LSU

Department of Civil & Environmental Engineering

CEE IN FOCUS

SPRING 2021 • VOLUME 20 • Number 2

FROM THE DEPARTMENT CHAIR

I would like to start by honoring the memory of and paying tribute to Mr. John A. Graves, who recently passed away. He was a graduate of the Department of Civil & Environmental Engineering (CEE) at LSU. He chaired the CEE Advisory Board for eight years and was a staunch and adamant supporter of the department. He was a visionary and committed to bettering the state of Louisiana through his multitude of projects that he was involved in. Some of them were the Pete Maravich Assembly Center, Country Club of Louisiana, the John J. Audubon Bridge, Cortana Mall, the Ritz-Carlton in New Orleans, and more. He was vastly involved in the levee rebuild following Hurricane Katrina, the largest Civil Works Program in US history. He also published *The Fortress of New Orleans*, documenting the project.

Tremendous effort was put forth by our faculty to adjust in preparing the online/hybrid classes they taught in the fall and spring semesters due to the COVID-19 pandemic. In addition to this challenge, we had to adapt in advising our students online. They indeed spent considerable time adapting to the new online environment. In addition, a few of our faculty had to cancel their plans for study abroad courses because of the pandemic. Our faculty and students are to be commended for adjusting to this new environment.

For the last year or so, Drs. John Pardue, Samuel Snow, and William Moe have been assisting the campus and East Baton Rouge Parish to track the presence of the SARS CoV-2 virus in wastewater. This helps monitor the presence of COVID-19 in specific regions without the need for medical testing. This is a combined effort of LSU CEE faculty together with faculty and staff in the LSU School of Veterinary Medicine.

In spite of COVID-19, the LSU Center for GeoInformatics (C4G), a research unit in CEE that is the home of the Louisiana Spatial Reference Center, maintained its activity in measuring subsidence of the coastal region of Louisiana. This was conducted with careful coordination that allowed C4G to remain productive through instrument maintenance, data reduction, and fieldwork.

In this newsletter, we also highlight the research endeavors of a senior faculty, Dr. Christopher Kees, who recently joined our department. He works in the coastal engineering area and is well-known in computational hydrology and porous media, as well as the coastal hydrodynamics community. He holds a joint appointment with the Center for Computation and Technology.

The Department of Civil and Environmental Engineering, according to the *U.S. News & World Report* 2022 "Best Graduate School" rankings, moved up 10 places in just one year from T-64 overall in 2021 to T-54 overall in 2022. This was a great testament to the CEE faculty for their dedication to research and guiding graduate students. We also highlight the awards and research grants obtained by our faculty and students during this period.

Finally, this edition of the newsletter marks 20 years since we began this publication, which continues to serve as a testament and record of the tremendous work and achievements in our department.

Dr. George Z. Voyiadjis, D.Eng.Sc.,
Boyd Professor
Chair and Bingham C. Stewart
Distinguished Professor of Engineering

DEPARTMENT NEWS

C4G MAINTAINS PROGRESS DESPITE COVID-19

On March 23, 2020, at 5 p.m., the stay-at-home order issued by Governor John Bel Edwards went into effect. To comply with the order, LSU's Office of Academic Affairs closed research labs, and as a result, most fieldwork at LSU was put on hold. However, with careful coordination, the LSU Center for GeoInformatics (C4G) has remained productive through instrument maintenance, data reduction, and fieldwork.

C4G is currently in the midst of a multi-year National Geodetic Survey (NGS) grant and has been tasked with obtaining and providing terrestrial gravity measurements throughout the state of Louisiana. It is measuring absolute gravity at CORS sites throughout the state and establishing reference marks with millimeter accuracy for the public's use. C4G is also working to better define the local gravity field by using a state-of-the-art zenith camera system that measures the deflection of the vertical. These efforts directly assist and inform the NGS Height Modernization program, with the new 2022 national datum as the end result.

To be able to continue their work on the NGS grant while also preserving LSU's social-distancing guidelines, instruments have been stored in C4G field technicians' homes to ensure continuous maintenance. One technician is holding two CG-5 relative gravity meters and is running regular drift calibrations to ensure they remain level to help avoid hysteresis. Another technician is maintaining a high vacuum on the FG5-X absolute gravity meter dropper, maintaining the reference helium-neon LASER, and housing the digital zenith camera. Our technicians keep Trimble R8 and R10 GPS units and two-meter rod tripods, allowing them to deploy directly into the field and helping to reduce the amount of time spent on-campus.

When C4G's observation fieldwork was put on hold, field staff initially focused efforts on compiling an accumulation of measurements from previous site visits. Technicians worked on data reduction and data management. The types of data they processed included:

Trigonometric 3D positions for reference marks were determined and stamped with codes: AA-Absolute gravity mark, ZM-Deflection of the vertical from the zenith mark, and RM-other 3D reference marks.

- GNSS positions for the reference and zenith marks.
- Particularly the height of RM1 relative to the CORS antenna was recorded.
- Differential leveling to refine the height between marks.
- Absolute gravity was observed at AA marks.
- Absolute gravity values were transferred to reference marks by processing relative gravity loops.
- Deflection of the vertical measured using the digital zenith camera was audited and related to the other data.

Prior to the COVID-19 pandemic restrictions, the absolute gravity measurements at C4G's CORS sites were a main priority for the grant work. However, after the restrictions were implemented, the work was put on hold as the CORS stations are typically located on substantial buildings and would involve some degree of human contact. This forced a focus shift from absolute gravity measurements over to the GPS on Bench Marks (GPSonBM) part of the grant project, which doesn't require person-to-person contact. The primary goal of the GPSonBM project is to improve the NGS transformation tools used to convert coordinate values from one datum to another. With a new datum to be imminently implemented by NGS, this is vitally important because the significant tectonic activity of Louisiana renders older data obsolete. For most long observations as part of the GPSonBM work, the technicians employ Trimble NetR9 receivers with Zephyr Geodetic antennas.

