Chair's Notes

I am happy to inform you that the department has completed another very successful year. Our students continue to excel academically. Student chapters of the American Society of Civil Engineers, the Institute of Transportation Engineers, and the Water Environment Federation had a busy year. Faculty members continue to be productive in teaching, research, and professional and university service. We went through a successful accreditation review. Also an internal university review found our undergraduate program to be strong and of high quality.

Our graduate programs are healthy. We have quite a few graduate students busy doing research. External research funding increased substantially this past year. You will find more on the accomplishments of individual faculty and other happenings in the department in other sections of the newsletter.

We are currently in a recruiting mode. A search is underway for the Malcolm and Linda Selig endowed faculty position made possible due to the generous contribution from one of our alums, Malcolm Selig. The endowed position is the first of its kind in the history of NDSU. Searches are also underway to fill positions vacated by Dr. La Palm who retired and Dr. Nelson who left to return to industry.

The Accreditation Board for Engineering and Technology (ABET) visited the College of Engineering and Architecture October 1-3, 2000. The team that reviewed the civil engineering undergraduate program consisted of a practicing civil engineer from California (ABET), one observer designated by the American Society of Civil Engineers and another by the North Dakota State Registration Board. We are looking forward to a full accreditation for six years. We will officially hear from the ABET in July 2001. The continuation of accreditation reaffirms the quality education offered by the department.

The CE Industrial Advisory Committee worked very closely with us on several issues related to ABET during the past couple of years. I want to thank them for their support and advice. Thanks to those of you who responded to our alumni and employer surveys seeking feedback on our program outcomes.

Many departmental alumni responded to the NDSU Development Foundation with gifts earmarked to the department. Several new scholarships were established in the past couple of years with the support of our alums and friends. Your support is greatly appreciated.

G. Padmanabhan
Chair and Professor
Civil Engineering Newsletter

Don Andersen and Frank Peloubet continue to operate the Transportation Technology Transfer Center funded by FHWA and the NDDOT. Additional funding is provided by the North Dakota Insurance Reserve Fund. The Center publishes the CenterLine newsletter in addition to presenting short courses on road-related topics. Don coordinated a workshop "Construction and Inspection" for recent employees of the local engineering firms. Don was elected Vice President of the North Dakota chapter of the National society for Professional Engineers. Don was the recipient of the Outstanding Service Award last year from the F-M Engineers Club and Chapter 4 of the North Dakota Society of Professional Engineers (NDSPE). He edits the NDSPE newsletter, North Dakota Professional Engineer.

Melanie Bengtson manages the department web page, http://hardhat.cme.ndsu.nodak.edu. She has added many new features to the page. Melanie continues as the departmental representative for visiting with prospective civil and general engineering students. She also assists the registrar’s office during freshman registration on behalf of the College of Engineering and Architecture. Melanie advises the professional sorority, Alpha Omega Epsilon. She is the President of the North Dakota section of the American Society of Civil Engineers. Melanie helps organize events for high school students during Science Olympiad and Expanding Your Horizon events held at NDSU.

Dinesh Katti received this year's College Researcher of the Year award. Dr. Katti co-authored a book "Influence of Gravity on Granular Soil Mechanics". He published two technical journal papers - "Influence of Swelling on Microstructure of Swelling Clays", in the Canadian Geotechnical Journal and "Modeling Microarchitecture and Mechanical Behavior Of Nacre Using 3D Finite Element Techniques, Part I: Elastic Properties", in the Journal of Material Science. The husband-wife team of Drs. Dinesh and Kalpana Katti obtained research funds of approximately $280,000 from the National Science Foundation. The team along with Frank Yazdani also secured approximately $60,000 for research from the North Dakota Department of Transportation. Dinesh also won a Faculty Institute for Excellence in Learning Fellowship awarded by an NDSU Bush grant for providing support and training for faculty interested in dramatically changing the way they teach and, consequently, how effectively students learn.

Kalpana Katti, in addition to the research funds obtained collaboratively with Dinesh Katti, has another NSF project "Designing new polymeric composites for Biomedical applications" for $75,000. Her research efforts focus primarily in the area of advanced nanocomposite materials. All of her research activities involve several graduate and undergraduate students. Dr. Katti also received a Faculty Institute for Excellence in Learning Fellowship award. Dr. Katti served on a National Science Foundation panel for reviewing proposals for the Civil and Mechanical Systems Division of Directorate of Engineering, National Science Foundation. She also served as a judge for senior division high school students at the North Dakota Science and Technology fair. Dr. Katti published two technical journal articles and four conference Proceedings papers.

