

Annual Report 2011

# Civil Engineering

COLLEGE OF ENGINEERING





# Contents

Message from the department head .....	1
Faculty .....	2
Features .....	5
Arsenic mobilization in deltaic groundwater .....	5
Biofuels co-product helps stabilize unpaved roads .....	6
Geocell-reinforced base layers for asphalt pavements .....	7
Reinforcing concrete crossties for higher speed rail tracks .....	8
Run-off-road crashes in Kansas and mitigation strategies .....	9
Unique modeling interface helps communicate complex water issues .....	10
Publications .....	11
Programs .....	15
Urban Water Institute .....	15
Civil Infrastructure System Laboratory .....	16
University Transportation Center .....	17
Mid-America Transportation Center .....	18
Projects .....	19
Grants .....	23
Professional leadership .....	26
Graduate program .....	30
Undergraduate program .....	31
Advisory council .....	32
Contact information .....	33

## MESSAGE FROM THE DEPARTMENT HEAD

Civil infrastructure is the glue that holds our communities and ultimately our nation together. From the National Road between Cumberland, W.Va., and Vandalia, Mo., completed in 1839, to the newest stretch of the Eisenhower Interstate System, our highways help connect towns and cities across the country. And within and between these communities, streets, bridges, buildings, levees, reservoirs and water systems create the critical infrastructural framework for society to function.



At K-State civil engineering we are delighted to educate tomorrow's civil engineers and develop research-based innovative solutions to meet current and future infrastructure challenges. Our students, faculty, staff, advisory council and alumni work together to realize our vision of excellence in teaching, research and service activities associated with a nationally recognized civil engineering program.

It is a pleasure to present to you the 2011 annual report of the department of civil engineering at Kansas State University. In its 104th year since establishment in 1907, the civil engineering department enrolled 269 undergraduate and 73 graduate students, and awarded 43 B.S. and 26 M.S. degrees in 2011. Forty-two undergraduate students received university or college scholarships worth more than \$111,000 and 93% of students sitting in the Fundamentals of Engineering examination in fall 2011 passed the test; the national average was 77%. CE hosted the 2011 ASCE Regional Student Conference and Competition in Manhattan with student participants from 12 universities. The KSU steel bridge team ranked number one in the regionals and qualified for its seventh consecutive appearance at nationals. The concrete canoe team came second in the regional competition. Senior Rachel Spicer received the 2011 Student Leadership

Award, a national recognition from ASCE for her multiple leadership roles with the ASCE student chapter.

The CE faculty includes 15 full-time professors and two instructors. As you will read in this report, all faculty members are active in research, most are licensed professionals, several serve on journal editorial boards, six are fellows of ASCE and four hold endowed professorships. In 2011, the department faculty had active projects worth more than \$11.3 million and annual expenditures exceeding \$2.5 million. CE faculty members have cumulatively authored more than 450 journal articles and, in 2011, they taught

more than 6,600 student credit hours of undergraduate and graduate courses.

In this annual report, you will find feature articles from each of the five areas represented by the CE faculty – environmental, geotechnical, structural, transportation and water resources engineering. Also included is information about activities related to the Civil Infrastructure Systems Laboratory, University Transportation Center, Mid-America Transportation Center, and CE undergraduate and graduate programs.

I invite you to read the entire report and visit our website at [www.ce.ksu.edu](http://www.ce.ksu.edu) to learn more about our department and programs.

*Alok Bhandari*

Alok Bhandari, Ph.D., P.E., FASCE  
 Department Head  
 Dr. Robert Snell Civil Engineering Alumni Professor  
 Director, Urban Water Institute

# FACULTY



**Alok Bhandari, P.E., F.ASCE**

••••• Ph.D., Virginia Tech, 1995  
 M.S., Virginia Tech, 1992  
 B.S., Jawaharlal Nehru Technological University, India, 1990  
*Research:* Environmental fate of pollutants in natural and engineered water systems; improved, cost-effective and sustainable methods of treating drinking water; wastewater, storm water and contaminated groundwater  
*Teaching:* Introduction to civil engineering, environmental engineering fundamentals, wastewater engineering – biological processes



**Sunanda Dissanayake, P.E.**

••••• Ph.D., University of South Florida, 1999  
 M.S., Asian Institute of Technology, 1993  
 B.S., University of Moratuwa, Sri Lanka, 1990  
*Research:* Traffic engineering, traffic control systems, modeling and simulation of transportation systems to improve safety in urban and rural highways  
*Teaching:* Route location and design, travel-demand modeling, transportation safety



**Asad Esmaily, P.E.**

••••• Ph.D., University of Southern California, 2001  
 M.S., University of Southern California, 1998  
 B.S., Tehran University, Iran, 1987  
*Research:* Smart bridge systems, feature-based structural damage detection, analytical performance of confined concrete models  
*Teaching:* Structural engineering in concrete, advanced reinforced concrete theory, structural dynamics



**Susan Gerth, P.E.**

••••• M.S., Kansas State University, 1982  
 B.S., University of Wisconsin-Platteville, 1978  
*Teaching:* Strength of materials, statics and dynamics



**Mustaque Hossain, P.E., F.ASCE**

••••• Ph.D., Arizona State University, 1990  
 M.S., Bangladesh University of Engineering and Technology, Bangladesh, 1986  
 B.S., Bangladesh University of Engineering and Technology, Bangladesh, 1983  
*Research:* Highway materials, pavement design, pavement performance evaluation, non-destructive testing of pavements  
*Teaching:* Engineering assembly, civil engineering materials, pavement design, sustainable transportation asset management



**Alexander P. Mathews, P.E.**

••••• Ph.D., University of Michigan, 1975  
 M.S., University of Rhode Island, 1968  
 B.S., University of Madras, India, 1966  
*Research:* Physicochemical processes including adsorption, ozonation and filtration for the treatment of water, wastewater, sludges and hazardous waste; biological waste treatment; fermentation by-products from wastes and renewable resources  
*Teaching:* Environmental engineering fundamentals, water and wastewater engineering, water treatment processes, environmental chemistry



**Ryan McGrath, P.E.**

••••• M.S., University of Colorado-Boulder, 2000  
 B.S., University of Hawaii, 1995  
*Teaching:* Elementary surveying, soil and foundation construction, advance surveying and civil design, water resources engineering



**Hani G. Melhem, P.E., F.ASCE**

••••• Ph.D., University of Pittsburg, 1989  
 M.S., University of Pittsburg, 1987  
 B.S., Cairo University, Egypt, 1981  
*Research:* Artificial intelligence and information systems, computer-controlled testing, experimental analysis, fatigue and fracture of structures, finite-element and numerical modeling of structures  
*Teaching:* Statics, structural engineering in steel, civil engineering project, advanced mechanics of materials and applied elasticity



**Natalie Mladenov**

••••• Ph.D., University of Colorado-Boulder, 2004  
 M.S., University of Colorado-Boulder, 1999  
 B.S., University of South Florida, 1995  
*Research:* Surface and groundwater quality, natural organic matter reactivity and metal interactions, fluorescence and UV-absorbance spectroscopy, organic aerosols



**Yacoub Najjar, P.E.**

••••• Ph.D., University of Oklahoma, 1990  
 M.S., University of Oklahoma, 1986  
 B.S., Yarmouk University, Jordan, 1983  
*Research:* Application of artificial neural networks and computational mechanics to civil infrastructure, interaction of soil and civil structures, geomechanics, geosynthetics and geoenvironmental systems  
*Teaching:* Foundation engineering, design with geosynthetics, neural networks in civil engineering



**Dunja Peric**

••••• Ph.D., University of Colorado-Boulder, 1990  
 M.S., University of Colorado-Boulder, 1988  
 B.S., University of Zagreb, Croatia, 1981  
*Research:* Experimental and computational modeling of localized deformation, failure and instabilities of geomaterials, development of sustainable reinforcement systems for civil infrastructure materials  
*Teaching:* Soil mechanics, ABAQUS applications in geosystems



**Robert J. Peterman, P.E.**

••••• Ph.D., Purdue University, 1996  
 M.S., Purdue University, 1989  
 B.S., Lafayette College, 1987  
*Research:* Behavior of prestressed concrete structures, experimental testing of concrete materials, durability of bridge decks and time-dependent deformation in structures  
*Teaching:* Mechanics of materials, prestressed concrete design



## FACULTY



### Hayder A. Rasheed, P.E., F.ASCE

••••• Ph.D., University of Texas-Austin, 1996  
M.S., University of Baghdad, Iraq, 1990  
B.S., University of Baghdad, Iraq, 1987

*Research:* Structural engineering and computational mechanics with emphasis on stability and nonlinear analysis of fiber-reinforced composites, reinforced/pre-stressed concrete structures and materials

*Teaching:* Introduction to structural analysis, advanced structural analysis-1, advanced structural analysis-2



### Kyle A. Riding, P.E.

••••• Ph.D., University of Texas-Austin, 2007  
M.S., University of Texas-Austin, 2004  
B.S., Brigham Young University, 2002

*Research:* Engineering assembly, durability of concrete structures and pavements, early age concrete structural behavior, concrete microstructure characterization and modeling, novel cementitious systems

*Teaching:* Statics, civil engineering materials



### Steven K. Starrett, P.E., D.WRE, F.ASCE

••••• Ph.D., Iowa State University, 1994  
M.S., Iowa State University, 1992  
B.S., University of Missouri-Rolla, 1989

*Research:* Surface water hydrology, urban non-point source pollution, artificial neural networks, application of geographical information systems (GIS) to water resources engineering, engineering ethics

*Teaching:* Introduction to civil engineering, water resources engineering, hydraulics of open channels, advanced hydrology, codes and professionalism in engineering, leadership and diversity in engineering



### David R. Steward, P.G.

••••• Ph.D., University of Minnesota, 1996  
M.S., University of Minnesota, 1991  
B.S., University of Minnesota, 1983

*Research:* Surface water hydrology, integrated modeling approaches to understand the response of natural/social systems to human/climate-induced changes in groundwater use and availability, mathematics and computer modeling of groundwater flow, application of GIS geospatial technology to water resources

*Teaching:* Hydraulic engineering; design of groundwater flow systems; numerical and analytical techniques for engineers, water and society



### Robert W. Stokes, F.ITE, F.ASCE

••••• Ph.D., Texas A&M University, 1984  
M.S., Ohio State University, 1977  
B.S., Antioch University, 1976

*Research:* Urban, rural and intercity transportation planning; highway design, planning and operations; traffic engineering; design and operation of turning lanes; traffic safety; transit planning, design and operations

*Teaching:* Highway engineering, planning and management, economics of design and construction, land development for civil engineers and planners

## FEATURE

# Arsenic mobilization in deltaic groundwater

Many of the world's river deltas contain high concentrations of naturally occurring arsenic. Assistant Professor Natalie Mladenov's research is probing the mechanisms by which arsenic, a toxic oxyanion, is mobilized in deltaic groundwater, specifically in the Ganges-Brahmaputra Delta of Bangladesh. Reliance on groundwater as a safe drinking water source in Bangladesh and India escalated at the end of the 20th century because surface waters were heavily polluted and groundwater was believed to be clean and safe. Later, arsenic was discovered in the groundwater. Today, tens of millions of people in the Ganges-Brahmaputra Delta of Bangladesh and deltaic regions of other Southeast Asian countries drink groundwater with dissolved arsenic (As) concentrations far above the World Health Organization guideline value of 10 µg L<sup>-1</sup>.

