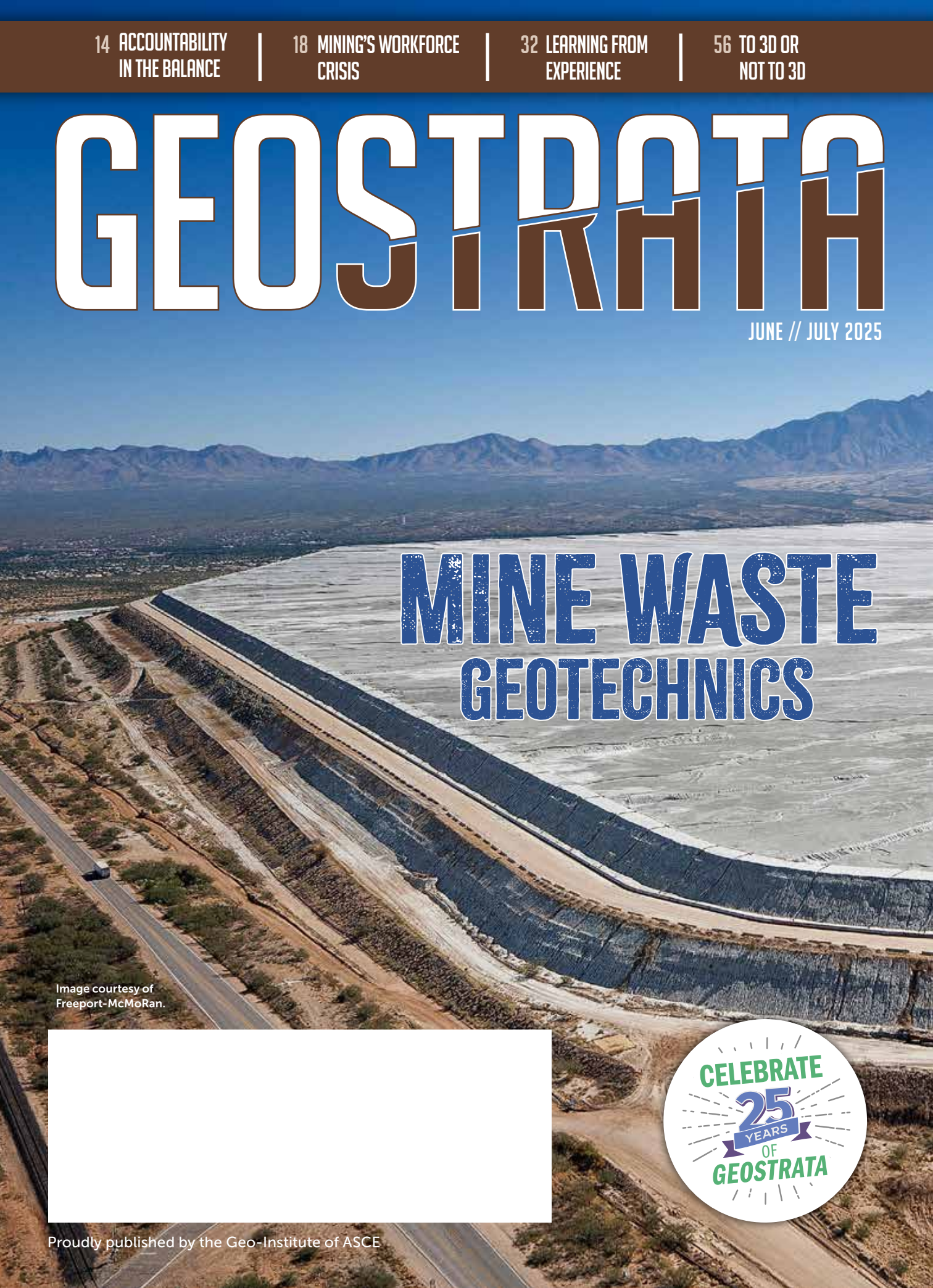
GEOSTRATA

JUNE // JULY 2025

MINE WASTE GEOTECHNICS



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CELEBRATE 25 YEARS OF GEOSTRATA