Ken Kellogg, along with Dr. Allan Kallmeyer of Mechanical Engineering department obtained a grant of $290,000 from the Army Research Office to study the durability of graphite fiber composites subjected to reduced temperature thermal fatigue. Dr. Kellogg continues to advise the ASCE student chapter. He organized events in the department for high school students during the Science Olympiad and Governor’s School.

George Lapalm retired after 27 years of distinguished service in the civil engineering department. He taught structural engineering courses. He coordinated the FE examination and advised the Tau Beta Pi student chapter for several years. Dr. La Palm has been conferred Emeritus status by NDSU. We wish George all the best in his retirement.

Wei Lin received the annual College of Engineering and Architecture Dean's Excellence in Teaching award in recognition of high student rating of his instructions. Dr. Lin has several grants from local utilities and regional sources. This year he activated the Water Environment Federation student chapter as a joint student chapter of American Water Works Association and Water Environment Federa-
tion. Four of Dr. Lin’s proposals were funded for a total of approximately $80,000. He has submitted four other proposals. He continues to work on a project funded by the NAVY. Dr. Lin has one paper published in a refereed journal and one in conference Proceedings. Dr. Lin graduated three MS students this year. One Ph.D student and five MS students are currently working with him and are in various stages of completion.

Brian Nelson is leaving for greener pastures after serving at NDSU for six years in the environmental area. He is returning to industry and we wish him all the best.

G. Padmanabhan continues to direct the project "An Adaptive Systemic Initiative of Tribal Collaboration for Increasing Native American Participation in Mathematics, Science and Engineering" funded by the ONR (NAVY). It is a multi-year project involving several NDSU faculty from Math, Science and Engineering. Dr. Padmanabhan contributed two chapters - one as a single author and another as a co-author - in a book "Science and Policy: Interbasin Water Transfer of Aquatic Biota" published by the Institute of Regional studies, NDSU. With Melanie Bengtson as the co-author, he completed a study on the influence of wetlands on flooding.

Amiy Varma continues to work on the projects "Acquisition of Networked Imaging Cluster for Characterization, Analysis, and Visualization of Materials, Processes, and Engineered Structures", $588,000 funded by National Science Foundation, and "Economic and Job Impacts of SDDOT Construction", $42,000 funded by South Dakota Department of Transportation. Dr. Varma continues to be active in several national committees of professional societies and university committees. Dr. Varma advises the Institute of Transportation Engineers student chapter.

Frank Yazdani has been busy with the North Dakota Department of Transportation project. Dr. Yazdani will be on sabbatical leave for a year. He has plans to work with UCLA, Berkeley researchers on damage mechanics and finite element modeling in structural engineering.

Some Program Statistics

Fall 2000 CE enrollment was 272 undergraduates, 13 Masters, and 7 Ph.D students. The undergraduate enrollment appears to have reached a plateau contrary to a declining trend nationally. In 2000-01 we graduated 42 undergraduates and 8 Masters students (5 and 1 female). The percentage of female students enrolled in the civil engineering program has increased from about 8% five years ago to 13%.

Almost all our graduating seniors take the FE examination and we have a 98% passing rate.

Student Competitions

More than twenty students participated in either the regional Concrete Canoe competition held at Iowa State in Ames, Iowa, April 7, or the Steel Bridge competition held at University of Iowa at Iowa City, Iowa, the first weekend of March.

Eight students participated in designing and building the steel bridge. Unfortunately the bridge deflected more than the allowed two inches.

Next Spring the Steel Bridge competition will be held at NDSU.

Twelve students participated in building and racing the canoe for the mid-west regional concrete canoe competition. The competition has several components. The first involves building a display showing the design plans, procedures and pictures of different stages of construction of the canoe. Next is a presentation on the design and construction. And then there were five races – men’s and women’s sprint, men’s and women’s endurance, and co-ed sprint. The team placed fifth overall.

