Virginia Tech's Center for Geotechnical Practice and Research (CGPR)
Fall 2019 Newsletter

What is the CGPR doing these days?

A Message from Jim Mitchell

The short answer to the above question is: A LOT! – and in this newsletter we are eager to inform our CGPR members and friends about some highlights. Of the five new projects being initiated this year, two address global challenges and three focus on more specific geotechnical problems with immediate application to practice. A listing of benefits of CGPR membership is provided, and we encourage you to take advantage of all those of particular interest to your organization. Recent and planned activities of our enthusiastic Graduate Student Organization are summarized, and news about our busy faculty members in the Geotechnical Engineering Group is briefly reported.

Of special note is the planned move, for family reasons, by Professor Mike Duncan and his wife Ann to California in early 2020. In his 35 years at Virginia Tech, Mike, through his outstanding contributions as a teacher, researcher, and practitioner, as well as a founder and director of the CGPR, has built and led our geotechnical engineering program to its present standing at the highest level in our profession. His emphasis on the fundamental areas of soil mechanics and foundation engineering, lessons from practice, clear and effective written and oral communication, and concern for the welfare of his students and colleagues leave a legacy that will be continued as core values well into the future. All of us thank Mike for all he has contributed here and wish him and Ann happiness and fulfillment in their new lives in California.

Finally, I note that CGPR Director George Filz will be retiring from his regular faculty position in December. Fortunately, he will continue some of his current activities at VT, particularly with respect to the CGPR. On January 1, 2020, George and Professor Adrian Rodriguez-Marek will be trading places in the CGPR; i.e., Adrian will be Director and George will serve as Co-director.

2019 New Initiatives

We are working on several of the top-ranked initiatives from our March 2019 annual meeting with CGPR members, including the following:

1. Envisioning the future of big data and cloud computing in geotechnical practice. Goals of this project are to identify potential benefits, opportunities, and challenges, as well as possible paths forward.

2. Designing geostructures for climate change and flooding. This project aims to describe the character and scope of the challenges ahead, as well as opportunities for geotechnical engineering.

3. Accounting for bending capacity and shear resistance from structural elements in limit equilibrium slope stability analysis.

4. Determining long-term strengths in stiff (intact and fissured) clays for use in analysis of slope stability and excavation support systems, including Potomac Group clays to the extent data and relevant case histories are available.

5. Evaluating hydraulic conductivity of soil-cement in vertical barriers and bottom seals.

Member-valued Benefits of CGPR Membership

- Concise and practical CGPR manuals, reports, and computer programs. Ninety-eight have been published to date, with more added every year, on topics requested by CGPR members. See www.cgpr.cee.vt.edu.
- Contacts with talented and well-educated Virginia Tech graduate students prior to their entry into the job market. You can access resumes and contact information for current geotechnical graduate students at the CPGR website.
- The annual CGPR meeting, which provides a unique forum for communication, interaction, and exchange of ideas among geotechnical consulting engineers, contractors, government agencies, and geotechnical faculty.
- Limited free consulting by geotechnical engineering faculty.
- Continuing education short courses.
- Issue-oriented workshops on member-defined topics.
- In-house visits by geotechnical faculty members, at member request.
- Special-request reference lists. If you need to locate information about innovative technologies, unusual applications, or just something new to you, we will search the literature to locate publications that may be helpful, and we will provide you with bibliographic information and abstracts. Contact Sandy Simpkins at sandy@vt.edu.
- Opportunity for interaction with Virginia Tech expertise and students in other areas beyond geotechnical engineering. Sandy Simpkins (sandy@vt.edu) will work with the CGPR directors to identify appropriate VT contacts for you.

In short, a principal benefit of CGPR membership is ready access and frequent contact with university resources (faculty, students, labs, and libraries).

2020 Annual Meeting & Lecture Program – March 25 and 26, 2020

Mark your calendars for the 2020 CGPR Annual Meeting and Lecture Program, which will be on March 25 and 26 at The Inn at Virginia Tech. The meeting and associated events will again provide an excellent opportunity to meet our graduate students and to provide your input on CGPR activities for the coming year. The featured speaker for the Lecture Program will be John Bachner, President of Bachner Communications, Inc, who will discuss loss prevention and related issues in his hallmark engaging style.

