

ZACHRY DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

LETTER FROM THE **DEPARTMENT HEAD**



The profession is at a point in time where technological advances, climate change, new development, renovation of existing infrastructure, and societal priorities are challenging us to find innovative adaptations, as well as creative new approaches, to meet the demands.

The faculty and students in our department are stepping up to offer new ideas, advanced research methods and face many of the current and anticipated challenges. There is a common theme to our research and that is to serve society at lower cost and faster resolution of problems that reduce the inconvenience to communities while enhancing safety. The research projects highlighted in this publication illustrate that commitment.

By incorporating the architecture of city drainage systems and readings from flood gauges into a comprehensive statistical framework, our researchers worked to accurately predict the evolution of floods in extreme situations like hurricanes.

Faculty and students across our nine specialties are joining the global

effort to stop the spread of COVID-19 by investigating the unintentional consequences of the virus such as monitoring wastewater systems in infected neighborhoods and the transmissibility through the freight transportation system.

One of the department's internally recognized strengths is the materials group which is largely focused on improving pavement performance for transportation systems. Innovations in new materials and structural design are being evaluated to respond to extreme natural or human-made disasters through existing knowledge paired with artificial intelligence.

Through these projects and many others, the faculty in the Zachry Department of Civil and Environmental Engineering is dedicated to improving the resilience and sustainability of our local and global communities.

We are saddened by the loss of Bartell Zachry whose extraordinary leadership in the profession and dedicated support of this department will be missed.

Sincerely,

Robin Autenrieth Department Head Professor A.P. and Florence Wiley Professor III



TEXAS A&M UNIVERSITY Zachry Department of Civil & Environmental Engineering

BY THE NUMBERS

RANKINGS (2021)



Undergraduate Program Ranked No. 8 (Public) (U.S. News & World Report)

TOP 10



Graduate Program Ranked No. 9 (Public) (U.S. News & World Report)

ENROLLMENT* FACULTY (FALL 2020) Academic Professional Track **R**41 $\mathbf{18}$ 822 Undergraduate Professors Associate Career Development Professors Professorship Holders 175 $\mathbf{185}$ Assistant **Endowed Chair** Holders Professors M.S. and M.E. Ph.D. *preliminary

DEGREES AWARDED (FALL 2019-SUMMER 2020) 242 B.S. 40 M.S. 46 M.E. 26 Ph.D.



29% Female Undergraduate Enrollment





Female Tenure and Tenure-Track Faculty



FLOOD PREDICTION TOOL BOOSTS EMERGENCY RESPONSE

Hurricanes are notorious for wreaking havoc on shorelines, toppling trees, tearing down power lines and, above all, causing severe floods. Conventionally, scientists have used physics-based models to predict where water might collect, overflow and cause flooding. These models capture how physical features of the Earth's surface and urban landscapes affect the flow of water over the ground.

By incorporating the architecture of city drainage systems and readings from flood gauges into a comprehensive statistical framework, researchers at Texas A&M can now accurately predict the evolution of floods in extreme situations like hurricanes. With their new approach, the research team said their algorithm could forecast the flow of flood water in near real time, which can then lead to timelier emergency response and planning.

"Not knowing where flood water will flow next is particularly detrimental for first responders who need to gauge the level of flooding for their rescue operations," Dr. Ali Mostafavi said. "Our new algorithm considers the underground drainage channels to provide an accurate representation of how floods propagate. This tool, we think, can vastly help disaster management because first responders will be able to see which way flood water will flow in real time."

While robust at predicting when and where floods will happen under most rainfall conditions, Mostafavi said these traditional models do not perform as well at predicting floods during incidents of torrential rainfall, like Hurricane Harvey.

"Physics-based models offer one perspective on how floods can spread, which is extremely useful, but the picture they provide is somewhat incomplete," he said. "We wanted to use existing data on how past floods have spread through the drainage channels to develop a model that would be able to predict, within a certain level of preciseness, how future floods will spread."



FEATURED RESEARCHER Dr. Ali Mostafavi Assistant Professor

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INTERDISCIPLINARY RESEARCH COMBATS COVID-19

Researchers in the department are joining the global effort to stop the spread of COVID-19 by investigating the unintentional consequences of the virus.

Dr. Xingmao "Samuel" Ma is working with a team to determine whether conventional chlorine-based disinfectants can remove COVID-19 from domestic wastewater systems in infected neighborhoods. This shows how water quality parameters can affect the performance of these disinfectants.