Homecoming 2001

Mark your calendars now – Homecoming is Saturday, October 20, 2001. The College of Engineering and Architecture hosts a reception for visiting alumni immediately following the game. The venue is upstairs in the new addition of the Fargo Dome. It’s a great time to get to-
gather over hors d’oeuvres and punch! Come join us!
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<thead>
<tr>
<th>Name of Scholarship</th>
<th>Recipient</th>
<th>Hometown</th>
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<tr>
<td>Phyllis &amp; Robert Anderson</td>
<td>Julia Anderson</td>
<td>Hibbing, MN</td>
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<td>American Society of Civil Engineers</td>
<td>Jason Link</td>
<td>Hazen, ND</td>
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<td>Asphalt, Inc.</td>
<td>Matthew Metzger</td>
<td>Carrington, ND</td>
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<td>J. Darrell Bakken</td>
<td>Carl Jackson</td>
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<td>Barr Engineering</td>
<td>Rasmussen, Lisa</td>
<td>Estelline, SD</td>
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<td>Bartlett &amp; West Engineering</td>
<td>Ryan Ackerman</td>
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<td>John &amp; Susan Bloom Memorial Endowment</td>
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<td>Arlan D. Gilbertson Memorial Scholarship</td>
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<td>Steven Schmidt</td>
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<td>Jacob Brotzler</td>
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<td>Emily Veikly</td>
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<td>Marie Vigness</td>
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<td>Joseph Lewis</td>
<td>Sheyenne, ND</td>
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<td>Cassie McNames</td>
<td>Watertown, SD</td>
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<td>Nancy Molick</td>
<td>Moorhead, MN</td>
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Where did our graduates go in 2000?

Abhe & Svoboda
Barnard Construction Company
Bernardin Lochmueller
Betker & Associates
Black & Veatch
Bolton & Menk
Bonestroo, Rosene, Anderli
Braun InterTec Corp
BRW Contractors (2)
Bucher, Willis & Ratliff
HNTB Corp.
H.R. Green
Idaho Department of Transportation
Kadrmas, Lee & Jackson, PC (3)
       Valley City, ND
KS Department of Transportation
MN Department of Transportation (3)
North Dakota Concrete Products
ND Department of Transportation (2)
       Fargo, ND
NDSU Graduate School
RLK Kuusisto Ltd.
Sabre Communications Corp
SRF Consulting Group
Steelox Systems, Inc.
Swenson Hagen & Co.
TIC – The Industrial Company
Ulteig Engineers (3)

US Air Force
Vulcraft (Div. of Nucor Corp)

Prior Lake, MN
Bozeman, MT
Evansville, IN
Plymouth, MN
Overland Park, KS
Sleepy Eye, MN
St. Paul, MN
Fargo, ND
Minneapolis, MN
Dallas, TX
Edina, MN
Minneapolis, MN
Boise, ID
Dickinson, ND
Topeka, KS
Detroit Lakes, MN
St. Paul, MN
Bismarck, ND
Bismarck, ND
Fargo, ND
Hibbing, MN
Sioux City, IA
Minneapolis, MN
Washington, OH
Bismarck, ND
Fargo, ND
Fridley, MN
Minneapolis, MN
Norfolk, NE

New Logo

The department has a new logo. The College of Engineering and Architecture and each department in the college have new logos developed this past year. We will use the logo in all our educational and research informational brochures. The logo of each department has something uniquely representing the department with a common background format representing the college.

Web Page

The department's web page has added several new features. Please visit the site and send your comments in. The URL for the web site is on the cover page.
ASCE
The ASCE student chapter had another busy year that included the regional concrete canoe and steel bridge competitions. Though they did not place in the steel bridge competition at the University of Iowa, they did place fifth overall in the concrete canoe competition held in Ames, Iowa. The students had a good time - including the many hours preparing the canoe amid the saw buzz and dust as they sanded the concrete and prepared and practiced assembling the steel bridge and running tests. Dr. Ken Kellogg is the adviser.

AWWA/WEF
A joint American Water Works Association (AWWA) and Water Environment Federation (WEF) student chapter was formed at North Dakota State University (NDSU) in January 2001 with the help from North Dakota Section of AWWA and North Dakota Water Environmental Association (WEA). In addition to bringing in practicing professionals as guest speakers, the newly formed organization of twelve members also organized site visits to Great Plains Synfuel Plant, Coteau's Freedom Mine, and Antelope Valley Power Plant, all in Beulah, North Dakota. They also visited Garrison dam and the hydro power plant. Dr. Wei Lin is the adviser.

Tau Beta Pi
Civil engineering students actively participated in activities. The chapter organized a workshop “Engineering Futures” designed and presented by speakers sponsored by the national chapter at NDSU. The sessions help develop skills required for working in teams. All civil engineering seniors enrolled in senior design (Capstone course) were required to attend the sessions.