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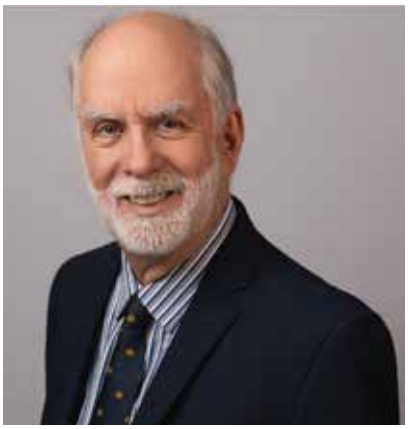
Richard J. Bathurst is a professor emeritus of civil engineering at the Royal Military College of Canada, and an internationally recognized expert in geosynthetics, MSE walls, and reliability-based design of reinforced soil structures. Bathurst's educational journey began at Queen's University in Kingston, Ontario, Canada, where he earned his bachelor's (1976), master's (1977), and doctoral (1986) degrees in civil engineering. He also holds a cross-appointment at Queen's University, and is a visiting research fellow at the Port and Airport Research Institute in Yokosuka, Japan. He's written more than 230 journal articles and contributed to the fifth edition of the Canadian Geotechnical Society's *Canadian Foundation Engineering Manual* and the Transportation Association of Canada's *Guide to Design, Construction, Maintenance and Inspection of Mechanically Stabilized Earth (MSE) Walls*.

Among his many professional appointments, Bathurst has served as president of the Canadian Geotechnical Society (2013-2014), the International Geosynthetics Society (1998-2002), and the North American Geosynthetics Society (1998). He's the editor-in-chief of the journal *Geosynthetics International* and the ASCE *International Journal of Geomechanics*, and has served on committees of the *Canadian Highway Bridge Design Code*, and the *AASHTO LRFD Bridge Design Specifications*.



Richard J. Bathurst

In 2017, Bathurst was elected fellow of the Royal Society of Canada, one of the highest academic honors in the country. He's also been recognized with the 2021 ASCE Thomas A. Middlebrooks Award for the paper "LRFD Calibration of Internal Limit States for Geogrid MSE Walls," that he co-authored with Tony Allen, Peiyuan Lin, and Nezam Bozorgzadeh in the November 2019 *JGGE*. He received the 2024 Julian C. Smith Medal of the Engineering Institute of Canada "for achievement in the development of Canada," and the named "Bathurst Reinforcement Lecture" of the International Geosynthetics Society, which is delivered every four years at the International Conference on Geosynthetics. Based on his distinguished career, Bathurst was selected as the Geo-Institute's Cross-USA Lecturer for 2024-2025.

During your childhood, you lived in Canada, England, Portugal, and Mozambique. How did these experiences shape your development as a person, an educator, and a civil engineer?

When I was living overseas, I was quite young, about eight years old in 1960. My grandfather had a farm in southern Mozambique. As a young kid, that was a fantastic adventure! He'd sleep with a shotgun under his bed, and my siblings and I would run all over the place. Only later did I recognize that in that place, and at that time, I was a privileged white person. I believe that influenced me much later in life.

You started as a mining engineering student. What made you change to civil engineering and later focus on geotechnical engineering?

I began in mining engineering at Queen's University with a scholarship from a company called Inco, which is now Vale. As part of the curriculum, I took a course in soil mechanics. The course was taught by Dr. Bob Mitchell in the civil engineering department, and I loved it. It was one of the few courses that really challenged me, because there were concepts like effective stress, undrained strength, and there seemed to be room for human judgment and experience, and arguably some black magic. I completed the course and immediately changed departments.

Which lesson(s) did you learn as a student that most directly influenced your success?