Mechanisms by which arsenic is brought into solution from arsenic-bearing sediments eluded investigators for a long time. Within the last decade, the scientific community has come to a consensus that the main mechanism responsible for arsenic mobilization in Southeast Asia is the dissolution of iron- and arsenic-bearing minerals by bacteria who use dissolved organic matter (DOM) as an energy source under anoxic conditions. This new knowledge has led to a keen interest in the sources of DOM and the additional roles DOM may play in arsenic mobilization.

Mladenov and her colleagues have helped pin down the major sources of DOM in an area of Bangladesh with extremely elevated arsenic concentrations. Their research thus far has provided new evidence that high amounts of aromatic organic compounds originating from buried organic material tend to be present where dissolved arsenic concentrations are elevated. The research team also found the lowest arsenic concentrations in village wells that had sewage pollution-derived DOM signatures, which suggests that surface water DOM is unlikely to fuel the arsenic mobilization process at large scales. Mladenov investigated other roles of DOM on arsenic mobilization and found that humic substances, a major class of aquatic DOM, may be acting as electron shuttles to accelerate reductive dissolution of iron oxides and may also be involved in metal complexation or competitive sorption reactions. In addition to providing strong evidence that humic substances have an important role in arsenic mobilization and potentially its maintenance in solution, these findings have important implications for the treatment of arsenic-contaminated water. Mladenov is now starting to examine how the chemical character of DOM influences arsenic removal and whether the presence of more aromatic DOM may impede treatment efforts or produce unintended disinfection by-products.

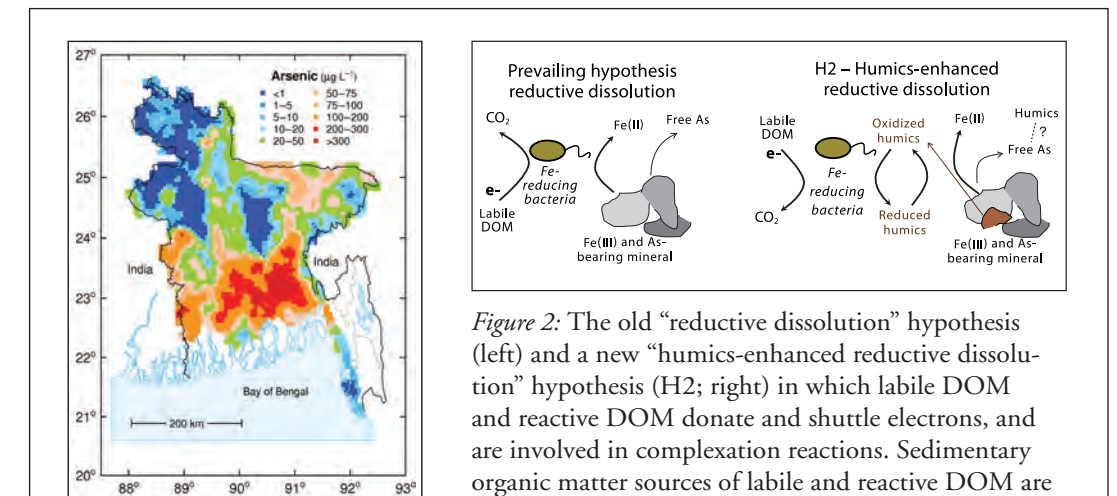


Figure 1: Distribution of dissolved arsenic in groundwater of Bangladesh (BGS and DPHE, 2001). Colors correspond to concentrations shown in the legend.

BGS and DPHE. 2001. *Arsenic contamination of groundwater in Bangladesh*. Kinniburgh, D G and Smedley, P L (Editors). British Geological Survey Technical Report WC/00/19. British Geological Survey: Keyworth.

## Biofuels co-product helps stabilize unpaved roads

Although unpaved roads often serve as the only transportation lifelines for a myriad of rural communities in the U.S. and throughout the world, they remain plagued by various failures. Perhaps the most peculiar form of failure caused by traversing vehicles is wash-boarding, characterized by the appearance of ripples. Additional manifestations of failures include raveling, rutting and potholing. Furthermore, fine particles are often uplifted, thus creating dust, and traffic and health hazards. From the point of view of soil mechanics, unpaved roads are in a state of perpetual failure caused by the lack of effective particle bonding mechanisms on the surface. This results in frequent maintenance operations, which are disruptive to traffic and costly. For example, Kansas alone has 98,000 miles of gravel roads that require regular maintenance.

Associate Professor Dunja Perić is investigating use of calcium lignosulfonate (CaL) for stabilization of unpaved roads resulting from the binding properties of CaL-water mixes. CaL is a light brown powder derived from lignin. The latter is found in the cell walls of most plants where it forms a bio-composite together with cellulose and hemicellulose, thus providing mechanical strength to the plants. CaL is a co-product of the growing biofuel industry as well as paper manufacturing. Cellulosic ethanol plants such as the one being built in Hugoton, Kansas,

separate cellulose and hemicellulose from lignin-producing CaL. Use of soil, the most abundant material on Earth, and lignin, the second most abundant terrestrial organic polymer, to build rural transportation lifelines appears to be a very sustainable concept.

Graduate students Paul Bartley and Wilson Smith have conducted multiple series of laboratory compaction and strength tests to develop a fundamental understanding of the strength characterization of sand-CaL-water mixes. Bartley has assessed the early-age strengths of these mixes that has enabled identification of sample configurations that yield maximum-strength benefits. Smith is evaluating rapid strength gains of sand-CaL-water mixes induced by air-drying. Smith presented a research poster at the State Capitol Graduate Research Summit, held in Topeka, Kansas, in February 2012. He was selected as one of two students to present their research posters at the 2012 Kansas Bio held at Overland Park, Kansas, in May 2012.

Perić's research on stabilization of unpaved rural roads was recently discussed in an article in *Prism* magazine of the American Society of Engineering Education. This research was supported by the Kansas State University Transportation Center; Borregaard LignoTech, Rothschild, Wisconsin; and Midwest Concrete Materials, Manhattan, Kansas.



## Geocell-reinforced base layers for asphalt pavements

A novel strategy is being evaluated for rehabilitation of low-volume paved roads that would have lower life-cycle costs than existing full-depth reclamation or cold-in-place recycling methods. Professor Mustaque Hossain is using the Civil Infrastructure Systems Laboratory's accelerated pavement testing (APT) system to evaluate asphalt pavements with geocell-reinforced bases. This project is jointly sponsored by the state transportation departments of Iowa, Kansas, Missouri and New York.

Geocellular confinement systems or geocells are three-dimensional honeycomb-like structures filled with in-fill materials to improve the shear strength of pavement base layers. The geocells are made of strips of polymeric materials connected at staggered points so that, when the strips are pulled apart, a large hollow, honey-combed mat is formed. The geocell-reinforced bases consist of three different in-fill materials capped with a 50-mm Superpave mixture layer.

Four lanes of pavement test sections were constructed in the K-State Civil Infrastructure Systems Laboratory. Three out of these four lanes had 50-mm geocell-reinforced bases and 25-mm cover of three different in-fill materials – crushed limestone, quarry by-products and recycled asphalt pavement. The fourth test lane was the control section consisting of a 300-mm crushed-stone base. The sections were paved with a 50-mm Superpave hot-mix asphalt (HMA) layer. The geocells used in this study were NE-OLOY™ polymeric alloy (nano-composite alloy of polyester/polyamide nano fibers, dispersed in polyethylene matrix) geocell manufactured by PRS-Mediterranean of Israel. This polymeric alloy has a similar flexibility at low temperatures as high-density polyethylene (HDPE), along with an elastic behavior similar to engineering thermoplastics.

All test sections are instrumented to measure the strains at the bottom of the HMA layer and stresses on top of the subgrade. Type T thermocouples are placed below the HMA layer to monitor HMA temperature during testing. The NPA geocells are instrumented with five embedded Vishay strain gages per lane. The HMA strain gages are H-Bar strain gages fabricated using Texas Measurements gages glued with epoxy to two pieces of aluminum.

The test sections were loaded to 50,000 to 70,000 repetitions of an 80-kN single-axle load of the APT system with a failure rut depth of 12.5 mm. All sections, except the control section, had this rut depth by 10,000 repetitions. Calculated and measured responses revealed that stresses on top of the subgrade exceeded the unconfined compressive strength of the soil on three test sections. Test sections were redesigned and reconstructed with the redesigned sections consisting of 75-mm geocell-reinforced bases, 50-mm cover and an HMA layer of 100 mm. The same infill materials were used in the test sections. The control lane had a depth of 200 mm. All sections successfully carried 1,000,000 repetitions of the 80-kN single-axle loads without rut depths exceeding 10 mm. Hossain is using the test results and 3-D finite-element modeling to develop a mechanistic-empirical design methodology for low-volume paved roads with geocell-reinforced bases.



FEATURE

# Reinforcing concrete crossties for higher speed rail tracks

Prestressed concrete railroad ties are a critical component of higher speed railway lines as they reduce the amount of deflection in the track. In order for these prestressed concrete ties to function adequately over their expected service life, the prestressing force must be fully introduced into the railroad tie at a location well before the rail load is applied. The length required to transfer the prestress force into the concrete member is referred to as the “transfer length.”

Professor Robert Peterman, along with colleagues from mechanical engineering (Terry Beck) and industrial engineering (John Wu), is conducting research that will generate a quantitative understanding of the interaction between the concrete mixes and prestressing steel reinforcements used in the fabrication of prestressed concrete crossties. The information gained from this two-and-one-half year, \$1.35 million research project funded by the Federal Rail Administration will generate information that will be valuable to the concrete crosstie industry and guide the proper design of crossties for life-long service on

higher speed railway tracks.

Since the prestressed concrete ties are relatively short, and have extremely large impact loads applied near the member ends, most prestressed concrete railroad tie producers utilize indented prestressing wires or strands. It is generally understood that these indentations serve to improve the bond between steel and concrete and therefore reduce the transfer length. However, because the application of these indented reinforcing steels has been so limited, current design codes in the United States do not yet address the transfer length of indented prestressing steels.

Graduate students Matt Arnold, Naga Bodapati and Joey Holste, along with a team of undergraduate students, are conducting laboratory work aimed at determining the performance of different indented reinforcement and concrete combinations. The research team will travel to the CXT Concrete Tie Plant in Tucson, Ariz., early next year for the plant phase of this investigation. This study is co-sponsored by the K-State University Transportation Center.



