



Department of
**CIVIL & ENVIRONMENTAL
ENGINEERING**





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- ▶ Structural Engineering
- ▶ Structural Mechanics

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CHAIR'S MESSAGE

The year, 2021, brought continued uncertainty. Through it all, I am proud to say that our students and faculty worked with cooperation and understanding through it all. Yes, there were some pains and the unknown can be frustrating, but on the whole we did the best we could and that is all that is asked. For 2022, I predict that we will continue to improve the ability of the faculty and students to teach and learn in this uncertain world.

I'm happy to report that through the pandemic, those associated with our department continued to be successful. Our graduates continued to gain meaningful employment when completing their studies, indicating that the profession of Civil Engineering continues to be a great choice for students. Our faculty continued to secure external funding, publish papers, and present (online) at national and international conferences, validating the quality of the research work being conducted. Even our alumni report that they are advancing in their careers.

For those who are and have been associated with the Civil Engineering Department at UAH, remember you are part of our current and future legacy. Make it a special. For those who are considering joining our department, please come along for the ride and see where we can take you in the future.

Sincerely,

Michael Anderson
Department Chair and Associate Dean
of Graduate Education & Research

THE AMERICAN SOCIETY OF ENGINEERS: UAH CHAPTER

The American Society of Civil Engineers is an organization that assists students in their professional and academic development. UAH's chapter of ASCE connects students with local professional practicing civil engineers and offers opportunities for mentorship. Students compete in competitions as a part of the ASCE Gulf Coast Student Conference, where they have the chance to develop technical civil engineering skills and student leadership. These events also allow students to connect with their fellow civil engineering peers and experience different sub-disciplines of civil engineering. This year UAH ASCE will be competing at Auburn University against other universities from Alabama, Mississippi and Louisiana. This past year UAH ASCE has placed first in the Utility Engineering and Surveying Institute (UESI) Surveying Competition and was invited to compete at the ASCE National Surveying Championship Finals

Competition hosted by the University of Wisconsin-Platteville. UAH ASCE also had several placements in other events, including first in the sustainable conference and pykrete competitions and fourth in the American Institute of Steel Construction (AISC) Steel Bridge competition.

MEET AN INDUSTRIAL ADVISORY BOARD MEMBER

SARAH L. YELDELL, P.E.

Ms. Yeldell is a native of Hendersonville, Tennessee. After graduating from Hendersonville High School in 1999, she attended UAH as a recipient of the UAH Presidential Scholarship and a member of the Honors Program, earning a Bachelor of Science in Civil Engineering with an environmental focus in December of 2003.



Sarah joined the Huntsville, Alabama office of QORE Property Sciences in 2002 as a Soils Lab Technician, becoming a Staff Geotechnical Engineer upon graduation. In 2005, Sarah moved to QORE's Environmental Department, and in 2010 QORE was purchased by S&ME. During her 17-year career, Sarah has chosen to specialize in environmental compliance for industries and municipalities. Her project experience includes performance and coordination of environmental compliance services pertaining to NPDES, RCRA, EPCRA, SPCC, and air permitting; Municipal Separate Storm Sewer (MS4) compliance; and FHWA Air Quality and Noise Impact Analyses. Sarah currently serves as head of the Industrial Compliance Workgroup for the S&ME Technical Leaders Group.

Since 2001, Sarah has been an active member of ASCE. At UAH, Sarah served as the Secretary and two-year President of the UAH Student Chapter and participated in the 2001, 2002, 2003, and 2004 Concrete Canoe competitions as a worker bee, report author, paddler, and presenter. She was recognized by the Huntsville ASCE Branch as the 2002 UAH Civil Engineering Student of the Year and as the 2016 Huntsville Civil Engineer of the Year and served as the Secretary of the Huntsville Branch from 2008 to 2012.