Even though the recent COVID-19 concerns and social distancing could have shut down most of C4G's normal observations, the digital zenith camera operates at night and is able to be deployed with just a single operator. These two factors have been beneficial in allowing this process to resume in earnest. During the period to date, 62 sites consisting of nearly 300 individual sessions have been observed with the digital zenith camera.

When the weather doesn't allow for outside work, field staff at C4G are processing data, attending NGS or Trimble webinars, or holding virtual meetings. C4G field staff meet at least twice a week to update each other on their progress and discuss plans for the week. Since the Phase 2 reopening, which began May 8, 2020, C4G has continued to use the same procedures

established in Phase 1 to keep the team and those around it safe. Using these procedures, C4G has safely maintained productivity. Given the uncertainty of how the COVID-19 situation could change, the C4G team is remaining confident it can continue to safely produce results that support NGS and the state of Louisiana.

LSU C4G is the home of the Louisiana Spatial Reference Center and creator and host of Louisiana's NGS CORS network. LSU created C4G to focus on research and services in geodesy and geoInformatics; as a result, C4G has established Louisiana's only statewide GPS/GNSS real-time network, C4GNet, which is entirely supported by subscribers to the RTN. (http://c4g.lsu.edu/)

LSU TEAM WINS AT 2021 WERC COMPETITION

Worldwide, the mining industry produces several large waste streams that require management, including the mine tailings, the ore waste from the mine. A team of LSU environmental engineering seniors designed a mine tailings reuse strategy as part of the 31st WERC Environmental Design Contest held April 11-14, 2021. For the second year, the competition was held virtually during the pandemic using judges from industry and governmental agencies. The LSU team won Task 4 and finished second in the overall mining-related tasks, winning a $1,000 prize. The reuse strategy designed by the LSU students included substituting tailings for aggregate and portland cement, producing a more sustainable concrete. In addition, the tailings-infused concrete had improved thermal properties for use in high-thermal mass building materials typically used in the southwestern US. Team members included Wade Hamilton (Summerville, South Carolina), Elizabeth Zorich (Biloxi, Mississippi), Autumn Richards (New Orleans), Hope Andrews (Denham Springs, Louisiana), and Sarah Servat (Kenner, Louisiana). The team was judged on a basis-of-design paper, a bench-scale discussion with judges, an oral presentation, and a scientific brochure. Universities in the competition included Arizona State University, Rice University, University of Florida, University of Colorado-Boulder, Montana Tech University, University of Arkansas, New Mexico State University, New Mexico Tech, Washington State University, Cal Poly-San Luis Obispo, University of Idaho, and the University of Tennessee-Chattanooga. Additional LSU teams competed effectively in Task 3 (use of agricultural waste products to remove metals from acid mine drainage) and Task 6 (open task). The award is the eighth won by LSU teams at the WERC competition in the past three years. Professor John Pardue and Research Associate Vijai Elango advised the teams in 2020-2021.

CEE DEPARTMENT RISES IN 2022 USNWR BEST GRADUATE SCHOOL RANKINGS

There was good news for the College of Engineering departments recognized in the U.S. News & World Report 2022 "Best Graduate School" rankings. The college itself dipped slightly to an overall ranking of T-113 from last year's T-102, finishing alongside two other Southeastern Conference institutions, the University of Arkansas and University of Georgia. Among public institutions, the college was ranked T-74, and it was the top-ranked school in Louisiana. The Department of Civil and Environmental Engineering moved up 10 places in just one year from T-64 overall in 2021 to T-54 overall in 2022.

To establish its rankings, U.S. News & World Report surveyed 216 engineering schools that grant doctoral degrees. The data collection was used for the overall rankings, 13 specialty rankings, and for populating each school's profile on usnews.com. Schools were ranked on peer-assessment and recruiter-assessment scores (40% of overall score), faculty resources (25% of overall score), research activity (25% of overall score), and student selectivity (10% of overall score).

CHRIS KEES JOINS CEE FACULTY

CSRS Distinguished Professor Chris Kees joined the LSU Department of Civil and Environmental Engineering faculty in 2020. Before joining LSU, Kees served as a research civil engineer in the Coastal and Hydraulics Laboratory of the US Army Engineer Research and Development Center, where he had conducted research and development in computational modeling since 2005. He received his PhD from the Department of Environmental Science and Engineering at the University of North Carolina at Chapel Hill, where he also received an MS from the Department of Mathematics. His teaching interests include computational methods for civil engineering applications, finite element methods, hydrology, fluid mechanics, and fluid-structure interaction phenomena. His research focuses on accurate and reliable computational simulation of dynamic hydrodynamic phenomena, particularly their interactions with three-dimensional structures. Recent applications have included floating bridges for the US Army, moored floating platforms for offshore wind turbines, and river levees. His research aims to produce models built on a firm foundation of physical theory and approximated with robust, accurate, and efficient numerical methods implemented on modern computing platforms.

Multiphase Fluid-Structure interaction and Infrastructure

Kees studies surface water flows in which the fluid-fluid (air/water) or fluid-solid (water/vessel, water/particle) interface dynamics are difficult to model with traditional approaches. He has developed formulations, numerical methods, and software that are robust and accurate with respect to complex interfacial dynamics and flow regimes. This approach is novel in coastal and hydraulic engineering and relies on original formulations and algorithms, as well as world-class high-performance computing.

Robust, accurate, and efficient computational simulators for fully three-dimensional, turbulent flows with complex interface dynamics in complex geometries can open doorways to understanding many processes that have hitherto relied on highly empirical correlations. Figures 1 and 2 show work conducted by Kees and his collaborators to answer key questions about the performance of offshore wind and military infrastructure.