FEATURE

# Run-off-road crashes in Kansas and mitigation strategies

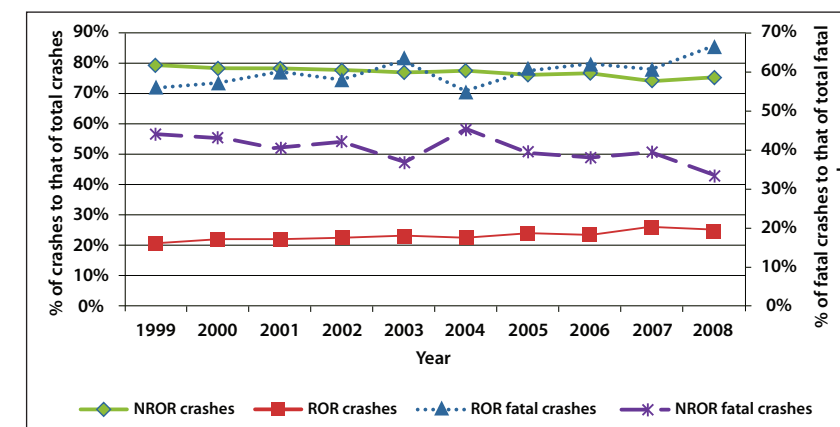
Motor vehicle crashes are among the leading causes of death in adults in the United States. Even though motor vehicle fatalities are at record low levels, on an average day in 2011, more than 90 people died on U.S. roadways. Analysis of national-level crash data reveals that about one-third of traffic fatalities are run-off-road (ROR) crashes. Statistics about fatalities in Kansas due to ROR crashes are even worse than national statistics, whereby the percentage of fatal ROR crashes has been about 66% of all fatal crashes. In fact, the percentage of ROR crashes reveals an upward trend among both fatal and all crashes in Kansas.

Associate Professor Sunanda Dissanayake is investigating crash data from the state of Kansas to identify the characteristics of ROR, contributory causes leading to such crashes and factors related to increased severity of ROR crashes, with the intention of recommending mitigation strategies

and countermeasure ideas. The study is funded by the K-State University Transportation Center.

Initial investigation of the ROR crashes and their comparison with non-run-off-road (NROR) crashes has yielded several interesting facts. Among such findings are the following characteristics:

- More ROR crashes occur under bad weather conditions as compared to NROR crashes.
- ROR crashes are more common on interstate roads, irrespective of whether they are in rural or urban areas.
- ROR crashes tend to be more severe in nature, leading to fatal and incapacitating injuries.
- ROR crashes are more common during the nighttime, with midnight to 3 a.m. being the three-hour time period with the biggest difference between ROR and NROR crashes.
- More ROR crashes occur during the weekends as compared to NROR crashes.
- A majority of ROR crashes involve single vehicles.



ROR crashes as a percentage of fatal and all crashes



A ROR crash where the vehicle has hit a tree

# Unique modeling interface helps communicate complex water issues

Scarcity of water resources poses risks to the economic, social and environmental well being of communities, regions, nations and ultimately the world. In the western Kansas region, the Ogallala Aquifer provides the primary source of water for agriculture and municipalities. However, groundwater declines threaten both short- and long-term viability of the water resource, the economy and the regional population. It is of national interest to identify and evaluate economically viable, socially acceptable and environmentally conscious water management strategies to sustain this important region, as well as other world water and agricultural resources.

Successfully dealing with water resources challenges at a land-grant university requires a three-legged stool of research, education and community engagement. Planning for future water needs also requires understanding the entirety of the water resource system. Overdrafts of groundwater result in declining groundwater stores, which in turn impact stream flow, riparian corridors and wetland habitat.

Professor David Steward is leading a cross-disciplinary team of researchers working on innovative tools and approaches to better understand and manage the relationships between water resources, societal needs, and how water is utilized in nature and agricultural production. Steward is applying his skills in mathematical and computer modeling to understand groundwater flow and transport, application of geographic information science (GIScience) to water resources, and integrated modeling approaches to describe the responses of natural and social systems to human and climate-induced changes in groundwater use and availability.

Water resource systems are spatial in nature, which allows storage, analysis, and modeling of the natural and social systems comprising a water resource system in a geographic information system (GIS), as well as thematic mapping, remote sensing, and telemetry data and methods. The research team is utilizing a modeling strategy developed within the European Union's Water Framework Directive called OpenMI (modeling interface). This tool is key to interdisciplinary studies as it provides standardized approaches to using the output from one modeling tool as an input for another tool. For example, an economic

model can predict crop choices based upon markets and policy, which impacts the water required for irrigation, which in turn limits future groundwater in storage. The research team is working to make people understand how precipitation models affect water table models, how water table models affect plant models and how plant models affect production models which, in turn, impact economics and communities.

Ultimately, society must wrestle with Benjamin Franklin's observation, "When the well's dry, we know the worth of water." Civil engineering researchers are providing the scientific and engineering knowledge critical to making informed decisions related to groundwater resources in western Kansas and similar regions.



## Books, Monographs and Book Chapters

### Structural Engineering

- Nayeri Amiri, S. and **Rasheed, H. A.** Elastic/Plastic Buckling of Spherical Shells under Various Loading. LAP LAMBERT Academic Publishing, ISBN-13:978-3845439853, 2011, 212 p.
- Deogratiou, E., **Russell E.**, and Landman E.D. "Incorporating robustness analysis into urban transportation process, in network reliability in practice, transportation research, economics and policy." Chapter 7 in Network Reliability in Practice. Eds: D. M. Levinson, H. X. Liu, and M. Bell, Chapter 7, Springer Science and Business Media, New York, 2011.

### Journal Publications

#### Environmental Engineering

- Palomo, M., and **Bhandari, A.** "Peroxidase-catalyzed stabilization of 2,4-dichlorophenol in alkali-extracted soils." Journal of Environmental Quality, 40:126-133, 2011.
- Christianson, L. E., **Bhandari, A.**, and Helmers, M. J. "Pilot-scale evaluation of denitrification drainage bioreactors: Reactor geometry and field performance." Journal of Environmental Engineering, 137:1943-1951, 2011.
- **Mladenov, N.**, Sommaruga, R., Morales-Baquero, R., Camarero, L., Laurion, I., Diéguez, M. C., Camacho, A., Delgado, A., Torres, O., Chen, X., Felip, M., and Reche, I. "Dusty skies, UV radiation, and bacteria influence organic matter concentration and optical quality in alpine lakes." Nature Communications, 2:405 DOI:10.1038/ncomms1411 (open access), 2011.
- **Mladenov, N.**, Alados-Arboledas, L., Olmo, F.J., Lyamani, H., Delgado, A., and Reche, I. "Applications of optical spectroscopy and stable isotope analyses to organic aerosol source discrimination in an urban area." Atmospheric Environment, 45:1960-1969, 2011.

#### Materials Engineering

- Liu, L., **Hossain, M.**, and Miller, R. "Costs and benefits of thin surface treatments on bituminous pavements in Kansas." Transportation Research Record, 3:2150, 77-54, 2011.
- Rahman, F., **Hossain, M.**, Romanoschi, S., and Hobson, C. "Kansas experience with thin Superpave mixture overlay of small aggregate top size." Transportation Research Record, 3:2204, 3-10, 2011.
- Islam, S. and **Hossain, M.** "Chip seal with lightweight aggregates for low-volume roads." Transportation Research Record, 3:2204, 58-66, 2011.
- Slatnick, S., **Riding, K. A.**, Folliard, K. J., Juenger, M. C. G., and Schindler, A. K. "Evaluation of autogenous deformation of concrete at early ages." ACI Materials Journal, 108, 21-28, 2011.
- **Riding, K. A.**, Poole, J. L., Folliard, K. J., Juenger, M. C. G., and Schindler, A. K. "A new model for estimating the apparent activation energy of cementitious systems." ACI Materials Journal, 108: 550-557, 2011.

#### Structural Engineering

- Bahrani, M. K., Vasseghi, A., **Esmacily, A.**, and Soltani, M. "Experimental study on seismic behavior of conventional concrete bridge bents." Journal of Seismology and Earthquake Engineering, 12, 107-118, 2011.
- Qiao, L. and **Esmacily, A.** "An overview of signal-based damage detection methods." Journal of Applied Mechanics and Materials, Vols. 94-96, 834-851, 2011.
- Abd El-Fattah, A., **Rasheed, H. A.**, and **Esmacily, A.** "A new eccentricity-based simulation to generate ultimate confined interaction diagrams for circular concrete columns." Journal of the Franklin Institute – Engineering and Applied Mathematics, 348, 1163–1176, 2011.

- Saqan, E. and **Rasheed H. A.** "Simplified nonlinear analysis to compute neutral axis depth in prestressed concrete rectangular beams." *Journal of the Franklin Institute-Engineering and Applied Mathematics*, 348, 1588-1604, 2011.
- **Rasheed, H. A.**, Nassajy, M., Al-Subaie, S., Abrishamchian, S. M., and Al-Tamimi, A. "Suppressing delamination failure mode in concrete beams strengthened with short CFRP laminates." *Mechanics of Advanced Materials and Structures*, 18, 194-200, 2011.
- Hawileh, R. A., Naser, M., and **Rasheed, H. A.** "3D finite-element transient thermal-stress analysis of FRP-strengthened concrete beam exposed to top-fire loading." *Mechanics of Advanced Materials and Structures*, 18, 172-180, 2011.
- Tamimi, A. K., Hawileh, R., Abdalla, J., and **Rasheed, H. A.** "Effects of ratio of CFRP plate length to shear span and end anchorage on flexural behavior of SCC R/C beams." *ASCE Journal of Composites in Construction*, 15, 908-919, 2011.

**Transportation Engineering**

- Roy, U. and **Dissanayake, D.** "Comparison of factors associated with run-off-road and non-run-off-road crashes in Kansas." *Journal of the Transportation Research Forum*, 50, 2011.
- **Dissanayake, D.** and Perera, R. "A survey-based study of factors related to older-driver highway safety." *Journal of Transportation Safety & Security*, 3:77-94, 2011.
- **Dissanayake, S.** and Liu, L. "Evaluation of criteria for setting speed limits on gravel roads." *Journal of Transportation Engineering*, 137, DOI:10.1061/(ASCE)TE, 2011.
- Karkle, D.E., M.J. Rys, and **Russell, E.R.** "Centerline rumble strips: A study of external noise." *Journal of Transportation Engineering*, 137:311, 2011.
- Karkle, D., Rys, M.J., and **Russell, E.** "State-of-the-art: Centerline rumble strips usage in the United States." *Journal of Transportation Research Forum*, 50:1, 2011.

**Water Resources Engineering**

- **Steward, D. R.**, Yang, X., Lauwo, S. Y., Staggenborg, S. A., Macpherson, G. L., and Welch, S. M. "From precipitation to groundwater base flow in a native prairie ecosystem: a regional study of the Konza LTER in the Flint Hills of Kansas, USA." *Hydrology and Earth System Sciences Discussion*, 8:4195-4228, 2011.

**Engineering Education and Professional Practice**

- **Bhandari, A.**, Ong, S. K., and Steward, B. L. "Student learning in a multidisciplinary sustainable engineering course." *Journal of Professional Issues in Engineering Education and Practice*, 137:1943-1951, 2011.

**Papers in Conference Proceedings**

**Environmental Engineering**

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## PROGRAMS



## Urban Water Institute

Establishment of the Kansas State University Urban Water Institute was recently announced with Professor Alok Bhandari, CE department head, named as founding director. The institute is physically located on the Olathe campus of K-State and interacts closely with faculty on the Manhattan campus.