SWE
In addition to being actively involved in ASCE and ITE the female students were active in the Society of Women Engineers student chapter.

ITE
The Upper Great Plains Transportation Institute and the department of civil engineering at North Dakota State University, along with the North Central Section Institute of Transportation Engineers (ITE), recently funded a new alliance for engineering students, the Transportation Student Association, to expose transportation students to all facets of the transportation industry. TSA is currently petitioning to become a recognized student organization on the NDSU campus. Formed in January, the group has funded student participation in conferences such as the Transportation Research Board Conference in Washington, D.C. In August, four students participated in the Institute of Transportation Engineers International Conference held in Chicago. TSA has visited with consulting firms such as SEH and URS/BRW where they were able to see how their classroom knowledge is applied to real-life situations as well as learn about job opportunities. Students participated in the Transportation Career Expo hosted by the Center for Transportation Studies (CTS) to increase awareness about careers in the field. They also toured the Human Factors Lab at the University of Minnesota to view the ways in which people react to transportation systems, and toured Caterpillar Paving Products and the Northwest Airlines Operations Control Center in Minneapolis. The organization currently has 32 members. Students who may be interested include students in civil, electrical, mechanical and industrial engineering, logistics, psychology, and agricultural economics. Dr. Amiy Varma advises the ITE student chapter.
1949
Roy Weigel of Minneapolis, MN retired in 1982 as the sole owner of Weigel Construction Company and wants to keep in touch with NDSU. Weigel Construction designs and builds concrete grain elevators. Prior to that he was practicing civil engineering designing concrete grain elevators for North Star Construction, St. Paul, MN and Grain States Construction, Minneapolis.

1956
Richard Marshall, a 1956 civil engineering graduate, died on February 24, 2000. Dr. Marshall directed wind research for the National Institute of Standards and Technology from 1986-1996. He worked in the Colorado State University’s Fluid Dynamics and Diffusion Laboratory. He conducted wind tunnel studies on tall buildings, including the New York’s World Trade Center. Last year he received the ASCE Structural Engineering Institute Walter P. Moore Jr. Award for technical excellence in developing structural engineering codes and standards.

1962
John Becker, District 6, Traffic Engineer is with the Idaho Transportation Department. He would like us to remind our graduates that quite a few entry level positions may open up with the potential for career advancement to mid and upper management.

1972
Daniel Spiegelberg is with Earth Tech in Huntsville, Alabama, as a Senior Professional, managing environmental and facility engineering support to the National Missile Defense Program. Daniel retired from the U.S. Navy, Civil Engineer Corps in 1992. He serves as a member of the Civil and Environmental Engineering Program Advisory Committee at the University of Alabama in Huntsville. As a practicing civil engineer he is happy to help out academic programs in providing practitioner-academe interaction.

1981
Jon Kreig, Delano, MN is with SRF consulting Group, Inc., Minneapolis, MN in their Traffic Engineering department. Jon moved from the City of Davenport, Iowa where he served as City Traffic Engineer. He has also held traffic engineering positions in the Cities of Abilene and Farmers Branch, Texas.

1991
Matt Volz, Topeka, Kansas works for the Kansas Department of Transportation. He is currently the Coordinator for Intelligent Transportation Systems for KDOT.

1991
Nolan Baier, Kingwood, Texas obtained an MBA at the University of Chicago and now works as a Senior Analyst for Reliant Energy, Houston, Texas. Prior to that Nolan worked for Koch Ind. Inc.

1995
Mathew Martinson, Lieutenant, U.S. PHS, took a permanent change of station to Bremerton, WA as a Senior Environmental Engineer in Indian Health Service.

1998
Michael Carpenter, St. Cloud, MN is currently working with Duffy Engineering & Associates, Sauk Rapids, MN, a structural consulting company. He worked for a year before that with Widseth, Smith Nolting of Crookston, MN.

1998
Roger Theis, Phoenix, AZ works for Val-Tec, Inc., a site development specialist company. He is happily married to 1997 NDSU graduate, Jodi Theis. Jodi is working on the Prescott, AZ Regional Mall which is scheduled to open March 2002.

1999

2000
Thomas Haag works at the Denver Office of Raytheon Engineers. Thomas is a project engineer for the design and construction of airports/airport expansion/rehabilitation.

Emy’s Corner
Emy Schulz, Acad. Asst.

