

# MOUNTAIN-PLAINS CONSORTIUM NEWS

## Project Highlights

### NDSU Work Will Help Indian Reservation Road Planning

An MPC-funded project at North Dakota State University will give road planners for the nation's Indian reservations tools for assessing and planning their road systems.

Indian reservations in the United States have a road network of about 50,000 miles. About half of those miles are under the jurisdiction of state, federal and local highway agencies. The remaining 25,000 miles are controlled by the U.S. Bureau of Indian Affairs and are referred to as the Indian Reservation Roads (IRR) network.

"We are taking the database of the IRR network and converting it into a format that is compatible with the analytical tools used by state and federal agencies to evaluate their roads," notes Doug Benson, the Upper Great Plains Transportation Institute researcher leading the effort. "Our goal is to make those analytical tools available to tribal highway planners so they can use them to evaluate and plan their highway networks."



The data used in the effort includes numerous engineering specifications including information on road and shoulder width, road surface and condition as well as strength. Additional data on safety issues and the amount of traffic are also considered.

"Currently we're completing the preliminary analysis of the IRR database and comparing it to the data requirements of HERS-ST (Highway Economic Requirements System – state version), one of the primary analytical tools used by highway planners," Benson says.

That comparison will help the researchers identify the data adequately supplied by the IRR database as well as data that are inadequate for use by HERS-ST. The next step in the project will be to develop software to address those inadequacies and convert the IRR data to data usable by HERS-ST and other tools.

"The asset management capabilities provided by these tools is critical to having a road network that meets needs in a cost-effective manner and allows for growth and planning," Benson says. Road planners use analytical tools to evaluate remaining life of roads, to prioritize repair and reconstruction projects, to assess safety concerns and to develop plans for road and highway investment.

The project was launched last summer and a prototype of the conversion software is expected to be ready in June. The project is being conducted with guidance from the USDOT's Asset Management Division, Federal Lands Highway Division, and Federal Highway Administration.

### **University of Utah Receives Software Donation**

PTV America, a leading multi-disciplinary transportation software and consulting firm and a subsidiary of PTV AG in Karlsruhe, Germany, announced a new partnership with the Utah Traffic Lab which is part of the University of Utah Department of Civil and Environmental Engineering.

PTV America has donated software with a commercial value of \$560,000 for training the next generation of transportation engineers. Peter Martin of the University of Utah is working with PTV America to implement the newest PTV Vision Suite of integrated transportation planning and operations analyses software into the academic curriculum and research efforts at the university. The software is the leading tool in more than 75 countries and allows University of Utah students and faculty to work with some of the most advanced technologies in the world.

### **CSU Researchers Examine Flexible Guardrails**

Colorado State University researchers are exploring whether wood or other biomass materials may be used in crash barriers.

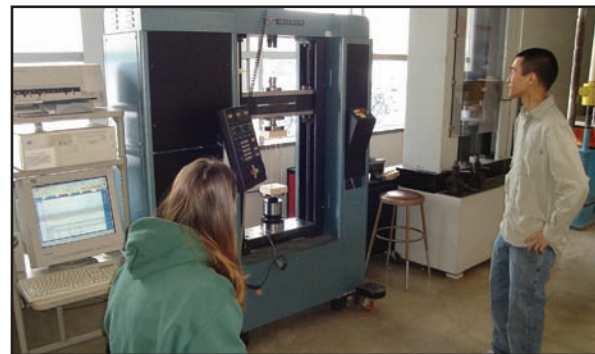
The overall objective of the project is to evaluate, construct and test crash barriers composed of low-diameter wood or biomass elements that are inexpensive, easily replaced, and that yield significantly under external loads.

Most existing crash barriers perform well, providing good overall protection, but often exert large forces on both the vehicle and occupants. The CSU research will examine prototypes of three-dimensional "soft" wood element networks that will provide the necessary impact resistance

while undergoing large deformations to soften the impact on vehicles and their occupants.

The project is directed by Paul Heyliger, CSU professor of civil engineering, and C.J. Riley, a Ph.D. student in structural mechanics. Riley earned his M.S. from CSU and spent two years with the Wyoming Department of Transportation developing design software for transportation structures.

Research assistants on the project include two civil engineering undergraduate students: Jordan Jarrett and David Sawahata. Jarrett is a senior who plans to go to graduate school at CSU to study structural and mechanics engineering. Sawahata is also a senior and participated in an internship coordinated by the MPC where he worked with the Wold County Public Works department.