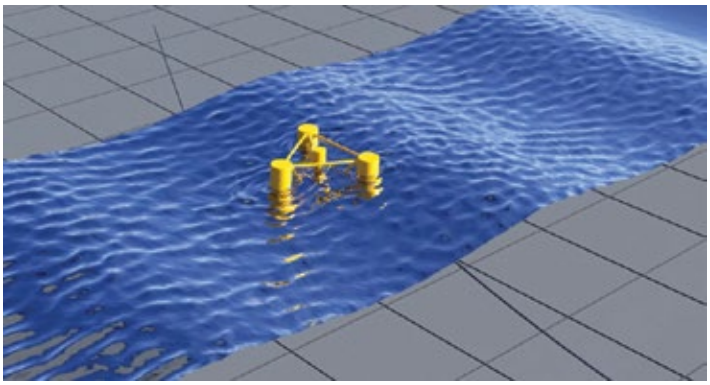

Figure 1. Computational modeling of mooring line tensions due to wave action for an offshore wind platform project in collaboration with Tristan de Lataillade (Edinburgh) and Aggelos Dimakopoulos (HR Wallingford Ltd.)

As evidence of the accuracy of these modeling approaches has accumulated over the last decade, interest in applying the approaches to analysis of federal and state flood and storm protective infrastructure is growing. Figure 3 shows a sector-gate-wave-overtopping simulation by Haydel Collins, an engineer for the US Army Corps of Engineers (USACE), New Orleans district, and former CEE graduate. Recent USACE projects involving the computational fluid dynamics approach have grown to include a range of studies formerly conducted only with physical models and two-dimensional hydrodynamic modeling.

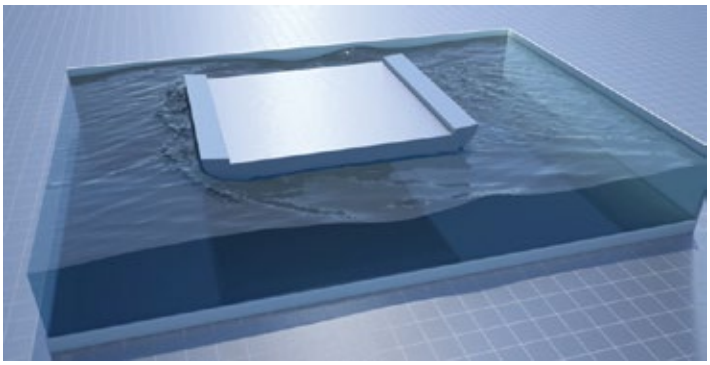

Figure 2. Drag force computation for a section of Improved Ribbon Bridge for the US Army Product Development Manager, Bridging. This model was used to augment scale-model studies and field tests to assess mooring requirements.

In addition to engineering applications, recent work provides evidence that we can now leverage the computational fluid mechanics approach for understanding such phenomena as two-phase flow in porous media, energy dissipation due to wave breaking, flows in complex vegetation, and sediment erosion and deposition, yielding rigorous multi-scale theories of these processes.

Granular Media and Sediment Dynamics

Kees is currently working on methods for high-resolution modeling of soil mechanics and sediment dynamics. These methods aim to resolve the interaction of air and water with small collections of interacting solid grains. The models are able to resolve the fluid boundary layer and interfacial dynamics around solid particles, along with solid particle contact interactions. These grain-resolving models can then be employed to support new continuum theories of coastal and riverine sediment dynamics and soil mechanics to achieve both an improved understanding of these processes and practical computational tools for engineering calculations at scales of interest.

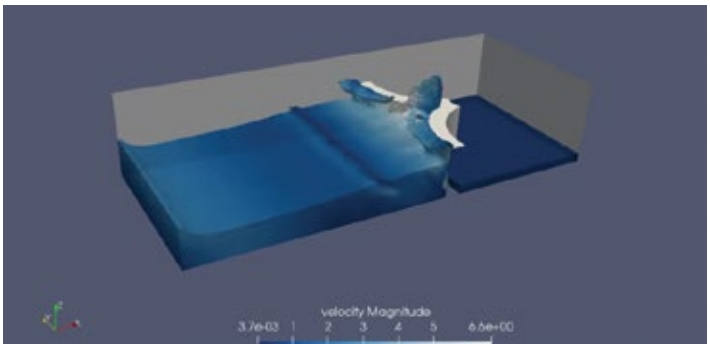

Figure 3. Overtopping of a sector gate system prototype conducted by Haydel Collins of the US Army Corps of Engineers, New Orleans district.

Community Engineering Software

Much of Kees' work makes its way into the Open Source modeling toolkit, Proteus. Proteus is a Python package that Kees began developing as a platform for modeling and numerical methods research at the US Army ERDC more than a decade ago. He spearheaded policies supporting the release of source code developed by US government staff, as well as strategies for building cross-laboratory collaborative development of software for the coastal and hydraulic engineering community, resulting in the release of Proteus on the public platform GitHub (https://github.com/erdc/proteus) under the liberal MIT software license. Proteus has more than 35 contributors and has been used to support a wide range of research and project activities over the last 10 years.

Figure 4. Kees and participants at the biannual Proteus Developers' Workshop in December 2019 at UC Berkeley.

US ARMY TAPS INTO LSU COASTAL AND ENGINEERING EXPERTISE TO AUGMENT RESILIENCE

The U.S. Army has turned to LSU experts to help make military operations better prepared and more resilient to climate-induced hazards with more than $9.3 million in funding over the next four years. Military operations, personnel, and infrastructure, including buildings, bridges, roads, and flood protection structures can be impacted significantly by flooding from intense precipitation events, subsidence, and rising seas. Anticipating Threats to Natural Systems, or ACTIONS, is a collaboration among the U.S. Army Engineer Research and Development Center's Environmental Laboratory, or ERDC-EL, LSU, and the University of Delaware.

