engineering from the University of Missouri-Columbia. Hartnagel's current research interests are related to the design, analysis and rating of steel and concrete bridges. Currently, experimental tests are being conducted on high performance steel bridge girders for strength and ductility characteristics.

Neil S. Grigg

Dr. Neil Grigg, professor and department head of civil engineering, received a bachelor's degree in engineering at the U.S. Military Academy, a master's degree in hydraulic/structural engineering at Auburn University, and a Ph.D. in hydraulic engineering at Colorado State University. Grigg specializes in infrastructure management. He is the author of the textbook, "Infrastructure Engineering and Management." Grigg was instrumental in establishing the TEL8 site at Colorado State University and assisted in developing the North Front Range Transportation Research Internship program.

Tom Sanders

Thomas G. Sanders is an associate professor of civil engineering at Colorado State University. He received his master's and Ph.D. in civil engineering at the University of Massachusetts. Sanders has over 125 publications and has presented 69 short courses on hazardous wastes, water quality monitoring, and activated sludge process control.

North Dakota State University

Douglas Benson

During his 11 years in transportation research, Mr. Benson has specialized in the analysis of railroad operations and the development of computer systems used for transportation analysis. Currently, he is project director of the American Short Line and Regional Railroad Association's national database system.

Since 1997, Benson has served as executive director for TEL8, a six-state videoconference network incorporating state departments of transportation and universities dedicated to transportation research.

Benson received a master of science degree in computer science from North Dakota State University. He also holds bachelor of science degrees in computer science, education, history, and psychology.

Mark Berwick

Mr. Berwick has been involved in research with the Upper Great Plains Transportation Institute since 1995, specializing in the areas of logistics and transportation management, specifically in the areas of motor carrier costing, economic development and business logistics.

Berwick received master of science and bachelor of science degrees in agricultural economics at North Dakota State University.

John Bitzan

Dr. Bitzan has more than 10 years of experience in economic research of transportation. His major research focus areas include railroad price and cost analysis, analysis of transportation industry structure, transport regulation and policy analysis, and railroad operations analysis. Bitzan has published numerous reports and journal articles. He has performed research for the U.S. Department of Agriculture, U.S. Department of Transportation, and the Federal Railroad Administration.

Bitzan received a Ph.D. in economics at the University of Wisconsin-Milwaukee. He received a masters of arts in applied economics at Marquette University and a bachelor of arts in economics at St. Cloud State University.

Jill Hough

As a transportation economist at the Upper Great Plains Transportation Institute, Ms. Hough conducts research in the areas of transit, low volume roads, economic development and logistics. She spent four months as interim director for the Federal Transit Administration's Transit Intelligent Vehicle Initiative in Washington, DC, working with industry groups to identify and prioritize user services. Hough has published numerous reports and journal articles.

She currently is attending UC-Davis working on her doctorate degree in Transportation Technology and Policy. She received master of science and bachelor of science degrees in agricultural economics at North Dakota State University.

Dennis Jacobson

An associate research engineer/program director for the DOT Support Center at the Upper Great Plains Transportation Institute, Jacobson brings over 28 years of experience to the Institute. He started with the NDDOT in 1972 and has served in various positions of authority culminating in his position as East Region Engineer in charge of all construction and maintenance in eastern North Dakota.

Kimberly Vachal

Ms. Vachal has extensive background in grain production and market intelligence. Her work focuses on identifying trends in the activities of North Dakota grain producers, elevators, agricultural processors and railroads. In addition to completing many research studies on grain and oilseed transportation issues, Ms. Vachal has worked on a number of projects in cooperation with the U.S. Department of Agriculture.

Vachal received master of science and bachelor of science degrees in agricultural economics at North Dakota State University.

Affiliated Faculty – NDSU

Don Andersen, Civil Engineering
Robert Arthur, Geosciences
Lynn Kalnbach, consultant
David Lambert, Agribusiness and Applied Economics
Jay Leitch, College of Business Administration
William Nanja, Agribusiness and Applied Economics
G. Padmanabhan, Civil Engineering
Ossama Salem, Construction Management and Engineering
Rodney Traub, Business Administration
Amiy Varma, Civil Engineering
Bill Wilson, Agribusiness and Applied Economics

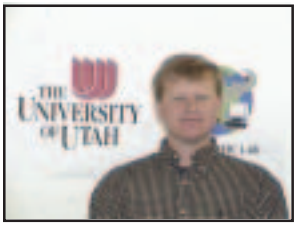
University of Utah

Peter Martin

Peter T. Martin earned a bachelor of science degree in civil engineering from the University of Wales in 1975, a master of science degree in transportation engineering from the University of Wales in 1987 and a doctorate in "Real-Time Transportation Modeling" from the University of Nottingham, England, in 1992. From 1975 to 1984, he practiced as a civil engineer in highway planning, design and construction. He earned membership of the UK Institution of Civil Engineers (professional registration) in 1978.

Currently, Martin is supporting the development of an Advanced Traffic Management System associated with the I-15 Reconstruction project of the Salt Lake Valley, Utah. He is building the "Utah Traffic Laboratory," which will allow real-time connection to the Utah DOT ITS Traffic Operations Center.

Affiliated Faculty



Joseph Perrin

Joseph Perrin, Ph.D., PE, PTOE, holds a faculty position as a research assistant professor with the Department of Civil and Environmental Engineering. He provides the day-to-day supervision of the MPC funded research in the lab.

University of Wyoming

Affiliated Faculty – Department of Civil and Architectural Engineering

Dr. Eugene M. Wilson is director of the Wyoming Technology Transfer Center and professor emeritus of civil engineering at the University of Wyoming. He was the university's program coordinator for the Mountain-Plains Consortium – Rural Transportation Research Program. Since 1975 he has been a traffic engineering consultant working with both private and public sectors. Wilson is nationally certified as a Professional Traffic Operations Engineer. Named the 59th honorary member of ITE's international board of directors, he also earned the ITE Lifetime Achievement Award for the Colorado-Wyoming section.

His bachelor and master of science degrees were earned at the University of Wyoming and his doctorate is from Arizona State University, all in civil engineering. Iowa, Wyoming, and Colorado awarded him status as a Professional Engineer.

Dr. Charles M. Dolan is professor and head of the Department of Civil Engineering at the University of Wyoming. He focuses his research on high performance materials such as glass, Kevlar and carbon fibers for reinforcing new and existing structures. He was the principal investigator for investigation of fiber-reinforced plastics for highway structures sponsored by the Federal Highway Administration. Among his other recent work is development of anchor systems for fiber reinforced plastic tendons; time behavior of non-metallic pressuring tendons; investigating long-term performance of non-metallic materials in concrete and evaluating bridge joint sealant materials.

His civil engineering degrees are a bachelor of science from the University of Massachusetts and a master of science and doctorate from Cornell University. He is a registered professional engineer in Wyoming, Washington, and Ontario.

Dr. Larry O. Pochop, professor of civil engineering at the University of Wyoming, specializes in hydrology, microclimatology, agricultural and municipal water conservation, and management.

He earned his bachelor of science degree from South Dakota State University, and his master of science degree and doctorate from the University of Missouri, Columbia. His degrees are in agricultural engineering. He is a professional engineer in Wyoming.

Dr. Jay A. Puckett is a professor of Civil Engineering at the University of Wyoming and a licensed engineer who has worked in research and development for 22 years. He was a subconsultant in the development of the LRFD Bridge Design Specification. Puckett has conducted numerous research projects in the area of software development and physical testing of bridges and bridge components ranging from lightly reinforced bridge decks, fiber-reinforced approach embankment fills, asphalt joints, temperature effects and wood girders. Software development efforts include analysis, design and rating tools for steel, concrete, pre-stressed concrete and wood.

Honored with research, graduate teaching and Most Outstanding Professor awards, his bachelor of science degree is from the University of Missouri and his master of science and doctorate degrees are from Colorado State University, all in civil engineering.

Donald E. Polson, a lecturer in the University of Wyoming College of Engineering, specializes in structural engineering with an emphasis in the design and use of temperate and tropical woods. In addition to teaching, he is a private consulting structural engineer and facilities consultant.

A Fulbright Scholar in 2000, Polson holds degrees from the University of Wyoming with a bachelor of science in civil engineering with the architectural option and a master of science with the structural concentration. Polson has also been honored with teaching awards.

Dr. John P. Turner is a professor in the University of Wyoming College of Engineering who specializes in soil and rock mechanics, foundation engineering, earth retaining structures, slope stability and innovative materials for waste containment. He has also been a field geologist for geotechnical site investigations and an exploration geologist.

He was a visiting professor at the University of Sydney, Australia, and the University of Canterbury, New Zealand, for the 1993-94 academic year. He holds a bachelor of science degree in geology from James Madison University, both bachelor of science and master of science degrees in civil engineering from the University of Wyoming and a doctorate in civil engineering (geotechnical) from Cornell University.

Dr. Thomas V. Edgar works with flow, deformation and pollutant migration in saturated and unsaturated porous media, slope stability and expansive soils. An associate professor in the University of Wyoming College of Engineering, Edgar recently worked with soil additives for unpaved road stability and long term maintenance, investigated effects of freeze and thaw on highway soils, studied protection of wellhead areas for public water supplies and conducted research on consolidation of partially saturated soils due to applied stress, moisture and thermal gradients.

Edgar has received teaching awards. His bachelor of science degree is from the University of Colorado and his master of science and doctorate are from Colorado State University, all in civil engineering.

Dr. Gregory V. Wilkerson is an assistant professor in the University of Wyoming College of Engineering. He works with research and development of solutions to water resource problems, multi-disciplinary approaches to stream restoration, river mechanics, sedimentation and erosion, environmental hydraulics, engineering hydrology and statistics. Wilkerson has a number of research projects in these areas.

His bachelor of science is from Georgia Institute of Technology and his master of science and doctorate are from Colorado State University. His degrees are all in civil engineering.

Dr. Cenk Yavuzturk is an assistant professor of architectural engineering in the University of Wyoming College of Engineering. His research interests are in HVAC-R equipment and systems, thermal systems modeling and simulation, ground source heat pumps, building energy analysis and energy management and building thermodynamics.

He holds a doctorate in mechanical engineering from Oklahoma State University and a Diplom Ingeniuer in energy and processing engineering from the Technical University of Berlin, Germany.

The Year in Review

Director's Summary

In FY 2001, we continued to implement our five-year strategic plan and made great progress towards many of the program goals stated earlier. In the next few pages, I will summarize some of our major accomplishments in education, research, technology transfer, and human resource development. Afterwards, certain FY 2001 program activities will be highlighted. It is important to note that this activity summary is not exhaustive in nature. Many additional products and achievements are reflected in our performance measures.

MPC Continues Distance Learning Program for DOT Employees

The MPC continued its strong tradition of distance education in FY 2001. The University of Utah and North Dakota State University offered distance education degree programs for state transportation department employees using interactive video and internet-based media. Altogether, 19 UDOT and NDDOT students were enrolled in graduate courses or worked on theses during the year.

A distance education milestone was achieved in FY 2001. The first NDDOT student graduated from the Master of Science program in May after taking all of his courses via TEL8. Four additional NDDOT students are in the thesis stage and are expected to receive master's degrees in the Summer or Fall of 2001.

MPC Initiates Distance Education Short Course Program for DOT Professionals

In FY 2001, MPC initiated a program of short courses for state DOT personnel via the TEL8 network, starting with two pilot courses: (1) *PE Exam: Question Preparation*, and (2) *Corrosion Science*. More than 120 students from five state transportation departments enrolled in these courses.

In a joint meeting with the TEL8 Board of Directors, the MPC Executive Committee formalized a plan for the development of additional short courses that would culminate in a certificate program for state DOT employees. The contents of the certificate program are being designed this year. Full implementation of the program is slated for 2002.