Jordan Jarrett and David Sawahata use an Instron testing machine to test a wood-dowel-based model to failure in compression. The models are a preliminary examination of using wood or biomass materials as flexible bending or compression members.

### **University of Wyoming Launches Transportation Safety Evaluation**

The University of Wyoming recently secured funding for a new study entitled: "A Comprehensive Transportation Safety Evaluation Program in the State of Wyoming." The main objective of the research is to develop and evaluate transportation safety techniques that can help Wyoming agencies reduce crashes and fatalities on rural roads. The MPC is providing half of the funding while matching funds were obtained from the Wyoming Department of Transportation (WYDOT).

The new federal transportation bill, SAFETEA-LU, requires state department of transportation agencies to address safety on local and rural roads. It is important for state, county, and city officials to cooperate in producing a comprehensive safety plan to improve safety statewide. The new legislation provides an opportunity to implement a more cohesive and comprehensive approach to local road safety in Wyoming. The University of Wyoming supports road safety efforts through its existing activities which include: training classes, newsletter publication, information dissemination, and technical assistance. The University of Wyoming can provide additional services to help WYDOT, as well as Wyoming counties and cities, in identifying low-cost safety improvements on high-risk rural roads statewide.

In this project, safety techniques and methodologies will be developed to identify and then rank high-risk locations on all rural roadways in Wyoming. What makes this project unique is the high percentage of gravel roads at the local level in Wyoming. The evaluation procedure developed will be based on roadway classification as well as surface type (paved versus unpaved).

As part of this study, a Local Road Safety Advisory Group has been established. The group includes representatives from: WYDOT, Wyoming LTAP, Wyoming Association of County Engineers and Road Superintendents, Wyoming Association of Municipalities, and FHWA. The group met in February and approved the general outline for this study.

Three counties will be included in the first phase of this study. All other counties will be invited to participate in future safety evaluations. A transportation safety engineer, Jim McGrath, has been hired to help in performing the study. McGrath will communicate with all of the project partners across the state while he performs the tasks associated with this project. The findings of the study will be presented at regional and national meetings and conferences.

## **A TLN Videoconferencing Facility at SDSU**

The first project to be completed by the MPC program at South Dakota State University (SDSU) was the establishment of a Transportation Learning Network (TLN) videoconferencing site. The facility, which boasts two 50-inch plasma monitors, was completed in December 2006. The videoconferencing facility is already being used to conduct meetings with other TLN partners and to receive graduate course instruction from other MPC universities.

## **CSU Research Evaluates Tire Rubber for Road and Bridge Construction**

Researchers at Colorado State University will study the beneficial use of waste tire rubber in low-volume road and bridge construction.

As part of the effort, researchers are evaluating the mechanical properties of expansive soil-rubber (ESR) mixtures required for the mechanistic design of low-volume road embankments. Experiments are being carried out at the recently renovated Geotechnical Graduate Research Laboratory at CSU.

Information generated during this stage of the project will be used to design a typical low-volume road embankment cross-section using a computer model and provide guidelines for the construction of a pilot road section in the field.



Carraro

The research is being directed by assistant professor Antonio Carraro. He has been on the faculty of CSU's Department of Civil Engineering at Colorado State University since 2004.

He specializes in experimental methods and behavior of geomaterials, geotechnical earthquake engineering, foundation engineering, and beneficial use of waste materials.

Gabriel Iltis, a Ph.D. student in the CSU Geotechnical Engineering Program, is a research assistant working with Carraro on the project.



Jesus Higuera Seda is also a research assistant on the project. He is an undergraduate student in the CSU Geotechnical Engineering Program.

A paper based on part of the research, “Beneficial Use of Waste Tire Rubber for Swelling Potential Mitigation in Expansive Soils,” was presented at the American Society of Civil Engineering Geo-Denver Conference in February and will be printed in the conference proceedings. Authors are undergraduate students J.H. Seda, J.C. Lee, and professor Antonio Carraro.



Research assistants Gabriel Iltis (left) and Jesus Higuera Seda (right) working on the preparation of specimens of expansive soil-rubber (ESR) mixtures for swell-consolidation testing.

## Workshops and Presentations

### Staff and Students Present Papers

Papers written by several MPC students and staff members were recently selected for presentation at national meetings.