Another academic year has rapidly come to an end. We have bid goodbye to the seniors. I will spend the summer catching up and preparing to welcome incoming freshmen and returning students in the fall.

A big change at home as well – Harold retired last December, after 35 years with the City of Fargo. The transition went very smoothly for him. He keeps busy and is thoroughly enjoying himself. I hope I will do as well
when it is my turn to join the ranks of the retirement world.

Have a great summer!

Civil Engineering Advisory Committee Members

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ND Science and Engineering Fair students Visit CE Department
This year NDSU hosted the North Dakota Science and Engineering Fair for high school students. After the Fair several students toured the department labs. They also visited with the CE students working on the concrete canoe. Needless to say they had several inquisitive questions.

Dr. Kalpana Katti who served as a judge in the Fair, had this to say: "I took this opportunity to talk to many students about their future academic plans and what motivated them to make their career choices. On the whole it was always a family member or relative or a teacher who motivated the students for choosing science and technology careers. In the senior division the projects ranged across diverse disciplines such as various branches of engineering, biology, chemistry, physics and even fractals in mathematics. I was impressed with the breadth of knowledge of the students. The project on multidimensional polynomials showed knowledge of the student way beyond his years. One civil engineering project involved a new 'slinky-composite' structural and materials design for designing tunnels resistant to earthquakes. On another note, I was disappointed to notice that there was not a single engineering based project by a female student, although several excellent biology-biotechnology and genetics based projects were done by female students. On talking to these girls I learned that they were intimidated by mathematics early on or found it uninteresting and boring and thus shied away from engineering."

50 Yr. Club Reunion
NDSU alumni, who graduated 50 or more years ago, had a reunion this year. Five of the CEA alums chose to take a tour of the CE department and reminisced about their past adventures in the college.

NDDOT Support Center
Beginning in January 2001, a designer from the DOT has established his permanent work office in the new DOT Support Center in Hastings Hall, NDSU. Seven engineering students were hired to work with the NDDOT designer on design projects assigned to the Fargo District Office. In addition, they were given assignments on revising existing CADD design standards using Microstation. During the Spring 2001 semester the students worked on plans relating to Interstate reconstruction, asphalt overlays, seal coats and traffic control. Four engineering students have been hired to work during the Summer 2001 semester and are continuing work on project designs and project data collection for the Fargo district office. Engineering students are gaining a much better understanding and appreciation for a junior engineers responsibilities and tasks in highway design and construction. Current plans are to continue the program and potentially expand into other engineering areas such as geotechnical and materials research in addition to roadway design.

ATAC Lab
The Advanced Traffic Analysis Center Lab at the Upper Great Plains Transportation Institute provides computer hardware and software that supports various traffic analyses, including traffic simulation, a traffic signal controller interface, and a video-detection data collection system. Several civil engineering graduate and undergraduate students work on ATAC projects and use the Traffic Lab. The ATAC and the UGPTI have supported ITE students attending TRB and ITE annual meetings.

Jorgenson honored
This year the F-M Engineers Club and Chapter 4 of NDSPE presented Dr. James Jorgenson the Elwin F. Chandler Award for Engineering and Professional Excellence. Jorgenson, former faculty member and chair of the department, is owner and presi-
RESEARCH HIGHLIGHTS

Dr. Wei Lin

_Determination of Factors Causing Elevated Phosphorus Levels in a Natural Wetland and Methods for Remediation_

Graduate Student: Rochelle Nustad

Wetlands are known for their capacity to act as sinks or traps for nutrients and are often used for phosphorus and ammonia removal from wastewater streams and agricultural runoff. However, natural peat wetlands near Detroit Lakes, MN, appear to be releasing phosphorus into a drainage ditch. The ditch water running through the wetlands enters Lake Sallie, an important recreational lake. A field study was conducted to determine the factors causing the elevated phosphorus levels in the ditch and a bench scale aeration study was conducted to determine the feasibility of aeration within the ditch as a method to decrease phosphorus at the outlet of the ditch. Use of aeration to reduce phosphorus levels was investigated through both field-testing and laboratory experiments.