"Our national security is so dependent on understanding coastal dynamics, whether for planning operations at our military bases or boosting our future Army capabilities. We need to improve our technology in understanding dynamic coastal environments for national security. This collaboration between our flagship universities of LSU and the University of Delaware and the ERDC-EL will contribute to national security," said LSU Vice President of Research and Economic Development Samuel Bentley.

LSU will focus on ecological, coastal, and water resource computational modeling and engineering to improve the functionality and resilience of military installations and operations under present and future conditions. ACTIONS will draw upon LSU as a research powerhouse with expertise in the LSU Center for Coastal Resiliency, LSU Center for River Studies, the LSU Coastal Sustainability Studio, as well as the Center for Computation & Technology and the Coastal Studies Institute. This is the largest grant to fund a single-team coastal science and engineering project at LSU.

Researchers will focus on developing and applying coastal and hydrologic models to delineate flood transition zones, areas susceptible to hydrologic and coastal flooding and its collective interaction known as compound flooding. The effects of climate change, such as sea-level rise, the frequency and intensity of precipitation events, wetland loss and other land form changes, will continue to alter the coastal land-margin and resulting flood transition zones. These zones will likely move inland under future conditions. Several military bases and their infrastructure are located within these flood hazard zones.

"Our team will build on a decade of progress we have made to assess the coastal dynamics of sea-level rise and to translate that new paradigm for the benefit of national security. A major goal will be to work with the ERDC-EL to advance compound flood modeling for present and future conditions of flood hazard zones on the coastal land-margin," said Scott Hagen, LSU Center for Coastal Resiliency director.

LSU has state-of-the-art research and education facilities, such as the 10,000-square-foot Lower Mississippi River Physical Model, which is one of the world's largest movable bed physical models, located in the LSU Center for River Studies.

"Our interdisciplinary team will create integrated and high-fidelity geospatial and modeling tools that identify and predict the geochemical and physical conditions that enhance domain awareness across coastal military installations and theaters, urban zones, and vulnerable natural systems. The products generated will provide superior information and enhance Army Futures Command's and other military unit's predictive, intelligence, and forensic capabilities," said Clint Willson, LSU Center for River Studies director.

"I'm excited by this collaboration," said Brandon Lafferty, acting deputy director of ERDC-EL. "Combining our expertise with that of our LSU and University of Delaware partners is the most effective way to conduct this storm surge and land usability research, and it will be very impactful to the Warfighter."

FACULTY ASSIST LOCAL COVID RESPONSE THROUGH WASTEWATER TESTING

The COVID-19 pandemic has required changes in many of the ways we pursue teaching, research, and service in the Department of Civil & Environmental Engineering at LSU. Professor John Pardue, together with Assistant Professor Sam Snow and Professor Bill Moe, has been assisting the campus and East Baton Rouge Parish with tracking the presence of the SARS CoV-2 virus, the virus that causes COVID-19 disease, in wastewater. This measurement allows LSU and the parish to understand the prevalence of the disease by area without the need for medical testing. The premise of the measurement strategy is straightforward; people with COVID-19 disease shed the virus while sick, and the amount of virus in the wastewater can be related to the number of cases in the drainage basin where the measurement is made. Because the wastewater collection network is designed to drain certain areas, we can strategically select sampling locations that give spatial information on disease prevalence. This technique is being used to track the virus in groups as large as city basins of more than 100,000 people to as small as the passengers on a long-haul aircraft.

In April 2020, LSU CEE faculty, together with faculty and staff in the LSU School of Veterinary Medicine, began planning city-monitoring networks using the existing sewer infrastructure as a guide. At the city level, flow-weighted composite samples are collected five days a week at three of the major basins in Baton Rouge, covering hundreds of thousands of residents. The data tracked the increase in cases as Baton Rouge moved into Phase 2 in Summer 2020. Importantly, the amount of virus plummeted in wastewater 10 days after the adoption of the mask mandates by the local Mayor-President Sharon Weston Broome and Governor John Bel Edwards. This data was presented to Dr. Deborah Birx during her visit to LSU and used subsequently as evidence of the efficacy of masks. Since the summer of 2020, viral concentrations have tracked cases in Baton Rouge, giving some advanced warning of surges or improvement in pandemic conditions. This method is being used worldwide to track the prevalence of the virus, and the techniques and processes developed in this project can be used for future pandemics or outbreaks.

Pardue subsequently set up an LSU campus-monitoring network that has been used during the 2020-2021 academic year at LSU. Through the network of 22 stations, every student living on campus is monitored indirectly once per week. Two types of samples are collected depending on the collection system—sampling at manholes directly in the collection system or in lift stations that are used to pump wastewater from certain dorms. These samples have been used to identify outbreaks in dorms in Fall 2020 and Spring 2021. These measurements drive individual medical testing in the dorms that identify students who require isolation or quarantine. Since much of disease spread is driven by asymptomatic carriers, this process has been critical to keeping the campus open by identifying cases quickly. Pardue serves on the President's Medical Advisory Team, which advises campus administration on COVID-related processes.

These public health research and service opportunities have been truly interdisciplinary, combining CEE faculty with knowledge of wastewater and wastewater collection with vet school faculty who are experts in virology, molecular analysis of viral targets, and the safe handling of pathogens. These two groups work together to make these measurements weekly, which drives real public health interventions. Establishing these collaborative programs on the fly is one of the key accomplishments of the program. This project provides further evidence of the collaborative, group dynamic of research today.