MPC Offers 28 Graduate Transportation Courses to On-Campus Students

In FY 2001, the MPC universities offered 28 graduate-level transportation courses. The 2001 MPC curriculum included several new courses such as *Railroad Planning & Design* and *Safety in Transportation.* The transportation portion of the curriculum is listed below.[1]

- Transportation Engineering (2)
- Highway Engineering
- Highway Design
- Geometric Design of Highways (2)
- Traffic Operation
- Highway Bridge Engineering
- Traffic Engineering
- Transportation/Traffic Safety (2)
- Quantitative Methods in Transportation
- Community Transportation
- Transportation Systems
- Transportation Modeling
- Transportation Planning (2)
- Transportation Administration
- Public Transportation
- Intelligent Transportation Systems
- Transportation Infrastructure Maintenance
- Pavement Design (2)
- Pavement Materials
- Pavement Distress & Rehabilitation
- Advanced Pavement Analysis
- Railroad Planning and Design
- Logistics & Distribution Management

Many additional courses in civil engineering, economics, and business also were offered by the participating academic departments.

[1]The number of universities offering a course is shown in parentheses.

MPC Develops New Logistics Minor

The curriculum committee of the College of Business Administration at North Dakota State University has approved a program plan for a minor in Logistics. The core of the new program will be a three-course sequence: Introduction to Transportation and Logistics, Advanced Logistical Analysis, and Supply Chain Management. The Center will provide faculty time, student support, and help in recruiting. Later this year, the plan will be docketed with the University Senate and Board of Higher Education. The minor should be available to students in 2002.

MPC Develops Doctoral Degree Plan

North Dakota State University has selected *Transportation and Logistics* as a priority area for the establishment of a doctoral degree. A program development committee has been established that includes representation from Agribusiness and Applied Economics, College of Business, Civil Engineering & Construction Management, Industrial & Manufacturing Engineering, and the Upper Great Plains Transportation Institute. The MPC director is the chair of this new committee. A program plan and proposal will be ready for submission to the University Senate and Board of Higher Education in 2002.

MPC Publishes 10 New Research Reports

MPC continued its strong research effort in FY 2001, publishing 10 new peer-reviewed reports.

- Defining a Road Safety Audit Program for Enhancing Safety and Reducing Tort Liability
- Adapting the Road Safety Audit Review for Local Rural Roads
- Performance Evaluation of Cement-Treated Roadway Bases
- An Evaluation of the Impacts of ITS/CVO Technologies throughout the Supply Chain
- Accident Data Availability
- Evaluation of Road Weather Information System Data & Dissemination of Data to the Public
- Inclement Weather Signal Timings
- Factors Affecting Rail Car Supply
- Incident Detection Algorithm Evaluation
- Transportation and Logistics Characteristics of the Potato Industry: Implications for Highway Planning

MPC Internship and Outreach Programs Stimulate Interest in Transportation

The *Northern Colorado Transportation Internship Program* and *Building a Better Future Through Engineering* are two examples of MPC efforts aimed at increasing the number of students and professionals attracted to the field of transportation. Although these programs are highlighted in the report, many other outreach events were conducted during the year, including:

- The MPC-X research seminar series which was presented via the TEL8 network
- National Transportation Week events that were held on multiple campuses, including a luncheon attended by 15 NDSU faculty from five departments
- Research papers that were presented by MPC faculty at various conferences and events

FY 2001 Program Highlights

Utah Project Scouts Future Engineers

Earning a Girl Scout patch may be the pathway to engineering for young women who participated in the first "BUILD-ing A BETTER FUTURE through ENGINEERING" April 17 at the University of Utah. At first expecting minimal interest, the University ended up welcoming the maximum of 50 girls plus 13 adults.

The program emphasized problem solving, exhibiting how engineers take ideas and turn them into reality by applying math and science. Using the familiar, the leaders talked, taught and provided hands-on experiences about things such as roller coasters and car safety enhancement.

Students had demonstrations about CORSIM traffic simulation, CCTV traffic monitoring, traffic survey instrument and teleconferencing. They based the day's events on a project called "Build a Better Future." Skill builders, technology, service projects, and career exploration were parts of the program. Things familiar to engineers were incorporated into the day. Some of the points in building a better future included learning about design, figuring out how things work, doing a construction project, and shadowing an engineer for a day to learn the profession.

The program encouraged the young women to consider studying engineering through hands-on activities and exposure to the traffic laboratory and institute. Dr. JoAnn Lighty, associate dean of the University of Utah College of Engineering, and Susan L. Philyaw of the Engineering Outreach Program coordinated the event. Graduate students at the day were Alecs Stevanovic and Mahesh Kumares.

CSU is Number One in Colorado

Colorado State University ranks as the top institution in Colorado according to performance measures established by the state legislature and the Colorado Commission on Higher Education Quality Indicator System. CSU was the state's only four-year institution to meet or exceed every performance indicator. The system measured achievement based on areas such as retention, graduation and success of recent graduates. The review process compared schools to peer institutions across the country. The results, released in January, showed CSU scored 1,844 points on a scale of 1,800 points. The university gained bonus points for exceeding several indicators which were worth 180 points each. A portion of annual funding is tied to the quality indicator scores.

MPC Pilot Short Courses a Hit

Preparing for the Professional Engineers Examination

While TEL8 videoconference classes prove themselves accessible and educational, the first Mountain-Plains Consortium short course proved to be a standout. In January, Dr. Peter Martin, with solid support from his colleague Dr. Joe Perrin, from the University of Utah Civil and Environmental Engineering Department prepared 89 students for the professional engineers examination. He credits the successful blend of videoconferencing and web accessibility as the keys to successful distance learning. Graduate courses have had web-based support for about five years. For this class, the appeal of having e-mail, chat rooms and online resources available enhanced the offering. It helps when the professor is energized. "I enjoy short courses, the challenge and excitement," Martin says. "It's easy to be jaded after 16 years of teaching and I'm grateful to have something new."

That something new created mounds of work, making a chalk and notes lecture into material that can work for electronic media and web-based dissemination. Martin calls the challenge fun. "For me, it means taking a chance to change and expand, to take a risk. It's not as safe as doing the same thing. I'm a natural communicator and this is much like broadcasting with cameras and an audience," Martin noted. "It's outside the cocoon." Videoconference students have a personal contact that in many ways exceeds the regular classroom according to Martin. Students have access through the virtual office. On Saturday mornings he chats with students from his home computer. He credits part of the enrollment in the prep course for the professional engineers examination to the availability factor. Some students cannot travel to conventional university settings for classes. With locations in several Department of Transportation offices and through Mountain-Plains Consortium universities, people's educational and professional needs can be met with little or no travel required. Martin also teaches courses in intelligent transportation systems through TEL8, as well as other graduate courses. More students can be served through videoconference classes, making each MPC school better able to use its teaching assets. Julie Rodriguez, program coordinator for TEL8, calls the growth in videoconference classes both exciting and challenging. Some fancy footwork was needed to have 13 sites on 12 phone lines for Martin's exam-prep class. "It was all worth it, though. And things will be smoother next time," she adds. These courses, demanded by DOTs, are reinforced by success Rodriguez says. "This continues to strengthen the relationship among DOT and MPC sites," according to Rodriguez. As faculty continue to develop new ways to teach transportation courses, meeting the needs of students spread across the region, technology continues to be implemented for successful education.

Fundamentals of Corrosion Science

University of Wyoming instructor Dr. Trey Hamilton taught a short course on corrosion science for the Mountain-Plains Consortium in April. Thirty-two students at five different Department of Transportation offices were able to take part through the TEL8 network.

His short course was the first in a series and a pre-requisite to later short courses, an excellent illustration of how the program is building and

offering education throughout the MPC geographic area.

Hamilton's course covered durability of reinforced and pre-stressed concrete construction, providing the fundamental knowledge of corrosion principles and processes that are necessary to understanding how reinforced and pre-stressed concrete perform in corrosive environments.

Specific topics were corrosion principles, electrochemical reactions, environmental effects, metallurgical effects, forms and rate of corrosion. He targeted the course for bridge engineers and facilities maintenance engineers.

Transportation Student Association formed at NDSU

Thirty-two North Dakota State University students can now call themselves members of the Transportation Student Association (TSA) thanks to funding from the Upper Great Plains Transportation Institute, the Department of Civil Engineering, and the North Central Section Institute of Transportation Engineers. TSA incorporates other previously formed student organizations to expose transportation students to all facets of the industry. Currently, the TSA includes members of the Institute of Transportation Engineers, American Road and Transportation Builders Association, and Council of Logistics Management (CLM). Students are petitioning to become a recognized NDSU student organization.

The new alliance is for all students interested in transportation including those in civil, electrical, mechanical, and industrial engineering; logistics; psychology; and agribusiness and applied economics. The group has funded student participation in conferences such as the Transportation Research Board Annual Meeting and the Institute of Transportation Engineers Annual Meeting. Typically, the group sends four to six members to each meeting.

In addition, TSA sponsors field trips each semester to the Minneapolis region. This winter, 15 TSA students traveled to the consulting firm URS/BRW and Northwest Airlines Operations Control Center at the Minneapolis International Airport. Students had an opportunity to ask questions to young engineers and professionals working in the private sector. Students also participated in the Transportation Career Expo hosted by the Center for Transportation Studies to increase awareness about careers in the field. Another trip in April included 10 students from civil engineering and agribusiness and applied economics. Once again, students had an opportunity to visit with professionals from the SEH consulting firm. The trip was finalized with tours of the Human Factors Lab at the University of Minnesota and the Caterpillar Paving Products plant.

Several NDSU faculty assist the TSA. Dr. John Bitzan advises the CLM students, while Shawn Birst and Kiel Ova provide guidance for the ITE chapter. Matthew Martimo, a graduate student in civil engineering and ATAC research assistant, is the current TSA president. The Upper Great Plains Transportation Institute is devoted to making a significant contribution to rural and small urban transportation and logistics through interdisciplinary university education, research, and service.

MPC Research Improves Engineering of Timber Railroad Bridges in Colorado

The Mountain Plains Consortium is supporting researchers engaged in a sequence of research projects on timber railroad bridges. The study, in cooperation with the Association of American Railroads, focuses on assessment of load resistance of existing open deck timber trestle railroad bridges in Colorado.

Loads on trains increased significantly during the 45-50 year lifespans of older bridges, in turn creating the need to consider the need to strengthen them. In an initial study, comprehensive static, ramp and moving train field load tests were conducted on three Colorado bridges. These were selected as representative bridges after visits to about 35 sites in four states. The aim was to rigorously examine load distribution characteristics.

In a subsequent study, one of the bridges was stiffened and retested under higher rolling train tests to examine the dynamic impact resistance and the effect of typical retrofit methods. In a third project, full-scale bridge chords were load tested in the laboratory at CSU to examine rigorous structural modeling without the complication of site specific conditions and substructure movement. This permitted comparison of actual field load response with existing code design methodology. The analytical work continues via a study of thorough modeling of sub-structure load resistance. The outcome of the projects will enable the AAR to provide realistic recommendations for improving design code requirements as well as field strengthening methods.

MPC Seminars Share Research Findings

The Mountain-Plains Consortium has developed a seminar series entitled MPC-X offered via the TEL8 telecommunications network. Four sessions were offered this past year from researchers at North Dakota State University and Utah State University. Approximately 35 practicing professionals attended the four seminars.

• Dennis Jacobson, Upper Great Plains Transportation Institute and director of the Department of Transportation Support Center, North Dakota State University, examined the actual placement of asphalt pavement on prepared bases to determine if the proper thickness of pavement is placed where data and calculations show it should be. His presentation reviewed two North Dakota case studies and their implications on pavement design and placement practices.

