SCHOOL OF Sustainable Engineering and the Built Environment

Charting a Smart and Sustainable Future

Annual Report
2018

Ira A. Fulton Schools of Engineering
Arizona State University

Dean Kyle Squires

Transcending the traditional

School of Sustainable Engineering and the Built Environment

School Interim Director Ram Pendyala

- Biofuels
- Waste conversion to energy
- Public health-technology-environment interactions
- Microorganism-human health connections
- Infrastructure and product lifecycle analysis
- Earth systems engineering
- Water purification
- Resource-climate interactions
- Indoor air quality
- Sustainable Construction
- Transportation Materials and Systems
- Project Performance
- Underground Infrastructure
- Construction Management

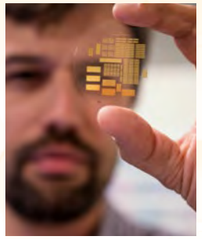
Focusing on the student experience and student success

School of Computing, Informatics, and Decision Systems Engineering

School Director Sandeep Gupta

- Personalized learning
- Educational gaming
- Energy-efficient data storage and computing
- Health informatics
- Haptic interfaces
- Assisting devices
- Health care system logistics
- Information assurance
- Production logistics
- Artificial intelligence
- Transportation

Inspiring future engineers



School Of Electrical, Computer and Energy Engineering

School Director Stephen M. Phillips

- Photovoltaics
- Power and energy systems
- Biosignatures discovery automation
- Wireless implantable devices
- Sensors and signal processing
- Flexible electronics
- Power grid management and stability
- Sensors and sensing

Pursuing use-inspired research

School for Engineering of Matter, Transport and Energy

School Director Lenore Dai

- Personalized learning
- Engineering education
- K-12 STEM
- Electrical energy storage
- Thermal energy storage and conversion
- Energy production separations
- Therapeutics and bioseparations
- Rehabilitation and robotics
- Adaptive and intelligent materials
- High-performance computing simulations
- Atmospheric processes

School of Biological and Health Systems Engineering

School Director Marco Santello

- Medical diagnostics
- Rehabilitation
- Neuroengineering
- Biomaterials and therapeutics delivery
- Synthetic and systems biology
- Healthcare technology

Attracting top faculty

Polytechnic Campus

School Director Ann McKenna

- Air Traffic Management
- Air Transportation Management
- Applied Science
- Environmental Resource Management
- Graphic Information Technology
- Industrial and Organizational Psychology
- Information Technology
- Manufacturing Engineering
- Professional Flight
- Technological Entrepreneurship and Management
- Aviation Management and Human Factors
- Environmental Technology Management
- Global Technology and Entrepreneurship
- Management of Technology
- Simulation, Modeling, and Applied Cognitive Science, Ph.D.

ASU Ira A. Fulton Schools of Engineering
Arizona State University

School of Sustainable Engineering and the Built Environment

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ssebe.engineering.asu.edu

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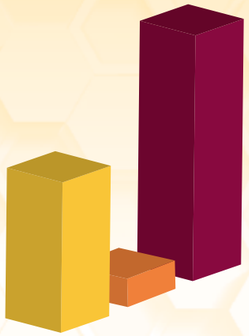
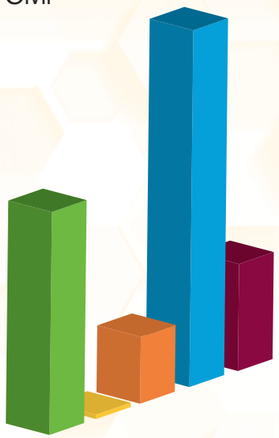


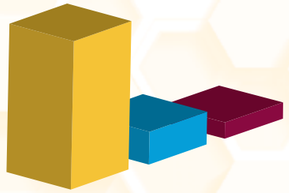
Undergraduate Degrees Conferred:

- **101** Construction
- **19** Construction Engineering
- **165** Civil

Graduate Degrees Conferred:



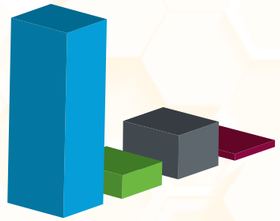
- **50** Construction Masters
- **1** Construction PhD
- **15** Construction Engineering Masters
- **80** Civil Masters
- **24** Civil PhD



Enrollment:

- **1322** Undergraduate
- **284** MS
- **136** PhD

Faculty



- **55** Tenured and Tenure-track Faculty
- **7** Full Time Lecturers
- **13** Research Faculty
- **2** Professor of Practice

SSEBE Research Expenditures:

$18,045,337

Total Scholarships and Fellowships Awarded 2018:

$239,268

National Academy of Engineering:

Edward Kavazanjian, Jr.
Bruce Rittmann

National Academy of Construction:

G. Edward Gibson, Jr.
William Badger (emeritus)

Canadian Academy of Engineering:

Samuel T. Ariaratnam

ASU Charter

ASU is a comprehensive public research university, measured not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves.

Mission

Demonstrate leadership in academic excellence and accessibility

Establish national standing in academic quality and impact of colleges and schools in every field

Establish ASU as a global center for interdisciplinary research, discovery and development by 2020

Enhance our local impact and social embeddedness

I am very pleased to share the 2018 Annual Report for the School of Sustainable Engineering and the Built Environment (SSEBE) at Arizona State University (ASU), the university ranked number one in innovation four years in a row by US News and World Report. As one of the six schools of the Ira A. Fulton Schools of Engineering, we have been making great strides in charting a smart and sustainable future for our planet, providing outstanding educational experiences for our students both inside and outside the classroom, and preparing a twenty-first century workforce that is ready to harness the power of technology to make the world a better place for all. I have had the privilege and honor of serving as Interim Director for SSEBE since July 1, 2018, and would like to acknowledge the outstanding leadership of our previous Director, Dr. G. Edward Gibson, Jr., who led the school from its infancy in 2010 to the dynamic enterprise that it is today. Under his leadership, the school experienced very significant growth in enrollment, research expenditures, and number of faculty; and realized the vision of a brand new building called College Avenue Commons (CAVC) that is a hub of project-based learning and university-industry-community partnerships.

The ASU Charter emphasizes the notions of Access and Inclusion in an effort to greatly expand opportunities for all segments of society to obtain a college education. In embracing this paradigm, SSEBE has committed itself to developing a diverse faculty, staff, and student body that is seeing much success. In 2018, we welcomed a number of outstanding new faculty members including Julian Tao, Kerry Hamilton, and Elham (Ellie) Fini. Our school is now home to nearly 1,750 students, about 425 of whom are graduate students, pursuing degree programs in Civil Engineering, Construction Engineering, Construction Management, and Environmental Engineering. The BS in Environmental Engineering program, launched in Fall 2017, has already achieved an enrollment of more than 100 students and is positioned to see continued steep growth in the years ahead. We have two online degree programs at the Master's level – one in Sustainable Engineering and another in Construction Management, with more to follow.

Our faculty are at the leading edge of innovation and discovery, pursuing research activities with an impact. Rosa Krajmalnik-Brown is pursuing cutting-edge research to understand gut-brain interactions and the role of gut bacteria in shaping symptoms associated with autism, helping advance treatments for those in the spectrum. Rolf Halden, Director of the Center for Environmental Health Engineering, whose work had previously led to a ban of harmful chemicals widely used in household soap products, is developing methods to measure extent of opioid use by studying sewage. Bruce Rittmann, Director of the Swette Center for Environmental Biotechnology, is a recipient of the 2018 Stockholm Water Prize, while Sam Ariaratnam, construction engineering program chair known worldwide for his work in trenchless construction and horizontal drilling, was recently inducted into the Canadian Academy of Engineering. Edward Kavazanjian, who leads the NSF Engineering Research Center for Bio-mediated and Bio-inspired Geotechnics, is leading a team to develop nature-inspired ecologically friendly and cost-effective infrastructure solutions. And the list goes on… please check out the feature stories in this annual report to learn more about a few of our innovative research activities.

We thank our many benefactors and partners who generously give to the school in support of its programs and students. We welcome opportunities to engage with you in our quest to improve the human condition, both locally and globally. With your support, and the great work of our exceptional faculty, staff, students, and leadership, I am confident that SSEBE will continue to thrive. Please get in touch or visit. We would love to connect!

Ram M. Pendyala, PhD
Professor and Interim Director,
School of Sustainable Engineering and the Built Environment

Civil, Environmental, and Sustainable Engineering

Keith D. Hjelmstad, Ph.D.
President's Professor
Civil, Environmental, and Sustainable Engineering Program Chair

As one of the largest civil engineering programs in the country we continue to be a national leader in the production of highly qualified civil engineers as we educate the people who will be responsible for the future of our built environment. The challenges of operating this large a program are many but the collaborations among our students, faculty, staff, and external partners is poetry in motion.

This past year we added an 'E' to our Friends of Civil *and Environmental* Engineering (FOCEE) to acknowledge the launch or our Environmental Engineering undergraduate program to recognize that many of our FOCEE firms straddle the line between civil and environmental engineering practice. The education committee of FOCEE has developed a menu of lectures by practicing engineers that faculty can draw on at any time to enhance the learning in their courses. We continue to appreciate the commitment of these industry leaders to our program.

This past year our faculty *Community of Practice for Teaching* completed its study of the book *Teaching and Learning STEM* by renowned engineering educators Richard Felder and Rebecca Brent. Many of the great ideas in that book are finding their way into our classrooms as we work toward making our learning environments more student centered. Our young faculty are particularly impressive in their eagerness to learn what is known about good teaching practices and their willingness to bring these ideas to fruition.

We get better every year, we do more every year, and we keep finding ways to bring significant impact to the world around us. I am confident that the coming year will be another great one!

Construction Engineering

Samuel T. Ariaratnam, Ph.D., P.E., P.Eng., F.ASCE, FCAE
Professor ▪ Construction Engineering Program Chair

Our program has had another successful year as we continue to send our graduates out into industry. Sparked by a strong construction industry sector, our senior undergraduate and a majority of our graduate students received excellent job offers once again this past year. Our rigorous curriculum and strong internship program are major reasons for this job success. Feedback from employers continues to be extremely positive as they cite the ability of our Construction Engineering graduates to understand both the design and construction aspects of the industry as being valuable to their core business. Furthermore, our graduates possess strong analytical and interpersonal skills that are vital for success in today's workplace.

We continue to attract the brightest and diverse students from all corners of the world. In particular, our Master's Degree program continues to see strong enrollment numbers. Additionally, many of our SSEBE undergraduate students are taking advantage of the 4+1 accelerated Master's program in Construction Engineering.

Our program continues to emphasize planning, design, and management for the construction of infrastructure including bridges, airports, pipelines, and other systems that are vital to our nation's economy. Training and graduating high-quality Construction Engineers is important as we strive to address domestic and global infrastructure needs to keep up with aging systems and rapidly increasing populations.

I promise that our program will continue to maintain a strong educational curriculum, work towards increasing enrollment to meet industry demands, and further cultivate fundraising efforts to support innovative program initiatives. The future is bright as the program continues to mature.

Environmental Engineering

Treavor H. Boyer, PhD
Associate Professor ▪ Environmental Engineering Program Chair

The Environmental Engineering (EVE) undergraduate program at Arizona State University is in its second year with approximately 100 students enrolled in the program. The EVE program offers a Bachelor of Science in Engineering (BSE) in Environmental Engineering and will seek ABET accreditation during the next ABET visit to the Fulton Schools of Engineering. The mission of the EVE program is to educate tomorrow's engineers to solve complex environmental problems and design systems at the human, urban, and planetary scale. The EVE program includes new courses that span introductory concepts, fundamental understanding, and engineering design, and also includes a new environmental engineering processes lab course and a required summer internship or research experience.

Highlights from the current 2018–2019 academic year include offering several new EVE courses including EVE 303 Environmental Engineering Fundamentals: Biological Processes, EVE 304 Environmental Engineering Processes Lab, and EVE 452 Fundamentals of Geoenvironmental Engineering. The EVE External Advisory Board met in November 2018, and reviewed and provided input on the required summer internship. The EVE program is fortunate to have an engaged External Advisory Board with members from national engineering consulting firms, city and state government, and industry. Finally, the EVE program was recently approved to offer a new Master of Science in Environmental Engineering. The next step is to develop the full program proposal for approval. I look forward to updating you on the progress and accomplishments of the EVE undergraduate and master's degree program in the coming years.

Graduate Program

Peter Fox, PhD, PE
Professor ▪ Graduate Program Chair

The School of Sustainable Engineering and the Built Environment graduate degree programs encompass Civil, Environmental and Sustainable Engineering (CESE), Construction Management (CON) and Construction Engineering (Con Eng) - CESE MS, CESE PhD, CON MS, CON PhD and Con Eng MSE.

The high quality of our research continues with our participation in 2 National Science Foundation Engineering Research Centers. Engineering Research Centers are the most prestigious grants awarded by the National Science Foundation. Our leadership and participation in these centers has gained us prestigious recognition from both other top universities and industries.

We continue to have more than 100 PhD students and our PhD student enrollment is growing as a consequence of our success at obtaining research centers and funding. We have continued to increase the number of enrolled under-represented groups and our goal to make our program more diverse and inclusive is being embraced by our faculty and research sponsors.

We are in the process of adding a graduate Environmental Engineering degree program to complement our growing undergraduate Environmental Engineering (EVE) degree program. Our goal to become a top 10 program in Environmental Engineering is close to fruition as our US News and World Report ranking jumped from 22 to 13 last year while the Civil Engineering program broke into the top 30. Our students are the key reason that we continue to improve and this year's group of graduate student applicants is the strongest I have seen. Former students should be proud of their accomplishments as they have helped build our graduate degree programs into their current successful state.