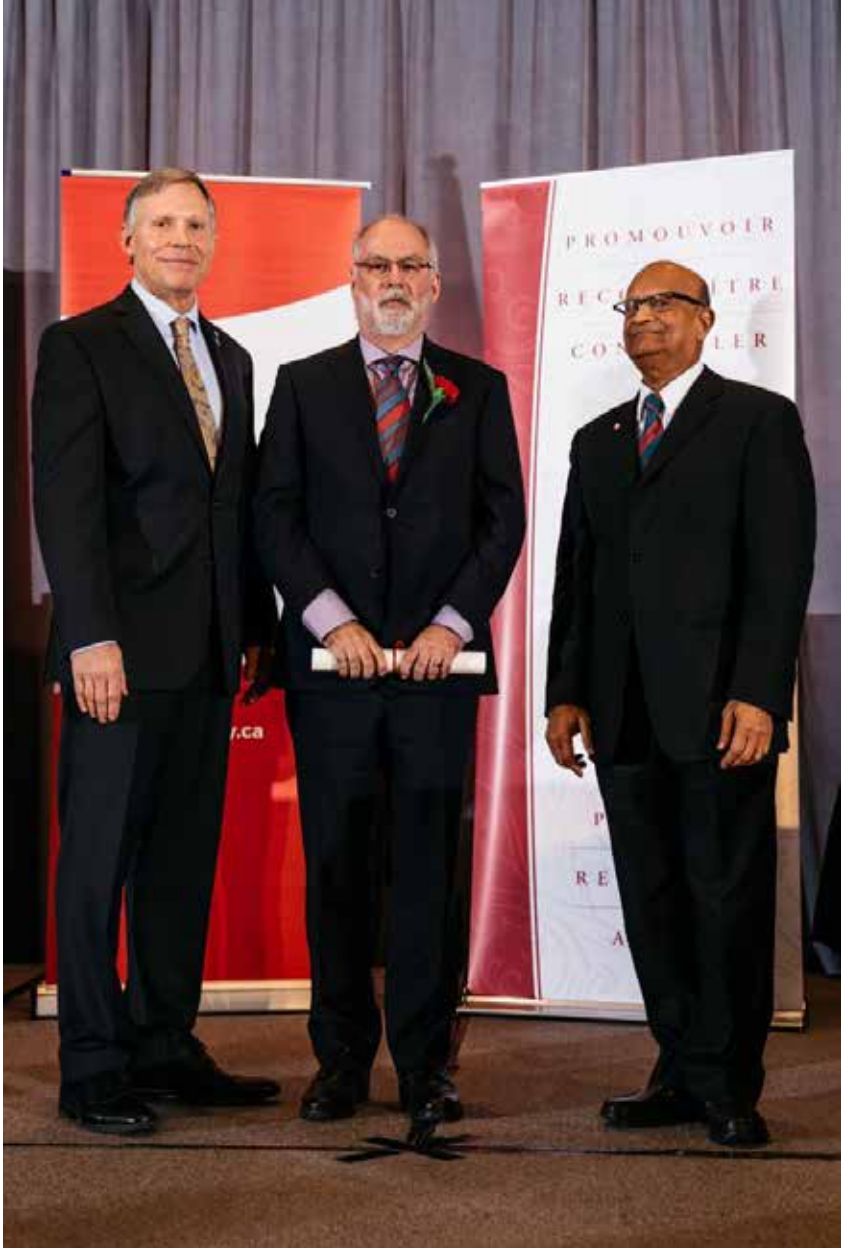
After breaking my glasses during frosh week, I had to sit at the front of every class because I was blind as a bat! In those days, professors said "Once you've picked a seat, you must stay there," so, even if I wanted to nod off, I couldn't avoid the lectures. The second lesson was to study for exams by doing old exams. I would sit down, imagine I was in an exam hall, and write out the answers in full. That served me very well. In fact, some professors would sometimes repeat exam questions from year to year, and some of those exams were open book! So, you can imagine my delight recognizing a question from an old exam paper I'd seen before, and having in front of me a well thought out answer.

What deficiencies are there in today's geotechnical engineering education, and how would you correct them?

Many academics would probably answer that question by lamenting the lack of space for certain topics. I enjoy teaching geosynthetics engineering, but because civil engineering programs comprise a broad basket of topics, you can't really teach much, so you're restricted to teaching it at the graduate level, which is a problem. A solution may be to break up civil engineering programs into different discipline programs, as is done in some places in Europe. This could allow programs to be more focused. Another problem is that class sizes are just too big. I'm probably at the smallest school in Canada that offers a civil engineering degree, so I was fortunate to sometimes have classes from 5 to 15 students. I believe students truly benefit from having small classes with engaged professors.

What's the most important (groundbreaking) contribution to geotechnical engineering and why?

I must bow down to Terzaghi and his concept of effective stress. Before that, engineers couldn't figure out how soils behaved. Today, modern commercial software tools allow us to conduct very sophisticated analyses. That's a huge



Bathurst's induction as a Fellow of the Royal Society of Canada in 2017.