Sarah has been married to her husband, Todd Watts, for 16 years. Todd is also a UAH civil engineering graduate and past UAH ASCE President, and they met while representing UAH at the 2001 National Concrete Canoe Competition in San Diego. They have two children, Micah (13) and Aerin (10), neither of whom show any interest in concrete.

CONGRATULATIONS TO OUR GRADUATES

MASTERS DEGREES

Jessica Lenette Morris

Izuchukwu Albert Ugwu

Thesis: "Post-Disaster Repair Planning
for Interdependent Infrastructure Systems
Prioritizing The Recovery of Critical Facilities"
Advisor: Dr. Abdullahi M. Salman

BACHELORS DEGREES

Logan A. Baldwin

Trevor A. Barylske

James Hunter Baugh

Cade H. Blair

Kelsi T. Burt

Brian A. Burton

Luke E. Childress

Daniel P. Dufrene

Miguel Esteban-Mateo

Tyler G. Forbes

Zoe Garcia-Peralta

Anthony Gleghorn

Taylor Alden Gordon

Alli Mechele Gower

Bailey Andrew Herfurth

Joseph A. Holbrook

Rebecca A. Ibsen

Paul Linus King IV

Reagan Lee Malone

Marlee Lyn Mason

Zeb Dylan Maze

Anna Michelle McFerrin

Mickey Kazuhiro Miki

Aaron C. Miles

Connor Grant Moore

Alexander Tate Rogers

Nathan Lloyd Rogers

Timothy Heath Senn, Jr.

Andrew Chase Shankles

Spencer Nelson Smith II

Houston John Tanner

Jack Alexander Utrevis

Nathanael Wade

Dylan Shane Weaver

**ERIC MERSCHMAN**

Eric Merschman is currently a graduate teaching assistant for CE 498/499 Senior Design course overseeing the structural design portion of students' projects. He is currently working towards his Ph.D. in Structural Engineering with a focus on decision-making under uncertainty for areas subjected to hurricanes. He notes that his research focuses on "reducing the uncertainty in decision-making for municipalities and quantifying how transportation networks can be more resilient to tropical cyclones over the lifespan of the network."

GET TO KNOW YOUR FUTURE CIVIL ENGINEERS!

**THANH CHI VU**

Thanh Chi Vu is a teaching assistant for CE 457/557 and CE483/583. He is a PhD candidate, working on Environmental Engineering, especially adsorption of nutrients, metals and organics from water. He is trying to synthesize low-cost but effective multifunctional adsorbents that can be used for different waters with different chemistry and for removing recalcitrant organic contaminants.

CHARGERS IN THE LAB

SOILS LAB

DR. AL-HAMDAN, PH.D.

CLINICAL ASSOCIATE PROFESSOR

The primary goal of this laboratory is to introduce junior and senior level undergraduate students to Geotechnical Engineering and the basic principles of soil mechanics (CE 373). Students conduct standard laboratory experiments to classify soil and determine the physical and mechanical properties such as specific gravity, permeability, compaction, consolidation, and shear strength. The properties of soil are critical for application in the design of foundations, dams, retaining walls, tunnels, offshore structures, and slope stability analysis. This laboratory work is supportive to the lecture material in Soil Mechanics (CE 372) and is a prerequisite to coursework that may include Foundations (CE 485), Earth Structures (CE 459), and more advanced elective courses in Geotechnics.

ENVIRONMENTAL LABS

PI DR. TINGTING WU, PH.D.

ASSOCIATE PROFESSOR

In the "Innovative Water Research and Technology" lab at UAH, we work on the development of innovative methods for advanced water/wastewater treatment and reuse. In particular, we focus on novel physiochemical methods such as advanced oxidation/reduction processes, electrochemical processes, and adsorption processes for the removal of a variety of pollutants from various environmental matrices. In collaboration with Dr. Duan from Optics, we are also developing a low-cost, distributed turbidity sensor network that utilizes glass optical fibers for real-time water quality monitoring in drinking water distribution systems.