Del E. Webb School of Construction

Anthony J. Lamanna, PhD, PE, F.ACI, F.ASCE
Associate Professor ▪ Del E. Webb School of Construction Program Chair

The Del E. Webb School of Construction (DEWSC) programs are growing and evolving to meet the needs of our students and industry employers.

We have successfully switched to a learning outcomes based educational format, where we measure what the students have learned and can do, rather than what we teach. The data from the first year under this format pointed out some areas in which we can do better…and we have made changes based on that data.

The Del E. Webb School of Construction has successfully made the case to have our program reclassified as a STEM. This did not require any changes to the curriculum. This change allows our students' accomplishments to count as part of the STEM community at ASU, and provides additional training opportunities for our international students. It also opens the door to additional time and money for those students utilizing the GI Bill.

With direct support from our industry partners, our student teams did very well at the Associated Schools of Construction competition in Reno. We sent 10 teams for a total of almost 70 students to compete!

I want to thank you for all of your support in the past, and encourage you to continue that support to help the Del E. Webb School of Construction improve for our students. You can provide support by being a guest lecturer in the classroom, arranging a site visit for the students, donating funds for our various initiatives, or hiring one of our students as an intern. Assisting us in recruiting more students is extremely helpful, and outreach efforts throughout K-12 can help boost the number of students entering our construction programs. The more students we recruit, the more graduates entering the workforce.

New Faculty Join SSEBE

Yuqiang Bi

Assistant Research Professor
PhD, University of Michigan, Ann Arbor

Joined SSEBE in July 2018

Areas of Research: Water treatment, nanotechnology, environmental geochemistry, contaminant remediation, environmental sustainability

Elham (Ellie) Fini

Associate Professor
PhD, University of Illinois at Urbana-Champaign

Joined SSEBE in September 2018

Areas of Research: Sustainable construction including development of bio-inspired and bio-based materials mainly focusing on bio-adhesives and sealants for use in construction applications

Kerry Hamilton

Assistant Professor
PhD, Drexel University

Joined SSEBE in August 2018 (50% SSEBE/50% Biodesign Institute)

Areas of Research: Risk assessment, environmental microbiology, water quality

Richard Standage

Lecturer
MS, Arizona State University

Joined SSEBE in January 2018

Areas of Research: Licensed concrete and general contractor with 40 years of concrete experience specializing in residential and small commercial concrete projects with research interests in concrete construction methodology and curriculum development for adult learners

Junliang (Julian) Tao

Associate Professor
PhD, Case Western Reserve University

Joined SSEBE in August 2018

Areas of Research: Bioinspired burrowing mechanisms, bioinspired geosystems, smart and sustainable geosystems, soil behavior

Nariman Mahabadi Mahabad

Assistant Research Professor
PhD, Arizona State University

Joined SSEBE in July 2018

Areas of Research: Computational and experimental geomechanics, multiphase flow in porous, pore-network modeling and bio-inspired geosystems with applications in subsurface energy recovery, geotechnical engineering, hydrology, and geoenvironmental engineering

Biotech pioneers Bruce Rittmann and Mark van Loosdrecht win 2018 Stockholm Water Prize

By revolutionizing microbiological-based technologies in water and wastewater treatment, Professors **Bruce Rittmann** and **Mark van Loosdrecht** have demonstrated the possibilities to remove harmful contaminants from water, cut wastewater treatment costs, reduce energy consumption, and even recover chemicals and nutrients for recycling.

Their pioneering research and innovations have led to a new generation of energy-efficient water treatment processes that can effectively extract nutrients and other chemicals — both valuable and harmful — from wastewater.

It has also led to the pair named this year's laureates of the prestigious **Stockholm Water Prize**, given annually by the **Stockholm International Water Institute (SIWI)** to promote excellent water achievements and inspire future water-wise action.

Rittmann is a Regents' Professor in the School of Sustainable Engineering and the Built Environment and director of the Biodesign Swette Center for Environmental Biotechnology at the Biodesign Institute at Arizona State University. Van Loosdrecht is a professor in environmental biotechnology at Delft University of Technology in the Netherlands.

The Stockholm Water Prize is an annual global award founded in 1991. It is appointed by SIWI and the Royal Swedish Academy of Sciences and awarded by SIWI to an individual, organization or institution for outstanding water-related achievements. King Carl XVI Gustaf of Sweden is patron of the prize.

In its citation, the Stockholm Water Prize nominating committee recognized Rittmann and van Loosdrecht for "pioneering and leading the development of environmental biotechnology-based processes for water and wastewater treatment. They have revolutionized treatment of water for safe drinking, and refined purification of polluted water for release or reuse — all while minimizing the energy footprint."

The professors' research has led to new processes for wastewater treatment currently used around the globe.

Crown Princess Victoria of Sweden presented the prize to Rittmann and van Loosdrecht on behalf of H.M. King Carl XVI Gustaf of Sweden, at a royal award ceremony during World Water Week in Stockholm. Photo: Jonas Borg/SIWI

Photo courtesy of Shutterstock

ASU professor shares insights on future of engineering

Mikhail Chester

From the horseshoe-shaped, glass-bottomed skywalk hovering 4,700 feet above the Grand Canyon floor to the highest dam in the Western Hemisphere towering 726 feet above the Colorado River, engineering innovations are crucial to the world's advancement.

The **National Academy of Engineering's 24th annual U.S. Frontiers of Engineering Symposium** covered progressive developments in four areas: quantum computing, the role of engineering in the face of conflict and disaster, resilient and reliable infrastructure, and theranostics.

NAE's mission is to advance the well-being of the nation by promoting a vibrant engineering profession and marshaling the expertise and insights of eminent engineers to provide independent advice to the federal government on matters involving engineering and technology.

Mikhail Chester, an associate professor of civil, environmental and sustainable engineering in the School of Sustainable Engineering and the Built Environment, was selected to participate in the symposium.

Chester represents one of only four ASU faculty members selected to participate in this prestigious symposium over the past 15 years.

Chester's research aligns with the symposium's theme of resilient and reliable infrastructure, particularly related to climate-driven extreme events such as heat, precipitation and coastal or urban flooding. He studies how infrastructure might break and, more importantly, how engineers can build more resilient and reliable infrastructure so it doesn't break or fail in the onset of extreme events.

Chester serves as a co-leader of ASU's Urban Resilience to Extremes Sustainability Research Network, also known as UREx SRN. The research network includes 17 partner institutions in nine cities across North and South America. Supported by a $12 million grant from the National Science Foundation, UREx SRN aims to devise, analyze and support urban infrastructure in the face of climatic uncertainty and put cities on paths to sustainable futures.

"I think climate change represents one of the greatest challenges to humanity," said Chester. "It touches on every aspect of our lives so it's important for engineers to create solutions for a better future."

ASU geotechnical engineering expert Ed Kavazanjian (middle) earned the American Society of Civil Engineers' highest honor for his outstanding career achievements.

ASU geotechnical engineering expert recognized with top honor

Prominent Arizona State University geotechnical engineer **Edward Kavazanjian** has earned the highest honor bestowed by the American Society of Civil Engineers on its members for their outstanding career achievements.

Kavazanjian, a Regents' Professor in the Ira A. Fulton Schools of Engineering, was recently named one of 10 ASCE Distinguished Members in 2018. Currently, there are 229 Distinguished Members among ASCE's membership of more than 150,000 people. Only 697 civil engineers have ever been honored in the 166-year history of ASCE.

"It certainly is an honor — ASCE is the preeminent professional society in my chosen field," said Kavazanjian, the Ira A. Fulton Professor of Geotechnical Engineering. "It is gratifying to be recognized for both my technical contribution and the leadership roles I have played over the 45 years I have been a member of ASCE."

Kavazanjian is an international leader in the field of geotechnical engineering. He initially gained prominence for his work on landfill engineering and seismic design of civil infrastructure and lately has taken a lead role in development of the emerging sub-discipline of biogeotechnical engineering. Geotechnical engineers study the behavior of earth materials such as soil to assess risks and stability for construction and excavation. They also design and monitor structure foundations and earthworks.

Kavazanjian is director of the Engineering Research Center for Bio-Mediated and Bio-Inspired Geotechnics, or CBBG. The center, funded by the National Science Foundation, focuses on cost-effective and ecologically friendly solutions inspired by nature for developing and rehabilitating resilient and sustainable civil infrastructure systems. His role as director includes engaging young engineers in the center's work to strengthen the pipeline of professional geotechnical engineers. His charitable donations also advance his mission of supporting students and faculty in the field.

Five faculty named President's Professors


Keith Hjelmstad

Five Arizona State University faculty members have been named **President's Professors**, an honor that recognizes faculty who have made substantial contributions to undergraduate education. Among them is **Keith Hjelmstad, professor of structural engineering in the School of Sustainable Engineering and the Built Environment**.

The criteria for the President's Professor honor include mastery of subject matter; enthusiasm and innovation in the learning and teaching process; ability to engage students both within and outside of the classroom; ability to inspire independent, creative and original thinking; innovation in course and curriculum design; and scholarly contributions.

"Engaging students both within and outside the classroom, inspiring original thinking, finding new ways of teaching ideas — these are at the core of who we are as an institution," ASU President Michael M. Crow said. "And these newest President's Professors exemplify these qualities. They have had a profound impact on students, and through that, on our greater community. They are an example of the great things that can be done when innovative thinking meets passion for education."

Hjelmstad has been a catalyzing force within the Fulton Schools, as well as nationally, in engineering education and research. His ability to engage, challenge and excite undergraduate students with his innovative curricula and courses has had a profound impact. He has completely revamped the sophomore-level mechanics courses through an effort he calls "the Mechanics Project," an effort to create an innovative, highly engaged learning environment for the students. Not only is the quality of the impact great, the quantity of students taught is huge, too. One nominator said, "Because he engages the students in their sophomore year, the impact on our upper-division courses is noticeable. I think it is fair to say that Professor Hjelmstad has made an observable change in the academic culture of our undergraduate civil and construction engineering programs."

ASU cements status as a top construction program at 2018 Construction Research Congress


Mounir El Asmar (left) accepts the Best Paper award from Charles Berryman, construction management department chair at Louisiana State University. Photo courtesy of Louisiana State University

Associate Professor **Mounir El Asmar** and Professor **G. Edward Gibson Jr.** of the School of Sustainable Engineering and the Built Environment were co-authors along with doctoral student **Abdulrahman Yussef** and ASU alum **David Ramsey** on the paper "Front End Engineering Design (FEED) for Large Industrial Projects: FEED Maturity and Its Impact on Project Cost and Schedule Performance." Their paper was named **Best Paper at the Congress** out of 374 accepted articles.


G. Edward Gibson, Jr.

Front End Engineering Design refers to the amount of engineering that needs to be completed early in a project's lifecycle before authorizing the funding of a large industrial construction project. A mature FEED means you are accounting for all the major engineering elements that can cause issues down the road for that project.

LOOKING AHEAD TO 2020

In addition to the Best Paper award, the researchers were excited to learn that ASU had been selected to host the next biannual **Construction Research Congress in 2020**.

Samuel T. Ariaratnam inducted into the Canadian Academy of Engineering as Fellow


Samuel Ariaratnam (right) Photo: Canadian Academy of Engineering

Professor Samuel T. Ariaratnam was one of 57 new **Fellows** and two new International Fellows inducted into the **Canadian Academy of Engineering** on June 18.

The CAE is Canada's national institution where the country's distinguished and experienced engineers provide strategic advice on matters of critical importance to Canada.

Members are nominated and elected by their peers for distinguished achievements and career-long service to the engineering profession. Fellows commit to ensuring that Canada's engineering expertise is applied to the benefit of all Canadians. The organization is an independent, self-governing, nonprofit organization established in 1987.

Ariaratnam is an internationally renowned leader in horizontal directional drilling and trenchless engineering applications. The construction engineering program chair at the School of Sustainable Engineering and the Built Environment focuses his research and technology development in construction engineering and applications of underground trenchless techniques.

During his career, Ariaratnam has published more than 300 technical reports and papers, co-authored eight textbooks and holds four patents. His contributions have been recognized by many top organizations in his field, including the American Society of Civil Engineers, which awarded him the prestigious John O. Bickel Award and the Arthur M. Wellington Prize. He was also elected Fellow of the ASCE in 2015.


Narayanan Neithalath

Ultra High Performance Concrete Materials award

The **Best Paper Prize** sponsored by the Concrete Society Yorkshire and Humberside Region at the **Sixth International Conference on Durability of Concrete Structures, University of Leeds, UK** was awarded to **Professors Barzin Mobasher** and **Narayanan Neithalath** and **A. Arora, M. Aguayo, F. Kianmofrad** and **Y. Yao** for their paper entitled "Developing Ultra-High-Performance Concrete Mix Designs for Arizona Bridge Elements."


Barzin Mobasher


Kristen Parrish

Kristen Parrish, associate professor in SSEBE is the recipient of the **2018 Construction Industry Institute (CII)Outstanding Instructor Award**.

"Workflow Stabilization with Fine-grained Work Packaging and Near Real-time Progress Monitoring" an article written by **David Grau**, associate professor in the School of Sustainable Engineering and the Built Environment, and co-authored with PhD graduate **Amin Abbaszadegan** was selected by the **Lean Construction Institute (LCI)** Research Committee for inclusion in the **Practitioners Guide to Essential Lean Research**.


David Grau

Making sustainable strides in nanotechnology


Paul Westerhoff

The Sustainable Nanotechnology Organization honored ASU Regents' Professor **Paul Westerhoff** with its **annual award for significant research contributions** to the field, while Assistant Professor **Francois Perreault** won the **Emerging Investigator Award**.

Westerhoff, who is also the Fulton Schools' vice dean for research and innovation, was recognized for more than a decade of contributions to research aimed at advances in water treatment and improving water quality and safety through nanotechnology solutions.