Bathurst at school in London, England, before his "geo" days.

Bathurst excavating buried geomembrane test samples at the location of a subsurface oil spill at a DEW line site in the Canadian Arctic.

Bathurst with colleagues Tony Allen (l) and Yoshi Miyata (r).

advancement compared to when I started at Golder and was tasked to carry out slope stability calculations manually. These modern computational engines are terrific if used correctly. The other thing that's really astonishing is the internet and our ability to find information. Another war story I tell young people is that if I wanted a paper during my Ph.D. work, I'd have to go to the library, ask the librarian to order it, and two weeks later it would come in the mail. Today, at the click of a button, you can find what you're looking for, and this has had a profound effect on research.

If you had to pick one accomplishment during your career, what would it be? And conversely, what do you regret doing or not doing?

My first choice is the development of the stiffness method for the internal stability design of MSE walls along with my long-time friend and colleague Tony Allen, who recently retired from the Washington State Department of Transportation, and Professor Yoshi Miyata in Japan. If I had a second choice, it would be the development of reliability-based design methods for MSE walls in a way that practicing geotechnical engineers can understand.

In terms of regrets, I have none. When you've been as lucky as I have, and things have fallen in your lap, it's hard to have regrets. Success in professional life is a combination of things. First you must have enough brains. Now, I'm not a genius, but I have just enough brains. The second thing is to have the opportunity, and then finally you must have the ambition to take advantage of them. Those three ingredients have been available to me, and allowed me to perform and achieve the accomplishments that I have been recognized for.

What's the future of AI in geotechnical engineering, and how can AI influence our field?

The immediate influence that I see with AI is the polishing of Western English writing by persons whose first language is not English. I see this every day. As editor-in-chief of two journals, 90 percent of the papers, if not more, come from authors whose first language is not English, and almost all of them admit to using AI to polish the English grammar in their manuscripts … and that's fine! But you must remember that these AI instruments aren't trained in the lexicon and thinking that goes into our geotechnical discipline and communication. For example, the other day, I received a paper where the AI instrument translated "failure limit states" to "diseases."

Which of your projects was the most challenging, and how did they influence you professionally?

One of the most challenging projects was developing the full-scale retaining wall test facility we built at RMC starting in 1988. Some of my elders said we should gather all the self-proclaimed experts in MSE wall design in a symposium and have a prediction exercise about the performance of a couple of real MSE walls. They looked around for the youngest guy in the room and said to me, "Go build a test facility and two test walls." That's how it started. The facility grew in size and utility and led to more than two decades of designing and carrying out experiments on MSE walls. This program assisted in the development of the stiffness method that recognizes that it's the stiffness of the reinforcement that is most responsible for the magnitude of reinforcement tensile loads under operational conditions, and not the strength of the soil as assumed in past design practice.

What advice would you give to a young engineer starting a career in geotechnical engineering?

The first thing I'd say is, be patient! Too often, young engineers are focused on climbing the organization ladder, and within a few weeks desire to become CEO of the company. What you must do is spend time in rank and get experience. That means going out on a drill rig, logging boreholes, sitting at the bottom of a test pit, and these sorts of things. When I listen to my Ph.D. students, they often say, "I'm going to do a Ph.D. program with a view of becoming a professor." I respond that the satisfaction that you can get from a consulting career can be just as rewarding as being an academic doing research.

What are the new areas in geotechnics where our field is advancing at a faster pace, and which ones will have the largest impact?

I believe that quantifying margins of safety in a probabilistic sense is the future for geotechnical design. Eventually, I see RBD replacing LRFD. Unfortunately, there are too many papers that are incomprehensible to non-experts. This doesn't help promote RBD to engineering practitioners. I hope the work that I've done can be communicated to practitioners so they understand what RBD is, and how to do it without, for example, resorting to Monte Carlo simulations. It just doesn't need to be so complicated. The challenge is to communicate the concepts and to develop simple tools so that geotechnical engineers can do the calculations themselves. If geotechnical engineers can't do the calculations themselves, they won't adopt new ways of thinking.

If you were going to start as an early career faculty, what area would you start your research on?