LSU PROFESSOR, RESEARCH TEAM CONTINUE STUDY OF CORONAVIRUS EFFECTS ON TRAFFIC

In March 2020, LSU Civil and Environmental Engineering Professor Brian Wolshon and a group of fellow researchers compared roadway travel statistics throughout the state of Florida for that month versus March 2019. This was done as states began to take their respective preventative measures against the coronavirus pandemic. The goal then, as it is now, was to understand the early impacts of government restrictions on social interaction with the expectation that it would be possible to determine their effectiveness in limiting the timing and extent of infections. What they found was that overall traffic volume decreased by 47.5% during the study period; there was a lag in response time between urban and rural areas; and that the greatest decline occurred later in the study period, suggesting multiple factors contributed in an additive way to increase the change in travel behavior.

A follow-up study has since been conducted, focusing on the period of March 1, 2020-June 1, 2020, and 10 states that represent a cross-section of populations, governmental responses, numbers of COVID-19 cases, and political leanings. The list includes Florida, Illinois, Indiana, Massachusetts, Michigan, Montana, New Hampshire, New York, Ohio and Vermont. The data from this study shows that:

- At the height of the lockdown during this period, traffic was down 60-65% across the 10 states and remained that way for about a month. That amount and its sustained duration is without equal in the last century.
- The level of traffic-volume "recovery" was slower than the decline, but by the end of the study, most states were in the range of 25%-30% below their 2019 levels. New Hampshire was on the lower end at 16% while Ohio was the highest at 44%. Researchers believe that this is a reflection of the levels of restrictions in place.
- The need for governmental responses should be appropriate to the threat faced and the specific characteristics of the location. For instance, the threat and outcomes faced by Montana were different than those of New York.

"The biggest a-ha moment was how consistent the amount of the drops were," Wolshon said. "Whether you had the state of New York, or Vermont, or Ohio, or Michigan, or Montana, the percentage drops were all really similar…everyone followed similar patterns and timings. And then how long they stayed at the bottom, except for Florida at three weeks, everyone stayed at the bottom. And then by the third week of April, everyone started coming back.

"You could make an argument with the data that we show that government actions lowered traffic, and that the decreased traffic led to a decrease in spread of the virus," Wolshon said. "When you're shutting down schools, businesses, etc., you're going to see traffic go down. You can't deny that human interaction spreads the virus."

Wolshon further stated that the group's work shows a consistency with growing scientific evidence that the spread of the virus appears to be primarily through human interaction at a "close interpersonal contact level," like the sort one would experience within a household and not like that of being in a shopping mall or outdoor stadium with reasonable social distancing.

There is more work to come on this project, as its focus will extend beyond the United States and examine the global response to the pandemic. Another area that will be examined is crash-related fatalities, which went up while traffic declined.

"The next logical step is were these patterns similar across the world?" Wolshon said. "Is human behavior more consistent than we think? Nobody likes to stay home; everybody wants to travel, etc. When governments have the ability to really lockdown an area, you can have beneficial outcomes, but at what cost? We want to try and look at the bookends of hardcore enforcement versus suggested guidelines versus [somewhere in the middle]."

Wolshon is joined on the project by Scott Parr, Embry Riddle Aeronautical University Department of Civil Engineering; Pamela Murray-Tuite, Clemson University Department of Civil Engineering; and Tim Lomax, Texas A&M University Transportation Institute.

FACULTY NEWS

VOYIADJIS ELECTED A SENIOR MEMBER OF NATIONAL ACADEMY OF INVENTORS

Boyd Professor and Chair of the LSU Department of Civil & Environmental Engineering George Voyiadjis has been elected a senior member of the National Academy of Inventors.

This year's class is comprised of 61 accomplished academic inventors representing 36 research universities, governmental entities and non-profit institutes worldwide.

The NAI Senior Member program is an exclusive award distinction created to showcase the innovative ecosystems at NAI member institutions, like LSU, which provide the supportive environment to foster novel discoveries. Senior members are chosen from active faculty, scientists, and administrators with success in patents, licensing, and commercialization who have produced technologies that have the potential for a real impact on the welfare of society.

"I am thrilled by this honor, as it further recognizes the adoption of these patent designs as a potential solution to extending the safe life-span of our aging bridge infrastructure, and with extension to any number of applications involving damage protection due to impact," Voyiadjis said. "They have the potential for providing safety improvement solutions throughout the engineering community."

Voyiadjis began his career at LSU in 1980 as an assistant professor after working at the California Institute of Technology, where he earned his master's in civil engineering, and Columbia University, where he earned his PhD in engineering mechanics. His primary research interests are in plasticity and the damage mechanics of metals, metal matrix composites, polymers, biological tissue, and ceramics with an emphasis on the theoretical modeling, numerical simulation of material behavior, and experimental correlation.

Voyiadjis has been recognized for his contributions to materials by being inducted to the Academia Europaea—Physics & Engineering Sciences and the European Academy of Sciences. He is also a Foreign Member of both the Polish Academy of Sciences, Division IV (Technical Sciences), and the National Academy of Engineering of Korea. He was also instrumental in LSU joining a consortium of universities and research centers that includes the University Carlos III of Madrid, the National Engineering School of Metz, the Polytechnic University of Poznan, and the Institute of Fundamental Technological Research of the Polish Academy of Sciences in Warsaw. Each year, the consortium organizes an international workshop devoted to the behavior of materials.

Over the last decade, Voyiadjis has helped LSU establish additional relationships with international institutions. In 2009, an exchange agreement with Ecole Nationale d'Ingenieurs in Metz, France, was made. The agreement included the exchange of faculty, research, graduate students, training, and internships. A common project also developed between LSU and ENIM-LaBPS that mainly concerned the friction definition at high-applied velocity. Analytical models have been developed at LSU and experiments performed at ENIM, with the work being presented at conferences and published in journals. New projects have been proposed related to the characterization and modeling of the microstructural behavior of materials using nano-indentation experiments and computational simulations.