Water has been identified as one of the most critical resources for the state of Kansas, the Kansas City metro area, the nation and indeed the globe. The National Academy of Engineering has identified 14 grand challenges for the 21st century. Water plays a key roll in three of these—providing access to clean water, restoring and improving urban infrastructure, and managing the nitrogen cycle. Several of the United Nation's Millennium Development Goals are directly or indirectly tied to water quantity and water quality. These include reducing child mortality rate, improving maternal health, combating malaria and other diseases, ensuring environmental sustainability and even providing active universal primary education.

The Urban Water Institute's location on the K-State Olathe campus is ideal as the Kansas City metropolitan area is home to a variety of world-renowned agencies, businesses and organizations that focus on water. The U.S. EPA Region 7 office located in Kansas City, Kan., focuses on protecting and improving water quality across America's greatest watershed, the Missouri-Mississippi Basin. Major international water-related businesses including consulting firms, equipment manufacturers

and testing service providers call the Kansas City metro area their home. By being strategically located on the Olathe campus, the Urban Water Institute will help connect the water industry in the KC region with more than 50 water experts and affiliates at Kansas State University's Manhattan campus. Assistant Professor Natalie Mladenov, Associate Professor Steve Starrett and Professor David Steward, all CE, serve among the institute's core faculty, and Steward also serves on the institute's faculty advisory committee.

The vision of the Urban Water Institute is to be a premier center of knowledge and outreach focused on sustainable water management in urban environments. Its mission is to advance and promote public policy, water management approaches and treatment technologies that support sustainable water use in urban and urbanizing communities. With its relationship with Kansas State University, the Urban Water Institute is part of the 2025 plan for the university—to be recognized as one of the nation's top 50 public research universities.

The K-State Urban Water Institute is supported by four KSU colleges—the College of Engineering, College of Arts and Sciences, College of Agriculture, and College of Architecture, Planning and Design. The institute recently launched its website: [www.k-state.edu/urbanwaterinstitute](http://www.k-state.edu/urbanwaterinstitute) and conducted its first outreach activity—a K-12 event that saw more than 100 fourth- through sixth-grade students from the Kansas City metro area participating in a lab/field experience to learn more about assessing the quality of water in urban ponds and evaluating the conditions of urban streams.



**Civil Infrastructure System Laboratory**

The Civil Infrastructure System Laboratory (CISL) is a unique facility operated by the civil engineering department at K-State. The mission of the laboratory is to test civil infrastructure elements under full-scale loading. The main indoor part of the facility is for accelerated pavement testing (APT) and for calibrating falling-weight deflectometer (FWD) tests. The outdoor part includes apparatus for load testing of full-scale



The accelerated pavement test assembly



Geocell installation



Falling-weight deflectometer tests on completed pavement test sections

bridge members, and an area for conducting concrete strength and durability tests under real environmental conditions.

The APT facility consists of a test frame in which a bogie with dual wheels can move forward and backward while a load is applied hydraulically (reacting against two main longitudinal girders). Tests can be conducted on three, 20-ft long and 16-ft wide test pits that can accommodate asphalt or concrete pavements. Lateral traffic wander can be applied in 0.5-inch increments, to a maximum wander of  $\pm 6$  inches, to simulate actual highway truck traffic distribution on the lane. Temperature of the pavement can be controlled within the range of  $-10^{\circ}\text{F}$  to  $140^{\circ}\text{F}$ .

The wheel assembly consists of a single or tandem axle with airbag suspension. The wheel assembly is an actual bogie from a standard truck. Loading of the axle is achieved by varying hydraulic pressure. At the end of the 20-ft travel, an energy absorption and release system transforms the kinetic energy of the carriage into potential energy in the springs. Compressed springs are used to launch the bogie in the opposite direction. It is also possible to achieve simulated one-way traffic using a hydraulic pump that can lift the wheels off the pavement surface after travel in one direction is completed.

In 2011, the work at CISL focused on conducting APT on Geocell-reinforced bases consisting of three different in-fill materials capped with a 50-mm Superpave mixture layer. Geocells are three-dimensional honeycomb-like structures filled with in-fill materials. The geocells used in this study are NEOLOY™ polymeric alloy manufactured by PRS-Mediterranean of Israel. The goal is to develop a rehabilitation strategy for low-volume paved roads that will be less expensive (in terms of life-cycle costs) than the existing full-depth reclamation or cold-in-place recycling methods. This research is sponsored by the state transportation departments of Iowa, Kansas, Missouri and New York.

Tests were also conducted on various geosynthetic products manufactured by Tencate Geosynthetics of the Netherlands. Three different geosynthetics for base reinforcement and with thinner asphalt layer were tested against a control section with no base reinforcement and thicker asphalt layer. The tests were able to identify the most promising geosynthetics to be used in reinforced bases with thinner asphalt layers.



**University Transportation Center**

While only about 40 percent of all vehicle miles are traveled on the four million miles of rural roadways in the United States, nearly 60 percent of the traffic accident fatalities occur on these roads. When adjusted for miles traveled, this fatality rate is nearly 2.5 times greater than that from accidents on urban roads. With longer driver response times due to a rural lifestyle, the likelihood of more severe crashes and a higher probability of rollovers, rural transportation safety is a national concern. The deteriorating rural transportation infrastructure and an aging rural population have further compounded the issues related to safety of rural transportation systems.

The need for a safer rural transportation system under resource-limited conditions requires innovative approaches that consider the sustainability of rural economics and communities; transportation resources will have to go further and do more than ever before. Rural transportation systems not only support motorists and rail traffic, but also continue to carry the majority of the nation's food supply. Thus, the safety and security of the nation's food supply is also influenced by the integrity of the rural transportation infrastructure.

Housed in the department of civil engineering, the K-State University Transportation Center (UTC) facilitates research, education and outreach associated with the sustainability and safety of rural transportation systems and infrastructure. The K-State UTC is one of 60 federally funded UTCs in the U.S. established under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users enacted in 2005. As a Tier II Center the K-State UTC receives approximately \$450,000 of federal funding each year that is supplemented by an equivalent amount of state funds through the Kansas Department of Trans-

portation's Kansas Transportation Research and New-Developments (K-TRAN) program.

The K-State UTC supports rural transportation system research by providing scholarships, graduate research assistantships, tuition, travel support and research funds to faculty in civil engineering, as well as electrical engineering, industrial engineering, and economics. Since its establishment in 2006, the UTC has secured and distributed more than 2.3 million dollars in research funding that has supported 30 research projects beyond those funded by the K-TRAN program. The center has awarded 36 scholarships and 27 graduate research assistantships.

Professor Robert Stokes has served as the director of the K-State UTC since 2008. In 2011, the center hosted the 93rd Annual Kansas Transportation Engineering conference that attracted more than 500 participants. The Traffic Assistance Services of Kansas (TASK) program, which is co-sponsored by the K-State UTC, was featured in Washington D.C. at the Transportation Research Board's UTC Spotlight Conference. Two UTC-supported projects were highlighted at the U.S. Department of Transportation's UTC Research Product Exhibition/Demonstration held at its headquarters in Washington, D.C. Professor Hani Melhem and co-investigators presented their work on innovative fiber-reinforced plastic bridge deck panels for accelerated deck replacement and Professor Robert Peterman and co-investigators demonstrated their newly developed laser-speckle imaging device – a non-contact strain sensor for prestressed concrete inspection of bridge structures and high-speed rail crossties.

Graduate student Wilson Smith was named the K-State UTC Student of the Year and was recognized for this achievement at the Transportation Research Board annual meeting in Washington D.C.

## PROGRAMS

# PROGRAMS

### Mid-America Transportation Center

K-State CE is a partner in the Mid-America Transportation Center (MATC), a Region 7 University Transportation Center of the U.S. Department of Transportation. The center is a consortium of five universities – the University of Nebraska-Lincoln, Kansas State University, the University of Kansas, Missouri University of Science and Technology, and the University of Iowa. MATC projects at K-State are administered by Professor Mustaque Hossain who serves as an associate director of the center.

The longevity of our transportation infrastructure is a concern due to diminishing highway revenues and increased usage. MATC projects at K-State focus on the preservation and safety of the regional transportation infrastructure due to increased truck loads from freight movements. Associate Professor Sunanda Dissanayake is conducting research on the safety of roads and highways, Professor Robert Peterman is studying bridges and railway infrastructure, and Professor Mustaque Hossain is researching the design and durability of asphalt materials and pavements.

K-State serves as the lead institution in a MATC co-sponsored, eight-state, pooled-fund study focusing on accommodating oversized/



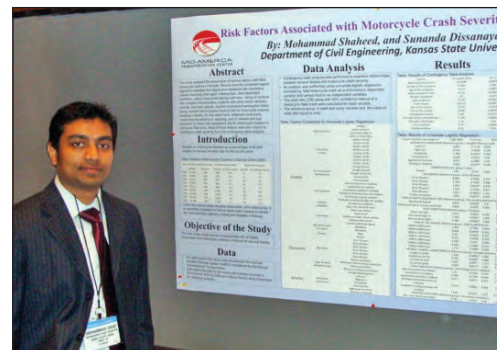
overweight vehicles at roundabouts. The project is being led by Professor Emeritus Eugene Russell and Adjunct Professor Dean Landman.

MATC sponsorship led to Dissanayake presenting a paper titled “Comparison of Contributory Causes of Fatal Truck and Non-Truck Crashes Using Bayesian Statistical Analysis” at the inaugural congress of ASCE’s Transportation and Development Institute in 2011. Former graduate student Litao Liu and Hossain published a paper in Transportation Research Record on the costs and benefits of thin surface treatments on bituminous pavements in Kansas. A poster, authored by graduate Farhana Rahman and Hossain from a MATC-sponsored project was presented at the 90<sup>th</sup> Annual Meeting of the Transportation Research Board held in Washington, D.C.

The transportation workforce development initiative and technology transfer projects of MATC have been in full force in 2011. The Center co-sponsored the summer internships of nine KSU students at the Kansas Department of Transportation in 2011, development of a new graduate certificate program in transportation engineering, the 2011 Kansas Transportation Engineering Conference held in Manhattan and several Superpave training sessions offered by KSU. The Superpave sessions trained and certified 68 participants in 2011.



Glenn Fager, KSU CE alumnus, lectures in a MATC-sponsored Superpave training class.



Mohammad Shaheed, a MATC-supported graduate student of Professor Sunanda Dissanayake, displays a poster at the 90<sup>th</sup> Annual Transportation Research Board Annual Meeting in January 2011.

## PROJECTS

# PROJECTS

### Environmental Engineering

#### The Role of Dust on Snow and Other Aeolian Inputs in Soil Formation and Biogeochemical Cycling in Barren, Alpine Catchments

P.I.: Natalie Mladenov; Co-P.I.s: Williams, Schmidt, and Blum  
National Science Foundation, \$556,774, 2001-2014

The combination of increasing temperatures and dust emissions, melting glaciers and surprisingly high amounts of microbial activity in recently deglaciated soils represent a new connectivity between geologic, biological and hydrologic processes in barren, alpine catchments. This project evaluates the provenance and chemical quality of aeolian deposition and investigates initial phases of weathering and biogeochemical cycling in barren, high-elevation soils using novel spectroscopic techniques, stable isotope and cation analyses, soil chemistry and mineralogy analyses, and bioavailability experiments. Hypotheses are being tested in the Green Lakes Four catchment of the Colorado Front Range, where aeolian deposition, soil microbial processes and nitrification, which have been studied independently over the last few decades, are being studied as interacting processes in an interdisciplinary investigation.