• Mark Berwick, Upper Great Plains Transportation Institute, North Dakota State University, examined intermodal truck/rail container traffic. North Dakota shippers do not have the opportunity to participate in the intermodal growth enjoyed by most of the United States. He developed an economic engineering model to estimate start-up and operating costs of an intermodal facility located on a shortline railroad. Analysis of intermodal traffic originating in North Dakota through the Public Use Waybill showed decreasing volume from 1995 to 1997.

• William Greeney, Utah State University Department of Civil and Environmental Engineering, initiated a project to develop and select advanced computer programs to improve roadway hydraulic design tools available for use by Utah Department of Transportation engineers and consultants. Development and selection of such computer software using engineering analysis and interactive graphics is expected to reduce design and production times, and improve quality control.

• William Grenney, Utah State University Department of Civil and Environmental Engineering, worked with requirements of the Americans with Disabilities Act of 1990 concerning complementary paratransit service to persons unable to use the fixed route system used by the general public. The objectives of his project were to identify existing paratransit services in the Logan, Utah, area, to describe the services of these providers; and to develop recommendation to improve services.

Colorado Internship Program Continues

Since 1998, Colorado State University and the MPO for the North Front Range of Colorado have collaborated in the Northern Colorado Transportation Research Internship program. Transportation agencies and industry contract with the agencies and provide paid internships and budget support.

Each semester students are made aware of the program, with qualified students interviewed and placed. Interns work on visible, ongoing, and sometimes contentious projects. They learn about the human side of transportation engineering by attending public forums and meetings.

Information from the regional transportation planning process serves as the basis for establishing student intern needs. Ten to 15 students are now placed annually. Several graduates obtained jobs with the firms in which they interned.

Vicky McLane, transportation program manager for the MPO, is positive about the program, saying "the program gets bright and talented young people into the field. I think everyone benefits from this."

Research Program

To address the Center's theme and vision, the research program seeks to identify topics important to the region by incorporating input from clients and peer reviewers. The MPC is working toward its goals of balancing its research program in rural and intermodal transportation to reflect priorities of major client groups, USDOT strategic goals and the Transportation, Science & Technology strategy. These efforts are outlined in this section. of the report. Brief descriptions are provided of research projects completed during the 2000-01 fiscal year and research projects initiated during the year.

Completed Research Projects: 2000-01

MPC Report No. 00-113 • Defining a Road Safety Audit Program for Enhancing Safety and Reducing Tort Liability • E. Wilson, University of Wyoming

This study evaluated the use of the Road Safety Audit Program, by a local rural road jurisdiction, to avoid tort liability while improving the safety of its road system. The study provided how the RSA might be accepted within the current legal framework and provided guidelines for its acceptance as a practical tool in managing liability. *(MPC Research Project #183)*

MPC Report No. 01-117A • An Evaluation of the Impacts of ITS/CVO Technologies Through-out the Supply Chain • Brenda Lantz, North Dakota State University

This report contains a brief description of Intelligent Transportation Systems (ITS) and ITS technologies for Commercial Vehicle Operations (ITS/CVO). Second, it discusses previous literature regarding benefits of ITS/CVO for motor carriers, as well as managing the change due to technology. In addition, the possible use of transportation inventory models as a method to examine benefits is explored. Finally, this methodology is illustrated with a case study analysis which reveals potential savings to both the company and their customers. Phase II of this project will involve data collection for a stratified random sample of carriers nationwide, and a subsequent detailed analysis for a wide variety of technologies and types of companies. *(MPC Research Project #188)*

MPC Report No. 01-118 • Accident Data Availability • Peter Martin, University of Utah

Accident information is valuable for identifying problem areas or locations of interest. The data is not readily available and its current format is a summary spreadsheet format using codes and mileposts to denote location, type and severity of accidents. This project investigated alternate forms of dissemination for the accident information. Costs, capabilities, and compatibility were reviewed for integration of the accident database with a GIS format to allow a graphical and spatial interface. The issues addressed by this research focused on information circulation. Two key elements identified in the research were making accident information more readily available and incorporating a GIS graphic interface with the accident information to allow for query searches on various accident attributes. *(MPC Research Project #184)*

MPC Report No. 01-119 • Evaluation of Road Weather Information System Data and Dissemination of Data to the Public • Peter Martin, University of Utah

This research document represents the analysis and recommendations of the University of Utah Traffic Laboratory (UTL) on the following Road Weather Information System (RWIS) topics: public dissemination of RWIS station information and the area of influence of available RWIS equipment. *(MPC Research Project #186)*

MPC Report No. 01-122 • Incident Detection Algorithm Evaluation • Peter Martin, University of Utah

This research examined a range of incident detection technologies to determine a recommended combination of approaches for use in the Utah Department of Transportation's (UDOT) Advanced Traffic Management System (ATMS). The technologies that were examined were computer-based Automatic Incident Detection (AID), Video Image Processing (VIP), and detection by cellular telephone call-ins. *(MPC Research Project #185)*

MPC Report No. 01-123 • Transportation and Logistics Characteristics of the Potato Industry: Implications for Highway Planning • Mark Berwick, North Dakota State University

Value-added processing is an important economic development goal in agricultural states and regions. The location of potato processing plants near sources of production is a recent trend, which has generated substantial economic benefits. However, the location of potato plants is impacting highway demand and truck use in parts of the mountain-plains region. Shifts in production from grains to potatoes and sugar beets can significantly increase the tons produced per acre and thus increase heavy truck traffic in rural areas. Little information exists regarding the logistical and spatial characteristics of the potato industry and its transportation needs. NDDOT requested an analysis of the transportation characteristics and highway implications of this industry including (1) trends in production and location of facilities, (2) impacts of processing plants on agricultural land use, (3) truck use characteristics, and (4) implications for highway maintenance and planning. This report provides the requested information and describes important advances in highway network modeling. *(MPC Research Project #191)*

MPC Report No. 01-124 • North Front Range Transportation Research Internships • Richard Gutkowski, Colorado State University

This report summarizes the work experiences of three earlier interns completing the Northern Colorado Transportation Internship Program (NCTIP) in December 1998. The NCTIP began in January 1998. Richard Gutkowski, civil engineering professor, wanted to provide Colorado State University students more educational opportunities in the area of transportation. He approached several governmental agencies along the Front Range of Colorado asking them to hire an intern. Now in its fourth year, NCTIP has placed about 25 students in many different organizations and companies. *(MPC Research Project #180*)

MPC-175 • An Evaluation of ITS/CVO Application Technology in Logistics and Supply Chain Management • B. Lantz, North Dakota State University

The truckload sector of the trucking industry is extremely competitive; companies must vie for business through lower rates, and more importantly, superior service. One potential strategy for a motor carrier company to better their service offering is through investment in technology. However, as indicated in a recent Transport Topics article, "Trucking companies risk being drowned by the flood of technologies and logistics services coming onto the market . . . a quandary for trucking's IT professionals: how to know which technologies will improve the way they do business and which may saddle them with extraneous information. . . to compete, trucking companies will have to provide better, faster service and at less cost." As this quote illustrates, commercial vehicle companies are in a precarious position. They realize that they must invest in technology to remain competitive, but are unsure which innovations will give them the desired results. Although there appears to be little disagreement about the potential benefits of ITS/CVO, the information available regarding specific benefits or impacts of these technologies is lacking. The methodology developed in this project will add greatly to the knowledge in this area.

MPC-176 • Road Dust Suppression: Effect on Maintenance, Stability, Safety, and the Environment • T. Sanders, Colorado State University

This research project will be a joint cooperative effort with the Larimer County Road and Bridge Division and Roadbind America Inc. Several one-mile sections of dirt roads in Larimer County will be used as test and control sections of the research. One or more test sections will be treated with chemical road dust suppressants and the other will remain untreated. More than one road dust suppressant beside Roadbind America Inc.'s lignosulfanate suppressant may be tested if other vendors are found who are willing to participate in the research. The county will provide all labor and equipment for preparation of the test sections and Roadbind America Inc. will provide the dust suppressant. The Colorado State University Dustometer, developed in previous research supported by the Mountain-Plains Consortium, will be used to quantify the amounts of dust released into the air from all the test and control sections. Measurements of drivability will be defined and measured (examples of drivability are breaking distance and vibrations). A record of all accidents on the roads will be kept during the research duration. In addition, Larimer County records will be investigated to determine if there is a relationship between the number of accidents (and fatalities) and the type of road treatment (or lack thereof) on the dirt roads. More than one county in the state may be investigated if better records are available.

MPC-177 • Moment-Rotation Tests of High Performance Steel (HPS) I-Girders • B. Hartnagel, Colorado State University

Bridge designers now have a new choice of steel available for bridge construction – high performance steel (HPS) grade 70W. The HPS70W was developed under a cooperative research program between the Federal Highway Administration (FHWA), the U.S. Navy, and the American Iron and Steel Institute (AISI). However, current bridge design provisions limit the flexural strength of girders with yield strength greater than 50 ksi (350 MPa) to the yield moment capacity. The flexural capacity of similar bridge girders designed with yield strength less than or equal to 50 ksi (350 MPa) is equal to the plastic moment capacity if certain restrictions are met. If the designer chooses, an inelastic analysis of the girder also is allowed with steel yield strengths less than or equal to 50 ksi (350 MPa). Inelastic analysis and design methods offer larger cost savings compared to the elastic analysis provisions. Even with the disadvantage on flexural capacity, HPS still is competitive with Grade 50 steels because of material savings obtainable with HPS. If the restrictions could be lifted or even relieved, the use of HPS would provide significant cost savings.

MPC-178 • Experimental Wood-Concrete Railroad Bridge • R. Gutkowski, Colorado State University

Due to increased train loads in recent decades, a 30 percent increase in design load requirements for timber trestle railroad bridges is imminent in the AREA design code. Existing bridges are being upgraded to more safely carry increased loads and to avoid potential structural problems leading to costly replacements. Large size solid timbers used in current configurations are increasingly difficult to obtain. Higher design loads will lead to even larger required sizes. The end result of the research is expected to be a prototype two-layer wood-concrete member, with the wood member being half the size of

currently used fully solid wood members, thus obviating the industry's concern about lack of available timber sizes.

MPC-179 • Full-Scale Laboratory Testing of a Timber Railroad Bridge • R. Gutkowski, Colorado State University

This project is being conducted in the Structural Engineering Laboratory at Colorado State University (CSU). A fullscale laboratory test specimen will essentially replicate (in size) a chord of an existing three span bridge that previously was field load tested before and after its strengthening. The specimen will involve fully connecting all caps and ties and the steel rail, as a stand alone specimen fully replicating the field construction techniques. The laboratory specimen reduces some of the site specific support conditions that complicate understanding of the behavior of this type of bridge as compared to existing code design procedures. After load testing the specimen, it will be strengthened with an additional stringer ply and retested to examine the changes in response. Load tests will be conducted using existing load frame and hydraulic actuator capability. Displacement and strain will be measured at predetermined locations during load testing. These results will provide an understanding of the behavior of the timber trestle bridge and consequences of strengthening and retrofit methods.

MPC-181 • University Transportation Survey • R. Gutkowski, Colorado State University

Colorado State University (CSU) is anticipating the approval of plans and federal funding for a regional (northern Colorado) transportation center to be located on the CSU campus in Fort Collins. This will serve nearby regional populace, primarily for their access to higher education. Related to this, the University of Northern Colorado in nearby Greeley is interested in including this development in its transportation planning. Since students can take inter-university courses, transit between institutions is important. In preparation for a potential transportation center for Fort Collins and Greeley and their environs, the local and county transportation planners are investigating practices in "university" communities throughout the nation. A survey process will be used to collect data pertinent to the study and decision making process.