NDSU Ph.D. student Chris Enyinda presented “Managing value chain through lean supply chain logistics: A comparison of military and commercial organizations” to the American Society of Business and Behavioral Sciences 14th annual conference Nov. 8 in Las Vegas, NV. The paper was also published in the conference proceedings.

Enyinda returned to Las Vegas in January to present another paper at the Society of Advancement of Management’s 2007 International Business Conference. The paper, “Mitigating and managing global supply chain risks and security: Leveraging

RFID technology,” was also published in the conference proceedings.

NDSU Ph.D. student Subhro Mitra’s paper, “Analyzing satellite imagery to develop freight generation data” was selected in the American Association of State Highway and Transportation Officials’ Geographic Information Systems for Transportation (GIS-T) 2007 Student Paper Contest. He will present his paper March 26, at the GIS-T Symposium in Nashville, TN. The paper will also be published on the GIS-T web site.

In addition to his GIS-T paper, Mitra was also selected to present his paper, “Analyzing the effects of spring highway load restrictions on North Dakota’s agricultural freight flows” at the 86th Annual Meeting of the Transportation Research Board in January in Washington, D.C.

University of Utah student Aleksandar Stevanovic presented “VISGAOST: VISSIM-based genetic algorithm optimization of signal timings” at the TRB meeting. The paper outlined research with advanced signal control methods in both a hypothetical grid network and a real-world arterial of actuated-coordinated intersections in Park City, Utah. University of Utah program director Peter Martin and student Jelka Stevanovic were coauthors.

University of Wyoming program director Khaled Ksaibati was coauthor of two papers presented at the TRB meeting: “Gravel Road Surface Performance Modeling” and “Recycled Glass Utilization in Highway Construction.”

Magdy Abdelrahman, an assistant professor of civil engineering at NDSU, was another TRB presenter. His paper, “Field evaluation of implementation issues for Superpave on low-volume roads,” was part of a session on pavement management for low-volume roads and identified potential issues of concern with using Superpave on low-volume roads.

The TRB Annual Meeting is the nation’s largest gathering of transportation professionals with more than 2,800 presentations in 500 sessions addressing topics of interest to policy makers, administrators,

practitioners, researchers and representatives of government, industry and academic institutions from around the world.

### **Rural Road Safety Workshops Held in Wyoming**

The University of Wyoming held several transportation safety workshops around the state in October to help rural units of government improve rural road safety.

Local Safety Tools Workshops were held in Rock Springs, Casper, and Gillette. The workshops are outgrowths of the Federal Highway Administration's Local Road Safety program. That program was developed specifically for local rural governments and is based upon the international concept called the Road Safety Audit (RSA). These workshops were presented by Eugene Wilson, consultant, and Paul Harker of the Federal Highway Administration.

"The Local Road Safety Program is a powerful tool to make local rural roads safer. It can also be adapted for local city governments as well as for state departments of transportation," says Wyoming MPC director Khaled Ksaibati. "For most local rural agencies there are fewer new projects being constructed and therefore the focus presented in these workshops was upon the existing roadways. The key to the success of the program is that safety issues are the entire focus."

As a follow up to the local safety tools workshops, the University of Wyoming organized a Low Cost Safety Improvements Workshop. This one-day workshop was held on the Transportation Learning Network. Participants from DOT's and local governments across region 8 attended the workshop. The course opened with an overview of highway safety issues with an emphasis on "do it now" solutions. Steps for identifying high-risk crash locations were then described. The rest of the workshop concentrated on learning a host of countermeasures to fix high-risk locations.

Presenting safety related workshops will increase the regional and local awareness in safety. The University of Wyoming will follow up the training

with wide distribution of safety-related "Tech Briefs" in the near future.

### **MPC to Sponsor Transit Coordination Workshop**

The MPC will sponsor a transit coordination workshop for tribal entities this spring in Bismarck.

The idea for the workshop came from tribal representatives involved in transit management. The Small Urban & Rural Transit Center (SURTC), a part of the Upper Great Plains Transportation Institute at North Dakota State University, recently completed a transit development plan for the Turtle Mountain Indian Reservation and Rolette County in North Dakota. The plan emphasized coordination between existing transit agencies and human service providers and inspired interest among other tribes in coordination efforts.