#### REU Site: Sustainable Production and Processing Systems for Biomass-Derived Fuels of the Future

P.I.: Alok Bhandari; Co-P.I.s: Raj Raman and Michelle Soupir  
National Science Foundation, \$312,000, 2010-2013

Biomass-derived fuels are a promising source of renewable energy with a potential to reduce energy imports while decreasing atmospheric emissions of fossil-fuel derived CO<sub>2</sub>. This project focuses on (i) educating the next generation of scientists and engineers about biomass-derived fuel production, (ii) training them to conduct high-quality scientific research and (iii) inspiring them to pursue graduate education. The REU site is hosted at Iowa State University. Each year, 10 participants are recruited and matched with one of five specific project areas based on their academic background and interests. Students spend 10 summer weeks on campus working on hypothesis-driven project topics contributed by nine faculty researchers who closely mentor and supervise each student’s research. Other enrichment activities include technical and professional seminars, field trips, attendance at an international conference, group meetings and work sessions, and a five-hour ethics workshop. Project success is measured through qualitative and quantitative assessments conducted by the PIs in collaboration with specialists in education research.

#### Enhanced Gas-Liquid Mass Transfer Using Magnetite Nanoparticles

P.I.: Alexander Mathews

National Science Foundation, \$311,287, 2010-2012

Nanoparticles and mesoporous nanoshells possess unique properties such as high surface area and mobility, and these can be used to advantage in changing bubble properties in gas-liquid mass transfer. This project investigates methods and mechanisms to enhance gas-liquid mass transfer and reaction rates using nanoparticles and nanoshells as shuttles. This process can provide a several-fold increase in mass transfer rates due to (1) a parallel liquid-solid-gas transfer mechanism in addition to liquid-gas mass transfer, (2) increased bubble residence time and (3) cavitating bubbles under ultrasonic fields. The project is examining the mecha-

nisms by which inert and adsorbent nanoparticles affect mass transfer rates in the transfer of dissolved organic contaminants from water to the air phase in the presence and absence of ultrasonic fields. Results of this work promises to provide more efficient means of conducting mass transfer operations in drinking water purification, multi-phase reactions in the process industries, and in the removal of volatile organic compounds from contaminated groundwater and wastewaters.

### Geotechnical Engineering

#### Finite-Element Analysis of Concrete Slab on Slab Embankment

P.I.: Dunja Peric; Co-P.I.: Asad Esmaily  
KSU University Transportation Center, \$30,000, 2009-2011

Current AASHTO specifications for structural design of bridge approach slabs do not take into account the interaction of slabs with underlying soil. Consequently the slabs experience a distress primarily in the form of cracking, also known as “the bump at the end of the bridge” because they are not designed to sustain the effects of differential settlements. This project assesses internal forces in approach slabs by means of a 3-D, finite-element analyses using ABAQUS. The response of a typical approach slab used for Kansas bridges is being modeled using worst-loading scenarios comprising a combination of dead and live loads. The effects of differential settlement magnitude, as well as of the slab dimensions on the induced internal forces, is being evaluated. A graphical design tool that relates maximum bending moments, deflections and rotations in the slab-on-grade and simply supported slabs is being developed. This project brings multiple benefits including 1) alleviated distress of bridge approach slabs; 2) decreased impact loads on the bridges, thus preventing further damage; 3) decreased maintenance cost; 4) improved rideability and safety of the traffic; and 5) reduced traffic disruptions due to maintenance.

#### Characterizing KDOT’s Chloride Permeability Testing Protocol: Reducing the Duration of Rapid Chloride Permeability Test

P.I.: Yacoub Najjar  
KSU University Transportation Center, \$90,000, 2008-2012

Reliable and economical design of Portland cement concrete (PCC) pavement structural systems

relies on various factors, among which is the proper characterization of the expected permeability response of the concrete mixes. For characterization of the permeability response of PCC pavement structure, the Kansas Department of Transportation (KDOT) uses the rapid chloride permeability test to determine the resistance of concrete to penetration of chloride ions, as well as the boil test to determine the percent of voids in hardened concrete. In this project, back propagation artificial neural network (ANN)-based and regression-based permeability response prediction models for rapid chloride and boil tests are being developed in order to reduce or eliminate the duration of the testing period. Comparison of the prediction accuracy of the developed ANN models and regression models show that ANN models outperform the regression-based models. The ANN-based permeability prediction models being developed from this research appear to be efficient in characterizing the permeability response of concrete mixes used in transportation applications.

### Materials Engineering

#### Kansas Pavement Preservation Initiative: Development of a Seal Coat Design and Construction Manual and Investigation of Design of Seal Coats with Lightweight Aggregates

P.I.: Mustaque Hossain; Co-P.I.: Dean Testa  
U.S. Department of Transportation, \$129,967, 2008-2012

Current seal and coat design methods used for preservation of asphalt pavements were designed for regular aggregates. K-DOT exclusively uses lightweight aggregates for asphalt pavement design. There have been recent problems in Kansas and lightweight aggregates have been blamed for these. Almost no information is available on seal coats with lightweight aggregates, necessitating the investigation for lightweight aggregates. This project includes the development of a one-day training class and a seal coat design manual for KDOT, and evaluation of the use of lightweight aggregates in chip seal in Kansas.

#### BRIGE: Linking the Microstructure, Performance and Sustainability of Mixed-Glass Cullet-Blended Cements

P.I.: Kyle Riding  
National Science Foundation, \$174,999, 2010-2012

Mixed-glass cullet is most often landfilled because of the difficulty and expense in recycling heterogeneous glass particles into new container glass. This material, however, has the potential to improve concrete properties while replacing millions of tons of cement in concrete each year with a corresponding reduction in greenhouse gas emissions. This project utilizes microstructural and thermodynamic modeling to predict the reactivity of mixed-glass cullet particles in concrete. Results from this research are providing a rational, materials science-based approach for optimizing mixed-glass cullet performance in concrete for precast applications and ultra-high performance concrete, which are usually cured at varying and elevated temperatures.

### Structural Engineering

#### KSU\_RC Upgrade for Performance and Capacity Assessment of RC Bridge Piers Considering New K-DOT LRFD Provisions and Plastic-Hinge Length

P.I.: Asad Esmaily; Co-P.I.: Hayder Rasheed  
Kansas Department of Transportation, \$58,240, 2010-2012

State DOTs are expected to use the new AASHTO LRFD bridge design code. This project addresses K-DOT’s need and provides the analytical tools necessary for a realistic performance assessment of bridge piers under various loading conditions. A displacement-controlled analysis procedure is used for performance assessment. Virtual analysis is conducted using the KSU\_RC as the analytical tool to perform moment curvature and force deflection. The program has been benchmarked against experimental data from a number of reinforced concrete bridge columns under a wide range of loading patterns, including non-proportional axial load and cyclic lateral displacement.

#### FRP Bridge Deck Panels

P.I.: Hani Melhem  
KSU University Transportation Center, \$36,500, 2010-2012

AASHTO provides load distribution factors for determining how much load a longitudinal beam supporting a bridge deck should be designed to hold. Since fiber-reinforced polymer (FRP) is a relatively new material used for bridge design, there are no provisions in the AASHTO specifications that provide a load distribution when designing beams supporting an FRP deck. In this project, FRP honeycomb, or FRPH, hollow-core deck panels, are being loaded and analyzed to provide information about a conservative load distribution that will assist engineers in future bridge designs with FRPH decks. Two support conditions are being evaluated: continuous panel supported by four beams and a simply supported panel with cantilever on

one side. Strain gauges are mounted at mid-span of each beam. Conservative design factors are being determined through data analysis for the FRPH deck.

#### Evaluating Time-Dependent and Bond Characteristics of Lightweight Concrete Mix for Kansas Prestressed Concrete Bridges

P.I.: Robert Peterman; Co-P.I.: Asad Esmaily  
Kansas Department of Transportation, \$94,486, 2008-2011

Self-consolidating concrete (SCC) is becoming increasingly popular in the fabrication of precast concrete members in the United States. Because of the successful implementation of SCC in the prestressed concrete industry, several precasters throughout the U.S. have also implemented lightweight SCC, in which the coarse and fine aggregates are replaced with lightweight aggregates to reduce the dead load by as much as 30%. Many bridges in Kansas are located in rural areas, thus creating long travel distances for prestressed girders to be delivered to the jobsite. Use of lightweight SCC promises to reduce bridge construction costs by increasing span-to-depth ratio for a given cross-section, smaller foundation requirements, reduced crane sizes and the possibility of shipping more members on a single truck. This project is focused on working with local prestressed concrete producers to develop a lightweight concrete mix for use in Kansas prestressed concrete bridge girders, and determine the material properties of the lightweight mix required for the design of a pretensioned concrete bridge.

#### EAGER: Engineered Bio-Composites for Sustainable Concrete

P.I.: Hayder Rasheed; Co-P.I.s: Dunja Peric and Larry Davis  
National Science Foundation, \$30,000, 2010-2012

Special attention is needed for more durable construction that requires less frequent and less expensive maintenance of highway infrastructure while utilizing materials whose use is sustainable. This project investigates incorporation of agricultural wastes to enhance the behavior of concrete. Renewable agricultural waste material is abundantly available as co-products of biofuel processing. This project is determining the optimum proportions of cellulose fibers and lignin that can sustain the performance of concrete under short-term loading. Lignin acts as a water reducer to control the water-cement ratio and improve strength and durability. Wheat fiber, on the other hand, acts as a micro-cracking barrier controlling the microstructure crack growth under early age and fatigue conditions. This project is focused on combining both bio-based materials in reinforcing cement concrete,

## PROJECTS

### Transportation Engineering

#### Effects of Geometric Design Features on Truck Crashes on Limited-Access Highways

P.I.: Sunanda Dissanayake  
Mid-America Transportation Center, \$54,601, 2010-2012

Greater amounts of freight are being transported by trucks, causing the number and percentage of trucks on the national highway system to increase significantly. Trucks are larger in size and weight and typically have different performance characteristics than passenger vehicles. Safe operation of these large trucks is a major concern as they disproportionately account for traffic fatalities. When trucks are involved in crashes with other smaller vehicles, the majority of fatalities involve the occupants of the other motor vehicle. A better understanding of the impact of geometric design features of highways on truck crashes can bring significant benefits. This project evaluates truck crashes in detail by developing models to determine the influence of various geometric design features, traffic and other characteristics of large-truck crash occurrence on limited-access roadways.

#### KSU University Transportation Center

P.I.: Robert Stokes  
U.S. Department of Transportation, \$198,229 (of \$450,000), 2010-2012

The goal of this project is to recruit and retain highly qualified students in programs of study that advance the mission of the K-State UTC. Project funds are also used to provide travel assistance for students to participate in conferences and workshops. Candidates for the UTC Scholarship and Assistantship Program are nominated by a member of the UTC faculty. The scholarship and assistantship awards are typically on the order \$5,000/semester, depending on availability of funds.