RESILIENT CIVIL INFRASTRUCTURE SYSTEMS (RCIS) LAB

PI: ABDULLAHI M. SALMAN, PH.D.
ASSISTANT PROFESSOR

Project: Support Testing of 3D Printed Concrete Structures for Lunar Subscale Landing Pad Fabrication

The RCIS lab at UAH is involved in a NASA-sponsored project to evaluate the mechanical properties of concrete that can be made from lunar materials. Despite the intensifying interest in moon exploration and settlement, the high cost of developing support structures for a long-term presence on the Moon continues to threaten the realization of such an idea. This is mainly due to the lack of economical and sustainable methods of transporting needed materials from Earth and an effective construction method. To overcome these challenges, extra-terrestrial structures need to be designed for and built with two prime considerations: in-situ resource utilization (ISRU) and the use of autonomous or remote construction methods (3D printing). The capability to autonomously or remotely construct infrastructure elements to protect astronauts from radiation, micrometeorites, dust, and the lunar environment does not currently exist. With NASA's plan to send a crewed mission to the Moon by 2024 with a sustained presence by 2028, there exists more than ever a need to develop the materials and manufacturing processes to enable this presence.

To support NASA's ongoing effort, the research at UAH will lay the groundwork for evaluating structures made from in-situ resources and the effect of manufacturing variables on the resulting properties. Critical to the success of this proposed effort will be verifying the structural integrity of printed structures using a variety of regolith simulants. This collaboration also lays the groundwork for further development of these technologies for remote terrestrial military applications in addition to remote space applications. The project has three objectives: (i) investigate the mechanical properties of potential lunar concrete materials that can be manufactured using in-situ materials and reinforced with pulled molten lunar regolith glass fiber and rebar cast from molten lunar regolith, (ii) investigate the mechanical properties of the concrete material manufactured using AM/AC methods, and (iii) investigate the impact of curing time on the properties of the concrete material. Currently, two potential lunar concretes that can be manufactured using in-situ lunar materials are being tested: Magnesium oxide-based concrete and Calcium Sulfo-Aluminate concrete. All the materials in the two concretes are extractable from lunar regolith.



CHARGERS IN THE LAB

TRAFFIC MODELING LAB

PI: RUI MA, PH.D.

ASSISTANT PROFESSOR

Project: Identifying traffic patterns in the COVID-19 pandemic using AI and deep learning

The pandemic drastically changed travel patterns throughout the world.

Dr. Rui Ma's research team has been monitoring the traffic characteristics in the

State of Alabama since the beginning of the COVID-19 pandemic. Dr. Ma's research

efforts provide unconventional perspectives to identify the normal and pandemic influenced daily traffic patterns.

Instead of using daily traffic volumes, Dr. Ma's team collected and analyzed fine resolution travel speed data for more than 17 months, and revealed the traffic pattern changes by investigating the travel speed contours along various major corridors near the City of Huntsville in Alabama. With the help of the Artificial Intelligence and Deep Learning methods, the team has developed and trained an autoencoder unsupervised model to improve and reconstruct speed contours, and then utilized Convolution Neural Networks and unsupervised clustering on the reconstructed spatio-temporal contours to classify various traffic speed patterns before and during the pandemic. The study results revealed five traffic patterns, among which it shows that the travel speed pattern in Alabama shifted ahead of the issuance date of the State stay-at-home order. The results further show that a new travel speed pattern appears at the end of stay-at-home order, which is different from either the normal pattern before the pandemic or the pandemic-influenced pattern, showing there emerges a 'new normal' travel pattern in the post-pandemic era.