MPC-182 • Evaluating the Long-Term Pavement Performance Data • K. Ksaibati, University of Wyoming

In 1987, Congress funded the Strategic Highway Research Program (SHRP). As part of SHRP, several pavement test sections were selected for monitoring around the country. Construction and performance data have been collected on all test sections and saved in the Long-Term Pavement Performance Information Management System (LTPPIMS). The collected data is beneficial for researchers and practitioners in investigating the long-term performance of pavements. Recently, the Federal Highway Administration released a computer program called Data Pave to help in making LTPP data available for any interested party. It is the main objective of this study to evaluate the capabilities of Data Pave and evaluate some of the pavement performance data for Region 8.

MPC-187 • Survey of Educational and Human Capital Needs of the Transportation Construction Industry • O. Salem, North Dakota State University

The major impediment to development and implementation of new safe and productive techniques and technologies in the U.S. transportation construction industry is that there is no coordinated effort to define the educational and research needs, to communicate these needs to research organizations, and to communicate the research outcomes back to the industry. For academia to efficiently serve the industry and consequently, the public, a model for fostering innovation in terms of productivity, quality, and safety improvement should be developed and implemented in the construction industry. This includes a systematic, scientific approach for defining industry needs for knowledge, research, and human capital improvement. This project will identify the educational and human capital needs for the U.S. road construction industry through design and development of a national survey, and the analysis of the feedback results.

MPC-189 • The Differential Effects of Deregulation on Rail Rates • J. Bitzan, North Dakota State University

It is well documented that railroad deregulation in the U.S. has been successful overall. Studies have shown increased productivity, decreased rates, and increased profitability in the rail industry as a result of deregulation. However, general evidence suggests that while railroad deregulation has benefitted shippers overall, through continued rail viability, rate savings, and improved service, the benefits have not been evenly shared. Before making policy changes, it is important to have a complete understanding of the impacts that regulatory change has on shippers and carriers. For the most part, the effects of deregulation on shippers and carriers have been well documented. However, one component of past regulatory change that is not well documented is the extent of differential rate changes that have been realized as a result of deregulation. This study will investigate the rate structure in the rail industry and how it has changed as a result of deregulation, highlighting the differential impacts that deregulation has had on rates among commodities, regions, and over time.

MPC-190 • Grain Highway Network Analysis: Use of Satellite Imagery and USDA Data to Forecast Heavy Truck Trips Generated from Rural Land Use Zones • D. Tolliver, North Dakota State University

The location of new facilities such as agricultural processing plants is significantly altering truck traffic patterns in rural areas. Large processing plants create substantial inbound truck flows that typically are concentrated on several collector or arterial highways. After a facility begins operation, the annual equivalent single axle loads (ESALs) on key access highways may be significantly higher than the design values. This project will build on an existing study. A prototype network model of a large corn processing plant is being developed in southeastern North Dakota. The model will simulate flows of corn based on forecasted supply, demand, and farmer delivery criteria. It will function in a GIS environment (ArcView) and will utilize three main GIS database layers: (1) corn production, (2) elevator capacities and demands, and (3) plant demand and capacity. The model will forecast grain flows from production zones to elevators, satellites, and processing plants; assign the predicted flows to truck types and highways; and estimate ESALs on key arterial and major collector highways.

MPC-192 • Biennial Strategic Transportation Analysis • G. Griffin, North Dakota State University

Freight transportation is vital to the economies of North Dakota and Region 8. The value of freight transportation services will only increase in the 21st century, as national and global trends affect trade and economic development in the region. In addition to these broad changes, railroad strategies and technology are impacting rural shippers and communities. Class I carriers are introducing 104-110 car shuttle train service for grain. At the same time, they are deploying 286,000-pound cars in grain service and evaluating the future potential of 315,000-pound cars. Collectively, these changes will impact the viability of branch lines and short line railroads and reduce the number of grain shipping stations in North Dakota and the region. Three related trends — continued rail-line abandonment, concentration of the Class I railroad industry, and growth of value-added processing — also will impact future transportation and logistical systems. Four overarching trends/issues will be investigated in this study: (1) implementation of grain shuttle train rates and services; (2) use of heavier rail cars on branch lines and short line railroads; (3) future adequacy and availability of intermodal services; and (4) optimal locations for value-added agricultural processors.

MPC-193 • Rigorous Computer Modeling of Timber Trestle Railroad Bridges • R. Gutkowski, Colorado State University

Nationally, the structural condition of short span timber trestle railroad bridges is one of concerning circumstances. Reports by the Association of American Railroads (AAR) indicate that degradation has been occurring with material failure evident at some sites. Railway car weights and train loads have increased considerably. Deterioration due to this heavy, frequent loading and aging and exposure is an important issue. Loosened connections, gaps due to shrinkage to moisture/drying cycles, support movement, differential bearing of members, etc., develop over time and are present in older bridges. These alter load capacity and stiffness from the original condition

and significantly affect behavior. To improve understanding of the load paths and structural behavior, it is necessary to accurately analytically model the geometry and member condition and properties of actual bridges. A recently developed, leading edge commercial software (Axis VM) will be employed to simulate (model) the standard open deck, timber trestle bridge configuration, including representation of actual condition. The resulting model will be used to predict the displacement response of the bridge under static loadings. Predicted response will be verified by comparison with the results of past load tests of such bridges.

MPC-194 • Effects of Environmental Exposure on Timber Bridge/Track Members and Connectors • R. Gutkowski, Colorado State University

A series of pilot laboratory tests will be conducted to expose full-size timber railroad bridge and track members and connections to realistic extremes of temperature and humidity on an accelerated time basis over six to nine months. An existing environmental chamber will be used to subject specimens to controlled levels and ranges of temperature and humidity. Specimens will include connection details typically used in timber railroad bridge and track construction, e.g., the steel rail to wood ties and the wood ties to the chord piles. The condition of wood material will be monitored continuously and effectiveness of the structural connections examined by specimen testing at scheduled times during the simulated exposure periods. CSU has acquired a state-of-the-art ENVIROTONICS walk-in environmental test chamber available to conduct the planned studies. Donated to CSU by Storage Technology, Inc., in Boulder, Colo., the chamber has been put in place at the Engineering Research Center (ERC) at CSU, where the study will be conducted. The temperature range available is -73C to +85C and can be controlled within +/- 1.1C and transitioned at up to 11C per hour. The humidity range is 20-95 percent RH. CSU will plan the environmental condition test program in conjunction with AAR research staff. Specimens will be configured to full-size to represent situations encountered in actual upgrade situations. Over a period of 6-8 months, various extremes of environmental conditions of temperature and humidity encountered in the mountain plains region of the MPC university states and other nearby states will be simulated. Advice of research scientists in the Atmospheric Sciences Department, located nearby to the ERC, will be used to determine typical climate conditions. It is expected that annual day-to-day variations and fluctuations of climate conditions can be represented.

MPC-195 • North Front Range Transportation Research Internships • R. Gutkowski, Colorado State University

Colorado State University (CSU) and the North Front Range Transportation and Air Quality Planning Council (NFRT Colorado & AQPC) (hereafter "the Council") will identify externally funded research projects which will benefit from the participation of student research interns. An annual process of identification and placement of interested, qualified student interns into active research activities in the projects and reporting of progress and outcomes is described. The NFRT & AQPC is the Metropolitan Planning Organization for an area comprised of Fort Collins, Loveland, and Greeley in Colorado, and the municipalities around and between these communities. In 1994 the NFRT & AQPC adopted the 2105 Regional Transportation Plan. The Council and local and county government transportation agencies have established and conducted an exhaustive, detailed project identification and prioritizing process consistent with the statewide planning process conducted via the Colorado Department of Transportation. This MPC project uses outcomes of this regional planning and subsequent state, county, and locally funded projects as the base for establishing student intern needs and matching the student to them, based on interests and qualifications.

MPC-196 • Moment-Rotation Tests of High Performance Steel (HPS) I-Girders • B. Hartnagel, Colorado State University

Bridge designers now have a new choice of steel available for consideration when planning a bridge. High-performance steel (HPS) grade 70W is currently available for bridge construction. Current bridge design provisions limit the flexural strength of girders with yield strength greater than 50 ksi (350 MPA) to the yield moment capacity. The flexural capacity of similar bridge girders designed with yield strength less than or equal to 50 ksi (350 MPa) is equal to the plastic moment capacity if certain restrictions are met. Research has shown that the capacity of girders fabricated from steel with a specified minimum yield strength greater than 50 ksi can sustain loads larger than the yield moment. However, more

research is necessary before changes in the design specification can be implemented. Before restrictions on the use of HPS can be removed, adequate knowledge of the material behavior must be known. This proposal is intended to provide additional information on the behavior of HPS. The analytical portion of the project will develop a finite element model of HPS I-girders. Results from this model will initially be compared to results from previous research for validation. An identical specimen will be used for this comparison. After a reliable model is developed, it will be used to predict the behavior of the experimental I-girders. It will also be used to predict the behavior of the experimental I-girders.

MPC-197 • Road Dust Suppression: Effect on Maintenance, Stability, Safety, and the Environment • T. Sanders, Colorado State University

This research project is a joint cooperative venture with the Larimer County Road and Bridge Division, Roadbind America, Inc., and other dust suppressant vendors. The research will be conducted on 10 half-mile sections of road in Larimer County. There are two types of roadbed gravel being investigated, 2.5 miles of each and five different treatments. The treatments are magnesium chloride, lignin sulfonate, a mixture of 50 percent lignin sulfonate and 50 percent magnesium chloride, a mixture of a Pennzoil and lignin sulfonate and a mixture of gravels while the Pennzoil mixes will be applied on only one gravel type. The remaining one-half mile section of each gravel type will be a control section, receiving no applications of dust suppressants. The county will provide all the labor and equipment for the preparation of the test sections and the vendors will provide the dust suppressant. The Colorado State University Dustometer, developed in previous research supported by the MPC, will be used to quantify the amounts of dust released into the air from all the test and control sections. Measurements of drivability will be defined and measured (examples of drivability are braking distance and vibrations). A record of all accidents on the roads will be kept for the duration of the research. In addition, Larimer County records will be investigated to see if there is a relationship between the number of accidents (and fatalities) and the type of road treatment (or lack thereof) on the dirt roads. More than one county in the state may be investigated if better records are available.

MPC-198 • Predicting the Fluctuations in Temperatures of Asphalt Pavements • C. Yavuzturk/ K. Ksaibati, University of Wyoming

Fluctuation in temperatures significantly affects pavement stability and the selection of asphalt-grading to be used in pavements. Ability to predict the asphalt pavement temperature at different depths based on ambient air. In addition, it will help engineers in selecting the asphalt grade to be used in various pavement lifts. The top pavement layer is normally exposed to greater temperature fluctuations than the layers below it. Knowledge of the temperature distribution of asphalt slabs will allow for a more sophisticated specification of asphalt for lower lifts (through specification of less expensive asphalt binders in lower lifts) and thus provide an economical solution to rising pavement construction costs. The study will also examine the variability of predicted pavement temperatures on various pavement materials such as dense and open-graded asphalt mixes.

MPC-199 • Low Volume Roads and Bridges • K. Ksaibati, University of Wyoming

In 1987, Congress funded the Strategic Highway Research Program (SHRP). As part of SHRP, several pavement test sections were selected for monitoring around the country. Construction as well as performance data have been collected on all test sections and saved in the Long Term Pavement Performance Information Management System (LTPPIMS). The collected data is very beneficial for researchers as well as practitioners in investigating the long-term performance of pavements. Recently, the Federal Highway Administration released a computer program called DataPave to help in making LTPP data available for any interested party. It is the main objective of ths study to evaluate the capabilities of DataPave and evaluate some of the pavement performance data for Region 8.