While I'm biased in favor of RBD, I think it's very important that young people spend some time researching a topic. I understand that this can be a challenge because what usually happens is a professor has a funded project and needs a student to do the work. Sometimes you end up doing a project that isn't immediately rewarding or won't impact engineering practice. Nevertheless, doing high-quality research trains the brain and lets you develop skill sets that can be handy later in life if you do become a consulting engineer or an academic.

Where in the world would you most like to travel, and why?

One place I've not been to is Greece. My wife Hana is Czech, and we have a condo in Bohemia. I'm hoping to travel there more. My wife promises me that I can have a space with a whole bunch of computer screens so I can indulge my research hobbies while we live together in a nice country.

What hobbies do you have to clear your mind after a long day of work?

Usually, my wife and I do some sort of recreational stuff. Until recently, we had a 38-ft Bayliner motor yacht, which is an ideal boat for where we live. But now that we no longer have it, we go on small cruise ships in the Caribbean that are piloted by someone else, and the drinks are brought to us.

An incremental panel wall taken to failure under surcharge in the RMC full-scale retaining wall test facility.

You worked for Golder Associates (now WSP) for three years between your master's and Ph.D. degrees. How did your experience in geotechnical consulting influence you personally and professionally?

The experience I had at Golder informed my future in many ways. It taught me practical soil mechanics and foundation design. You must quickly get to the core of the problem and solve it because the clock is ticking, and someone is paying you for an answer. One lesson is that you don't have to find the best answer, but you must supply an answer that works and is cost effective, and, these days, sustainable. The other reason why it was a good experience for me is that I had the good fortune of learning from a number of Canadian geolegends at Golder, such as Jack Crooks, Victor Milligan, and John Seychuk. Golder also sent me out in the field as part of monitoring programs on different projects. I got to see how things were designed, and then how they were built. I worked in Trinidad on two piling projects as an inspector and on earth dams in northern Ontario. Those experiences gave me case studies that I've shared with my students and also gave me an appreciation of practical research topics. There are lots of problems that geotechnical engineers and designers face in practice that are potential research topics, and intellectually demanding.

If you had to choose a career path other than engineering, what would it be and why?

If I had enough brains and opportunity, I'd like to have been a physicist because those folks get to probe the very nature of our existence at the quantum level or on the big-scale cosmos level.

Hana and Richard on a Caribbean cruise in 2023.

Bathurst (r) with his some of his geo-buds. L to r: R. Kerry Rowe, Richard Brachman, Malek Bouazza, and Andy Take.

Reflecting on your academic journey, do you have a favorite professor or mentor who inspired your engineering career?

It's wonderful to be able to namedrop mentors in an interview like this. One is Professor Leo Rothenburg, a Russian immigrant who did his Ph.D. thesis in micromechanics of granular assemblages. When I first came to Queen's to pursue my Ph.D., I was searching for a topic, and Leo had just joined Golder Associates. He had developed several very advanced statistical mechanics models to support his ideas regarding the relationship between micromechanical structure of granular media and stresses recorded at the macro scale. It happened that RMC had taken delivery of two mainframe computers, and they were doing nothing, so, the stars aligned. I had a really interesting topic, a super mentor, and the equipment to carry out computationally demanding numerical simulations. In fact, even though I'm best known for geosynthetics and MSE walls, my most highly cited papers are in micromechanics. At the time, there wasn't much research money available for micromechanics research, but interest in geosynthetics was exploding on the geotechnical landscape. A couple of mentors, Professors Gerry Raymond at Queen's, and Peter Jarrett at RMC, among others, told me that I needed to get in on the ground floor of geosynthetics, so I changed direction. These mentors influenced me at exactly the right time. Other legends like J.P. Giroud and Alan McGown were also there when I needed them. A number of very enlightened administrators at RMC made things easy by clearing the path and telling me, "Okay, go do your stuff." I was very lucky. One of the important lessons I tell others is that you don't want to work alone. The days of being a Lone Ranger are over. You need to work in collegial groups in which the sum of the collaborators is greater than each member individually. A great example of this philosophy is the collegial and collaborative research environment that I enjoy at the GeoEngineering Centre at Queen's-RMC. GS

Student authors Sergio Marin (l) and Jorge E. Orozco-Herrera (r).

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