His research has been supported by the U.S. Environmental Protection Agency, the National Science Foundation and the Department of Defense among other major funding groups and agencies.

Westerhoff was also selected as a new **IWA Fellow** by the **International Water Association** and selected by the Water Environment Federation (WEF) Board of Trustees as the **2018 recipient of the Fair Distinguished Engineering Education Medal**.

In work that has often involved collaborations with biologists, chemists and sociologists, Westerhoff has helped to make strides in understanding the potential effects of nanomaterials in water and explored the use of nanomaterial-based technologies for water reuse and treatment, including the removal of pollutants.

Perreault's Emerging Investigator Award recognizes researchers who within a decade of earning their doctoral degrees are making impacts in the field of sustainable nanotechnology that bring environmental, societal or economic benefits.

The award also notes Perreault's role in nanotechnology education, including teaching a graduate-level environmental nanotechnology course and conducting education outreach activities for high school students.


Research by Assistant Professor Francois Perreault (center) has had a significant impact on the use of nanomaterials in a variety of biological, chemical and environmental processes, including those related to water treatment. Photo courtesy of Kyle Doudrick/ Sustainable Nanotechnology Organization


Douglas Rice is pursuing a doctoral degree in the Civil, Environmental and Sustainable Engineering program

Douglas Rice, whose research is conducted under Perreault's guidance, entered one of the more than 40 research poster presentations — predominantly from students — in the conference poster competition. He was one of about 20 students to participate in the "Nano Pitch."

Rice won the first-place award for his presentation on research into biofouling, which is the growth of microorganisms that attach themselves to material surfaces — a common problem in water treatment.

NASA project receives Best Paper Award


Subramaniam (Subby) Rajan

Subramaniam (Subby) Rajan, professor in the School of Sustainable Engineering and the Built Environment and his graduate students successfully completed the research project ***Development and Implementation of an Orthotropic Plasticity Progressive Damage Model for Transient Dynamic/Impact Finite Element Analysis of Composite Structures*** **awarded by NASA under the Advanced Composites Project (ACP, 2015-2018).**

ACP goals include development and use of high fidelity and rigorous computational methods, improved test protocols, standardized inspection techniques, and manufacturing process simulation to shorten the timeline to bring innovative composite materials and structures to market.

Under the ACP program, NASA has worked with key players from Government (FAA and DoD), industry, and academia to mature and verify the methodology, to ensure effective transition to industry, and to assure safety through certification authorities such as the FAA with the goal of reducing the current 5-10 year development and certification timeline by 30%.

ASU was one of nine universities awarded a project. The research done at ASU has resulted in a computer model for composites programmed into a widely used commercial software, LS-DYNA that is used by leading aerospace, automotive and defense industries all over the world. In addition, ASU has developed new experimental techniques for characterization behavior of composites. Research publications in leading journals have resulted in a **best paper award by the *NASA Ceramic and Polymer Composites Branch and an honorable mention by ASCE Journal of Aerospace Engineering.***


(a) ASU model prediction showing damage and localized failure


(b) Tested composite panel


ASU computer model results for damage prediction of a composite panel impacted by a 50 gm aluminum projectile hitting the panel at 385 ft/s

Funding the Future: Maricopa County, ASU combat urban heat

The Maricopa County Industrial Development Authority (IDA) approved a grant to the ASU Foundation for research to help reduce urban heat and improve air quality. The three-year $2.99 million grant will help get the **Healthy Urban Environments (HUE) Initiative** at ASU off the ground. **Matthew Fraser**, a professor in the School of Sustainable Engineering and the Built Environment will co-direct the HUE Initiative with Charles Redman, founding director of the School of Sustainability and co-director of the HUE Initiative.


Matthew Fraser

Scholarships and Fellowships	Recipients
ACEC of Arizona Youth Scholarship	Ana Repta, Maxwell Nelson
AGC Construction ASU Student Scholarship	Randy Biersdorff, Franklin Lee, Jeffrey Hubler, Nicholas Baltazar
Amy and Kent Geiser Honorary Scholarship	Ayanna Harris
Andrew Hammeman Scholarship	Tanner White, Jesus Frausto, Jesus Godoy
Arizona Society of Civil Engineers (AzSCE) Scholarship	Jose Gamez Garcia
Bechtel Construction Scholarship	Raymundo Torres, Kyle Mathews
Ben C Griggs Memorial Scholarship	Corando Chavera, Liam Gorman
Betty Hum Graduate Assistantship	Monica Perrin, Anusree Saseendran
Briston Veteran Advancement Scholarship	Herbert Dudley
Carl L. and Jean Wolcott Meng Memorial Scholarship	Aidan Bjelland
Charles and Nancy O'Bannon Scholarship - Civil	Joel Ramirez
Charles and Nancy O'Bannon Scholarship for Construction	Sylvia Faszczewski
Construction in Indian Country Native American Scholarship	Kindell Davis, Shandiin Yessilth, Dzani Little, Uriel Duncan, Robyn Haskey, Calvin Price, Letia Secody
CRMA Joseph Quigley Memorial Scholarship	Ross Yalch, Cameron Clark
Daniel & Katherine Mardian Scholarship	Jessica Miranda Molina, Simran Johal, Jessica Salto
Dave Clifton Memorial & ASPE Chapter 6 Scholarship	Braden Harrison, Adam Bevier
Del E. Webb Finance & Accounting Scholarship	Jeffery Cathey, David Bittner
Del E. Webb Foundation Graduate Fellowship	Monica Perrin, Anusree Saseendran, Anna Thurston, Yutian Chen, Lucien El Asmar
Del E. Webb Foundation Women in Contruction Scholarship	Paige Wildin, Macy Canete, Cassidy Hunter
Del E. Webb Memorial Scholarship	Nicholas Akkerman, Thomas McCarthy, Joan Hannoona, Ryan Cooper
Del E. Webb School of Construction Scholarship	Brittany Wells, Jac Symmes, Ashley Colaizzi, Alan Albert, Patrick Gallagher, Julian Cervantes
Desert Star Construcion Excellence in Luxury Home Building Scholarship	Trevor Williams
DL Withers Construction Scholarship	Michael Prime, Maxwell Ruhnke
Dr. Matthew W. Witczak Endowed Fellowship	Hossein Noorvand
Dr. Matthew Witczak Scholarship	Joel Ramirez, William Selby
Dr. Sandra L. Weber Memorial Scholarship	Nathan Nulliner, Gianfranco Fazzino
Edward and Amelia Kavazanjian Endowed Fellowship	Juan Paez
Eric & Kristina Petrie Scholarship	Connor Elmasry
FNF Construction, Inc. Scholarship	Nathan Eldodt, Chris Ayala
Frank M. Chandler Memorial Scholarship	Chad Greco, Jacob Masica
James Fann Memorial Scholarship	Tanner Spohn, Jacob Dittbrenner

2018 Scholarships and Fellowships

Jan Bennett Endowed Scholarship	Giovanni Sanchez, Uriel Carranza
Jan Tuma Memorial Scholarship	Cole Maurer
Jason McElroy Memorial Scholarship	Robin Lifshitz
Jerry King Scholarship	Jay Nguyen
Jim Bebout Scholarship	Jonathan Lyle
John G. Colton Construction Study Fund	Alexander Terberg, Spencer Kolesar
L.C. Jacobson Graduate Fellowship	Steven Call, Anna Thurston, Yutian Chen, Lucien El Asmar, Anusree Saseendran
Martin H. Rosness Memorial Scholarship	Susan Cihelka
Marvin Sheldon Memorial Scholarship	Charles Cederstrom
Opus West Construction Corporation Undergraduate Scholarship	Jacob Canevett, Marisol Magana
Paragon Structural Design, Inc. Scholarship	Jose Gamez Garcia
PENTA Building Group	Stettler Anderson, Tyler Jacob
Phoenix/Scottsdale Groundwater Contamination Scholarship	Aide Robles
Pulte Home Corporation Scholarship	Keoni Kabza
R. Glen Schoeffler Scholarship	Valentino Nunez
Richard E. Mettler Residential	Anna Thurston
Robert H. Johnson Undergraduate Scholarship	Noah Martin, Jessica Miranda Molina, Simran Johal, Ryan Moody, Jeffrey Hardison
Robert J. Wheeler Memorial Scholarship	Sylvia Faszczewski, William Hannen, Joseph Debose, Margo Saucedo
Ron Pratte Scholarship	Adrian Guerena
Samuel F. Kitchell Undergraduate Leadership Award	Jesse Zwick, Hannah Patterson, Tanner Esparza
Stephen & Theresa Pisarcik Scholarship	Thomas Partin
Suntec Concrete Scholarship	Jonathan Lyle, Hannah Patterson, Tanner Esparza, Giovanni Sanchez
Team DSC Scholarship for Excellence in Craftsmanship	Fernando Escobar
The Ames Family Scholarship	Kaira Coburn
The Beavers Heavy Construction Scholarship	Marcus Henley, Allen Wells, Sean Godfrey, Samantha Miller, Jake Ellis
William A. Pulice Scholarship	Payton Schei

Congratulations to the above students on their achievement and a special thank you to the donors for their contributions. Total scholarships and fellowships were awarded in the amount of:

$239,268

Doctoral Graduates in 2018

Matthew Joseph Aguayo
Phase Change Materials in Infrastructural Concrete and Buildings: Material Design and Performance
Chair: Narayanan Neithalath

Mohammed Algahtany
Assessment and Development of Contractors Mitigation Practices Towards Risks out of Contractors Control in the Saudi Construction Industry
Chair: Kenneth Sullivan

Aashay Arora
Evaluation of the Performance of Multi-Component Cementitious Composites: Multi-Scale Experimental Characterization and Numerical Simulation
Chair: Narayanan Neithalath

Rebekah Burke
Early Design Decisions in Building Materials for Higher Performing Buildings
Chair: Kristen Parrish

Virginia Counts
Electronic Communications for Professionals: Challenges and Opportunities
Co-Chairs: Braden Allenby and Kristen Parrish

Erin Michelle Driver
Critical Assessment of Sampling and Monitoring Techniques for Environmental Remediation and Population Health Exposure
Chair: Rolf Halden

Daniel Eisenberg
How to Think about Resilient Infrastructure Systems
Co-Chair: Thomas Seager

Sepideh Hakim Elahi
Engineering a Proteoliposome Transporter to Capture Radioactive Cesium from Water
Chair: Otakuye Conroy-Ben

Adam Gushgari
Tracking Chemical Indicators of Public Health in the Urban Water Environment
Chair: Rolf Halden

Kristen Caroline Hurtado
An Andragogically-Centered Schema for a Heuristic Approach to Post-Collegiate Development in the Built Environment
Chair: Kenneth Sullivan

Ara Ko
On the Statistical and Scaling Properties of Observed and Simulated Soil Moisture
Chair: Giuseppe Mascaro

Heuidae Lee
Improving Activated Carbon Performance in Point of Use and Municipal Processes
Chair: Paul Westerhoff

Jiangtao Liu
Passenger-focused Scheduled Transportation Systems: From Increased Observability to Shared Mobility
Chair: Xuesong Zhou

Monirehalsadat Mahmoudi
Shared Mobility Optimization in Large Scale Transportation Networks: Methodology and Applications
Chair: Xuesong Zhou

Jose Medina Campillo
A Simplified Pavement Condition Assessment and its Integration to a Pavement Management System
Co-Chair: Kamil Kaloush

Pu Yang
Discrete element modelling of the mechanical response of cemented granular materials
Chair: Narayanan Neithalath

Michelle Nichole Young
Understanding the Mechanisms and Potential of Microbial Peroxide-Producing Cells (MPPCs)
Chair: Bruce Rittmann

SSEBE Outstanding Senior Award

Nicholas Akkerman
Sylvia Faszczewski
Raveena John
Ryan Maes
Jordan Seawright
Ryan Windish


Nicholas Akkerman


Courtney Burdett


Diana Gonzalez

SSEBE Leadership and Service Award

Courtney Burdett
Miranda Desimone
Sydney Doidge
Jose Gamez Garcia
Diana Gonzalez
Annika Hjelmstad
Noah Martin
Esai Ponce
Nathan Reisenauer
Tanner Schafersman
William Selby
Nicholas Smart


Raveena John

SSEBE 4.0 Awards

Ahmed Abunkheila
Nicholas Akkerman
Alissa Albrecht
Courtney Burdett
Sydney Doidge
Abdinur Hussein
Simran Johal
Raveena John
McKay Larsen
Cade Lortie
Noah Martin
Alexander McCoy
Ryan Normand
Esai Ponce
Jordan Seawright
Jordan Schlueter
Kristine Sorensen
Ryan Windish


Ryan Windish

Tempe Town Lake near the Arizona State University campus was the site of the concrete canoe contest, a signature event of the American Society of Civil Engineers Pacific Southwest Competition. Pictured are two ASU students steering their team's canoe, named "Bullet Bill." Photographer: Marco-Alexis Chaira/ASU

Civil engineering students compete and connect at ASCE Pacific Southwest Conference

For the first time in 15 years, one of the leading civil and environmental engineering student events came to Arizona State University April 12 to 14.

The annual American Society of Civil Engineers Pacific Southwest Conference competitions cohosted by ASU's **School of Sustainable Engineering and the Built Environment** and Northern Arizona University brought about 1,500 students from 18 universities in California, Hawaii, Nevada and Arizona to ASU's main campus.

Along with competition judges, students' family members and alumni of the universities, nearly 2,000 people gathered to cheer on teams in more than a dozen tests of engineering knowledge and skills over the course of the weekend.