In collaboration with the Centers for Disease Control and Prevention, Dr. Shankar Chellam is monitoring raw sewage and the air in the proximity of wastewater treatment plants for COVID-19. Sewage measurements could serve as an early warning of the community spread and presence of COVID-19. Early detection has the potential to better prepare public health professionals to respond to spread in the population.

Dr. Xiubin "Bruce" Wang and Dr. Yunlong Zhang are investigating the transmissibility of a pandemic through the

freight transportation system to reveal places where the transmission has the largest effect on the spread and on the network operational efficiency.

Wang and doctoral student Chaolun Ma are researching how to control the hidden spread of COVID-19 and the general conditions needed to get the pandemic under control through various methods such as community sampling or temperature checks at mass gatherings.

Dr. Ali Mostafavi is working to better understand, predict and effectively respond to the risk of infectious disease outbreaks in urban areas and will analyze the data through spatial modeling, network analysis and machine learning techniques to reveal hidden pandemic spread risks in urban areas.

In the beginning stages of the pandemic, Dr. Qi Ying worked with colleagues on accurately predicting COVID-19 cases and deaths in China. He also researched the effect of traffic emission control on air quality during the lockdown period in China.



LITTLE NAMED UNIVERSITY DISTINGUISHED PROFESSOR

Dr. Dallas Little received his doctoral degree from Texas A&M in 1979. Now, 40 years later, he has been awarded the highest faculty honor — University Distinguished Professor.

This title identifies faculty members who are preeminent in their respective fields. They exemplify outstanding teaching, mentoring, discovery and service.

Little, referred to as the "father of chemomechanics" by some of his colleagues, is a recognized international leader for his work on predictive performance modeling and design of structural pavement systems, characterization and modeling of damage and healing mechanisms in asphalt paving composites, and chemical soil stabilization. He has made critical contributions to the transportation industry.

IN MEMORIAM OF FORMER STUDENT BARTELL ZACHRY JR.

Henry Bartell Zachry Jr. '54 was many things to Texas A&M — distinguished and outstanding alumnus, Corps of Cadets Hall of Honor member and avid supporter.

Zachry, who passed away June 10, 2020, at age 86, leaves a legacy of extraordinary leadership, service and support for the College of Engineering. He was a significant force in the construction industry as the leader of the infrastructure company H.B. Zachry Company, which was initially founded by his father and fellow Aggie, H.B. "Pat" Zachry Sr. '22.

Zachry's unwavering support of the university led him to fund two President's Endowed Scholarships in memory of his father. He and his family, company and foundation also created faculty chairs, professorships and fellowships, and funded many scholarships for exceptional civil engineering students.

In 2005, the Zachry Department of Civil and Environmental Engineering was named in honor of the Zachry family.



RESEARCHING INFRASTRUCTURE UNDER EXTREME LOADS

Artificial intelligence (AI) has revolutionized nearly every field it has touched and Dr. Stephanie Paal works to wield that power in the civil engineering field.

Paal received the Faculty Early Career Development (CAREER) Award from the National Science Foundation — one of the most prestigious awards for up-and-coming researchers. The grant provides funding to support promising integrated research and education projects.

Paal is using the CAREER Award to leverage existing knowledge and AI to understand the performance of civil infrastructure under extreme loads such as natural or humanmade disasters like earthquakes, hurricanes or fires.

Innovations in new materials and structural design are being created to respond to these extreme situations. There is a need for a rapid and reliable approach to understand the behavior of existing and new structures in light of these innovations. "The integrated research and educational plan aims toward a more intelligent and informed approach to design, analysis and evaluation of our built world in the face of disasters and response to the ever-changing technological landscape," she said. "Moreover, although Al-based approaches are very promising right now, my integrated plan will focus on determining when and to what extent these approaches are suitable within the applied science domains."

Paal takes a multidisciplinary, collaborative approach to education and outreach, which is integral to the research plan, called STEM in Motion. ►



FEATURED RESEARCHER Dr. Stephanie Paal Assistant Professor spaal@civil.tamu.edu





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ZACHRY DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

Building our world and our future

Developing a resilient and sustainable infrastructure

Preparing workforce-ready civil and environmental engineers

One department | Nine specialties

An extensive alumni network