The federal highway bill, SAFTEA-LU, mandates transit projects have coordination plans established between traditional transit providers and human services entities to extend mobility opportunities. With this workshop, MPC hopes to address the requirements of the federal legislation and enhance the efficiency and effectiveness of transit systems that operate on North Dakota's four major Indian reservations.

UGPTI staff members Carol Wright, Gary Hegland, and Jon Mielke will conduct the training which will:

- educate tribal representatives on the mandates that exist for coordination;
- give specific examples of the benefits of coordination;
- help to identify potential agencies and organizations with whom tribal agencies may want to coordinate;
- provide information to tribal representatives on how to initiate coordination efforts; and
- educate tribal representatives on how to monitor their results and sustain coordinating efforts into the future.

The materials for this workshop will be specifically designed for transit systems that serve Indian reservations. The material will take into account the challenges faced by transit operators on Indian reservations which often include poverty, remote locations, and low levels of personal mobility. The development of a coordination plan will position tribal transit operators to take advantage of expanded federal funding under the federal highway bill.

MPC has a five-year strategic plan, which has identified coordination and planning of rural transit services as one of its priorities. This training is part of the overall strategic plan.

### **MPC Sponsors Attendance at RFID Conference**

The MPC sponsored a trip for several NDSU faculty and students in October to a national conference on transportation applications for radio frequency identification technology (RFID).

More than 80 experts in transportation, technology and research policy from universities, government, and private industry attended the Washington, D.C., conference. The conference was organized and hosted by the Transportation Research Board of the National Academies of Science.

“The presence of a major RFID manufacturing firm in NDSU’s Research and Technology Park as well as NDSU’s research program into RFID, gives us some unique opportunities as to incorporate the technology into our research and education programs,” noted MPC director Denver Tolliver. “The conference allowed us to see how RFID is being viewed on a national scale and how we can contribute to both policy discussions and research direction.”

Joseph Szmerekovsky, assistant professor of management at NDSU, attended with support from the MPC. “The best part of the conference for me was the small-group breakouts where we were able to participate in a lot more discussion and a lot more interaction,” he says. “Getting a feel for what other people were thinking and doing was very helpful, particularly the need for research

on return on investment and cost-benefits. Those are the sort of things that I’m involved in.”

Participants at the conference gathered in break-out groups to discuss RFID policy and institutional issues and RFID applications in the supply chain, construction, and operations, safety and security.

The MPC provided funding to support attendance at the conference for additional NDSU faculty and students, including: Ergin Erdem, graduate student in industrial and manufacturing engineering; Jing Shi, associate professor of industrial and manufacturing engineering; David Wells, professor of industrial and manufacturing engineering; and Hai Zeng, Ph.D. student in transportation and logistics.

## **Faculty Activities**

### **CSU Faculty Member Named to Transportation Authority Steering Committee**



Gutkowski

CSU faculty member Richard Gutkowski was recently named to the North Front Range Regional Transportation Authority Citizens’ Coalition Steering Committee.

The committee, made up of two dozen people from across the region, will meet for three months to develop a regional plan for roadway and transit projects. The plan will be considered as a ballot measure later this year. The group will explore issues of equity, shareback, tax rates, maintenance and regional transit and develop intergovernmental agreements between the region’s jurisdictions.

The MPC and CSU were among the sponsors for the North Front Range Transportation Choices Summit last year. The transportation authority is building on the summit’s initial work to establish priorities and find resources to address the region’s transportation issues.



## Visiting Professor from Sweden Cooperates in MPC Bridge Projects

Elzbieta Lukaszewska, research scientist in the Division of Timber Structures at Luleå University of Technology (LUT) in Sweden is working as a visiting scientist at Colorado State University. She is cooperating with Richard Gutkowski in various MPC research projects on composite wood-concrete layered bridge deck systems.

At LUT, Lukaszewska is also completing doctoral studies involving interconnections for prefabricating stiffened wood-concrete panels. She will be at CSU for six months, focusing on rigorous computer models. Prior to her arrival, she visited the University of Canterbury in New Zealand for five weeks, as part of Gutkowski's cooperation with researchers at that institution.

## CSU Prof Honored for Work in Hungary

As part of the commemoration to mark the 50th anniversary of the 1956 Hungarian Revolution, Richard Gutkowski was one of four individuals named as Honorary Lifetime Members of the Hungarian Club of Colorado.