"When I was a high school student I recall watching videos about the steel bridge competition and just being in awe with how team members built their bridges with such ease and great coordination. Never did I think that I would be a project manager for such a team one day," said team captain Jose Gamez. Pictured left to right: Bill Selby, Mohammad Alsmadi, Jose Gamez and Francisco Camou. Photographer: Erika Gronek/ASU

Building a legacy of construction excellence at major competition

First-place heavy/civil team: (left to right, back to front) Jacob Dittbrenner, Samuel Schlinger, Nathan Eldodt, coach Aaron Cohen, Brittany Wells, Tanner Schafersman, Jacob Ellis and Shay Snider. Photo courtesy of Associated Schools of Construction for Regions 6 and 7.

First-place mixed-use team: (left to right, back to front) Tylar Deveraux, Reed Peterson, Matthew Mavrosakis, Dominic Bergs, Alex Cahalan, Nichlaus Henry and Harrison Showe. Photo courtesy of Associated Schools of Construction for Regions 6 and 7.

Teams must perform under pressure to solve complicated challenges encountered by professionals in the construction industry. Their ability to organize, lead and manage the building process — from scheduling and planning to cost estimating and blueprint reading — plays an instrumental role in devising an accurate and feasible solution worthy of a first, second or third place trophy.

The Associated Schools of Construction Student Competition, commonly known as the Reno competition, is held annually in Nevada. More than 1,000 students from 49 universities competed in this year's event, one of the largest construction management competitions in the U.S.

Ten teams comprised of 68 construction management and engineering majors in the Fulton Schools' Del E. Webb School of Construction and the School of Sustainable Engineering and the Built Environment participated in the competition. Two teams placed first in the categories of heavy/civil and mixed-use construction while another team claimed third place in concrete solutions.

"The Reno competition is a culmination of the skills and abilities our students are learning," said **Aaron Cohen**, a construction management lecturer who has been coaching these teams since joining the Fulton Schools faculty in 2010. "When our students are successful at this event, it's a validation of our reputation as one of the premier schools for construction management in the country."

Aaron Cohen

Professor Studies Augmented- and Virtual-Reality to help Students think like Experts at Student Construction Competition in Reno

In order to create buildings that effectively meet the needs of their eventual occupants, industry professionals must apply both explicit knowledge (defined as knowledge that can be easily articulated or verbalized and is typically gained from books or manuals) and tacit knowledge (defined as knowledge that can only be gained through experience or the "know-how" of completing a task).

Traditionally, educators have focused on teaching explicit knowledge to their students, but with the need for more talented construction labor and management, there has been a push in recent years to foster more tacit knowledge among college graduates. This push has challenged educational researchers to create new approaches to enable students to develop construction-related tacit knowledge.

Augmented Reality (AR) and Virtual Reality (VR) may provide unique learning environments that can support this type of knowledge. Similar to the yellow first-down line on televised American football games, AR superimposes virtual graphical content on top of a user's view of the real world. Similar to video game environments, VR creates completely virtual environments for exploration.

Steven Ayer

In a building context, this means that users of AR can *physically* explore Building Information Modeling content, while users of VR can *virtually* navigate this model content. **Steven Ayer's** research aims to study the ways in which these two different modes of visualization enable different types of behavior among users. **Ayer is an assistant professor in the School of Sustainable Engineering and the Built Environment.**

During the **2018 Associated Schools of Construction (ASC) student competition** in Nevada, Ayer's research team conducted an initial study of these two visualization media.

This National Science Foundation-funded project involved Co-PI's Jeremi London (Virginia Tech) and Wei Wu (Fresno State), along with Master student Justin Hartless (pictured). The team developed a design review activity where participants were asked to explore full-scale models of tiny house designs in order to assess what changes would need to be made to the designs to support a building occupant in a wheelchair.

In VR, participants virtually navigated the space. In AR, participants physically navigated the space in a real wheelchair.

While VR and AR both offered some advantages, the physical exploration affordances of AR enabled student participants to more-closely demonstrate the types of decision-making behaviors demonstrated by practitioner experts. This research will offer initial evidence to help educators and practitioners to more-effectively develop learning environments that support tacit knowledge generation to prepare the construction management workforce of the future.

Evvan Morton won ASU's 2018 Martin Luther King Jr. Student Servant-Leadership Award. Her academic and service achievements have made her a National Science Foundation IGERT-SUN Fellow, a Walton Global Sustainability Studies Scholar and a recipient of and the Brown and Caldwell Women in Leadership Scholarship. Photographer: Charlie Leight/ASU.

It takes a village: acting locally, thinking globally

Evvan Morton has a clear-cut, big-picture career ambition. She wants to help bridge the gap between the worlds of engineering and science and the sphere of public policy on a global level.

As Morton sees it, bringing the goals and mindsets of those often-divergent camps into harmony is the only way definitive progress can be made against widespread looming threats to the planet's environment.

After earning a bachelor's degree, Morton did two stints as an intern at the National Renewable Energy Laboratory in Golden, Colorado. One of her assignments there was with the Strategic Energy Analysis Center researching the role of the United States in deployment of renewable energy technologies in developing countries. She performed a case study of a project to assist the Philippines in pursuing sustainability objectives.

Morton's most long-term hands-on project began in 2015, the summer after her first year in the **Civil, Environmental and Sustainable Engineering doctoral program** in Arizona State University's Ira A. Fulton Schools of Engineering.

She became part of a team of engineering teachers, researchers and students at the University of Virginia, the University of North Carolina at Charlotte and Clemson University working to introduce renewable energy technology and environmental protection practices to a remote rural village — Sittee River, population estimated at no more than 350 people — in the Central American country of Belize.

In July, the team returned to the village for a fourth straight summer for a month-long stay to continue training members of the community to participate in the project and "empowering them to take ownership of it," Morton says.

The mission is to establish a sustainable waste management system in Sittee River, which started with the team building an anaerobic digester for use by the village residents.

The digester consists of a large container in which food waste and other organic waste can be placed — including manure, which acts to balance the acidity level inside the container — to undergo a series of biological processes through which microorganisms break down biodegradable material in the absence of oxygen.

One of the end products of the process is biogas, which can be combusted to generate electricity and heat, or be processed into renewable natural gas and fuels. The team has designed its digester to provide gas that villagers can use to cook food.

"You can hook up gas from the digester to a stove. And the sludge left over from the anaerobic breakdown of the waste material can be used for fertilizer," Morton explains.

With the extra fertilizer, villagers can expand their farming and produce more vegetables to sell to support their local economy, she says.

The anaerobic digester is only one phase of the project. The digester enables villagers to refrain from their usual practice of burning waste materials in open fires, which puts harmful particulates in the air and produces the kind of greenhouse gas emissions that contribute to troublesome climate change.

"We want to make this the starting point for a broader waste management system that would include people in the village employed to pick up the waste to transport it to a landfill or some type of recycling center," Morton says. "There aren't many recycling resources and the closest landfill is an hour's drive away and most people don't have a car, so there are hurdles."

Despite the low-tech devices involved and the project's relatively small scale, it presents all the challenges of instituting sustainable energy systems and environmentally beneficial practices in larger regions of developing countries.

Project team members have had to find effective ways to communicate with, earn the trust of, educate and motivate people in a different culture.

They have had to build a working relationship with the village council and will try to help the community seek aid from Belize's government to support Sittee River's local sustainability efforts.

They also had to secure funding for the project, which they did through a competitive process for a grant from the Integrative Graduate Education and Research Traineeship: Solar Utilization Network, known as the IGERT-SUN program, a National Science Foundation doctoral student training program.

Four of the team's members, including Morton, have produced a research paper, "Sustainability Approach: Food Waste-to-Energy Solutions for Small Rural Developing Communities," published earlier this year in the International Journal of Environmental, Cultural, Economic, and Social Sustainability.

Shakira Hobbs and Evvan Morton pictured with children in the Sittee River community as they conduct a house-to-house census in the village. Morton and Hobbs also interviewed residents about their waste disposal practices as part of their efforts to introduce environmental health measures to the village. Photo courtesy of Evvan Morton and Shakira Hobbs

Revitalizing agriculture south of Baghdad with reclaimed water

Peter Fox

In 1990, Iraq had a vibrant agricultural economy that made it self-sufficient in food. Today, Iraq must rely on imports for 70% of its food supply. Neighboring countries have been reducing the water supplies to the Tigris and Euphrates Rivers which are the life blood of Iraq. Recently, Iraq had to ask Turkey to stop filling a reservoir to maintain flows as drought has compounded the water supply issues in Iraq.

Ahmed Aljanabi has been funded by the Iraqi Ministry of Higher Education to complete his PhD at Arizona State University. Aljanabi has been working on identifying new water resources for Baghdad under the supervision of **Professors Peter Fox and Larry Mays** in the School of Sustainable Engineering and the Built Environment.

Larry Mays

Using optimization models, Aljanabi has demonstrated that reusing water from the two main water resource recovery facilities in Baghdad for irrigation can revitalize agricultural lands south of Baghdad. Aljanabi plans to continue this work when he returns to Baghdad with a grant under the Partnerships for Enhanced Engagement in Research (PEER) Program and the U.S. Agency for International Development (USAID).

The project entitled "Developing Water Allocation Optimization Models for Iraq Using Different Sources of Water to be Allocated for Different Uses, Baghdad as a Case Study" was one of only 27 selected for funding from 467 proposals received. Mays and Fox will continue to advise Aljanabi to complete the goals of the research project which will host a set of workshops to assess the feasibility of using reclaimed water in the adjacent agricultural lands South of Baghdad. If successful, the benefits would include reviving an important economic activity in Iraq and reducing Iraq's reliance on imported food.

The project will also foster relationships between ASU and the University of Technology in Baghdad which will facilitate the administration of the grant.

Student chapters in the School of Sustainable Engineering and the Built Environment receive awards

The IFMA Student Chapter at SSEBE receiving the 2018 IFMA Student Chapter of the Year Award

- **Design-Build Institute of America (DBIA) advised by Dr. Mounir El Asmar: Nguyen Le** and **Lucien El Asmar** from the **Construction Management** program attended the Design-Build Institute of America (DBIA) Regional Conference in San Diego and received the **Design-Build Western-Pacific Regional Scholarship.**
- **Construction Management Association of America (CMAA) advised by Dr. Steven Ayer:** The CMAA Chapter at SSEBE received the **"Best Tour Safety Practices" award** from the Ira A. Fulton Schools of Engineering.
- **Sigma Lambda Chi – Honor Society for Construction Management (SLC) advised by Dr. Matthew Eicher:** The SLC Chapter at SSEBE received the **National Gold award** two years in a row for being SLC's Top Five Performing Chapters in the U.S.
- **International Facility Management Association (IFMA) advised by Dr. Kenneth Sullivan:** The IFMA Student Chapter at SSEBE received the **"Best Serving Graduate Students Organization" award** from the Ira A. Fulton Schools of Engineering.

Nguyen Le received the IFMA International Student of the Year award.

Namho Cho received KSEA-KUSCO Scholarship

Akshay Gundla, a PhD student in the School of Sustainable Engineering and the Built Environment, has been awarded the **Outstanding Mentor Award** in the amount of $500 from the **Graduate and Professional Student Association** at Arizona State University.

Gundla is also the recipient of the **Association of Modified Asphalt Producers (AMAP) 2018 Dr. David R. Jones IV Scholarships in the amount of $2,000.** His primary research interests are in the area of testing and evaluation of asphalt binders, with a special focus on non-linear viscoelasticity.

(Left to right) Associate professor Robert Wang, doctoral students Prathamesh Vartak and Nedo Askari and Associate Professor Kristen Parrish. Photographer: Marco-Alexis Chaira

Sub-zero sustainability

An ASU research team's energy-saving solution for frozen food storage could mean big costs savings

Kristen Parrish's work focuses on integrating energy efficiency methods into the design, construction and operational processes of buildings.

Robert Wang's expertise in thermal science includes the applications of thermoelectricity, thermal energy storage and phase change materials and processes.

With those combinations of skills, together they are a formidable force in the quest for well-preserved, quality ice cream.

Their know-how is especially valuable if you have very large facilities filled with vast quantities of food that must be kept frozen under precise technical specifications to maintain its optimal attributes as an edible.

Parrish, School of Sustainable Engineering and the Built Environment and Wang, SEMTE, associate professors in the Ira A. Fulton Schools of Engineering, are working on just such a project with Arizona's Salt River Project water and power utility and Viking Cold Solutions, the leading thermal energy storage provider to the low-temperature cold-storage market.

The companies and the ASU researchers are experimenting with Viking Cold Solutions novel thermal energy storage and cooling technology in the 10,400-square-foot ice cream freezer in the Bashas' Family of Stores grocery chain's 800,000 square-foot distribution center in Chandler, Arizona.

The ice cream freezer uses a good portion of the total power required to operate the entire facility that hums constantly with the running of refrigeration equipment and electrical systems.

"Annually, the facility requires the equivalent amount of energy needed to power almost 1,000 homes for a year," says Chico Hunter, SRP's research and development manager.

That includes providing the energy to keep the ice cream storage space at a constant minus 18 degrees Fahrenheit.

Parrish and Wang, along with Nexant, an industrial energy consulting and services company, are monitoring and measuring the performance of the system, which offers the advantage of a low-tech chemical and mechanical cooling technique.

The thermal energy system utilizes proprietary, food-safe phase change material formulas comprised of deionized water and inorganic salts held in individually sealed plastic cells. The cell modules are designed to be installed above the storage racks in the ice cream freezer.

As phase change material transitions from liquid to solid and from solid to liquid, the system absorbs or releases large amounts of energy while maintaining a stable temperature.

"Keeping a space cold is essentially a process of removing heat," Wang explains. In this system, as the phase change material encased in the plastic melts, "it absorbs the surrounding heat and keeps the freezer cold."