Another collaboration began in 2009 when students from LSU travelled to the University of Lorraine in France to conduct high-impact experiments at the National Engineering School of Metz, now a department at UL. A number of joint-journal papers and conferences between the two followed, and, during UL Professor Alexis Rusinek's last visits to LSU, a new lab called MATEX, or Materials Under Extreme Loading Laboratory, was initiated here that allows for the study of the behavior of materials at high-impact loads.

LSU CIVIL ENGINEER RECEIVES PRESTIGIOUS POWE JUNIOR FACULTY ENHANCEMENT AWARD

LSU Civil & Environmental Engineering Assistant Professor Hai "Thomas" Lin has received a Ralph E. Powe Junior Faculty Enhancement Award from the Oak Ridge Associated Universities consortium, or ORAU, to investigate new materials and processes to improve the sustainability and resiliency of civil engineering infrastructure. Lin is one of 35 junior faculty in the US to be granted this prestigious award. This year, there were 167 applicants.

"ORAU is proud to recognize the research and professional growth of these emerging leaders as they support the future of science and technology," said Ken Tobin, ORAU vice president, University Partnerships Office.

According to the United Nations, buildings and related construction account for about 35% of global fossil fuel energy use and 40% of energy-related greenhouse gas, or CO2, emissions. While progress towards sustainable buildings and construction is advancing, the development of sustainable or "green" building materials is not keeping up with the demand for new construction and the resulting strain on the environment. However, researchers have been exploring sustainable synthetic materials that mimic biochemical processes, such as bio-brick and self-healing bio-concrete, to improve or replace conventional construction materials, such as brick and concrete. With this award, Lin will explore the use of emerging mycelium biocomposites as a "green" building material to improve the sustainability of civil engineering infrastructure. "If successful, the mycelium biocomposites will reduce the cost and environmental impacts of building materials and thus bring significant economic and environmental benefits to our society," Lin said.

The Ralph E. Powe Junior Faculty Enhancement Awards program provides funds to enrich the research and professional growth of young faculty, such as Lin. All of the recipients are in the first two years of a tenure track position and will receive $5,000 in seed money for the 2020-2021 academic year to enhance their research during the early stages of their careers. Each recipient's institution matches the ORAU award with an additional $5,000, making the total prize worth $10,000 for each winner. Winners may use the grants to purchase equipment, continue research, or travel to professional meetings and conferences.

"This award provides me seed money and motivates me to pursue this project, which serves as the first step of my career goal towards the successful development of sustainable bio-inspired materials to improve the sustainability of civil infrastructure," Lin said.

SEC ANNOUNCES VOYIADJIS WINNER OF 2021 FACULTY ACHIEVEMENT AWARD FOR LSU

Boyd Professor and Chair of the LSU Department of Civil & Environmental Engineering George Voyiadjis was named winner of the 2021 SEC Faculty Achievement Award for LSU.

A Distinguished Member of the American Society of Civil Engineers, Voyiadjis is also a Senior Member of the National Academy of Inventors and holds the highest professorial rank awarded by the LSU System–the Boyd professorship. His research interests are in plasticity and the damage mechanics of metals, metal matrix composites, polymers, biological tissue, and ceramics. He has secured more than $30 million in research funding and has helped LSU establish several relationships with international institutions as a foreign member of academies in Europe, Poland, and Korea.

"Dr. Voyiadjis is recognized worldwide as an authority in the field of multi-scale modelling of size effects in materials, and his accomplishments, along with sustained energy, attest to the extremely broad impact he has had nationally and internationally," said Stacia Haynie, executive vice president and provost at LSU. "He has distinguished himself as a renowned scientist, outstanding teacher, and tireless mentor."

To receive an SEC achievement award, the faculty member must have achieved the rank of full professor; have a record of extraordinary teaching, particularly at the undergraduate level; and have a record of research that is recognized nationally and/or internationally

STUDENT NEWS

RONE DEFENDS HONORS THESIS AND RECEIVES ACCOLADES

Emily Rone, a civil engineering major with a minor in structural engineering, graduated last fall with the distinction of being the December 2020 McLaughlin Medalist. Rone, a native of Mandeville, Louisiana, earned the award as the engineering student graduating with the highest GPA. She finished with a 4.18 and College Honors and Sophomore Honors distinctions.

One of the requirements to graduate from the Ogden Honors College is to write and defend a thesis. Rone's honors thesis explained how a bridge replacement project is designed, including selection of an alignment from different alternatives, design of various superstructure and substructure components, and estimating costs. Additionally, Emily conducted a comparative study between the traditional and the empirical concrete deck design methods. Rone's nearly 100-page thesis was defended in front of a panel of three LSU faculty with numerous CEE faculty in attendance. Faculty acknowledged her command of the material and clarity of her articulation.

While at LSU, Rone was the recipient of numerous scholarships and awards. It was announced in February 2020 that Rone had been awarded the ASCE Scholarship Award. This is awarded to ASCE student members in good academic standing. She was also a member of the American Society of Civil Engineers, the AISC Steel Bridge Team, Tau Beta Pi Engineering Honors Society, Phi Kappa Phi Honors Society, National Society of Collegiate Scholars, Geaux Big, and the LSU Wesley Foundation.

Rone is currently pursuing a master's in civil engineering with a specialization in structural engineering while she works part-time at Stantec.

"Through every aspect of my college experience, whether it be at late-night study sessions, football gamedays, Ogden Honors College events, or just spending time between classes, my friends are what got me through, and I'm excited to see what experiences await us in the future," Rone said.