#### A Review of K-DOT Overhead Guide Sign Lighting Policy

P.I. Margaret Rys; Co-P.I.s Andre Rys and Eugene Russell  
Kansas Department of Transportation, \$89,000, 2010-2012

The goal of this project is to determine the minimum retro-reflectivity levels for the overhead guide signs that will satisfy FHWA requirements and be consistent with minimizing life-cycle costs. It includes a study of the cost and safety benefits of using different retro-reflective sheeting versus

external lighting for the overhead guide signs, and the most cost-effective means of external illumination considering the life-cycle costs of newer, lower energy systems.

### Water Resources Engineering

#### Hyper-Extractive Economies and Sustainability: Policy Scenarios for Sustainable Water Use in the High Plains Aquifer

P.I.: David Steward; Co-P.I.s: Joseph Aistrup, Laszlo Kulcsar, Jeffrey Peterson, Steve Welch  
National Science Foundation, \$1,499,000, 2009-2012

Southwest Kansas sits on the Ogallala Aquifer, one of world's largest underground sources of freshwater, which is also quickly becoming a depleted natural resource. Hyper-extractive practices produce economic and resource path dependencies, which when placed in relation with global processes such as international migration and the emergence of global commodity chains, shape future patterns of population growth and economic development. This project focuses on investigating changes in the parameters of irrigated agriculture that will produce sustainable uses of the aquifer without jeopardizing the region's economy. To model this system, researchers are using an integrated, cross-disciplinary, system-level theoretical approach that links land and water use patterns, economic trends and population dynamics to issues of sustainability. The project focuses on 1) accurately modeling the current hyper-extractive system; 2) forecasting the outcome of possible policy approaches to transition the current system toward possible paths that are more sustainable for the social, economic and natural systems of the groundwater-based economies of the High Plains Aquifer; and 3) communicating the model's outcomes to stakeholders and policy makers for the purpose of developing legislation to implement policy changes designed to enhance sustainability. Involvement of researchers, educators, students, elected leaders and stakeholders ensures development of a healthy dialogue about the possibility of changing policy to implement some combination of reforms to enhance regional sustainability.

## GRANTS

### Grants in progress (total: \$11,365,513)

#### Environmental Engineering

(total current projects: \$1,724,068)

- Performance and Acceptance of Denitrification Bioreactors for Agricultural Drainage. Pre-Doctoral Fellowship Grant, U.S. Department of Agriculture National Institute of Food and Agriculture. Christianson, L.; Helmers, M.; **Bhandari, A.** \$40,000, 2011-2012 (at Iowa State U).
- Occurrence and Movement of Antibiotic Resistant Bacteria and Resistance Genes in Tile-Drained Agricultural Fields Receiving Swine Manure Application. National Pork Board. **Bhandari, A.**; Soupir, M.; Moorman, T. \$30,000, 2011-2012 (at Iowa State U).
- REU Site: Sustainable Production and Processing Systems for Biomass-Derived Fuels of the Future. National Science Foundation. **Bhandari, A.**; Raman, D.R.; Soupir, M. \$312,000, 2010-2013 (at Iowa State U).
- REU Site: Bridging the Diversity Gap: Research Experiences in the Geosciences for Community College Students and Transfers. Tim, U.; Kaleita A.; and **Bhandari A.** National Science Foundation, \$150,000, 2010-2012 (at Iowa State U).
- Hickory Grove Watershed Improvement Plan. Soupir, M.; Helmers, M; **Bhandari, A.** Iowa Department of Natural Resources, \$149,000, 2009-2011 (at Iowa State U).
- Application of Advanced Oxidation Processes for Groundwater Remediation. Himabindu, V. and **Bhandari, A.** Department of Science and Technology, Government of India, \$10,000, 2009-2011.
- Producer Education of Nitrate Reduction Strategies and Evaluation of Acceptance. **Bhandari, A.** U.S. Department of Agriculture NCR-SARE Program. \$10,000, 2009-2011 (at Iowa State U).
- Evaluating Denitrifying Bioreactors for Edge-of-Field Nitrogen Management in Iowa's Tile-Drained Landscapes. **Bhandari, A.** and Helmers, M. Leopold Center for Sustainable Agriculture, \$55,000, 2009-2011 (at Iowa State U).
- Enhanced Gas-Liquid Mass Transfer Using Magnetite Nanoparticles. National Science Foundation. **Mathews, A. P.** \$311,287, 2009-2012.
- The Role of Dust on Snow and Other Aeolian Inputs in Soil Formation and Biogeochemical Cycling in Barren, Alpine Catchments. National Science Foundation, **Mladenov, N.**; Williams, Schmidt, and Blum. \$556,774, 2011-2014.
- International Planning Visit: Investigating the Interactions Between Dissolved Organic Matter, Microbial Communities, and Arsenic Biogeochemistry in Groundwater of a Pristine Delta. National Science Foundation, **Mladenov, N.** \$19,943, 2011-2012.
- Acquisition and Upgrade of Instrumentation for Research on Transport and Reactivity of Dissolved and Particulate Organic Materials in Soils, Sediments

and the Atmosphere. National Science Foundation. McKnight, D.M; **Mladenov, N.**; Anderson S.; Williams, M.W. \$80,064, 2009-2011.

### Geotechnical Engineering

(total current projects: \$404,248)

- Characterizing KDOT's Chloride Permeability Testing Protocol: Reducing the Duration of the Rapid Chloride Permeability Test. KSU University Transportation Center. **Najjar, Y.** \$139,124, 2008-2012.
- Course Development – Neural Networks in Civil Engineering. KSU University Transportation Center. **Najjar, Y.** \$12,000, 2011.
- Knowledge Discovery in Transportation Databases (KDiTD). KSU University Transportation Center. **Najjar, Y., Peric, D.,** and **Dissanayake, S.** \$208,124, 2007-2013.
- Towards Sustainable Pavements: Engineered Agricultural Waste for Alleviation of Thermal Cracking, Phase I. KSU University Transportation Center. **Peric, D.** and **Rasheed, H. A.** \$15,000, 2010-2012.
- Finite Element Analysis of Concrete Approach Slab on Soil Embankment. KSU University Transportation Center. **Peric D.** and **Esmaily A.** \$30,000, 2009-2011.

### Materials Engineering

(total current projects: \$2,517,670)

- Use of High-Volume Reclaimed Asphalt Pavement (RAP) for Asphalt Pavement Rehabilitation Due to Increased Highway Truck Traffic from Freight Transportation. Mid-America Transportation Center. **Hossain, M.** \$44,782, 2010-2012.
- Transportation Workforce Development Initiative. Mid-America Transportation Center. **Hossain, M.** \$33,041, 2010-2012.
- KSU MATC Technology Transfer Program. Mid-America Transportation Center. **Hossain, M.,** \$35,973, 2010-2012.
- Kansas Pavement Preservation Initiative. U.S. Department of Transportation. **Hossain, M.,** and Romanoschi, S. A. \$120,000, 2007-2011.
- Assessment of General Aviation Airports in Kansas. Kansas Department of Transportation. **Hossain, M.** \$82,000, 2008-2012.
- Structural Characteristics of Aged Hot-Mix Asphalt Pavements. Kansas Department of Transportation. **Hossain, M.** \$72,000, 2009-2011.
- Review of Data in CMS and QC/QA Data Bases to Improve Current Specifications for Superpave and Concrete Pavements in Kansas. Kansas Department of Transportation. **Hossain, M.** and Ingram, L. \$52,000, 2009-2011.
- Kansas Pavement Preservation Initiative: Development of a Seal Coat Design and Construction Manual and Investigation of Design of Seal Coats with Light-

weight Aggregates. U.S. Department of Transportation. **Hossain, M.** and Testa, D. \$129,967, 2008-2012.

- Kansas Pavement Preservation Initiative: Rehabilitation of Ultrathin Bonded Bituminous Surface. U.S. Department of Transportation. **Hossain, M.** and Testa, D. \$67,866, 2008-2012.
- Accelerated Pavement Testing of Paved Low-Volume Roads with Geocell Reinforcement. U.S. Department of Transportation. **Hossain M.** \$286,000, 2009-2012.
- Mid-America University Transportation Center. U.S. Department of Transportation. **Hossain, M., Stokes, R.W., Peterman, R.J.,** and **Dissanayake, S.** \$231,000, 2011.
- Durable Superpave (SM and SR) Mixes in Kansas. Kansas Department of Transportation. **Hossain, M.** \$38,000, 2011-2013.
- Accelerated Testing of Paved Roads with Geosynthetics-Reinforced Base. Tencate Geosynthetics. **Hossain, M.** and **Najjar, Y.** \$197,367, 2011-2012.
- Sustainable and Durable Concrete Pavement Aggregates. Kansas Department of Transportation. **Riding, K. A.** \$49,000, 2012-2013.
- Determination of Acceptance Criteria for Prestressing Strand in Pretensioned Applications. Precast/Prestressed Concrete Institute. **Riding, K. A., Peterman, R. J.,** and Murray, L. \$295,530, 2011-2014.
- Carbon Emissions and Energy Efficiency (Phase 2): Improving Energy and Fuel Efficiencies in KDOT Operations. Kansas Department of Transportation. **Riding, K. A., Stokes, R.W.,** and Keen, J. \$60,000, 2011-2012.
- Evaluation of Concrete Strength and Permeability. Kansas Department of Transportation. **Riding, K. A.** \$174,000, 2010-2012.
- Measurement of the Pore-Size Distribution of Limestone Aggregates in Concrete Pavement Cores. Kansas Department of Transportation. **Riding, K. A.** \$11,700, 2011-2012.
- Kansas Sustainable Concrete Pavements Initiative – Potential Use of Nanotechnology. Kansas Department of Transportation. **Riding, K. A.** \$38,945, 2010-2012.
- Effect of Y-Cracking on CRCP Performance. Oklahoma Department of Transportation. **Riding, K. A.** \$44,998, 2010-2012.
- Kansas Sustainable Concrete Pavements Initiative. Kansas Department of Transportation. **Riding, K. A.** \$43,500, 2010-2012.
- BRIGE: Linking the Microstructure, Performance, and Sustainability of Mixed-Glass Cullet-Blended Cements. National Science Foundation. **Riding, K. A.** \$174,999, 2010-2012.
- Carbon Emissions (Phase 1): Establish Carbon Emissions Baseline for Kansas Department of Transporta-

tion (KDOT). Kansas Department of Transportation. **Riding, K. A.** and **Stokes, R.W.** \$80,000, 2010-2011.

- Collaborative Research: New Natural Supplementary Cementitious Materials for Concrete. National Science Foundation. **Riding, K. A.** \$210,618, 2010-2013.
- Evaluation of Canadian Unconfined Aggregate Freeze-Thaw Tests for Identifying Nondurable Aggregates. Kansas Department of Transportation. **Riding, K. A.** and **Hossain, M.** \$12,250, 2009-2012.