MPC-200 • Defining a Road Safety Audit Program for Enhancing Safety and Reducing Tort Liability • E. Wilson, University of Wyoming

The unique problems faced by local rural road jurisdictions, when coupled with the modern decline of the traditional defense of sovereign immunity, expose these jurisdictions to tort liability settlements or judgments. Road jurisdictions, in addition to safely serving road users, also need to effectively manage their assets. To maximize the use of their dollars, they need to be able to minimize their tort liability. Road Safety Audits have been used globally since the late 1980s to improve road safety in countries worldwide and has been used by some USDOTs since 1997. The validity and practicality of this approach to help local rural road jurisdictions enhance road safety and minimize their tort liability is the focus of this project.

MPC-201 • Updating the Uniform Rail Costing System Regressions • J. Bitzan, North Dakota State University

The Uniform Rail Costing System (URCS) is used to estimate individual railroad shipment variable costs for regulatory purposes. It is composed of a three phase process as follows: (1) Phase I. Regression equations are estimated for 16 individual cost accounts, where output and capacity variables are used as independent variables; (2) Phase II. Individual railroad unit costs are estimated by multiplying the percent of each cost account's expenses that are estimated to be variable by the railroad's total cost in that particular account and dividing by the number of service units (the percent of each cost account's expenses that are variable is estimated using the regression coefficients estimated in Phase I, along with individual railroad output and capacity measures); (3) Phase III. The number of service units (e.g. gross ton-miles) are computed from the attributes of the shipment, multiplied by each unit cost, and summed to get total variable cost. The accuracy of the entire URCS process depends on the accuracy of the Phase I regressions, as these are used to estimate the percent of various cost accounts that are variable. The regression coefficients used to estimate cost variability in URCS reflect 1978-1985 data. Many mergers have occurred since then, and many changes have occurred in the locomotive fleet, traffic control, and other aspects of railroad operations. Many smaller railroads — including some beltway railroads — were included in the 1978-1985 data set. None of the railroads in the 1978-1985 data set approaches the size of the BNSF, the UP, and the CBX and NS systems of today. Because of the concentration that has occurred since 1985, the Class I industry of today may exhibit different characteristics than the industry of the early 1980s. This study will re-estimate the Phase I URCS regressions using current data.

MPC-202 • Truck Costing Model for Transportation Managers • M. Berwick, North Dakota State University

The motor carrier industry has been a recurrent subject for cost studies. All of the referenced studies use an economic-engineering approach to estimate trucking costs. The economic-engineering model estimates the production function with a given set of factor prices. Most studies use survey as a data collecting tool to arrive at costs by averaging information received from the survey. Cost components are easily identified in the economic-engineering approach and thus cost estimates of a new startup firm are readily available. A weakness of the economic-engineering approach is that the results are based on average values of input prices and resource usage. Thus, the results are accurate for a limited population. Furthermore, a new study must be undertaken to update the results. An Owner/Operator Spreadsheet Costing Model developed in 1996 has been useful, however, it is based on a spreadsheet and is not a stand-alone model or software product. The model will be a stand-alone product that may be employed by transportation managers and researchers. The model will be expanded to include many truck configurations and also capture terminal and line haul costs.

MPC-203• Containerized Grain and Oil-seed Exporters - Industry Profile and Survey • K. Vachal, North Dakota State University

Competitive access to an array of agricultural markets is critical to agricultural shippers and rural economies in the Midwest. One sector that has gained notoriety in recent years is the sector marketing its grain and oilseed products via container. It seems that technological advancements in shipping, grain production, grain handling, communications, sophistication of buyer expectations, and grain producer business developments may lend themselves to continued development of this sector. It has been estimated that currently, less than one percent of the U.S. grain and oilseed production is marketed via container. A recent survey of grain industry experts suggests that this volume could increase by more

than 300 percent over the next five years. Limited, and rather disjointed, information exists for profiling the industry or identifying trends required for regional and national logistical planning, distributing resources for economic development, addressing regulatory issues, planning infrastructure investment, and other facets associated with this sector of the grain transportation industry.

MPC-204 • Strategies for Improving DOT Retention and Motivation Among Professional Staff • G. Griffin, North Dakota State University

Retention of qualified DOT employees is reportedly a problem with many, if not all, Region 8 DOTs. This appears to be true nationwide as well. This perception is based on anecdotes from several people including the chief engineer of the North Dakota DOT, director of AASHTO, and the executive director of TRB. This seems to be especially true of highly skilled technical people such as engineers. DOTs are reportedly recruiting from other DOTs in an attempt to bid engineers away to their own organization. This is not even a short term solution since such tactics are readily available to all DOTs. It results in increased salaries, turnover, possibly poor morale, and does nothing to increase retention and motivation. This project will identify the scope of the problem on a national scale. One other perceived problem that DOTs face is an organizational structure and culture that does not capitalize on the full potential of the human capital that they employ. This is part of the retention problem. The organization and culture most likely does not emphasize the job attributes that employees need to satisfy their psychological well being. These issues, although separate, are related and need to be addressed if DOTs hope to maximize their contribution to mobility with the limited resources they have available. This project will utilize the Job Characteristics Model and the corresponding Job Description Survey (JDS), or some other applicable model, to analyze the motivating potential of jobs of DOT professionals and how they would react to a job with high motivating potential. Further, strategies are developed that DOTs can implement to improve both retention and motivation simultaneously.

MPC-205 • Predicting and Classifying Voluntary Turnover Decisions for Truckload Drivers • G. Griffin, North Dakota State University

Voluntary turnover rates among truckload carriers are extremely high, ranging from 50 to over 100 percent annually. These high turnover rates result in elevated costs for carriers in terms of recruitment and training as well as costs associated with reduced productivity and decreased customer satisfaction resulting from inexperienced drivers. Although much research has been conducted to determine the relationship between the job satisfaction of drivers and the likelihood of them leaving or intending to leave an organization, research addressing other reasons why drivers may leave their organization has been lacking. Truckload carriers are not only concerned about why drivers leave their organizations, they are also interested in what they can do to predict who will leave and what interventions they can use to prevent some high performing drivers from leaving. In our current tight labor market, truckload carriers that focus on reducing voluntary turnover will have a competitive advantage over other carriers who do not understand the importance of driver retention. As a result, this project will serve to increase the understanding of voluntary turnover of drivers.

MPC-206 • Attitudinal Analysis of Bus Rapid Transit Alternative • J. Hough, North Dakota State University

Bus Rapid Transit (BRT) is a relatively new concept in the United States. The BRT system uses a designated bus lane to service passengers along a corridor. The system is much like a rail system, except it can be implemented and maintained at a fraction of the cost. Curitiba, Brazil, implemented the first recognizable BRT system. BRT may allow second-tier cities (Populations below 400,000) to better plan their transportation strategies to effectively meet the needs of their residents. One important question is "what conditions and criteria must these cities have in order to successfully implement a BRT system?" The focus of this study is to develop a travel demand model that will predict mode share based on the individuals' preferences within their particular city. The results of this study will help determine if individuals are likely to choose to ride the BRT system. The results from the select FTA demonstration sites will be applied to select cities in the

MPC states to identify the viability of implementing BRT in the MPC region. FTA recognizes that BRT systems will help with the mobility issues that are continuous problems in large, as well as, smaller communities.

MPC-207 • An Evaluation of Region 8 State Departments of Transportation and Metropolitan Planning Organizations' GIS Technology Application • D. Benson, North Dakota State University

GIS resources have become an important tool for transportation analysis and require effective management to fully utilize its technology. This study will identify and assess the current state of GIS in the region's DOTs and MPOs, and develop a resource tool outlining potential areas of coordination and cooperation among GIS users. Additionally, the study will identify GIS resources available for transportation researchers in the region.

MPC-208 • Surface Street Level of Service Using Existing Detector Infrastructure • P. Martin, University of Utah

Interstates and freeways have a long history of the use of detection devices to record flow, speed, and other traffic measures. Increasingly, even the smallest surface streets are being instrumented as the cost of detection falls and the integrity of communications continues to improve dramatically. Traffic engineers rely on the "Level of Service" (LOS) as a standard measure of traffic conditions. With capacity known, it is now possible to determine the LOS for a road, in real time. This information can serve a variety of useful purposes – automatic identification of congestion associated with tourist areas, air quality impact assessment, traveler information, and measurement of traffic generation.

MPC-209 • Advanced Traffic Management System Evaluation Data Collection Method-ology • P. Martin, University of Utah

Sophisticated micro simulation models, such as MITSIM, INTEGRATION and WATSIM are useful tools to test the potential impact of new ITS technologies, such as route diversion variable message signs, in-vehicle driver alarms, and weather sensitive speed advisory signs. Once implemented, the modeling should be tested with field observations. Rigorous experimental design demands that both pre- and post-date will be available. Frequently, the "pre data" is overlooked. Subsequent evaluations are weakened.

MPC-210 • Adaptive Signal Control for Down-town Salt Lake City • P. Martin, University of Utah

As new fixed timing plans are implemented, they already begin to age and are incapable of accommodating incidents such as accidents, inclement weather, or holiday fluctuations. Adaptive signal control reacts to traffic instead of assuming that everyday is the same and attempting to guess the most appropriate average signal timing for the peak periods. Adaptive signal timing can be thought of as an on-line Transyt or Synchro that optimizes coordinated signal timing based on the current traffic demand.

MPC-211• Evaluating and Improving the Safety of Pedestrian Crossing in Utah • W. Cottrell, University of Utah

This research would be performed in response to a recognized need for pedestrian safety improvements. During 1998, there were 748 reported pedestrian-motor vehicle crashes in Utah. A total of 41 of these involved pedestrian fatalities. The Utah Crash Outcome Data Evaluation System (Utah CODES) has been provided information on automobile accidents in the state since 1992. This database, along with supplementary information from UDOT, would be used to generate a pedestrian-vehicle incidents database. Cluster analysis and other statistical techniques would be used to measure the similarities between data groups. Upon the identification of clusters, an inventory of transportation supply and demand information would be made for the sites at which clustering pedestrian-vehicle accidents have occurred. Field work would be performed to ensure the accuracy of the supply data; some demand information may be obtained, as well.

MPC-212 • Intelligent Transportation Systems Course • P. Martin, University of Utah

The principal investigator teaches an advanced course on Intelligent Transportation Systems with a rural emphasis. Currently, the course is delivered in a traditional "chalk and talk" format. The need is to develop the course so that it may be delivered across the TEL8 network.

MPC-213 • Paratransit Coordination for Rural Communities • P. Martin, University of Utah

Rural transit systems need to improve operating performance and increase accountability. In 1999, 1,074 small urban and rural agencies provided 280 million miles of service. APTA Fact Book 1999 shows 554 agencies provided a much greater number of miles of service in urban areas total approximately 8.3 billion. The ratio suggests that coordination among rural systems may be one solution for improvement. Better vehicle utilization may also improve the ratio. The challenges faced by rural mobility managers in delivering coordinated services have been many. One challenge has been the cost/benefits of technology. This demonstration would address the following technology issues: (1) rural systems have lower access to new technological products and training; (2) agencies buying rides from mobility managers demand accountability; (3) cost of computer-aided dispatch (CAD) systems may be greater than a small system's entire annual budget; (4) how much should be invested in CAD systems by small transit agencies; and (5) institutional change forced by technology.