ENVIRONMENTAL ENGINEERING STUDENTS AND RESEARCH UPDATES

The 2021 spring semester brought several exciting developments for Assistant Professor Samuel Snow's research group. First, several of the student researchers are poised to graduate after spending three and a half years doing research in the Snow lab, including Gabrielle Langlois; Grace Lowry, a former researcher in the group for more than a year; and PhD candidate Mostafa Maghsoodi, who will defend his thesis in April. Undergraduate student Andrea Martinez, graduating from LSU's Environmental Engineering program in May, has decided to join Snow's research group as a master's student starting in fall 2021.

THREE LSU CIVIL ENGINEERING STUDENTS RECEIVE THE LOUISIANA ASPHALT TECHNOLOGY SCHOLARSHIPS

Three civil engineering students—Andrea Guajardo, Payton Nickles, and Peyton Callender—were recently named the recipients of the Louisiana Asphalt Technology Scholarships that are funded by the National Association of Asphalt Pavement Association Research and Education Foundation and the Louisiana Asphalt Pavement Association. Member asphalt construction companies that sponsored these scholarships include Barriere Construction Company, New Orleans and R. E. Heidt Construction Company, Lake Charles. This scholarship program was developed in an effort to encourage young men and women to choose asphalt science and technology courses as a part of their curriculum.

"An example of partnership among academia, government, and industry, this scholarship is intended to not only benefit the asphalt industry by providing a trained workforce in asphalt technology, highway construction, and rehabilitation, but also benefit the individuals who choose careers in the public sector at the federal, state, or municipal level" said Louay Mohammad, LSU Professor of Civil Engineering and Director of the Engineering Materials Characterization Research Facility at LTRC. The scholarships, each $2,000, are presented yearly to college sophomore, juniors, or seniors who are US citizens and already enrolled in a full-time civil engineering curriculum.

LSU NOMINATES FOUR STUDENTS TO COMPETE FOR THE PRESTIGIOUS UDALL SCHOLARSHIP

LSU has nominated four students to compete for the prestigious Udall Scholarship. The Udall Foundation awards scholarships to college sophomores and juniors for leadership, public service, and commitment to issues related to Native American nations or to the environment. Everett Craddock, of Lafayette, Louisiana, is one of the nominees and is a junior pursuing a degree in environmental engineering. As a member of the LSU Honors College and a LASAL Scholar, Craddock has worked with NOAA as an undergraduate Hollings Scholar. In the future, he wishes to pursue a master's of environmental management and ensure proper emphasis is placed on adapting scientific findings into policy and management solutions in order to address both physical and socioeconomic vulnerability in coastal communities as climate-induced threats become more severe. Craddock, along with Jonah Foster, Alexia LaGrone, and Sarah Tarver, will compete with students from universities across the country for the chance to be named a 2021 Udall Scholar. Students are selected through an internal competition at LSU. In 2021, the Udall Foundation anticipates awarding 55 scholarships of up to $7,000 each.

ALUMNI NEWS

FERNANDEZ APPEARS IN *L'ARPENTEUR*

Benjamin Fernandez, LSU CEE alumnus, licensed PE, and current geodetic surveyor with LSU's Center for Geoinformatics (C4G), appeared in the journal of the Louisiana Society of Professional Surveyors, *L'Arpenteur*. Fernandez's paper is titled LSU C4G and Deflection of the Vertical and discusses C4G's goal of measuring gravity throughout the state of Louisiana. C4G is in the midst of a multi-year NGS grant and has been tasked with obtaining and providing terrestrial gravity measurements in support of National Geological Survey's (NGS) efforts.

LSU ENVIRONMENTAL ENGINEERING ALUMNUS HELPS SAVE BROWN PELICANS

Just four miles northwest of Cameron, Louisiana, in the western portion of Calcasieu Lake, is the only brown pelican rookery in Southwest Louisiana—Rabbit Island. This once 200-acre mass of land is home to thousands of brown pelicans who nest during the warmer months. However, the island is now down to just 30 acres, with the tide washing away nearly half of the eggs that are laid each year.

To combat this problem, LSU Environmental Engineering alumnus Beau Tate is working alongside other environmental groups to add more land to Rabbit Island, ensuring the brown pelican population continues to flourish.

"Just 11 years ago, more than 1,000 pelicans nested on Rabbit Island," Tate said. "By 2018, that number had dwindled down to 400. The restoration project will bring the island's elevation from 1 ft. to 3.5 ft., allowing for more nesting area."

In order to build up the island, Weeks Marine dredged up 606,300 cubic yards of sediment from the Calcasieu Ship Channel two miles away and transported it to the island. The goal is to add 88 acres back to the island, including vegetation.

Tate, who is a civil and coastal engineer for Royal Engineering in Lafayette and is serving as the senior design engineer on the restoration project, is working alongside the Coastal Protection Restoration Agency (CPRA), the Louisiana Department of Wildlife & Fisheries, and the Department of the Interior to restore the island. Tate and others at Royal Engineering performed a data gap analysis and directed the collection of topographic and bathymetric surveys, tide and current data, geotechnical investigations, and analysis within the project area. They then completed the development of project alternatives and oversaw an environmental investigation that produced a report detailing environmental conditions and identified potential permitting considerations.

The $16.4 million-project is being funded by a BP oil settlement from the oil spill that took place in the Gulf of Mexico in 2010. Louisiana received $5 billion in natural resource damages from the settlement, with $220 million specifically for bird restoration projects such as the one on Rabbit Island. The project began in August 2020 and will be completed in March, during the early stage of the brown pelican nesting season, which starts on March 15. Working on such a tight deadline is stressful, Tate said.

"You do everything you can to make sure your specifications are clear to ensure you don't have any hiccups."

Tate, who graduated from LSU in 1998, says that Rabbit Island is one of the more sensitive projects he has worked on, though he has also worked on projects dealing with oysters, manatees, and dolphins.

"This was definitely one of the more restrictive ones as far as having a time frame and holding the contractor to that time frame," he said. "But I love watching our projects come to fruition."