### Structural Engineering

(total current projects: \$1,707,085)

- KSU\_RC Upgrade for Performance and Capacity Assessment of RC Bridge Piers Considering the New K-DOT LRFD Provisions and the Plastic-Hinge Length. Kansas Department of Transportation. **Esmacily, A.** and **Rasheed, H.** \$40,000, 2010-2012.
- Innovative Systems of FRP Bridge Deck Panels with Crash-Worthy Guardrails. KSU University Transportation Center. **Melhem, H.** \$36,500, 2010-2012.
- Developing Short-Span Alternatives to Reinforced Concrete Box Culvert Structures in Kansas. Kansas Department of Transportation. **Peterman, R. J.** \$75,000, 2011-2012.
- Quantifying the Effect of Prestressing Steel and Concrete Variables on the Transfer Length in Pretensioned Concrete Crossties. Federal Rail Administration, CXT Concrete Ties, Inc., and KSU University Transportation Center, **Peterman, R. J.;** Beck, B. T.; and Wu, C. H. \$1,091,540, 2011-2013.
- Determining the Transfer Length in Prestressed Concrete Railroad Ties Produced in the United States. Mid-America Transportation Center. **Peterman, R. J.** \$55,835, 2011-2012.
- Long-Term Monitoring of a Pretensioned Concrete Bridge Near Winfield, Kan. Kansas Department of Transportation. **Peterman, R. J.** \$19,343, 2011-2012.
- Determining the Stresses in Steel Railroad-Track Rails Due to Freight Movement Using Non-Contact Laser-Speckle. **Peterman, R.J.;** Beck, B.T.; and Wu, C.H. Mid-America Transportation Center. \$63,921, 2010-2011.
- Evaluating the Long-Term Monitoring of the Time-Dependent Characteristics of Self-Consolidating Concrete in an Instrumented Prestressed Concrete Bridge. Kansas Department of Transportation, **Peterman R. J.** and **Esmacily A.** \$85,496, 2009-2011.
- Amelia Earhart Bridge— Evaluating Long-Term Monitoring of Time-Dependent Characteristics.

Kansas Department of Transportation. **Peterman R. J.** and **Esmacily A.** \$80,650, 2009-2013.

- LRFD Software for Design and Actual Ultimate Capacity of Confined Rectangular Columns: Phase 2. Kansas Department of Transportation. **Rasheed, H.A.** and **Esmacily, A.** \$59,900, 2010-2012.
- EAGER: Engineered Bio-Composites for Sustainable Concrete. National Science Foundation. **Rasheed, H. A., Peric, D.,** and Davis, L. \$30,000, 2010-2012.
- LRFD Software for Design and Actual Ultimate Capacity of Confined Rectangular Columns: Phase 2. Kansas Department of Transportation and KSU University Transportation Center. **Rasheed, H. A.** and **Esmacily, A.** \$68,900, 2010-2012.

### Transportation Engineering

(total current projects: \$1,231,913)

- Effects of Geometric Design Features on Truck Crashes on Limited-Access Highways. Mid-America Transportation Center. **Dissanayake, S.,** \$54,512, 2010-2012.
- Characteristics and Contributory Causes Related to Large Truck Crashes (Phase II). Mid-America Transportation Center. **Dissanayake, S.** \$47,900, 2009-2012.
- Improving Safety of Teenage and Young Adult Drivers in Kansas - Phase II. Kansas Department of Transportation. **Dissanayake, S.** \$23,000, 2009-2011.
- Identification of Safety Belt Restraint Usage Characteristics Related to 5-14 Year Olds. Kansas Department of Transportation. **Dissanayake, S.** \$40,000, 2009-2011.
- Improving Safety of Teenage and Young Adult Drivers in Kansas-Phase I. Kansas Department of Transportation. **Dissanayake, S.** \$35,000, 2008-2011.
- Keeping Vehicles on the Roadway in Rural Areas: Analysis of Run-Off-the-Road Crashes. KSU University Transportation Center. **Dissanayake, Rys, M. S., Russell, E.,** and **Stokes, R.** \$119,972, 2009-2013.
- Rural Transportation Initiative Supporting Agricultural Transition and Sustainability. KSU University Transportation Center. **Dissanayake, S.,** Apley, M. D., **Steward, D. R.,** and White, B. J. \$50,000, 2006-2012.
- Developing Safety Performance Functions for Kansas Safety Studies. KSU University Transportation Center, Kansas State University, **Dissanayake, S.** and **Russell, E.** \$40,000, 2009-2011.
- KSU University Transportation Center. U.S. Department of Transportation. **Stokes, R.W.** and **Bhandari, A.** \$198,229 (of \$450,000), 2010-2011.
- Traffic Assistance Services for Kansas Program (TASK). Kansas Department of Transportation, **Stokes, R.W.,** Mulinazzi, T., and Bergens, L. \$100,000, 2011.
- Study of KDOT Policy on Lane and Shoulder Mini-

mum Width for Application of CLRS. Kansas Department of Transportation. Rys, M. and **Russell, E.** \$59,000, 2009-2011.

- A Review of KDOT Overhead Guide Sign Lighting Policy. Kansas Department of Transportation. Rys, M., Rys, A. and **Russell, E.** \$89,000, 2010-2012.
- Optimizing the Analysis of Routing Superloads to Provide Efficient Corridors. **Russell E.** and Landman, D.E. Kansas Department of Transportation. \$37,000, 2010 – 2011.
- Accommodating Oversized/Overweight Vehicles at Roundabouts. **Russell, E.** and Landman, E.D. Eight-State Pooled Fund Project, \$338,300, 2010-2012.

### Water Resources Engineering

(total current projects: \$3,780,529)

- MRI: Acquisition of a Hybrid GPU Computing Cluster High-End Applications in Science and Engineering. National Science Foundation. Andresen, D., Caragea, D., Esry, B., **Steward, D. R.,** and Dodds, W. \$700,000, 2011-2014.
- Hyper-Extractive Economies and Sustainability: Policy Scenarios for Sustainable Water Use in the High Plains Aquifer. National Science Foundation. **Steward, D. R.,** Aistrup, J. A., Kulcsar, L., Peterson, J. M., and Welch, S. M. \$1,499,999, 2009-2012.
- New Water Management Technologies to Sustain Rural Economies. U.S. Department of Agriculture. Hargrove, W.L., Aiken, R. M., Brouk, M. J., Clark, G. A. Klocke, N. L., Lamm, F. R., Peterson, J. M., Schlegel, A. J., **Steward, D. R.,** and Stone, L. R. \$1,580,530, 2006-2011.



## PROFESSIONAL LEADERSHIP

# PROFESSIONAL

### Alok Bhandari

- Fellow, American Society of Civil Engineers (ASCE)
- Member, Association of Environmental Engineering and Science Professors (AEESP)
- Member, American Society of Engineering Education (ASEE)
- Member, Water Environment Federation
- Member, Kansas Society of Professional Engineers (KSPE)
- Member, Sigma Xi
- ASCE Environmental and Water Resources Institute, Environmental Council Awards Committee
- AEESP Education Committee
- AEESP Demographics and Diversity Committee
- KSPE Membership Committee
- KSPE Tri-Valley Chapter, Board Member
- Associate Editor, Journal of Hazardous, Toxic and Radioactive Waste Management
- Director, K-State Urban Water Institute
- Dr. Robert Snell Civil Engineering Alumni Professorship

### Sunanda Dissanayake

- Member, ASCE
- Member, Institute of Transportation Engineers
- Member, Kansas Association for Uniform Traffic Control

- Member, Chi Epsilon Honor Society
- Fulbright Scholar, University of Peradeniya, Sri Lanka
- ASCE, Transportation and Development Institute (TDI) Local Roads and Streets Committee
- ASCE, TDI Transportation Safety Committee
- Transportation Research Board (TRB), Vehicle User Characteristics Committee
- Associate Editor, Journal of Transportation Safety and Security
- Kansas Department of Transportation (K-DOT), Kansas Transportation and New Development (K-TRAN) Technical Committee
- K-DOT, K-TRAN Transportation Operations Panel
- K-DOT, K-TRAN Local Governments Panel

### Asad Esmaeily

- Member, ASCE
- Member, Engineers without Borders Kansas Professional Chapter
- ASCE-American Concrete Institute (ACI) Joint Committee on Reinforced Concrete Columns
- Chair, ASCE-Engineering Mechanics Institute (EMI) Experimental Analysis and Instrumentation Committee

- Technical and Scientific Organizing Committee, 13th International Conference on Nonconventional Materials and Technologies, Changsha, Hunan, China.
- Associate Editor, Journal of Bridge Engineering
- Guest editor, Journal of Engineering Mechanics – Special Issue on Experimental Methods in Damage Detection and Wind Engineering
- KSU College of Engineering, Meyers-Alford Teaching Excellence Award

### Mustaque Hossain

- Fulbright Commission Application Review Committee
- TRB, Committee on Full-Scale and Accelerated Testing
- TRB, Flexible Pavement Design Committee
- TRB, Committee on Strength and Deformation Characteristics on Pavement Management
- TRB, Asset Management Committee
- TRB, University Representative
- ASCE Committee on Highway Construction
- Associate Director, Mid-America Transportation Center
- President, ASCE Kansas Section
- K-DOT, K-TRAN Pavement Panel
- K-DOT, K-TRAN Technical Committee
- KSU, Munger Professorship in Civil Engineering
- KSU Civil Engineering, ASCE Student Chapter Outstanding Faculty Award
- KSU Civil Engineering, Chi Epsilon Chapter Student Advocate Award
- Training Organizer, Superpave Field Lab Technician Certification Training, Kansas State University, held at various times in 2011

### Natalie Mladenov

- Member, AEESP
- Member, American Geophysical Union (AGU)
- Member, American Society of Limnology and Oceanography
- Member, Tau Beta Pi Engineering Honor Society
- Member, American Association of University Women

### Alexander Mathews

- National Council of Examiners for Engineering and Surveying, Examining Committee
- American Institute of Chemical Engineers, Separations Division

### Hani Melhem

- Fellow, ASCE
- ASCE Council for Computing and Information Technology
- ASCE-American Concrete Institute (ACI) Joint Committee on Pre-Stressed Concrete
- Organizer, Kansas Bridge Workshop
- KSU Civil Engineering, Outstanding University and Professional Service Award
- Conference Organizer, 18th Annual Kansas Bridge Design Workshop, Kansas State University



## PROFESSIONAL LEADERSHIP

# PROFESSIONAL

### Yacoub Najjar

- Member, ASCE
- TRB, Committee on Modeling for the Design, Construction, and Management of Geosystems
- Board member, Innovations Conference on Asphalt and Transportation, Bradley University
- Associate editor, International Journal of Geomechanics
- Associate editor, Computers and Geotechnics
- Planning committee, Kansas Geotechnical Engineering Conference
- Thomas and Connie Paulson Civil Engineering Outstanding Faculty Award
- KSU Civil Engineering, ASCE Student Chapter Advisor of the Year Award
- KSU Civil Engineering, Chi Epsilon Chapter Undergraduate Outstanding Teaching Award

### Dunja Peric

- Member, ASCE
- Eminent visiting scholar, University of New South Wales, Australia
- Associate editor, Journal of Geotechnical and Geoenvironmental Engineering
- KSU Civil Engineering, Outstanding Colleague Award