Virginia Tech's Geotechnical Engineering Graduate Students, Fall 2019

Geotechnical Student Organization News

The GSO was very active last year and will be again this year, including the following events:

- A beginning-of-semester ice-breaker party at which we welcomed new and returning graduate students.
- A field trip to the Hokie Stone Quarry, which is the source of the limestone blocks used for buildings on campus.
- Participation in the Virginia Tech Science Festival, which attracts about 5,000 people a year, mostly between the ages of 5 and 15.

- Host of the Geo-Institute 2019 Cross-USA Lecture by Dr. Bob Bachus of Geosyntec.

- Hosted the “VT Alumni and Friends Reception” at GeoCongress in Philadelphia. This was a very successful event, with over 100 attending. We hope to do this again in Minneapolis in 2020.

- Participation in an Open House event for freshmen in Virginia Tech’s College of Engineering. Undergraduate students enter specific engineering departments in the sophomore year, and the Open House provides freshmen with information they can use to choose their preferred departments. GSO students will set up posters, videos, demonstrations, and hands-on activities involving soil and rock sampling, in-situ testing, laboratory testing, and mechanically stabilized earth walls.

- Educational outreach events at Radford High School's TechCon event, and at Roanoke STEAM (science, technology, engineering, arts, and math) Day, by about 1,000 K-12 students from across Virginia and West Virginia.

- An end-of semester holiday party, at which we say goodbye to graduating students.

Graduate Geotechnical Seminar

The graduate program in Geotechnical Engineering at Virginia Tech includes a one-credit seminar course in each of the Fall and Spring semesters. One of the objectives of the graduate seminars is to expose our students to professional practice. Towards this objective, we usually invite colleagues to present practice-oriented presentations to the seminar class. We would like to offer an invitation to all CGPR member organizations to present in our seminars. Our students benefit from exposure to high-quality case histories and practice-oriented presentations. This also becomes an additional opportunity for CGPR members to interact with our students. If you are interested, please contact Ms. Sandy Simpkins (sandy@vt.edu) or Prof. Adrian Rodriguez-Marek (adrianrm@vt.edu).

Faculty News

Professor Sherif Loft Abdelaziz will be joining the geotechnical program at VT in January 2020. His specialized expertise is in thermal and energy geotechnics focusing

on heat exchanger foundations, hydro-thermo-mechanical behavior of soils across micro- to macro-length scales, and bioinspired techniques to enhance soil properties. Over the last few years, Abdelaziz has investigated the response of energy foundations under operational thermal and mechanical loads, the micro- and macro-scale effects of freezing-thawing-heating-cooling cycles on cohesive soils, and the use of biopolymer-nanocomposites to improve the resiliency of earthen infrastructures.

Professor Tom Brandon and VT alums Dan VandenBerge and Rick Valentine wrapped up their investigation of the failure of the 240-ft-tall MSE slope at the Yeager Airport in Charleston, WV. Be on the lookout for subsequent papers on the topic. Brandon, VandenBerge, and other VT geotechnical alums have nearly finished the update of the legacy manual NAVFAC DM 7.01 *Soil Mechanics*. This effort has lasted two years. They will soon start updating the second manual in the series, NAVFAC DM7.02 *Foundations and Earth Structures*. Brandon, along with Professors Mike Duncan and Steve Wright, are progressing on the 3rd edition of *Soil Strength and Slope Stability*.

Professor Mike Duncan will again support student attendance at the annual Geo-Congress in Minneapolis in February, 2020, using funds from his professorship. As usual, each student will receive their conference registration fee, half their airfare cost up to $300, and $150 extra. Student attendance at the Geo-Institute conferences has become a hallmark of Virginia Tech's Geotech program and a valuable part of the students' education. The students develop professional confidence and networking skills that ease their entry into the profession. 2020 will be the last year that Mike's professorship will be available to support student attendance at Geo-Congresses, because he and his wife Ann will be leaving Virginia Tech and moving to California in Spring 2020. Although Mike's professorship will no longer be available, the tradition will continue, supported by the *Ann and Mike Duncan Endowment for Geotechnical Student Travel* (www.cee.vt.edu/duncan-endowment). This endowment was established in 2015 by Tom Brandon, George Filz, Pat Lucia, and Ray Martin, with contributions from CGPR member organizations, Virginia Tech alumni, friends, and faculty, and from Ann and Mike. The Endowment's funding is approaching its initial goal of $400,000, and hopefully will have reached that goal by the time Ann and Mike leave Blacksburg next Spring. The fully funded endowment will make it possible to support VT graduate students attendance at Geo-Institute conferences in perpetuity.