An important feature of the method is "it's a passive energy process," Wang adds. "No electricity is needed to drive the melting process of the phase change material."

The benefit SRP and Bashas' hope to reap from the project is not simply energy efficiency but also significant energy costs savings. The thermal energy process enables Bashas' to reduce the amount of time it has to run the facility's conventional electrical refrigeration system during more expensive peak load hours – that's between 2pm and 7pm each day when customer demand is highest for SRP and when the cost of power is up to three times as high as during nonpeak hours.

Bashas can now run the electrical refrigeration system mostly during nighttime hours when costs are lower.

Assistant Professor Giuseppe Mascaro's research focuses on statistical analysis of rain gauge data collected by the Flood Control District of Maricopa County for the past thirty years to better forecast extreme weather and build better infrastructure.
Photographer: Deanna Dent

Modeling the present to improve future predictions of extreme rain

Last year, three hurricanes brought record rain, intense flooding and widespread damage to Texas, Florida, Puerto Rico and the U.S. Virgin Islands. California floods led to the Oroville Dam crisis, where the main and emergency spillways eroded and resulted in extensive evacuations. And last summer, heavy rains led to a deadly flash flood that tore through a canyon near Payson, Arizona.

Extreme weather, including heavy rainfall, drought and excessive heat, threatens urban centers on an unprecedented scale. That's why **Giuseppe Mascaro**, an assistant professor of civil engineering in the School of Sustainable Engineering and the Built Environment, sought to characterize daily rainfall in the Phoenix metropolitan area and throughout Central Arizona using statistical models. His results are published in the Journal of Hydrology.

"Why do we want to characterize extremes?" asked Mascaro, "The recent occurrence of natural disasters triggered by heavy rainfall and the perception that this has been happening more frequently than usual require conducting this type of quantitative analysis to understand the current situation, compare it with the past and try to model the future."

Statistical models of extreme rainfall are crucial to support water, engineering and climate studies. Mascaro's models will inform efforts in flood prediction, water management and urban infrastructure design. Additionally, Mascaro's models will evaluate the ability of current climate models to reliably forecast heavy rainfall scenarios in the future.

Projections of several climate models suggest a warmer climate will impact the occurrence and intensity of rainfall extremes. Mascaro's investigation of rainfall extremes at the seasonal scale could be used as a diagnostic tool to assess the ability of climate models to simulate extreme events in the current climate and then decrease the uncertainty of future projections.

In addition to informing the climate sciences, Mascaro's results will have far-reaching impacts for research networks currently active at ASU, such as the Urban Resilience to Extremes Sustainability Research Network and the Decision Center for a Desert City.

The weather-related effects of climate change will affect the next phase of urban living.

Wanda Dalla Costa stands in front of a shade structure she built in Gila River Community as part of a dialogue with GRIC around traditional building, design and materials. Photo by Selina Martinez.

ASU professor, students work with residents on more efficient, culturally relevant housing

Family is the most important thing to people who live in the Gila River Indian Community, and the houses they live in should reflect that reality.

That was the key concept that members of the community told a group from Arizona State University. About 30 community members participated in an idea session with several graduate students and an architecture professor to design new housing that would be culturally relevant.

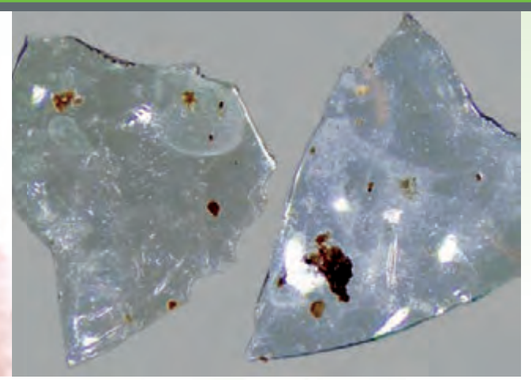
Wanda Dalla Costa, an architect and Institute Professor in the Herberger Institute for Design and the Arts and the **School of Sustainable Engineering and the Built Environment**, has been working with the Gila River Indian Community on the concept for about three years. She calls it "design sovereignty."

"They've been residents of the desert for thousands of years, and they've figured out how to live in the climate," said Dalla Costa, a member of the Saddle Lake First Nation in Alberta, Canada. Dalla Costa was the first First Nations woman to become a registered architect in Canada.

Last year, Dalla Costa met with several Gila River residents for the first time to talk about what their houses should look like. They produced about half a dozen designs, ranging from about 1,600 to 2,600 square feet.

The goal is to train Gila River residents to build the houses. Last spring, ASU architecture master's student Selina Martinez designed a traditional adobe shade structure, or "vatho," which was constructed by a team of Gila River builders, led by master builder Aaron Sabori.

Dalla Costa hopes to come up with about six final designs, with one or two selected to go into construction drawings. Then a prototype would be constructed within the next year.



Don't throw those contact lenses down the drain

ASU scientists report 1st nationwide study showing environmental costs of lenses

Every year, about 45 million Americans rely on contact lenses to see the world more clearly. This $2.7 billion U.S. market has made contact lenses more comfortable and disposable. Every day, these plastic lenses are tossed away by consumers in various ways, perhaps without much thought to their ultimate environmental fate.

Now, Arizona State University scientists are reporting the first nationwide study that shows consumers, by discarding used lenses down the drain, may be unknowingly contributing to plastic pollution.

The ASU research team presented their results at the 256th National Meeting and Exposition of the American Chemical Society (ACS), held in Boston from August 19–23.

The inspiration for this work first began from personal experience.

"I had worn glasses and contact lenses for most of my adult life," said **Rolf Halden**, director of the Biodesign Institute's Center for Environmental Health Engineering at ASU. "But I started to wonder, has anyone done research on what happens to these plastic lenses after their useful lifespan is over?"

Halden, Charles Rolsky and a third member of the team, **Varun Kelkar**, began to investigate.

His team had already been working on plastic pollution research, and it was a startling wake-up call when they couldn't find studies on what happens to contact lenses after use.

"Then we began looking into the U.S. market and conducted a survey of contact-lens wearers," said Rolsky, a PhD student who is presenting the work.

"We found that 15 to 20 percent of contact-lens wearers are flushing the lenses down the sink or toilet," he said. "This is a pretty large number, considering roughly 45 million people in the U.S. alone wear contact lenses, amounting to 1.8–3.36 billion lenses flushed per year, or about 20–23 metric tons of wastewater-borne plastics annually."

Lenses that are washed down the drain typically are conveyed to wastewater-treatment plants. The study showed that wastewater plants fragment them into microplastics, which accumulate in sewage sludge. For about every two pounds of wastewater sludge, a pair of contact lenses typically can be found.

Sewage sludge is an abundant material routinely applied on land for sludge disposal and soil conditioning, thereby creating a pathway of macro- and microplastics from lenses to enter terrestrial ecosystems where potential adverse impacts are poorly understood, Halden said.

Run-off from sludge-amended soils can pollute surface waters. Fragmented contact lenses also may pass through the wastewater-treatment plant to enter surface waters as microplastics contained in reclaimed water.

Aquatic organisms are known to mistake microplastics for food, introducing the indigestible plastics into long food chains. Some microplastics eventually can find their way into the human food supply, causing inadvertent uptake and unwanted human exposures to both the plastic polymer and a spectrum of environmental contaminants that tend to stick to the surface of plastics.

Analyzing what happens to contact lenses and lens fragments once emitted by wastewater-treatment plants has been a challenge for researchers. First, contact lenses are transparent, which makes them difficult to observe in the complicated milieu of a wastewater-treatment plant. Second, the unusual plastics used in contact lenses — a combination of poly(methylmethacrylate), silicones and fluoropolymers to create a soft material that allows oxygen to pass through the lens to the eye — are not routinely screened for environmental monitoring studies. Thus, pollution from contact lenses has avoided detection until now.

Charles Rolsky is a PhD student presenting the work at ACS. Photo courtesy of Todd Macmillan

TV documentary spotlights autism, microbiome research by ASU engineering and biodesign faculty

A recently broadcast multipart Korean television documentary that explores new treatments for people with autism and gastrointestinal problems includes reports on research led by three Arizona State University faculty members.

James Adams, Rosa Krajmalnik-Brown and **Dae-Wook Kang** collaborated on the research projects whose results are featured in the documentary.

Together they co-authored the study "Treating gastrointestinal disorders in children with autism using microbiota transplant therapy," which drew the attention of the producers of the science educational documentary for the Educational Broadcasting System, one of the major television networks in South Korea, similar to the Public Broadcasting System in the United States.

The research journal Microbiome published a paper about the therapy co-authored by Adams, Krajmalnik-Brown and Kang along with several colleagues.

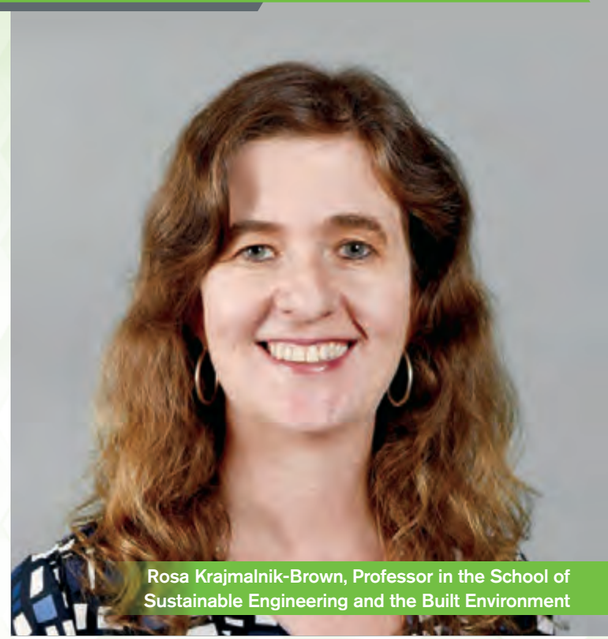
The World Health Organization estimates 1 in 160 children have autism spectrum disorder, which is characterized by some degree of impaired social behavior, communication and language. Symptoms begin in childhood and can persist through adolescence and adulthood.

Strikingly, many children and adults with autism have chronic gastrointestinal problems, and it was this aspect that the ASU team wanted to better understand. Adams found that the severity of these problems correlated with the severity of autism.

A follow-up study led by **Krajmalnik-Brown** and **Kang** and published in 2013 revealed that children with autism had about 25 percent fewer species of bacteria in their gut compared to healthy controls.

The lower diversity of gut bacteria is generally associated with worse gut problems. The team led a phase-one clinical trial of 18 children with autism, treating them with microbiota transplant therapy.

The therapy involves first using an antibiotic to kill pathogenic bacteria, then a bowel cleanse to remove remaining bacteria and the antibiotic, and then seven to eight weeks of full-spectrum microbiota, using gut bacteria from people without autism spectrum disorder.



Rosa Krajmalnik-Brown, Professor in the School of Sustainable Engineering and the Built Environment

By the end of treatment, there was an 80 percent reduction in symptoms of the gastrointestinal disorder and a 25 percent reduction in autism symptoms. The improvements remained when the researchers performed a follow-up exam eight weeks after treatment ended.

The Korean documentary, titled "Microbiome Human," focuses on the role of the microbiome in the human body, and a segment in Part 1 of the series features a young boy with autism who had experienced severe diarrhea since infancy. After the microbiota transplant therapy, his gastrointestinal problems ceased and his autism symptoms were significantly less prominent, according to both an autism evaluator and the boy's mother.

Adams is a President's Professor of materials science and engineering in ASU's Ira A. Fulton Schools of Engineering, and leader of the Autism/Asperger's Research Program at ASU. He teaches in the School of Materials Science and Engineering program in the Fulton Schools' School for Engineering of Matter, Transport and Energy.

Krajmalnik-Brown is a professor of environmental engineering who works in the **Biodesign Institute's Swette Center for Environmental Biotechnology and the Center for Fundamental and Applied Microbiomics.** She teaches in the School of Sustainable Engineering and the Built Environment.

Kang is an assistant research scientist in both the Swette Center for Environmental Biotechnology and the Center for Fundamental and Applied Microbiomics.

TOMNET University Transportation Center Takes a Deep Dive into the Future of Transportation

Researchers collect data to explore how people will use and adopt emerging transportation technologies, helping to shape smart cities of tomorrow.

There is a great generational divide in how emerging and transformative transportation technologies may be adopted and used in the years ahead. This is just one of the findings of a large multi-year research study being led by SSEBE researchers under the auspices of the TOMNET University Transportation Center (UTC) led by Arizona State University (ASU). The **Center for Teaching Old Models New Tricks (TOMNET)** is a $10 million Tier 1 UTC funded by the US Department of Transportation in 2016 and aims to derive deep behavioral insights on the many factors that affect people's mobility choices. TOMNET is developing and testing new transportation simulation models that can accurately forecast future travel demand in an era of emerging transportation technologies and shared mobility options.

As one of its signature projects, TOMNET is conducting a large-scale four-city survey to understand people's preferences and choices when it comes to transportation. The survey is intended to collect very detailed and in-depth data about people's mobility patterns, and attitudes towards emerging transportation options such as autonomous vehicles and ride-sharing services. TOMNET consortium members – Georgia Tech, University of Washington, and University of South Florida – as well as a sister University Transportation Center (called D-STOP) led by the University of Texas at Austin, are joining forces with ASU to collect data from a sample of 5,000 residents in the four metropolitan regions of Phoenix, Tampa, Austin, and Atlanta.

Sara Khoeini

In Fall 2018, the ASU team – led by TOMNET Assistant Director, **Sara Khoeini** – conducted a smaller scale pilot survey, with a respondent sample of 260 persons, to obtain an initial set of insights on mobility preferences, choices, and attitudes. The ASU team included TOMNET Associate Director, Dr. Deborah Salon, an Assistant Professor in the School of Geographical Sciences and Urban Planning, and SSEBE PhD student Denise Capasso da Silva.