Gutkowski received the honor in recognition for facilitating cooperation at the doctoral school level between the Department of Civil Engineering at Colorado State University and the Civil Engineering Department at the Budapest University of Technology and Economics. Recipients were recognized during a memorial service at the Hungarian Park in Denver where a wreath was placed in honor of those lost in the revolution.

Colorado Governor Bill Owens keynoted the opening events at a ceremony held at the State Capitol Building. U.S. Congressman Tom Tancredo keynoted the later banquet ceremony.



Colorado Governor Bill Owens and Eugene Megyesy, Honorary Consul General of the Republic of Hungary, at an awards ceremony recognizing CSU faculty member Richard Gutkowski and three others as Honorary Lifetime Members of the Hungarian Club of Colorado.

## Student Activities

### Burgers Named Student of Year for Region VIII



Burgers

Travis Burgers, former MPC student at Colorado State University, was named Student of the Year for Region VIII at the Transportation Research Board annual meeting in Washington in January. Each year, the U.S. Department of Transportation honors the most outstanding student from each participating University Transportation Center for achievements and promise for future contributions to the transportation field.

Students of the year are selected based on their accomplishments in such areas as technical merit and research, academic performance, professionalism, and leadership. Each student receives a certificate from DOT and \$1,000 from the student's UTC.

Burgers earned his M.S., degree in civil engineering from CSU in August 2005, and a B.S. degree in engineering from Dordt College, Sioux Center, IA, in 2003. He is presently a doctoral student in biomechanics at the University of Wisconsin-Madison.

Burgers held a dual appointment as a graduate teaching assistant and a graduate research assistant in the Department of Civil Engineering at CSU from 2003 to mid-2005. As a graduate teaching assistant, he was an instructor in various undergraduate laboratory-based courses. As a graduate research assistant he was supported via funds from the MPC. He worked on an innovative repair method for timber bridges adapted from an aerospace industry process termed "Z-spiking" used in making laminated composites. His study consisted of applying Z-spikes (fiberglass reinforced polymer rods) to damaged stringer members. He conducted extensive laboratory tests of a full-scale chord of an open-deck timber trestle railroad bridge that had been reinforced by Z-spiking. The work was also presented at the 2006 International Association for Bridge and

Structural Engineering held in Budapest, Hungary, and published in the proceedings.

In summer 2004, Burgers served as a mentor to a student in the McNair scholars program for underrepresented undergraduate students. He helped the student integrate research and education via overseeing his designing and conducting a summer research project in transportation-related research.

He was surveying assistant in highway work with Wilsey & Associates. He also was a test lab assistant for Behr Heat Transfer, conducting burst, pressure and wind tunnel tests on oil coolers and evaluating test outcomes.

Presently, Burgers is conducting research on press-fit fixation and visco-elastic response of a bone-implant interface. This technology will contribute to improved understanding and treatment of osteoarthritis of the knee by combining 3-D computational modeling and cadaveric mechanics testing of femurs surgically treated with implants. He hopes to apply such studies to other medical conditions, physical trauma, and bone injuries.

### MPC Sponsors Railroad Awareness Week Activities at NDSU

During the week of Nov. 6-10, the Upper Great Plains Transportation Institute and the Department of Civil Engineering at NDSU observed "Railroad Week" to raise awareness of the importance of railroad transportation in the United States and draw attention to potential careers in the railroad industry. Events during the week were sponsored by MPC.

"With the continued steady growth of the railroad systems through increased global trade and movement of goods and freight from the central region to the ports, we are opening new doors for our civil engineering and transportation students by making them aware of the many benefits of this industry," notes Dinesh Katti, chair of the Department of Civil Engineering.

"The railroad industry is facing a mass retirement of management personnel and is starving for engineering and management personnel to fill



these voids. Awareness weeks such as this will hopefully educate students and make them aware of the great opportunities available in the railroad industry.”

The week-long event also drew attention to efforts at NDSU to increase its focus on railroad engineering. In partnership with the Association of American Railroads and a number of Class I and regional railroads, NDSU is boosting railroad-focused scholarship and internship programs and adding railroad-related material to course content and research programs.

Craig Rocky, vice president of policy and economics with the Association of American Railroads, emphasized the need for such an event.

“One of the commonly misunderstood aspects of the railroad industry is its significance to the economy,” he said. Rocky notes that railroads account for 42 percent of all ton-miles of goods shipped in the United States. “The industry has also thrown off huge social benefits,” he says, listing congestion mitigation, pollution reduction, transportation safety and fuel efficiency.