New Research Projects: 2000-2001

Colorado State University

MPC-214 • Pultruded Composite Shear Spike for Repair of Large Timber Members • D. Radford, B. Hartnagel, R. Gutkowski

In many installations, timber railroad bridges are 50-100 years old, but still necessary for daily operation. Numerous timber-based highway bridges exist too, primarily on secondary roads. The latter are often in jurisdictions where new construction funds are very limited. Hence, economic repair of bridges is vital to the nation's infrastructure. Fiber reinforced composites are extremely popular for infrastructure and in situ infrastructure repair. Common approaches are fiberglass wrap (bandages) or adding reinforcing plates (patches) to the sides of members. These require that the members be removed from the bridge for the repair to be made. They also degrade with time due to exposure. Alternatives to these techniques that do not require member removal and are embedded in the member are invaluable to low cost, long lasting repair. A recent MPC research project explored an innovative alternative to fiberglass wrap and patch repair techniques. A "shear spike" insert approach was tried on small wood members (based on nominal 2 x 2 and 2 x 4 sizes) and show promising results for application to full-size bridge members. Shear spikes are composite rods inserted from the bottom to the top of the beam, in situ. Pre-drilled holes and an injected adhesive are used to bond the spikes to the wood. They are produced by pultrusion with principal fiber content being in the axial direction. They serve to tighten the member to restore overall stiffness and add horizontal shear resistance, among other benefits. Results of the study showed a substantial rejuvenation result. In some cases, repairs to split members resulted in strength and stiffness comparable to undamaged control specimens.

MPC-215 • Structural Modeling of Sub-structure Resistance for Timber Trestle Railroad Bridges • R. Gutkowski

Ordinary structural modeling of bridges does not account for the presence of "discontinuities" such as loosened connections, gaps due to shrinkage from moisture/drying cycles; support movement, differential bearing of members, etc. These alter load capacity and stiffness from the original condition and significantly affect behavior. A need exists to reflect the aspects into an improved structural analysis and design process for timber trestle

railroad bridges. Software features (e.g., gap elements; interface element, etc.) exist in available commercial software to include the above "discontinuities" and free displacement. This is proving successful for the lab specimen. A need exists to better represent the substructure resistance that exists in the field compared to laboratory support conditions.

MPC-216 • Experimental Thick-Deck Wood-Concrete Highway Bridge Construction • R. Gutkowski, J. Balogh

Commonly, deteriorating wood bridge decks are completely replaced without consideration of a possible retrofit. This is likely due to lack of potential approaches to strengthen such decks. One approach to strengthening a wood bridge deck is to add a concrete deck layer and interconnect it to the wood deck. A prior MPC project showed this to be successful using a notched shear key/anchor detail tested in the laboratory under static loads. A need exists to examine field application. A concrete overlay technique recently developed in Europe is used. It involves a unique, but readily done, interlayer connection method. While a mechanical connector is involved, it is not relied upon for interlayer shear transfer needed to affect the desired composite behavior. Instead, a notched shear key is utilized to rely on wood to concrete shear and bearing to achieve the interlayer force transfer. The mechanical connector serves to tighten the concrete to wood bearing surfaces after hydration drying of the concrete has taken place. It is not affected itself by curing of the concrete, as it is anchored into the wood by gluing or grouting. A popular tourist community in Colorado has expressed interest in such new experimental bridge construction to achieve a significant traffic re-routing to improve mobility and relieve congestion. The low cost, ease of construction and "fit" of the bridge's appearance to the community character are motivations. However, the load capacity needed greatly exceeds that of the shorter span applications envisioned in the prior study, resulting in a "thick deck." Mechanically, ordinary decks and slabs are usually governed by "thin plate theory" (Kirchoff plate theory) because their depth/span ratio is such that only flexural deformations are pertinent. The depth/span ratio of the envisioned prototype is such that shear deformation is important, too. Thus, the system may be controlled by Mindlin plate theory, which accounts for shear deformation. To proceed to any envisioned pilot field application, it is imperative to examine ultimate strength for a "thick deck" as compared to the more slender decks previously examined. Fundamentally, the thick deck mechanics differ from a thin deck in mathematical modeling, too. Extrapolation of the findings for a thin deck specimen to the loads required in the field application (HS-20 loding) is high risk without a study of the underlying mechanics differences.

MPC-217 • Road Dust Suppression: Effect on Maintenance, Stability, Safety and the Environment (cont.) • T. Sanders

This research project is a joint cooperative venture with the Larimer County Road and Bridge Division, Roadbind America Inc. and other dust suppressant vendors. The research will be conducted in 10 half-mile sections of road in Larimer County. There are two types of roadbed gravel being investigated, 2.5 miles of each, and five different treatments. The treatments are magnesium chloride, lignon sulfanate, a mixture of 50 percent lignon sulfanate and 50 percent magnesium chloride, a mixture of Pennzoil and lignon sulfanate and a mixture of Pennzoil and magnesium chloride. The first three dust suppressants will be used on both gravels while the Pennzoil mixes will be applied on only one gravel type. The remaining one-half mile section of each gravel type will be a control section, receiving no applications of dust suppressants. The county will provide all the labor and equipment for the preparation of the test sections and the vendors will provide the dust suppressant. The Colorado State University Dustometer, developed in previous research supported by the Mountain-Plains Consortium, will be used to quantify the amounts of dust released into the air from all the test and control sections. Measurements of driveability will be defined and measured (examples of driveability are braking distance and vibrations). A record of all accidents on the roads will be kept for the duration of the research. In addition, Larimer County records will be investigated to see if there is a relationship between the number of accidents (and fatalities) and the type of road treatment (or lack thereof) on the dirt roads. More than one county in the state may be investigated if better records are available.

North Dakota State University

MPC-218 • Leveraging Technology Investments - Integration of GPS, GIS and Maintenance Management • D. Jacobson

The North Dakota Department of Transportation has invested thousands of dollars in developing a Geographic Information System for managing transportation assets. One of the early benefits of this effort was the integration of all existing databases. Now all of the resident transportation data can be accessed from the Roadway Information Management System (RIMS). Another was the development of a robust mapping system that replaced an archaic manual system of mapping. Transportation managers are now searching for secondary benefits from this investment in technology. The objective of this project is to develop a methodology with accompanying software programs which will enable maintenance managers to use GPS and GIS technology to capture maintenance program needs and product graphic and tabular reports of planned and executed programs and unfunded maintenance backlogs.

MPC-219 • Bus Rapid Transit: An Examination of Political Feasibility Using Case Studies • J. Hough

Many cities in the United States would like to implement light rail service. However, the high implementation cost impedes many cities and forces them to look for alternative transportation options. As a result, several cities are considering Bus Rapid Transit (BRT). Four cities will be selected as case studies to investigate the key political factors involved in BRT. The cities will be selected based on specific criteria such as population size, technologies implemented, and whether the system is a "true" BRT or a hybrid BRT with only select BRT features adopted, e.g., guided system or mixed traffic system, low floor doors or regular doors, etc. In-depth interviews and surveys will be conducted for each of the case study cities. Interviews of transit managers and key city officials will be conducted primarily to identify key political factors that may impede or support BRT. In addition, surveys of transit employees and other local officials along with city residents will be conducted to identify their perceptions of the factors involved in the selection of BRT for the city. Economic factors will be evaluated primarily through budgets and revenue forecasts. One of the proposed tangible results of this research project will be a "decision tree" which will be developed as part of the research framework. The decision tree would provide a framework for communities that are considering implementing BRT to use to aid in their decision process.

MPC-220• Costs, Pricing, and Regulatory Alternatives for Mergers • J. Bitzan

Recently, there has been a wave of mergers in the U.S. rail industry. These mergers have included those by the Burlington Northern and Sante Fe railroads, the Union Pacific and Southern Pacific railroads, and Conrail with the CSX and Norfolk Southern Railroads. A recent study sponsored by the Federal Railroad Administration (FRA) found that railroads are natural monopolies when the alternative to a merged railroad is duplicate side-by-side rail networks, but that rail mergers extending the size of rail networks lead to increases in railroad costs. This suggests that further end-to-end mergers are not beneficial unless significant service improvements are obtained. While the study provides a useful starting point for examining the welfare implications of railroad mergers, it does not provide a detailed analysis of specific rail mergers that have occurred, an assessment of the pricing effects of mergers, or an assessment of the impacts of mergers on service. This study will build upon the findings of the FRA study and others to provide a detailed analysis of previous rail mergers in terms of costs, pricing, and service, and to discuss the implications of these findings for the future of regulatory oversight of mergers.

MPC-221 • Trip Generation Rates for Grain Elevators: A Tool for State and Local Highway Planners • D. Tolliver, K. Vachal

This project will develop truck trip generation models and rates for grain elevators. There are 8,000 to 10,000 of these facilities located in the United States. At present, highway planners have no way of estimating potential trips to and from these facilities other than by direct surveys or local traffic counts, which are costly and time-consuming. The ITE trip generation tables, which are widely used by highway planners, include the aggregate categories of "Ports & Terminals" and "Industrial." However, land uses such as "light industrial," "heavy industrial," or "warehouse" do not adequately describe grain elevators. This study will utilize data from a comprehensive inventory and field survey of more than

450 elevators in North Dakota and a broader survey of grain elevators and processors in the Great Plains region. The trip generation models will predict truck trips as a function of fixed facility attributes (e.g., train loading and storage capacities), crops handled, county crop production levels and densities, elevator density in the surrounding market area (e.g., elevators or storage capacity per square mile in the county), and transportation system access and performance factors (e.g., distance from NHS, distance from river, rail access). The trip generation models will predict both inbound and outbound truck trips and include seasonal variance factors for adjusting average daily trips.

MPC-222 • Strategies for Improving DOT Employee Retention and Motivation • L. Kalnbach, D. Jacobson

Human capital is the most critical asset in determining the success of an organization. Therefore, it is important to address issues that adversely affect the contribution that human capital can make. It is reported that there are two major issues of concern among DOTs regarding their human capital – retention and motivation. These two issues probably stem from several factors, including two that are related: (1) a shortage of qualified people, and (2) a lack of understanding of how organizational structure and culture affect the ability to realize the full potential of human capital. The study consists of two phases. Seven state DOTs, including Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Wyoming will be involved in the first part of the study, while a case study approach will be used in the second part of the project. Face-to-face interviews will be conducted in the first phase of the study, however, the objectives of the second phase of the study will be accomplished through the use of written surveys, focus group discussions, and a private seminar for participating DOTs.

University of Utah

MPC-225 • Evaluation of the I-15 High Occupancy Vehicle Lanes • P. Martin

One of the main objectives of the I-15 HOV lanes is to increase the average number of persons per vehicle. The HOV lanes will have an impact on travel patterns on the mainline and possibly have an effect on adjacent alternate routes. Knowing this impact is important to make policy decisions or before any changes are made. Such changes might include the decision to implement HOV lanes on other freeways in the area, or to decide the minimum passenger level (2 passengers or 3 passengers) allowed in the lane. Violation rates should also be measured because they are an indicator of the public acceptance of the new lanes. The impacts on alternate routes also need to be assessed.

MPC-226 • Adaptive Signal Control for Downtown Salt Lake City, Utah - Part II • P. Martin

As new fixed timing plans are implemented, they already begin to age and are incapable of accommodating incidents such as accidents, inclement weather, or holiday fluctuations. Adaptive signal control reacts to traffic instead of assuming that everyday is the same and attempting to guess the most appropriate average signal timing for the peak periods. Adaptive signal timing can be thought of as an on-line Transyt or Synchro that optimizes coordinated signal timing based on the current traffic demand.

University of Wyoming

MPC-223 • Evaluating the Impact of DOT's QC/QA Programs on Pavement Performance • K. Ksaibati

Most Departments of Transportation (DOTs) have developed and implemented various types of Quality Control/Quality Assurance (QC/QA) programs. Such programs require significant resources to be invested in testing before, during, and after finishing the construction of pavement structures. The testing may include aggregate gradation, asphalt content, density of compacted mix, and smoothness of finished surface. The test results are normally utilized by DOTs to calculate the incentives/disincentives based on statistical evaluation and standard procedures. It is important after QC/QA programs have been in place for several years to determine their impact on the overall quality and long-term performance of pavements.