Among the many key findings, the TOMNET team has discovered a great generational divide in the extent to which people embrace emerging transportation technologies. Among those 18-30 years of age, only 3.7 percent indicate that they are not familiar with ride-hailing services such as Uber and Lyft. But among those over 70 years of age, 25.5 percent indicate that they have never heard of such services. For all age groups above 40 years old, more than one-half of the individuals indicate that they are familiar with the service but do not use it. TOMNET Assistant Director, Khoeini, who is an Assistant Research Professor in SSEBE, noted that "Mere familiarity with a service does not necessarily mean that it will be used; there are a number of other factors that affect the extent to which individuals can and will embrace new mobility options. For example, it can be very inconvenient for a household with two workers and three children to use services such as Uber and Lyft, while those in the oldest age group may not be very comfortable with using technology and smartphone apps for hailing rides." While 37 percent of those 18-30 years of age indicated using ride-hailing services at least once a month, the corresponding percent for the older age groups is much smaller.

A similar pattern was discovered in the potential adoption of and willingness to ride in autonomous vehicles. Among those younger than 30 years of age, only 19 percent indicated that they would not ride in an AV alone or with others they know, while 65 percent said that they would. But among those over 70 years of age, 41 percent indicated that they would not ride in an AV, and a mere 34 percent indicated that they would be agreeable to riding in an AV. **Ram Pendyala**, TOMNET Director and Professor in SSEBE, said that the findings are not surprising. "We expect older individuals to be more cautious when it comes to using new and unproven technologies; they are unlikely to embrace automated vehicles after spending a lifetime getting used to human-driven vehicles. If autonomous vehicles are to greatly enhance mobility for seniors, we need older individuals to be willing, able, and interested to embrace emerging transportation technologies."

The study team plans to publish a number of white papers based on results from the Greater Phoenix pilot survey as well as the full-scale survey scheduled to take place in four cities in late spring 2019. For more details about the study and to access early results, please visit the study website or contact TOMNET Assistant Director, **Dr. Sara Khoeini**, at ***skhoeini@asu.edu***.

Workers from Arizona Pipeline leave a very small footprint after installing utilities in a local neighborhood. Photo courtesy of Samuel Ariaratnam.

ASU engineers break new ground with local governments

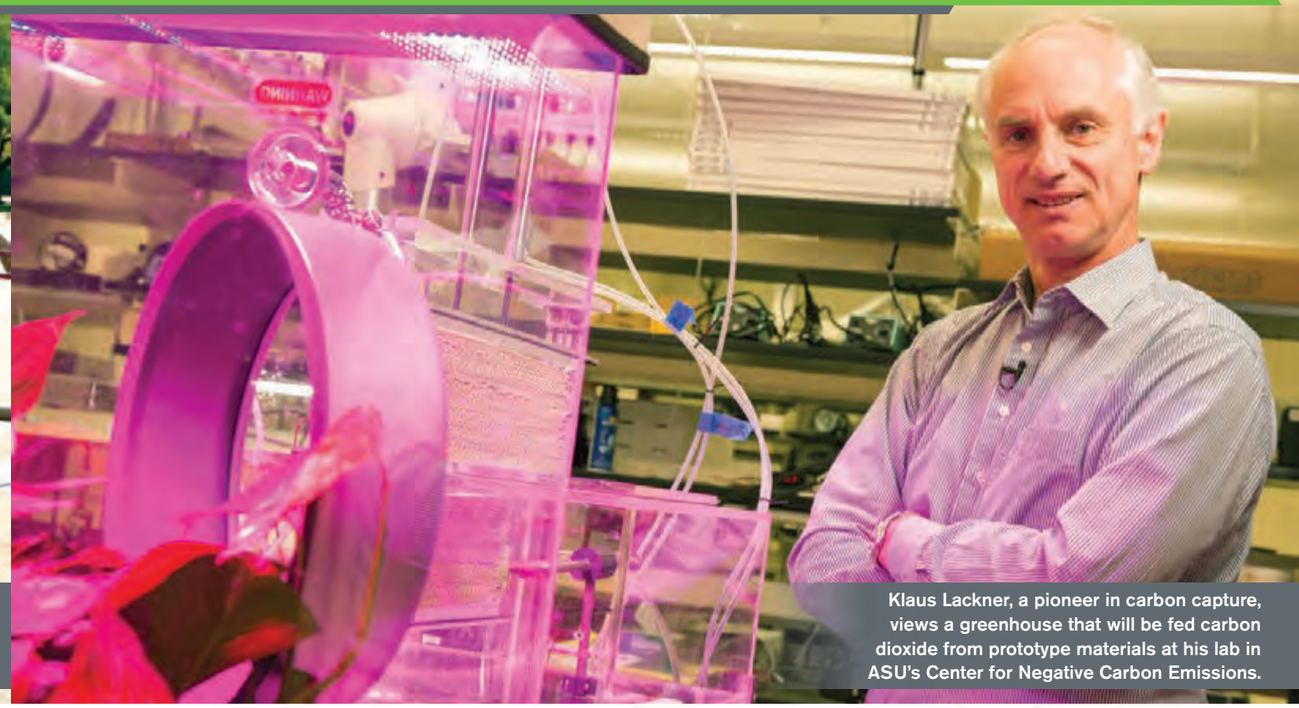
While you were at work today, it's possible that a new telecommunications conduit system was installed along the entire length of your neighborhood without leaving a trace — except possibly for a few paint marks above existing underground utilities and small pothole repairs needed in the street or sidewalk. "No streets were demolished, your driveway remained intact and the trees in your neighborhood playground were left unscathed," explains **Samuel Ariaratnam**, Ph.D., P.E. from ASU's School of Sustainable Engineering and the Built Environment (SSEBE).

According to Ariaratnam, pipes carrying utilities like telecommunications, electrical, water, gas and fuel are now installed using horizontal directional drilling (HDD), also known as trenchless or no-dig drilling, with nominal disruption to highways, streets, sidewalks, railways, riverbeds and ecologically sensitive areas.

"Instead of digging a trench, HDD contractors bore holes beneath the surface and pull those pipes through — not only leaving the landscape virtually unmarred, but also saving the costs of restoration," Ariaratnam says.

Although HDD technology has been around for about 40 years, "we're in the middle of a resurgence of the fiber optics revolution," says Ariaratnam. "In the next year or so, especially as new telecommunications technologies like Google Fiber come to the valley, it is possible we'll see 80 to 100 HDD rigs in the Phoenix area."

ASU Professor Samuel Ariaratnam (left) and Lecturer Aaron Cohen bring their ASU Pitchforks to a horizontal directional drilling industry event.



Klaus Lackner, a pioneer in carbon capture, views a greenhouse that will be fed carbon dioxide from prototype materials at his lab in ASU's Center for Negative Carbon Emissions.

Creating a carbon economy

Like throwing trash into the street, each year we pump tons of carbon dioxide into the atmosphere. The **Center for Negative Carbon Emissions** is developing technology poised to collect and reuse carbon while cleaning the air.

Klaus Lackner has been thinking about how to manage carbon since the 1990s. A physicist and environmental engineer and the director of the **Center for Negative Carbon Emissions**, Lackner has built a machine that pulls carbon from the air.

"There's no practical way to stop this in time," Lackner said, referring to the predicted global rise in temperature. "We have to take it back. We have to think about these technological fixes."

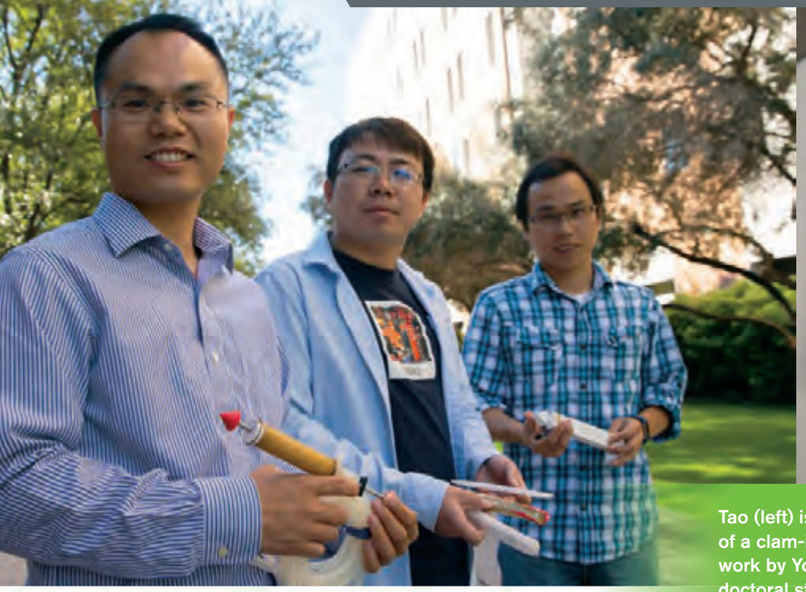
Lackner pointed out the planet is beyond being repaired by planting trees, for instance. The problem is simply too huge.

A financier, a businessman, a policy expert and the inventor of a carbon-capture machine discussed the opportunities and obstacles involved in turning waste into capital at "Hacking for Carbon: Building an Innovation Pipeline for the New Carbon Economy."

Pull carbon out of the air, make money from it and save the human race.

Speeding up that process and creating a large-scale economic sea change was the topic of a panel hosted by Arizona State University at the Barrett & O'Connor Center in Washington, D.C.

Their panel was part of a workshop, the goal of which was to consider how government, philanthropy and private capital can fund and de-risk a pipeline to create new technologies for the energy transition from hydrocarbons to renewable energy like solar and wind power.



Tao (left) is shown here with 3D-printed early prototypes of a clam-inspired burrower. He is being assisted in the work by Yong Tang (center) and Sichuan Huang (right), doctoral students in civil, environmental and sustainable engineering. Photographer: Erika Gronek/ASU

Research

Above: The illustration shows a schematic for specific applications of the underground wireless sensing networks being developed in the Signals in the Soil research project. Three applications of the networks enabled by self-boring sensor robots are precision agriculture, monitoring of soil contaminants and monitoring of infrastructure. The dashed lines indicate the traveling paths of the self-boring sensing nodes. Illustration courtesy of Junliang Tao

Burrowing sensor robots could unearth nature's subterranean secrets

Robots are increasingly at work on land, at sea, in the air and out in space. Three Arizona State University engineers are now setting the stage to deploy robotic mechanisms in what might be the toughest environment the technology will encounter: underground.

"We want to make robots effective tools in a place where there are so many things that could stop them from working," says **Junliang "Julian" Tao**, an associate professor of civil, environmental and sustainable engineering.

Tao has earned support from a National Science Foundation Early-Concept Grant for Exploratory Research Signals in the Soil award to develop "paradigm-shifting platform technology" for "self-boring robots" from which the next generation of underground wireless sensing networks can be launched.

Tao is teaming with Fulton Schools Assistant Professors Daniel Aukes and Hamidreza Marvi to devise approaches for modeling, designing, prototyping and defining the essential technological characteristics of such networks using bio-inspired robots.

The new grant enables the team to develop sensors that can be integrated into robots capable of deploying themselves autonomously, and boring underground with minimal disturbance to the soil and minimal operational intervention by humans on the surface. The robots will also be able to change locations and return to the surface for maintenance as needed.

The robots will operate in wide-area subterranean sensing networks that will be especially valuable for evaluating the conditions of soils at sites where building foundations, dams, levees, tunnels, roads, irrigation systems and other infrastructure are to be constructed.

The system will enable more precise agricultural practices, ground contaminant monitoring and other environmental health assessments. Other benefits of the system over current technologies would be more efficient below-ground geotechnical, biological and water studies and better predictive analysis of the vulnerability or resiliency of land to impacts from earthquakes or flooding.

"An active underground wireless sensing network like the one we are proposing is basically nonexistent," Tao says.

Wireless sensing networks without cumbersome wires and cables are gaining popularity for above-ground applications, Tao says, so developing these networks for underground applications is the next logical step to advance the technology.

Specifically, they want self-boring robots that can mimic what moles, worms, clams, plant roots and seeds do in excavating, digging and undulating their way into and through sand, silt, clay and the many other types of soils — and around the many subsurface obstacles.

Multiple challenges stand in the research team's way.

"It will take exceptionally flexible and robust robots," Aukes explains. "They will be confronted with solid materials, liquids and gases, all the things that can foul traditional robots."

Beyond refining the robotics and sensing technologies for such an undertaking, the project requires making robots capable of a range of burrowing techniques optimally suited to navigating in soil, Marvi says.

The team must also clear hurdles that have so far stalled significant advances in below-ground sensing networks, Tao says. Installation of current systems can require extensive excavations and keeping immobile buried sensors operating at peak efficiency is troublesome.

Soils can cause energy dissipation resulting in degradation of the electromagnetic waves sensors use to transmit information, Tao says. This causes unreliable communication between a network's sensing nodes.

With self-boring robotic sensing nodes, the researchers expect to overcome those drawbacks with sensors that deploy themselves autonomously, thus alleviating the need for excavation.

The sensor nodes can also change locations after being buried, providing a "dynamic" sensing network — in other words, a network able to cover large subterranean areas.

Tao points out that the sensors will be capable of surfacing from underground for service and recharging. Sensor nodes will also be able to move closer to each other to improve data transmission reliability.

The team will also formulate strategies for effective underground sensor signal transmission, the recharging of sensors, the actuation and control of the robots, and communication between all the network components.

The researchers are also tasked with developing a rapid prototyping method to systematically design and fabricate the robots that will be adaptable in underground environments.