_Investigation of Ozone Byproduct formation in Drinking Water Treatments_

Graduate Student: Stuart Hurley

Fargo and Moorhead are the first two cities in North Dakota and Minnesota, respectively, that use ozonation in drinking water treatment. A research is currently under way to study the factors that affect ozone demand and ozonation byproduct formation in the ozonation systems. An investigation also is carried out to study the removal of ozonation byproducts in the filter systems. The major objectives of this project include: identifying and quantifying major ozonation byproducts; investigating the impact of ozone dose, pH, temperature and other factors on byproducts formation; studying the removal of bio-degradable byproducts in the filtration systems; and investigating the impact of secondary disinfection and biological growth to the water quality in distribution systems. The research activities include analysis of water treatment plant operating data; collecting water samples from ozonation chambers, medium filter effluent, clear well, and distribution system for chemical and biological analyses.

_Investigation of Metal Removal by Constructed Wetlands_

Graduate Student: Eric Dodds

Mine drainage water often contains high metal concentrations, which can be toxic to natural environments. A cheap and easy method for treating the drainage water has been desired since recognition of this type of problem. Due to remote locations with limited buildable space, water treatment plants are often not feasible. Natural wetlands have been recognized as effective treatment possibilities for contaminated waters. Therefore, constructed wetlands have been designed and created to perform the same functions in a more controlled system by several mining companies. Metal removal through wetlands is driven by several mechanisms, such as ion-exchange and precipitation, and controlled by several factors, such as temperature and pH. Peat is recognized as an effective metal sorbent in wetlands. Research is currently under way to study the factors that affect metal removal by peat. The major objectives of this project include: determining metal sorption capacity by peat; investigating the impact of temperature and pH on metal sorption; and determining the impact of competitive sorption on metal removal capacity. The research activities include taking and digesting peat samples from constructed wetland, performing batch sorption tests, and metal analysis by atomic emission spectroscopy.
Dr. G. Padmanabhan and Melanie Bengtson

A Hydrologic Model for Assessing the Influence of Wetlands on Flood Hydrographs in the Red River Basin

This research involves the development and application of a hydrologic model for investigating the integrated effect of wetlands on flooding over a watershed scale. The Maple River watershed was modeled. Various categories and surface areas of wetlands were identified in each subwatershed. Storage volumes were estimated for the drained wetlands in each subwatershed based on the surface areas of the wetlands. The estimated storage provided by restoring these drained wetlands was modeled using diversions in the HEC-1 model. As flow arrived at the outlet of each subwatershed, a percentage was diverted from the outflow, representing the runoff that might be stored within wetlands. The results indicated that restoring all drained wetlands (representing about 0.24% of surface area in the Maple River watershed) would lower the flood stage for the 100 year flood event by less than 0.4% even when the wetlands are modeled as empty before the flood event begins. Increasing the percent of restored wetlands to 1% by watershed area (4 times the present area) reduced the 100-year flood stage by only 0.9%. Therefore it does not appear that the volume of storage gained by restoring the drained wetlands in the Maple River watershed would significantly affect the peak flood stage for a rare flood event such as the flood of 1997.

Dr. Wei Lin (Civil Engineering), Dr. Jimmie Richardson (Soil Science), Dr. Malcolm Butler (Zoology), and Dr. G. Padmanabhan (Civil Engineering)

Phosphorus Transport through a Wetland Ecosystem

Graduate Student: Kishora Panda

The research project intends to investigate phosphorus as the health indicator in three selected restored wetlands in Minnesota. The objectives of the study include studying the seasonal water quality changes, phosphorus forms and concentrations in wetland water, plants and sediments, phosphorus mass balance, and the potential effects of wetland fish on phosphorus dynamics. The tasks will include analyzing existing data, field sampling of water, plants, and fish, and water quality modeling. The experimental strategy for the study is to monitor surface and groundwater inflow and outflow of the wetlands, to sample water, plants, sediments and fish in the wetlands and test for different forms and concentrations of phosphorus, and to develop a water quality model to analyze future scenarios. The sampling and testing will help study the phosphorus dynamics in the wetlands. A non-point source pollution model will be developed to track the nutrient transport through the wetlands. The results of this study will provide a better understanding of the phosphorus transport and deposition in the wetlands. It will also help learn the potential effects of transitory fish population on wetland water quality.