MPC-224• Utilizing the GLWT in Evaluating Moisture Susceptibility of Asphalt Mixes • K. Ksaibati

The main objective of this study is to obtain mixtures and mechanical properties for various asphalt mixes. These properties will be utilized in evaluating the effects of moisture on various types of asphalt mixes. The Georgia Loaded Wheel Tester (GLWT) will be utilized in predicting the moisture resistance of the asphalt mixes included in the study.

Human Resource Development

The MPC's goal is to increase the number of students, faculty and staff interested and involved in the undergraduate, graduate and professional programs of the Center. As outlined in our strategic plan, it is the Center's intent to increase faculty involvement in transportation, increase student participation in transportation programs, and increase participation by transportation professionals. This section highlights the Center's student and faculty activities and professional development during the past year. It also includes short biographies of our current graduate students.

MPC Graduate Students

Colorado State University

Mike Griffeth is pursuing a masters degree in Structural Engineering at Colorado State University. He received a bachelor of science in Civil Engineering in 1998 from the University of New Hampshire (Durham, NH). Griffeth's work background includes an internship during the summers of 1996 and 1997 with Globe Hollow Water Treatment Plant Engineering, where he was a design engineer assistant for state and local projects, which included producing WaterCAD simulations of flow-test results and future development conditions; and operating AutoCAD to create and modify project drawings. During the summer of 1998 Griffeth assisted in the layout and erection of a new building and utilities bridge using a theodilite and laser with the Aldrich Construction Company, Inc. in Manchester, Conn.

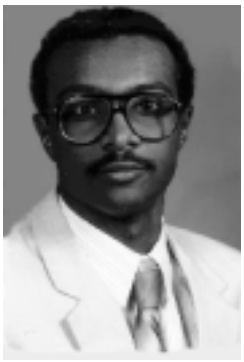
Griffeth is an entry student and has interests in projects on railroad bridges.

Mark Miller

Mark Miller is a registered professional engineer in the states of Wyoming and Nebraska, and has more than 13 years of experience in the structural design of government administrative, production, air-craft repair and maintenance, space craft launch and assembly, and military housing facilities.

Miller currently is the director of Operations, 302D Civil Engineer Squadron, Peterson AFB and previously has held positions as the Regional Officer in Charge of Construction, U.S. Forces Korea; Lead Structural Engineer, Dept. of Civil Engineer, U.S. Air Force Academy, Colo.; and the Structural Engineer in Charge of Launch Facilities, Cape Canaveral AFS, Fla., where he was responsible for the structural renovation and upgrade of launch complex's 17 and 41 in support of the Delta GPS and Titan IV launch programs.

Miller is a 1986 graduate of the University of Wyoming, 1999 graduate of Squadron Officer's School, Maxwell AFB, Ala.; and is a graduate student in structural engineering at Colorado State University. He is conducting master of science thesis work on the three dimensional, space frame modeling of open deck, timber trestle railroad bridges. This work is in conjunction with an MPC-sponsored project to examine load paths in such bridges via laboratory and field testing.



Abdalla Shigidi

Abdalla Shigidi has a bachelor of science degree in Civil Engineering from the University of Khartoum-Sudan. He completed a master of science in Structural Engineering at Colorado State University in 1996. His master of science research was on the MPC project "Dynamic Impact Load Testing of a Moderate Weight Timber Bridge Guardrail."

Shigidi currently is pursuing a Ph.D. in Civil Engineering at CSU. His main transportation research focus is on timber bridge guardrails under static and dynamic loading. He presently is working on the current MPC project "Full-Scale Laboratory Testing of a Timber Trestle Railroad Bridge."

Before coming to the United States, Shigidi worked for two years as a construction engineer. He participated in the erection of a number of reinforced concrete high-rise buildings. Presently, Shigidi is manager of the Structural Engineering Laboratory at CSU. He oversees all laboratory testing conducted at that facility.

An Vinh Tran

An Vinh Tran has earned a masters degree in Civil Engineering (Structural and Geotechnical Engineering Program), Colorado State University, May 1999. He received a bachelor's degree in Civil Engineering in 1998 from Colorado State University.

The purpose of Tran's research is to study the pier moment-rotation behavior of compact and noncompact I-shape bridge girders fabricated from high performance steel (HPS). To accomplish the purpose, the research consists of two main objectives. The first objective is to compare experimental laboratory moment-rotation tests and corresponding numerical moment-rotation finite element analysis of four HPS70W steel girders to the current AASHTO LRFD moment rotation equations. The second objective is to compare inelastic moment-rotation post peak behavior of numerical non-composite models to corresponding numerical composite models.

Tran would like to continue the doctorate's study in Structural and Geotechnical Engineering, and work as a professional engineer in the field of structural and geotechnical engineering.

North Dakota State University

Brian Gibson

Brian Gibson currently is in the Natural Resources Management graduate program and is fulfilling the requirements for the Transportation Option of the agribusiness and applied economics program at North Dakota State University. His thesis topic is a hedonic study of traffic volume and noise and their effects on housing values in the Fargo-Moorhead area.

Gibson graduated in 1999 from Minnesota State University-Moorhead with a bachelor of arts degree in economics.

Alan Dybing

Alan Dybing is working toward his M.S. degree in Agribusiness and Applied Economics. His research includes the Estimation of Elasticities of Demand for Rail and Truck Transportation of Grain in North Dakota.

Alan received his B.S. in Agricultural Education at North Dakota State University, Fargo, ND.

Weijun Huang

Weijun Huang is working toward a master's degree in Agribusiness and Applied Economics. Weijun's research, "Shuttle Adoption Strategy," tries to find key factors affecting shuttle train adoption for grain elevators. It uses a spatial logit model to analyze the data for elevators. It focuses on the geographic characteristics and elevators' own characteristics. Weijung would like to get a job in the agriculture or transportation field in the United States or Canada.

Weijung earned an M.S. in Business Administration at Oklahoma City University and a B.S. in Grain Machinery at Zhengzhon Grain University, China. He received the "Outstanding Teacher in Hunan Province" award in 1998.

Darren Koehl

Darren Koehl expects to receive his M.S. degree in Agribusiness and Applied Economics with a transportation logistics option in December 2001. He is working on a wheat trade model for his thesis. The model includes the introduction of genetically modified wheat and its impact on world wheat trade.

Darren received his B.S. in Agricultural Economics at the University of Illinois at Urbana-Champaign, May 2000.

Kiel Ova

Kiel Ova received his master's degree in Civil Engineering, with a Transportation Option, at North Dakota State University, December 2000. He received a bachelor of science degree in Civil Engineering in 1998 at North Dakota State University.

Ova has worked with the low-volume road program, including "Guidelines for Consolidating Township Roads" and the County Road Planning Workbook, primarily dealing with geographical information systems (GIS). His interests include traffic modeling and Intelligent Transportation Systems (ITS). He is currently employed with the Upper Great Plains Transportation Institute in the Advanced Traffic Analysis Center (ATAC).

Ryan Tepley

Ryan Tepley received his bachelor of arts degree in Economics and bachelor of science in Finance in spring 1998, from NDSU. He began graduate studies at NDSU in Economics emphasizing transportation and logistics in the fall 1998 and completed his coursework in fall 1999.

Currently Tepley is working on a master's thesis in the area of grain logistics, specifically transportation by truck. The research analyzes the tradeoffs between various truck configurations to explore implications on grain supply chain efficiency, alternate transportation modes, effects on infrastructure, and impacts on other roadway users. Tepley is currently employed at Border States Electric Supply in Fargo, ND.

North Dakota Department of Transportation

Paul Benning

Paul Benning received his B.S. degree in civil engineering from NDSU. He continues to take graduate classes at North Dakota State University toward a master of science degree in civil engineering. Paul is a registered Professional Engineer in the state of North Dakota and is currently employed by the North Dakota DOT in the local government division.

Bob Fode

Bob Fode received his B.S. in Civil Engineering from the University of North Dakota. His area of research is in traffic engineering. He previously worked with the NDDOT in the construction division, construction pool, design division, traffic section, and is currently in the construction division.

Fode is preparing a comprehensive research paper on "Synthesis of Ride Quality Initiatives." His future plans include finishing his Master's degree in Transportation Engineering and becoming a registered engineer Spring 2001.

Tom Bold

Tom Bold received a B.S. degree in Civil Engineering, from North Dakota State University, a B.S. Degree in Business Administration from the University of Mary, Bismarck, ND, and an AAS degree in Electronics Technology from Bismarck State College, Bismarck, ND.

Tom is currently employed by the NDDOT in the materials and research division.

Chad Orn

Chad Orn received his B.S. degree in Civil Engineering from North Dakota State University. He is currently employed by the NDDOT in the design division.

James Rath

James Rath received a B.S.C.E. degree from the University of North Dakota,. He plans to complete graduate courses by Spring 2004 and his thesis by Spring 2005. James currently is employed by the NDDOT in the design division.

Esther Vogel

Esther Vogel received her B.S. in Civil Engineering from the University of North Dakota in 1981. She has been a hydraulic engineer in the design division of the NDDOT since 1990, and is responsible for hydraulic analysis on grading projects and investigating drainage problems.

Vogel began working with the NDDOT in 1979. She worked as a construction field engineer for seven years and a design engineer in the traffic section for four years. Currently, Vogel is preparing a comprehensive research paper on "Evaluation of Plastic Centerline Drainage Pipe." She expects to graduate this fall.

Darcy Rosendahl

Darcy Rosendahl earned a B.S. degree in Civil Engineering from North Dakota State University in 1983. He also attended Dickinson State College for two years. His research includes working on NDDOT experimental projects, whitetopping of bituminous pavement, and chip seals. Rosendahl is currently the planning division director.

Currently, Darcy is preparing a comprehensive research paper on "Evaluation of Ride Panel Results vs Existing Measures of Ride Quality." He expects to graduate in Spring 2001.

Joel Wilt

Joel Wilt earned his B.S. in Civil Engineering from the University of North Dakota in 1989. He currently is the assistant district engineer in Williston, N. Dak., and is responsible for construction and maintenance of highways in the district.

Wilt is a registered professional engineer and a charter member of the American Society of Highway Engineers, Central Dakotah Section. He plans to complete his master's degree in Civil Engineering in Spring 2002.

Stephen Bryan is employed at MK Centennial Engineering. A previous traffic lab research assistant, Bryan holds a bachelor of science degree from the University of Utah.

Mark Bunnell, who earned a bachelor of science degree from the University of Utah, is completing his master's degree. He has been an intern with the Utah Department of Transportation in civil engineering.

Alfredo Gonzales earned a bachelor of science degree from the Institute Tecnologico de Oaxaca, Mexico, in civil engineering. He is pursuing a master of science degree in engineering. In Mexico, Gonzales designed a plan for the state of Oaxaca to allocate federal funds in rural communities. His plan consisted of developing access roads, power and portable water infrastructure, and food storage and distribution to communities.

Fredrick Kuhnow holds a bachelor of science degree from the University of La Sirena in civil engineering. While working on his master's degree, Kuhnow is a teaching assistant and has worked at Salt Lake City's materials lab since 1998.

Michael Wright, who earned his bachelor of science in civil engineering degree at the University of Utah, is pursuing his master of science degree. He earned a general science/honors degree at Weber State University in 1995. Among honors he has earned are second place Overall-ITE Intermountain Section Student Paper contest in 1998; best transportation student, Western Coal Transportation Institute, 1999; Transportation Graduate Scholarship, Thornton Department of Civil and Environmental Engineering Scholarship 1996-97; Presidential Commendation Scholarship, 1991-92 and 1994-95. Wright has completed three publications.

Chintan Jhaveri graduated from the S.V. Regional College of Engineering and Technology, Surat, India with honors in Civil Engineering in the summer of 2000. He is enrolled in the Master of Science

program of the Department of Civil and Environmental Engineering.