The team will use 3D printing, materials science and soft robotics to find solutions using non-traditional materials, flexible elements and designs that enable navigation through granular mediums like soil and sand.

That wide-ranging array of objectives is why Tao says he wanted specific collaborators who would bring multiple areas of expertise to the endeavor.

The project will also provide hands-on experience and education for students. The NSF award provides $300,000 over two years, some of which will support the participation of two engineering doctoral students in the research. Tao, Aukes and Marvi foresee underground networks of bio-inspired, self-boring robotic sensors revealing more secrets of nature that will inspire further efforts to push the technology toward new possibilities.

Building today involves much more than the skilled craftsmanship on display at building sites, like that of ASU's Palo Verde Main residential hall shown under construction here. The industry's technological evolution has brought more advanced engineering techniques and more science-based approaches into the work performed before such projects get off the ground.

STEM designation is step up for construction management program

Excelling in construction management today requires knowledge of an extensively and rapidly expanding set of new tools.

Fundamental business skills — budgeting, scheduling, project planning, contracting, personnel supervision and the like — are still essential to effectively manage projects. But today's increasingly multifaceted construction industry demands a trove of more wide-ranging talents.

Students pursuing **construction management degrees** in Arizona State University's **Del E. Webb School of Construction** are exploring multiple branches of engineering, the scientific foundations of building methods and materials, and the intricate workings of advanced information, design and visualization technologies.

Acknowledging that multidisciplinary breadth and depth, the Office of the University Provost at ASU recently recognized the science, technology, engineering and math education that has been steadily integrated into the construction management program over the years by approving its reclassification from a business management program to a STEM program — formally a Construction Engineering Technology/Technician classification.

The recognition isn't simply to reinforce the academic credentials of the program that's accredited by the American Council for Construction Education. More than anything, the STEM designation will benefit students in significant ways, says **Associate Professor Anthony Lamanna, chair of the undergraduate construction management program.**

The STEM connection "carries more weight than ever" in the construction industry and the job market in general, says **Lamanna,** the **Sundt Professor of Alternative Delivery Methods and Sustainable Development in the School of Sustainable Engineering and the Built Environment.** A degree in a STEM field tells prospective employers those graduates have the training and experience "to fit into a work environment that is technologically advanced, where the tech people are no longer just support staff but are equipped to be among the leaders of companies," Lamanna says.

ASU's construction management students are now schooled in a variety of information and visualization technologies to aid design and planning, as well as high-tech tools used in the field for site analysis to guide building strategies. Here ASU students use a device to help identify sections of a bridge that need to be rebuilt or reinforced.

Anthony Lamanna

Beyond giving graduates the range of expertise to qualify them for higher-level positions, the certified STEM program can offer some extra advantages to at least two groups of students: U.S. military veterans and international students striving to establish careers in the United States.

Students who are on active military duty, reserve duty or who are civilian veterans are eligible for more financial support and more time to complete college studies when they are enrolled in STEM degree programs than in other programs.

That's an especially big boost for those in the military who are transitioning into civilian life and seeking the education to launch careers, says Mike Gonzalez, the Southwest Region Director of McCarthy Building Companies, a major U.S. construction contractor. In 2018, the company's Southwest Region operations provided 28 internships and hired 30 full-time construction management graduates from STEM programs.

"The STEM factor is also likely to be a big draw for students from other countries," says James Murphy, president and CEO of Phoenix-based Willmeng Construction and a 1998 graduate of the construction management program.

The ASU construction management degree will now give international students **three years — rather than one** — after graduation to secure a job in the United States, which will make it easier to establish permanent residency status in the U.S. and to later pursue citizenship.

Students also benefit from industry partners that support the school by sponsoring training programs, guest lecturing in classes, providing internships and hiring graduates of the program.

A STEM designation's value also includes elevating perceptions of both construction education and the construction industry.

Online graduate programs

Advancing construction education through real-world projects

Selecting the lowest bidder isn't always going to be the best option when it comes to construction, though it was how business was run for decades. Considering the experience, reputation and safety records of potential builders — the methodology of alternative delivery — can lead to a better end product and satisfaction.

Understanding the ins and outs of alternative delivery and other construction management practices are necessary to staying relevant in today's construction industry, and among the major tenets stressed in construction management.

Arizona State University's **online master's program in construction management** helps bring industry professionals up to speed on the principles needed to efficiently and effectively build tomorrow's infrastructure today.

"In recent years, the construction industry has been observing a major paradigm shift to adopt new and emerging technologies that drastically improve performance," says **Steven Ayer**, assistant professor in the School of Sustainable Engineering and the Built Environment. The School of Sustainable Engineering and the Built Environment offers an **online Master of Science in construction management** through its Del E. Webb School of Construction for individuals seeking opportunity in upper management. The construction management program has more than 50 years of history at ASU, with established ties to industry, alumni, internship opportunities and professional organizations to help students get ahead.

Many of our students are coming to us for master's degrees because they are discovering they need them to progress further in their careers," says **Tony Lamanna**, construction management program chair.

The ASU online master's degree in construction management courses are taught by faculty members who have previously worked in industry or for government, such as **Wylie Bearup**, and are research leaders in their fields, like **Mounir El Asmar**. El Asmar is an associate professor and co-directs the National Center of Excellence on SMART Innovations.

"Diverse faculty with diverse sets of expertise allow students to select courses based on their own interests, job requirements or career outlook," says El Asmar, who teaches in both the construction management and sustainable engineering online master's degree programs.

Students also learn how emerging and cross-disciplinary technologies can be applied to the field of construction, gaining valuable perspectives from ASU faculty while studying from anywhere in the world.

While earning their degrees, online construction management students also have the option to choose a three-credit independent project where faculty mentors guide them to apply what they've learned to solve a particular problem they are passionate about — all on their own schedules and timelines. It's one of the many advantages of the online program.

What differentiates ASU's construction management program from others is its hands-on approach to education, with students working together with both faculty and industry leaders to explore actual challenges and real-time problems within the industry.

"Graduates from our best-in-class program will have enhanced management and technology skills, including those necessary for being successful in sustainable construction, technology in the built environment and innovative project delivery methods," says **Kenneth Sullivan**, associate professor of construction management.

Learning how to utilize these methods as the construction industry transitions to focus on sustainability and alternative delivery — any method of building that isn't the traditional design-bid-build approach — will result in higher quality infrastructure.

Construction managers have a large impact on people's daily lives and thus a responsibility to think and build sustainably — one of many aspects of the online master's degree in construction.

Mastering a sustainable future for the built environment

The goal of sustainable engineering is to enable long-lasting improvement of the human condition. It transcends traditional engineering education by integrating considerations of complex social, environmental, political and economic factors into engineering theory and practice in order to achieve more economically, technically, environmentally, institutionally and socially efficient and robust solutions.

The School of Sustainable Engineering and the Built Environment now offers a multidisciplinary professional **online Master of Science degree in sustainable engineering.**

The degree is ideal for professionals and graduate level students with engineering and physical science backgrounds who wish to advance their careers or move toward incorporating sustainable engineering solutions and practices.

Courses in the degree program cover a range of topics, including areas such as earth systems engineering, industrial ecology, design for sustainability, life cycle assessment, environmental technologies, energy systems and conservation, green construction practices, water systems, transportation systems and sustainable technology systems.

Approved in 2014, the degree program is one of the newest in the Fulton Schools with its first student graduating from the program in fall 2018.

"A degree in sustainable engineering helps educate practitioners on how to solve problems, not just create cookie-cutter designs," says **ASU President's Professor Brad Allenby**, who authored the first textbook in sustainable engineering and teaches courses in the online program, "and thus makes them more useful as professionals, and more employable."

As sustainability is far more than only engineering environmentally friendly building materials and energy sources, a cross-disciplinary approach is key to an effective education, Allenby says. Students of this program are exposed to sustainable engineering case studies that include the redesign of the Panama Canal, mining in Indonesia, making meat in factories instead of growing chickens and cattle and even the weaponization of information systems in American politics — which affects the viability and sustainability of democratic and pluralistic political systems.

"Emerging technologies pose unique ethical and institutional questions across all fields of engineering," Allenby notes, "and the world needs professionals with the capability to provide sophisticated responses to such challenges."

A particular strength of the sustainable engineering online master's program is that it offers students resources beyond the Fulton Schools, such as classes and opportunities for research in the School of Sustainability and research initiatives such as Healthy Urban Environment.

From sustainable engineering issues affecting ASU's hometown to infrastructure and process challenges around the world, learning the latest strategies in sustainable engineering can help create a positive future for humanity.

5 women engineers diversifying the industry

Each year during **National Engineers Week**, the National Society of Professional Engineers designates an "Introduce a Girl to Engineering Day."

Terracon, an employee-owned consulting engineering firm that provides environmental, facilities, geotechnical and materials services, is an industry leader in diversity and inclusiveness. Based in Olathe, Kansas, the company's Tempe office employs five female engineers, **three of them ASU alumni**, each bringing an expertise to its many service lines.

Terracon's women engineers are (left to right) Marissa Raleigh, Jennifer Tran, Laura Spencer, Brittany Dalton and Kendra Clouse.

Terracon's women engineers:

Jennifer Tran, PE, MBS, *Senior Project Manager*, Geotechnical Services

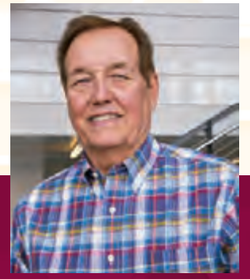
Laura Spencer, PhD, PE, *Group Manager*, Geotechnical Services

Brittany Dalton, *Staff Professional*, Geotechnical Services graduated from ASU six years ago.

Kendra Clouse, *Dispatcher, Tech Level 3,* Materials Services graduated from ASU with a degree in construction management with a concentration in concrete industry management

Marissa Raleigh, *Assistant Project Manager*, Materials Services earned a civil engineering degree from ASU.

Gone tutoring: Retired engineer helps students reel in success



Arizona State University structural engineering alumnus **John P. Nerison, PE**, volunteers his free time by tutoring students from across the country online. He wants to give back to the engineering profession and community by helping more students thrive in their engineering education. Photographer: Jessica Hochreiter/ASU

Monireh Mahmoudi, former doctoral student in the School of Sustainable Engineering and the Built Environment (SSEBE), began her career as a tenure-track assistant professor in the School of Packaging, College of Agriculture and Natural Resources, at Michigan State University (MSU) in August 2018. Mahmoudi received her PhD in Transportation Engineering under the supervision of **Dr. Xuesong Zhou** in May 2018.

During her PhD program Mahmoudi was the recipient/finalist of several research awards including the **2016 IBM Service Science student paper award, 2016 Women in OR/MS Monsanto award, 2016 Institute of Transportation Engineers (Western District) best paper award, 2016 National Conference on Rural Public and Intercity Bus Transportation best paper award,** and **2015 ITS Arizona best graduate student paper award.**

Fred Bueler III, *Project director*, Chasse Building Team, earned his bachelor degree in civil engineering from ASU and has been in the building industry for 13 years, 10 with Chasse. Projects completed under Bueler's leadership include the full campus re-build of Frank Elementary School in Tempe; the development of shopping center Edison Point in Maricopa and redevelopment of Town & Country Shopping Center in Phoenix. (Steve Burks, AZBigMedia)

Honoring outstanding contributors to construction and civil engineering

In March 2018, the School of Sustainable Engineering and the Built Environment hosted their annual **Academy of Distinguished Alumni and Hall of Fame awards ceremony and dinner.**

The Academy of Distinguished Alumni honors a select group of SSEBE alumni who have had stellar careers and given back to the programs within the school.

Established in 1990, the Hall of Fame recognizes individuals who are not alumni but have contributed to the advancement of the School of Sustainable Engineering and the Built Environment, its educational and research mission and its preparation of the industry's workforce.

2018 Hall of Fame

Bo Calbert served as president of McCarthy Building Companies – Southwest Division from 2000 to his retirement in 2016, concluding 35 years with the company. His commitment to the Block 12 Building fundraising campaign was instrumental in helping construct the College Avenue Commons building.

Charles E. O'Bannon (posthumous) retired from ASU in 1997 after 33 years as a professor, including seven years serving as chair of civil engineering. During his tenure, he established a legacy of inspiring hundreds of leaders in civil engineering and construction. His daughters Carey O'Bannon Kyler and D'Ann O'Bannon Clewis accepted the honor posthumously on behalf of their father.

George J. "Jim" Geiser | LeRoy C. Hanneman Jr. | Geza E. Kmetty | Debra Larson | Valerie S. Roberts | Michael D. Roy

2018 Academy of Distinguished Alumni

This year's awardees include:

- **George J. "Jim" Geiser, PE** ('77 BS, Civil Engineering) retired USMC and retired principal of Prelude Engineering
- **LeRoy C. Hanneman Jr.** ('69 BS, Construction) former president, chief operating and executive officer of Del Webb Corporation
- **Geza E. Kmetty, PE** ('65 BS, Civil Engineering) Principal in Charge, Kmetty Consulting.
- **Debra Larson, PE** ('94 PhD, Civil Engineering) provost and vice president for academic affairs at California State University, Chico
- **Valerie S. Roberts** ('87 BS, Construction) senior vice president of Global Field Services at Jacobs Engineering
- **Michael D. Roy** ('79 BS, Construction – Office Operations) executive vice president of Bragg Companies, Inc.