RESEARCH GRANTS & CONTRACTS

1. "Support Testing of Planetary 3D Printed Concrete Structures for Subscale Landing Pad Fabrication", Sponsored by National Aeronautics and Space Administration (NASA), Marshall Space Flight Center, January 4, 2021 – December 31, 2022. (\$99,986).
2. "Destruction of PFAS using Plasmonic Photocatalysts", SERDP program, Department of Defense (DOD), September 30, 2021 – September 30, 2022. (\$249,889).
3. "Distributed Fiber-optic Turbidity Sensor Network", 17th Annual P3 Award (Phase I), United States Environmental Protection Agency (USEPA), December 2020 – November 2022. (\$25,000).
4. "Low-cost Household Water Filter for PFAS Removal", 16th Annual P3 Award (Phase I), United States Environmental Protection Agency (USEPA), November 2019 – May 2022. (\$24,997).

PUBLICATIONS 2022

1. Preetha, P.P., Shirani-bidabadi, N., Al-Hamdan, A.Z., and Anderson, M., (2021). "A Methodical Assessment of Floodplains in Mixed Land Covers Encompassing Bridges in Alabama State: Implications of Spatial Land Cover Characteristics on Flood Vulnerability," *Water Resources Management*, 35, 1603-1618.
2. R Ma, S Chen, HM Zhang (2021). Time series relations between parking garage occupancy and traffic speed in macroscopic downtown areas—a data driven study. *Journal of Intelligent Transportation Systems*, 25, 423-438.
3. Y Tan, R Ma, Z Sun, P Zhang (2021). "Emission exposure optimum for a single-destination dynamic traffic network," *Transportation Research Part D: Transport and Environment* 94, 102817.
4. M Liang, HM Zhang, R Ma, W Wang, C Dong (2021). "Cooperatively coevolutionary optimization design of limited-stop services and operating frequencies for transit networks," *Transportation Research Part C: Emerging Technologies* 125, 103038.
5. N Shirani-bidabadi, R Ma, M Anderson (2021). "Within-day travel speed pattern unsupervised classification—a data driven case study of the State of Alabama during the COVID-19 pandemic," *Journal of Traffic and Transportation Engineering (English Edition)* 8.
6. RK Mazumder, S Rana, AM Salman (2021). "First level seismic risk assessment of old unreinforced masonry (URM) using fuzzy synthetic evaluation," *Journal of Building Engineering* 44, 103162.
7. E Asadi, AM Salman, Y Li, X Yu (2021). "Localized health monitoring for seismic resilience quantification and safety evaluation of smart structures," *Structural Safety* 93, 102127.
8. RK Mazumder, AM Salman, Y Li (2021). "Reliability Assessment of Oil and Gas Pipeline Systems at Burst Limit State Under Active Corrosion," *International Probabilistic Workshop*, 653-660.
9. RK Mazumder, AM Salman, Y Li, X Yu (2021). "Asset Management Decision Support Model for Water Distribution Systems: Impact of Water Pipe Failure on Road and Water Networks," *Journal of Water Resources Planning and Management* 147 (5), 04021022.
10. RK Mazumder, AM Salman, Y Li (2021). "Failure risk analysis of pipelines using data-driven machine learning algorithms," *Structural Safety* 89, 102047.
11. E Asadi, Y Li, Z Shen, H Zhou, A Salman (2021). "Life-cycle resilience and sustainability assessment of reinforced concrete buildings with thermal-mass shear walls," *Life-Cycle Civil Engineering: Innovation, Theory and Practice*, 1326-1331.
12. W Yang, M Bunian, X Chen, S Heald, L Yu, J Wen, Y Lei, T Wu (2021). "Plasmon-enhanced Catalytic Ozonation for Efficient Removal of Recalcitrant Water Pollutants," *ACS ES&T Engineering*, 1, 874-883.
13. Ali, E, Woldeyes, K and Urgessa, G. (2021). "Fire Performance of Functionally-Graded-Material Sheathed Load Bearing Thin-Walled Structural Framing," *Fire Safety Journal* 125, 103425.
14. Ali, E, Woldeyes, K and Urgessa, G. (2021). "Influence of non-uniform elevated temperature on the structural stability and strength of gypsum-sheathed cold-formed steel beam channel members," *Journal of Civil Engineering and Architecture* 15, 285-293.



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