BETZER LAUNCHES NEW CAREER WITH EVANS-GRAVES ENGINEERS AND PUBLISHES ARTICLE

Logan Betzer graduated from LSU with his bachelor's in civil engineering in 2015. In July 2020, Betzer finished 13 months of employment with Jones|Carter in Houston, and in August, moved back to New Orleans to begin a new position with Evans-Graves Engineers. He recently passed the PE exam and an article he wrote under LSU CEE Professor Navid Jafari as an undergraduate was published in December 2020. The article is titled Real-Time Water-Level Monitoring Using Live Cameras and Computer Vision Techniques."

ZHANG LEADS FIRST PLACE PROJECT

Zhiming Zhang graduated from LSU with his PhD in civil engineering in 2020. He currently works as a postdoctoral research associate at the School for Engineering of Matter, Transport, and Energy (SEMTE) at Arizona State University. Over the summer of 2020, Zhang organized a team composed of five current doctoral students and postdocs from four universities to attend the 1st International Project Competition for Structural Health Monitoring (IPC-SHM, 2020). They submitted three projects in this competition and the third project, led by Zhang, took first place.

JOHN GRAVES PASSES AWAY AT 79

John Arthur Graves passed away peacefully on Saturday, January 16, at Our Lady of the Lake Hospital. At 79, Graves worked at a pace of many half his age, ever chasing one more win. Strong, visionary, and always teaching, "JAG's" legacy will loom as large as his once-commanding presence.

Born in Baton Rouge in 1941, Graves moved to Opelousas, graduating from AIC, now Opelousas Catholic, where he was involved with student government, played football and basketball, and ran track until suffering a back injury that would continually haunt him. But it was the death of his father while he was in high school that would deepen his resolve and shape his life. Graves rose from humble beginnings—working full-time while in school, including as a rodman surveying the Bonnet Carre Spillway. He graduated LSU with a BS in civil engineering and joined Edward E. Evans & Associates in May 1965, the same month his wife Cynthia gave birth to their first of five children. Believing in a well-rounded education, Graves continued his post-graduate studies in business at LSU, then worked with the College of Engineering to create more well-rounded students. He had great admiration for Evans, and it seems the feeling was mutual as Evans placed Graves in charge of the firms' operations at the age of 29, and in 1986, sold to John what would become Evans-Graves Engineers.

Today it is virtually impossible to travel through south Louisiana without seeing John Graves' impact—from the Maravich Assembly Center and neighborhoods across Baton Rouge, including Country Club of Louisiana, to the John J. Audubon Bridge; from Cortana Mall to the Ritz-Carlton in New Orleans, his influence on the landscape endures. Graves' legacy continues in the engineering community, as there is a "tree" of former Evans-Graves Engineers populating many of south Louisiana's top firms. Of all of his projects, Graves' greatest achievement was the levee rebuild following Hurricane Katrina. It was the largest civil works program in US history and completed on time and under budget. He also published *The Fortress Of New Orleans*, documenting the project.

Graves supported causes for which he felt strongly, most recently serving on the boards of the LSU Department of Civil & Environmental Engineering—including eight years as chair—Pennington Biomedical Research Center, B1Bank, and St. Joseph's Academy, as well as being a parishioner at Our Lady of Mercy. Not always serious, Graves relished his time in the Baton Rouge Roundtable, where he served as president; riding with the Krewe of Bacchus; and commingling at the City Club of Baton Rouge. He loved LSU and was proud to have been inducted into both the LSU Civil and Environmental Engineering (2009) and LSU College of Engineering (2016) Halls of Distinction. John Graves' legacy lives not only in the Louisiana landscape but also in his family, as his children have gone on to enjoy success in their own rights in business, medicine, and politics. While Graves was always more challenging to his own children, he was extremely proud of each, always introducing them to clients and friends. He loved family gatherings, employing Christmas, Mardi Gras, LSU Football, and any other excuse for food—particularly desserts—wine, and fun.

Graves is survived by his wife of 56 years, Cynthia Sliman Graves, five children, and nine grandchildren: Angelle Graves Hamilton and her husband Art, of Atlanta; Dr. Kurt Graves and his wife Alysia; Ashlyn Graves White and her husband Randy of New Orleans; Congressman Garret Graves and his wife Carissa; Katelin Graves Walker and her husband Lee of Memphis; and his sister Patricia Graves Gray and her husband Chuck of Houston. Grandchildren include Madelyn Graves, Conner Graves, Reily Hamilton, Ralston Graves, Graves Hamilton, Kadence Walker, Calla Graves, Lena Mathile Walker, and Kulshan Graves. He was preceded in death by his mother Lena Courville Graves and his father William Roscoe Graves who graciously prepare for his arrival.

(Reprinted from Nola.com)

LSU | College of Engineering

Department of Civil &
Environmental Engineering
3255 Patrick F. Taylor Hall
Baton Rouge, LA 70803

ADDRESS SERVICE
REQUESTED

ALUMNI REGISTRATION & UPDATES

The Department of Civil & Environmental Engineering is always interested in how our alumni are doing. We hope you will take the time to send your updates to **mlane10@lsu.edu** or, if you prefer, you can "snail mail" them to:

Department of Civil and Environmental Engineering
Louisiana State University
Attn: Madison Lane
3255 Patrick F. Taylor Hall
Baton Rouge, LA 70803-6405

Please include basic information, such as your full name, year of graduation, degree, mailing address, email address, telephone number, company, and your title/position. For your update, please include information on your recent professional and personal developments, along with a high-resolution photo, if available.

Thanks for staying in touch!

To connect with the LSU College of Engineering, please visit **lsu.edu/eng**
and find us on Facebook at **facebook.com/LSUCEE** and Twitter at **twitter.com/LSU_CEE**.

Visit the LSU ASCE website at lsu.edu/eng/CEE