Morteza Abbaszadegan

Professor

PhD, University of Arizona

Expertise: Health-related water microbiology, microbial detection, pathogens inactivation and removal technologies

Braden Allenby

President's Professor

PhD, Rutgers University

Expertise: Industrial ecology, sustainable engineering, emerging technologies, weaponized narrative

Absar Alum

Assistant Research Professor

PhD, University of Arizona

Expertise: Environmental microbiology, environmental toxicology, rapid detection methods/biosensor, control of microbial contaminants, fate and transport of pathogens

Samuel Ariaratnam

Professor and Construction Engineering Program Chair

PhD, University of Illinois at Urbana-Champaign

Expertise: Underground infrastructure management & rehabilitation, trenchless construction methods, urban utility systems

Efthalia Chatziefstratiou

Lecturer

PhD, The Ohio State University

Expertise: Engaged student learning/active learning, structural engineering, environmental sciences

Mikhail Chester

Associate Professor & Director, Metis Center for Infrastructure and Sustainable Engineering

PhD, University of California, Berkeley

Expertise: Sustainable and resilient infrastructure; climate adaptation; life-cycle assessment

Oswald Chong

Associate Professor

PhD, University of Texas at Austin

Expertise: Energy modeling and degradation, information technology and systems, project management systems, heavy infrastructure systems

Aaron Cohen

Lecturer

MS, DePaul University

Expertise: Heavy/civil concentration for the DEWSC construction management degree program

Steven Ayer

Assistant Professor

PhD, The Pennsylvania State University

Expertise: Building information modeling (bim); mixed- and virtual-reality for education

❖**SSEBE Teaching Award**

Wylie Bearup

Professor of Practice & Beavers-Ames Heavy Civil Engineering Chair

PhD, University of Illinois

Expertise: Public owner construction processes, public finance, alternate project delivery methods

Yuqiang Bi

Assistant Research Professor

PhD, University of Michigan, Ann Arbor

Expertise: Water treatment, nanotechnology, environmental geochemistry, containment remediation, environmental sustainability

Treavor Boyer

Associate Professor and Environmental Engineering Program Chair

PhD, University of North Carolina at Chapel Hill

Expertise: Physical-chemical processes applied to drinking water and wastewater treatment

Otakuye Conroy-Ben

Assistant Professor

PhD, University of Arizona

Expertise: Metal/multidrug efflux in bacteria, endocrine disruption bioassays, organic micropollutants

Paul Dahlen

Assistant Research Professor

PhD, Arizona State University

Expertise: Petroleum/ chlorinated hydrocarbon contaminant fate and transport in the environment

Wanda Dalla Costa

Associate Professor

MArch, University of Calgary, MDR, Southern California Institute of Architecture

Expertise: Indigenous architecture, planning and placekeeping; community engagement; sustainable design

Anca Delgado

Assistant Professor

PhD, Arizona State University

Expertise: Soil microbial processes, bioremediation, microbial kinetics, bioreactors, analytical chemistry

❖**Graduate College Outstanding Faculty Mentor for 2018**

Thomas Dempster

Associate Research Professor

PhD, Arizona State University

Expertise: Phycology; algal taxonomy and physiology; large scale cultivation of microalgae for biofuels and high value products

Celina Dozier

Lecturer

PhD, The University of Texas at Austin

Expertise: Computer methods, fluid mechanics, environmental sampling and analysis lab

❖ **New faculty**

Mounir El Asmar

Associate Professor

PhD, University of Wisconsin-Madison

Expertise: Construction, innovative project delivery methods, performance, decision making, sustainable construction

❖ **2018 Fulton Exemplar Faculty**

James Ernzen

Associate Professor

PhD, University of Texas at Austin

Expertise: Concrete materials and concrete construction operations; project delivery methods

Margaret Garcia

Assistant Professor

PhD, Tufts University

Expertise: Water system sustainability and resilience, systems analysis, socio-technical systems

Sergio Garcia-Segura

Assistant Research Professor

PhD, University of Barcelona, Spain

Expertise: Development of electrochemical and photoelectrochemical water treatment technologies

G. Edward Gibson, Jr.

Professor and Sunstate Chair

PhD, Auburn University

Expertise: Front end planning, risk management, engineering education, dispute resolution

❖ **SSEBE Service Award**

David Grau

Assistant Professor

PhD, The University of Texas at Austin

Expertise: Lean construction, systems engineering, sensing and information technologies, project controls

Elham (Ellie) Fini

Associate Professor

PhD, University of Illinois at Urbana-Champaign

Expertise: Sustainable construction including development of bio-inspired and bio-based materials mainly focusing on bio-adhesives and sealants

❖ **New faculty**

Peter Fox

Professor and Graduate Chair

PhD, University of Illinois at Urbana-Champaign

Expertise: Water reuse, biological treatment processes and brine disposal/ desalination

Andrew Fraser

Assistant Research Professor

PhD, Arizona State University

Expertise: Climate change mitigation and infrastructure adaptations to foster system resilience

Matthew Fraser

Professor

PhD, Caltech

Expertise: Urban air quality, environmental impacts of energy production

❖ **Top 5% Teaching Award**

Yuanming Guo

Assistant Research Professor

PhD, Arizona State University

Expertise: Health risk assessment, subsurface contaminant fate and transport, soil/groundwater remediation

Rolf Halden

Professor & Director, Biodesign Center for Environ. Health Eng.

PhD, University of Minnesota

Expertise: Urban water cycle, public health engineering, sustainable cities, green chemistry & green engineering, wastewater epidemiology, exposure assessment

Nasser Hamdan

Assistant Research Professor

PhD, Arizona State University

Expertise: Biogeotechnics, biogeochemistry, geomicrobial processes, soil treatment and stabilization

Kerry Hamilton

Assistant Professor

PhD, Drexel University

Expertise: Risk assessment, environmental microbiology, water quality

❖ **New faculty**

Faculty

Keith Hjelmstad

President's Professor and CESE Program Chair

PhD, University of California, Berkeley

Expertise: Structural engineering, computational mechanics, engineering education

Christian Hoover

Assistant Professor

PhD, Northwestern University

Expertise: Fracture and multi scale experimental mechanics of porous materials

Sandra Houston

Professor

PhD, University of California, Berkeley

Expertise: Geotechnical engineering, unsaturated soils, expansive and collapsible soils, arid region soils

Kristen Hurtado

Assistant Research Professor

MS, Arizona State University

Expertise: Project management and planning, organizational change, sourcing, and professional training

Rosa Krajmalnik-Brown

Professor

PhD, Georgia Institute of Technology

Expertise: Microbial ecology management for bioremediation, bioenergy, and human health

Joseph Kunkel

Visiting Eminent Scholar

MA, University of Maryland, College Park

Expertise: Architectural design in indigenous cultures

Klaus Lackner

Professor & Director, Center for Negative Carbon Emissions

PhD, Heidelberg University, Germany

Expertise: Carbon sequestration, carbon footprinting, innovative energy and infrastructure systems and their scaling properties

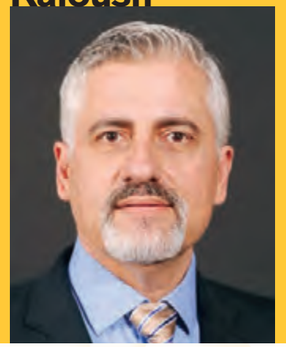
Anthony Lamanna

Associate Professor & Sundt Professor of Alternative Delivery Methods and Sustainable Development, DEWSC Program Chair

PhD, University of Wisconsin

Expertise: Anchorage to Concrete, Sustainable Development, Resilient Systems, Adaptive Reuse

Kamil Kaloush



Professor & Director, National Center of Excellence on SMART Innovations

PhD, Arizona State University

Expertise: Pavements design, laboratory testing, field performance, management, urban heat island

❖ **Top 5% Teaching Award**

Edward Kavazanjian, Jr.

Professor & Director, Center for Bio-mediated and Bio-inspired Geotechnics

PhD, University of California, Berkeley

Expertise: Biogeotechnical engineering, geotechnical earthquake engineering, waste containment, mechanical properties of municipal solid waste

Sara Khoeini

Assistant Research Professor

PhD, Georgia Institute of Technology

Expertise: Travel behavior analysis and demand modeling, Travel survey methods, Sustainability and energy

Kraig Knutson

Senior Lecturer

PhD, Arizona State University

Expertise: Historical construction methods, infrastructure security and application of industrial engineering techniques to construction processes

Peter Lammers

Research Professor

PhD, Portland State University

Expertise: Environmental engineering, microbial photosynthesis, algal biomass cultivation, bioenergy, wastewater treatment

Christopher Lawrence

Lecturer

PhD, Arizona State University

Expertise: Engineering mechanics, geotechnical engineering, numerical methods, and civil engineering materials

Yingyan Lou

Associate Professor

PhD, University of Florida

Expertise: Transportation network modeling and analysis, optimization of multi-modal transportation networks

Nariman Mahabadi Mahabad

Assistant Research Professor

PhD, Arizona State University

Expertise: Computational and experimental geomechanics, geotechnical engineering, hydrology, and geoenvironmental engineering

❖ **New faculty**

Michael Mamlouk

Professor

PhD, Purdue University

Expertise: Pavement design and management, pavement maintenance and rehabilitation, and material characterization

Bruce Marsh

Professor of Practice

MS, Oregon State University

Expertise: Large complex earth system projects (Panama Canal, Dubai, mining & water)

Giuseppe Mascaro

Assistant Professor

PhD, University of Cagliari, Italy

Expertise: Stochastic hydrology, climate downscaling, hydrometeorological extremes, hydrologic modeling, food-water-energy nexus

Larry Mays

Professor

PhD, University of Illinois

Expertise: Hydrosystems, hydrology, hydraulics, sustainability, optimization, risk, reliability, planning, management, modeling

Ram Pendyala

Professor and Interim Director, Director, TOMNET University Transportation Center

PhD, University of California, Davis

Expertise: Transportation systems engineering, activity-travel demand modeling, emerging transportation technologies/data

❖**2018 Fulton Exemplar Faculty**

Francois Perreault

Assistant Professor

PhD, University of Quebec in Montreal

Expertise: Environmental nanotechnology, water quality, and ecotoxicology of emerging contaminants

Subramaniam (Subby) Rajan

Professor

PhD, University of Iowa

Expertise: Finite element analysis, experimental techniques, design optimization, high performance computations

T. Agami Reddy

Professor

PhD, University of Perpignan, France

Expertise: Sustainable energy processes and systems, building energy efficiency, data analytics

Barzin Mobasher

Professor

PhD, Northwestern University

Expertise: Mechanics of composite materials, development of new construction materials, durability of building materials

Rebecca Muenich

Assistant Professor

PhD, Purdue University

Expertise: Environmental modeler focused on trade-offs within the food-energy-water nexus

Narayanan Neithalath

Professor

PhD, Purdue University

Expertise: Science of infrastructural materials (cement and concrete), new structural materials and systems, development and modeling

Kristen Parrish

Associate Professor

PhD, University of California, Berkeley

Expertise: Energy efficient buildings, and integrated planning, design, and construction

Bruce Rittmann

Regents Professor & Director, Biodesign Swette Center for Environmental Biotechnology

PhD, Stanford University

Expertise: Environmental biotechnology, managing microorganisms to enhance environmental and health sustainability

Thomas Seager

Associate Professor

PhD, Clarkson University

Expertise: Resilient infrastructure systems, life cycle assessment of emerging technologies, team science

Shahnawaz Sinha

Assistant Research Professor

PhD, University of Colorado-Boulder

Expertise: Drinking water treatment, water quality research, pilot-scale studies

Richard Standage

Lecturer

MS, Arizona State University

Expertise: Licensed concrete and general contractor with 40 years of concrete experience specializing in residential and small commercial concrete projects

❖**New faculty**

Kenneth Sullivan

Associate Professor

PhD, University of Wisconsin-Madison

Expertise: Organizational change, procurement, facilities management, performance measurement, talent profiling & development

❖2018 Fulton Exemplar

Pingbo Tang

Associate Professor

PhD, Carnegie Mellon University

Expertise: Automated spatiotemporal data analytics for civil systems safety and productivity

Junliang (Julian) Tao

Associate Professor

PhD, Case Western Reserve University

Expertise: Bioinspired burrowing mechanisms, bioinspired geosystems, smart and sustainable geosystems, soil behavior

❖New faculty

Leon van Paassen

Associate Professor

PhD, Delft University of Technology

Expertise: Engineering geology, environmental biotechnology, geotechnical, geo-environmental and mining engineering, biogeotechnical engineering

Enrique Vivoni

Professor & Associate Dean Graduate College

PhD, Massachusetts Institute of Technology

Expertise: Hydrologic interactions with climate, ecosystems and landscapes in arid regions

Kristen Ward

Lecturer

PhD, University of Arizona

Expertise: Structural engineering, engineering mechanics, earthquake engineering, numerical methods

Zhihua Wang

Associate Professor

PhD, Princeton University

Expertise: Energy-water nexus; hydroclimate modeling; infrastructure design; urban sustainability

Paul Westerhoff

Regents Professor and Vice Dean for Research and Innovation

PhD, University of Colorado

Expertise: Expert in water quality and treatment, including use and risks of nanotechnology

Avi Wiezel

Associate Professor & Assistant Dean for Facilities

PhD, Technion-Israel Institute of Technology

Expertise: Leadership for project based companies

❖Top 5% Teaching Award

Claudia Zapata

Associate Professor

PhD, Arizona State University

Expertise: Environmental effects on fluid flow and volume change of unsaturated/problematic soils

Xuesong Zhou

Associate Professor

PhD, University of Maryland

Expertise: Dynamic traffic assignment, traffic demand analysis, traffic flow estimation and prediction, train timetabling

Faculty Emeritus

William W. Badger, PhD
Howard H. Bashford, PhD
Allan Chasey, PhD
Apostolos Fafitis, PhD
William Houston, PhD
Paul Johnson, PhD
Matthew Witczak, PhD

Farewell

We thank the following faculty for their service and wish them well.

Aaron Cohen, Lecturer, returned to private practice, May 2018

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