Professor George Filz's research and consulting activity continues to focus on the deep-mixing method of ground improvement, column-supported embankments, flood protection systems, and seepage barriers for dams, levees, and environmental projects. With graduate students and other VT faculty, he is wrapping up CGPR reports on excavation bracing systems, construction working platforms, and optimizing soil-cement mix design. With CGPR Honorary Member Alex Reeb, he has begun CGPR reports on methods to measure hydraulic conductivity of seepage barriers and on the applicability of limit-equilibrium slope stability analyses when structural elements cross failure planes. Filz received the American Council of Engineering Companies of Florida

(ACEC-FL) Engineering Excellence Award for his work at Kennedy Space Center in support of NASA's Space Launch System.

Professor Russell Green was awarded the 2018-2019 College of Engineering Certificate of Teaching Excellence, which is awarded annually to 4 of approximately 330 College of Engineering Faculty at Virginia Tech. Additionally, Kristin Ulmer (PhD student co-advised by Russell and Adrian Rodriguez-Marek) won first place in the ASCE Geo-Institute's annual GeoPoster Competition at the 2019 GeoCongress in Philadelphia. Russell is working with Sneha Upadhyaya (PhD student) and Adrian Rodriguez-Marek on a CGPR report about selecting appropriate values of the factor of safety against liquefaction triggering based on the cost of mispredictions. He is working on another report with Rachel Kizer (MS student) about using vertical drains to mitigate the risk of liquefaction triggering.

Professor Rodriguez-Marek is conducting research on the quantification of uncertainty in seismic site response for nuclear applications in a project funded by the *Electricité de France*, the French national power company. The research involves extensive collaboration with colleagues in the U.S. and Europe working on seismic hazard analysis for critical facilities. Professor Rodriguez-Marek is also leading a project funded by the Nuclear Regulatory Council to improve on current approaches for conducting site response analyses for Nuclear Power Plants. He is also working on several CGPR projects including one on geotechnical considerations in the mitigation of adverse effects of global warming with Professor Nina Stark; a report on the selection of factor of safety for liquefaction triggering evaluations with Professor Russell Green; and a report on guidelines for conducting site response assessment for Central and Eastern U.S., also with Professor Green.

Professor Nina Stark and her students just concluded an active and successful field work season in 2019 with geotechnical data collection in different coastal and riverine environments stretching from Alaska to North Carolina. She is also a founding member and steering committee member of the recently formed, NSF-supported Nearshore Extreme Events Reconnaissance (NEER) Association, which has just initiated two new projects. One NSF-funded project in collaboration with the University of North Carolina collects geotechnical measurements in the Arctic. Another project, funded by the Naval Research Lab, correlates geotechnical in-situ data and sonar data with sediment transport processes in marine environments. Stark maintains a blog on her research group's activities at http://coastalgeotech.blogspot.com/ and tweets most recent activities on twitter at @NinaStark18.

Professor Alba Yerro-Colom enabled Virginia Tech to rise from Associate status to Board Member status in the Anura3D MPM Research Community, effective January 2019. This community consists of eleven partners from Europe and the U.S, with the common goal of developing advanced numerical software, based on the Material Point Method, which can effectively model large deformations and soil-water-structure interaction problems. As part of her activities, Professor Yerro-Colom organized the 12th Annual Material Point Method Workshop (9-11 September 2019) at Virginia Tech, with

attendees from the U.S. and abroad. Professor Yerro Colom was also an invited speaker at the Workshop on Numerical Simulation Methods for Large Deformation Problems in Geotechnics at Tongji University (23 May 2019, Shanghai).

Contact Information

We look forward to another productive year of CGPR activity. If you have any comments or questions, or if we can be of any other assistance, please let us know.

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