Dr. Kalpana Katti

Molecular Control of Interfaces in Polymer-Hydroxyapatite composite for Bone Replacement

Students: Praveen Gujjula (Graduate student), Timothy Arens (undergraduate researcher), Arunkumar Ayyarsamy (graduate student)

The molecular control of crystallization of inorganic phases by organic has shown great promise for fabrication of new composites for several applications. Synthetic hydroxyapatite (HAP) has the identical chemical and crystallographic structure as the apatite of living bone but possesses poor strength and is also susceptible to fatigue failure. Yet, it represents a good material system for bone replacement due to excellent bone bonding properties. In the quest for new materials for bone re
placement, it is of interest to form composites with mechanical properties similar to that of bone to avoid problems such as
stress shielding of surrounding bone that are associated with the current coated metallic implants. The focus of this project is
to investigate means of controlling mechanical properties in in-situ HAP-polymer composites for their potential use as bone
replacement. A molecular control of the inorganic-organic interfaces will be attempted. The specific objectives are 1) to de-
velop a fundamental understanding of molecular level interactions of organic and inorganic phases in polymer-hydroxyapatite
in-situ composites. The specific role of ionic polymer chains on micro-crystalline aggregate formation and nucleation and
growth of HAP will be investigated and 2) correlate molecular parameters (such as vibrational band intensity changes and
shifts) to macroscopic mechanical behavior such as tensile and compressive strengths. This project is funded by the National
Science Foundation and the National Institutes of Health.

Dr. Kalpana Katti, Dr. Frank Yazdani, and Dr. Dinesh Katti

Cost Effective Nonflammable Pipe Liners

Graduate Student: Arunkumar Ayyarsamy

Polyethylene liners are currently used to line drainage conduits under roads. These liners melt and are destroyed when ex-
posed to fire. This imposes extensive repair costs. A nonflammable liner material needs to be identified which satisfies the
flow, strength and UV resistance requirements. A thorough literature search for material specifications will be conducted to
identify a nonflammable material/coating system. For potential coating materials, appropriate application method will be
identified. A solution strategy will be recommended. This project is funded by the North Dakota Department of Transportation.

Dr. Dinesh Katti and Dr. Kalpana Katti

Evaluation and Modeling of Interlayer Forces in Montmorillonite For Development of a Particu-
late Based Model for Swelling Clays

Graduate Students: Mohamed Matar, Vijayakumar Shanmugasundaram, and Steven Schmidt

The understanding, modeling and prediction of interaction of clays with water and other environmental fluids is an important
issue in the field of geotechnical engineering, geoenvironmental engineering as well as industrial applications such as com-
posite materials, muds for oil well drilling and water treatment. The swelling response of saturated montmorillonite and the
corresponding development of swelling pressure when swelling is restrained is the result of fairly complex interactions a)
within the interlayers of the clay particle and b) the interactions between the particles. The recent advances in experimental,
analytical and computational mechanics areas will allow the researchers to model and simulate these complex interactions
and allow for prediction of the swelling response using Discrete Element Method (DEM). The PIs plan to consider both the
interlayer and interparticle interactions. The interlayer interactions will include silica-water interactions including hydrogen
bonding at silica-water interface and the hydrogen bonding between water molecules in the interlayers. The focus of this work
is to understand and model the significant interlayer forces in montmorillonite clay during hydration and swelling to provide a
foundation for the development of particulate-based models for swelling clays. A combination of analytical characterization
techniques (fourier transform infrared spectroscopy (FTIR), X-ray diffraction and scanning electron microscopy (SEM)) and
analytical description of forces from classical physics will be used for implementation into DEM. This project is funded by the
National Science Foundation.

Dr. Kalpana Katti and Dr. Dinesh Katti
Simulation Based Materials Design of Biomimetic Nanocomposites

Graduate Students: Mohamed Matar and Jingpeng Tang

A shift from a test-based to simulation-based methodology is desired for new nanostructured engineered systems. Also, for complex nanocomposite systems, the modeling methodology must cover length scale from molecular (nanometer) to meso and macroscale. Specifically, the research attempts to model and simulate mechanical responses of nacre (inner layer of seashell), a biomimetic layered nanocomposite of an organic (polymer - protein) and an inorganic (ceramic - calcium carbonate) components. Nacre which is predominantly calcium carbonate has fracture toughness and other mechanical properties several orders of magnitude superior to those of aragonite. In order to facilitate simulations-based materials design it is necessary to quantitatively describe what nuances of the nanoarchitecture of nacre (such as nanoscale roughness of organic-inorganic interfaces, presence of mineral contacts in organic layer etc) contribute to the mechanical response. Our multiscale modeling and simulation approach will address these issues quantitatively. For the first time, a robust multiscale modeling scheme in a truly hierarchically structured nanocomposite system will be developed. This will result in potential criteria for practical, simulation-based materials design of scalable and complex (hybrid) composites containing both a soft and a hard component using the concepts of both biomimetics and nanotechnology. Funding for this project is provided by the National Science Foundation.