During Railroad Week at NDSU, Brian Lindamood of Alaska Railroad Corp. discussed challenges of expanding and operating a railroad in Alaska.

Rocky notes that all modes of freight transportation in the United States are reaching capacity. “Historically, railroads have been looked to as a safety valve for capacity concerns, particularly in a growing economy,” he says. “Railroads are in a position unlike anything they’ve faced in the past. In certain places and in certain corridors, capacity is being reached. In the past there’s been excess capacity everywhere.”

The railroad industry reinvests 40 percent of its revenues into maintaining its assets. “We’re seeing increasing increments of that investment being directed toward expansion,” Rocky notes.

That presents important opportunities for new graduates. “As railroads devote greater and greater amounts to expansion, they’re also paying great attention to engineering, operations and strategic planning. Those are key elements for our industry to expand and reach a level that is optimal.”

“All railroads are actively involved in programs to build more capacity,” Rocky says. They are looking at new technology, recruiting and training programs, and new operating plans and joint efforts among railroads.”

During the week, railroad professionals addressed civil engineering classes and students in the Masters of Military Logistics program. Brian Lindamood of Alaska Railroad Corp. presented technical facts on railroad engineering and railroad transportation to support military logistics, as well as the uniqueness of the Alaska Railroad. “Railroads have inherent advantages to most other modes of transportation when measured in economic terms of volume and as those other means of transportation struggle with capacity and operational costs, railroads will continue to reap the growth benefits of being a viable alternative,” he said. Lindamood received an M.S. in civil engineering from NDSU.

Dan Zink, Red River Valley and Western Railroad, presented information on regional railroad operations in the northern plains and issues related to short-line and regional railroads.

## MPC Sponsors NDSU ITE Field Trip to Minneapolis

The North Dakota State University student chapter of the Institute of Transportation Engineers (ITE) took a field trip to Minneapolis Nov. 17-18 thanks to MPC support.

Eight civil engineering students toured transportation-related facilities and job sites, such as the Roseville Traffic Maintenance Center, the Hiawatha Light Rail System and the “Unweave the Weave” project on the interchange of Interstate Highways 35E and 694. The group also attended a “Trans Talk” at the University of Minnesota featuring 2007 ITE International president-elect Earl Newman. They also attended the 2006 North Central ITE Annual Conference.



Students in the NDSU student chapter of ITE toured project sites in Minneapolis-St. Paul in November.

Roseville Traffic Maintenance Center



“Unweave the Weave” Project

## First MPC Student in South Dakota Begins Work



Boushek

Amanda Boushek, of Echo, MN, is working on her M.S. degree in civil engineering. She earned her B.S. degree in civil engineering from South Dakota State University (SDSU). In the summer of 2006, Amanda became the first SDSU graduate student to work on an MPC-sponsored research project.

Her research work focuses on the development and evaluation of self-consolidating concrete mix designs for structural applications in highway box culverts. The project is co-sponsored by the South Dakota Department of Transportation.

## New Faculty



Mahgoub

**Hesham Mahgoub** joined the Department of Civil and Environmental Engineering at South Dakota State University (SDSU) as an assistant professor soon after SDSU became a partner in MPC. Dr. Mahgoub is a valuable addition to the department in the transportation area. His previous research work

includes virtual commercial vehicle inspection stations, sustainable infrastructure development for rural communities, pavement materials and construction, infrared technology in pavement evaluation, and recycled materials properties. Before joining SDSU in August 2006, Dr. Mahgoub was a visiting professor at the University of Central Florida in Orlando from 2001 until 2006. Dr. Mahgoub has a B.S., M.S., and Ph.D. degrees in civil engineering, all from the Cairo University, Egypt.



Zhang

**Jun Zhang** joined the Department of Industrial and Manufacturing Engineering at NDSU in October as an assistant professor. Her research interests include: lean manufacturing and logistics; production planning and inventory control; scheduling; simulation optimization; models

and methodologies of stochastic optimization; health care engineering; facility design; supply chain management; artificial intelligence; machine learning and data mining; and computer integrated manufacturing. Zhang holds a B.S. and an M.S. in mechanical engineering from Beijing Institute of Technology, China, and a Ph.D. in industrial engineering from Purdue University. Before coming to NDSU, she was a research assistant for the School of Industrial Engineering at Purdue.



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