Naree Kim graduated from the University of Utah with a Bachelor of Science in summer of 2000. She is enrolled in the Master of Engineering program of the Department of Civil and Environmental Engineering.

Bhargava Rama graduated from the Indian Institute of Technology, Kharagpur, with a Bachelor of Technology, with honors, in Civil Engineering in the summer of 2000. He is enrolled in the Master of Science program of the Department of Civil and Environmental Engineering.

Aleksandar Stevanovich graduated from the University of Belgrade, Yugoslavia, with a Bachelor of Science, with honors, in Applied Sciences and Civil Engineering in the summer of 1998. He is enrolled in the Master of Science program of the Department of Civil and Environmental Engineering.

University of Wyoming

Roger Owers

Roger Owers is a law student working toward a juris doctorate at the University of Wyoming, with an anticipated graduation date in May 2001. Owers received a master's degree in construction management from Arizona State University in 1995 and a bachelor's degree in civil engineering from the University of Arizona in 1993.

His research, to date, has focused on tort liability of transportation departments and on road safety audits. He also published an article in the ASCE Journal of Construction Management in September 1996. After completing his doctorate, Owers plans to work for the Transportation Department or as a transportation contractor.

Student Program Activities

Awards • Honors • Scholarships

Jennifer Bjorge, North Dakota State University
Paul E.R. Abrahamson Scholarship, 2000-01
Agribusiness and Applied Economics major with a concentration in Communications and Public Relations

Eric Berge, North Dakota State University
Paul E.R. Abrahamson Scholarship, 2000-01
Agribusiness and Applied Economics major

Brock Lautenschlager, North Dakota State University
Paul E.R. Abrahamson Scholarship, 2000-01
Custom option of study concentrating in Accounting in Agribusiness and Applied Economics

Derek Kost, North Dakota State University
2000-01 Transportation Engineering Scholarship
Civil Engineering major

Jason Link, North Dakota State University
2000-01 Transportation Engineering Scholarship
Civil Engineering major

Kiel Ova, North Dakota State University
Eno Fellowship, 2001

Workshops • Conferences

Kiel Ova, NDSU, Eno Transportation Foundation Leadership Development Conference, 2001.

Activities

North Dakota State University's first-ever solar race car, Prairie Fire, placed fourth out of nine vehicles in the stock car class division in its debut performance, and first among rookie teams. The race ran from July 15 to July 25, 2001, and covered 2,247 miles along historic Route 66 from Chicago to Claremont, California. In 11 days, five drivers rotate in the third heaviest vehicle in the race. In the first third of the race, the car was not performing as they expected and was using too much energy. The students went through the car, analyzing and rejecting possibilities. It turned out to be brake pads that were not retracting. Race days were from 8:00 a.m. to 6:00 p.m. Sixteen students and advisor, Dr. Wayne Reitz, with four support vehicles made the trip. It's an expensive proposition, with NDSU students having one of the least costly cars at approximately $50,000. The faster cars can cost up to $6 million. The Prairie Fire team consisted of students from electrical, mechanical and computer science. The Mountain-Plains Consortium, along with the UGPTI and the Advanced Traffic Analysis Center, supported this year's team with a cumulative $5,000 contribution.

MPC Student Award Winner, 2000-01

Name: Kimberly R. Doyle
Colorado State University
Hometown: Defreestville, NY

Kimberly R. Doyle, EIT, earned her Master of Science in Civil Engineering from Colorado State University, Fort Collins, and is ABET accredited. Her Bachelor of Science in Civil Engineering is from The University of North Carolina, Charlotte, and her Associate of Applied Science in Civil Engineering Technology is from Hudson Valley Community College, Troy, N.Y.

Ms. Doyle has been a graduate teaching assistant and graduate research assistant. Among her contributions in those capacities, she load tested for a full scale model timber trestle railroad bridge; investigated discrepancies between controlled laboratory testing and field testing of railroad bridges, and co-authored three technical papers published in two international scientific journals. She also lectured on engineering and supervised laboratory work.

A member of Tau Beta Pi, National Engineering Honor Society, and Chi Epsilon, National Civil Engineering Honor Society, Ms. Doyle was on the deans' list, chancellor's list, president's list and received the UNCC Spirit Award.

Her professional experience involves work as a draftsman where she performed soil and on-site concrete tests, drafted engineering details for building and site plans and prepared exhibits. Her career path
continued with engineer-in-training assignments with a professional engineer and continued to project structural engineer where Ms. Doyle designed framing and foundation layouts for residential and commercial projects as well as inspecting for design compliance, and was responsible for composing field reports and working with AutoCAD.

She is employed with EagleSpan Steel Structures, Inc., Loveland, Colo., Ms. Doyle is a project structural engineer. Her responsibilities include designing primary and secondary elements for commercial steel buildings and bridges; administration and employment of specialty engineering software, and coordination of engineering projects with clients and engineering graphics.

Faculty Activities

New Faculty

Dr. Sandra Woods signed on in January to lead the Colorado State University Department of Civil Engineering. Woods received a B.S. degree in civil engineering from Michigan State University in 1976. She received M.S. and Ph.D. degrees in civil engineering from the University of Washington in 1980 and 1985 respectively. She joined the faculty at Oregon State University in 1984.

While on the Oregon State University civil engineering faculty for 16 years, Woods developed a program for under-represented engineering students, led the development of an environmental engineering degree program, established a residence hall for women engineering students and helped establish an EPA Hazardous Substance Research Center. Woods served as faculty associate to the provost and interim dean of Distance and Continuing Education. Her research focuses on the bioremediation of contaminated groundwater. She was a Presidential Young Investigator and a member of the Governor's Task Force on the State of Oregon's Environment.

"We have hired an accomplished and experienced researcher and administrator who can assist our faculty," said Neal Gallagher, dean of the College of Engineering. "Woods will also be a mentor and role model for the nearly 50 percent of our undergraduate engineering students who are women."

Sabbatical • Development Leave

Kimberly Vachal, Associate Research Fellow at North Dakota State University, is currently working on a doctorate on Public Policy at the School of Public Policy, George Mason University in Fairfax, Virginia. After finishing her first semester of course work, she is back at the Transportation Institute for the summer. She returns to GMU in August to complete course work over the next two semesters. Her area of emphasis is freight transportation.

Honors • Awards

Dr. Richard Gutkowski participated as the invited National Delegate (representing the United States) to the World Conference on Timber Engineering-2000 held in Vancouver, British Columbia, Canada. This is the premier international conference for the community of academics and industry in the field of timber engineering.

Other Activities

- In Fall 2000, Dr. Richard Gutkowski undertook mentoring of undergraduate student, Carlos Enciso, as part of the Students as Leaders in Engineering program of the Woman and Minorities in Engineering Program.
- Dr. Richard Gutkowski participated, by formal arrangement with Fachhochschule Deggendorf in Deggendorf, Germany, in hosting interested undergraduate civil engineering students for 4-6 month periods of research work experience in the Structural Engineering Laboratory for the practical training requirement of their curriculum. Typically, one to four students participate at their personal and/or German government expense and compensation. In 2000 three students were hosted and there is an agreement for two future students in Spring 2001.
- During National Transportation Week, the UGPTI hosted a luncheon for 15 NDSU faculty. Departments represented were Agribusiness and Applied Economics, Construction Management, Civil Engineering, Computer Science, Industrial Manufacturing and Engineering and the College of Business Administration. Dr. Velmer Burton, Dean of the Graduate School was keynote speaker. He unveiled a proposal to establish a Ph.D. program in transportation and logistics and indicated that the President of NDSU was submitting a formal written request to the Board of Higher Education this year. He anticipates the program to be implemented during the 2003 academic year. The MPC director is chairing an interdepartmental committee to develop the proposal and oversee the program.

Workshops • Conferences • Presentations

2001

R.M. Gutkowski, A.M.T. Shigidi, A.V. Tran, and M. Peterson. Field Studies of a Strengthened Timber Railway Bridge, Transportation Research Record, Transportation Research Board, National Research Council, Washington, D.C. (CSU)

Dr. Tom Sanders, professor of Civil Engineering at CSU conducted the "Hazardous Materials/ Wastes Managers" short course which was held June 12-14, 2001 in Fort Collins, Colorado. The course was attended by 13 professionals from the western United States. The course covered all the pertinent laws and regulations governing the proper storage, transportation and ultimate disposal of hazardous wastes. The CHMM certification exam was given at the conclusion of the short course.

Brenda Lantz, "ISS II Presentation." NCSTS Conference, June 2001.

Brenda Lantz, "ISS II Presentation." CMVSA Conference, New Orleans, Louisiana, May 2001

Mark Berwick, "Logistics Characteristics of the North Dakota Potato Industry." Transportation Research Board, Washington, DC, January 2001.

John Bitzan, "Railroad Costs, Mergers." Transportation and Public Utilities Group of the Allied Social Science Meetings, New Orleans, Louisiana, January 2001.

John Bitzan, "Railroad Costs: Implications for Policy." Transportation Research Board, Washington, DC, January 2001.

2000

R.M. Gutkowski, J. Balogh, J. Natterer, K. Brown, and P. Etournaud. "Laboratory Tests of Composite Wood – Concrete Beam and Floor Specimens." Proceedings of World Conference on Timber Engineering - 2000, Whistler Resort, British Columbia, Canada. (CSU)

R.M. Gutkowski, K.R. Doyle, and J. Balogh. "Laboratory Tests of Timber Trestle Bridge Chord." Proceedings of World Conference on Timber Engineering - 2000, Whistler Resort, British Columbia, Canada. (CSU)

R.M. Gutkowski, A.M.T. Shigidi, and M.L. Peterson. "Field Tests of a Strengthened Timber Trestle Railroad Bridge." Proceedings of World Conference on Timber Engineering - 2000, Whistler Resort, British Columbia, Canada. (CSU)

R.M. Gutkowski. "International Trends in Wood Construction Industry and Markets." Invited lecture, Institute for Wood Construction, Ecole Polytechnique Federale de Lausanne, Laussane, Switzerland. (CSU)

R.M. Gutkowski. "Tests and Analysis of Composite Wood-Concrete Members and Systems." Invited lecture, Institute for Wood Construction, Ecole Polytechnique Federale de Lausanne, Laussane, Switzerland. (CSU)

R.M. Gutkowski. "Wood Residential and Commercial Construction." Invited lecture, Institute for Wood Construction, Ecole Polytechnique Federale de Lausanne, Laussane, Switzerland. (CSU)

R.M. Gutkowski. "Wood Construction for Housing, Buildings and Rehabilitation." Invited lecture, Institute Universita di rchitecture, University of Venice, Venice, Italy. (CSU)

R.M. Gutkowski. "Wood Construction for Housing, Buildings and Rehabilitation." Invited lecture, Institute of Civil Engineering and Architecture, Technical University of Trento, Trento, Italy. (CSU)

R.M. Gutkowski. "Composite Behavior of Mixed Wood - Concrete Floor/Deck Systems." Invited lecture, Institute of Civil Engineering, Technical University of Florence, Florence, Italy. (CSU)

R.M. Gutkowski. "Conventional U.S. Bridge Construction." Invited lecture, Institute for Wood Construction, Ecole Polytechnique Federale de Lausanne, Laussane, Switzerland. (CSU)

Journal Articles

R.M. Gutkowski. "Case Studies: Scott Lancaster Memorial Bridge, Weld County roadway bridge, LaPlata County roadway bridge." Invited lecture. Institute for Wood Construction, Ecole Polytechnique Federale de Lausanne, Laussane, Switzerland. (CSU)

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R.M. Gutkowski. "USA Timber - Bridge Construction, Part 2." "Wood Focus," The magazine of the Institute of Wood Science - Spring Issue, Stocking Lane, Hugh Herd on Valley, High Wycombe, Buckinghampshire, UK. (CSU)