Dr. Dinesh Katti and Dr. Frank Yazdani

Modeling Rate-Dependent Response of Clays

Graduate Student: Jingpeng Tang

The precise prediction of ground or structural response to rapid loading caused by detonation, shock, severe earthquake or other dynamic loading is critical for adequate design of structures and sensitive equipment used in industrial, defense and the nation’s civil infrastructure. Although, significant progress is made in the area of modeling and simulation, the constitutive models for soils used are generally inadequate in being able to take into account the strain rate effect on the response. The use of such deficient material models in modeling and simulation results in incorrect response of structures and sensitive equipment to dynamic loading. Some of the major areas where such prediction is important includes, structures and equipment used for national defense, structures exposed to bomb threats, highway guard rails, highway bridge piers exposed to vehicle impact, bridge and marine installations exposed to ship impact, airport runways, earthquake resistant structures, machine foundations etc. The research involves 1) quantitatively understanding the clay response to loading rate, 2) developing constitutive models to accurately predict the response and 3) implement the material model into finite element analysis. This project is funded by the ND EPSCOR.

Dr. Frank Yazdani and Dr. Dinesh Katti

Concrete Mix Design for Dowel Bar Retrofit

Graduate Student: Marwa Salaheldin

The North Dakota Department of Transportation (NDDOT) has been experimenting with dowel bar retrofits for rehabilitation of certain concrete pavement highways. Several commercially available patch mix materials have been used in the studies. These materials have shown to have some problems as far as durability, undesirable shrinkage characteristics and high cost. The objective of this study is to determine if a low cost, high performance patch mix can be developed using locally available materials. This project is funded by the NDDOT.

Drs. Ken Kellogg, Uday Vaidya (PI), Mohammad Mahinfalah, and Alan Kallmeyer
Sandwich Composite Materials Research

This is a two-year National Science Foundation grant under an NSF-EPSCoR consortium effort between NDSU, the University of Puerto Rico, Mayaguez, and Auburn University. The inter-institutional team will investigate advanced sandwich composite materials that have applications in the marine, aircraft, automotive and sporting goods industries. Sandwich composite materials are considered to have significant advantages over traditional materials such as steel and aluminum due to their lightweight characteristics and ability to tailor properties for strength and stiffness. Some of the research issues of the work include cost-effective processing, noise and vibration damping studies and energy absorption mechanics.

Dr. Ken Kellogg and Dr. Alan Kallmeyer

Composite Material Characterization Under Extreme Environmental Conditions

This 3-year grant from the Army Research Office focuses on durability issues of high strength graphite-fiber composites when subjected to moisture and low temperature thermal fatigue. Research is underway on pultruded glass-reinforced composites and on fiber/epoxy composites.

Dr. Ossama Salem (Construction Engineering and Management)

Construction Research

Graduate Students: Adham Shahin, Mohammed Haque, and Mohammed Hegab

Research by graduate students with emphasis in construction management and engineering includes the following: developing optimization models using Integer Programming and Genetic Algorithm techniques to reduce the rebar cutting wastes, a prototype software to plan cutting patterns for rebars, a decision support system using an internet interface and a knowledge-base system to help managers in their equipment fleet management and replacement decisions, and a statistical model to help contractors determine the productivity of various microtunneling machines in different project environments involving trenchless technology.

Reader Response
| Name: ____________________________ | ____________________________ |
| Address: __________________________ | ____________________________ |
| City: ____________________________ State: ______ | ____________________________ |
| Zip: ___________ Graduation Year:_____ | ____________________________ |
| Employer: __________________________ | ____________________________ |
| Location: __________________________ | ____________________________ |

### Alumni News

Please use the space below to let us know what you have been doing since you left NDSU.

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Return to: Civil Engineering Department (701) 231-7244
North Dakota State University (701) 231-6185 FAX
Fargo, ND  58105 http://hardhat.cme.ndsu.nodak.edu/

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Dr. La Palm receiving a memento from Dr. Don Andersen presented by the faculty and staff of the CE department at his retirement dinner.

ND Science and Engineering fair students visiting with ASCE student chapter members working on the concrete canoe.

Floating the concrete canoe.
NDSU Civil Engineering students posing in front of the steel bridge they designed and fabricated for the steel bridge competition