### Robert Peterman

- Member, ASCE
- Member, Precast/Prestressed Concrete Institute (PCI)
- Secretary, PCI Prestressing Steel Committee
- PCI, Bridge Committee
- PCI, Strand Bond Task Force
- PCI, Journal Advisory Committee
- TRB, Committee of Dynamics and Field Testing of Bridges
- Keynote speaker, 2011 Annual PCI Conference
- KSU Martin K. Eby Distinguished Professorship in Engineering
- KSU Civil Engineering, Outstanding Research Award

### Hayder Rasheed

- Fellow, ASCE
- Member, American Concrete Institute (ACI)
- Task Group Chair, ACI Committee on Fiber-Reinforced Polymer Reinforcement
- ACI, Composite and Hybrid Structures Committee
- Associate editor, International Journal of Structural Stability
- Associate editor, Open Journal of Computational Mechanics
- KSU Civil Engineering, Outstanding Graduate Faculty Award
- KSU Civil Engineering, Outstanding Teaching Award

### Kyle Riding

- Member, ASCE
- Member, ACI
- Member, American Ceramic Society (ACerC)
- ACI, Wason Medal for Materials Research
- Secretary, ACI Committee on Properties of Concrete at Early Ages
- Secretary, ACerC Cements Division
- Co-chair, ACerC Annual Meeting
- ACI, Committee on Durability of Concrete
- ACI, Committee on Material Science of Concrete
- Associate editor-in-training, Journal of Materials in Civil Engineering
- Board member, ACI Kansas Chapter

### Eugene Russell

- Life member, American Railroad Engineering and Maintenance of Way Association
- Life member, National County Highway Association
- Member, Sigma Xi
- Member, Transportation Research Forum
- Member, Association of Pedestrian and Bicycle Professionals
- Member, Canadian Society of Civil Engineers
- Member, Transportation Association of Canada
- Chair, TRB Roundabouts Task Force
- Academy of Civil Engineers, Missouri University of Science and Technology

### Steven Starrett

- Member, ASEE
- Member, American Academy of Water Resource Engineers (AAWRE)
- Program evaluator, Accreditation Board for Engineering and Technology
- Program committee chair, ASCE-EWRI Annual Conference
- Organizing committee chair, Ethics Workshop, 2011 ASCE National Convention
- Executive board member, National Institute of Engineering Ethics
- ASCE, Committee on Licensure and Ethics
- ASCE Watershed Management Committee
- AAWRE, Admissions Committee

### David Steward

- Member, ASCE
- Member, AGU
- AGU, Groundwater Technical Committee
- KSU Representative, Consortium of Universities for the Advancement of Hydrologic Science
- KSU Representative, Universities Council on Water Resources



### Robert Stokes

- Executive committee member, Council of University Transportation Centers
- Associate editor, ITE Journal of Transportation
- Co-director, K-DOT-KSU-University of Kansas (KU), Traffic Assistance Services for Kansas Program
- Board member, KU Local Technical Assistant Program
- Director, Kansas Transportation Engineering Conference
- Director, K-State University Transportation Center
- Conference organizer, Annual Transportation Engineering Conference, Kansas State University, April 12-13, 2011
- Workshop organizer, Traffic Assistance Services of Kansas, Kansas State University, the University of Kansas and K-DOT, held at various times and various locations in 2011





## GRADUATE PROGRAM

K-State CE offers comprehensive programs leading to the degrees master of science and doctor of philosophy in civil engineering. Graduate students work with their committees to create personalized graduate programs of study in specializations such as environmental engineering, geotechnical engineering, materials engineering, structural engineering, transportation engineering and water resources engineering. An active research program is conducted in each of these areas, and it is the goal of the department to maintain a close connection among graduate study, research, teaching and engineering practice. In 2011, 73 students were enrolled in K-State CE graduate programs. Twenty-six M.S. degrees and one Ph.D. degree were awarded.

Students admitted for work toward a M.S. degree select a program of study requiring the completion of a master's thesis or a master's report within their area of interest. Students supported on research projects are typically expected to complete a thesis. Students admitted for work toward a Ph.D. degree are required to develop an original research program, and complete a doctoral dissertation under the guidance of a program of study committee made of faculty members from the CE department and other departments.

K-State CE also offers a graduate certificate program in transportation engineering. Graduate students majoring in any specialization can earn this certification after completing 12 credit hours of course work required for the certificate.

The primary requirement for admission to the CE graduate program is the receipt of a B.S. degree from a civil engineering undergraduate program accredited by the Accreditation Board of Engineering and Technology (ABET) or considered equivalent to an ABET-accredited program. For international programs, Kansas State University reserves the right to make the determination whether a civil engineering program is equivalent to an ABET-accredited undergraduate program in the United States. Students not possessing an undergraduate degree in civil engineering may be admitted if their undergraduate program is closely related to a specific specialty in civil engineering, and they complete the necessary deficiencies in their subject of specialization.

A valuable source of information about the CE graduate programs is the Graduate Handbook published by the department and accessible at the following website: [www.ce.ksu.edu/grad](http://www.ce.ksu.edu/grad).



## UNDERGRADUATE PROGRAM



In the next decade, another billion people will be added to the earth's population. This growth creates enormous demands for infrastructure to produce energy, transport people and goods, dispose wastes, clean the environment, and construct living and working spaces. The skills of civil engineers will, as always, be central to meeting these demands.

Civil engineering is the engineering of constructed facilities and systems: buildings, bridges, tunnels, dams, harbors, airports, waterways, highways, hydropower, irrigation, water supply, wastewater treatment and environmental health systems. As a rule, if a facility is one-of-a-kind, large and important in the daily lives of many people, chances are civil engineers participated in the planning, design and construction of that facility.

The K-State CE undergraduate program is fully accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology (ABET). Students enrolling in the bachelor of science program in civil engineering are required to successfully complete 128 credit hours of required courses in the curriculum. The CE program offers students the opportunity

to pursue one of five curriculum tracks: general civil engineering, construction engineering, environmental engineering, structural engineering and transportation/materials engineering. In 2011, the department enrolled 269 students and awarded 43 B.S. degrees. CE undergraduate students received 42 scholarship awards worth \$110,000. Senior Rachel Spicer received the 2011 National Award for Student Leadership from ASCE for her multiple leadership roles with the ASCE student chapter.

Extracurricular opportunities include the ASCE student chapter, the Institute of Transportation Engineers student chapter, the Chi Epsilon honorary and the Women in Civil Engineering organization. Students enthusiastically participate in competition teams such as the concrete canoe and steel bridge teams. The K-State CE steel bridge team routinely ranks among the top teams in the regional competition and made its seventh consecutive appearance in the national competition in 2011. Student performance in the Fundamentals of Engineering test has been excellent with our pass percentage for the October 2011 FE exam being 93%, compared to the national pass rate of 77%.

## ADVISORY COUNCIL

The mission of the council is to provide a continuing liaison between the academic community and practicing profession, and to assist the CE department, College of Engineering and Kansas State University in providing the highest quality of civil engineering education.

Functions of the council are to review programs and goals, and advise the department head and dean of the college.

Goals and objectives of the civil engineering advisory council include the following:

- coordinating with the department to stay informed about its needs;
- consulting and assisting the department head and faculty on departmental curricula, including instructional and organizational matters;
- presenting information on needs and services of the department to interested parties;
- assisting in the collection of case studies and problem materials for educational purposes;
- assisting in the process of faculty recruitment and faculty-industry interaction;
- assisting the department in developing research and technology transfer;
- assisting with ABET accreditation; and
- providing support to students and faculty through engagement in department and classroom activities.

### John H. Ahern

Vice-President (Engineering)  
EvapTech, Inc., Lenexa, Kan.

### Greg Allison

Vice-President (Civil Engineering)  
MKEC Engg., Wichita, Kan.

### Darold Davis

Senior Project Manager  
Garver, Tulsa, Okla.

### Larry W. Emig

Retired Engineer  
KDOT, Topeka, Kan.

### Dianne Honomichl

### Robert B. Thorn

Retired Partner  
Finney & Turnipseed, Topeka, Kan.

### Keith A. Warta

President  
Bartlett & West, Inc., Topeka, Kan.

### Karla S. Waters

Project Manager  
Wilson & Comp., Inc, Salina, Kan.

### Greg D. Weathered

Assoc Vice-President  
HNTB Corp., Overland Park, Kan.

### Jon D. Nelson

Vice-President  
Tetra Tech, Tulsa, Okla.

### Cathy S. Ritter

President  
Constellation Design, Timonium, Md.

### Vicki J. Scharnhorst

President  
40th Parallel Consulting, Boulder, Colo.

### James Tadtman

President  
Wildcat Construction, Wichita, Kan.

### Catherine Patrick

Director of Operations  
KDOT, Topeka, Kan.



## CONTACT INFORMATION

<b>Bhandari, Alok</b>	Professor Department Head	Fiedler 2118	785-532-1586	bhandari@ksu.edu
<b>Dissanayake, Sunanda</b>	Associate Professor	Fiedler 2109	785-532-1540	sunanda@ksu.edu
<b>Esmaeily, Asad</b>	Associate Professor	Fiedler 2112	785-532-6063	asad@ksu.edu
<b>Gerth, Susan</b>	Instructor	Fiedler 2114	785-532-1579	sgerth@ksu.edu
<b>Hossain, Mustaque</b>	Professor	Fiedler 2124	785-532-1576	mustak@ksu.edu
<b>Mathews, Alexander</b>	Professor	Fiedler 2131	785-532-1582	alex@ksu.edu
<b>McGrath, Ryan</b>	Instructor	Fiedler 2109	785-532-0889	rdmcgrath@ksu.edu
<b>Melhem, Hani</b>	Professor	Fiedler 2127	785-532-1584	melhem@ksu.edu
<b>Mladenov, Natalie</b>	Assistant Professor	Fiedler 2122	785-532-0885	mladenov@ksu.edu
<b>Najjar, Yacoub</b>	Professor	Fiedler 2111	785-532-2468	ea4146@ksu.edu
<b>Peric, Dunja</b>	Associate Professor	Fiedler 2108	785-532-7612	peric@ksu.edu
<b>Peterman, Robert</b>	Professor	Fiedler 2113	785-532-7612	bob@ksu.edu
<b>Russell, Eugene</b>	Emeritus Professor	Fiedler 2133	785-532-1588	geno@ksu.edu
<b>Rasheed, Hayder</b>	Associate Professor	Fiedler 2126	785-532-1589	hayder@ksu.edu
<b>Riding, Kyle</b>	Assistant Professor	Fiedler 2107	785-532-1578	riding@ksu.edu
<b>Starrett, Steven</b>	Associate Professor	Fiedler 2132	785-532-1583	steveks@ksu.edu
<b>Steward, David</b>	Professor	Fiedler 2129	785-532-1585	steward@ksu.edu
<b>Stokes, Robert</b>	Professor	Fiedler 2123	785-532-1595	drbobb@ksu.edu

### General inquiries

Civil Engineering  
Kansas State University  
2118 Fiedler Hall  
Manhattan, KS 66506-5000  
785-532-5862  
ce.ksu.edu

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